

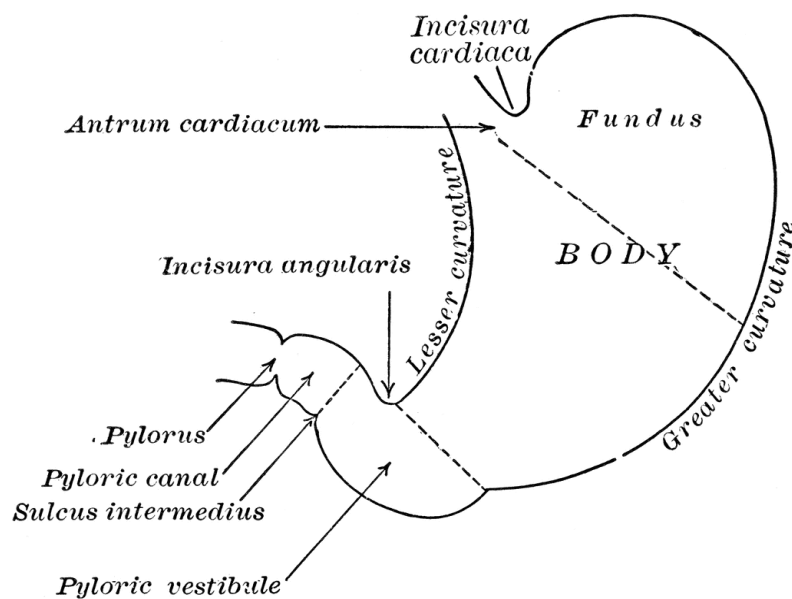
GIS-Anatomy

Lecture #8: The Stomach

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Introduction:

The stomach is a dilatation of the GIT between the oesophagus and the duodenum, present in the *epigastric* and *left hypochondriac* regions, its lower end usually reaches the *umbilical* level. It's variant in size and shape and position. The stomach may be short, horizontal and steer-horn shaped, or large fish-hook shaped reaching the pelvis.



The stomach is divided into 3 regions:

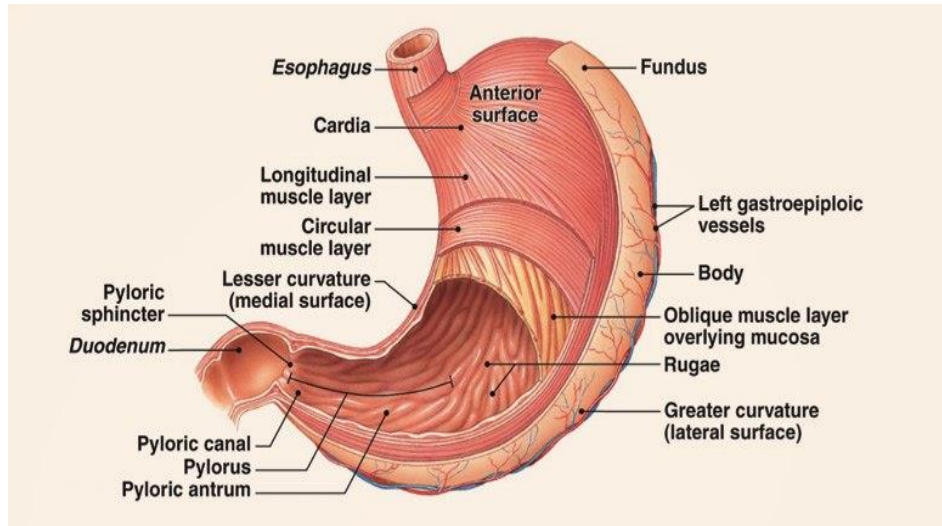
- 1) **The Fundus**: the area above the entrance of the oesophagus (the entrance is called the *Cardiac area*).
- 2) **The Body**: extends from the fundus downwards to the *angularis incisure* (or angular notch).
 - *Incisura angularis*: the most inferior part of the lesser curvature.
- 3) **The Pyloric part**: extends from the angularis incisure to the Pylorus (aka Pyloric sphincter). Composed of two areas:
 - i. *Pyloric antrum*: the dilated area (which connects to the body of the stomach)
 - ii. *Pyloric canal*: the rest (which ends with the pyloric sphincter and connects to the duodenum)

Stomach's surfaces:

Its right surface/side is called **the Lesser Curvature**: extends from the lower end of the oesophagus to the pyloric sphincter.

Its left surface/side is called **the Greater Curvature**.

It also has anterior & posterior surfaces.



Layers of the stomach:

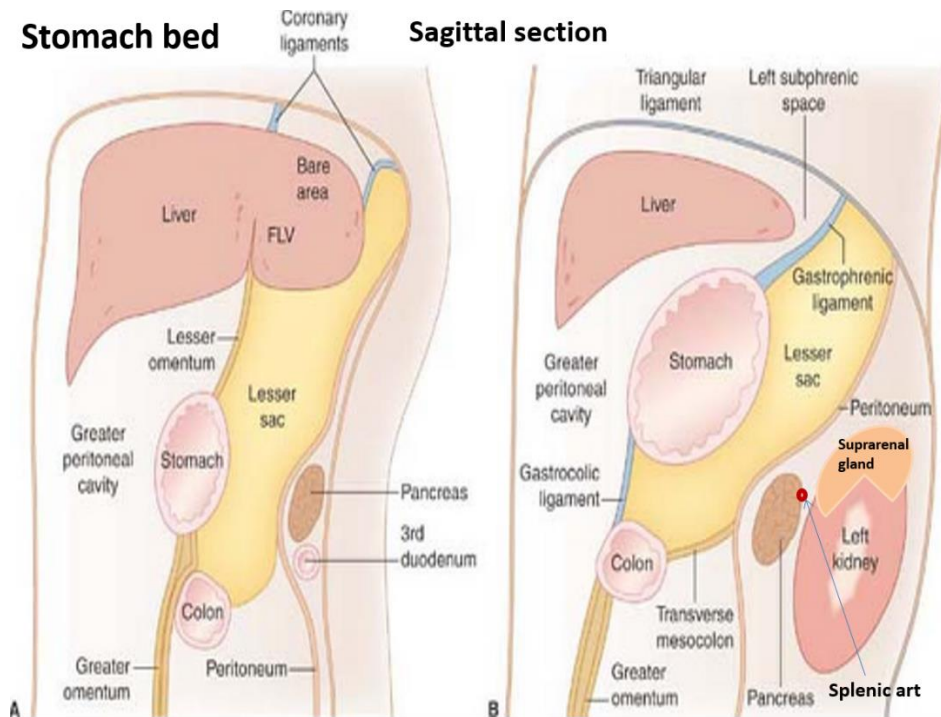
- 1) **Mucosa**: wrinkled/folded into a series of ridges termed **the Rugae** which allow the stomach to dilate and expand (after food & water consumption).
- 2) **Submucosa**
- 3) **Muscularis externa**: composed of 3 layers of muscles (as opposed to the rest of the GIT which has only 2 layers).
 - i. **Oblique muscular layer**: the innermost layer
 - ii. **Circular layer**
 - iii. **Longitudinal layer**: outermost layer.
- 4) **Serosa**: a layer of peritoneum covering the stomach.

The stomach can be visualised using:

- 1) **X-Rays & Barium Meal**: the technique involves ingestion of a radioactive material (Barium) <to absorb the X-rays and appear on the image> which produces a cast inside the stomach wall that allows visualisation through X-Rays of the stomach, pylorus, and duodenum. We can see Rugae with this method.
- 2) **Gastroscopy**: a gastroscope, which is a thin flexible tube, is swallowed through the oesophagus reaching the stomach and duodenum to allow for examination of these areas.

Prevention of Reflux:

The oesophagus enters the stomach at an acute angle, producing the more important action of a sphincter, which prevents the reflux of stomach contents into the oesophagus (even in an upside-down position). The actual Lower Oesophageal Sphincter isn't as strong/efficient in preventing this regurgitation.



Relations of the stomach:

Anterior relation of the stomach:

- 1) **Left lobe of the Liver**
- 2) **the Diaphragm**
- 3) **Anterior Abdominal Wall.**

Posterior relation of the stomach (aka **Stomach Bed**):

- 1) **Pancreas**
- 2) right behind the Pancreas is **the Splenic Artery** (which travels to the spleen)
- 3) the **Left Kidney**
- 4) **Left Suprarenal Gland.**
- 5) **The Spleen**
- 6) **Transverse Colon & Mesocolon**

Meso- = mesentery

Superior relation of the stomach:

Lesser Omentum; through which the vessels pass (*Right and Left Gastric arteries*)

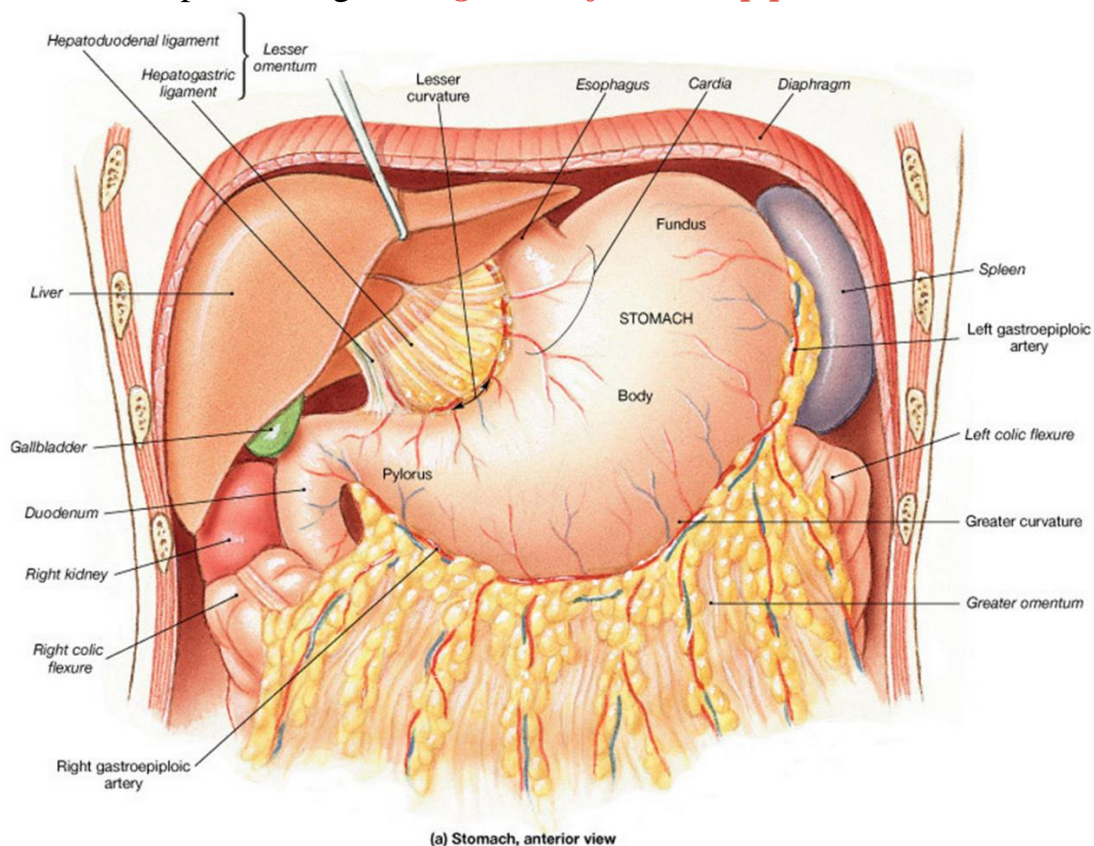
Inferior Relation of the stomach:

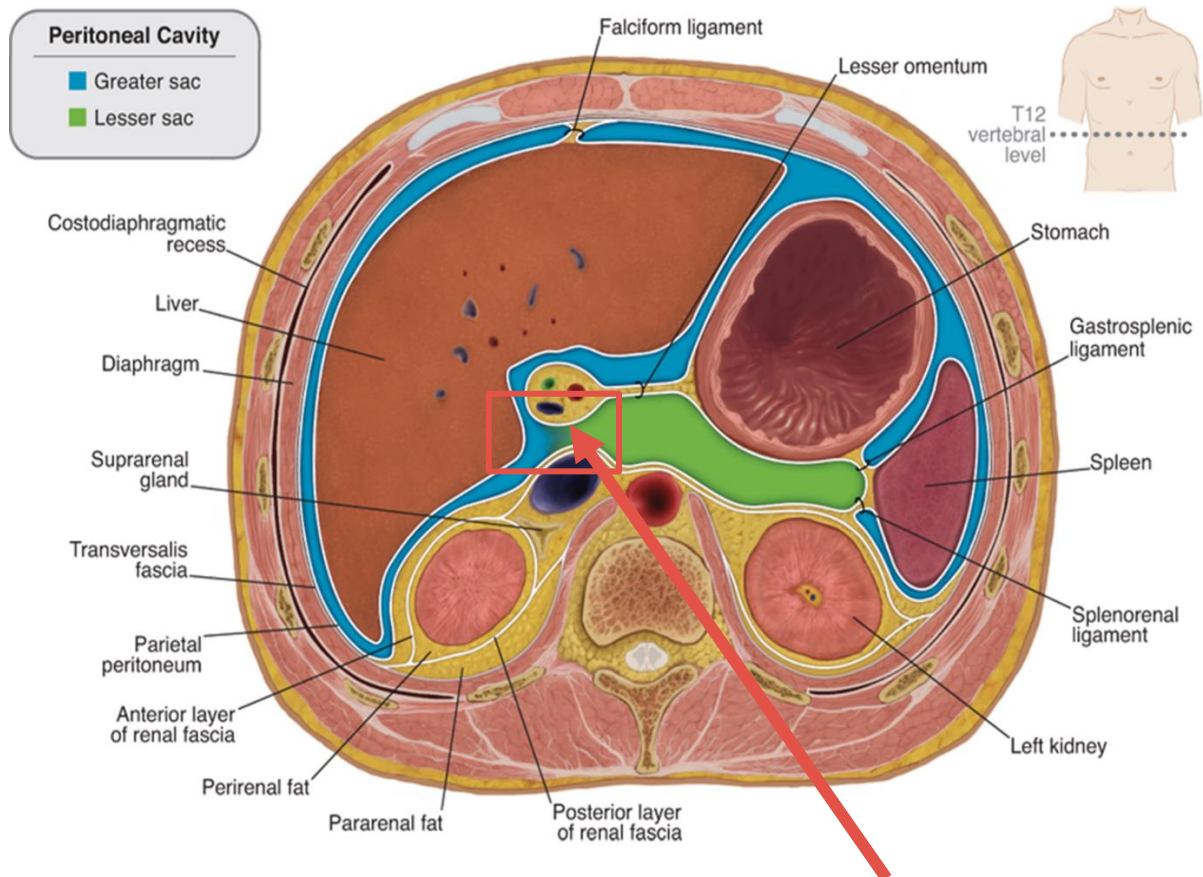
Greater Omentum: extends downwards and reflects back to fuse with the mesocolon.

- Resembles an apron that covers the contents of the stomach (in order to see the organs, we lift it).
- Also called **the Policeman of the Abdomen:** whenever an organ is inflamed, it moves towards the area of inflammation to cover & localise it (e.g. in **Appendicitis** it moves to surround & contain the inflamed part & prevent it from spreading to other parts of the abdomen.)

Without it, the appendix rupture would've released pus throughout the entire abdomen and caused a general inflammation termed Peritonitis which is severe & fatal.

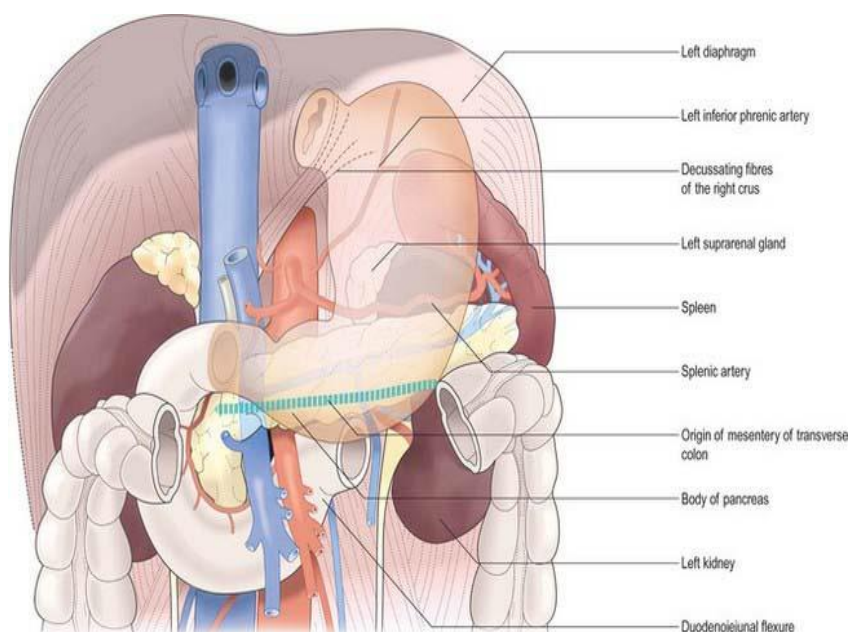
- In **C-section** (aka Caesarean section) procedure: a transverse cut is made in the abdominal wall to deliver a foetus and is afterwards re-sealed. When the surgery is performed the second time around, we will find the Greater Omentum sticking to the scar in the anterior abdominal wall and we'd have to dissect it in order to reach the foetus.
- Vessels that pass through it: *Right & Left Gastroepiploic Arteries*





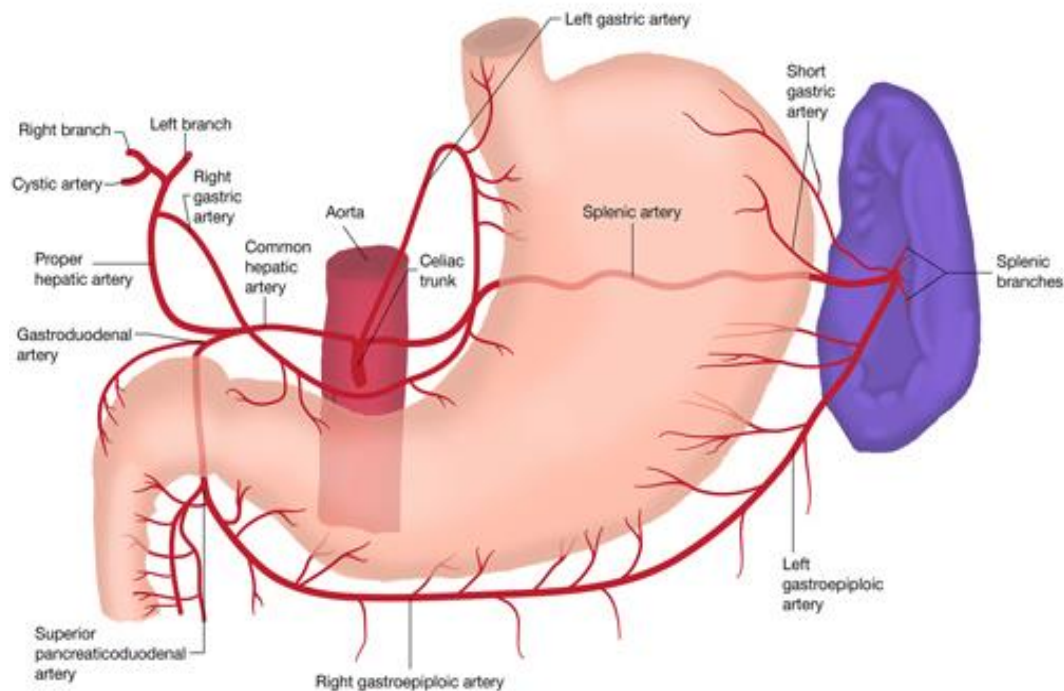
Connecting the lesser sac with the greater sac is **the Epiploic Foramen** (aka the foramen of Winslow)

- *Anteriorly*: the free margin of the lesser omentum (Contains: Common Bile Duct, Hepatic Artery, Portal Vein)
- *Posteriorly*: IVC
- *Superiorly*: Greater & Lesser Omenta.
- *Inferiorly*: Greater Omentum



Posterior relation of stomach

Arterial Supply of the Stomach



Recall: 3 main arteries supply the GIT:

- 1) the coeliac trunk: the foregut; a branch of the abdominal aorta; above the lesser curvature
- 2) superior mesenteric artery: the midgut
- 3) inferior mesenteric artery: the hindgut

The **Coeliac A.** gives 3 branches:

- 1) **Left Gastric Artery**, supplies the stomach at the upper part of the lesser curvature, and the lower part of the oesophagus.
- 2) **Splenic Artery**, tortuous artery passing behind the pancreas to supply the spleen.
- 3) **Common Hepatic Artery** (sometimes called only Hepatic Artery) which supplies the liver. Branches into:
 - i. **Right Gastric Artery**: supplies the lower part of the lesser curvature
 - ii. **Proper Hepatic Artery**: which divides into right and left branches
 - iii. **Gastroduodenal Artery**: passes behind the duodenum and branches into:
 - > **Right Gastroepiploic A.**: supplies the Greater Curvature of the stomach.
 - > **Superior Pancreaticoduodenal A.**: supplies the Pancreas & Duodenum

Branches of the **Splenic A.:**

- 1) Left Gastroepiploic A.
- 2) Short Gastric A.
- 3) Branches to Pancreas ← extra
- 4) Posterior Gastric

Blood Supply of the **Lesser Curvature of the Stomach:**

- 1) **Left Gastric A.:** from the Coeliac A. [upper part]
- 2) **Right Gastric A.:** from the Hepatic A. [lower part]

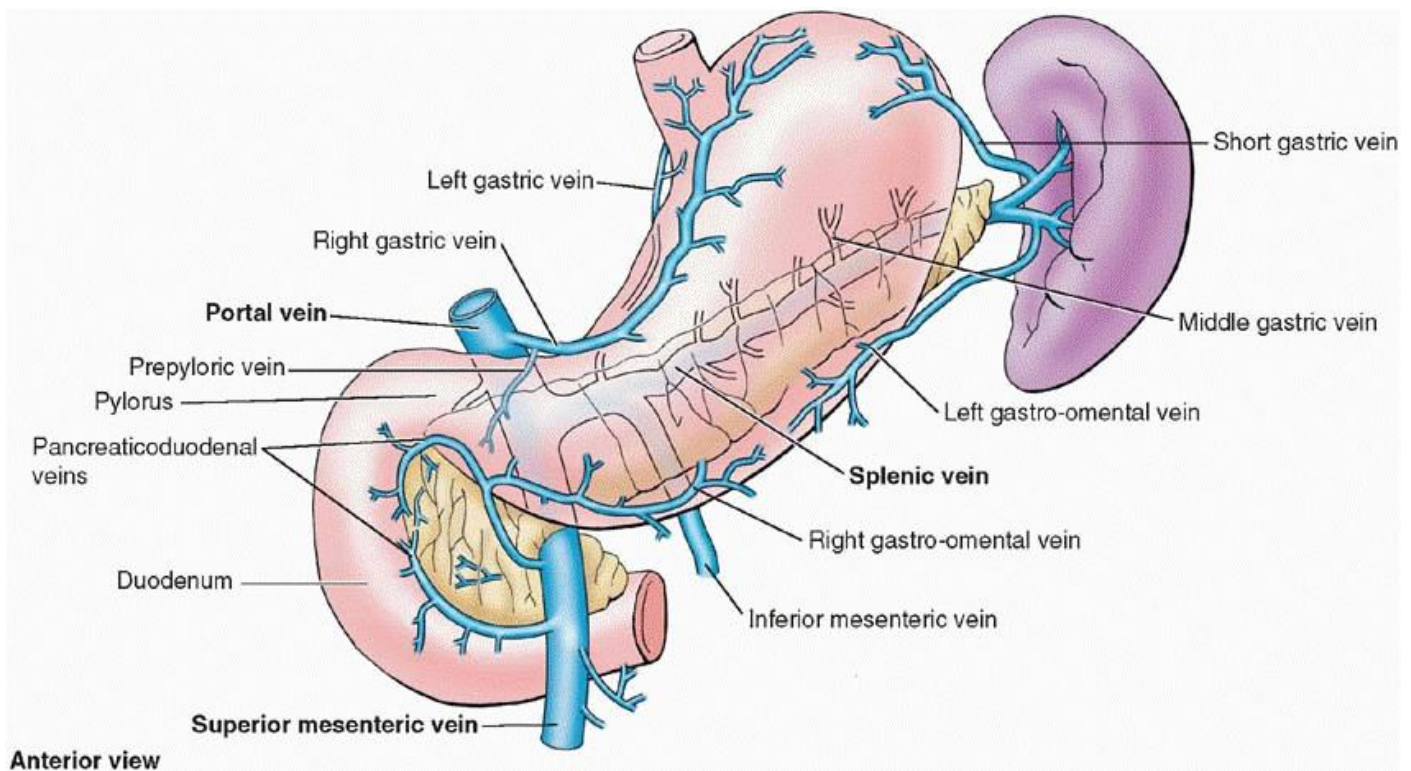
Blood supply of the **Greater curvature of the stomach:**

- 1) **Left Gastroepiploic A.:** from the Splenic A., which supplies the upper portion of the greater curvature.
- 2) **Right Gastroepiploic A.:** from the Gastroduodenal A., which supplies the lower portion of the greater curvature.

{They both anastomose.}

Blood supply of the **Fundus: Short Gastric A.**

Venous Drainage of the Stomach

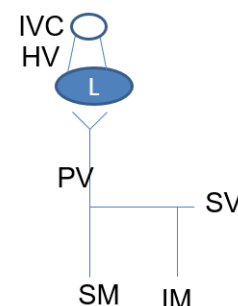


same names as the arteries; drain to the portal circulation (For toxin clearance, drug absorption...etc)

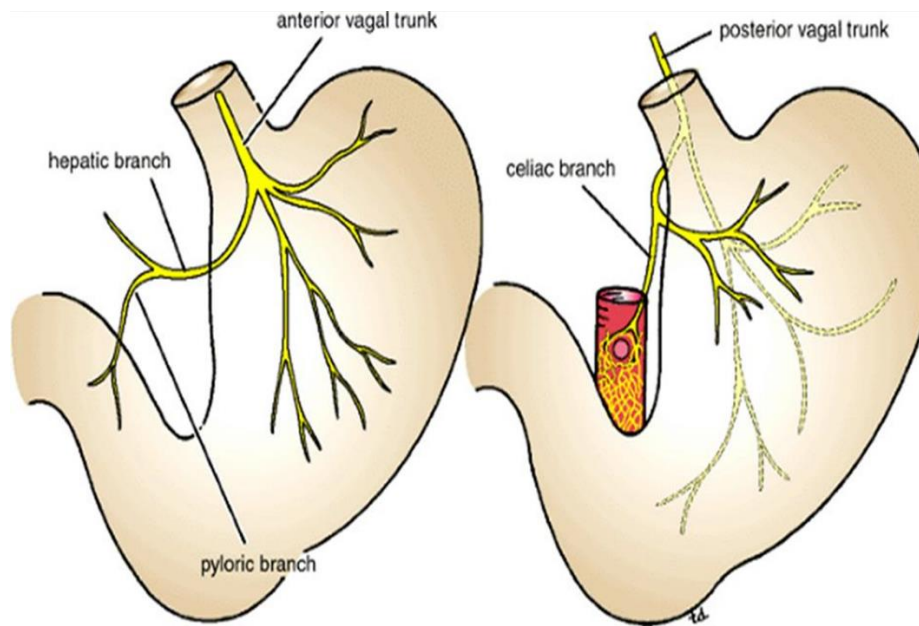
- 1) the **Left and Right Gastric veins** drain directly to the **Portal Vein**
- 2) the **Right Gastroepiploic Vein** drains to the **Superior Mesenteric Vein** which drains to the **PV**
- 3) the rest drain to the **Splenic Vein** {**Short Gastric v., Lt Gastroepiploic v.**}

Recall: The portal vein is made from the fusion of:

Splenic V.
Inferior Mesenteric V.
Superior Mesenteric V.



Nerve Supply of the Stomach



Parasympathetic innervation: motor & secretomotor

A. **Anterior Vagal Trunk:** from *Lt. Vagus Nerve*.

- Supplies the Anterior surface of the stomach.
- A large **hepatic branch** passes up to the liver, and from this a **pyloric branch** passes down to pylorus.
- Causes sphincter dilatation, and release of gastric secretions.

B. **Posterior Vagal Trunk:** from *Rt. Vagus Nerve*

- Divides into branches that supply mainly the Posterior surface of the stomach.
- A large branch passes to **Coeliac & Superior Mesenteric Plexuses** and (postganglionic) is distributed to the intestines as far as splenic flexure of colon and to Pancreas.

Sympathetic innervation:

- carries pain-transmitting nerve fibres & motor to Pyloric sphincter.
- Supply to the foregut: **Greater Splanchnic Nerve (T5-T9)**

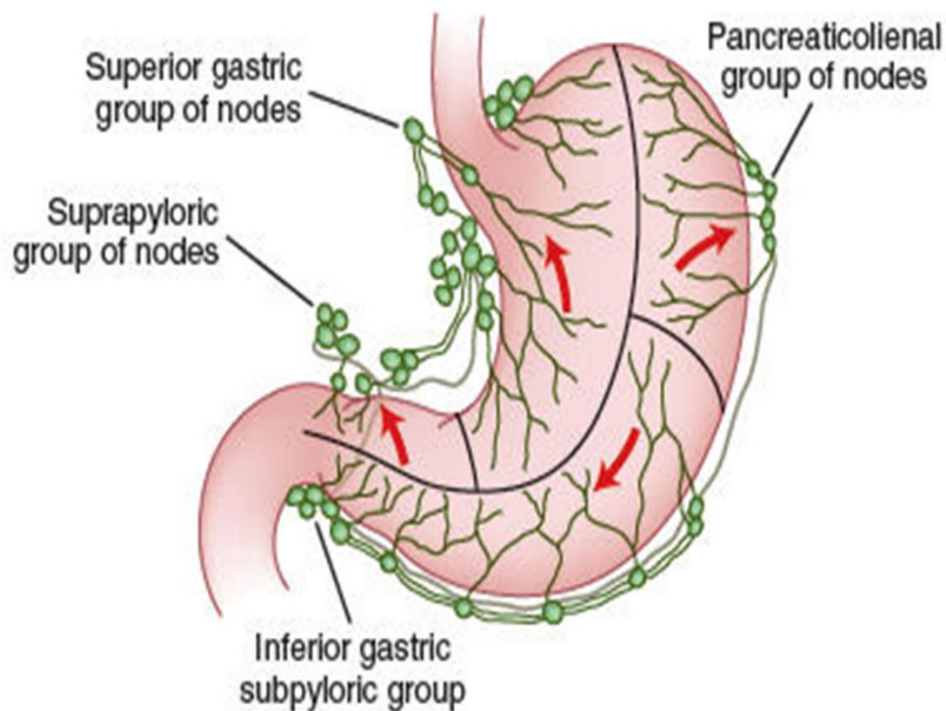
Branches of the sympathetic trunk that supply the abdomen:

- 1) Greater Splanchnic Nerve (Ganglia: T5-T9) → foregut & Adrenal Medulla
- 2) Lesser Splanchnic Nerve (T10-11) → midgut
- 3) Least (Renal) Splanchnic Nerve (T12) → kidney

Sympathetic	Parasympathetic
Preganglionic fibers arise from T5 – T9 spinal segment (via greater splanchnic nerves)	Preganglionic fibers arise from left and right vagus
Postganglionic fibers from coeliac ganglia.	Postganglionic fibers from ganglion in submucosal and myentric plexuses.
Vasomotor	Secretomotor
Motor to the pyloric sphincter	Inhibitor to pyloric sphincter
Inhibitor to the rest of the musculature	Motor to the musculature
Carry pain sensation	Carry sensation of hunger and nausea

- **Gastric Pain** is referred to the epigastric region (due to innervation by T6-T10 spinal segments)
- **Vagotomy** – surgical procedure of cutting vagal trunks to cure chronic peptic ulcers (the patient had excessive secretion of HCl in the stomach).
- The Vagus nerve passes behind the ear to the neck in the carotid sheath, therefore playing with that area could trigger vomiting (since it supplies the stomach; increases gastric secretions & causes gastric contractions & then vomiting).

Lymphatic Drainage of the Stomach



Lymph nodes are distributed alongside the arteries.

All the lymphatic drainage of the stomach goes to Lymph nodes situated around the Coeliac A. called the **Coeliac LNs**.

{Hepatic LNs also eventually drain into Coeliac LNs}

At the Lesser curvature:

- 1) accompany the **Left Gastric A.** -> **Superior Gastric group of LNs** which drain into **Coeliac LN**
- 2) accompany the **Right Gastric A.** -> **Suprapyloric Group of LNs** which drain into the **Hepatic LN**.

At the Greater curvature:

- 1) accompany the **Splenic A.** -> **Pancreaticolienal group of LNs** which drain into the **Coeliac LN**
- 3) accompany the **Right Gastroepiploic A.** -> **Inferior Gastric Subpyloric group** which drain into **hepatic & coeliac LN**.

Histology of the Stomach

Normal Histological Features of the stomach:

The gastric mucosa consists of:

- 1) **Surface Epithelium**
- 2) **Gastric Pits**
- 3) **Gastric Glands**

The *lining epithelium* of the stomach, and *gastric pits* is entirely made up of **mucous columnar cells**. These cells produce a thick coating of mucus, that protects the gastric mucosa from acid and enzymes in the lumen.

The *gastric glands* extend in the mucosa, *from the stomach lumen to the muscular mucosae*; they open via *gastric pits*.

Glands differ in different regions of the stomach:

1- **Cardiac area**

- Small area of predominantly *mucus* secreting glands surrounding the entrance of the oesophagus.
- Glands have *long ducts*; they are *less coiled* than in the **pyloric** antrum glands.

2- **Fundus and body**

- Consists of *short ducts* and *long straight tubular alveoli*
- they secrete *gastric juices*, as well as *protective mucus*.
- The glands contain:
 1. **mucous cells** (secrete mucus)
 2. **oxyntic = parietal cells** (secrete acid and intrinsic factor)
 3. **Peptic cells= chief cells** (secrete pepsinogen enzyme)
 4. **Endocrine cells** (secrete gastrin)

3- **Pyloric portion**

- The glands have *long ducts* and *short coiled alveoli*, contain:
 1. **mucus secreting cells**
 2. **Scattered 'G' cells** (endocrine cells secrete gastrin).

Types of cells present in the stomach:

Mucous secreting cells:

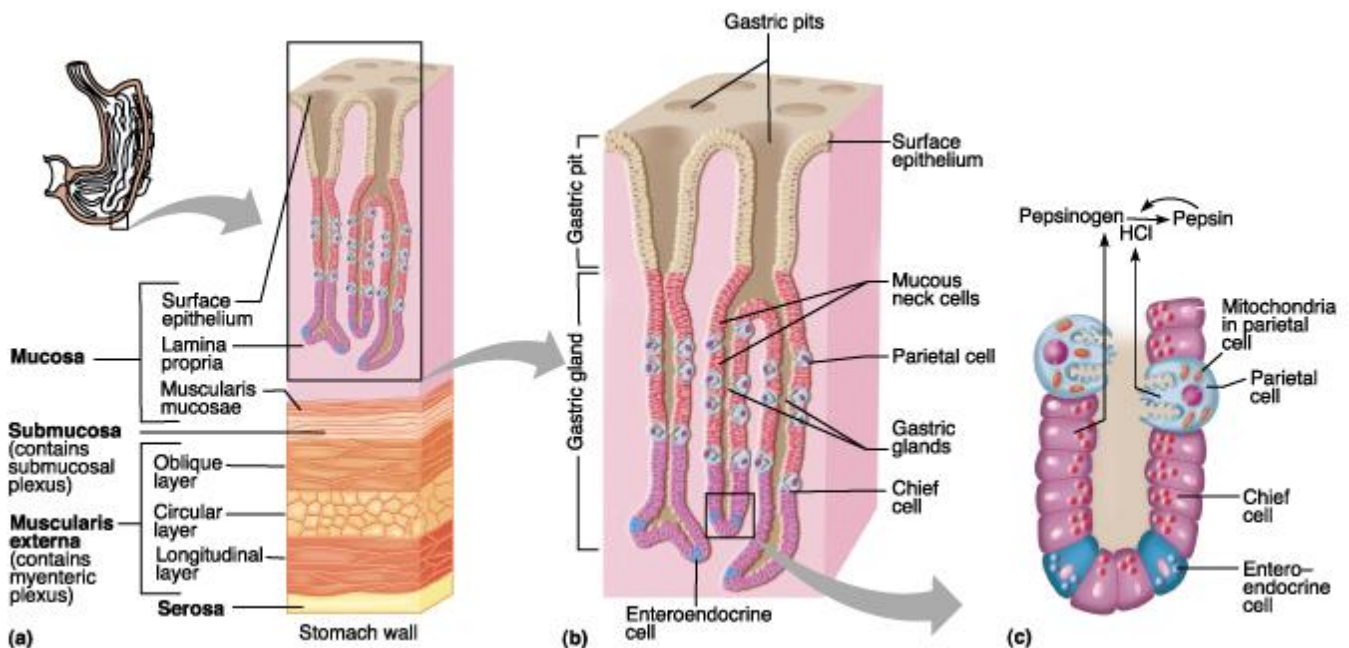
- Columnar cells
- Present all over the stomach on the mucosal surface (goblet cells) where: they line the *luminal surface of the stomach*. The mucous cells are present in the *gastric pits*, in the *neck of glands* and *in the glands*.
- They secrete mucus and bicarbonate.

Oxyntic cells = Parietal cells:

- present in the **fundus and body**.
- They are distributed throughout the length of the glands, but are numerous in the middle portion.
- Large, rounded cells with **eosinophilic** cytoplasm and centrally located nucleus.
- They Produce gastric acid.

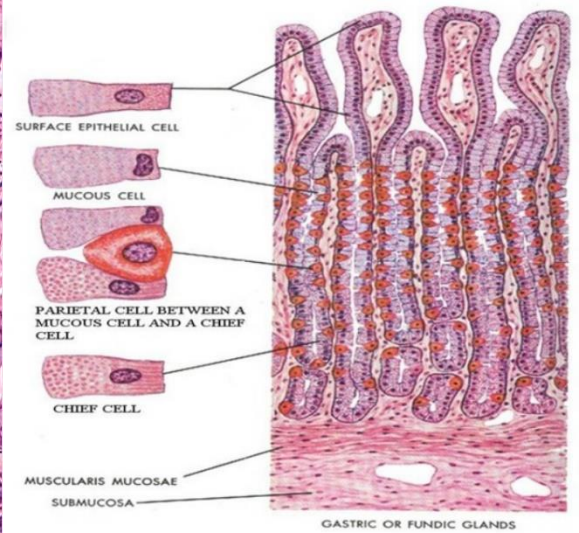
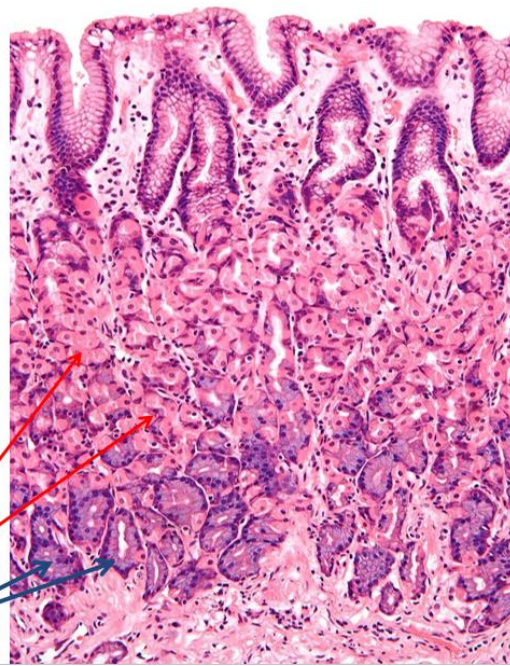
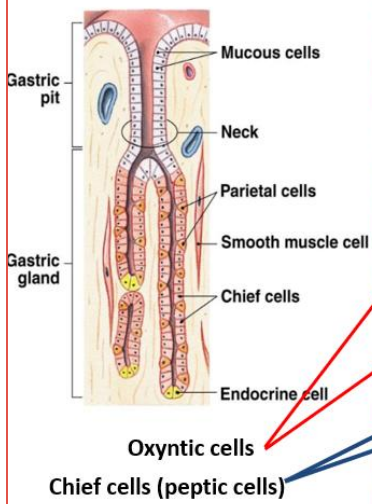
Peptic or zymogenic cells = Chief cells:

- Clustered at the base of the glands.
- Identified by basally located nuclei and strongly **basophilic** granular cytoplasm.
- Produce pepsinogen which digests protein.

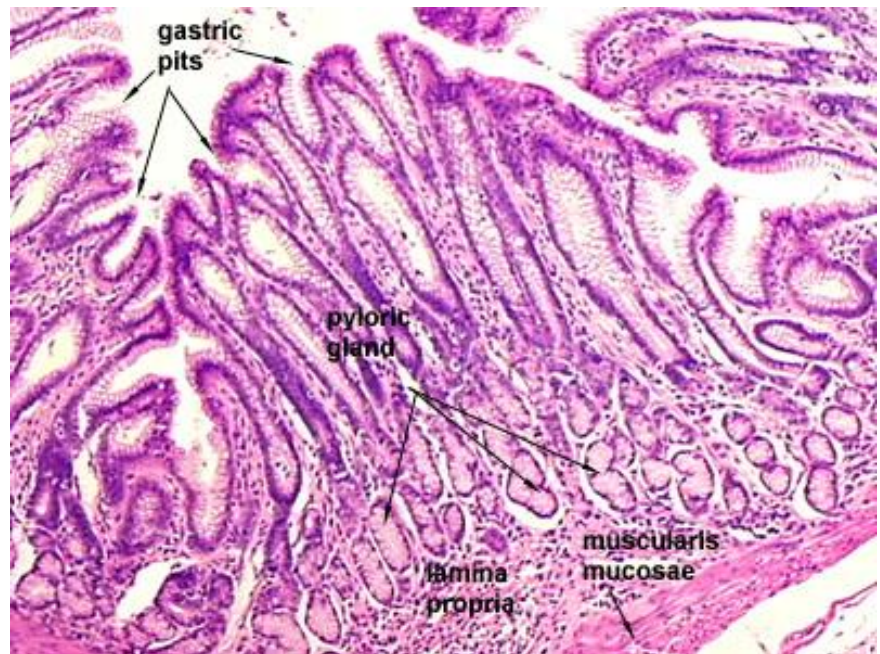


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Fundus and body gastric gland



Pyloric region



Fundus vs Pylorus

