Histology of Digestive system (Gastrointestinal tract and Esophagus)

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ABSTRACT
The portion of the alimentary canal that extends from the proximal part of the esophagus to the distal part of the anal canal is a hollow tube of varying diameter. This tube has the same basic structural organization throughout its length. Its wall is formed by four distinctive layers. From the lumen outward, they are: 
- Mucosa, consisting of a lining epithelium, an underlying connective tissue called the lamina propria, and the muscularis mucosae, composed of smooth muscle. 
- Submucosa, consisting of dense irregular connective tissue. 
- Muscularis externa, consisting in most parts of two layers of smooth muscle. 
- Serosa, a serous membrane consisting of a simple squamous epithelium, the mesothelium, and a small amount of underlying connective tissue. An adventitia consisting only of connective tissue is found where the wall of the tube is directly attached or fixed to adjoining structures (i.e., body wall and certain retroperitoneal organs).

INTRODUCTION
The absorption of digested nutrients, water, and electrolytes is possible because of projections of the mucosa and submucosa into the lumen of the digestive tract. These surface projections greatly increase the surface area available for absorption and vary in size and orientation. They consist of the following structural specializations.
- Plicate circulares are circumferentially oriented submucosal folds present along most of the length of the small intestine.
- Villi are mucosal projections that cover the entire surface of the small intestine, the principal site of absorption of the products of digestion.
- Microvilli are tightly packed, microscopic projections of the apical surface of intestinal absorptive cells. They further increase the surface available for absorption [1].

In addition, the glycocalyx consists of glycoproteins that project from the apical plasma membrane of epithelial absorptive cells. It provides additional surface for adsorption and includes enzymes secreted by the absorptive cells that are essential for the final steps of digestion of proteins and sugars. The epithelium selectively absorbs the products of digestion both for its own cells and for transport into the vascular system for distribution to other tissues [2].

Analysis of mucosa:
The structure of the esophagus and gastrointestinal tract varies considerably from region to region; most of the variation occurs within the mucosa. The epithelium differs throughout the alimentary canal and is adapted to the specific function of each part of the tube. The histologic characteristics of these layers are described below in relation to specific regions of the digestive tube. The mucosa has three principal functions: protection, absorption, and secretion [1].

The epithelium of the mucosa serves as a barrier that separates the lumen of the alimentary canal from the rest of the organism:
The epithelial barrier separates the external luminal environment of the tube from the tissues and organs of the body. The barrier aids in protection of the individual from the entry of antigens, pathogens, and other noxious substances. In the esophagus, a stratified squamous epithelium provides protection from physical abrasion by ingested food. In the gastrointestinal portion of the alimentary tract, tight junctions between the
simple columnar epithelial cells of the mucosa serve as a selectively permeable barrier. Most epithelial cells transport products of digestion and other essential substances such as water through the cell and into the extracellular space beneath the tight junctions [1].

The submucosa consists of a dense, irregular connective tissue layer containing blood and lymphatic vessels, a nerve plexus, and occasional glands:

The submucosa contains the larger blood vessels that send branches to the mucosa, muscularis externas, and serosa. The submucosa also contains lymphatic vessels and a nerve plexus. The extensive nerve network in the submucosa contains visceral sensory fibers mainly of sympathetic origin, parasymathetic (terminal) ganglia, and preganglionic and postganglionic parasymathetic nerve fibers. The nerve cell bodies of parasympathetic ganglia and their postganglionic nerve fibers represent the enteric nervous system, the third division of the autonomic nervous system. This system is primarily responsible for innervating the smooth muscle layers of the alimentary canal and can function totally independent of the central nervous system. In the submucosa, the network of unmyelinated nerve fibers and ganglion cells constitute the submucosal plexus (Meissner's plexus).

As noted, glands occur occasionally in the submucosa in certain locations. For example, they are present in the esophagus and the initial portion of the duodenum. In histologic sections, the presence of these glands often aids in identifying the specific segment or region of the tract [2].

Comprehensire research about serosa and adventitia:

The serosa is a serious membrane consisting of a layer of simple squamous epithelium, called the mesothelium, and a small amount of underlying connective tissue. It is equivalent to the visceral peritoneum described in gross anatomy. The serosa is the most superficial layer of those parts of the digestive tract that are suspended in the peritoneal cavity. As such, the serosa is continuous with both the mesentery, and the lining of the abdominal cavity.

Large blood and lymphatic vessels and nerve trunks travel through the serosa (from and to the mesentery) to reach the wall of the digestive tract. Large amounts of adipose tissue can develop in the connective tissue of the serosa (and in the mesentery).

Parts of the digestive tract do not possess a serosa. These include the thoracic part of the esophagus and portions of Structures in the abdominal and pelvic cavities that are fixed to the cavity wall—the duodenum, ascending and descending colon, rectum, and anal canal. These structures are attached to the abdominal and pelvic wall by connective tissue, the adventitia, which blends with the connective tissue of the wall (2).

Stomach:

The stomach is an expanded part of the digestive tube that lies beneath the diaphragm. It receives the bolus of macerated food from the esophagus. Mixing and partial digestion of the food in the stomach by its gastric secretions produce a pulpy fluid mix called chyme. The chyme then passes into the small intestine for further digestion and absorption [2].

The stomach is divided histologically into three regions on the basis of the type of gland that each contains:

Gross anatomists subdivide the stomach into four regions. The cardia surrounds the esophageal orifice; the fundus lies above the level of a horizontal line drawn through the esophageal (cardiac) orifice; the body lies below this line; and the pyloric part is the funnel-shaped region that leads into the pylorus, the distal, narrow sphincteric region between the stomach and duodenum. Histologists also subdivide the stomach, but into only three regions. These subdivisions are based not on location but on the types of glands that occur in the gastric mucosa. The histologic regions are the. [3]

- Cardiac region (cardia), the part near the esophageal orifice, which contains the cardiac glands.
- Pyloric region (pylorus), the part proximal to the pyloric sphincter, which contains the pyloric glands.
- Fundic region (fundus), the largest part of the stomach, which is situated between the cardia and pylorus and contains the fundic or gastric glands. [4]

Gastric Muscularis externa:

The muscularis externa of the stomach is traditionally described as consisting of an outer longitudinal layer, a middle circular layer, and an inner oblique layer. This description is somewhat misleading, as distinct layers may be difficult to discern. As with other hollow, spheroidal organs (e.g., gallbladder, urinary bladder, and uterus), the smooth muscle of the muscularis externa of the stomach is somewhat more ram domly oriented than the term "layer" implies. Moreover, the longitudinal layer is absent from much of the anterior and posterior stomach surfaces, and the circular layer is poorly developed in the periesophageal region. The arrangement of the muscle layers is functionally important, as it relates to its role in mixing chyme during the digestive process as well as to its ability to force the partially digested contents into the small intestine. Groups of ganglion cells
and bundles of unmyelinated nerve fibers are present between the muscle layers. Collectively, they represent the myenteric (Auerbach's) plexus, which provides innervations of the muscle layers. [4]

**Conclusion:**
1. The absorptive surface area of the small intestine is amplified by tissue and cell specializations of the submucosa and mucosa.
2. Each circular fold is circularly arranged and extends about one half to two thirds of the way around the circumference of the lumen.

**REFERENCES**