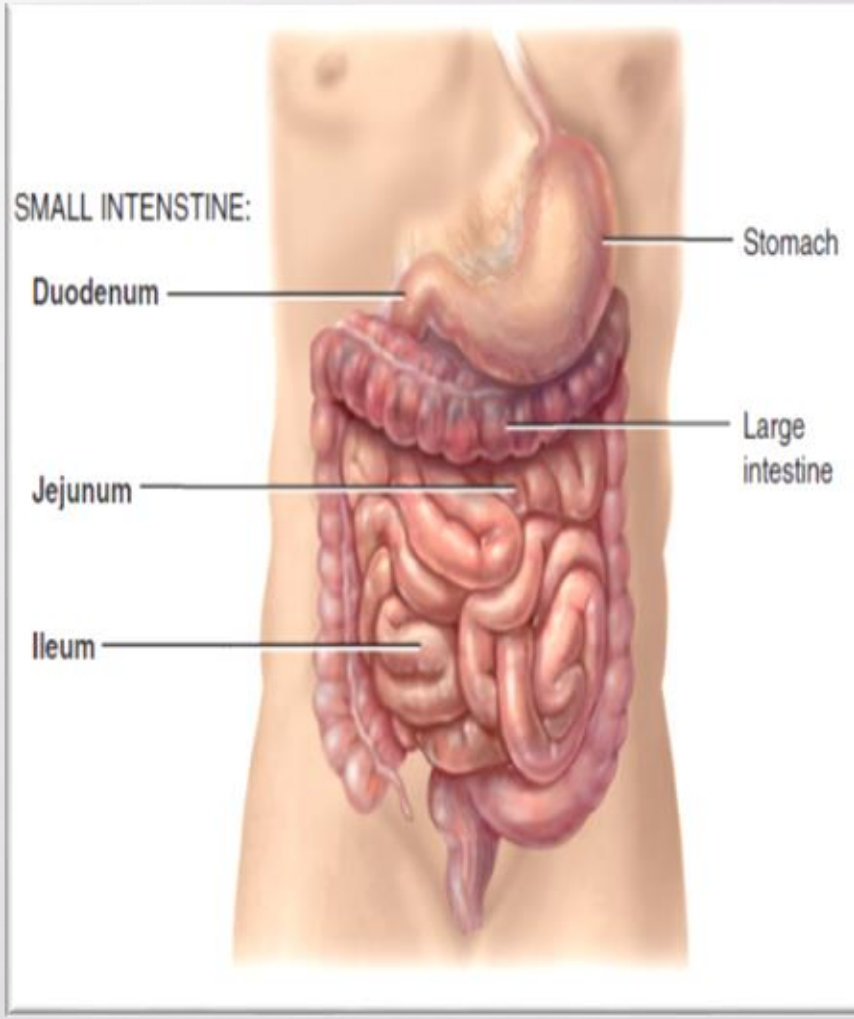
Gastrointestinal Tract (GIT)

Small Intestine

- Most digestion and absorption of nutrients occur in **small intestine**.
- Its length alone provides a large surface area.
- Surface area is further increased by circular folds, villi, and microvilli.
- Begins at the pyloric sphincter of the stomach, opens into the large intestine.
- It is 2.5 cm in diameter and 3 m long.

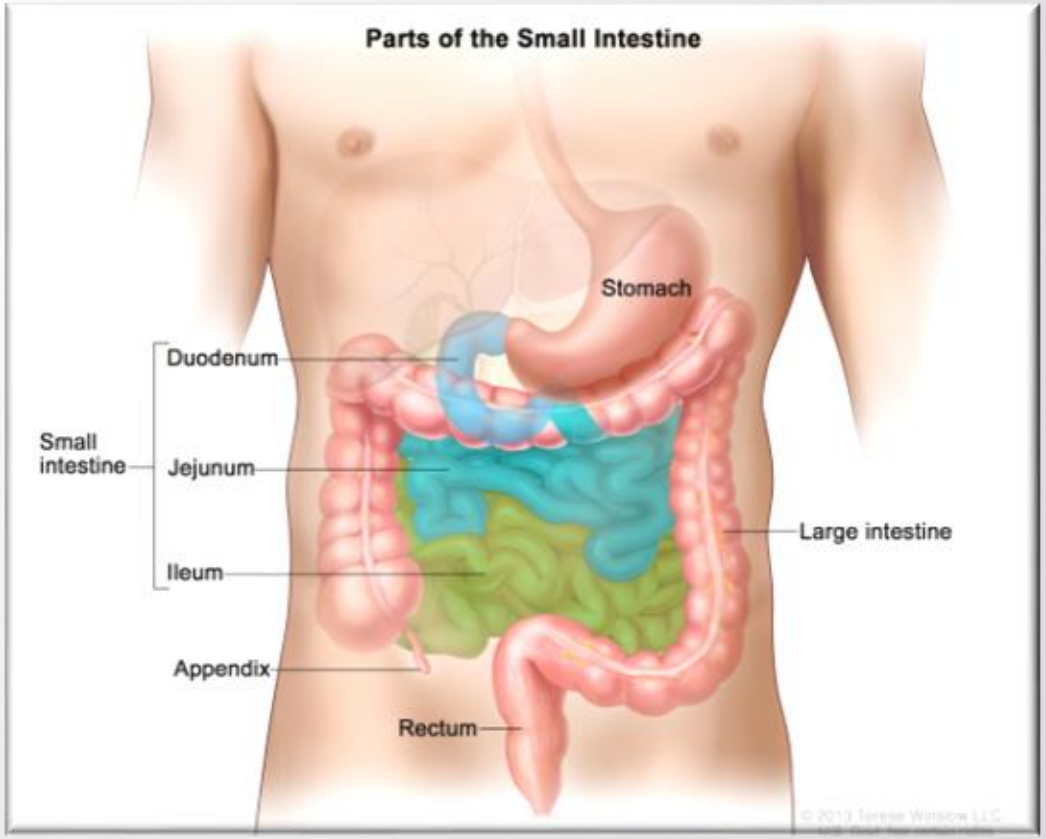


Anatomy Of The Small Intestine

READ ONLY

Divided into three regions:

- The first part is the **duodenum.**
- The shortest region.
- Retroperitoneal.
- Starts at the pyloric sphincter of the stomach.
- C-shaped tube that extends about 25 cm.

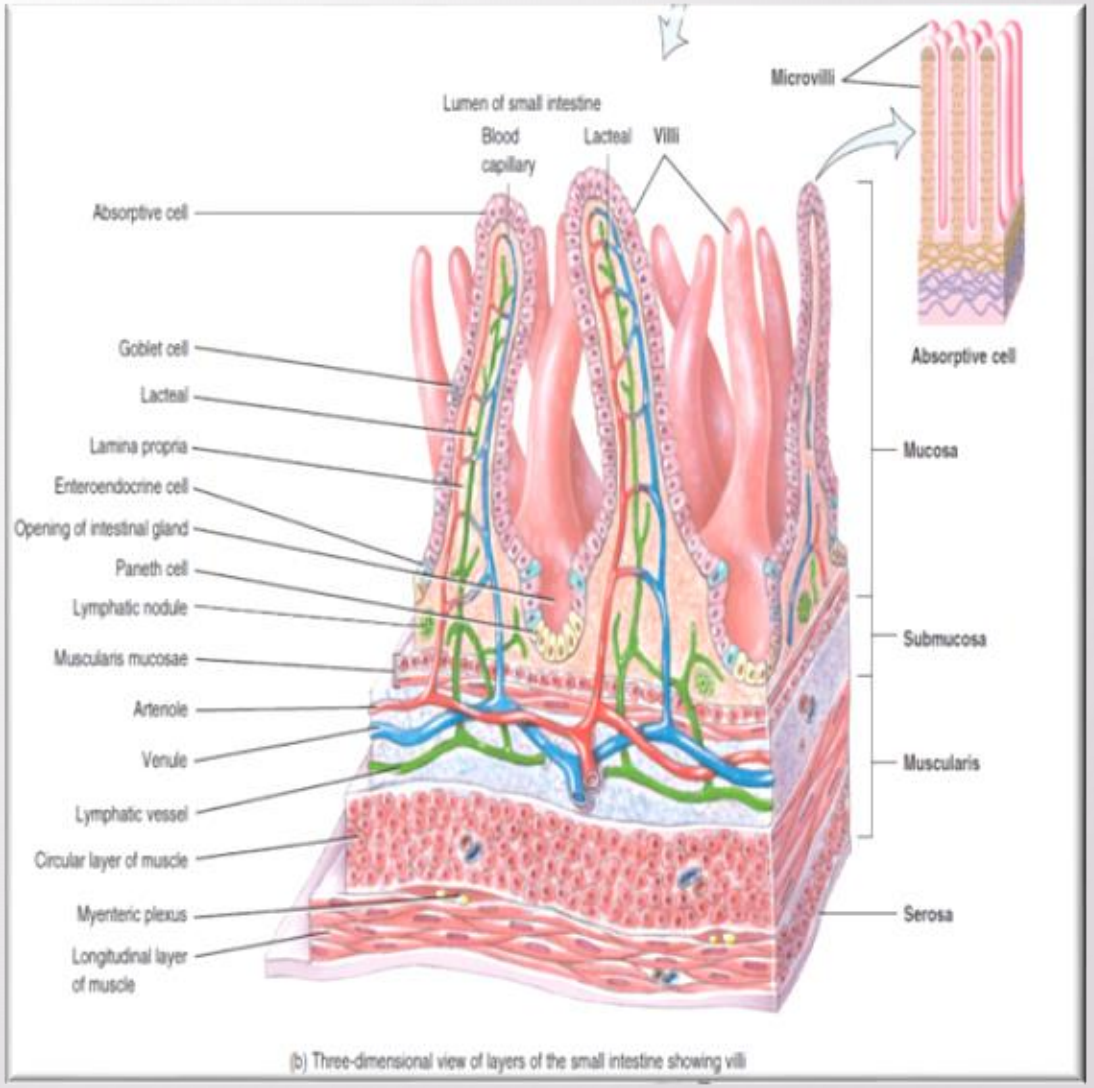


- The **jejunum:** 1 m long and extends to the ileum.
- The **ileum:** about 2 m, joins the large intestine at a smooth muscle sphincter called the **ileocecal sphincter.**

Histology Of The Small Intestine

The small intestine is composed of: mucosa, submucosa, muscularis, and serosa

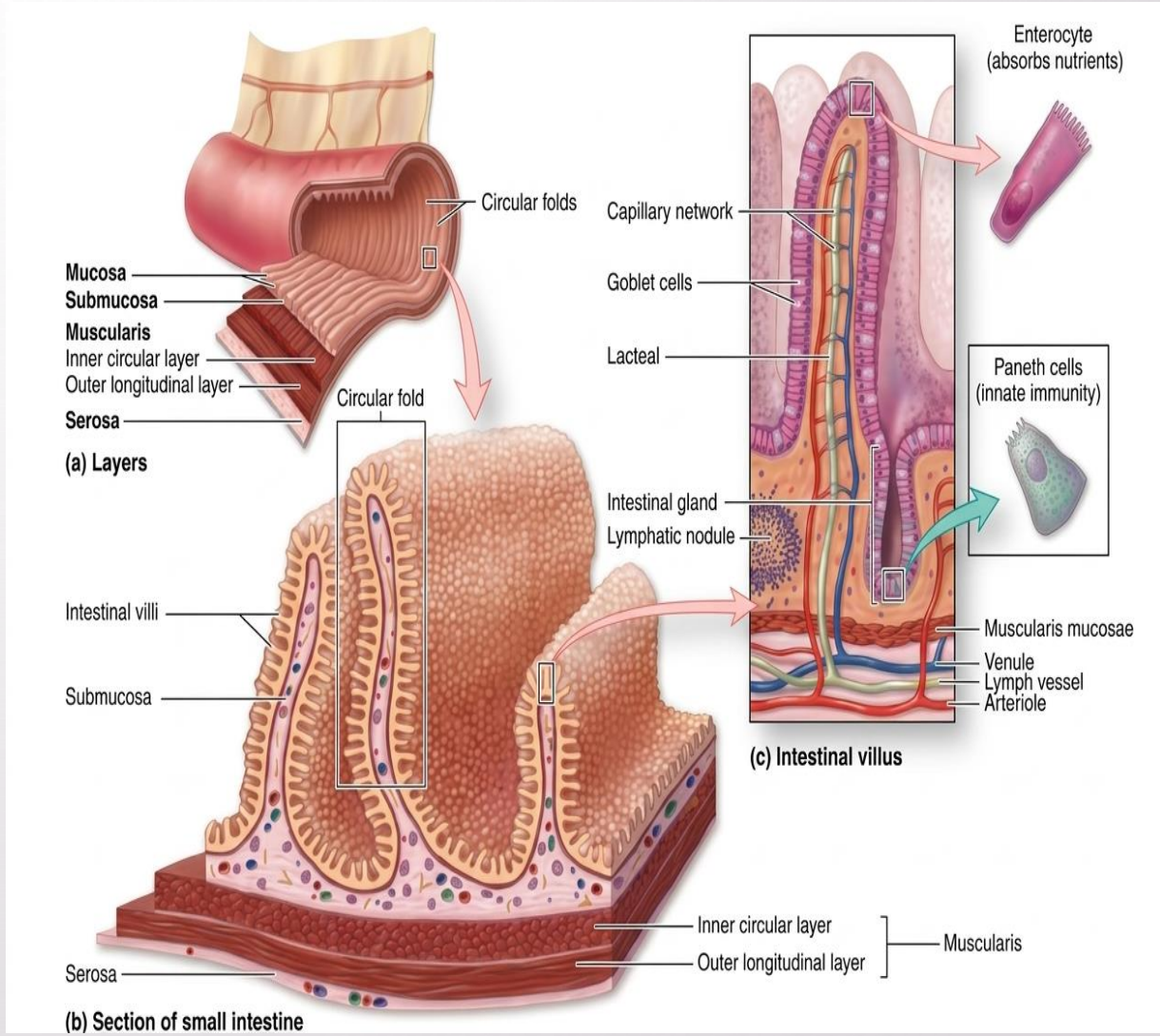
- The **mucosa:** epithelium, lamina propria, and muscularis mucosae.
- The epithelial layer: simple columnar epithelium----many types of cells.
- Shows permanent circular or semilunar folds (plicae circulares)---consisting of mucosa and submucosa---**best developed in the jejunum.** Seen in longitudinal section

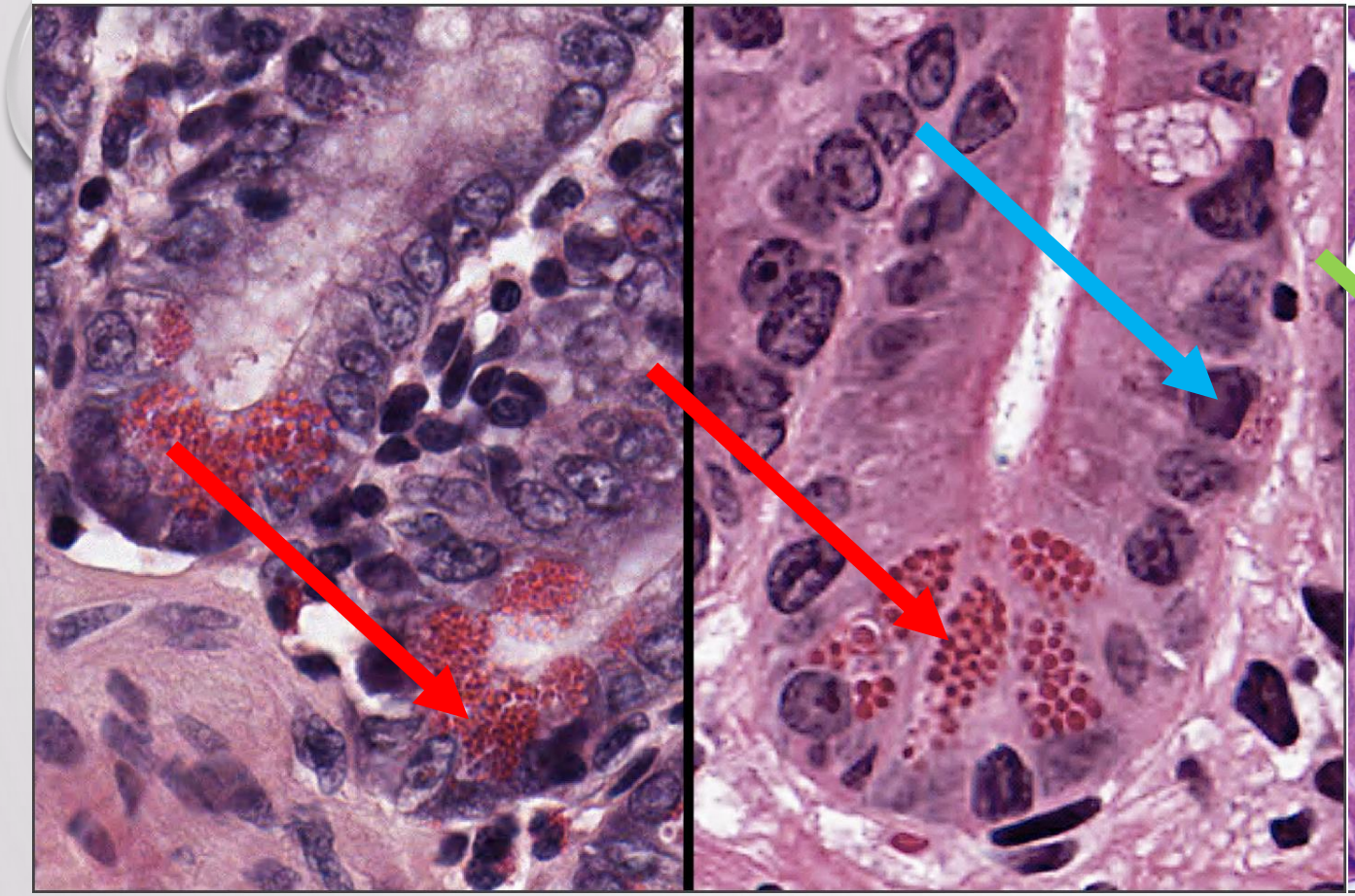


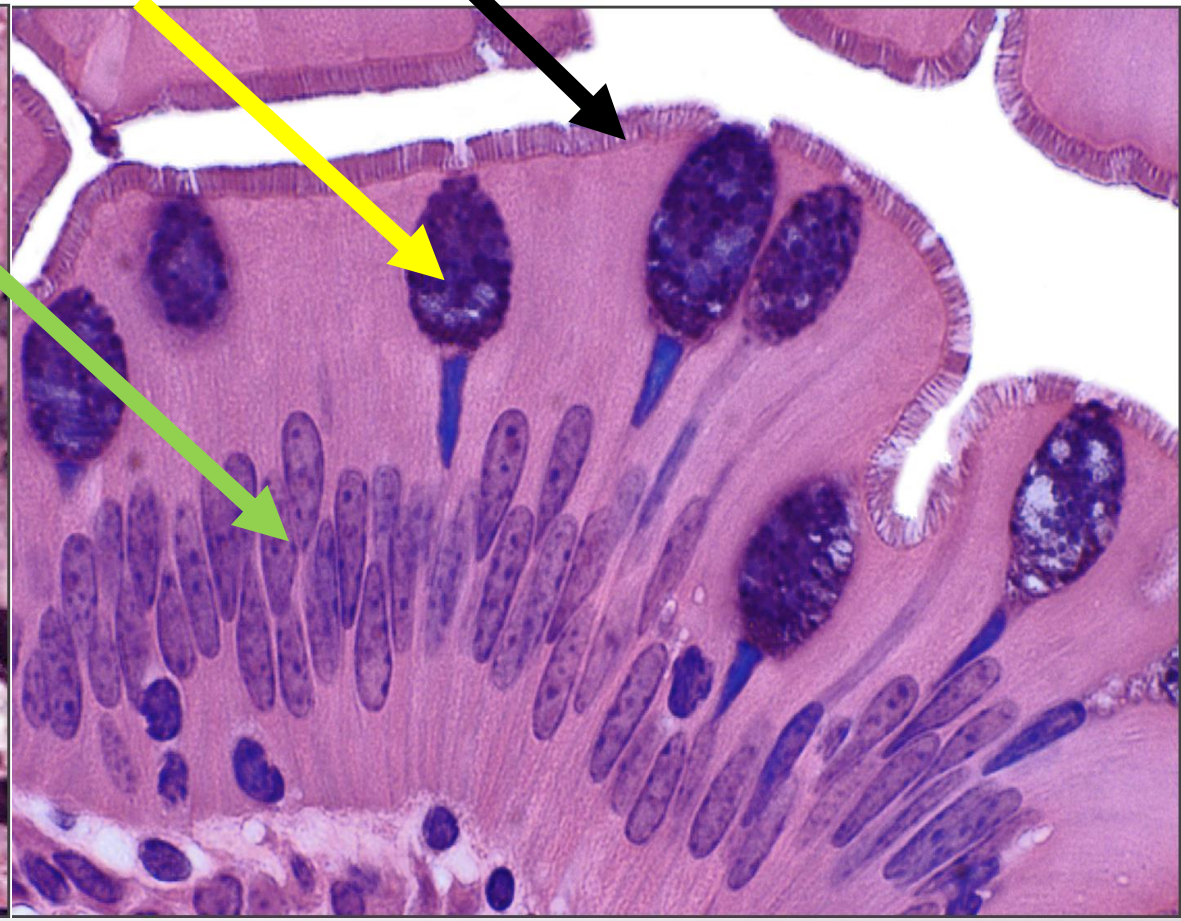
Histology Of The Small Intestine

- Villi: short (0.5-1.5 mm) mucosal outgrowths that project into the lumen through the entire length---covered by simple columnar epithelium of absorptive cells called **enterocytes**, with many interspersed **goblet** cells.
- Each villus has a core of loose CT and contains fibroblasts, smooth muscle, lymphocytes and plasma cells, fenestrated capillaries, and a central lymphatic called a **lacteal**.

- Between the villi are the openings of short tubular glands called intestinal glands or crypts (or crypts of lieberkühn) and the epithelium of each villus is continuous with that of the intervening glands





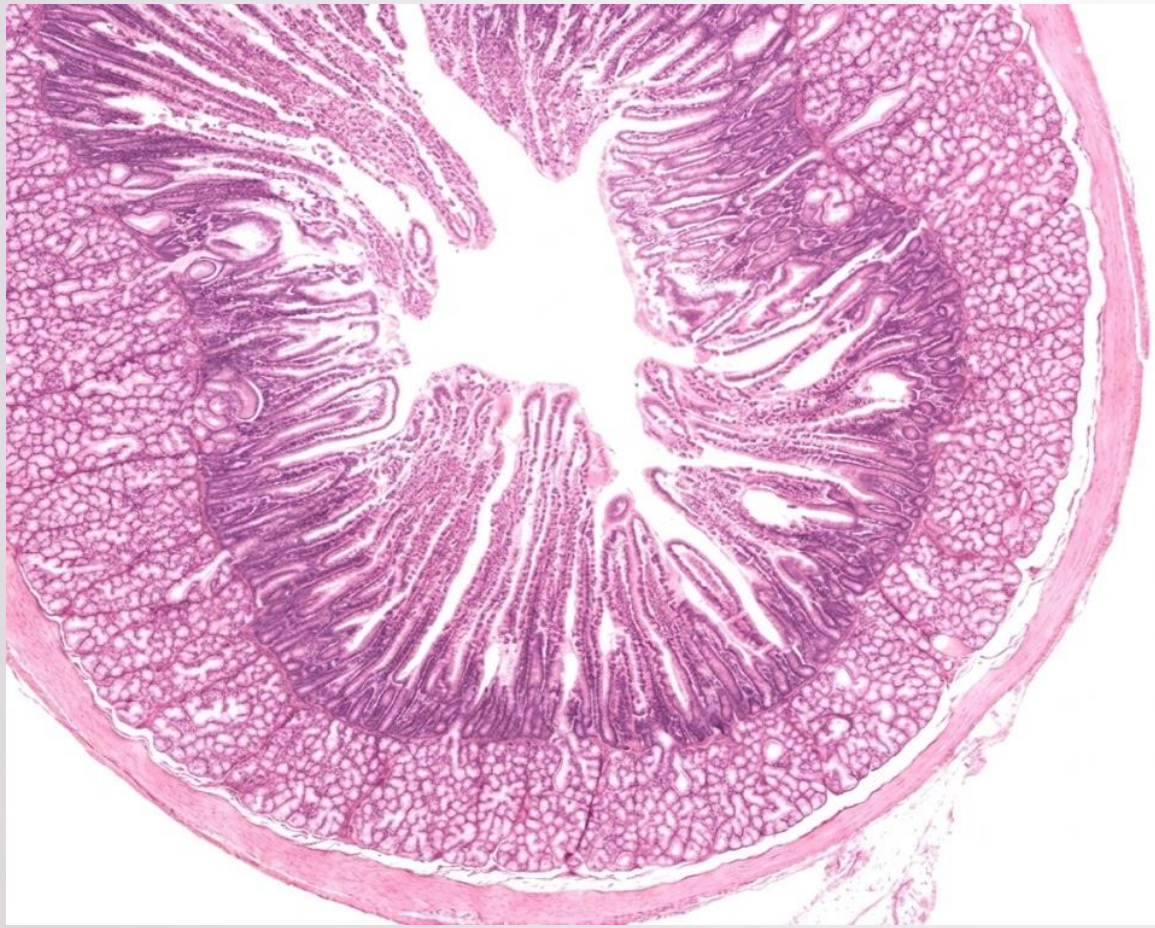


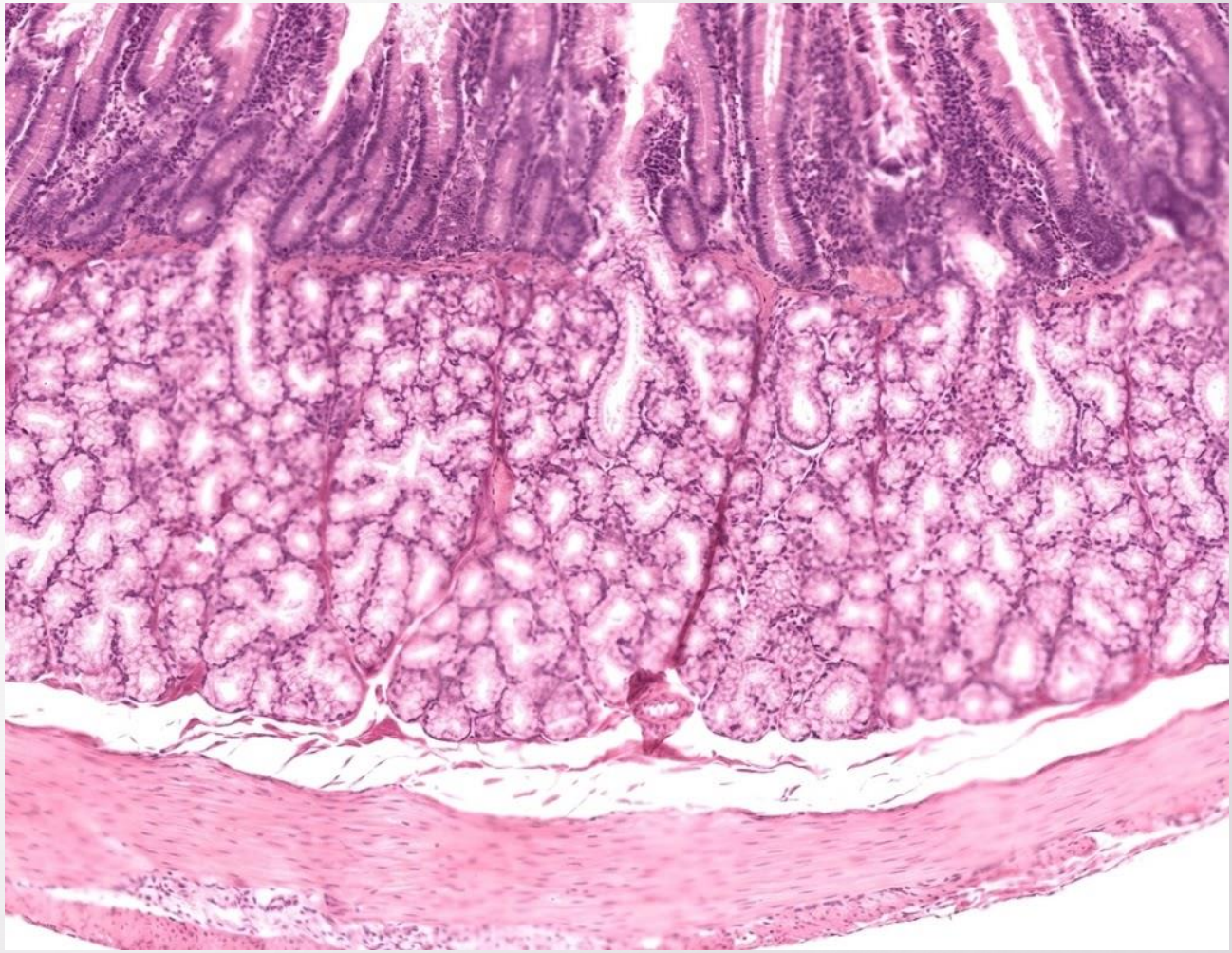
1. **Enterocytes (absorptive cells):** tall columnar cells-–apical end called brush border---densely packed microvilli covered by glycocalyx.
2. **Goblet cells:** secrete mucins---mucous.
3. **Paneth cells:** contains eosinophilic granules. Secrete lysozyme (bactericidal enzyme), defensins phospholipase A---break down membranes and cell walls and. Regulating the microbial population in the small intestine.

4. **Enteroendocrine** cells: mentioned earlier.

5. **M (microfold) cells** are specialized epithelial cells in the mucosa of the ileum overlying the lymphoid follicles of Peyer patches, selectively endocytose antigens and transport them to the underlying lymphocytes and dendritic cells.

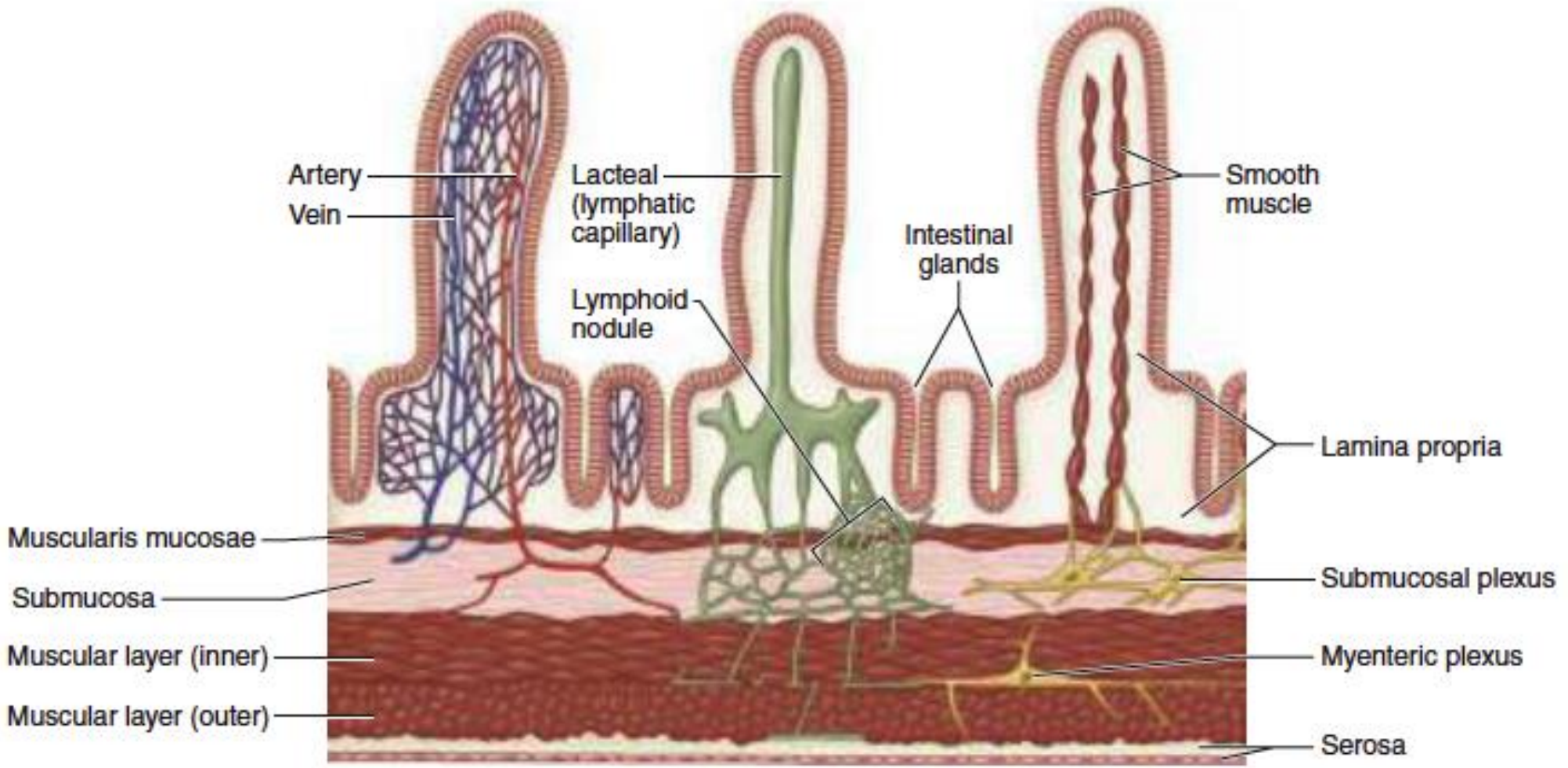
Small Intestine





- The lamina propria: abundance of mucosa-associated lymphoid tissue (MALT).
- **Submucosa:** of the duodenum contains **duodenal glands (***brunner's glands*).. Alkaline mucus---neutralize gastric acid---pancreatic enzymes.
- Ilium: MALT (Peyers patches) present in LP and submucosa.
- **Muscularis**: well-developed with myenteric (Auerbach) nerve plexus---peristaltic movement.
- Covered by **serosa**.

FIGURE **15–28** **Microvasculature, lymphatics, and muscle in villi.**

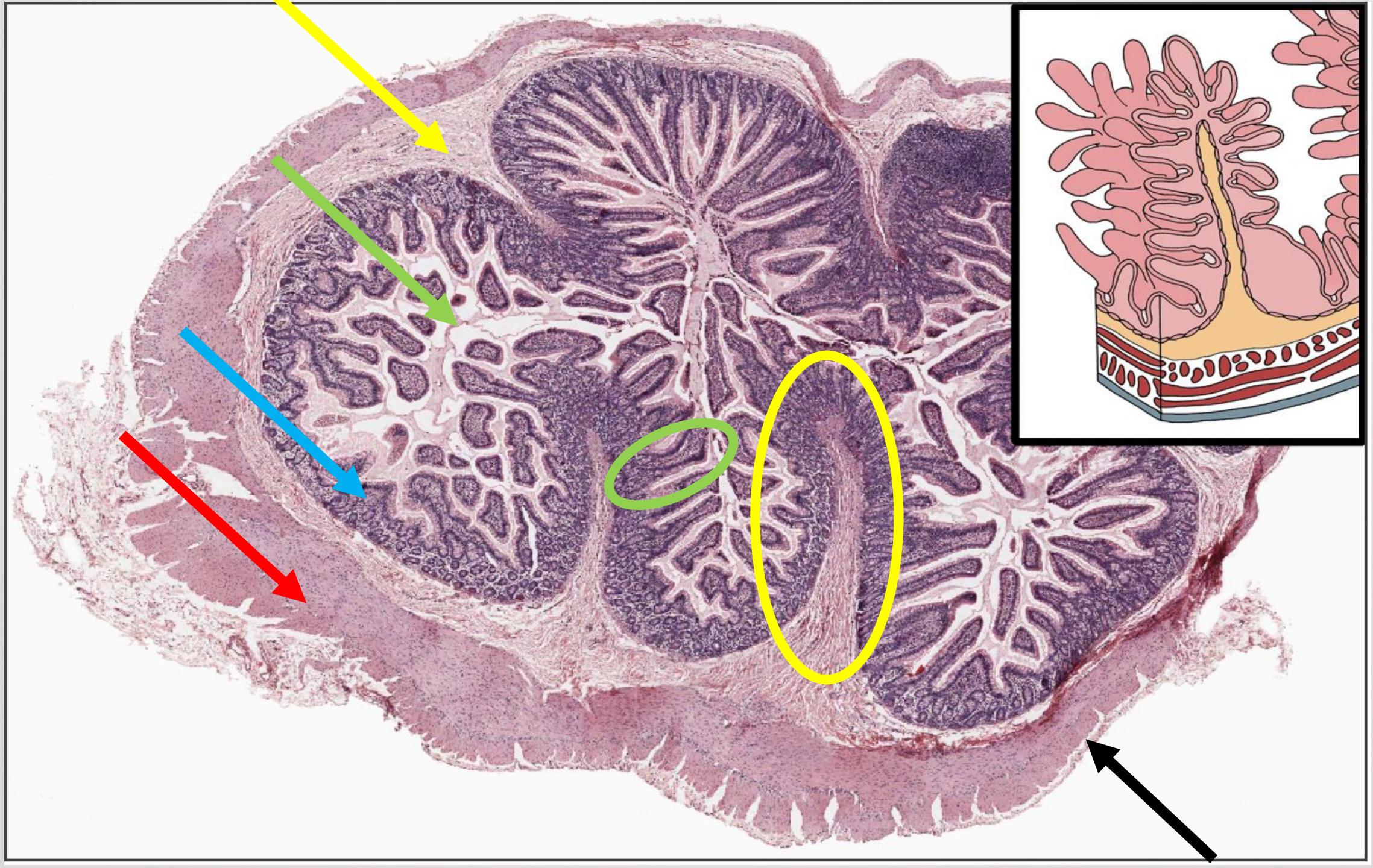


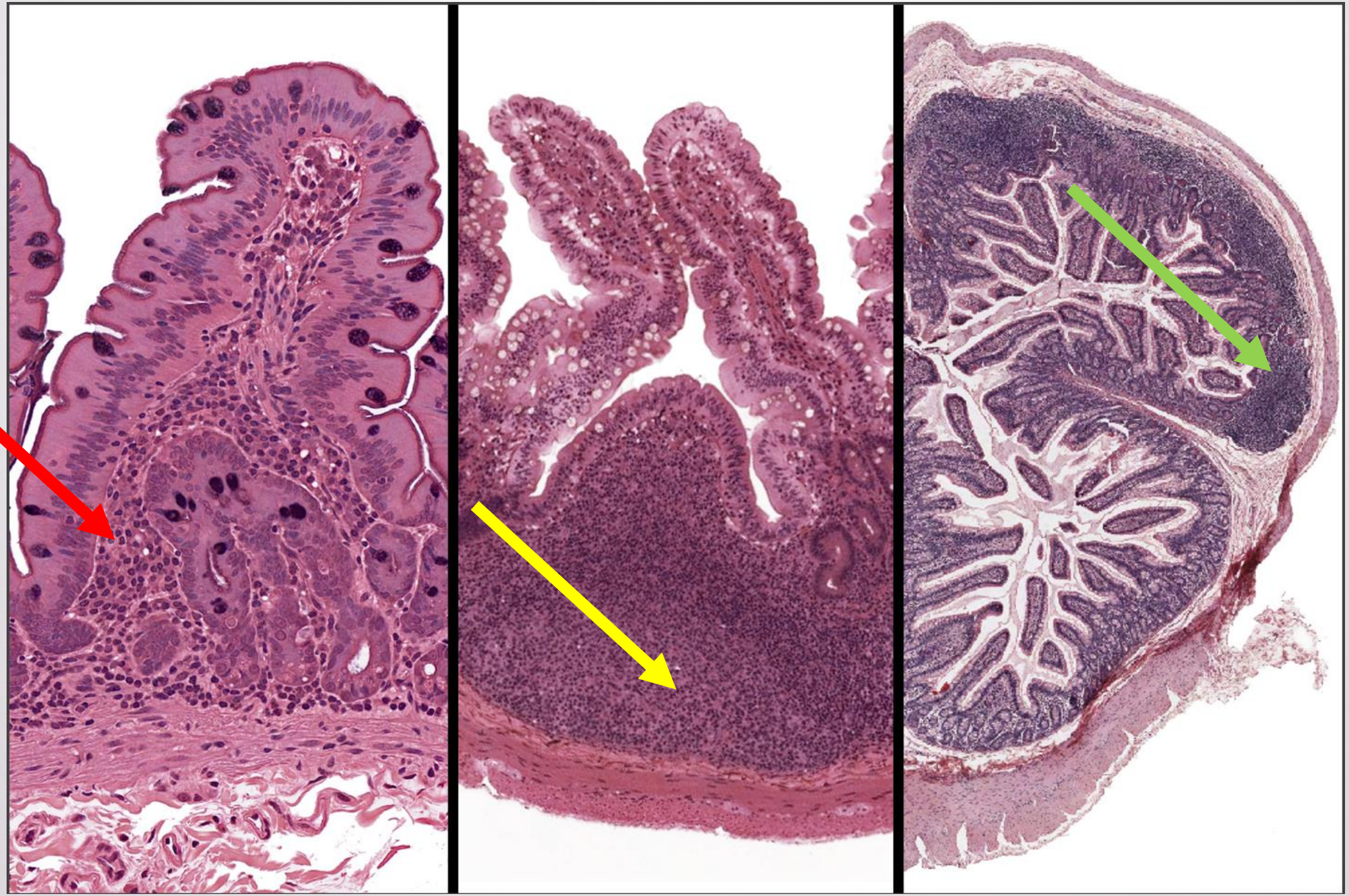
MEDICAL APPLICATION

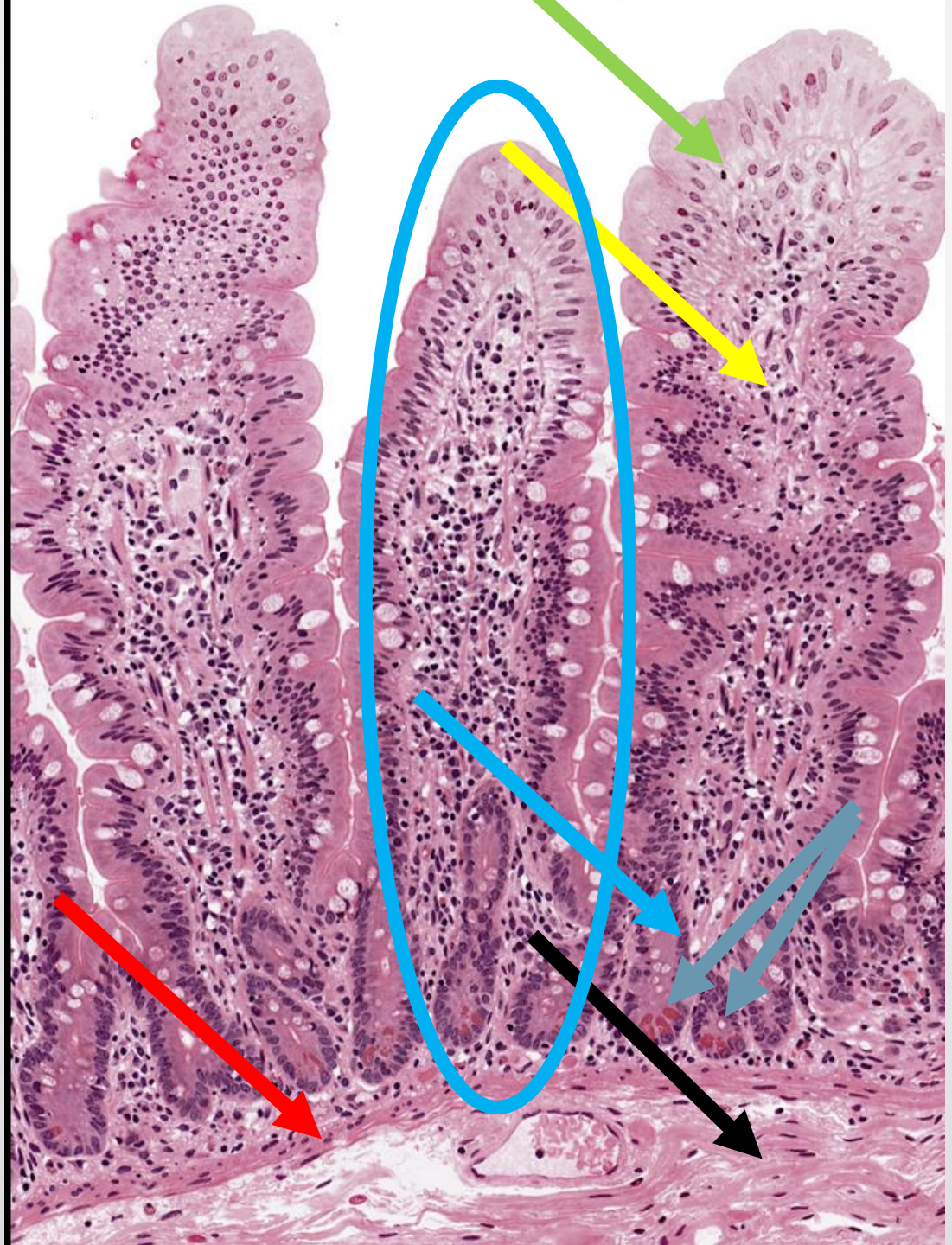
Celiac disease (celiac sprue) is a disorder of the small intestine mucosa that causes **malabsorption** and can lead to damage or destruction of the villi. The cause of celiac disease is an immune reaction against gluten or other proteins in wheat and certain other types of grain. The resulting inflammation affects the enterocytes, leading to reduced nutrient absorption.

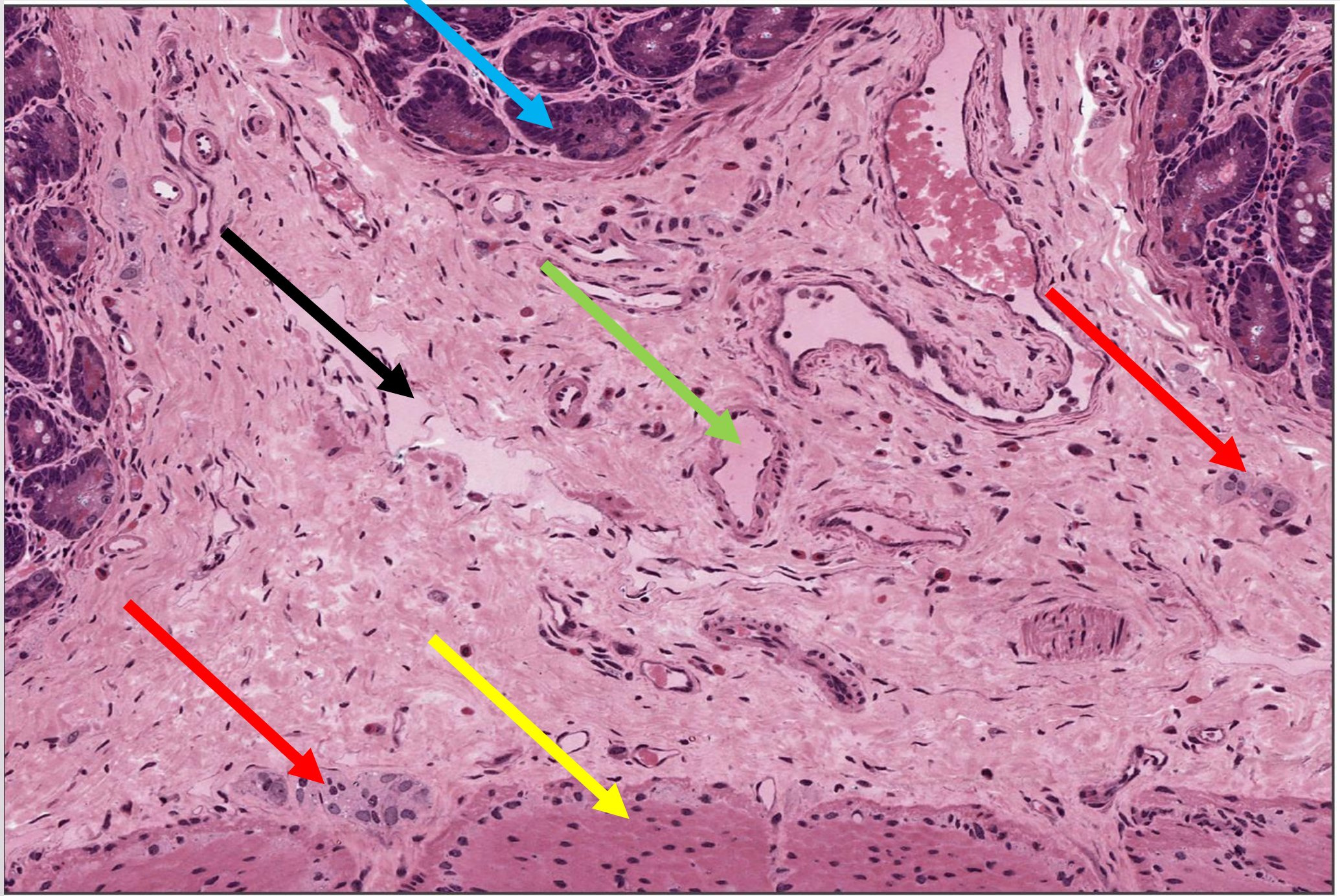
MEDICAL APPLICATION

Crohn disease is a chronic inflammatory bowel disease that occurs most commonly in the ileum or colon, resulting from a poorly understood combination of immune, environmental, and genetic factors. Excessive lymphocytic activity and inflammation occur in any or all layers of the tract wall, producing pain, localized bleeding, malabsorption, and diarrhea.







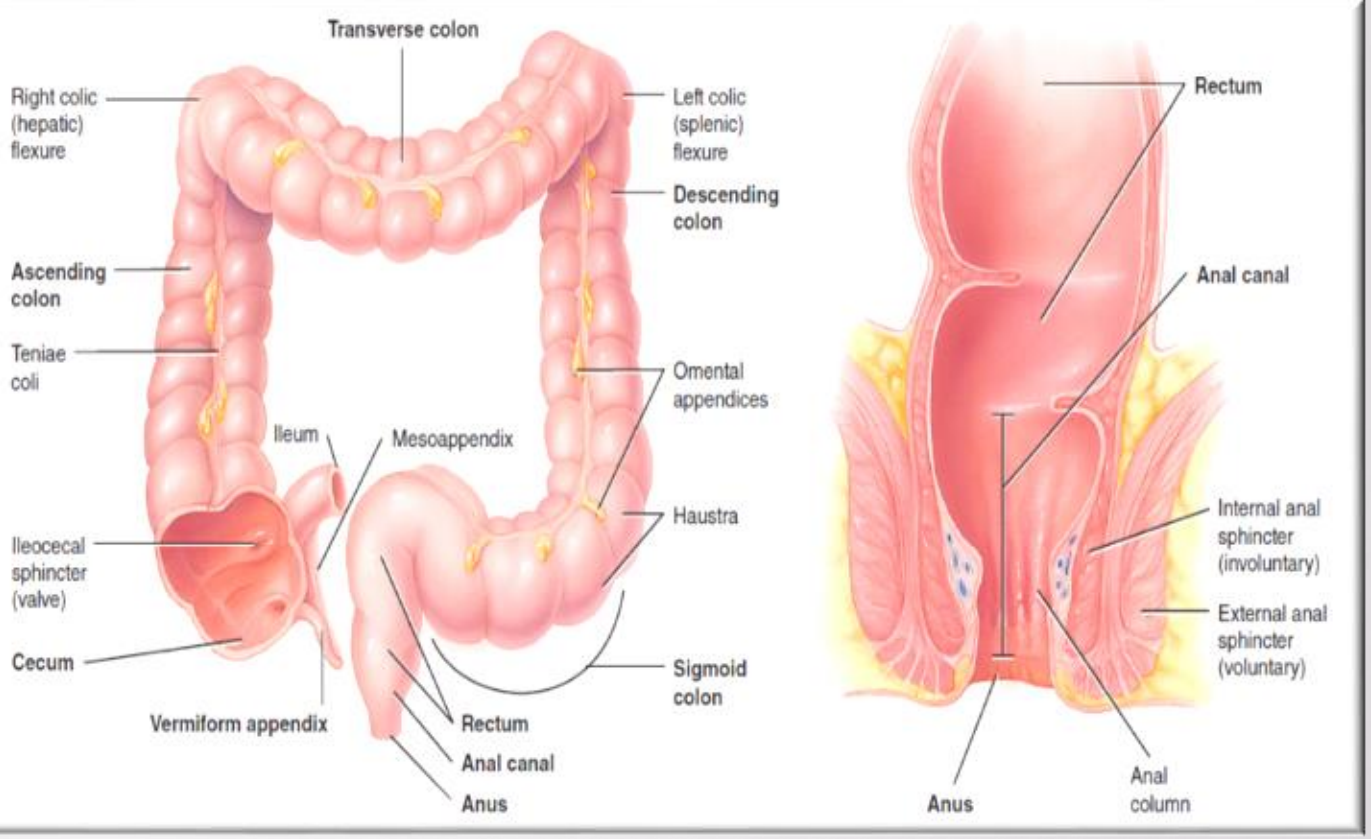


The Large Intestine

- 1.5 m long and 6.5 cm in diameter.
- Extends from the ileum to the anus.
- Attached to the posterior abdominal wall by its mesocolon (double layer of peritoneum)
- Four major regions: cecum, colon, rectum, and anal canal.

- The ileocecal sphincter (fold of mucous membrane called): the opening from the ileum into the large intestine.
- **Cecum:** hangs inferior to the ileocecal valve.
- **Appendix:** attached to the cecum. Is a twisted, coiled tube, measuring about 8 cm.

- Colon: is divided into ascending, transverse, descending, and sigmoid portions.
- Ascending and descending colon are retroperitoneal; the transverse and sigmoid colon are not.
- The **rectum** is about 15 cm in length and lies anterior to the sacrum and coccyx.



- **Anal canal** : terminal part of the large intestine, is 2–3 cm long.
- The mucous membrane of the anal canal is arranged in longitudinal folds called **anal columns** that contain a network of arteries and veins.
- **Anus:** opening of the anal canal to the exterior, guarded by an **internal anal sphincter** (involuntary) and an **external anal sphincter** (voluntary).

Histology Of The Large Intestine

- <u>The wall contains the typical four layers: mucosa, submucosa, muscularis, and serosa:</u>

➢ **The mucosa:** simple columnar epithelium, lamina propria, and muscularis mucosae.

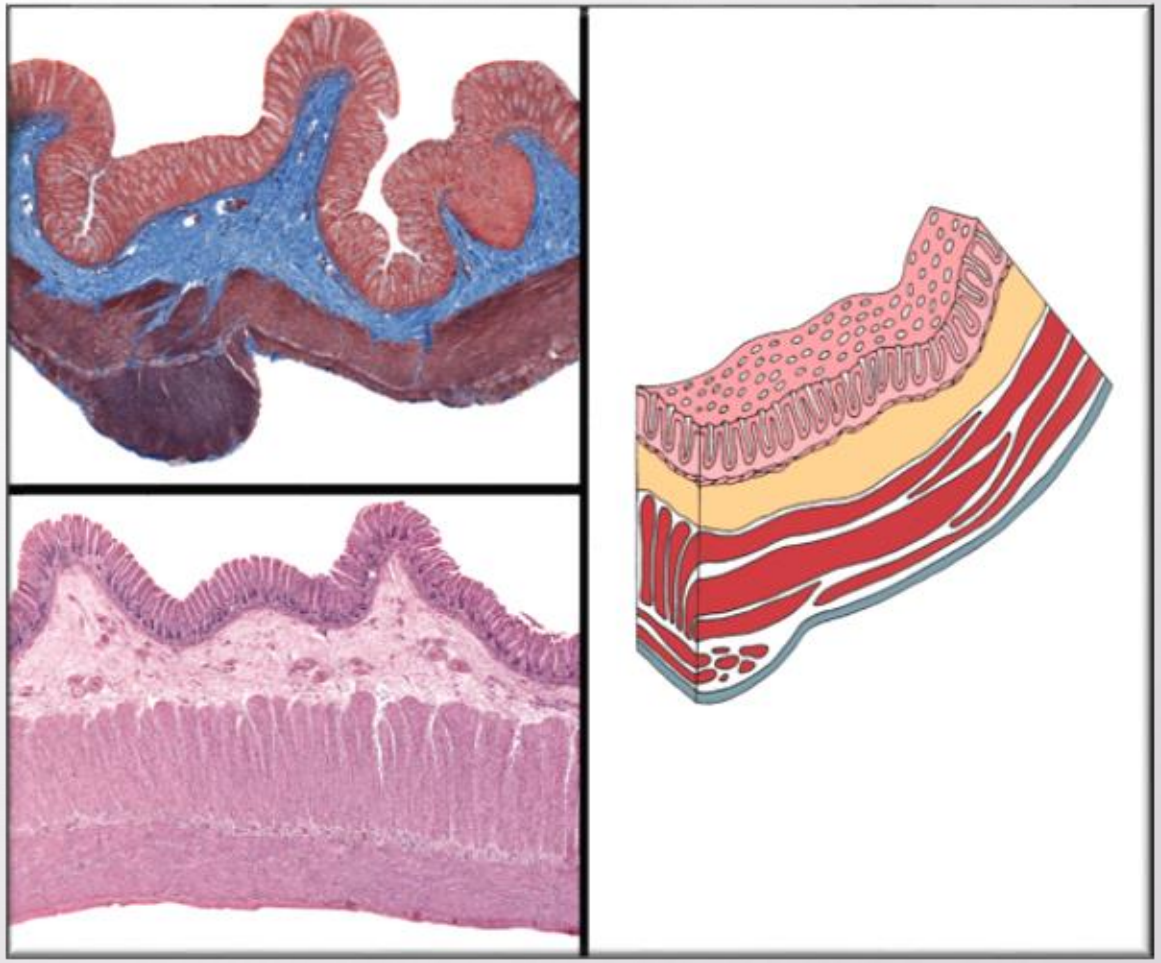
✓ The epithelium contains mostly absorptive (**colonocytes**) and **goblet** cells.

✓ Much more absorption occurs in the small intestine than in the large intestine.

✓ Tubular intestinal glands.

✓ Small number of **enteroendocrine** cells

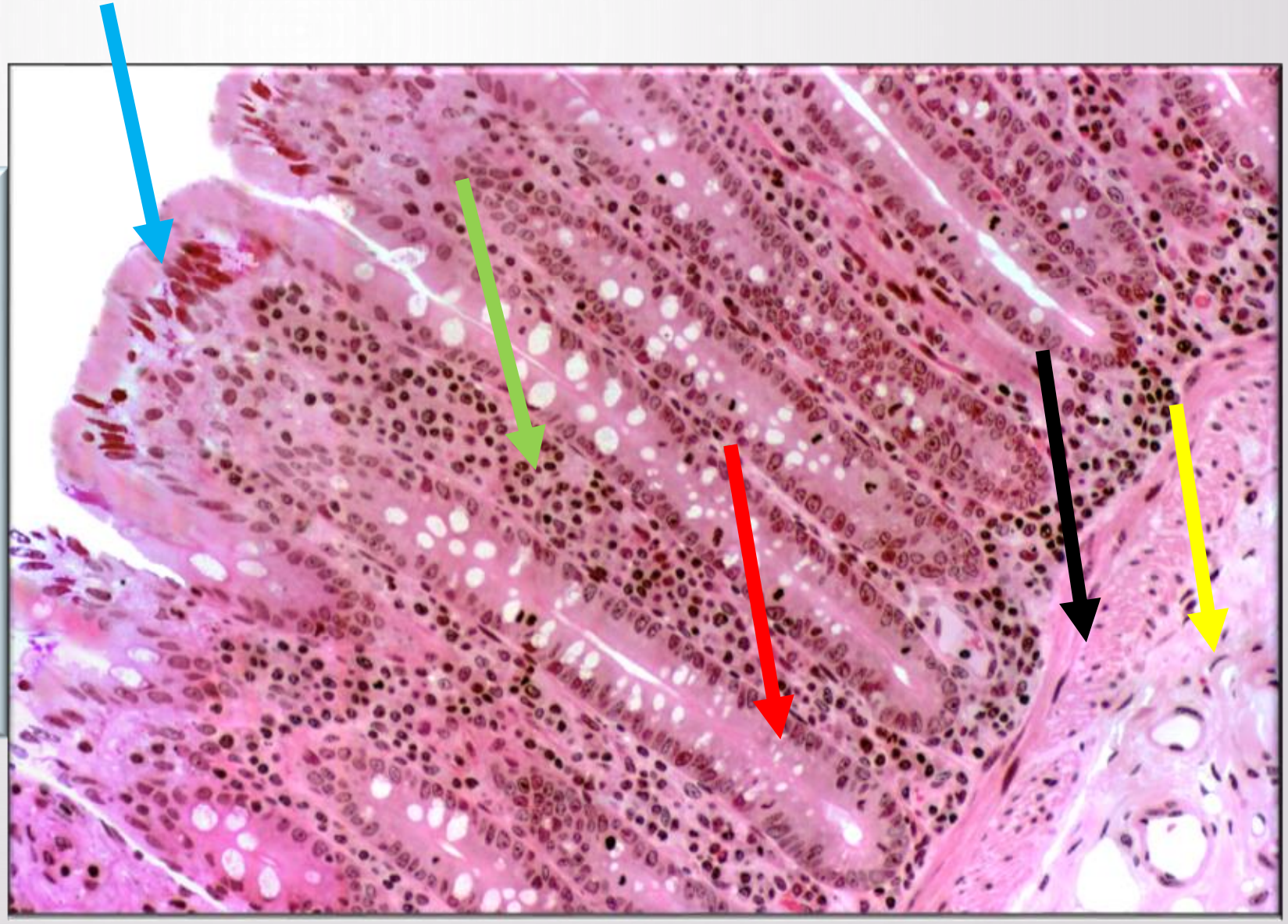
✓ LP is rich with **MALT**----due to large bacterial population

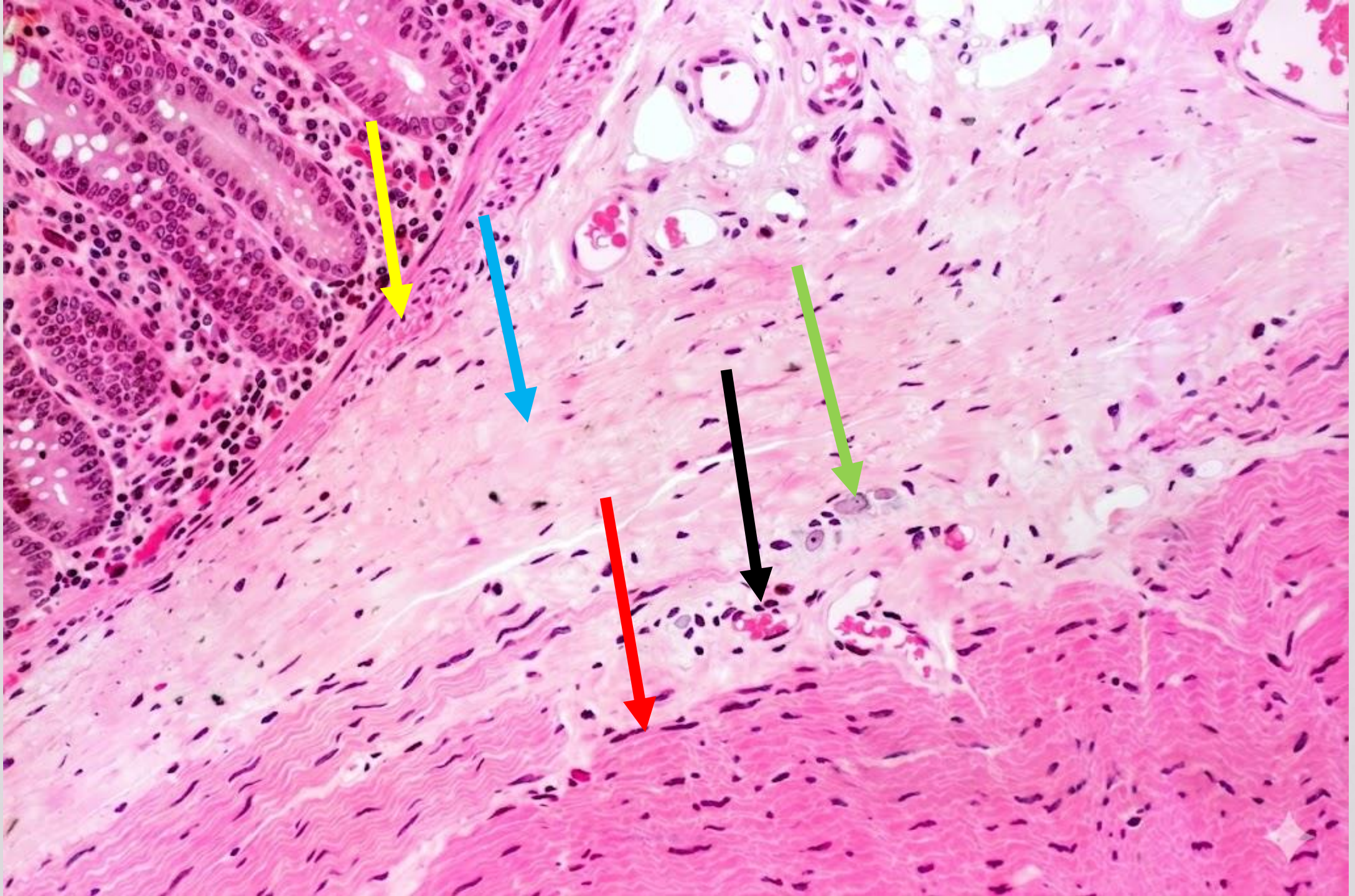


- Mucosa of the large intestine does not have as many structural adaptations that increase surface area (*except in the rectum has no major folds*

Large Intestine

- **The submucosa** of the large intestine consists of connective tissue.
- **The muscularis**: external longitudinal (gathered into teniae coli) and internal circular layers.
- **The serosa** is part of the visceral peritoneum.



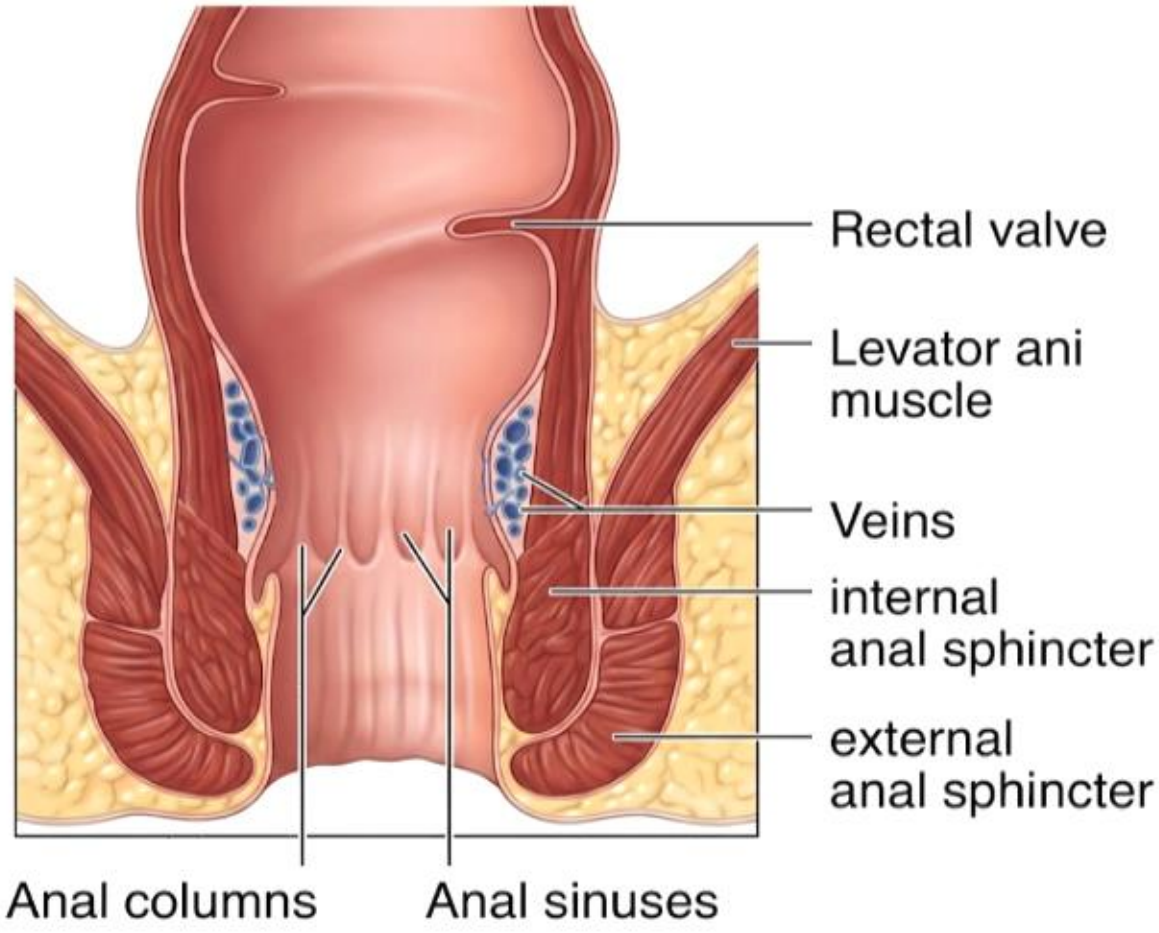


Appendix

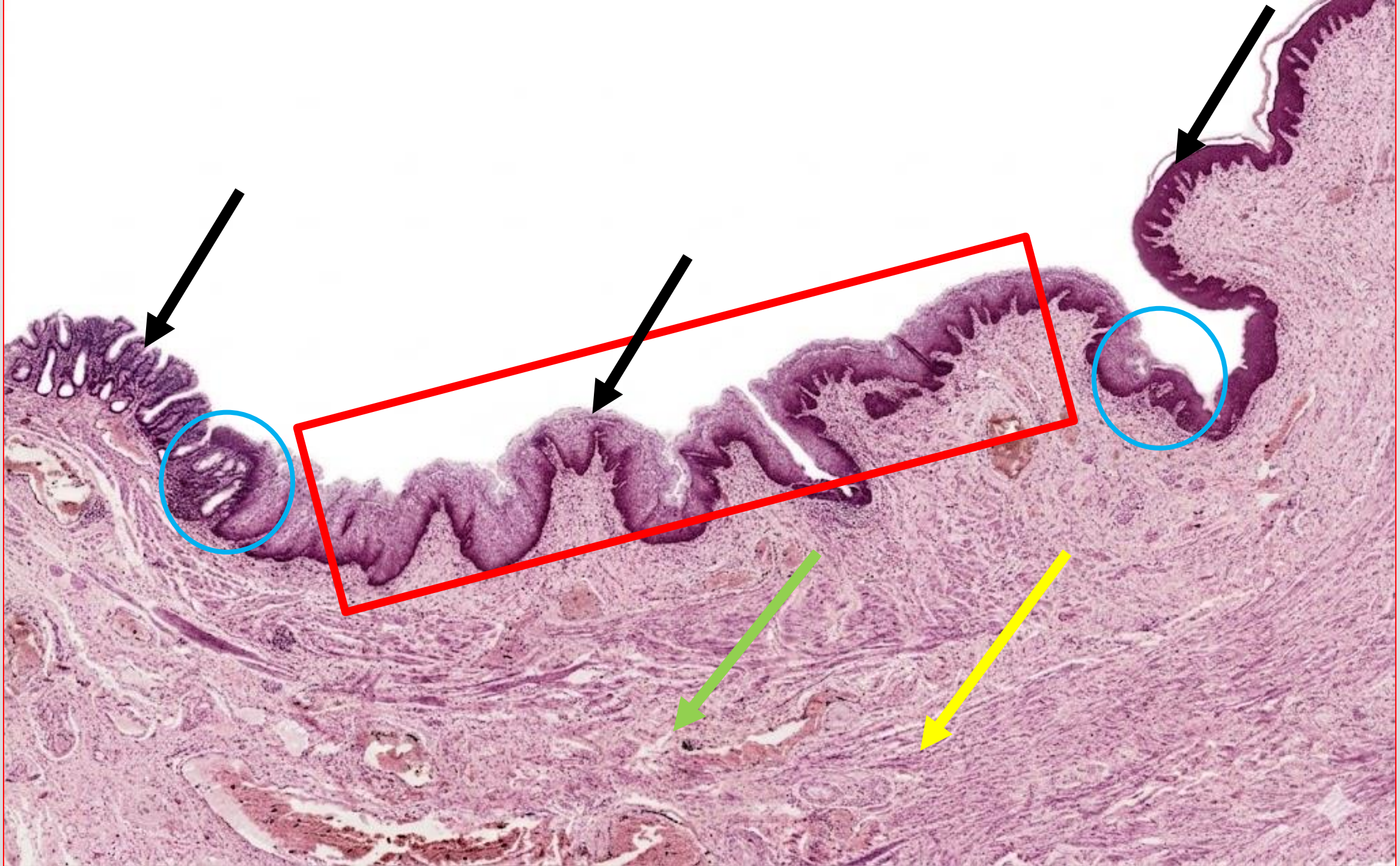
- Has little or no absorptive function but is a significant component of MALT

Anal Canal

- The anal canal, 3-4 cm long.
- At the rectoanal junction the simple columnar mucosal lining of the rectum is replaced by stratified squamous epithelium.
- The mucosa and submucosa form several longitudinal folds---anal columns; lamina propria and submucosa include sinuses of the rectal venous plexus.



- Near the anus the circular layer of the rectum's muscularis forms the internal anal sphincter.
- Defecation involves the action of voluntary muscle comprising the external anal sphincter



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** 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