**Lecture title: Digestive system**

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**Cardiac Region** The first category is the cardiac glands.

These are found in the most proximal region of the stomach (i.e., that part closest to the input of the esophagus), called the "cardiac region," because it's located close to the heart.

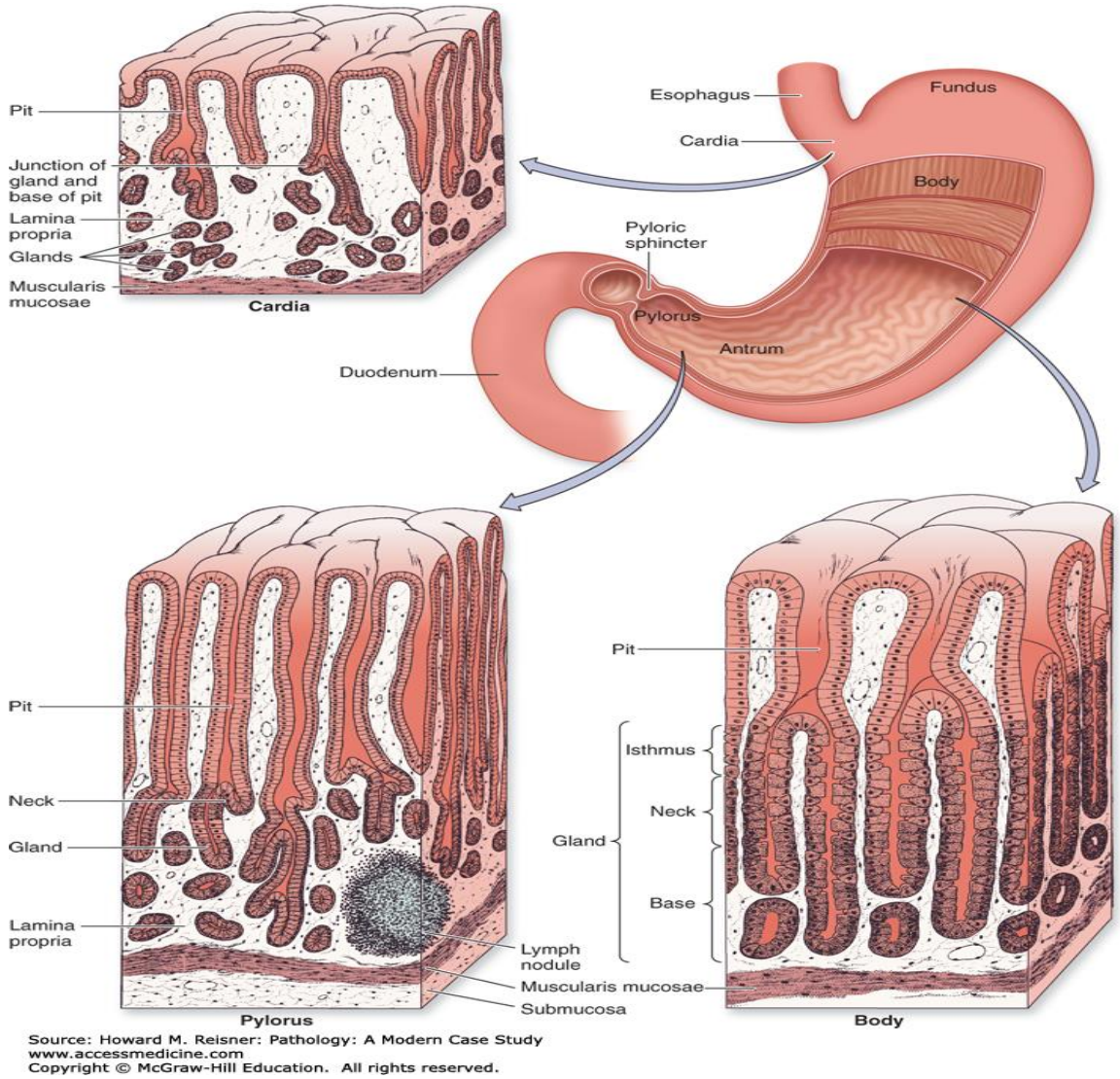
The gastric pits are wide and deep At the bottom of the gastric pits are the openings into the secretory portions of the glands. The glands themselves are short, branched tubular, slightly coiled with wide lumen extending deep into the mucosa, and are lined with simple cuboidal mucous secreting cells.

They are limited in their distribution to the region immediately adjacent the esophagus. Occasionally similar glands can be found in the esophagus itself. These are called "esophageal cardiac glands," and probably represent individual variations in development.

The second and by far the most numerous type of gastric gland is **the Fundic gland**. these are found underlying the bulk of the gastric mucosa. these glands produce the bulk of secretions in the stomach.

They are deep, straight glands, with a mixed population of cells...the fundic glands, like the other types, open into the base of comparatively shallow gastric pits. Each gland consists of a neck, a long body and a dilated base or fundus.

**The fundic glands are lined by four cell types;** mucous neck cells, enzyme-producing cells, acid-producing cells and scattered endocrine cells




**Mucous Neck Cells**

They are found in the neck of the gland and are smaller than the surface

mucous cells They have basal nuclei and finely granular cytoplasm due to the presence of small mucus vacuoles that are distributed throughout the cytoplasm By LM, mucin granules do not appear unless stained by PAS.

## Enzyme-Producing Cells

They are also called chief or peptic or zymogen cells. They are the most numerous cell types within the fundic glands, hence the name chief cells

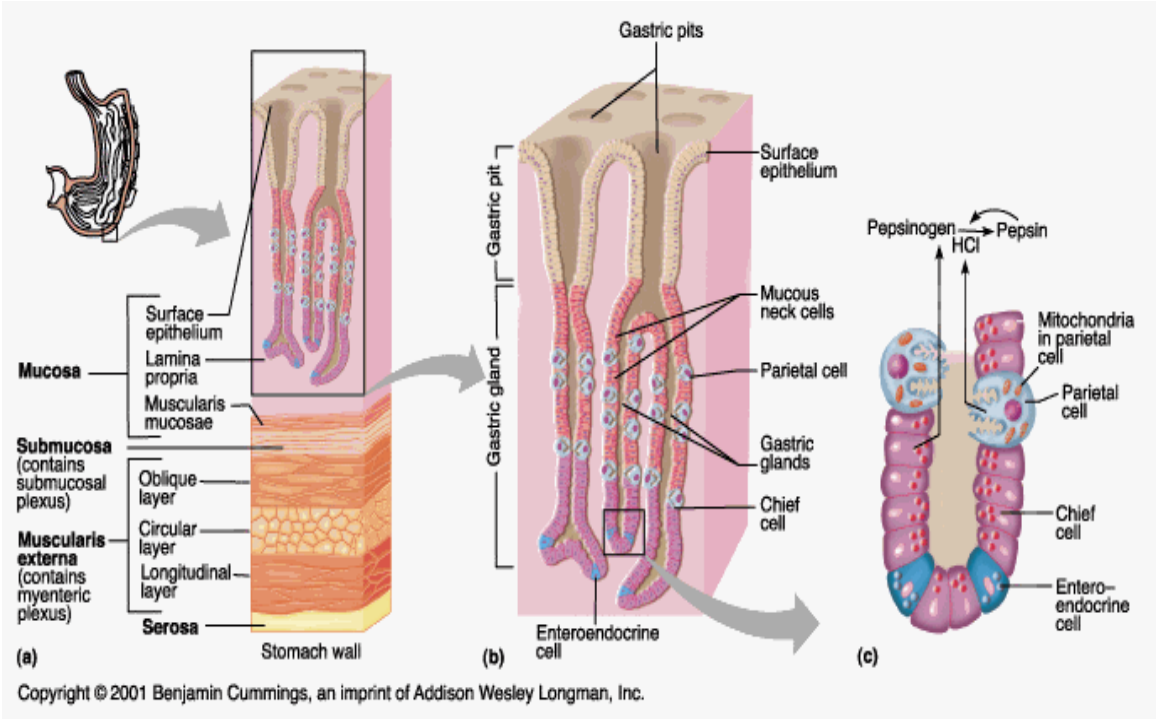
The cells are cuboidal or pyramidal exhibiting all the criteria of protein-secreting cells: deep cytoplasmic basophilia, vesicular nucleus, and prominent nucleoli. The cell apices appear acidophilic due to the presence of eosinophilic refractile cytoplasmic granules called zymogen granules. The zymogen granules contain the inactive enzyme precursor pepsinogen, which is released into the lumen of the stomach where it is converted by the HCl into active enzyme pepsin.

## Acid-Producing cells

They are also called parietal or oxyntic cells. They are round or pyramidal-shaped with spherical central nuclei. They are very conspicuous, much larger than chief cells, and very strongly eosinophilic. The base of the cell bulges outward and its narrow apex reaches the lumen of the gland.
The parietal cells make hydrochloric acid, to keep the pH of stomach juice low (about 2.0 to 3.0 is typical). This pH is necessary to activate the gastric enzymes. Parietal cells are also thought to secrete the substance called intrinsic factor which is essential for the absorption of vitamin B12 in the ileum.

## Enteroendocrine

They are small spherical cells and are sited on the epithelial basement membrane. In H&E sections, they have a spherical, central dark-staining nucleus and a rim of clear cytoplasm Some cells have an affinity for silver stains and are called argyrophil cells, others have an affinity for bichromate salts and are called chromaffin cells. The cells store and secrete serotonin, somatostatin, vasointestinal polypeptide-like (VIP), gastrin, bombesin-like peptides. These hormones regulate the gastrointetinal functions..




▲Near the base of the intestinal glands, acidophilic granular cells (of Paneth) are present in ruminants and horses .

They are pyramid-shaped cells with prominent spherical, acidophilic granules located between the nucleus and the cell apex.

## Pyloric Region

The third category of gastric glands is pyloric glands, found in the region of the pylorus, the junction with the first part of the intestine.

Pyloric glands produce a mucous secretion. Structurally they closely resemble the glands of the cardiac region, though in the pyloric stomach the gastric pits tend to be deeper and the glands larger and more obvious.

## Non-Glandular Region

The non-glandular region is lined by stratified squamous keratinized epithelium derived from that of the esophagus. It is entirely absent in carnivores, small in pigs, wide in horse and reaches its greatest development in ruminants where it is subdivided into three distinct compartments; rumen, reticulum and omasum..
The structure of the other layers within the non-glandular are the same as seen for any tubular organ within the digestive tract.

## Ruminants Stomach.

The four divisions of the ruminant stomach are the rumen, the reticulum, the omasum, and the abomasum.The first three compartments are referred to as fore stomach. The fourth compartment is referred to as true stomach.

## Rumen

The rumen is the site for microbial fermentation of fibrous ingesta. Its mucosa is active in the absorption of short-chain volatile fatty acids produced during the fermentation process. The ruminal mucosa has numerous finger-like or tongue-shaped projections called ruminal papillae.

The mucosa comprises lamina epithelialis and lamina propria.

The epithelium is stratified squamous keratinized epithelium.

The ruminal epithelium has protective, metabolic and absorptive functions.

There is no muscularis mucosae in the rumen.

The lamina propria and the submucosa combine to form a single underlying connective tissue support for the epithelium. A dense network of fenestrated capillaries lies beneath the epithelium.

The submucosa is looser than the propria and contains many blood vessels, lymphatics and nerve plexus.

There are no glands present in either the propria or submucosa..

The tunica muscularis consists of inner circular and outer longitudinal layers of smooth muscles with myentric plexus in-between. The serosa consists of loose connective tissue with an outer mesothelial covering.

## Reticulum

The reticulum is designed for mechanical breaking down of the ingesta into fine particles.

The reticular wall comprises mucosa, submucosa, tunica muscularis and serosa. The reticular mucosa is organized into permanent anastomosing folds giving it a characteristic honeycomb appearance. The sides of the folds have many conical papillae.. A band of smooth muscles is located in the upper part of the large reticular folds derived from the lamina muscularis of the esophagus. At places where the reticular folds intersect, the muscle bundles pass from one fold into another, forming a

continuous network of smooth muscles throughout the reticular mucosa. The contraction of the muscle bundles serves to contract the openings of the honeycomb, somewhat like a purse-string closes a purse.

The submucosa blends with the overlaying lamina propria without any demarcation, and is composed of loose connective tissue contains blood vessels, lymphatics and nerves.

## Omasum

The omasum is involved in mechanical breaking down of the ingesta into fine particles. The mucosa is organized into longitudinal omasal laminae of five different lengths. The lamina epithelialis is stratified squamous keratinized type.

N.B. Each large omasal fold has, therefore, three muscle layers: two lateral layers derived from the muscularis mucosae, and one central layer originating from the inner circular layer of the tunica muscularis.

The outer serosa is a loose connective tissue layer with an outer mesothelial covering.

## Abomasum

The abomasum is the true glandular stomach of ruminants. The submucosa of this region is much more developed than in the previous divisions of the stomach.

The abomasum, unlike the rumen, reticulum, and omasum, does not absorb nutrients. As with monogastric animals, it prepares food for enzymatic breakdown and absorption in the small intestine.