Digestive System
Esophagus and Stomach
Lec. 20

Histology

Second year

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General Plan of the Digestive System

- The digestive (gastrointestinal) tract is a long hollow tube that extends from the esophagus to the rectum. It includes the esophagus, stomach, small intestine (duodenum, jejunum, ileum), large intestine (colon), and rectum. The wall of the digestive tube exhibits four layers that show a basic histologic organization. The layers are the mucosa, submucosa, muscularis externa, and serosa or adventitia. Because of the different functions of the digestive organs in the digestive process, the morphology of these layers exhibits variations.

1. **The mucosa** is the innermost layer of the digestive tube. It consists of a covering epithelium and glands that extend into the underlying layer of loose connective tissue called the **lamina propria**. An inner circular and outer longitudinal layer of smooth muscle, called the **muscularis mucosae**, forms the outer boundary of the mucosa.

2. **The submucosa** is located below the mucosa. It consists of dense irregular connective tissue with numerous blood and lymph vessels and a **submucosal (Meissner's) nerve plexus**. This nerve plexus contains postganglionic parasympathetic neurons. The neurons and axons of the submucosal nerve plexus control the motility of the mucosa and secretory activities of associated mucosal glands. In the initial portion of the small intestine, the duodenum, the submucosa contains numerous branched mucous glands.

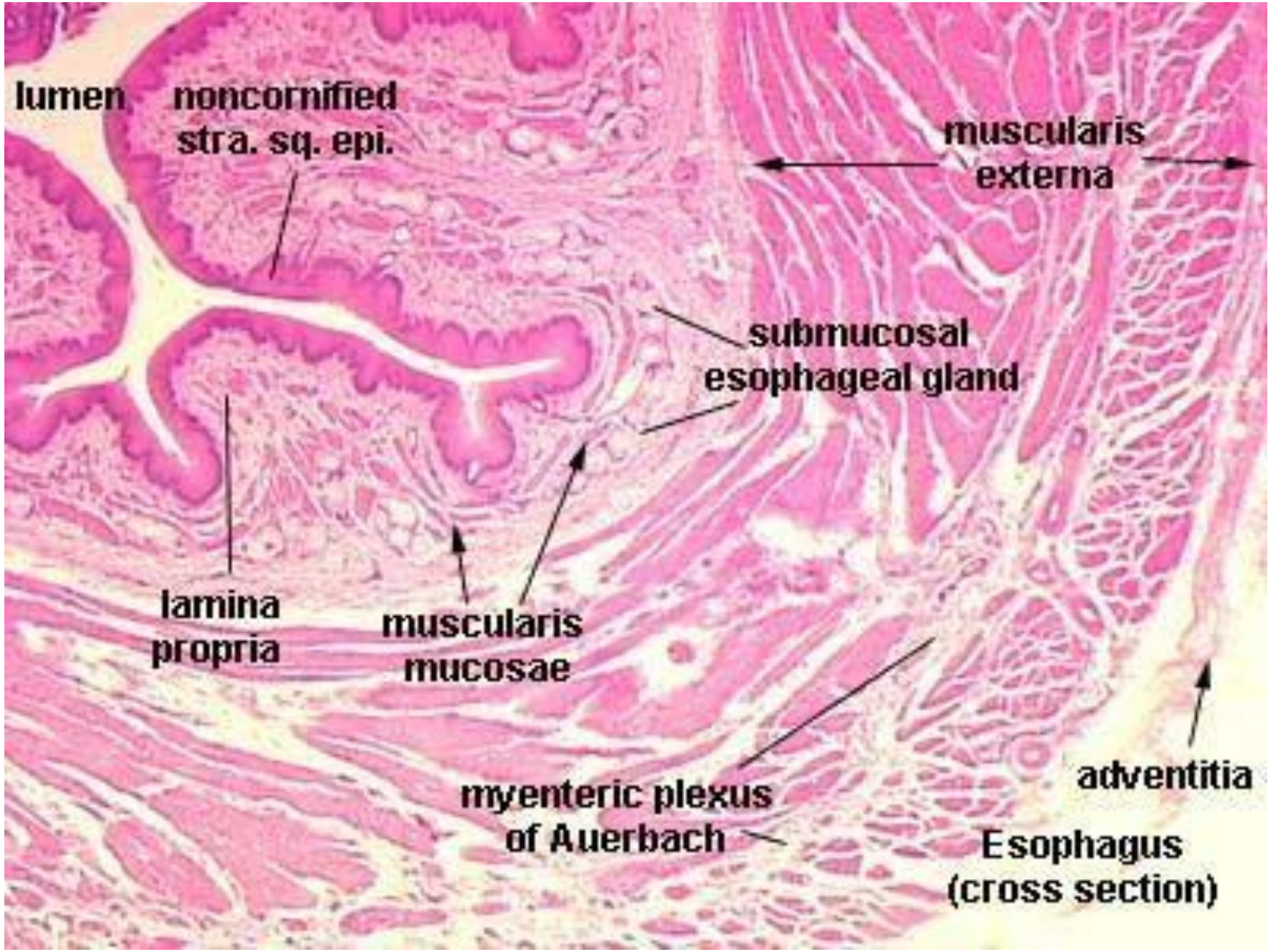
3. The muscularis externa is a thick, smooth muscle layer located inferior to the submucosa. Except for the large intestine, this layer is composed of an inner layer of circular smooth muscle and outer layer of longitudinal smooth muscle. Situated between the two smooth muscle layers of the muscularis externa is connective tissue and another nerve plexus called the myenteric (Auerbach's) nerve plexus. This plexus also contains some postganglionic parasympathetic neurons and controls the motility of smooth muscles in the muscularis externa.

4. The serosa is a thin layer of loose connective tissue that surrounds the visceral organs. The visceral organs may or may not be covered by a thin outer layer of squamous epithelium called **mesothelium**. If mesothelium covers the visceral organs, the organs are within the abdominal or pelvic cavities (intraperitoneal) and the outer layer is called serosa. The serosa covers the outer surface of the abdominal portion of the esophagus, stomach, and small intestine. It also covers parts of the colon (ascending and descending colon) only on the anterior and lateral surfaces because their posterior surfaces are bound to the posterior abdominal body wall and are not covered by the mesothelium. When the digestive tube is not covered by mesothelium, it then lies outside of the peritoneal cavity and is called **retroperitoneal**. In this case, the outermost layer adheres to the body wall and consists only of a connective tissue layer called **adventitia**. The characteristic features of each layer of the digestive tube and their functions are discussed in detail with each illustration of the different organs.

Esophagus

- The esophagus is a soft tube approximately 10 inches long that extends from the pharynx to the stomach. It is located posterior to the trachea and in the mediastinum of the thoracic cavity. After descending in the thoracic cavity, the esophagus penetrates the muscular diaphragm. A short section of the esophagus is present in the abdominal cavity before it terminates at the stomach. In the thoracic cavity, the esophagus is surrounded only by the connective tissue, which is called the adventitia. In the abdominal cavity, a simple squamous mesothelium lines the outermost wall of the short segment of the esophagus to form the serosa.

- Internally, the esophageal lumen is lined with moist, nonkeratinized stratified squamous epithelium. When the esophagus is empty, the lumen exhibits numerous but temporary longitudinal folds of mucosa. In the lamina propria of esophagus near stomach are the esophageal cardiac glands. In the submucosa are small esophageal glands. Both glands secrete mucus to protect the mucosa and to facilitate the passage of food material through the esophagus. The outer wall of the esophagus, the muscularis externa, contains a mixture of different types of muscle fibers. In the upper third of the esophagus, the muscularis externa contains striated skeletal muscle fibers. In the middle third of the esophagus, the muscularis externa contains both skeletal and smooth muscle fibers, while the lower third of the esophagus is composed entirely of smooth muscle fibers.

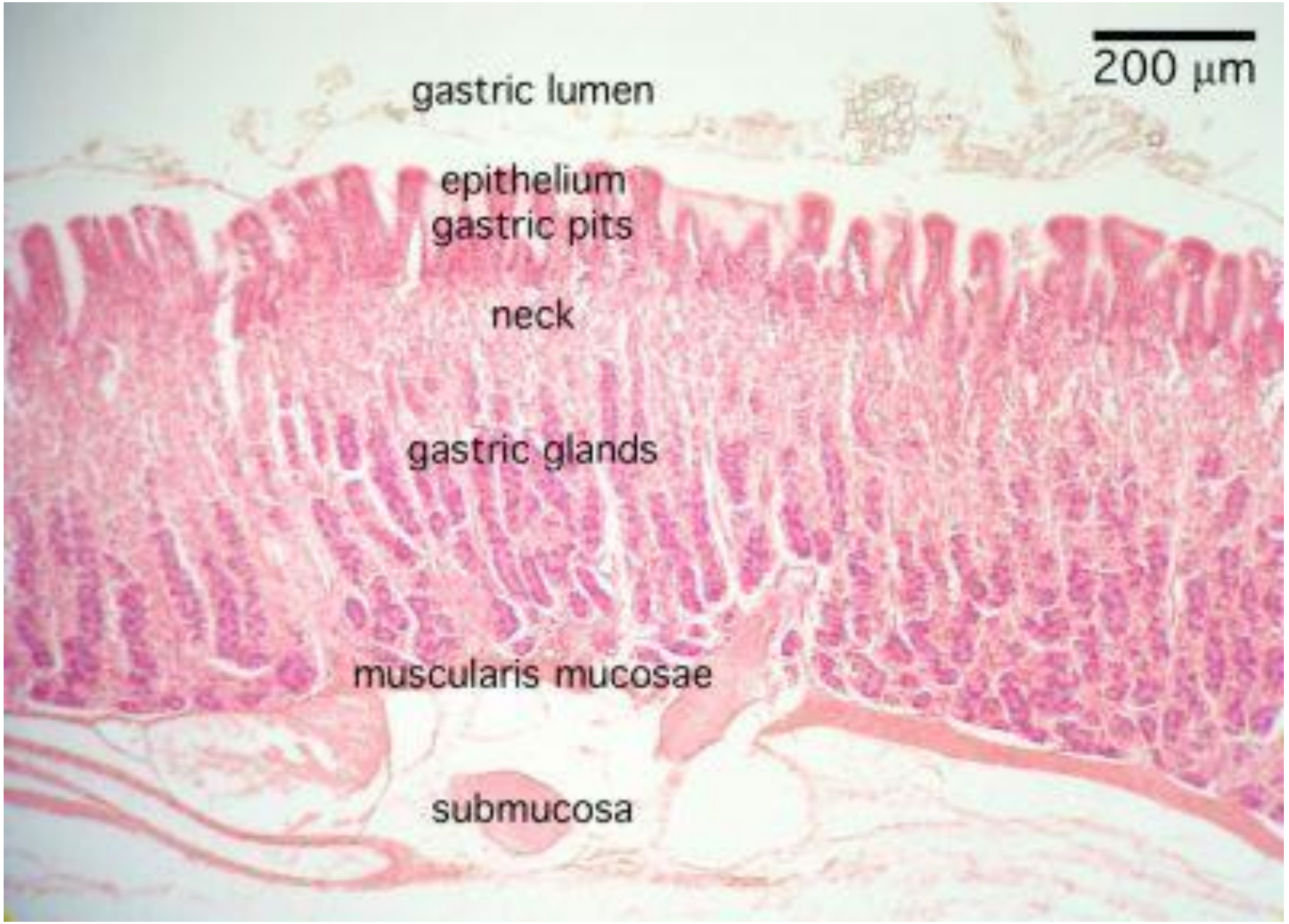

lumen
noncornified
stra. sq. epi.
muscularis
externa
submucosal
esophageal gland
lamina
propria
muscularis
mucosae
myenteric plexus
of Auerbach
adventitia
Esophagus
(cross section)

Stomach

- The stomach is an expanded hollow organ situated between the esophagus and small intestine. At the esophageal-stomach junction, there is an abrupt transition from the stratified squamous epithelium of the esophagus to the simple columnar epithelium of the stomach. The luminal surface of the stomach is pitted with numerous tiny openings called **gastric pits**. These are formed by the luminal epithelium that invaginates the underlying connective tissue lamina propria of the mucosa. The tubular gastric glands are located below the luminal epithelium and open directly into the gastric pits to deliver their secretions into the stomach lumen. The gastric glands descend through the lamina propria to the muscularis mucosae.

- Below the mucosa of the stomach is the dense connective tissue submucosa containing large blood vessels and nerves. The thick muscular wall of the stomach, the muscularis externa, exhibits three muscle layers instead of the two that are normally seen in the esophagus and small intestine. The outer layer of the stomach is covered by the serosa or visceral peritoneum. Anatomically, the stomach is divided into the **narrow cardia,** where the esophagus terminates, an upper dome-shaped **fundus,** a lower **body** or **corpus**, and a funnel-shaped, terminal region called the **pylorus**. The fundus and the body comprise about two thirds of the stomach and have identical histology. As a result, the stomach has only three distinct histologic regions.
- **The fundus and body** form the major portions of stomach. Their mucosae consist of different cell types and deep gastric glands that produce most of the gastric secretions or juices for digestion. Also, all stomach regions exhibit rugae, the longitudinal folds of the mucosa and submucosa. These folds are temporary and disappear when the stomach is distended with fluid or solid material.

fundus


200 µm
gastric lumen
epithelium
gastric pits
neck
gastric glands
muscularis mucosae
submucosa

Stomach: Pyloric Stomach