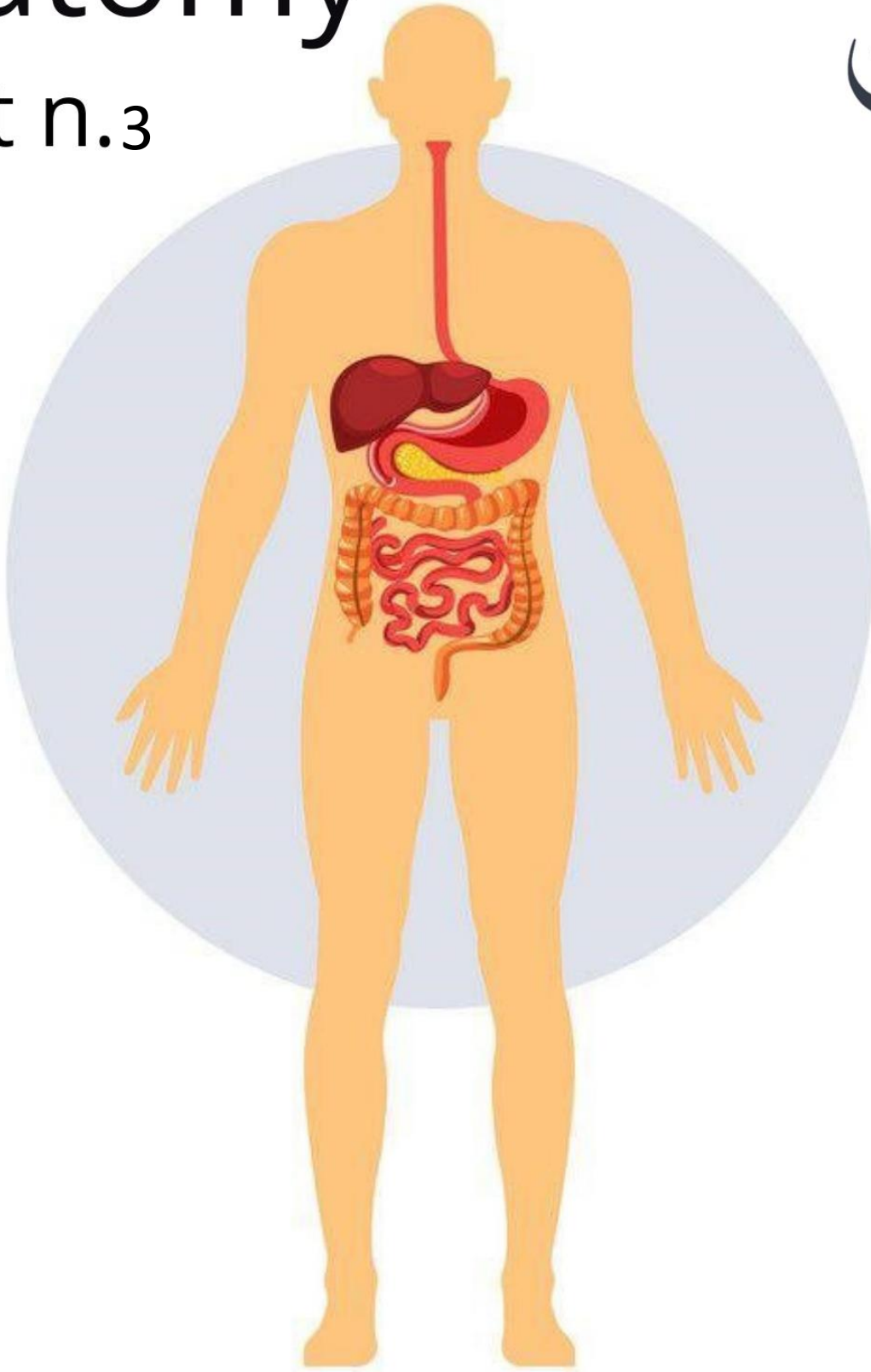


Anatomy

Sheet n.3



DIGESTIVE SYSTEM

Writer: محمود جرادات
عمر عنانزة

Corrector: صهيب زعيتير

Stomach and Esophagus

Slides → RED

Doctor words → Black

Important → Purple

Doctor words from slides → Underline

Extra information → Light Blue

Esophagus

◆ In this picture, note that the esophagus is a continuation of the pharynx. We studied that the pharynx is divided into:

1. Nasopharynx: behind the nose
2. Oropharynx: behind the oral cavity
3. Laryngopharynx: behind the pharynx

◆ **The esophagus is a tubular structure (muscular, collapsible tube)** it is completely tube, not opened anteriorly like the pharynx, about 10 in. (25 cm) long that is continuous above with the laryngeal part of the pharynx opposite the sixth cervical vertebra (start)

And **END** at the **cardia** of the stomach.

◆ The esophagus conducts food from the pharynx into the stomach. Wavelike contractions of the muscular coat, called peristalsis, propel the food onward. (The most important function)

Peristalsis movement move the bolus downward from pharynx to the stomach

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

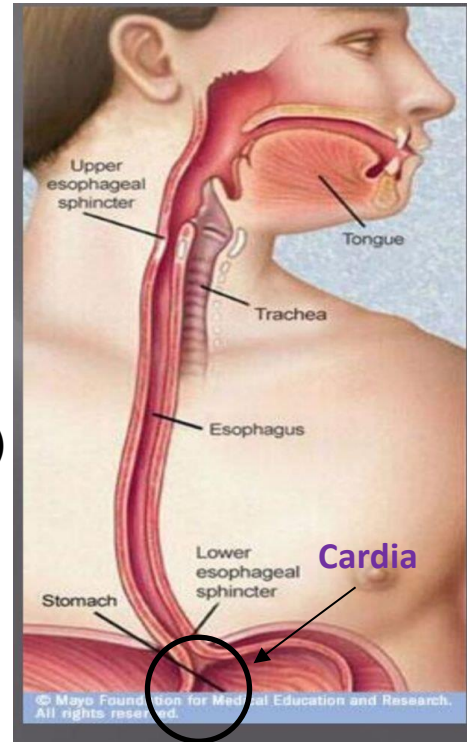
◆ **In the neck, the esophagus lies in front of the vertebral column; laterally, it is related to the lobes of the thyroid gland; and anteriorly, it is in contact with the trachea and the recurrent laryngeal nerves**

◆ **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.**

◆ If we look at cross section of esophagus, we will see mucosa, submucosa, muscular layer, and **adventitia** (adventitia because most of the esophagus out of the abdomen)

◆ What is the lining epithelial of esophagus?... **stratified squamous non-keratinized epithelial**



THE RELATIONS OF THE THORACIC PART OF THE ESOPHAGUS :

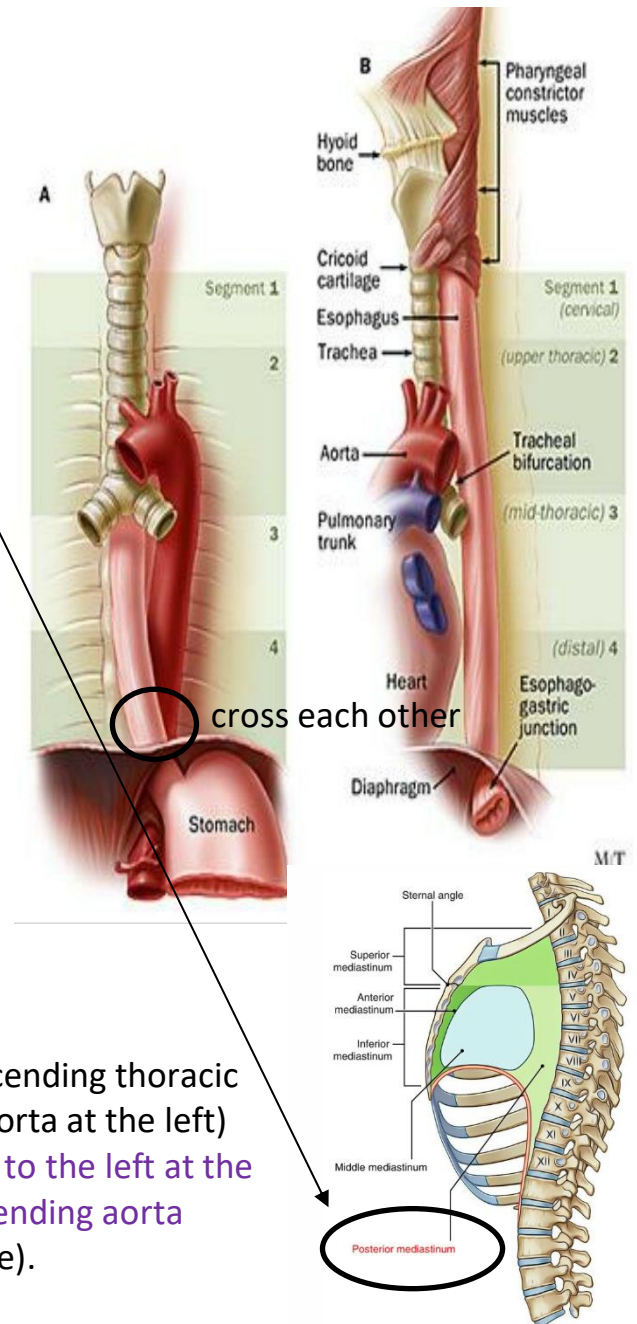
◆ **Anteriorly:** The trachea and the left recurrent laryngeal nerve (branch of the vagus, it is located between the esophagus and trachea, and it is short at the right side and longer at the left side, because the origin of each side is different); **the left principal bronchus, which constricts it; and the pericardium, which separates the esophagus from the left atrium**

◆ **Posteriorly:** located at the posterior mediastinum **The bodies of the thoracic vertebrae; the thoracic duct; the azygos veins; the right posterior intercostal arteries; and, at its lower end, the descending thoracic aorta**

◆ **Right side:** The right mediastinal pleura and the terminal part of the azygos vein and right lung

◆ **Left side:** The left subclavian artery, the aortic arch, the thoracic duct, and the left mediastinal pleura and left lung

◆ If we look the relation of esophagus with descending thoracic aorta(esophagus at the right side and thoracic aorta at the left) but at the lower part **esophagus opens one inch to the left at the level of T10 (esophageal orifice), while the descending aorta opens in midline at the level of T12 (aortic orifice).**



◆ **Lodge of Foreign Body in the Esophagus:**

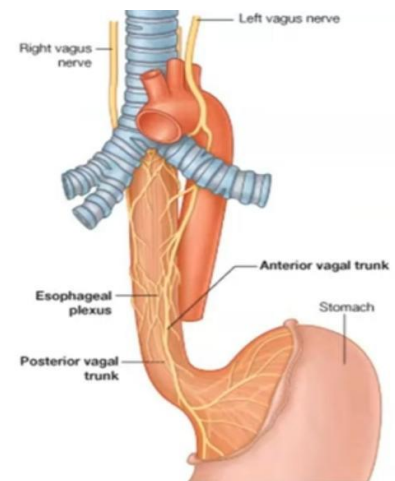
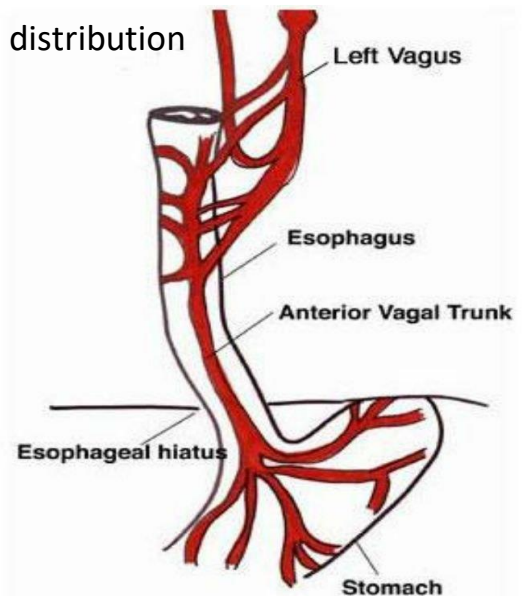
◆ Sometimes when a child swallow foreign body it stops at a region of the esophagus, and this region form narrowing to prevent the subject from passing, these regions are:

1. Beginning of the esophagus: because the pharynx is dilated and the esophagus is narrow, so it can stop here.
2. Cross of left main bronchus: it contains cartilage, and it crosses anterior to esophagus so lodge could happen here.
3. The arch of the aorta: apply pressure at the esophagus
4. Through the diaphragm: when esophagus passes there, there is a narrowing.

THE INERVATION OF THE ESOPHAGUS:

- ◆ 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 run anterior to the stomach after it Penetrates the diaphragm, the right vagus lies posterior and runs posterior to stomach after it penetrates the diaphragm.
- ◆ 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.

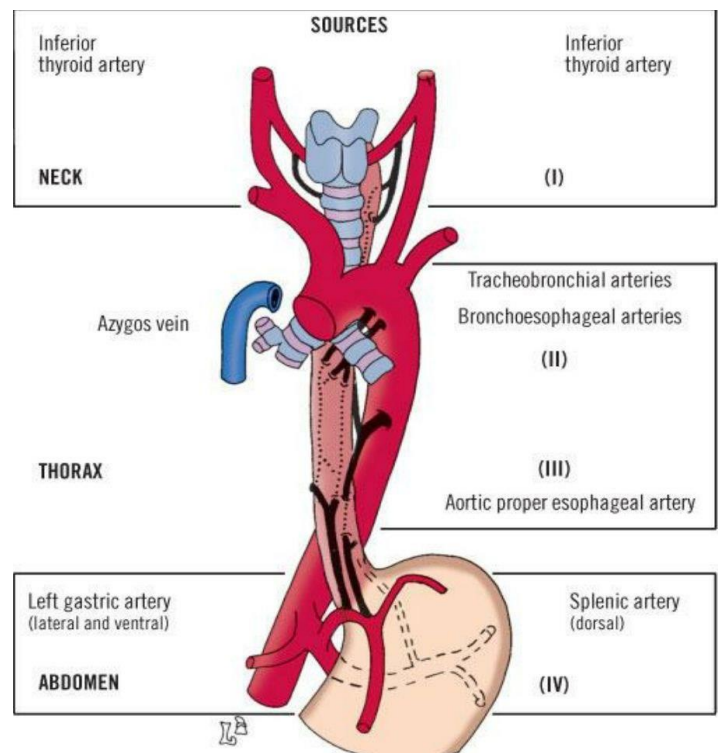
Nerves distribution



Esophageal plexus means parasympathetic and sympathetic.

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 **veinous** drainage is the reverse of the artery!!
- ◆ 1-The veins from the upper third drain into the inferior thyroid veins, 2- from the middle third into the azygos veins, and 3- from the lower third into the left gastric vein, a tributary of the portal vein.



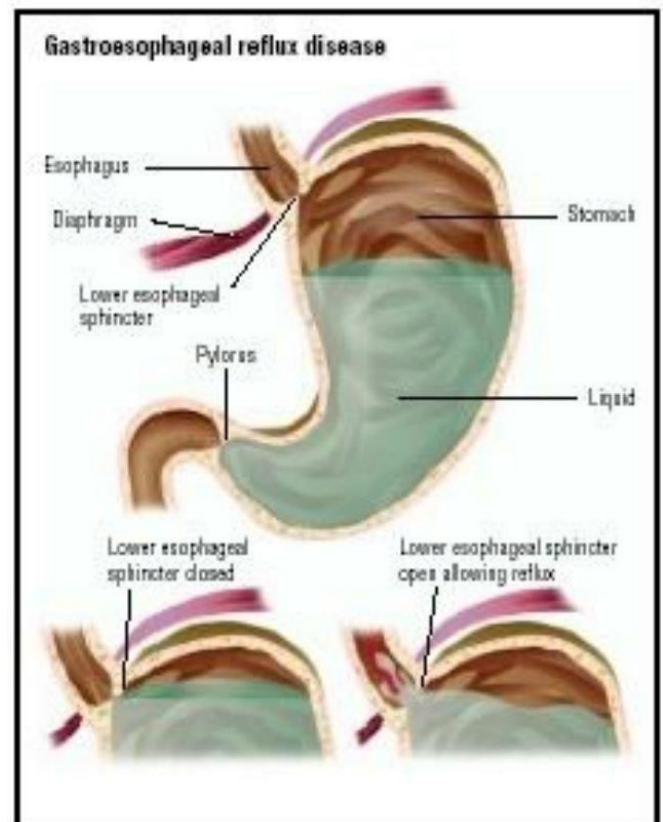
LYMPH DRAINAGE:

- ◆ 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)
- ◆ 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. Then at the end, esophageal nerve plexus goes to myenteric plexus which is responsible for peristaltic movement and the secretion of glands of the esophagus.

Note: cardia= Gastroesophageal

GASTROESOPHAGEAL SPHINCTER: sphincter

- ◆ We are in anatomy different from physiology, in physiology it is called “sphincter” because it works as sphincter while in anatomy we say, “**no anatomical sphincter**”, because **there is no thickening in the inner smooth muscle**, so Cardia is not anatomical sphincter.
- ◆ pylorus is an anatomical sphincter.
- ◆ Cardia prevents regurgitation of the material from stomach to esophagus.
- ◆ No anatomic sphincter exists at the lower end of the esophagus
- ◆ 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.**

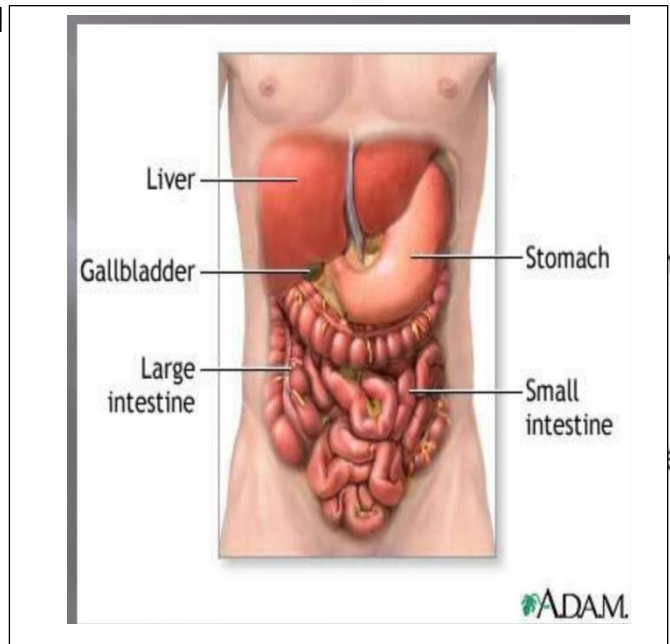


Stomach

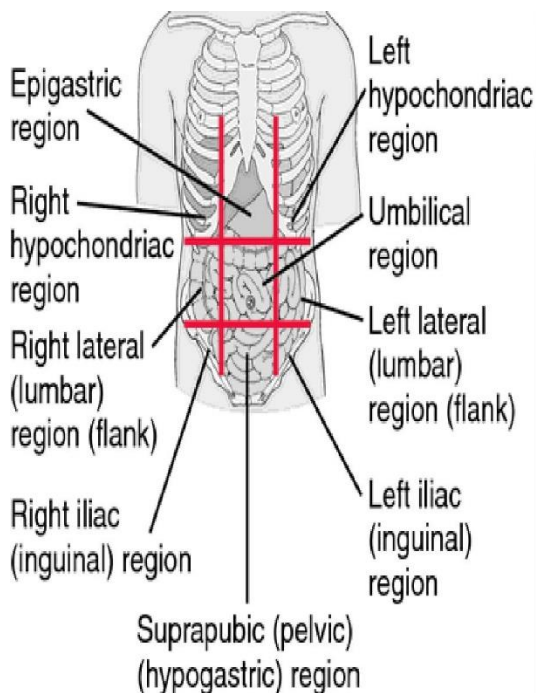
◆ After the esophagus there is dilation, and this dilation is the stomach, then the stomach is a dilated organ in the abdomen.

◆ **The stomach is a dilated part 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 THE STOMACH

◆ It is roughly J-shaped

◆ **Steer horn in obese person** زي البوق

◆ has two openings, the 6- cardiac and 11- pyloric orifices

◆ Two curvatures, 4- the greater and 5- lesser curvatures

◆ Two surfaces, an anterior and a posterior surface

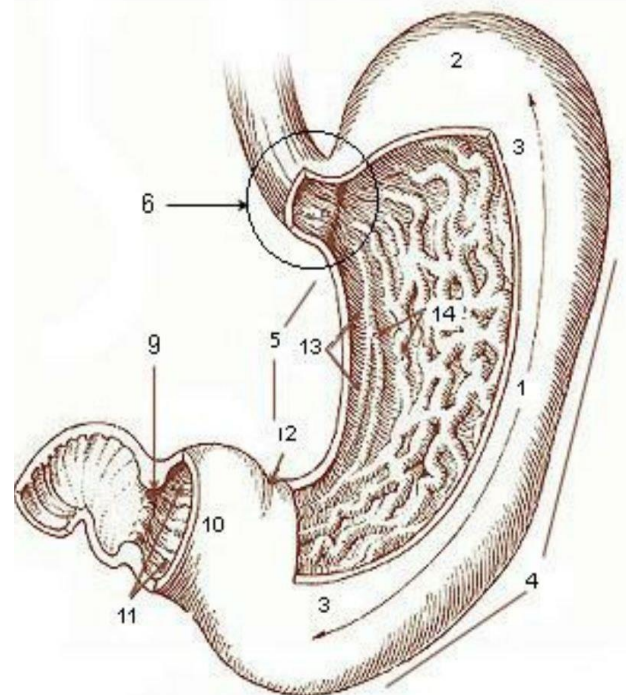
◆ 2- Fundus, 14- Rugae (folding of the mucosa of the stomach)

◆ 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



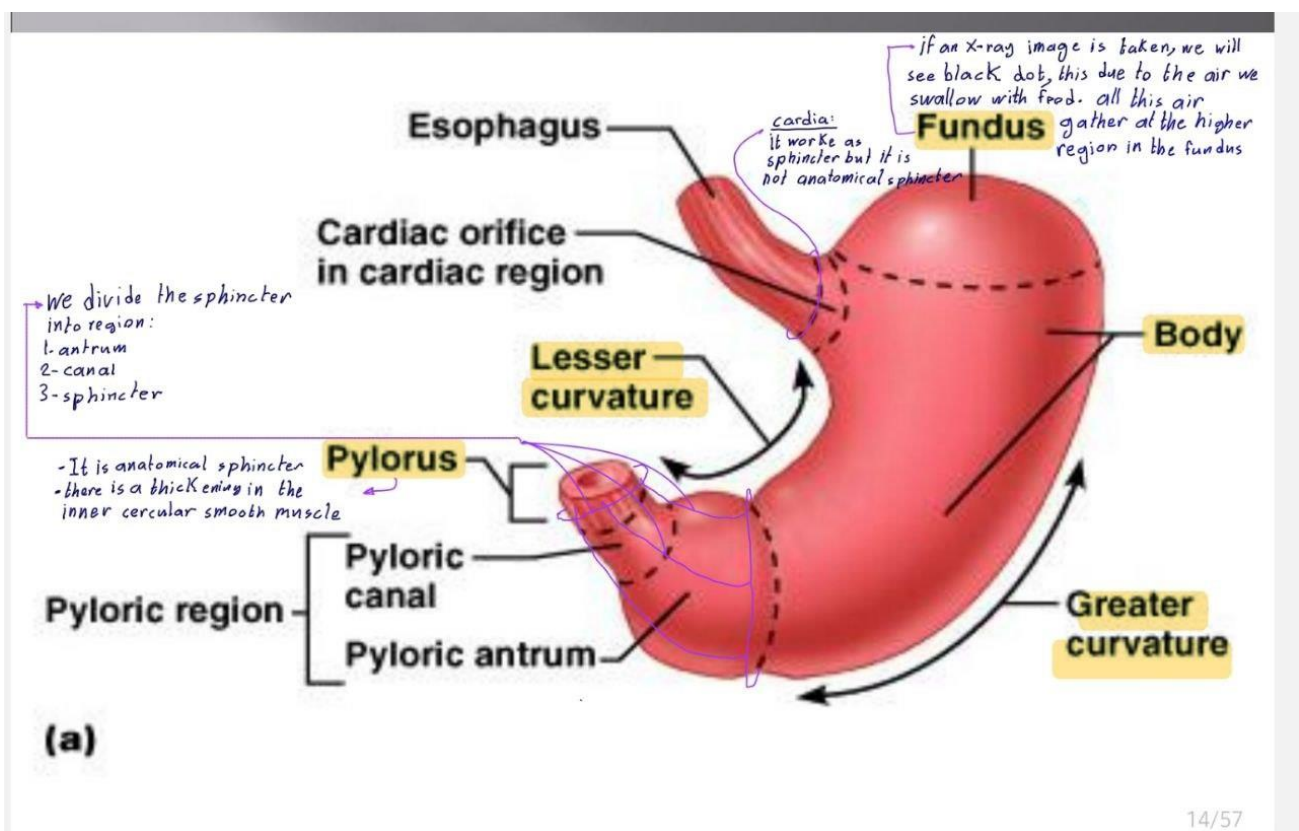
FUNCTION OF THE STOMACH

The most important function of the stomach is the digestion.

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
- ◆ When bolus enter the stomach, it mixed with secretions of the stomach, converted to semifluid chyme, and it stay in the stomach from 2 to 4 hours, then it will go evacuation by pyloric sphincter to duodenum. Is this mean that the evacuation starts after 2 hours? yes, and with stages, but by the end of 4 hours it will be complete empty.
- ◆ It controls the rate of delivery of the chyme to the small intestine so that efficient digestion and absorption can take place.
- ◆ Sympathetic nervous system: close the sphincter.
- ◆ Parasympathetic NS: help the contraction of the stomach and inhibition of the sphincter, opening form, and then evacuation will happen.

PARTS OF THE 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)
- ◆ The incisura angularis is the landmark that separate the body of the stomach from the pylorus.

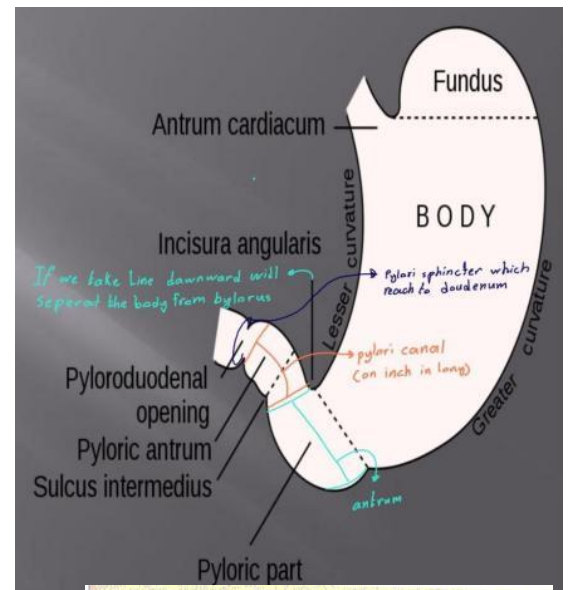
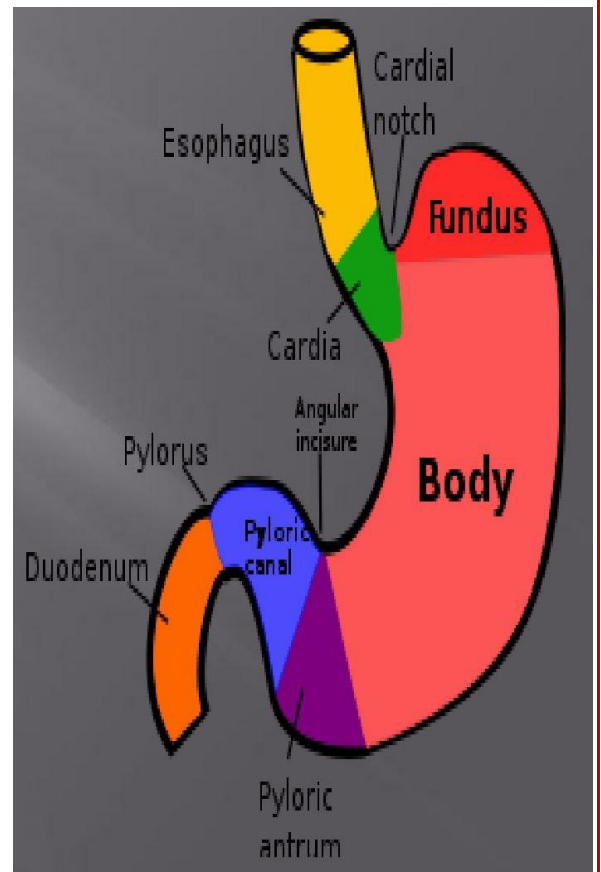
3- Pyloric region divided into:

a- Pyloric antrum:

- ◆ This extends from the incisura angularis to the pylorus

B- Pylorus:

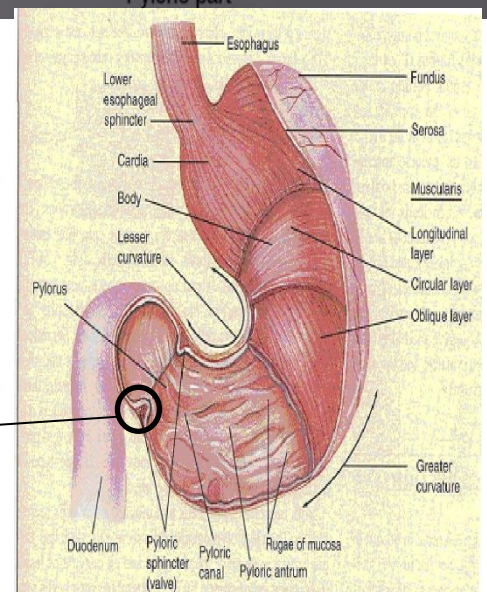
- ◆ The most tubular part of the stomach
- ◆ The thick muscular wall is called the pyloric sphincter.



ORIFICES OF THE STOMACH:

- ◆ **CARDIAC ORIFICE**
- ◆ **PYLORIC ORIFICE**

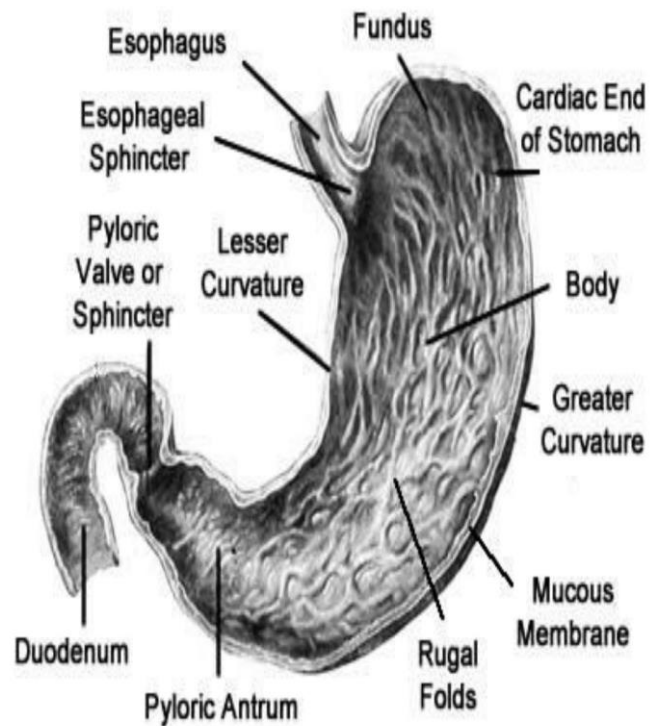
The thickening of the inner circular smooth muscle at the sphincter



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.

◆ It is very important, it has surface anatomy



THE SITE OF CARDIAC ORIFICE: (FROM THE SURFACE)

- ◆ at the level of 7th Lt. costal cartilage.
- ◆ 1 inch to Lt. of midline.
- ◆ 45 cm from incisors in the oral cavity.

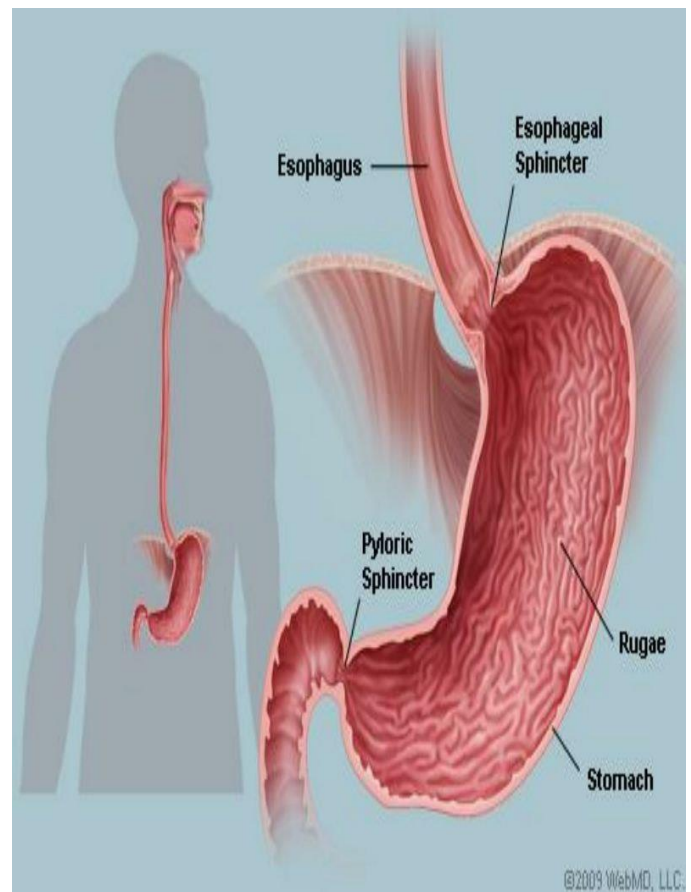
Incisors= الاسنان الامامية

- ◆ These days every Gastroenterologist have Gastroscope in their clinic. We can examine the esophagus, stomach, and duodenum.
and you enter it into the oral cavity and continue pushing it (you can see the mucosa of the esophagus).
when you reach 45cm this means that you reach the cardia.

A student asked a question: is this long is fixed in all people?

Answer: mostly fixed, it can be longer or shorter by 2cm, but the average is 45cm

- ◆ 10 cm from ant. abdominal wall

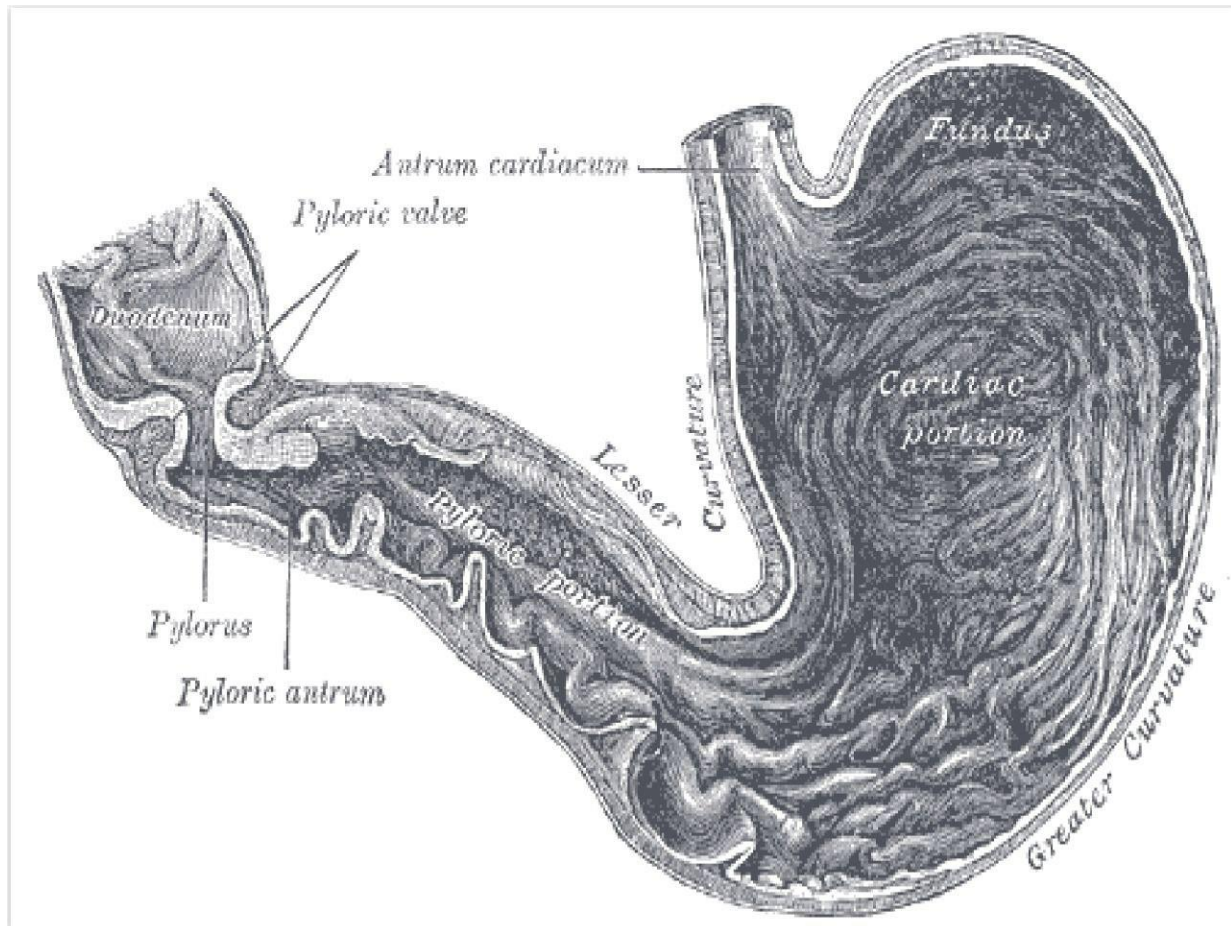
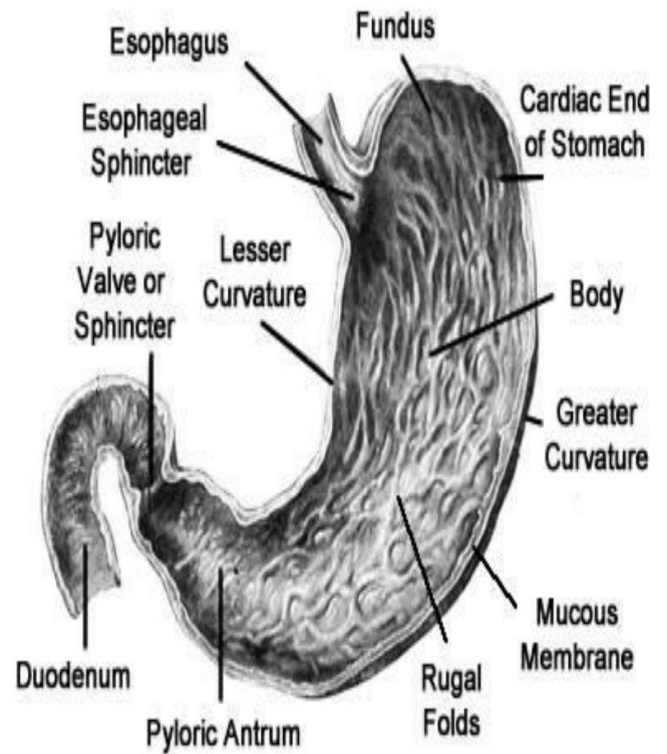


PYLORIC ORIFICE

- ◆ Present at end of the pyloric canal.
- ◆ On the level of L1 .
- ◆ 1 in. 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).

◆ The folding of mucosa forms rugae, there are Oblique and longitudinal rugae ,in the lesser Curvature there is longitudinal rugae.

The scientists explain that when someone takes Fluid (water for example) it will run direct to Duodenum ,the part that become mixed in Stomach is very little because of longitudinal Rugae.



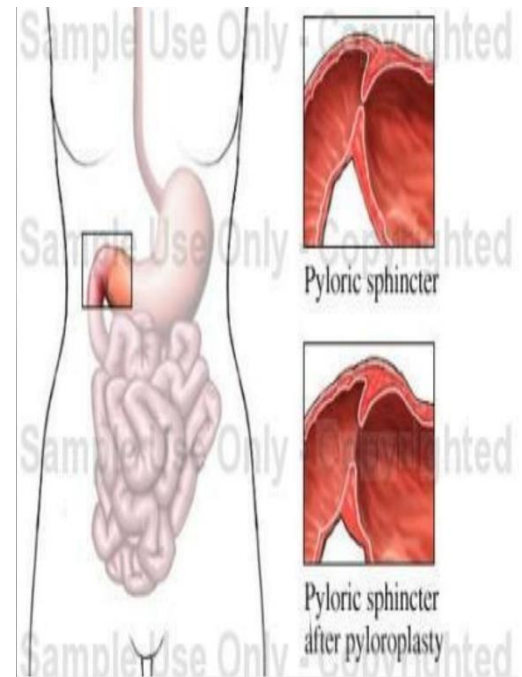
PYLORIC OPENING...CONT

- ◆ The pyloric sphincter controls the outflow of gastric contents into the duodenum.
- ◆ The sphincter receives motor fibers from the sympathetic system and inhibitory fibers from the vagus nerve.

Pyloric sphincter has sympathetic & parasympathetic.

Sympathetic: contraction, and when get inhibited it opens the opening.

Parasympathetic: contraction of smooth muscle of the body of the stomach.



PYLORIC ORIFICES...CONT

Function of pyloric opening control by:

1- Hormonal influences from stomach & duodenum.

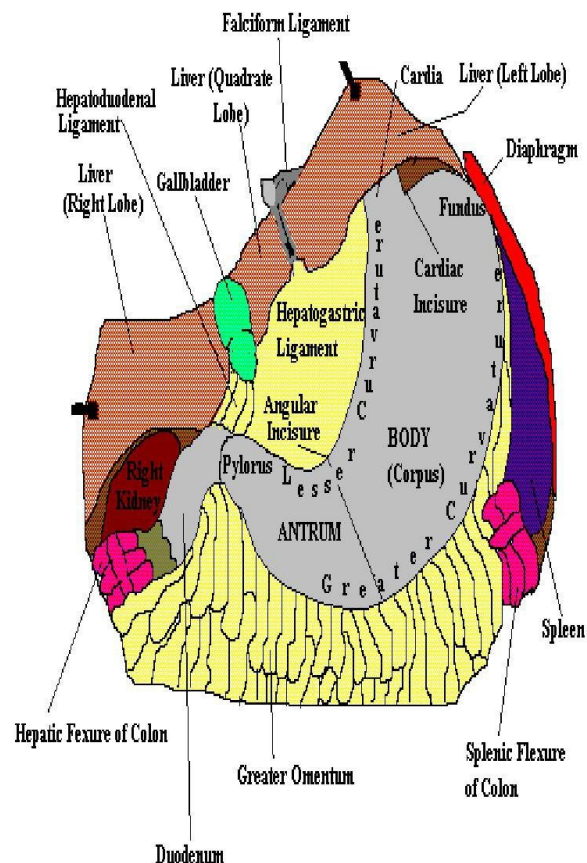
2- Nerve fibers.

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.
- ◆ The lesser curvature is attached to the lesser omentum (two layers of peritoneum that makes connection between the liver and the stomach, it contains fat, nerves, blood vessels and lymph nodes “between the two layers”)
- ◆ The lesser omentum has opening (epiploic foramen or foramen of Winslow) it's located deep to lesser



omentum and reaches to behind the stomach and in front of pancreas, so there is a space deep to the edge of lesser omentum called lesser sac (it's opening from foramen of Winslow).

2- The greater curvature:

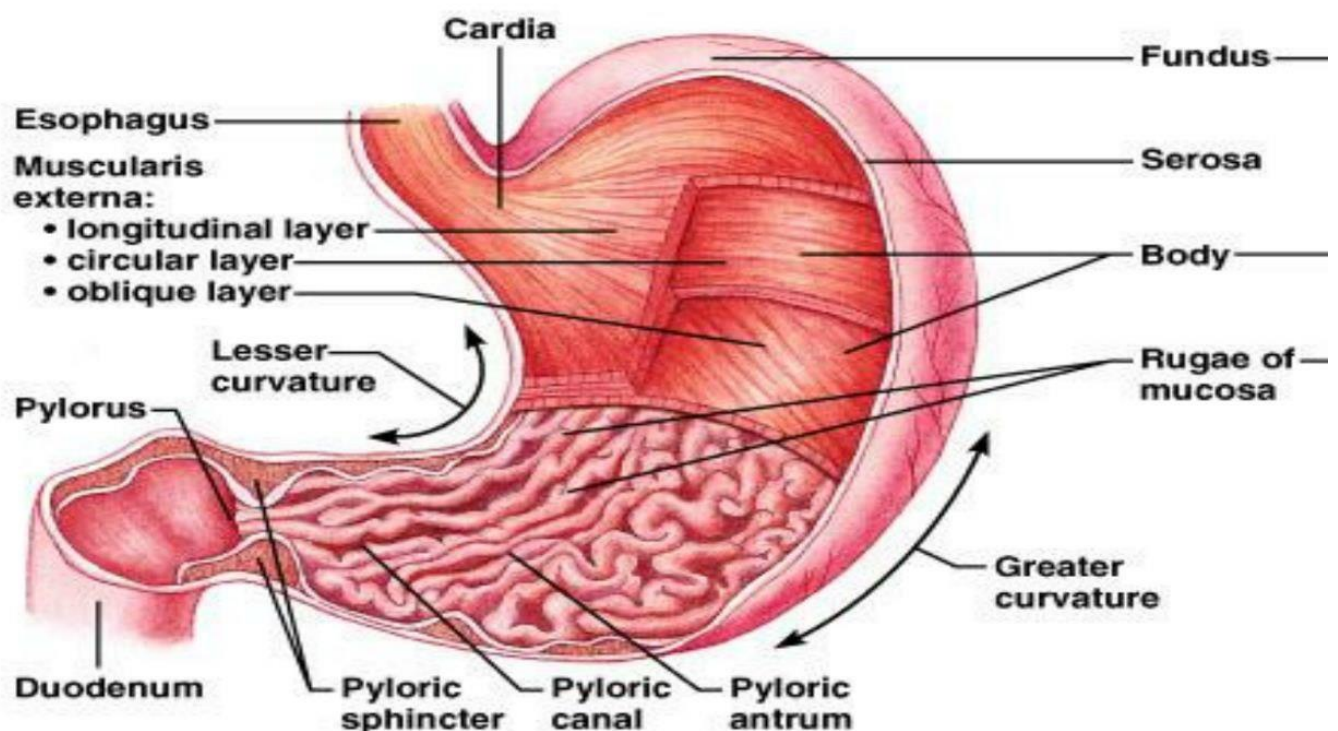
◆ Much longer than the lesser curvature

◆ 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.

◆ The greater **omentum** is attached to greater curvature, pylorus, and duodenum, it has two layers of peritoneum, runs downward to abdominal cavity, and returns in abdomen and goes to transverse colon. (End at transverse colon)

◆ that's why transverse colon is intraperitoneal organ (like stomach) while the ascending and descending colon are retroperitoneal (they are attached to posterior abdominal wall). بس امامهم مش محوطهم.

HISTOLOGY OF THE STOMACH



(b)

The lining epithelial of the stomach is simple columnar epithelium without goblet cells.

The stomach is the only organ in GIT that contains three muscular layers (smooth muscle), the **most inner is oblique**, the **inner is circular**, the **outer is longitudinal**.

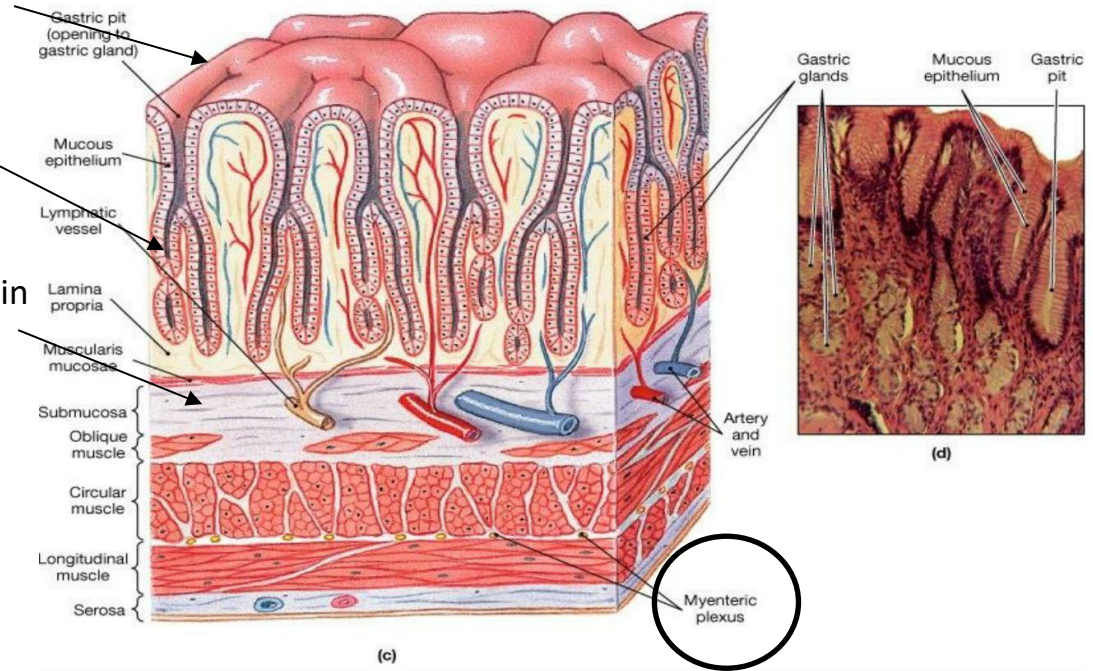
THE STOMACH - MICROSCOPIC ANATOMY

Surface epithelium

Gastric gland in lamina propria.

Submucosae contain lymph vessels and capillaries.

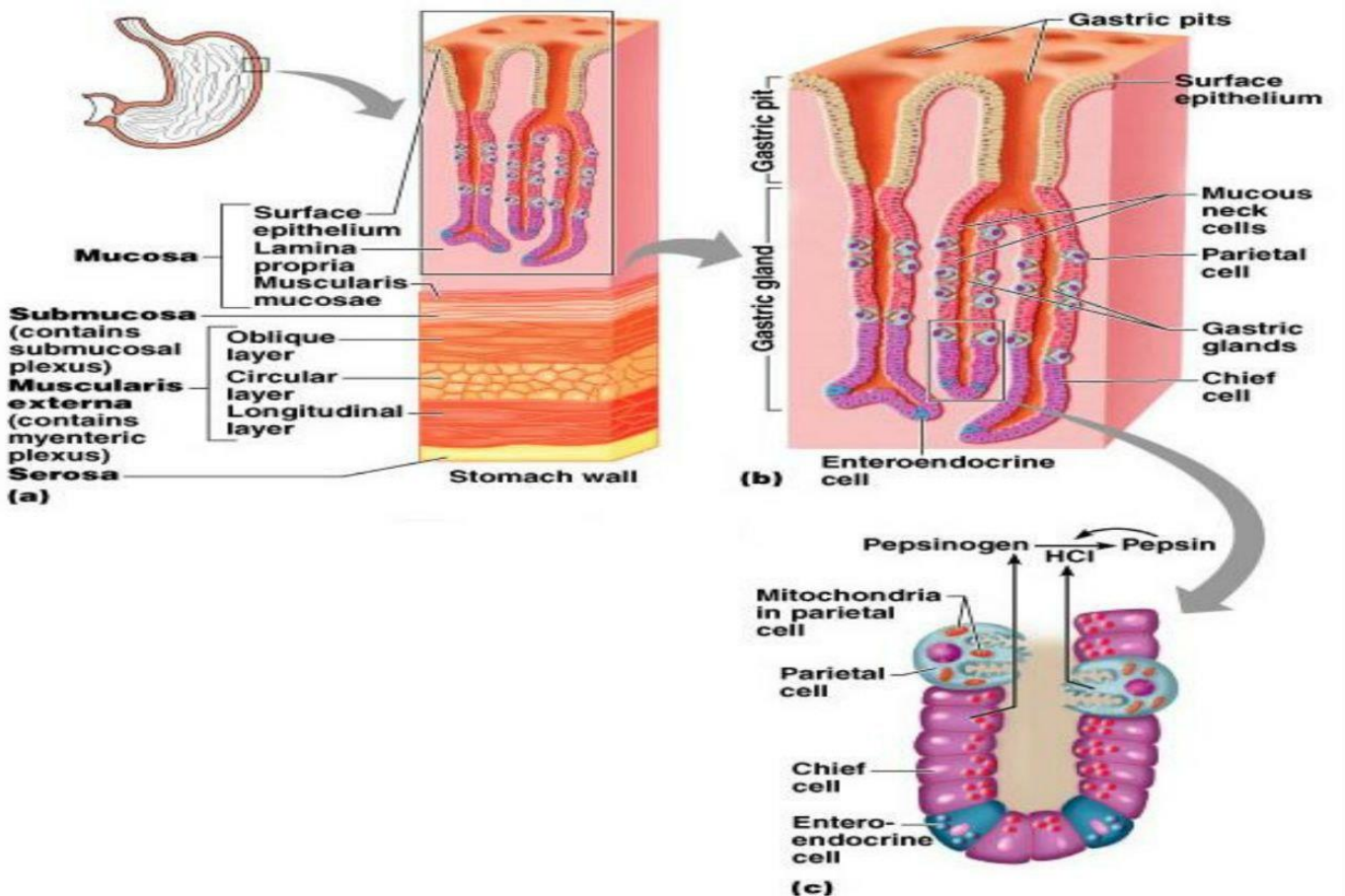
Myenteric plexus gives innervation.



MUCOSA MEMBRANE

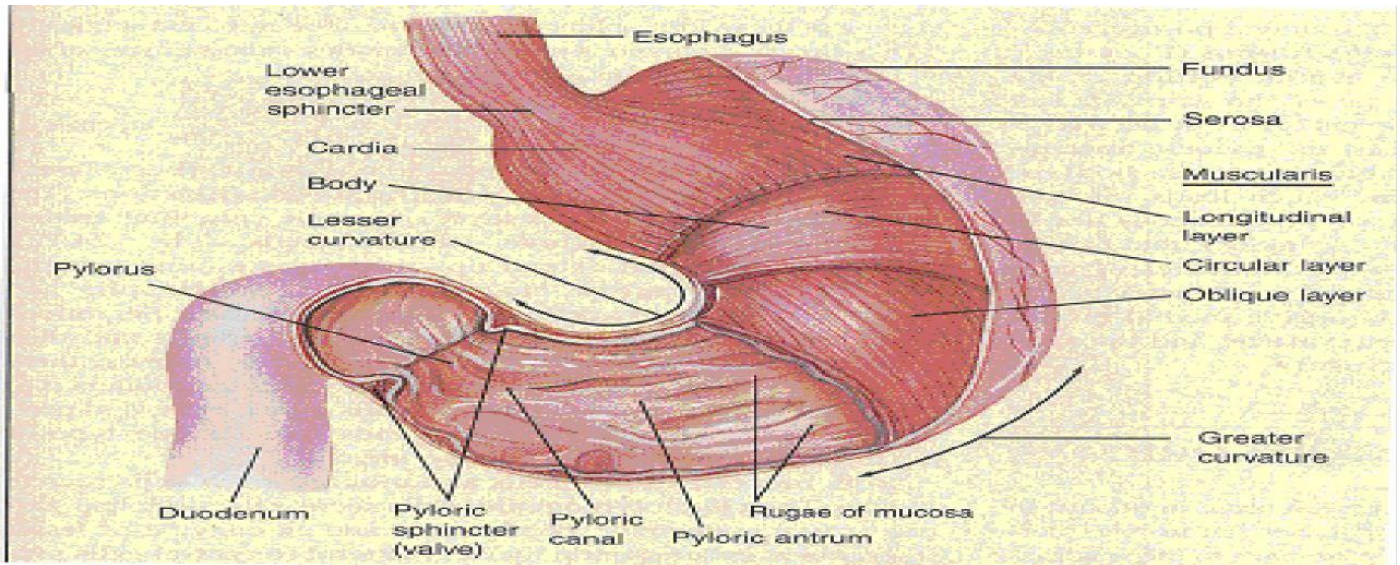
◆ The mucous membrane of the stomach is thick and vascular and is thrown into numerous folds, or rugae mainly longitudinal in direction

◆ The folds flatten out when the stomach is distended.



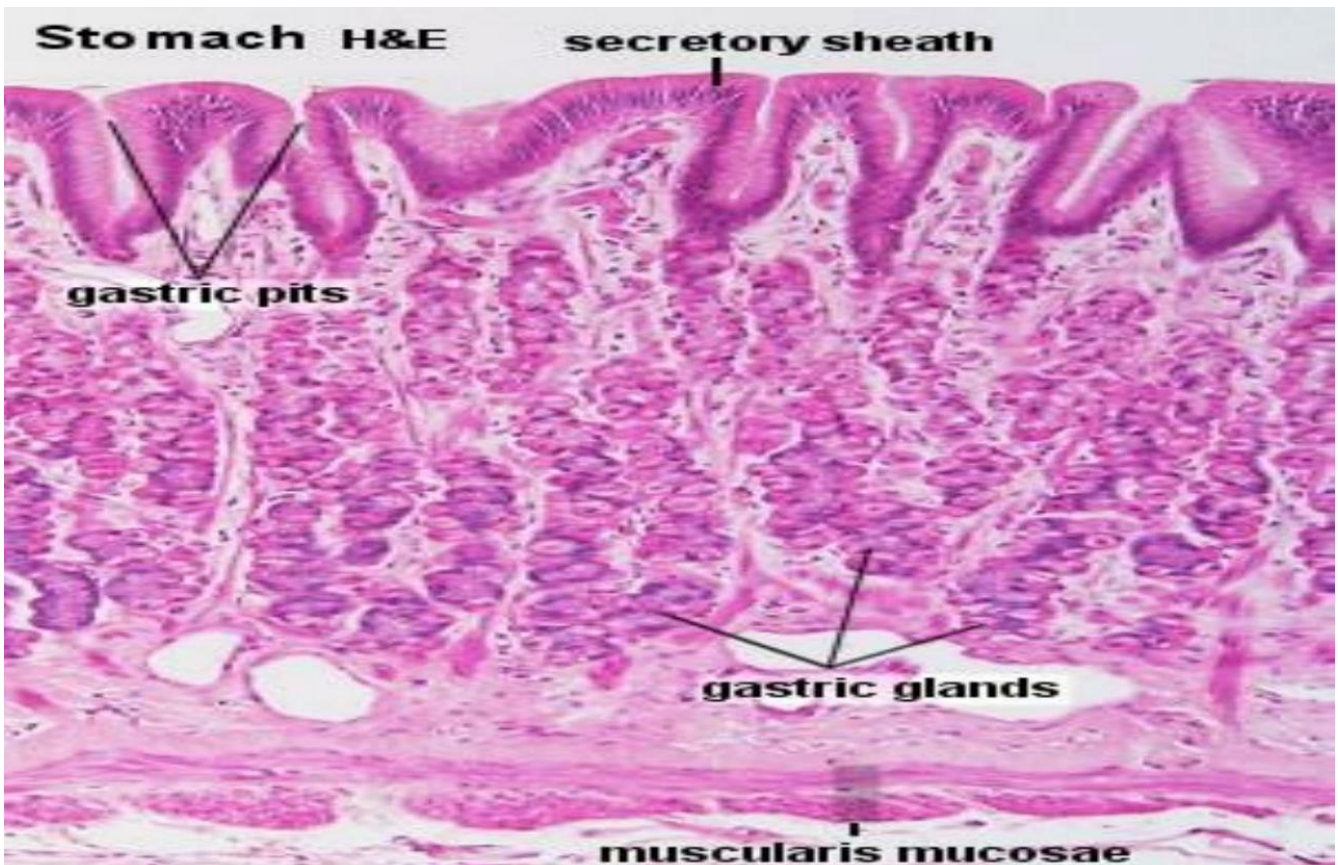
MUSCULAR WALL OF THE STOMACH

◆ The muscular wall of the stomach contains longitudinal fibers (outer surface), circular fibers (inner surface), and oblique fibers.



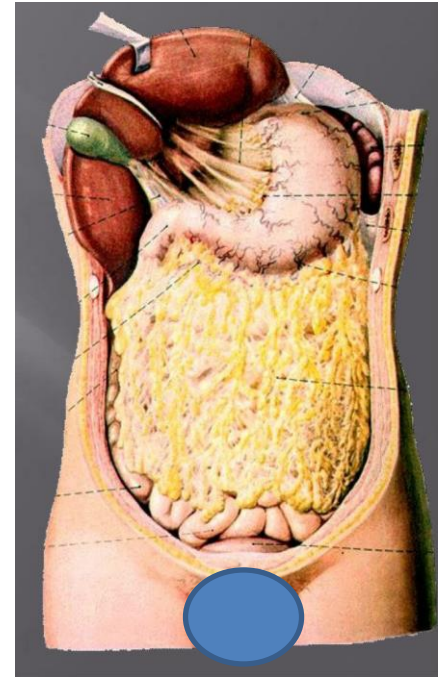
◆ The oblique is absent at the pyloric sphincter, the inner circular makes the sphincter only. (there are 2 layers only at sphincter region)

STOMACH - MICROSCOPIC ANATOMY



PERITONEUM OF THE STOMACH

- ◆ The peritoneum (visceral peritoneum) completely surrounds the stomach.
- ◆ It leaves the lesser curvature as the lesser omentum. (That is attached to the liver)
- ◆ It leaves the greater curvature as the gastrosplenic ligament 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.



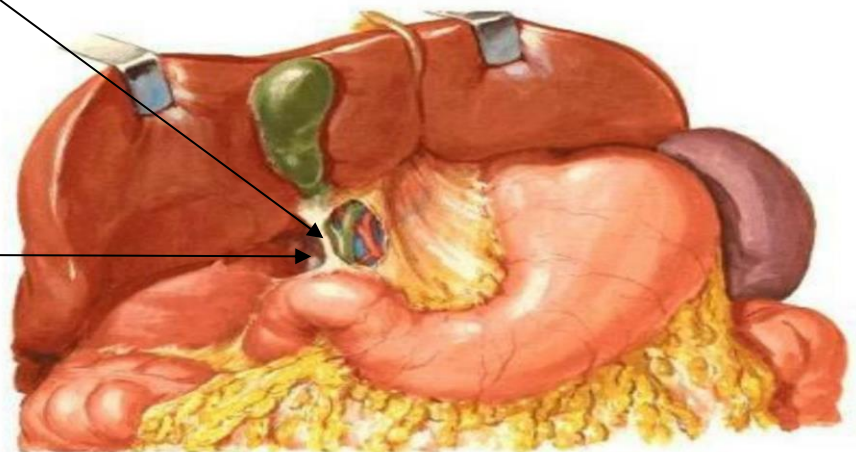
Free edge of lesser omentum
Contains common bile duct
comes from the liver to
duodenum.

hepatic artery and portal vein,
they go to liver.

Foramen of Winslow

If we have liver injury and
Bleeding in liver, we put clamp
on the free edge of lesser
omentum to stop bleeding.

Liver in Situ

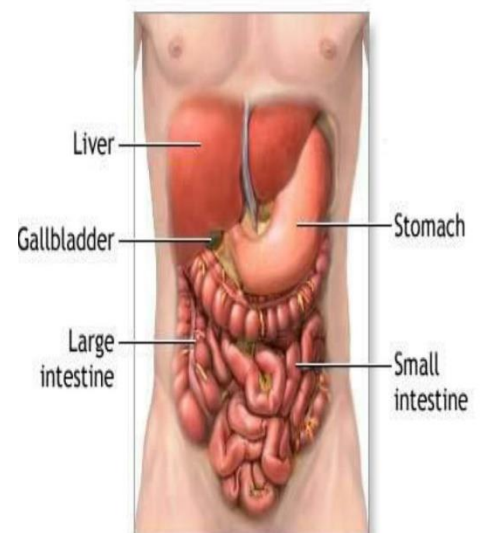


RELATION OF STOMACH

The stomach has two surfaces:

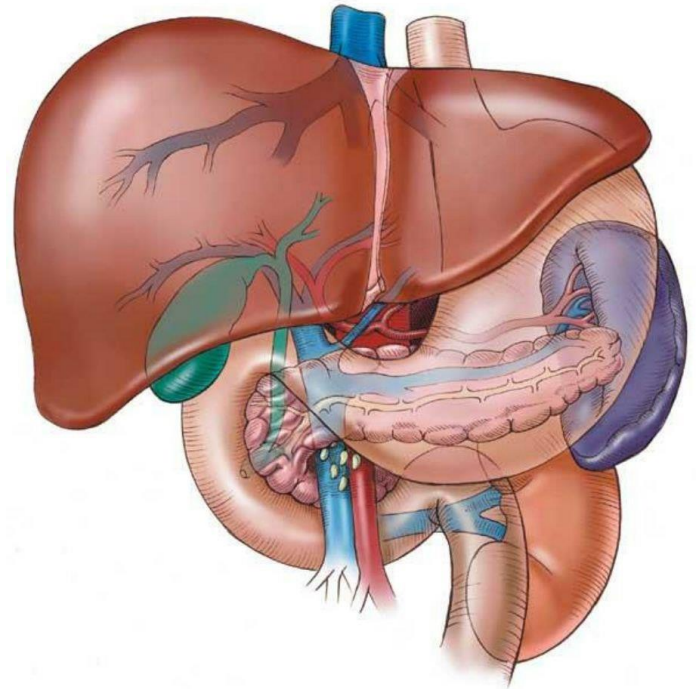
1- Anterior- superior: الشغلات الي قدامها

- ◆ The anterior abdominal wall.
- ◆ The left costal margin.
- ◆ The left pleura and lung.
- ◆ The diaphragm. (The diaphragm is located above the fundus of the stomach)
- ◆ The left lobe of the liver.



2- Posteriorly = stomach bed

- ◆ **The lesser sac** (When we eat a lot it will bloat to back because there is a space)
- ◆ **The Lt. crus of diaphragm.** (Origin of diaphragm)
- ◆ **The spleen.** (The most lateral organ behind the stomach, that's why it has anterior and Posterior relations)
- ◆ **The left suprarenal gland.**
- ◆ **The upper part of the left kidney.**
- ◆ **The splenic artery.** (Because it is on the upper border of pancreas)
- ◆ **The body of pancreas.**
- ◆ **The transverse mesocolon.**
- ◆ **The transverse colon.**



BLOOD SUPPLY

◆ The blood supply of the stomach comes from celiac trunk which is a branch of abdominal aorta at the level of T12 or L1.

◆ It gives 3 branches:

1- Left gastric artery (in lesser Omentum) that gives esophagus and supplies the stomach.

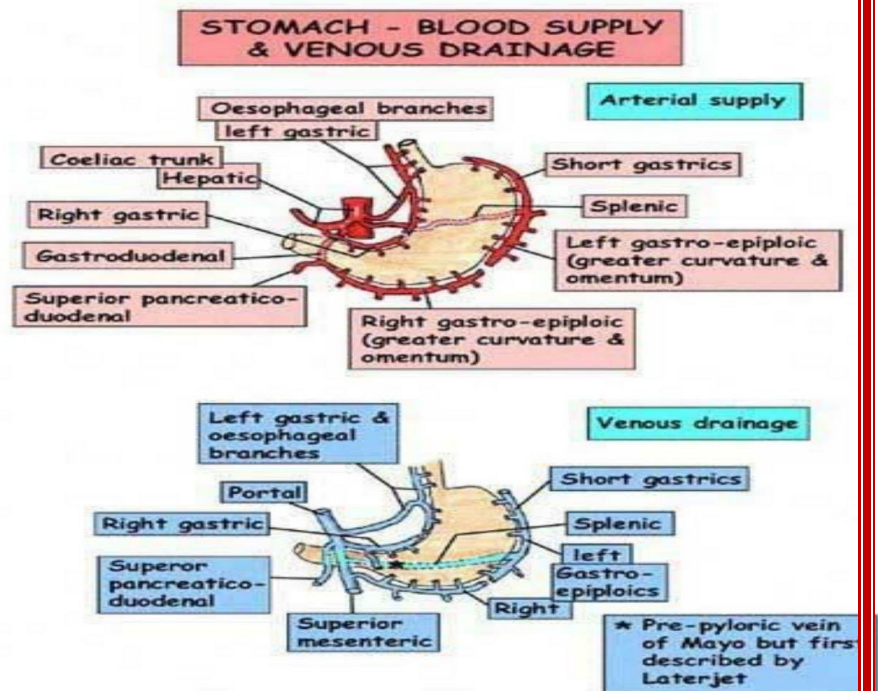
2- Splenic artery "Tortuous", Go to spleen, gives Short gastric and left gastroepiploic.

tortuous means that the artery has a winding or twisting course rather than running in a straight line.

3- Hepatic artery gives right gastric, gastroduodenal, and right gastro – epiploic.

Summary

The blood supply of the stomach: Two gastric artery (L,R), Two Gastro-epiploic(L,R), short gastric, all of them originate from Celiac trunk



THE VENOUS DRAINAGE (WE WILL TALK ABOUT IT IN NEXT SLIDES)

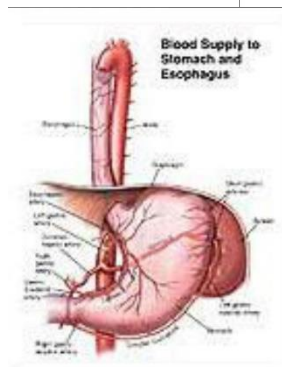
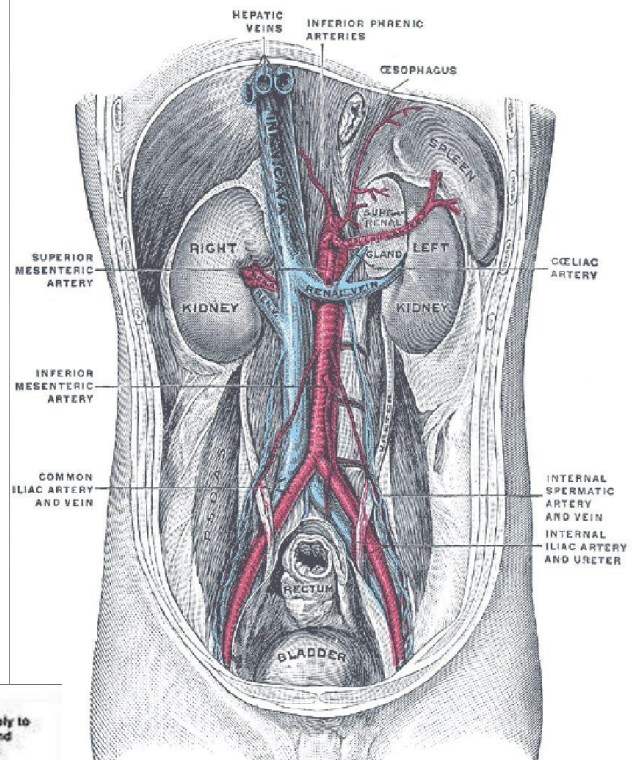
- ◆ All of them go to portal vein (look at the upper picture carefully).

BLOOD SUPPLY

- ◆ The arteries are derived from the branches of the celiac artery.
- ◆ The celiac trunk arises from the front of the abdominal aorta, and it's located at the level of T12 to L1 above the pancreas.
- ◆ Its 1 cm long.

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



Important!!!

Left and right gastric both in lesser omentum

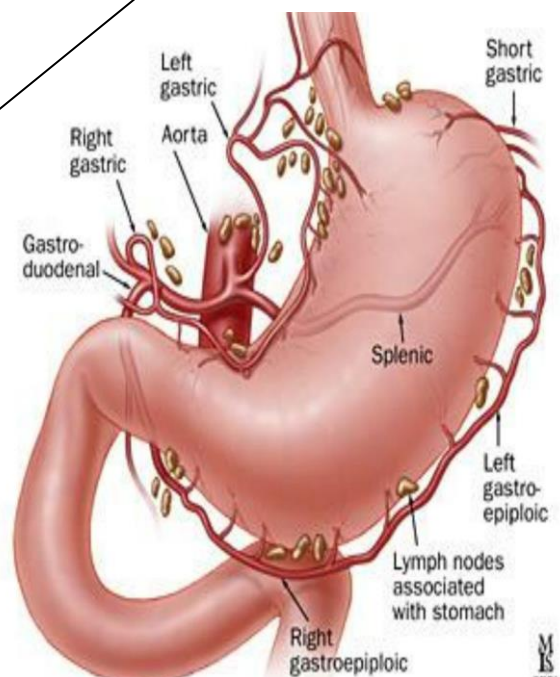
BLOOD SUPPLY FOR STOMACH

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

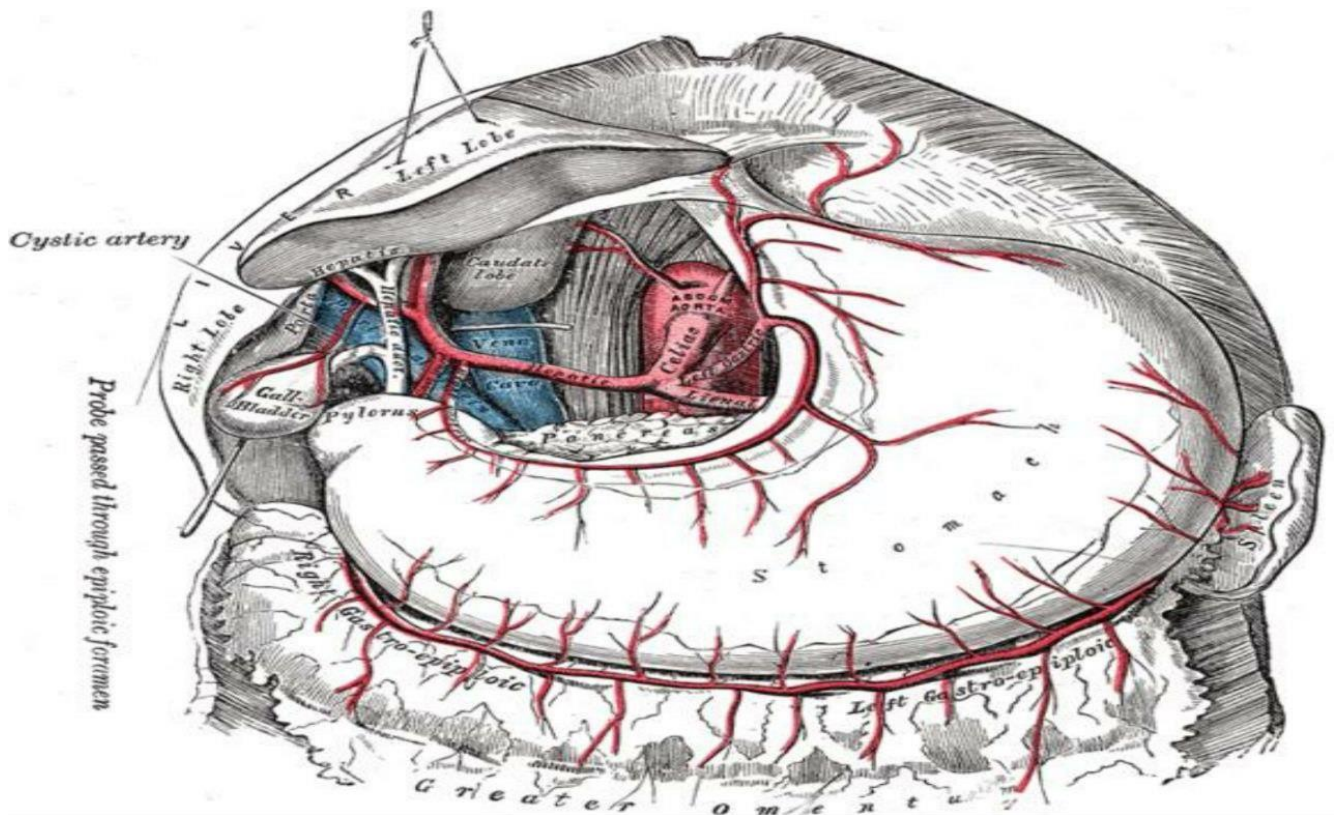
2- The right gastric artery

- ◆ 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.



3- The short gastric arteries

- ◆ Arise from the splenic artery (5-7 arteries)
- ◆ Arises from splenic artery in the gastrosplenic ligament
- ◆ Pass upward in the gastrosplenic to supply the fundus



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

Important!!!

5- The right gastroepiploic artery

Left and right gastroepiploic both in greater omentum

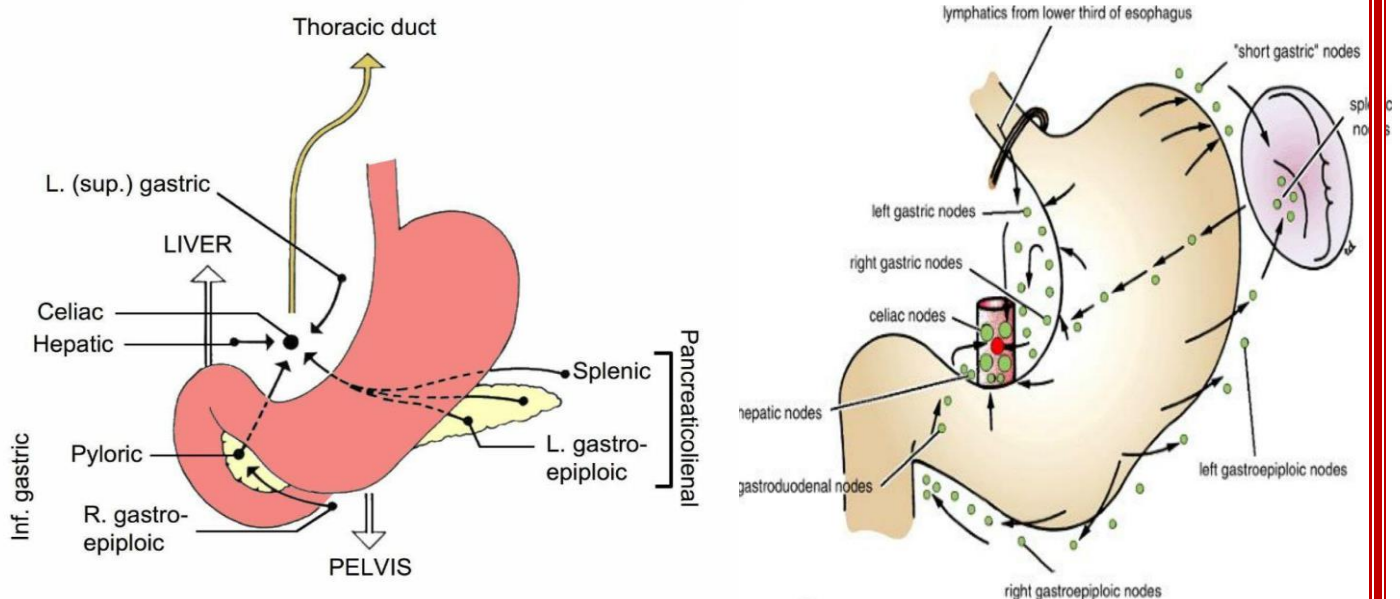
- ◆ arises from the gastroduodenal branch of the hepatic artery
- ◆ It passes to the left and supplies the stomach along the lower part of the greater curvature in the greater omentum.

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 root of the celiac artery on the posterior abdominal wall.



NERVE SUPPLY FOR THE 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 the stomach comes from vagus (anterior and posterior)
- ◆ 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

◆ The posterior vagal trunk

◆ mainly from the right vagus nerve

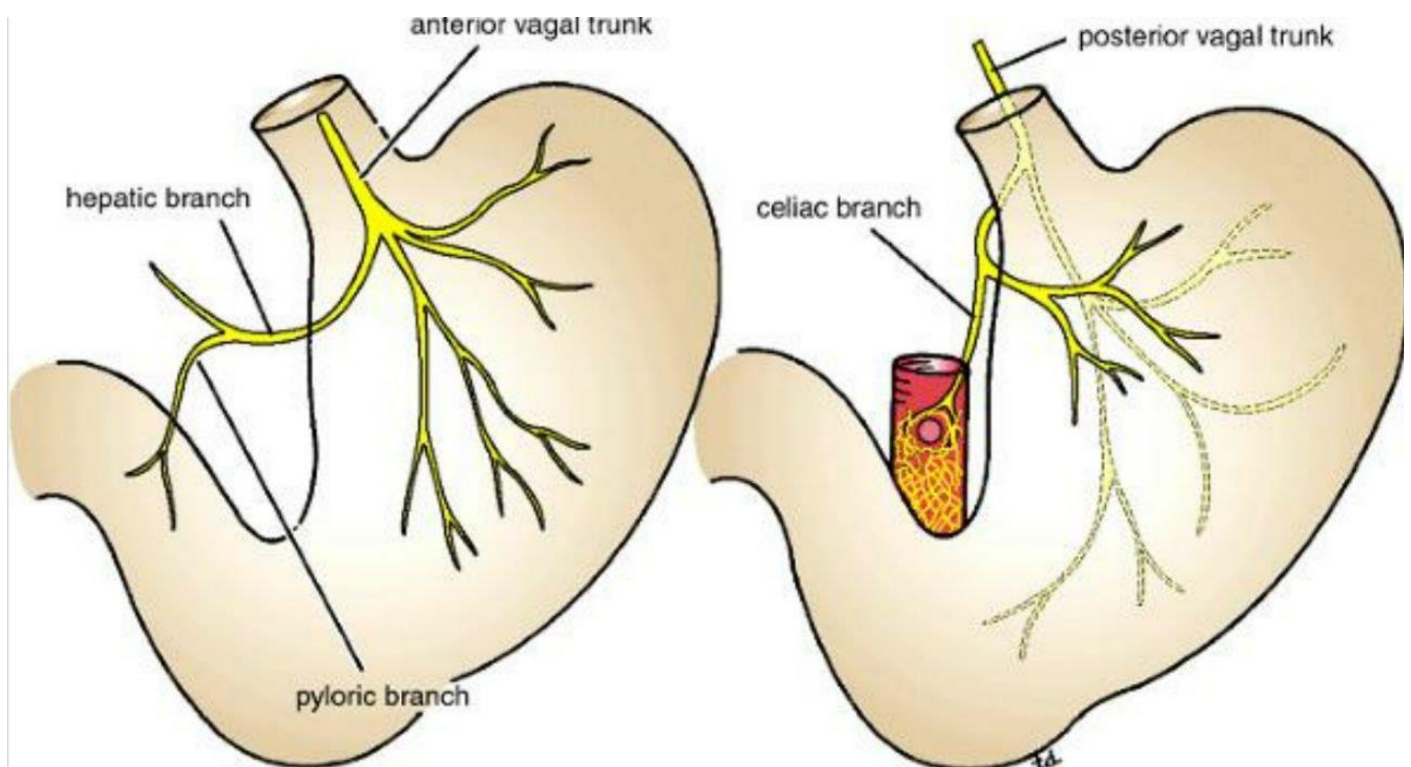
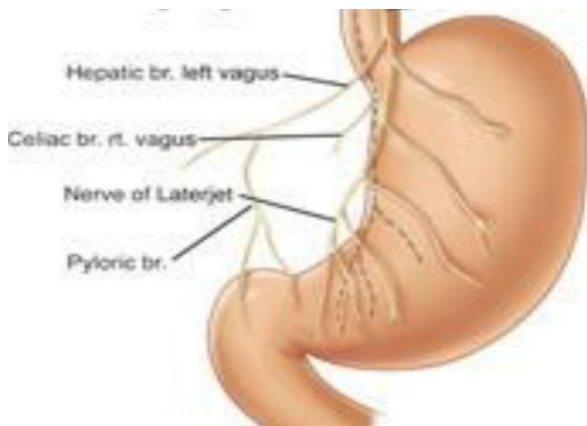
◆ **Distribution :**

1- mainly the posterior wall of the stomach.

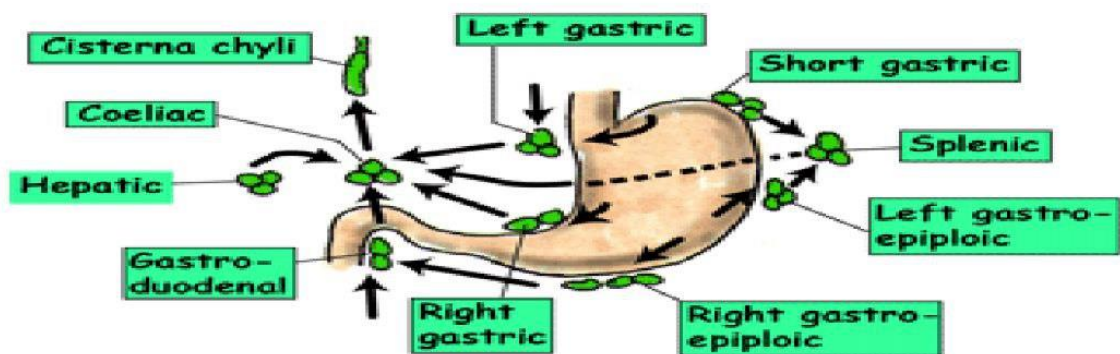
2- Ant. Wall of body of stomach

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

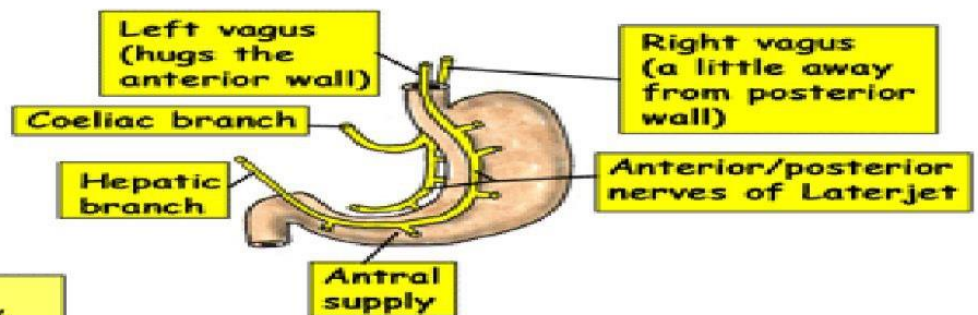
4- post. Nerve Laterjet → pylorus



STOMACH - LYMPHATIC DRAINAGE & NERVE SUPPLY



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



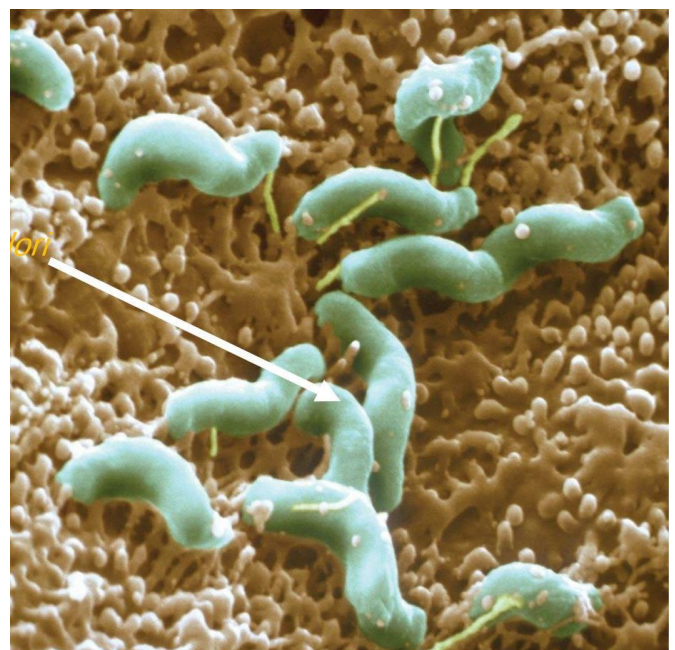
Vagus nerves are 80% sensory. 20% motor for increasing motility, opening pylorus & initiating secretions

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

CLINICAL NOTES

- ◆ Gastric Ulcer
- ◆ Truncal vagotomy → Sectioning the vagus nerves below the diaphragm around the esophagus.
- ◆ Highly selective vagotomy (cut all branches of the vagi except Latarjet.n)
- ◆ Peptic ulcer (D.U) (caused by Helicobacter pylori)
- ◆ Gastroscopy
- ◆ Pyloroplasty (drainage) = gastro-jejunosotomy

Truncal vagotomy is a surgical procedure used to treat certain conditions of the stomach and upper digestive tract, particularly peptic ulcers. It involves cutting or dividing the main branches of the vagus nerve, known as the "trunks," that innervate the stomach.



تم بحمد الله تعالى

V2: colon instead of column page 20