

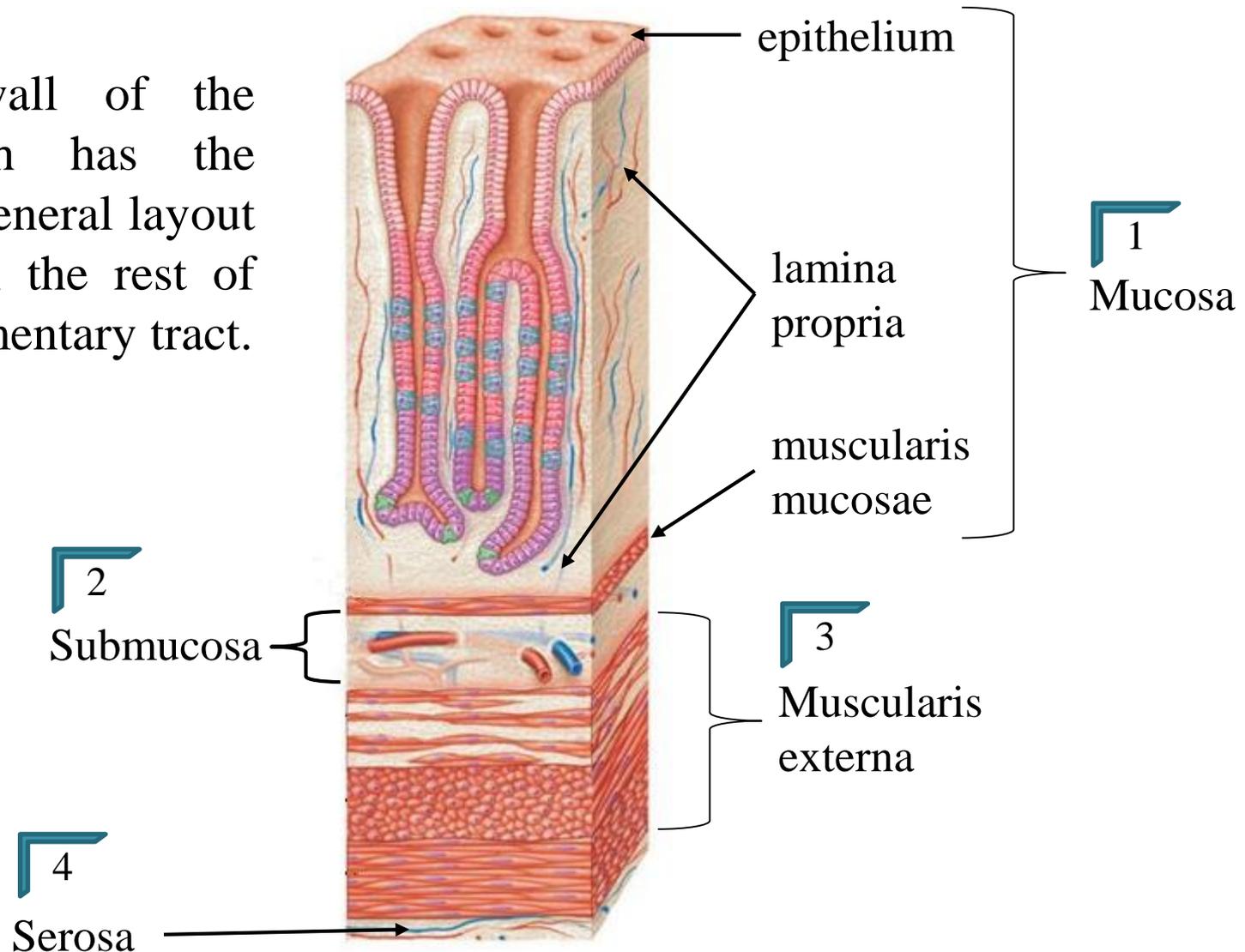


# HISTOLOGY OF THE STOMACH AND THE INTESTINES

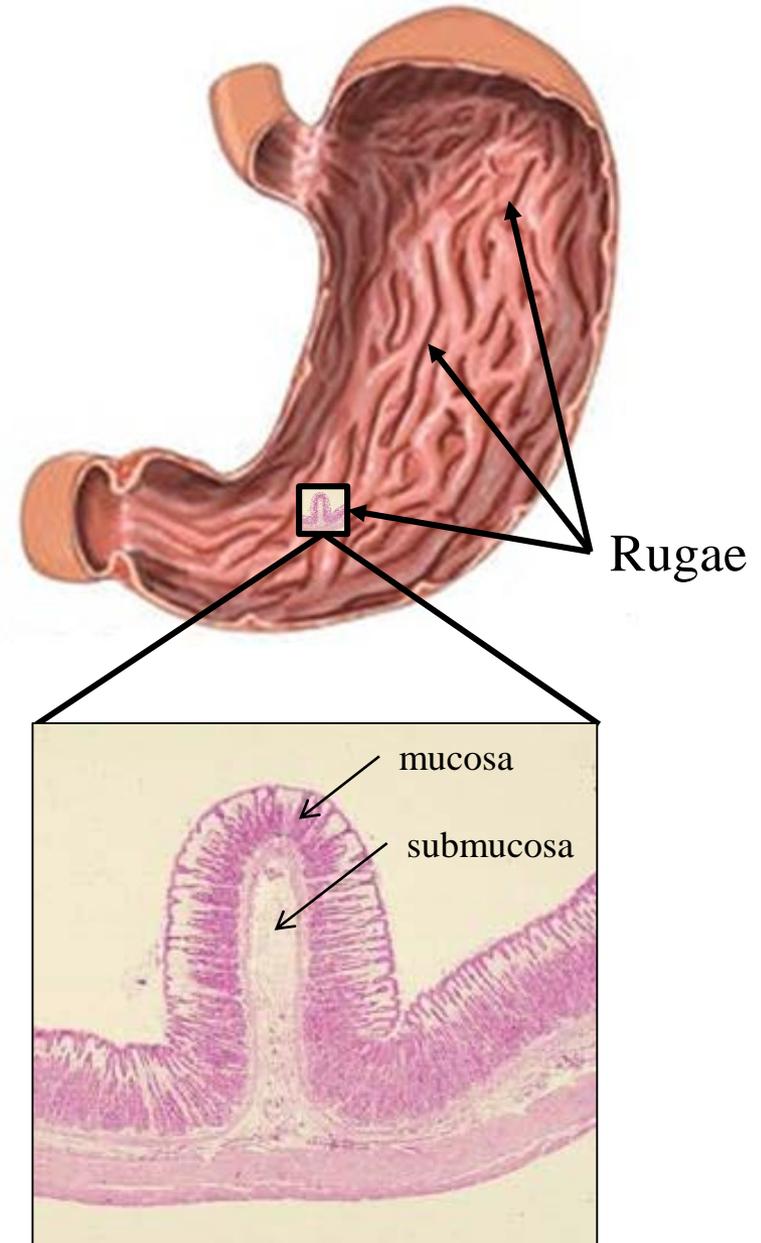
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# Histology of the Stomach

The wall of the stomach has the same general layout seen in the rest of the alimentary tract.

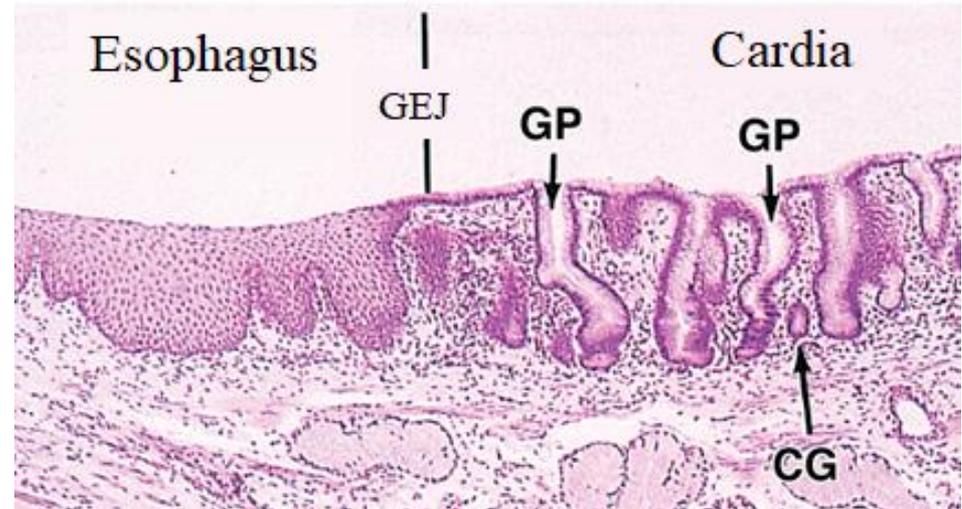
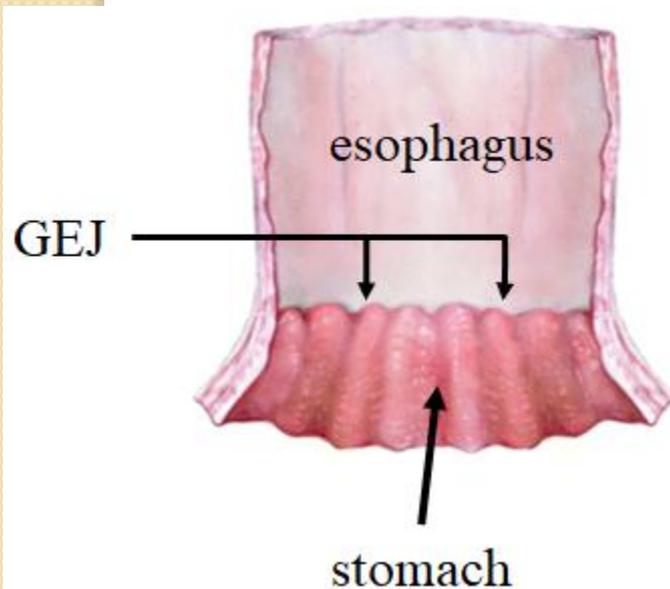


- The inner surface of an empty stomach shows several longitudinal folds of *mucosa and submucosa* called **Rugae**.
- These disappear when the stomach is distended, thus allowing the stomach to increase in size



# 1 Mucosa - Epithelium

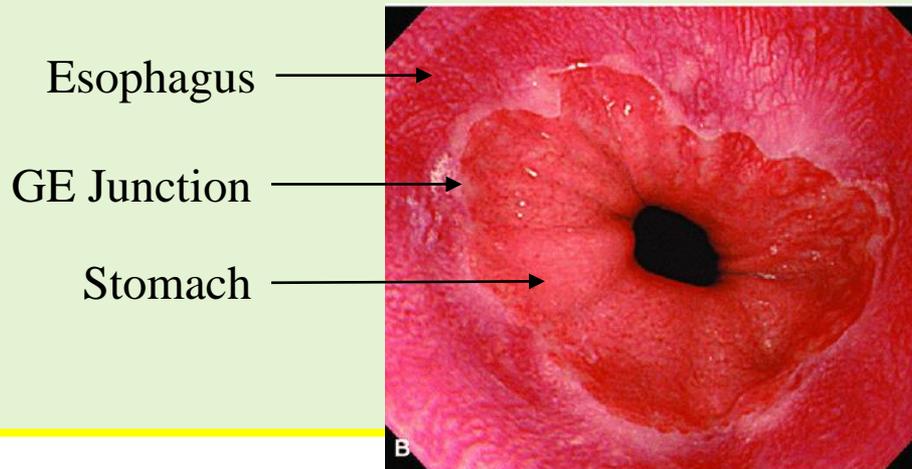
- The stomach is lined by simple columnar epithelium.
- This simple columnar epithelium begins *Abruptly* at the gastro-esophageal junction (GEJ).



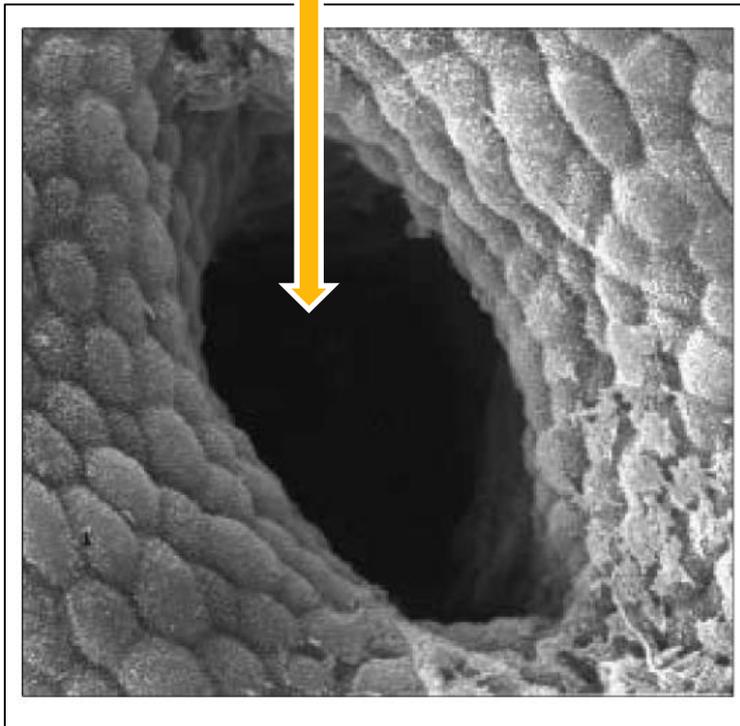
GP = gastric pit. CG = cardiac glands.

## Endoscopic difference between the *Esophageal* and *Gastric* mucosa

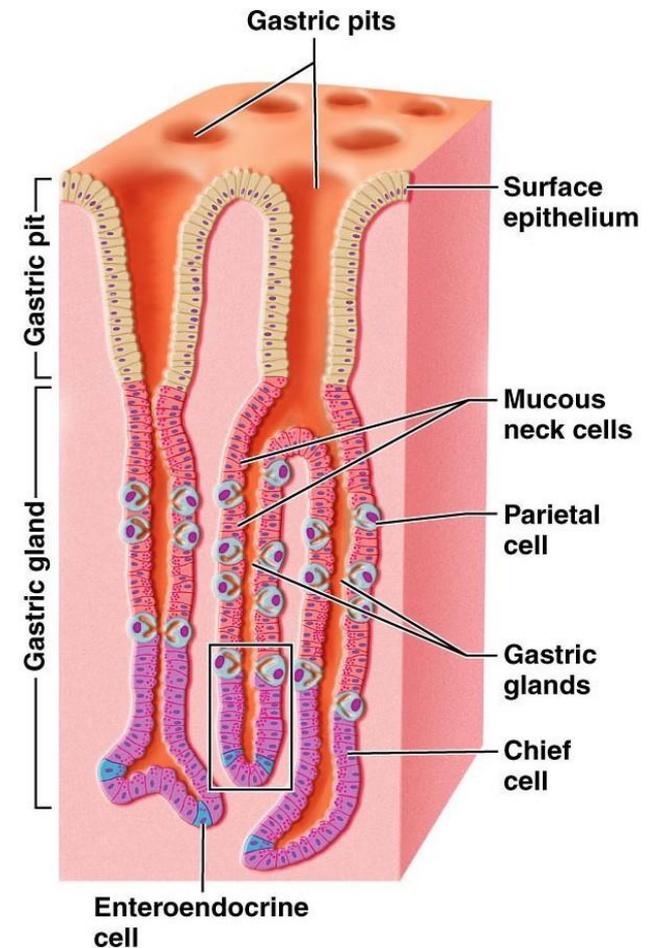
|            | Esophagus         | Stomach   |
|------------|-------------------|---|
| Color      | Pink in color     | Red in color  |
| Brightness | Not shiny         | Shiny – due to the presence of mucous layer                                 |
| Surface    | Smooth - No folds | Presence of folds – Rugae (unless the stomach is inflated during procedure) |



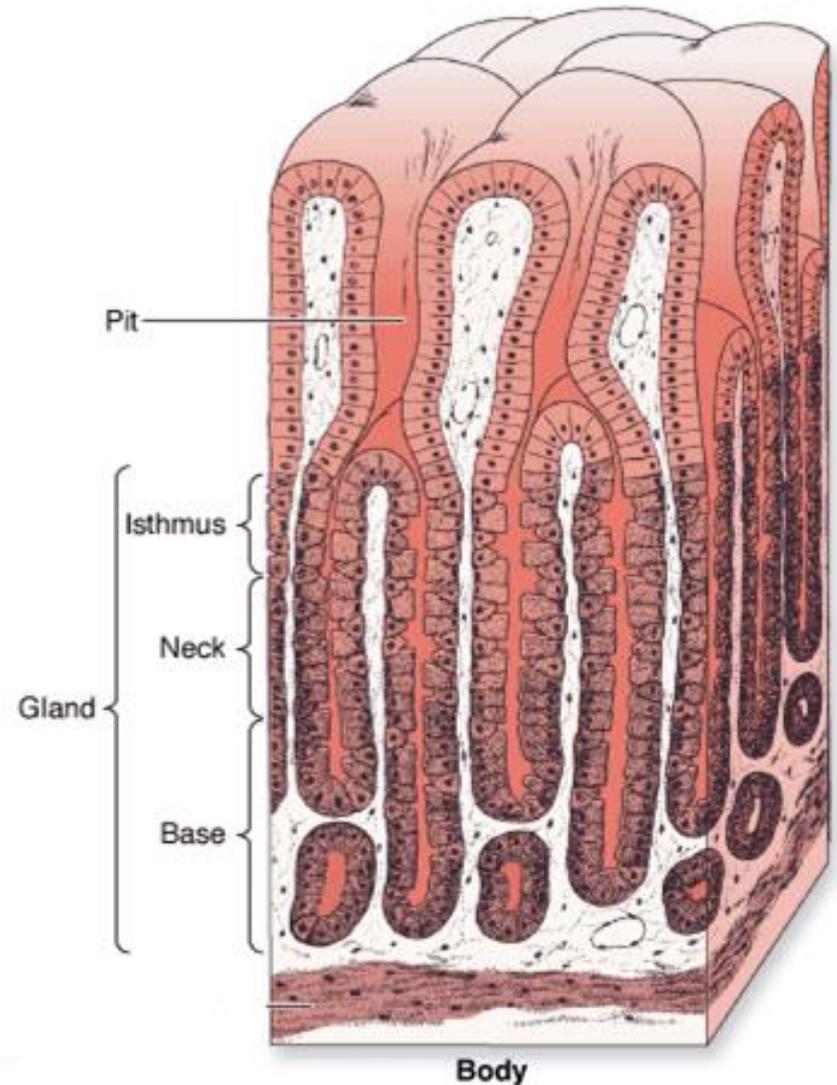
- The epithelium invaginates the lamina propria to form **Gastric Pits**



- **Branched Tubular Gastric Glands** open into these pits

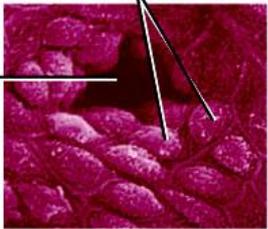


- Each gastric gland is divided into the following regions:
  1. ***Isthmus*** - at its junction with the pit
  2. ***Neck*** - next to the isthmus
  3. ***Base*** - the deepest part



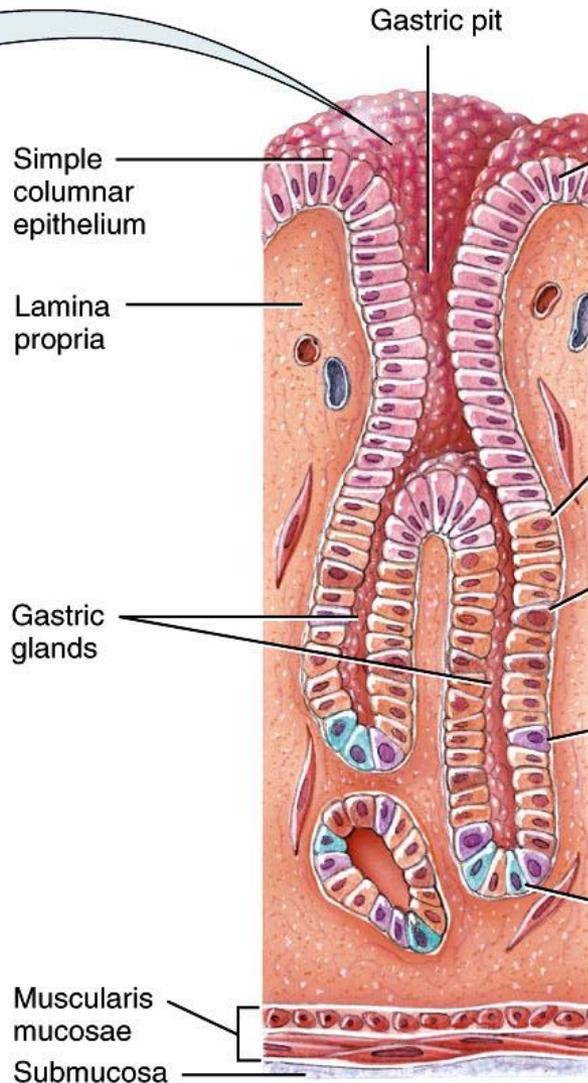
# Cells of the Gastric Epithelium

Surface mucous cells



**SEM** about 1000x  
Stomach mucosa

Gastric pit



1

Surface mucous cell  
(secretes mucus)

2

Mucous neck cell  
(secretes mucus)

3

Parietal cell  
(secretes hydrochloric acid and intrinsic factor)

4

Chief cell (secretes pepsinogen and gastric lipase)

5

G cell (secretes the hormone gastrin)

6

Stem Cells

## 1) Surface Mucous Cells:

- Line the lumen of the stomach and the gastric pits.
- Columnar cells. Basal part contain the oval nucleus and rough endoplasmic reticulum. The apical part is filled with mucinogen granules.
- The mucus secreted by these cells:
  - Forms a thick, viscous, gel-like coat on the surface of the stomach that can be easily seen. This coat acts as a physical barrier against microorganisms and the abrasive effects of food in the stomach.
  - Contains bicarbonate ions that neutralize the acid in the lumen thus protecting the wall of the stomach.



Prostaglandins increase the thickness of the mucus and the amount of bicarbonate ions produced by these cell thus enhancing their protective property. Aspirin (and other NSAIDs) reduces the production of prostaglandins thus reducing the protection provided by surface mucous cells.

## 2) Neck Mucous cells:

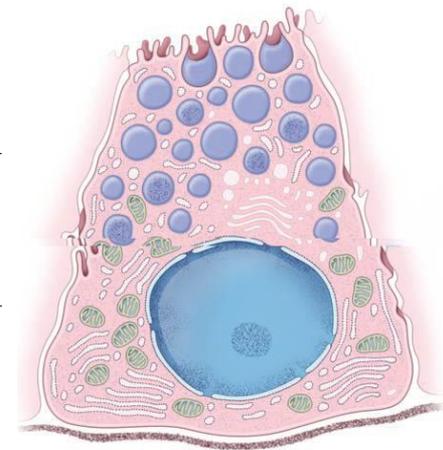
These are present in the neck region of the gastric glands. They produce thin mucus that doesn't form a visible coat over the mucosa.

## 3) Stem cells:

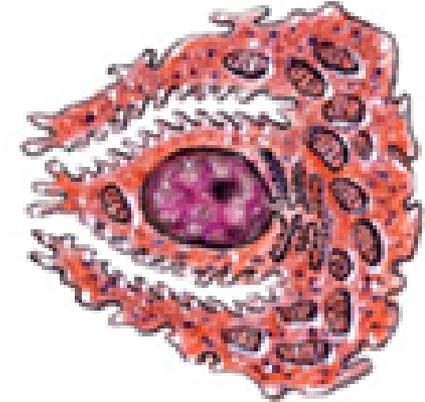
Undifferentiated highly mitotic cells that are usually present in the neck region of the gastric glands. **They divide and differentiate to form the surface epithelial cells and the various cells of the gastric glands.**

## 4) Chief cells:

- Lower part of the gland.
- Abundant rough endoplasmic reticulum in the basal part → Basophilic.
- Acidophilic secretory vesicles in apical part.
- **Secrete Pepsinogen and Gastric Lipase.**

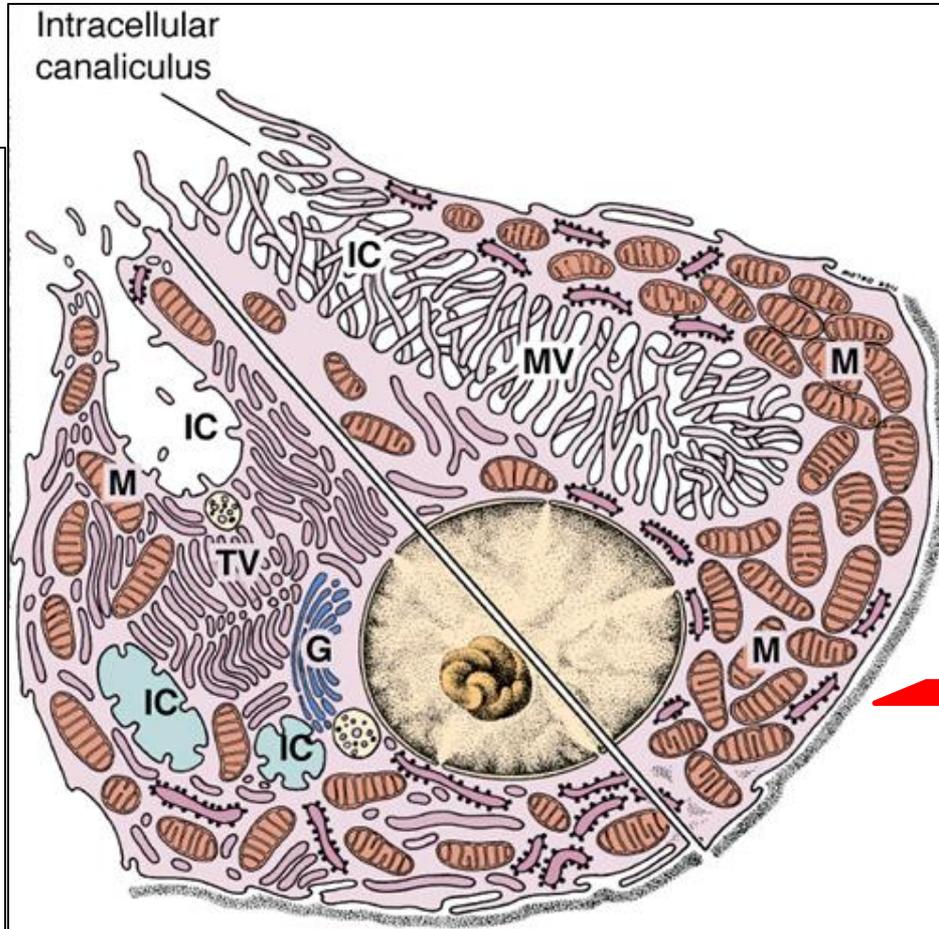


## 5) Parietal (Oxyntic) Cells:

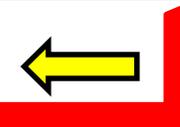


- In upper part of gland
- Large pyramidal cells
- Central nucleus
- Abundant mitochondria → Eosinophilic
- *Special features depending on activity*
- Long life span → about 200 days
- **Function:**
  - a) Secretion of HCl
  - b) Secretion of Intrinsic Factor (Important for the absorption of Vitamin B<sub>12</sub>)

**Resting phase:**  
the canaliculus is short and the microvilli are absent; however, the cytoplasm is filled with **tubulovesicular structures** that fuse with the cell membrane when the cell is activated producing the deep canaliculus and the microvilli



**Active phase:**  
the cell has a deep circular invagination, **the intracellular canaliculus**, into which protrude numerous microvilli. This provides an increased surface area for secretion



## Differences between Parietal and Chief cells of the gastric epithelium

| Feature \ Cell | Parietal                              | Chief   |
|----------------|---------------------------------------|---|
| Location       | Upper part of gastric glands          | Lower part of gastric gland                       |
| Size           | Larger                                | Smaller   |
| Cytoplasm      | Acidophilic                           | Basophilic  |
| Vesicles       | Tubulovesicles                        | Secretory vesicles in the apical part of the cell |
| Secretes       | Hydrochloric acid<br>Intrinsic Factor | Pepsinogen<br>Gastric Lipase                      |

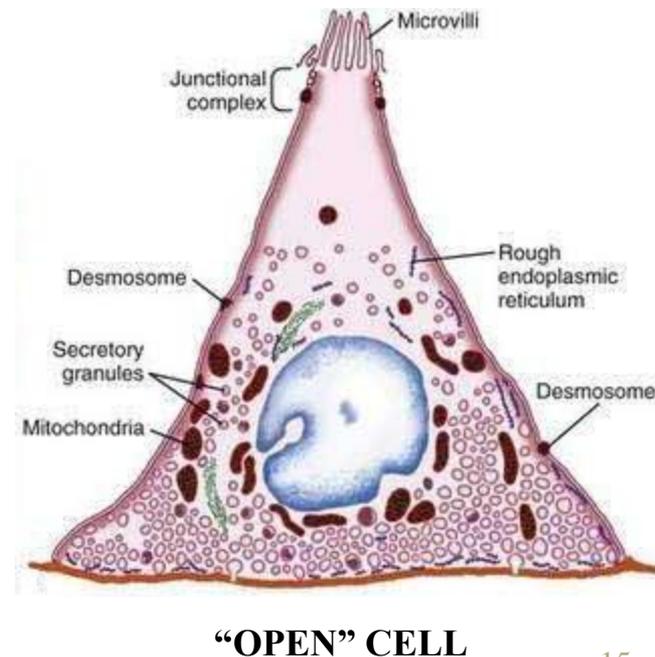
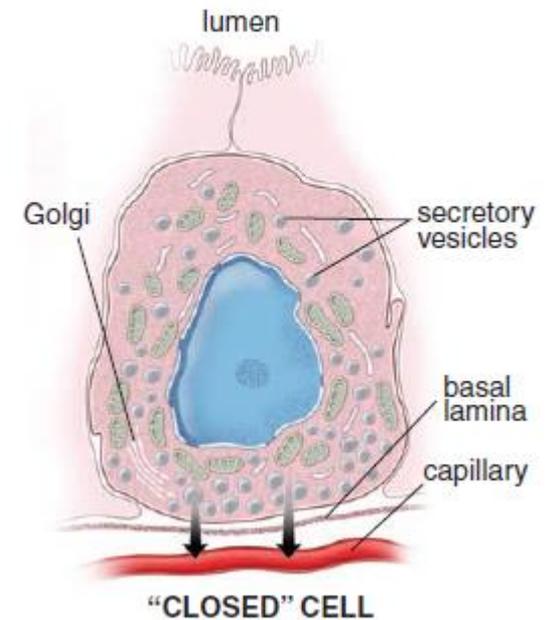
## Factors protecting gastric mucosa against HCl:

1. Mucus and bicarbonate secreted by the surface epithelium.
2. The surface epithelial cells have tight intercellular junctions and ion transporters that maintain the  $H^+$  and  $HCO_3^-$  concentrations.
3. Rapid turnover of the surface epithelial cells: about 5 days.
4. Extensive blood vessels in the lamina propria that provide nutrients, remove toxic material and help replace damaged cells.

Failure of these factors will make the gastric mucosa susceptible to damage by HCl and this will ultimately lead to ulceration. Damage to parietal cells will also lead to Vitamin B<sub>12</sub> deficiency (due to lack of intrinsic factor), which causes pernicious anemia.

## 6) Enteroendocrine cells:

- Found in the lower part of the gland.
- **Secrete hormones.**
- Secretory granules are usually found in the lower part of the cell. Example: G-cells which secrete gastrin.
- They could of two types:
  1. ***Closed type*** in which the cell is not in contact with lumen.
  2. ***Open type:*** the cell has a wide basal region with a thin apical process that reaches the lumen. The process ends in several microvilli which act as chemoreceptors that detect the contents of the lumen.



## Regional differences in mucosa

- 1) **The Cardia:** simple branched spiral gland.  
Mainly mucus secreting.
- 2) **Pylorus:** Deep pit. 2-3 spiral glands open into pit.  
Mucus and Gastrin secreting.
- 3) **Fundus/Body:** Pit not deep. 5-7 tubular glands open into pit. All cell types, mainly Parietal and Chief cells, are present.

## 2

## The other layers

- **Mucosa:** *lamina propria* is a loose connective tissue layer that surrounds and supports the gastric pits and glands. It's highly vascular and contains smooth muscle cells and some lymphoid cells. The *muscularis mucosae* is a smooth muscle cell layer that separates the mucosa from the submucosa.
- **Submucosa** is a connective tissue layer present under the mucosa. It contains the submucosal plexus and some lymphoid cells, macrophages, and mast cells.
- **Muscularis externa** has 3 layers: outer *Longitudinal*, middle *Circular* and inner *Oblique*. Help mix food well with gastric juice. Circular layer in pylorus thickens to form the pyloric sphincter. The myenteric plexus is located between these layers.
- **Serosa** (visceral peritoneum): areolar connective tissue and mesothelium. Continuous with the lesser and greater omenta.