

Regulation of digestion

Functions of the Digestive System

1. **Ingestion** takes place when materials enter the digestive tract through the mouth .
2. **Mechanical processing** is crushing and shearing that makes materials easier to propel along the digestive tract.
3. **Digestion** refers to the chemical breakdown of food into small organic fragments suitable for absorption by the digestive epithelium.
4. **Secretion** is the release of water, acids, enzymes, buffers, and salts by the epithelium of the digestive tract and by glandular organs.

Functions of the Digestive System

5. **Absorption** is the movement of organic molecules, electrolytes(inorganic ions), vitamins, and water across the digestive epithelium and into the interstitial fluid of the digestive tract.

6. **Excretion** is the removal of waste products from body fluids. The process called **defecation**, or *egestion*, *ejects materials* from the digestive tract, eliminating them as **feces**.

Histological Organization of the Digestive Tract

The four major layers of the digestive tract are

- (1) the *mucosa*,
- (2) the *submucosa*,
- (3) the *muscularis externa*,
- (4) the *serosa*.

The structure of these layers varies by region. **Figure 24–3** is a composite view.

Figure 24-3 The Structure of the Digestive Tract. A diagrammatic view of a representative portion of the digestive tract. The features illustrated are typical of those of the small intestine.

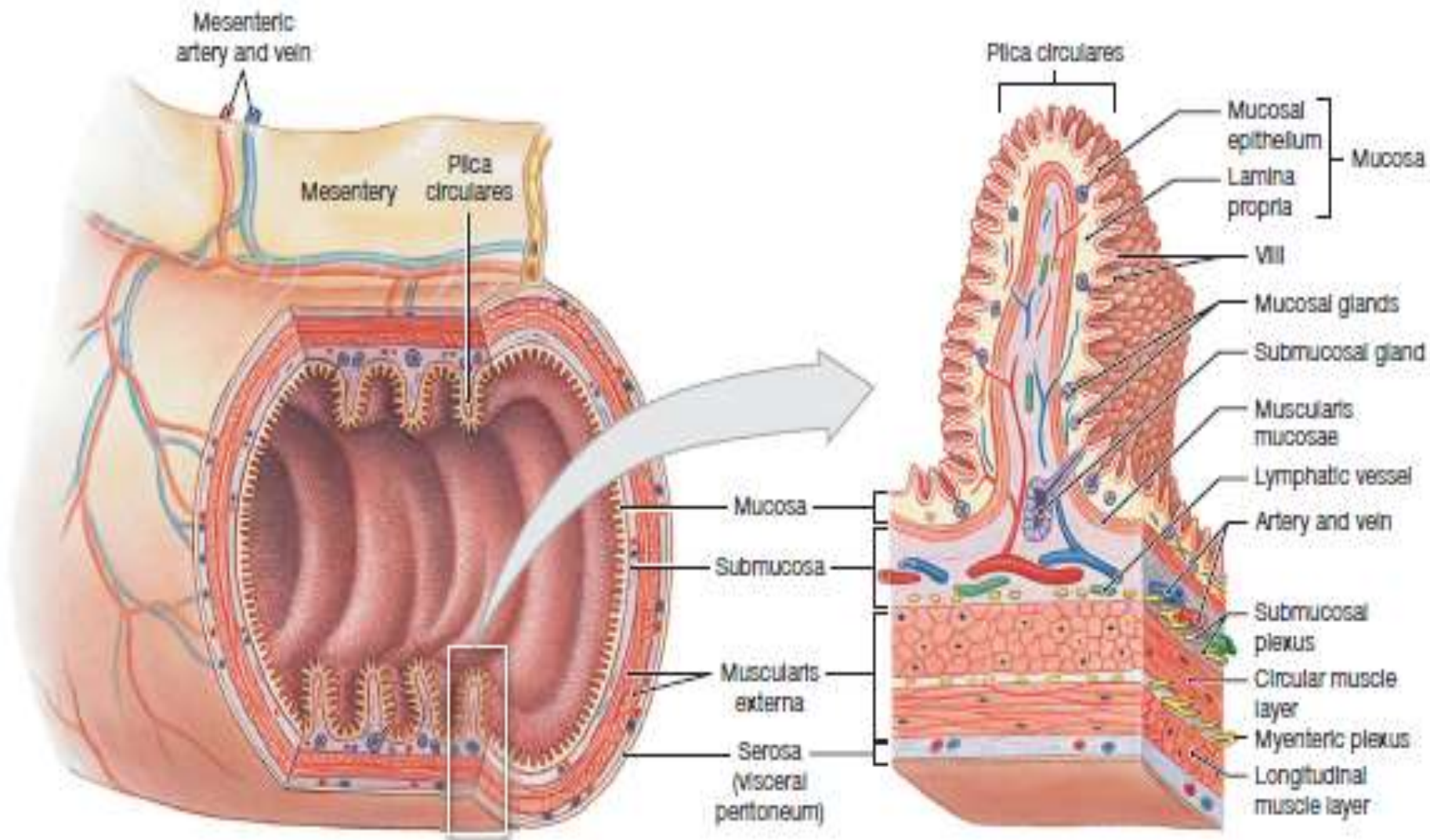
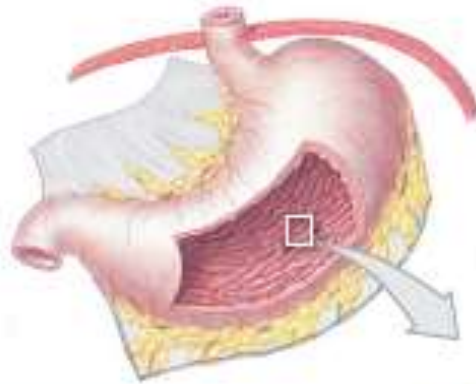


Figure 24–13 The Stomach Lining.



Layers of the Stomach Wall

Mucosa

Gastric pit (opening to gastric gland)
Mucous epithelium

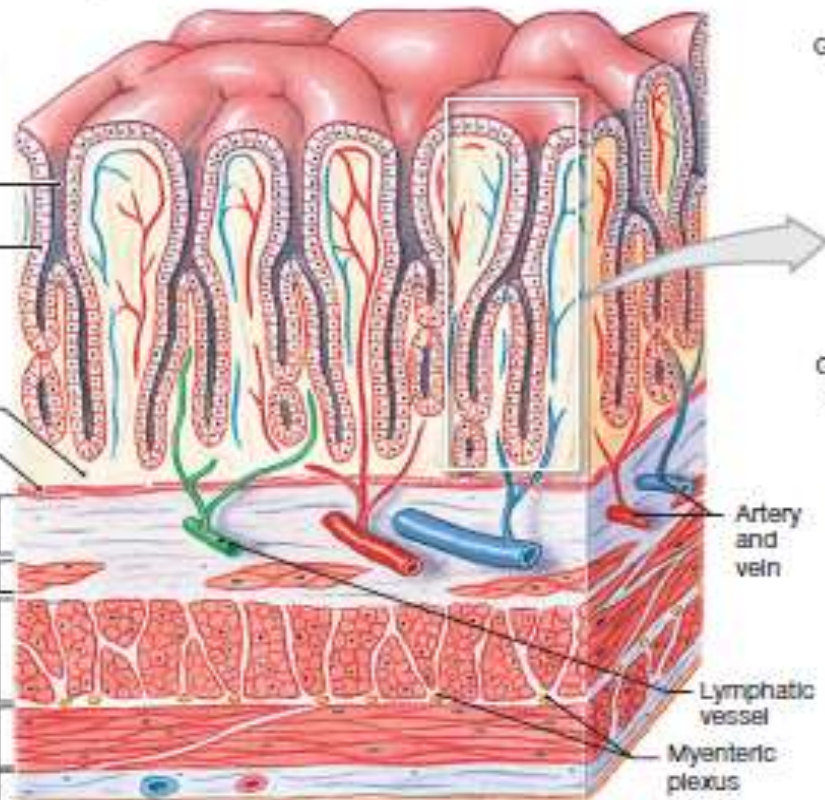
Lamina propria
Muscularis mucosae

Submucosa

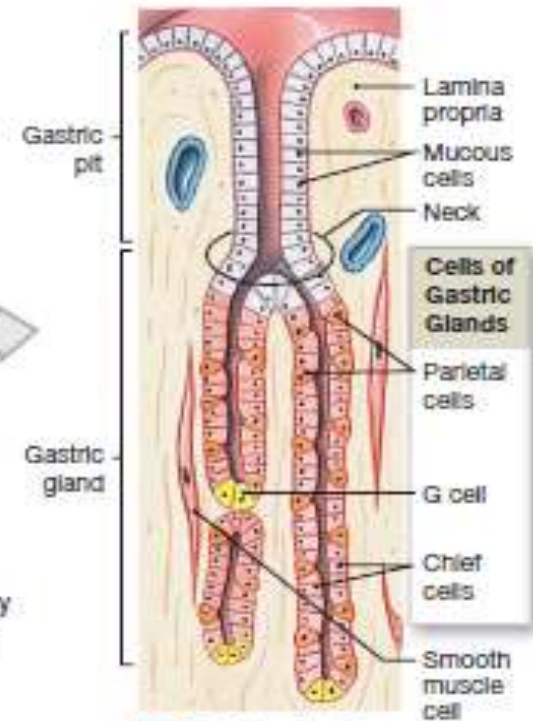
Muscularis externa

Oblique muscle
Circular muscle
Longitudinal muscle

Serosa



a Stomach wall



b Gastric gland

1 - The Mucosa

The inner lining, or mucosa, of the digestive tract is a *mucous membrane*. It consists of an *epithelium*, moistened by glandular secretions, and a *lamina propria* of areolar tissue.

- **The Digestive Epithelium.**

The mucosal epithelium is either simple or stratified, depending on its location and the stresses placed on it.

- **The Lamina Propria.**

The lamina propria is a layer of areolar tissue that also contains blood vessels, sensory nerve endings, lymphatic vessels, smooth muscle cells, and scattered lymphoid tissue.

Muscularis mucosae

In most areas of the digestive tract, the lamina propria contains a narrow sheet of smooth muscle and elastic fibers.

This sheet is called the **muscularis mucosae** .

The smooth muscle cells in the muscularis mucosae are arranged in two concentric layers.

1- The inner layer encircles the lumen (*the circular muscle*)

2 -*the outer layer* contains muscle cells oriented parallel to the long axis of the tract (*the longitudinal layer*).

Contractions in these layers alter the shape of the lumen and move the epithelial pleats and folds.

2 - The Submucosa

The submucosa is a layer of dense irregular connective tissue that binds the mucosa to the muscularis externa (Figure 24–3). The submucosa has numerous blood vessels and lymphatic vessels. In some regions it also contains exocrine glands that secrete buffers and enzymes into the lumen of the digestive tract. Along its outer margin, the submucosa contains a network of intrinsic nerve fibers and scattered neurons. This network is the **submucosal plexus, or *plexus of Meissner***.

3 - The Muscularis Externa

The submucosal plexus lies along the inner border of the muscularis externa, also called the muscularis. Smooth muscle cells dominate this region. Like the smooth muscle cells in the muscularis mucosae, those in the muscularis externa are arranged in an inner circular layer and an outer longitudinal layer. These layers play an essential role in mechanical processing and in moving materials along the digestive tract.

In this layer there is a the myenteric plexus, or *plexus of Auerbach*.

4 - The Serosa

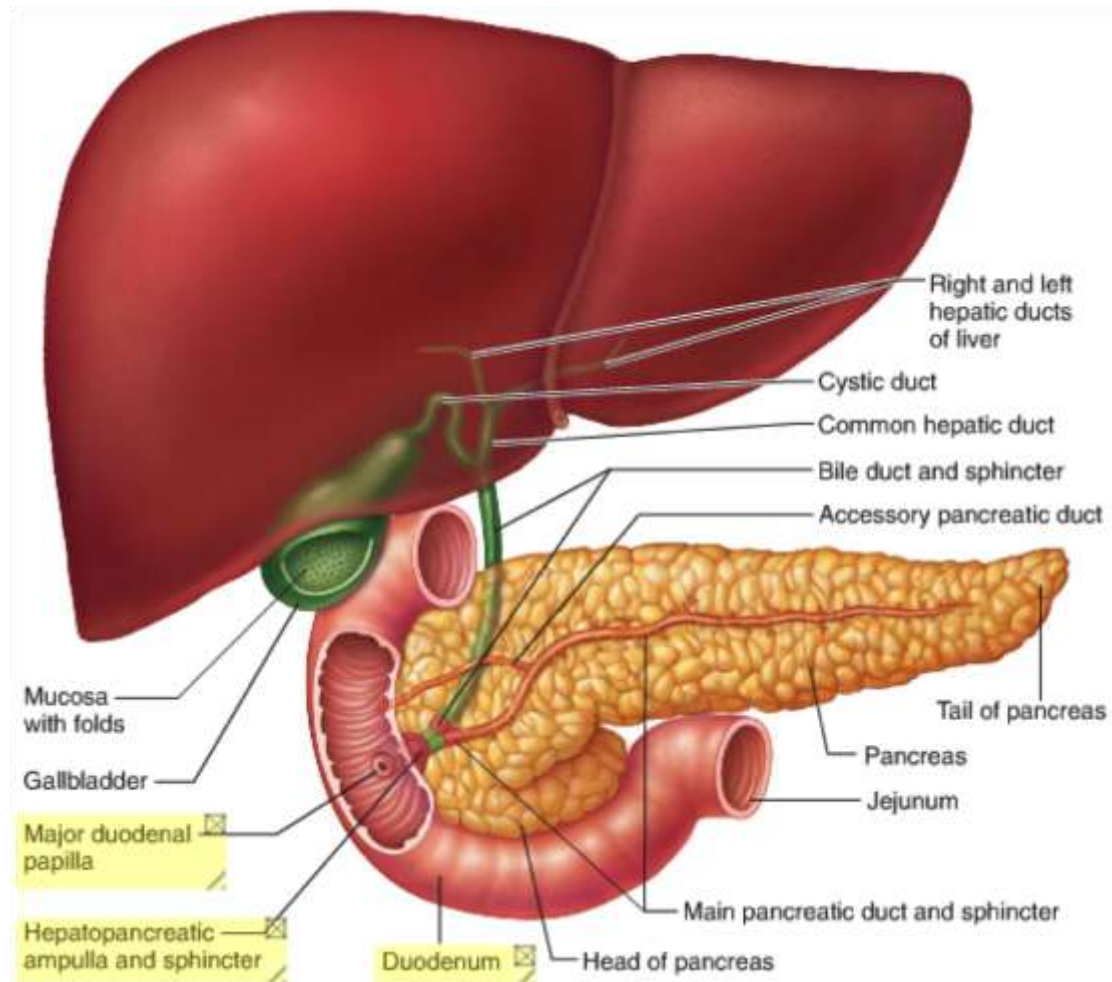
A serous membrane known as the serosa covers the muscularis externa along most portions of the digestive tract inside the peritoneal cavity (Figure 24–3).

There is **no serosa** covering the muscularis externa of the oral cavity, pharynx, esophagus, and rectum. Instead, a dense network of collagen fibers firmly attaches the digestive tract to adjacent structures. This fibrous sheath is called an *adventitia* .

- The activities of the digestive system are regulated by both hormones and neural reflexes. Four important hormones and their effects on target cells follow:
- Gastrin is produced by enteroendocrine cells of the stomach mucosa. Effects include:
 - Stimulation of gastric juice (especially HCl) secretion by gastric glands.
 - Stimulation of smooth muscle contraction in the stomach, small intestine, and large intestine, which increases gastric and intestinal motility.
 - Relaxation of the pyloric sphincter, which promotes gastric emptying into the small intestine.
- Secretin is produced by the enteroendocrine cells of the duodenal mucosa. Effects include:
 - Stimulation of bicarbonate secretion by the pancreas, which stabilizes the pH of the chyme when released into the duodenum.
 - Stimulation of bile production by the liver.
 - Inhibition of gastric juice secretions and gastric motility, which in turn slows digestion in the stomach and retards gastric emptying.

- Cholecystokinin (CCK) is produced by the enteroendocrine cells of the duodenal mucosa. Effects include:
 - Stimulation of bile release by the gallbladder.
 - Stimulation of pancreatic juice secretion.
 - Relaxation of the hepatopancreatic ampulla and opening of the hepatopancreatic sphincter, which allows the flow of bile and pancreatic juices into the duodenum.
- Glucose insulintropic peptide (GIP) is produced and released by the enteroendocrine cells of the duodenal mucosa in response to the presence of the glucose in the small intestine. This hormone stimulates the pancreas to begin releasing insulin. Some researchers refer to this hormone as *glucose-dependent insulintropic peptide* (still maintaining the abbreviation of GIP; some also use GDIP).
- The second regulatory agent of the digestive system is the nervous system.

hepatopancreatic ampulla



- References :
- Human physiology, Stuart Ira Fox.
- Fundamentals of anatomy and physiology, Martini.