

DIGESTIVE SYSTEM

OVERVIEW OF THE DIGESTIVE SYSTEM

I Mucosa

Functions:

1. Absorption is provided by specialized structures such as plicae circularis, villi, microvilli;
2. Protection is provided by separation of the intestinal lumen from the rest of the body;
3. Secretion is carried out by glands distributed throughout the length of the digestive tube synthesizing enzymes, hormones, antibodies.

- **Epithelium** lines the inner organs of digestive system

- **Lamina propria** – LCT

Functions: contains glands, blood vessels, nerve plexuses, provide immune defense

- **Muscularis mucosae** – smooth muscle cells

Functions: the contraction of muscularis mucosae produces independent movement (contraction) of mucosa

II Submucosa – DCT

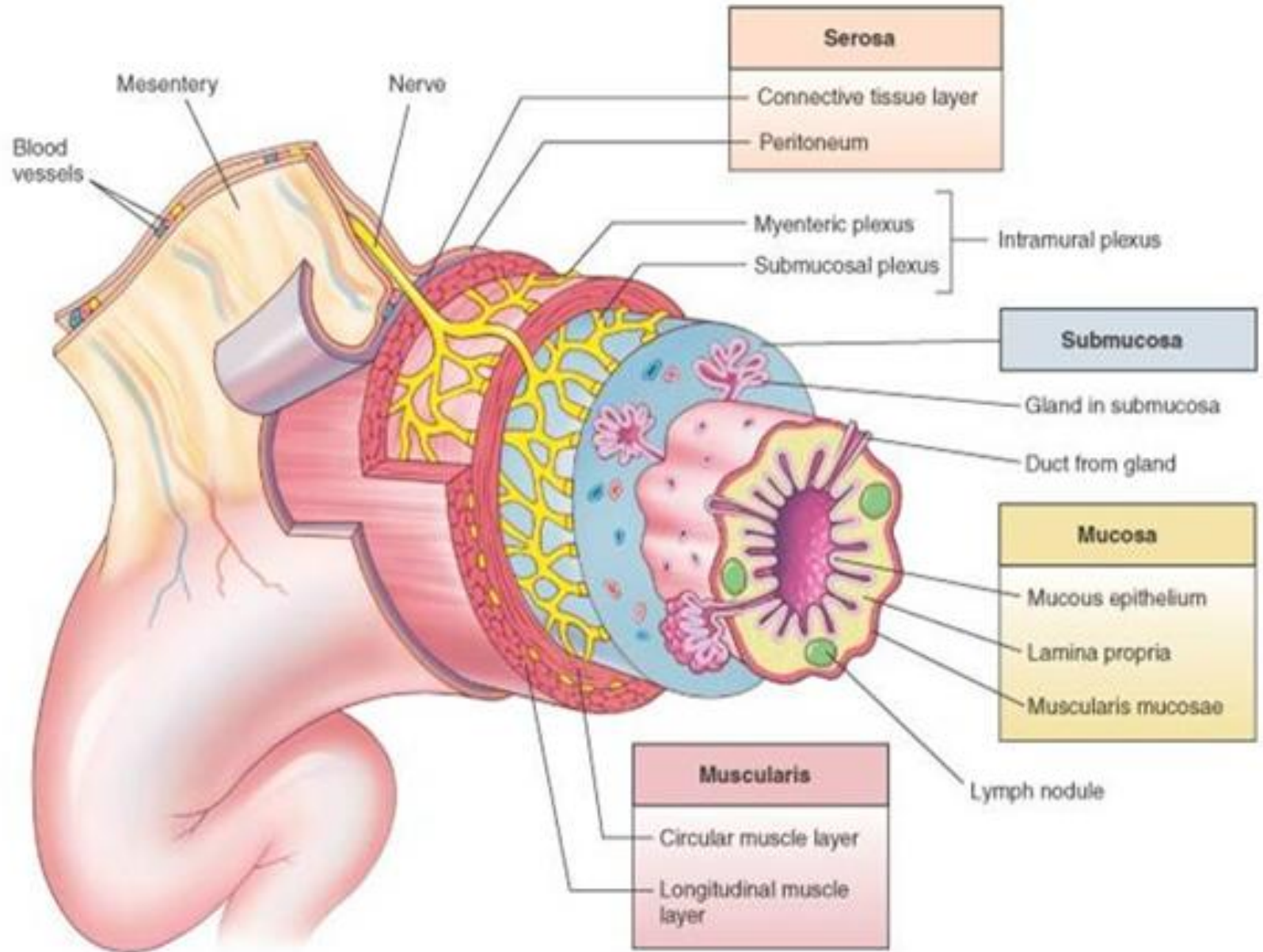
Functions: provide the movement of mucosa, formation of folds, contains glands, blood vessels, nerve plexuses

III Tunica muscularis externa – smooth muscle tissue. Most of parts have two layers. Inner layer compresses and mixes the contents, external layer propels the contents by shortening the tube.

Functions: peristalsis, formation of sphincters

IV Adventitia –LCT /**Serosa** –LCT covered by mesothelium.

OVERVIEW OF THE DIGESTIVE SYSTEM



ESOPHAGUS – TUBE ORGAN THAT DELIVERS FOOD AND LIQUIDS FROM THE PHARYNX TO THE STOMACH

I Mucosa

- **Epithelium** – stratified squamous non-keratinized epithelium
- **Lamina propria** – LCT.

Esophageal cardiac glands

Localization: at the level of cricoid cartilage and in the lowest portion of the esophagus.

Structure: simple branched glands containing mucous cells, solitary parietal cells, endocrine cells (enterochromaffine, enterochromaffine-like cells)

- **Muscularis mucosae** – smooth muscle cells with longitudinal direction.

II Submucosa – DCT

Esophageal glands proper

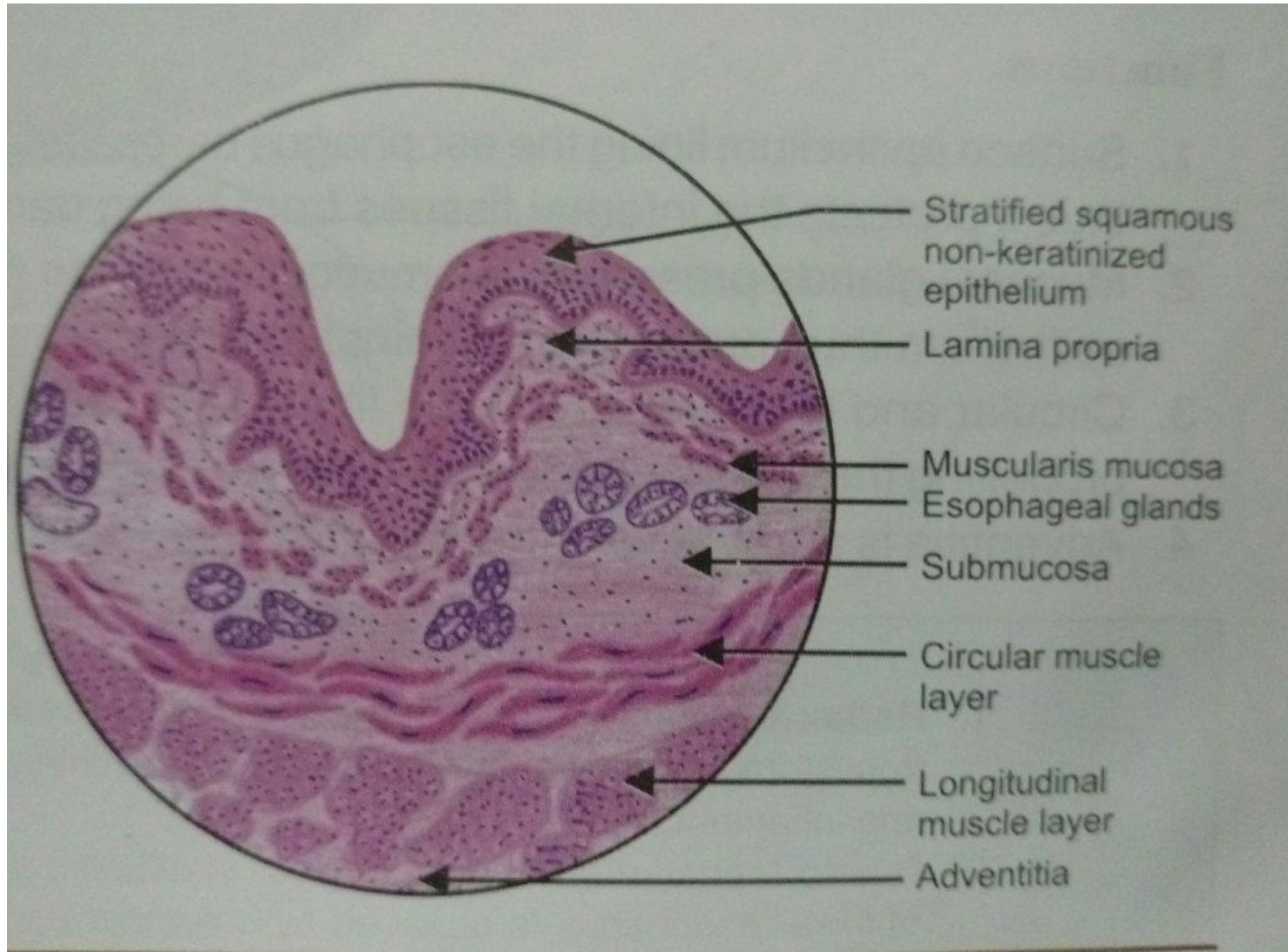
Structure: compound branched tubulo-alveolar glands containing mucous cells.

III Tunica muscularis externa – upper 1/3 of esophagus is formed striated muscle tissue, lower 2/3 –smooth muscle tissue. Has two layers. Inner circular, outer-longitudinal.

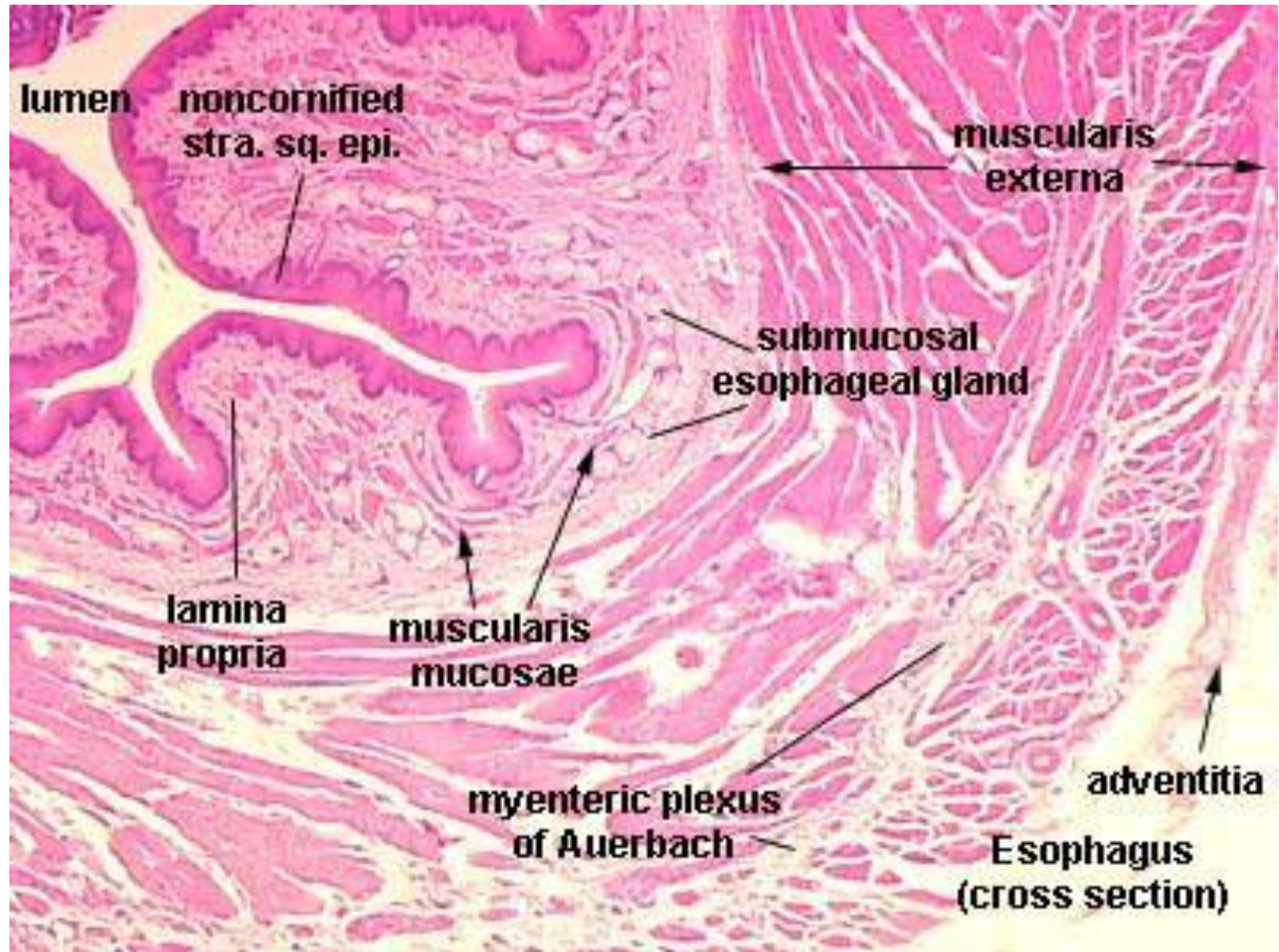
IV Adventitia –LCT in the mediastinum.

Serosa –LCT covered by mesothelium in the abdominal portion.

ESOPHAGUS



ESOPHAGUS



STOMACH

Functions:

- 1. Break down the bolus of food**
- 2. Break down proteins and lipids**
- 3. Cause the death of pathogenic microorganisms**
- 4. Absorption of water, salts, monosaccharaides, alcohols**
- 5. Production of biologically active substances**

STOMACH

Regions (based on glands) of the stomach :

1. Cardia
2. Pyloric
3. Body
4. Fundus

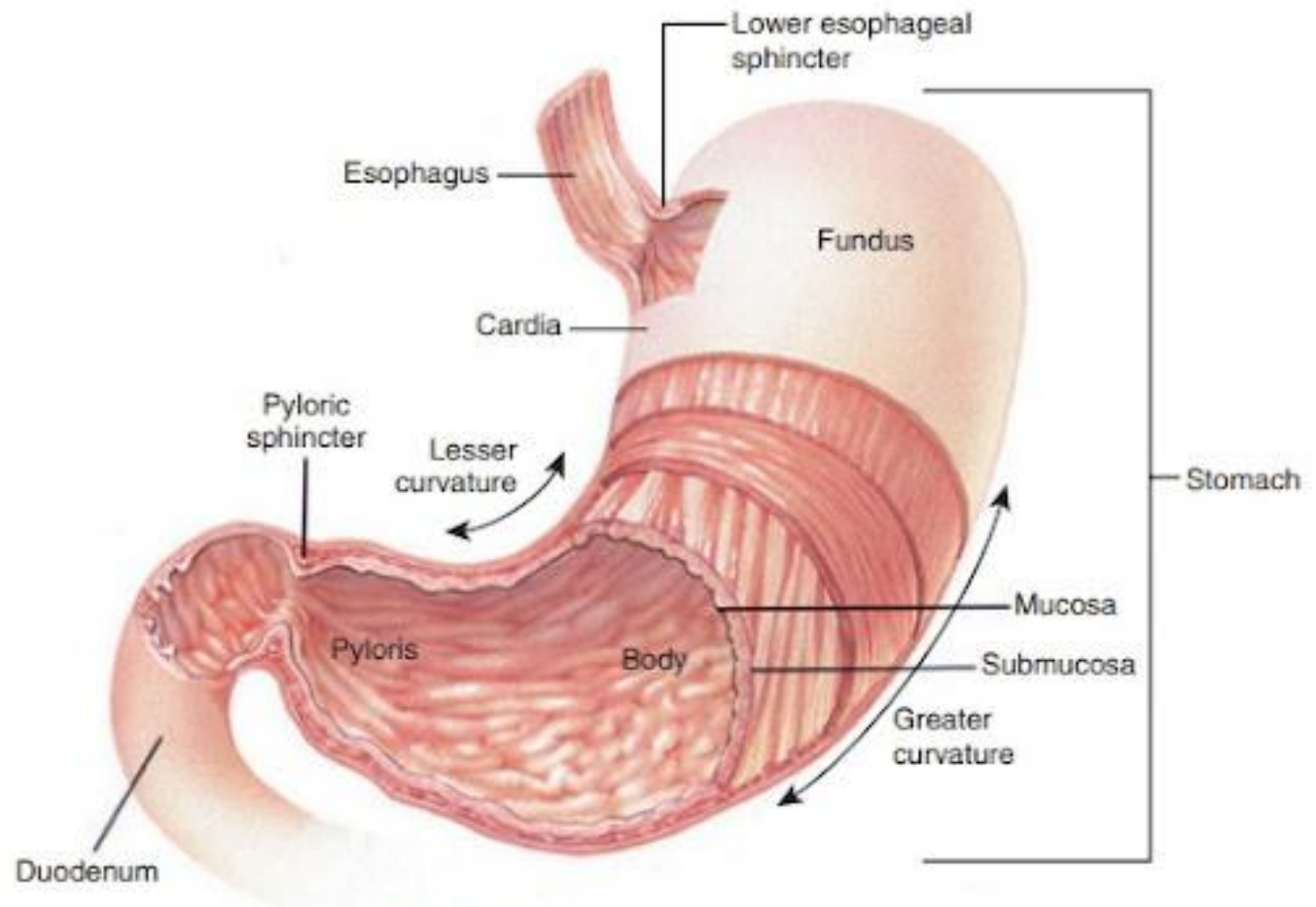
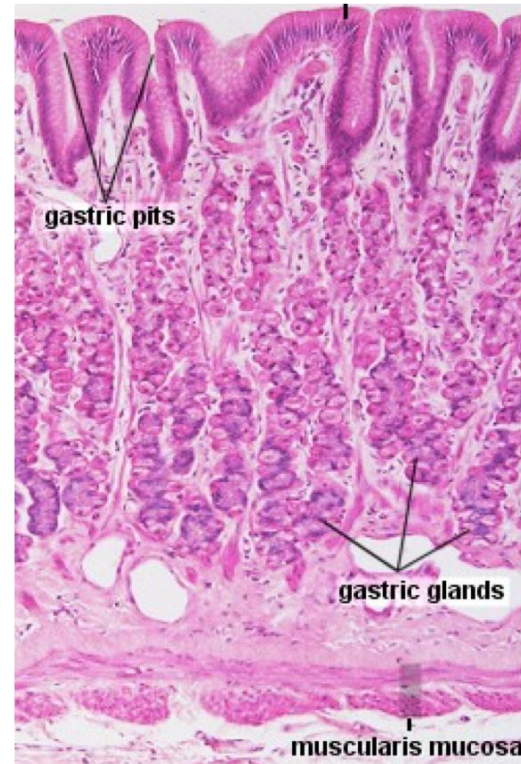
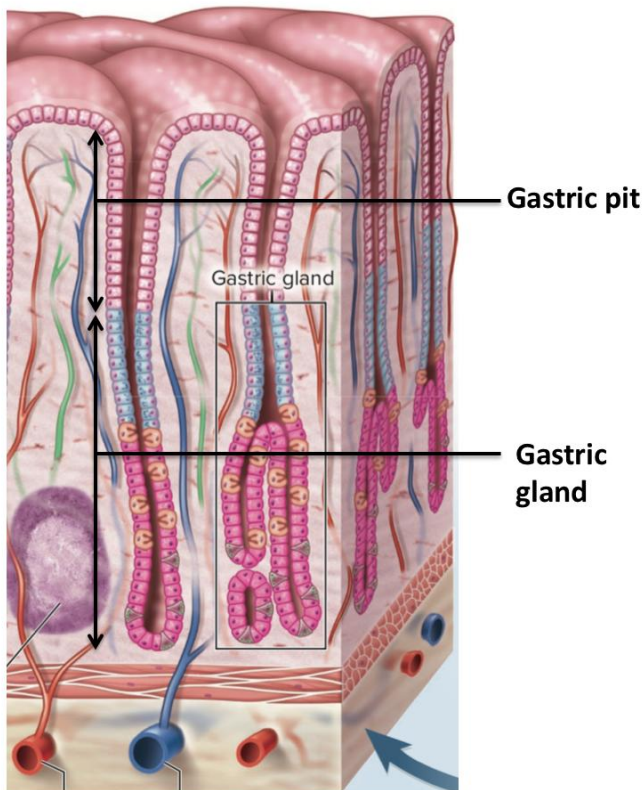


FIGURE 24-8 The stomach.

MUCOSA FORMS

1. **Rugae** are formed by mucosa and submucosa
2. **Mammilated area** are formed by aggregations of gastric glands which are separated from each other by connective tissue
3. **Gastric pits** invagination of epithelium into the lamina propria



STOMACH

The structure:

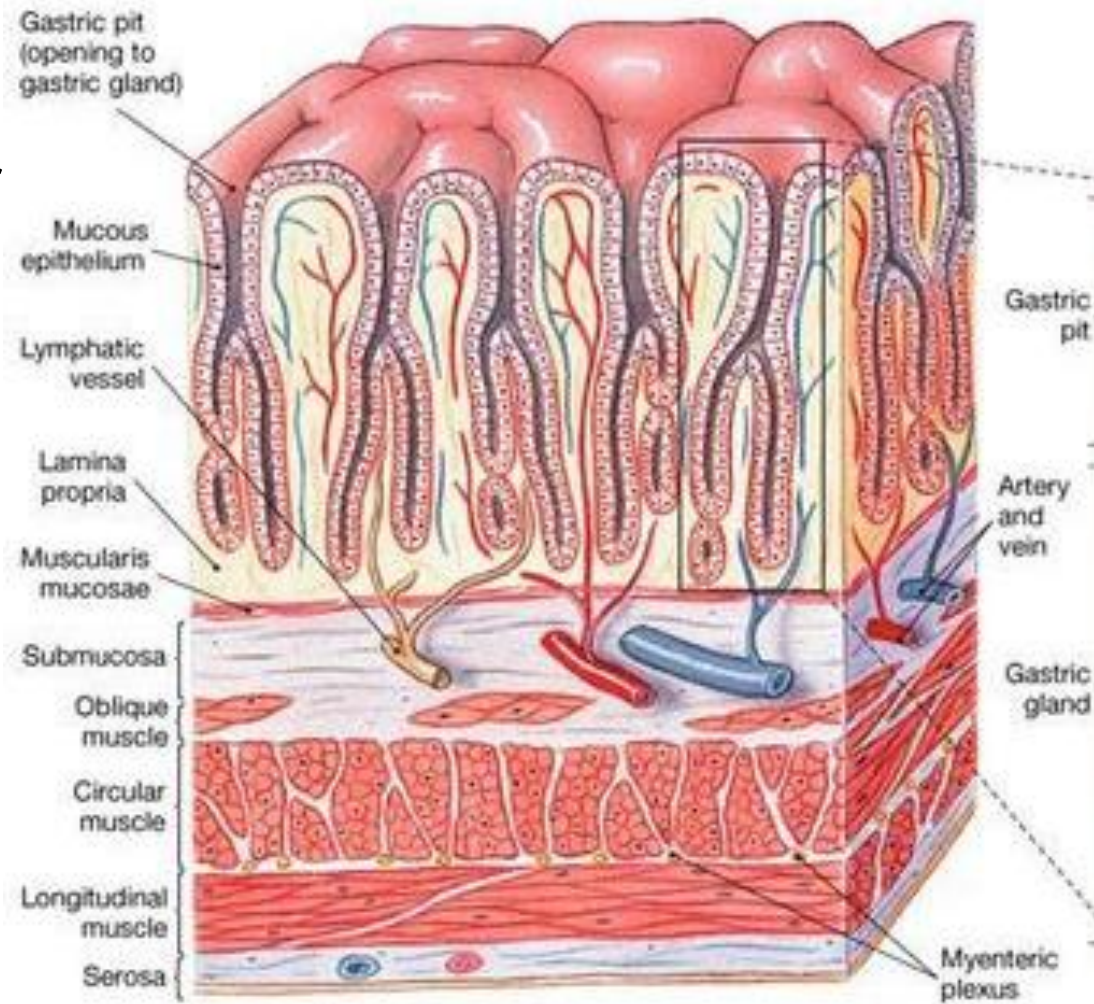
1. Tunica mucosa

- **Epithelium** – simple columnar glandular epithelium
- **lamina propria** -LCT.
- **muscularis mucosae**- smooth muscle tissue.

2. Tunica submucosa -LCT.

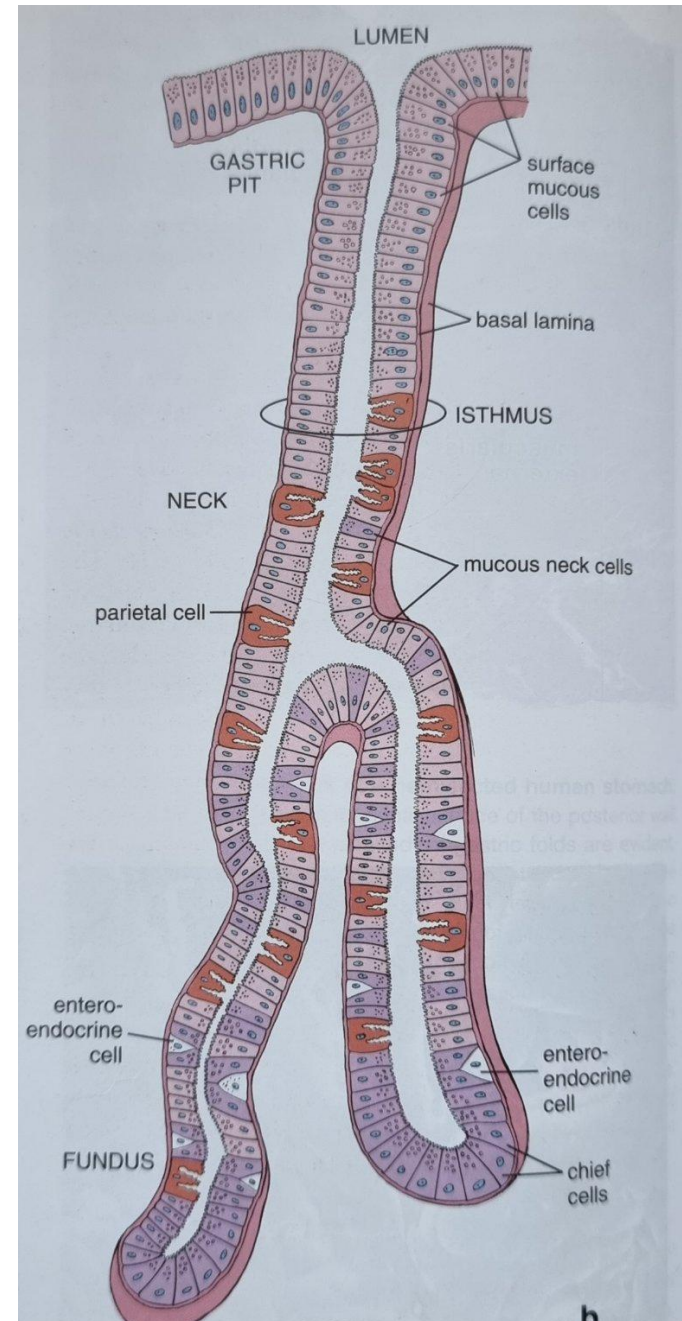
- ## 3. Tunica muscularis externa-
- 3 layers: inner- oblique, middle –circular, outer longitudinal.

- ## 4. Tunica serosa-
- LCT+mesothelium.



EPITHELIUM OF STOMACH-SIMPLE COLUMNAR GLANDULAR

1. **Chief cells** produce chemosin (breaks down the protein of milk) and pepsinogen that is converted to pepsin () by HCL at a pH lower than 5
2. **Parietal cells** produce H^+ and CL^- (HCL-hydrochloric acid)
3. **Mucous neck cells** produce mucous
4. **Stem cells** – cambial cells
5. **Enteroendocrine cells.** They are part of diffused neuroendocrine system (APUD)



ENTEROENDOCRINE CELLS

EC (enterochromaffine cells) produce **serotonin** (regulate the secretion of digestive enzymes, mucous secretion and motility of stomach) and **melatonin** (regulates the photoperiodicity).

ECL (enterochromaffine-like cells) produce **histamine** that regulates the activity of parietal cells.

G-cells produce **gastrin** which stimulate chief and parietal cells.

P-cells produce **bombesin** which stimulates parietal cells, secretion of pancreatic juice and stimulation of contraction of gallbladder.

D-cells produce **somatostatin** inhibit the production of gastrin, secretin and histamine.

D1-cells produce **vasoactive interstitial peptide (VIP)** which decrease blood pressure and stimulates the secretion of pancreatic enzymes.

A-cells produce **glucagon** which convert glycogen onto glucose

SMALL INTESTINE

Functions:

- 1. Break down and absorb lipids carbohydrates and proteins**
- 2. Performs mechanical functions. Peristaltic contractions pushes the chymus towards the large intestine**
- 3. Perform endocrine function producing biologically active substances**

LAYERS OF SMALL INTESTINE

1. Tunica mucosa

- **Epithelium** - simple columnar epithelium with brush border
- **Lamina propria** - LCT
- **Muscularis mucosae**- layer of smooth muscle cells

1. Tunica submucosa - LCT

2. Tunica muscularis externa- 2 layers: inner-circular, outer-longitudinal

3. Tunica serosa and adventitia (duodenum)

Mucosa forms plicae circularis, villi, crypts.

Plicae circularis (circular folds) are permanent transverse folds, formed by mucosa and underlying submucosa.

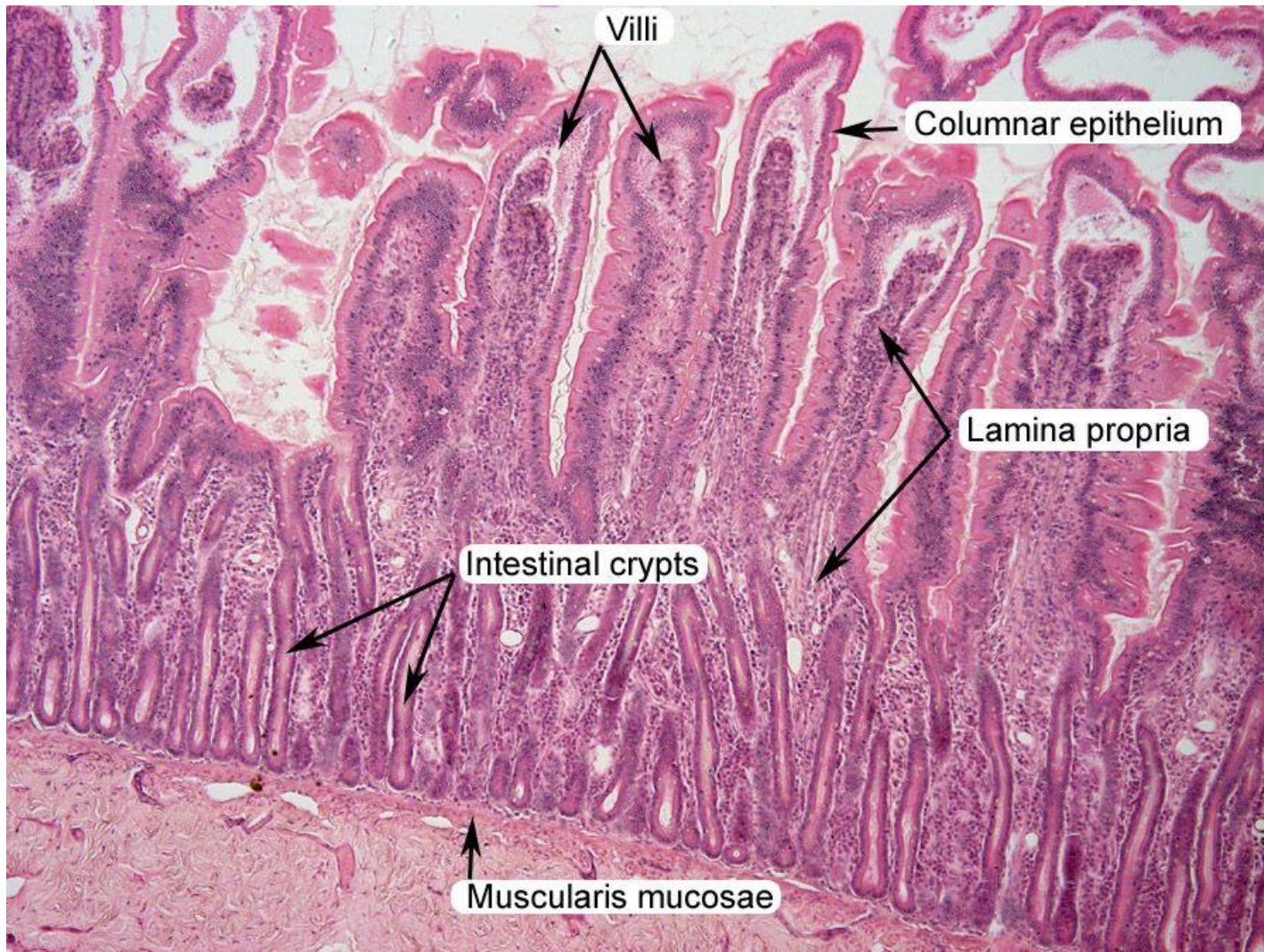
Villi are fingerlike projections of mucosa.

Cells of villi: enterocytes with brush border, goblet cells, enteroendocrine cells.

Crypts are invagination of epithelium into the lamina propria.

Cells of crypts: enterocytes with and without brush border, goblet cells, enteroendocrine cells, Paneth cells

SMALL INTESTINE



EPITHELIUM OF THE SMALL INTESTINE

Simple columnar epithelium with brush border

Epithelial cells:

1. Enterocytes with brush border

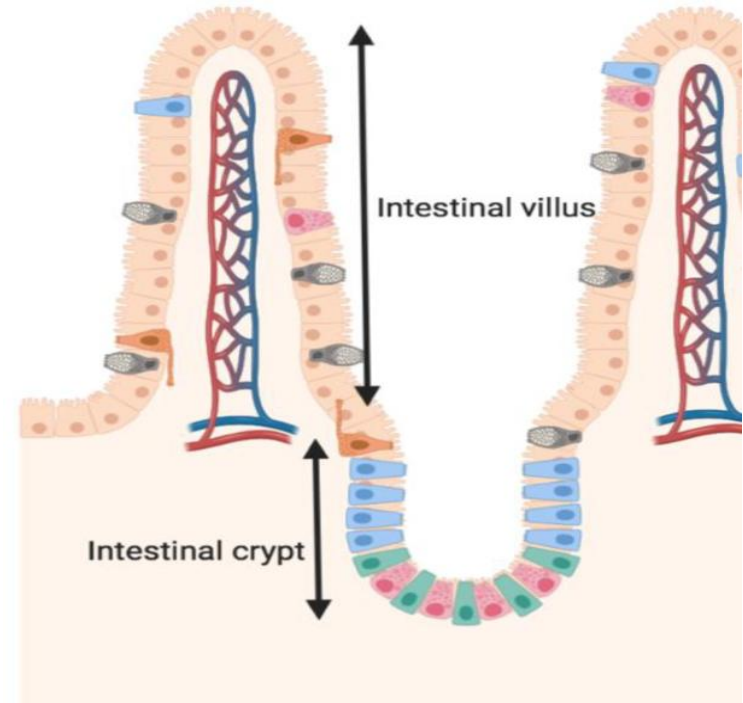
- Have microvilli on the apical surface
- Nucleus is oval and in the basal portion of the cell
- Organelles: RER and lysosomes are well-developed
- Functions: parietal digestion

2. Goblet cells –produce mucous

3. Paneth cells – neutralize hydrochloric acid, synthesize dipeptidase (erepsin), which breaks down proteins to amino acids

4. Enterocytes without brush border – participate in regeneration

5. Enteroendocrine cells



- Enterocyte
- Goblet cell
- Enteroendocrine cell
- Transit-amplifying cell
- Paneth cell
- Stem cell

ENTEROENDOCRINE CELLS OF SMALL INTESTINE

EC (enterochromaffine cells) produce **serotonin** (regulate the secretion of digestive enzymes, mucous secretion and motility of stomach) and **melatonin** (regulates the photoperiodicity).

S- cells produce **secretin** that stimulates excretion of pancreatic juice

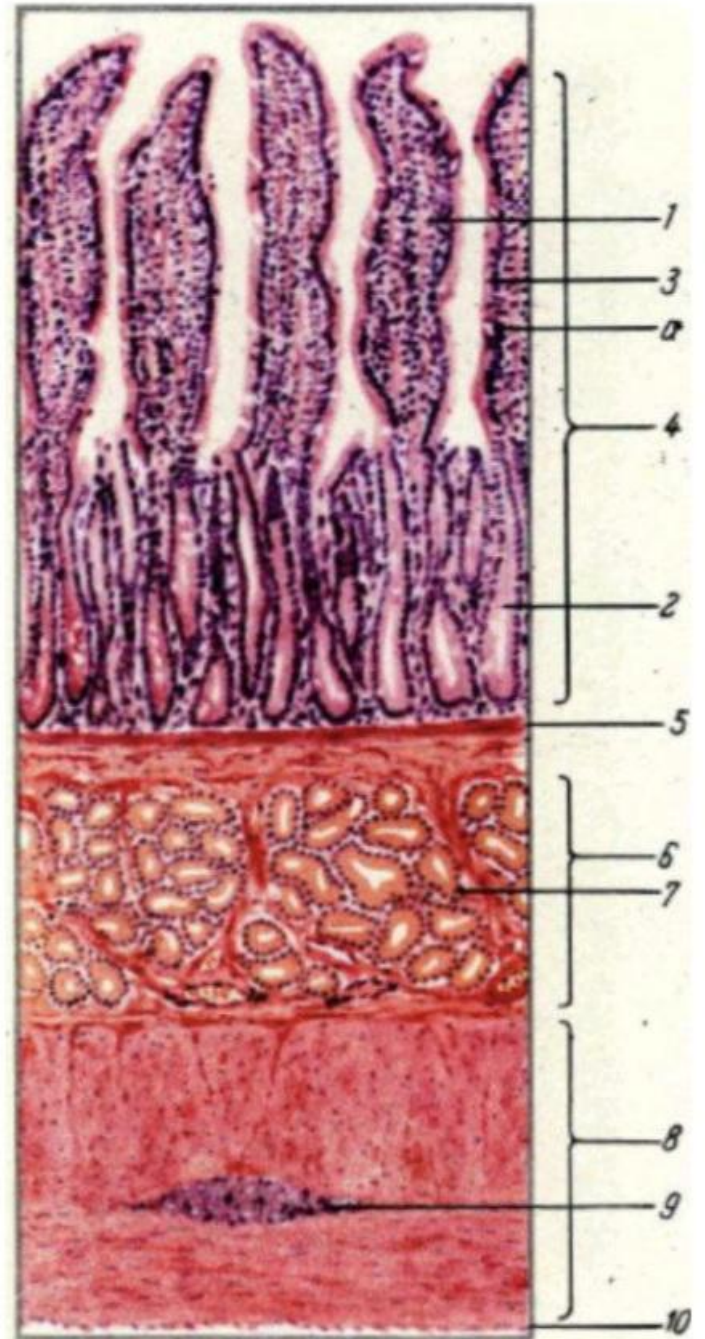
I-cells produce **cholecystokinin** that stimulates the contraction of gallbladder and activity of pancreas, impact on motility of the digestive system and increase the activity of S-cells

G-cells produce **gastrin** which stimulate chief and parietal cells.

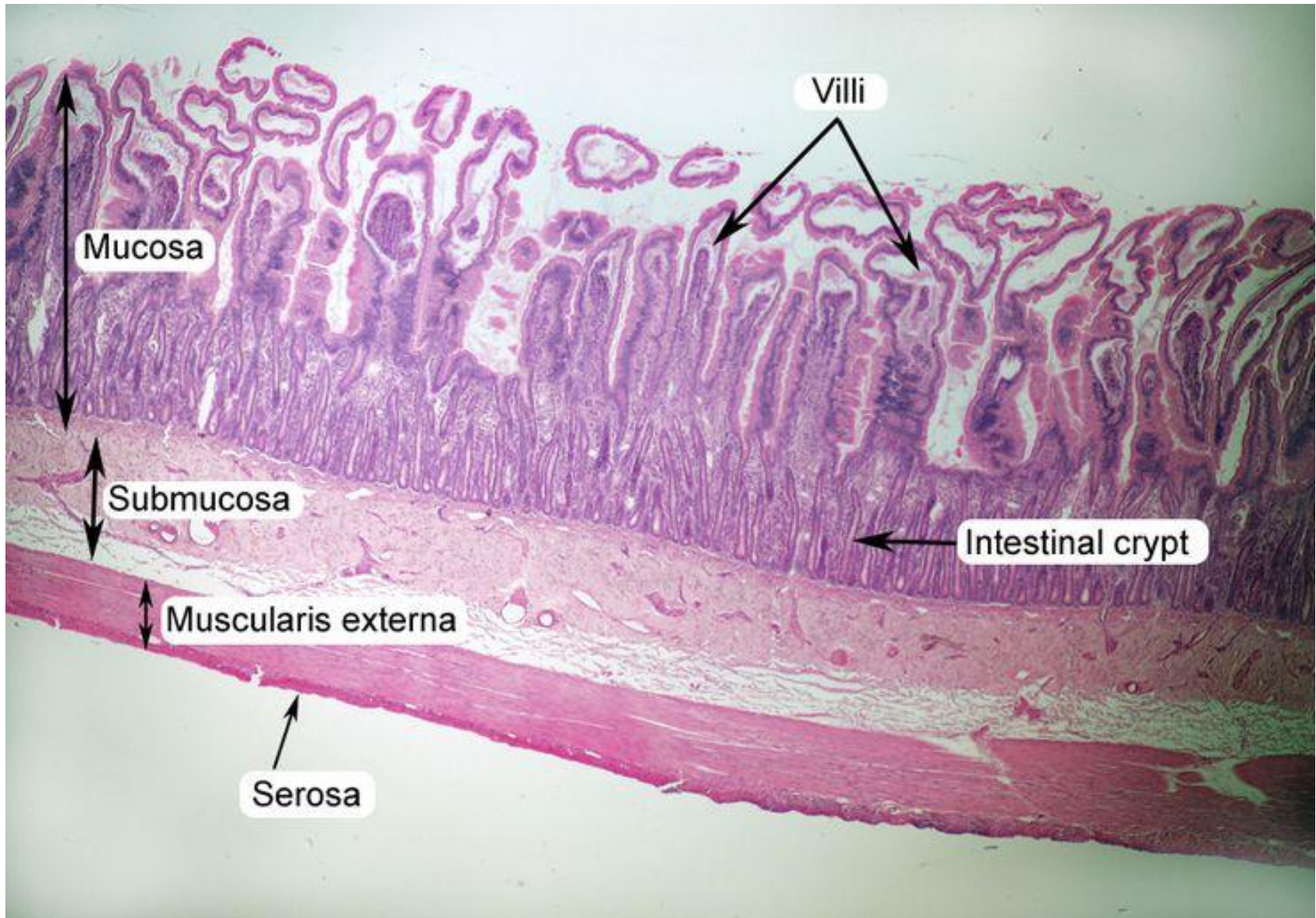
D-cells produce **somatostatin** inhibit the production of gastrin, secretin and histamine.

A-cells produce **glucagon** which convert glycogen onto glucose.

SMALL INTESTINE



SMALL INTESTINE



LARGE INTESTINE

Functions:

- **Movement of fecal masses**
- **Excretion of metabolic products, salts, heavy metals**
- **Production of vitamins A,D**

LARGE INTESTINE

1. Tunica mucosa

-**Epithelium**- simple columnar epithelium

-**Lamina propria** –LCT+lymphatic follicles

-**Muscularis mucosae**- poor-developed layer of smooth muscle cells

2.**Tunica submucosa** –LCT + aggregations of lymphatic follicles

3.**Tunica muscularis externa** – 2 layers: inner-circular, outer-longitudinal

4.**Tunica serosa or adventitia**- everywhere seros caudal part is covered by adventitia

Mucosa forms just crypts.

Crypts are invagination of epithelium into the lamina propria.

Cells of crypts: enterocytes without brush border, goblet cells, enteroendocrine cells.



RECTUM

Parts of rectum:

I Pelvic part – Epithelium-simple cuboidal

II Anal part

1) Columnar zone

Epithelium: stratified columnar epithelium

Lamina propria: contains blood vessels, solitary lymphatic follicles, rudimental anal glands

2) Transitional zone

Epithelium: stratified squamos non-keratinized epithelium

Lamina propria: sebaceous glands

3) Cutaneous zone

Epithelium: stratified squamos keratinized epithelium

Lamina propria: sweat and sebaceous glands

