

STOMACH AND ESOPHAGUS

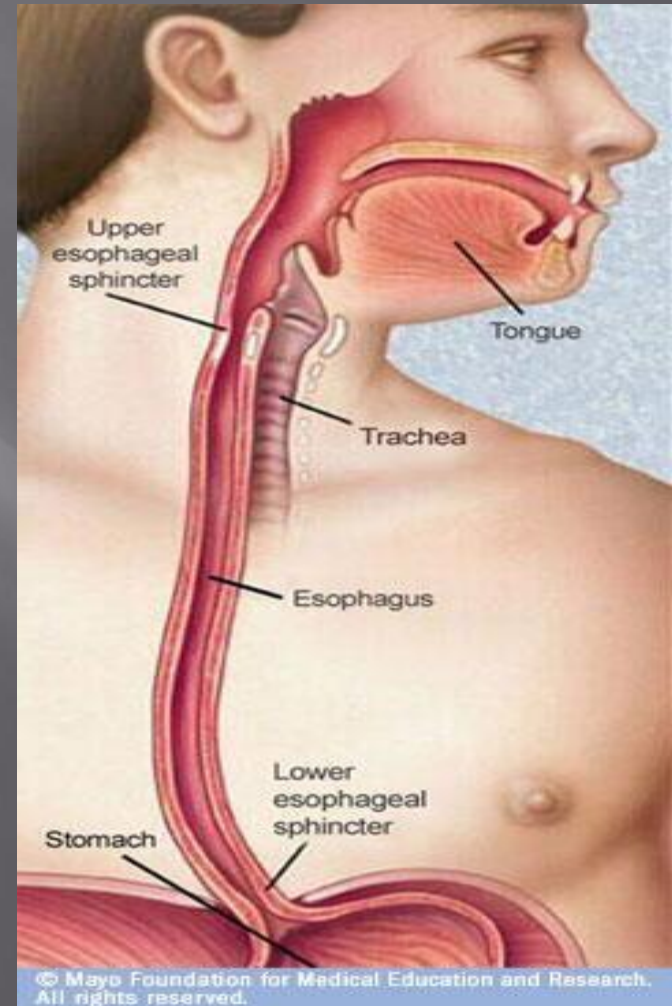
Modified by: Rani Tachijian

Esophagus

- The esophagus is a tubular structure (muscular, collapsible tube) about 10 in. (25 cm) long that is continuous above with the laryngeal part of the pharynx opposite the sixth cervical vertebra and ends at the cardia in the stomach. It is different from the pharynx because it is a complete tube while the pharynx is deficient (open) anteriorly. Esophagus is made up of mucosa, submucosa, muscular layer and adventitia (most of the esophagus out of the abdomen and its epithelium is stratified squamous non-keratinized).
- The esophagus conducts food from the pharynx into the stomach. Wavelike contractions of the muscular coat, called peristalsis, propel the food onward.

It passes through the diaphragm at the level of the 10th thoracic vertebra to join the stomach

- In the neck, the esophagus lies in front of the vertebral column; laterally, it is related to the lobes of the thyroid gland; and anteriorly, it is in contact with the trachea and the recurrent laryngeal nerves
- In the thorax, it passes downward and to the left through the superior and then the posterior mediastinum
- At the level of the sternal angle, the aortic arch pushes the esophagus over to the midline



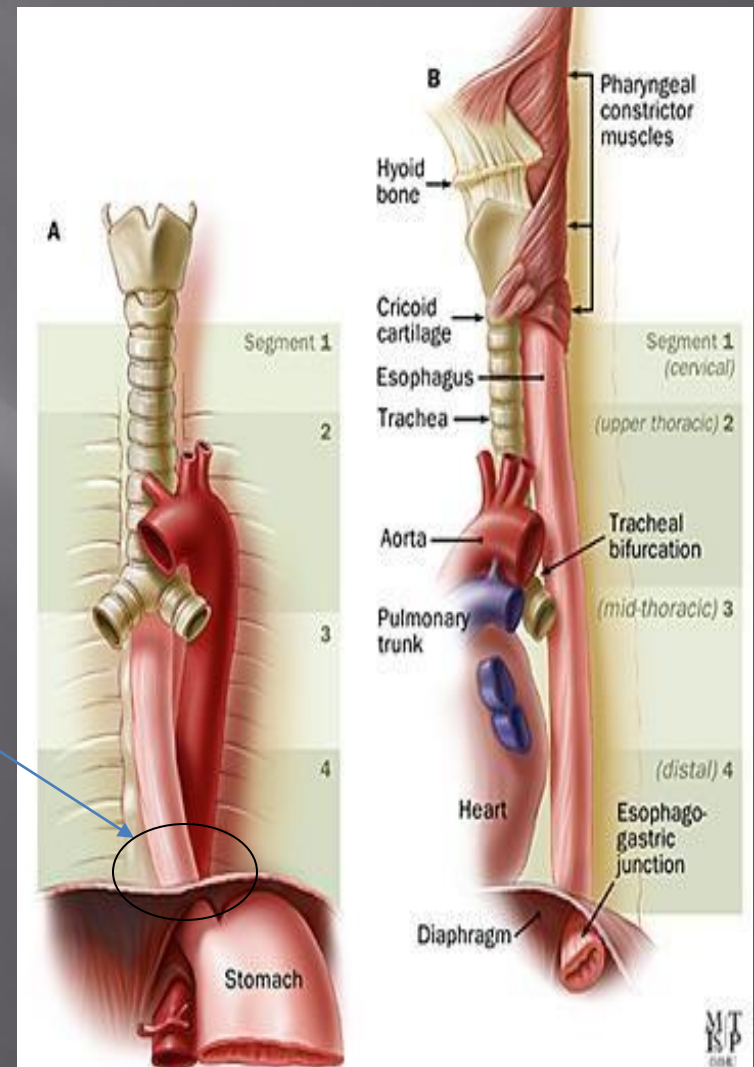
□ The relations of the thoracic part of the esophagus :

□ Anteriorly: The trachea and, **in between them**, the left recurrent laryngeal nerve (branch of vagus nerve. Also, the left recurrent laryngeal nerve is longer than the right, which is in the neck, because their origins are different); the left principal bronchus, which constricts it; and the pericardium, which separates the esophagus from the left atrium

□ Posteriorly: **(is in the posterior mediastinum)** The bodies of the thoracic vertebrae; the thoracic duct; the azygos veins; the right posterior intercostal arteries (branches from the descending thoracic aorta); and, at its lower end, the descending thoracic aorta (in the upper part, the esophagus is on the right while the descending thoracic aorta on the left. In the lower part, the esophagus opens 1 inch to the left at the level of T10 (called the esophageal orifice) while the aorta opens in the midline at the level of T12). So, esophagus R→L, descending thoracic aorta L→R in the midline. They cross in the lower part, above the diaphragm.

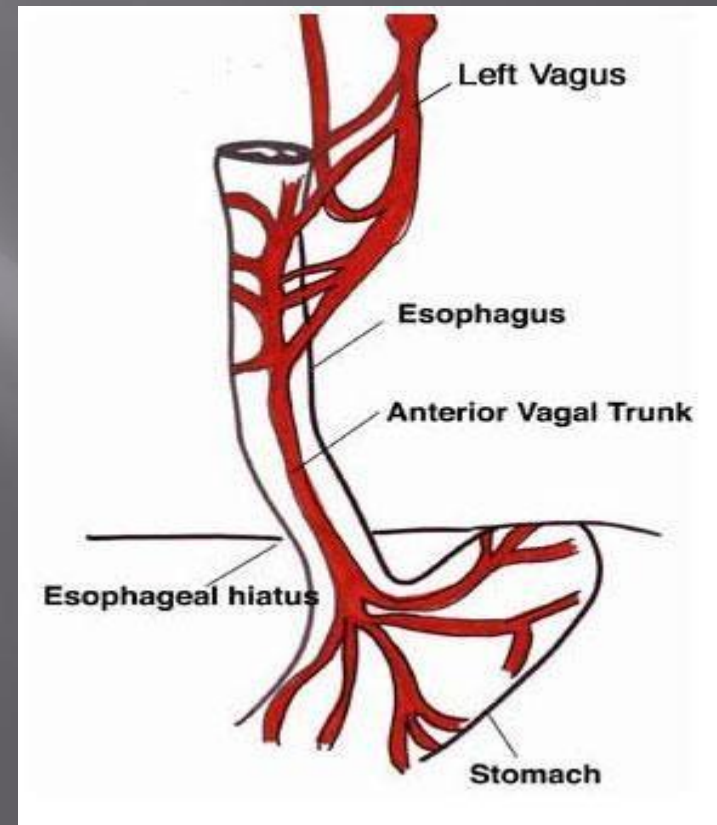
□ Right side: The mediastinal pleura and lung and the terminal part of the azygos vein

□ Left side: **left pleura and lung**, The left subclavian artery, the aortic arch (it is anterior at first then goes left), the thoracic duct, and the mediastinal pleura



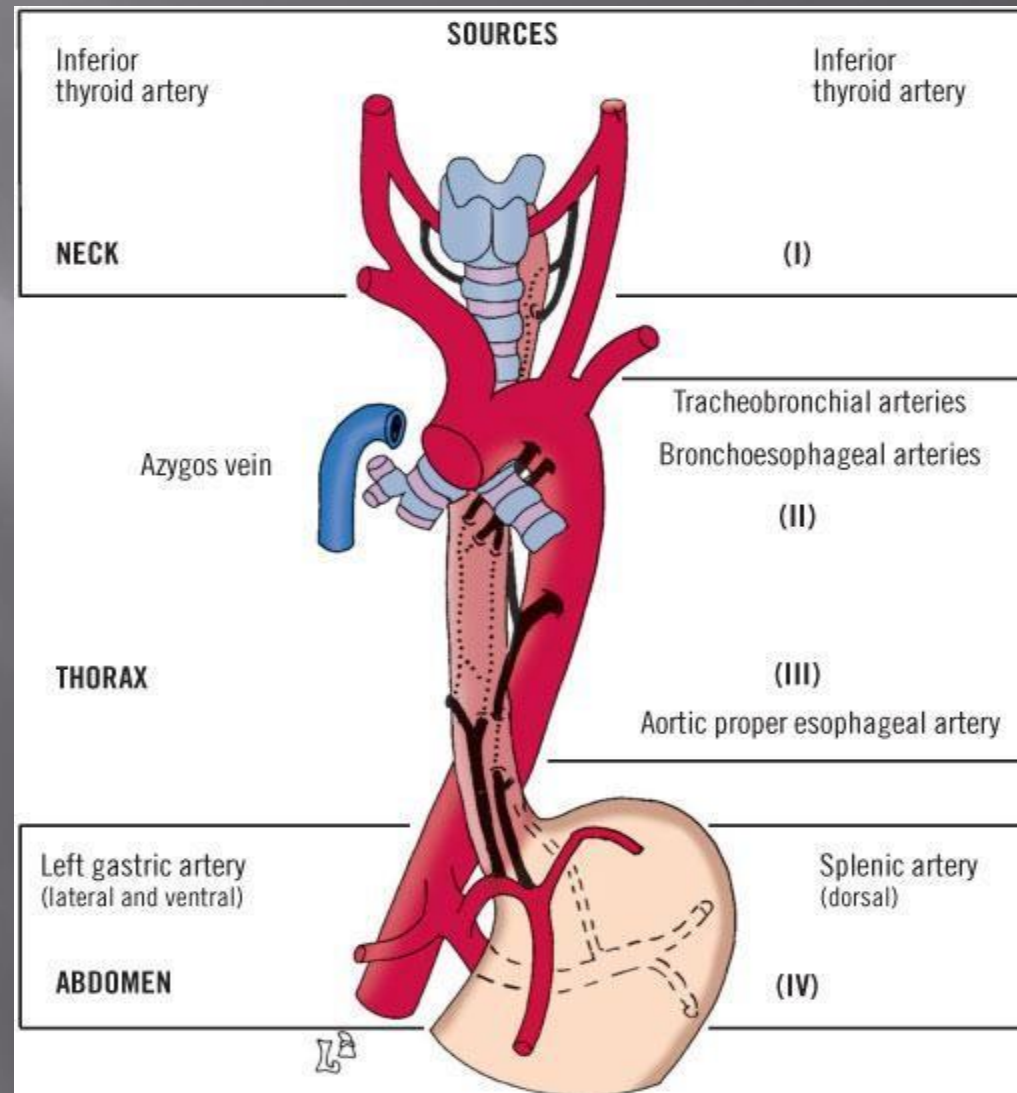
Esophagus has 3 parts: one in the neck, one in the chest (majority) and one in abdomen (very short).

- Inferiorly to the level of the roots of the lungs, the vagus nerves leave the pulmonary plexus and join with sympathetic nerves to form the esophageal plexus
- The left vagus lies anterior to the esophagus and the right vagus lies posterior
- At the opening in the diaphragm, the esophagus is accompanied by the two vagi, branches of the left gastric blood vessels, and lymphatic vessels
- Fibers from the right crus of the diaphragm pass around the esophagus in the form of a sling.
- In the abdomen, the esophagus descends for about 0.5 in. (1.3 cm) and then enters the stomach
- It is related to the left lobe of the liver anteriorly and to the left crus of the diaphragm posteriorly.



Blood Supply of the Esophagus

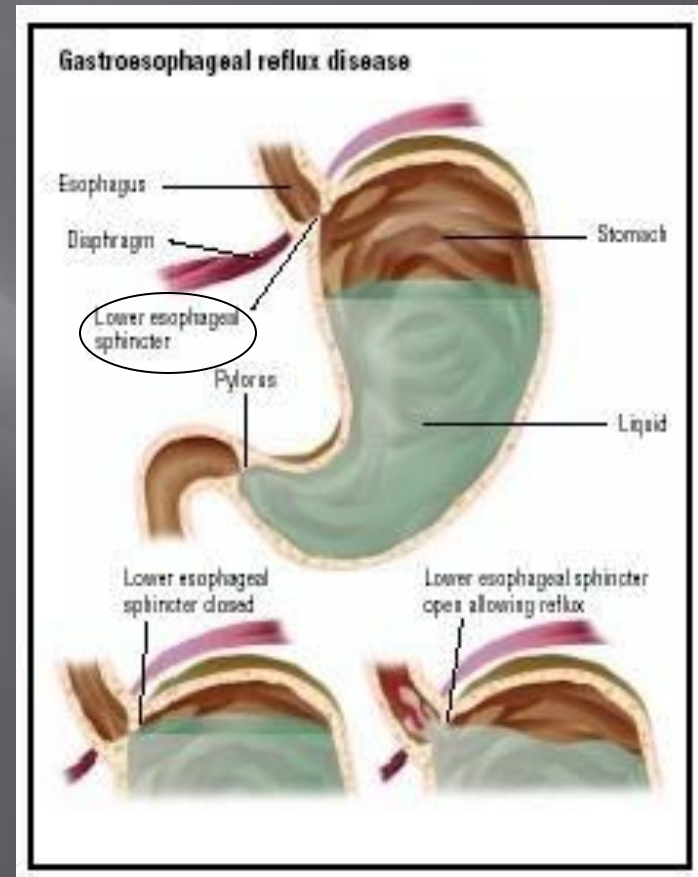
- The upper third of the esophagus is supplied by the inferior thyroid artery,
- the middle third by branches from the descending thoracic aorta,
- and the lower third **below diaphragm** by branches from the left gastric artery
- The veins from the upper third drain into the inferior thyroid veins, from the middle third into the azygos veins, and from the lower third into the left gastric vein, **(same names)** a tributary of the portal vein.



- Lymph vessels from the upper third of the esophagus drain into the deep cervical nodes,
- from the middle third into the superior and posterior mediastinal nodes,
- and from the lower third into nodes along the left gastric blood vessels and the celiac nodes (related to stomach, we'll come to it later on in the lecture)
- The esophagus is supplied by parasympathetic and sympathetic efferent and afferent fibers via the vagi and sympathetic trunks
- In the lower part of its thoracic course, the esophagus is surrounded by the esophageal nerve plexus (sympathetic & parasympathetic) which all ends at myenteric plexus which is responsible for peristalsis and secretion from esophageal glands.

Gastroesophageal Sphincter

- No anatomic sphincter exists at the lower end of the esophagus (no thickening of inner circular smooth muscles) while the pyloric sphincter IS an anatomical sphincter.
- However, the circular layer of smooth muscle in this region serves as a physiologic sphincter
- As the food descends through the esophagus, relaxation of the muscle at the lower end occurs ahead of the peristaltic wave so that the food enters the stomach
- The tonic contraction of this sphincter prevents the stomach contents from regurgitating into the esophagus.
- The closure of the sphincter is under vagal control, and this can be augmented by the hormone gastrin and reduced in response to secretin, cholecystokinin, and glucagon.



VERY IMPORTANT NOTES, DOCTOR SAID SOMETIMES THEY ARE ASKED ABOUT IN THE EXAM:

Sometimes, when infants swallow foreign bodies, they get stuck in the esophagus at certain points, which means something is causing narrowing at these sites, where are they?

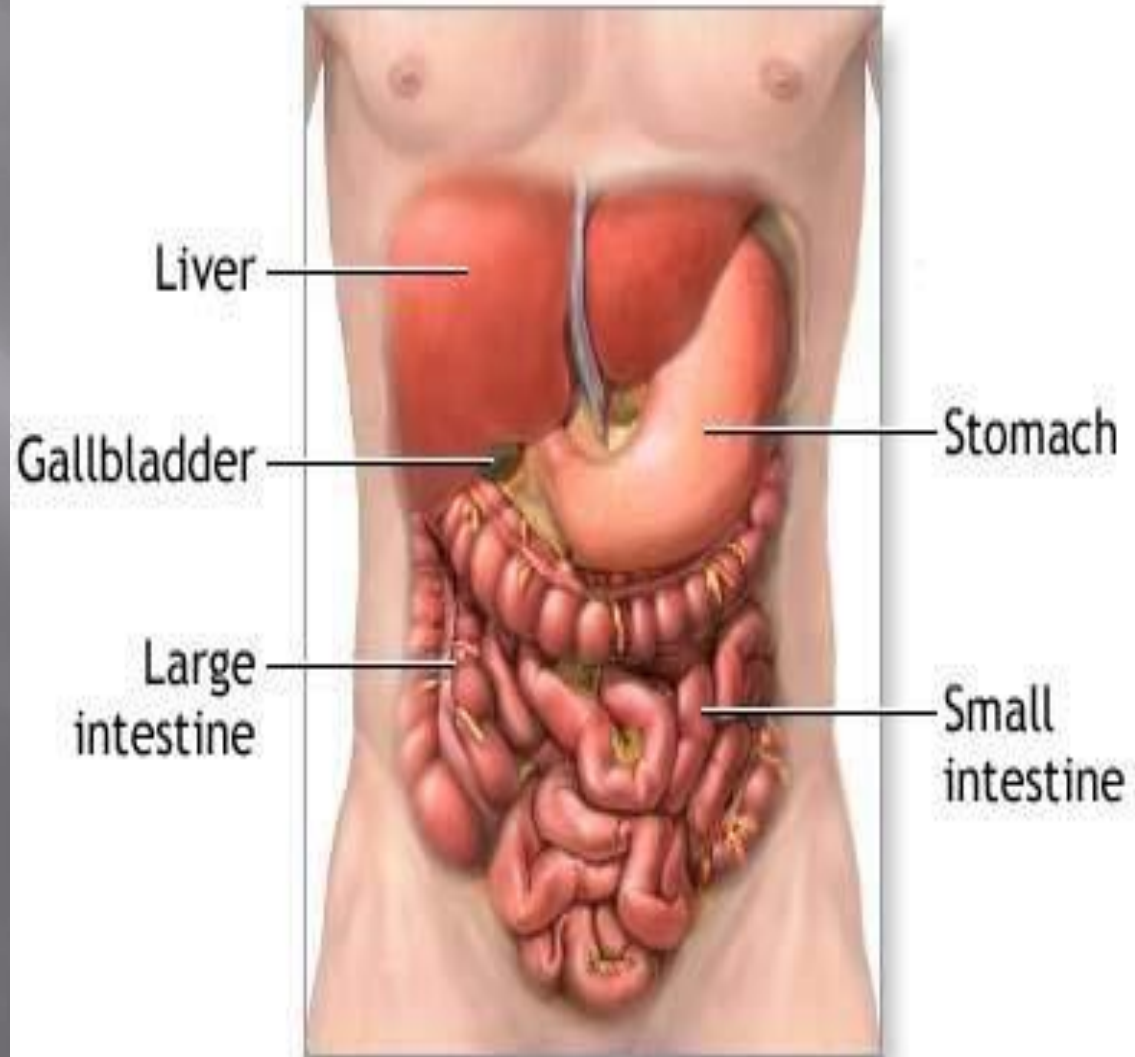
1. Beginning of the esophagus (pharynx is dilated and, thus, esophagus is narrow)
2. Cross of left main bronchus (it has cartilage, and the bronchus crosses in front of the esophagus, so the foreign body might lodge here).
3. Arch of the aorta (remember how we said it is, first, anterior and, then, on the left side which pressures the esophagus.
4. Through the diaphragm (esophagus narrows when passing through it).

stomac

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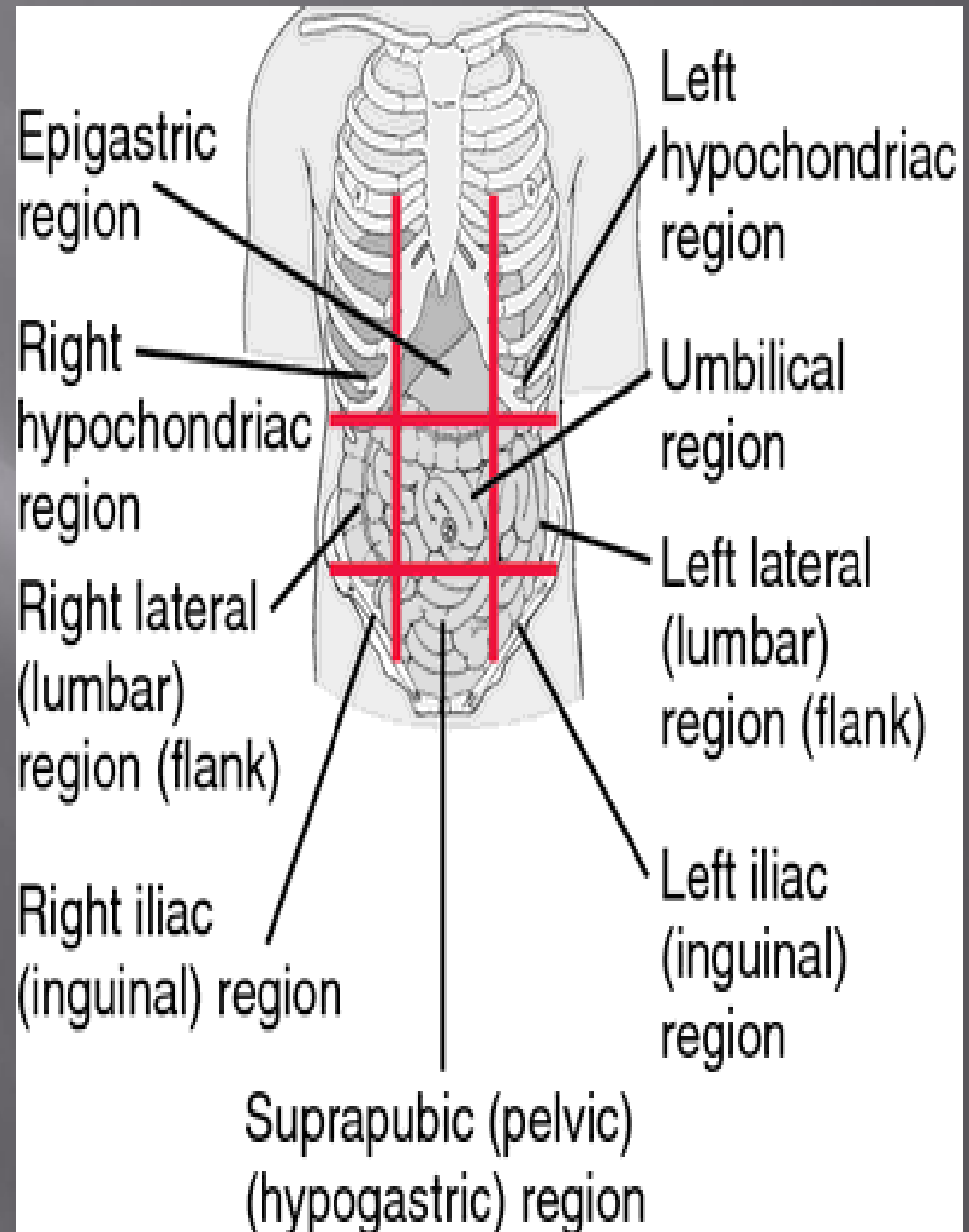
Stomach

- The stomach is a dilated part in the epigastric region of the alimentary canal
- Between the esophagus and the small intestine



Stomach site

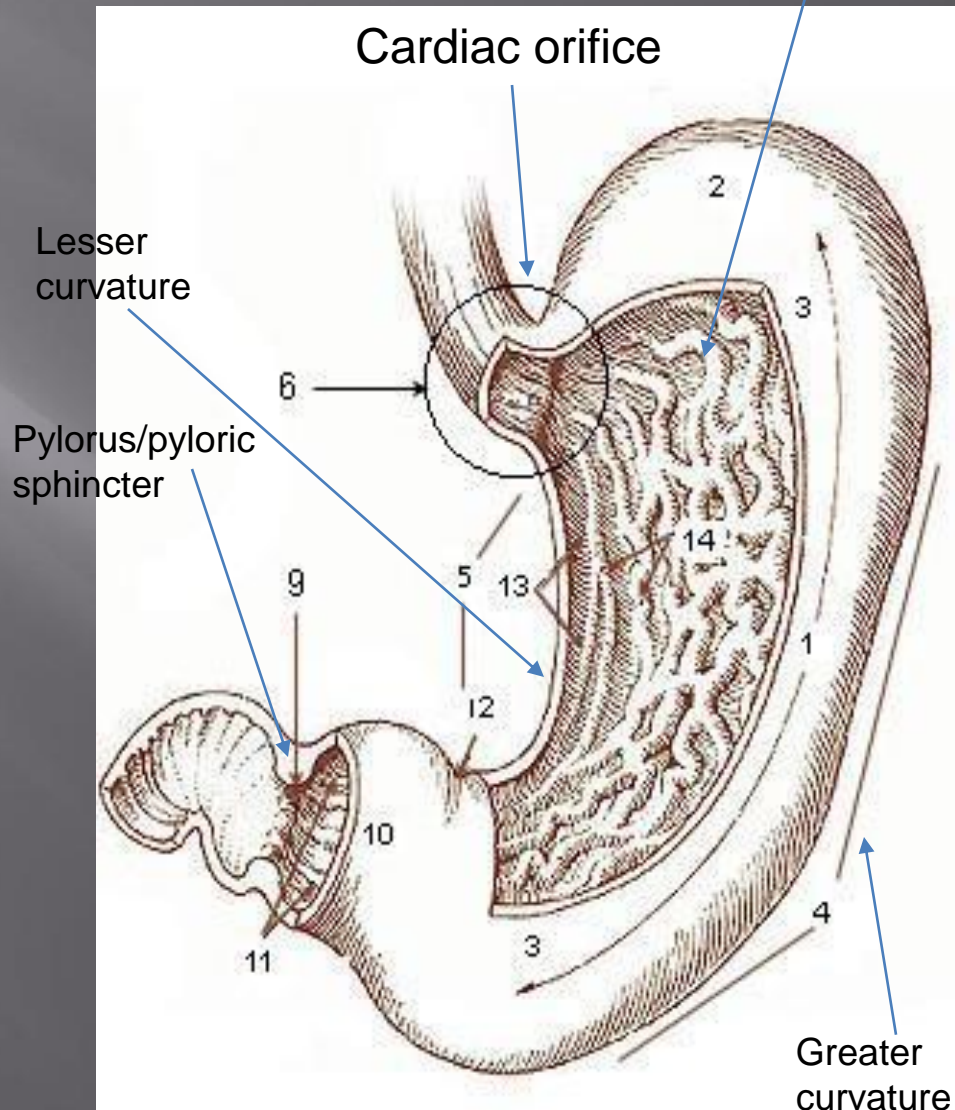
- It occupies the left upper quadrant mainly in the epigastric region



Shape of stomach

These folds are called rugae

- It is roughly J-shaped
- Steer horn in obese person
- has two openings, the cardiac and pyloric orifices
- Two curvatures, the greater and lesser curvatures
- Two surfaces, an anterior and a posterior surface



Shape of stomach.....cont

- ▣ Its shape undergoes considerable variation in the same person and depends on
 - The volume of its contents
 - The position of the body
 - The phase of respiration.

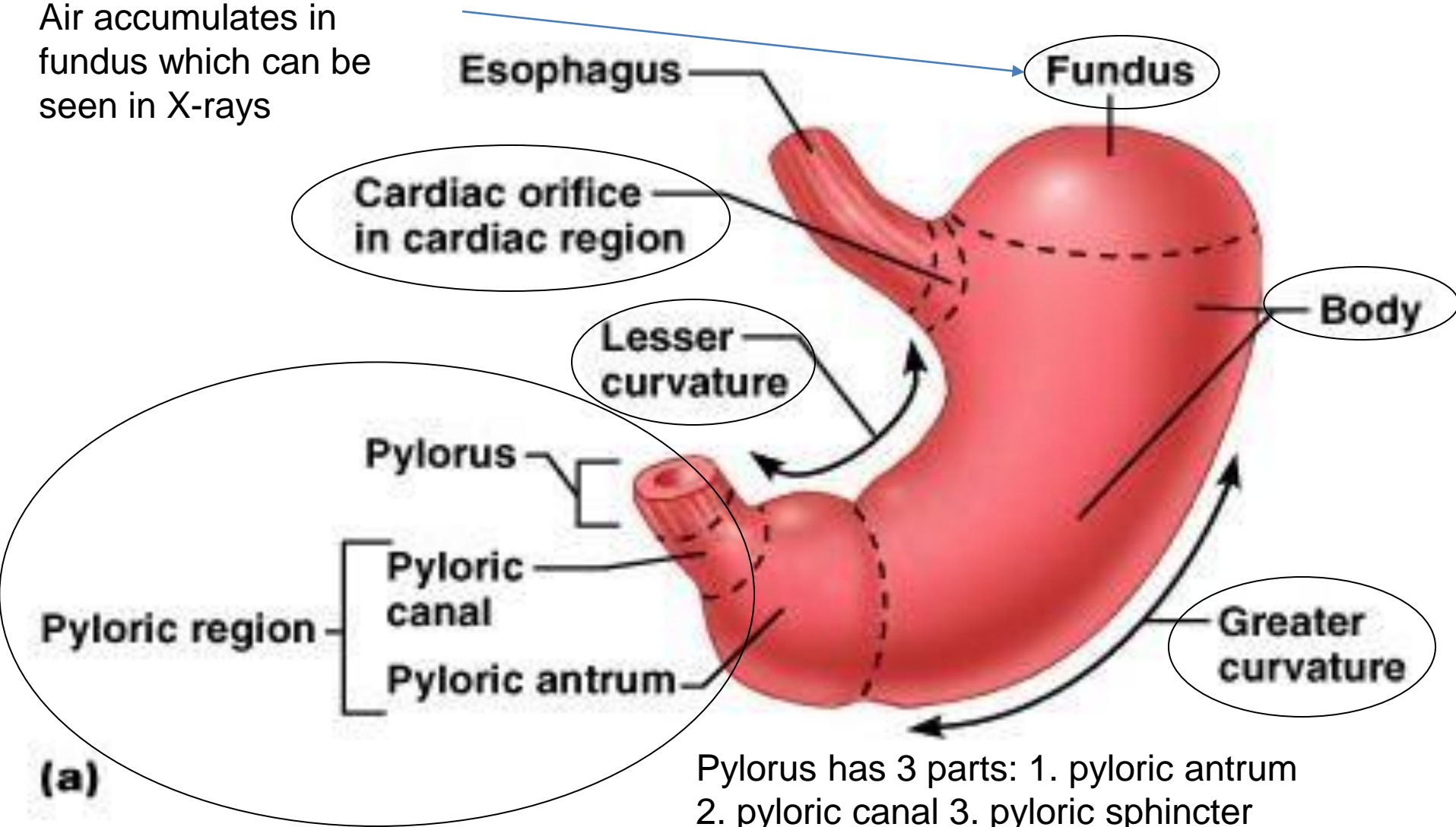
Function OF stomach

Has three main functions:

- ▣ It stores food (in the adult it has a capacity of about 1500 mL)
- ▣ It mixes the food with gastric secretions to form a semifluid chyme (this is the main function, which is digestion. It stays in the stomach 2-4 hours then evacuated through pyloric sphincter to duodenum. Sympathetic fibers cause pyloric sphincter to shut and parasympathetic cause stomach to contract and pylorus to relax/inhibits the sphincter).
- ▣ It controls the rate of delivery of the chyme to the small intestine so that efficient digestion and absorption can take place.

Parts Stomach

Air accumulates in fundus which can be seen in X-rays

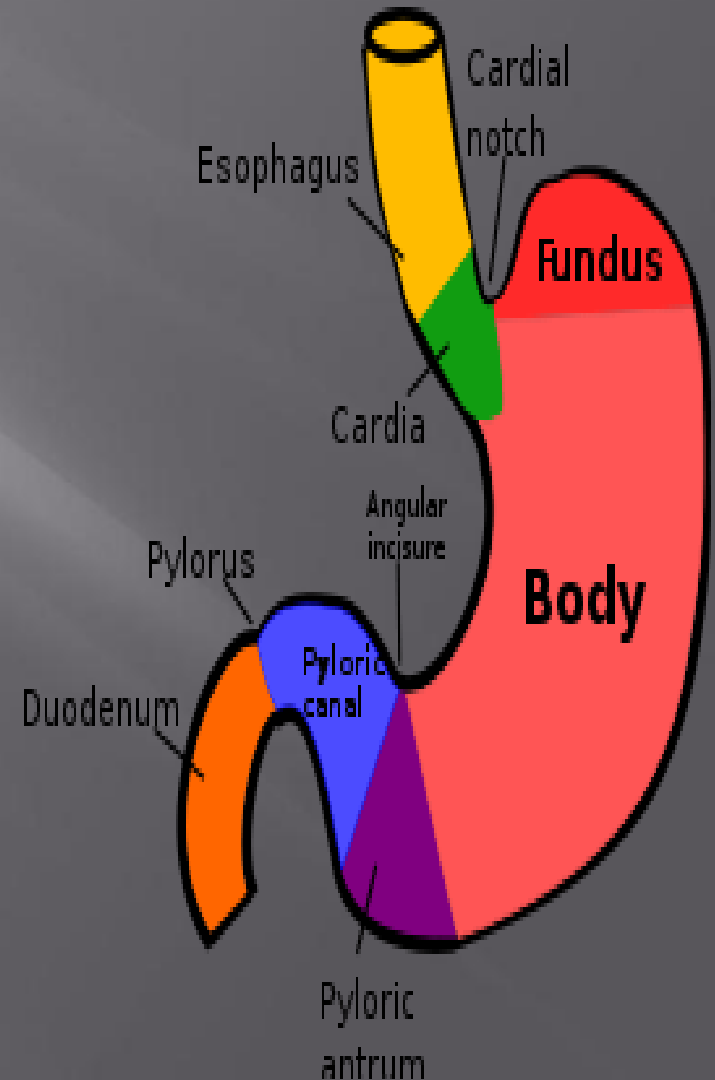


Parts of stomach

The stomach is divided into the following parts :

1- Fundus:

- ▣ Dome-shaped
- ▣ Projects upward and to the left of the cardiac orifice
- ▣ It is usually full of gas.



2 Body:

-Extends from the level of the cardiac orifice to the level of the **incisura angularis** (a constant notch in the lower part of the lesser curvature)

3 Pyloric region

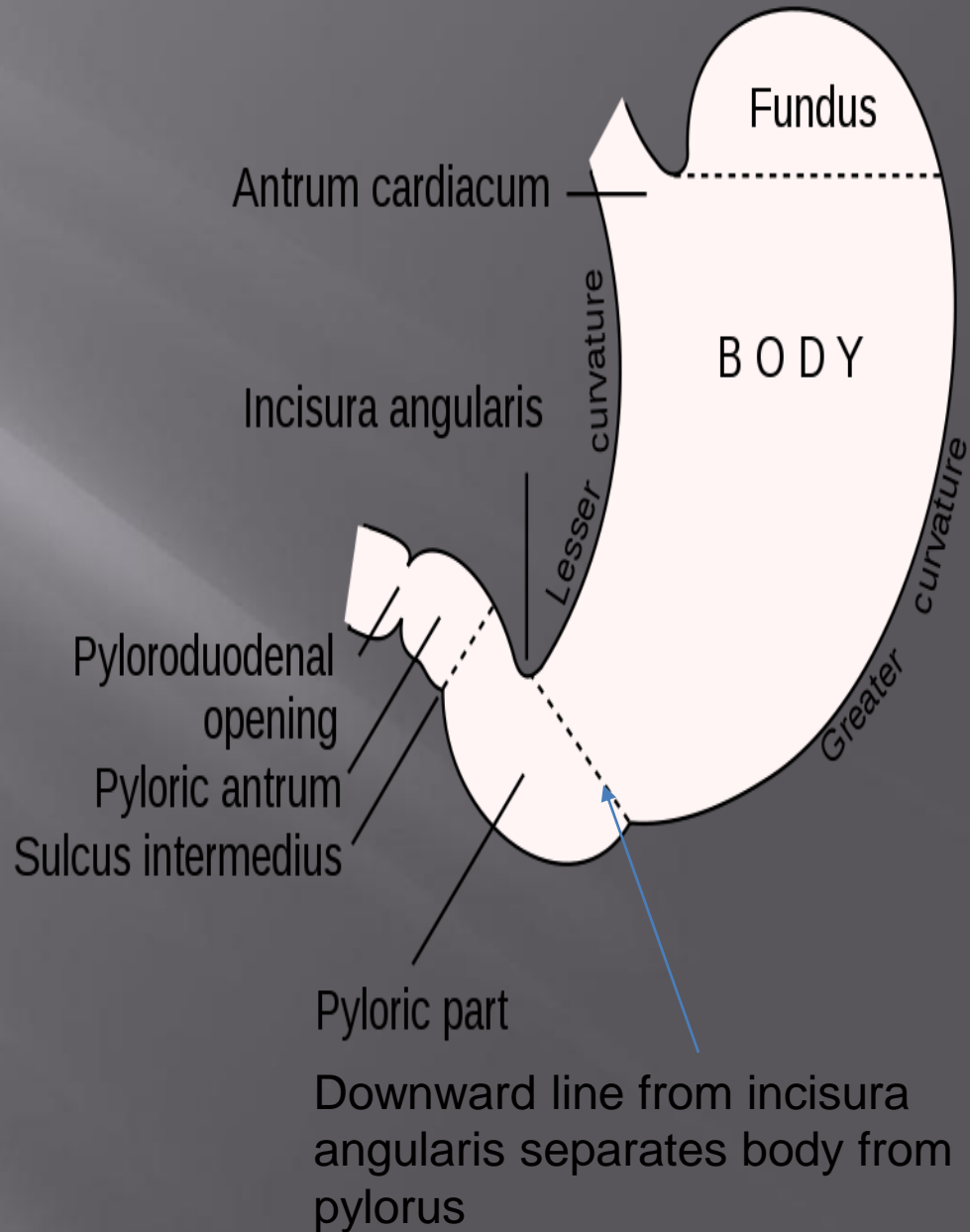
divided into:

a- Pyloric antrum:

- This extends from the incisura angularis to the pylorus

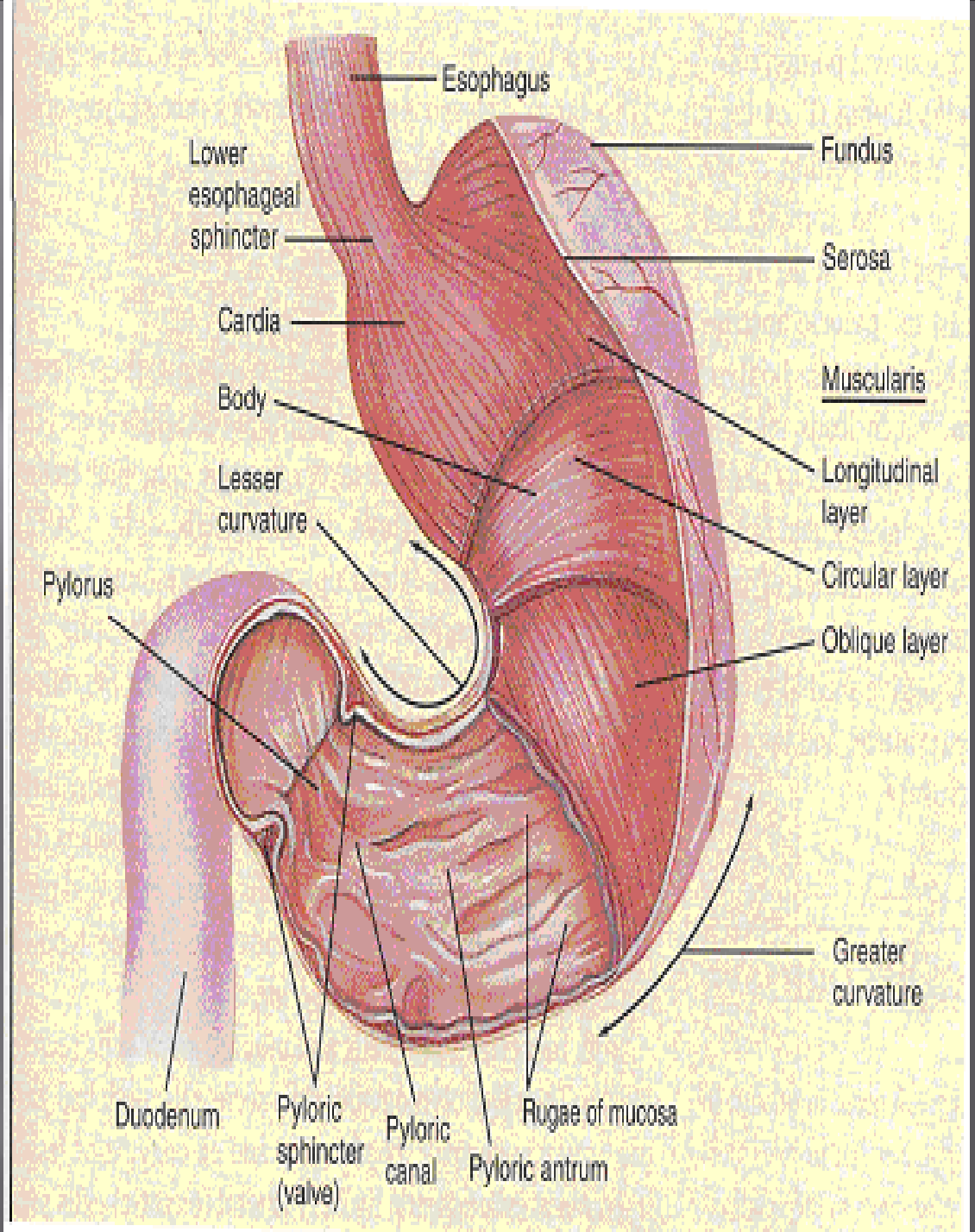
B Pyloric canal: 1 inch in length

C Pyloric Sphincter



B- Pylorus:

- The most tubular part of the stomach
- The thick muscular wall is called the pyloric sphincter



Orifices of the stomach

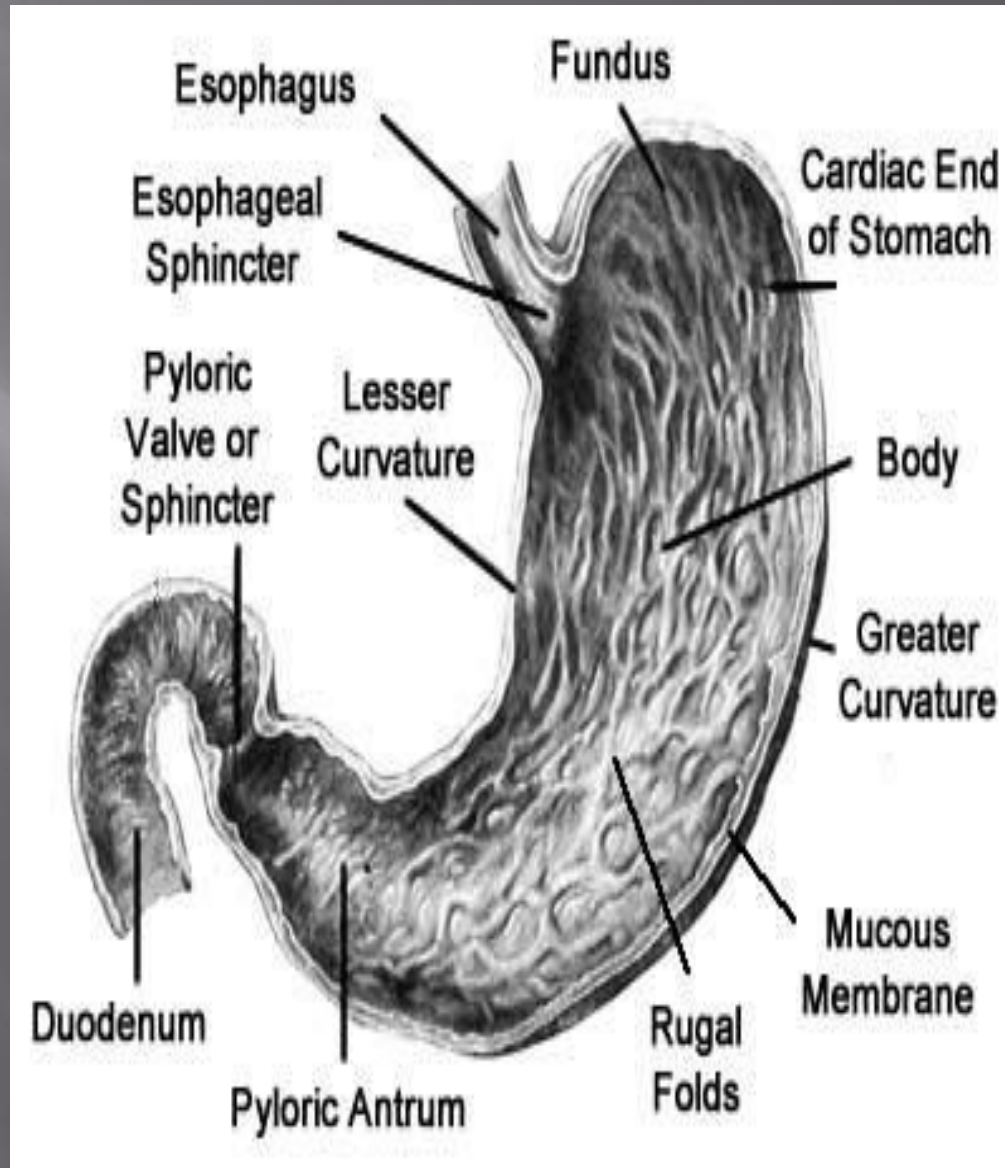
- *Cardiac orifice*
- pyloric orifice

Cardiac orifice

-The cardiac orifice is where the esophagus enters the stomach

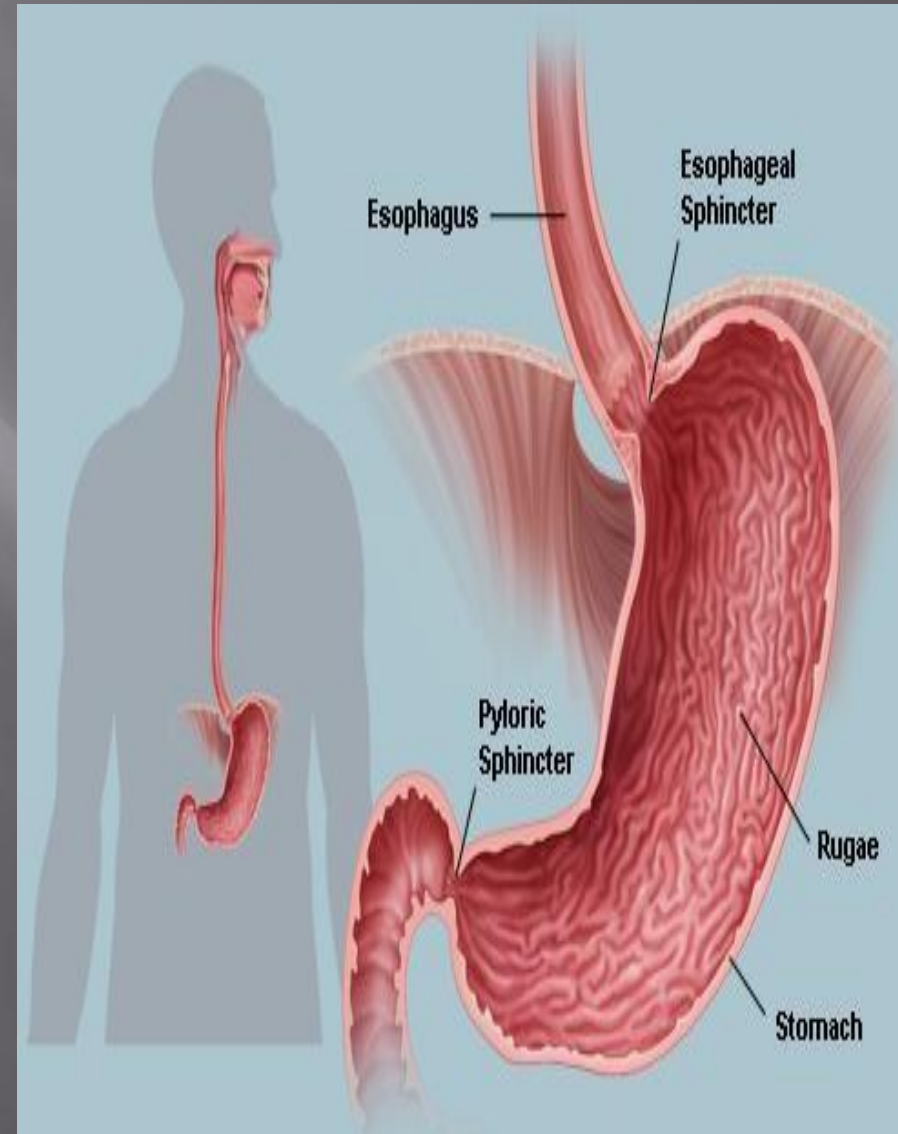
-No anatomic sphincter can be demonstrated here

-A physiological sphincter → physiological mechanism exists that prevents regurgitation of stomach contents into the esophagus



The site of Cardiac orifice

- 7th Lt. costal cartilage
- 1 inch to Lt. of midline
- 45 cm from incisors in the oral cavity.
- Important when using gastroscope for esophagus, stomach and duodenum
- 10 cm from ant. abdominal wall



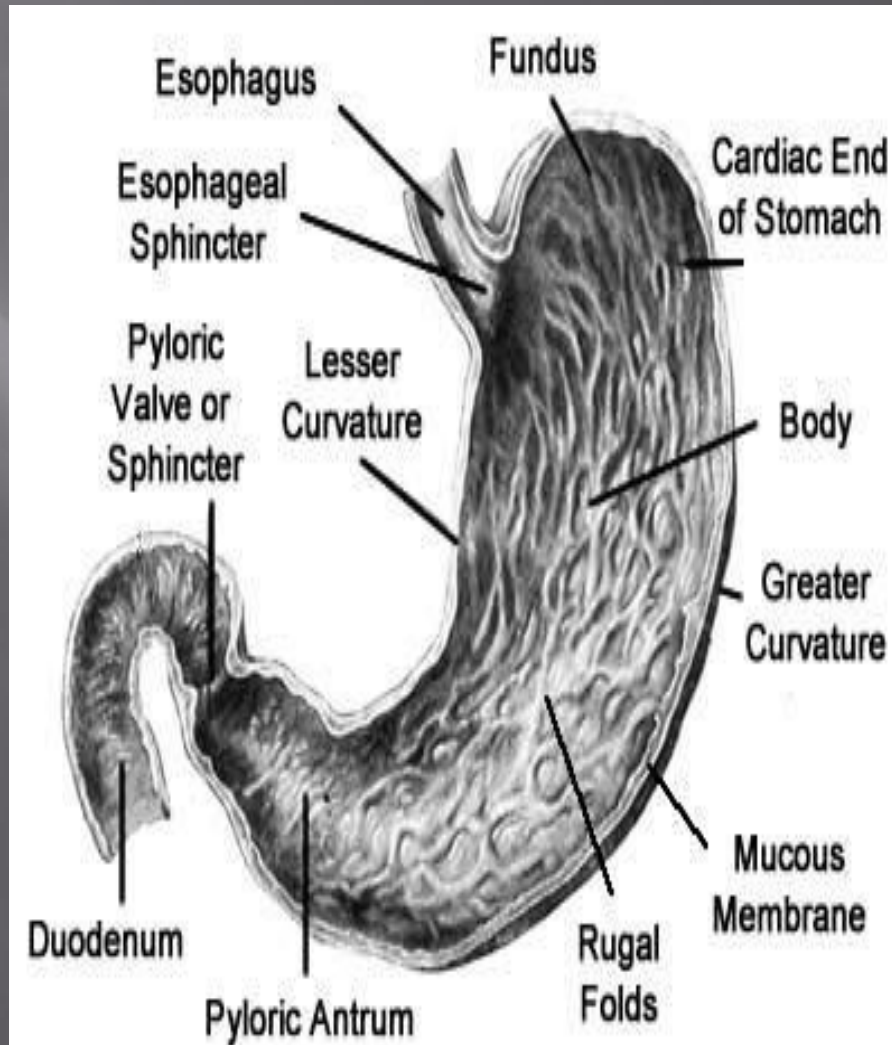
pyloric orifice

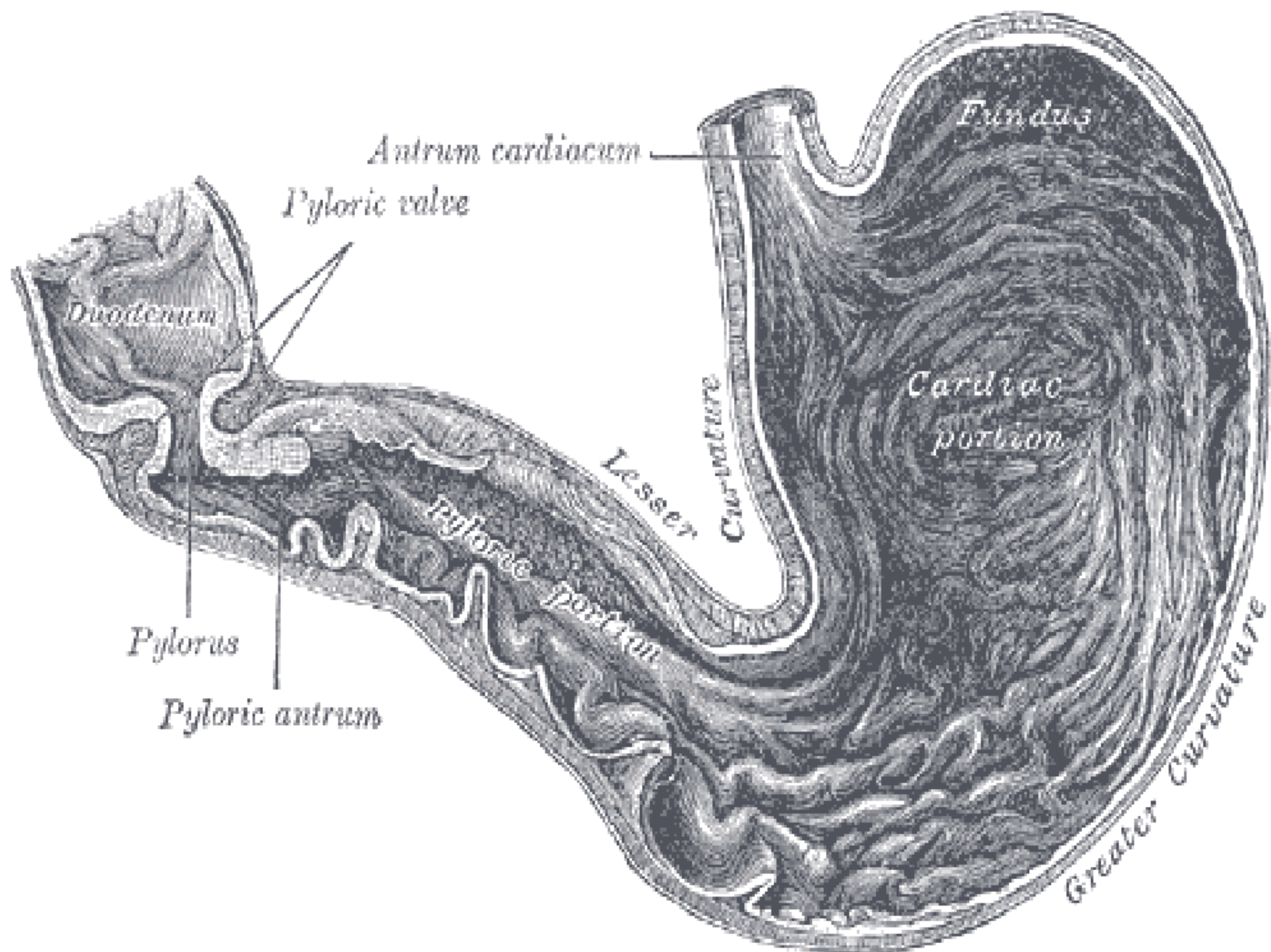
We have 2 types of rugae: oblique and longitudinal. Longitudinal prominent in lesser curvature for easy passage of fluids to duodenum. Thus, intake of water before/during/after food has little/no effect on what happens in stomach.

- Present at end of the pyloric canal
- On the level of L1 we have transpyloric line which passes through the pylorus
- 1" to the Rt. of the midline.

The circular muscle coat of the stomach is much thicker here and forms the **anatomic and physiologic pyloric sphincter**

- Its position can be recognized by a slight constriction on the surface of the stomach (The pylorus lies on the transpyloric plane).





Fundus

Antrum cardiacum

Pyloric valve

Duodenum

Cardiac portion

Lesser Curvature

Pyloric portion

Pylorus

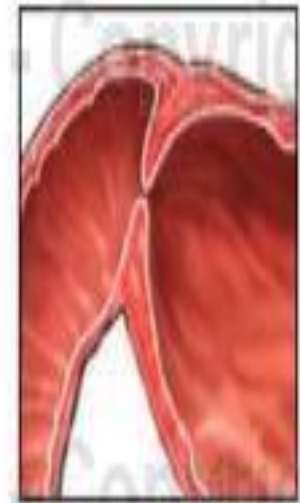
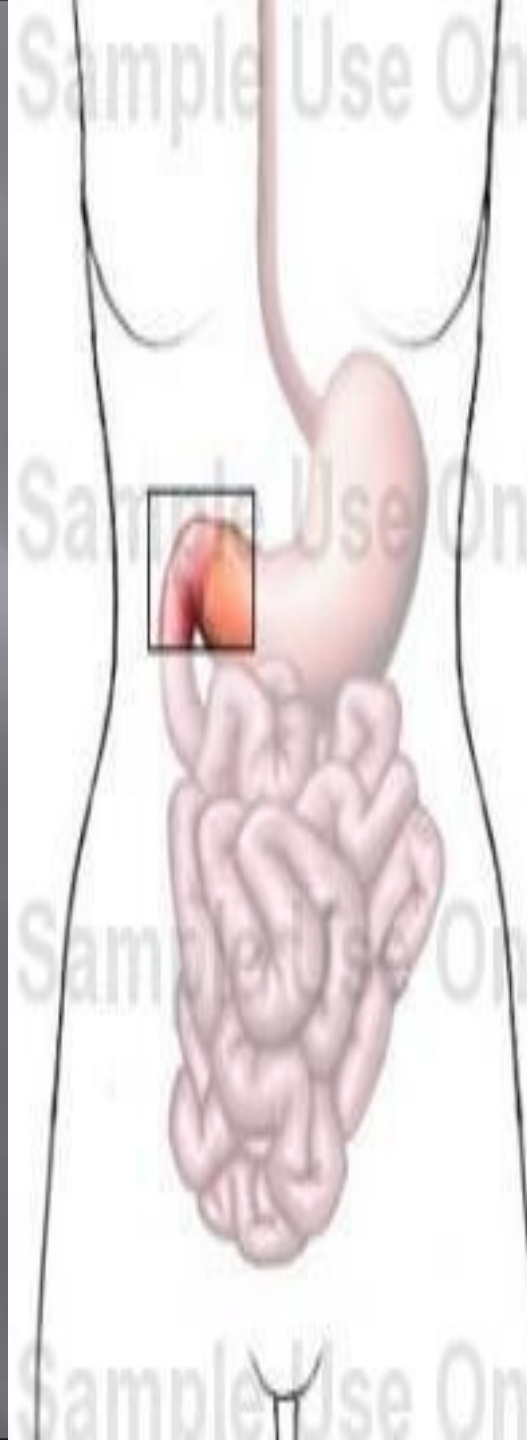
Pyloric antrum

Greater Curvature

Pyloric opening...cont

-The pyloric sphincter controls the outflow of gastric contents into the duodenum.

-The sphincter receives **motor** fibers from the sympathetic system (causes its contraction) and **inhibitory** fibers from the **vagus nerve** (the parasympathetic works on contraction of STOMACH's body smooth muscles).



Pyloric sphincter



Pyloric sphincter after pyloroplasty

Pyloric orifices.....cont

Function of pyloric opening control by: 1-

Hormonal influences from stomach &
duodenum

2- Nerve fibers

Filling stomach → Myenteric fibers → relaxation of
sphincter

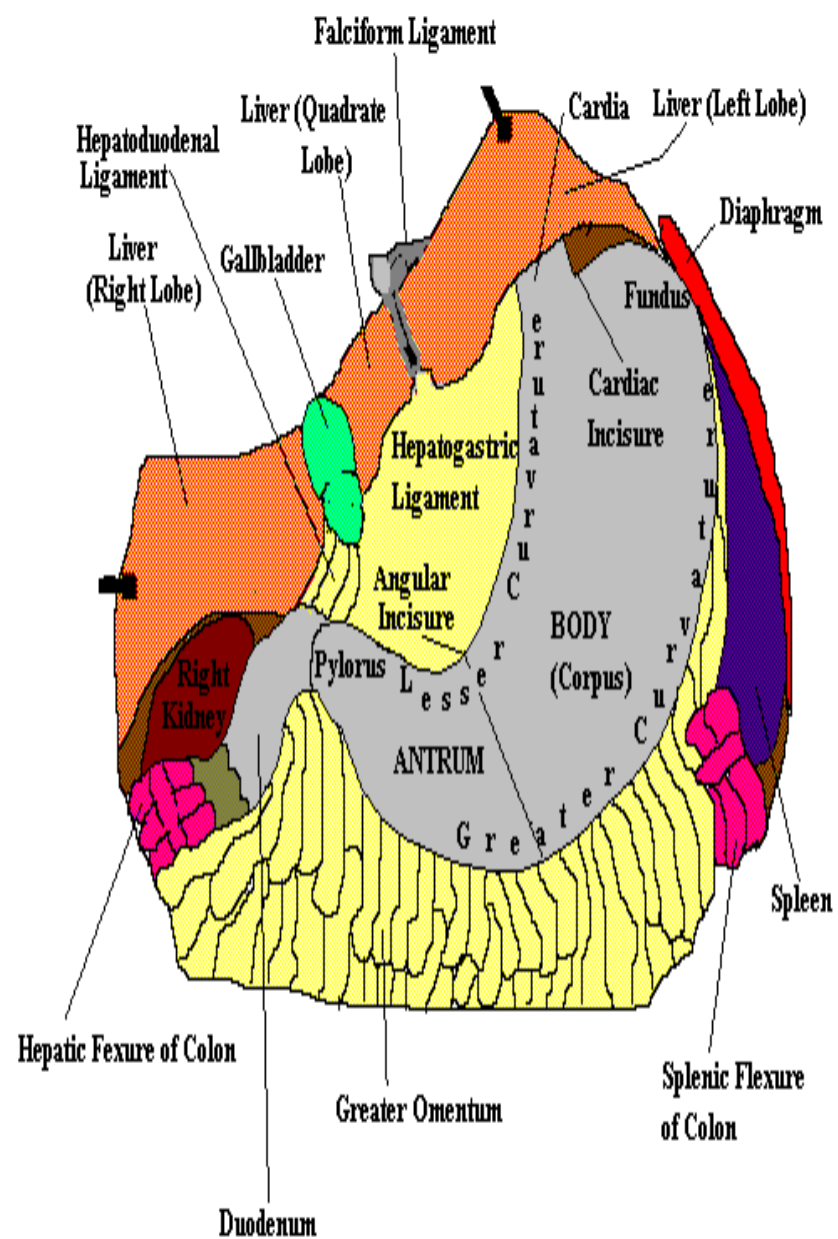
Curvatures of stomach

1- The lesser curvature

- Forms the right border of the stomach
- Extends from the cardiac orifice to the pylorus

We have what we call lesser omentum attached to it (yellow part in this picture above the lesser curvature).

What is the lesser omentum? 2 layers of peritonium, connecting the liver and stomach, and contains fat, nerves, blood vessels and lymph vessels in between those 2 layers. The lesser omentum contains epiploic foramen (foramen of Winslow), it is deep to the edge of lesser omentum and opens behind the stomach, in front of the pancreas (this space between the stomach and pancreas is called the lesser sac).



2- The greater curvature

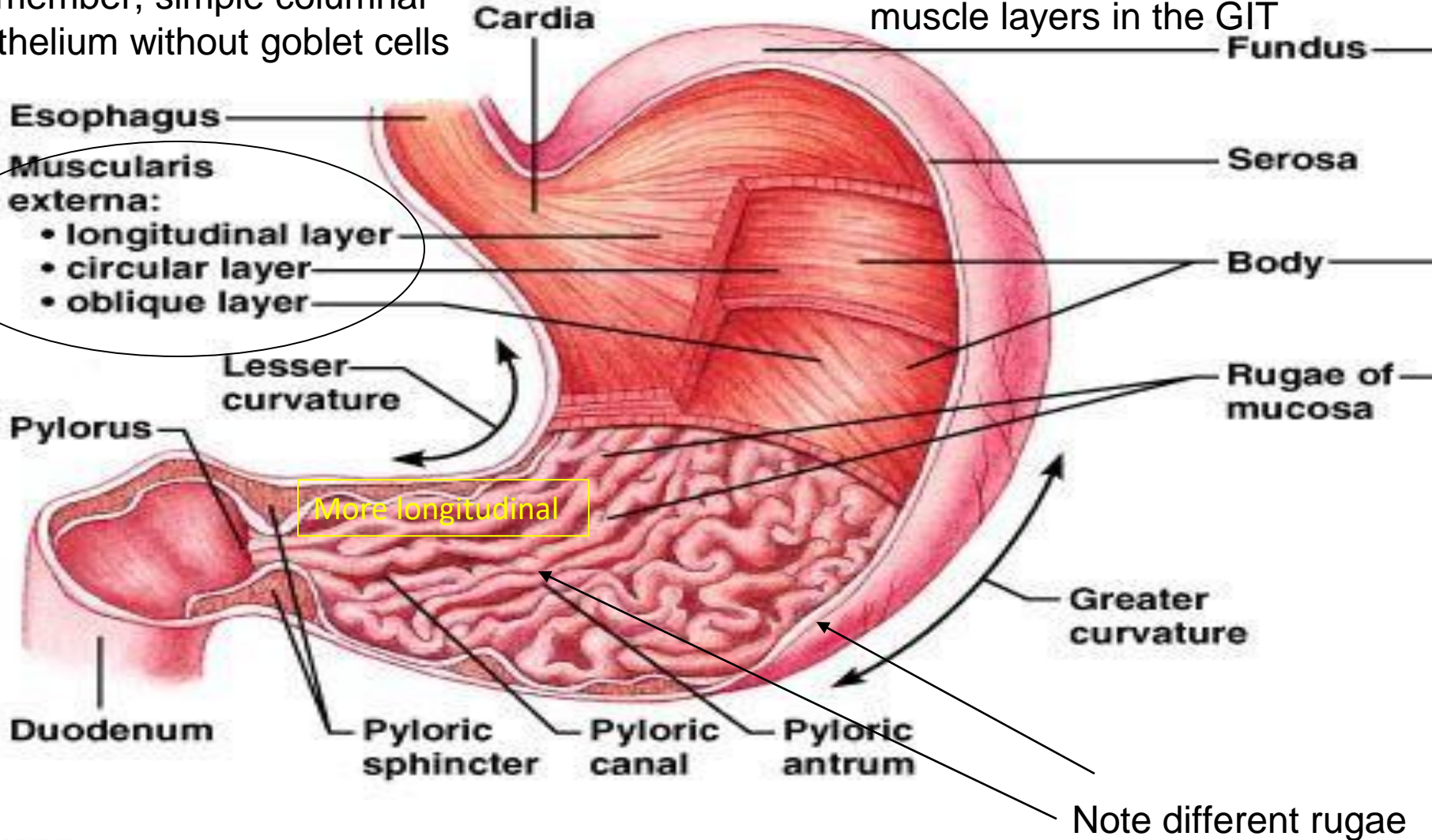
- Much longer than the lesser curvature
- Extends from the left of the cardiac orifice, over the dome of the fundus, and along the left border of the stomach to the pylorus

Greater omentum is attached to greater curvature, pylorus and first part of duodenum, and ,again, it is made up of 2 layers which down through the abdominal cavity then it returns to the transverse colon, hence, the transverse colon is intraperitoneal, like the stomach, but the ascending and descending colons are retroperitoneal (peritoneum in front and attached to posterior abdominal wall).

Histology of the Stomach

Remember, simple columnar epithelium without goblet cells

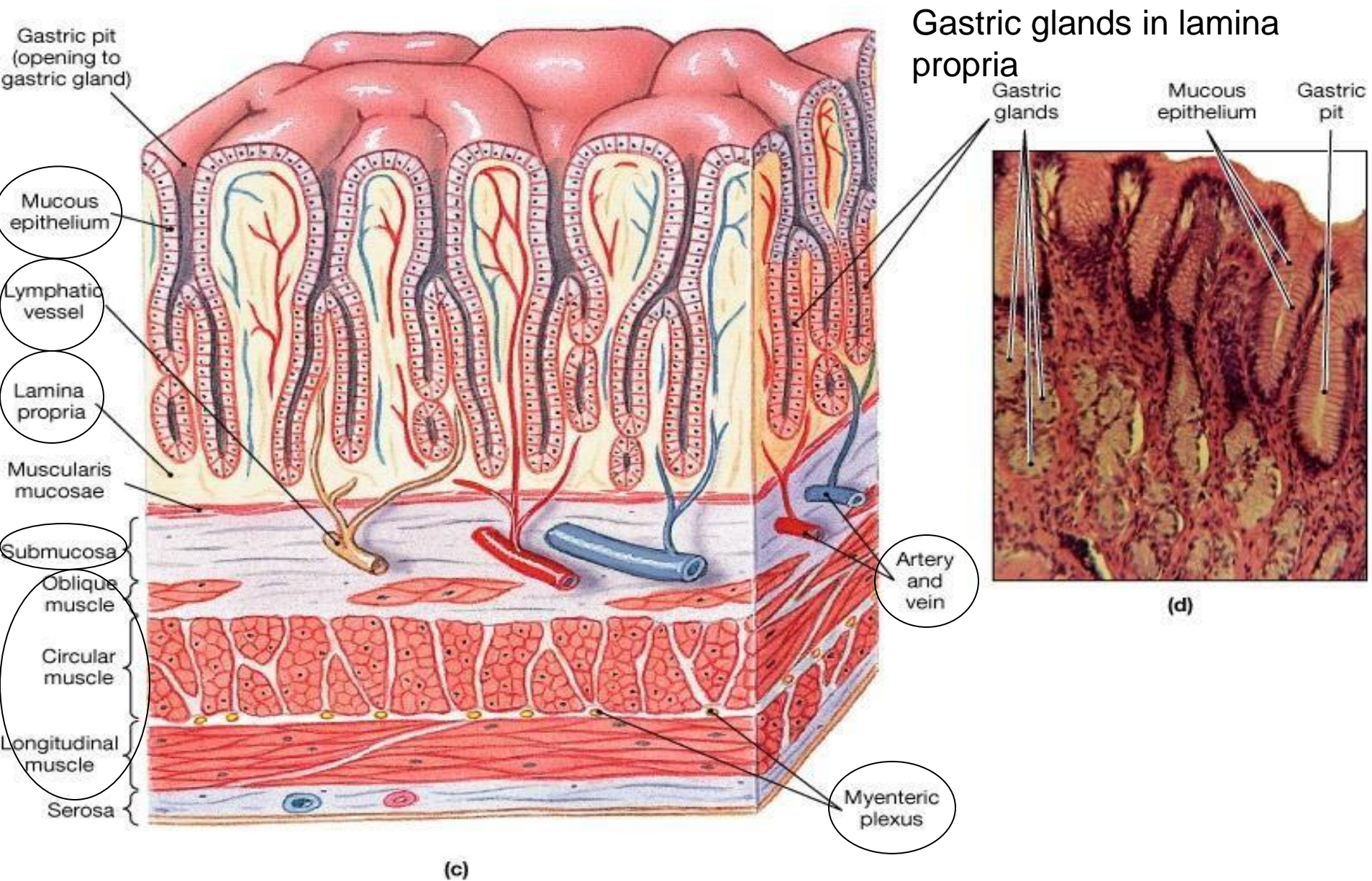
Only organ with 3 different muscle layers in the GIT



(b)

Note different rugae

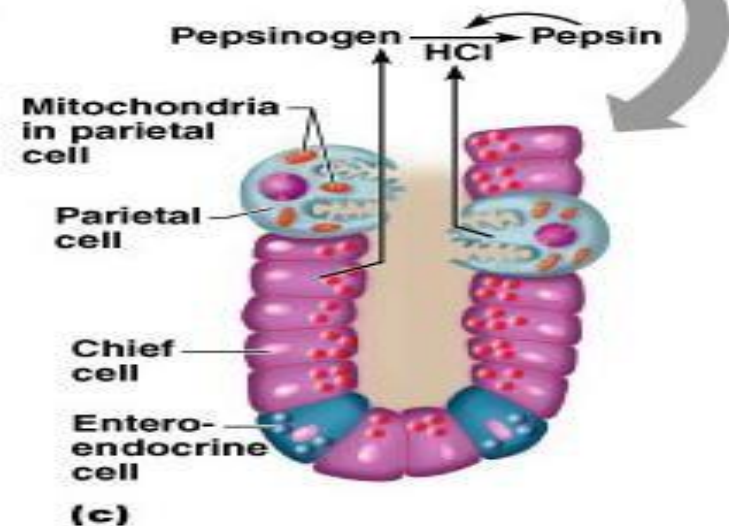
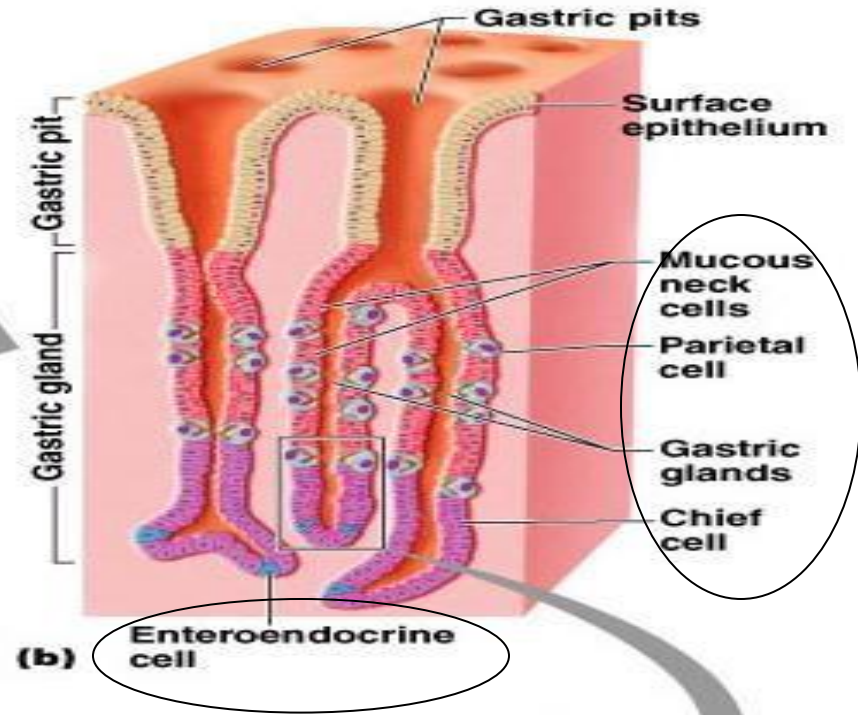
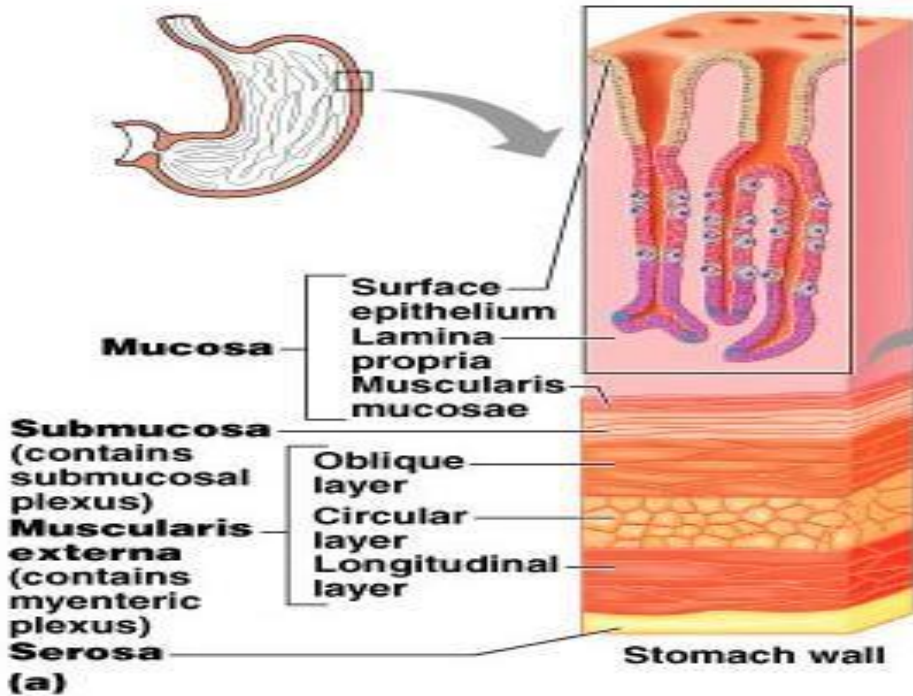
The Stomach – Microscopic Anatomy



Mucous membrane

- ▣ The mucous membrane of the stomach is thick and vascular and is thrown into numerous folds, or **rugae** mainly longitudinal in direction
- ▣ The folds flatten out when the stomach is distended.

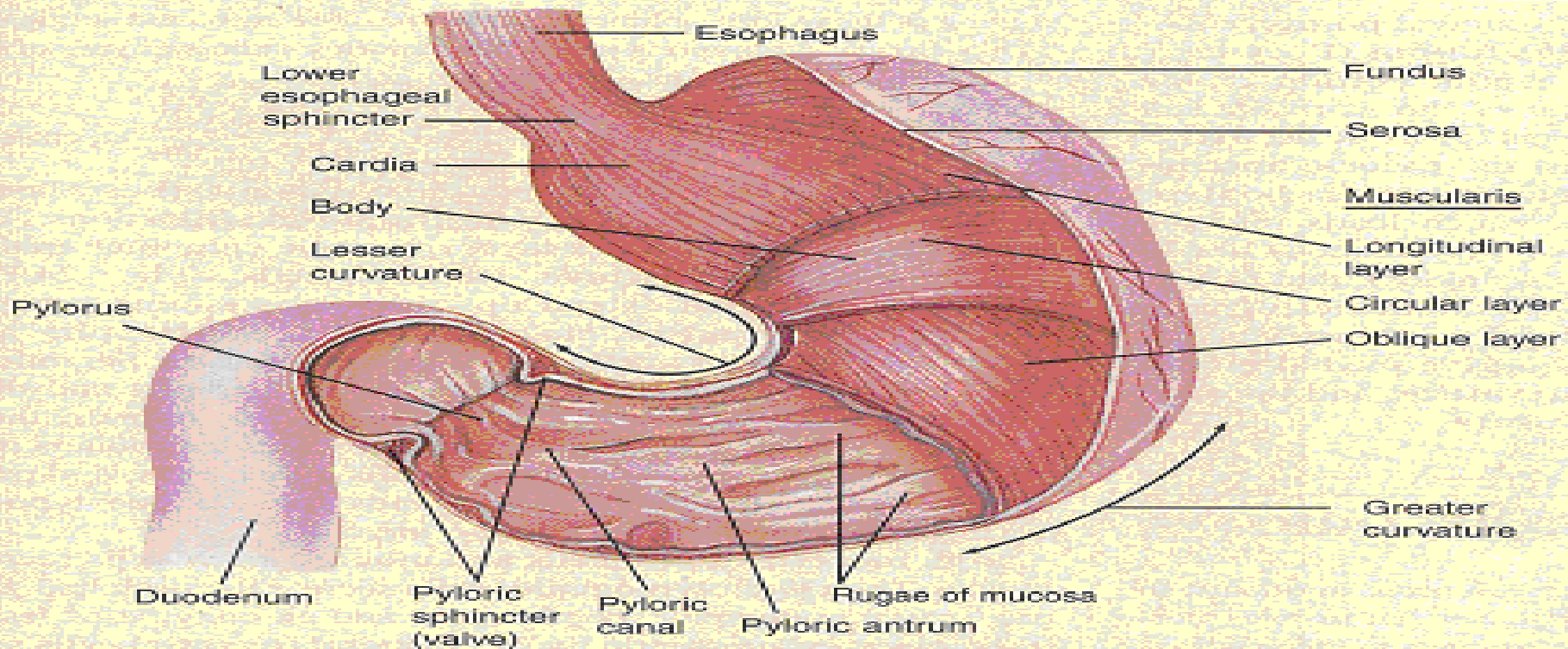
Stomach - Microscopic Anatomy



We will come back to it in histology

muscular wall of stomach

- ▣ The muscular wall of the stomach contains longitudinal fibers (outer surface), circular fibers (inner surface), and oblique fibers (most inner). Note: oblique layer absent at pyloric sphincter, that's why circular layer forms sphincter.



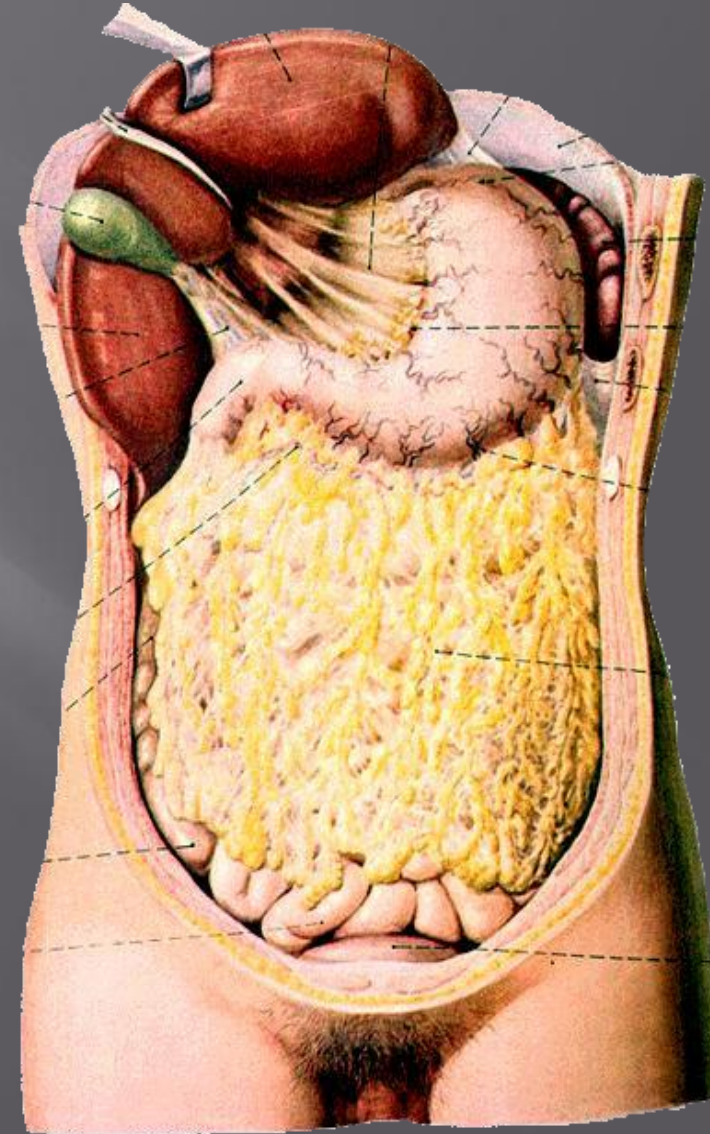
Stomach - Microscopic Anatomy



Peritoneum of stomach

- ▣ The peritoneum (visceral peritoneum) completely surrounds the stomach.
- ▣ It leaves the lesser curvature as the **lesser omentum**
- ▣ It leaves the greater curvature as the **gastrosplenic** ligament (between spleen and fundus of stomach) and the **greater omentum**

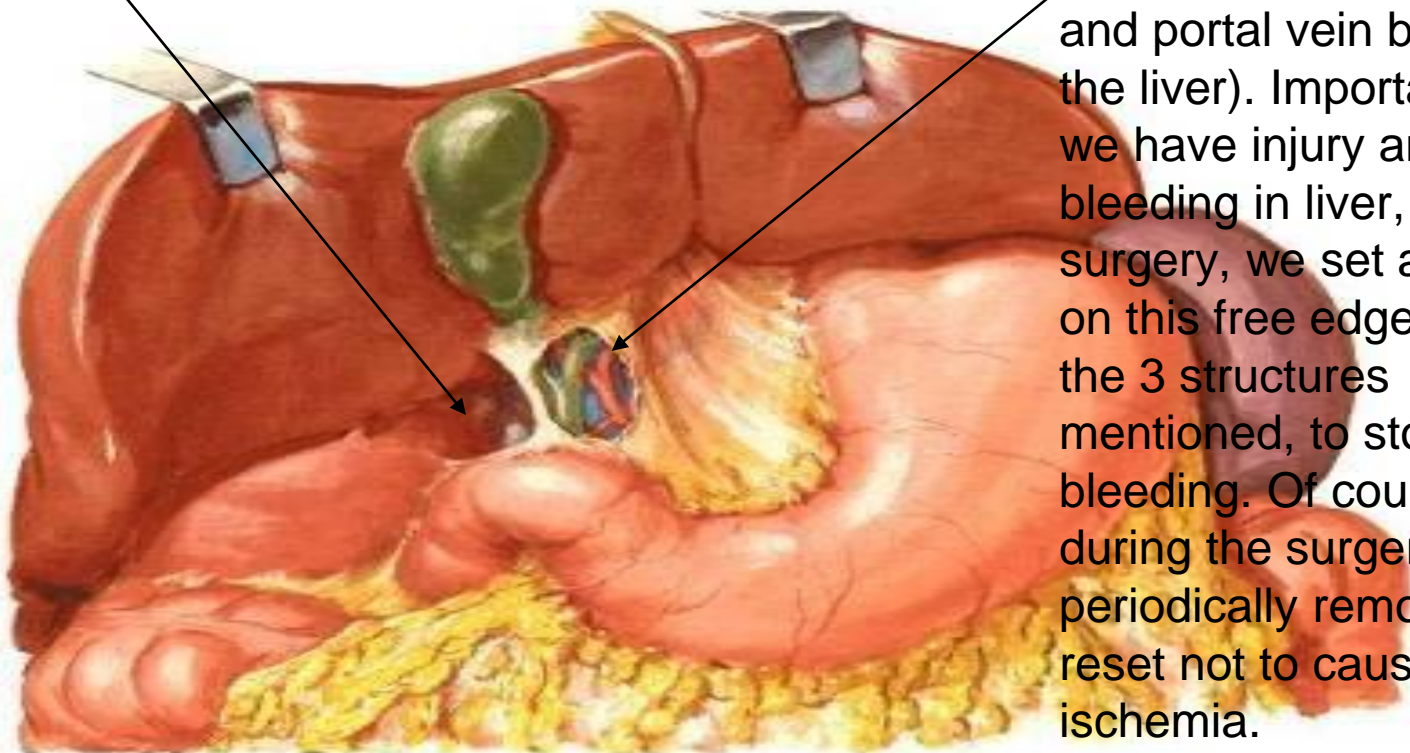
- ▣ The gastrosplenic ligament extends from the upper part of the greater curvature to the spleen, and the greater omentum extends from the lower part of the greater curvature to the transverse colon



- ▣ **The lesser curvature is suspended from the liver by the lesser omentum**
- ▣ **Gastrophrenic ligament between the fundus and the diaphragm.**

Epiploic foramen (foramen of Winslow)

Liver in Situ

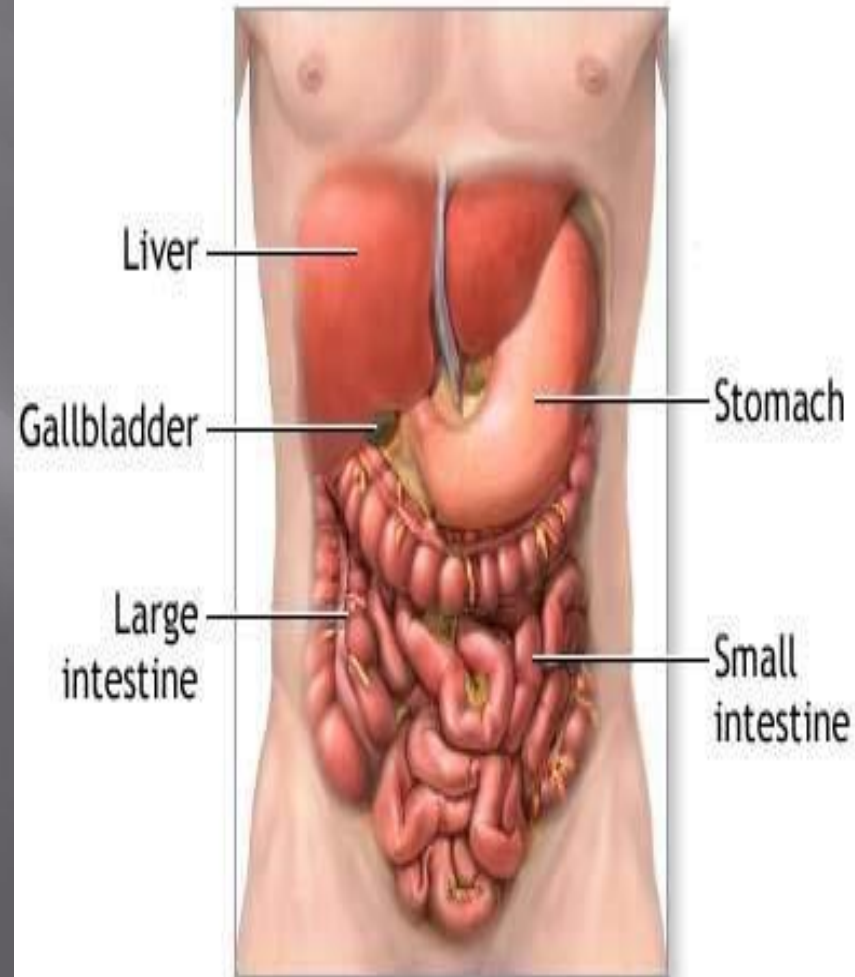


Free edge of lesser omentum (common bile duct FROM liver to duodenum, hepatic artery and portal vein both TO the liver). Importance: if we have injury and bleeding in liver, during surgery, we set a clamp on this free edge, sealing the 3 structures mentioned, to stop the bleeding. Of course, during the surgery it is periodically removed and reset not to cause ischemia.

Relations of stomach

Anterior- superior surface

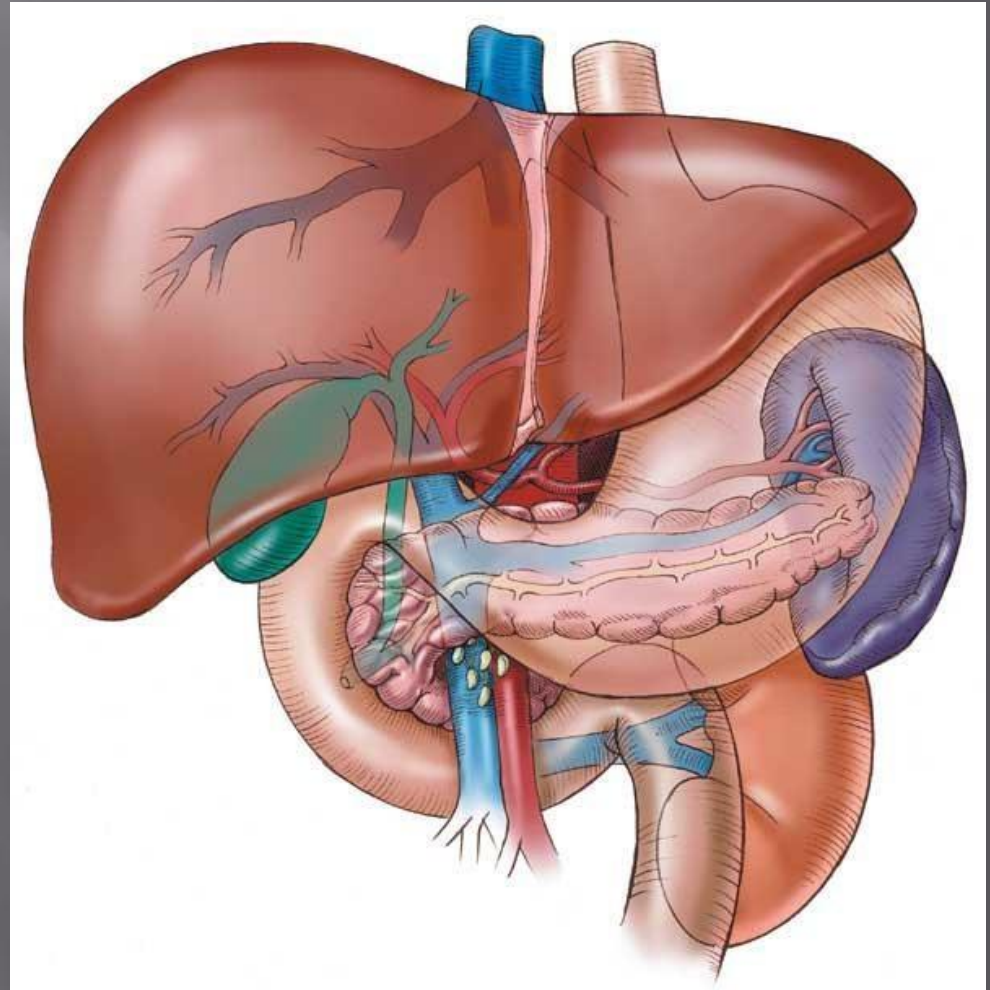
- The anterior abdominal wall
- the left costal margin
- the left pleura and lung
- the diaphragm
- the left lobe of the liver



Relations of stomach...cont

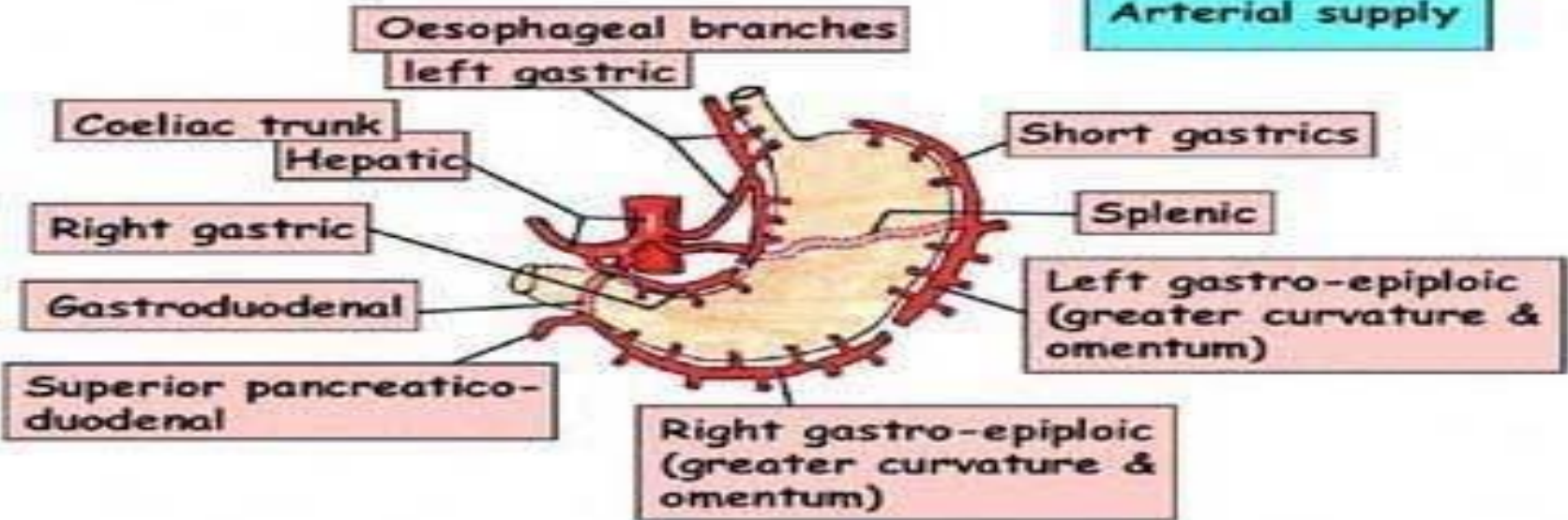
Posteriorly = stomach bed

- The lesser sac (space to allow distention of stomach after eating)
- the Lt. crus of diaphragm (origin of diaphragm)
- the spleen the most lateral organ to stomach posteriorly, also some of it is anterior to stomach
- the left suprarenal gland
- the upper part of the left kidney
- the splenic artery on upper border of pancreas
- the body of pancreas
- the transverse mesocolon
- the transverse colon

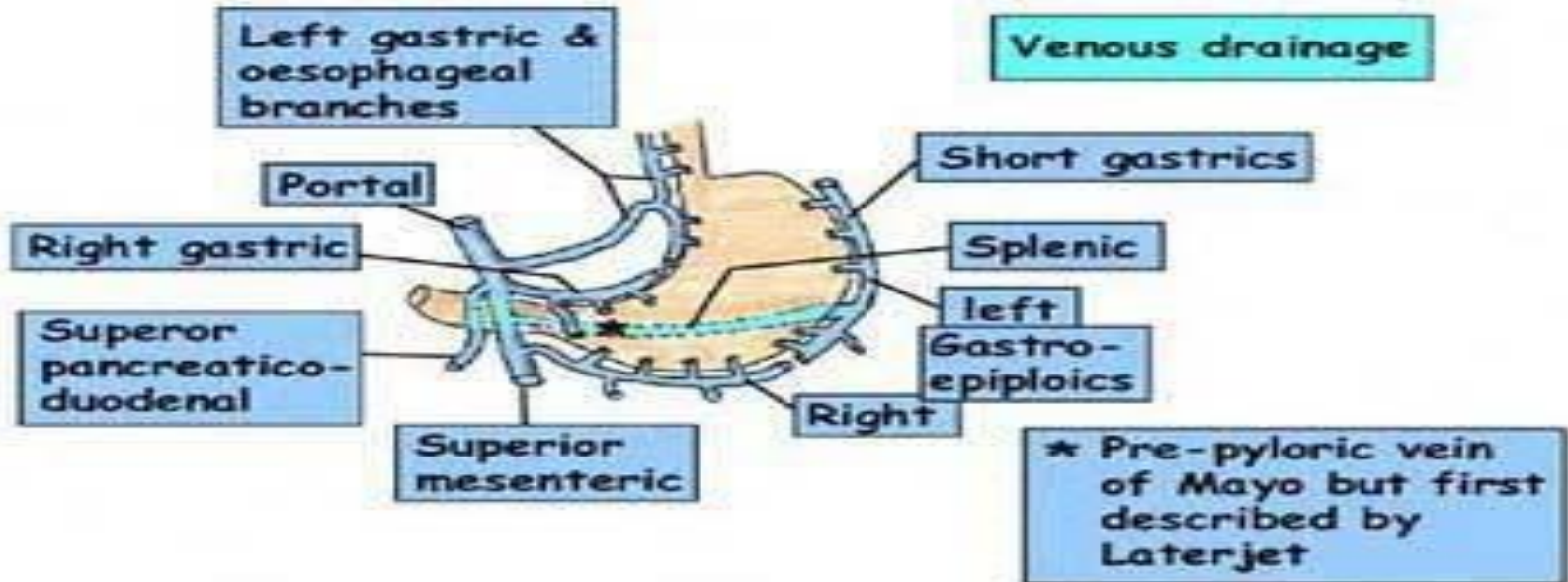


STOMACH - BLOOD SUPPLY & VENOUS DRAINAGE

Arterial supply



Venous drainage

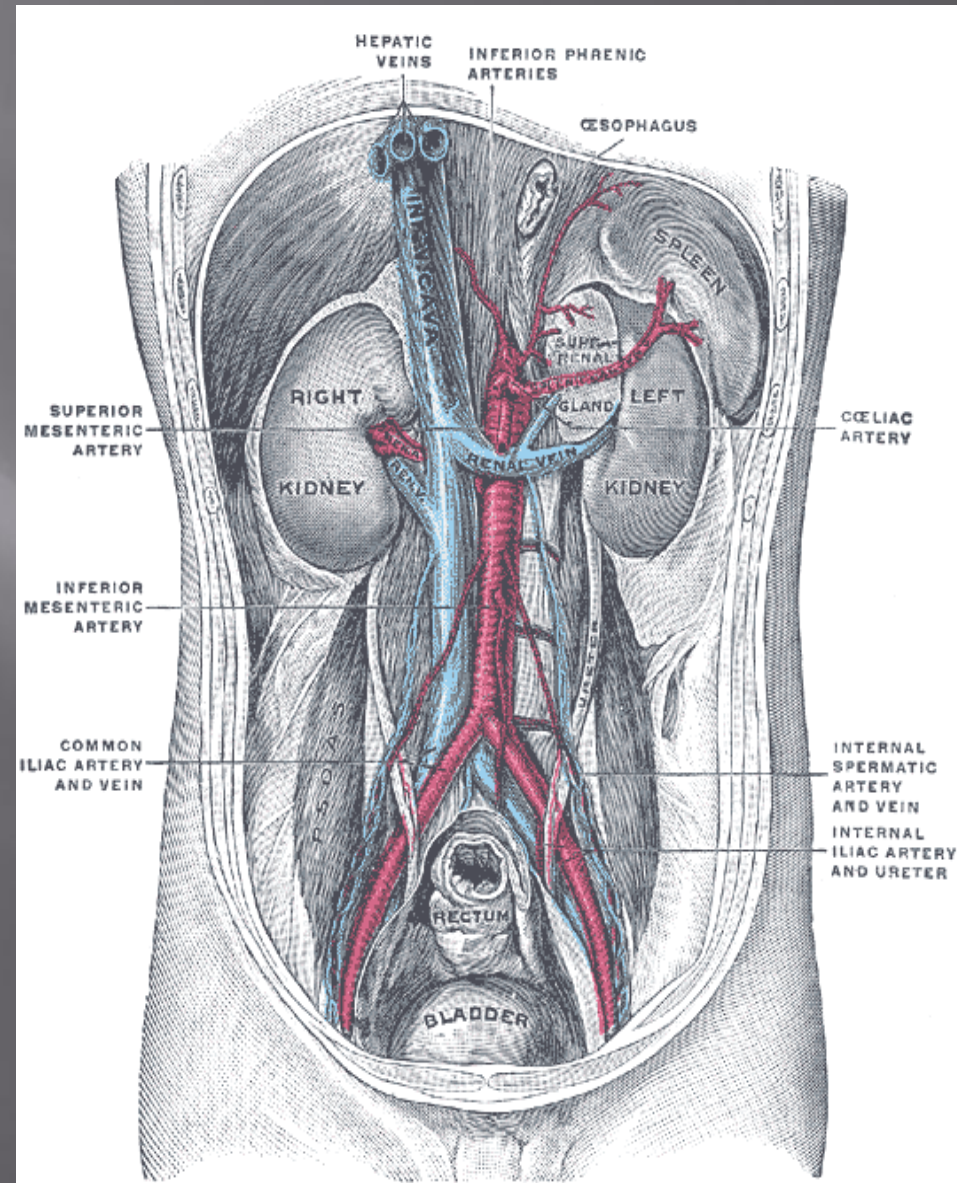


Blood supply...cont

- The arteries are derived from the branches of the **celiac artery**

- The celiac trunk arise from the front of the abdominal aorta and its located at the level of **lower border of T12 to upper border of L1** above the pancreas

- Its 1 cm long



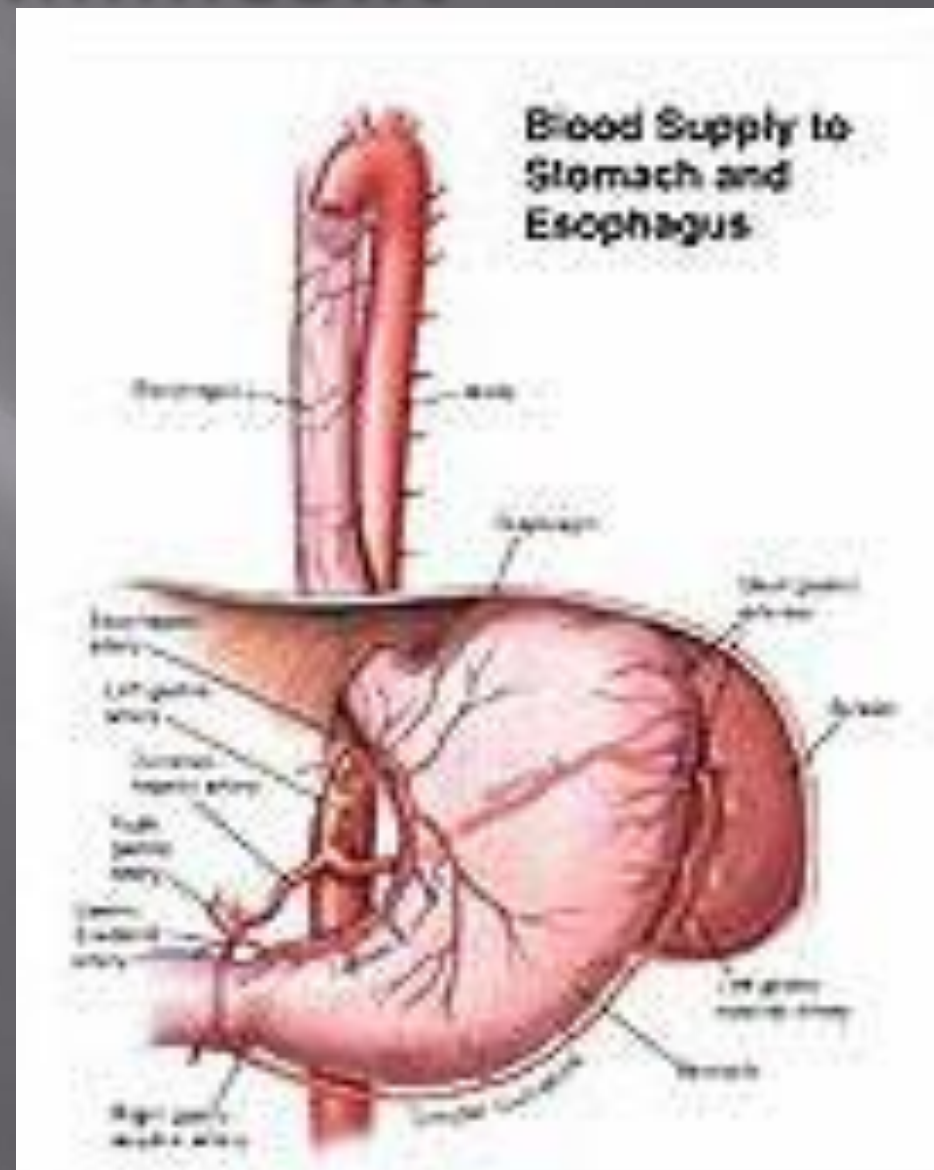
Blood supply for stomach.....cont

Relations of celiac artery

- On each side : celiac ganglia+ lymphatic nodes
- Crus of diaphragm and lumbar nerves
- Its Branches for foregut

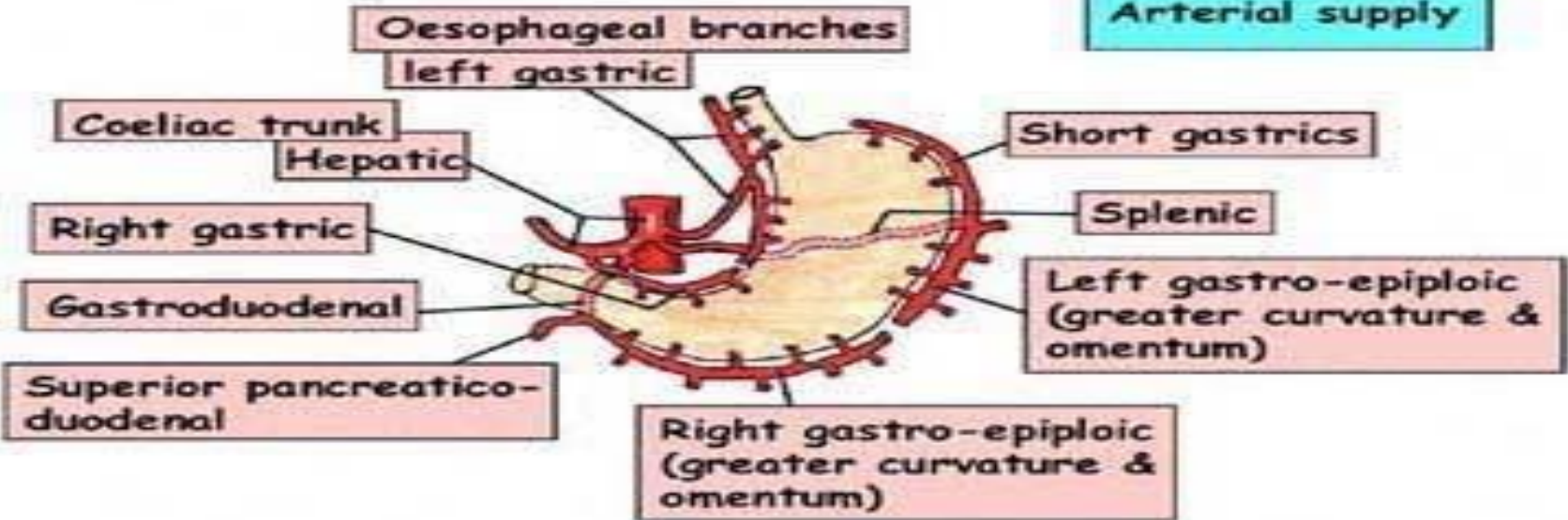
Main distribution

- Lt.gastric.a
- Splenic.a
- Hepatic.a

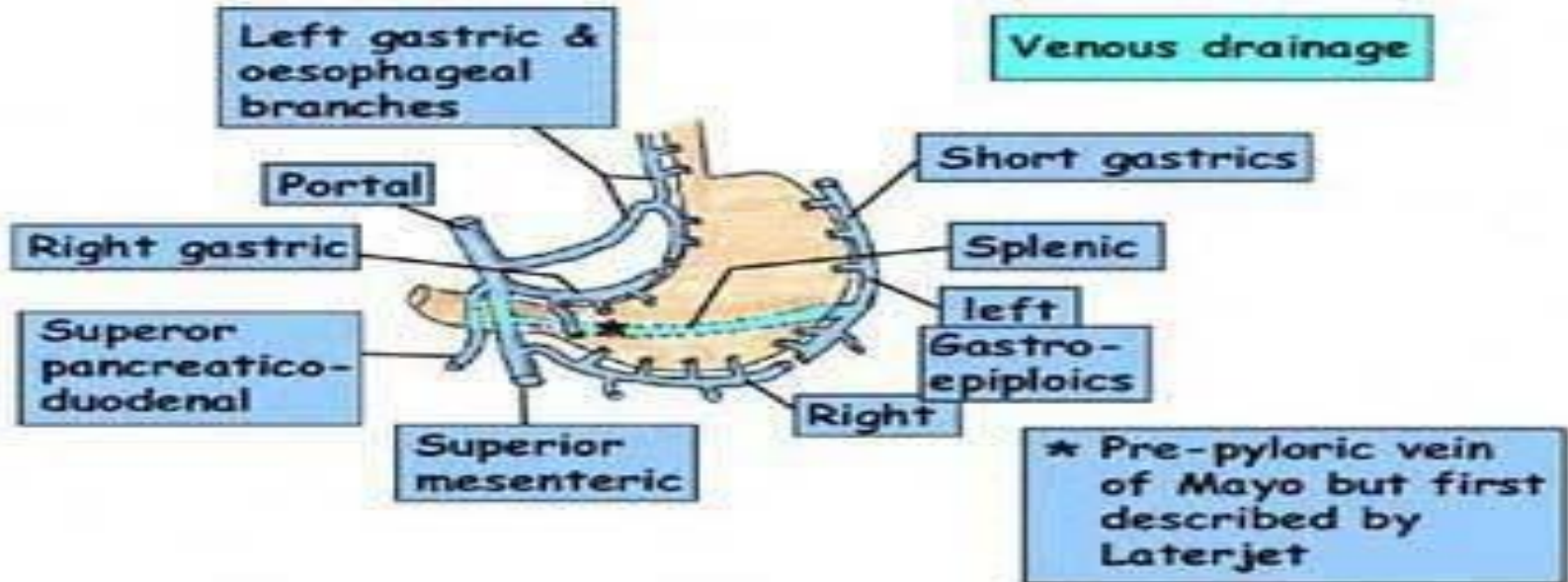


STOMACH - BLOOD SUPPLY & VENOUS DRAINAGE

Arterial supply



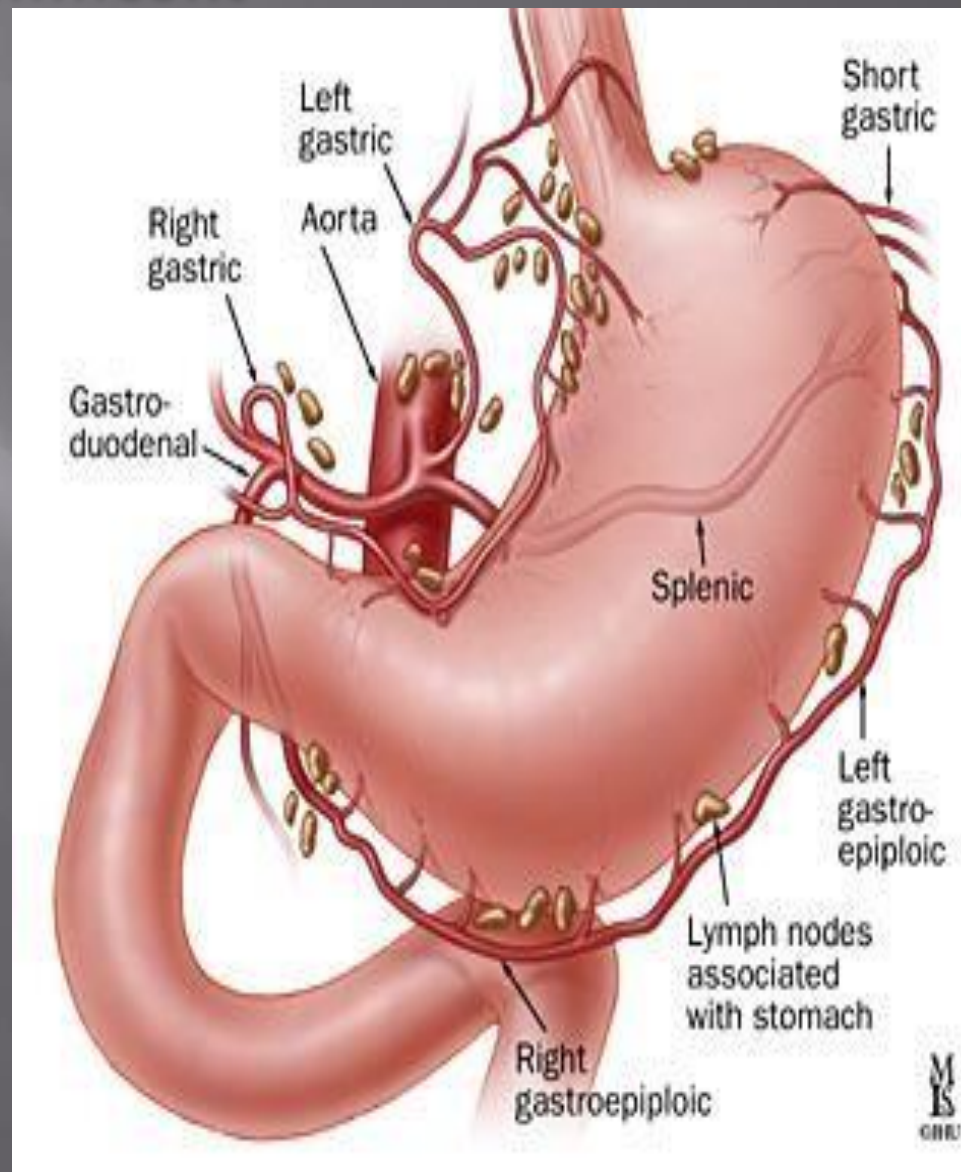
Venous drainage



Blood supply for stomach.....cont

1 The left gastric artery

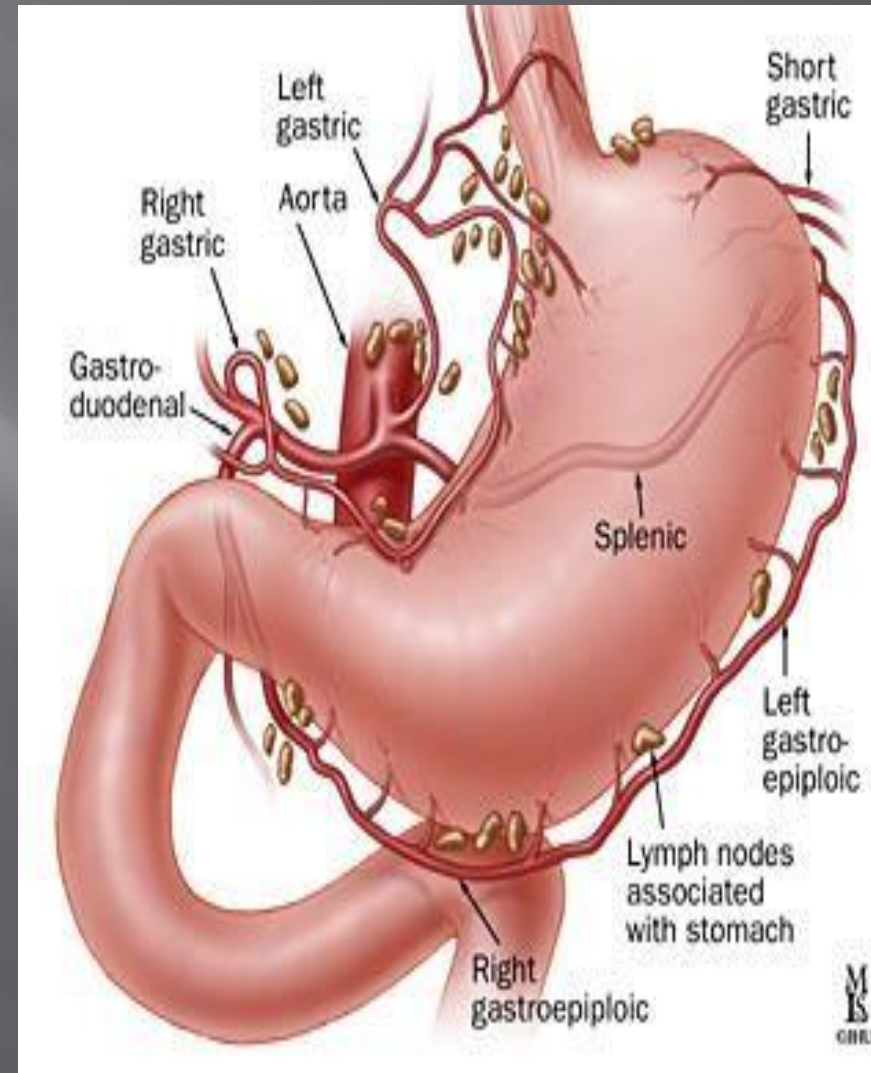
- Arises from the celiac artery
- It passes upward and to the left to reach the esophagus
- Then descends along the lesser curvature of the stomach
- It supplies the lower third of the esophagus and the upper right part of the stomach



Blood supply.....cont

2- The right gastric artery

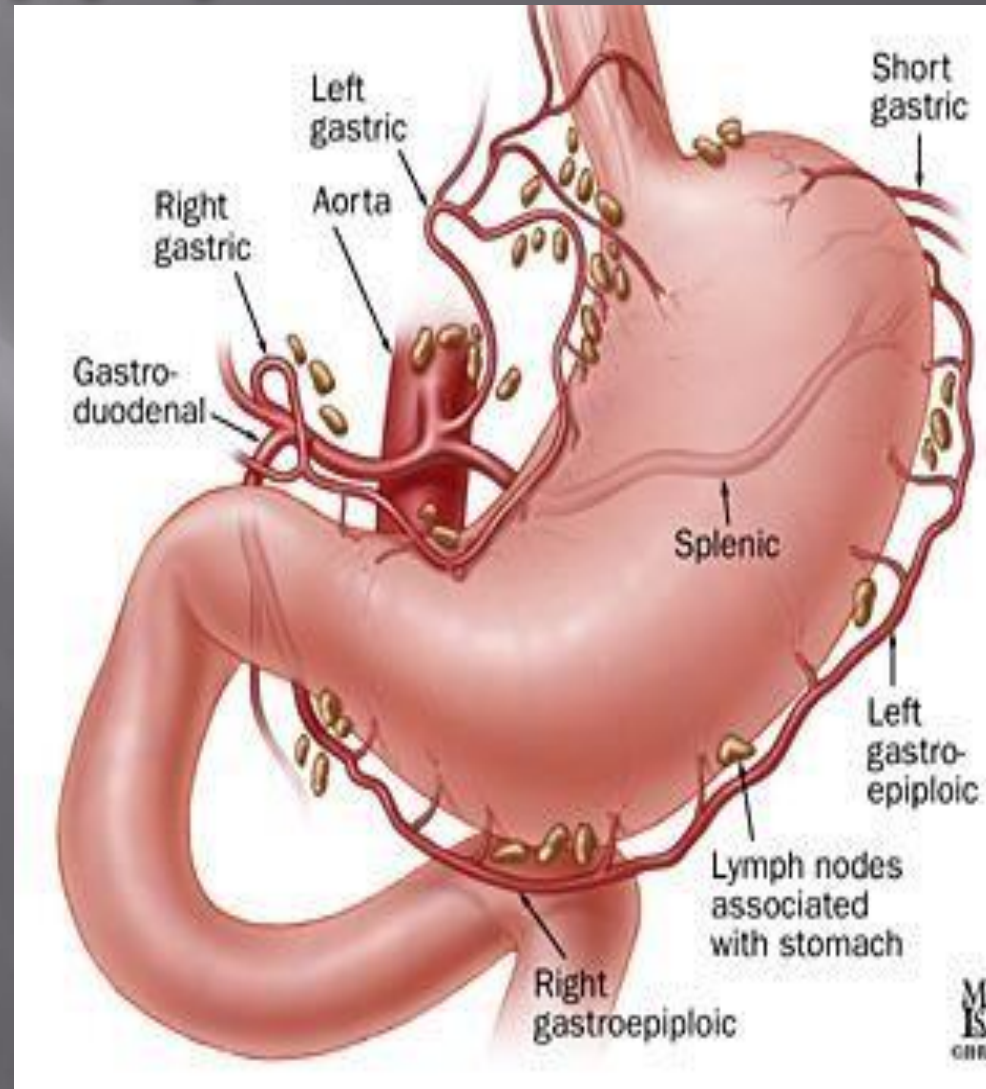
- arises from the hepatic artery at the upper border of the pylorus
- runs to the left along the lesser curvature.
- It supplies the lower right part of the stomach.



Blood supply...cont

3- The short gastric arteries

- Arise from the splenic artery (*tortuous artery going to spleen*) (5-7 arteries)
- Arises from splenic artery in the gastrosplenic ligament
- pass upward in the gastrosplenic to supply the fundus



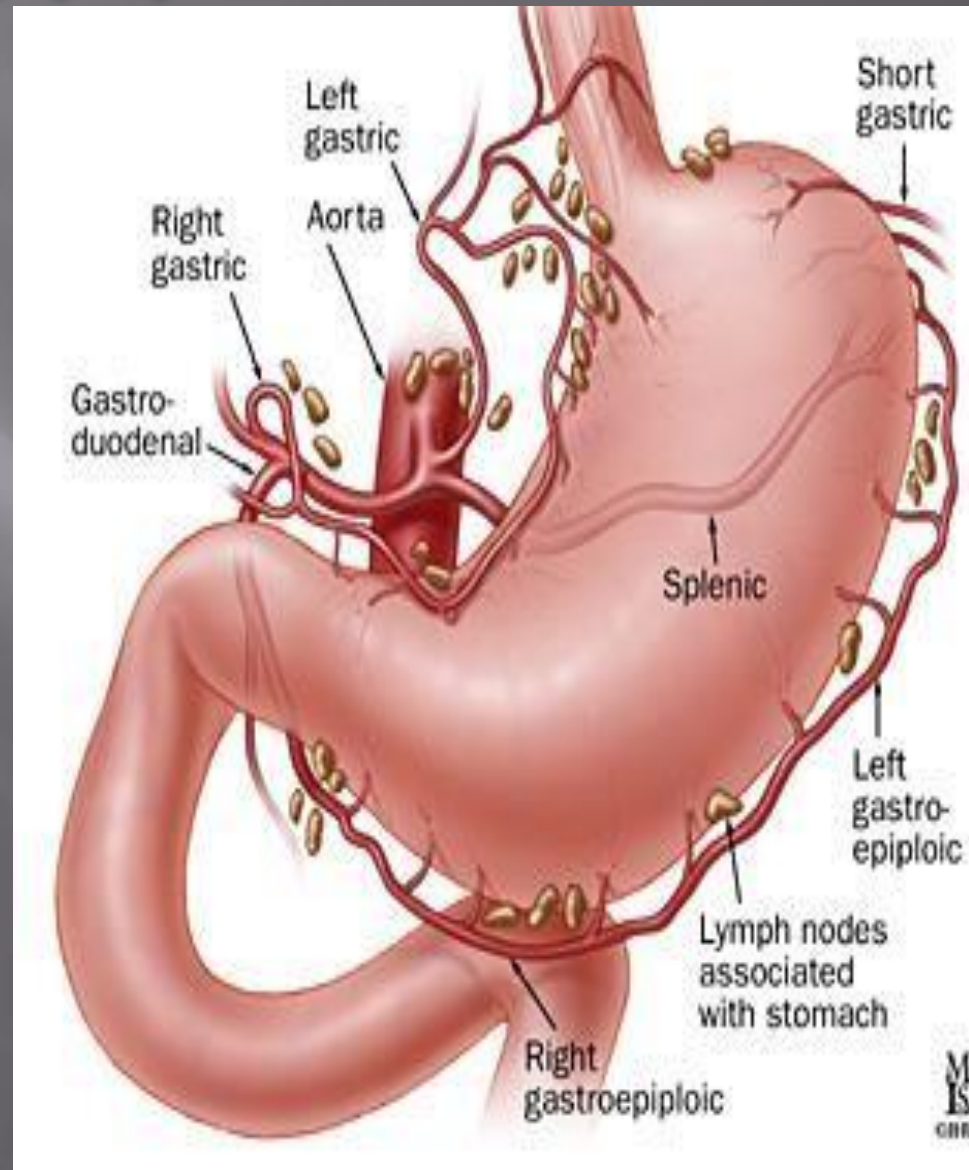
Blood supply.....cont

4- The left gastroepiploic artery

- Arises from the splenic artery before the hilum of the spleen
- Passes forward in the gastrosplenic (ligament)
- Supply the stomach along the upper part of the greater curvature in the greater omentum

5- The right gastroepiploic artery

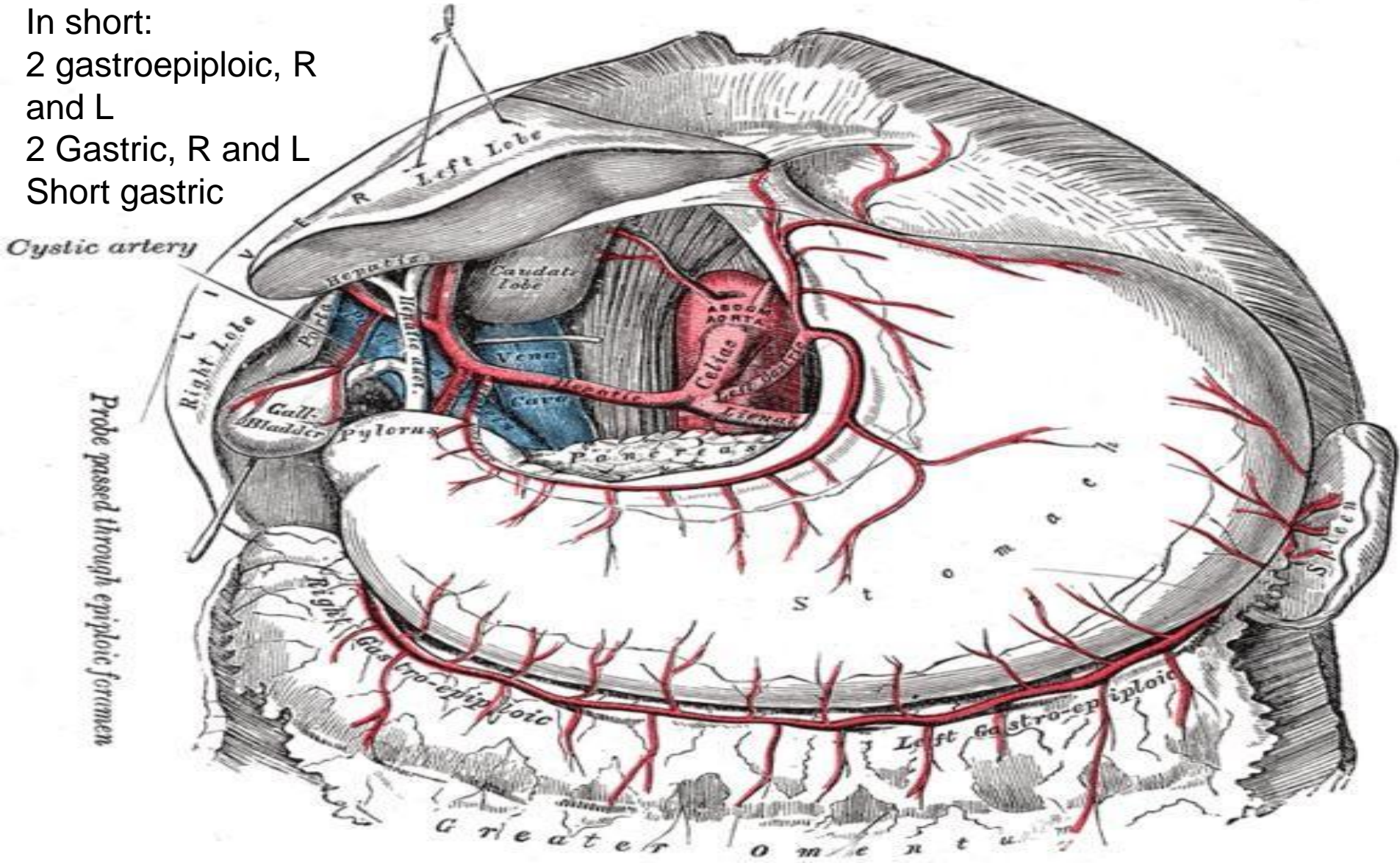
- arises from the gastroduodenal branch of the hepatic artery
- It passes to the left and supplies the stomach along the lower part of the greater curvature in the greater omentum.



Blood supply of stomach

In short:

- 2 gastroepiploic, R and L
- 2 Gastric, R and L
- Short gastric

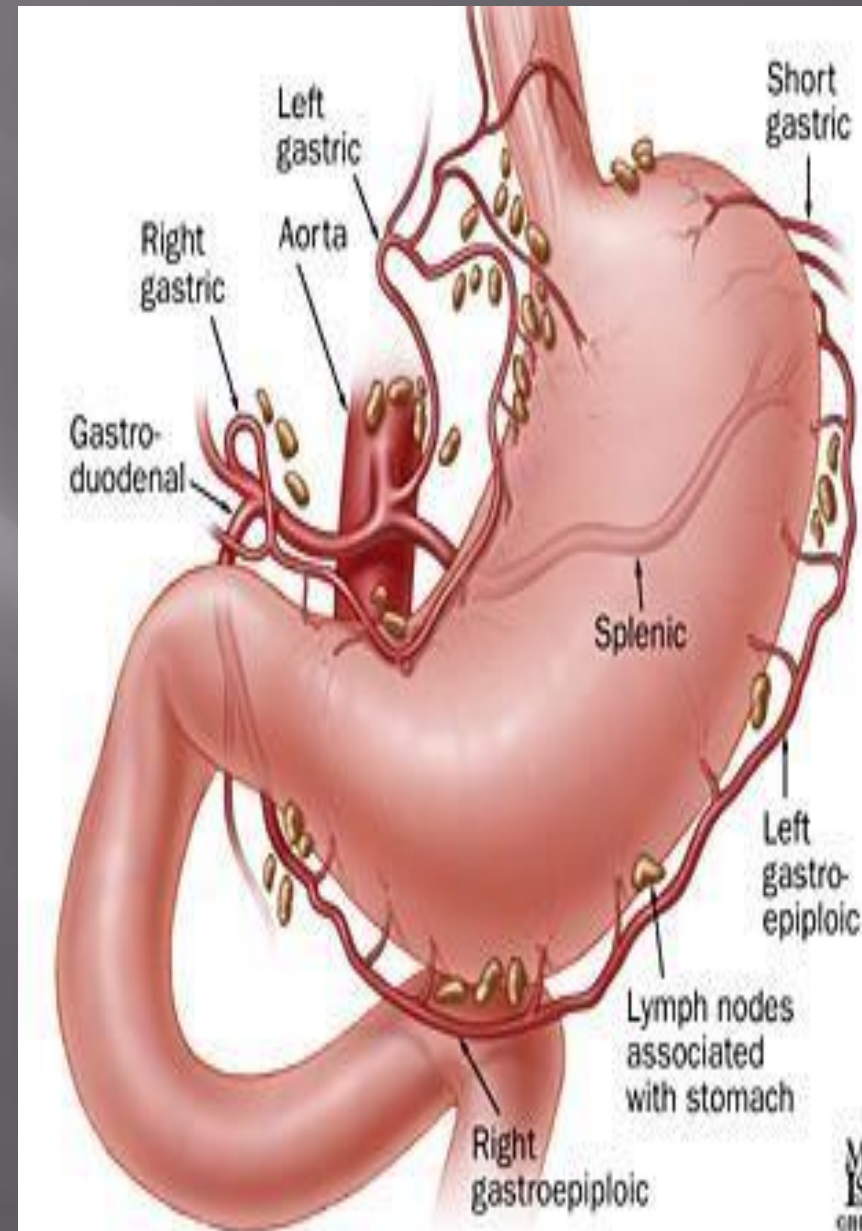


Venous drainage

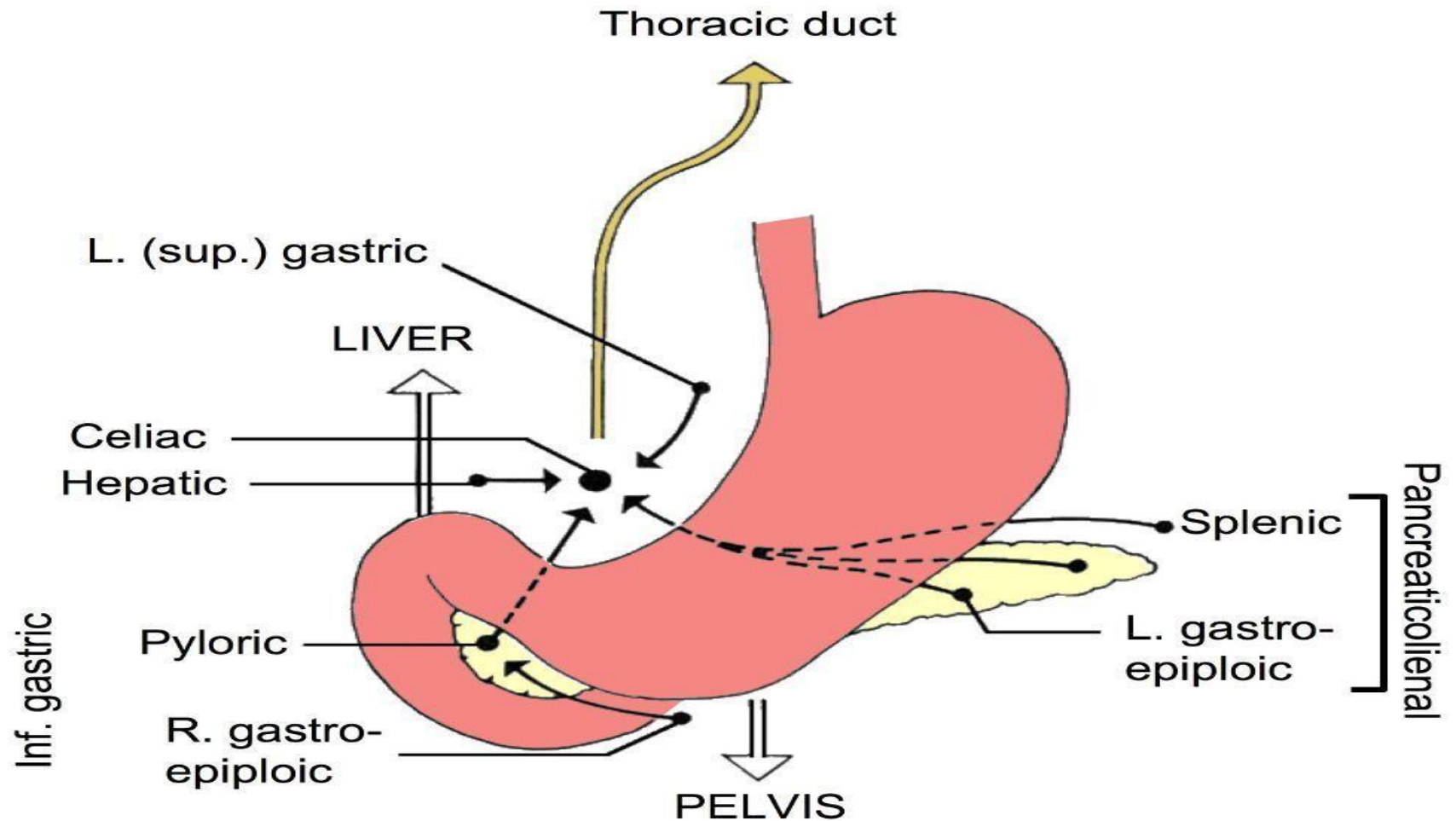
- The veins drain into the portal circulation
- The left and right gastric veins drain directly into the portal vein
- The short gastric veins and the left gastroepiploic veins join the splenic vein
- The right gastroepiploic vein joins the superior mesenteric vein (which meet the splenic vein behind the neck of pancreas) to form the portal vein

Lymphatic drainage

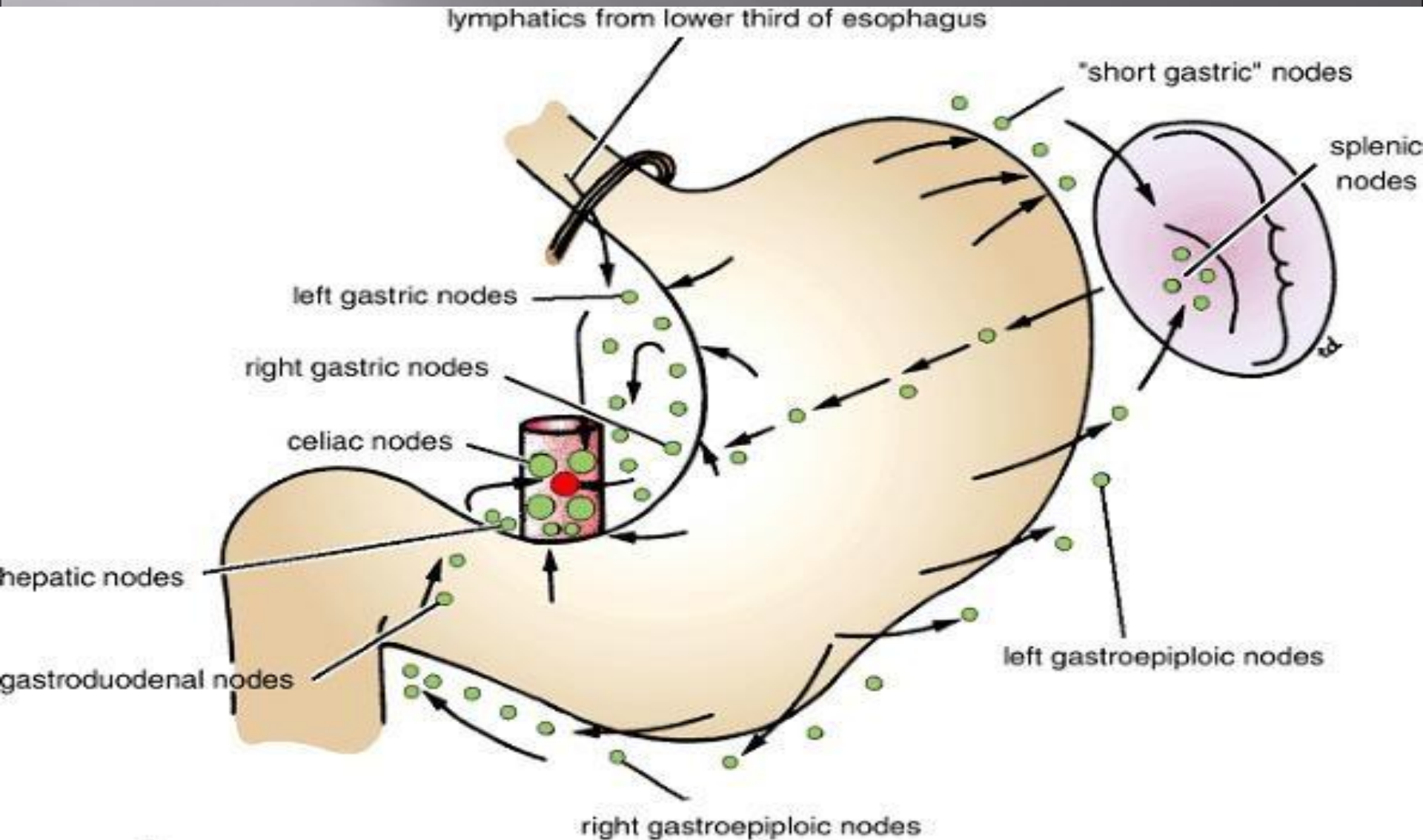
- Follow the arteries of stomach
- The left and right **gastric nodes**
- The left and right **gastroepiploic nodes**
- The **short gastric nodes**
- All lymph from the stomach eventually passes to the celiac nodes located around **the celiac trunk** the root of the celiac artery on the posterior abdominal wall.



Lymphatic drainage

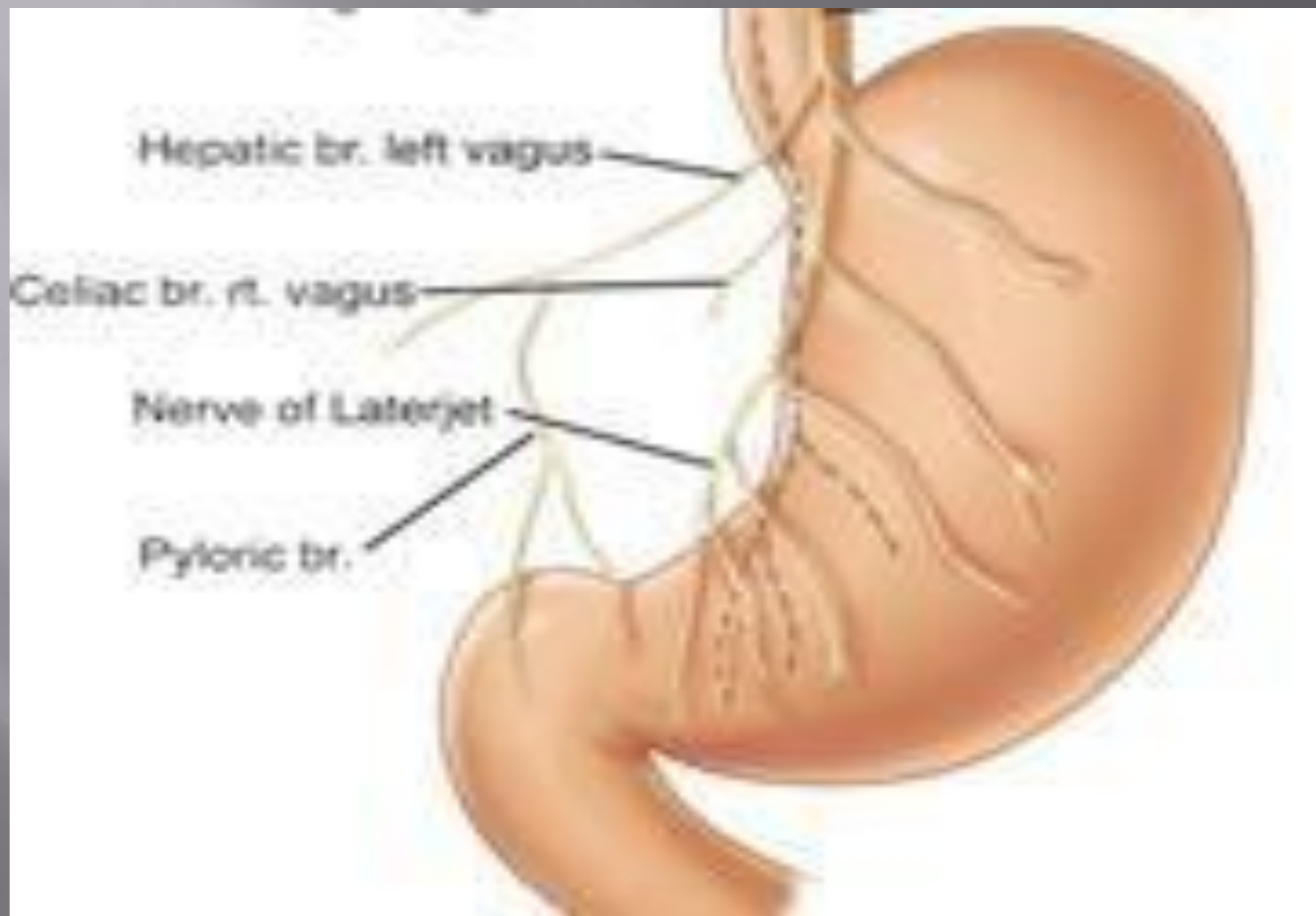


Lymphatic drainage....cont



Nerve supply for stomach

- ▣ The nerve supply **includes sympathetic fibers** derived from the **celiac plexus**
- ▣ **parasympathetic fibers** from the right and left **vagus nerves** .
- ▣ The sympathetic innervation of the stomach carries a **proportion of pain sensation**
- ▣ The parasympathetic vagal fibers are **secreto-motor** to the **gastric glands** and **motor** to the muscular wall of the stomach(peristaltic movement)
- ▣ The pyloric sphincter receives **motor fibers** from the sympathetic system and inhibitory fibers from the vagus.n.



Nerve supply of stomach.....cont

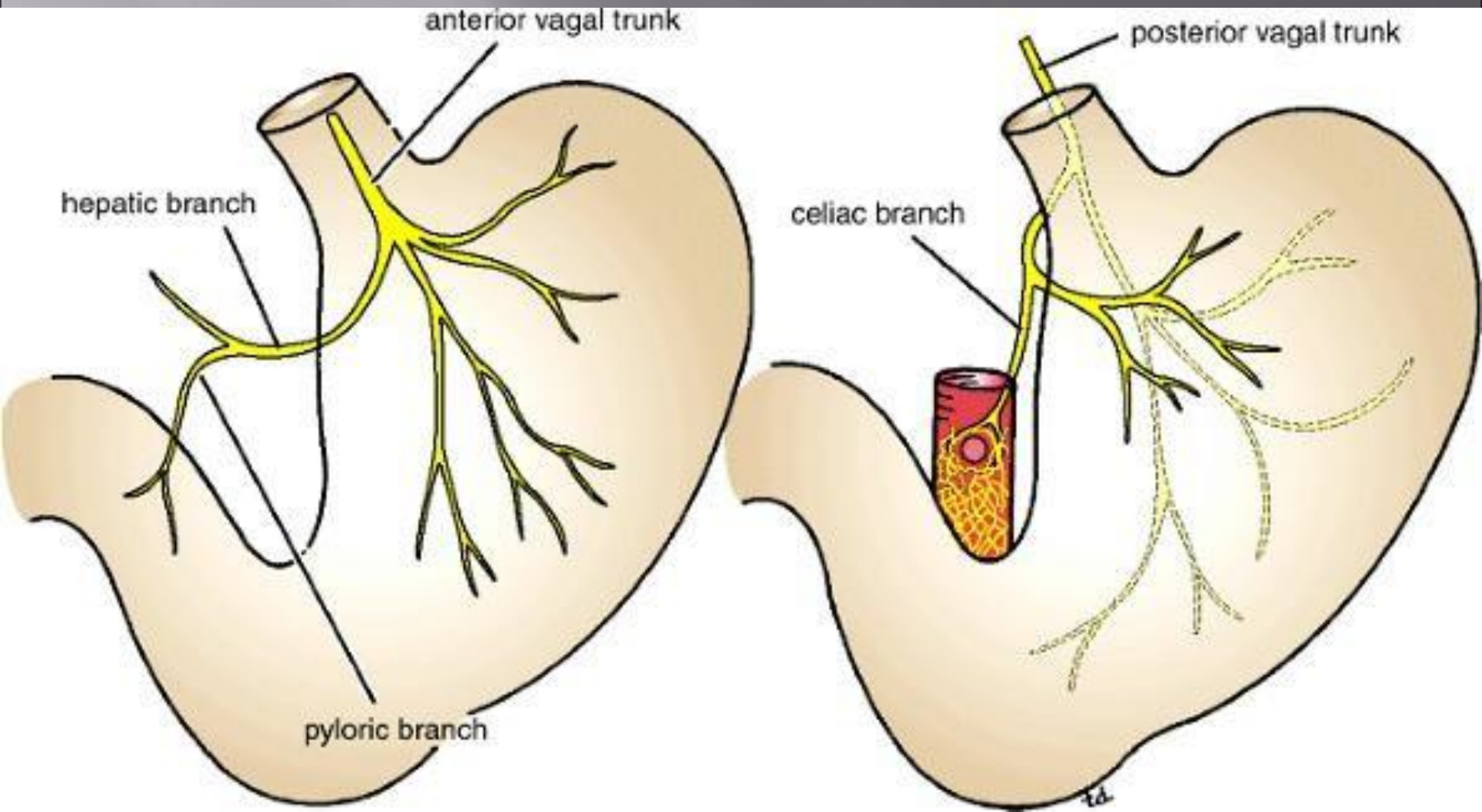
- ▣ **The anterior vagal trunk**

- mainly from the left vagus nerve

Distribution

- 1 The anterior surface of the stomach.
- 2 A large hepatic branch passes up to the liver
- 3 Ant. Nerve Laterjet → pylorus

Nerve supply of stomach.....cont



Nerve supply of stomach.....cont

▣ The posterior vagal trunk

- mainly from the right vagus nerve

- Distribution

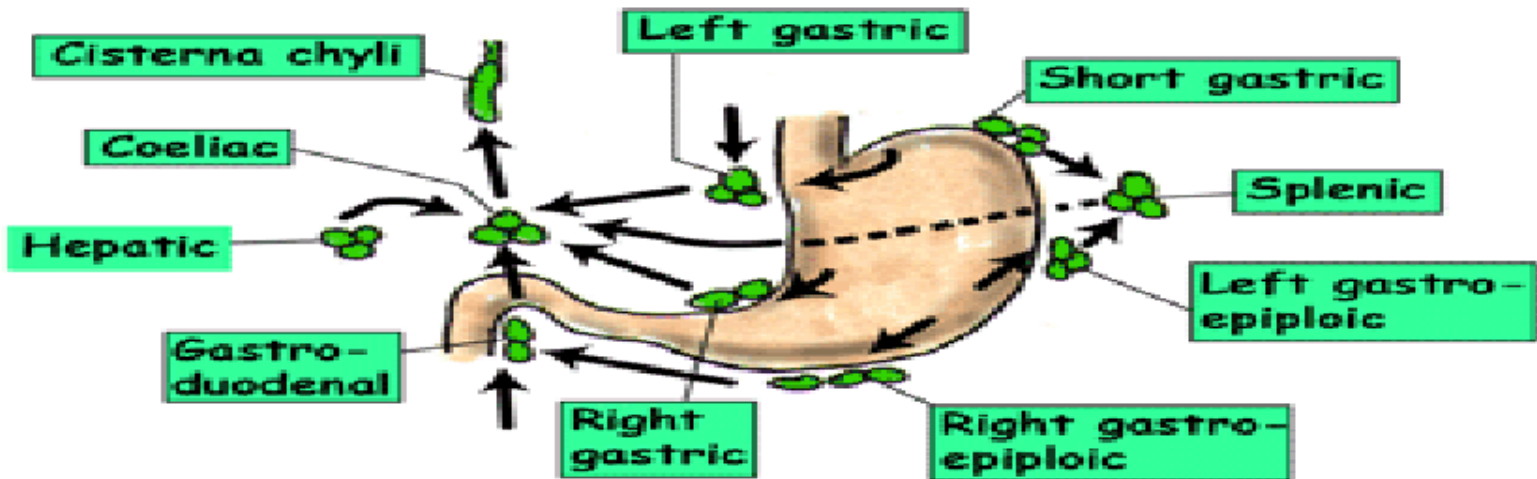
1 mainly the posterior wall of the stomach.

2 Ant. Wall of body of stomach

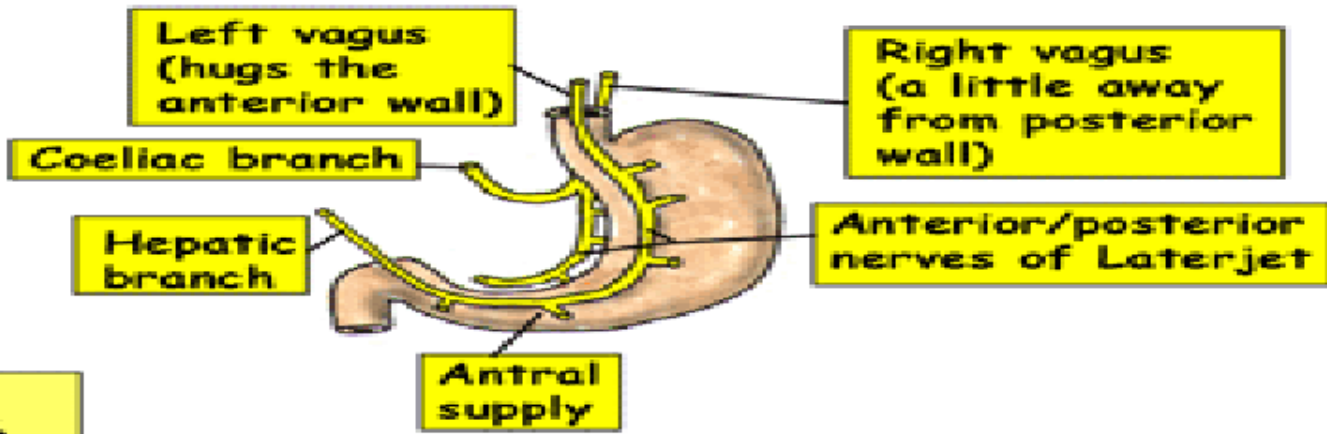
3 Celiac branch → small intestine and large intestine as far as distal third of transverse colon + as far as to splenic flexure + pancreas

4 post. Nerve latorjet → pylorus

STOMACH - LYMPHATIC DRAINAGE & NERVE SUPPLY



Sympathetics
 Greater splanchnic nerves (T5-9) for decreasing motility, vaso-constriction, closing pylorus & sensation



Vagus nerves are 80% sensory, 20% motor for increasing motility, opening pylorus & initiating secretions

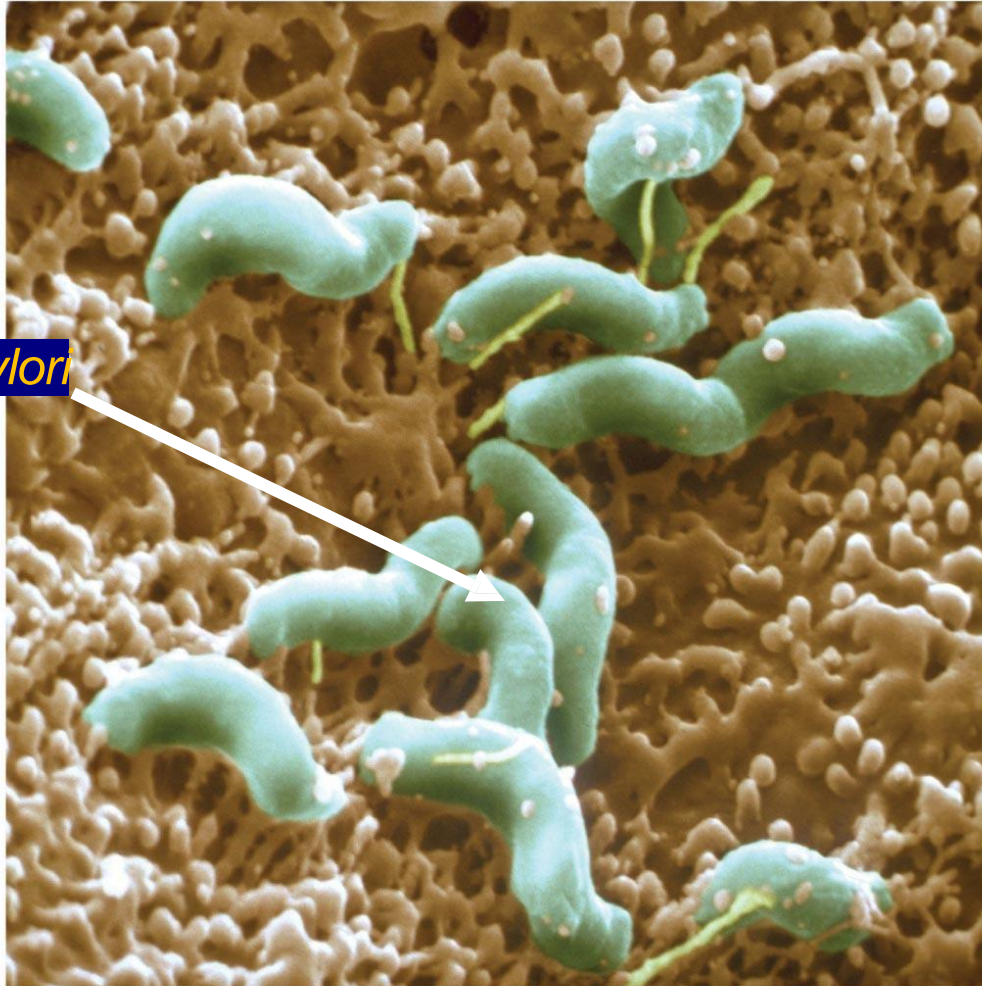
Note: Highly selective vagotomy destroys vagus to fundus & body but preserves nerve to antral pump

Clinical notes

- ▣ Gastric Ulcer
- ▣ Trunkal vagotomy → Sectioning the vagus nerves below the diaphragm around the esophagus.
- ▣ Highly selective vagotomy(cut all branches of the vagi except laterjet.n)
- ▣ **Peptic ulcer**(D.U)
- ▣ Gastroscopy
- ▣ Pyloroplasty(drainage)= gastro- jejunostomy

Causes of Ulcers in stomach

Helicobacter pylori



Good luck!
You can do it.