

Digestive System

222 Descriptive Histology

Components of the digestive system

A. Alimentary Canal

- Oral Cavity and the pharynx
- Esophagus
- Stomach
- Small intestine (duodenum, jejunum, ileum)
- Large intestine (cecum and appendix, ascending, transverse, descending, sigmoid colon)
- Rectum
- Anal canal

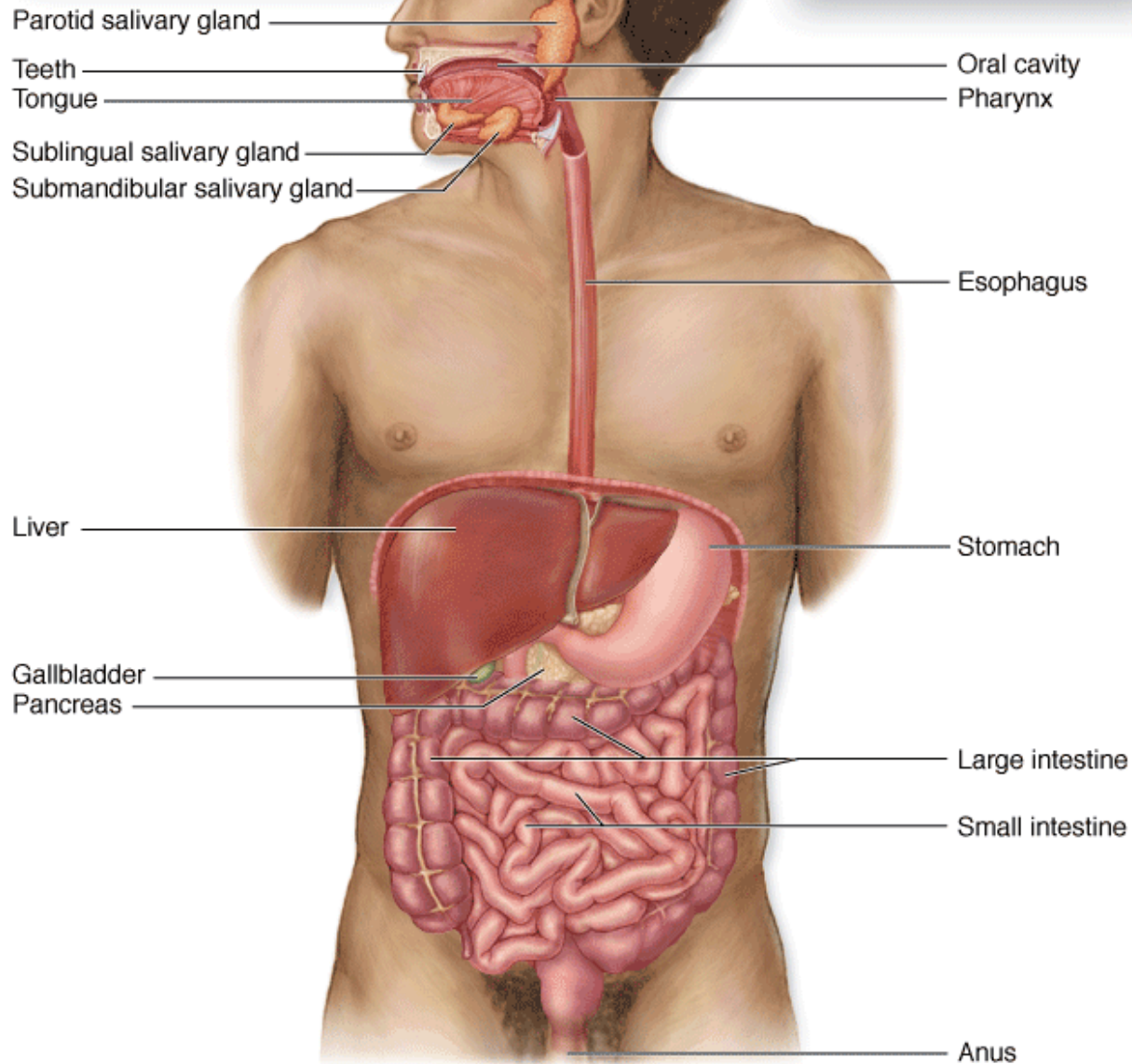
B. Accessory Digestive Organs

- Teeth
 - Tongue
 - Salivary Glands
 - Liver
 - Gall Bladder
 - Pancreas
-



Accessory digestive organs

**Gastrointestinal tract
(digestive organs)**



Histology of Alimentary canal wall

Same four layers from esophagus to anal canal

1. Mucosa
2. Submucosa
3. Muscularis externa
4. Serosa or adventitia



Mucosa

Epithelium
Lamina propria
Muscularis
mucosae

Submucosa

Submucosal gland
Blood vessel
Submucosal nerve plexus

Muscularis

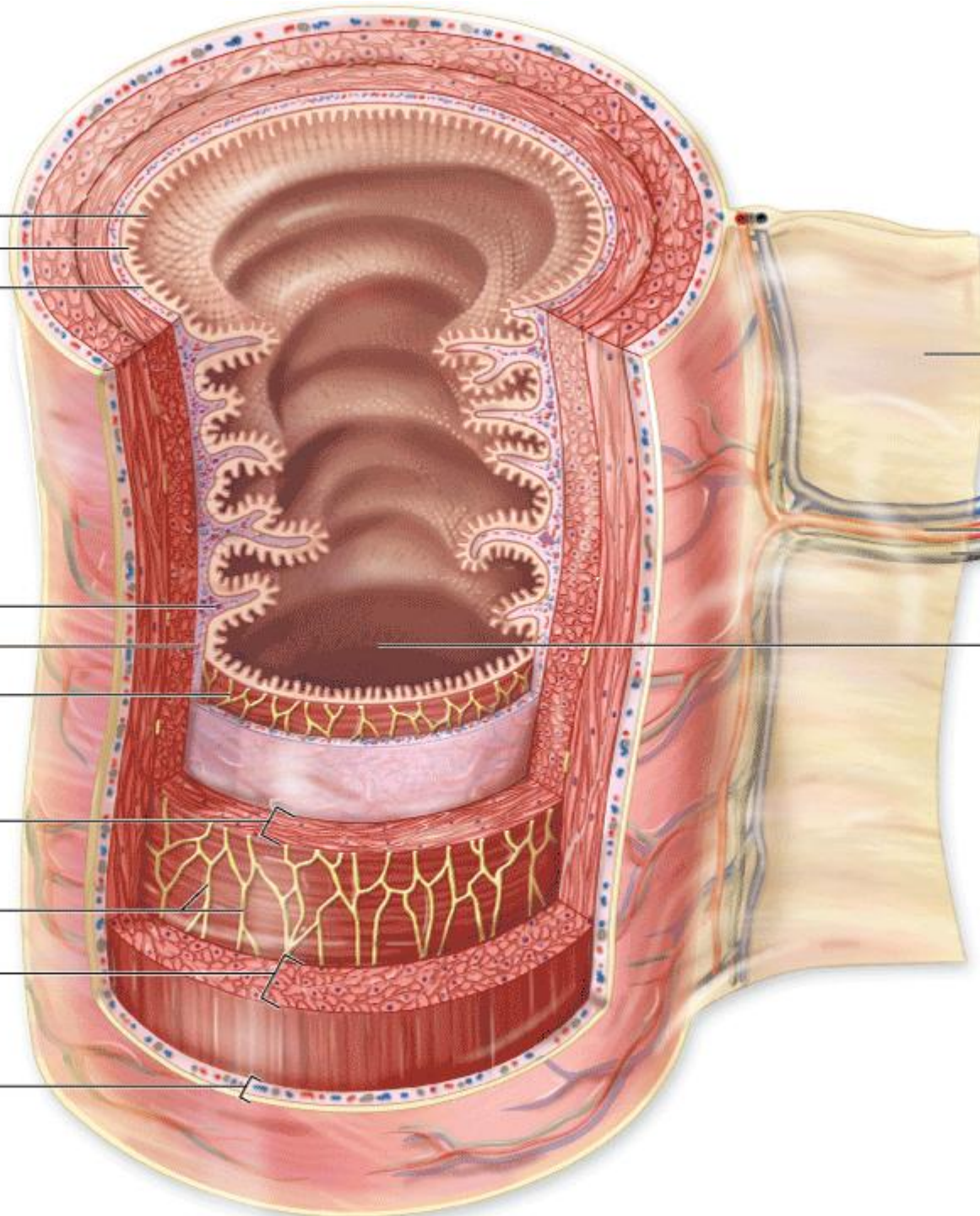
Inner circular layer
Myenteric nerve plexus
Outer longitudinal layer

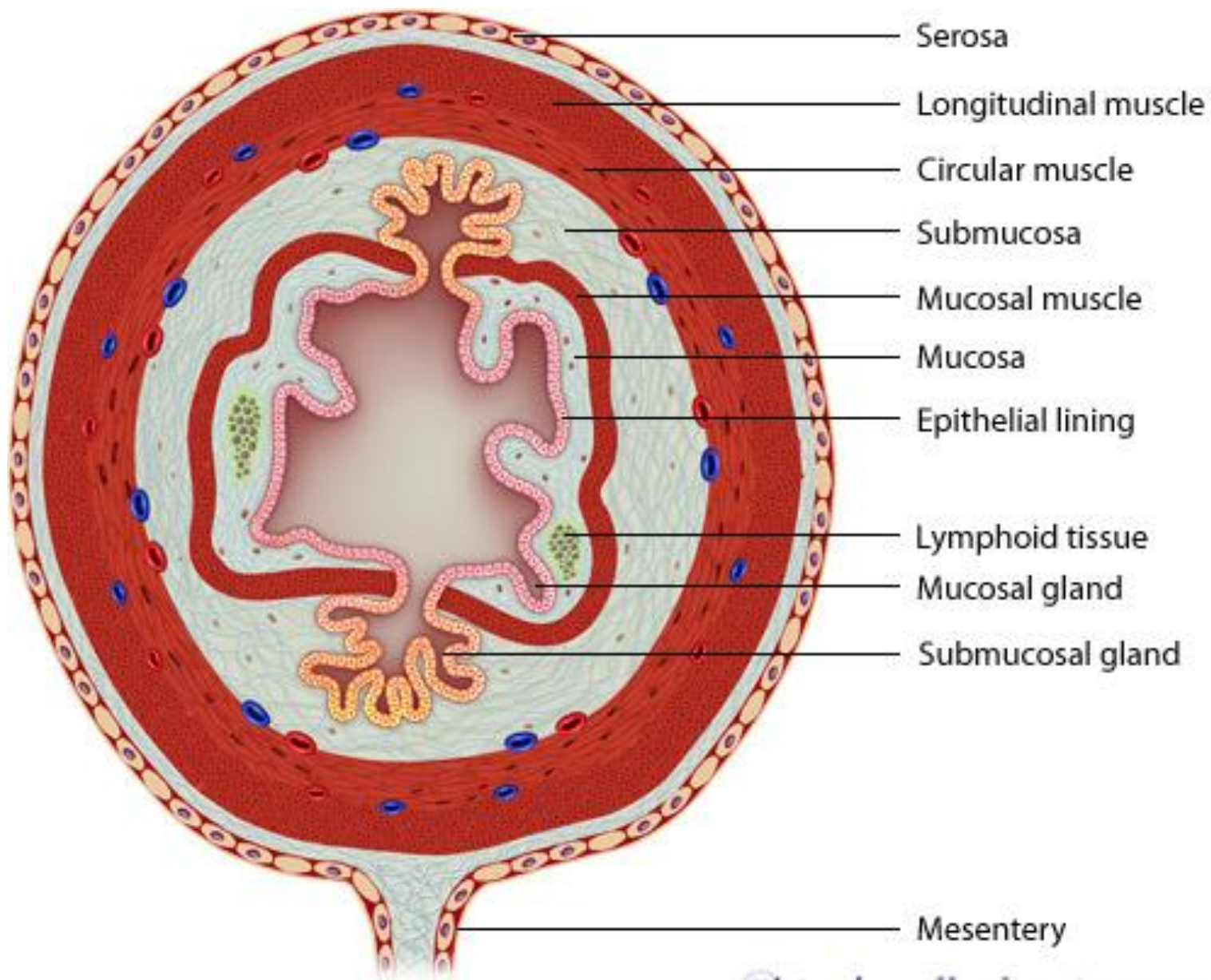
Serosa

Mesentery

Vein
Artery
Lymph vessel

Lumen





The main functions of the digestive tract's lining are to:

- ▶ Provide a selectively permeable barrier between the contents of the tract and the tissues of the body,
- ▶ Facilitate the transport and digestion of food,
- ▶ Promote the absorption of the products of this digestion,
- ▶ Produce hormones that affect the activity of the digestive system,
- ▶ Produce mucus for lubrication and protection.



I. Mucosa (Inner Layer)

Three sub-layers

1. Lining epithelium
2. Lamina propria
3. Muscularis mucosae

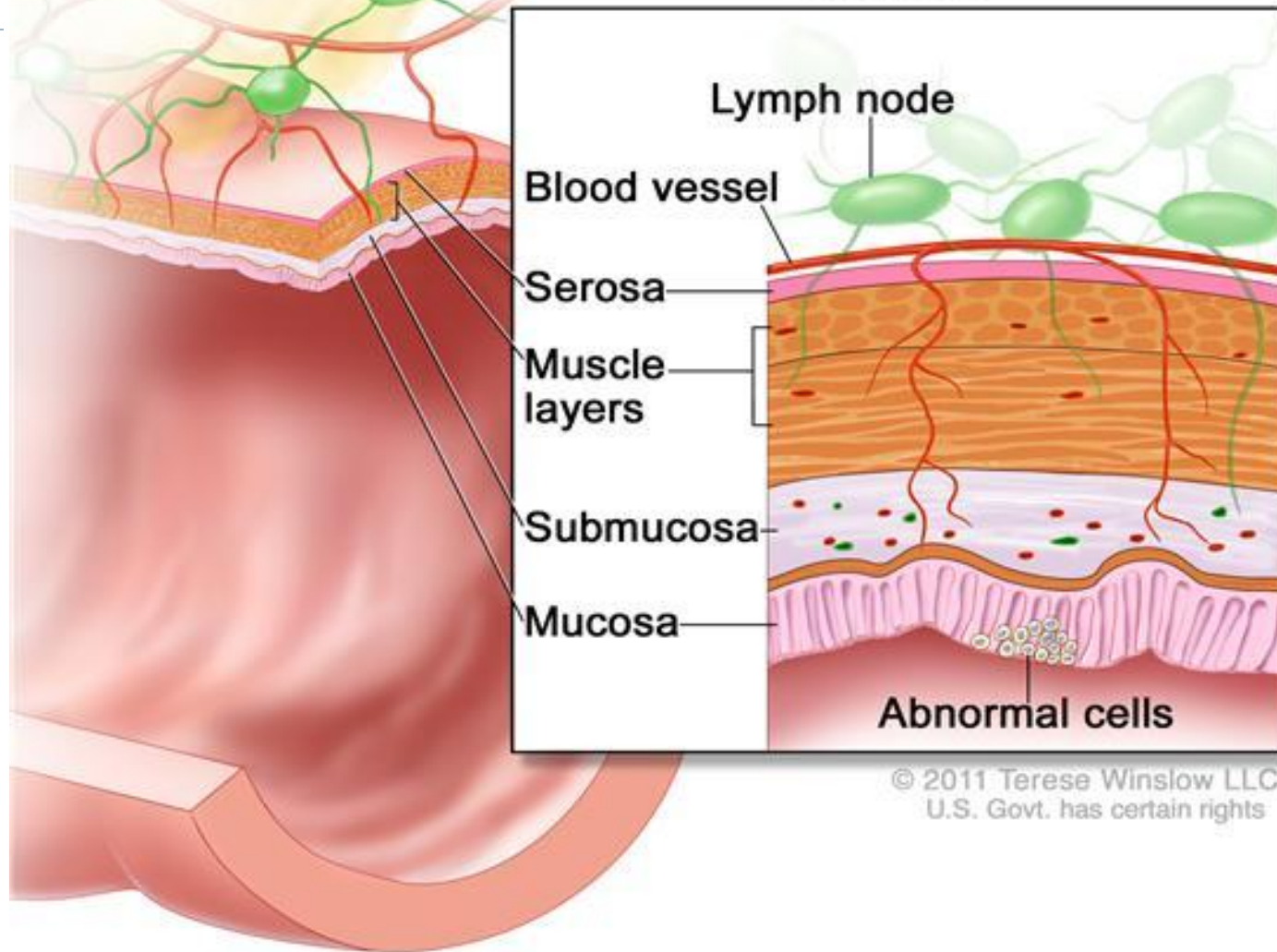


Mucosa con.

- ▶ **Epithelium: absorbs nutrients, secretes mucus**
 - ▶ Continuous with ducts and secretory cells of intrinsic digestive glands (those within the wall)
 - ▶ Extrinsic (accessory) glands: the larger ones such as liver and pancreas
- ▶ **Lamina propria**
 - ▶ Loose connective tissue with nourishing and absorbing capillaries
 - ▶ Contains most of mucosa-associated lymphoid tissue (MALT)
- ▶ **Muscularis mucosae**
 - ▶ Thin layer of muscle producing only local movements



Stage 0



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2. Submucosa

- ▶ Dense Connective tissue containing major blood and lymphatic vessels
- ▶ Submucosal nerves plexus
- ▶ Contain Glands and lymphoid tissue
- ▶ Contain many elastic fibers so gut can regain shape after food passes



3. Muscularis externa

Two layers of smooth muscle responsible for peristalsis and segmentation

- ▶ Inner circular layer (circumferential)
 - ▶ Squeezes
 - ▶ In some places forms sphincters (act as valves)
- ▶ Outer longitudinal layer: shortens gut
- ▶ In between lies Myenteric nerve plexus, blood and lymph vessels



4. Serosa

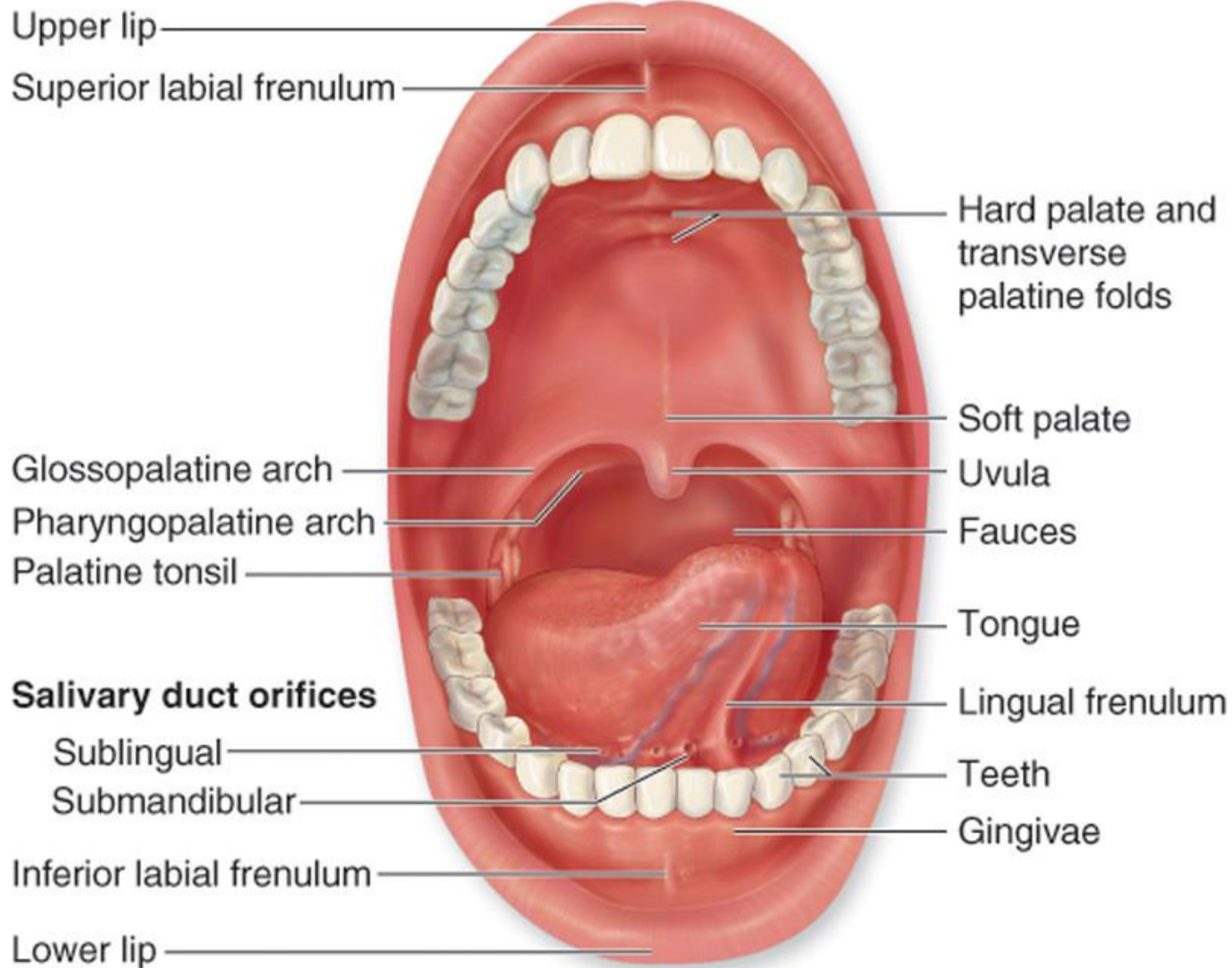
- ▶ Simple squamous epithelium (mesothelium)
 - ▶ Thin layer of loose connective tissue underneath rich in blood and lymph vessels and adipose tissue.
- ▶ Exceptions:
 - ▶ Parts not in peritoneal cavity have thick adventitia, lack serosa
 - ▶ Some have both, e.g. retroperitoneal organs



Oral Cavity

- ▶ Stratified Squamous epithelium
 - ▶ Keratinized layer (gingiva)
 - ▶ Nonkeratinized layer (soft palate, lips, cheeks and the floor of the mouth)





(a)

Tongue

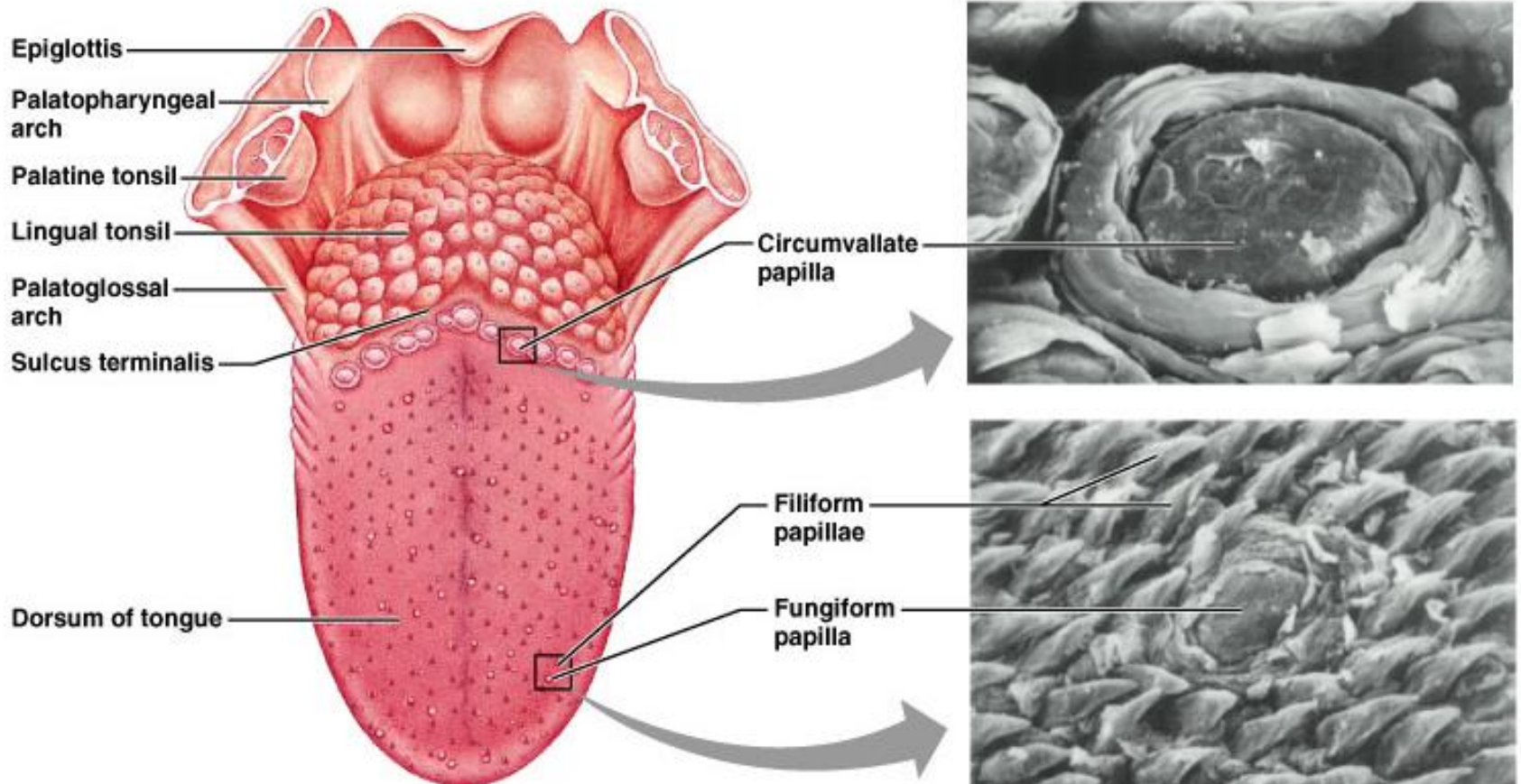
- ▶ Striated muscles covered by mucous membrane
 - ▶ Grip and reposition food
 - ▶ Forms “bolus” of food (lump)
 - ▶ Help in swallowing
 - ▶ Speech – help form some consonants
- ▶ Taste buds contained by circumvallate and fungiform papillae
- ▶ Lingual tonsil – back of tongue



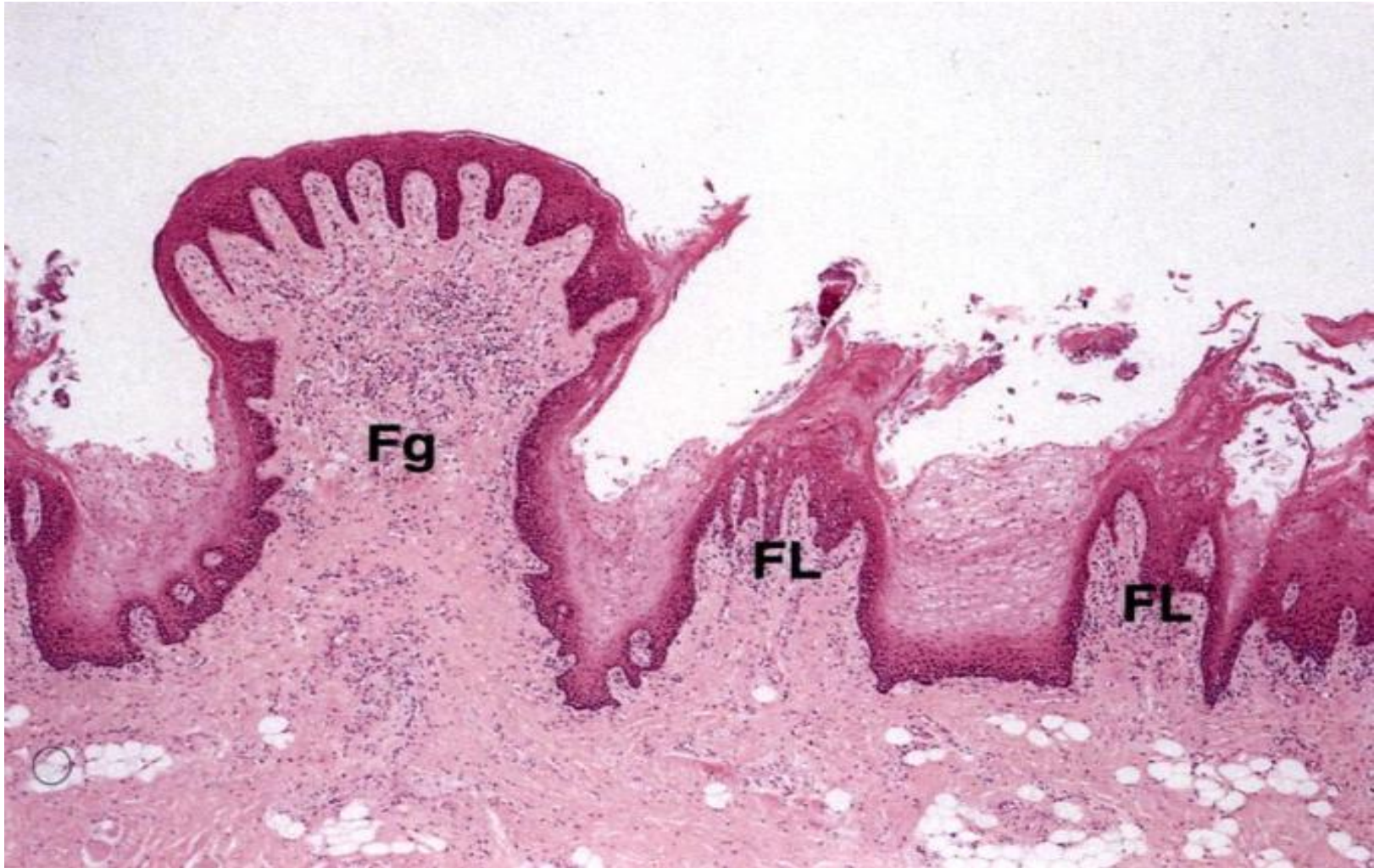
The papillae of tongue

- ▶ **FILIFORM** (sharp, often partly keratinized conical projections; most numerous; lacks taste buds)
- ▶ **FUNGIFORM** (resemble mushrooms; occur singly and scattered; each papilla with taste buds)
- ▶ **FOLIATE** (poorly-developed in humans; occur in rows separated by furrows into which serous glands drain; many taste buds)
- ▶ **CIRCUMVALLATE** (largest and least numerous (7-12 only; each papilla surrounded by a ring like ridge of mucosa separated by a circular furrow; furrow wall with many taste buds; also with serous (von Ebner's gland))





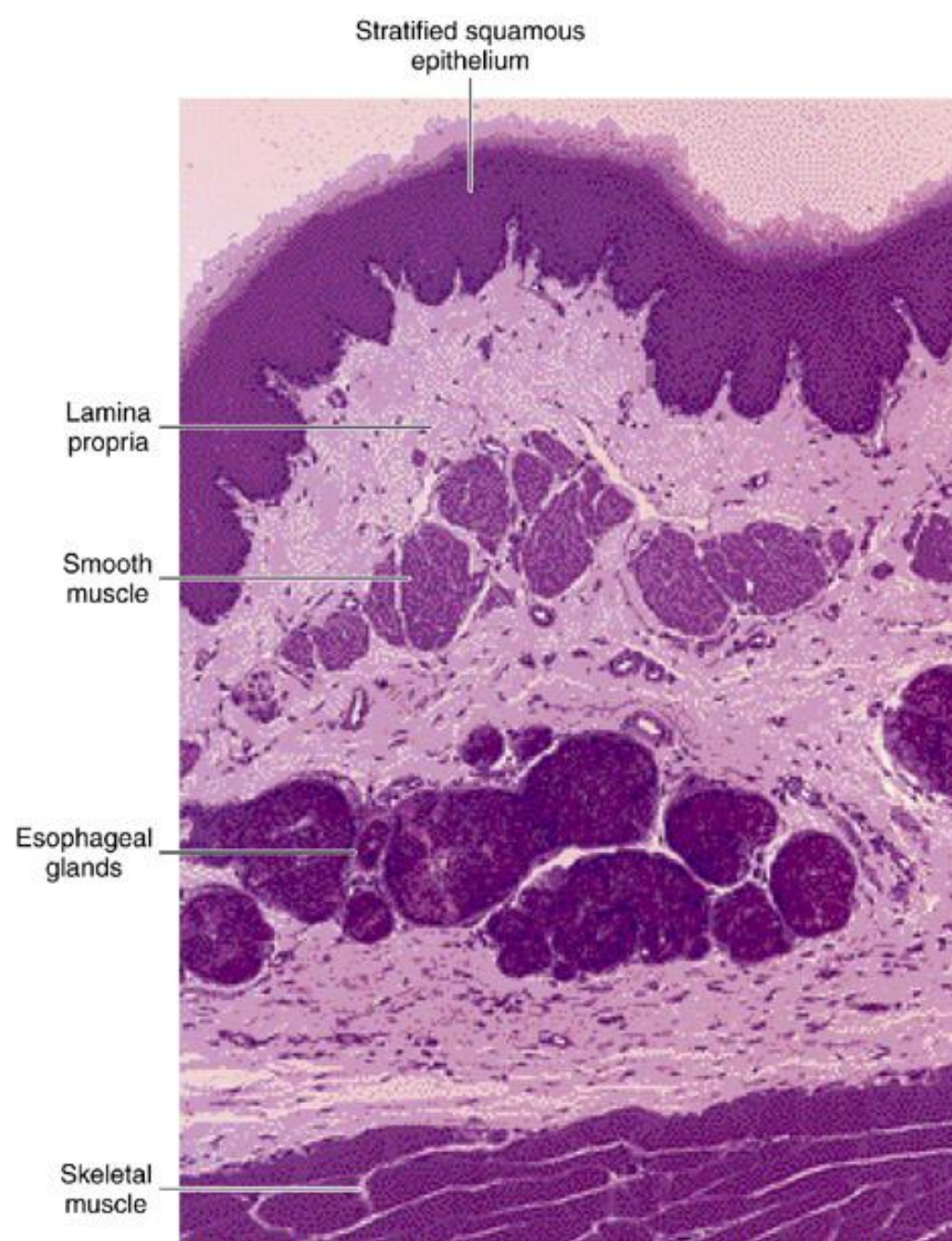
Filiform and Fungiform Papillae



Esophagus

- ▶ Muscular tube that transports food from mouth to stomach.
- ▶ Lining same as in much of the oral cavity - nonkeratinized stratified squamous epithelium.
- ▶ Layers same as general digestive tract as outlined above.





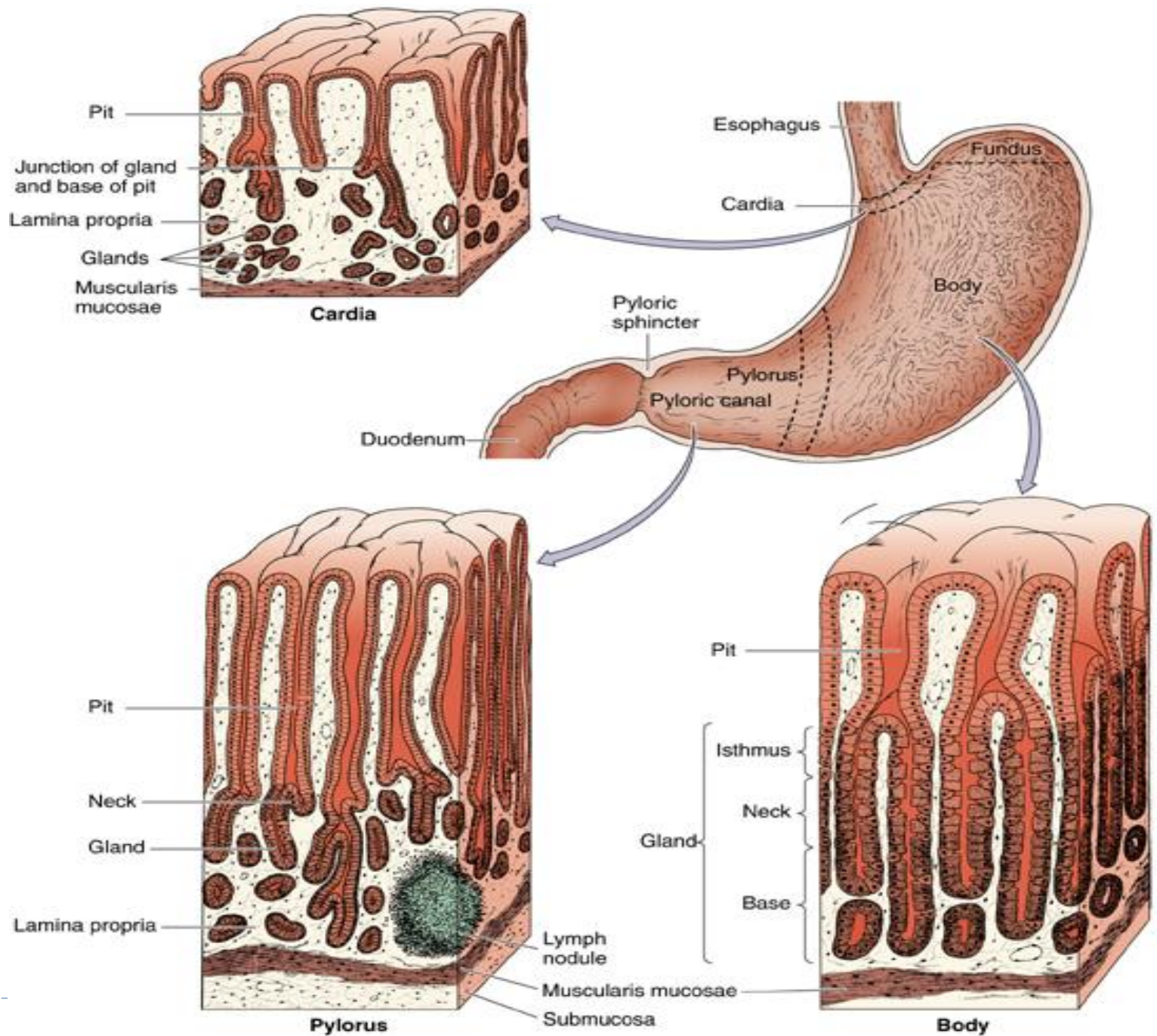
Section of the upper region of the esophagus. Mucous esophageal glands are in the submucosa; striated skeletal muscle is in the muscularis. PAS and PT stain. Low magnification.

Stomach

There are 3 major regions of the stomach, each with a different histological structure.

1. The cardia - cardiac stomach
2. The body (corpus) and fundus
3. The pylorus - pyloric stomach





Stomach

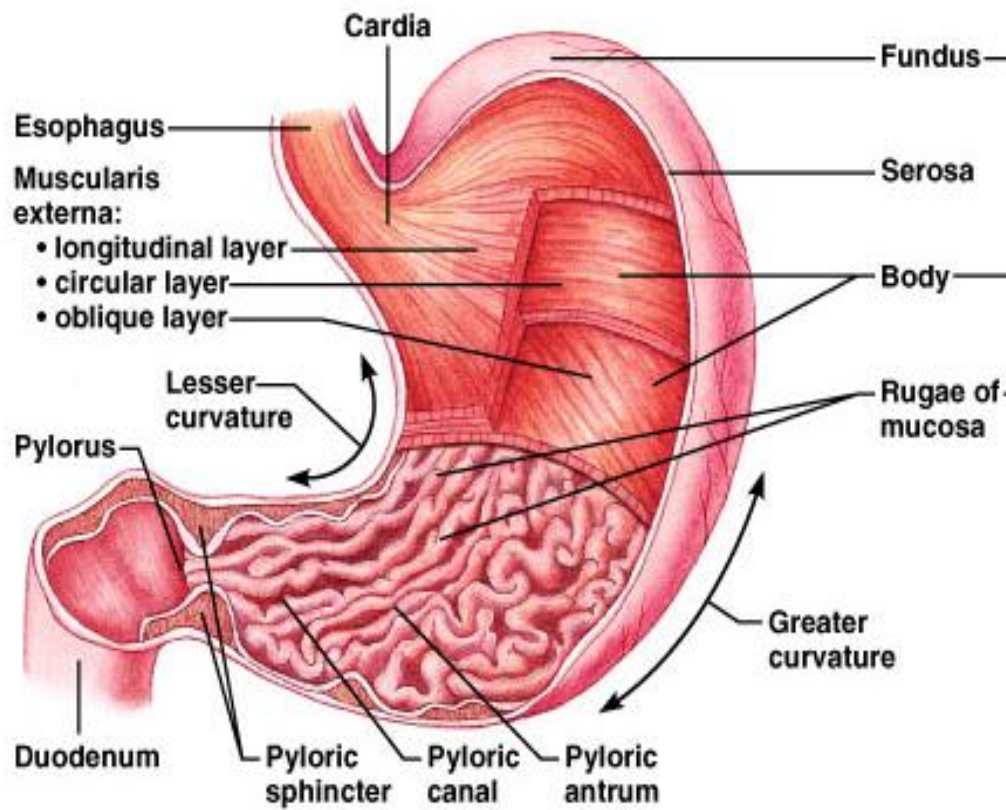
The inner surface of the stomach is thrown into folds called **rugae** that include both mucosa and submucosa. (see next slide)

1. The mucosa of the rugae is also folded. These folds form invaginations, such that the basal areas of the invaginations penetrate into mucosal lamina propria.
2. The upper portion of these invaginations in the mucosa are called the gastric pits - foveolae gastricae.

The epithelial lining of the the pits and general surface area of the stomach consists of simple columnar epithelium of mucous secreting cells in all parts of the stomach.

3. The gastric glands of the stomach connect to the bottoms of the gastric pits. The cellular structure of these glands is different in the different parts of the stomach.
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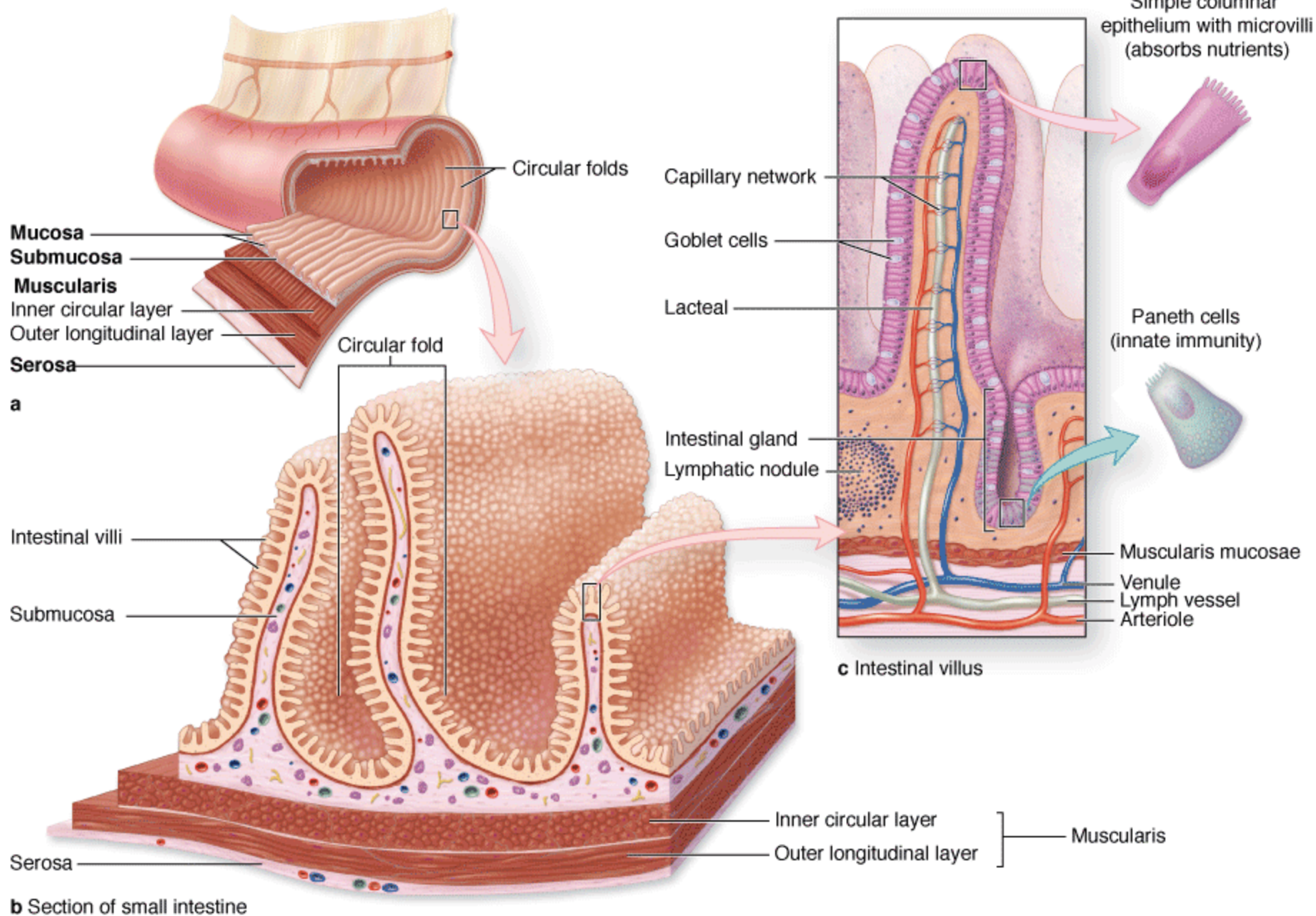
Small Intestine

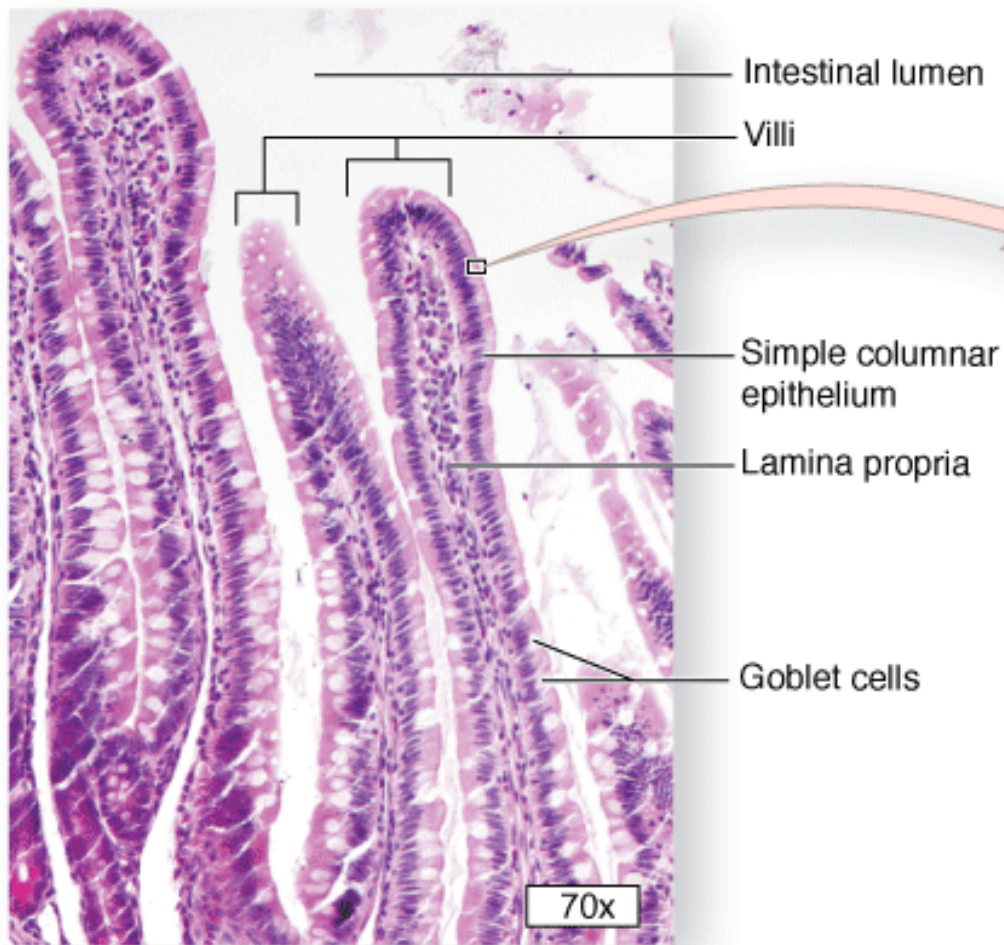
- ▶ Consists of 3 segments

1. Duodenum
2. Jejunum
3. Ileum

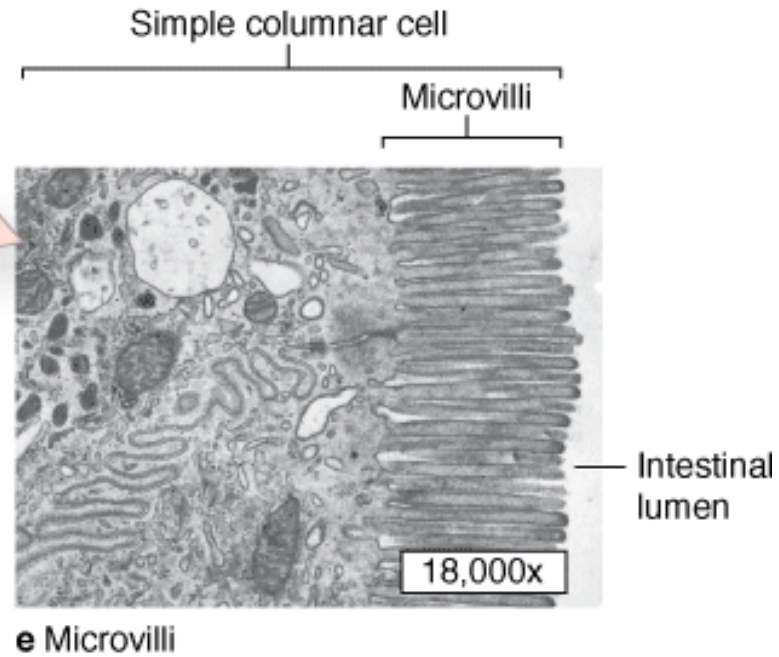
- ▶ Receives chyme from the stomach, bile from the liver, and digestive enzymes from.....
- ▶ Site of complete digestion and absorption.
- ▶ Undigested fraction is channeled to large intestine







d Intestinal villi



Source: Mescher AL: *Junqueira's Basic Histology: Text and Atlas, 12th Edition*: <http://www.accessmedicine.com>

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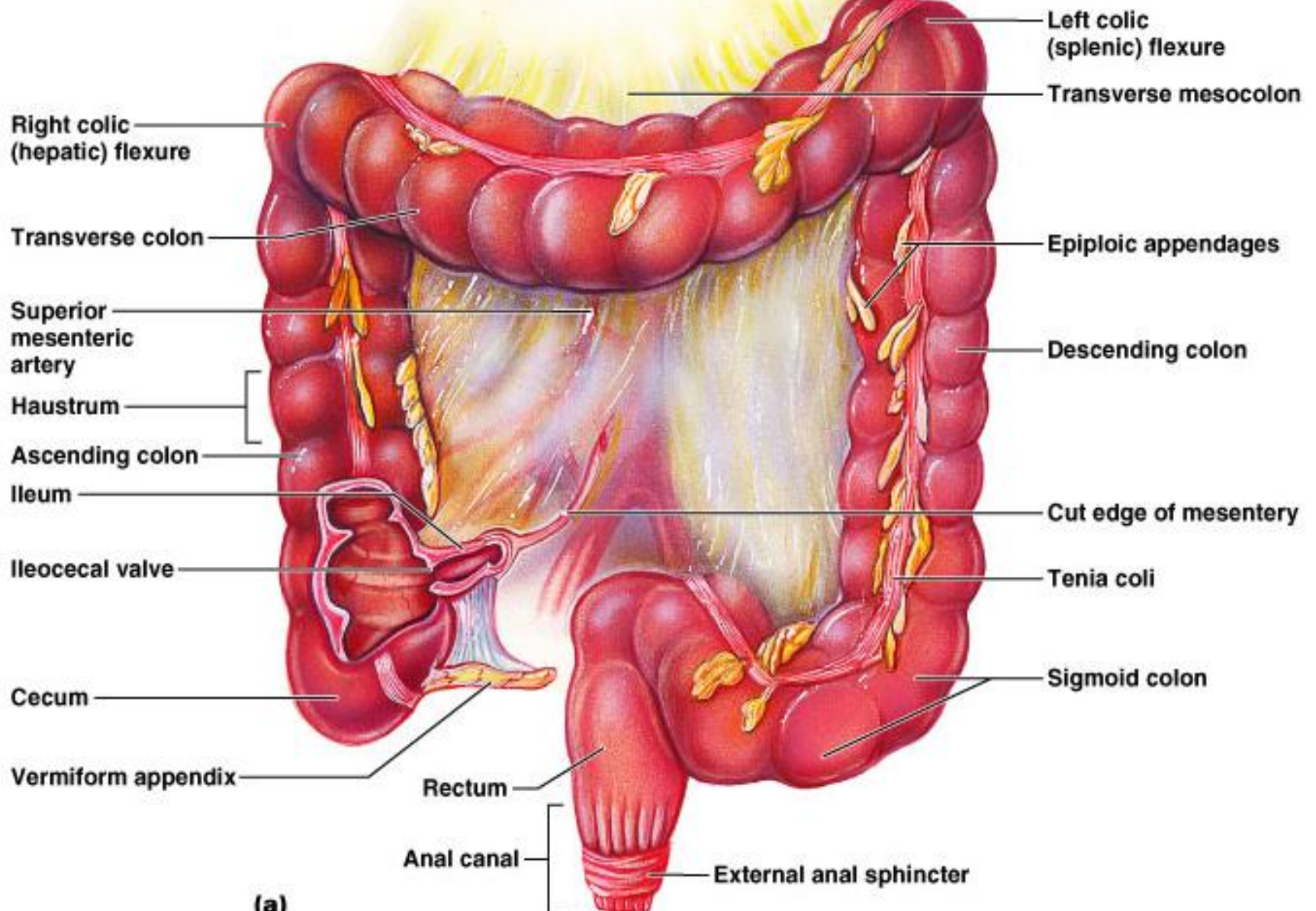
Large Intestine

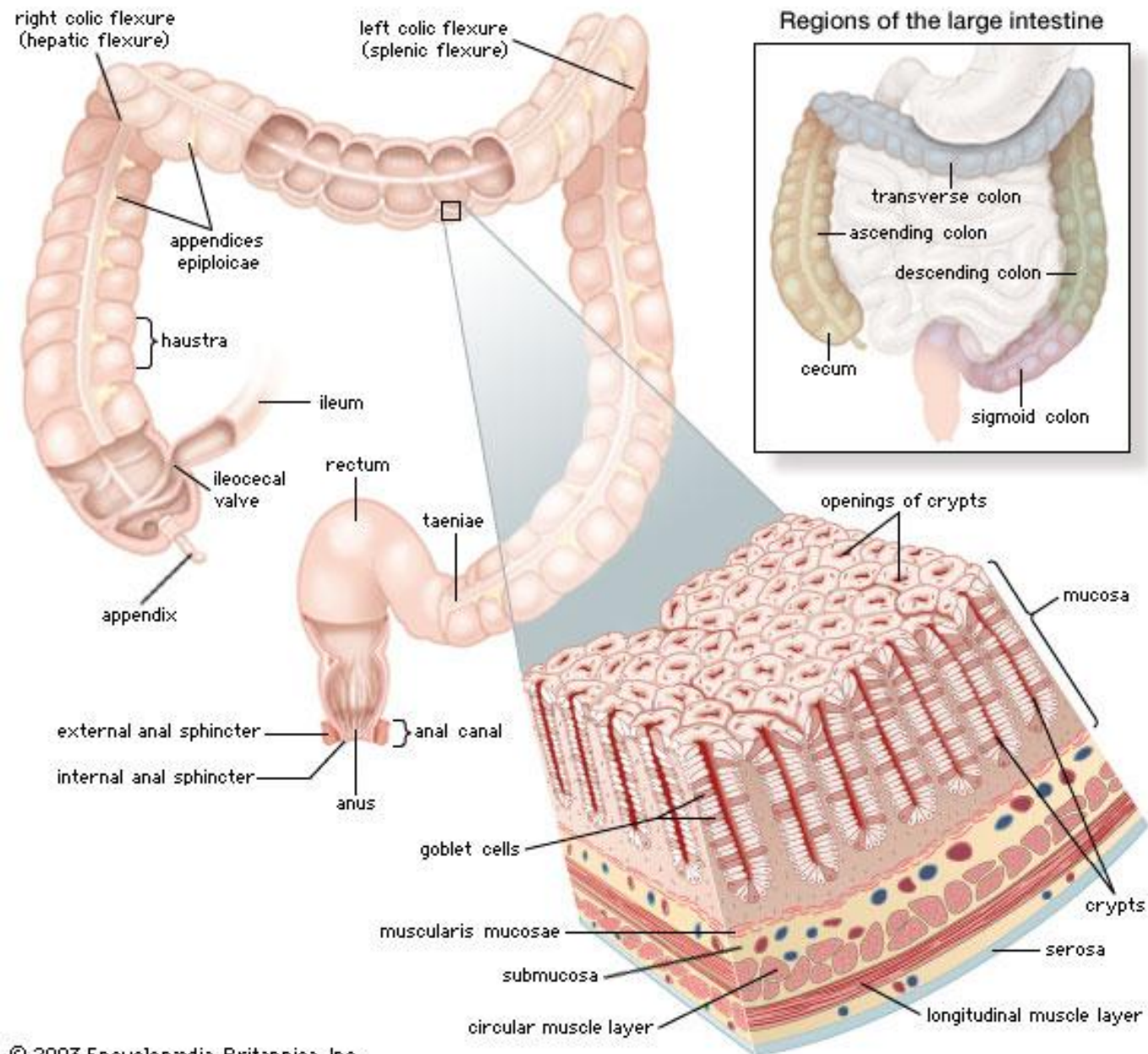
Consist of

1. Cecum
2. Appendix
3. Colon
4. Rectum
5. Anal canal

Main Function to absorb water and electrolytes



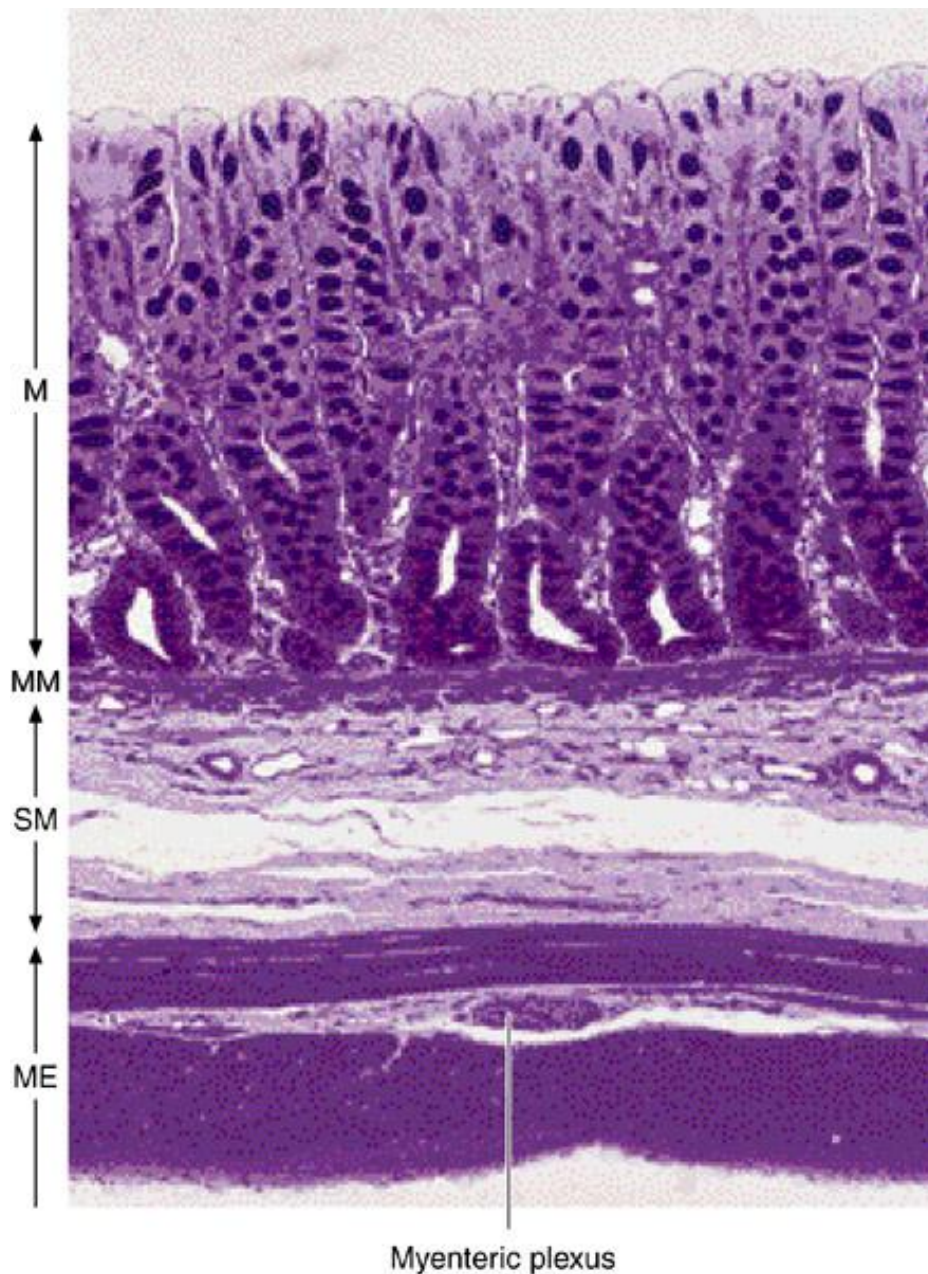




Large Intestine

- ▶ No villi
 - ▶ Fewer nutrients absorbed
- ▶ “Columnar cells” = absorptive cells
 - ▶ Take in water and electrolytes
- ▶ A lot of goblet cells for mucus
 - ▶ Lubricates stool
- ▶ More lymphoid tissue
 - ▶ A lot of bacteria in stool

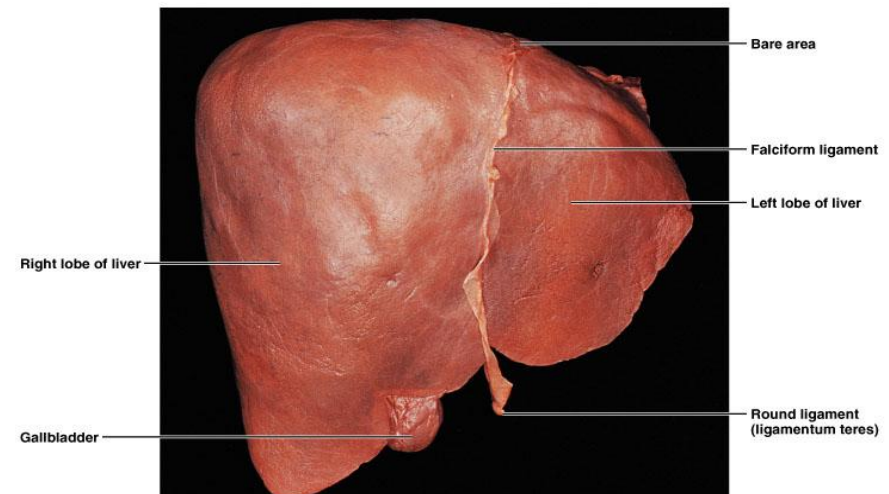
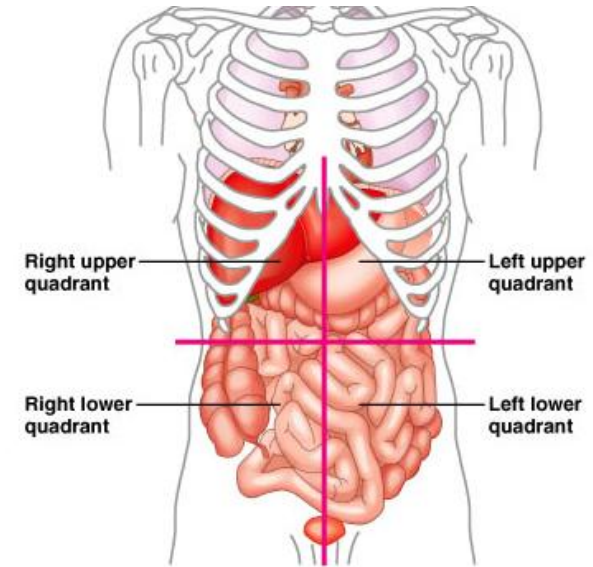




Section of large intestine
with its various layers.
Note the absence of villi.
M, mucosa; MM, muscularis
mucosae; SM, submucosa;
ME, muscularis externa. PT
stain. Low magnification.

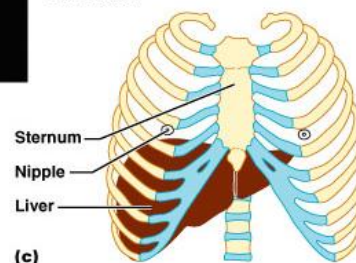
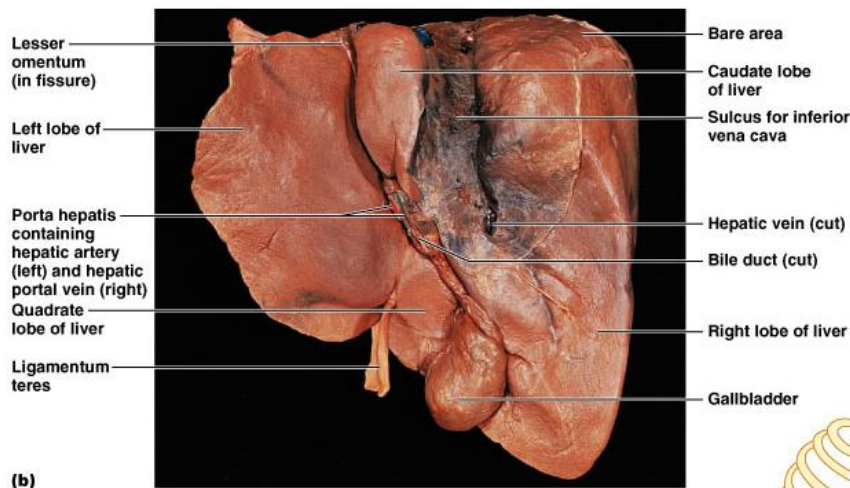
Liver structure

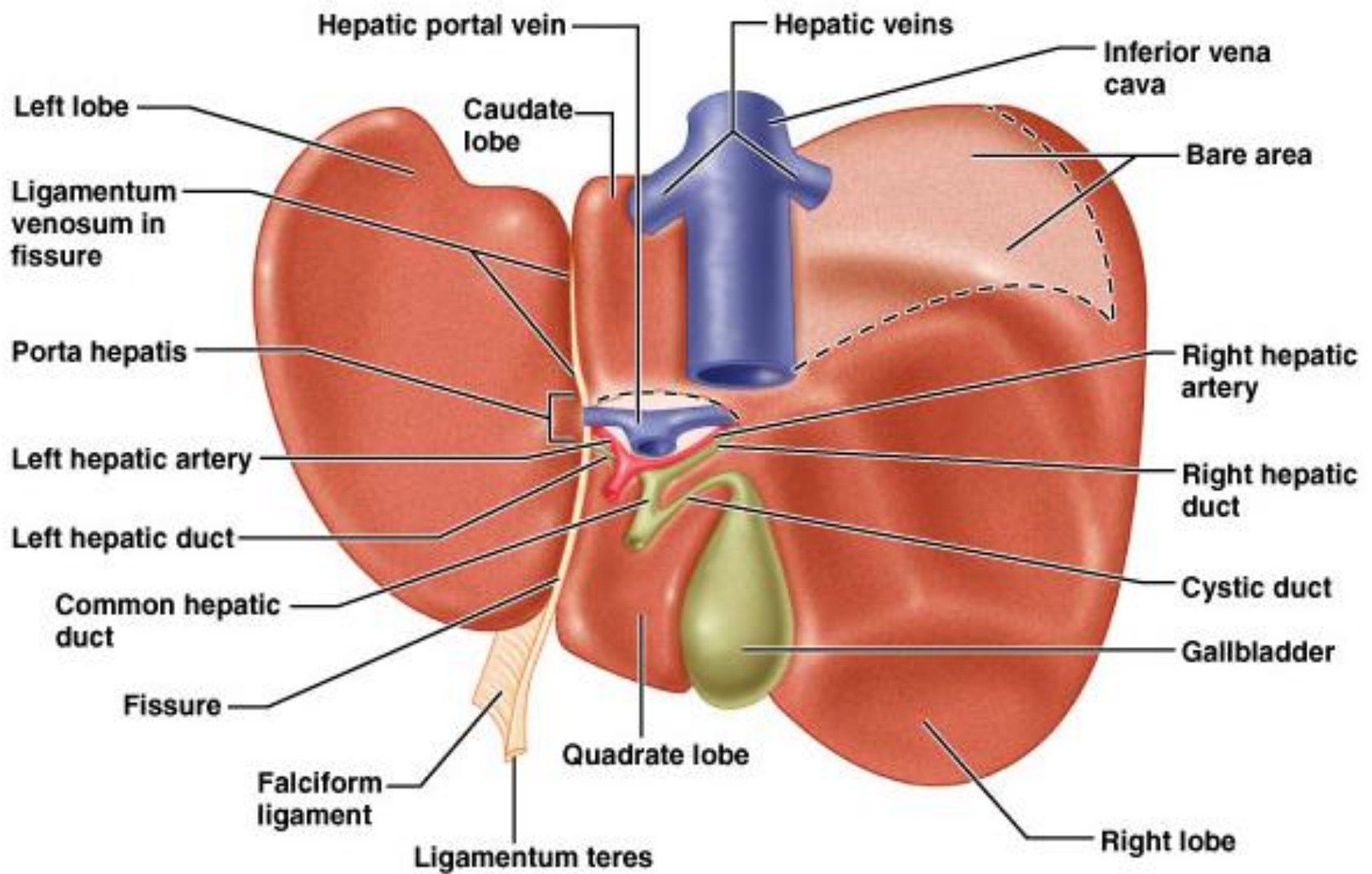
- ▶ Largest gland in the body (about 1.5 kg)
- ▶ Over 500 functions
- ▶ Inferior to diaphragm in RUQ and epigastric area protected by ribs
- ▶ R and L lobes
 - ▶ Plus 2 smaller lobes
- ▶ Falciform ligament
 - ▶ Mesentery binding liver to anterior abdominal wall
- ▶ 2 surfaces
 - ▶ Diaphragmatic
 - ▶ Visceral
- ▶ Covered by peritoneum
 - ▶ Except “bare area” fused to diaphragm



Liver structure con

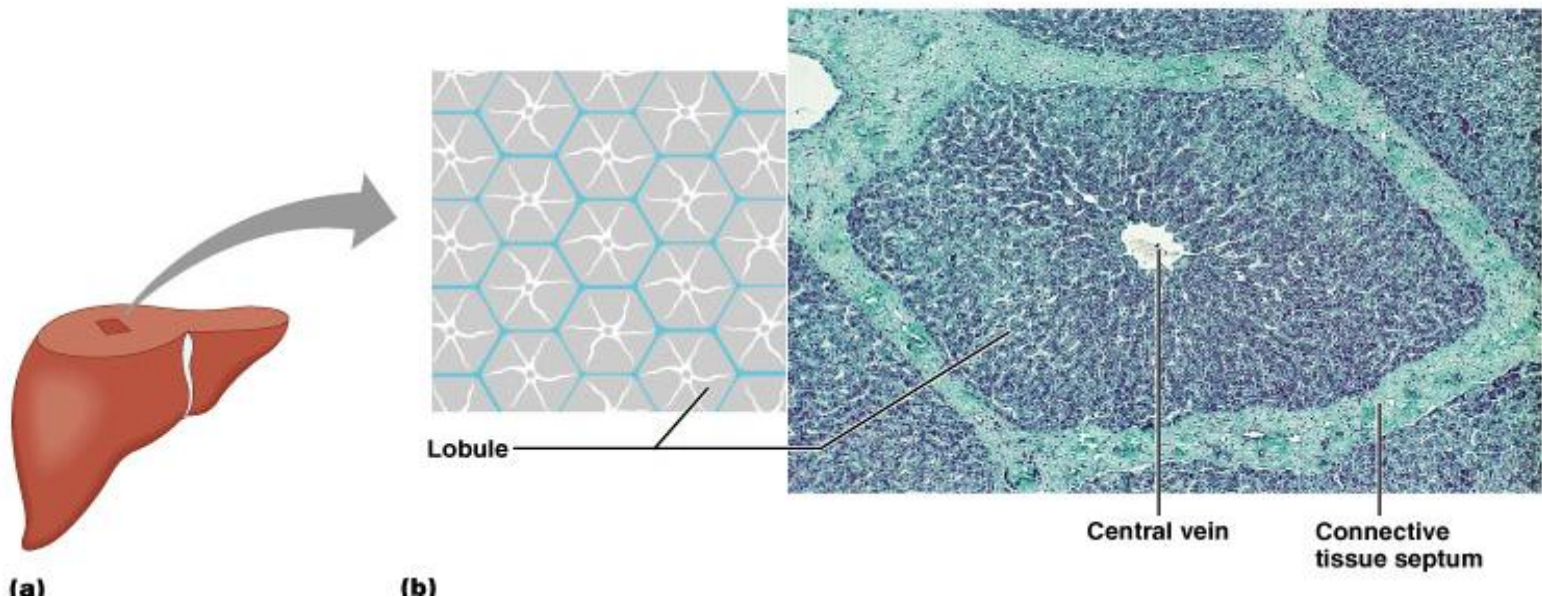
- ▶ *Fissure* on visceral surface
- ▶ *Porta hepatis*: major vessels and nerves
 - ▶ enter and leave
 - ▶ *Ligamentum teres*: remnant of umbilical vein in fetus, attaches to navel





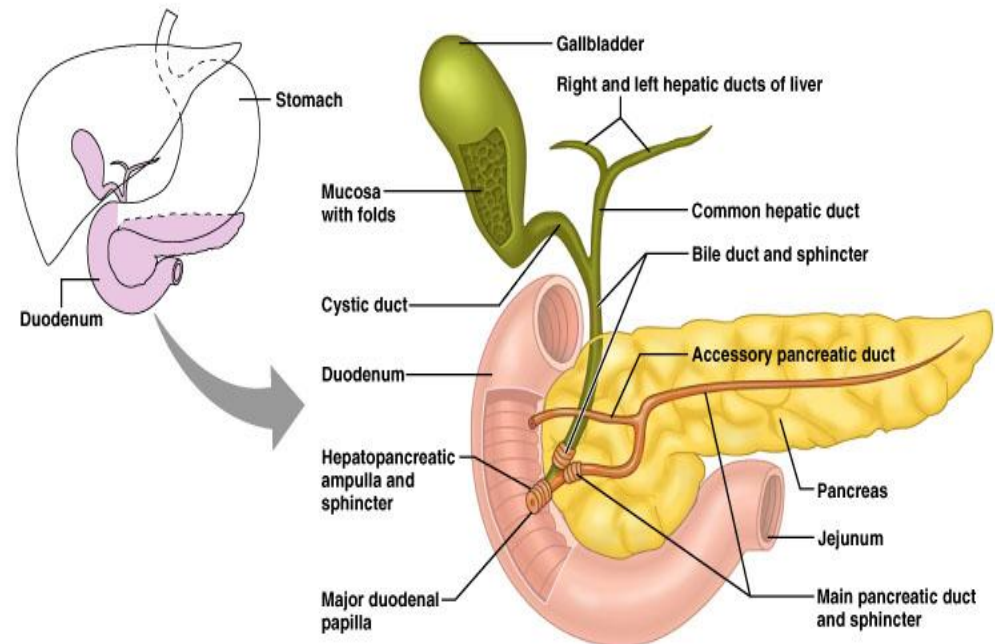
Liver Histology

- ▶ Liver lobules (about one million of them)
 - ▶ Hexagonal solid made of sheets of **hepatocytes** (liver cells) around a central vein
 - ▶ Corners of lobules have “**portal triads**”



Gallbladder

- Bile is produced in the liver and stored in the gallbladder then excreted into the duodenum when needed (fatty meal)
- If bile salts crystallize, gall stones are formed
- Intermittent pain: ball valve effect causing intermittent obstruction
- Or infection and a lot of pain, fever, vomiting, etc.



Extra reading

- ▶ <http://instruction.cvhs.okstate.edu/histology/HistologyReference/hrd1.htm>
- ▶ <http://www.youtube.com/watch?v=HA8iL7hs5YY>

