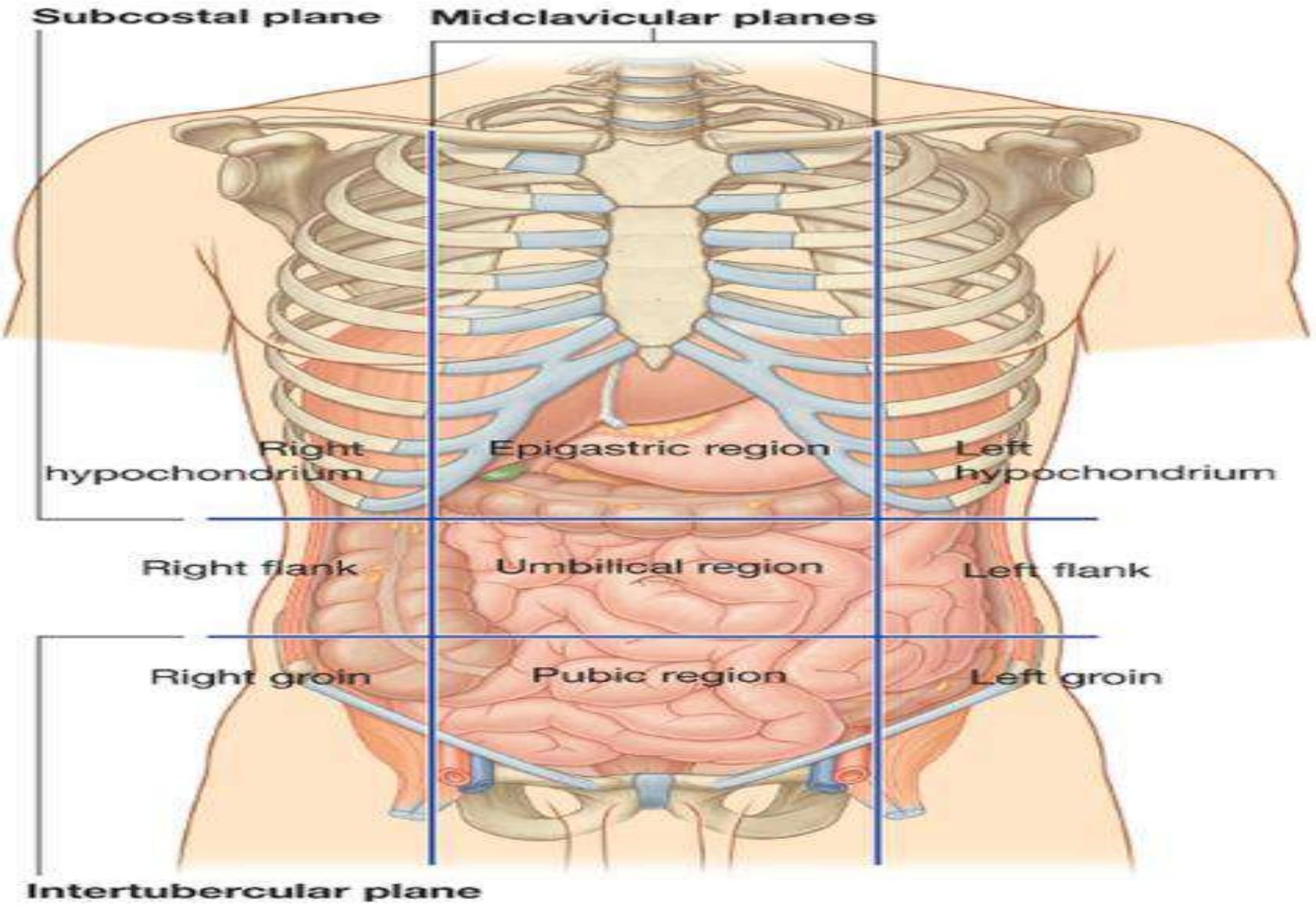
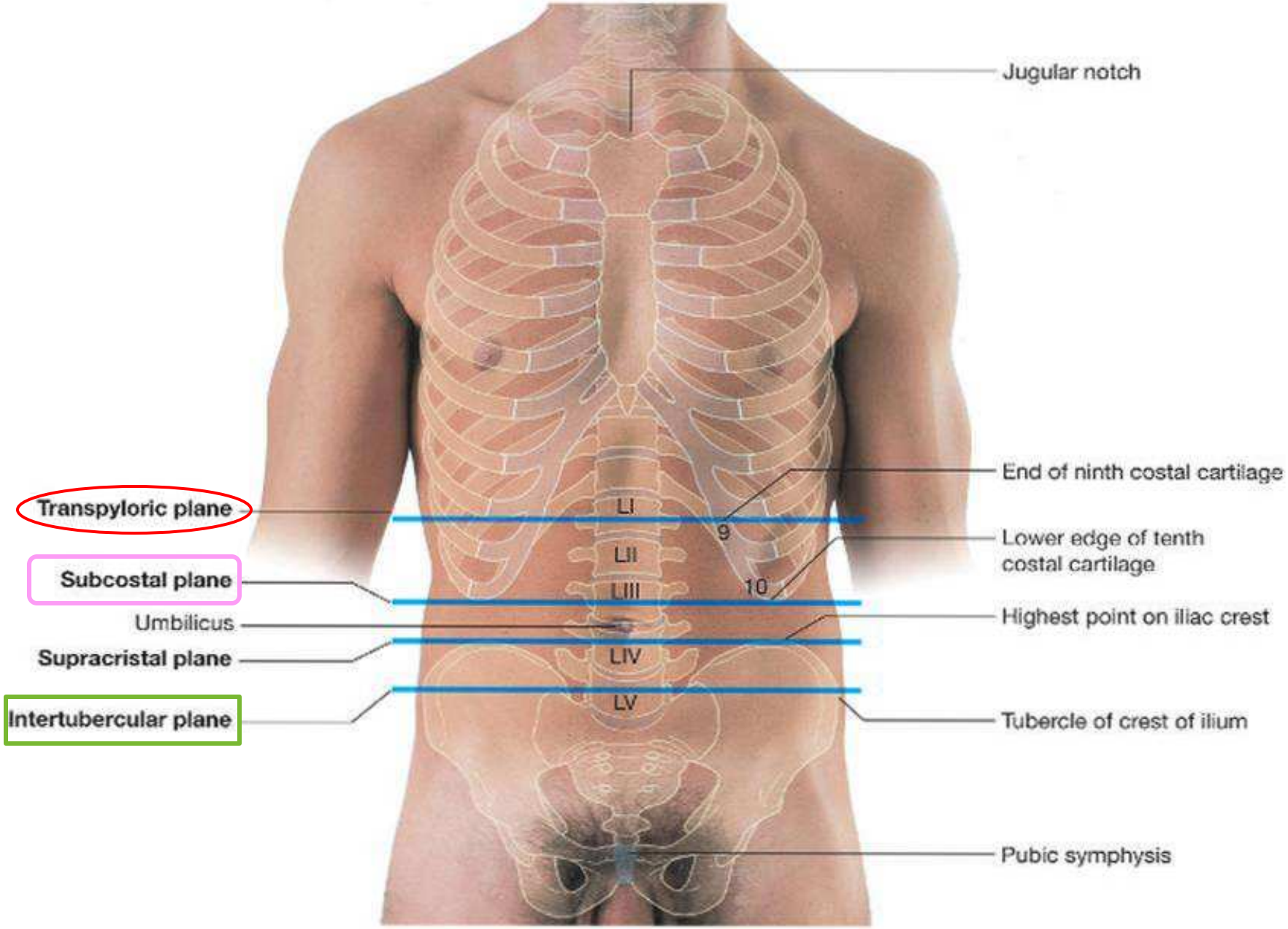
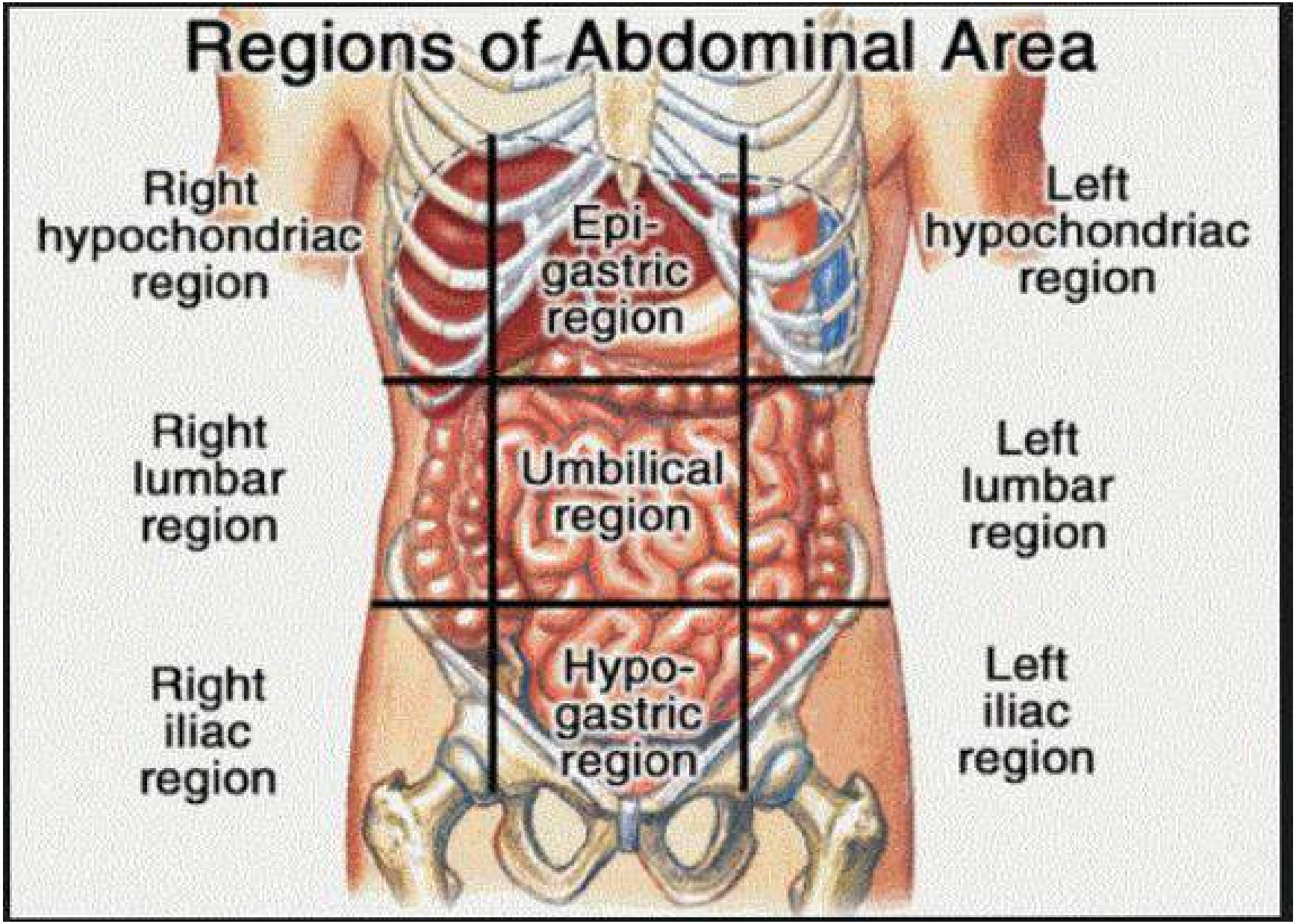
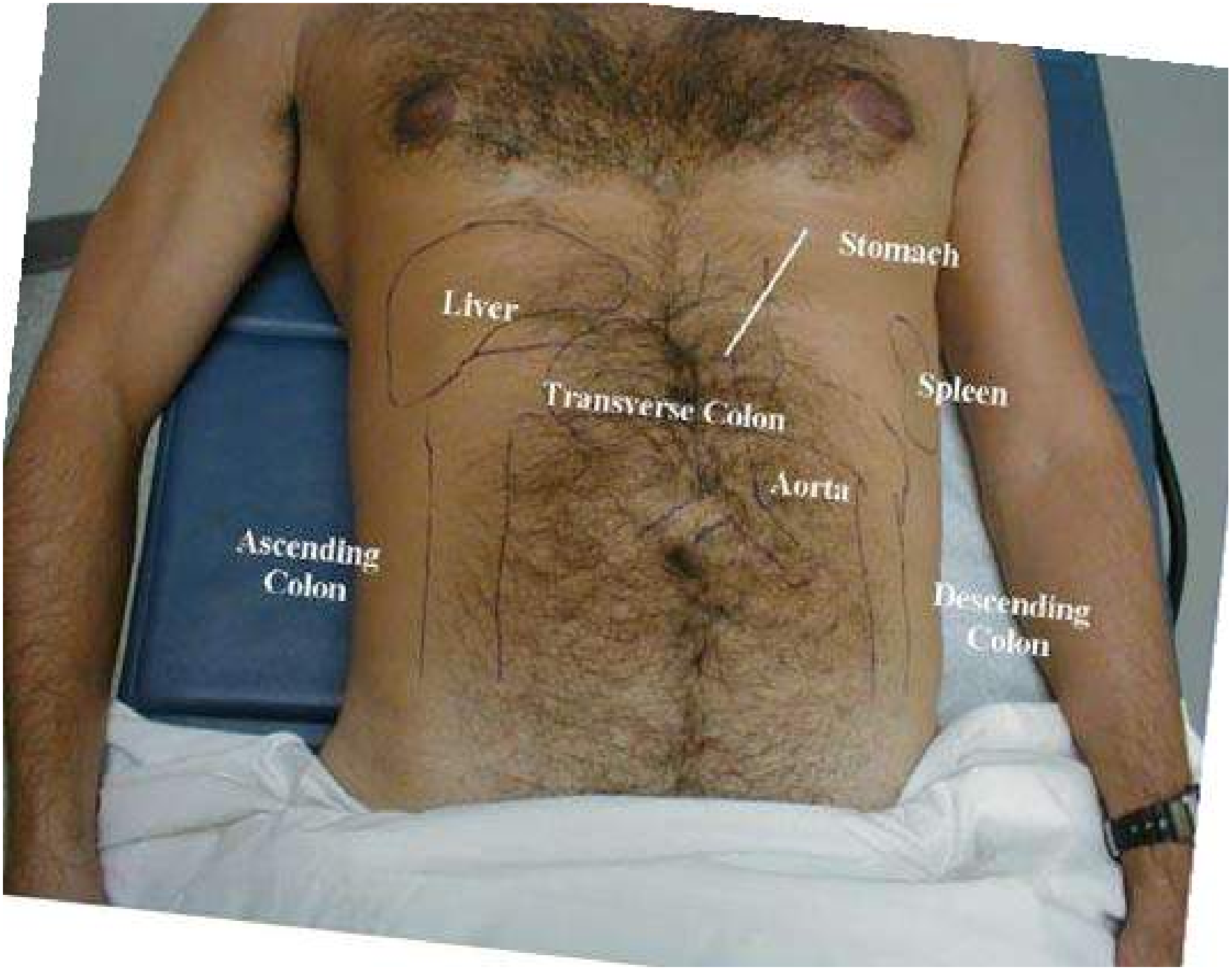
Abdominal Regions




Jugular notch
End of ninth costal cartilage
Transpyloric plane
LI
9
Lower edge of tenth costal cartilage
LII
Subcostal plane
LIII
10
Umbilicus
Highest point on iliac crest
Supracristal plane
LIV
LV
Intertubercular plane
Tubercle of crest of ilium
Pubic symphysis

Regions of Abdominal Area




Stomach
Liver
Spleen
Transverse Colon
Aorta
Ascending Colon
Descending Colon

The Body Regions

Right Hypochondrium **(Liver & Gallbladder)**	***Epigastric area :*** **Stomach &Pancreas**	**Left Hypochondrium :** **(Spleen , fundus of stomach)**
Right Lumbar : **(Kidney & Adrenal gland)**	***Umbilical area*** **Small Intestine**	**Left Lumbar :** **(Kidney & Adrenal gland)**
Right Iliac fossa **: Appendix, Rt ovary Cecum**	***Hypogastric region :*** **(Urinary bladder ,small intestine)**	***Left Iliac fossa :*** **(Pelvic Colon ,Lt ovary)**

Abdominal Lines and Planes

Vertical Lines: Midline, mid-clavicular line

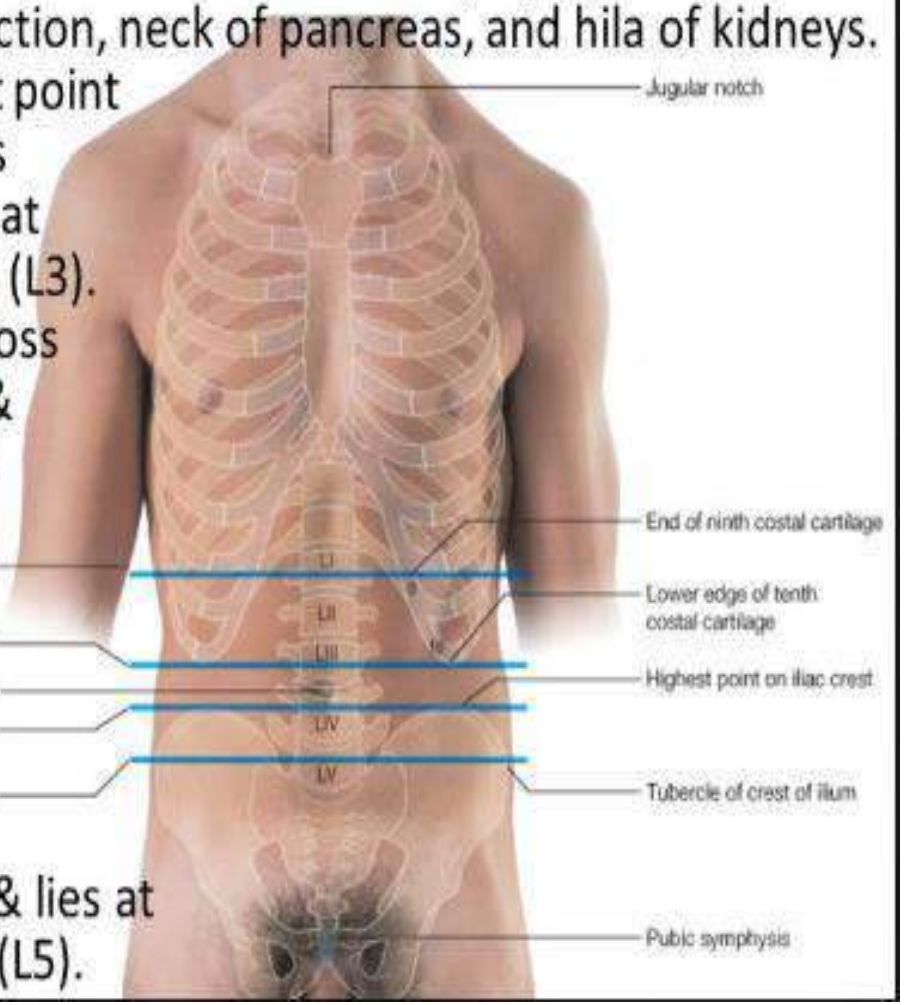
Horizontal Planes:

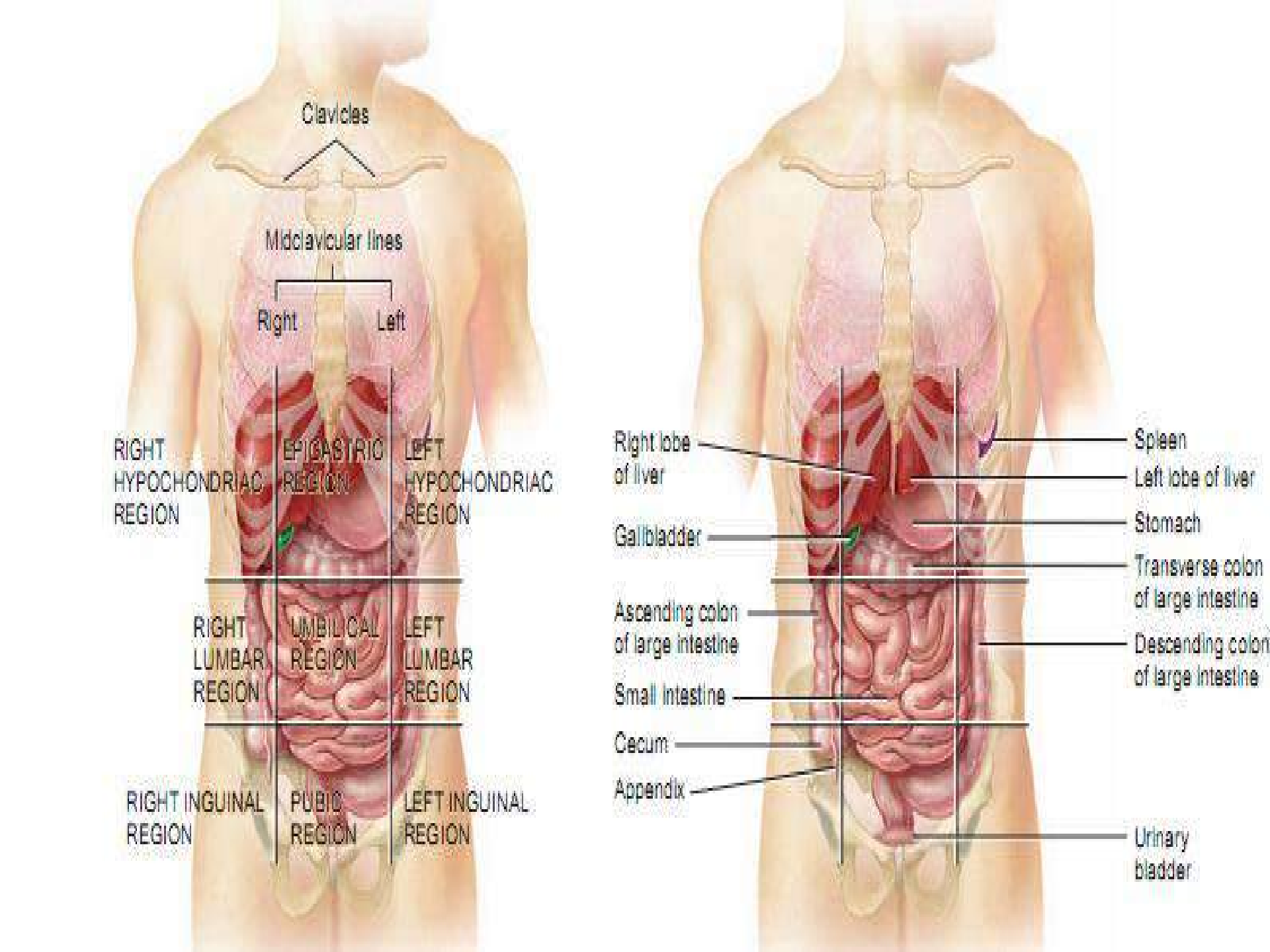
Transpyloric Plane : passes through tips of ninth costal cartilages on both sides. It lies at level of body of first lumbar vertebra (L1), pylorus of the stomach, duodenojejunal junction, neck of pancreas, and hila of kidneys.

Subcostal Plane : joins lowest point of costal margin on both sides that is 10th costal cartilage & at level of third lumbar vertebra (L3).

Intercristal Plane : passes across highest points on iliac crests & lies on level of body of fourth Lumbar vertebra (L4). This is commonly used as a surface landmark when performing a **lumbar spinal tap**.

Intertubercular Plane : joins tubercles on iliac crests & lies at level of fifth lumbar vertebra (L5).




Clavicles
Midclavicular lines
Right
Left
RIGHT HYPOCHONDRIAC REGION
EPIGASTRIC REGION
LEFT HYPOCHONDRIAC REGION
RIGHT LUMBAR REGION
UMBILICAL REGION
LEFT LUMBAR REGION
RIGHT INGUINAL REGION
PUBIC REGION
LEFT INGUINAL REGION
Right lobe of liver
Gallbladder
Ascending colon of large intestine
Small intestine
Cecum
Appendix
Spleen
Left lobe of liver
Stomach
Transverse colon of large intestine
Descending colon of large intestine
Urinary bladder

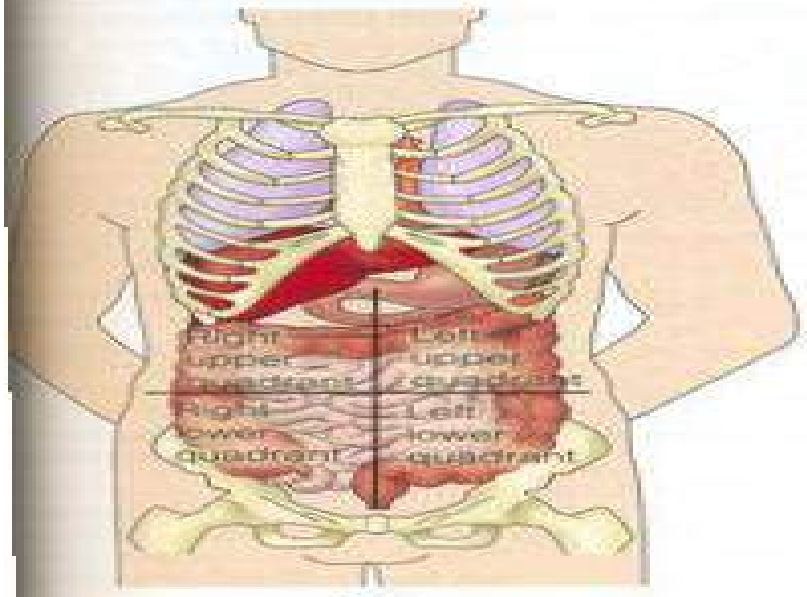
The **epigastric** (ep"i-gas'trik) **region** is located superior to the umbilical region (*epi* = upon, above; *gastric* = stomach).

The **hypogastric (pubic) region** is inferior to the umbilical region (*hypo* = below).

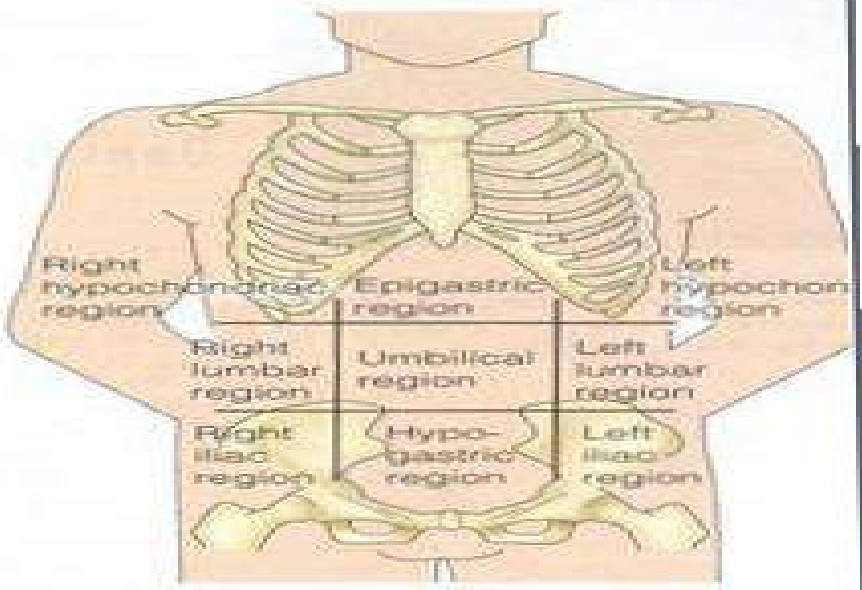
The **right** and **left iliac, or inguinal, regions** are lateral to the hypogastric region (*iliac* = superior part of the hip bone).

The **right** and **left lumbar regions** lie lateral to the umbilical region (*lumbus* = loin).

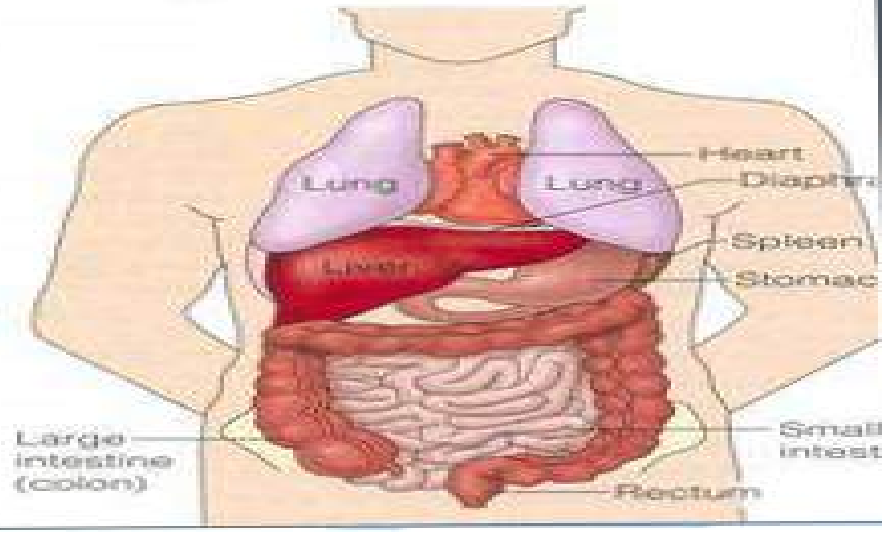
The **right** and **left hypochondriac** (hi"po-kon'dre-ak) **regions** flank the epigastric region and contain the lower ribs (*chondro* = cartilage).



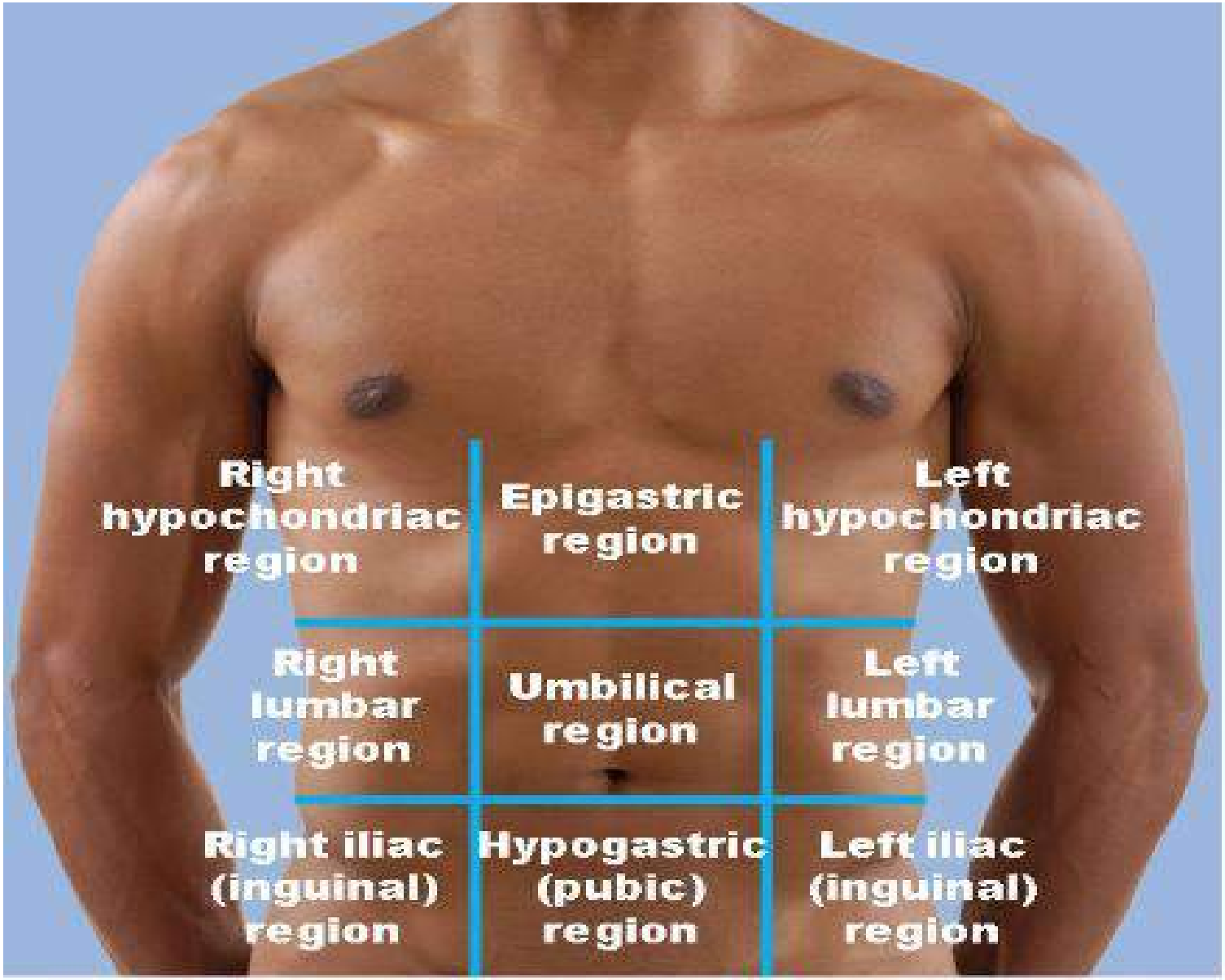
(a)



(b)



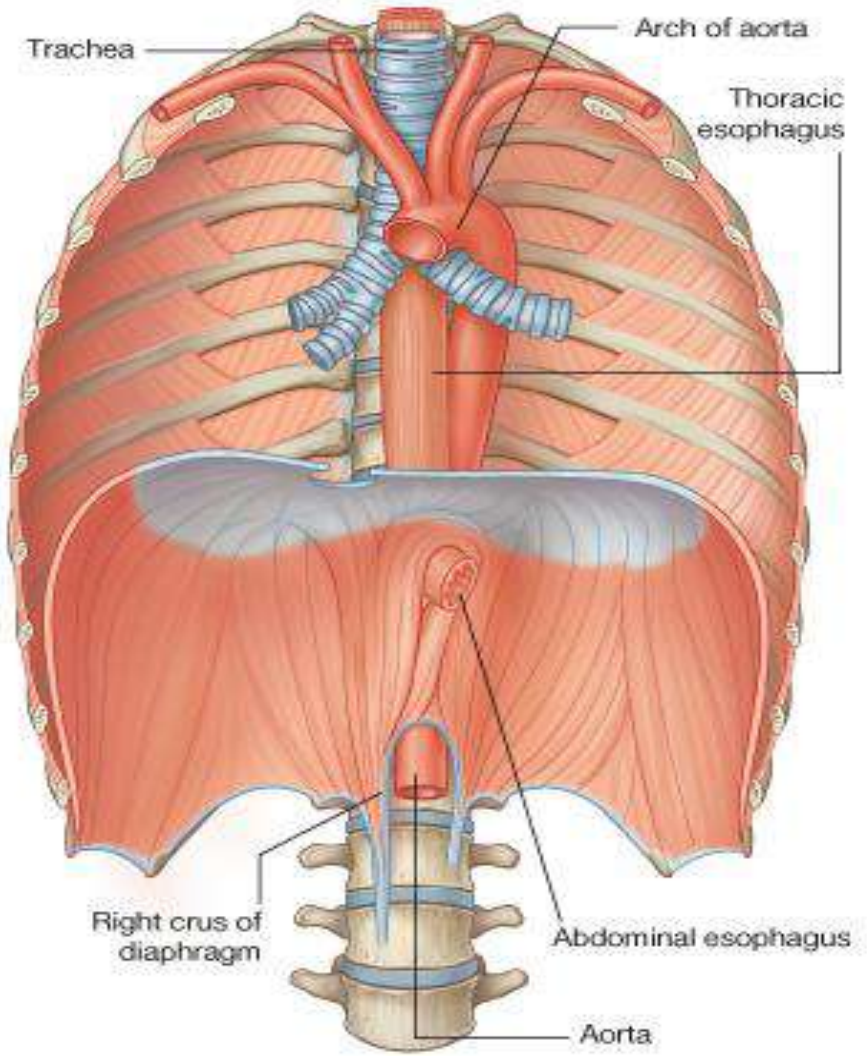
Abdominopelvic surface and ... (a) The four quadrants. (b) Nine regions defined by four planes. The superior horizontal plane ... inferior aspect of the ribs; the inferior hori-



(a) Nine regions delineated by four planes

ESOPHAGUS

- **The esophagus enters the abdomen through an opening in the *Right crus* of the diaphragm.**
- **After a course of about (2.5 cm), it enters the stomach on its right side.**



ESOPHAGUS

- **The esophagus is related**

Anteriorly → posterior surface of the left lobe of the liver, left Vagus.

Posteriorly → the left crus of the diaphragm, right Vagus.

- **The esophagus conducts food from the pharynx into the stomach.**
- **Wave-like contractions of the muscular coat, called *peristalsis*, propel the food onward.**

ESOPHAGUS

- **Blood Supply from the left Gastric Artery .**
- **The *veins* drain into the left Gastric vein, a tributary of the portal vein.**
- **The *lymph vessels* follow the arteries into the left gastric nodes.**
- **Anterior and posterior gastric *nerves* (vagi) and sympathetic branches of the thoracic part of the sympathetic trunk supply the esophagus.**

GASTROESOPHAGEAL SPHINCTER

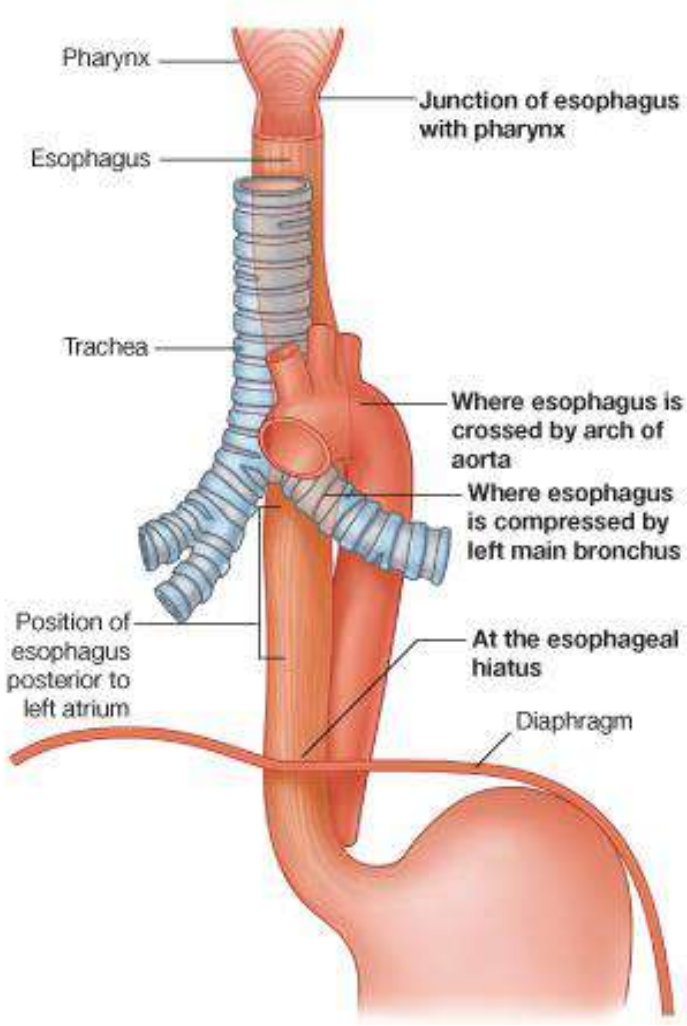
- ***No anatomic sphincter*** **exists at the lower end of the esophagus.**
- **However, the circular layer of smooth muscle in this region serves as a *physiologic sphincter.***
- **As the food descends through the esophagus, relaxation of the muscle at the lower end occurs ahead of the peristaltic wave so that the food enters the stomach.**

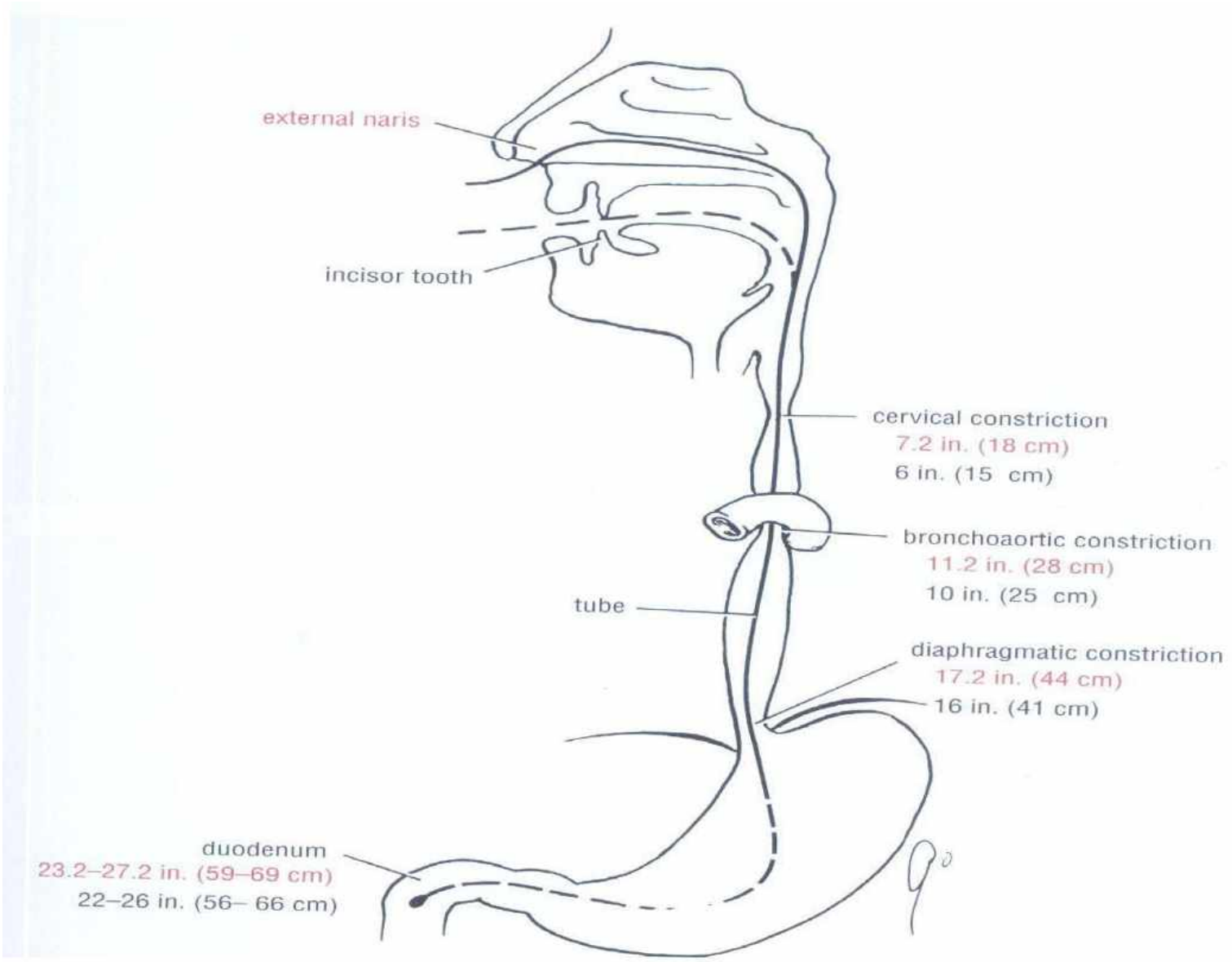
NARROW AREAS OF THE ESOPHAGEAL LUMEN

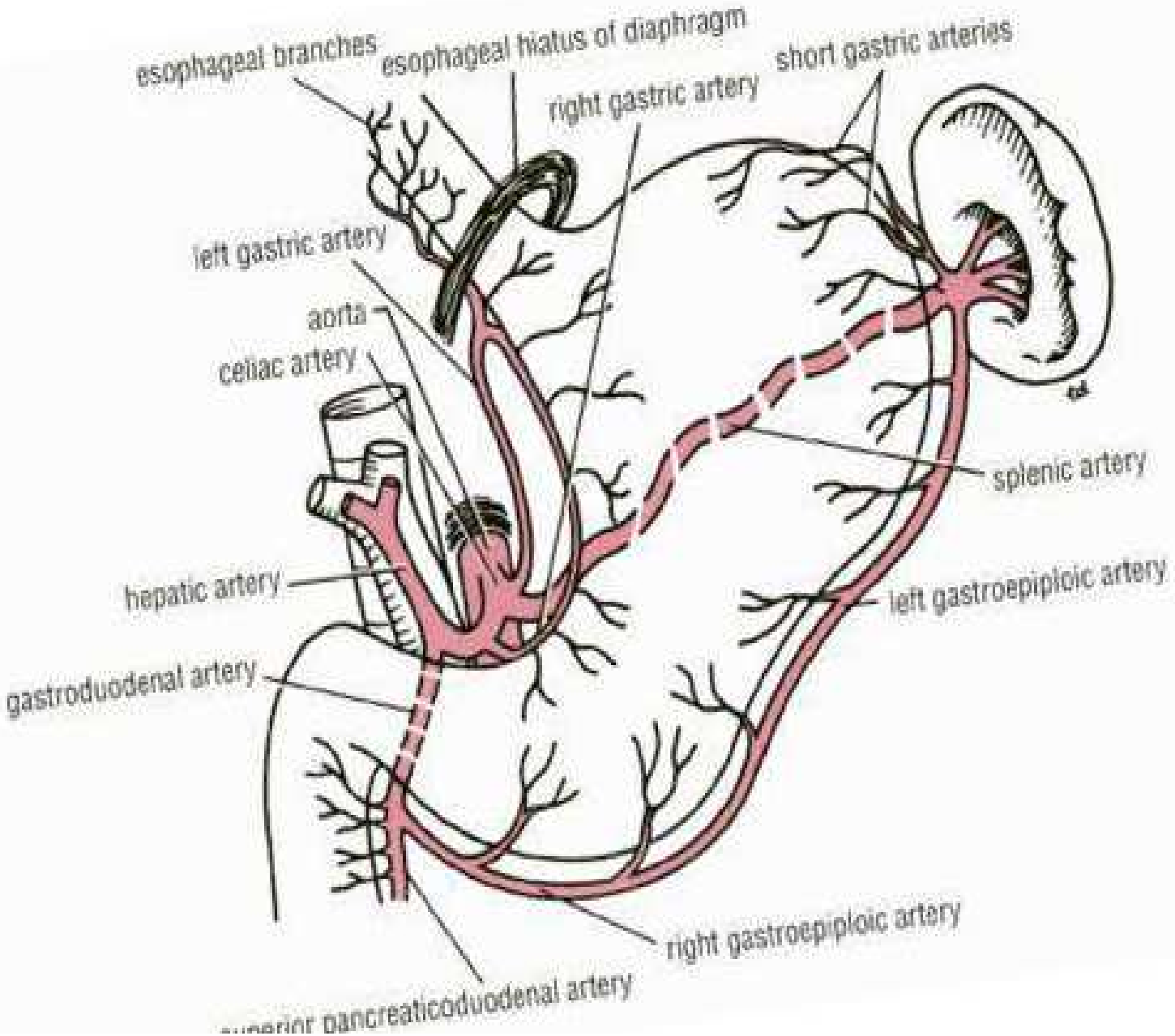
The esophagus is narrowed at four sites: 7-9-11-15 inch from incisor teeth.

- **At the beginning, behind the cricoid cartilage of the larynx.**
- **Where it is crossed by arch of aorta in superior mediastinum.**
- **Where the left bronchus in posterior mediastinum cross the front of the esophagus.**
- **Where the esophagus enters the stomach.**

These three sites may offer resistance to the passage of a tube down the esophagus into the stomach.

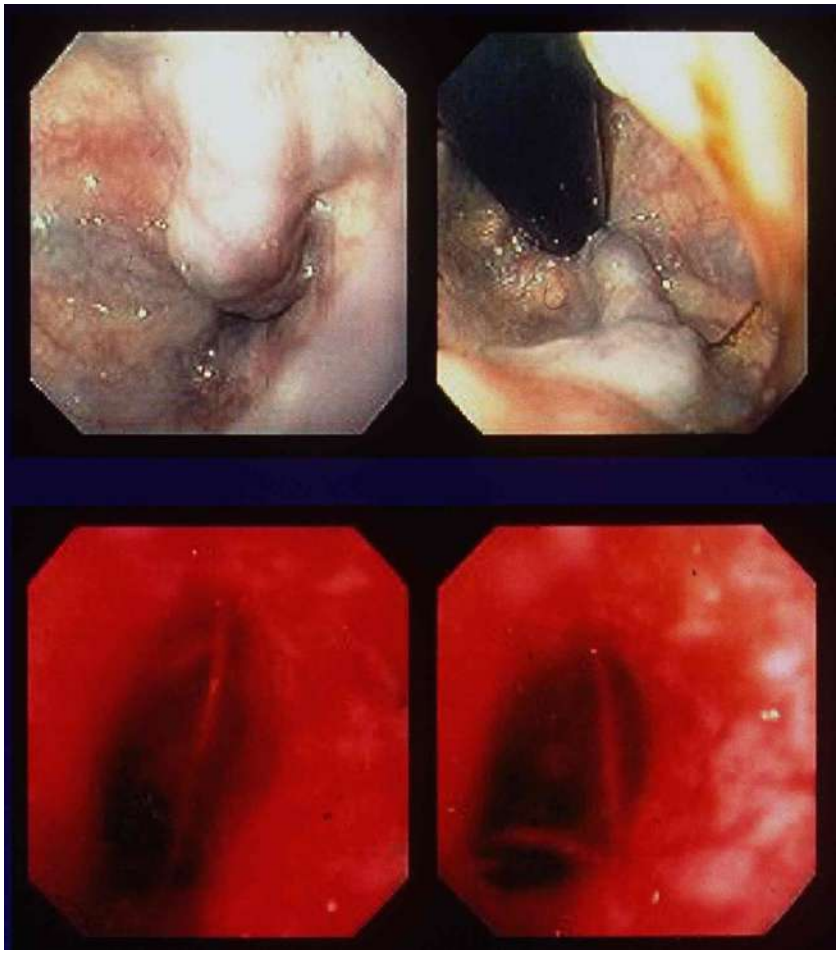



external naris
incisor tooth
cervical constriction
7.2 in. (18 cm)
6 in. (15 cm)
bronchoaortic constriction
11.2 in. (28 cm)
10 in. (25 cm)
tube
diaphragmatic constriction
17.2 in. (44 cm)
16 in. (41 cm)
duodenum
23.2–27.2 in. (59–69 cm)
22–26 in. (56– 66 cm)


esophageal branches
esophageal hiatus of diaphragm
right gastric artery
short gastric arteries
left gastric artery
aorta
celiac artery
splenic artery
hepatic artery
left gastroepiploic artery
gastroduodenal artery
right gastroepiploic artery
superior pancreaticoduodenal artery

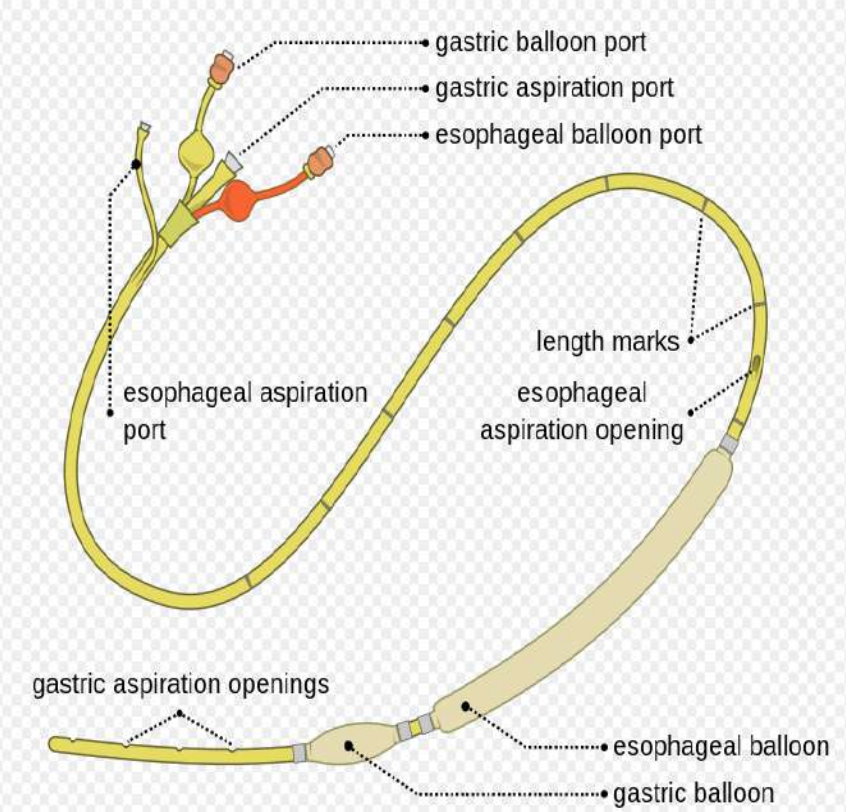
BLEEDING ESOPHAGEAL VARICES

- **At the lower third of the esophagus is an important *Portal-Systemic Venous Anastomosis.***
- **Here, the esophageal tributaries of the *left gastric vein* (which drains into the portal vein) Anastomose with the *Esophageal tributaries of the Azygos Veins* (systemic veins).**
- **Should the portal vein become obstructed, as, for example, in cirrhosis of the liver, portal hypertension develops, resulting in dilatation and varicosity of the portal-systemic anastomoses.**
- **Varicose esophageal veins may rupture, causing severe vomiting of blood *(Hematemesis).***

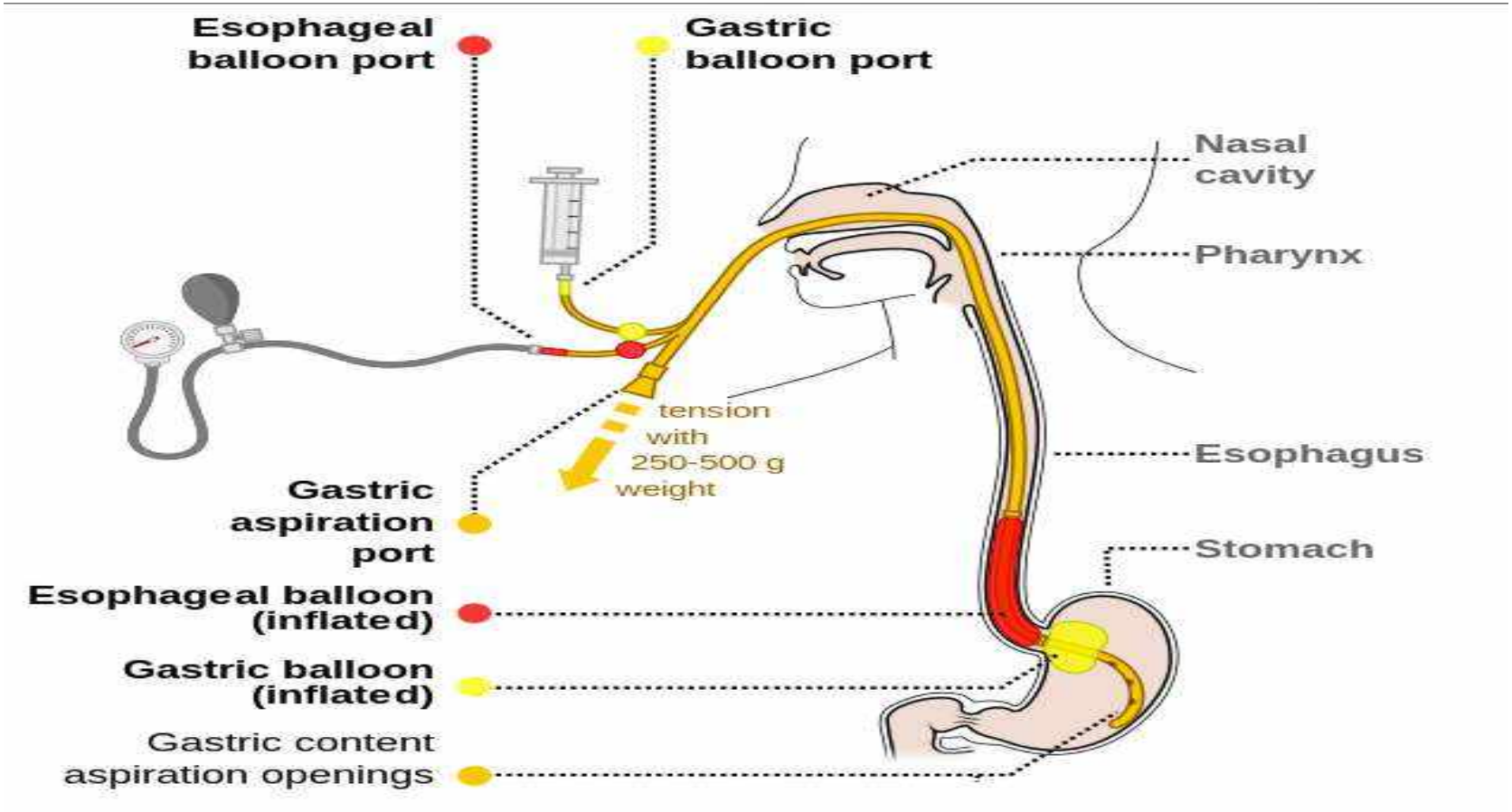


ANATOMY OF THE INSERTION OF THE SENGSTAKEN-BLAKEMORE BALLOON FOR ESOPHAGEAL HEMORRHAGE

- **The *Sengstaken-Blakemore Balloon* is used for the control of massive esophageal hemorrhage from esophageal varices.**
- **A gastric balloon anchors the tube against the esophageal—gastric junction.**
- **An esophageal balloon occludes the esophageal varices by counter pressure.**

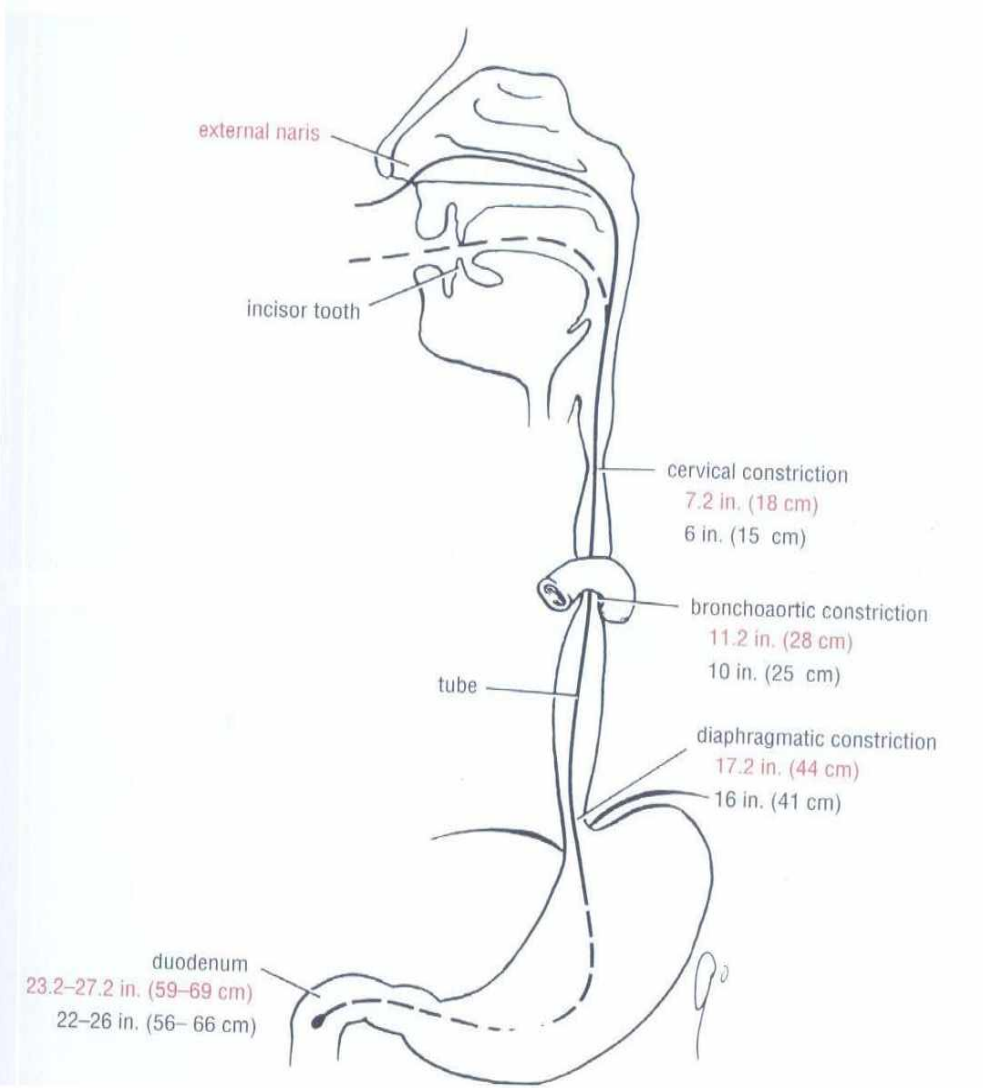


SENGSTAKEN-BLAKEMORE TUBE



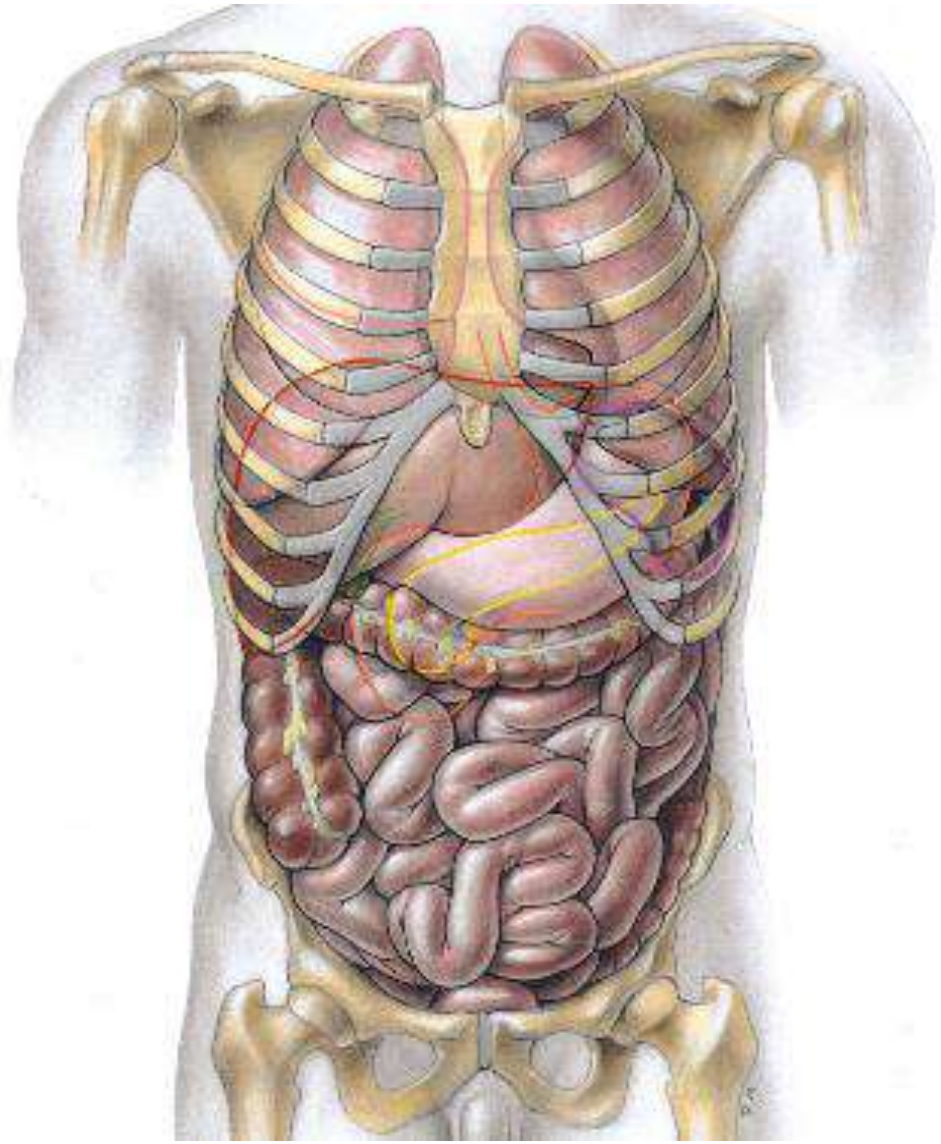
SENGSTAKEN-BLAKEMORE BALLOON

- **The tube is inserted through the nose or by using the oral route.**
- **The lubricated tube is passed down into the stomach, and the gastric balloon is inflated.**
- **In the average adult the distance between the external orifices of the nose and the stomach is (44 cm), and the distance between the incisor teeth and the stomach *is (41 cm).***



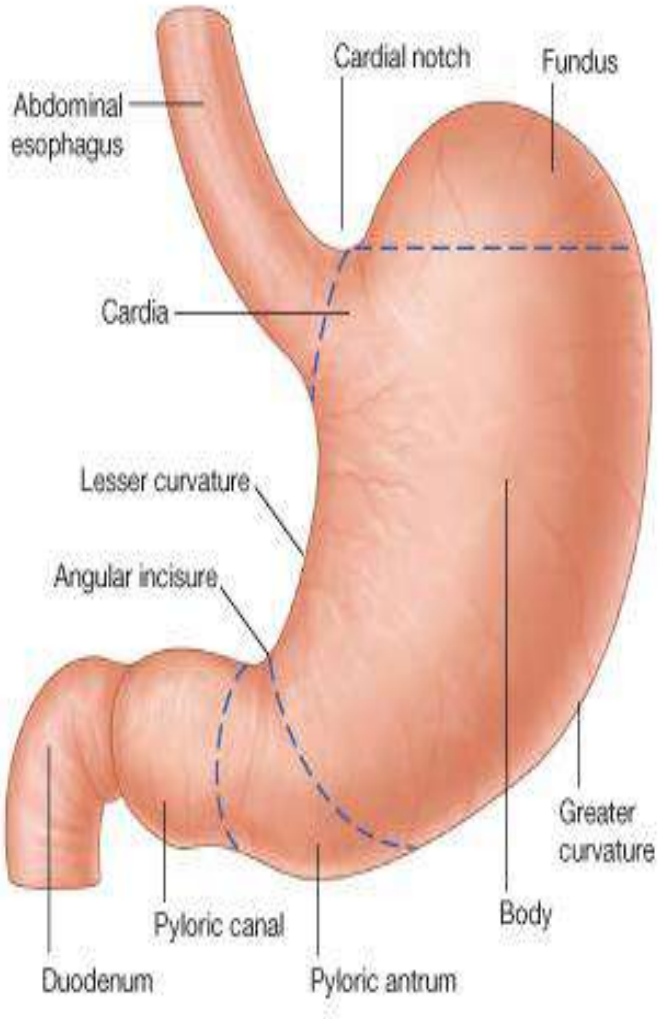
STOMACH

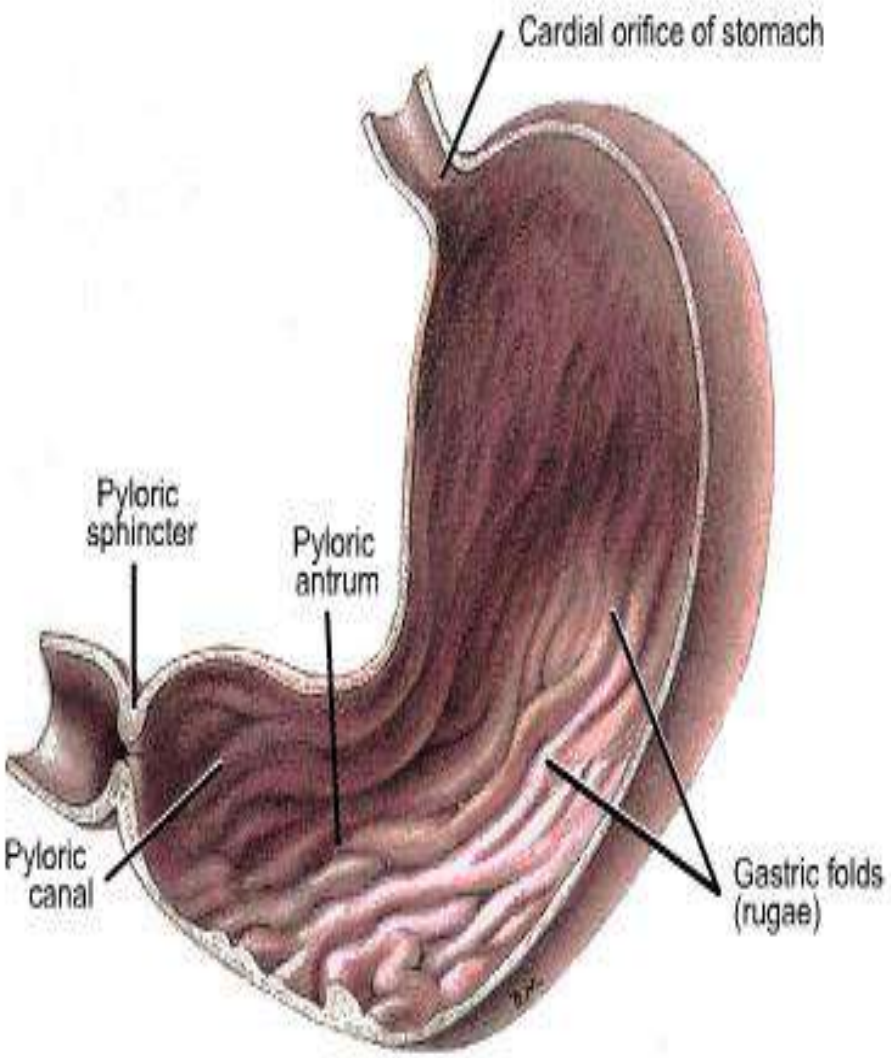
- **The Stomach is situated in the upper part of the abdomen, extending from beneath the left costal margin region into the epigastric and umbilical regions.**
- **Much of the stomach lies under cover of the lower ribs.**



STOMACH

- **It is roughly J shaped and has two openings, the cardiac and pyloric orifices; two curvatures, the greater and lesser curvatures; and two surfaces, an anterior and a posterior surface.**

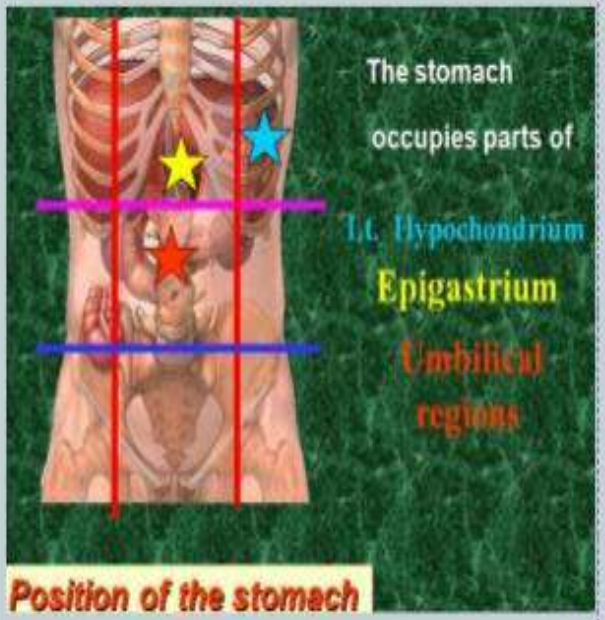



Cardial orifice of stomach
Pyloric sphincter
Pyloric antrum
Pyloric canal
Gastric folds (rugae)

STOMACH

- **The stomach is relatively fixed at both ends but is very mobile in between.**
- **It tends to be high and transversely arranged in the short, obese person *(Steer-Horn Stomach).***
- **Elongated vertically in the tall, thin person *(J-shaped Stomach).***
- **Its shape undergoes considerable variation in the same person and depends on the volume of its contents, the position of the body, and the phase of respiration.**

Position and Shape of Stomach



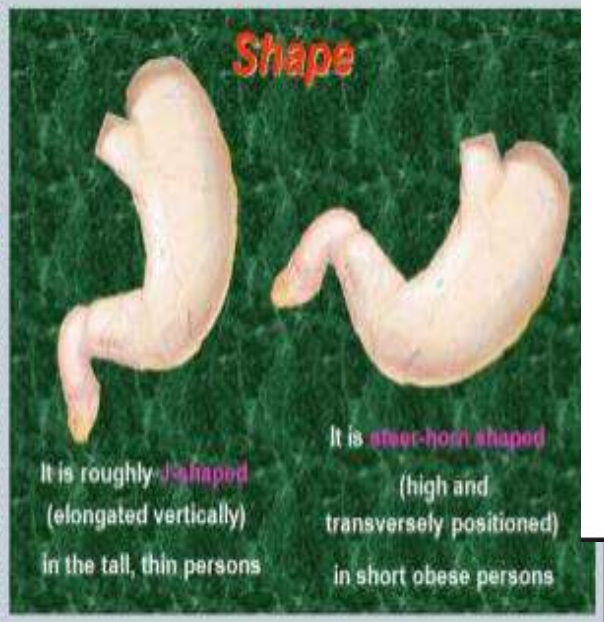
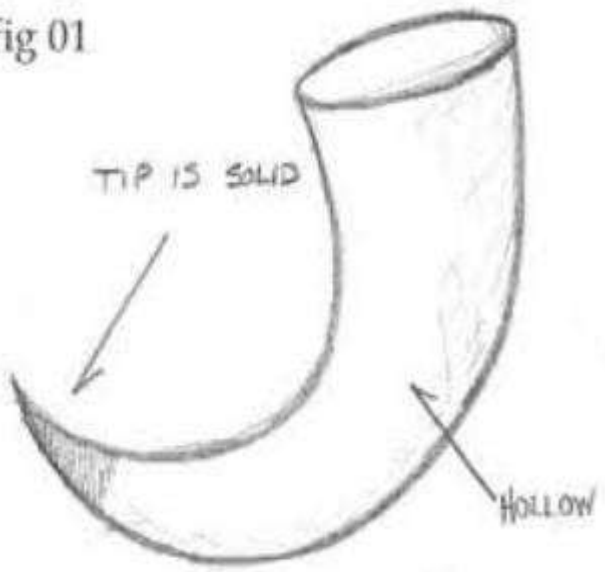
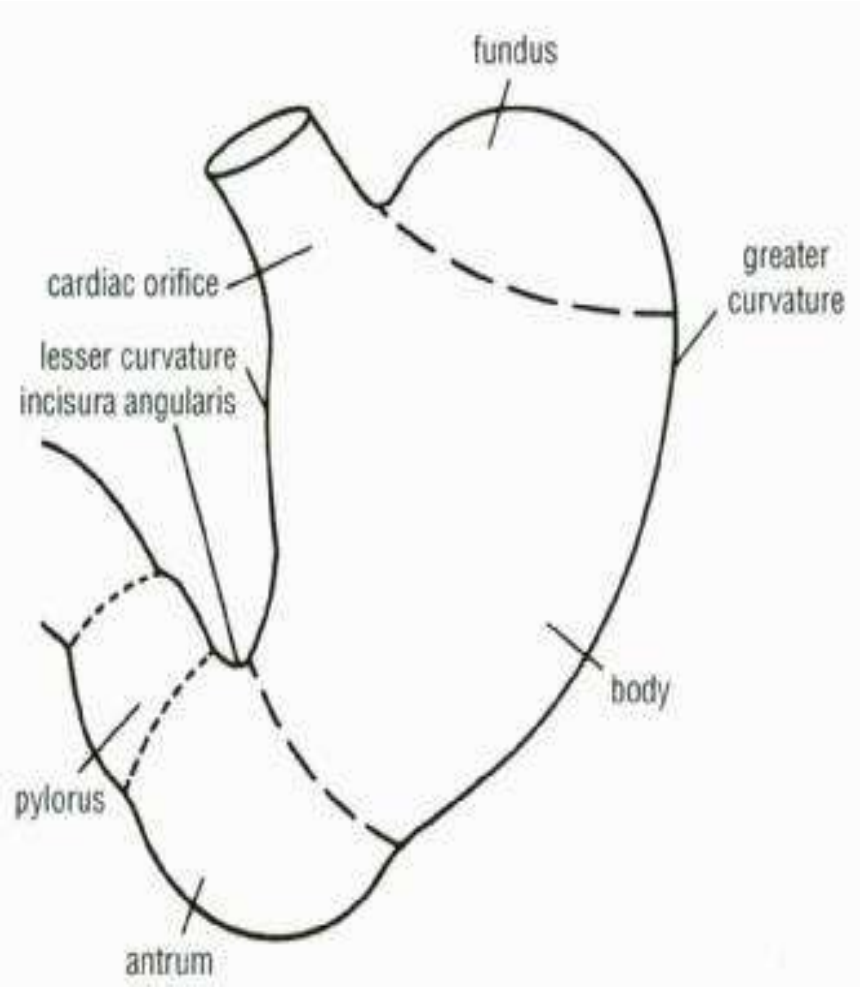


fig 01



STOMACH

- **The stomach is divided into the following parts:**
- **The *Fundus* is dome-shaped and projects upward and to the left of the cardiac orifice. It is usually full of gas.**
- **The *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.**

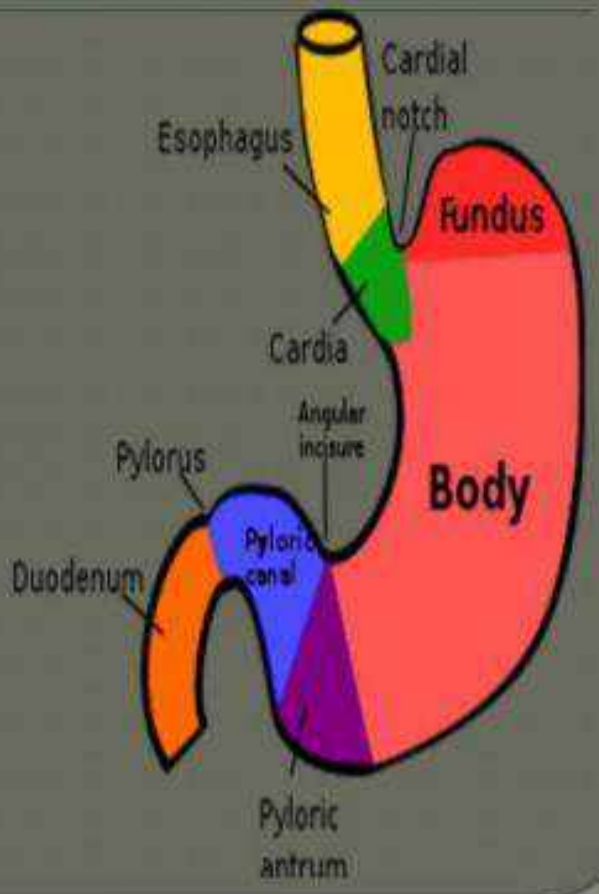


Parts of stomach

The stomach is divided into the following parts :

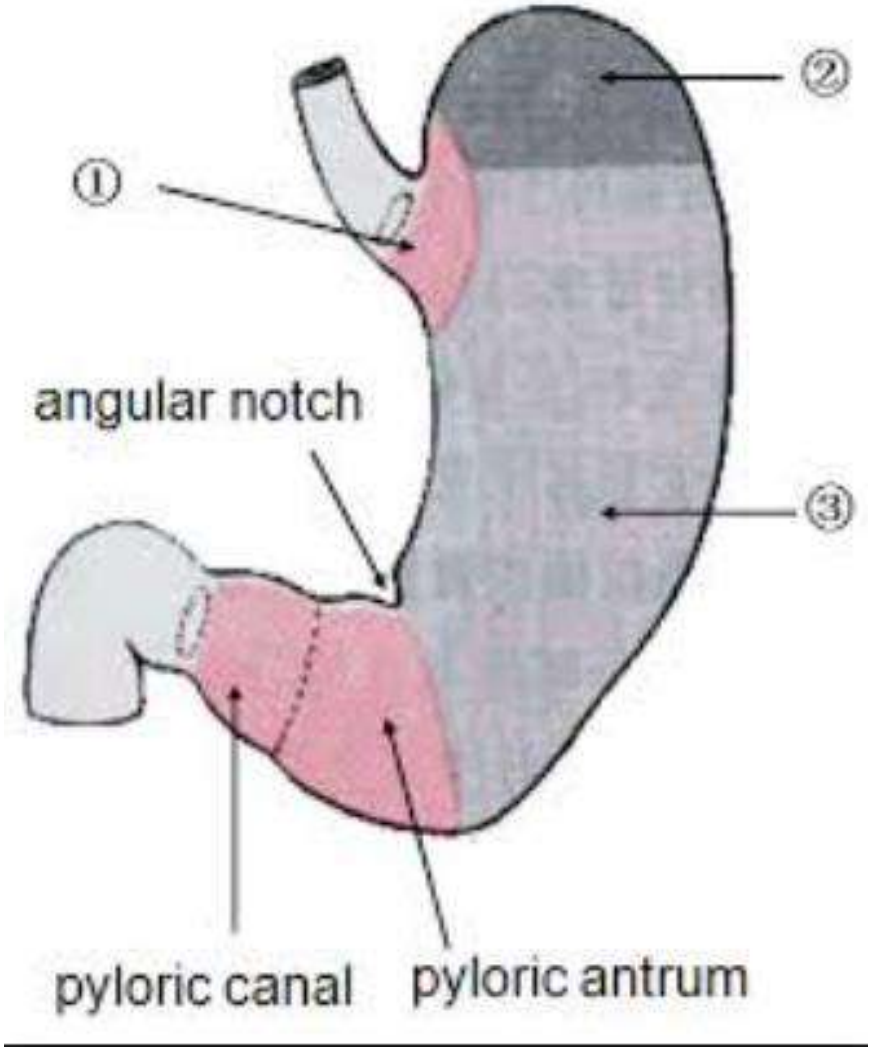
1- Fundus:

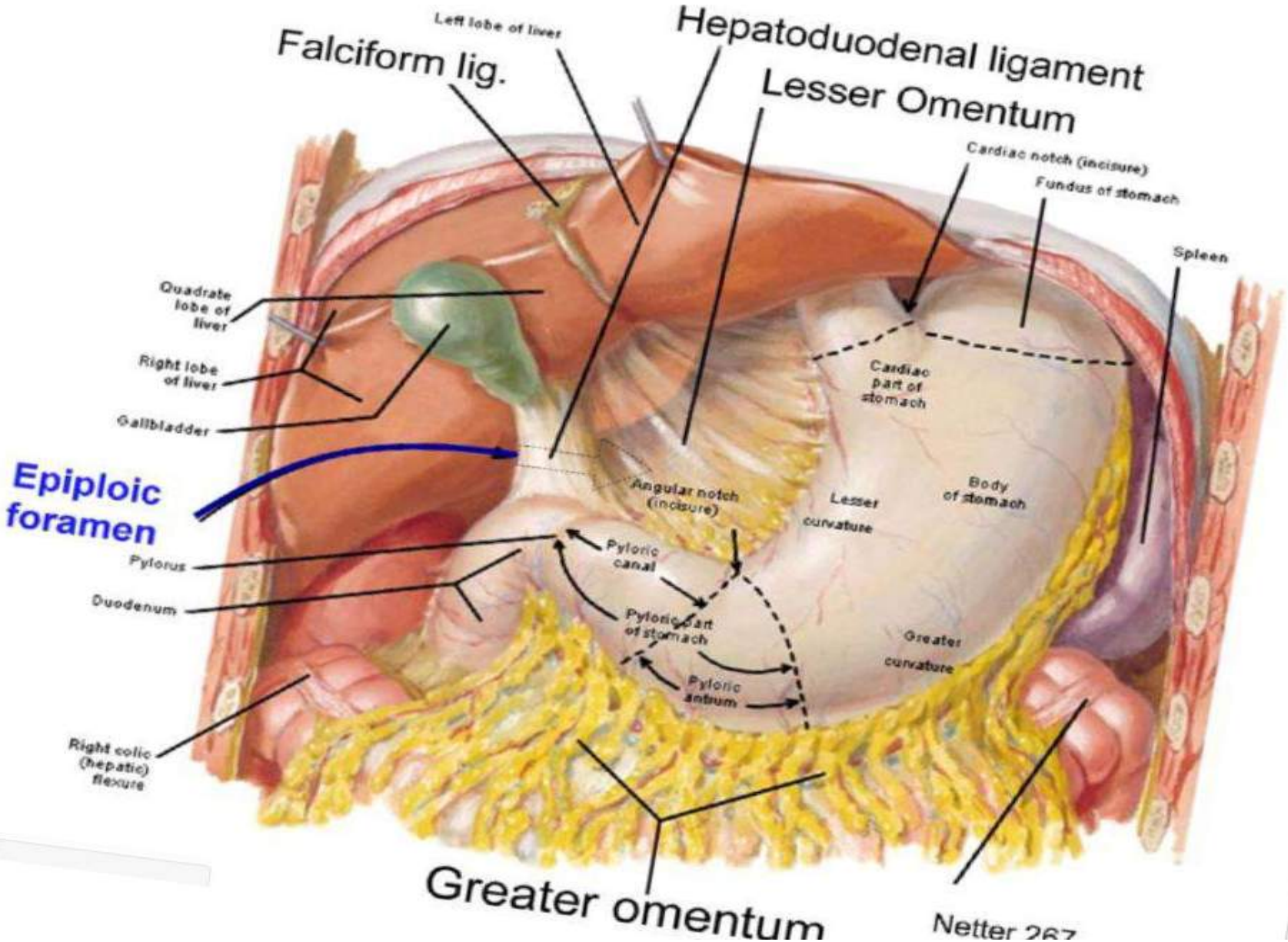
- Dome-shaped
- Projects upward and to the left of the cardiac orifice
- It is usually full of gas.



STOMACH

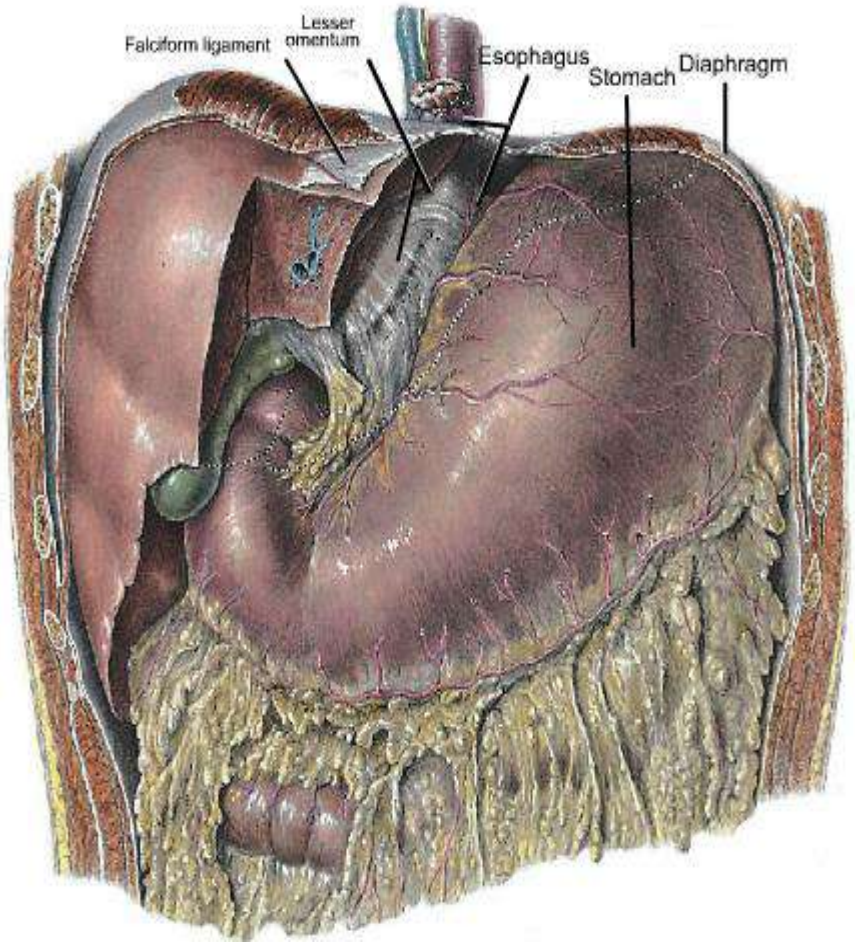
- The ***Pyloric Antrum*** extends from the incisura angularis to the pylorus.
- It is dilatation just to RT of body.
- The ***Pyloric Canal*** is the tubular narrow part of the stomach 2-3 cm in length.
- Pyloric sphincter the narrow thickened end of stomach cavity.




Left lobe of liver
Falciform lig.
Hepatoduodenal ligament
Lesser Omentum
Cardiac notch (incisure)
Fundus of stomach
Spleen
Quadrate lobe of liver
Right lobe of liver
Gallbladder
Epiploic foramen
Cardiac part of stomach
Angular notch (incisure)
Lesser curvature
Body of stomach
Pylorus
Pyloric canal
Duodenum
Pyloric part of stomach
Greater curvature
Pyloric antrum
Right colic (hepatic) flexure
Greater omentum
Netter 267

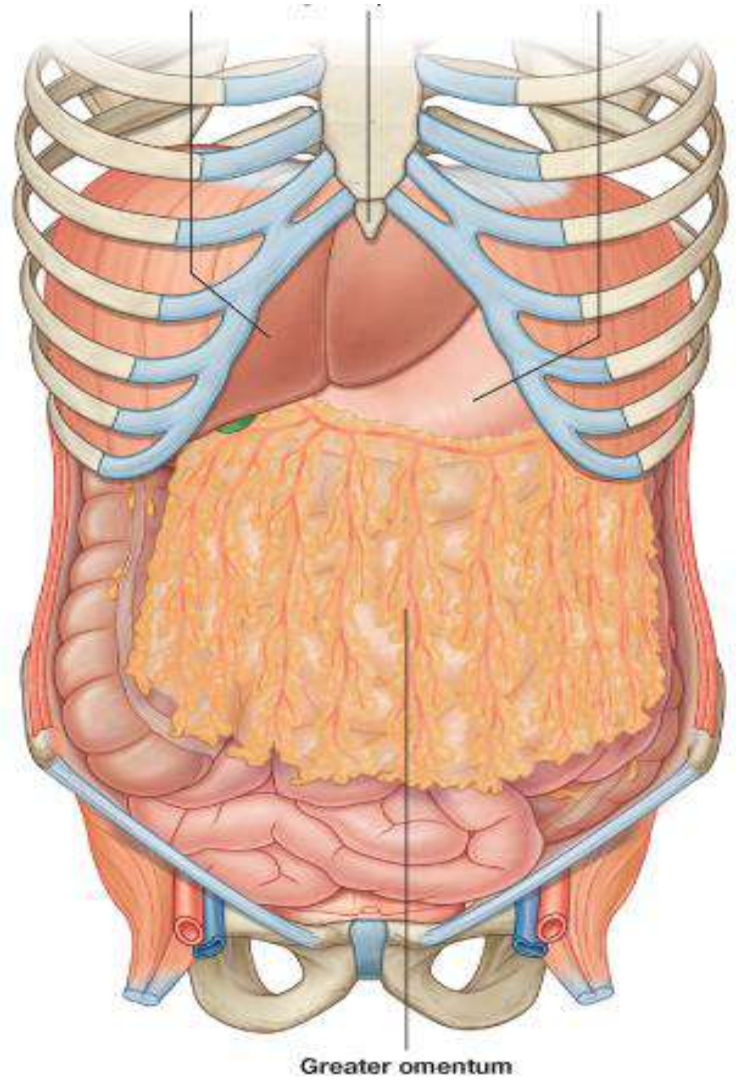
STOMACH

- **The *Lesser Curvature* forms the right border of the stomach and extends from the cardiac orifice to the pylorus.**
- **It is suspended from the liver by the lesser omentum.**



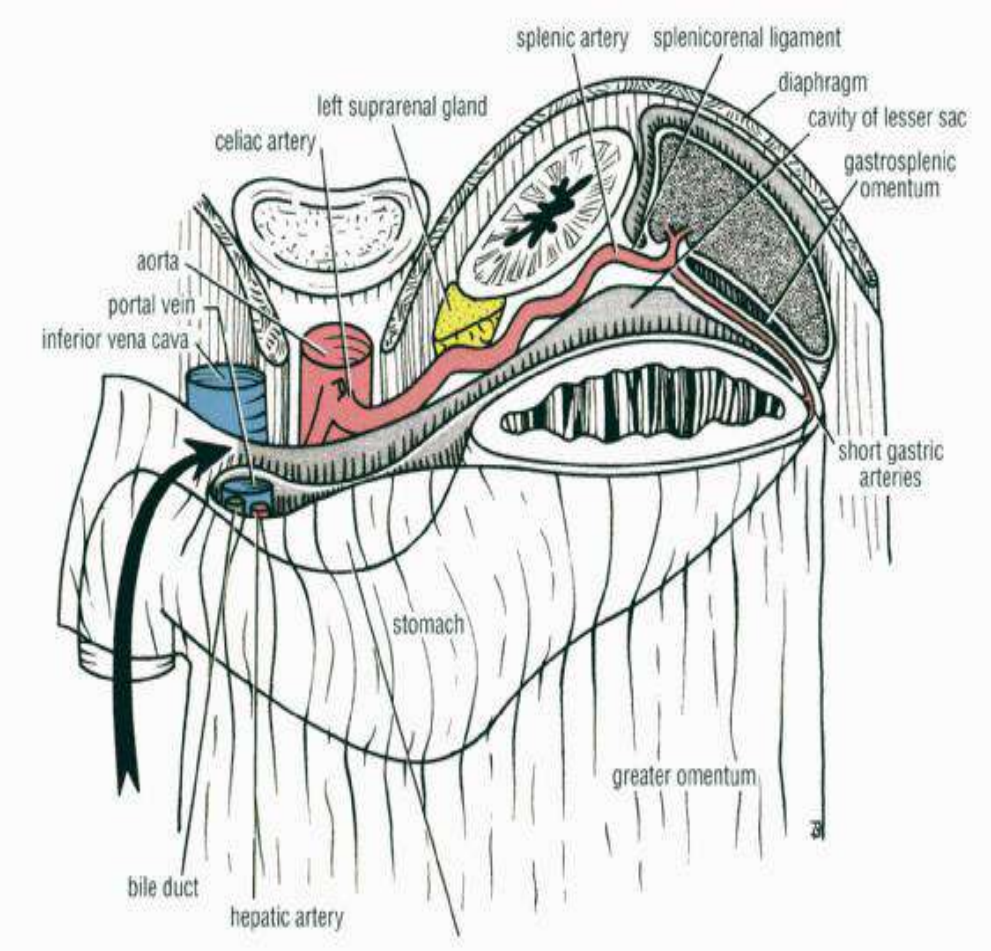
STOMACH

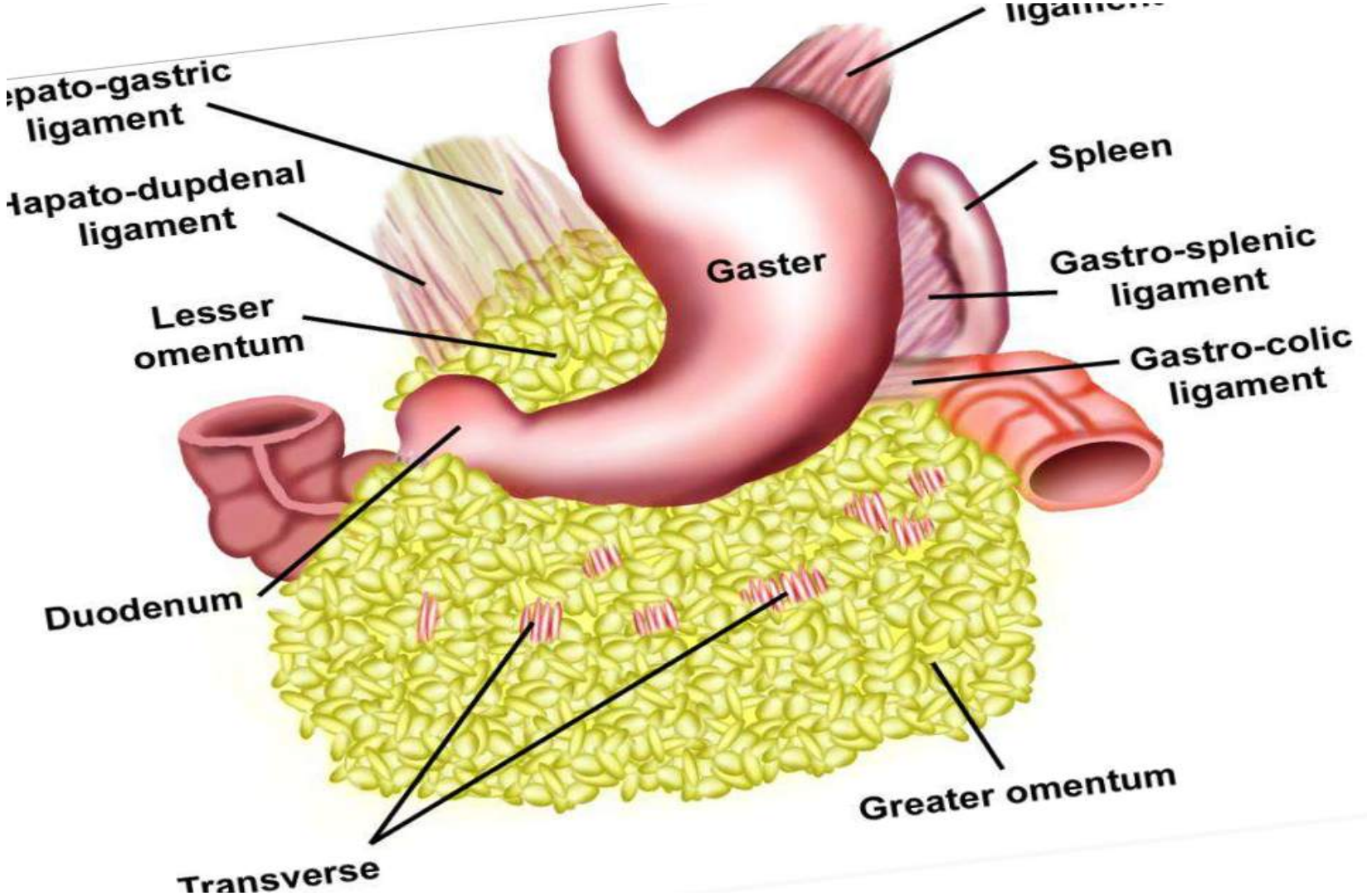
- **The *Greater Curvature* is much longer than the lesser curvature and extends from the left of the cardiac orifice, over the dome of the fundus, and along the left border of the stomach to the pylorus.**



STOMACH

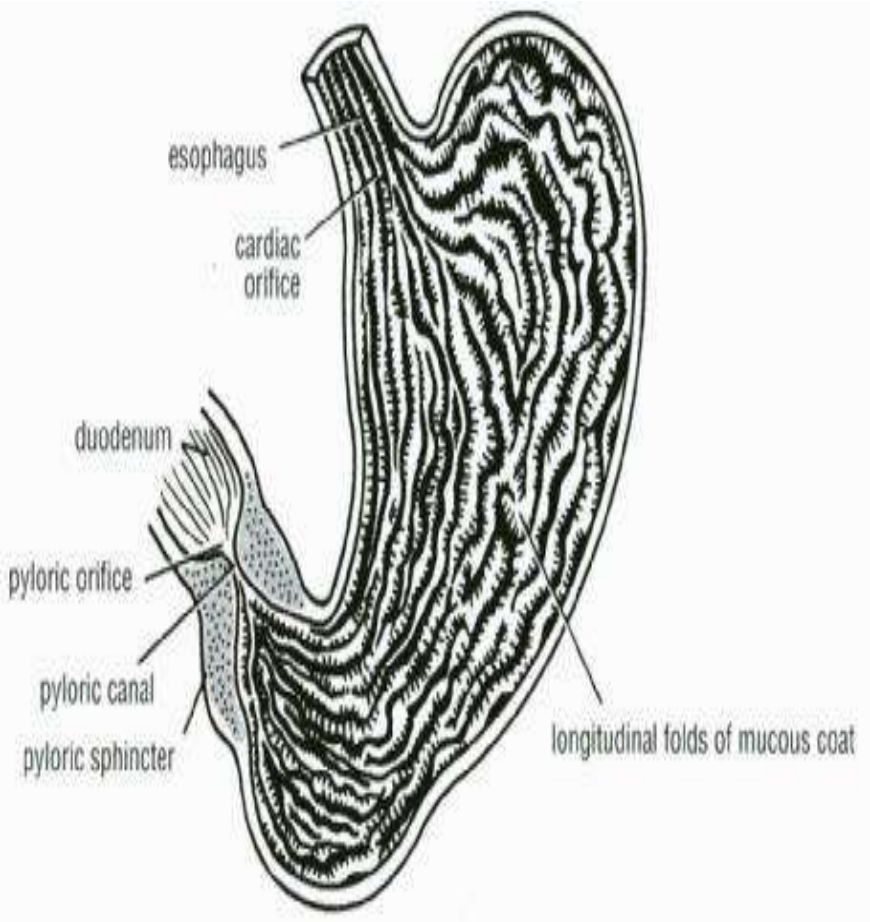
- ***The Gastro Splenic (ligament)*** **extends from the *upper part of the greater curvature to the spleen*.**
- **The *Greater Omentum* extends from the *lower part of the greater curvature to the transverse colon.***




epato-gastric ligament
Hapato-dupdenal ligament
Lesser omentum
Duodenum
Transverse
Gaster
Spleen
Gastro-splenic ligament
Gastro-colic ligament
Greater omentum

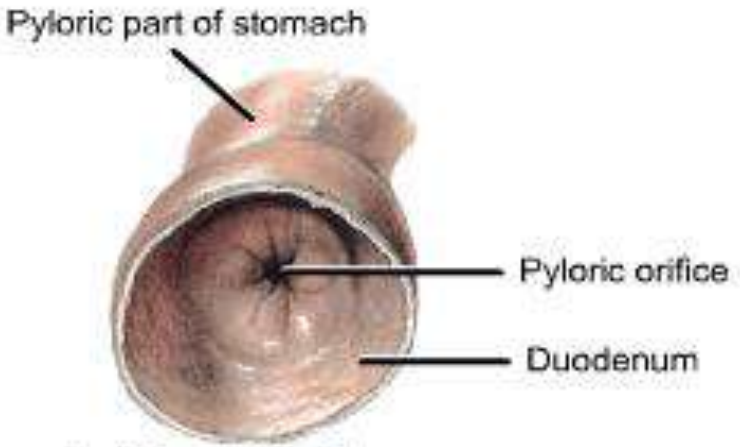
STOMACH

- **The cardiac orifice is where the esophagus enters the stomach.**
- **Although no anatomic sphincter can be demonstrated here, a physiologic mechanism exists. that prevents regurgitation of stomach contents into the esophagus.**



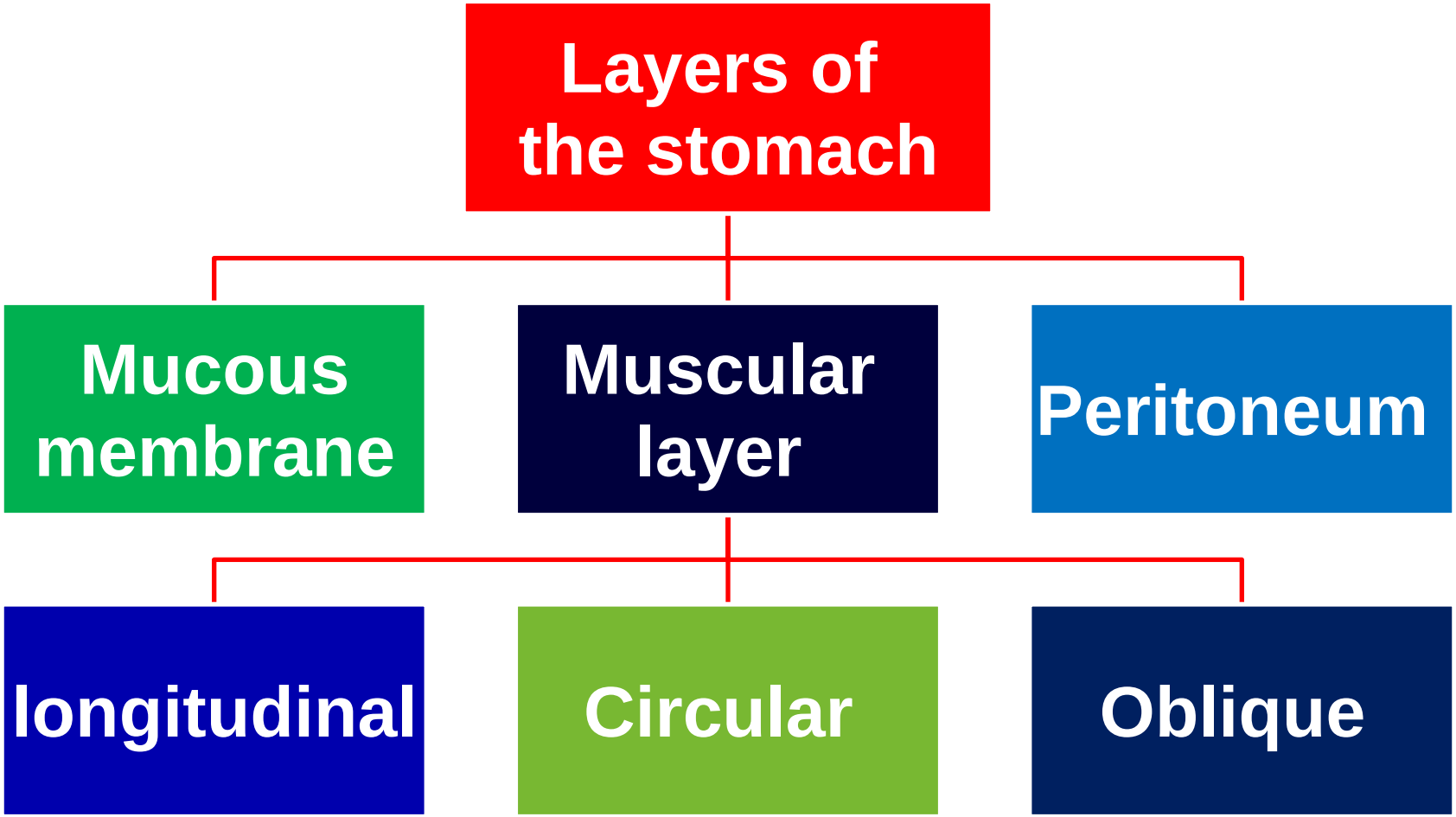
STOMACH

- **The pyloric orifice is formed by the pyloric canal, which is about (2.5 cm) long.**
- **The circular muscle coat of the stomach is much thicker here and forms the *Anatomic and Physiologic Pyloric Sphincter.***
- **The pylorus lies on the *Trans-Pyloric Plane*, and its position can be recognized by a slight constriction on the surface of the stomach.**
- **The pyloric sphincter controls the rate of discharge of the stomach contents into the duodenum.**

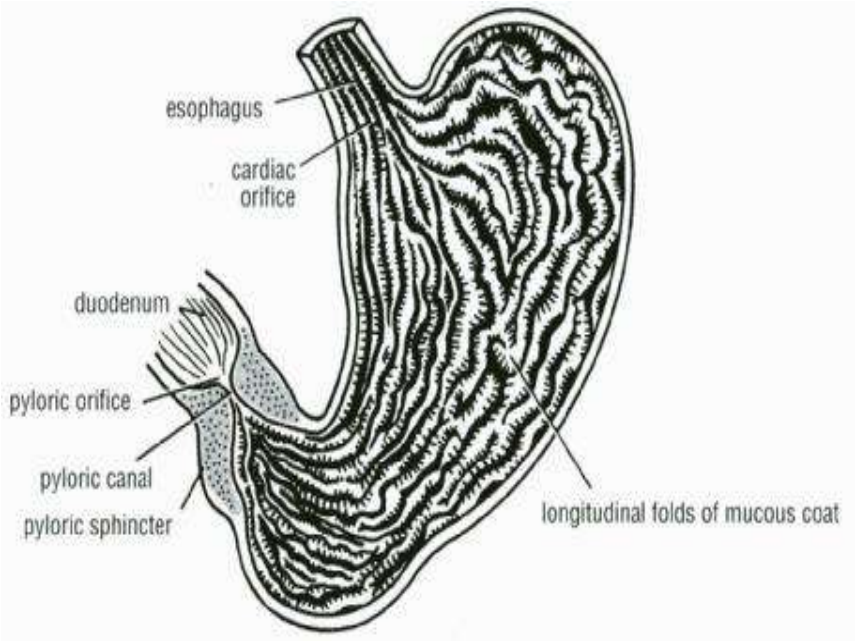


Interior of Duodenum

LAYERS OF THE STOMACH



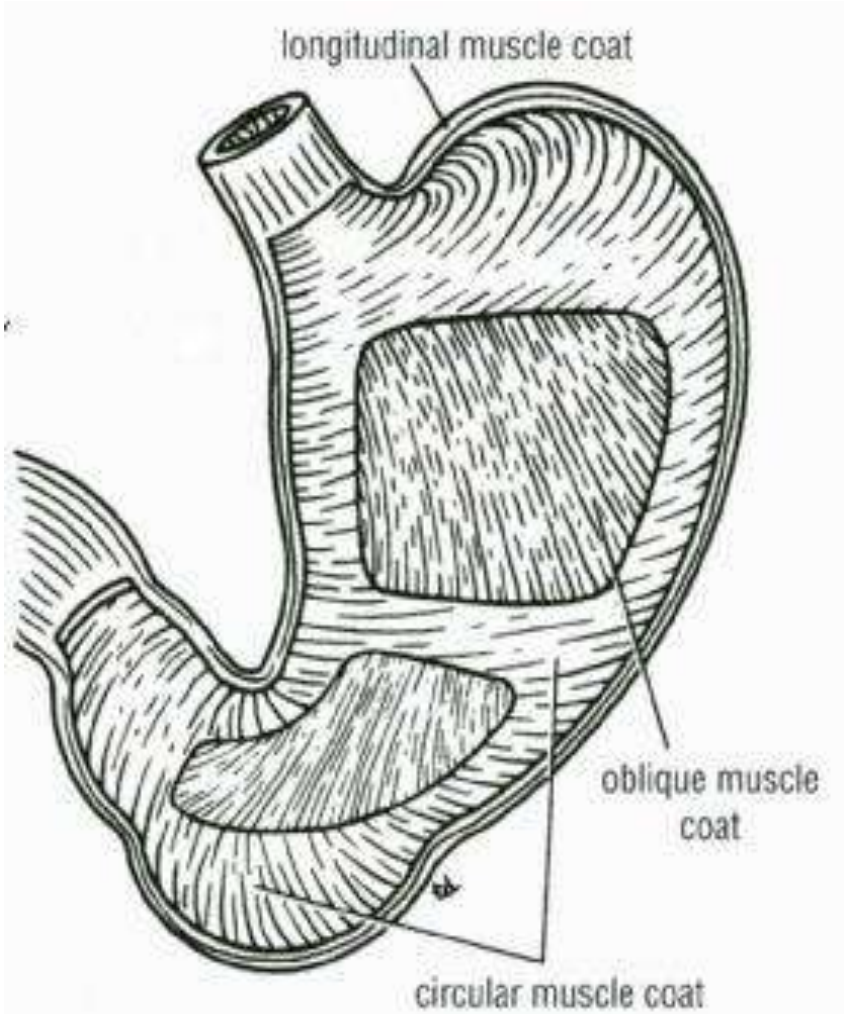
STOMACH



- **The *Mucous Membrane* of the stomach is thick and vascular and is thrown into numerous folds, or *Rugae*, that are mainly longitudinal in direction.**
- **The folds flatten out when the stomach is distended.**

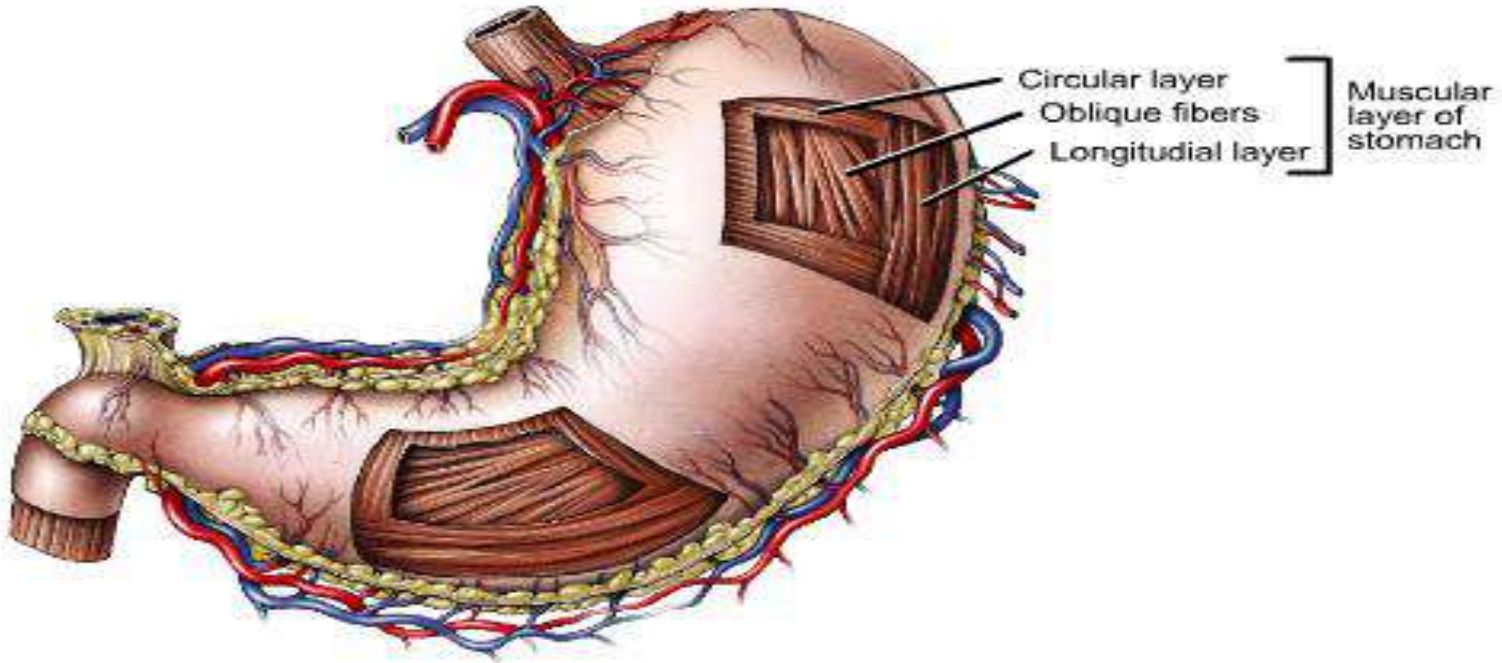
STOMACH

- **The *muscular wall* of the stomach contains longitudinal fibers, circular fibers, and oblique fibers.**
- **The *longitudinal fibers* are the most superficial and are the most concentrated along the curvatures.**



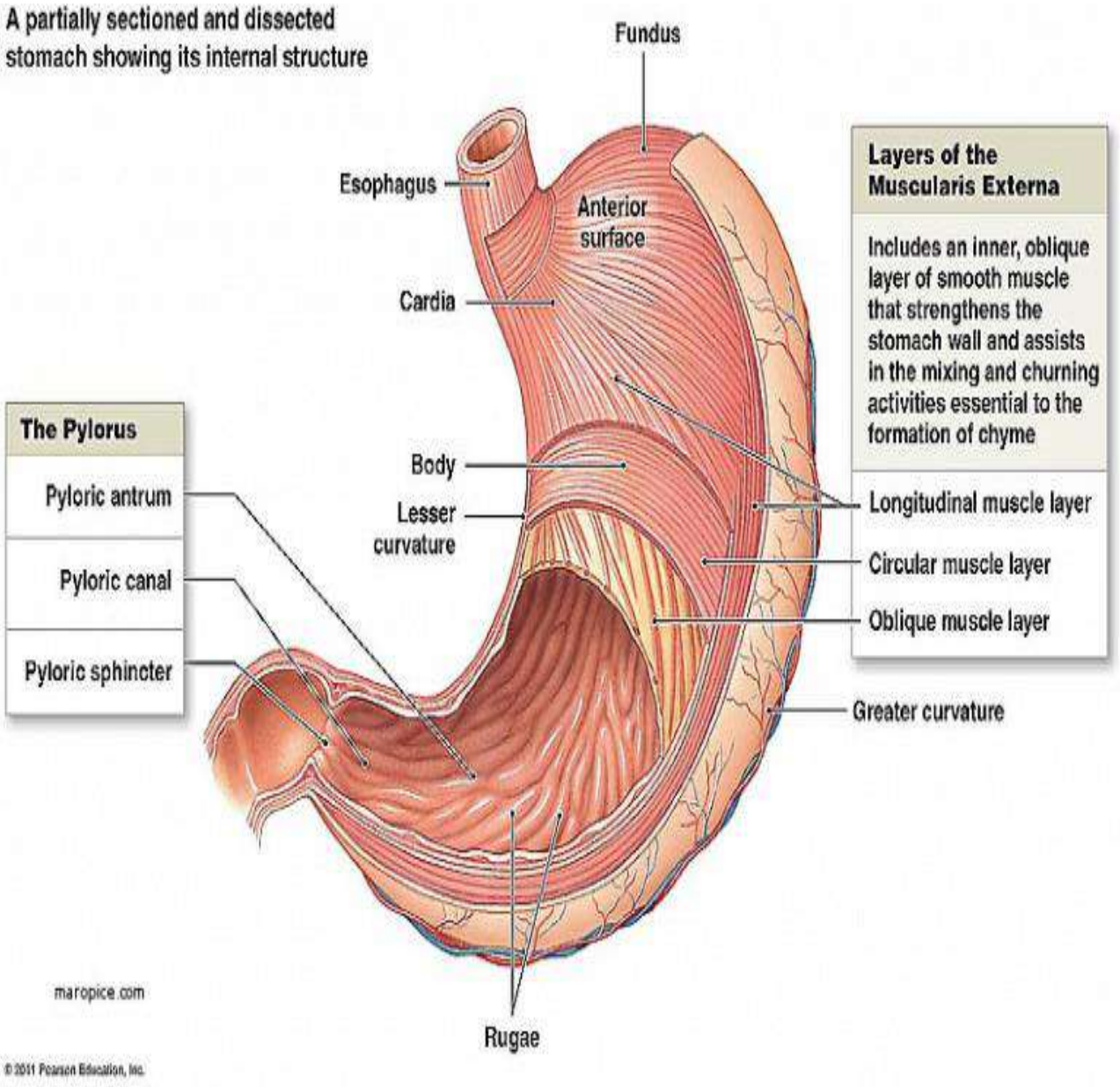
STOMACH

- **The inner *circular fibers* encircle the body of the stomach and are greatly thickened at the pylorus to form the pyloric sphincter.**
- **Few circular fibers are found in the region of the fundus.**



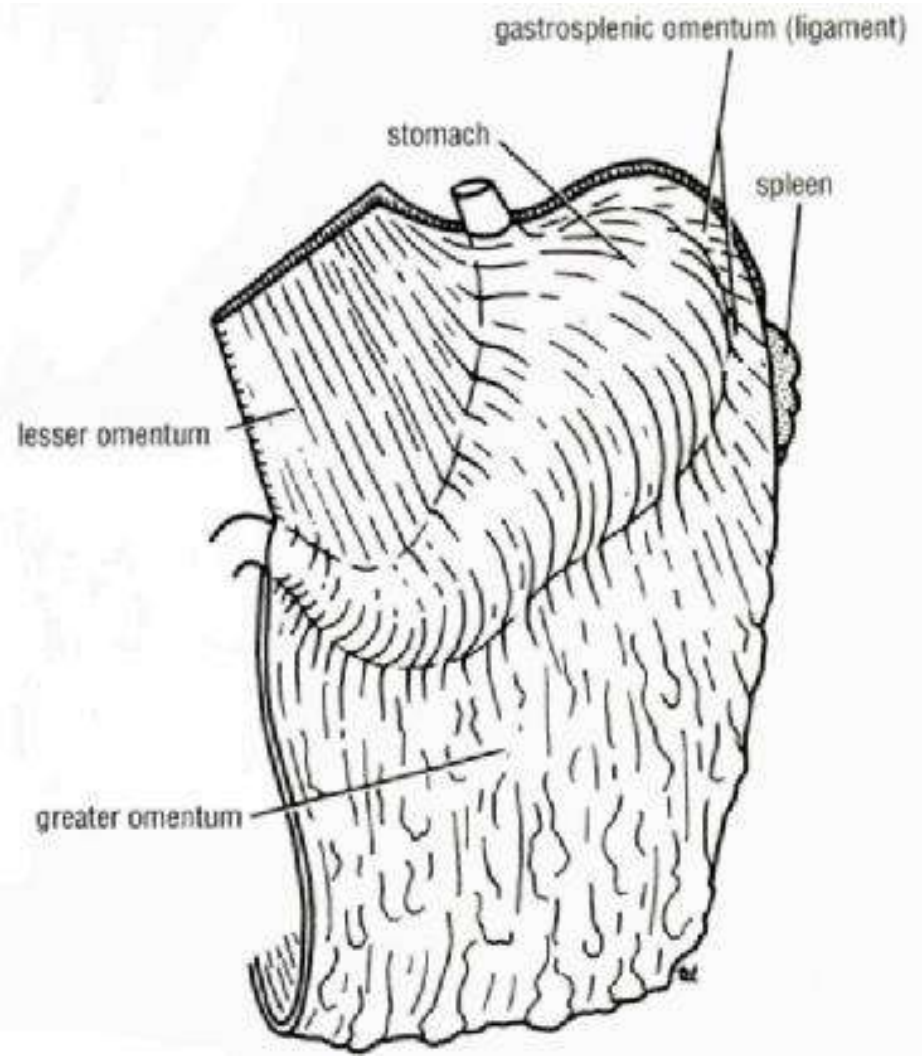
STOMACH

- The ***oblique fibers*** form the ***innermost muscle coat.***
- They loop over the fundus and pass down along the anterior and posterior walls, running parallel with the lesser curvature.



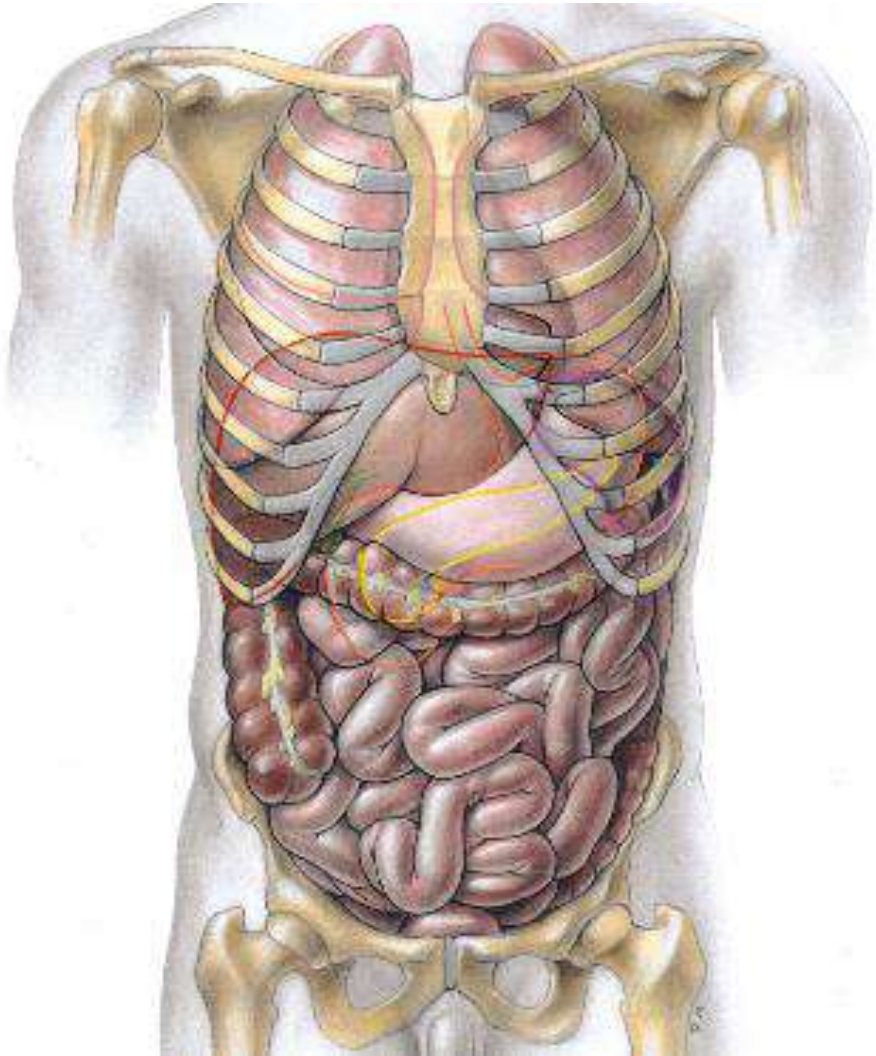
STOMACH

- **The *Peritoneum* (visceral peritoneum) completely surrounds the stomach.**
- **It leaves the lesser curvature as the *lesser Omentum* and the greater curvature as the *gastrosplenic* omentum and the *Greater Omentum*.**



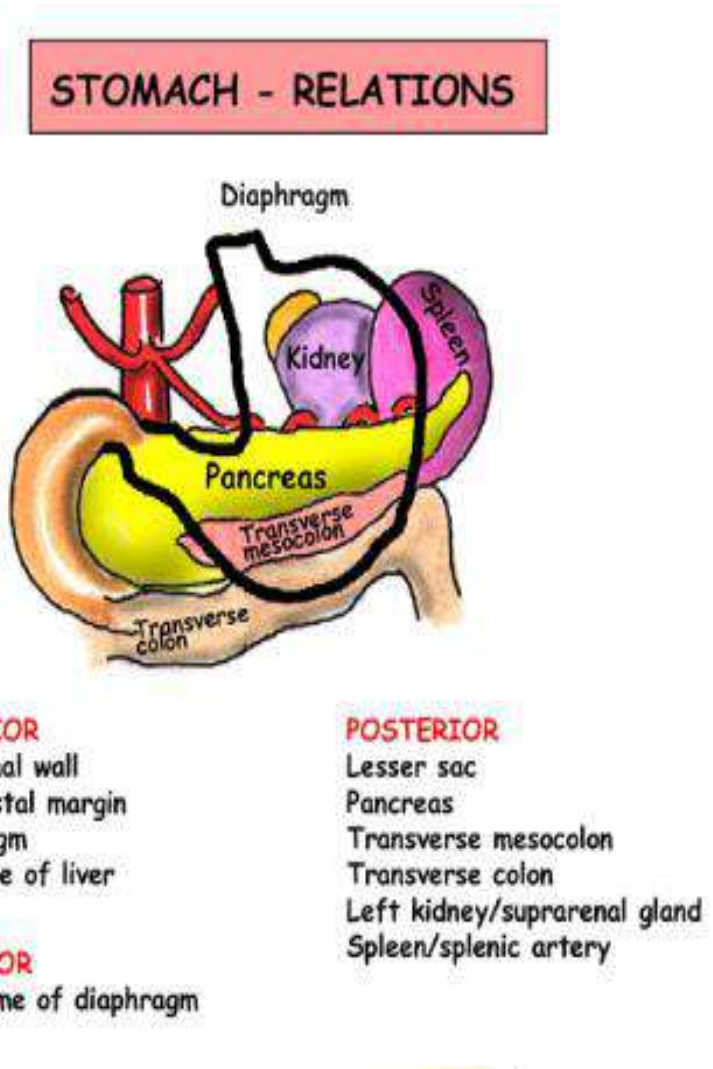
RELATIONS OF THE STOMACH

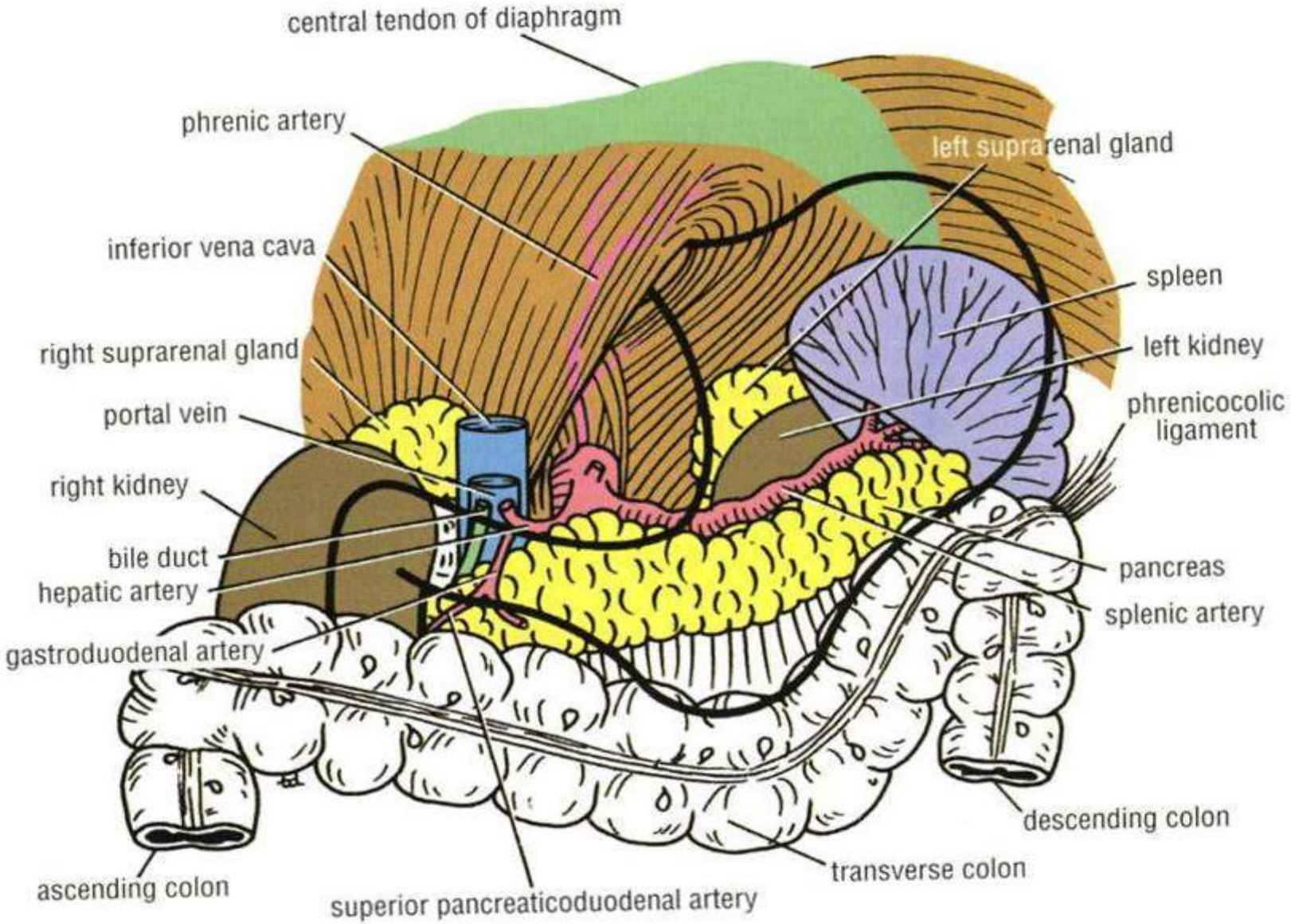
- ***Anteriorly:***
- **Anterior abdominal wall.**
- **Left costal margin.**
- **Left pleura and lung.**
- **Diaphragm.**
- **Left lobe of the liver.**



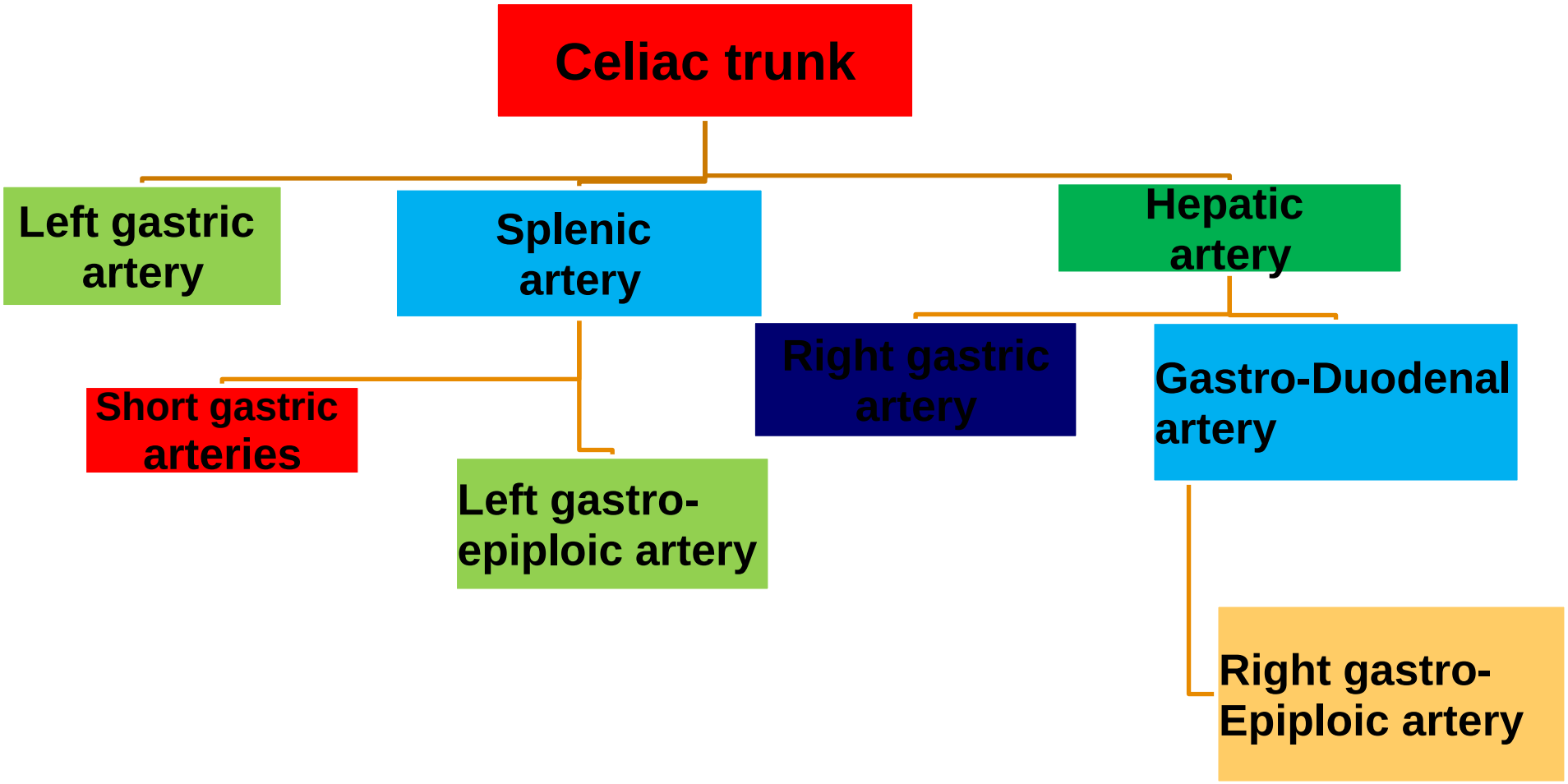
RELATIONS OF THE STOMACH

- ***Posteriorly: Stomach Bed***
- **lesser sac.**
- **Diaphragm.**
- **Spleen.**
- **Splenic artery.**
- **Left suprarenal gland.**
- **Upper part of the left kidney**
- **Pancreas.**
- **Transverse mesocolon.**
- **Transverse colon.**



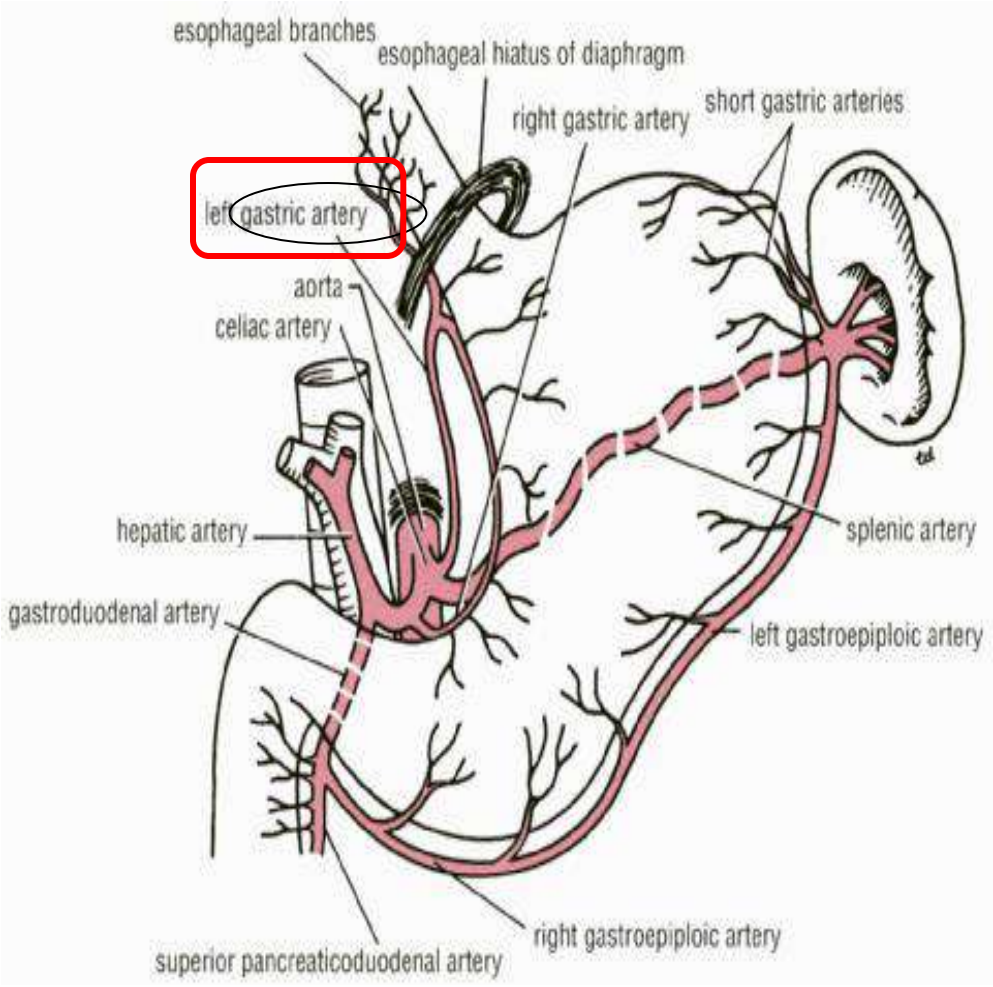

central tendon of diaphragm
phrenic artery
left suprarenal gland
inferior vena cava
spleen
right suprarenal gland
left kidney
portal vein
phrenicocolic ligament
right kidney
bile duct
pancreas
hepatic artery
splenic artery
gastroduodenal artery
descending colon
transverse colon
ascending colon
superior pancreaticoduodenal artery

BLOOD SUPPLY OF THE STOMACH



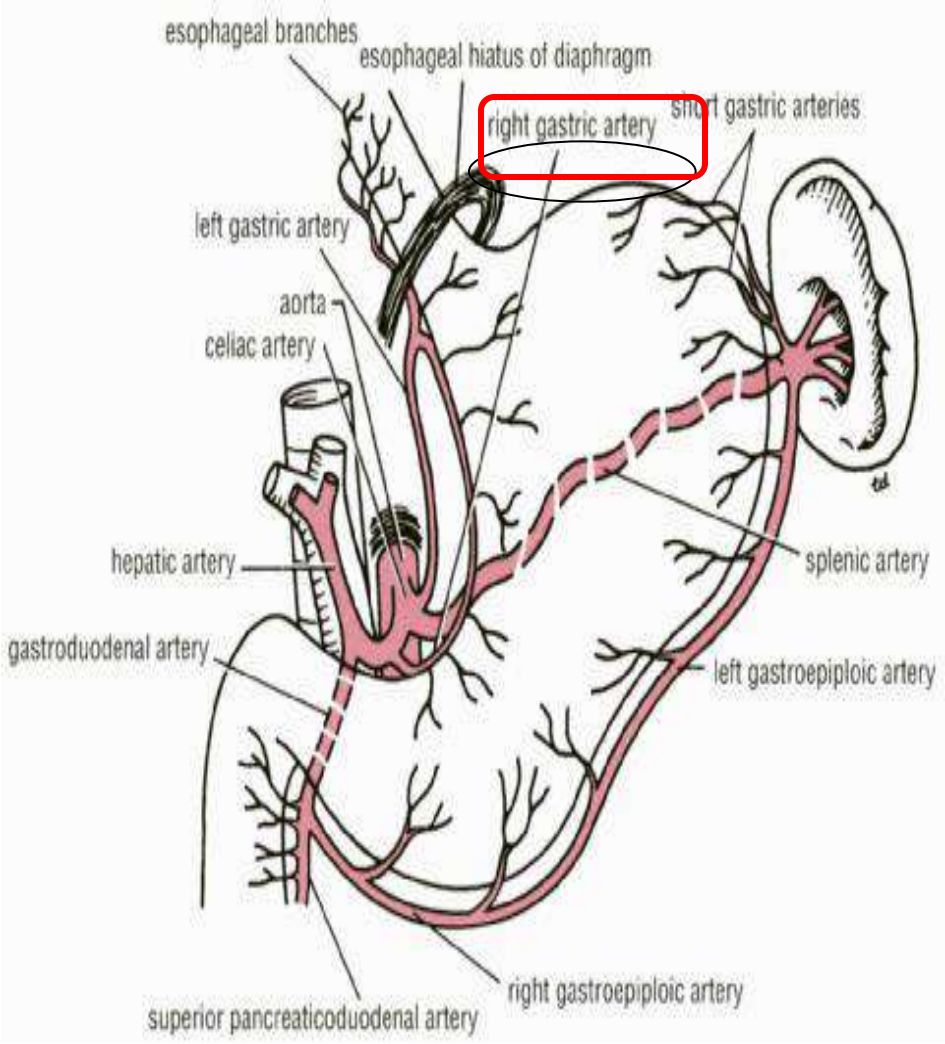
BLOOD SUPPLY OF THE STOMACH

- **The *left Gastric Artery* passes upward and to the left to reach the esophagus and 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.**



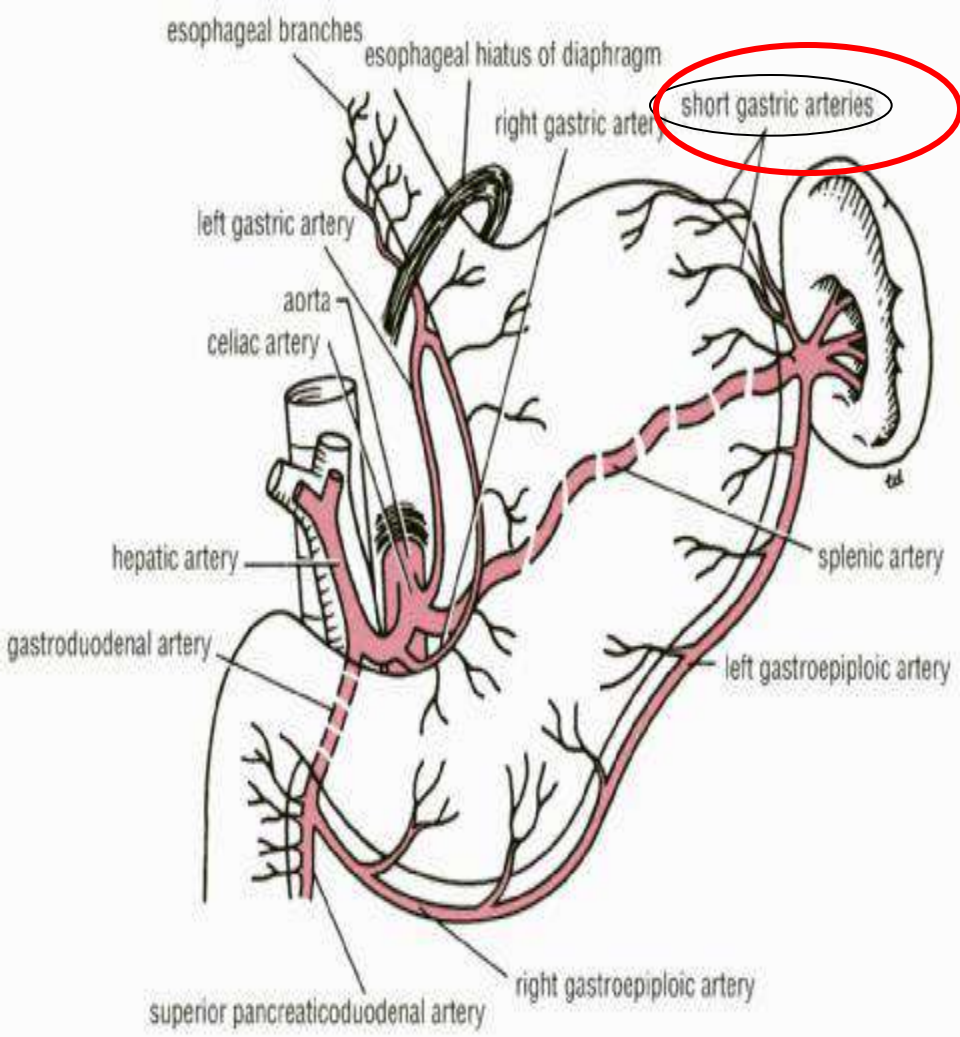
BLOOD SUPPLY OF THE STOMACH

- **The *Right Gastric Artery* arises from the Hepatic artery at the upper border of the pylorus and runs to the left along the lesser curvature.**
- **It supplies the lower right part of the stomach.**



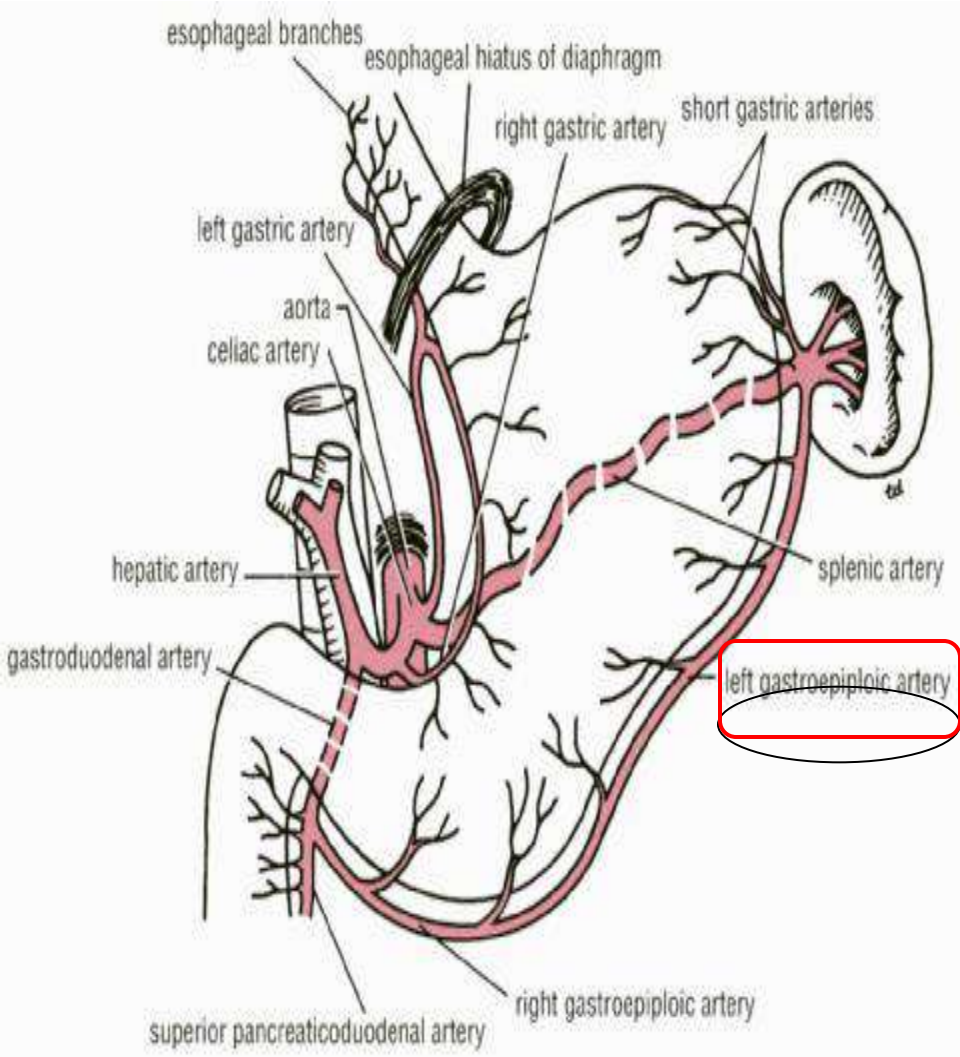
BLOOD SUPPLY OF THE STOMACH

- **The *Short Gastric Arteries* arise from the Splenic Artery at the hilum of the spleen and pass forward in the gastrosplenic (ligament) to supply the fundus.**



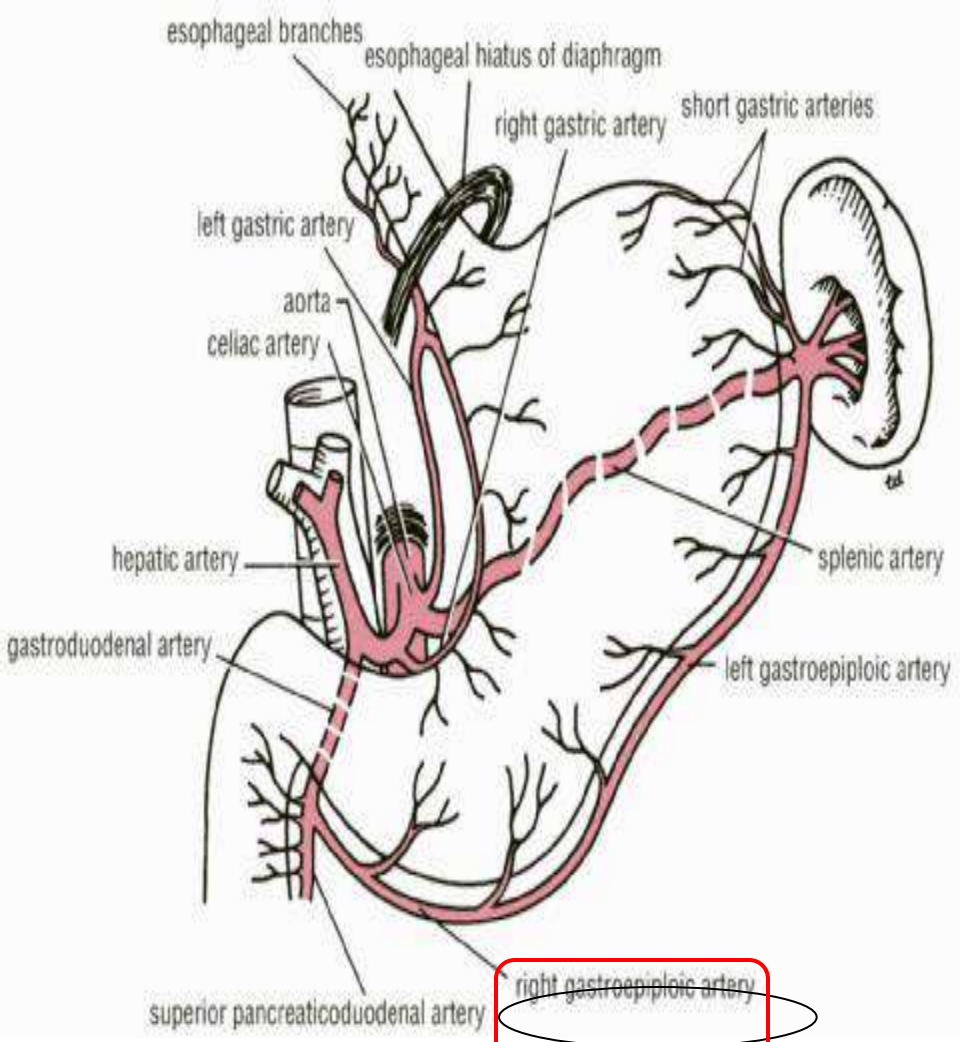
BLOOD SUPPLY OF THE STOMACH

- **The *Left Gastroepiploic Artery* arises from the splenic artery at the hilum of the spleen and passes forward in the gastrosplenic omentum (ligament) to supply the stomach along the upper part of the greater curvature.**



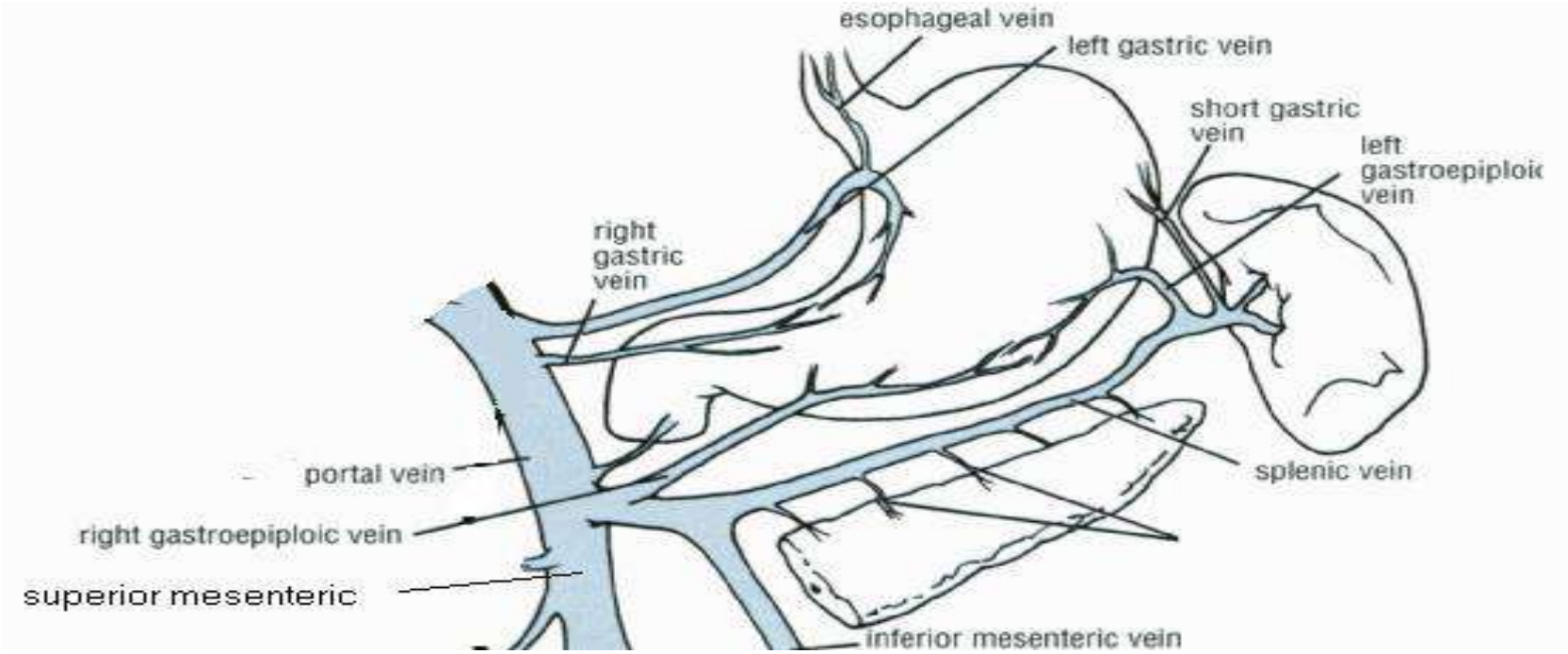
BLOOD SUPPLY OF THE STOMACH

- **The *Right Gastroepiploic Artery* arises from the gastro duodenal branch of the hepatic artery.**
- **It passes to the left and supplies the stomach along the lower part of the greater curvature.**



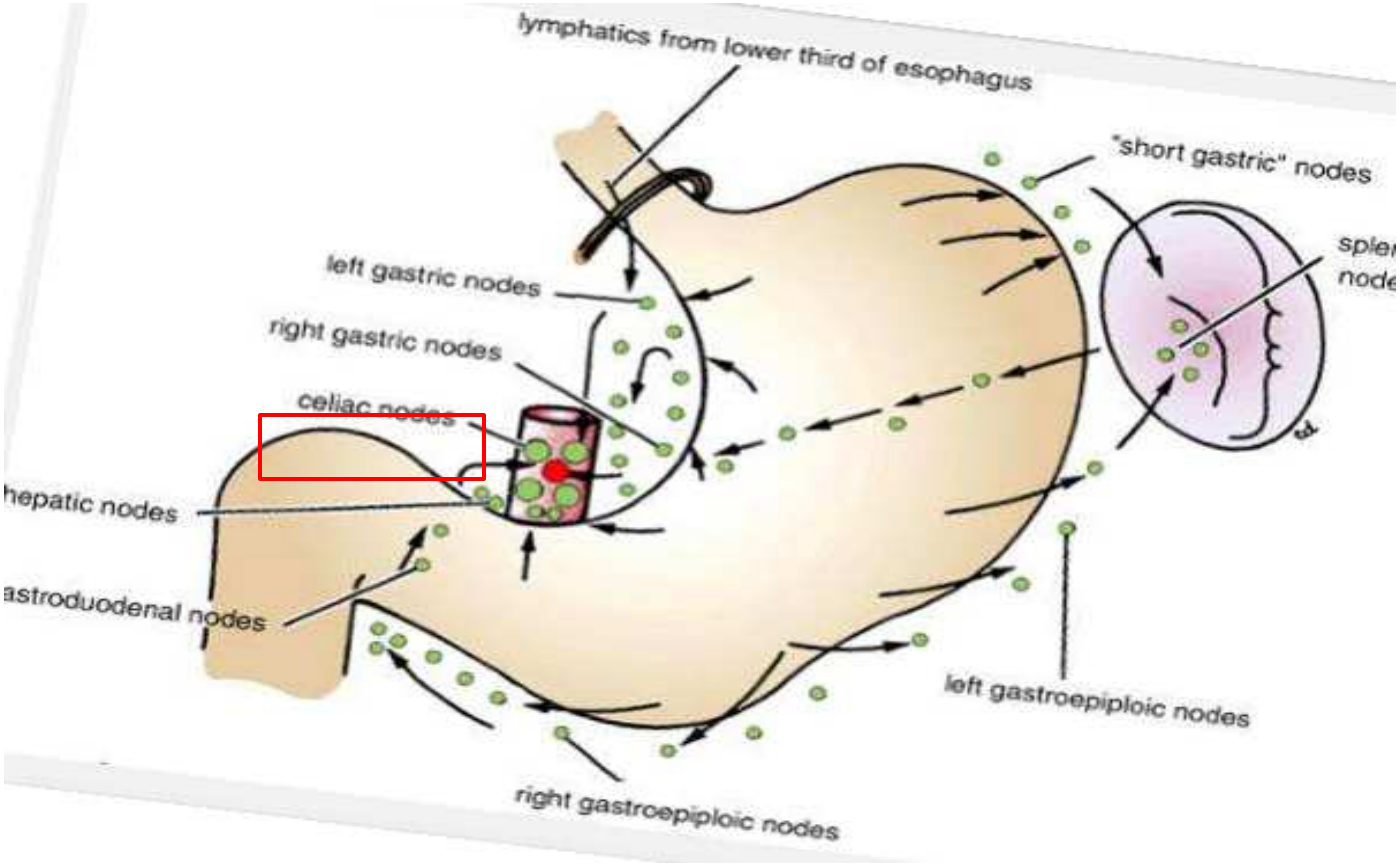
VENOUS DRAINAGE OF THE STOMACH

- The veins drain into ***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.**

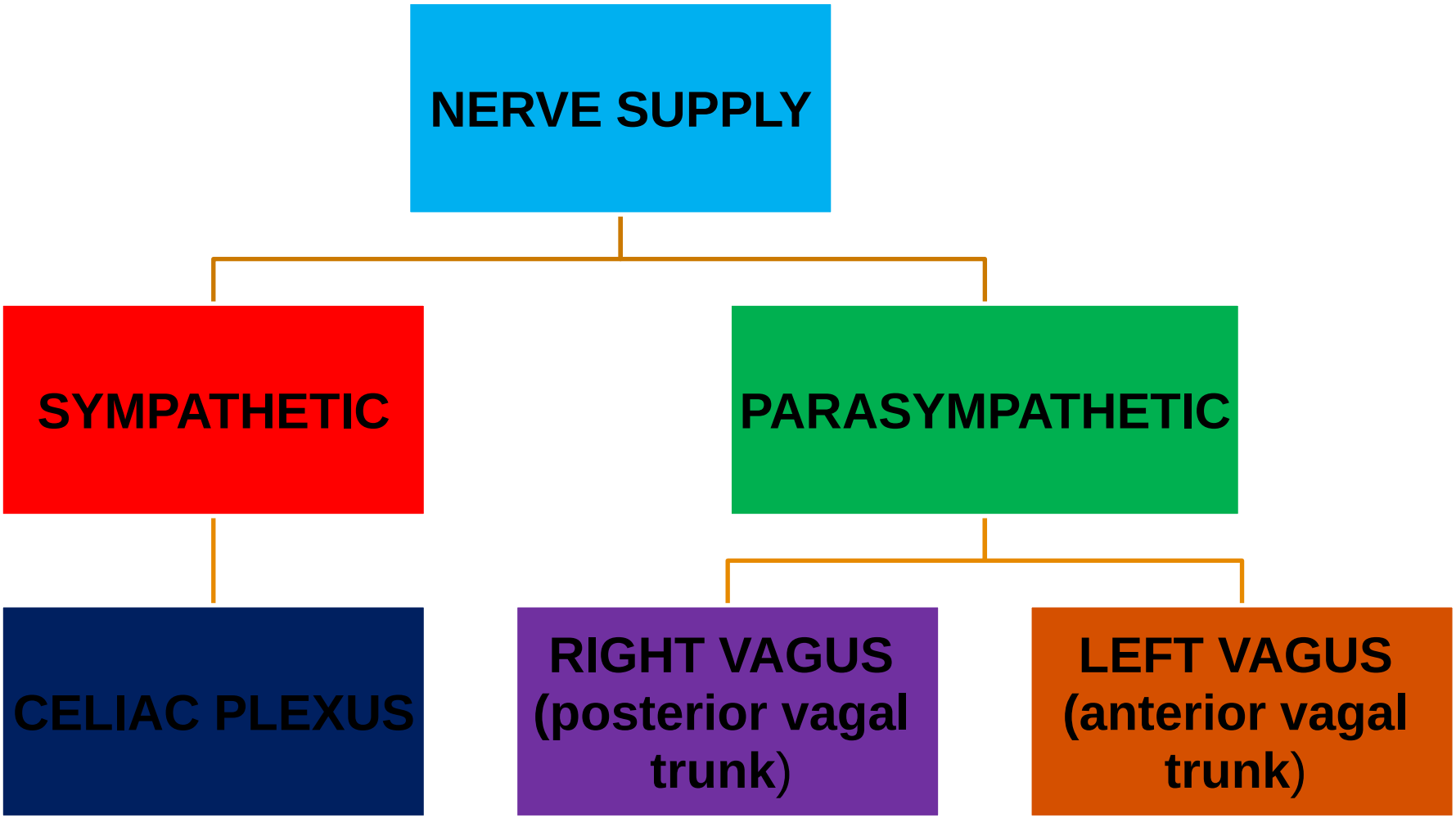


LYMPH DRAINAGE OF THE STOMACH

- **The lymph vessels follow the arteries.**
- **All lymph from the stomach eventually passes to the celiac nodes located around the root of the Celiac Artery on the posterior abdominal wall *(Celiac lymph nodes).***

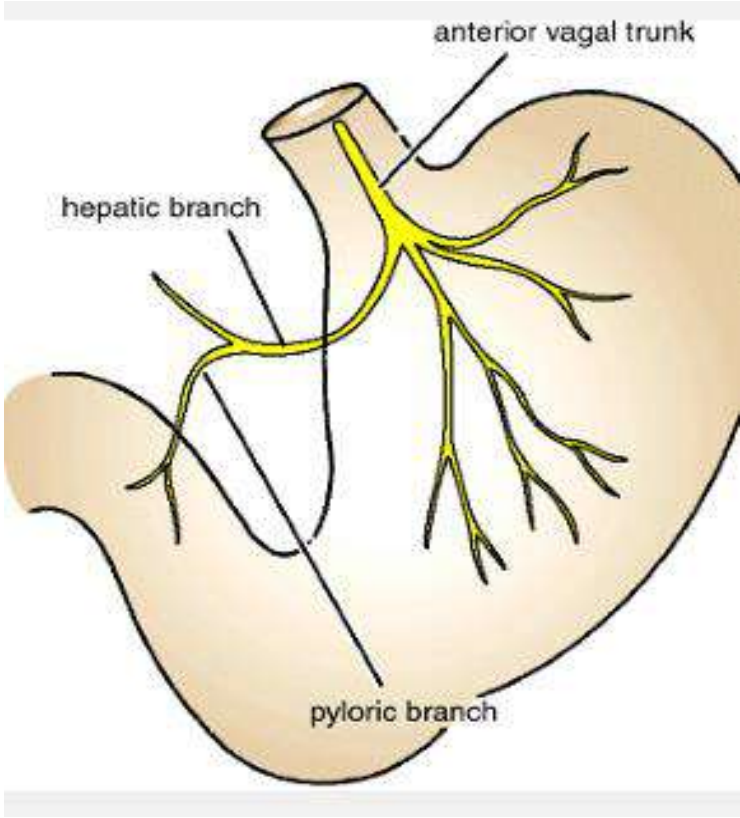


NERVE SUPPLY OF THE STOMACH



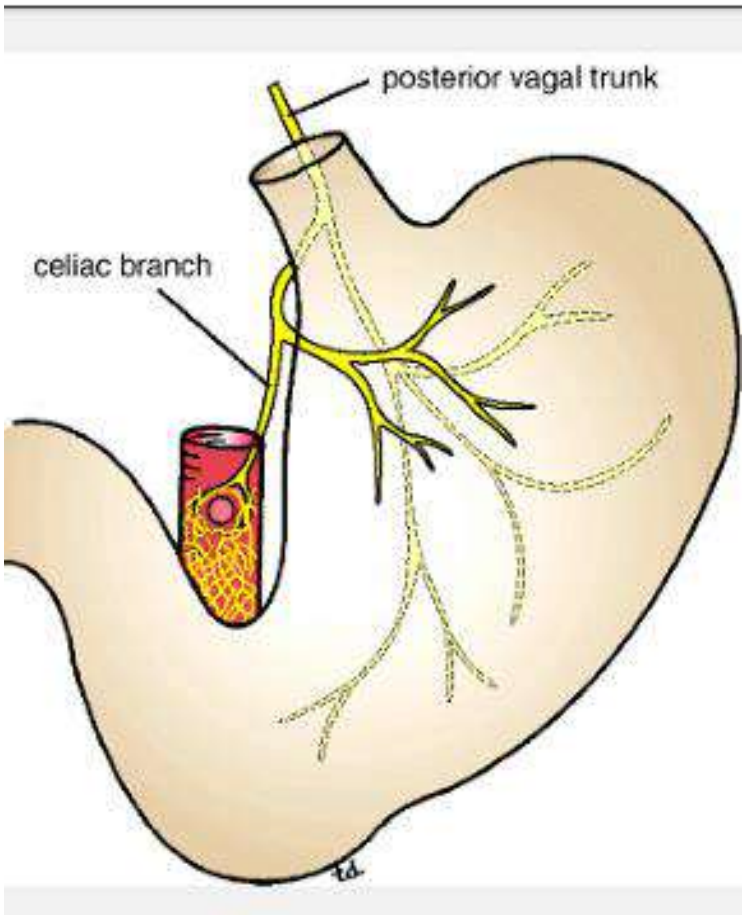
NERVE SUPPLY OF THE STOMACH

- ***The Anterior Vagal Trunk,*** **enters the abdomen on the anterior surface of the esophagus.**
- **The trunk, which may be Single or Multiple, then divides into branches that supply the anterior surface of the stomach.**
- **A large *Hepatic Branch* passes up to the liver, and from this a *Pyloric Branch* passes down to the pylorus.**



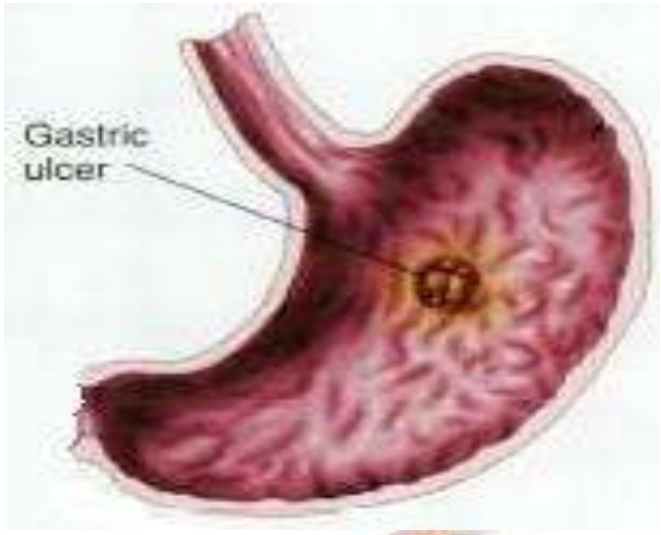
NERVE SUPPLY OF THE STOMACH

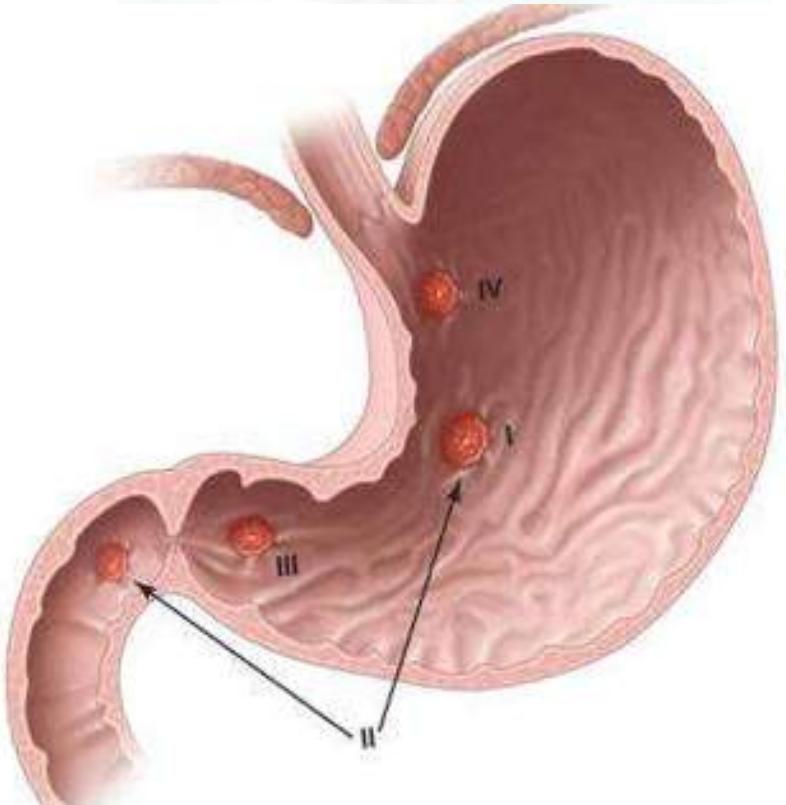
- **The *Posterior Vagal Trunk*, enters the abdomen on the posterior surface of the esophagus.**
- **The *Single Trunk* then divides into branches that supply mainly the posterior surface of the stomach.**
- **A large branch passes to the celiac and superior mesenteric plexuses and is distributed to the intestine as far as the splenic flexure and to the pancreas.**



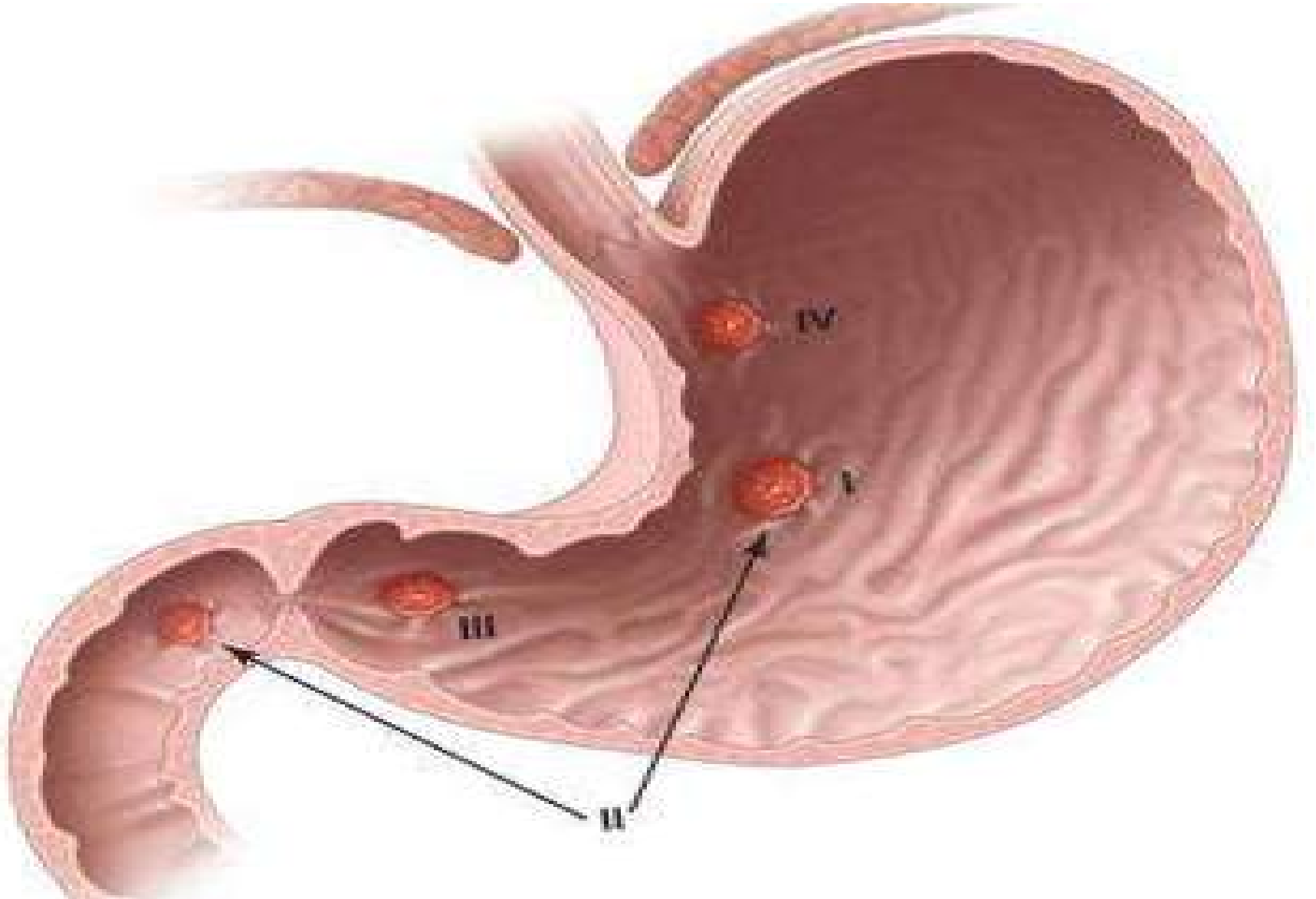
GASTRIC ULCER

- **Gastric ulcers occur in the alkaline-producing mucosa of the stomach, usually on or close to the lesser curvature.**
- **A chronic ulcer invades the muscular coats and, in time, involves the peritoneum so that the stomach adheres to neighboring structures.**
- **An ulcer situated on the posterior wall of the stomach may perforate into the lesser sac or become adherent to the pancreas.**
- **Erosion of the pancreas produces pain referred to the back.**





Types of gastric ulcers

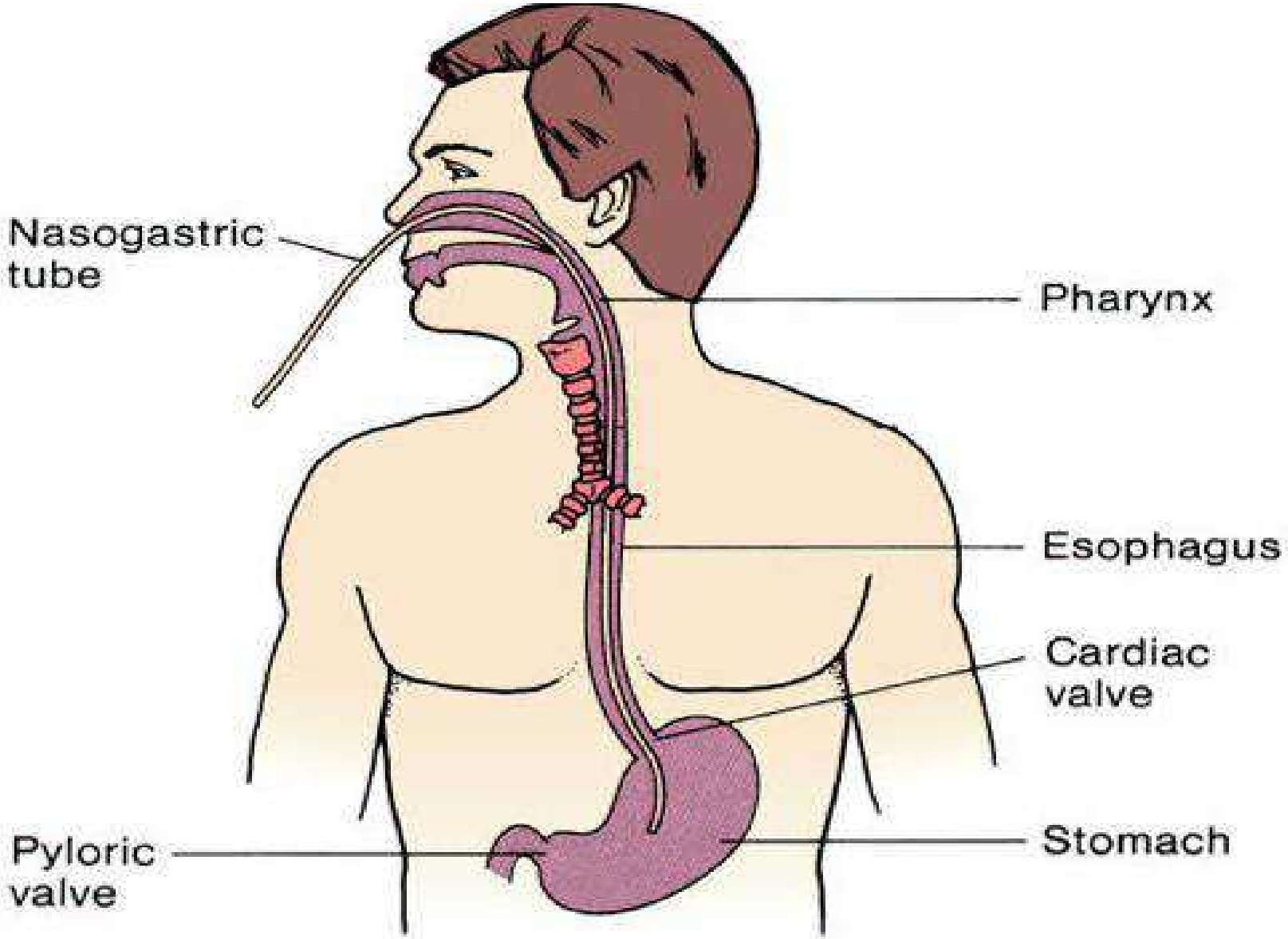


GASTROSCOPY

- **Gastroscopy is the viewing of the mucous membrane of the stomach through an illuminated tube fitted with a lens system.**
- **The patient is anesthetized and the gastroscope is passed into the stomach, which is then inflated with air.**
- **With a flexible fiber optic instrument, direct visualization of different parts of the gastric mucous membrane is possible.**
- **It is also possible to perform a mucosal biopsy through a gastroscope.**

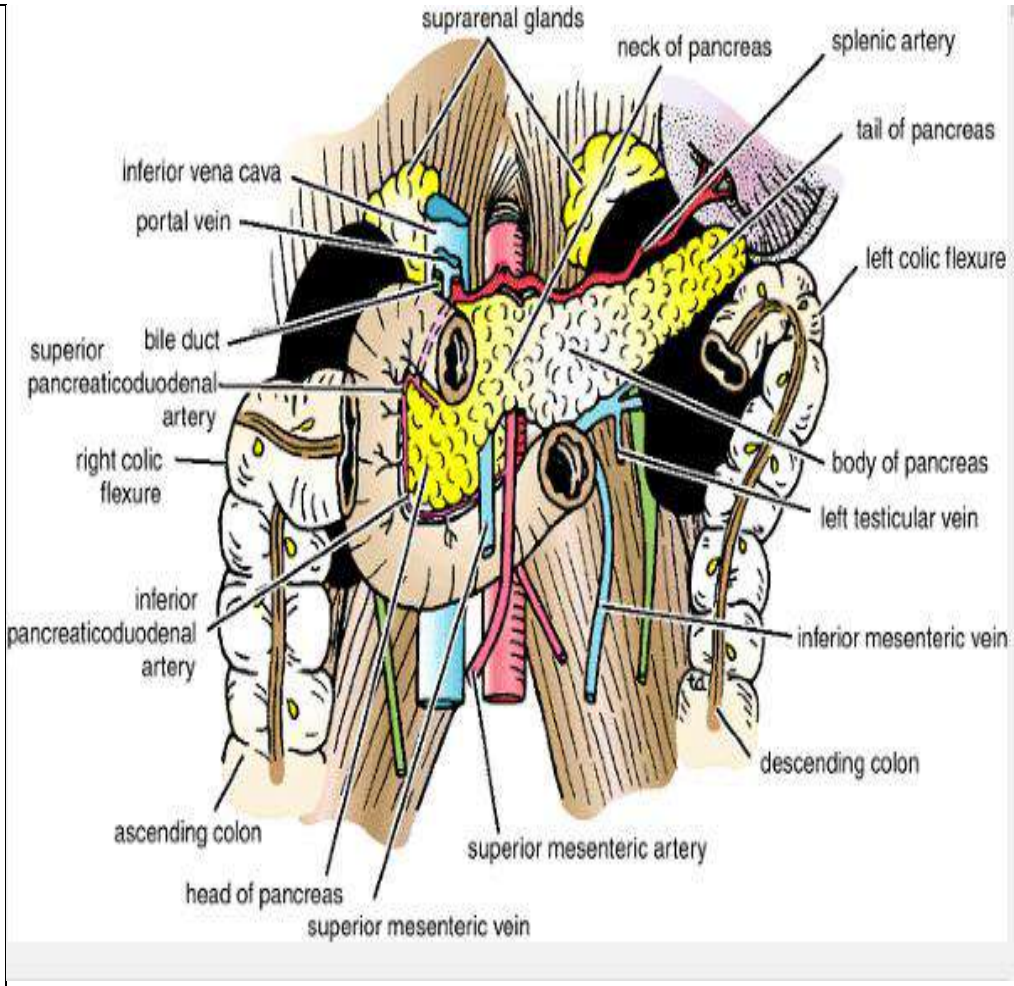
NASOGASTRIC INTUBATION

- **Nasogastric intubation is a common procedure and is per formed to:**
- **Empty the stomach.**
- **Decompress the stomach in cases of intestinal obstruction.**
- **Before operations on the gastrointestinal tract.**
- **Obtain a sample of gastric juice for biochemical analysis.**


Nasogastric tube
Pharynx
Esophagus
Cardiac valve
Stomach
Pyloric valve

SMALL INTESTINE
Duodenum

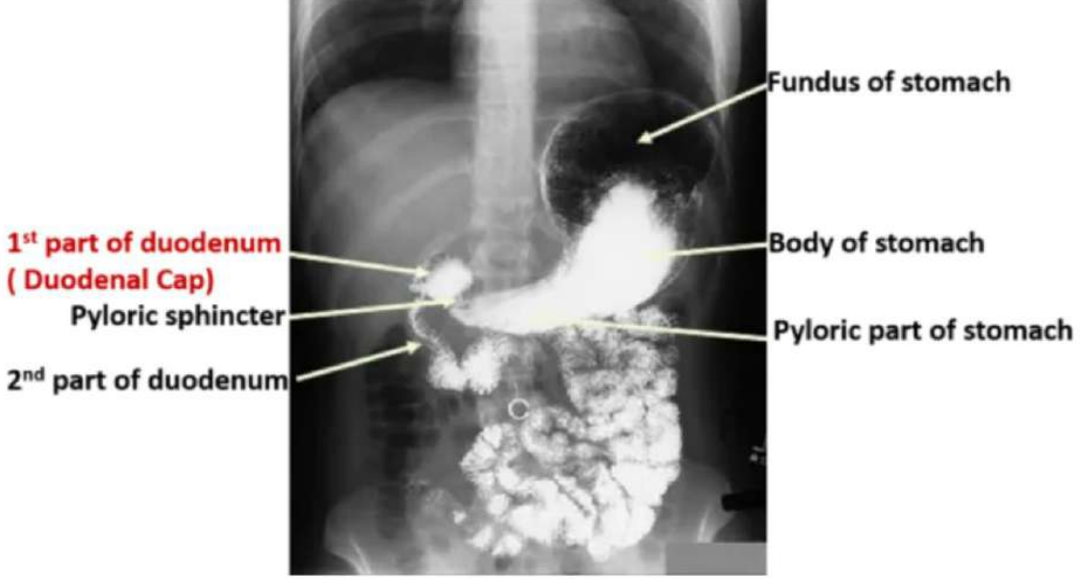
- **The duodenum is a C-shaped tube, about (25 cm) long, that joins the stomach to the jejunum.**
- **It is important because it receives the openings of the bile and pancreatic ducts.**
- **The duodenum curves around the head of the pancreas.**

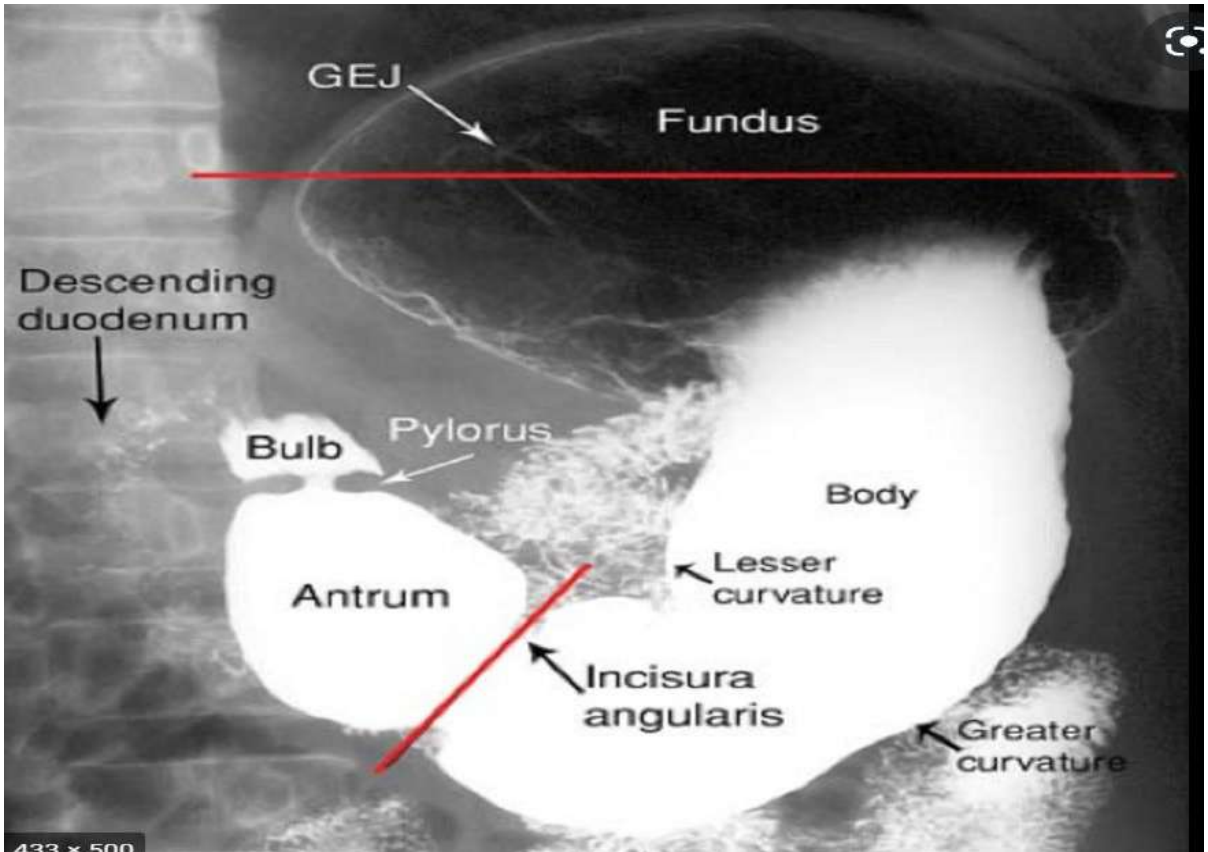


Duodenum

- **The first inch of the duodenum resembles the stomach in that it is *Intraperitoneal* covered on its anterior and posterior surfaces with peritoneum the lesser sac lies behind this short segment. *Duodenal cap***

- **The remainder of the duodenum is *Retro-Peritoneal*, being only partially covered by peritoneum.**


Fundus of stomach
1st part of duodenum
(Duodenal Cap)
Body of stomach
Pyloric sphincter
Pyloric part of stomach
2nd part of duodenum

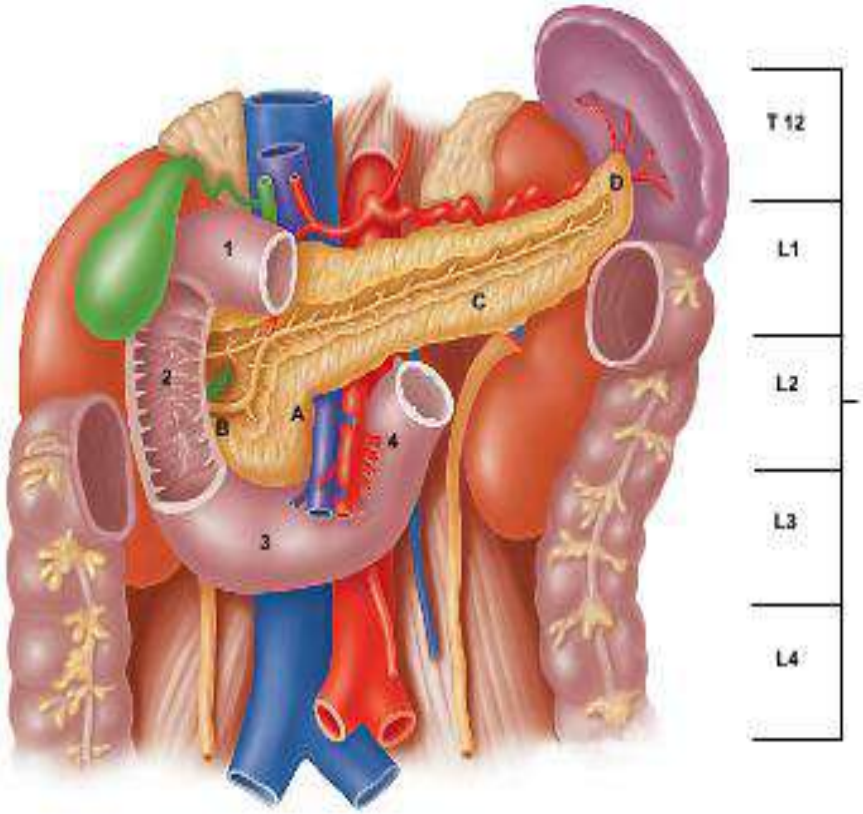

GEJ
Fundus
Descending
duodenum
Bulb
Pylorus
Body
Lesser
curvature
Antrum
Incisura
angularis
Greater
curvature
433 × 500

Parts of the Duodenum

- **The Duodenum is situated in the Epigastric and Umbilical regions and, for purposes of description, is divided into four parts.**

First Part of the Duodenum

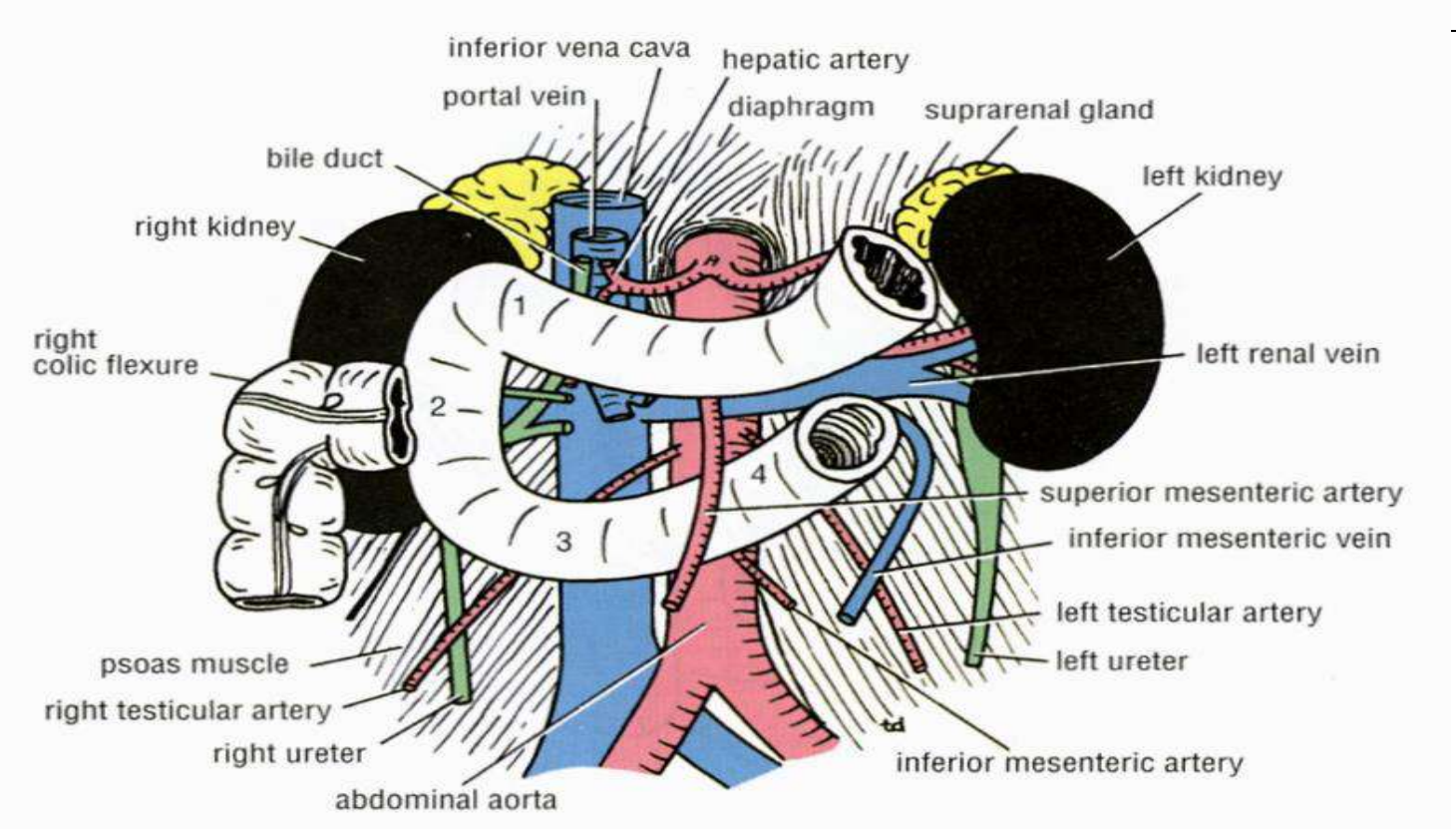
- **The first part of the duodenum is *(2 inch)* long and begins at the pylorus and runs upward and backward on the right side of the L1.**
- **It thus lies on the Trans-Pyloric plane L1.**

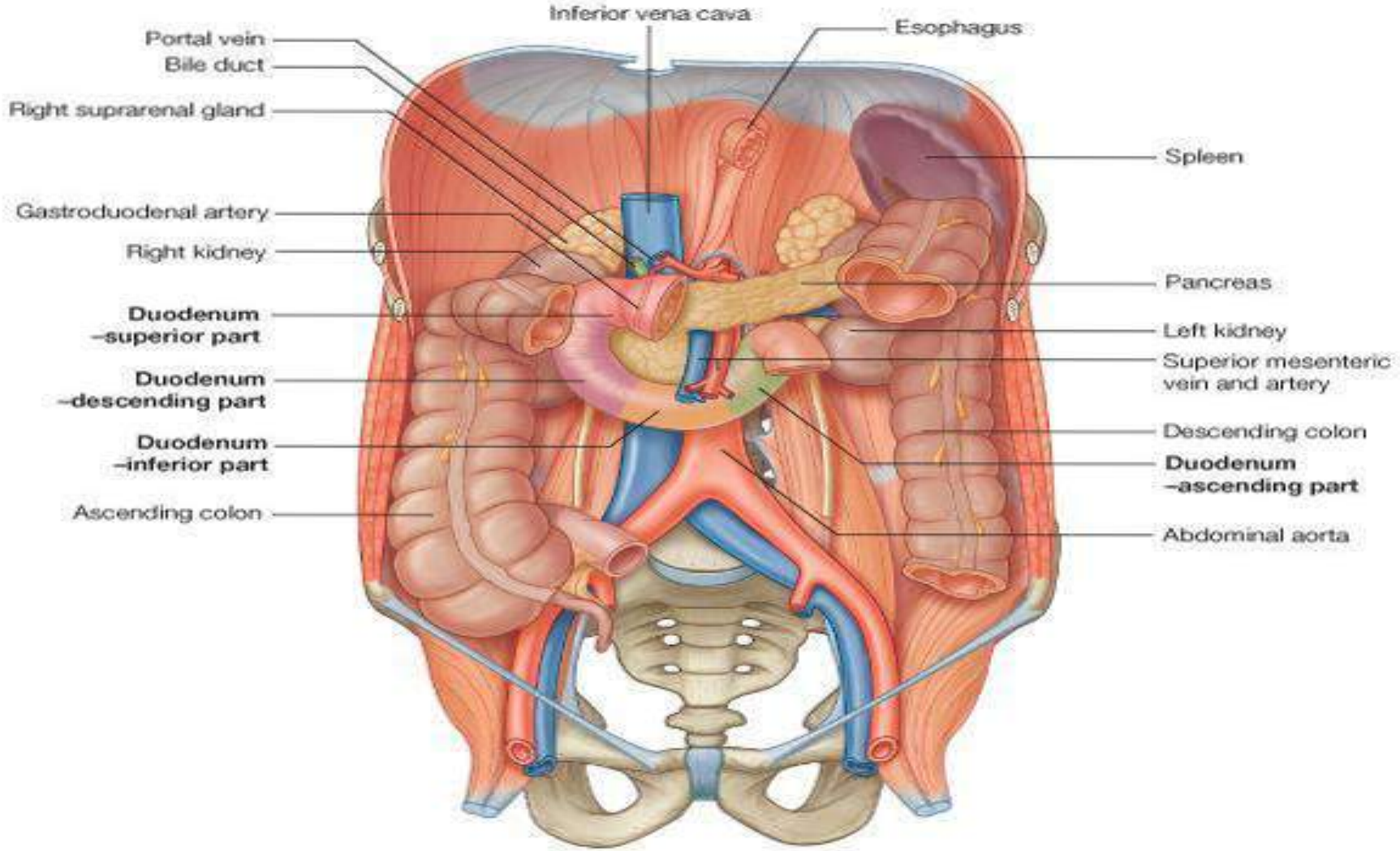


Parts of the Duodenum

The *relations* of the first part are:

- *Anteriorly:* The quadrate lobe of the liver and the *Gall Bladder.*
- *Posteriorly:* The lesser sac (first inch only), the gastro duodenal artery, the bile duct and portal vein, and the inferior vena cava.
- *Superiorly:* The entrance into the lesser sac (the Epiploic Foramen).
- *Inferiorly:* The head of the pancreas.




Inferior vena cava
Esophagus
Portal vein
Bile duct
Right suprarenal gland
Spleen
Gastroduodenal artery
Right kidney
Pancreas
Duodenum –superior part
Left kidney
Superior mesenteric vein and artery
Duodenum –descending part
Descending colon
Duodenum –inferior part
Duodenum –ascending part
Ascending colon
Abdominal aorta

Relations of 1st Part of Duodenum

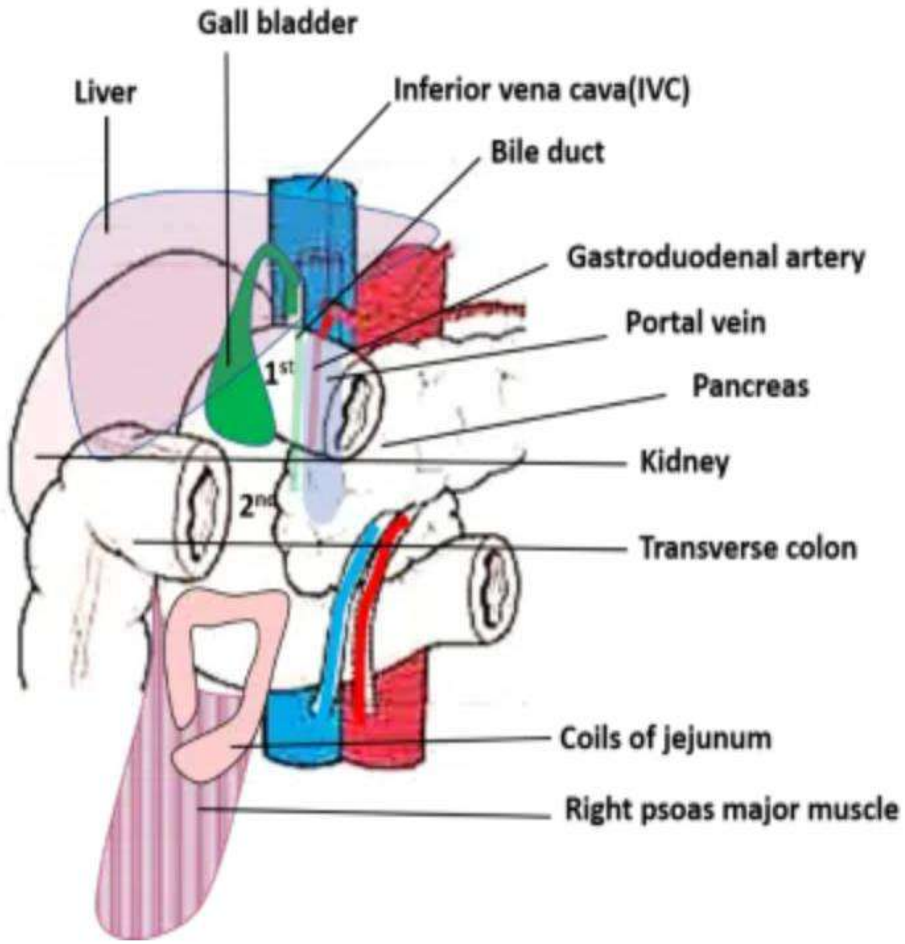
Anterior: Liver, Gall bladder

Posterior: Bile duct, Portal vein
Gastroduodenal artery
Behind all these IVC

Relations of 2nd Part of Duodenum

Anterior: Liver, Transverse colon, Coils of jejunum

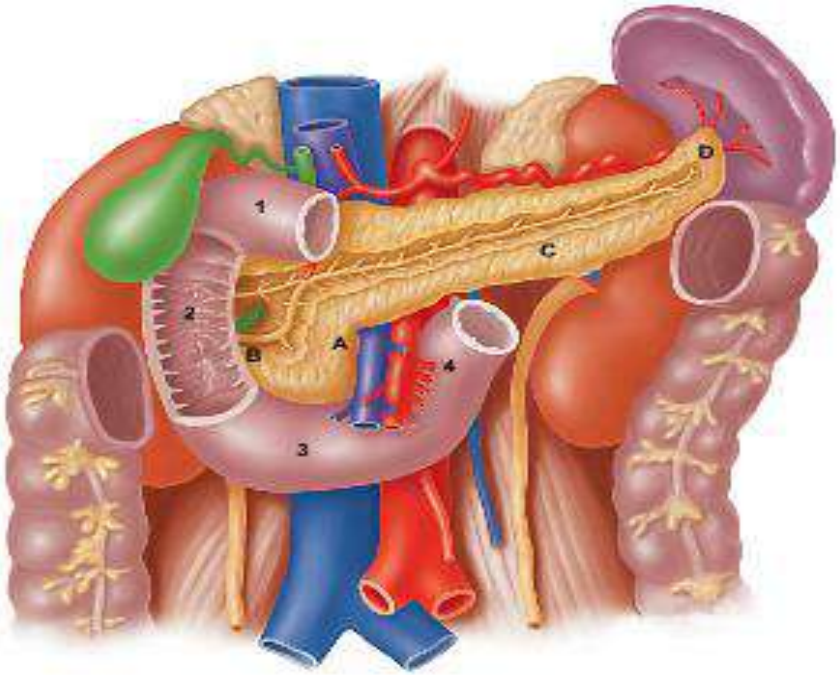
Posterior: Right kidney, Inferior vena cava
Right psoas major

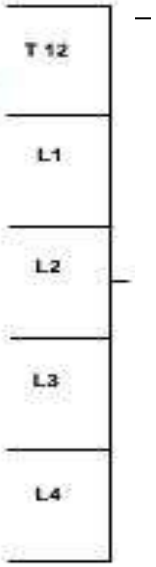


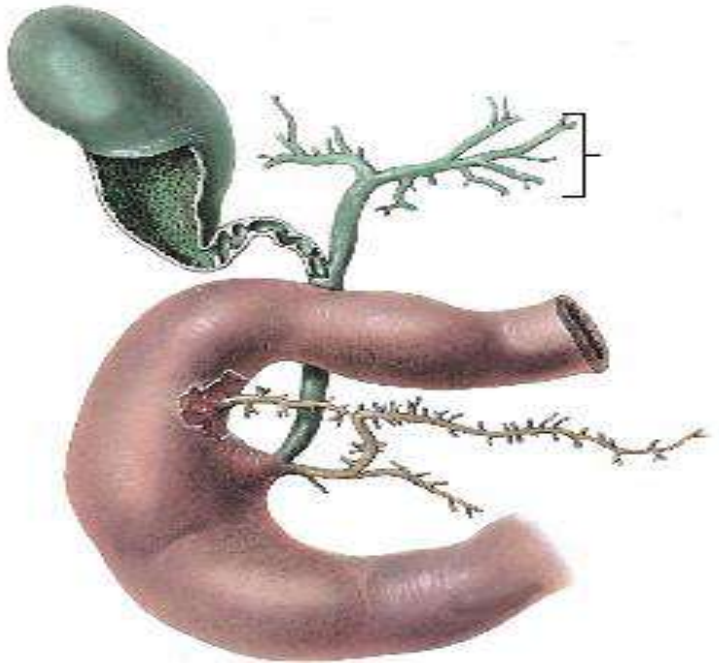
Parts of the Duodenum

Second Part of the Duodenum

- **The second part o the duodenum is *3 inch* long and runs vertically downward in front of the hilum of the right kidney on the right side of the L2,3.**
- **About halfway down its medial border, the bile duct and the main pancreatic duct pierce the duodenal wall.**

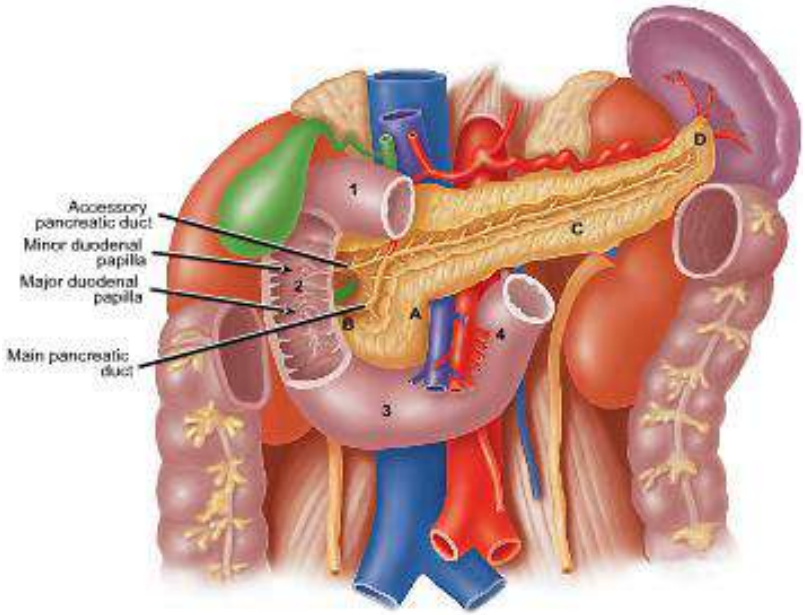


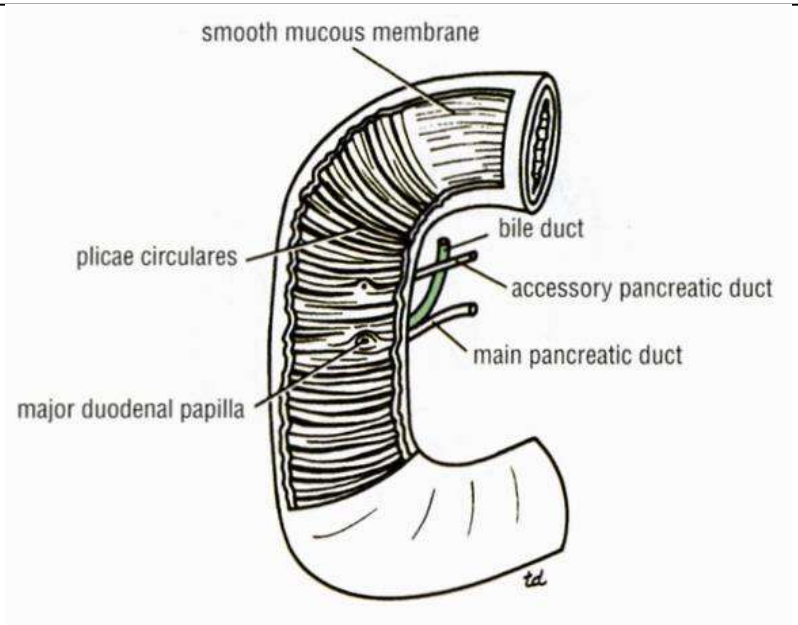


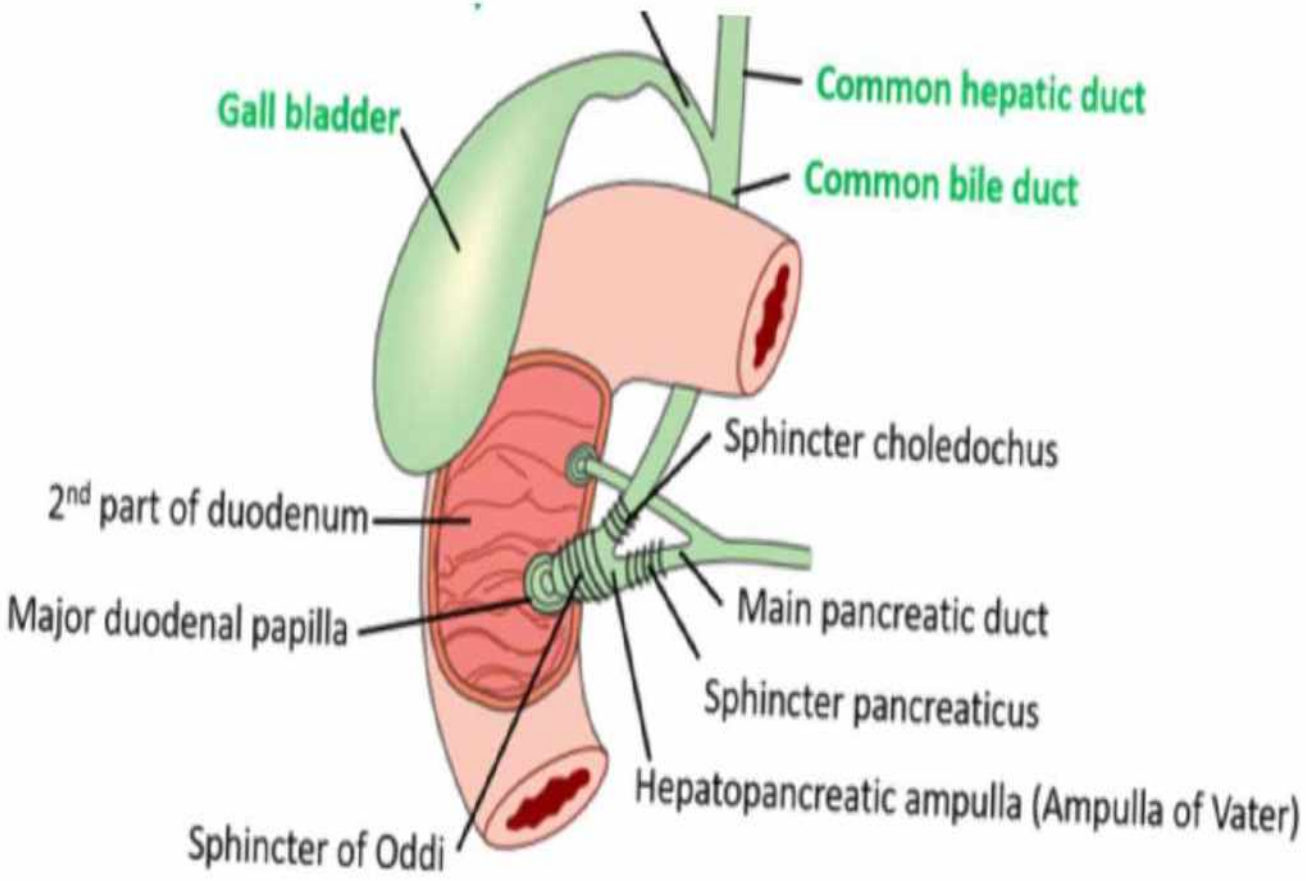


Parts of the Duodenum

- **They unite to form the ampulla that opens on the summit of the major duodenal papilla.**
- ***The Accessory Pancreatic Duct of Santorini*, if present, opens into the duodenum a 1 cm higher up on the minor duodenal papilla.**



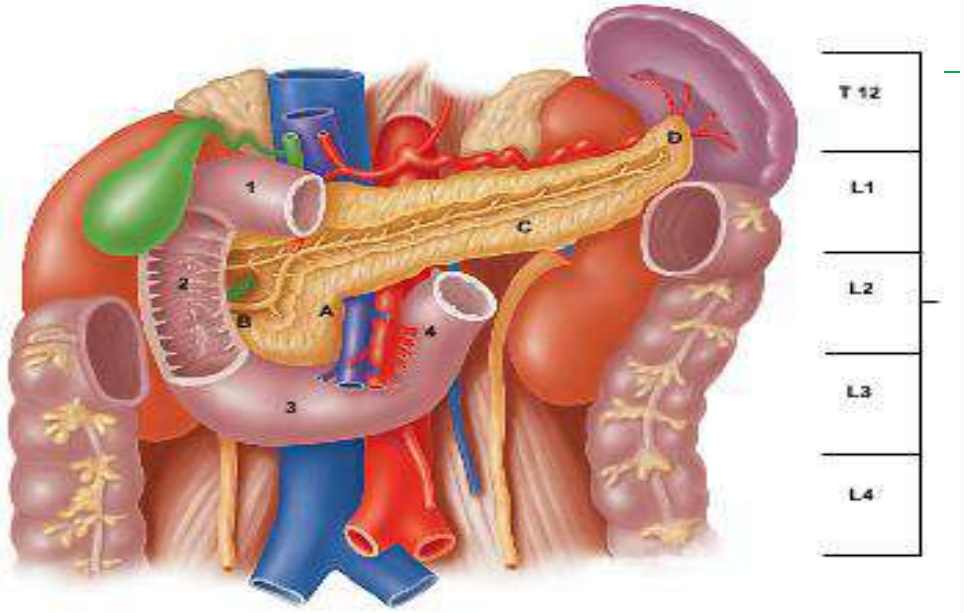


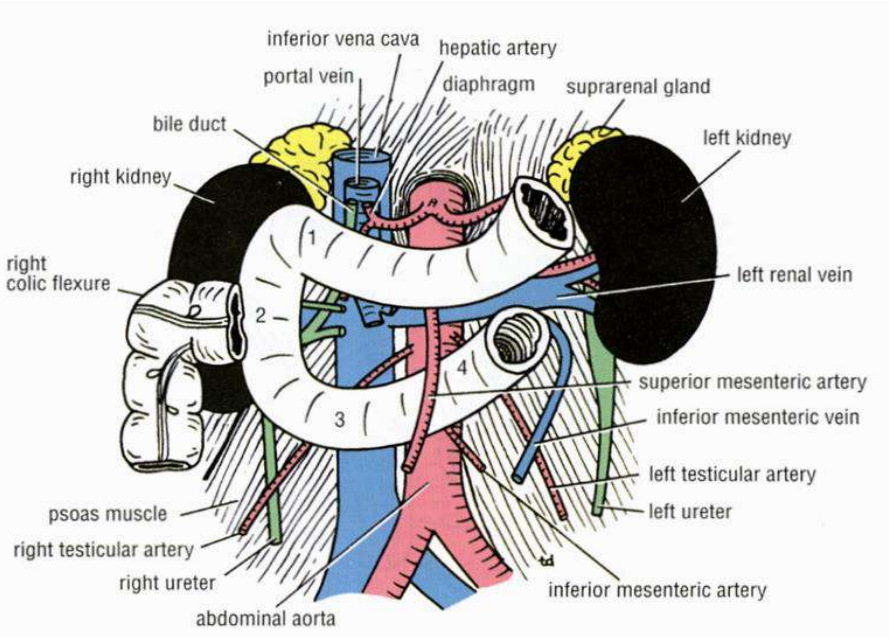

Gall bladder
Common hepatic duct
Common bile duct
Sphincter choledochus
2nd part of duodenum
Major duodenal papilla
Main pancreatic duct
Sphincter pancreaticus
Hepatopancreatic ampulla (Ampulla of Vater)
Sphincter of Oddi

Parts of the Duodenum

The *relations* of the second part are:

- ***Anteriorly:*** **The fundus of the gallbladder and the right lobe of the liver, the transverse colon, and the coils of the small intestine.**
- ***Posteriorly:*** **The hilum of the right kidney and the right ureter.**
- ***Laterally:*** **The ascending colon, the right colic flexure, and the right lobe of the liver.**
- ***Medially:*** **The head of the pancreas, the bile duct, and the main pancreatic duct.**

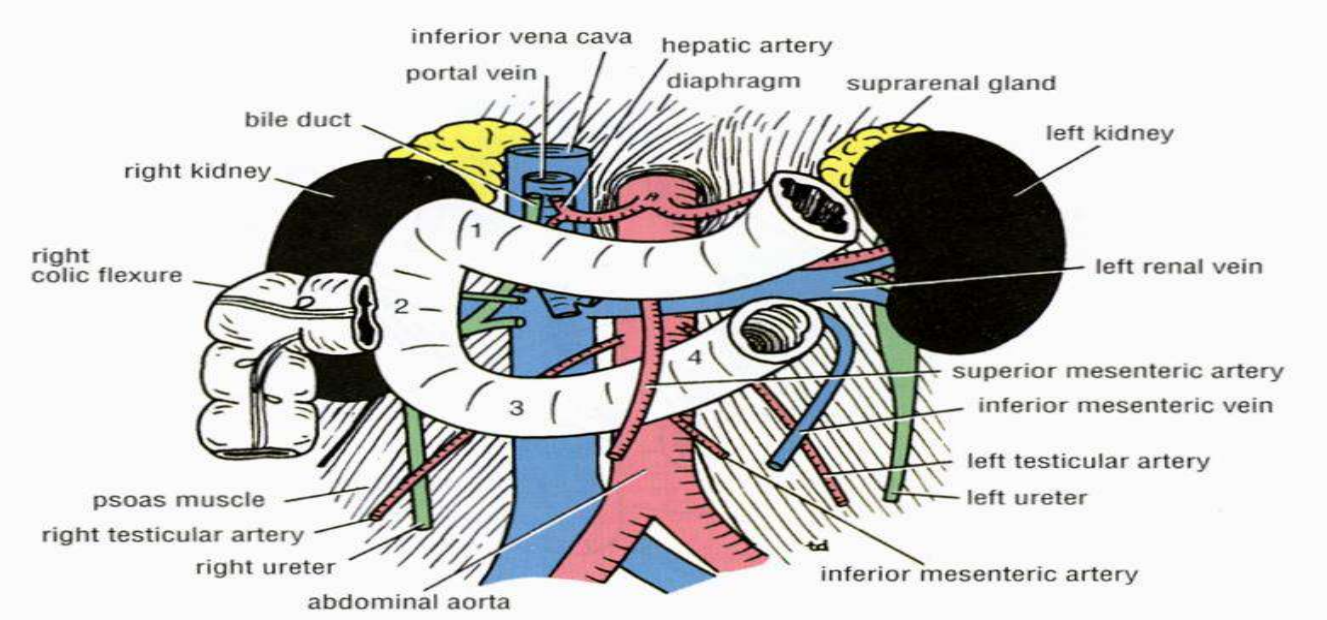




Parts of the Duodenum

Third Part of the Duodenum

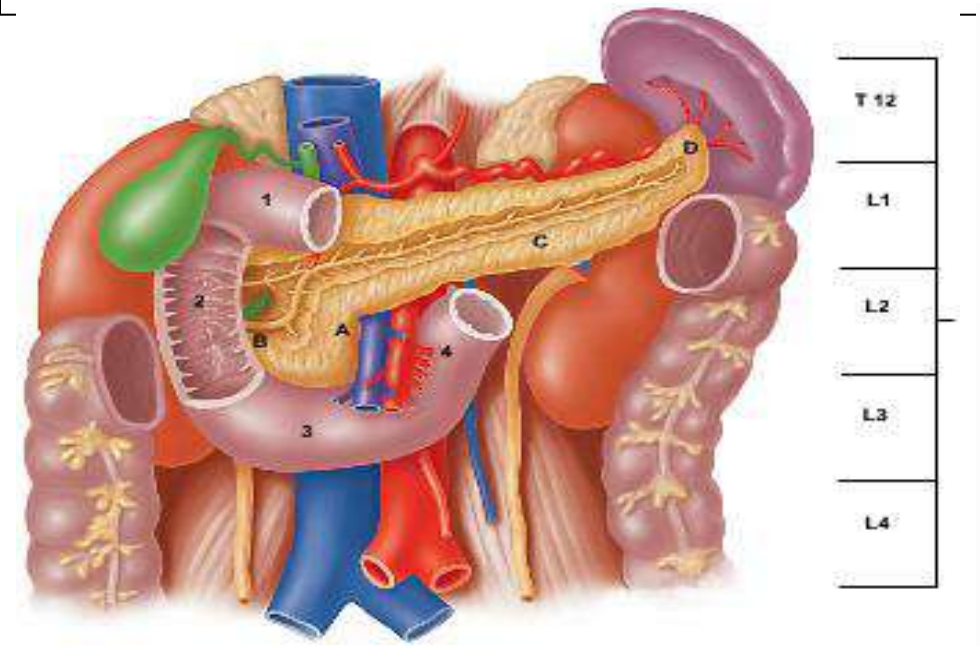
- **The third part of the duodenum is *(4 inch)* long and runs horizontally to the left on the Subcostal plane, passing in front of the vertebral column and following the lower margin of the head of the pancreas.**

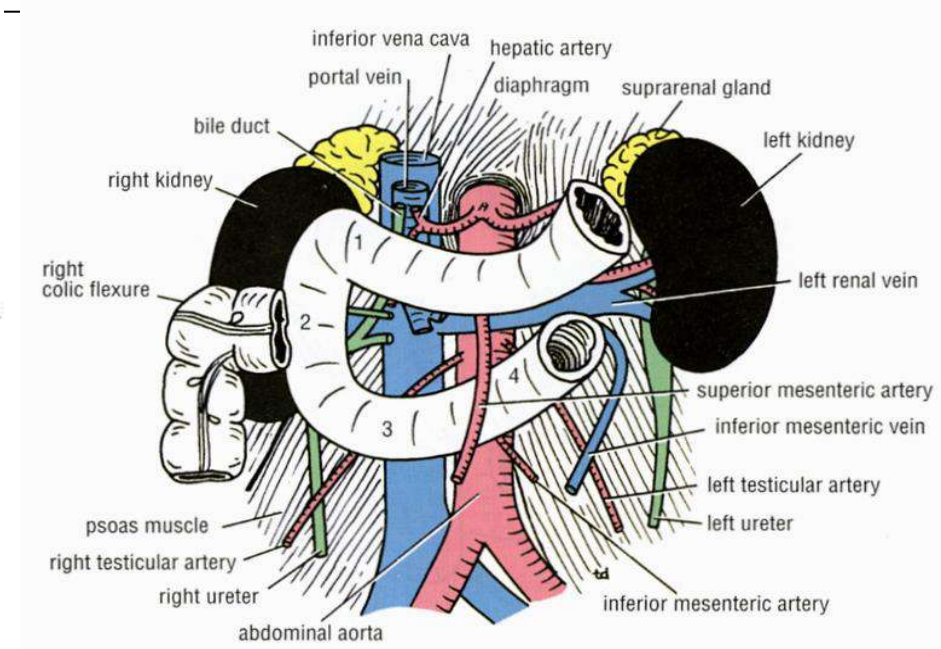


Parts of the Duodenum

The *relations* of this part are:

- ***Anteriorly:*** **The root of the mesentery of the small intestine, the superior mesenteric vessels contained within it, and coils of jejunum.**
- ***Posteriorly:*** **The right ureter, the right psoas muscle, the inferior vena cava, and the aorta , IMA.**
- ***Superiorly:*** **The head of the pancreas.**
- ***inferiorly:*** **Coils of jejunum.**

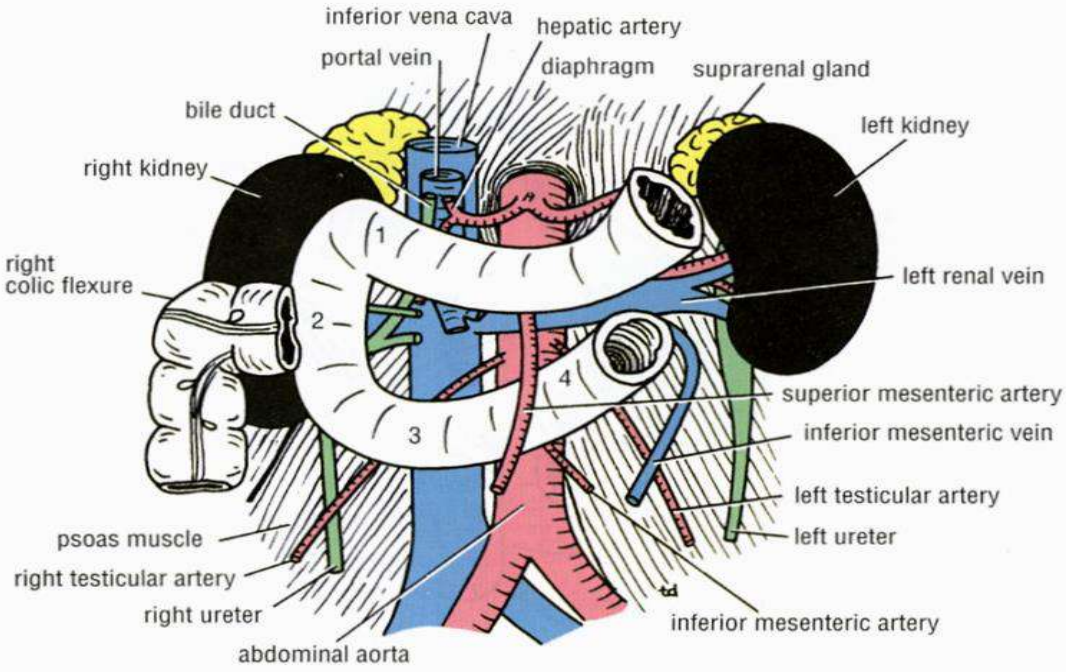


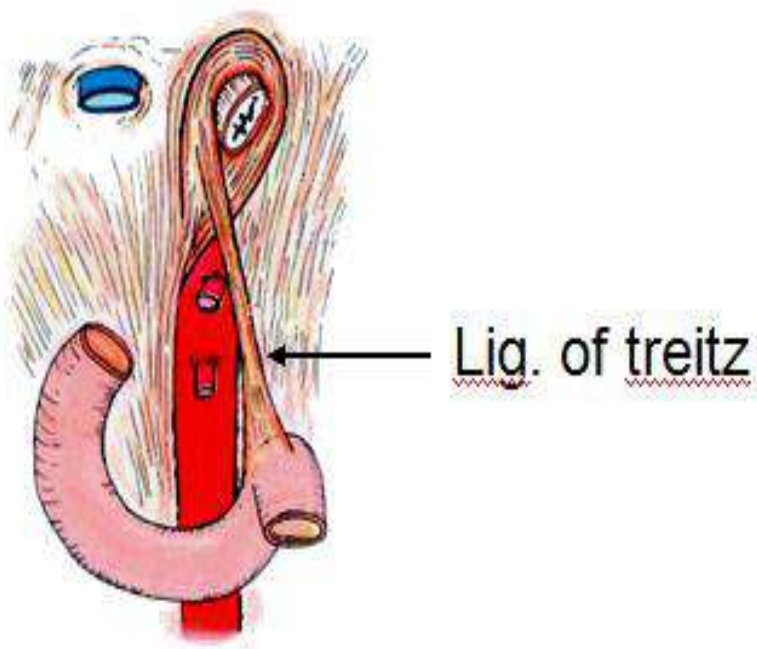


Parts of the Duodenum

Fourth Part of the Duodenum

- **The fourth part of the duodenum is *1 inch.* long and runs upward and to the left to the duodenojejunal flexure.**
- **The flexure is held in position by a peritoneal fold, the *ligament of Treitz*, which is attached to the right crus of the diaphragm.**

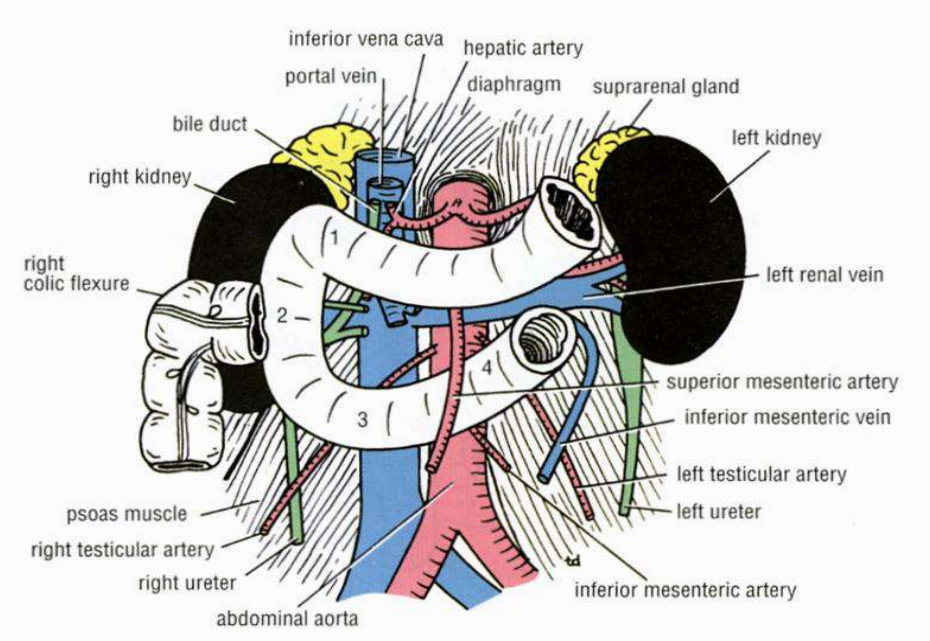


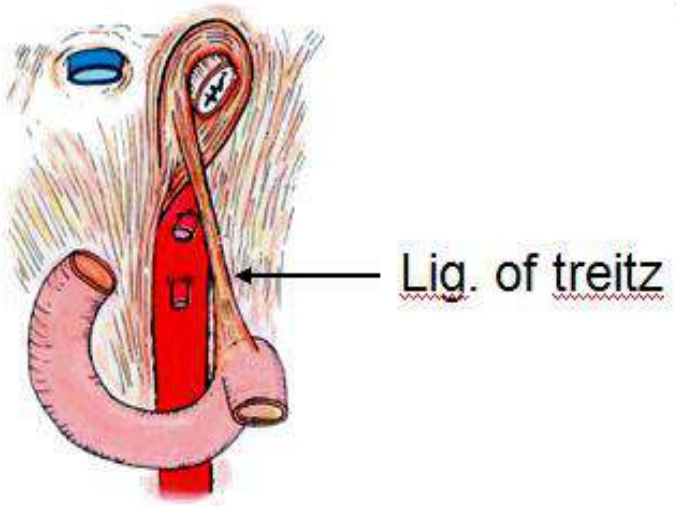


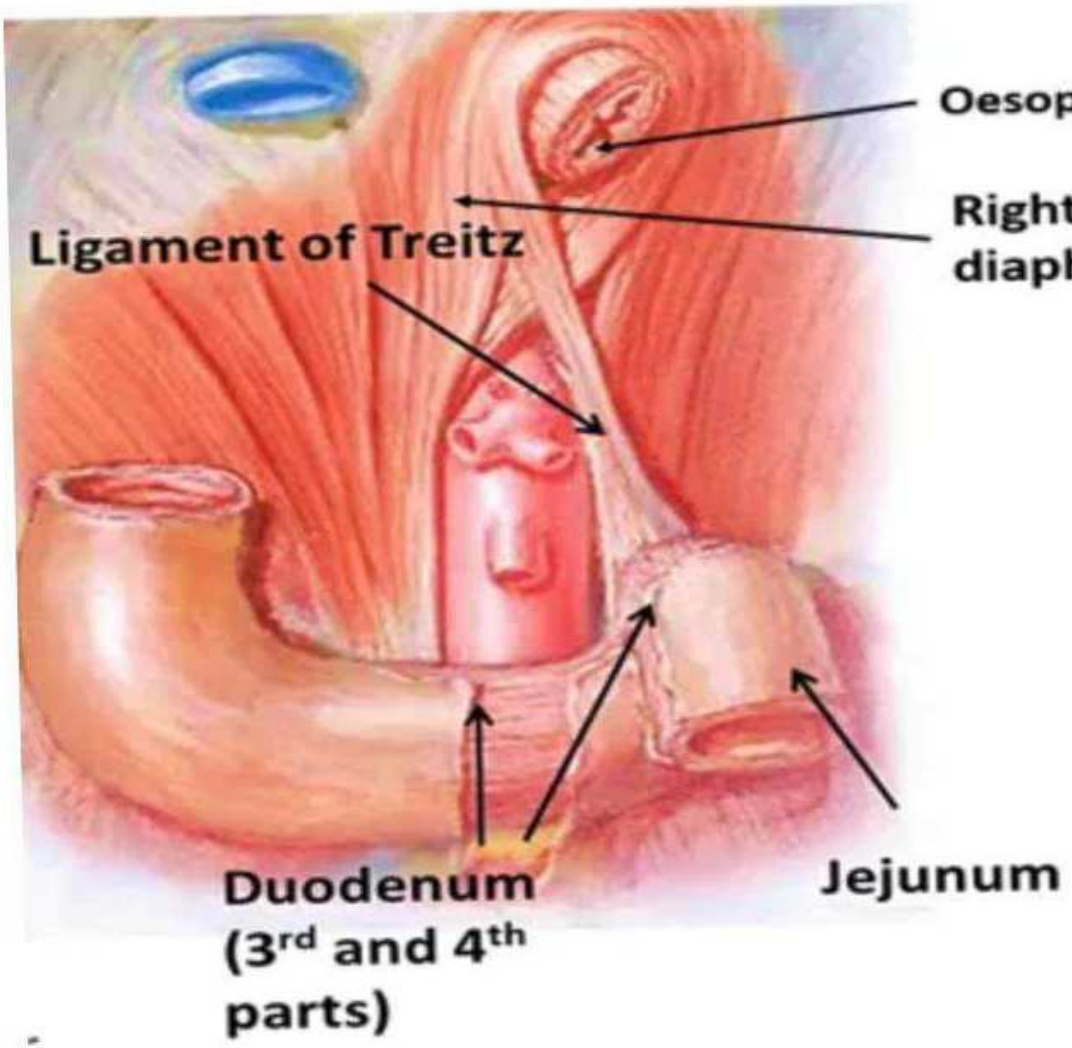
Parts of the Duodenum

The *relations* of this part are:

- **Anteriorly: The beginning of the root of the mesentery and coils of jejunum.**
- **Posteriorly: The left margin of the aorta and the medial border of lie left psoas muscle.**



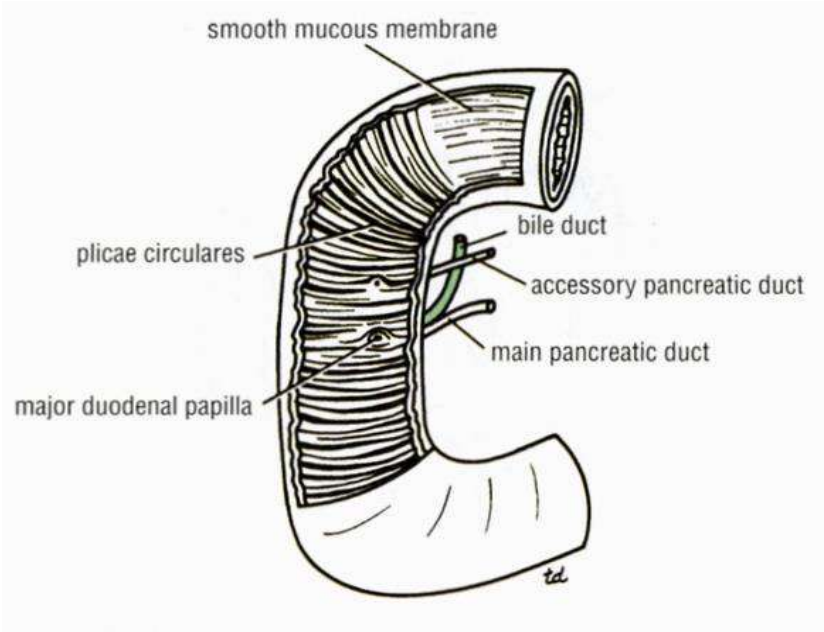



Oesophagus
Right Crus of diaphragm
Ligament of Treitz
Duodenum (3rd and 4th parts)
Jejunum

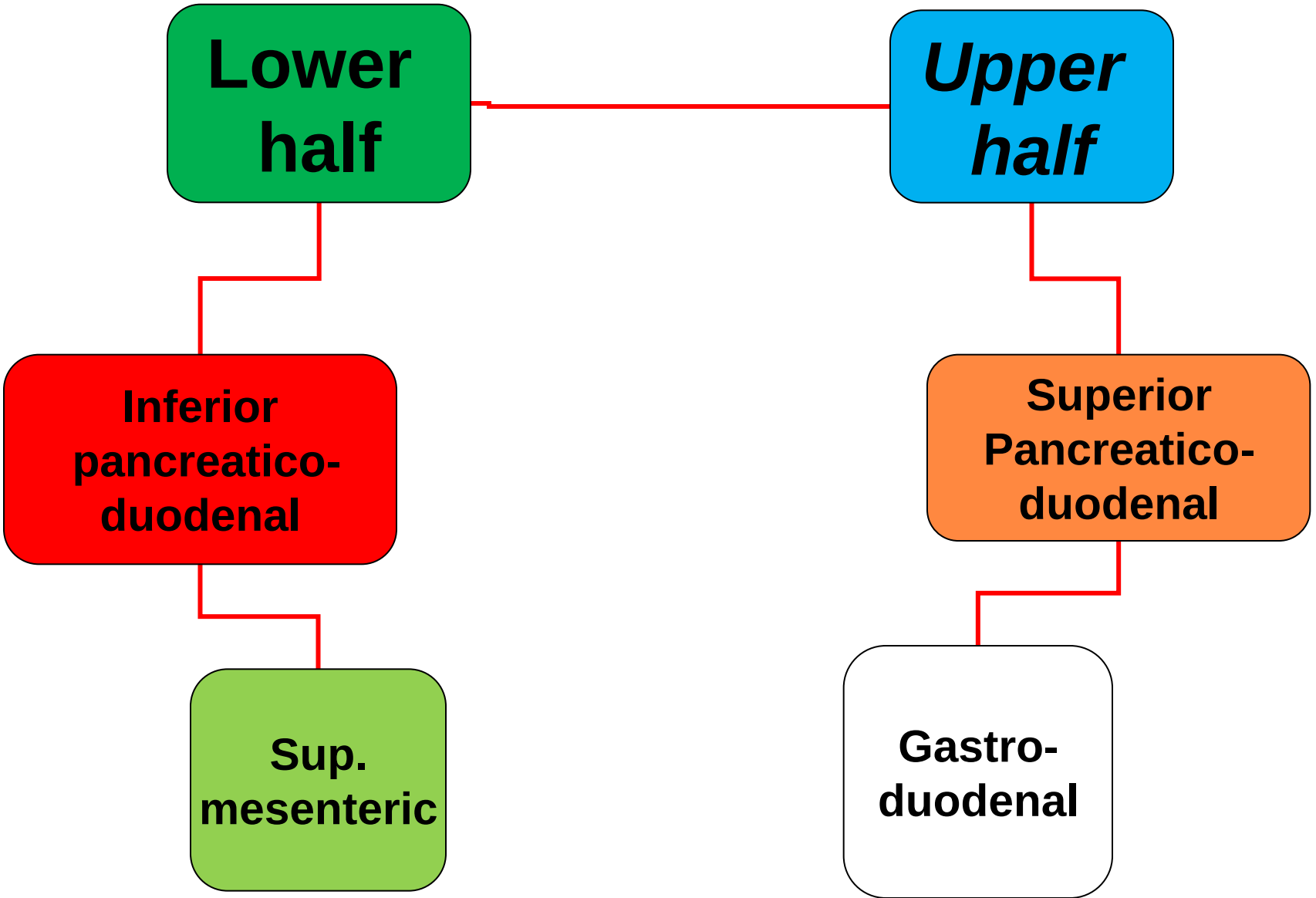
Duodenum

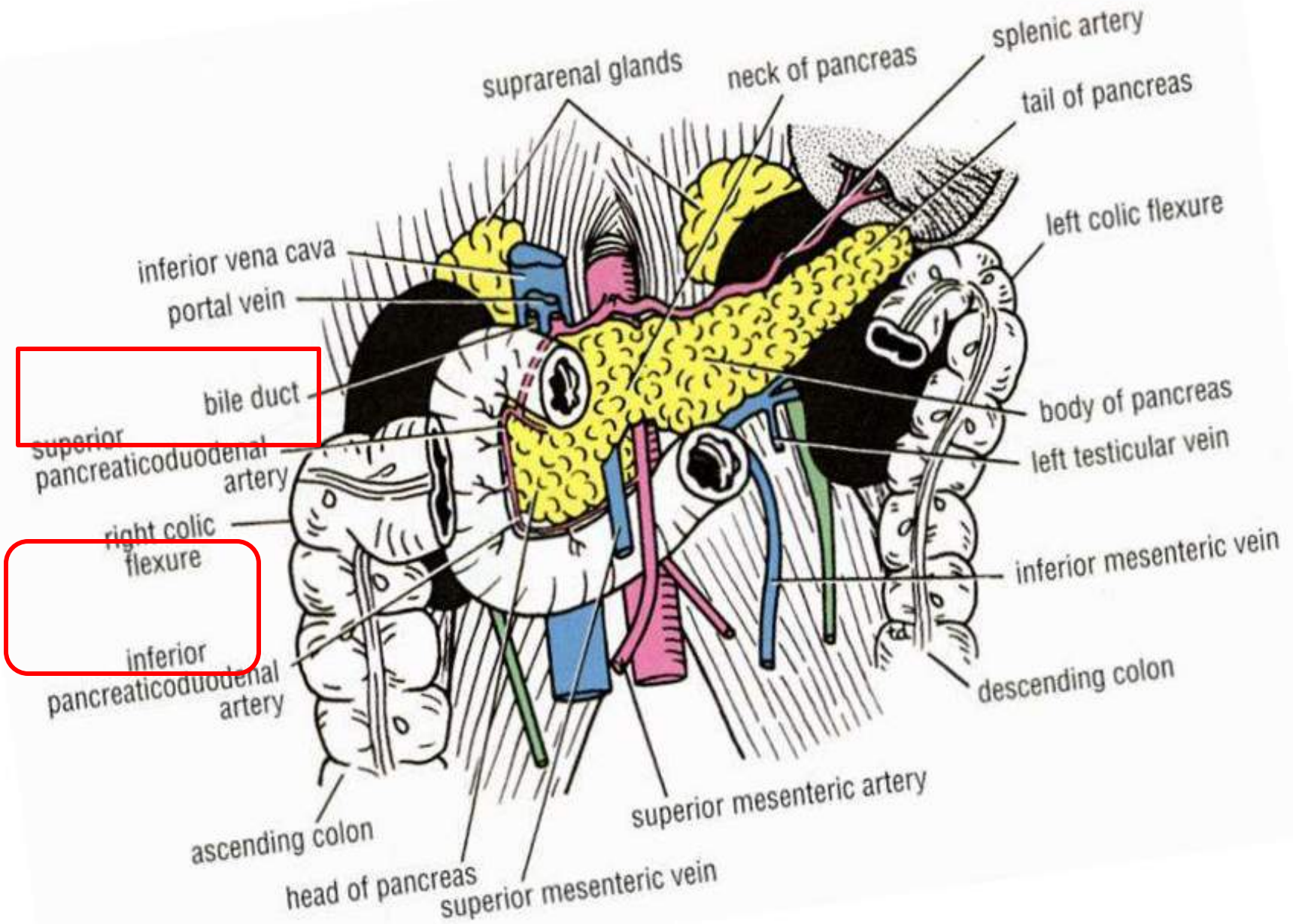
- **The mucous membrane of the duodenum is Thick.**
- **In the first part of the duodenum it is Smooth.**
- **In the remainder of the duodenum it is thrown into numerous circular folds called the *Plicae Circulares*.**

- **At the site where the bile duct and the main pancreatic duct pierce the medial wall of the second part is a small, rounded elevation called the *major duodenal papilla.***
- **The accessory pancreatic duct, if present, opens into the duodenum on a smaller papilla about (1.9 cm) above the major duodenal papilla.**



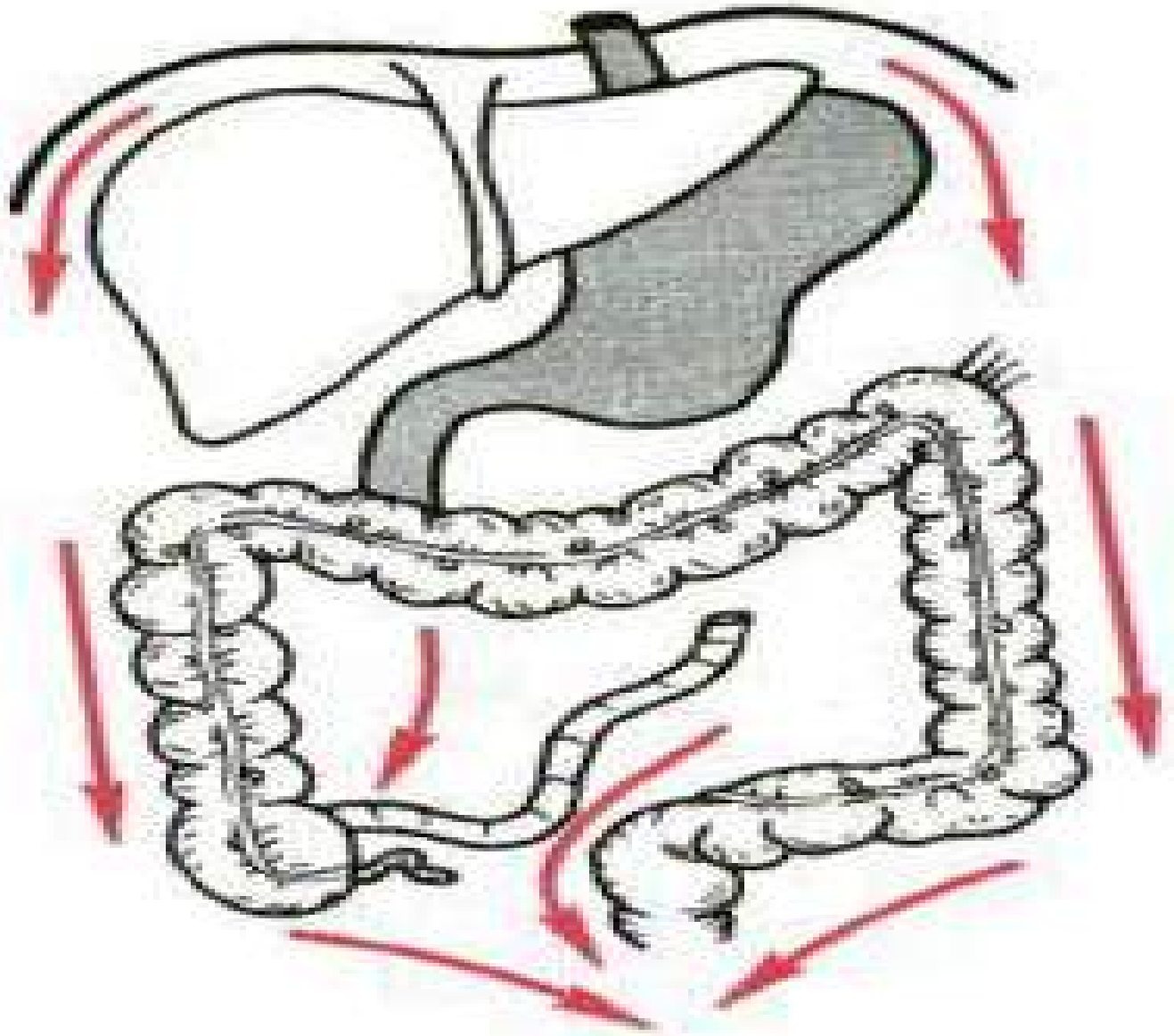
Blood Supply of Duodenum

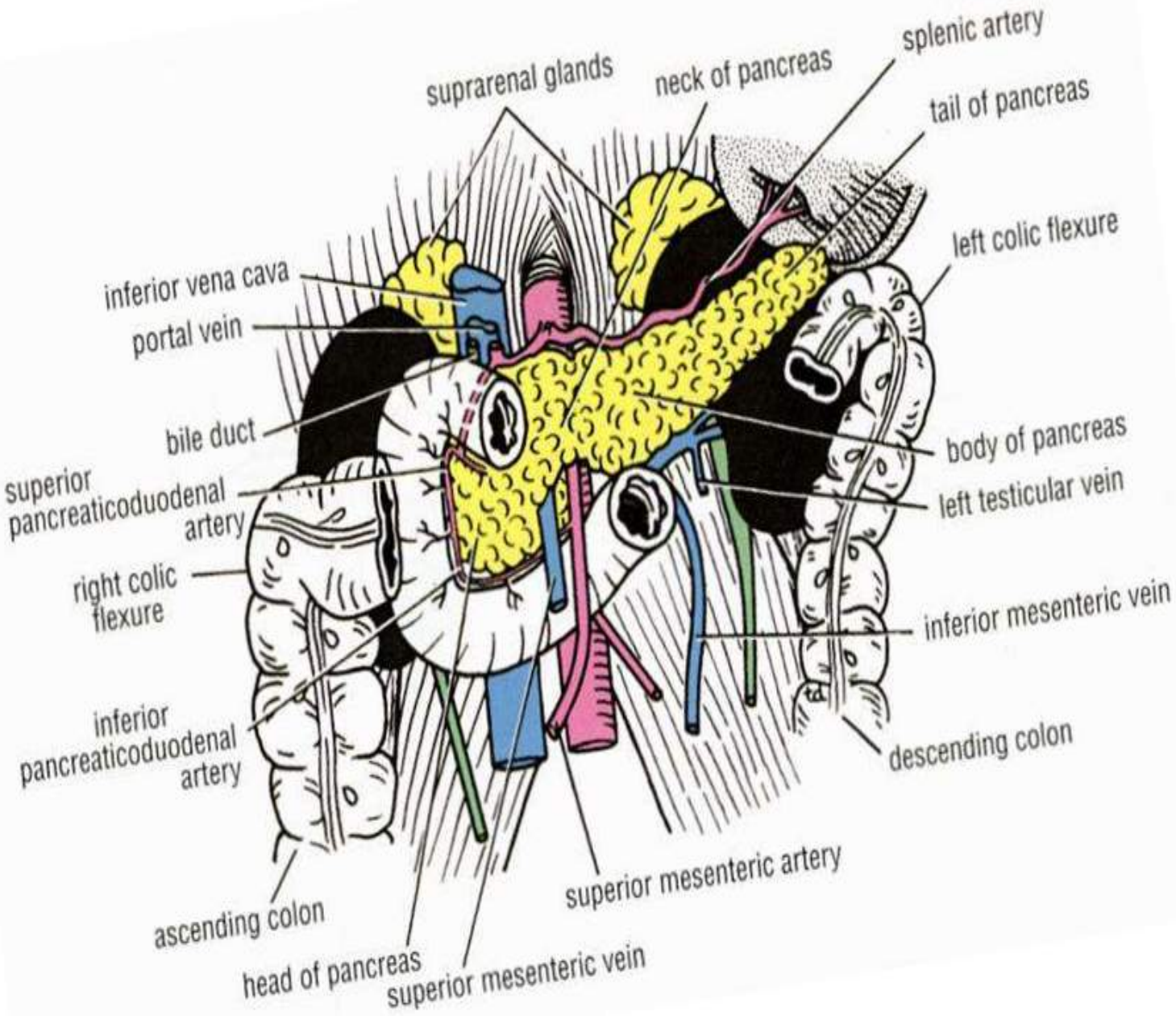



suprarenal glands
neck of pancreas
splenic artery
tail of pancreas
left colic flexure
inferior vena cava
portal vein
bile duct
body of pancreas
left testicular vein
pancreaticoduodenal artery
right colic flexure
inferior mesenteric vein
descending colon
pancreaticoduodenal artery
ascending colon
superior mesenteric artery
head of pancreas
superior mesenteric vein

DUODENAL ULCER

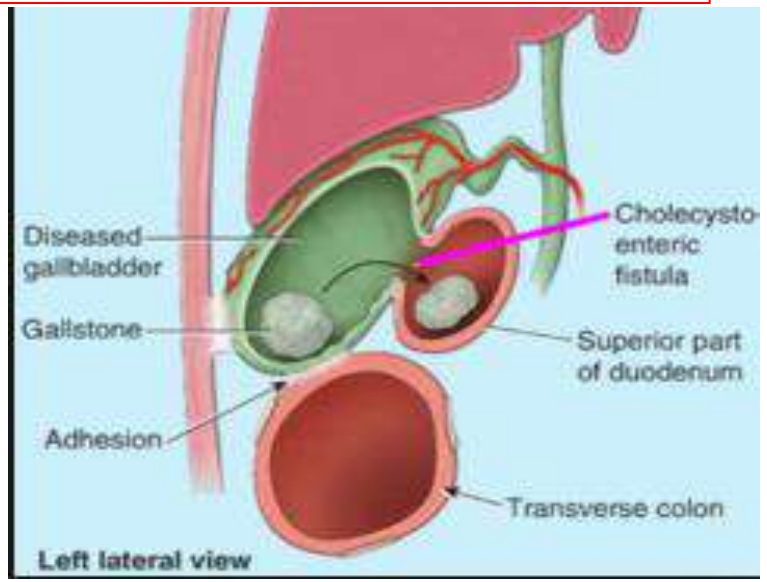
- **As the stomach empties its contents into the duodenum, the acid chyme is squirted against the Antrolateral wall of the first part of the duodenum.**
- **This thought to be an important factor in the production of a duodenal ulcer at this site.**
- **An ulcer of the anterior wall of the first inch of the duodenum may *Perforate* into the upper part of the greater sac, above the transverse colon.**




suprarenal glands
neck of pancreas
splenic artery
tail of pancreas
left colic flexure
inferior vena cava
portal vein
bile duct
body of pancreas
superior pancreaticoduodenal artery
left testicular vein
right colic flexure
inferior mesenteric vein
inferior pancreaticoduodenal artery
descending colon
ascending colon
superior mesenteric artery
head of pancreas
superior mesenteric vein

IMPORTANT DUODENAL RELATIONS

- **The relation to the duodenum of the gallbladder, the transverse colon, and the right kidney should be remembered.**
- **Cases have been reported in which a large gallstone ulcerated through the gallbladder wall into the duodenum. Gall stone ileus**
- **Operations on the colon and right kidney have resulted in damage to the duodenum.**

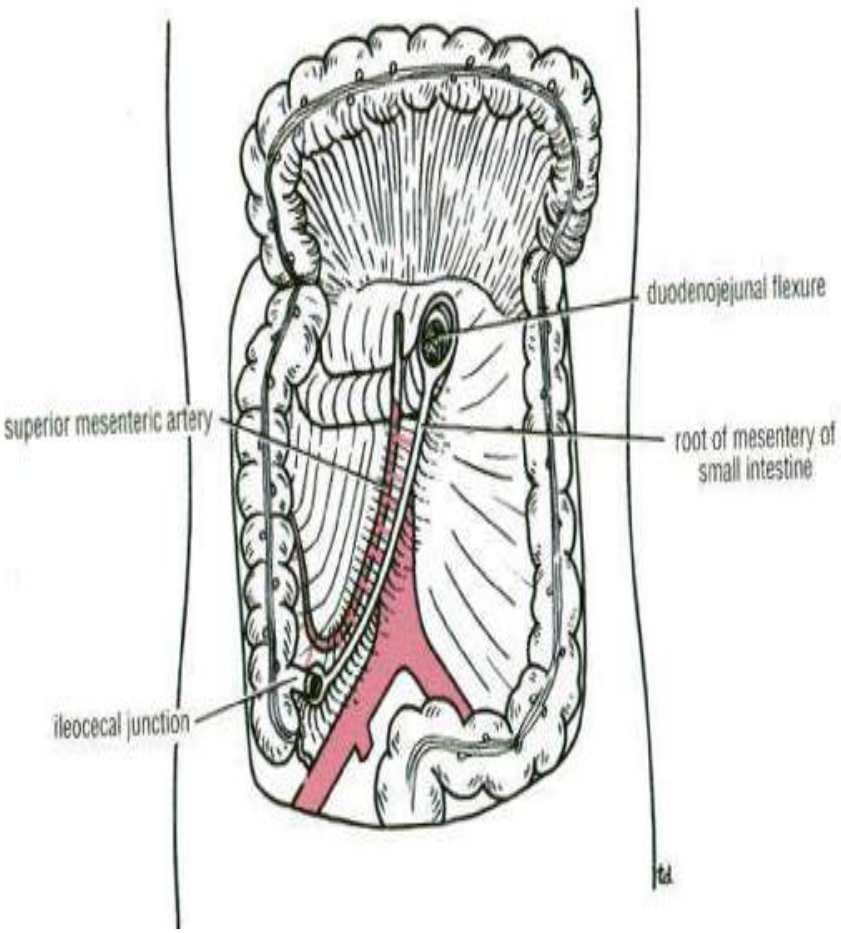


Jejunum and Ileum

- **The jejunum and ileum measure about 20 ft. (6 m) long, the *Upper Two Fifths* of this length make up the jejunum.**
- **Each has distinctive features, but there is a gradual change from one to the other.**
- **The jejunum begins at the duodenojejunal flexure, and the ileum ends at the ileocecal junction.**

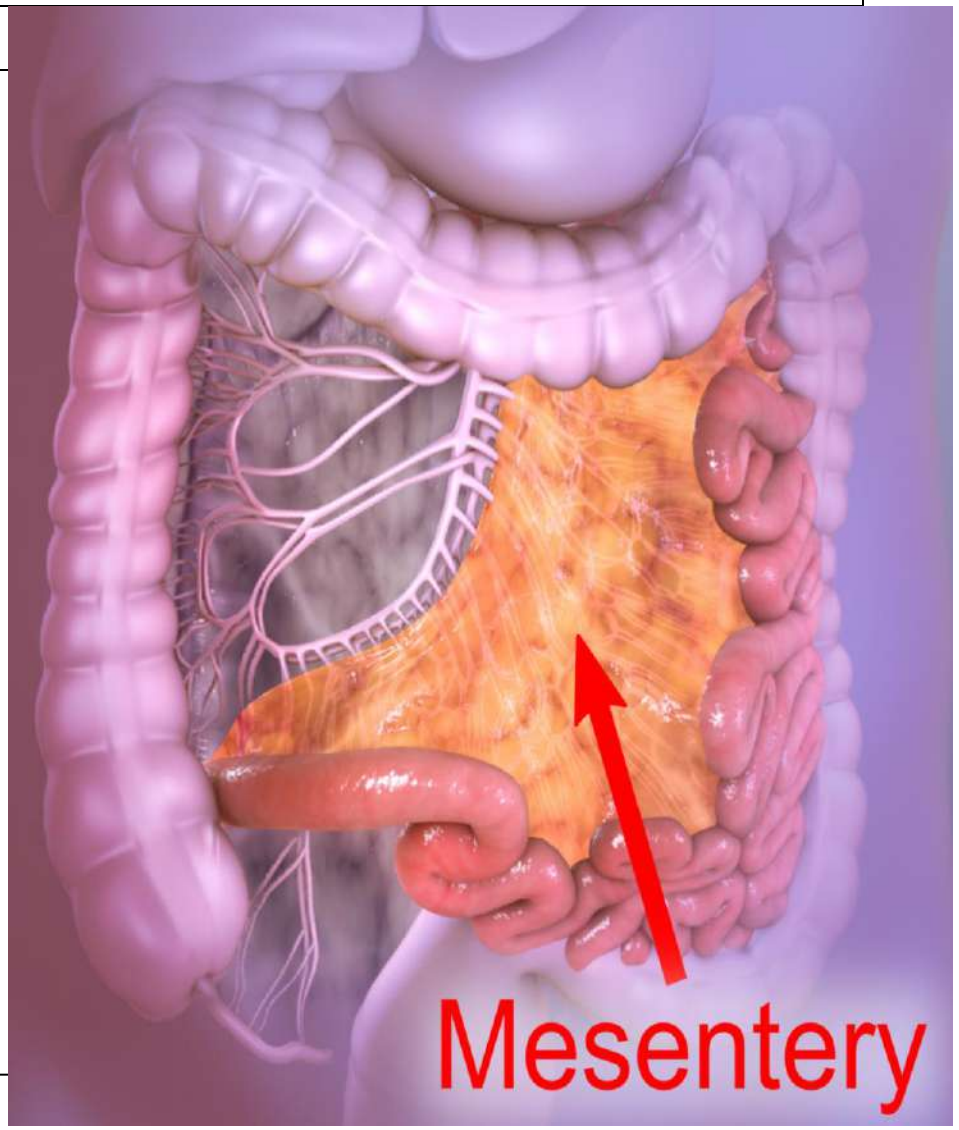
Jejunum and Ileum

- **The coils of jejunum and ileum are freely mobile and are attached to the posterior abdominal wall by a fan-shaped fold of peritoneum known as the *Mesentery* of the small intestine.**
- **The long free edge of the fold encloses the mobile intestine.**



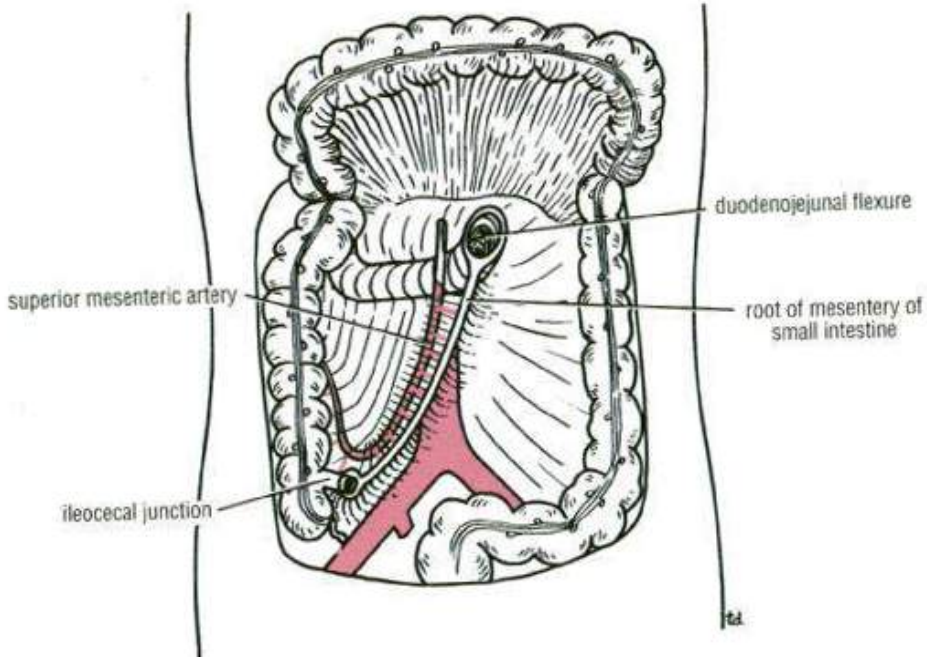
Jejunum and Ileum

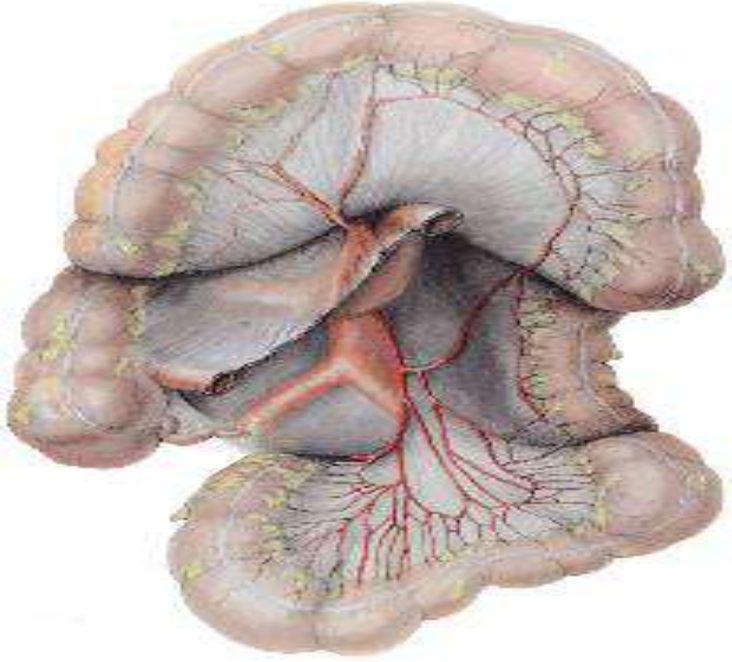
- **The short root of the fold is**
- ***6 inches long .***
- ***crosses 6 structures .***
- ***contain 6 structures .***
- **Continuous with the parietal peritoneum on the posterior abdominal wall.**



Jejunum and Ileum

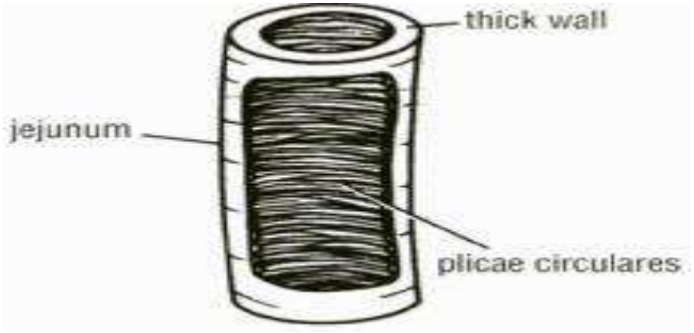
- **The root of the mesentery permits the entrance and exit of the branches of the superior mesenteric artery and vein, lymph vessels, and nerves into the space between the two layers of peritoneum forming the mesentery.**

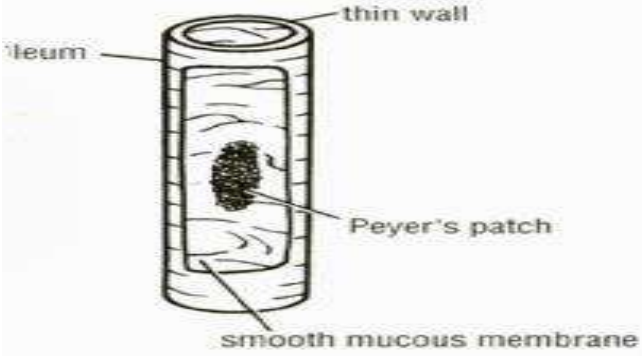




Differences between the Jejunum and Ileum

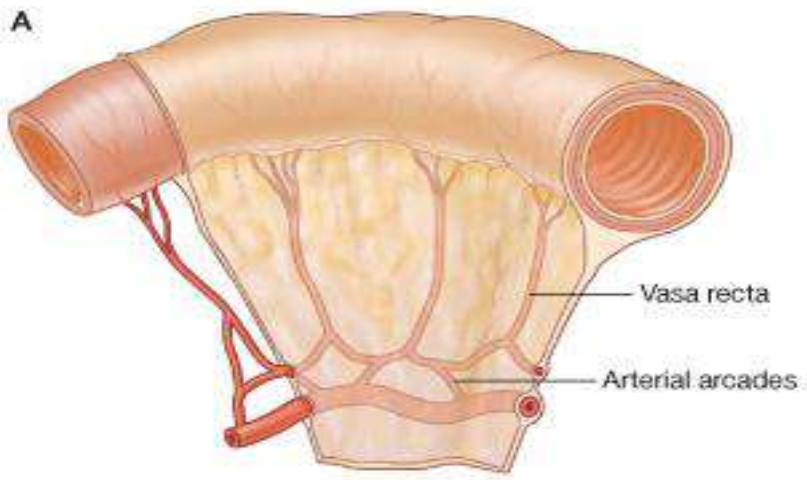
Aspect	Jejunum	Ileum
site	upper part of the peritoneal cavity	the lower part of the cavity and in the pelvis
structure	wider bored, thicker walled, redder	narrower, thinner
plicae circulares	larger, more numerous, and closely set in the jejunum	smaller and more widely separated
Jejunal mesentery attachment	posterior abdominal wall above and to the left of the aorta	below and to the right of the aorta

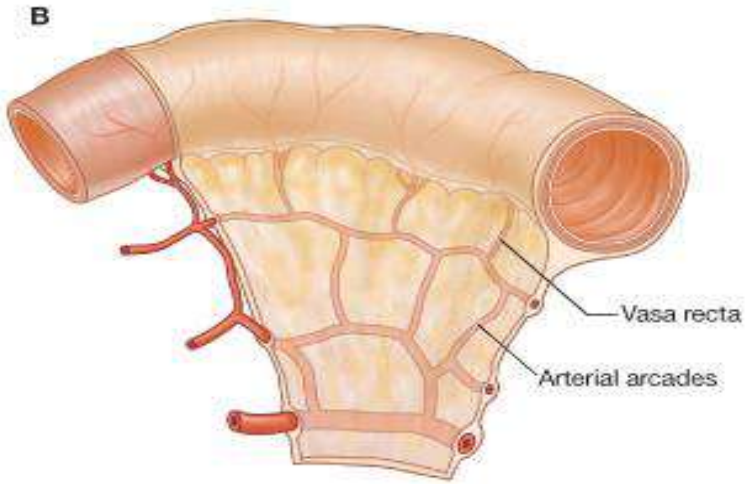


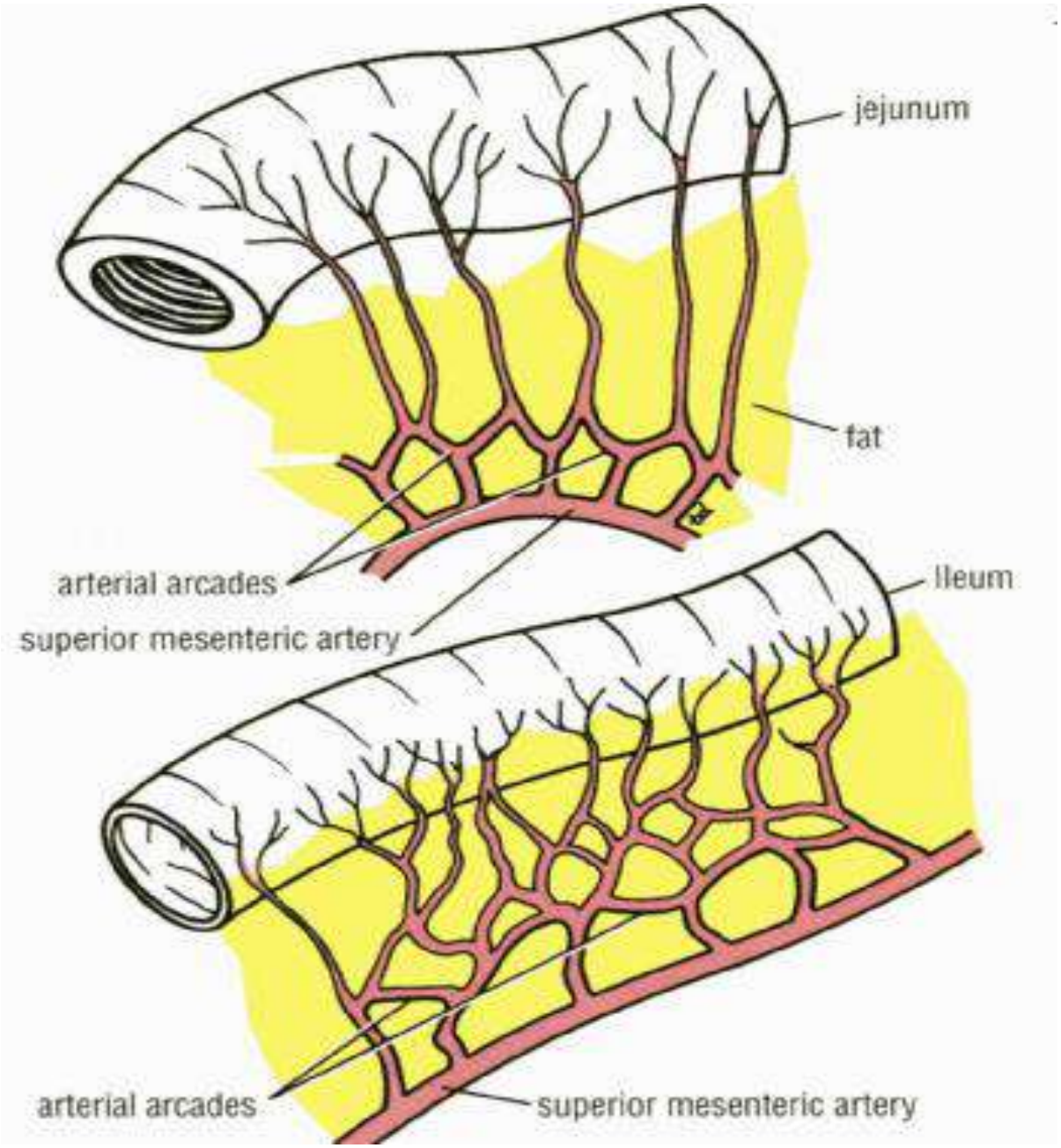


Differences between the Jejunum and Ileum

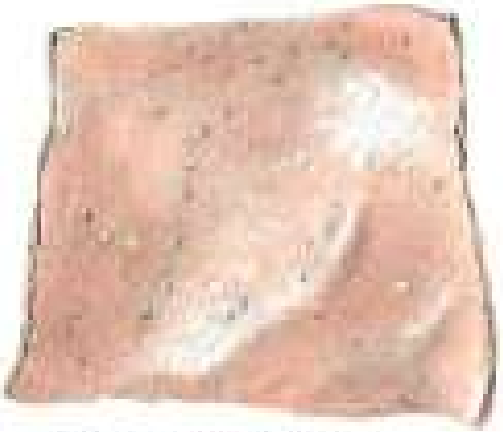
Aspect	Jejunum	Ileum
Mesenteric vessels	One or two arcades with long and infrequent branches	Three or four arcades
Mesentery	Fat is deposited near the root and is scanty near the intestinal wall	Fat is deposited throughout so that it extends from the root to the intestinal wall
Peyer's patches	Not present	lower ileum along the antimesenteric border







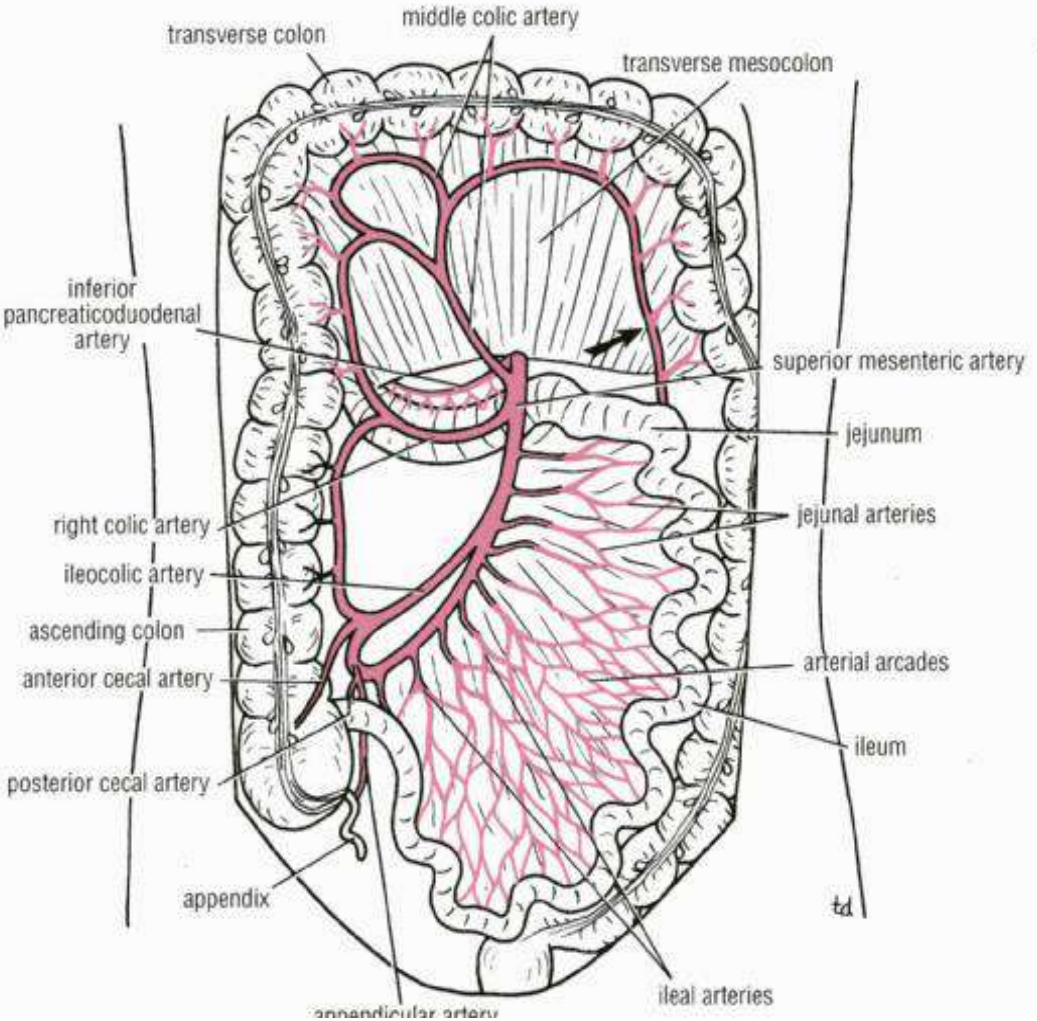
Proximal Jejunum



Distal Ileum

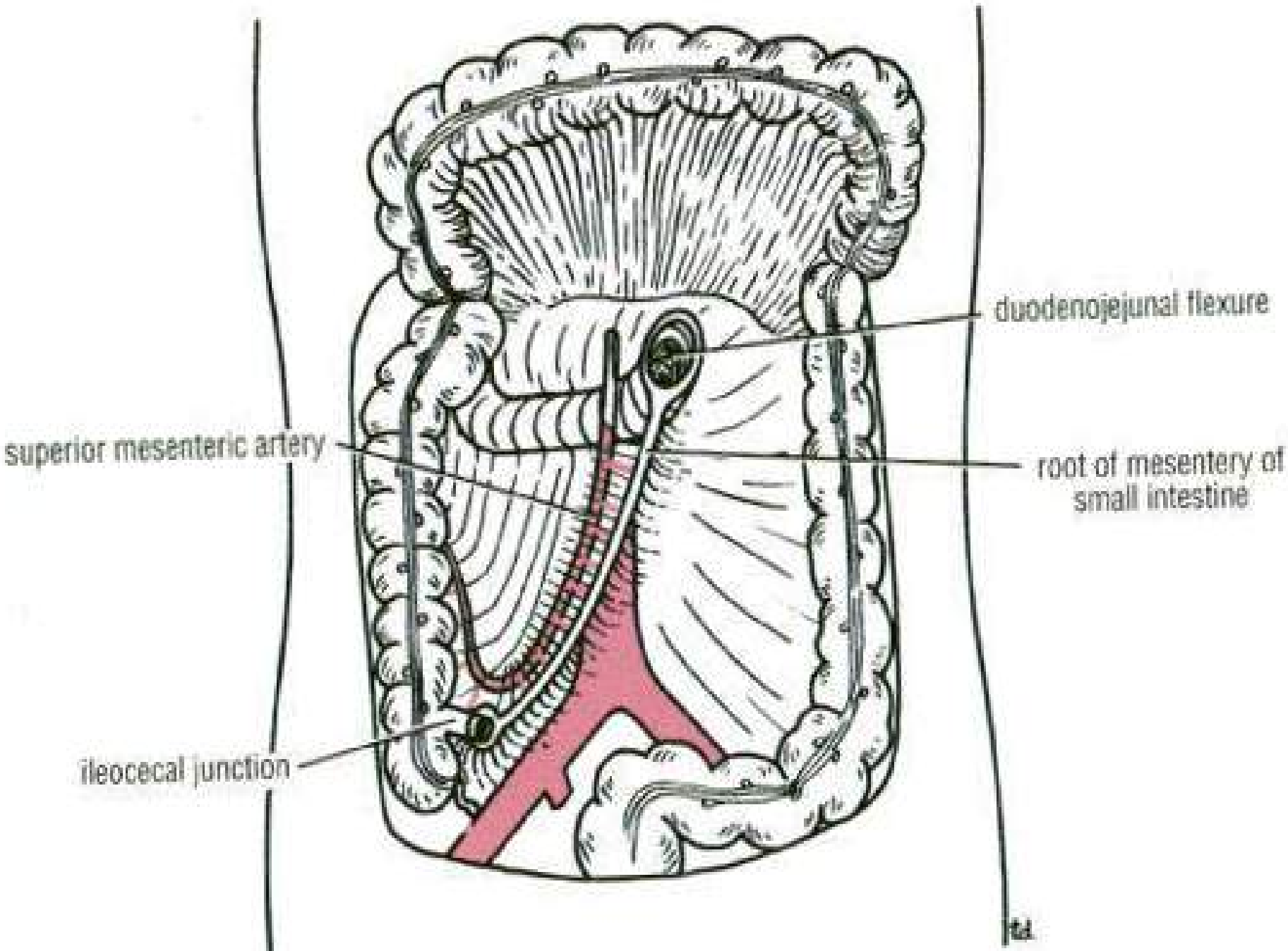
Jejunum and Ileum

- **The *arterial supply* is from branches of the *Superior Mesenteric Artery*.**
- **The intestinal branches arise from the *left side* of the artery and run in the mesentery to reach the gut.**
- **They Anastomose with one another to form a series of arcades.**
- **The lowest part of the ileum is also sup plied by the ileocolic artery.**



Jejunum and Ileum

- **The *veins* correspond to the branches of the superior mesenteric artery and drain into the superior mesenteric vein.**
- **The *lymph vessels* reach the superior mesenteric nodes, which are situated around the origin of the superior mesenteric artery.**
- **The *nerves* are derived from the sympathetic and parasympathetic (vagus) nerves from the superior mesenteric plexus.**

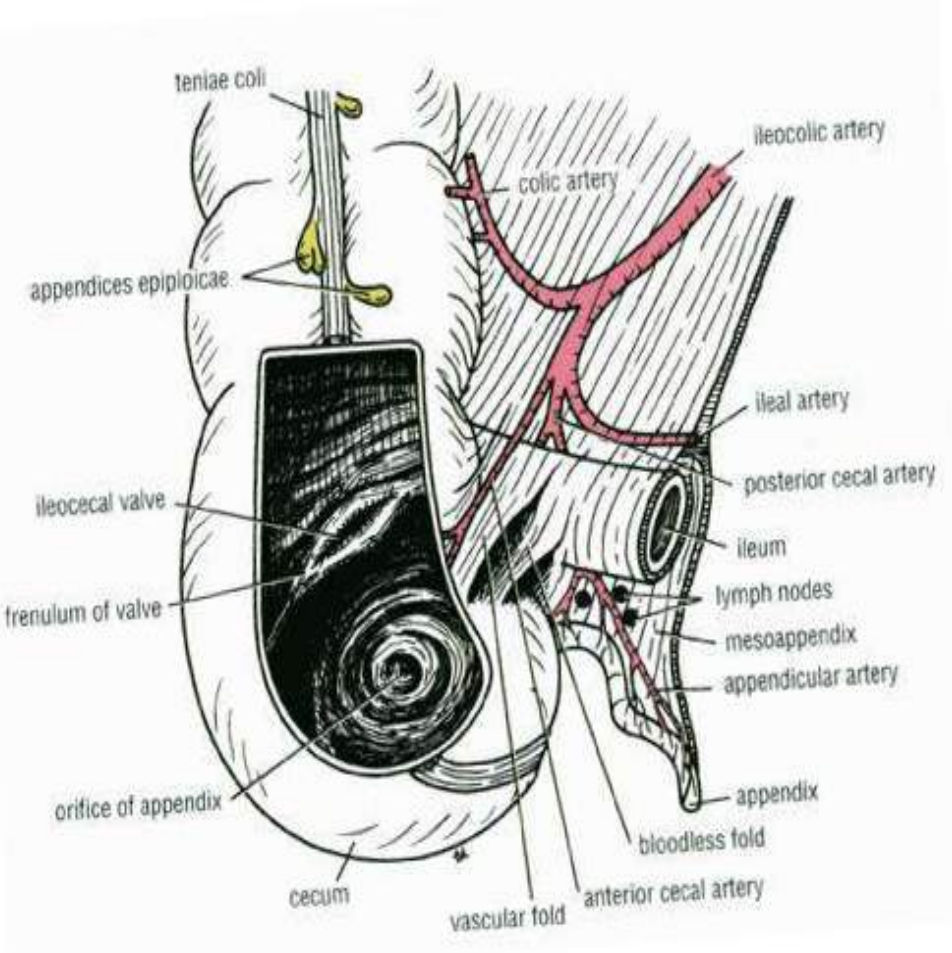

duodenojejunal flexure
superior mesenteric artery
root of mesentery of small intestine
ileocecal junction

MESENTERIC ARTERIAL OCCLUSION

- **The superior mesenteric artery, a branch of the abdominal aorta, supplies an extensive territory of the gut, from halfway down the second part of the duodenum to the left colic flexure.**
- **Occlusion of the artery or one of its branches results in death of all or part of this segment of the gut.**
- **The occlusion may occur as the result of an embolus, a thrombus, an aortic dissection, or an abdominal aneurysm.**

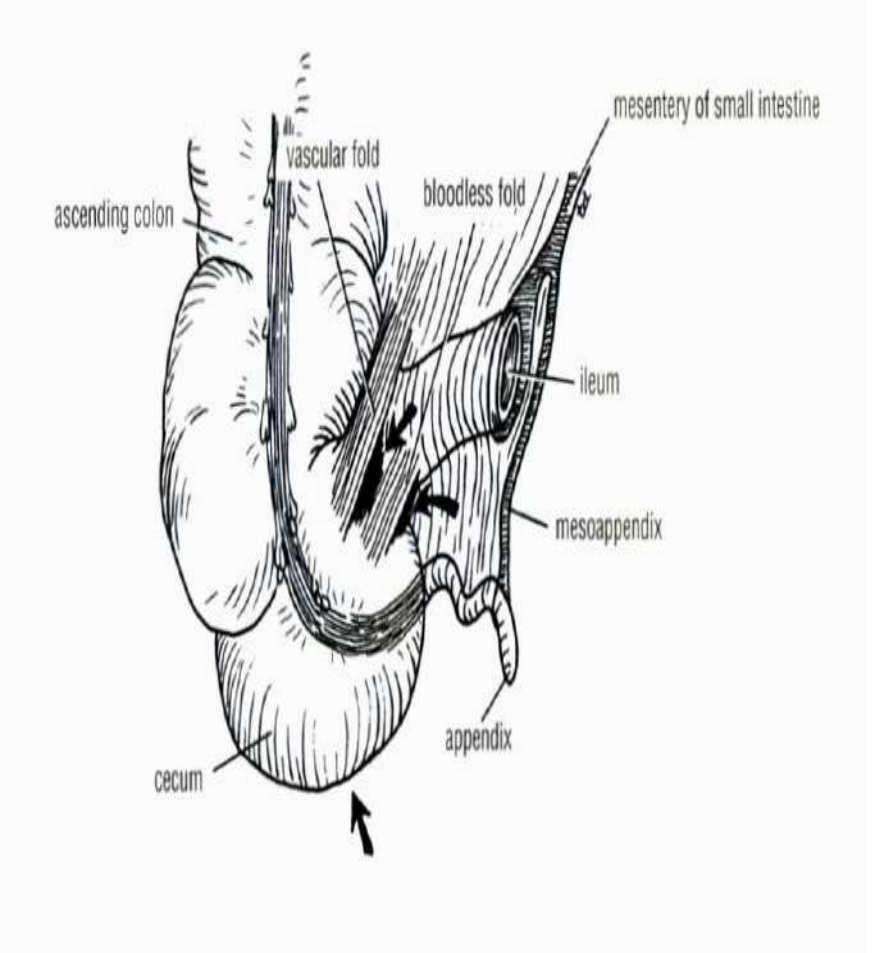
LARGE INTESTINE
Cecum

- The **cecum** is that part of the large intestine that lies ***Below*** the level of the junction of the ileum with the large intestine.
- It is a blind-ended pouch that is situated in the right iliac fossa.
- It is about (6 cm) long and is completely covered with peritoneum.



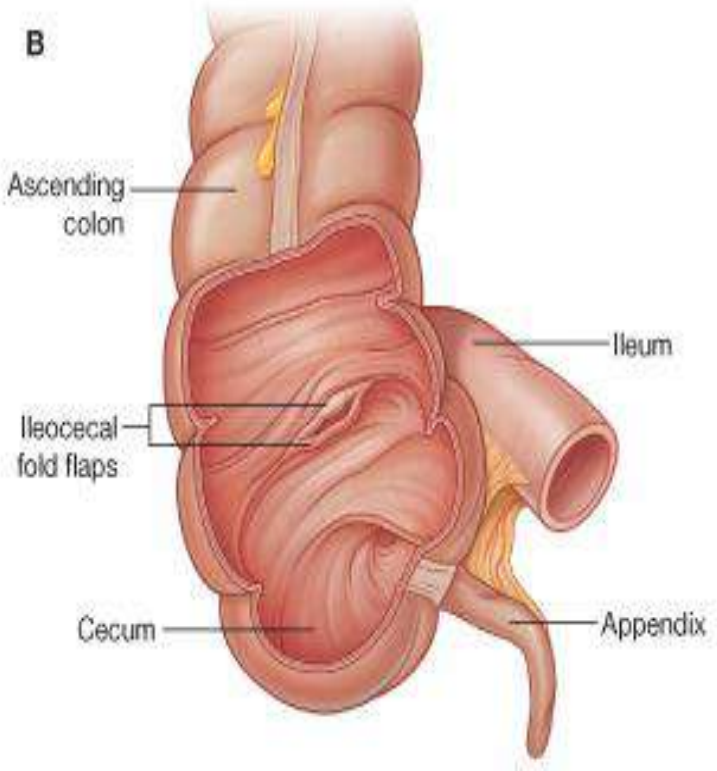
Cecum

- In the colon, the longitudinal muscle is restricted to three flat bands, the ***Teniae Coli,*** which converge on the base of the appendix .
- The cecum is often distended with gas and can then be palpated through the anterior abdominal wall in the living patient.



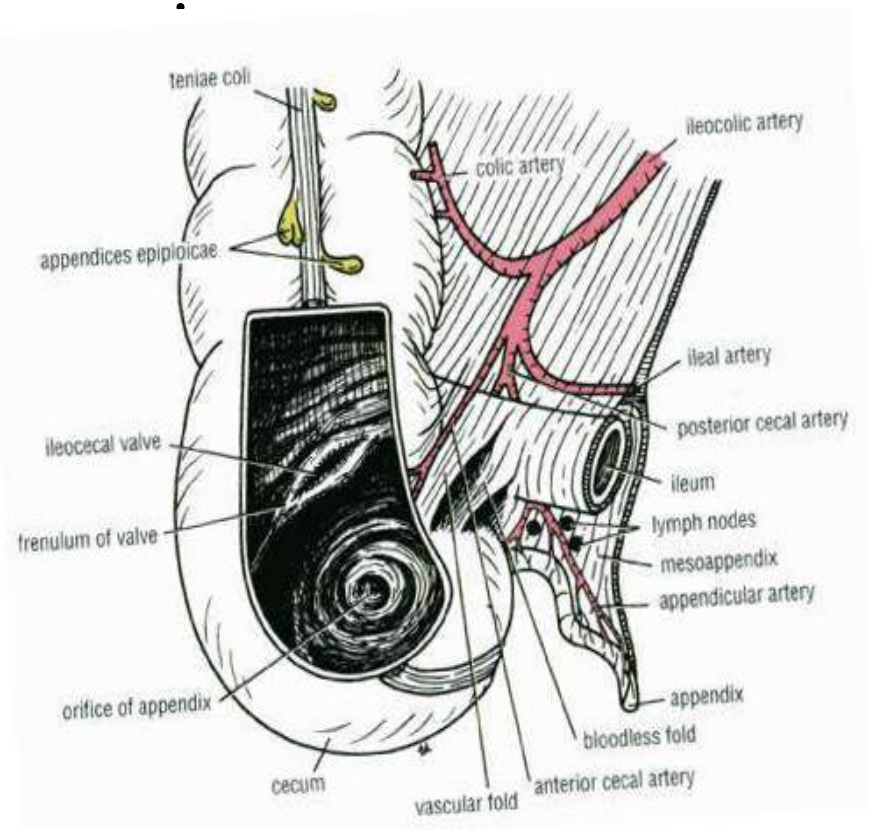
Cecum

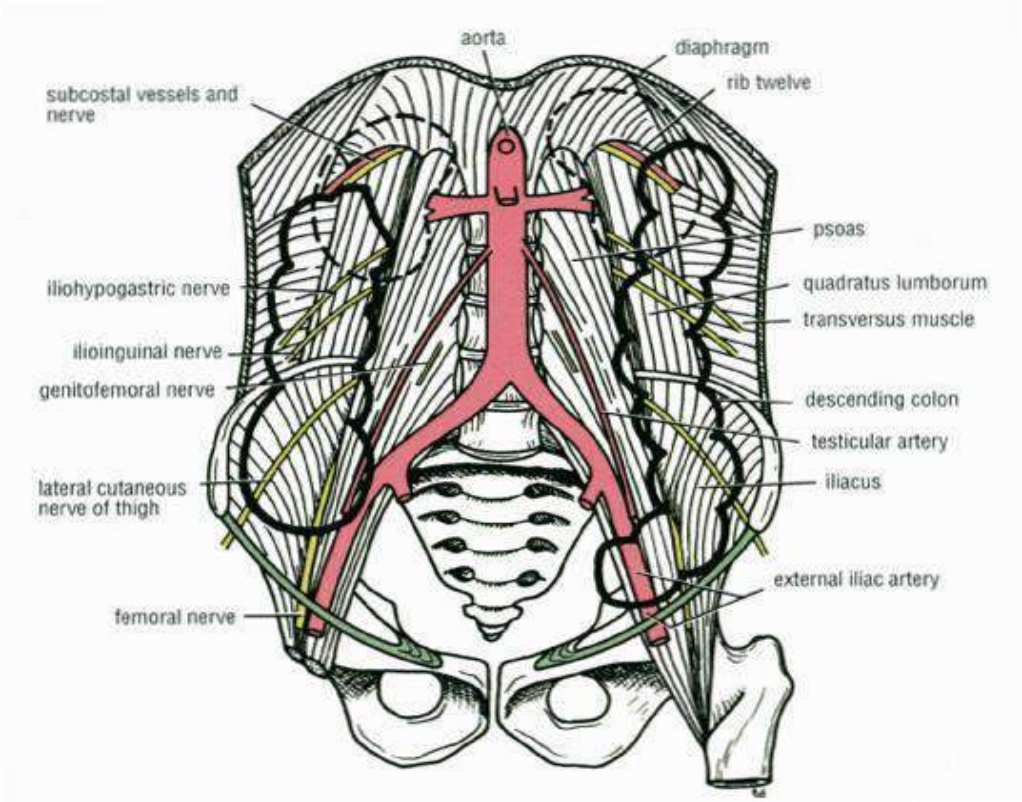
- **The terminal part of the ileum enters the large intestine at the junction of the cecum with the ascending colon.**
- **The opening is provided with two folds, or lips, which form the so-called *Ileocecal Valve.***
- **The appendix communicates with the cavity of the cecum through an opening located below and behind the ileocecal opening.**



Relations of the Cecum

- ***Anteriorly:*** **Coils of small intestine, sometimes part of the greater omentum, and the anterior abdominal wall in the right iliac**





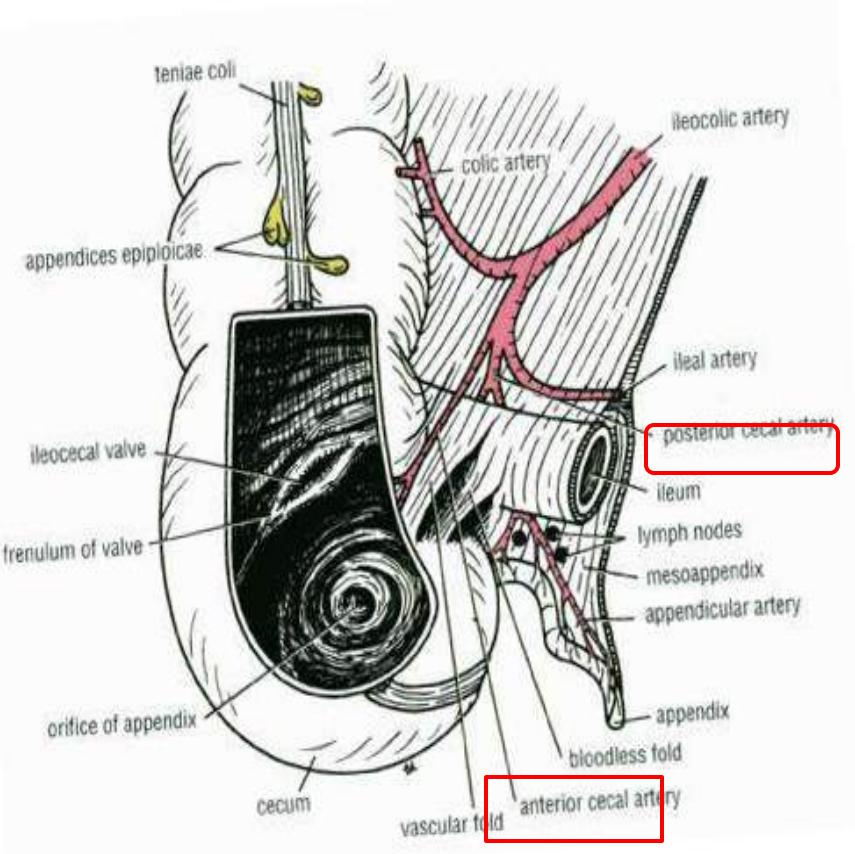
- ***Medially:*** **The appendix arises from the cecum on its medial side.**

Posteriorly: **The psoas and the iliacus muscles, the femoral nerve, and the lateral cutaneous nerve of the thigh. The appendix is commonly found behind the cecum.**

Cecum

- **Blood Supply** from Anterior and posterior cecal arteries form the ileocolic artery, a branch of the superior mesenteric artery.

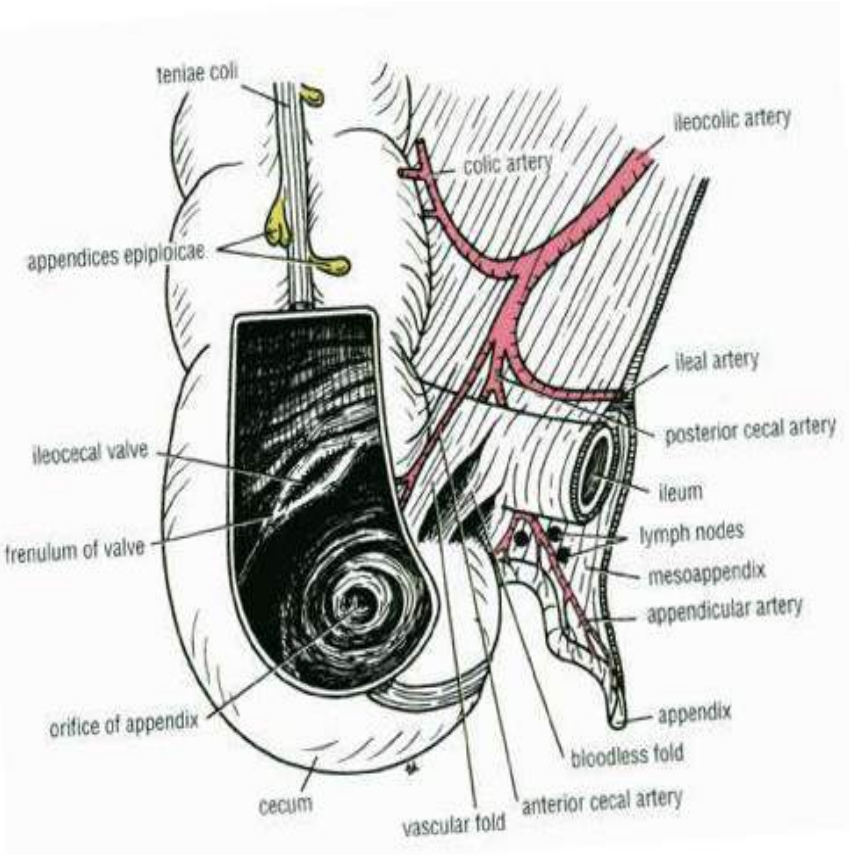
- The *veins* correspond to the arteries and drain into the superior mesenteric vein.



Ileocecal Valve

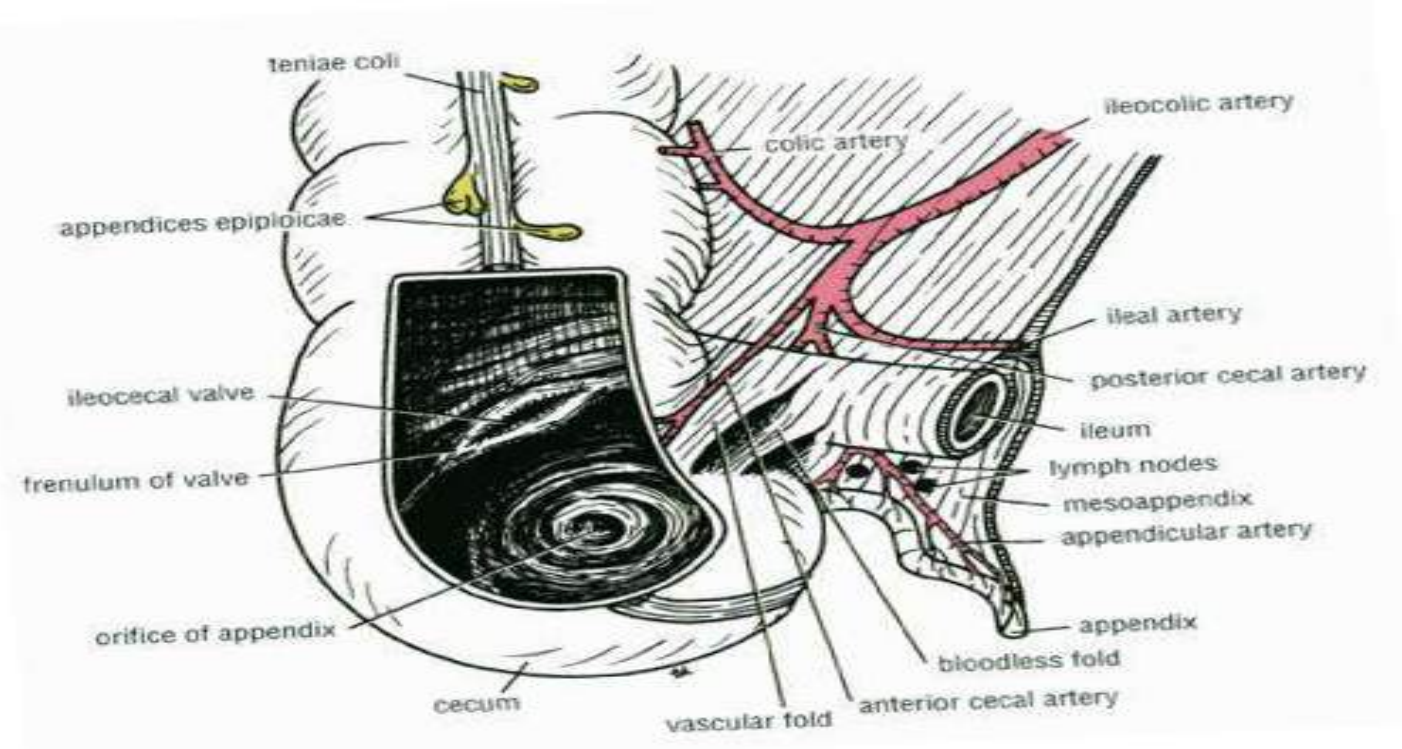
- **A rudimentary structure, the ileocecal valve consists of two horizontal folds of mucous membrane that project around the orifice of the ileum.**

- **The circular muscle of the lower end of the ileum called the ileocecal sphincter serves as a sphincter and controls the flow of contents from the ileum into the colon.**
- **The smooth muscle tone is reflexly increased when the cecum is distended; the hormone gastrin, causes relaxation of the muscle tone.**



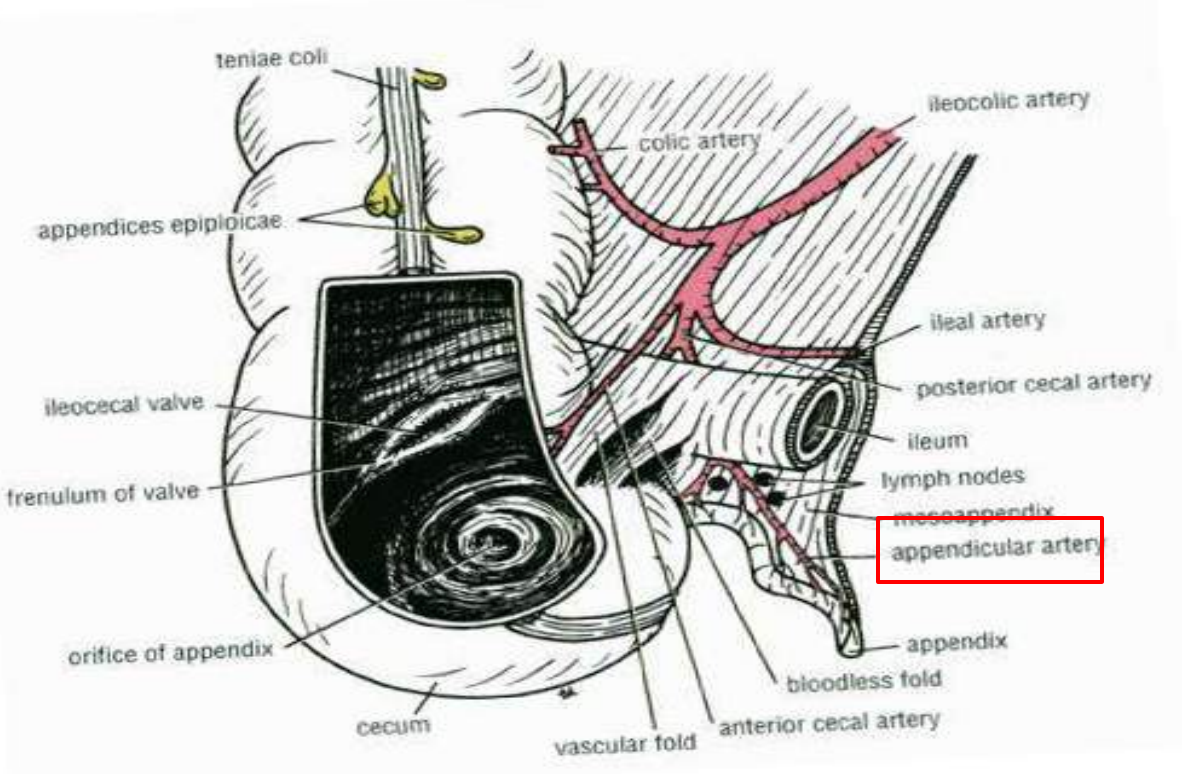
Appendix

- The appendix is a narrow , worm like muscular tube containing a large amount of lymphoid tissue.
- It varies in length from *(8-13 cm).*
- The base is attached to the *poster medial* surface of the cecum about *(2.5 cm)* below the ileocecal junction.
- The remainder of the appendix is free.



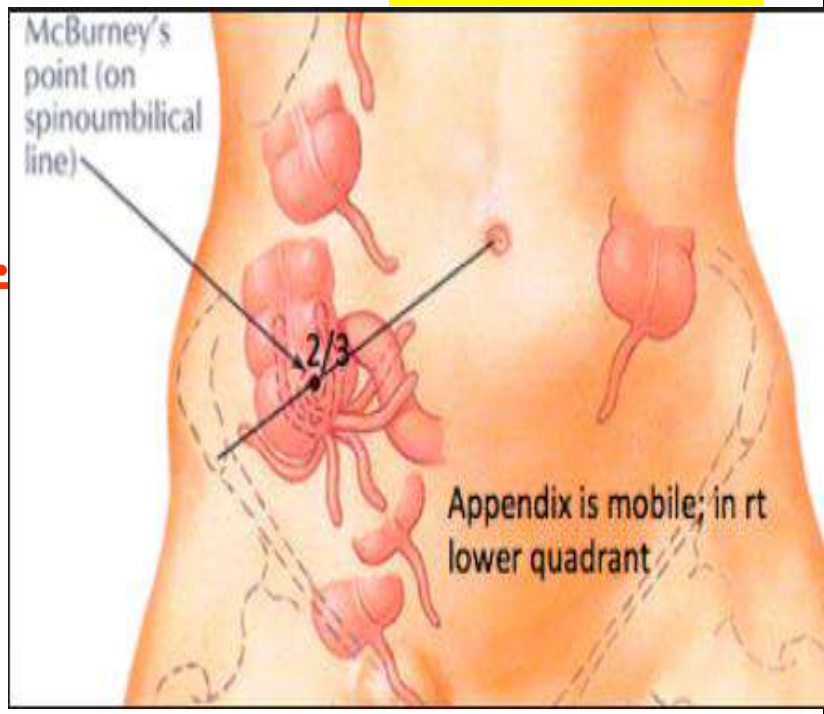
Appendix

- **It has a complete peritoneal covering(Meso-Appendix) triangular in shape which has apex attached to the lower layer of the mesentery of the small intestine and base that surrounds the appendix .**
- **The mesoappendix contains the appendicular vessels and nerves.**

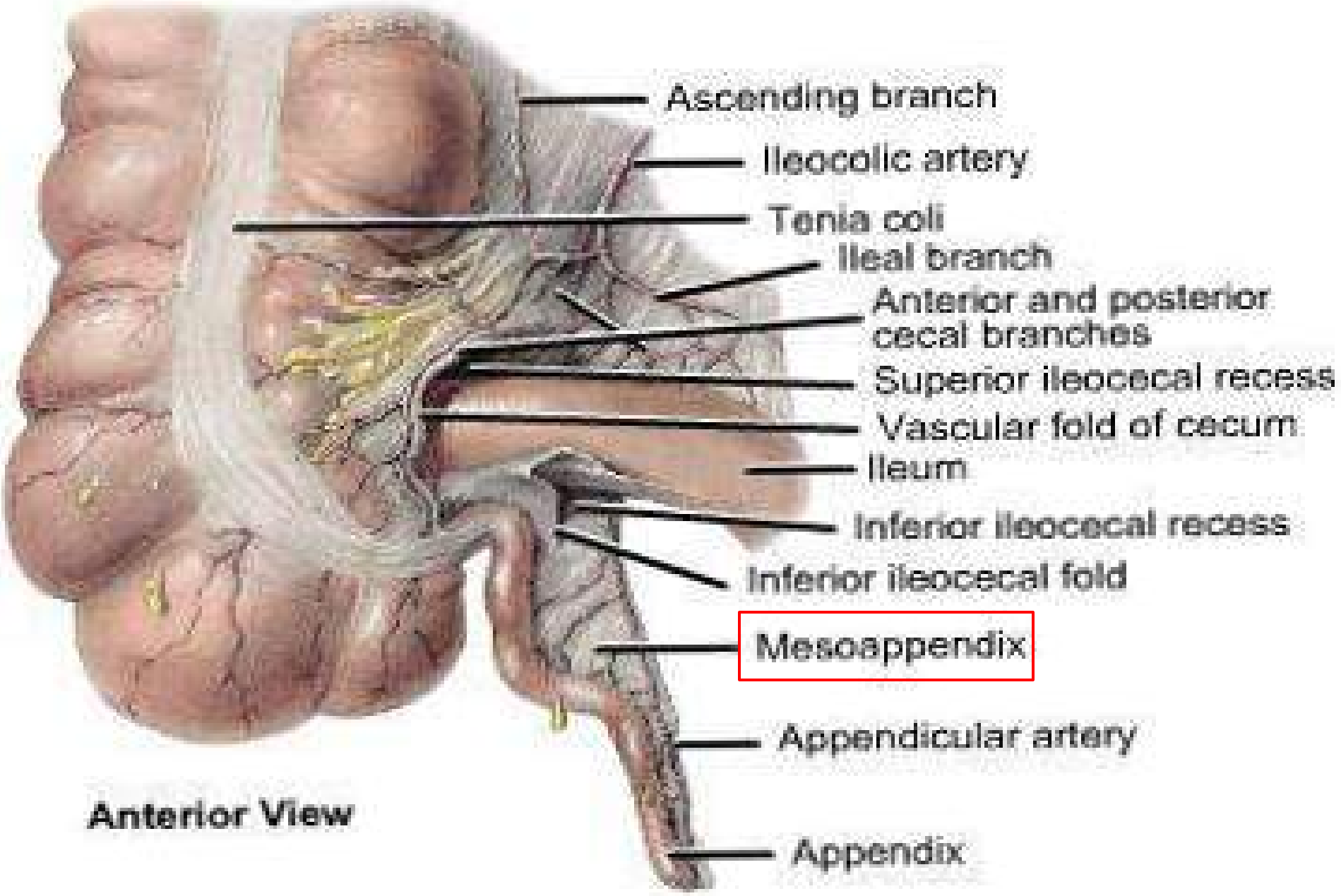


Appendix

- **The appendix lies in the right iliac fossa, and in relation to the anterior abdominal wall its base is situated *One Third of the Way Up* the line joining the right anterior superior iliac spine to the umbilicus (*McBurney's point).***

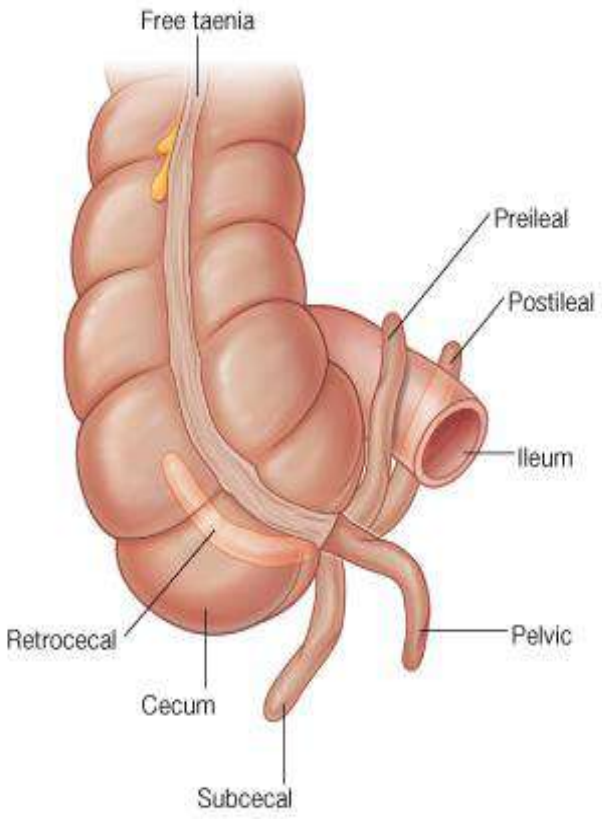


- **Inside the abdomen, the base of the appendix is easily found by identifying the *Teniae Coli* of the cecum and tracing them to the base of the appendix, where they converge to form a continuous longitudinal muscle coat.**


Ascending branch
Ileocolic artery
Tenia coli
Ileal branch
Anterior and posterior cecal branches
Superior ileocecal recess
Vascular fold of cecum
Ileum
Inferior ileocecal recess
Inferior ileocecal fold
Mesoappendix
Appendicular artery
Appendix
Anterior View

Common Positions of the Tip of the Appendix

- **The tip of the appendix is subject to a considerable range of movement and may be found in the following positions:**
  - **Coiled up behind the cecum, *(Retrocecal 74%)***
  - **Hanging down into the pelvis against the right pelvic wall, *Pelvic 21%)***
  - **Projecting upward along the lateral side of the cecum, *(Paracecal%)***
  - **Below the cecum, *(Subcecal)***
  - **Front of or be hind the terminal part of the ileum, *(pre- and post ileal)***



VARIABILITY OF POSITION OF THE APPENDIX

- **The *Inconstancy* of the position of the appendix should be borne in mind when attempting to diagnose an *Appendicitis.***
- **A Retrocecal appendix for example may lie behind a cecum distended with gas, and thus it may be difficult to elicit tenderness on palpation in the right iliac region.**
- **Irritation of the psoas muscle, conversely, may cause the patient to keep the right hip joint flexed.**
- **An appendix hanging down in the pelvis may result in absent abdominal tenderness in the right lower quadrant, but deep tenderness may be experienced just above the symphysis pubis.**
- **Rectal or vaginal examination may reveal tenderness of the peritoneum in the pelvis on the right side.**

PREDISPOSITION OF THE APPENDIX TO INFECTION

- **The following factors contribute to the appendix's susceptibility to infection:**
- **It is a long, narrow, blind-ended tube, which encourages stasis of large-bowel contents.**
- **It has a large amount of lymphoid tissue in its wall .**
- **The lumen has a tendency to become obstructed by hardened intestinal contents (enteroliths), which leads to further stagnation of its contents.**

PREDISPOSITION OF THE APPENDIX TO PERFORATION

- **The appendix is supplied by a long small artery that does not anastomose with other arteries *End Artery*.**
- **The blind end of the appendix is supplied by the terminal branches of the appendicular artery.**
- **Inflammatory edema of the appendicular wall compresses the blood supply to the appendix and often leads to thrombosis of the appendicular artery.**
- **These conditions commonly result in necrosis or gangrene of the appendicular wall, with perforation.**
- **Perforation of the appendix or transmigration of bacteria through the inflamed appendicular wall results in infection of the peritoneum of the greater sac.**

PAIN OF APPENDICITIS

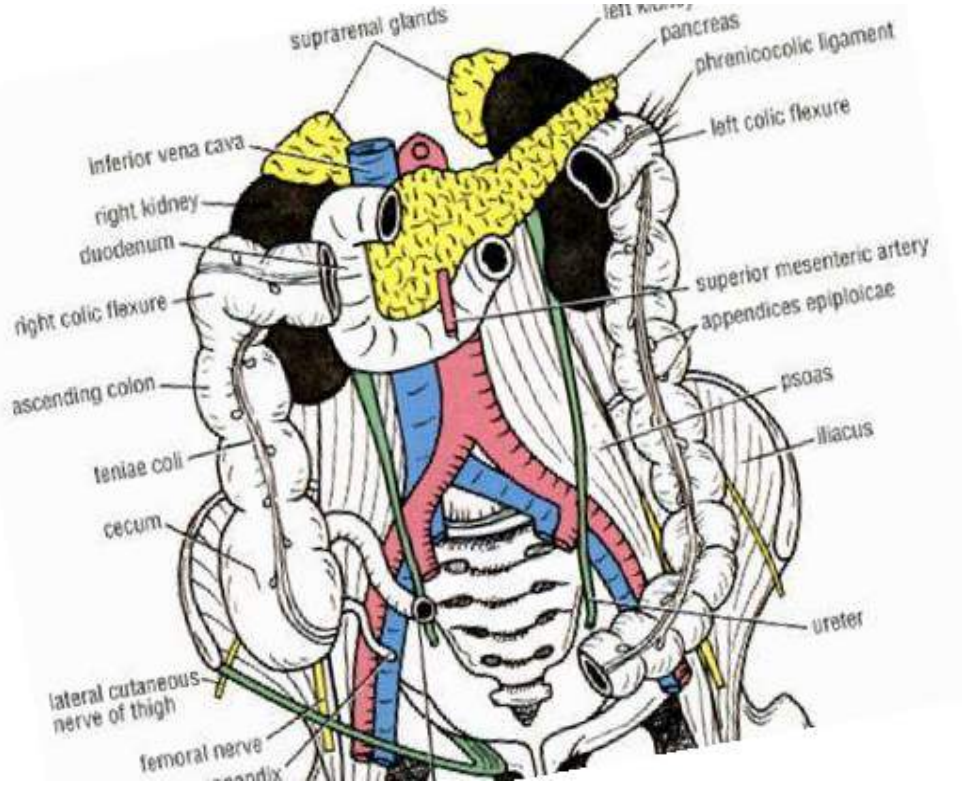
- ***Visceral Pain*** **in the appendix is produced by distention of its lumen or spasm of its muscle.**
- **The afferent pain fibers enter the spinal cord at the level of *T10*, and a vague referred pain is felt in the region of the umbilicus.**
- **Later, the pain shifts to where the inflamed appendix irritates the parietal peritoneum. *Somatic***
- **Here the pain is precise, severe, and localized.**

Appendix

- ***The appendicular artery*** **Branch of the posterior cecal artery. It passes to the tip of the appendix in the mesoappendix.**
- **The *appendicular vein* drains into the posterior cecal vein.**
- **The *lymph vessels* drain into one or two nodes lying in the mesoappendix and then eventually into the superior mesenteric nodes.**
- **Afferent nerve fibers concerned with the conduction of visceral pain from the appendix accompany the sympathetic nerves and enter the spinal cord at the level *T10.***

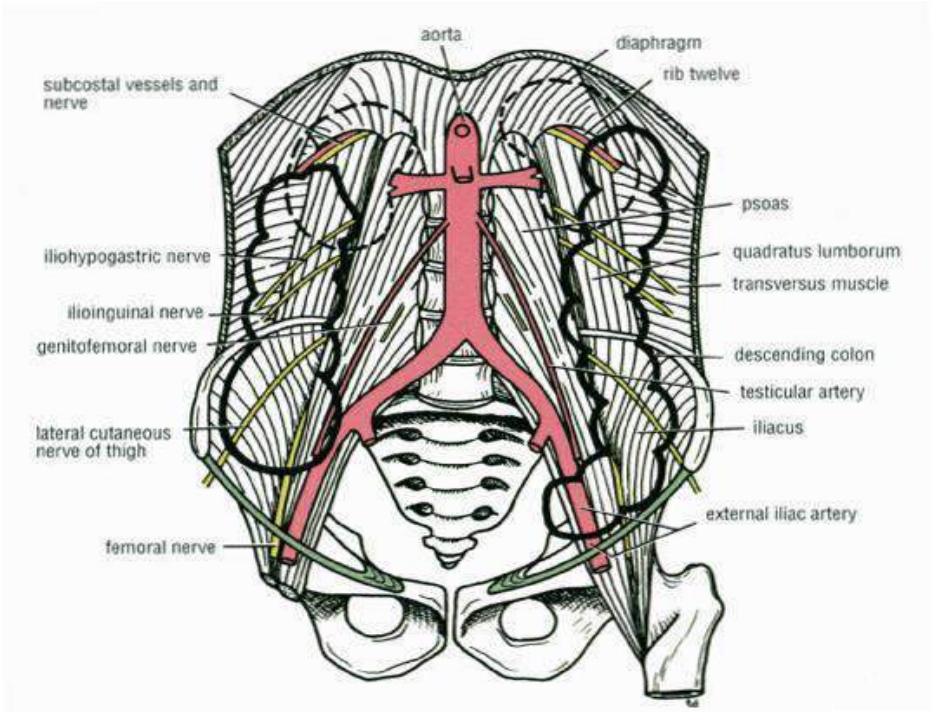
Ascending Colon

- **The ascending colon is about *(13 cm)* long and lies in the right lower quadrant.**
- **It extends upward from the cecum to the inferior surface of the right lobe of the liver, where it turns to the left, forming the right colic flexure, and becomes continuous with the transverse colon.**
- **The peritoneum covers the front and the sides of the ascending colon, binding it to the posterior abdominal wall.**



Relations of the Ascending Colon

- **Anteriorly:** **Coils of small intestine, the greater omentum, and the anterior abdominal wall.**
- **Posteriorly:** **The iliacus, the iliac crest, the quadratus lurnborum, the origin of the transversus abdominis muscle, and the lower pole of the right kidney. The iliohypogastric and the ilioinguinal nerves cross behind it.**



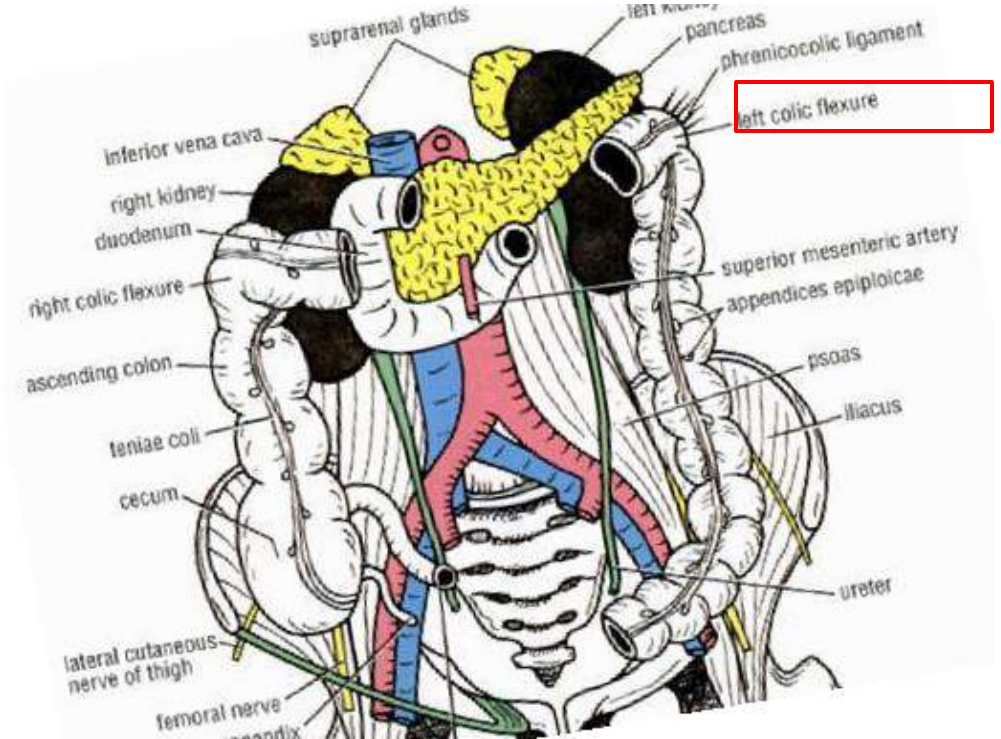
Ascending Colon

- **The *Ileocolic and Right colic* branches of the superior mesenteric *artery* supply this area.**
- **The *veins* correspond to the arteries and drain into the superior mesenteric vein.**

Transverse Colon

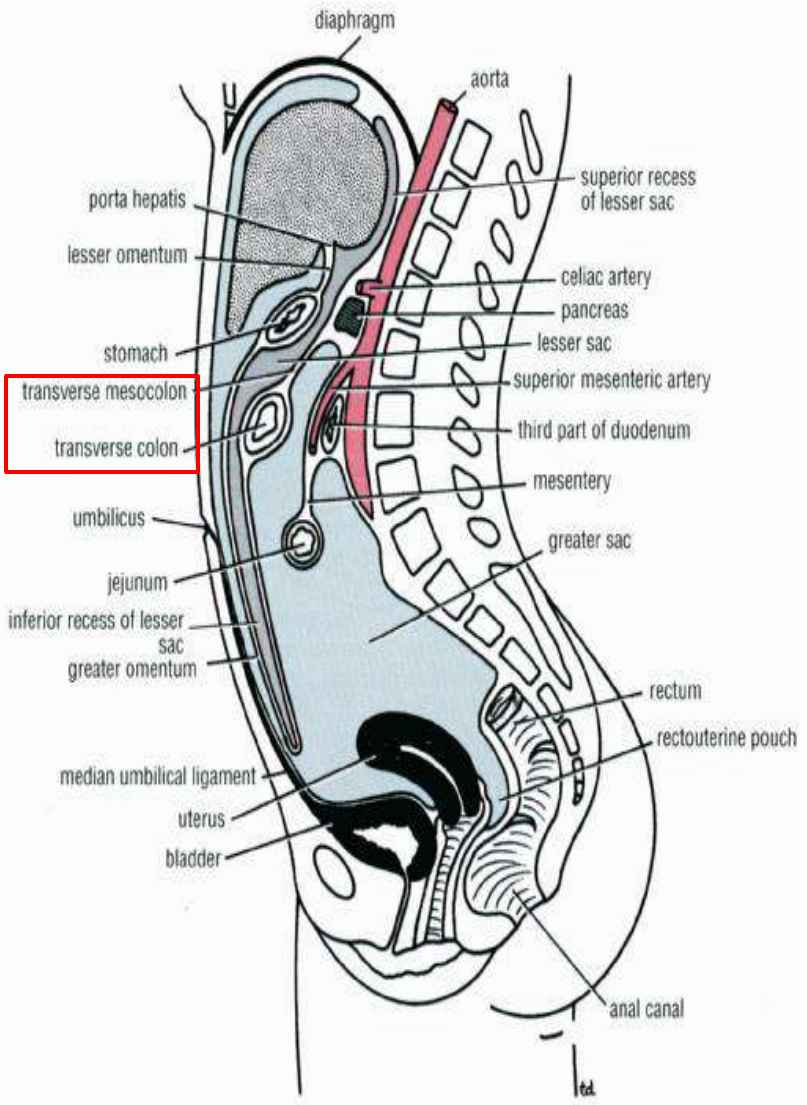
- **The transverse colon is about *(38 cm)* long and extends across the abdomen, occupying the umbilical region.**
- **It begins at the right colic flexure below the right lobe of the liver and hangs downward, suspended by the transverse mesocolon from the pancreas.**
- **It then ascends to the left colic flexure below the spleen.**

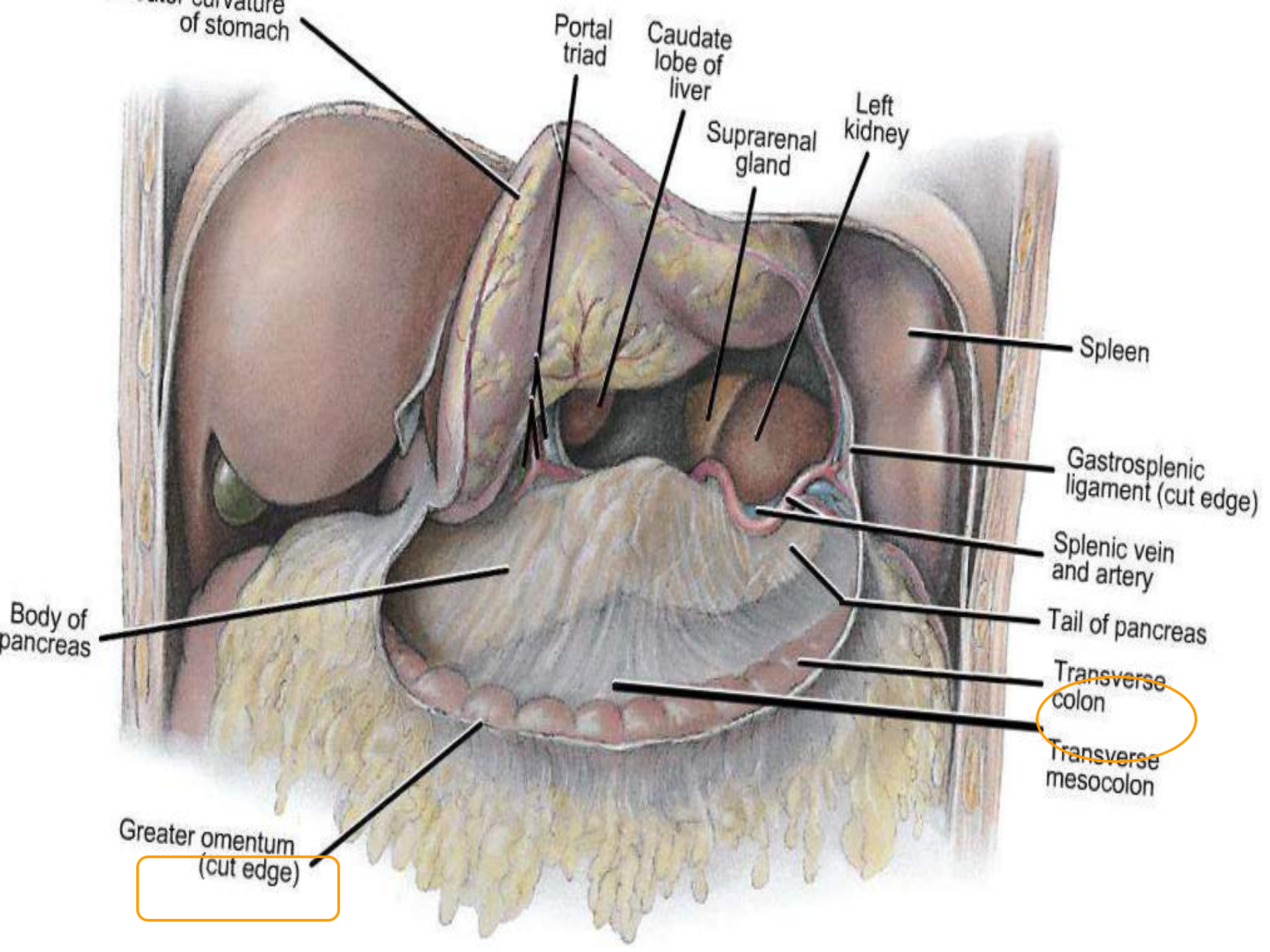
• The left colic flexure is *higher* than the right colic flexure and is suspended from the diaphragm by the *Phrenicocolic ligament*.



Transverse Colon

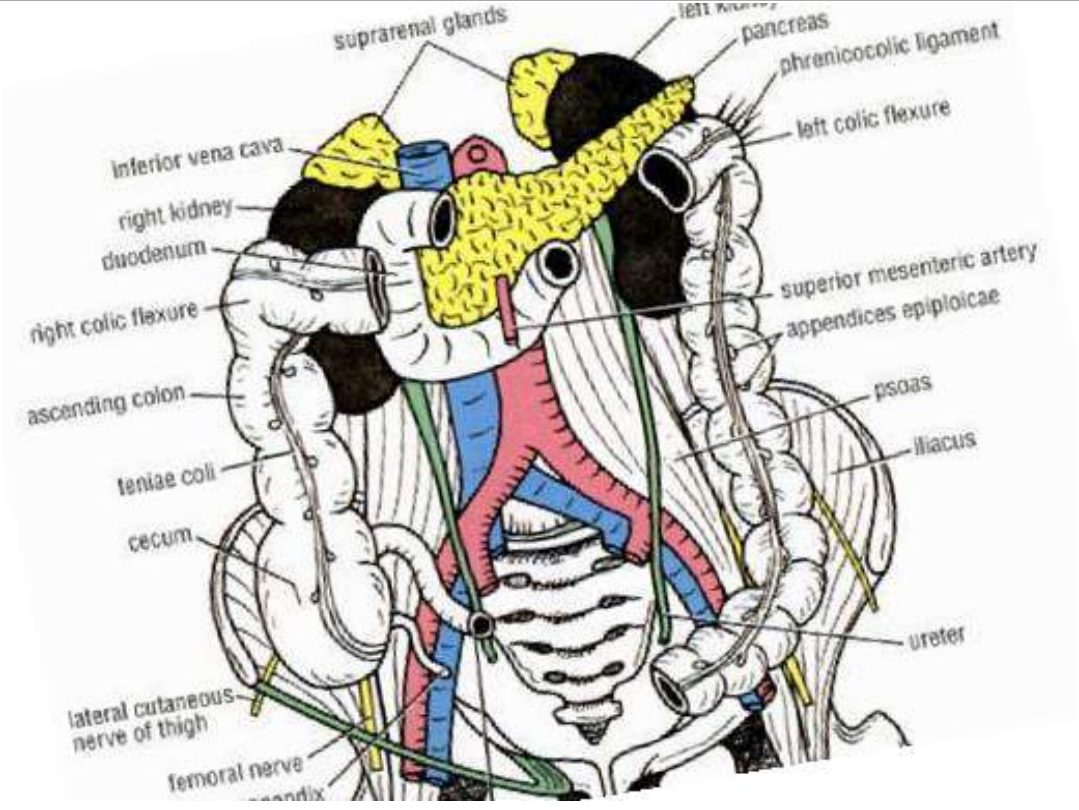
- The ***Transverse Mesocolon***, or mesentery of the transverse colon, suspends the transverse colon from the anterior border of the pancreas.
- The mesentery is attached to the ***Superior border*** of the transverse colon, and the posterior layers of the greater omentum are attached to the ***Inferior border***.
- Because of the length of the transverse mesocolon, the position of the transverse colon is extremely variable and may sometimes reach down as far as the pelvis.




of stomach
Portal triad
Caudate lobe of liver
Suprarenal gland
Left kidney
Spleen
Gastrosplenic ligament (cut edge)
Splenic vein and artery
Tail of pancreas
Body of pancreas
Transverse colon
Transverse mesocolon
Greater omentum (cut edge)

Relations of the Transverse Colon

- ***Anteriorly:*** **The greater omentum and the anterior abdominal wall (umbilical and Hypogastric regions.**
- ***Posteriorly:*** **The second part of the duodenum, the head of the pancreas, and the coils of the jejunum and ileum.**



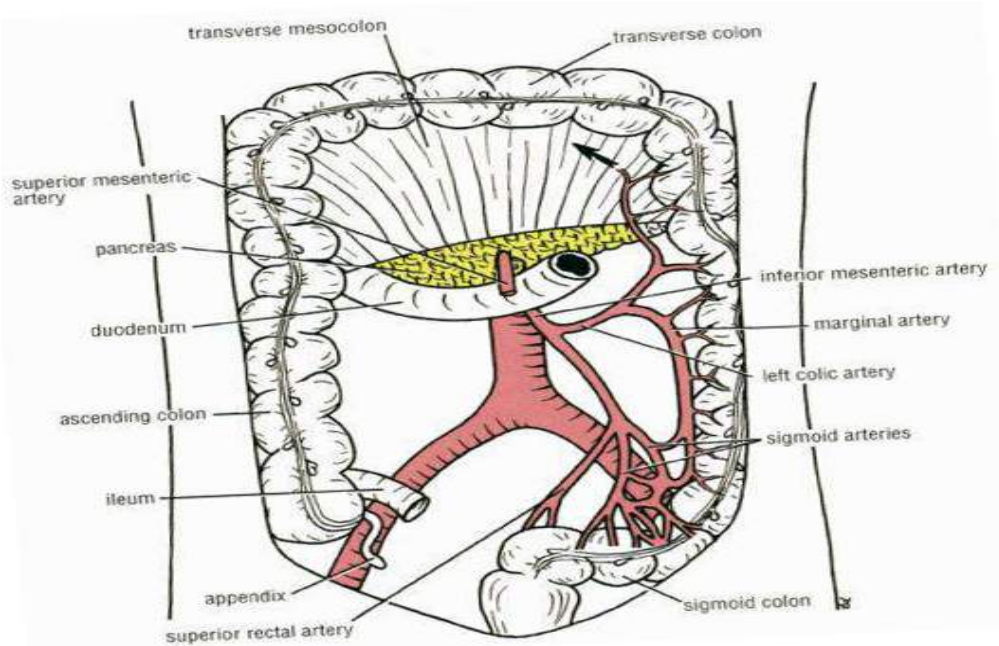
Transverse Colon

- ***Blood Supply***

  The proximal two thirds are supplied by the *Middle Colic Artery*, a branch of the superior mesenteric artery.

  The distal third is supplied by the *left colic artery*, a branch of the *inferior mesenteric artery.*

- ***The veins*** **correspond to the arteries and drain into the superior and inferior mesenteric veins.**



Transverse Colon

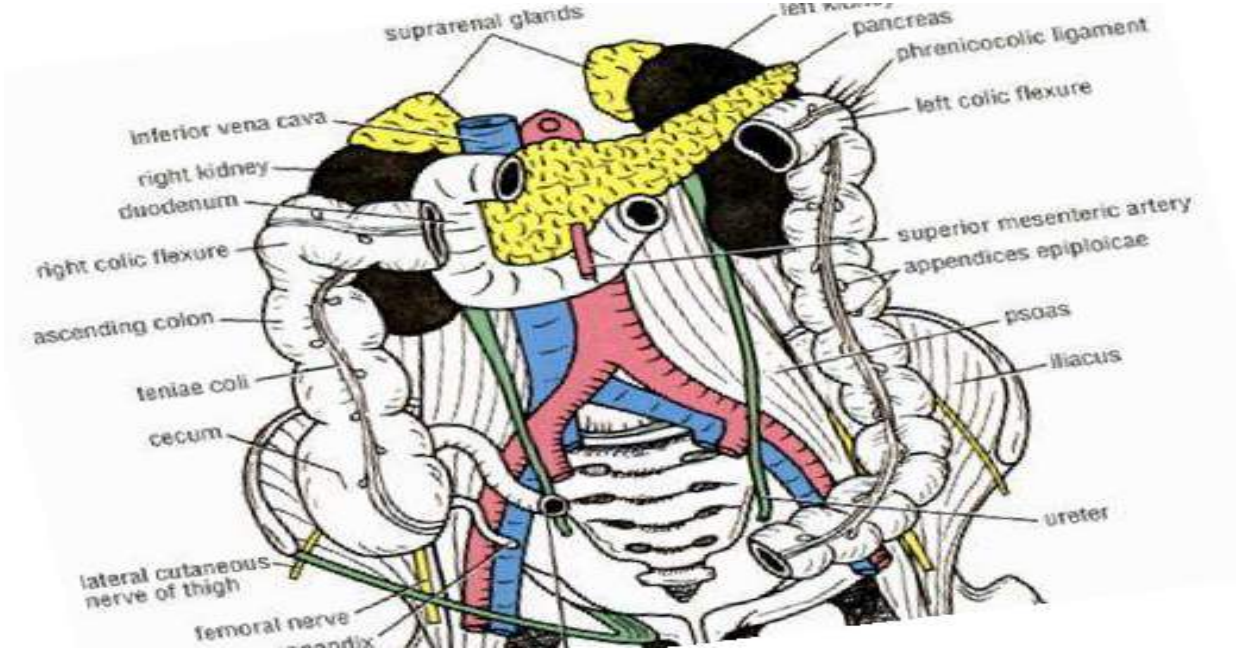
- ***Lymph Drainage***

- **The proximal two thirds drain into the colic nodes and then into the superior mesenteric nodes.**

- **The distal third drains into the colic nodes and then into the inferior mesenteric nodes.**

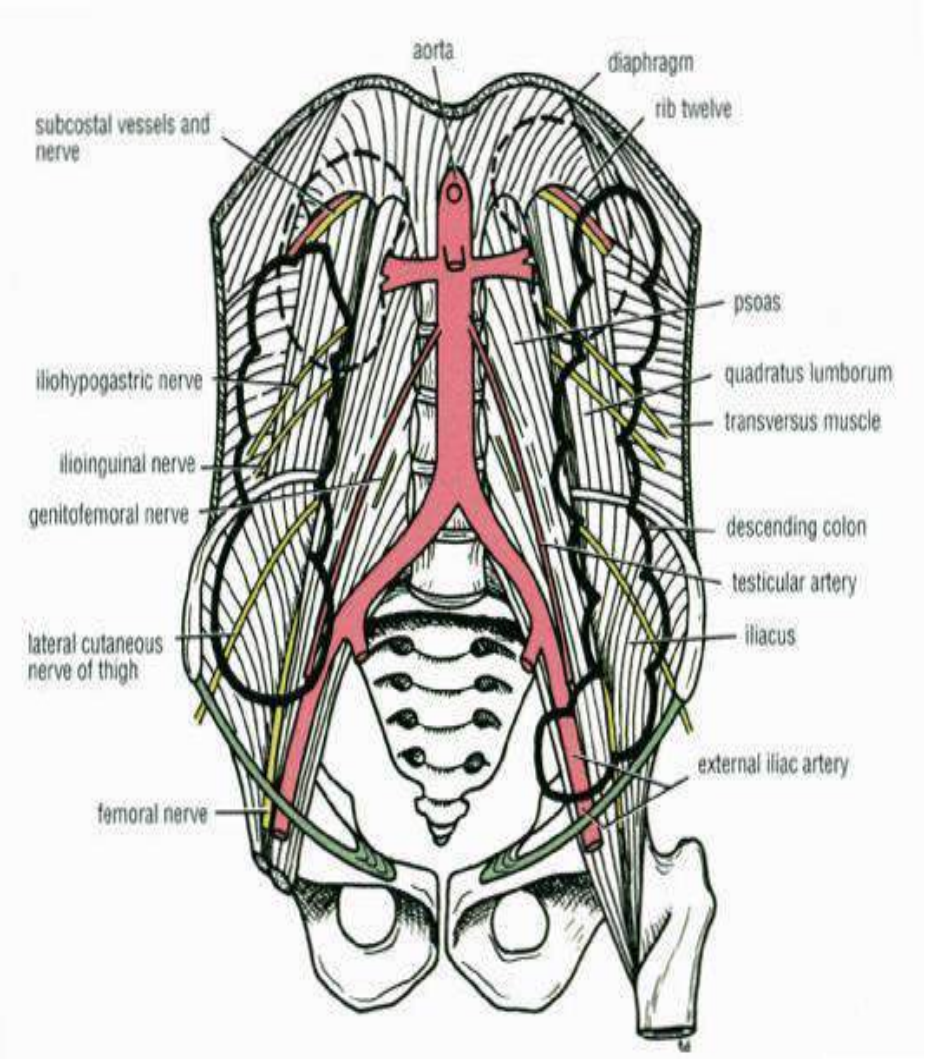
Descending Colon

- **The descending colon is about (25 cm) long and lies in the left upper and lower quadrants.**
- **It extends downward from the left colic flexure, to the pelvic brim, where it becomes continuous with the sigmoid colon.**
- **The peritoneum covers the front and the sides and binds it to the posterior abdominal wall.**



Relations of the Descending Colon

- • ***Anteriorly;*** **Coils of small intestine, the greater omenturn, and the anterior abdominal wall.**
- • ***Posteriorly:*** **The lateral border the left kidney, the origin of the transversus abdominis muscle, the quadratus lumborum, the iliac crest, the iliacus, and the left psoas, The iliohypogastric and the ilioinguinal nerves, the lateral cutaneous nerve of the thigh, and the femoral nerve also lie posteriorly.**

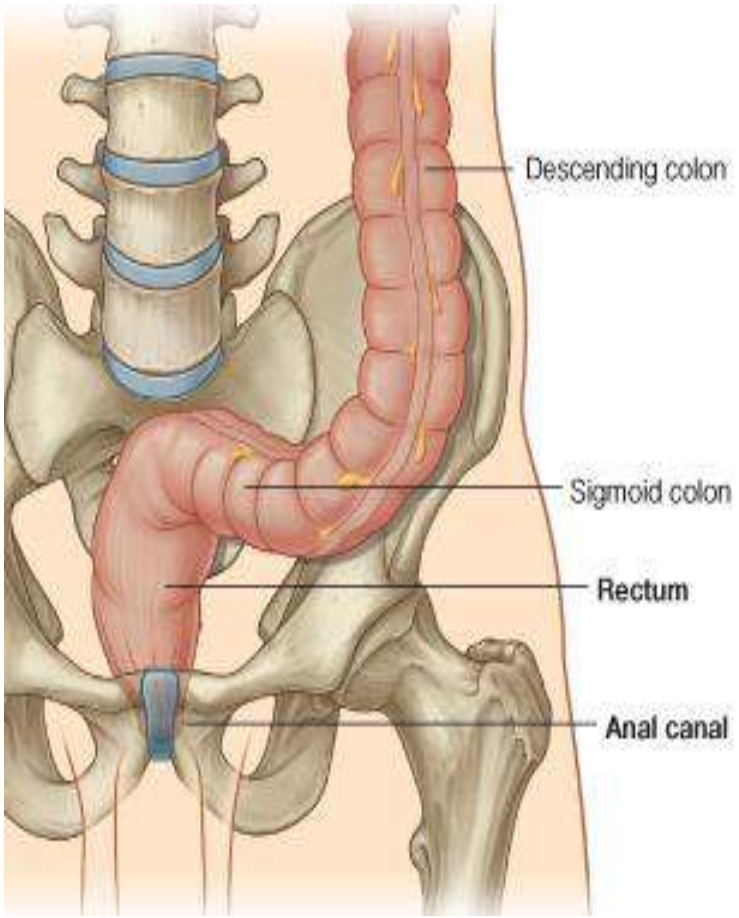


Descending Colon

- **The *left colic and the sigmoid branches* of the inferior mesenteric *artery* supply this area.**
- **The *veins* correspond to the arteries and drain into the inferior mesenteric vein.**
- **Colic *lymph* nodes and the inferior mesenteric nodes around the origin of the inferior mesenteric artery.**

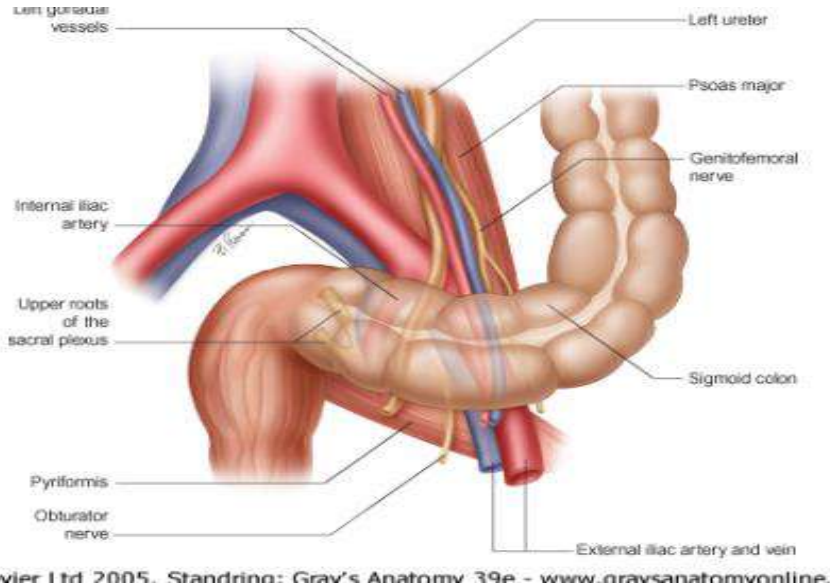
Sigmoid colon

- Is of variable length ***5 - 35 inch***.
- It start infront of external iliac artery at left side of pelvic inlet.
- Ends at 3rd sacral piece by becoming rectum.
- Has S shaped course ,first to Rt then downwards , backwards and to left.



Relation of sigmoid colon

- Urinary bladder below and infront.
- Rectum and sacrum behind.
- Uterus separate it from bladder in females.
- Terminal coils of ileum on its RT side
- ***Pelvic mesocolon:*** inverted V shape, lateral ascending ,medial descending limb
- NB In apex of this fold lie left ureter, Sup rectal artery lie in descending limb.



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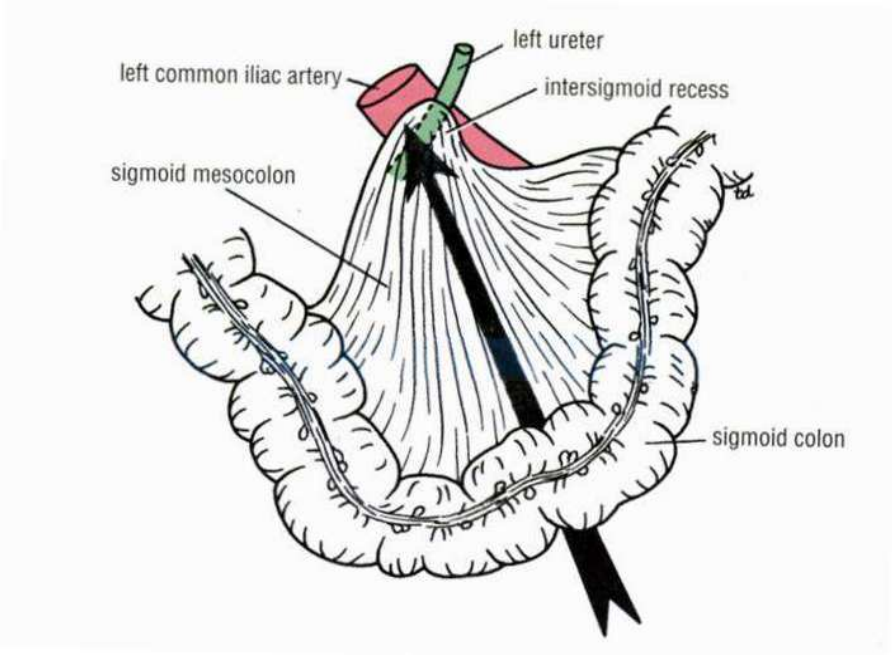
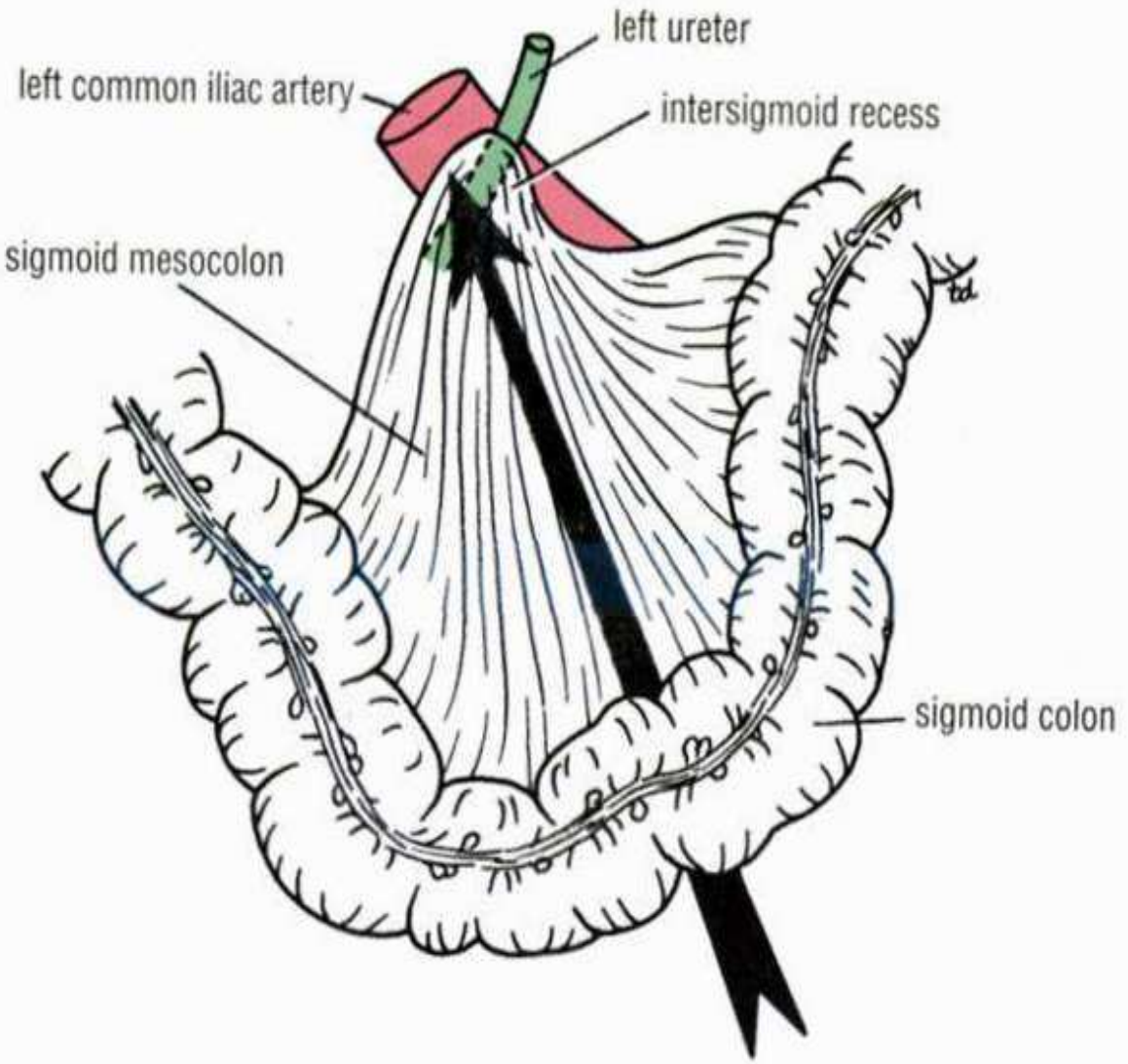
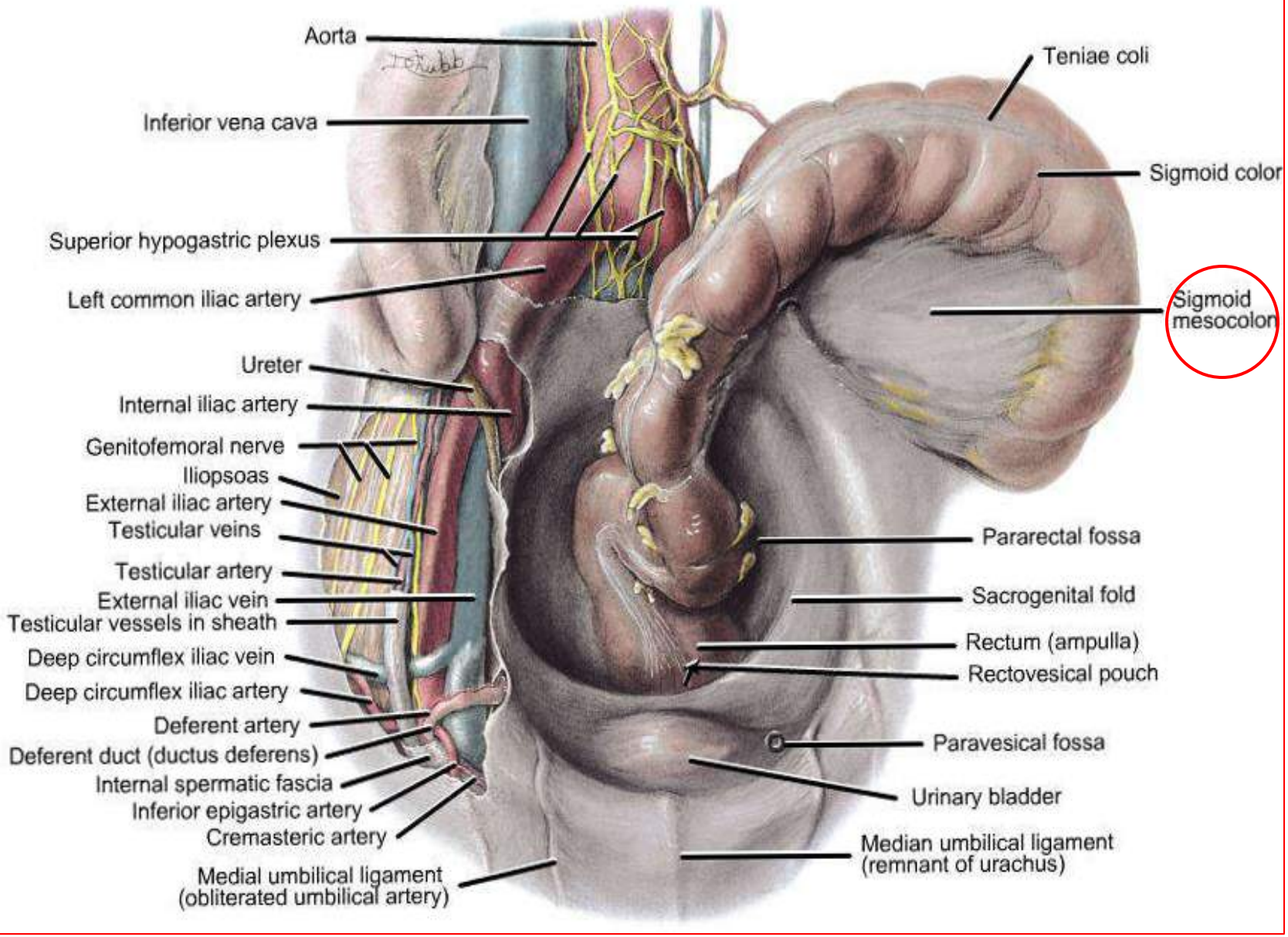



left ureter
left common iliac artery
intersigmoid recess
sigmoid mesocolon
sigmoid colon

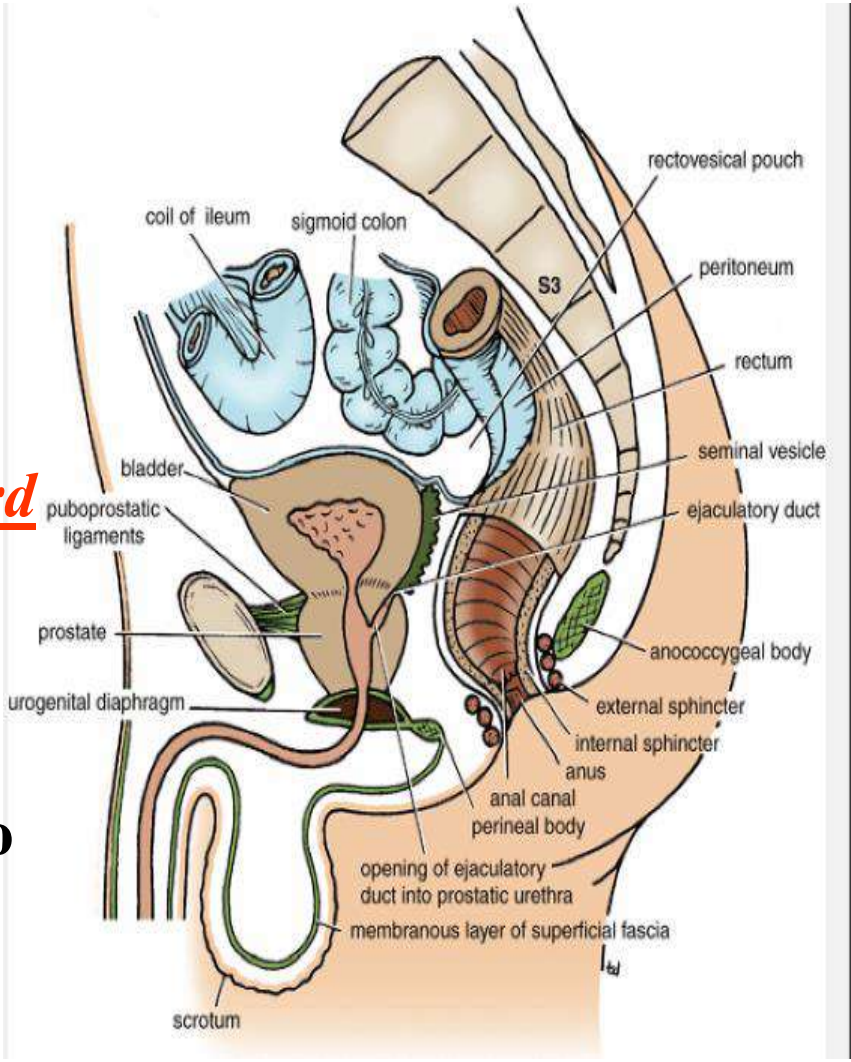

Aorta
Inferior vena cava
Superior hypogastric plexus
Left common iliac artery
Ureter
Internal iliac artery
Genitofemoral nerve
Iliopsoas
External iliac artery
Testicular veins
Testicular artery
External iliac vein
Testicular vessels in sheath
Deep circumflex iliac vein
Deep circumflex iliac artery
Deferent artery
Deferent duct (ductus deferens)
Internal spermatic fascia
Inferior epigastric artery
Cremasteric artery
Medial umbilical ligament
(obliterated umbilical artery)
Teniae coli
Sigmoid color
Sigmoid mesocolon
Pararectal fossa
Sacrogenital fold
Rectum (ampulla)
Rectovesical pouch
Paravesical fossa
Urinary bladder
Median umbilical ligament
(remnant of urachus)

Rectum

- 5 inches long occupy posterior part of pelvis.
- Begins infront 3rd sacral vertebra.
- Descend following concavity of sacrum.
- End one inch below and infront of coccyx by bending sharply ***downward and backward*** to form anal canal.
- Lower part is dilated to form rectal ampulla.

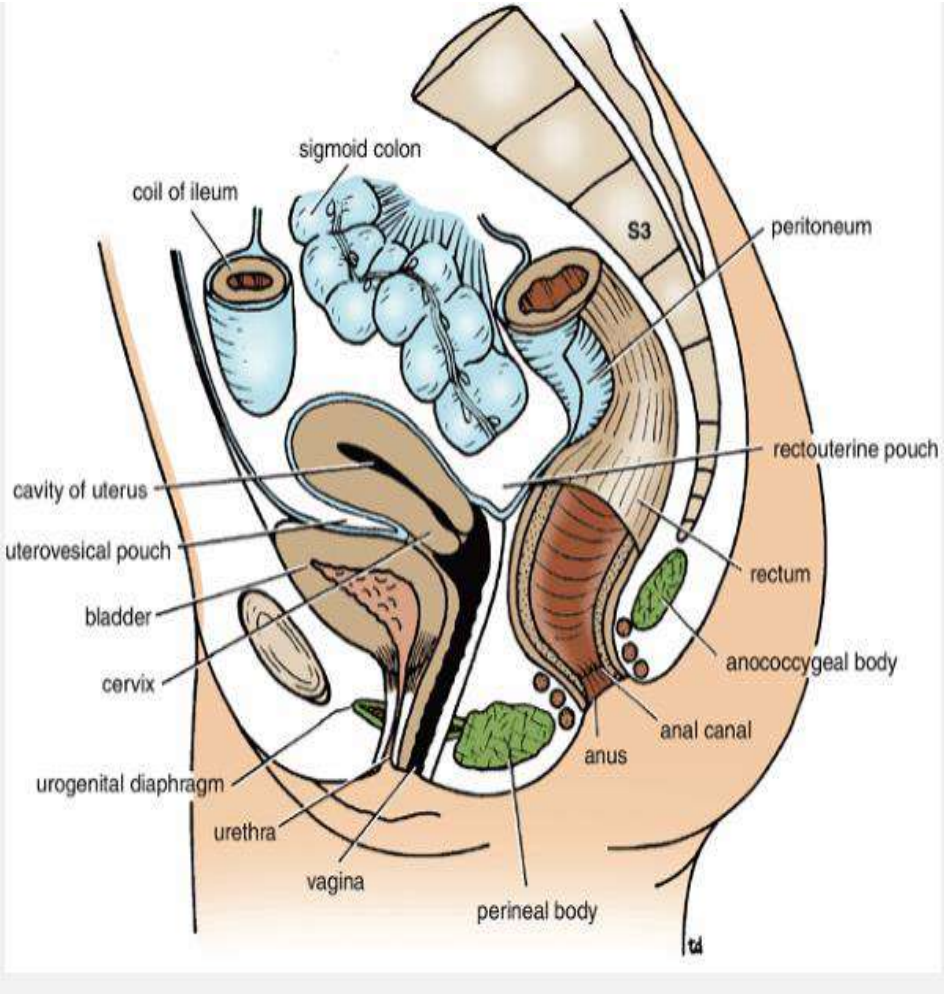
• **NB:** Recto-Anal angle correspond to

- Apex of prostate in male .
- Lower ¼ of vagina in female.



Rectum

- **3 lateral flexions LRL form valve of houston,pass ½ way wall of rectum**
- ***Peritoneal covering:***
- **Upper part front and sides.**
- **Middle part front only**
- **Lower part Retroperitoneal**

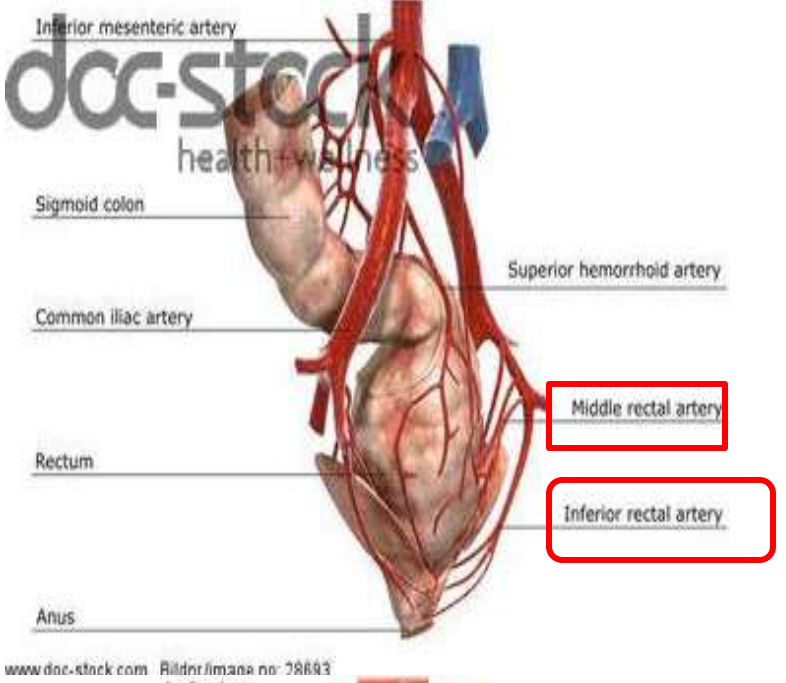


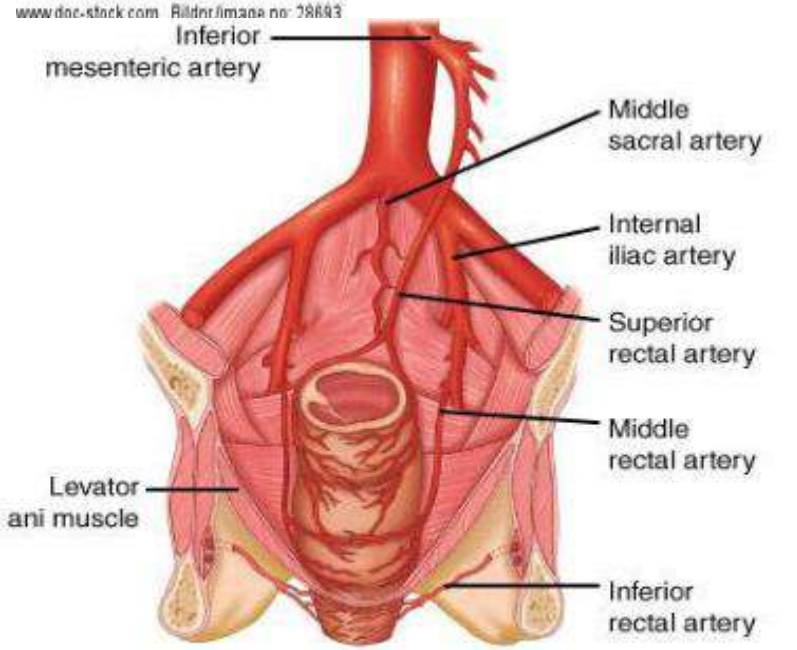
Relation of rectum

- ***Posterior relations***
- **Sacrum,coccyx,median sacral artery.**
- ***On each side :***
- **Pyriformis m,sympathatic trunk, lateral sacral nerves, and vessels**
- ***Anterior relations***
- ***In males***
  - **Upper 2/3 coils of small intestine.**
  - **Lower1/3 Post surface of urinary bladder.**
  - **Ampulla of rectum prostate.**
- ***In females:*** **Upper2/3 coils of intestine**
- **Lower 1/3 back of vagina ,cervix**

Rectum

- ***Arterial supply:***
- **Superior 1/3 superior rectal artery.**
- **Middle 1/3 middle rectal artery**
- **Lower 1/3 inferior rectal artery**
- ***Venous drainage***
- **Superior rectal vein portal venous system IMV ⟶ splenic vein.**
- **Middle, Inferior veins to systemic veins.**

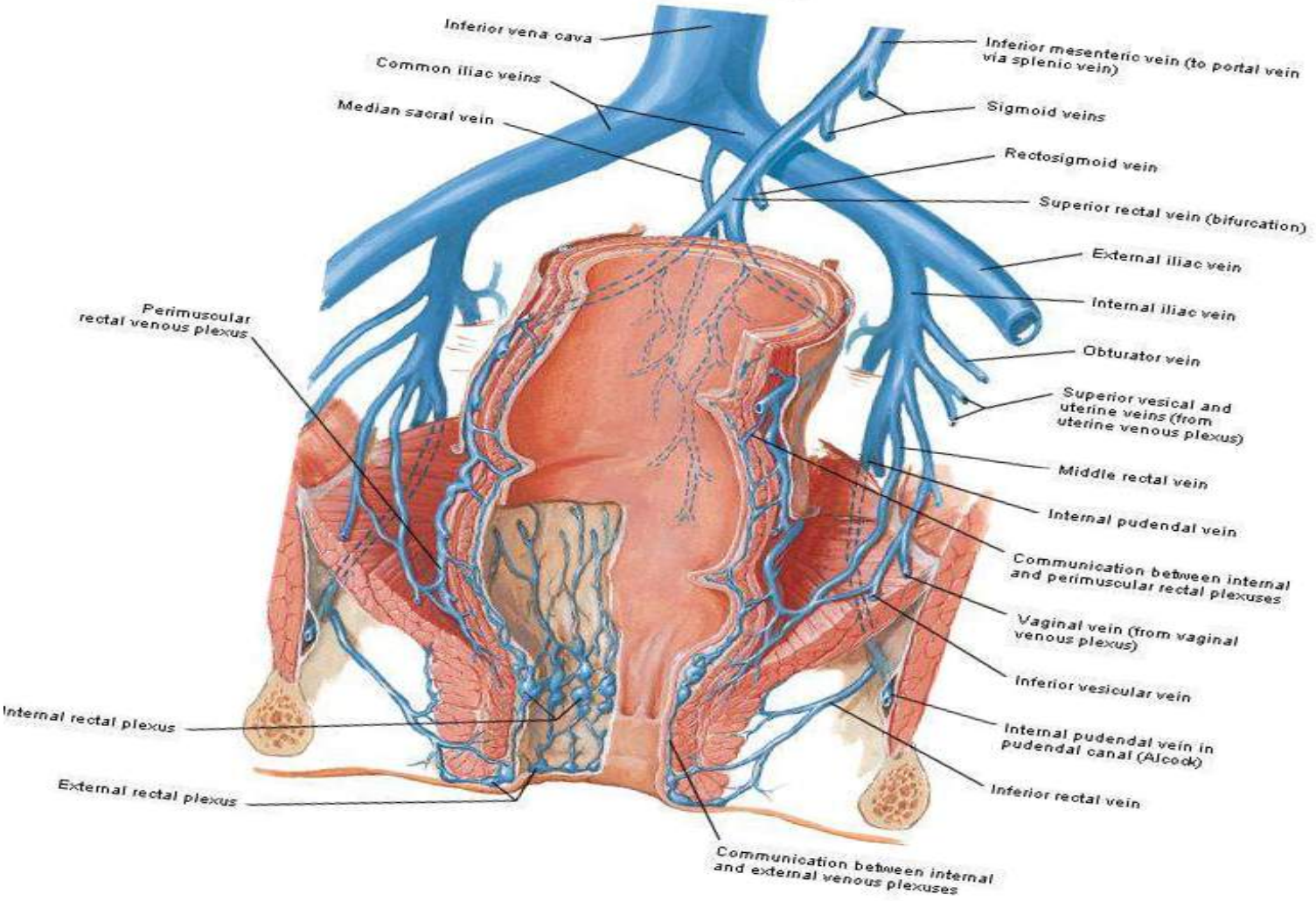


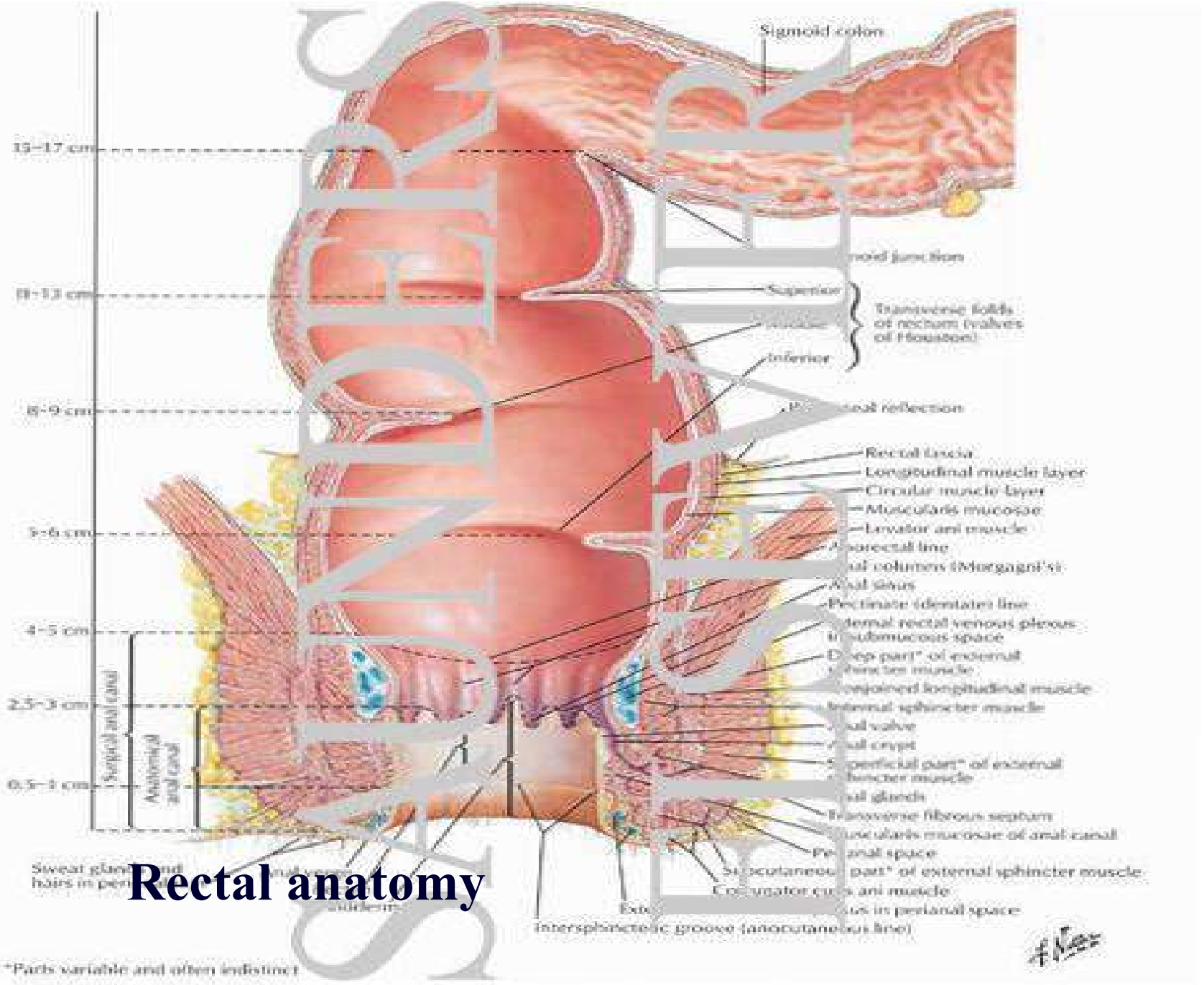


Arterial supply to the rectum and anal canal

Veins of Rectum and Anal Canal

Anterior View





Rectal anatomy

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Difference between small and large intestine

- ***Taenia coli:***

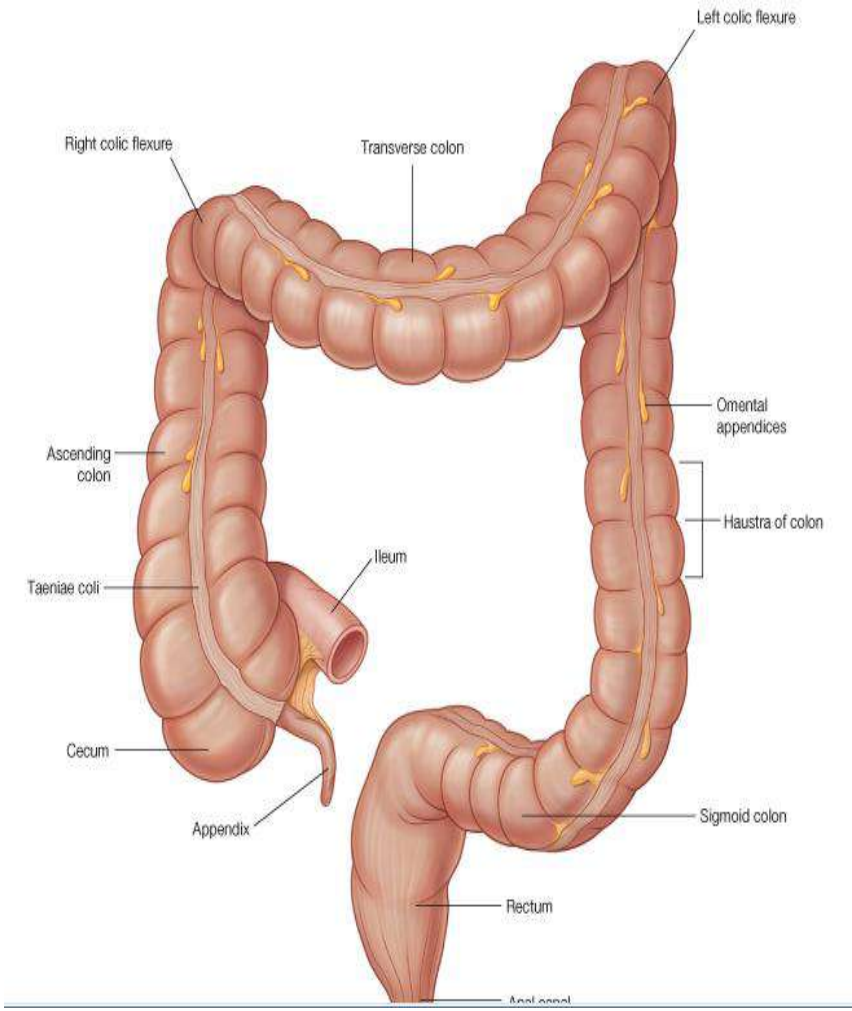
Outer long . muscle layer forming three bands, begins at base of appendix, end at junction of sigmoid and rectum. not found in appendix , or rectum.

- ***Sacculations (Haustration):***

Due to one foot short of *Taenia coli* , than colon.

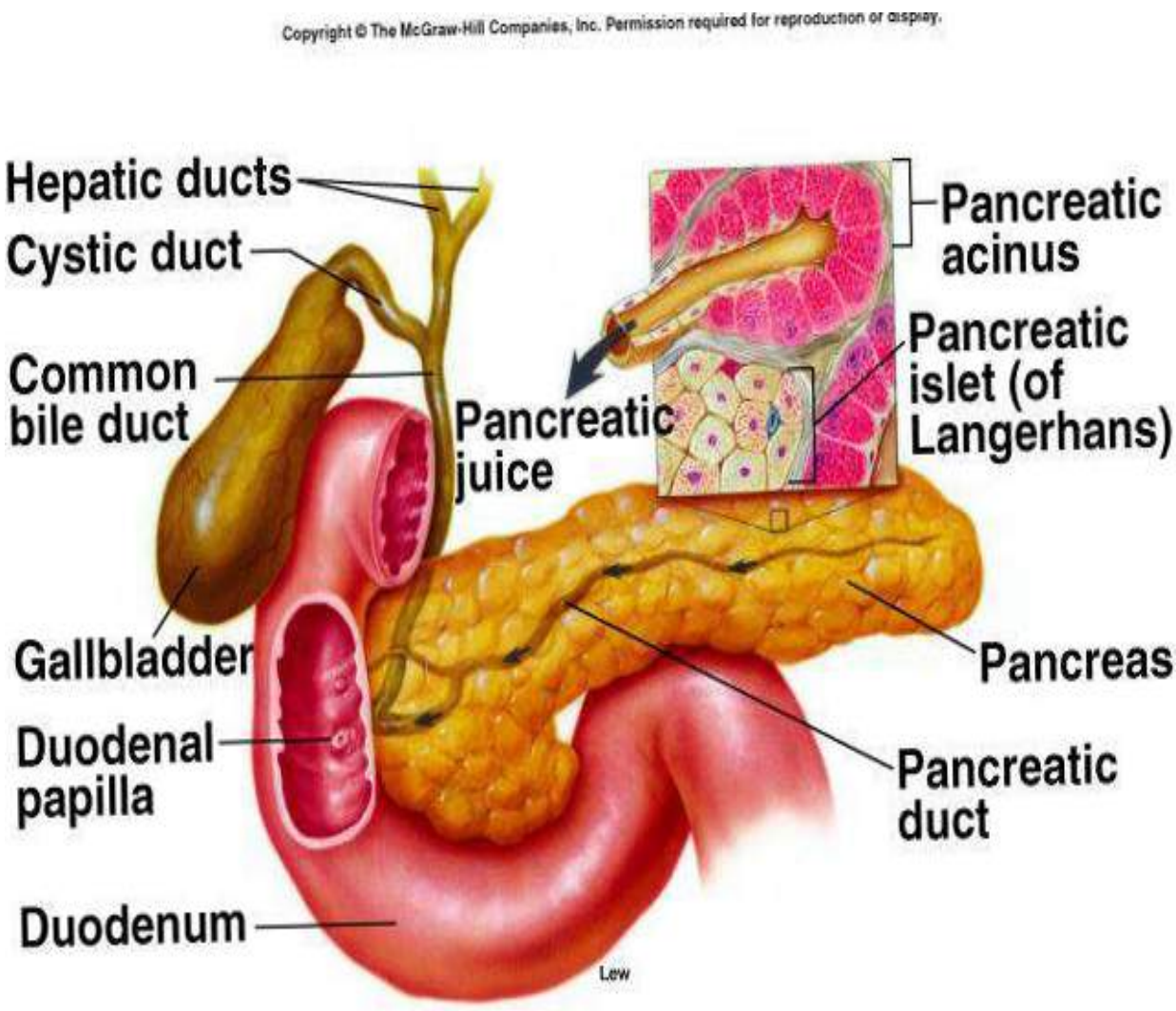
- ***Appendices epiploicae:***

Peritoneal bag of fat, not found in rectum, caecum ,appendix.



Pancreas

- ***Exocrine:***
  - ***Acini:***
- **Secrete pancreatic juice.**
- **Endocrine:**
  - **Islets of Langerhans:**
- **Secrete insulin and glucagon.**



5-Pancreatic Secretion

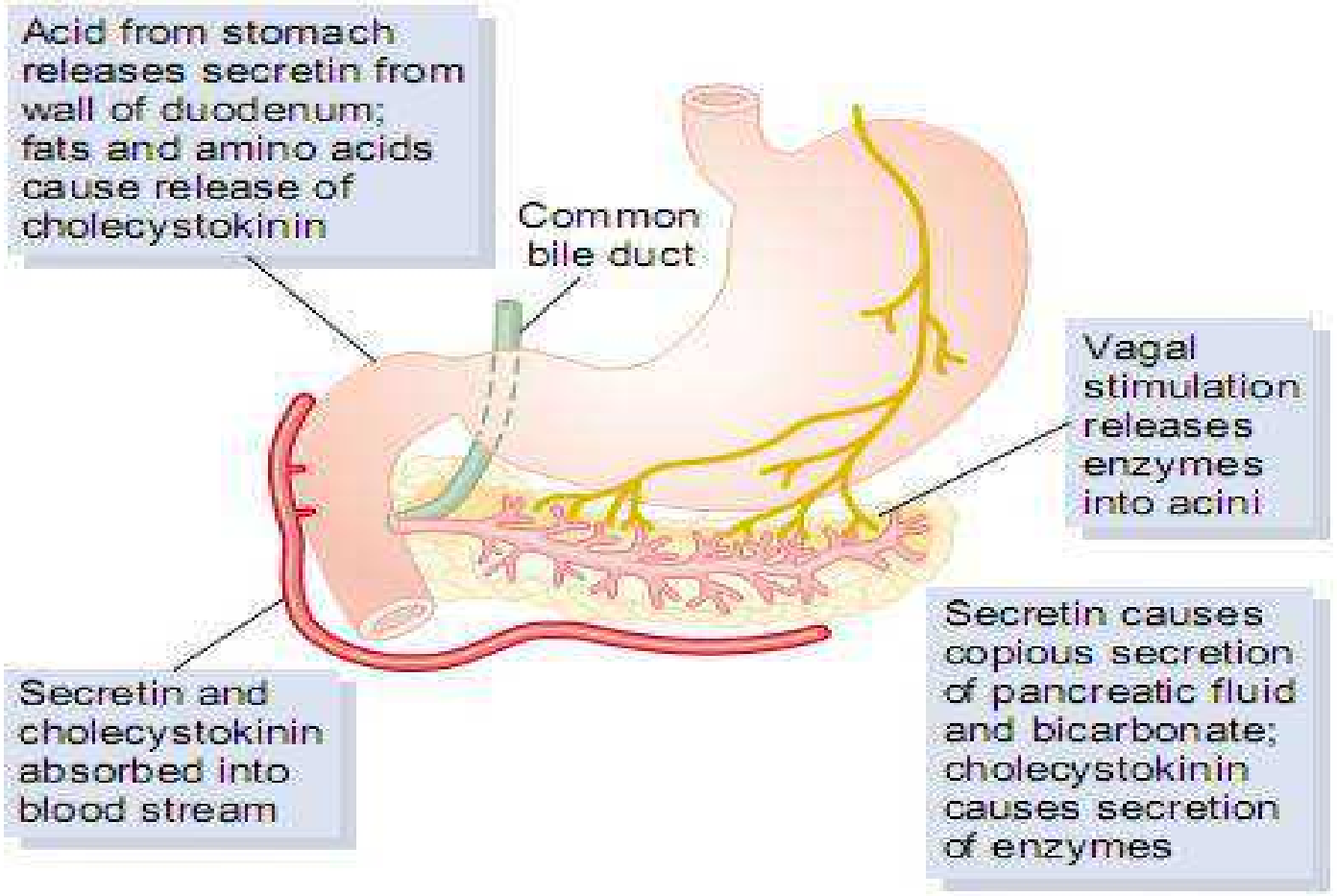
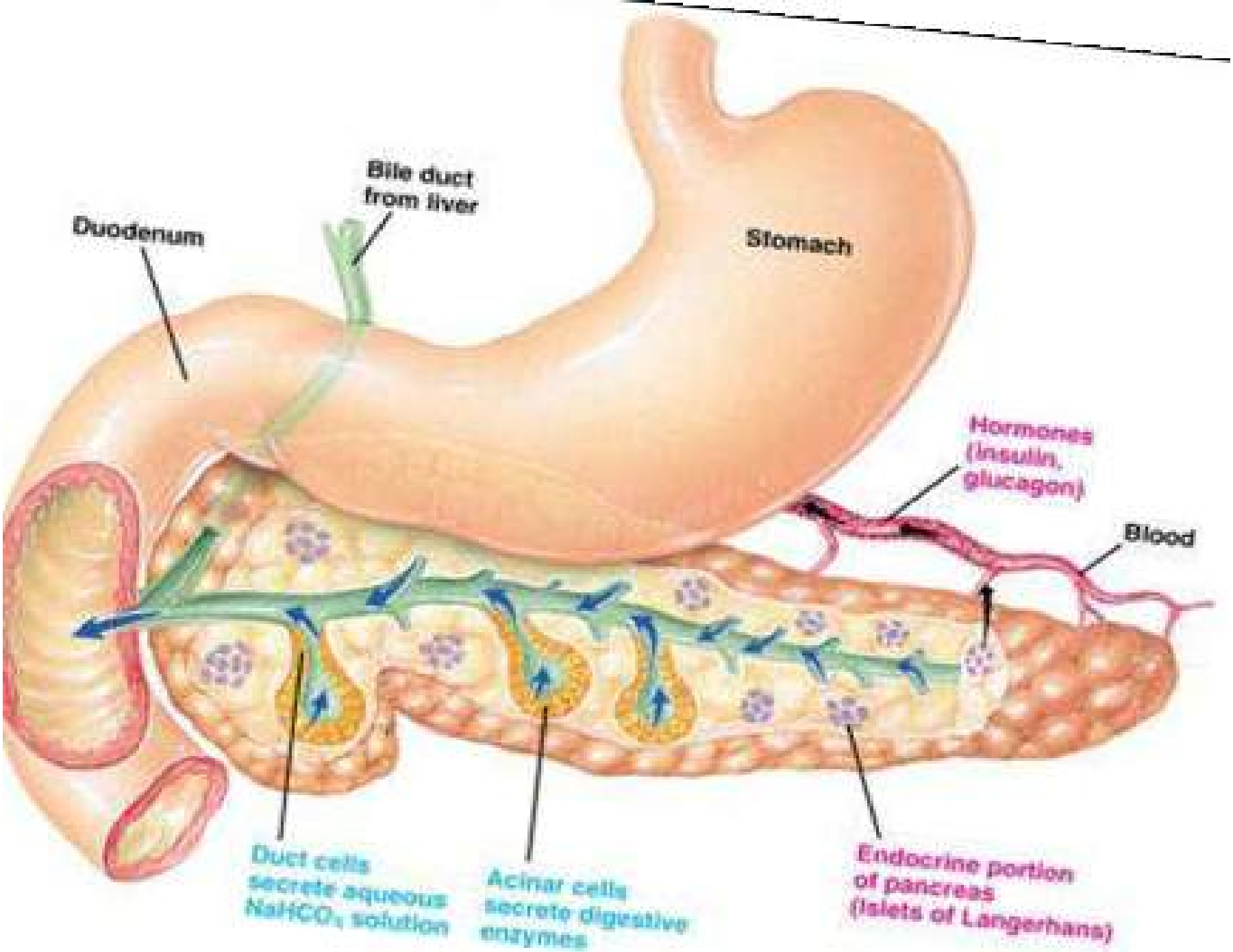


Figure 64–10

Regulation of pancreatic secretion.


Bile duct from liver
Duodenum
Stomach
Hormones (insulin, glucagon)
Blood
Duct cells secrete aqueous $NaHCO_3$ solution
Acinar cells secrete digestive enzymes
Endocrine portion of pancreas (islets of Langerhans)

- **Pancreatic secretion contains *multiple enzymes* for digesting all of the three major types of food: proteins, carbohydrates, and fats. It also contains large quantities of *bicarbonate ions*, which play an important role in neutralizing the acidity of the chyme emptied from the stomach into the duodenum.**

- **Pancreatic enzymes for digesting Proteins are *Trypsin, Chymotrypsin,* and *Carboxypolypeptidase*. By far the most abundant of these is trypsin.**

- **The pancreatic enzyme for digesting Carbohydrates is *pancreatic Amylase*, which hydrolyzes starches, glycogen, and most other carbohydrates (except cellulose) to form mostly disaccharides and a few trisaccharides.**

- **The main enzymes for Fat digestion are:**
- **(1) *Pancreatic lipase*, which is capable of hydrolyzing neutral fat into fatty acids and monoglycerides**
- **(2) *Cholesterol esterase*, which causes hydrolysis of cholesterol esters**
- **(3) *Phospholipase*, which splits fatty acids from phospholipids.**

Pancreas

- **Pancreatic juice**
  - **1.0-1.2 L/day**
  - **Mostly water some salts, bicarbonate, enzymes**
- **Alkaline, pH 7.1-8.2.**
- **Buffers acidic gastric juice, stops pepsin activity, creates proper alkaline pH for enzymes acting in the intestine.**
  - **Enzymes include:**
    - **Pancreatic amylase**
    - **Trypsinogen, Chymotrypsinogen, Procarboxypeptidase (inactive zymogens)**
    - **Pancreatic lipase**
    - **Ribonuclease and deoxyribonuclease**

A-aqueous Pancreatic Secretion

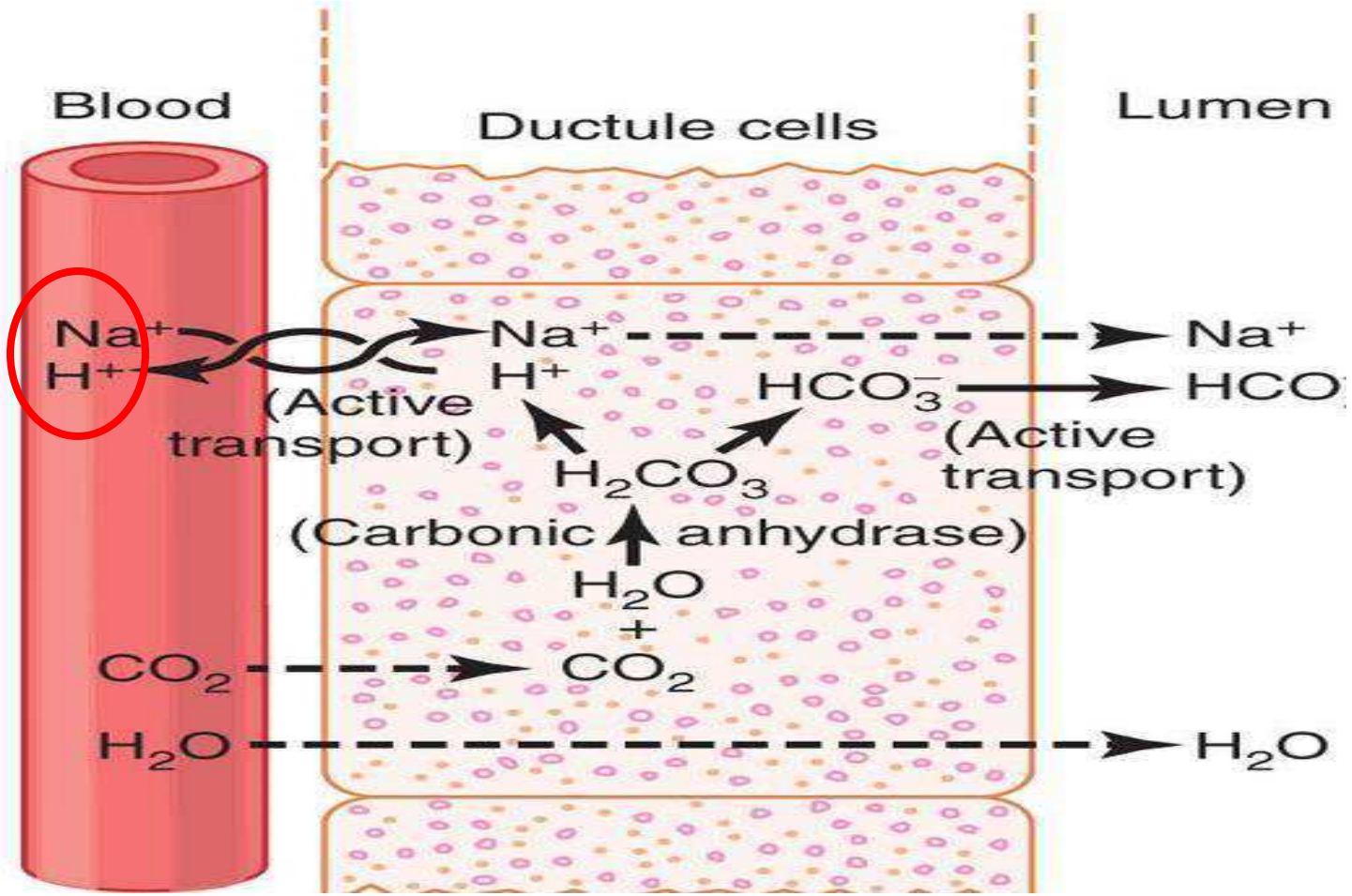
- **Composition;**
  - **Water**
  - **HCO_3^-**
  - **Poor in enzymes.**
- **Secretion;** **Actively by epithelial cells of pancreatic *Ducts***
  It is stimulated by secretin & VIP.
- **Function;**

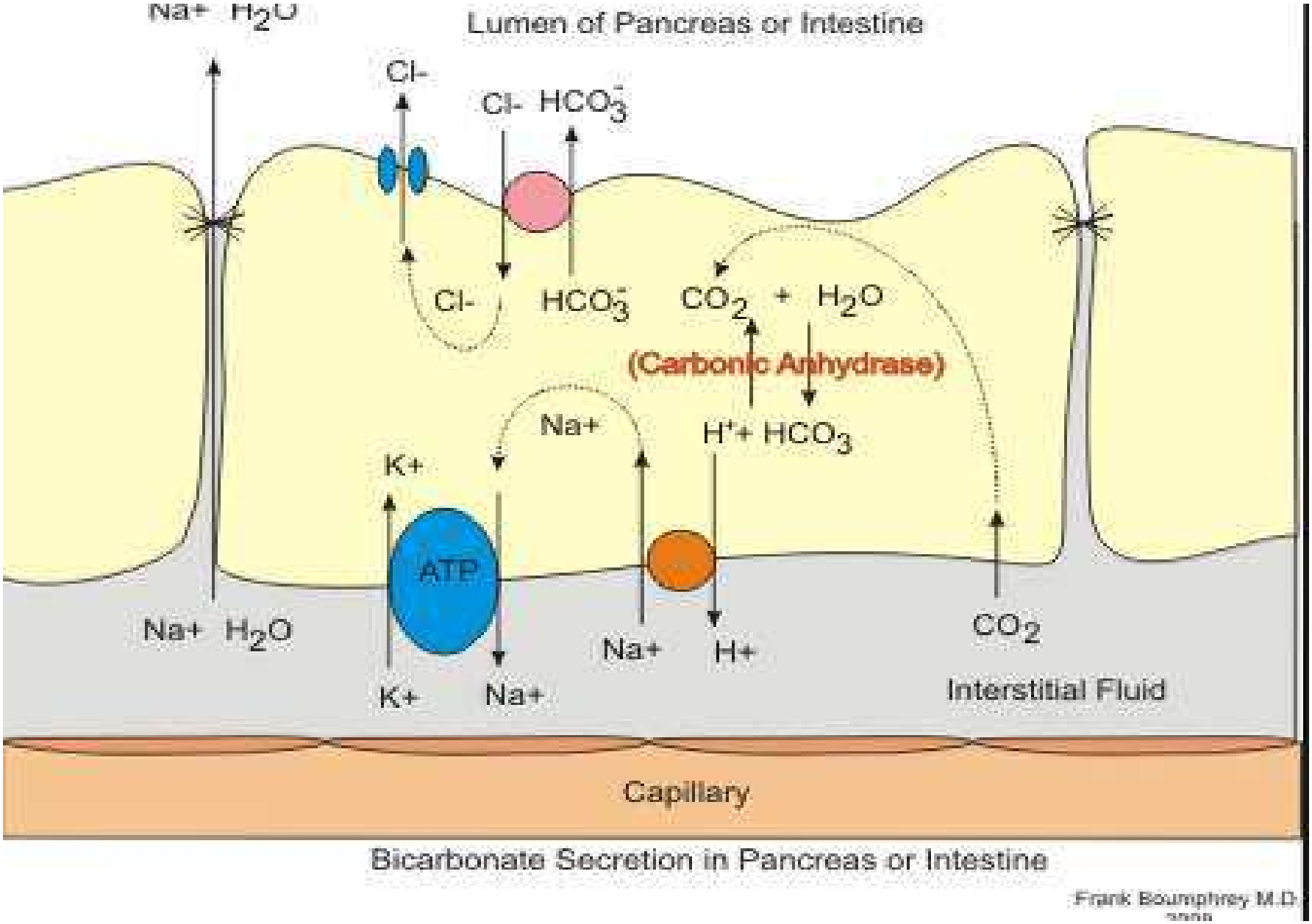
- ***Neutralize the acid chyme emptied by the stomach into the duodenum to protect the delicate duodenal mucosa from harmful effect of acidity&pepsin.***

  $$HcI+NaHco_3=NaCl+H_2Co_3$$

- ***Provide the alkaline pH optimum for the action of pancreatic & intestinal enzymes .***

Mechanism of HCO_3^- secretion





Bicarbonate Secretion in Pancreas or Intestine

Frank Boumphrey M.D.

B-Pancreatic enzymes

- They are fully sufficient for ***complete digestion of food.***
- They are secreted from the ***Acinar cells.***
- The juice is small in volume, poor in HCO_3^- and Rich in the following enzymes:-
  - Pancreatic amylase.
  - Pancreatic lipase.
  - Pancreatic Proteolytic enzymes.

Pancreatic enzymes

1-Proteolytic:

Secreted in inactive form, become activated only in small intestine. *By Enterokinase enzymes secreted by Intestinal mucosa in response to chyme.*

- **Trypsinogen** $\xrightarrow{EK}$ **Trypsin (Endopeptidase)** $\xrightarrow{\text{Trypsin}}$ **peptides**
- **Chymotrypsinogen** → **chymotrypsin (endopeptidase)** $\xrightarrow{\text{Trypsin}}$ **peptides**
- **Procarboxypeptidase** → **carboxypeptidase** → **Amino acids**

It is an Exopeptidase. It is the only Proteolytic enzyme that can release amino acids.

- **d-Proelastase** → **Elastase (acts on elastin).**

2-Lipolytic:

a- **Pancreatic lipase acts on TG → Monoglycerides and fatty acids. It is the only enzyme that accomplish fat digestion. It needs bile salts.**

b-Prophospholipase A2.

c-Cholesteryl ester hydrolase(*cholesterol esterase)*

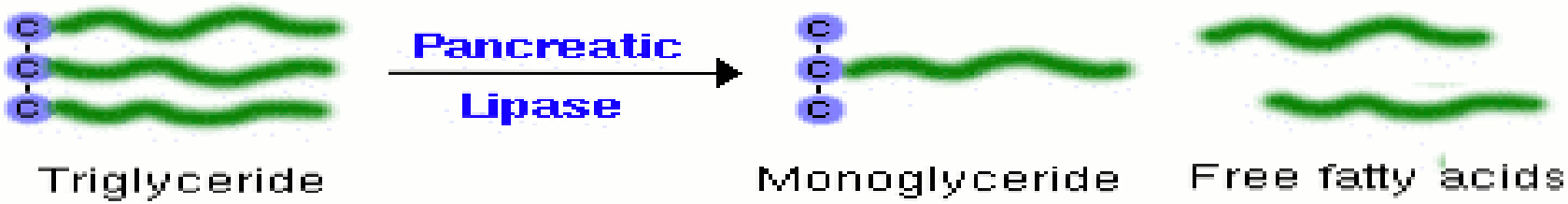
3-α-Amylase:

Act on starch → maltose and maltotriose & dextrins.

More potent than ptyalin.

4-Nucleases:

Act on RNA, DNA → nucleotides.



Protection Of The Pancreas From Autodigestion

- ***All Proteolytic enzymes are secreted in an inactive form to protect the pancreas against Autodigestion, and they become activated only in small intestine under the effect of Trypsin.***

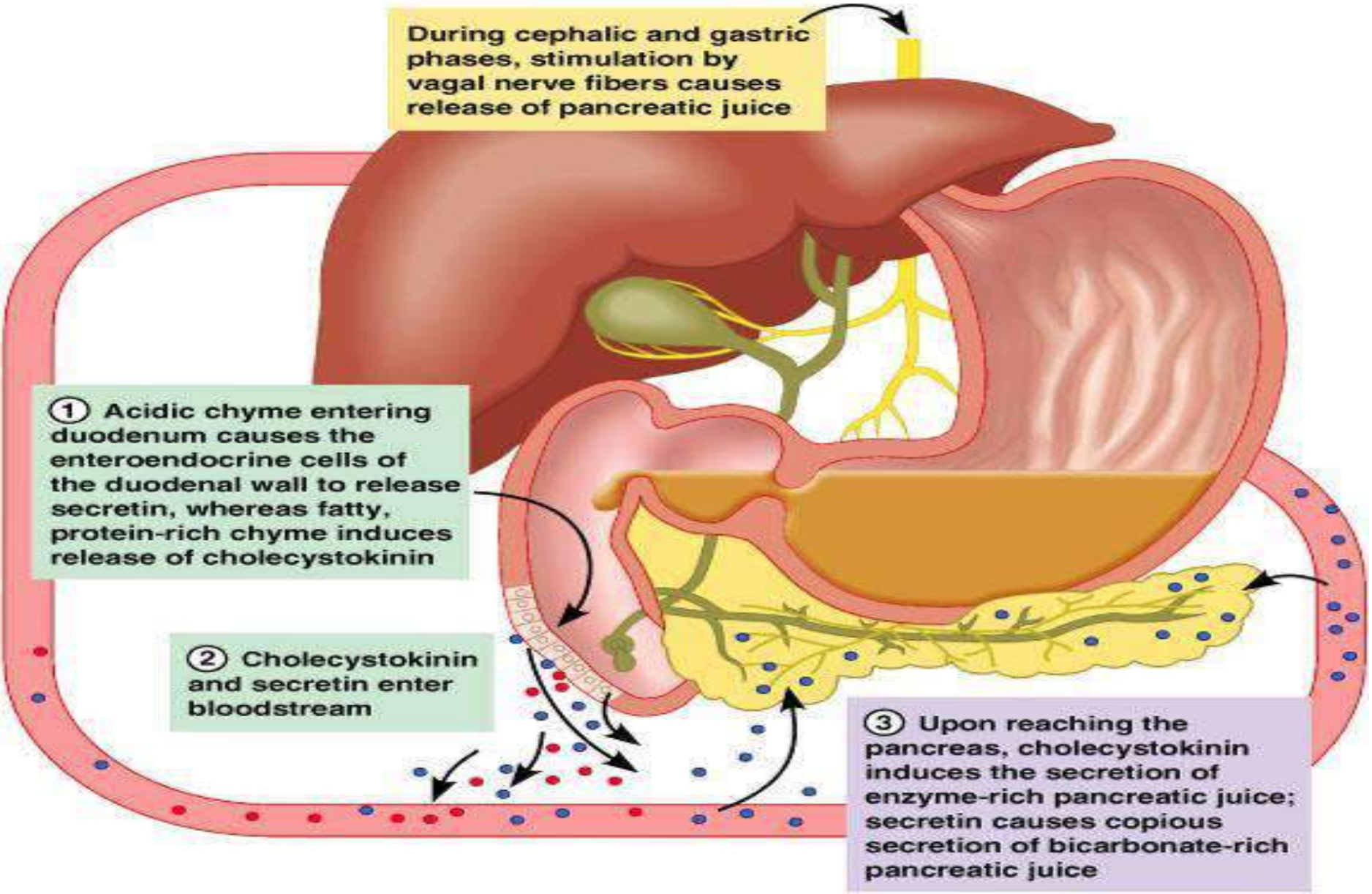
- ***The pancreas also secretes a Trypsin Inhibitor that blocks any trypsin activity inside the pancreas, because normally, some trypsinogen is activated to trypsin in the pancreas.***

Predict the mechanism of pancreatitis?

Regulation of Pancreatic Secretion

- **Basic Stimuli That Cause Pancreatic Secretion:**
- ***Acetylcholine*, which is released from the parasympathetic Vagus nerve endings and from other cholinergic nerves in the enteric nervous system**
- ***Cholecystokinin*, which is secreted by the duodenal and upper jejunal mucosa when food enters the small intestine**
- ***Secretin*, which is also secreted by the duodenal and jejunal mucosa when highly acidic food enters the small intestine**

Regulation of Pancreatic Secretion



- **Secretin, in contrast to the first two basic stimuli, stimulates secretion of large quantities of water solution of sodium bicarbonate by the pancreatic *Ductal epithelium.***

- **Acetylcholine and Cholecystokinin, stimulate the *Acinar cells of the pancreas*, causing production of large quantities of pancreatic digestive enzymes but relatively small quantities of water and electrolytes to go with the enzymes.**

- **Secretin is released from the mucosa of the small intestine when the *pH* of the duodenal contents falls below *4.5 to 5.0,* and its release increases greatly as the pH falls to 3.0.**
- **This immediately causes copious secretion of pancreatic juice containing large amounts of sodium bicarbonate**
- **Because the mucosa of the small intestine cannot withstand the digestive action of acid gastric juice, this is an essential protective mechanism to prevent development of *Duodenal ulcers*.**

- **Bicarbonate ion secretion by the pancreas provides an appropriate pH for action of the pancreatic digestive enzymes, which function optimally in a slightly alkaline or neutral medium, at a pH of 7.0 to 8.0.**
- **Fortunately, the pH of the sodium bicarbonate secretion averages 8.0.**

Regulation of secretion of pancreatic juice (Phases of Pancreatic Secretion)

1-Nervous:

During the Cephalic 20% (both conditioned & unconditioned reflexes) and Gastric phase 10% (presence of food in the stomach), there is stimulation of Vagus nerve → act on acinar cells of pancreas → pancreatic juice (secretion rich in digestive enzymes, poor in fluid).

2-Hormonal:

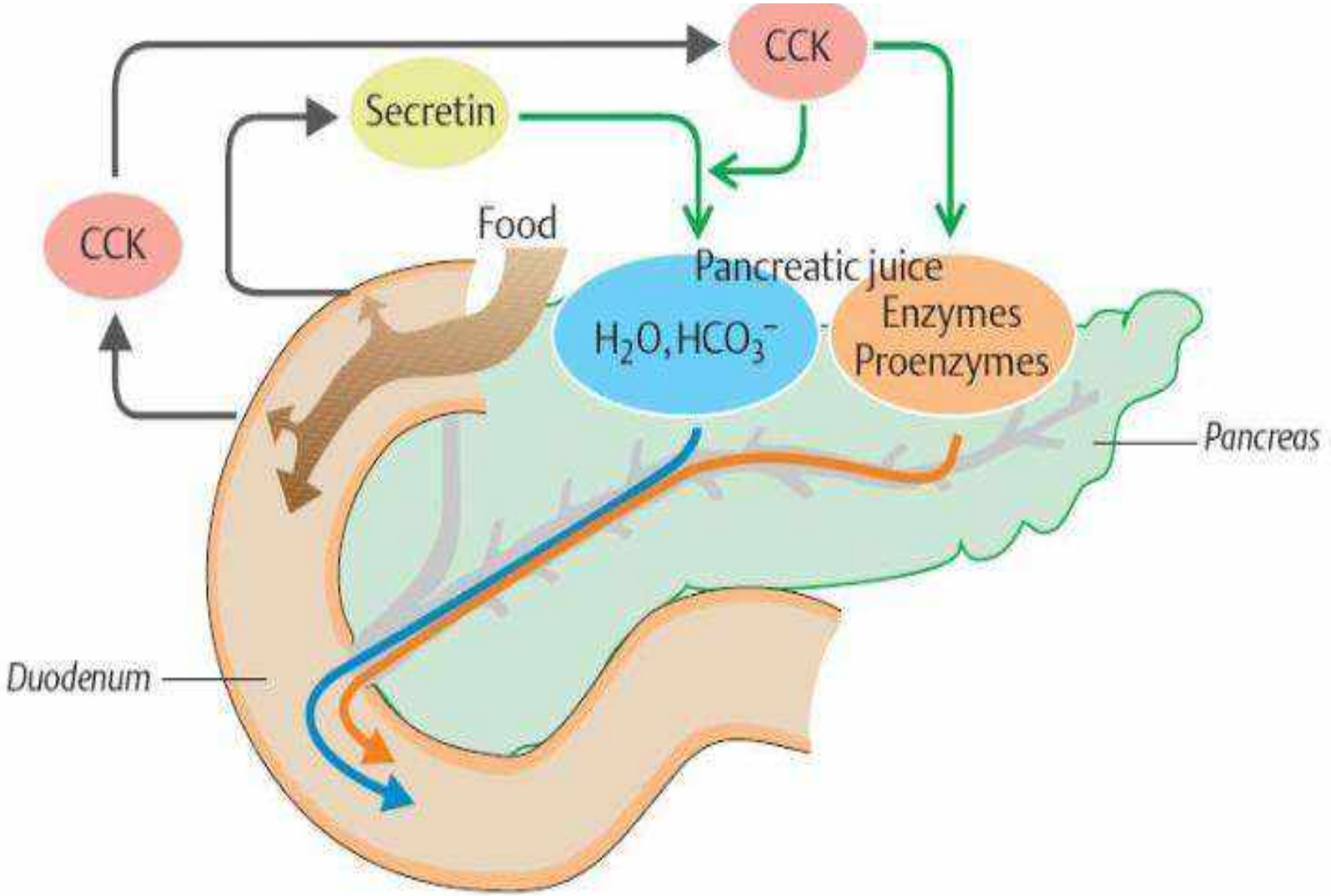
During the Intestinal phase of gastric secretion two important GIT hormones; secreted by duodenal mucosa stimulate the secretion of pancreatic juice:

a-Secretin hormone: It stimulates the secretion of pancreatic juice, large in volume, rich in HCO_3^-.

b-Cholecystokinin hormone (CCK): It stimulates the secretion of pancreatic juice, small in volume, rich in enzymes.

Secretin

- It is a polypeptide hormone secreted from specialized cells called S cells in the glands of the duodenum& jejunum contain 27 amino acid.
- It is secreted in response to:-
  - Acidic chyme in the duodenum.
  - Products of protein digestion.
- Function:-
  - Stimulate secretion of pancreatic juice rich in Hco_3 from pancreatic duct cells.
  - Stimulate secretion of Hco_3 from duct cells of the biliary tract which increase Bile flow *(Choleretic).*
  - Augment the action of CCK on pancreatic cells.
  - Inhibit gastric acid secretion & emptying.
  - Has trophic effect on exocrine pancreas.

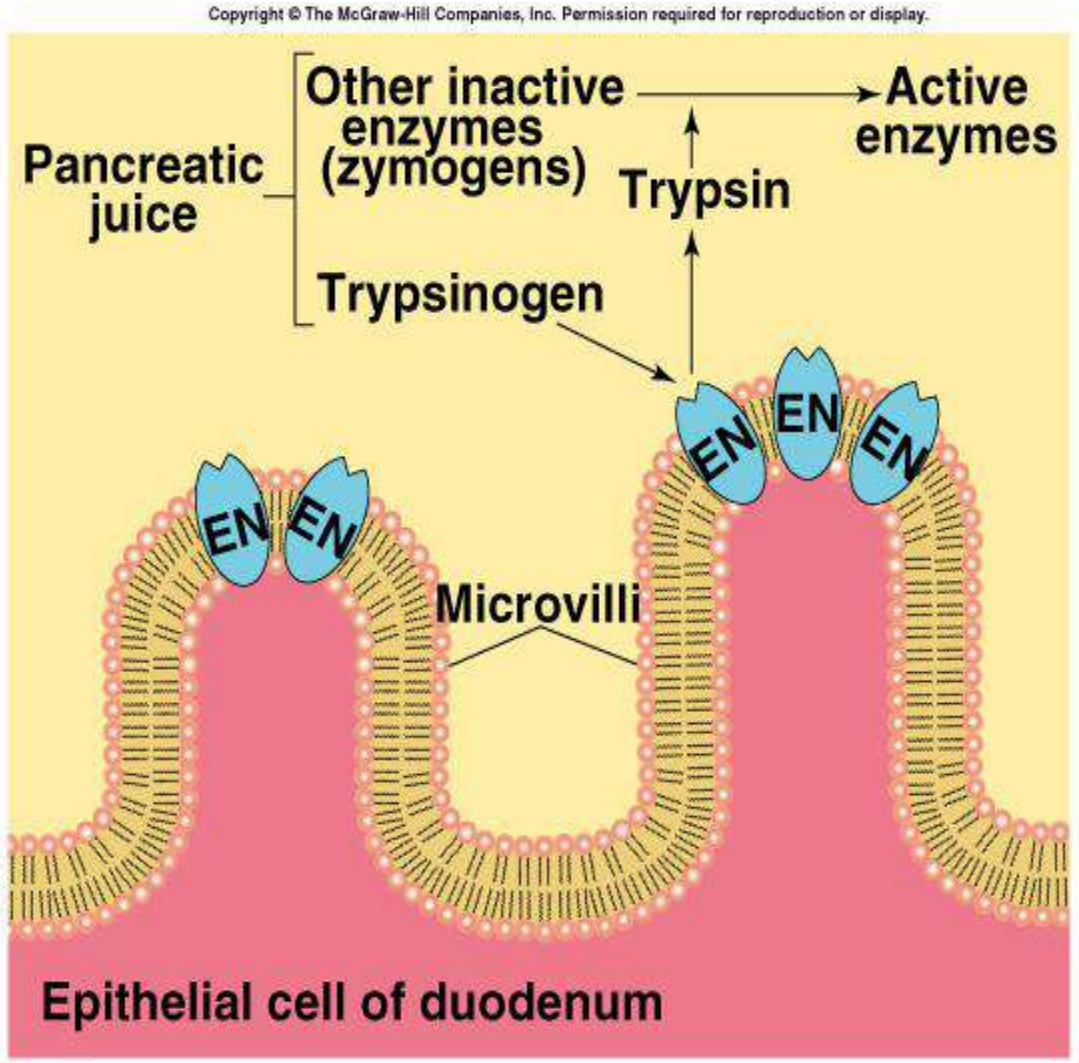

CCK
Secretin
CCK
Food
Pancreatic juice
H_2O, HCO_3^-
Enzymes
Proenzymes
Pancreas
Duodenum

Cholecystokinin

- **It is secreted from:-**
  - **I cells in the upper small intestine contain 33 amino acid.**
  - **Nerves in the distal ileum.**
- **It is secreted in response to products of fat & protein digestion.**
- **Function:-**
  - **Inhibit gastric motility, emptying & secretion.**
  - **Stimulate pancreatic acinar cell to secrete juice rich in enzymes.**
  - **Trophic to exocrine pancreas**
  - **Augment action of secretin.**
  - **Stimulate gall bladder contraction (act as cholagogue).**
  - **Involved in regulation of food intake.**

Pancreatic Juice

- Complete digestion of food requires action of both ***Pancreatic and Brush border enzymes***.
- Most pancreatic enzymes are produced as zymogens.
- Trypsin (when activated by enterokinase) triggers the activation of other pancreatic enzymes.
- Pancreatic trypsin inhibitor attaches to trypsin.
- Inhibits its activity in the pancreas.



Pancreatic Juice

- Contains H_20, $HC0_3^-$ and digestive enzymes.

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Table 18.4 Enzymes Contained in Pancreatic Juice

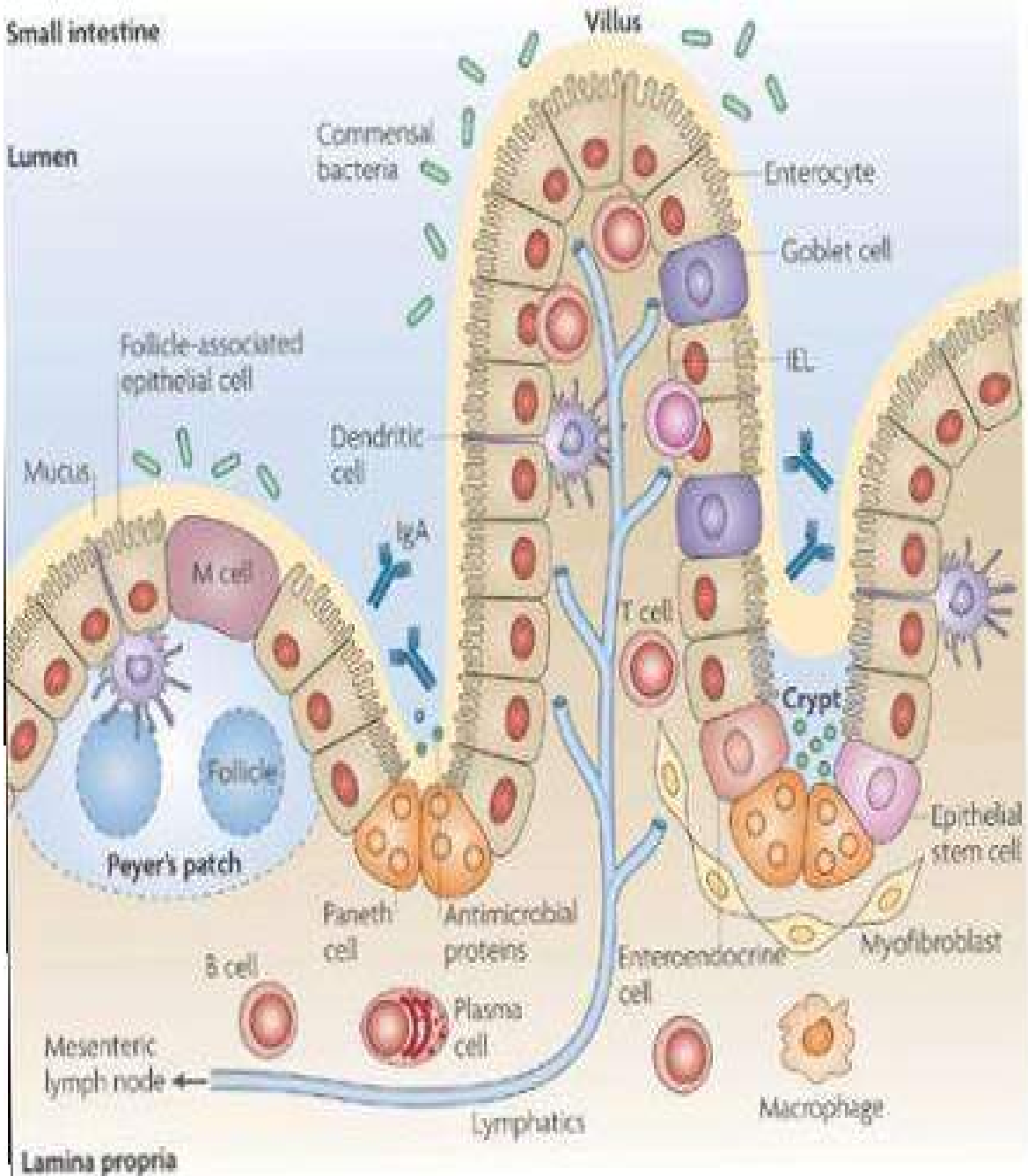
Enzyme	Zymogen	Activator	Action
Trypsin	Trypsinogen	Enterokinase	Cleaves internal peptide bonds
Chymotrypsin	Chymotrypsinogen	Trypsin	Cleaves internal peptide bonds
Elastase	Proelastase	Trypsin	Cleaves internal peptide bonds
Carboxypeptidase	Procarboxypeptidase	Trypsin	Cleaves last amino acid from carboxyl-terminal end of polypeptide
Phospholipase	Prophospholipase	Trypsin	Cleaves fatty acids from phospholipids such as lecithin
Lipase	None	None	Cleaves fatty acids from glycerol
Amylase	None	None	Digests starch to maltose and short chains of glucose molecules
Cholesterolesterase	None	None	Releases cholesterol from its bonds with other molecules
Ribonuclease	None	None	Cleaves RNA to form short chains
Deoxyribonuclease	None	None	Cleaves DNA to form short chains

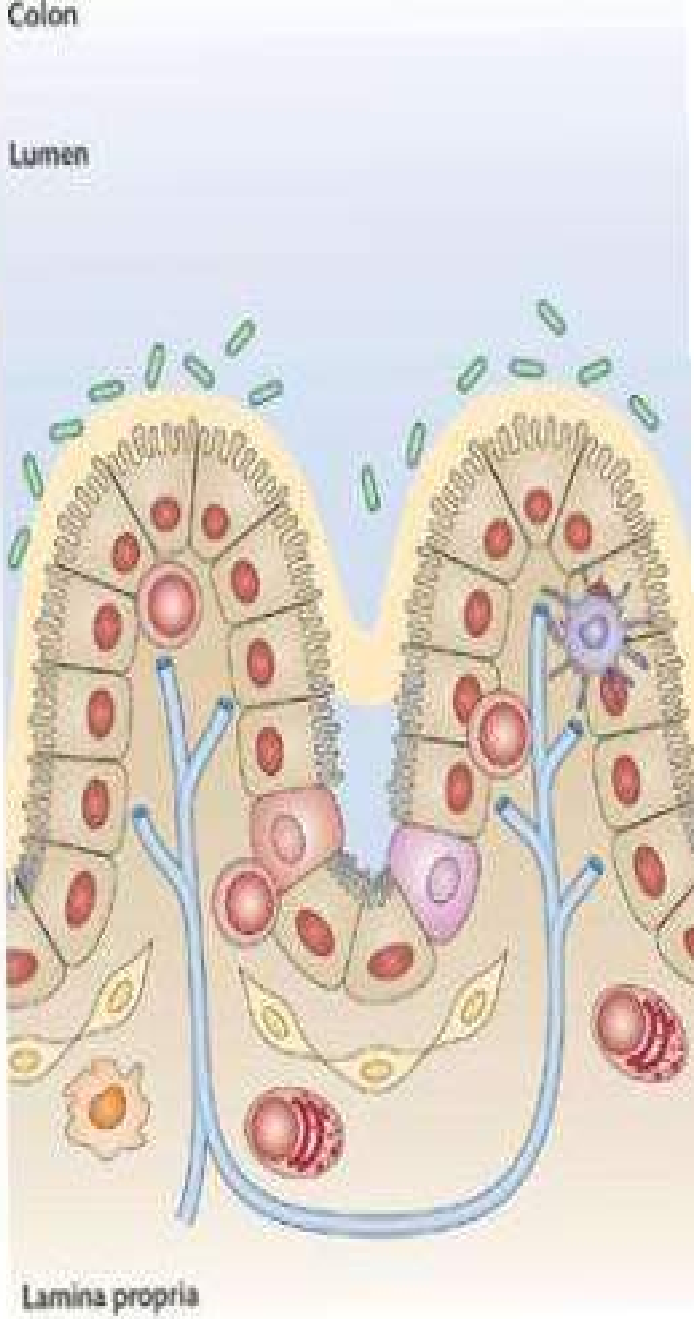
7-Secretions of the Small Intestine

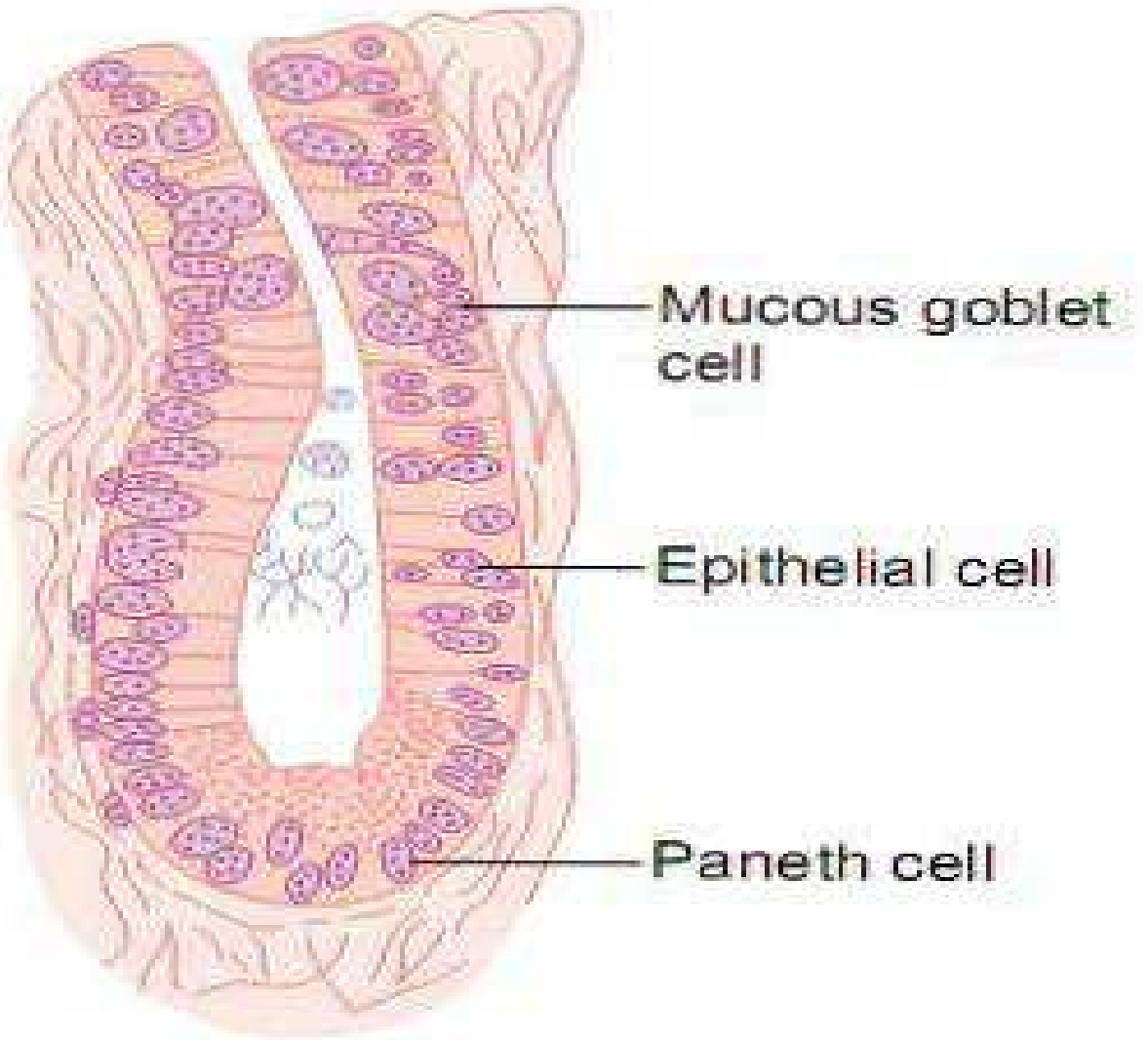
- **Secretion of Mucus by Brunner's Glands in the Duodenum :**
- ***Brunner's Glands***, **is located mainly between the pylorus of the stomach and the ampula of Vater. These glands secrete *large amounts of alkaline mucus* in response to**
  - **(1) *Tactile or irritating stimuli* on the duodenal mucosa**
  - **(2) *Vagal stimulation*, which causes increased Brunner's glands secretion concurrently with increase in stomach secretion.**
  - **(3) Gastrointestinal hormones, especially *secretin*.**
- **Brunner's glands are inhibited by sympathetic stimulation.**

Secretion of Intestinal Digestive Juices by the Crypts of Lieberkühn

- These crypts lie between the intestinal villi Located over the entire surface of the small intestine.
- The surfaces of both the crypts and the villi are covered by an epithelium composed of two types of cells:
- (1) Moderate number of *Goblet cells*, which *secrete mucus* that lubricates and protects the intestinal surfaces, and
- (2) Large number of *Enterocytes,* which, in the crypts, secrete large quantities of water and electrolytes and, over the surfaces of adjacent villi, reabsorb the water and electrolytes along with end products of digestion.


Small intestine
Villus
Lumen
Commensal bacteria
Enterocyte
Goblet cell
Follicle-associated epithelial cell
IEL
Dendritic cell
Mucus
IgA
M cell
T cell
Crypt
Follicle
Peyer's patch
Epithelial stem cell
Paneth cell
Antimicrobial proteins
Myofibroblast
Enteroendocrine cell
B cell
Plasma cell
Mesenteric lymph node
Lymphatics
Macrophage
Lamina propria


Colon
Lumen
Lamina propria



ure 64–13

- ***The intestinal secretions are formed by the enterocytes of the crypts at a rate of about 1800 ml /day. These secretions are almost pure extracellular fluid and have a slightly alkaline pH in the range of 7.5 to 8.0. The secretions are also rapidly reabsorbed by the villi.***

Digestive Enzymes in the Small Intestinal Secretion

- **The enterocytes of the mucosa, covering the villi, contain digestive enzymes that digest specific food substances *while they are being absorbed* through the epithelium. These enzymes are the following:**

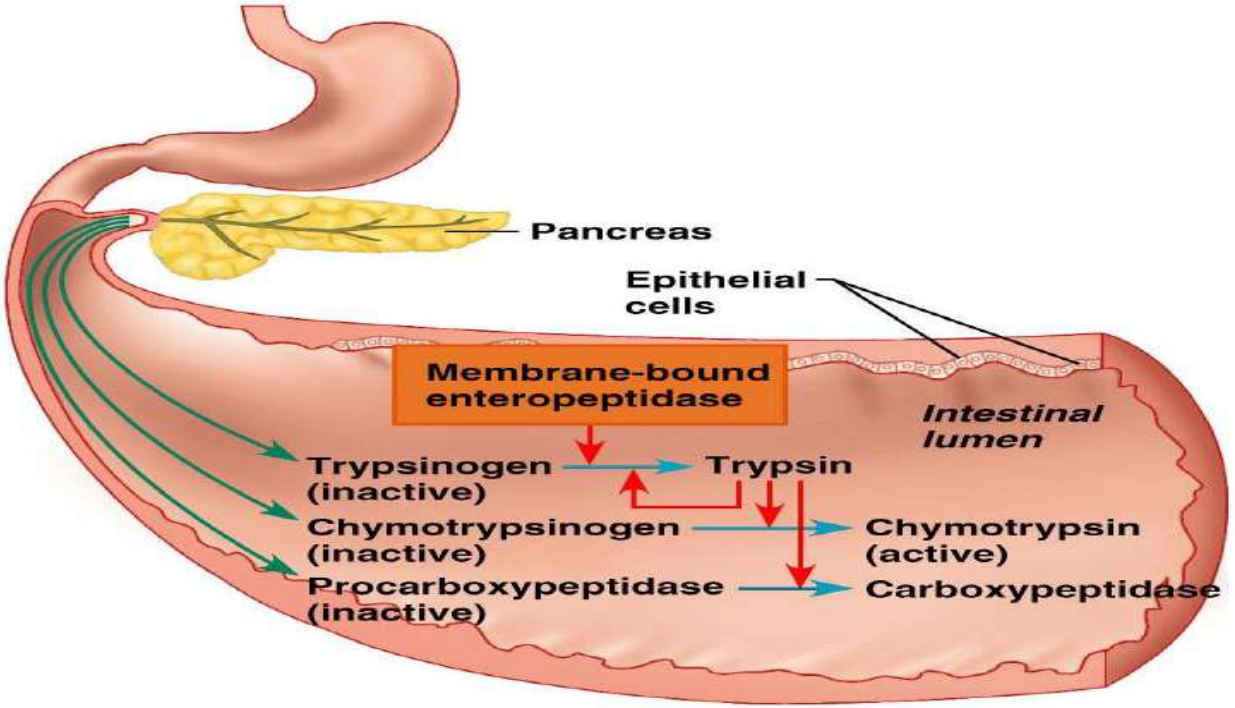
- **(1) *Several peptidases:* for splitting small peptides into amino acids.**
- ***(2) Four enzymes sucrase, maltase, isomaltase, and lactase:* *for* splitting disaccharides into *monosaccharide's.***
- ***(3) Small amounts of intestinal lipase:* for splitting neutral fats into glycerol and fatty acids.**

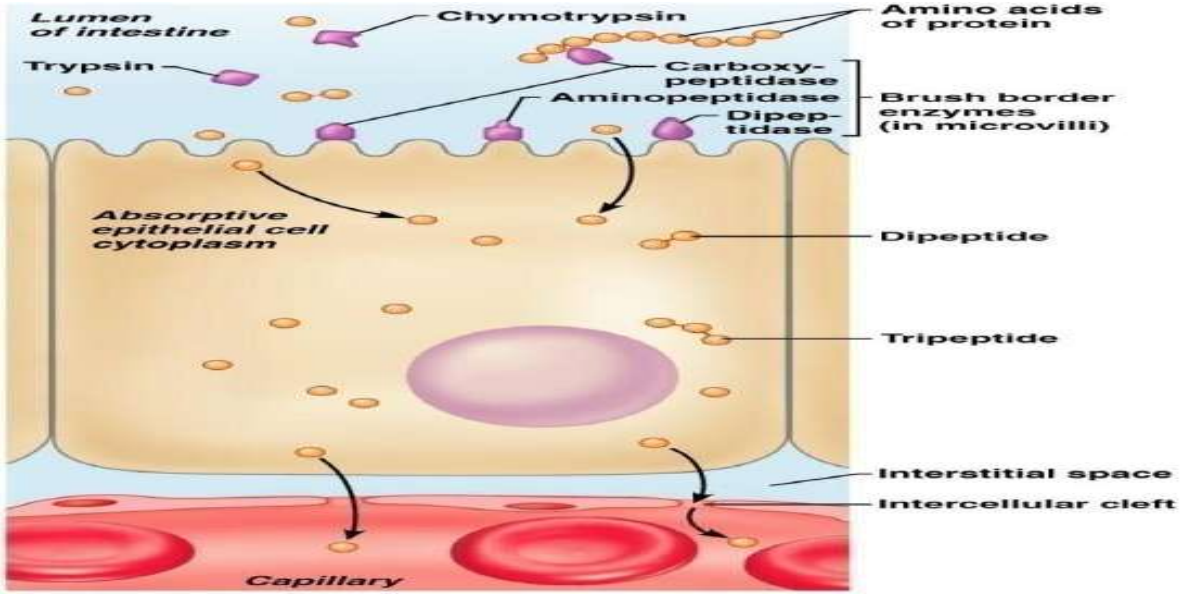
Regulation of Small Intestine Secretion-Local Stimuli

- **The most important means for regulating small intestine secretion *are local enteric nervous reflexes,* especially reflexes initiated by tactile or irritative stimuli from the chyme in the intestines.**
- **The life cycle of an intestinal epithelial cell is about *5 days.***

Small Intestine: Chemical Digestion

Brush border enzymes *Enteropeptidases* (Enterokinase) converts trypsinogen to trypsin Trypsin activates other zymogens Various other brush border enzymes complete digestion of protein and carbohydrate molecules



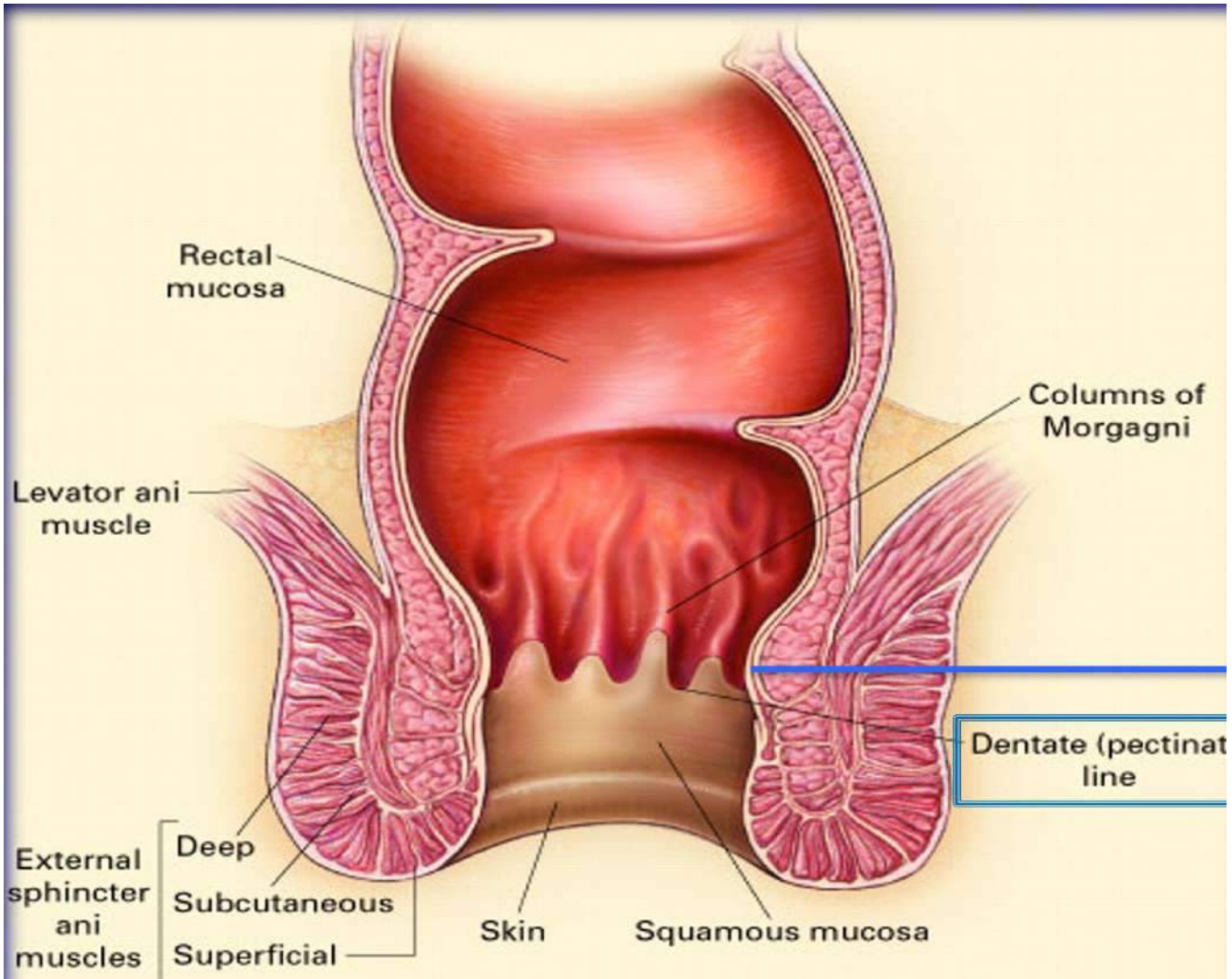


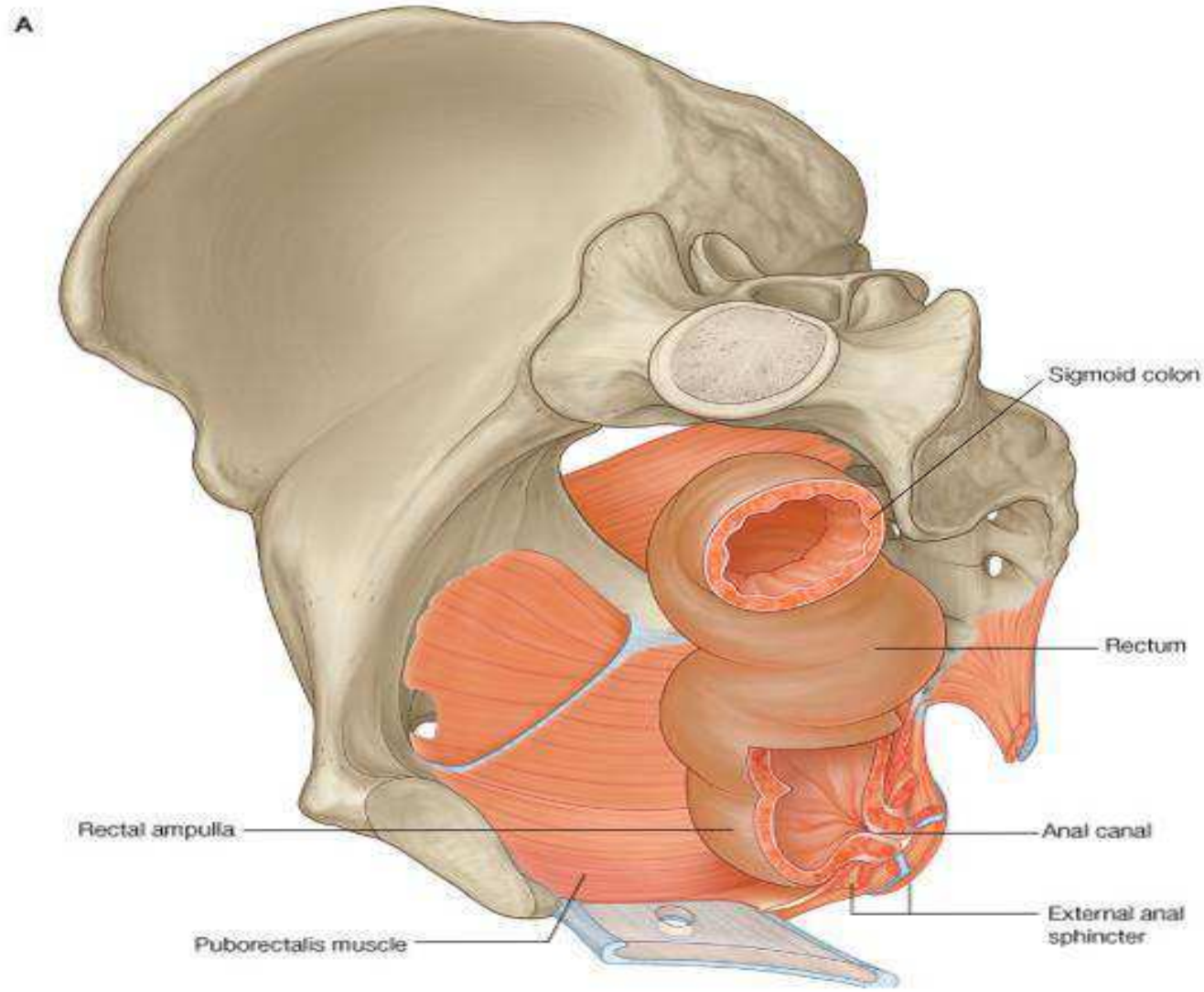
8-Secretion of Mucus by the Large Intestine

Mucus Secretion:

- **The mucosa of the large intestine has many crypts of Lieberkühn; however, unlike the small intestine, there are *no villi.***
- **The epithelial cells secrete almost *no digestive enzymes*.**
- **Instead, they contain mucous cells that secrete only *mucus.***
- **This mucus contains moderate amounts of bicarbonate ions.**

Anal Canal


Rectal mucosa
Columns of Morgagni
Levator ani muscle
Dentate (pectinat line
External sphincter ani muscles
Deep
Subcutaneous
Superficial
Skin
Squamous mucosa

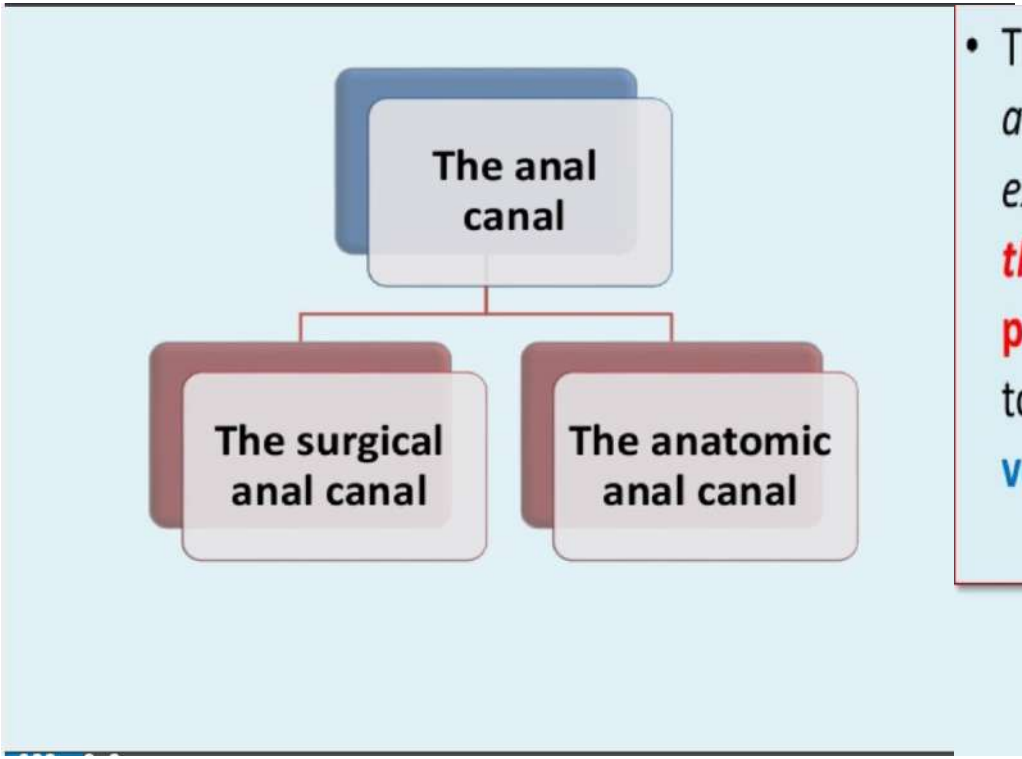

A
Sigmoid colon
Rectum
Rectal ampulla
Anal canal
External anal sphincter
Puborectalis muscle

Anatomy

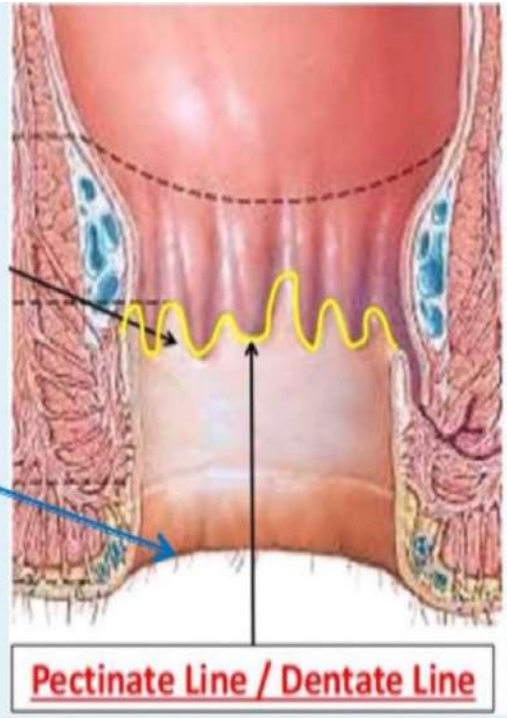
- ***Surgical Anal canal :*** **Is about 4 cm long.(shorter in females)**

.

- **It extends from the anal verge to the anorectal junction. which is upper border of sphincter muscles at puborectalis .**



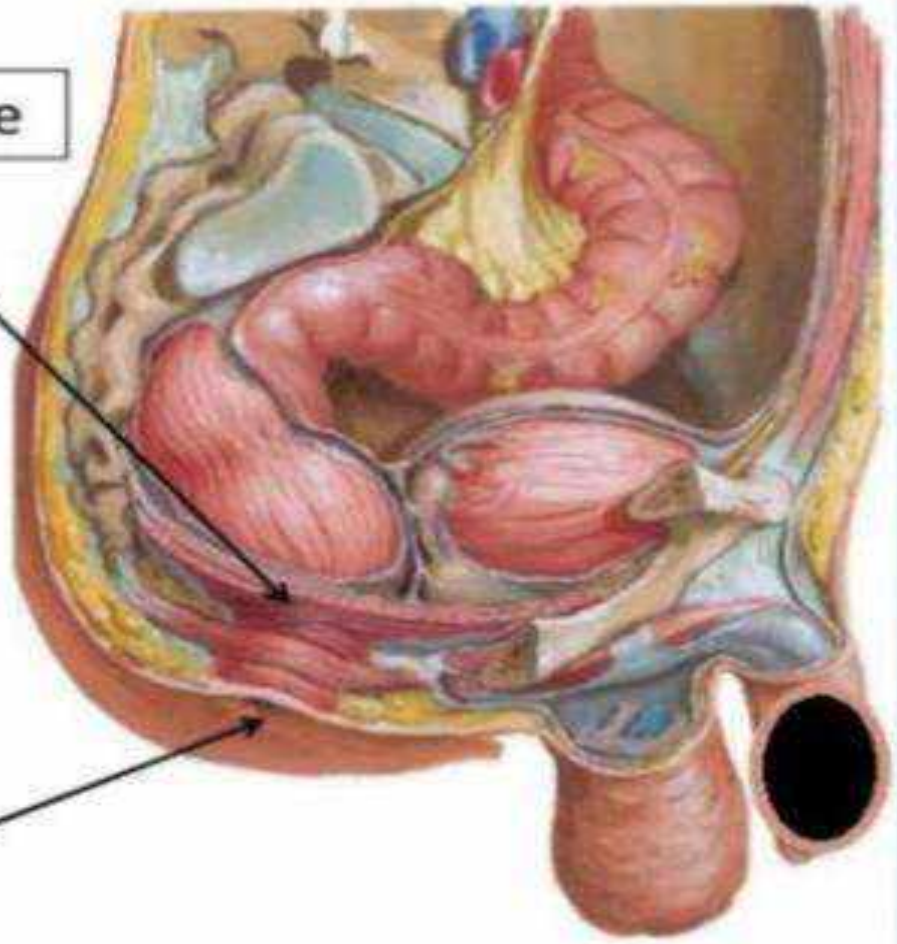
- The *anatomic anal canal extends from* ***the dentate*** *or* ***pectinate line*** *to* ***the anal verge.***



Anal canal

Anal Canal – Extent & Course

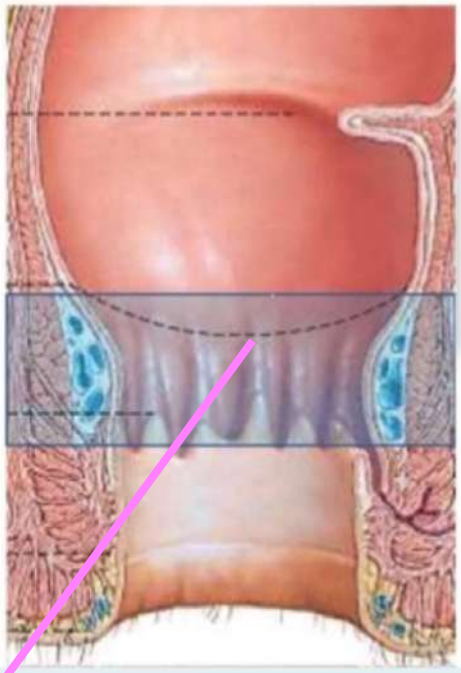
- Terminal part of Large Intestine
- Begins at ano-rectal jn
- At a point 2-3cm in front & little below tip of coccyx
- Downwards & Backwards
- Opens at anal orifice – 4cm below & in front of tip of coccyx

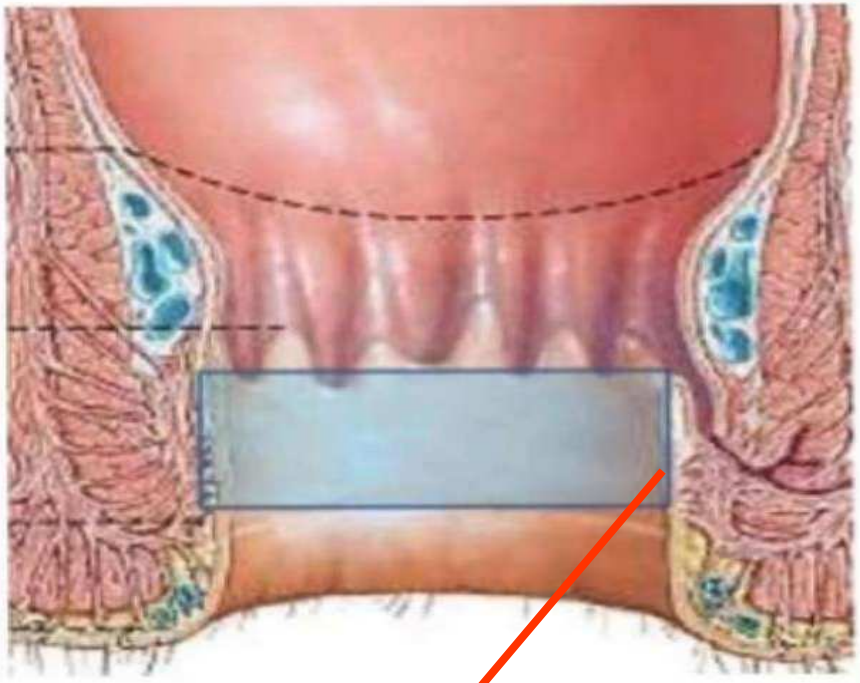


Interior of anal canal

Upper part

- 15 mm
- Endodermal origin
- Lined by semitransparent mucous membrane
  - Simple columnar / Stratified columnar or squamous
- Plum red due to?





Upper part of anal canal.

Pecten

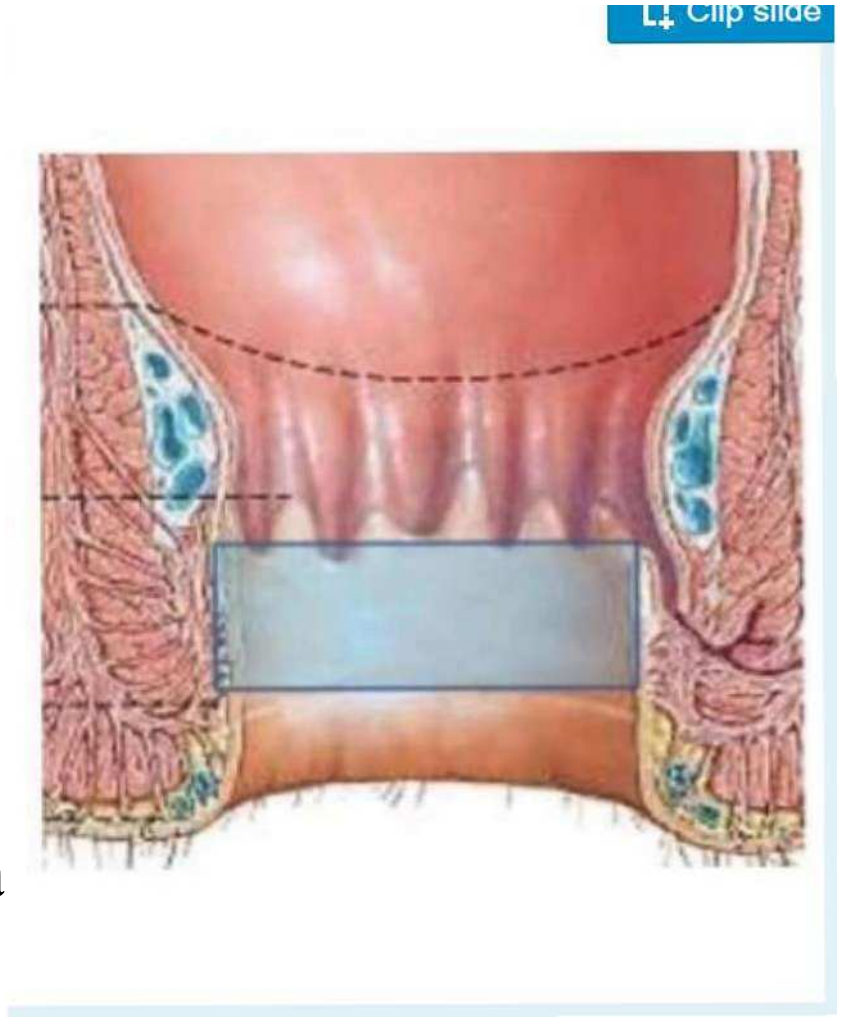
- ***Pecten(Anoderm) :*** **Is the thin hairless part of the external anal canal that is**

exposed by traction, has no sweat glands .

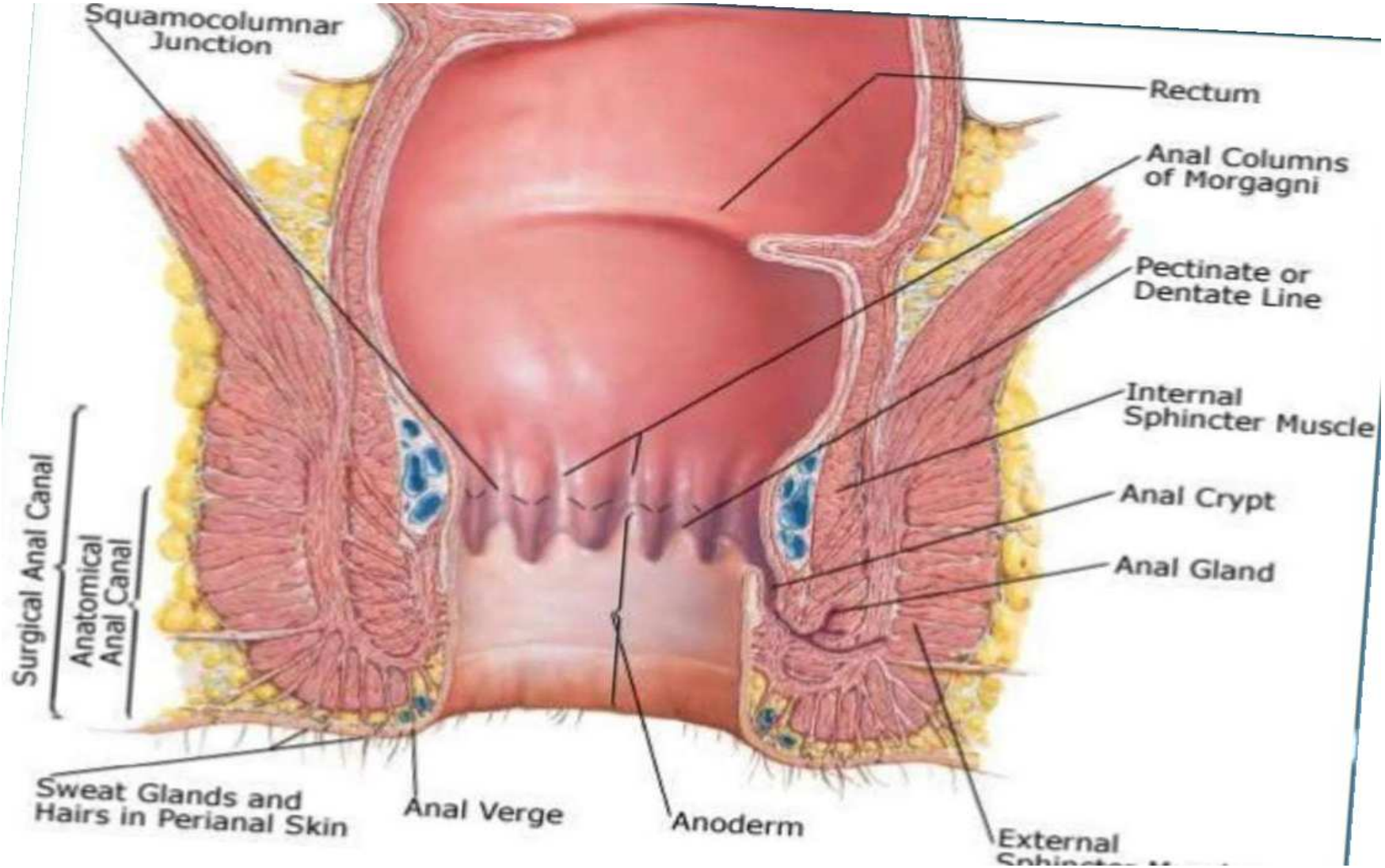
(Non-keratinized Stratified Squamous Epithelium)

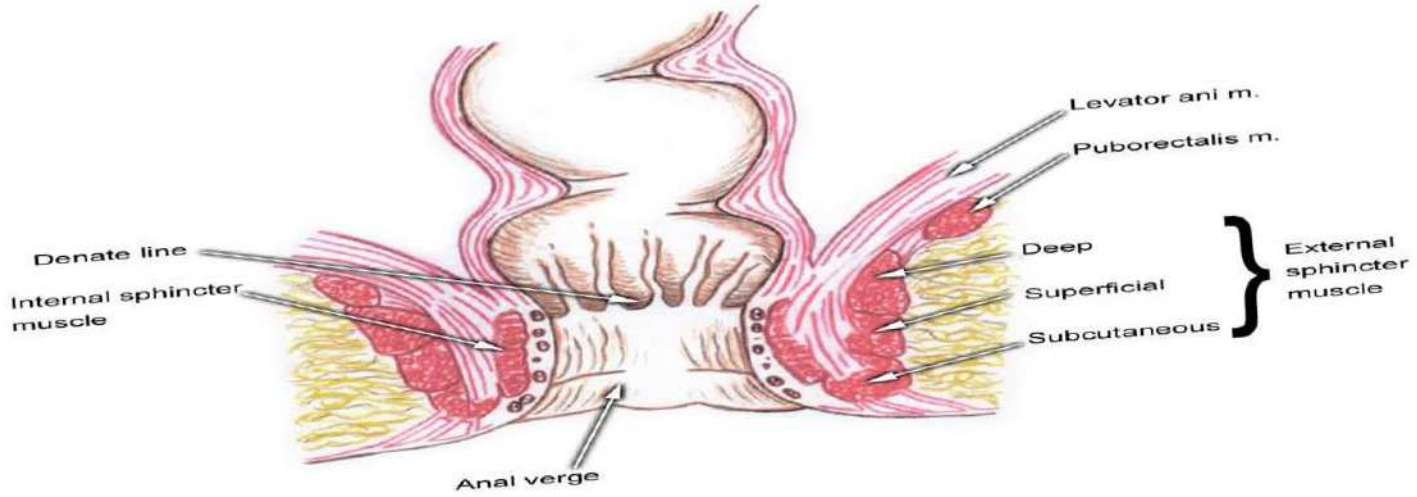
The junction between the Pecten and large bowel mucosa is known as

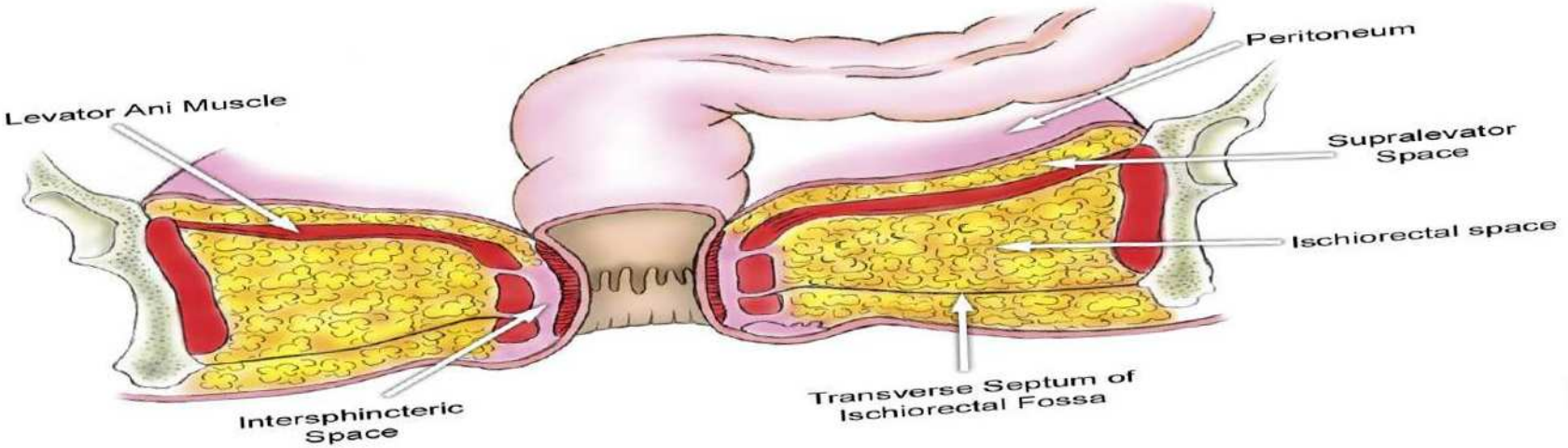
Dentate line : **which bisect the ana canal.**



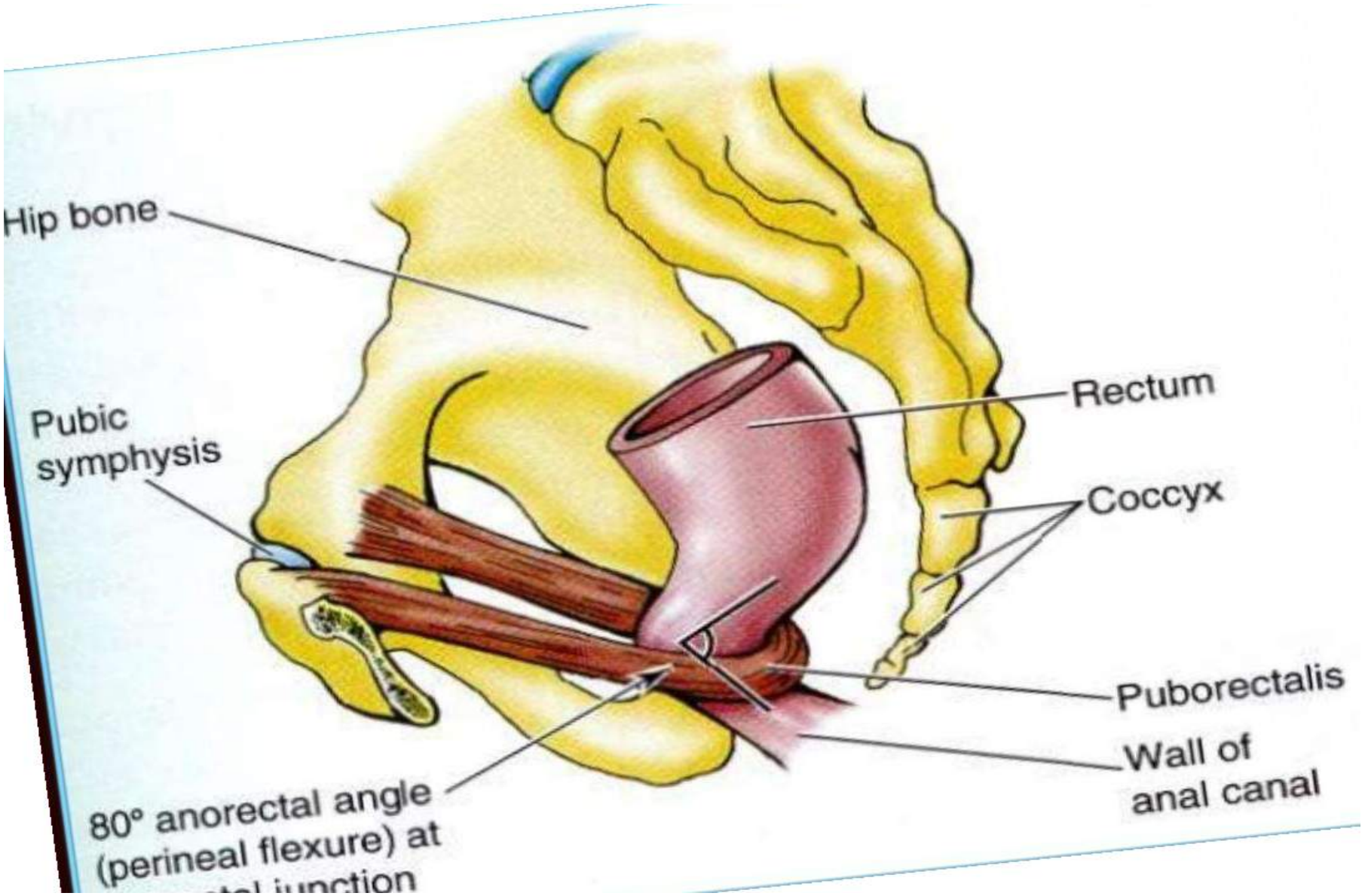
Anatomy Of Anal Canal







Anal Verge : **is the junction between anoderm meet the hair bearing peri anal skin, at lower border of sphincter**


Hip bone
Pubic symphysis
Rectum
Coccyx
Puborectalis
Wall of anal canal
80° anorectal angle (perineal flexure) at

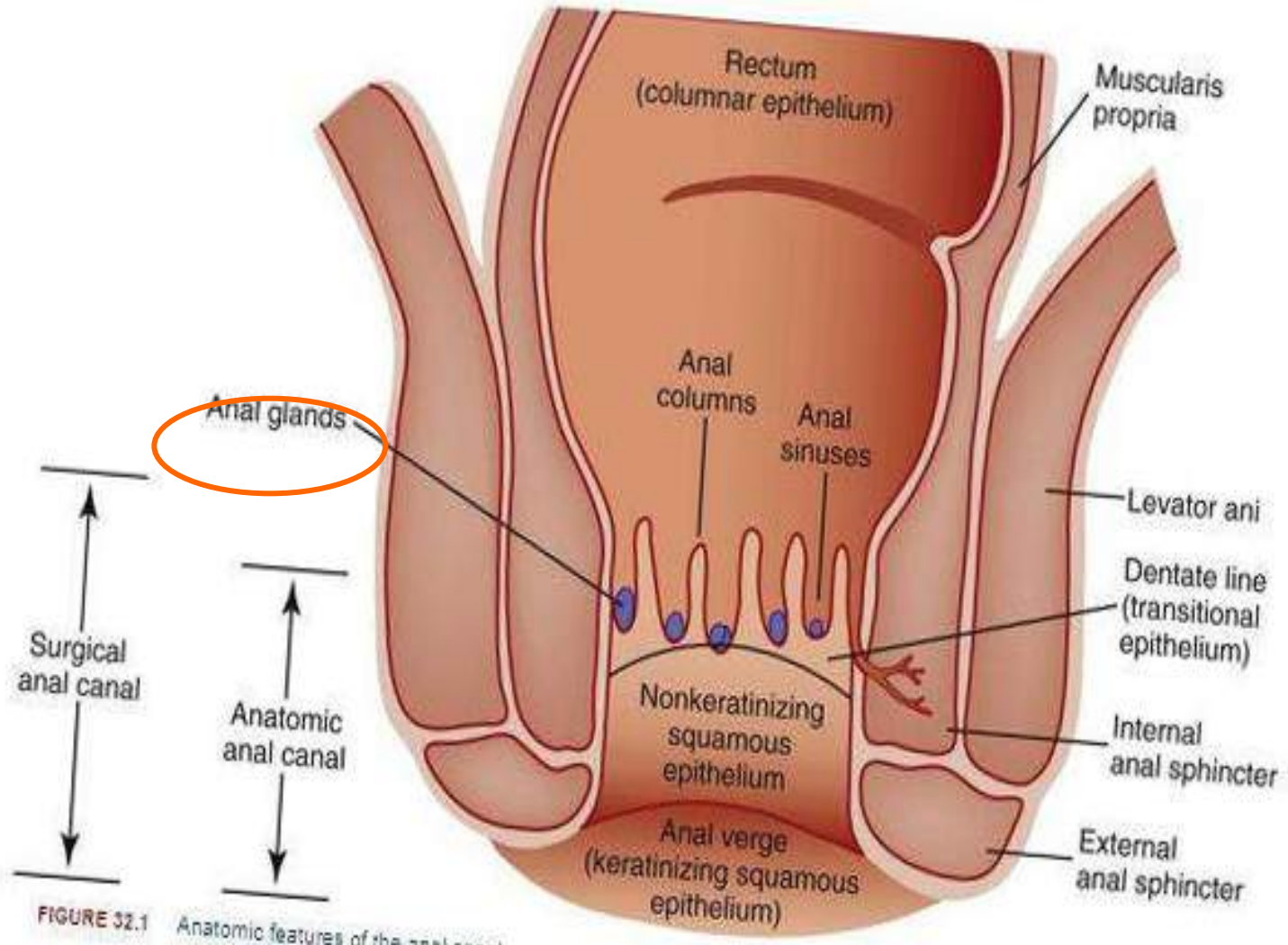
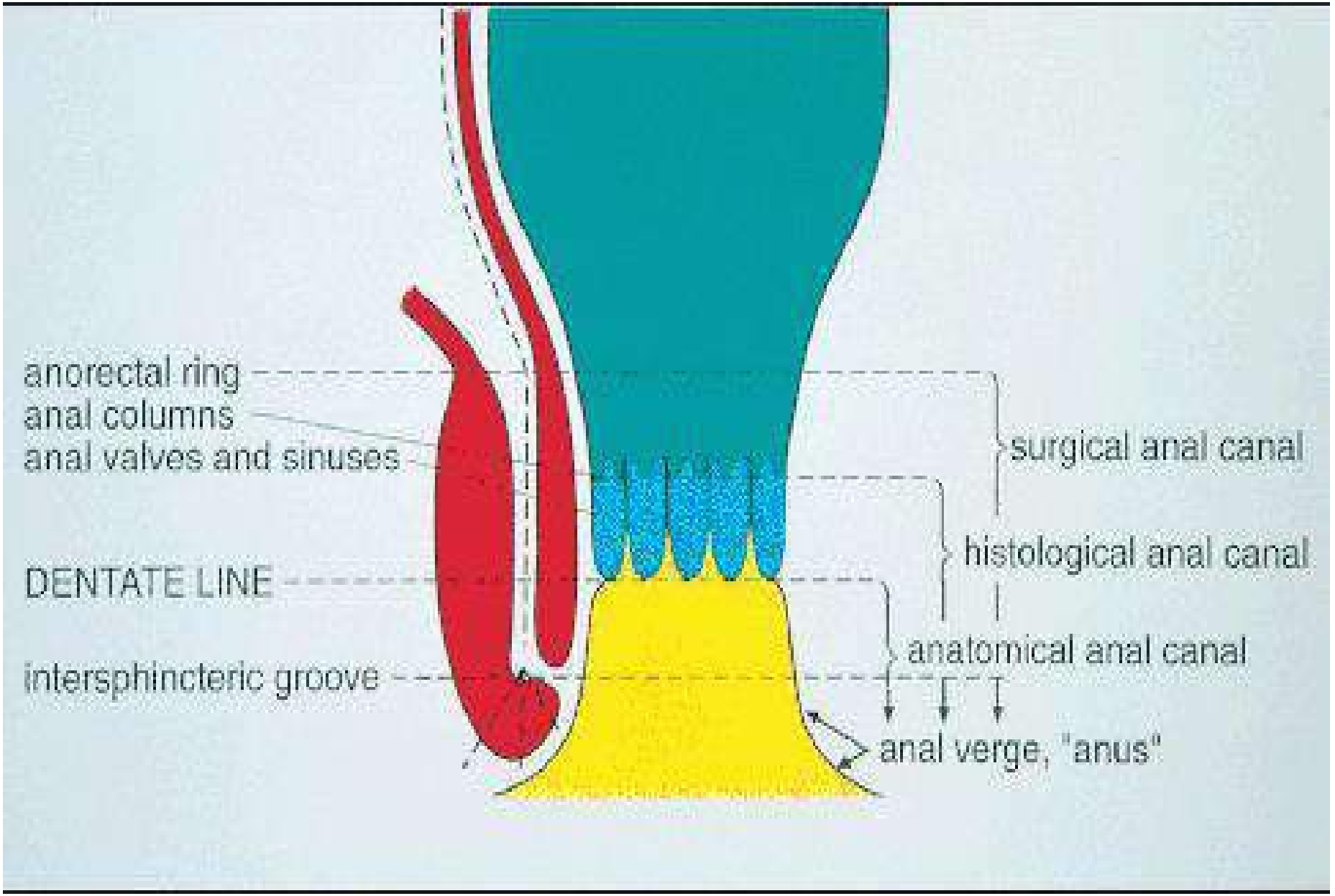


FIGURE 32.1 Anatomic features of the anal canal.


anorectal ring
anal columns
anal valves and sinuses
DENTATE LINE
intersphincteric groove
surgical anal canal
histological anal canal
anatomical anal canal
anal verge, "anus"

- **Above Dentate line there is transitional zone extends (from 1cm to 2 cm) having sensitive modified non-keratinized squamous epithelium.**
- **Above transitional zone there is insensitive large bowel mucosa (columnar epithelium).**
- ***Anatomical anal canal* :**

is about 3 cm long .

- **It extends from anal verge to slightly above the dentate line.**

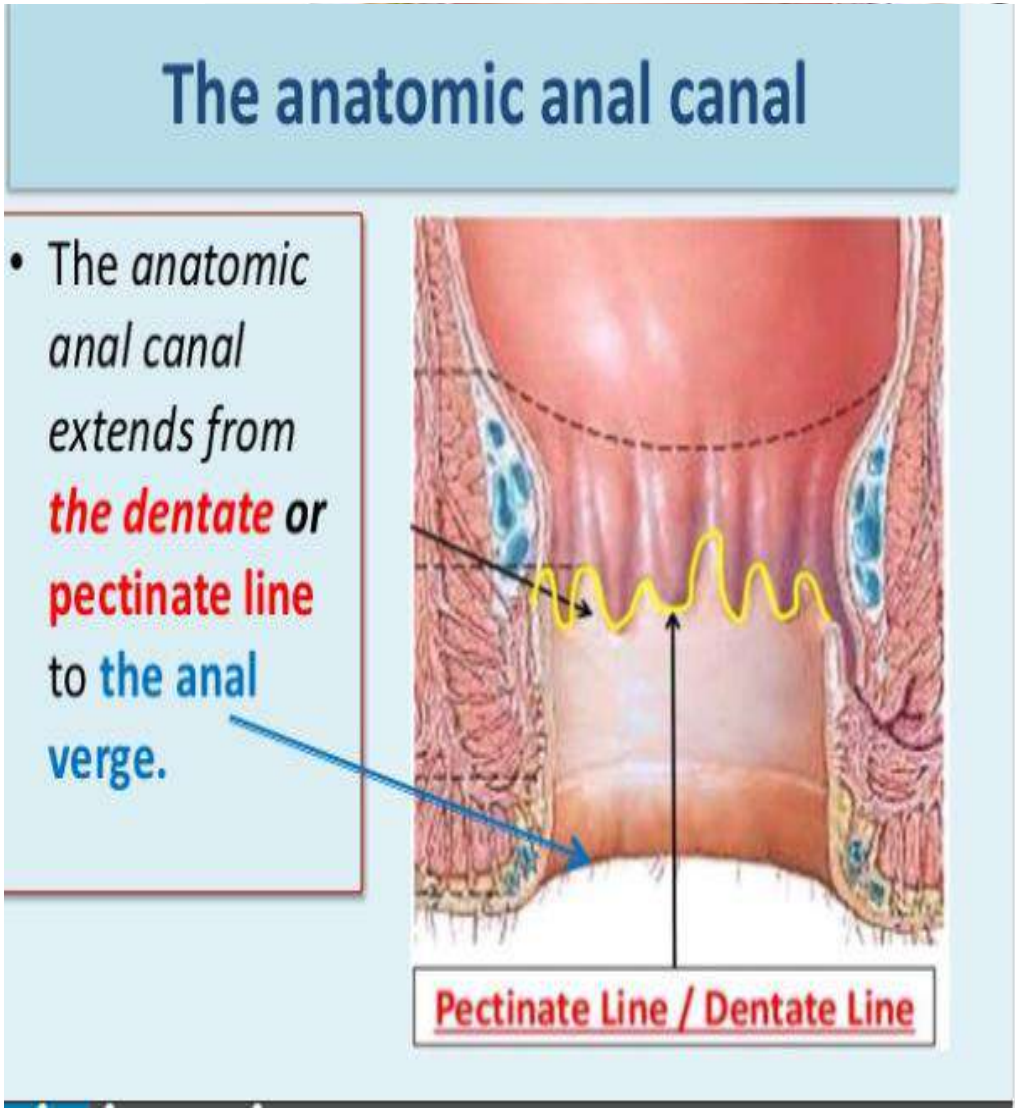
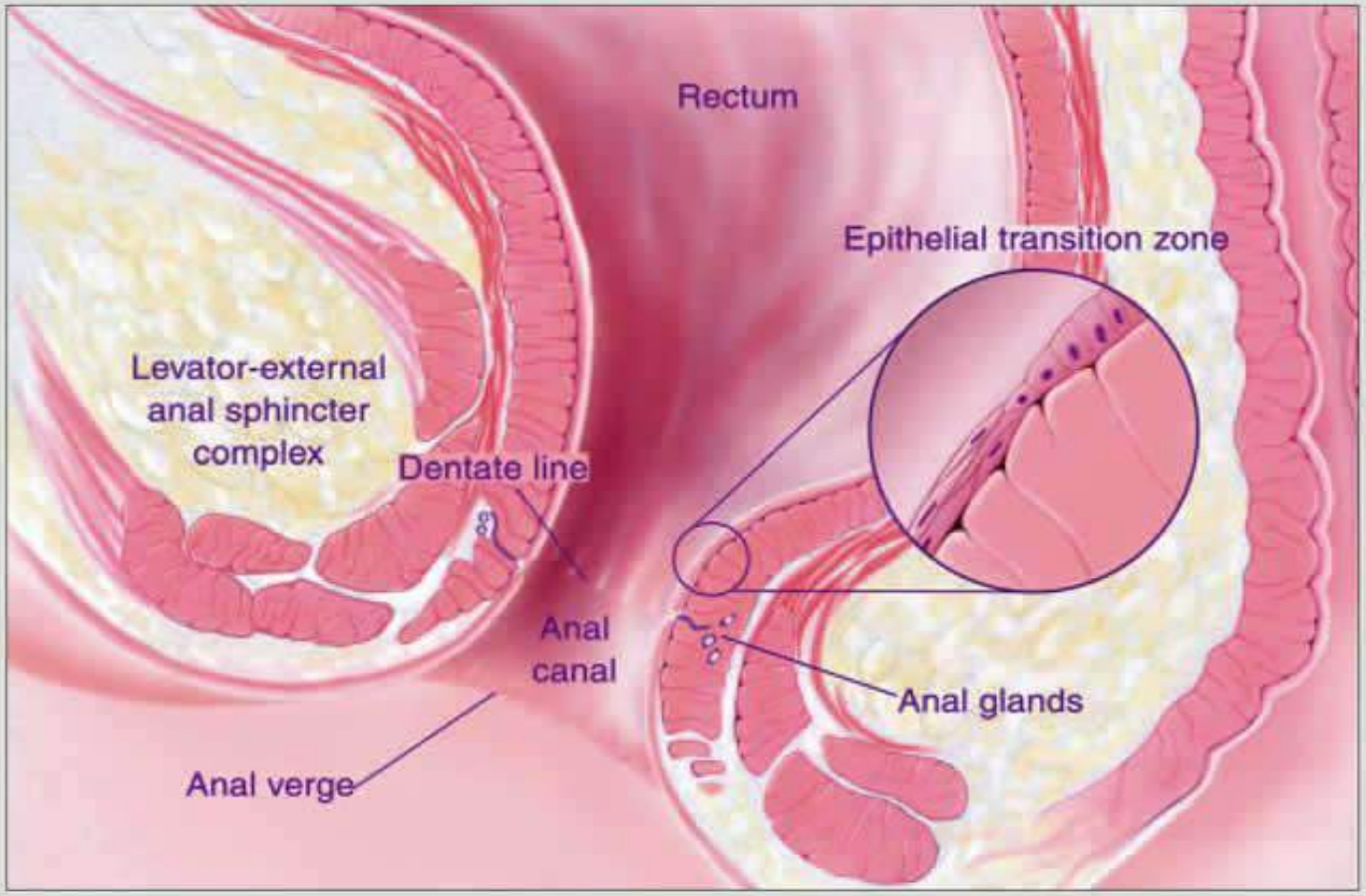


FIGURE 1

Anorectal anatomy



The anorectal area—the terminal portion of the GI tract—includes the rectum and the anal canal. The rectum is the last 12 cm above the anal verge. The anal canal extends from the anal verge to the proximal level of the levator-external anal sphincter complex. The dentate line is approximately 2 cm from the anal verge and is a place of transition from columnar epithelium to squamous epithelium. Between these layers is transitional epithelium. The anal glands—branched, straight tubular glands with ducts lined with stratified columnar epithelium—empty into the anal canal at the base of the anal columns. A clear sense of anorectal anatomy is fundamental to the evaluation of patients with anorectal disease.

Here and on the cover: Michele Graham

Cont ..

Muscle layers :

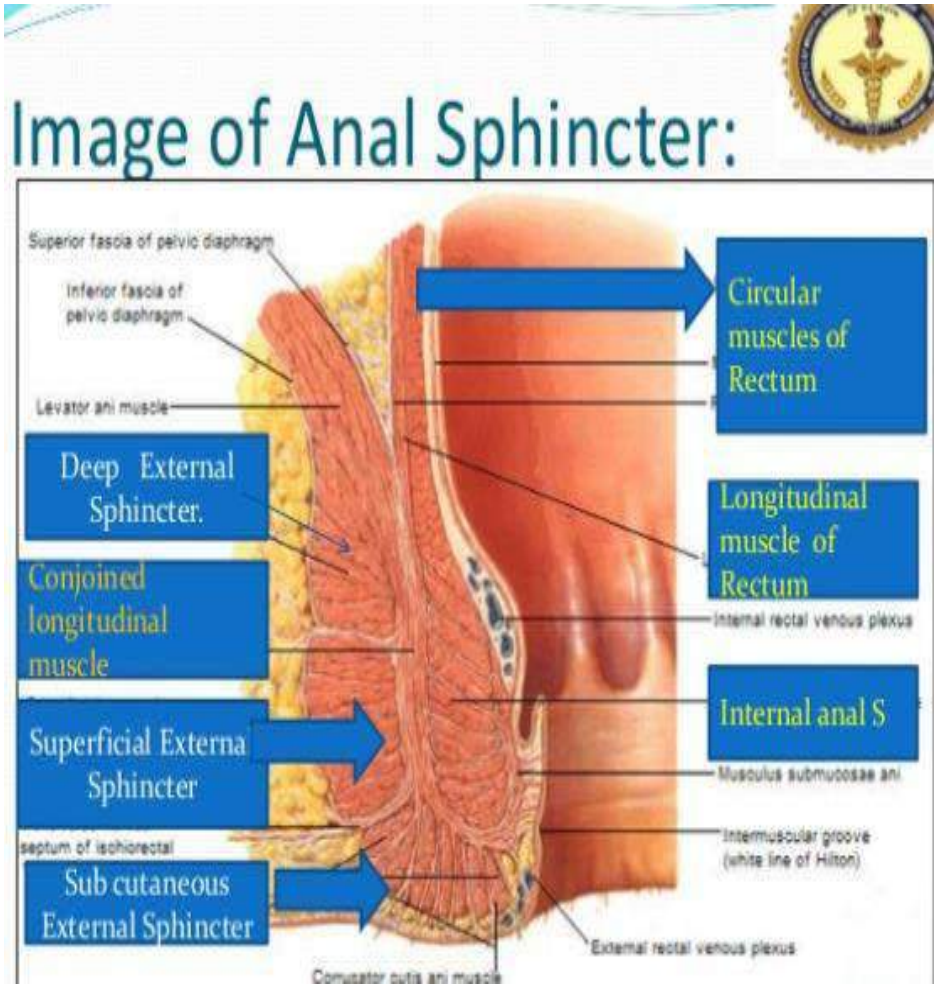
- ***Internal Sphincter :***

Is a condensation of

Circular Smooth Muscle of the rectum and is continuous with circular muscle of the whole

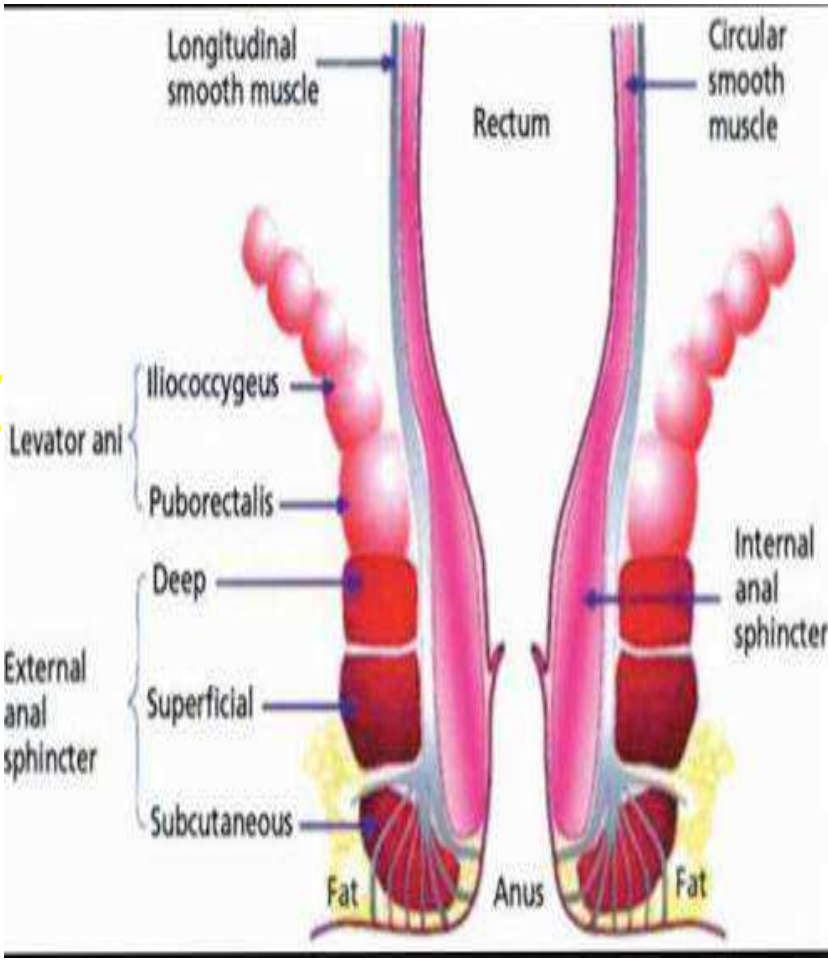
GIT. (autonomic nervous system)

- **It maintains *Tone and Resting Pressure* within anal canal (anal continence).**



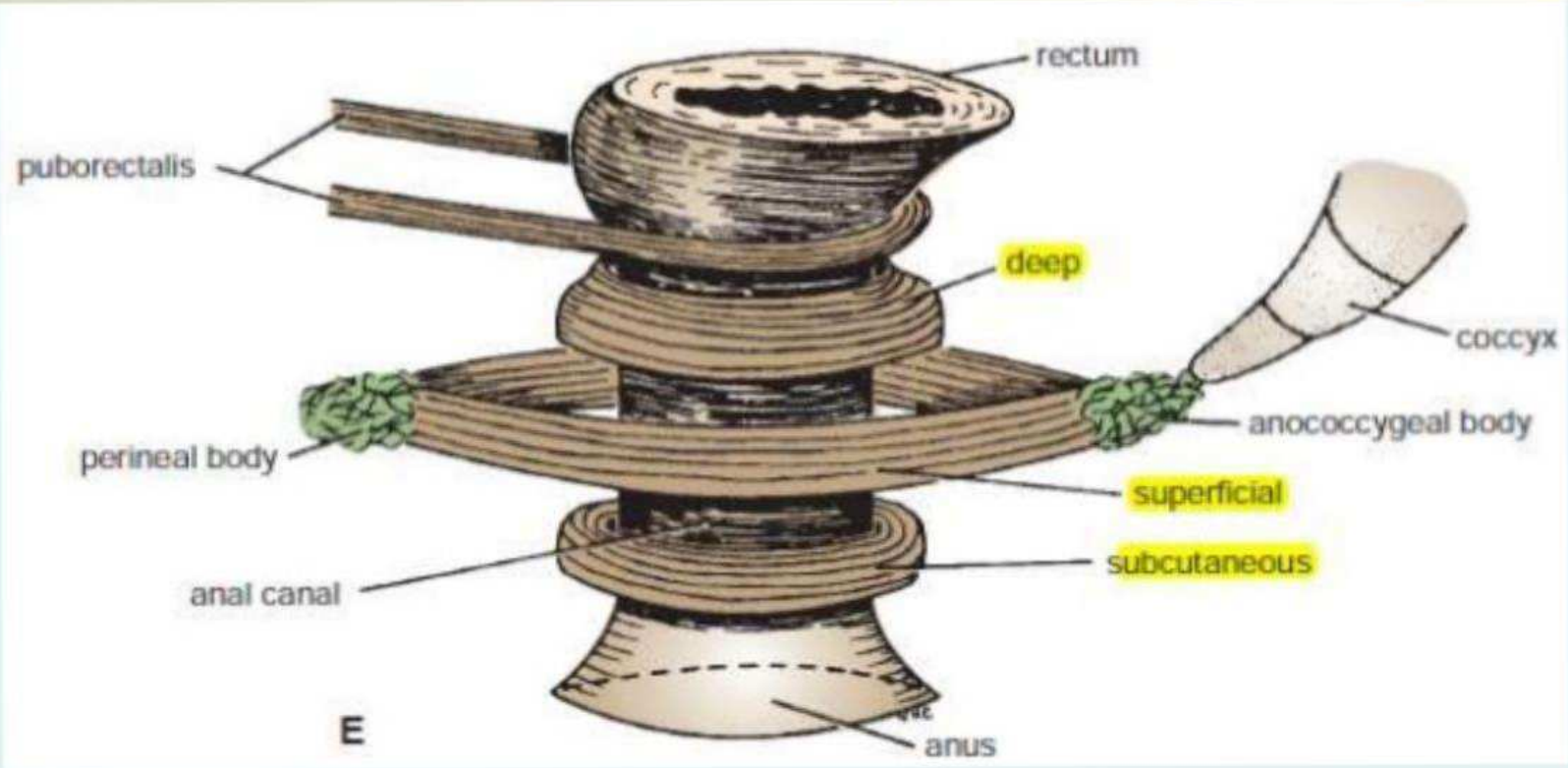
Cont ..

- ***External Sphincter:*** **Consist of ending of longitudinal muscle of the rectum at the anus as series of fibrous bands which radiate to the perianal skin (somatic nerves).**
- ***Three parts Sub mucous , Superficial and Deep part*** **.**
- **The circular muscle of the external sphincter consists of lower part of levator ani, known as the puborectalis sling.**
- **Responsible for *Squeeze Pressure.***



The external sphincter

Clip slide



The *deep external anal sphincter : ring, together wiht the puborectalis muscle.*
Superficial : elliptical ,and attached to coccyx
Subcutanenous :ring

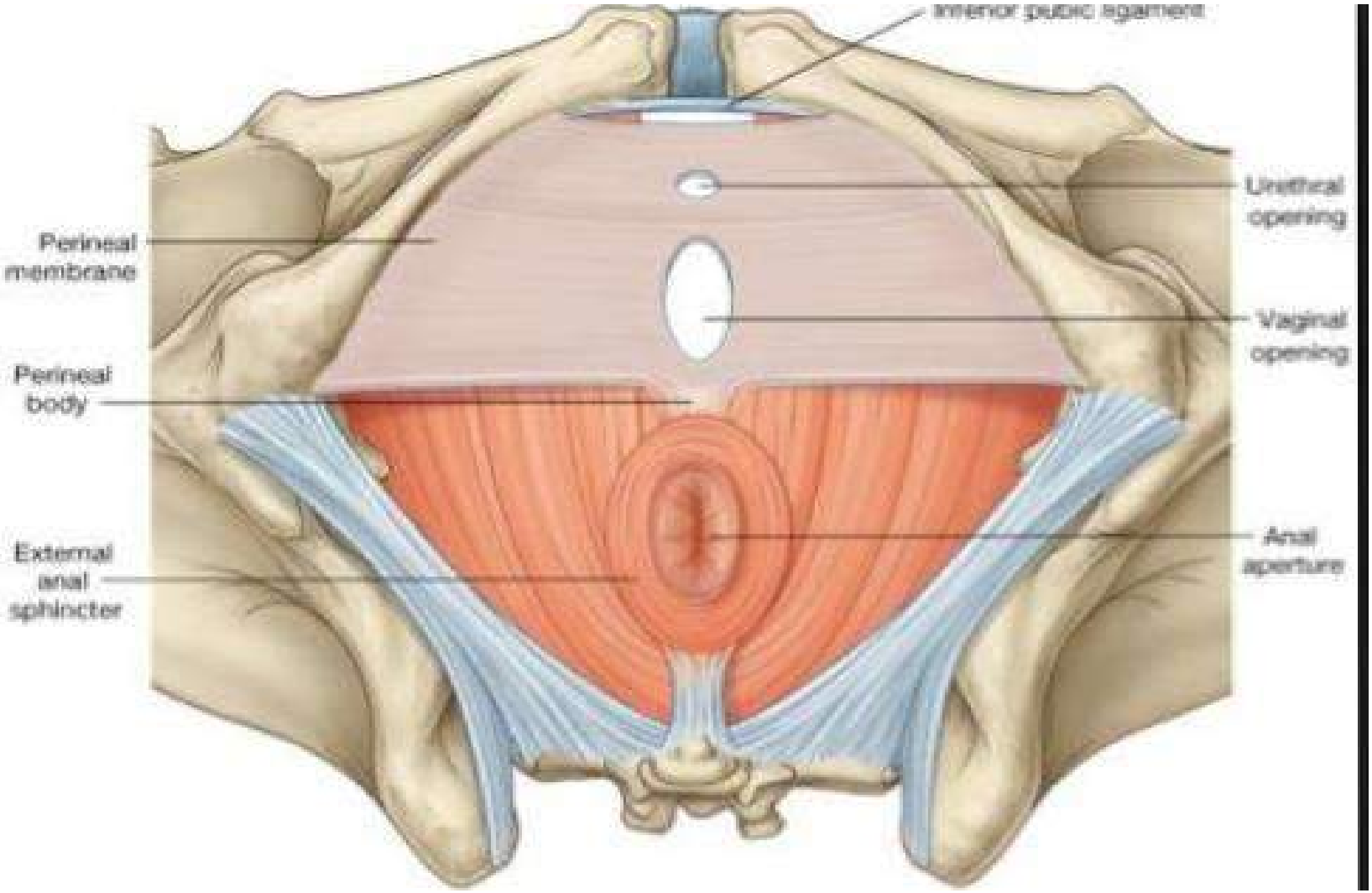
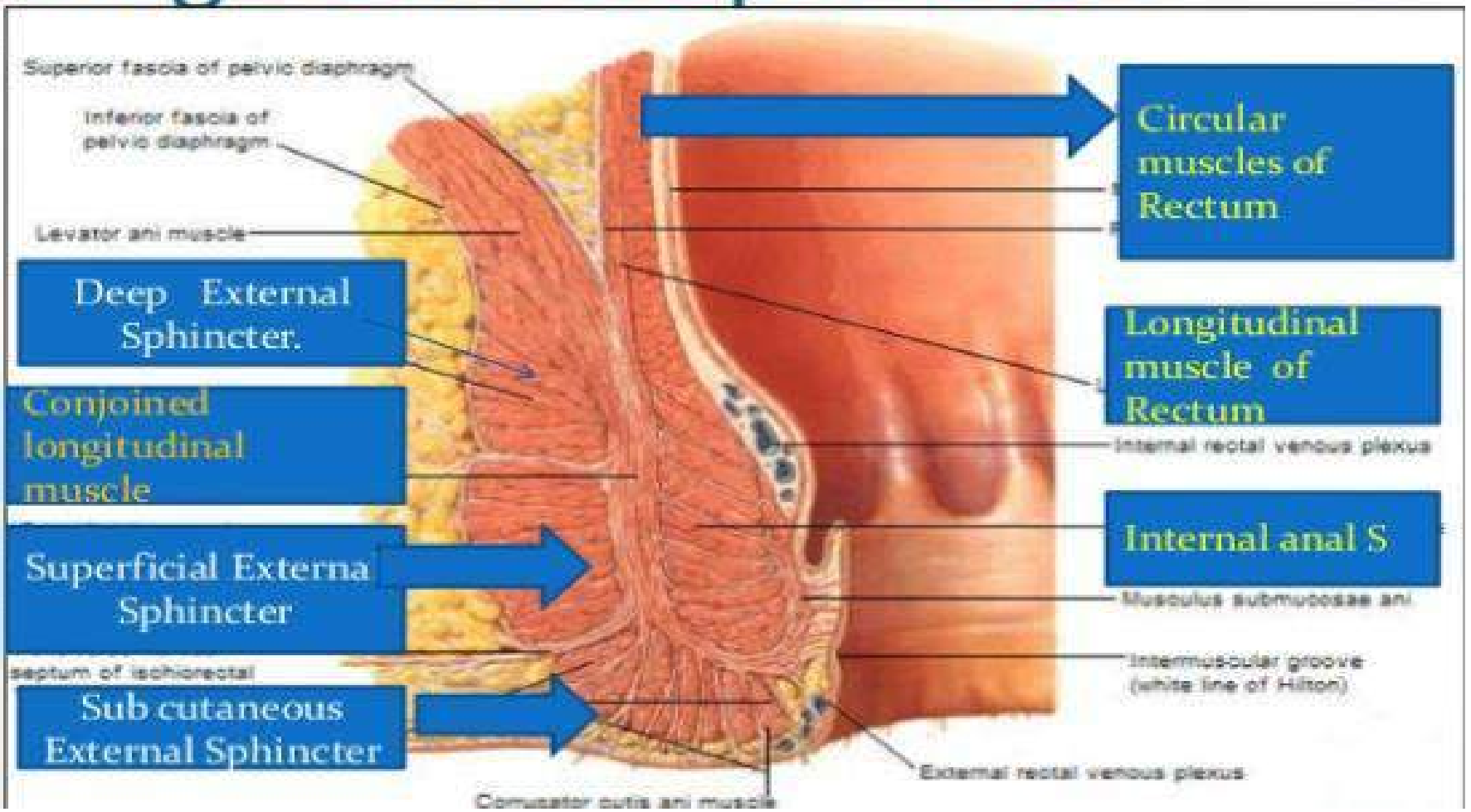

Inferior pubic ligament
Urethral opening
Perineal membrane
Vaginal opening
Perineal body
Anal aperture
External anal sphincter

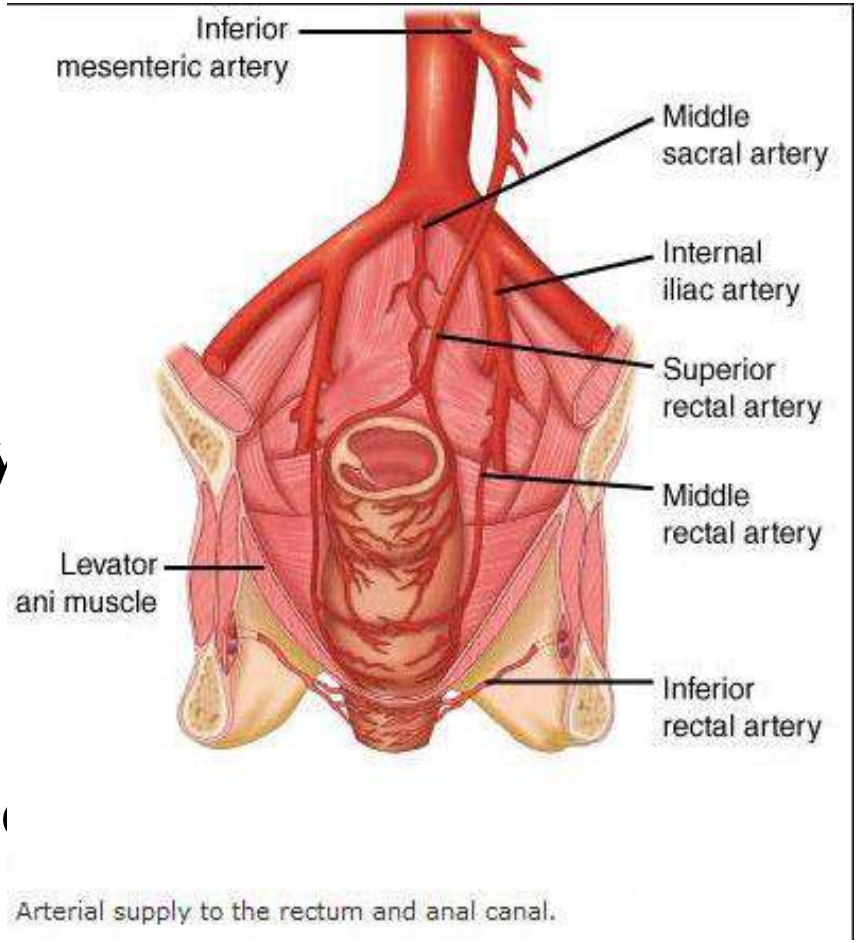
Image of Anal Sphincter:



Cont ..

Blood supply

- **The anal area receives an intercommunicating blood supply from superior, middle, inferior rectal arteries .**
- **Venous drainage goes mainly to superior rectal vein then portal system, but from anal sphincter and below the drainage goes towards systemi circulation .**



Arterial supply to the rectum and anal canal.

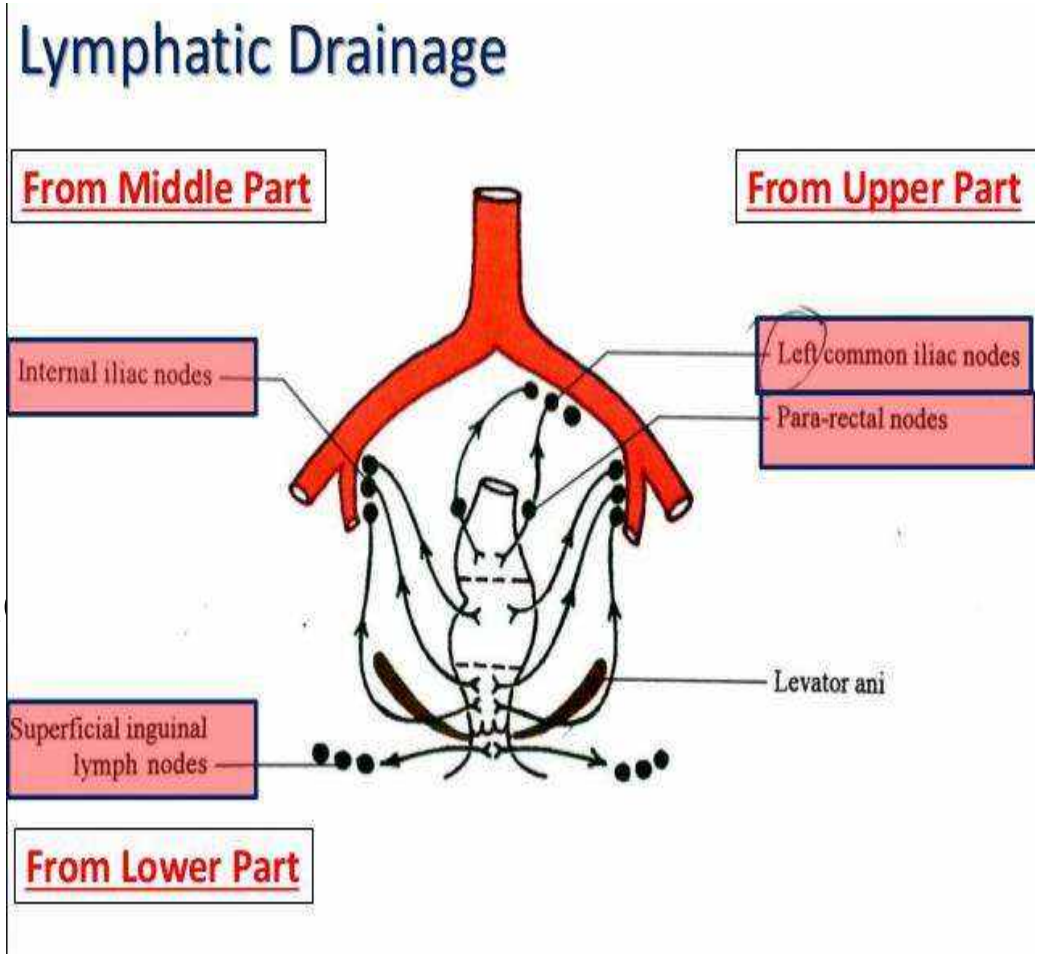
Cont ..

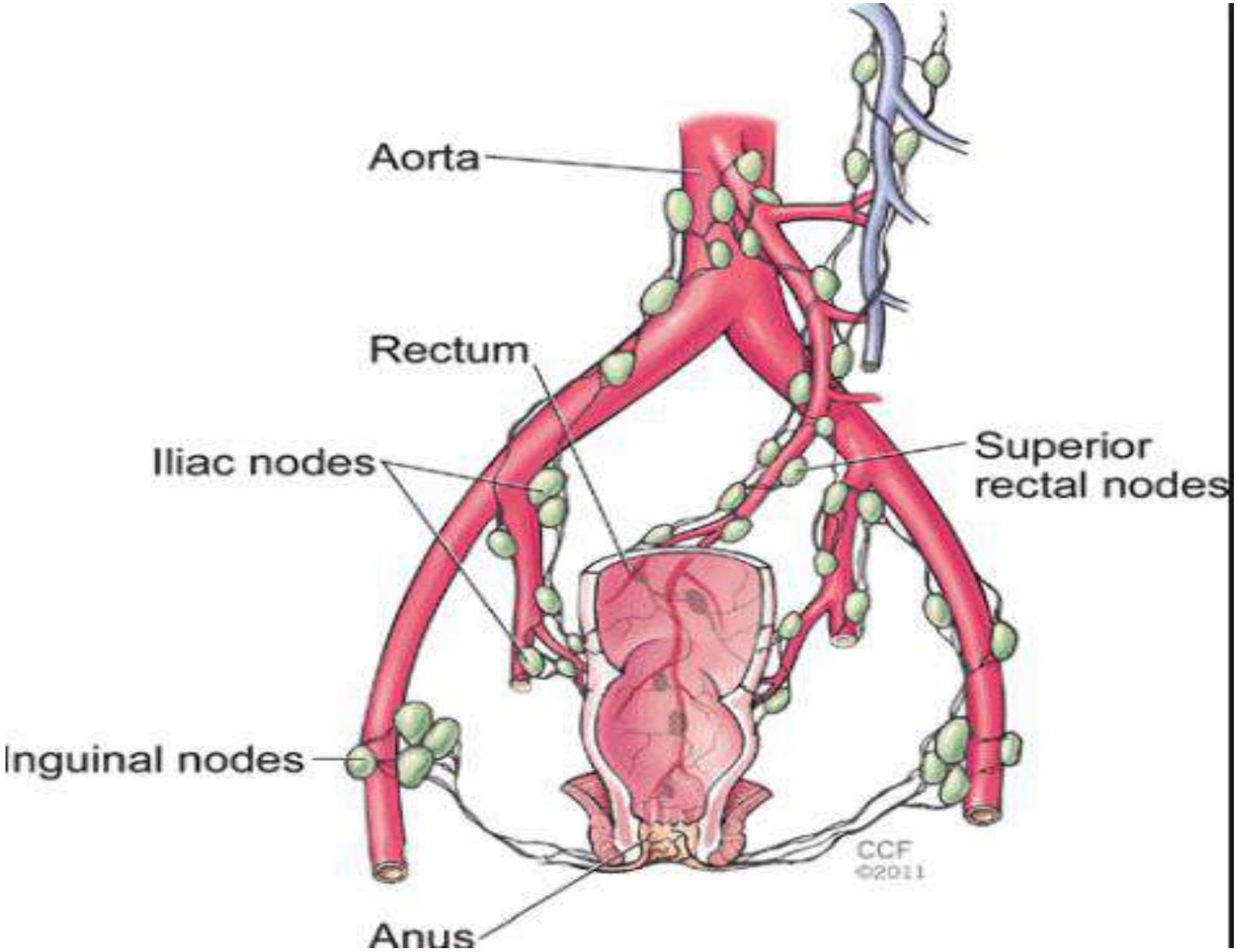
- ***Lymphatic drainage***
- ***Above dentate line:***

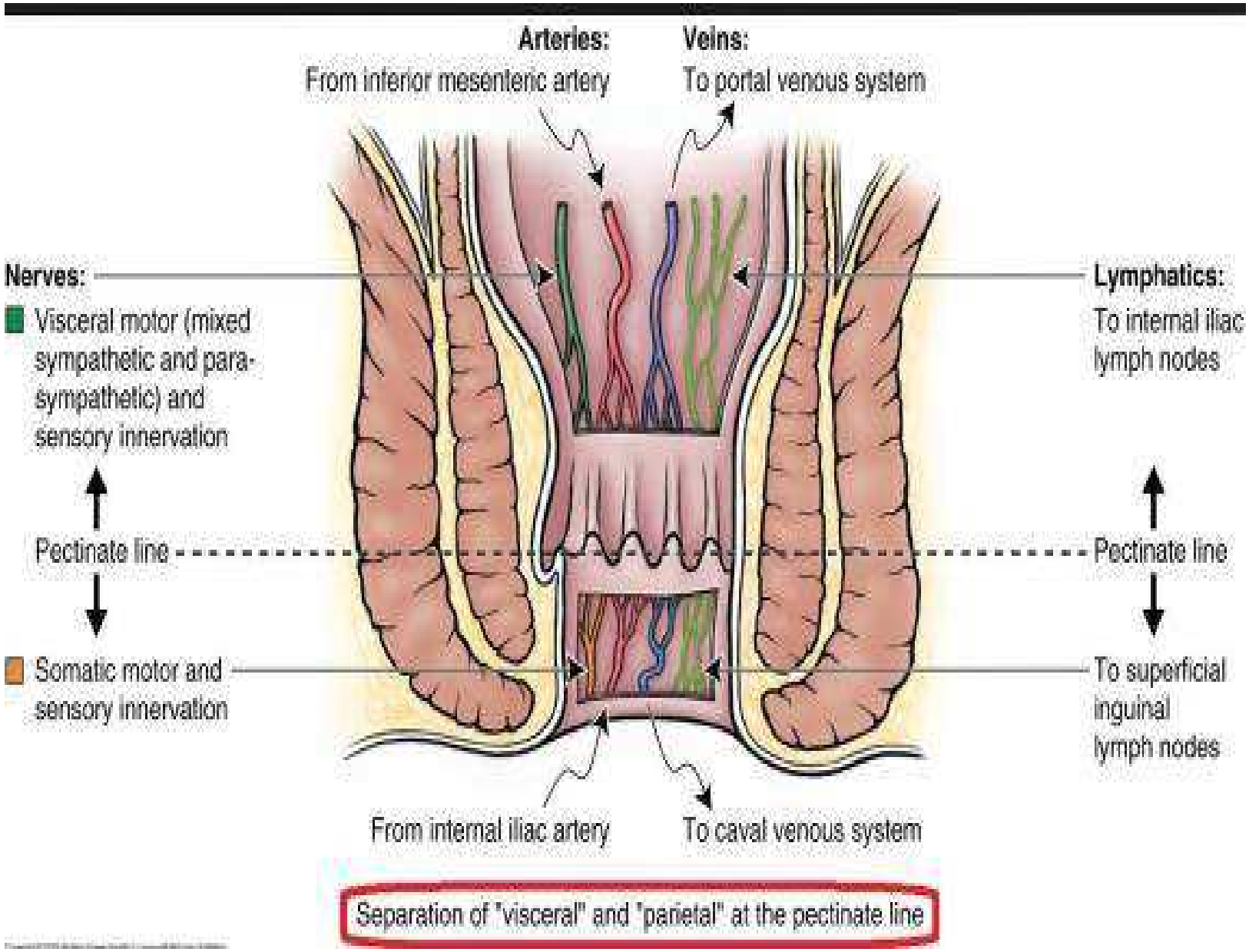
To inferior mesenteric and internal iliac nodes

- ***Below dentate line :***

To superficial inguinal nod




Aorta
Rectum
Iliac nodes
Superior rectal nodes
Inguinal nodes
Anus
CCF
©2011


Arteries:
From inferior mesenteric artery
Veins:
To portal venous system
Nerves:
Visceral motor (mixed sympathetic and para-sympathetic) and sensory innervation
Pectinate line
Somatic motor and sensory innervation
Lymphatics:
To internal iliac lymph nodes
Pectinate line
To superficial inguinal lymph nodes
From internal iliac artery
To caval venous system
Separation of "visceral" and "parietal" at the pectinate line

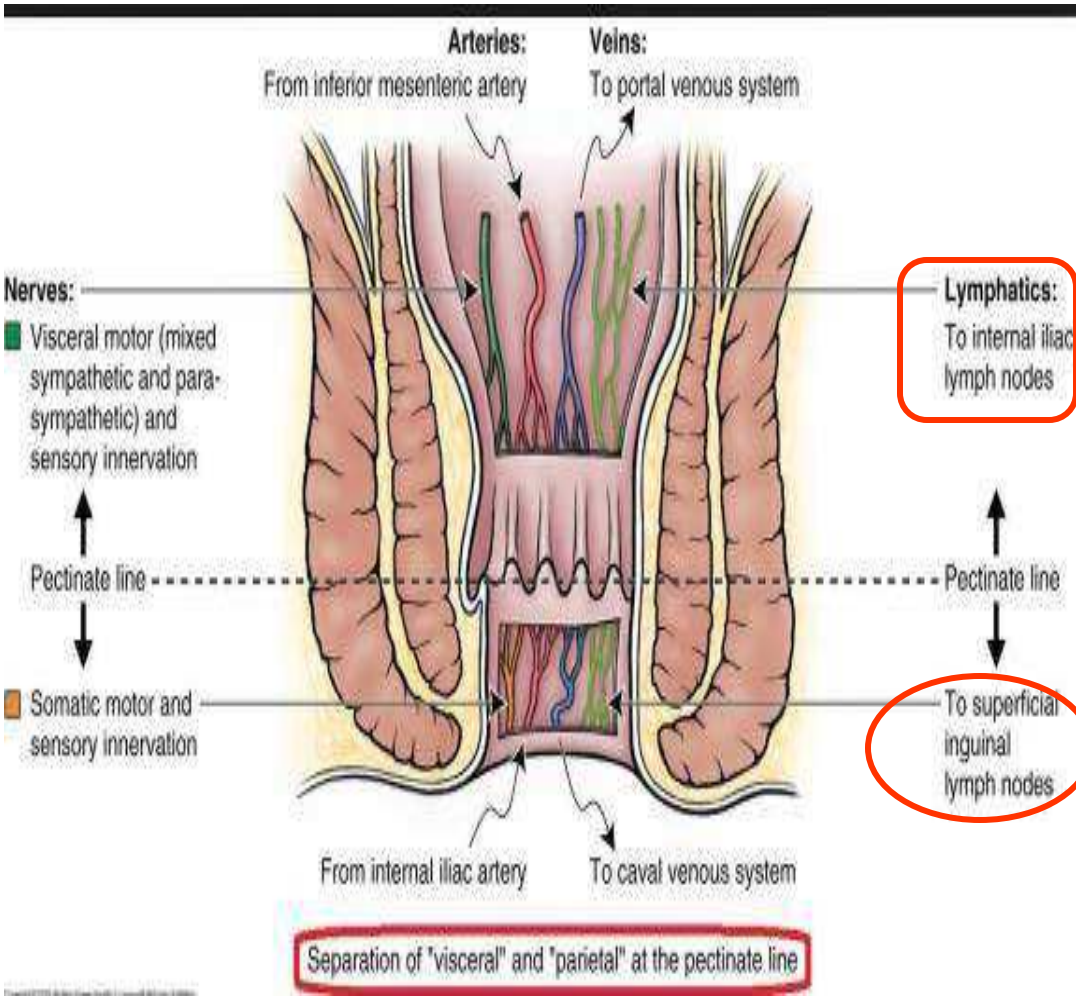
Cont ..

- **Lymphatic drainage**
- ***Above dentate line***

To inferior mesenteric and internal iliac nodes

- ***Below dentate line***

To superficial inguinal nodes



COLONOSCOPY

- **Since colorectal cancer is a leading cause of death in the Western world, colonoscopy is now being extensively used for early detection of malignant tumors.**
- **In this procedure, the mucous membrane of the colon can be directly visualized through an elongated flexible tube, or endoscope.**
- **Following a thorough washing out of the large bowel, the patient is sedated, and the tube is gently inserted into the anal canal.**
- **The interior of the large bowel can be observed from the anus to the cecum.**

COLONOSCOPY

- **Photographs of suspicious areas, such as polyps, can be taken and biopsy specimens can be removed for pathologic examination.**
- **Although a relatively expensive procedure, it provides a more complete screening examination for colorectal cancer than combined fecal occult blood testing and the examination of the distal colon with sigmoidoscopy.**


SNELL RICHARD
6010345 75 M
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11:24:30
COLON
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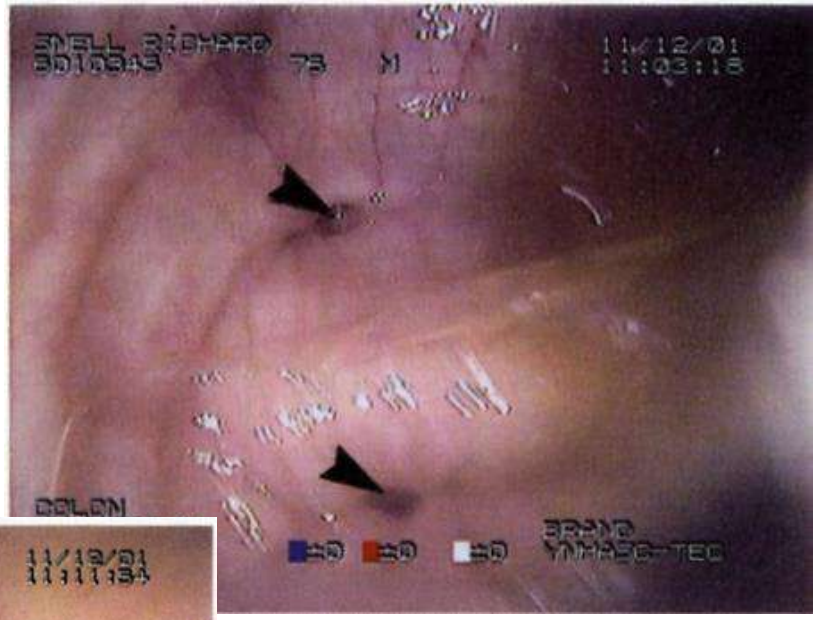
PENTAX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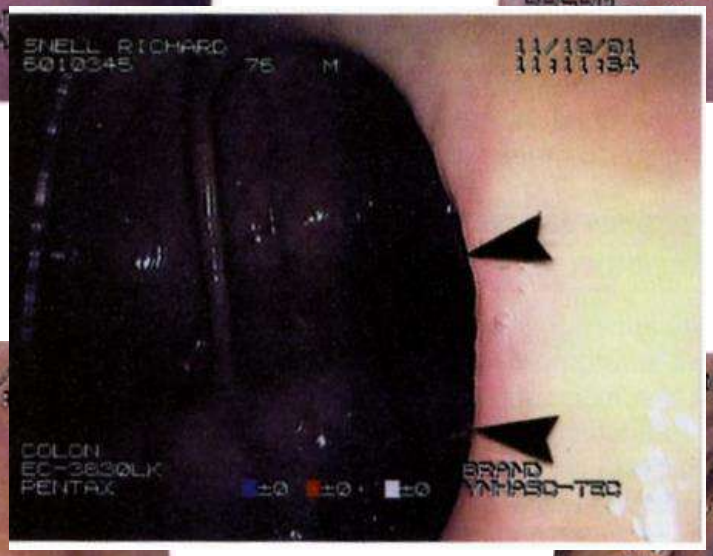
11:03:18
COLON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COLON
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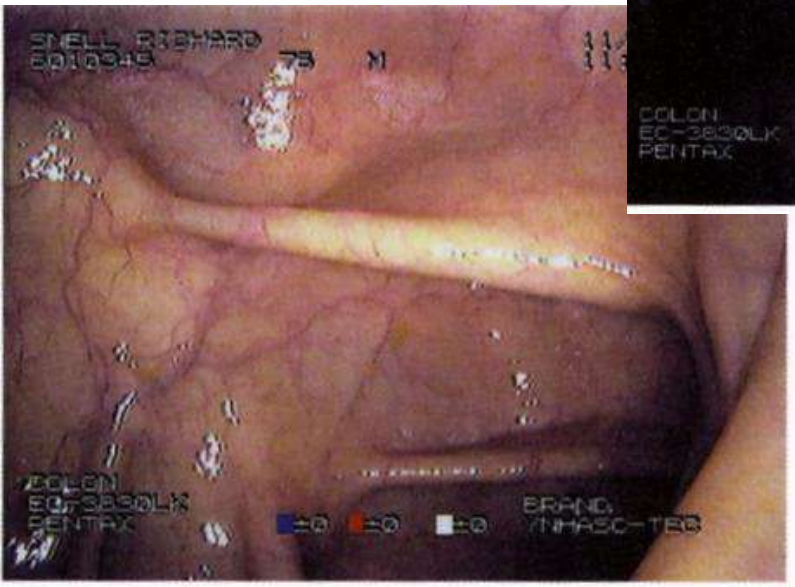
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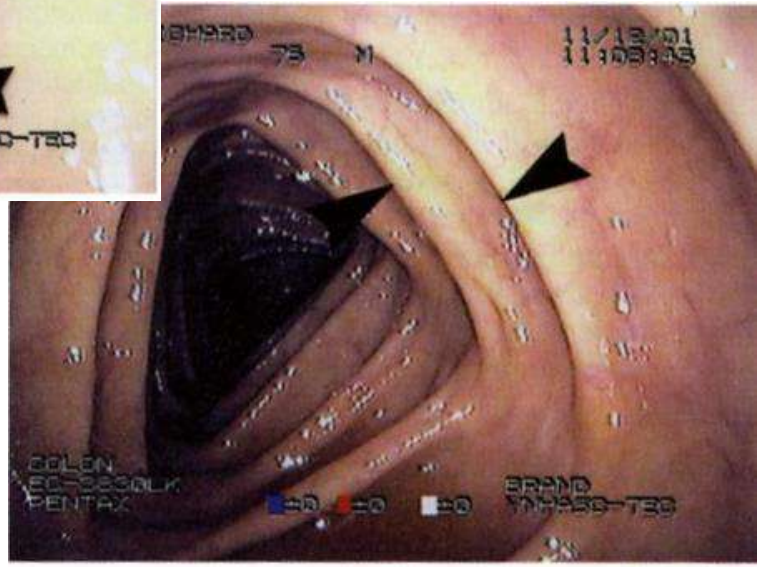

11/12/01
COLON
EC-3830LK
PENTAX

CANCER OF THE LARGE BOWEL

- **Cancer of the large bowel is relatively common in persons older than 50 years.**
- **The growth is restricted to the bowel wall for a considerable time before it spreads via the lymphatics.**
- **Bloodstream spread via the portal circulation to the liver occurs late.**
- **If a diagnosis is made early and a partial colectomy is performed, accompanied by removal of the lymph vessels and lymph nodes draining the area, then a cure can be anticipated.**

Abdominal Vasculature:

Arterial supply

Abdominal Aorta

The main bld. Supply to the abdomen comes from:

Abdominal Aorta

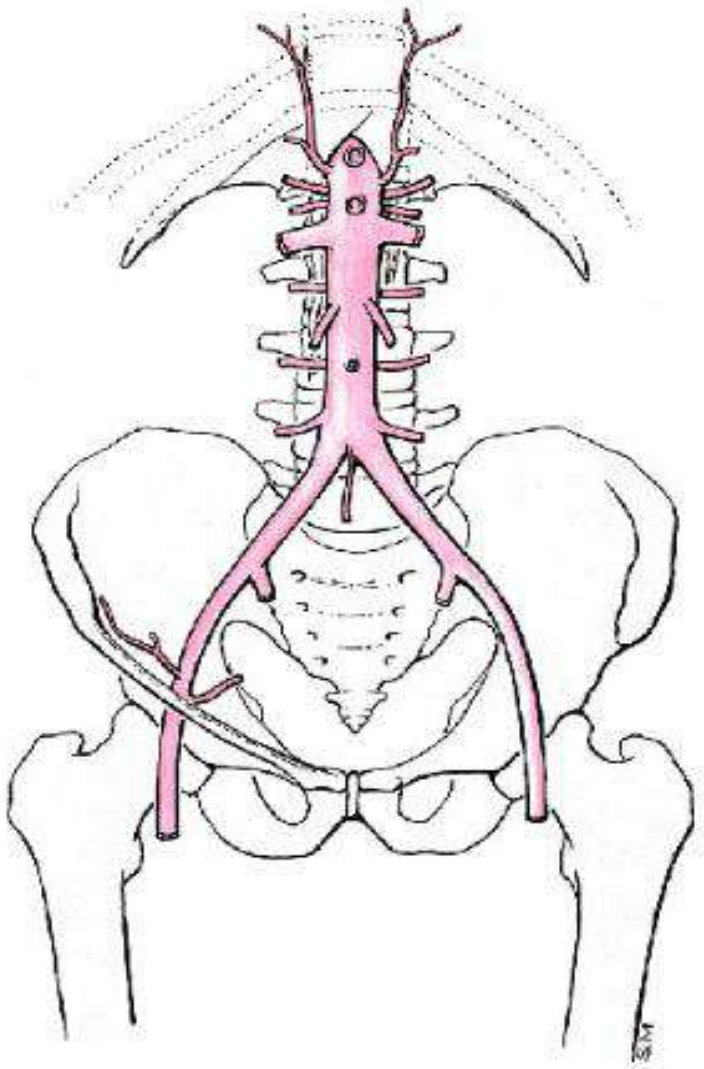
- **Starts in aortic hiatus opposite to**

Lower border of *T12*

- **Descend infront of upper 4 lumbar vertebrae, slightly curved to Lt.**
- **Ends opposite to *L3-L4 disc* 2cm below and to left of umbilicus by dividing into: *2 Common Iliac Arteries***

To its Rt lie IVC,cisterna chyli, azygos v

To its lt lie Lt sympathetic trunk.



Branches of Abd. Aorta

Abd. Wall branches:

5 lumbar Arteries (each side)

1st lumbar = inf. phrenic artery

Abd. Cavity branches: (Visceral)

3 Anterior

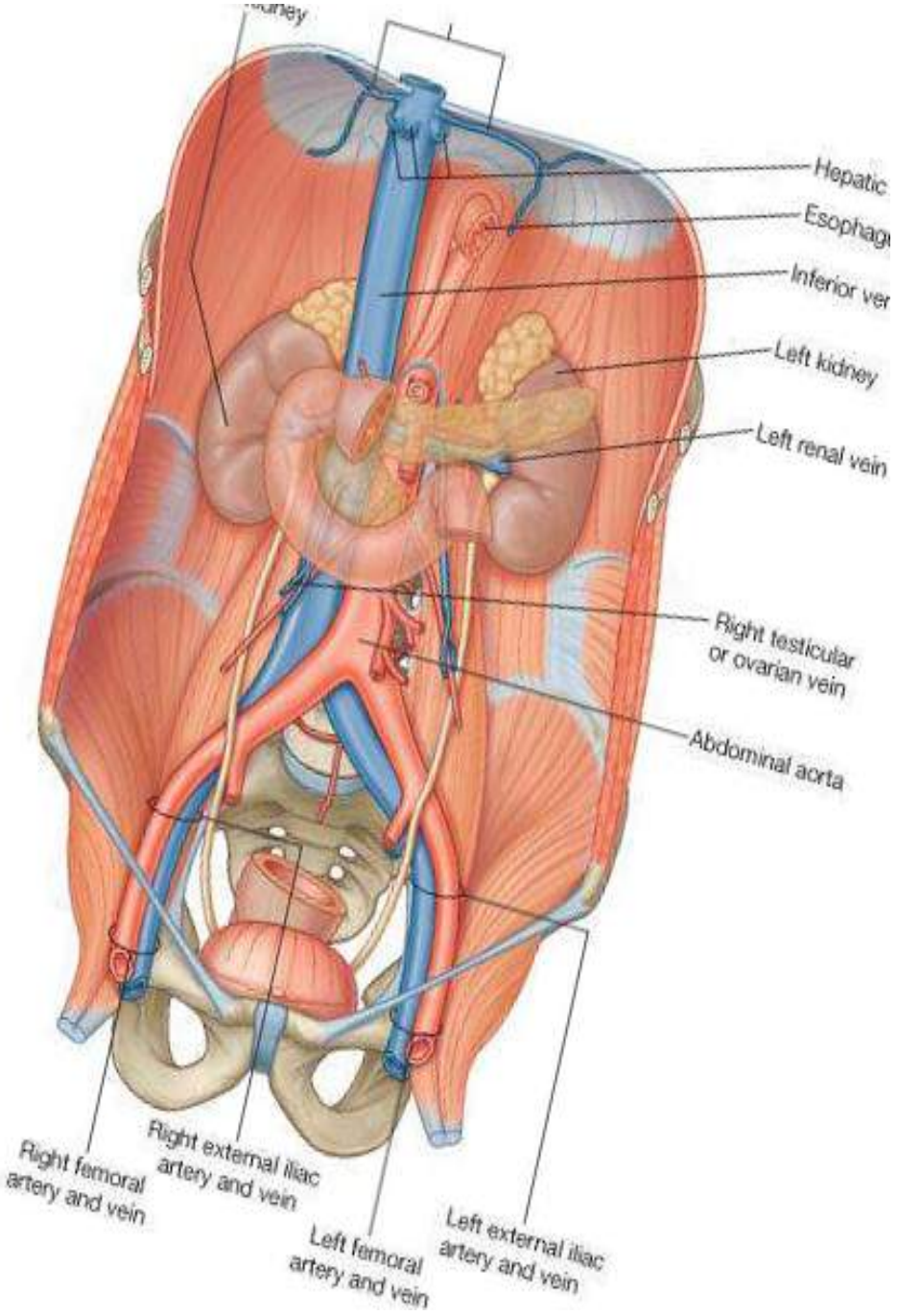
3 lateral

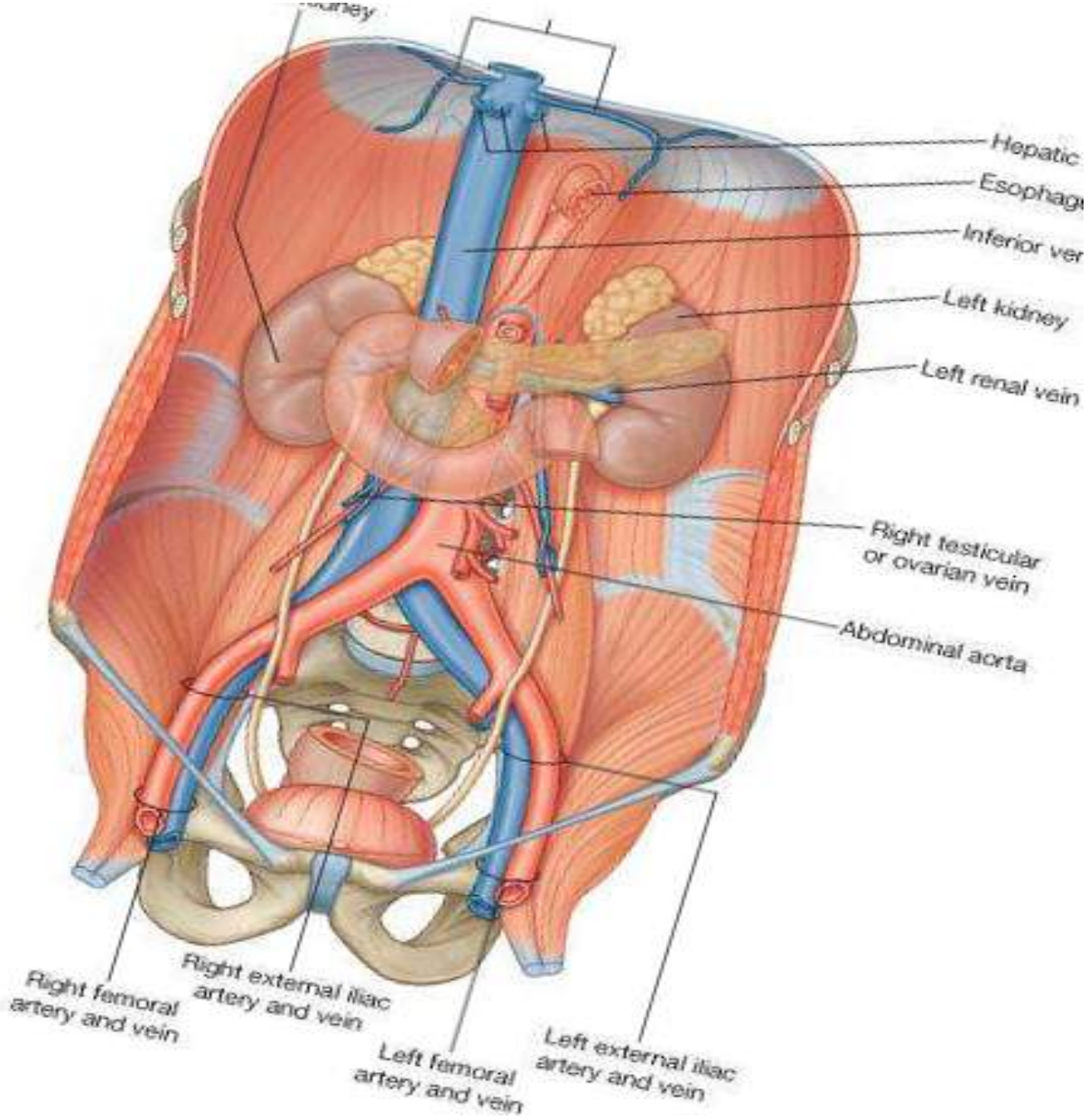
3 Terminations

- ***3 anterior: Single***
- **Celiac trunk T12**
- **Sup. Mesenteric L1**
- **Inf. Mesenteric L3**
- ***3 lateral: Paired***
- **Suprarenal**
- **Renal L2**
- **Gonadal (testicular or ovarian)**
- ***3 Terminations:***

2 common iliac A (L4)

Median sacral a. single




Hepatic
Esophag
Inferior ver
Left kidney
Left renal vein
Right testicular
or ovarian vein
Abdominal aorta
Right femoral
artery and vein
Right external iliac
artery and vein
Left femoral
artery and vein
Left external iliac
artery and vein

Celiac Trunk

At level of *T12* just beneath the hiatus

Very short 1 cm

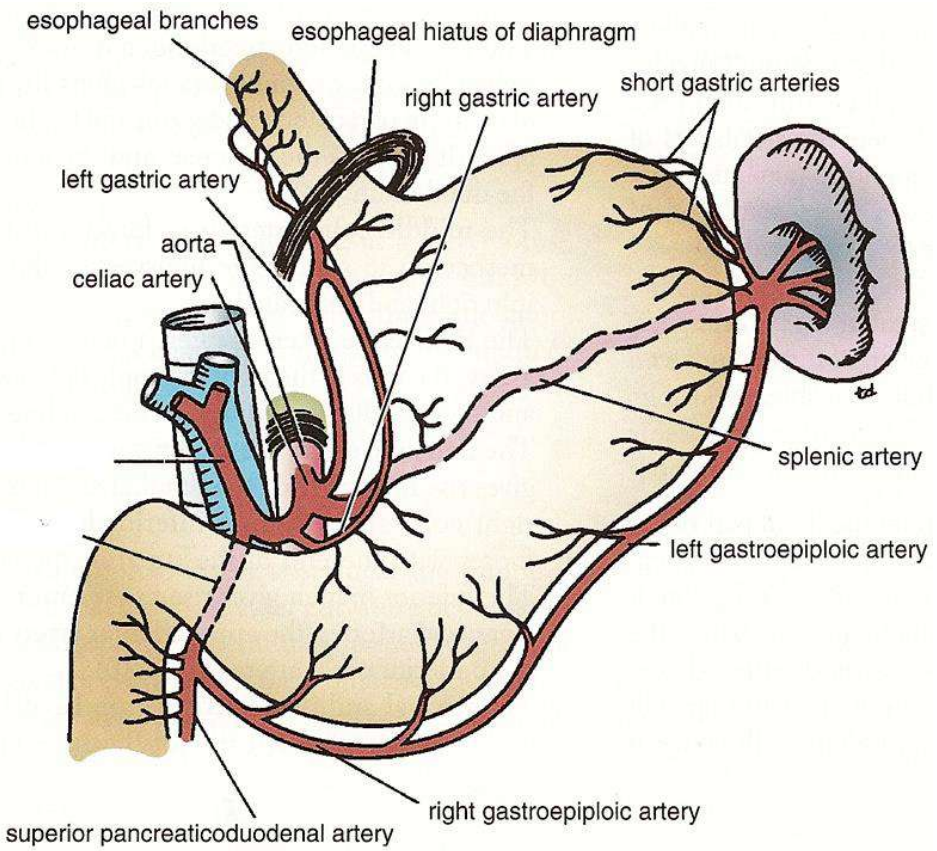
Divides into 3 branches:

Lt.: Splenic A. (largest)

Rt.: Common hepatic a.

Sup.: Left gastric a.

(lesser curvature superiorly)



Splenic Artery

Largest branch of *Celiac Trunk*

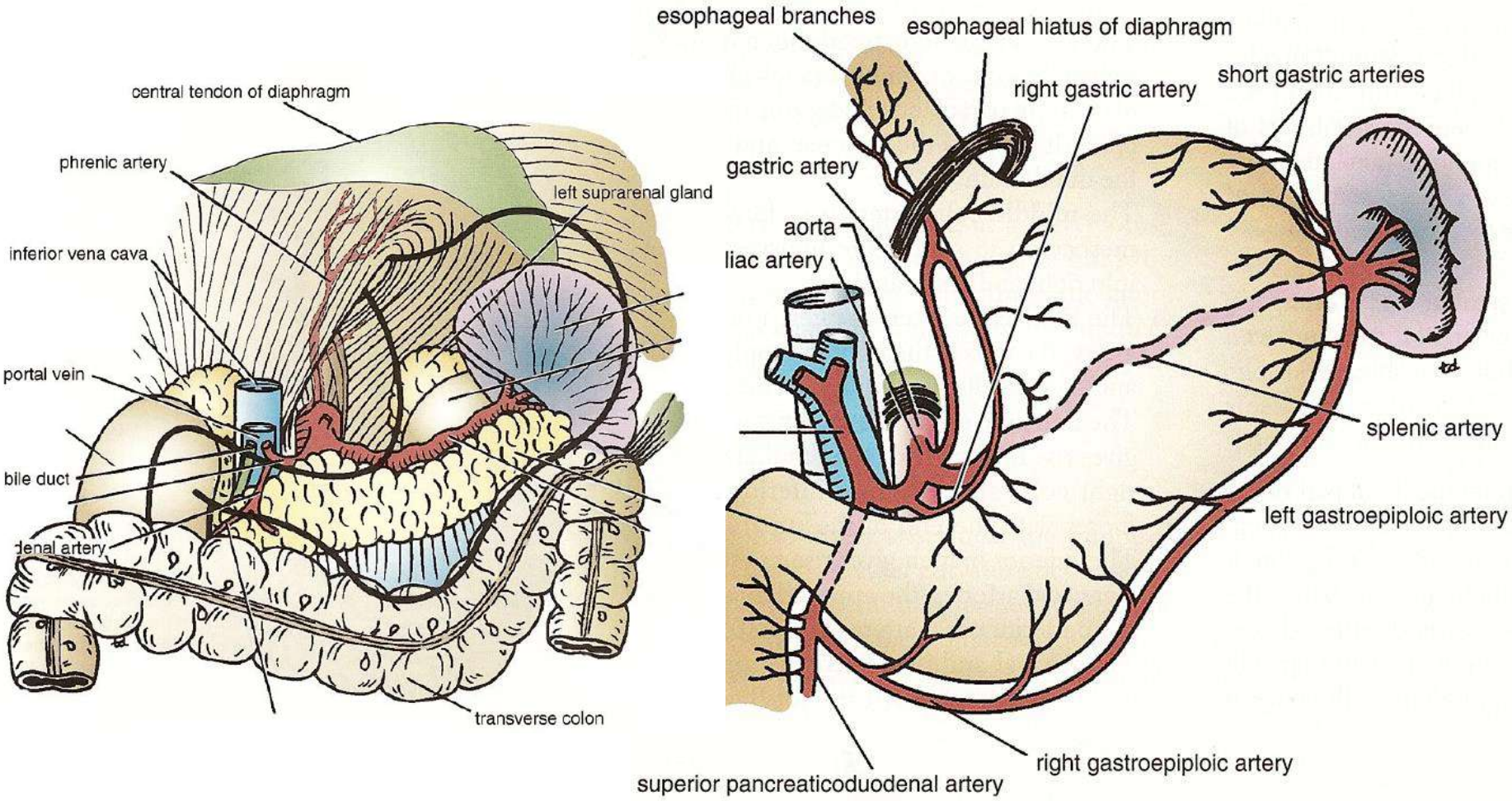
Pass Post. to the stomach & Sup. to pancreas at upper border, very tortuous course.

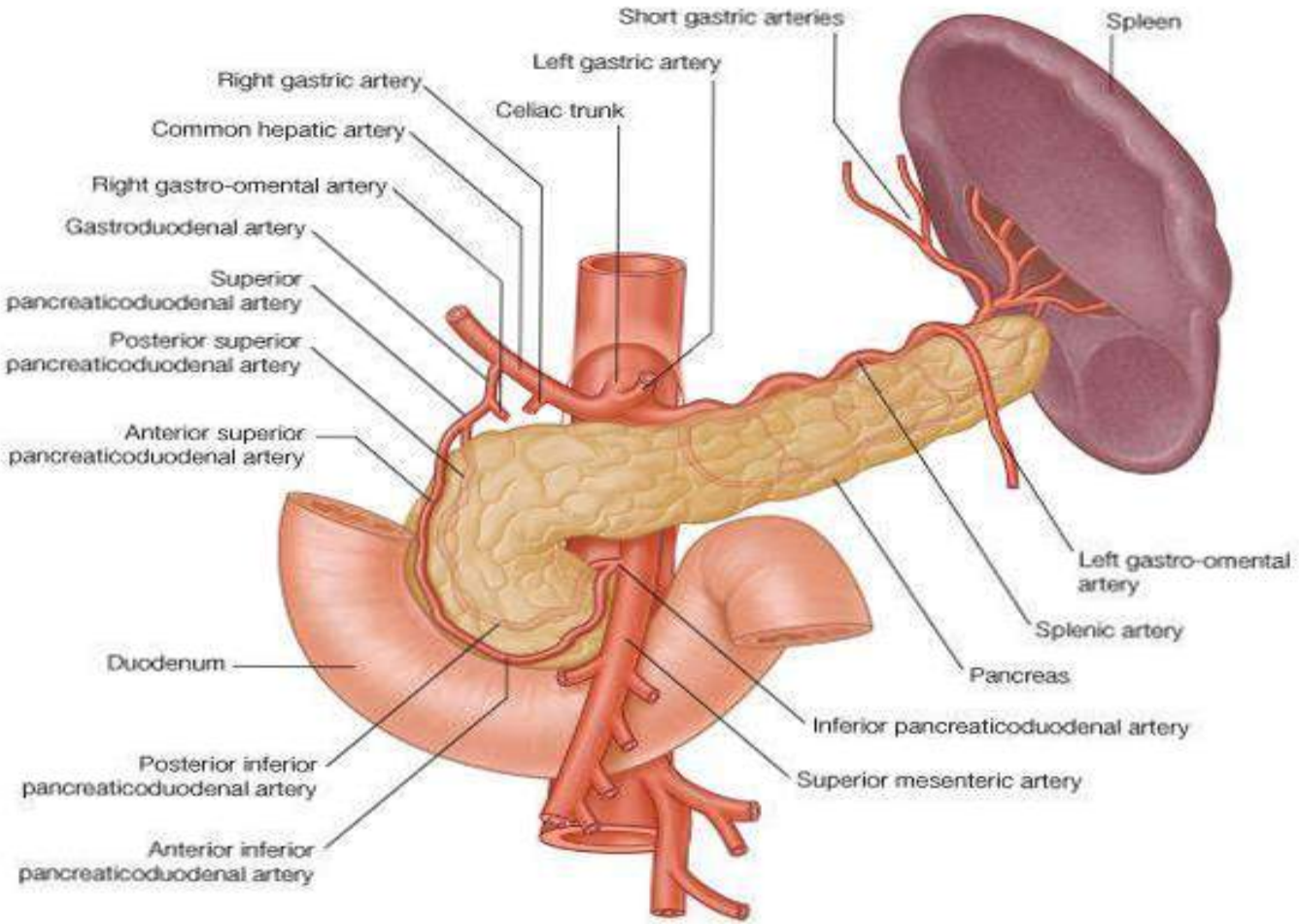
Enters the linorenal ligament to reach the hilum of the spleen, where it divide into *5-6* terminal branches

Branches:

- **Pancreatic arteries**
- **Short gastric arteries 5-6 (to the fundus) pass through gastrosplenic lig**
- **left gastro-epiploic a. (greater curvature on lf.)**

Splenic Artery




Short gastric arteries
Spleen
Left gastric artery
Right gastric artery
Celiac trunk
Common hepatic artery
Right gastro-omental artery
Gastroduodenal artery
Superior pancreaticoduodenal artery
Posterior superior pancreaticoduodenal artery
Anterior superior pancreaticoduodenal artery
Left gastro-omental artery
Splenic artery
Pancreas
Duodenum
Inferior pancreaticoduodenal artery
Posterior inferior pancreaticoduodenal artery
Superior mesenteric artery
Anterior inferior pancreaticoduodenal artery

Hepatic Artery

Right branch of celiac trunk

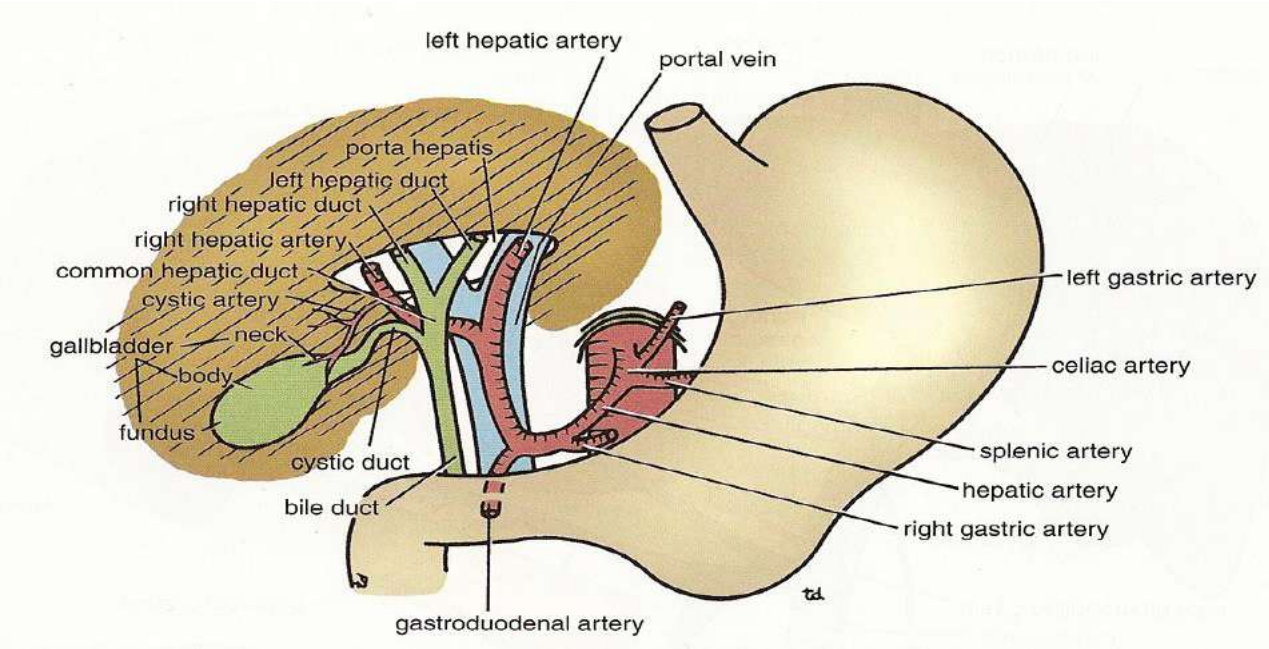
Pass in the Rt. Side to the hilum of the liver, infront of portal vein, till it reach upper border of first part of *D1*

It divide like a *T* on its side to

Descending limb: **Gastro-duodenal a**

Ascending limb: **Hepatic artery, between to layers of lesser omentum Part of**

the portal triad



Porta Hepatis

In the middle of visceral surface

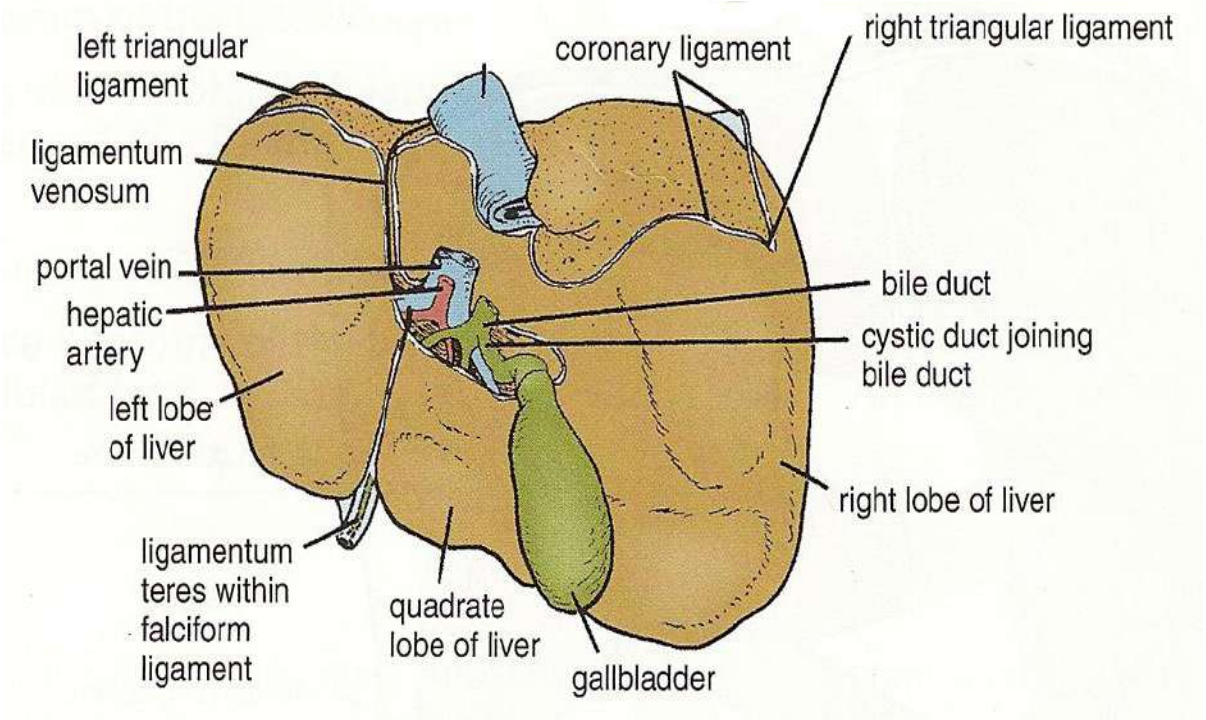
Contains:

(PortalTriad)

Portal vein *(in)*

Hepatic artery *(in)*

Bile duct *(out)*



Hepatic Artery

Branches:

Rt. Gastric a.: pass to left

Gastroduodenal a.:

descends behind duodenum (1st part)

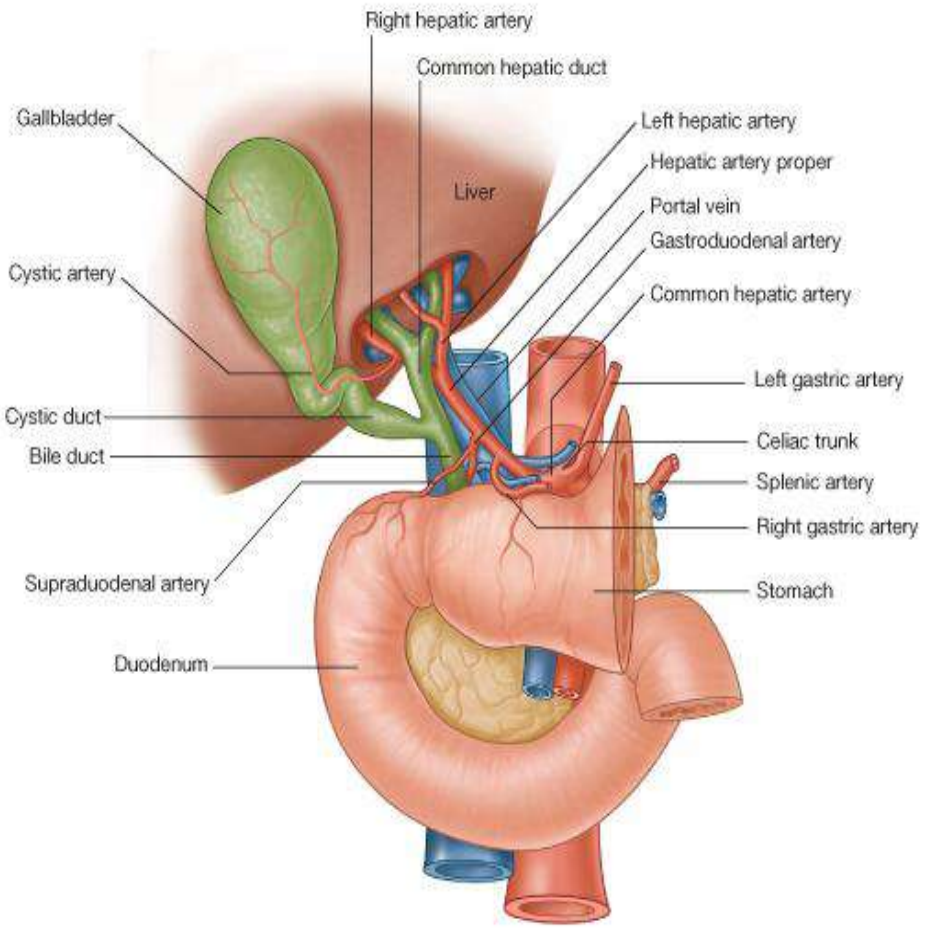
gives: Rt. Gastro-epiploic & sup. Pancreatic duodenal

2 terminations:

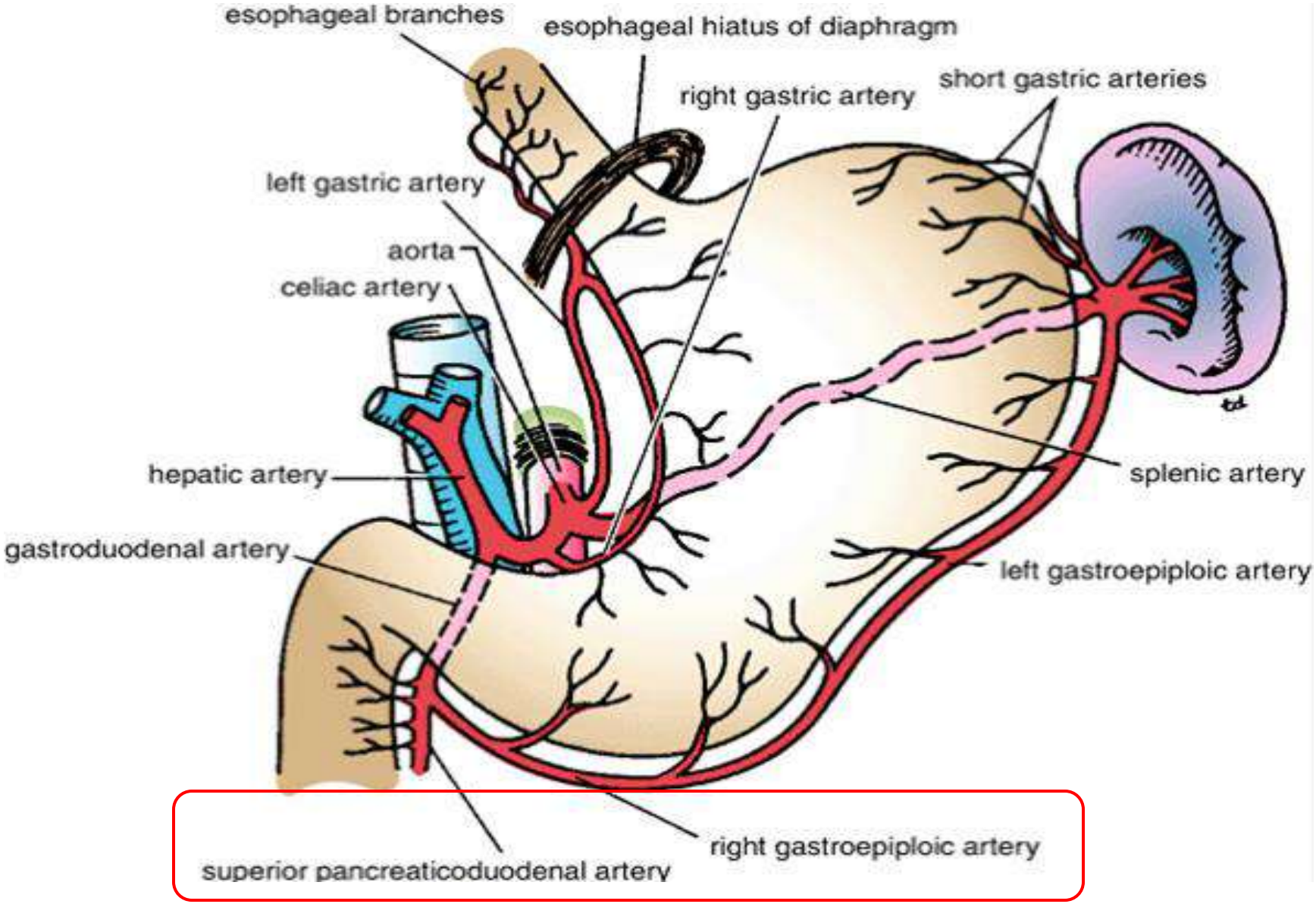
Lf. Hepatic a.

Rt. Hepatic a.

Cystic A. comes from Rt. Hepatic a.



Celiac Trunk Branches (Review)



Superior Mesenteric Artery

Arises:

Below celiac trunk & just above the left renal vein, at *L1*, Sup mesenteric vein , lie on the Rt side of artery ,in its concavity

Descends:

post. to *neck of Pancreas*

Ant. to 3rd part of duodenum

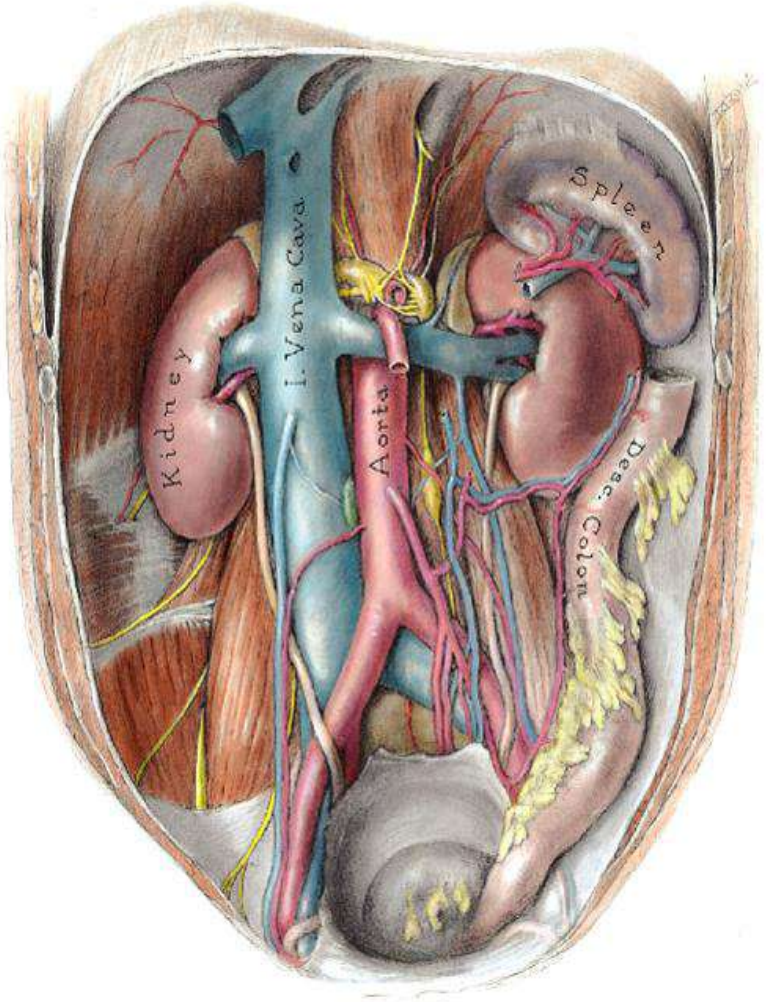
Supplies the intestine:

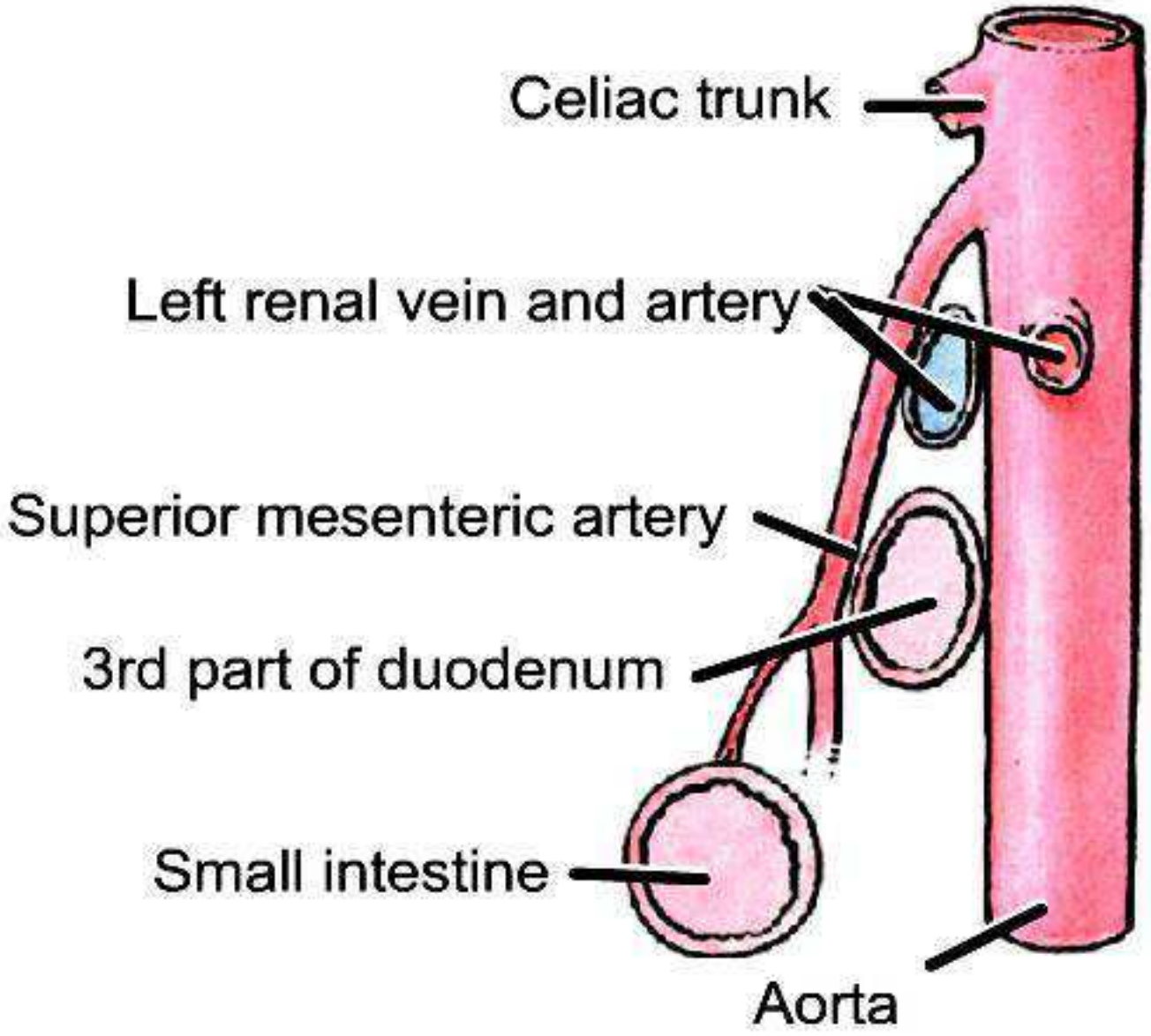
from lower ½ of duodenum

↓

Until proximal 2/3 of transverse colon

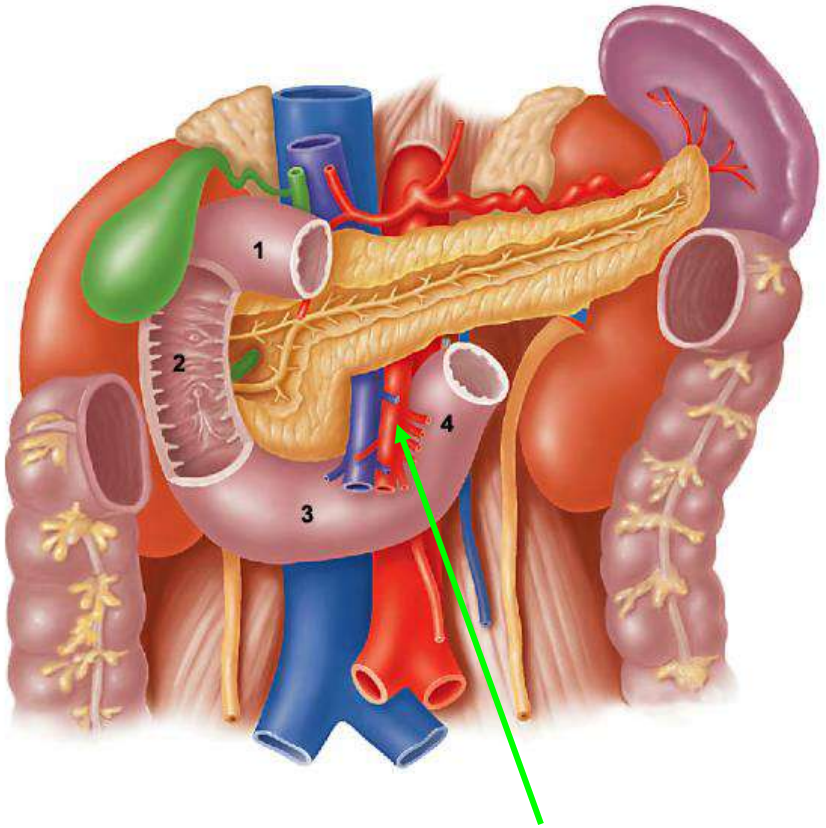
***End* by anatomizing with ileal branches of ileocolic artery**



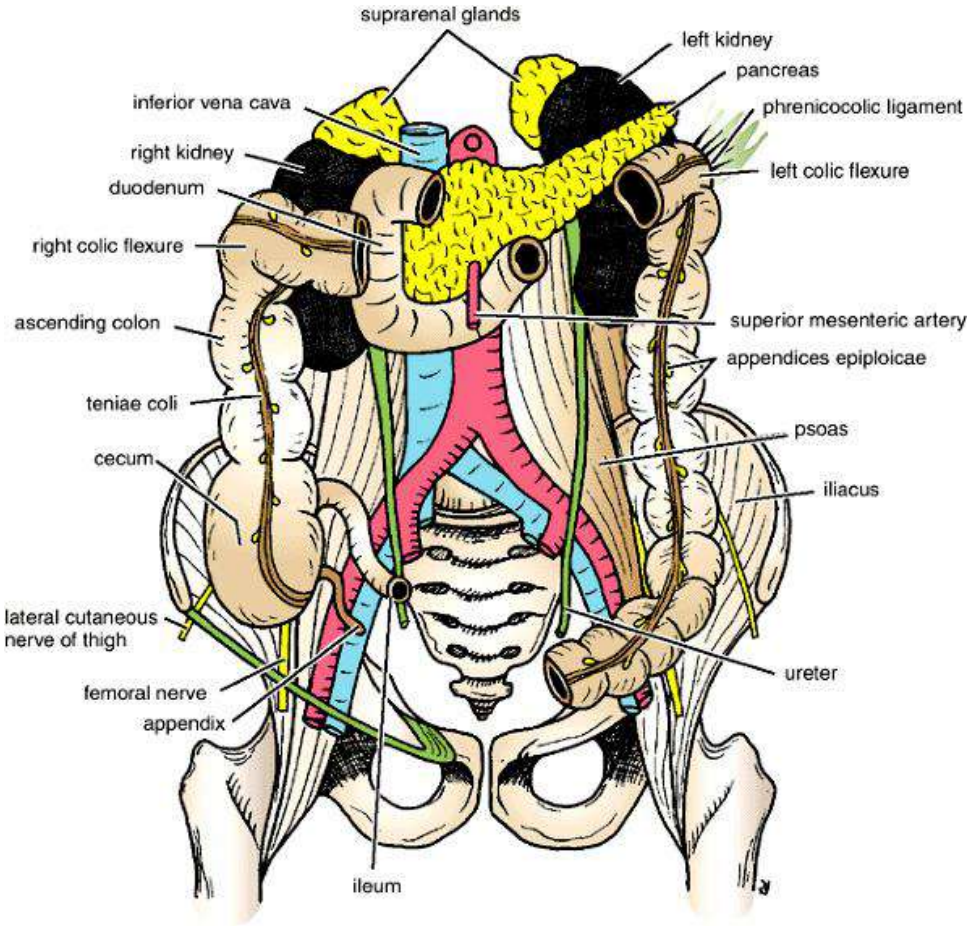


Lateral View (from left)

Relations of Superior Mesenteric Artery



Sup. Mesenteric a.



Main Branches of Sup. Mesenteric

1. ***Inf. pancreatic duodenal a.***

   Anastomose with sup. Pancreatic duodenal a.

2. ***Jejunal & ileal branches.***

12 or more arise from convex Lt side of SMA

3. ***Ileocolic a.:***

- **Ileal arteries: to terminal ileum**
- **Ant, pos cecal arteries: front, and back of cecum**
- **Appendicular A:descend behind terminal ileum to reach Meso A**
- **Ascending branch:lower1/3 of ascending colon .**

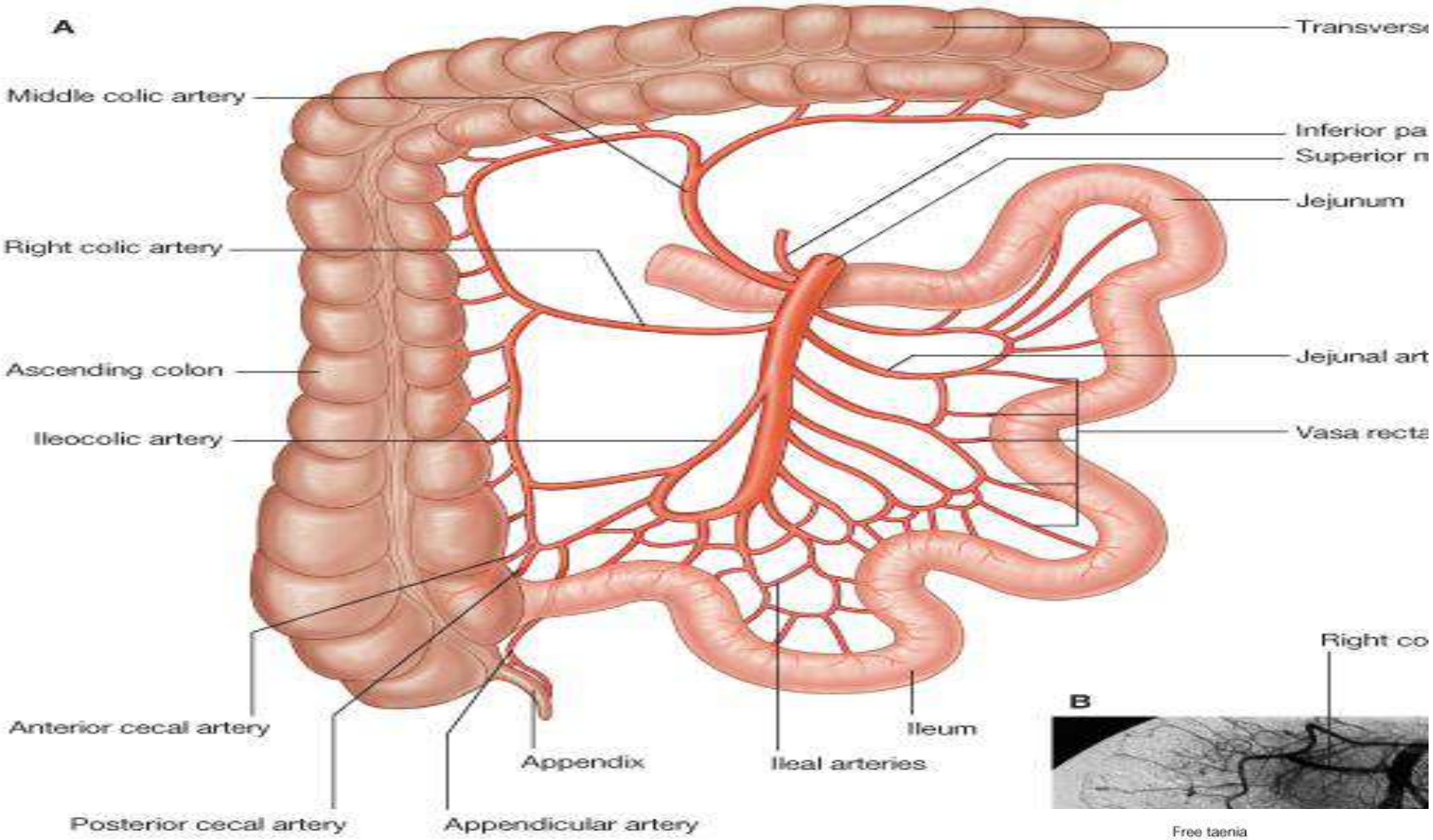
4. ***Right colic a.:***

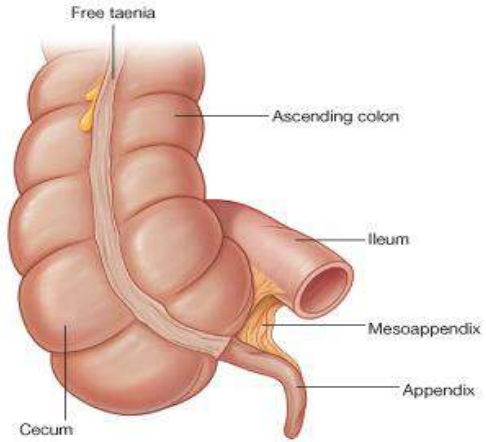
   Supplies the upper2/3 ascending colon, hepatic flexure

5. ***Middle colic a.:***

   Supplies proximal 2/3 of transverse colon

Rt hepatic artery may arise from SMA in 25% of people


A
Transverse
Middle colic artery
Inferior pa
Superior m
Jejunum
Right colic artery
Jejunal art
Ascending colon
Vasa recta
Ileocolic artery
Right co
B
Anterior cecal artery
Ileum
Appendix
Ileal arteries
Posterior cecal artery
Appendicular artery
Ileocolic arte


Free taenia
Ascending colon
Ileum
Mesoappendix
Appendix
Cecum

Inferior Mesenteric Artery

Supplies intestine:

From distal 1/3 of transverse colon

↓

Upper ½ of Anal canal

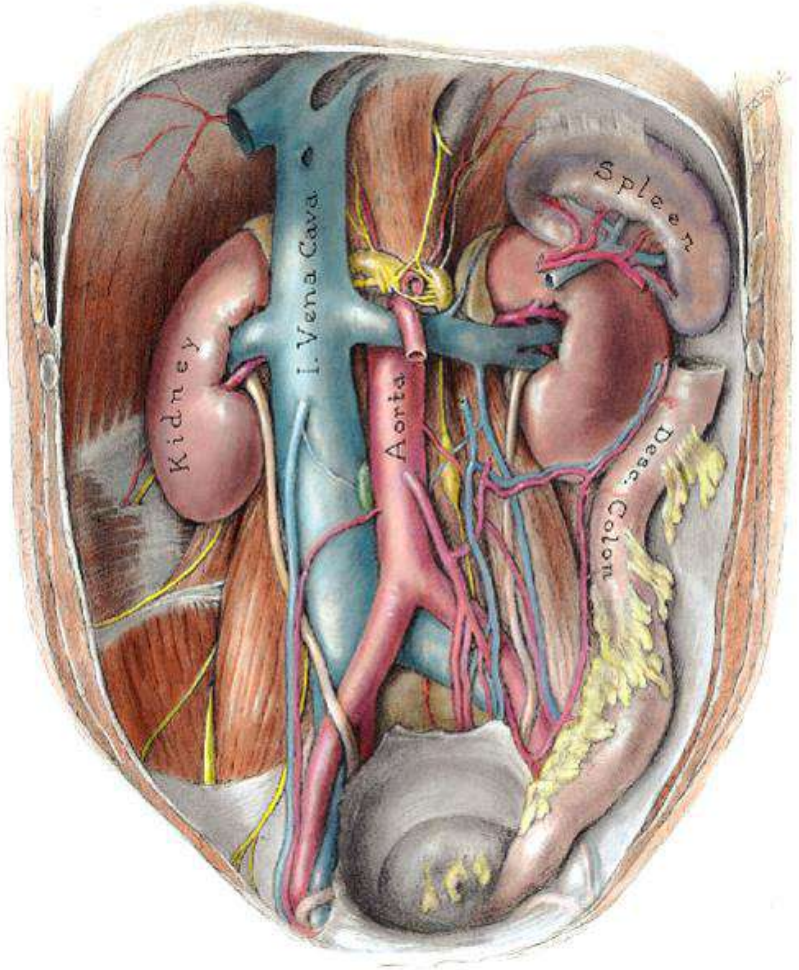
Arise: **from abdominal aorta at level of L3**

End: **by becoming superior rectal A, which cross lt CIA to enter pelvis**

At its origin lie behind D3

IMV lie on its Lt side

Runs downward to the left.



Branches of Inf. mesenteric A

Left Colic:

supplies distal 1/3 of trans. Colon & descending colon

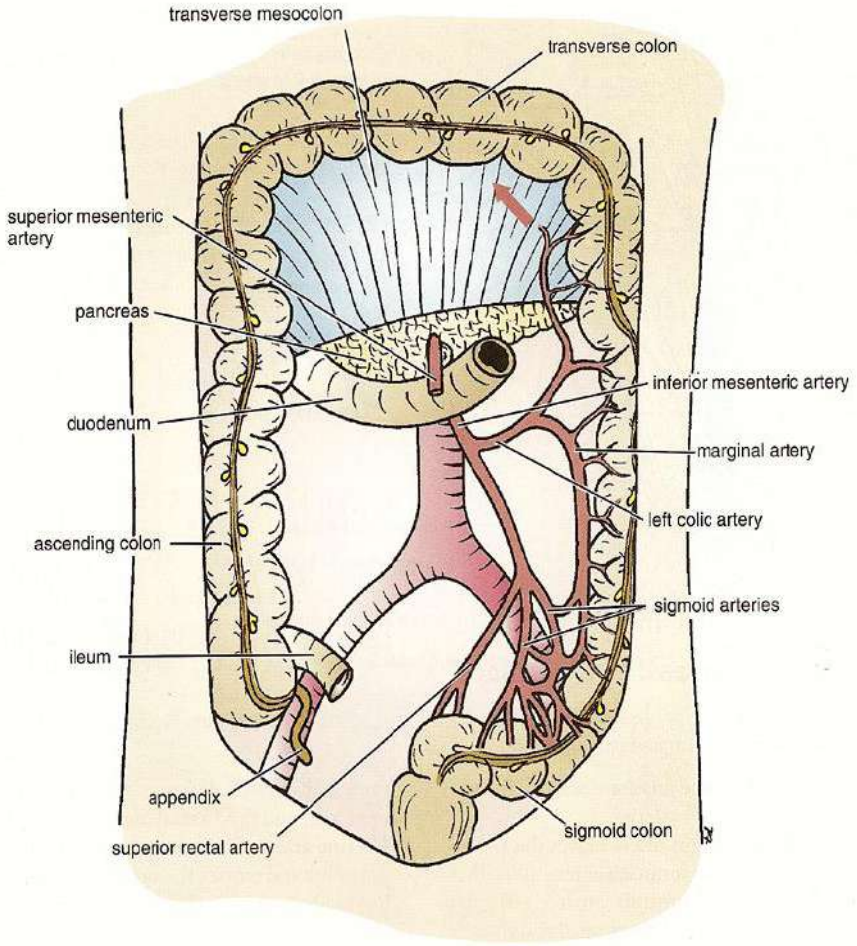
Sigmoid arteries:

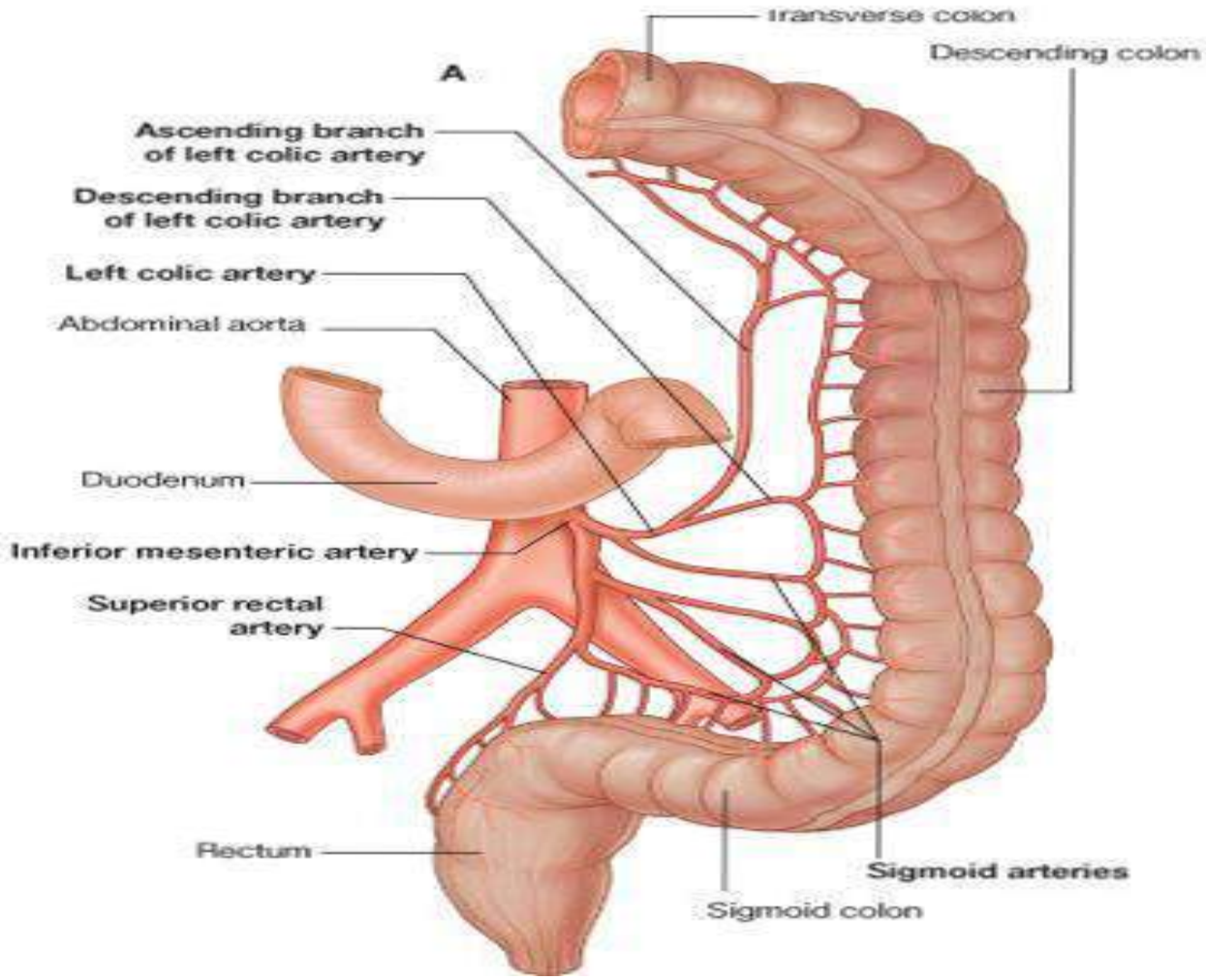
3-4 branches

sigmoid colon

Superior rectal a.: **Begins at middle of Lt CIA**

Enter descending limb of sigmoid mesocon,continue behind rectum and divide into Rt,Lt branches, supply rectum & upper ½ of anal canal,anastomose with M,I rectal arteries




A
Transverse colon
Descending colon
Ascending branch of left colic artery
Descending branch of left colic artery
Left colic artery
Abdominal aorta
Duodenum
Inferior mesenteric artery
Superior rectal artery
Rectum
Sigmoid arteries
Sigmoid colon

Venous Drainage:

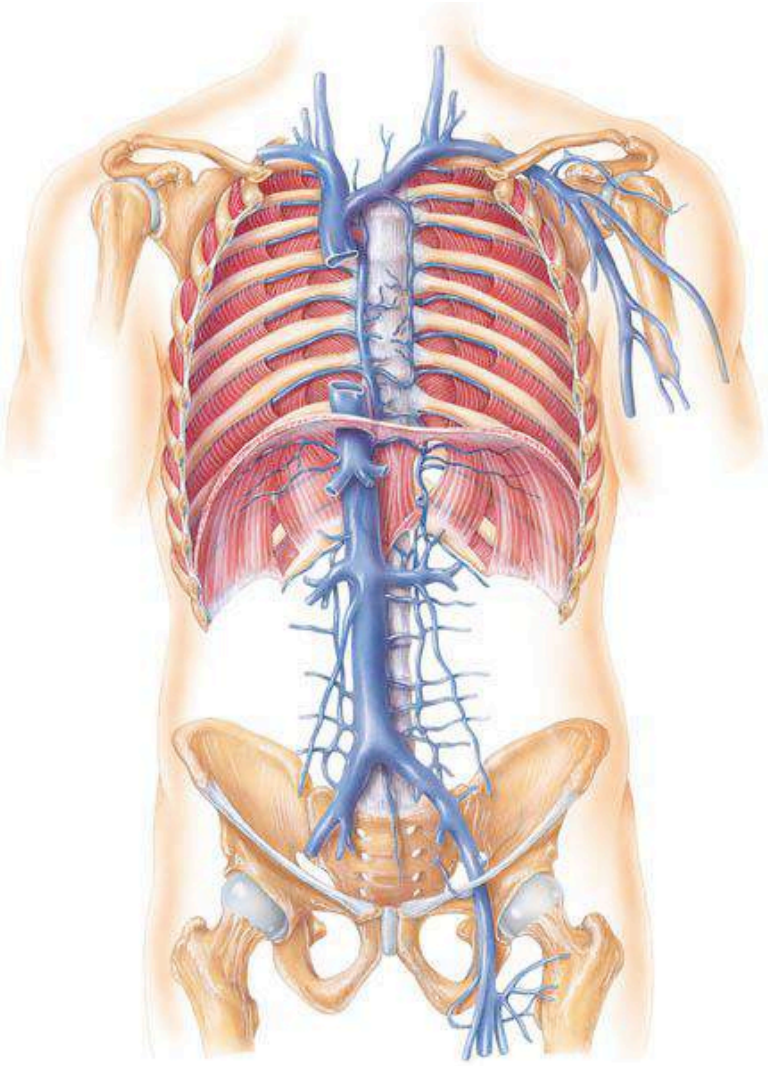
IVC & Portal Vein

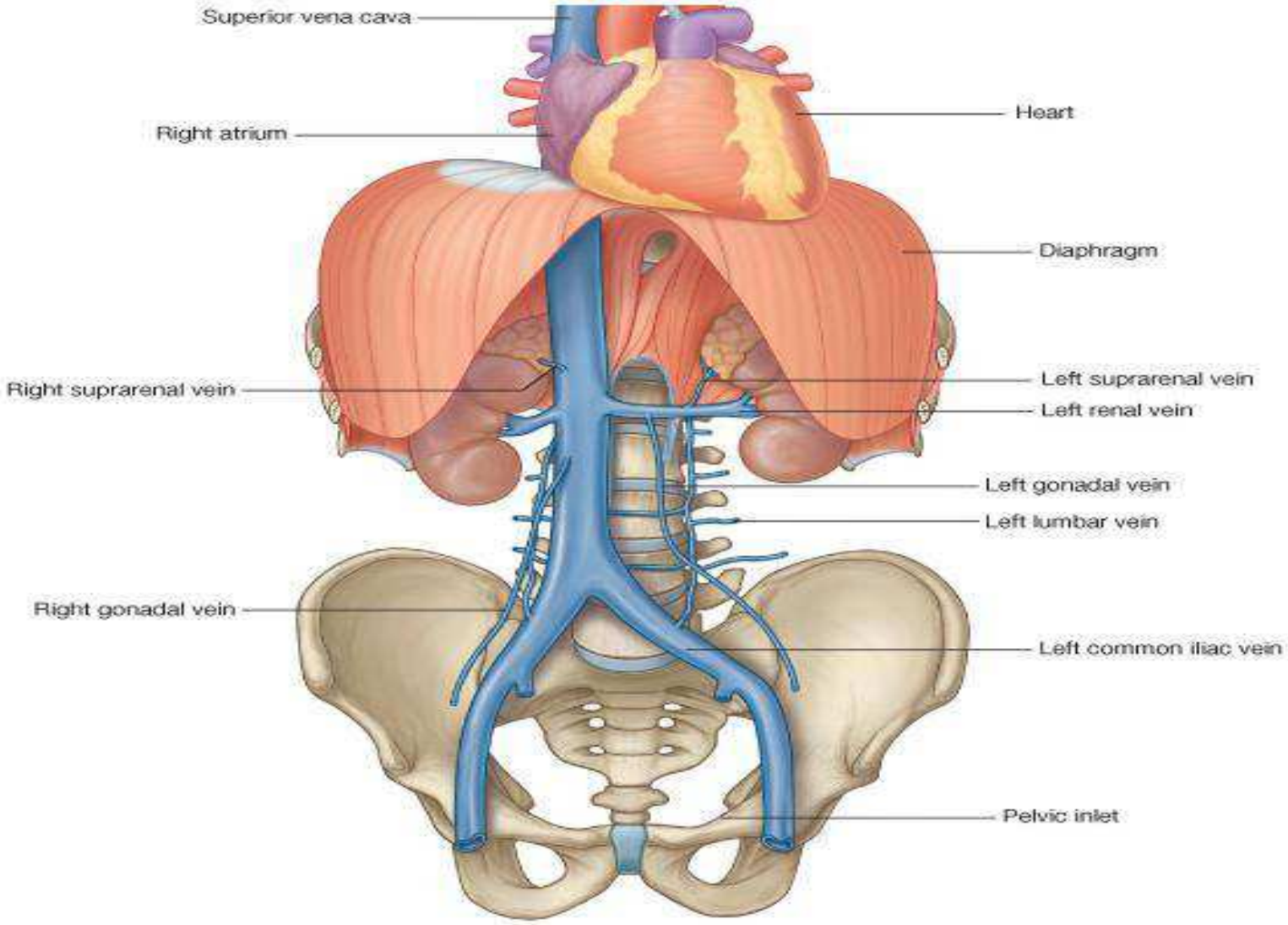
IVC

- IVC is formed on Rt side of L4-L5 V
- On Rt side of abdominal aorta
- Union of Rt , Lt common iliac veins
- Ascend to reach IVC opening in centra tendon of diaphragm at *T8.*
- End in Rt atrium

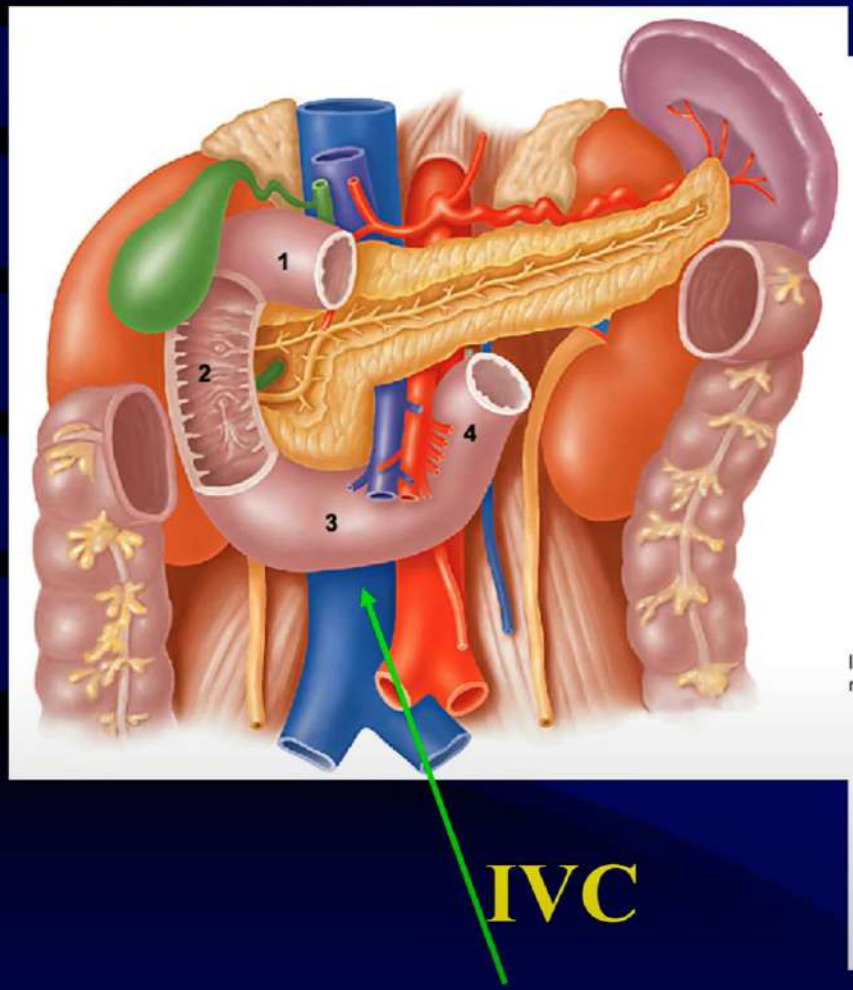
Tributaries of IVC

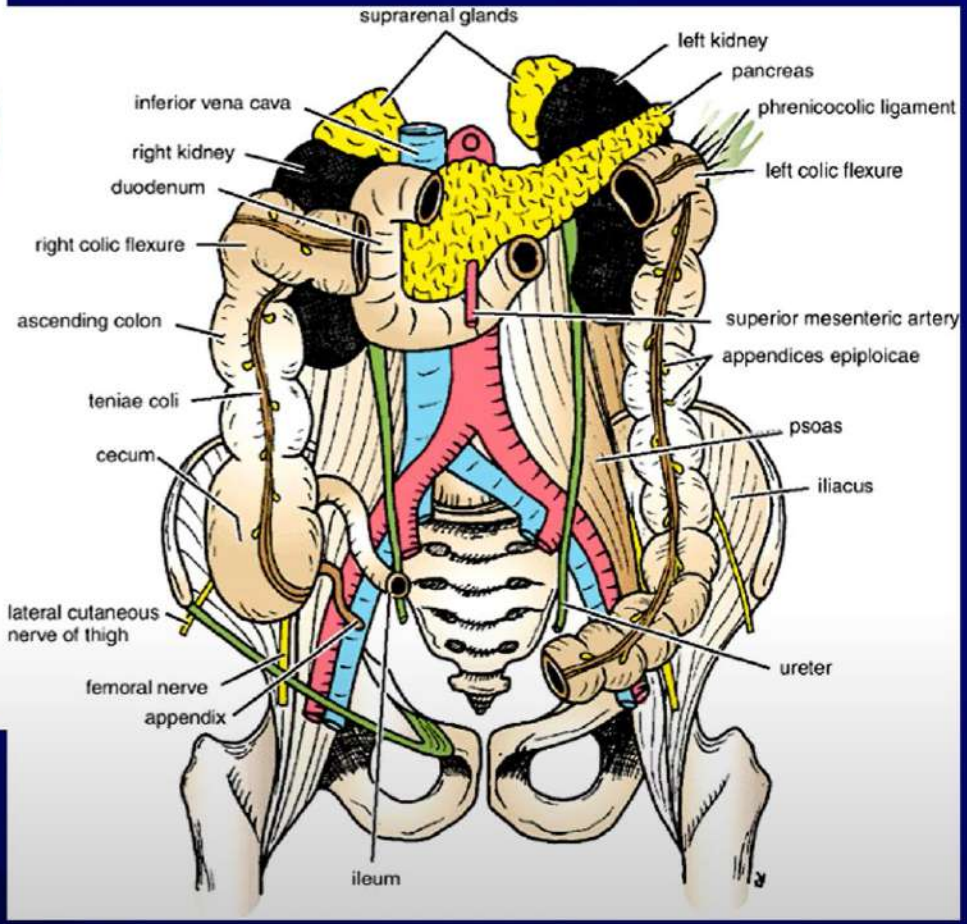
- Two pair of veins: Hepatic, Renal
- Two single Rt veins: Rt suprarenal, Rt testicular,(ovarian).
- Four pairs of lumbar veins.

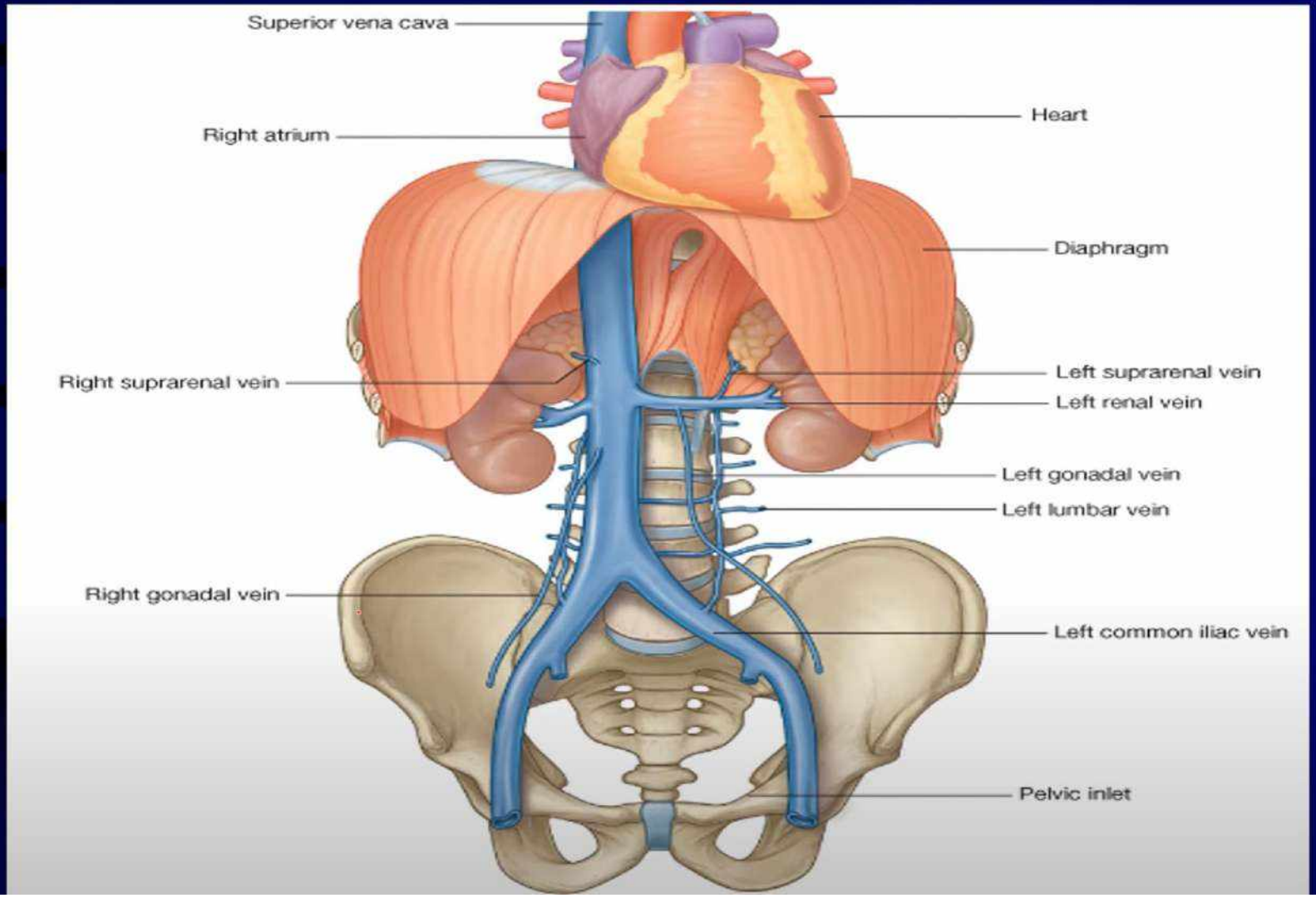



Superior vena cava
Heart
Right atrium
Diaphragm
Right suprarenal vein
Left suprarenal vein
Left renal vein
Left gonadal vein
Left lumbar vein
Right gonadal vein
Left common iliac vein
Pelvic inlet

Relations of IVC






Superior vena cava
Heart
Right atrium
Diaphragm
Right suprarenal vein
Left suprarenal vein
Left renal vein
Left gonadal vein
Left lumbar vein
Right gonadal vein
Left common iliac vein
Pelvic inlet

Portal Vein

Drains GIT & Abd. Viscera (Spleen & Pancreas & GB)

3 inches long 12 mm in diameter

Enters porta hepatis as a part of the *Triad*

(Conveys 70% of bld. To liver)

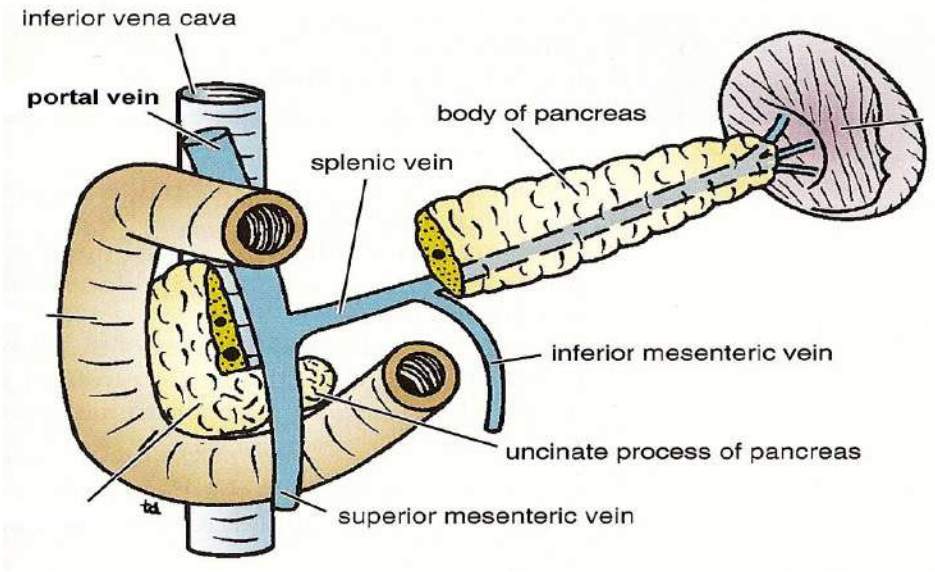
Formed *Behind the Neck*

of pancreas by union of:

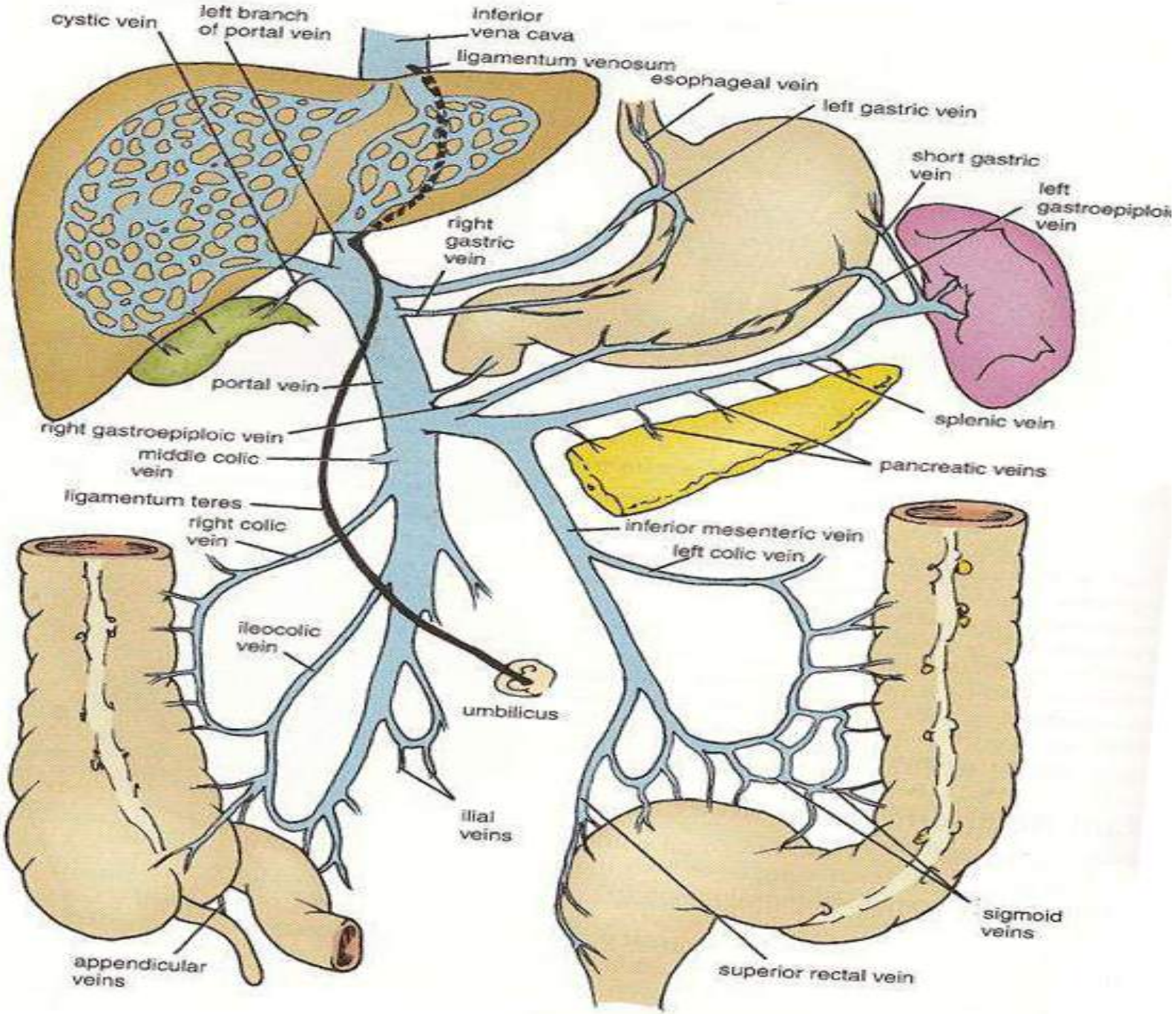
- **Sup. Mesenteric vein**
- **Splenic vein**

Ascend upward to RT behind D1,

Infront of IVC .



Bld. Comes from 3 ant. visceral branches of aorta (Celiac trunk, sup. Mesenteric & inf. mesenteric)is returned by portal vein


cystic vein
left branch of portal vein
inferior vena cava
ligamentum venosum
esophageal vein
left gastric vein
short gastric vein
left gastroepiploic vein
right gastric vein
portal vein
right gastroepiploic vein
middle colic vein
splenic vein
pancreatic veins
ligamentum teres
right colic vein
inferior mesenteric vein
left colic vein
ileocolic vein
umbilicus
iliac veins
sigmoid veins
appendicular veins
superior rectal vein

Main Tributaries of Portal Vein

Splenic vein:

From spleen, pancreas & stomach

Most important Tributary is IMV

Superior Mesenteric vein:

from intestine (Duodenum → 2/3 of trans. Colon)

Inferior Mesenteric vein:

from Distal 1/3 of trans. Colon → anal canal (upper 1/3)

Other branches

Rt. & Lt. Gastric veins , pancreatico - duodenal v

Cystic vein to RT branch of portal vein

Porto-Caval Anastomoses

Portal system Anastomose with systemic (caval) venous system at 4 areas:

1. ***At abdominal esophagus:***

   Esophageal veins drain into:

   Azygos vein (Systemic)

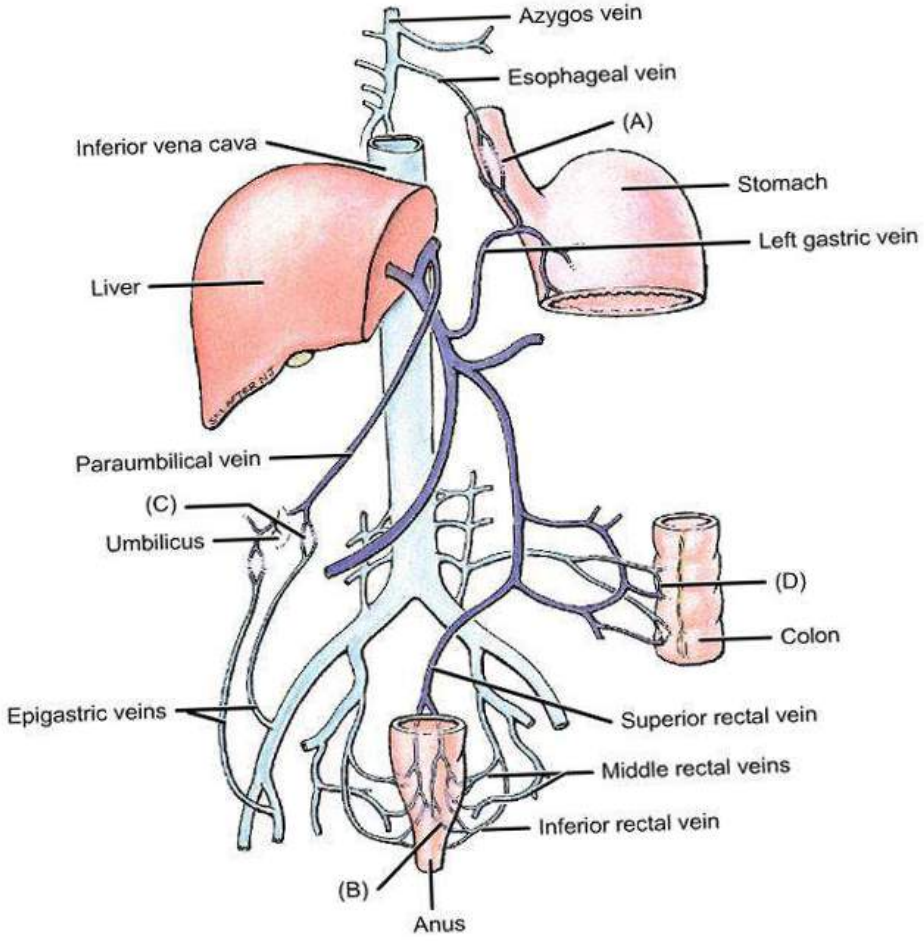
   left gastric vein (portal)

2. ***At anal canal & Rectum:***

   Rectal veins drain into:

   Sup. Rectal vein (portal)

   Middle & Inf. rectal (systemic)



3. *Around the umbilicus:*

Paraumbilical veins **(Portal)**

with lig. teres inside falciform lig.

veins of Ant. abd. Wall

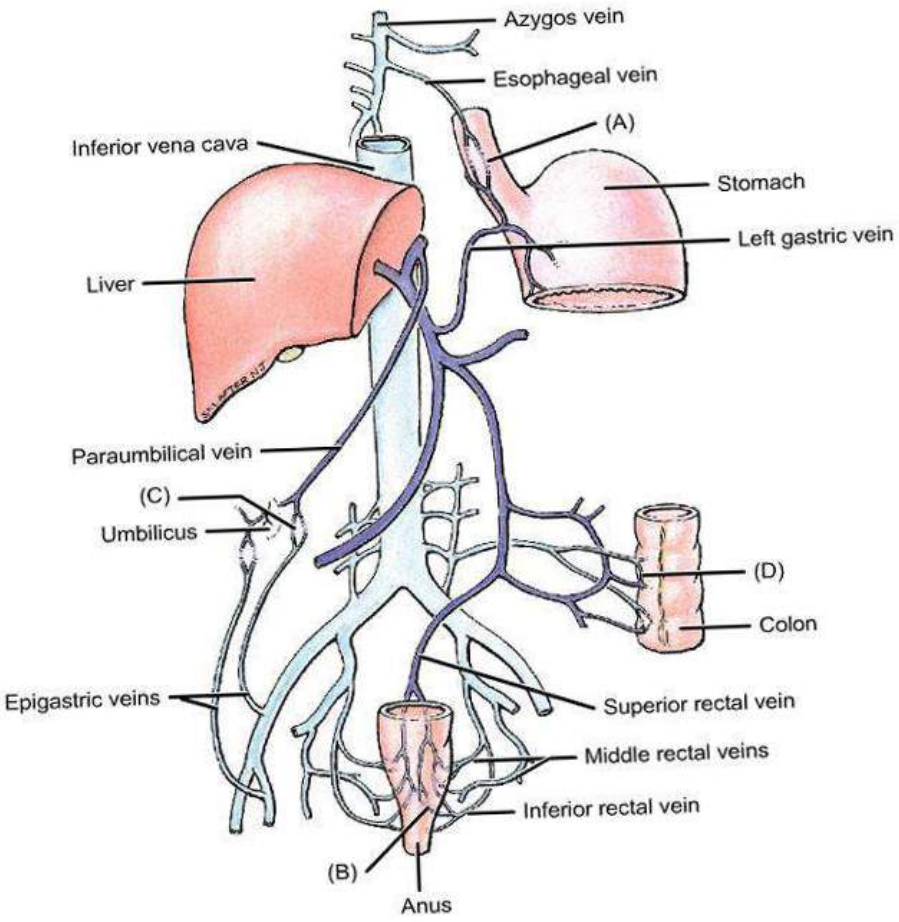
(systemic)

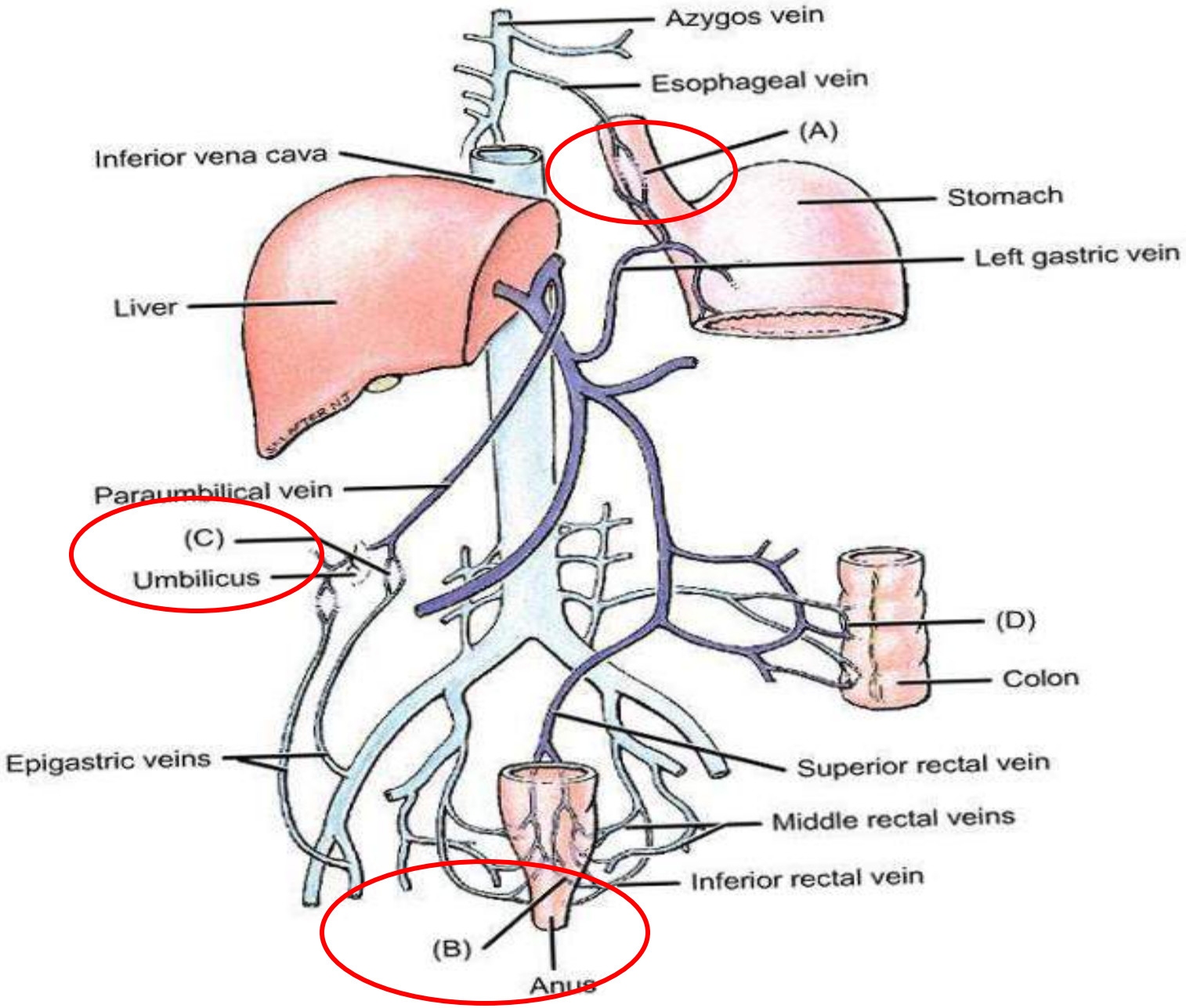
4. *Posterior (behind) to Ascending & Descending colons:*

Colic veins **(portal)**

Retroperitoneal veins of the wall

(systemic)




Azygos vein
Esophageal vein
(A)
Inferior vena cava
Stomach
Left gastric vein
Liver
Paraumbilical vein
(C)
Umbilicus
(D)
Colon
Epigastric veins
Superior rectal vein
Middle rectal veins
Inferior rectal vein
(B)
Anus

Portal Hypertension

Liver disease (Cirrhosis)

↓

Obstruction of portal vein

↓

bld. Accumulation & Portal hypertension

↓

Bld. Flow from Portal to Systemic circulation

(at porto-caval anastomosis sites)

⇓

Dilatation of veins

(Varicose veins)

Porto-Caval Varices

A sign of portal hypertension & liver disease

At 4 regions:

Around esophagus:

Esophageal varices

(easily ruptured ⇒ internal bleeding)

At anal canal:

Hemorrhoids

Around Umbilicus:

Caput Medusa (head of Medusa)

Behind ascending & descending colons.

spleen

- ***Intraperitoneal***

In the left hypochondriac region

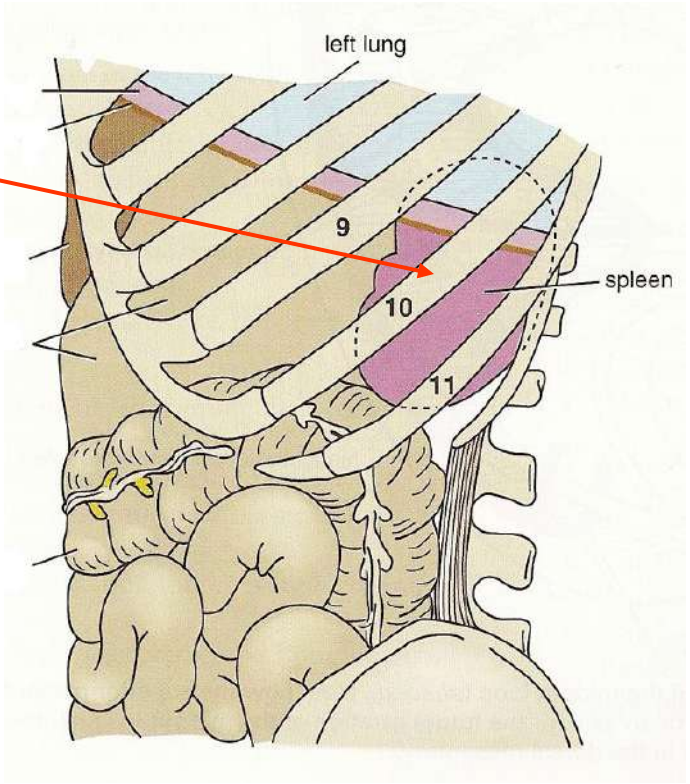
(over 9th, 10th & 11th ribs).

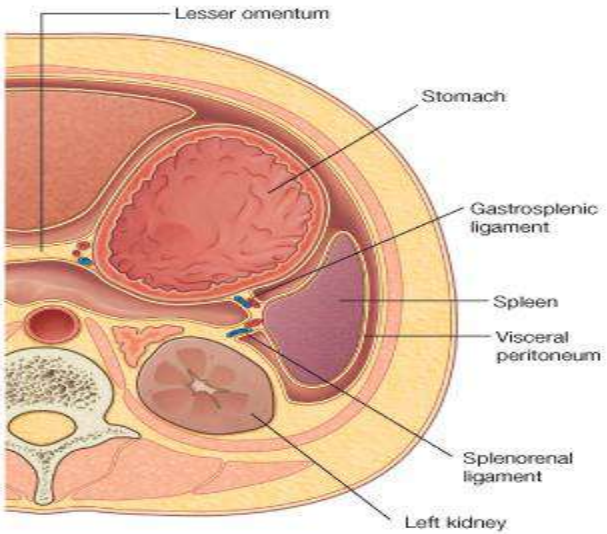
Attaches to stomach by:

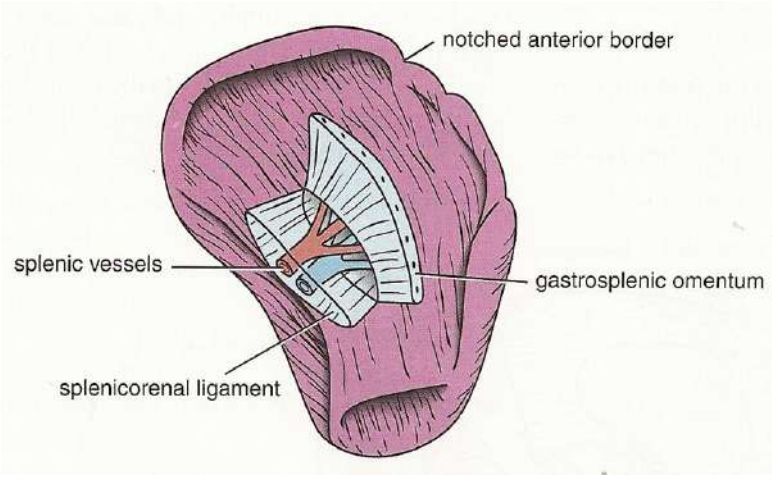
Gastro splenic lig.

Attaches to Lf. Kidney by:

Splenicorenal lig.





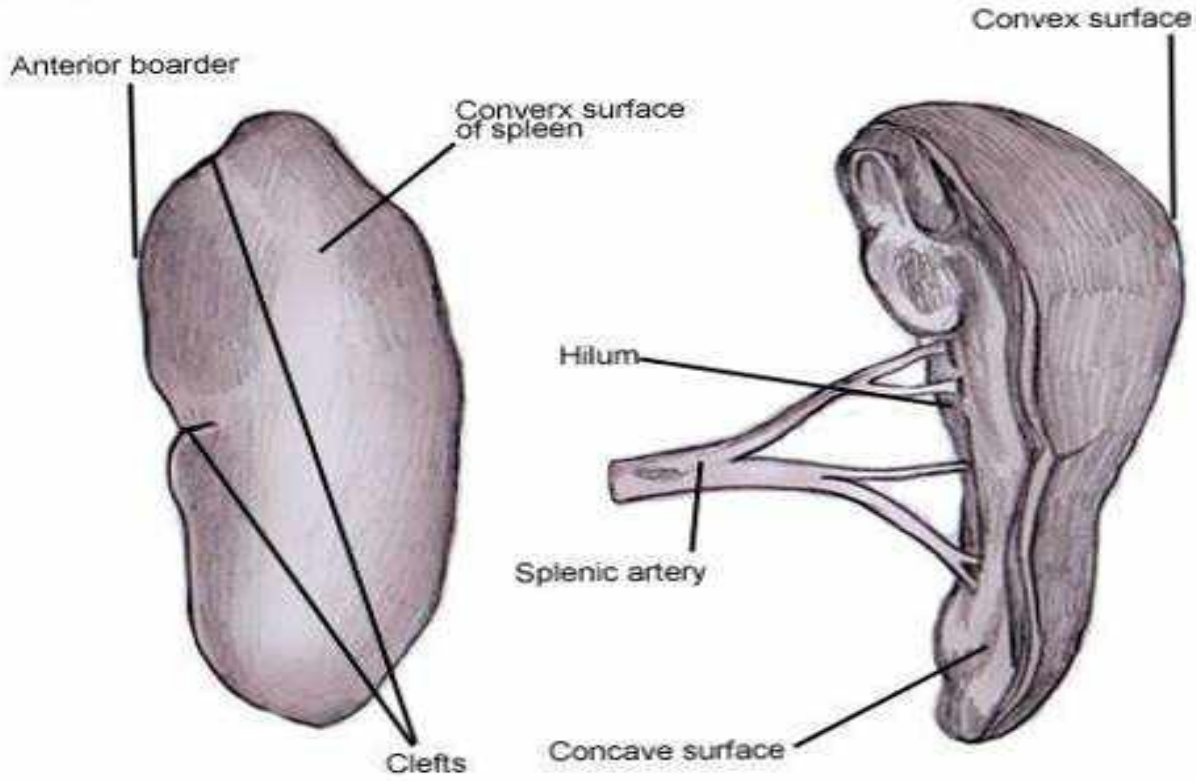


Spleen

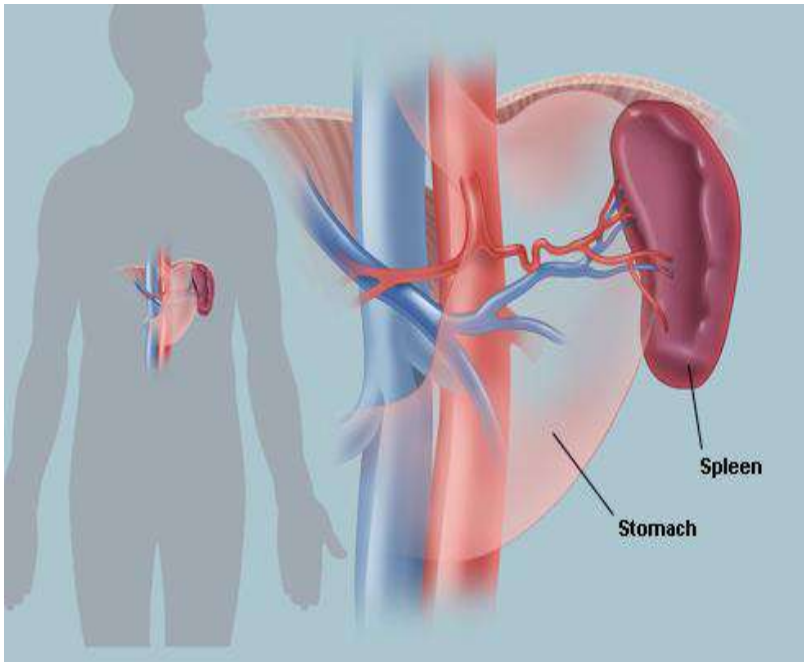
- **Is reddish and largest single mass of lymphoid tissue.**
- **Blood rich organ that filter the blood.**
- **Fist size, *5 inches long 3 inches wide one inch thick*, protected by rib cage.**
- **150 Gm in weight.**
- **Lie in left hypochondrium, look like a shoe.**
- **Between fundus of stomach and diaphragm.**
- **Lie behind 9^{th},10^{th},11^{th} rib.**

SPLEEN

- **It has posterior medial end is tapering and directed upwards , backwards and medially.**
- **Anterior lateral end is broad and directed downwards ,forward and laterally upper pole of left kidney.**
- **Spleen has two borders superior is notched near its anterior end.**
- **Has two surfaces diaphragmatic is smooth and convex ,visceral surface is irregular and concave.**

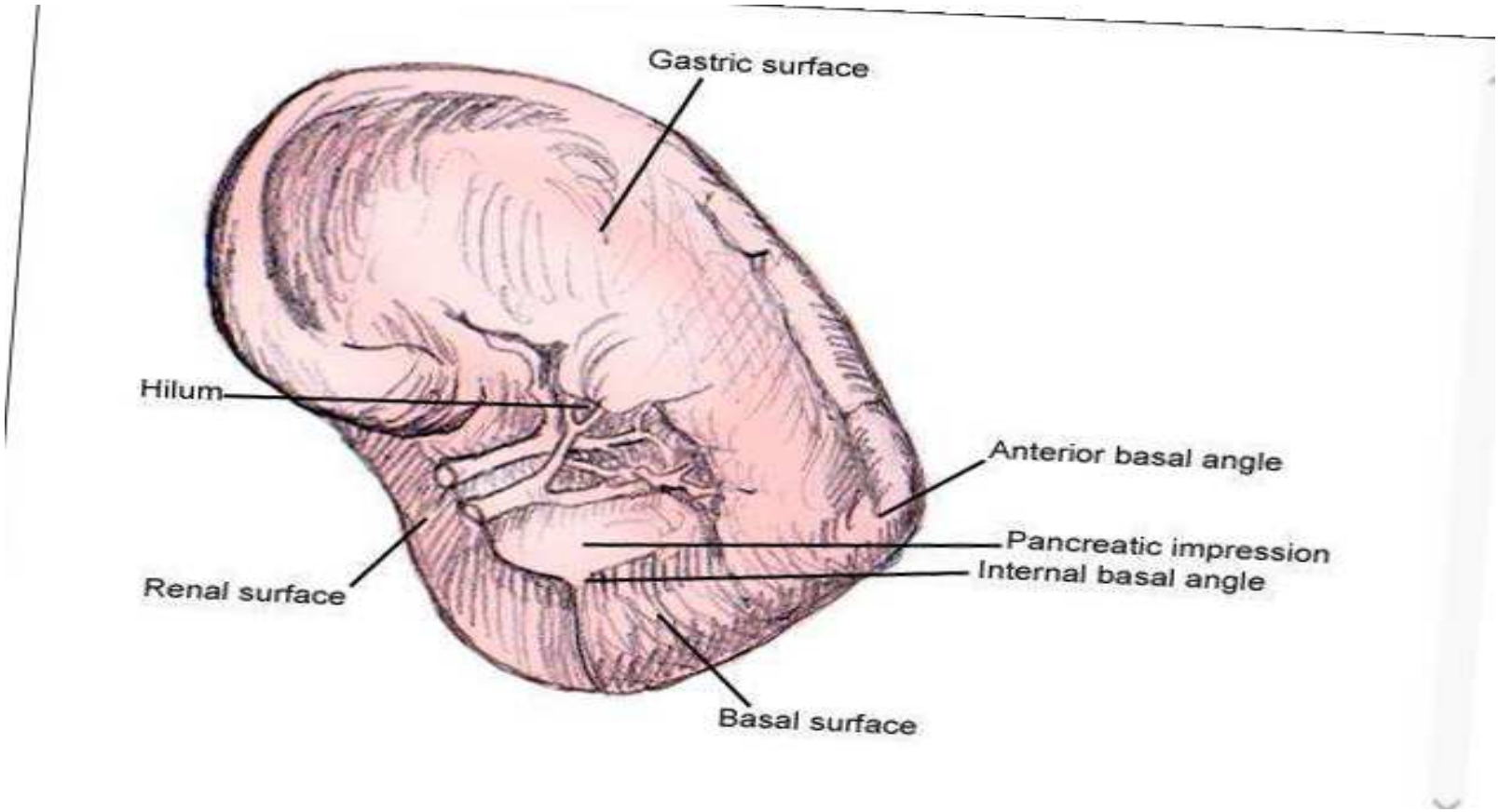

Anterior boarder
Converx surface of spleen
Clefts
Convex surface
Hilum
Splenic artery
Concave surface

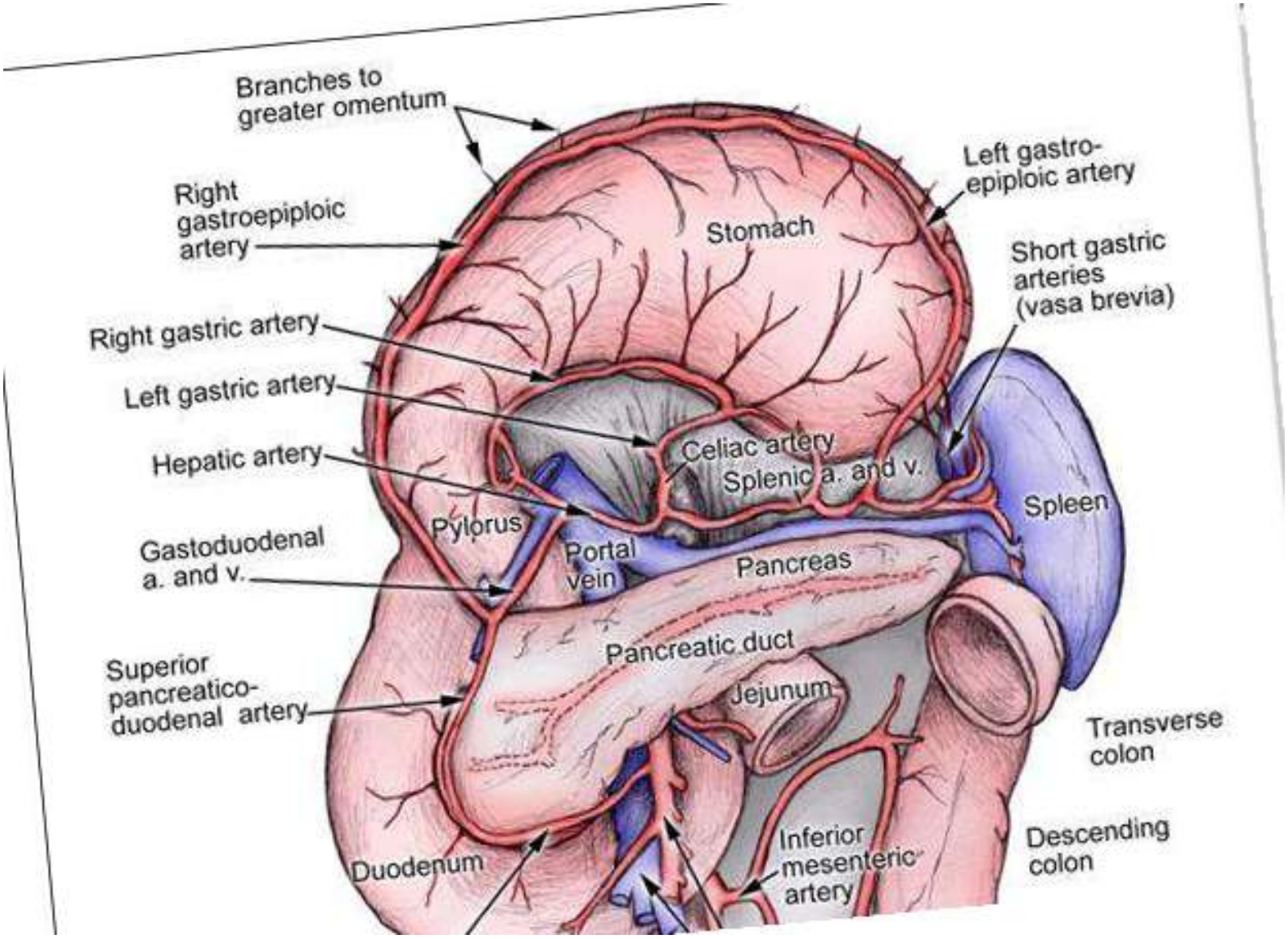
spleen



Relation of spleen

- ***Gastric impression :*** **for fundus of stomach above hilum.**
- ***Renal impression :*** **for left kidney below hilum.**
- ***Colic impression :*** **for splenic flexure of colon.**
- ***Pancreatic impression :*** **for the tail of pancreas between hilum and colic impression.**
- **Hilum is found in inferior medial part of gastric impression.**
- **Hilum transmit splenic vessels and provide attachments for ligaments**


Gastric surface
Hilum
Anterior basal angle
Pancreatic impression
Internal basal angle
Renal surface
Basal surface


Branches to greater omentum
Right gastroepiploic artery
Left gastro-epiploic artery
Stomach
Short gastric arteries (vasa brevia)
Right gastric artery
Left gastric artery
Hepatic artery
Celiac artery
Splenic a. and v.
Spleen
Pylorus
Gastoduodenal a. and v.
Portal vein
Pancreas
Pancreatic duct
Superior pancreatico-duodenal artery
Jejunum
Transverse colon
Inferior mesenteric artery
Descending colon
Duodenum

Pancreas

Both exocrine & endocrine gland *6 inches* long.

- ***Retroperitoneal*** **except the *tail* part.**
- **Extend along post abd wall from duodenum on the Rt, to spleen on Lt.**

Exocrine:

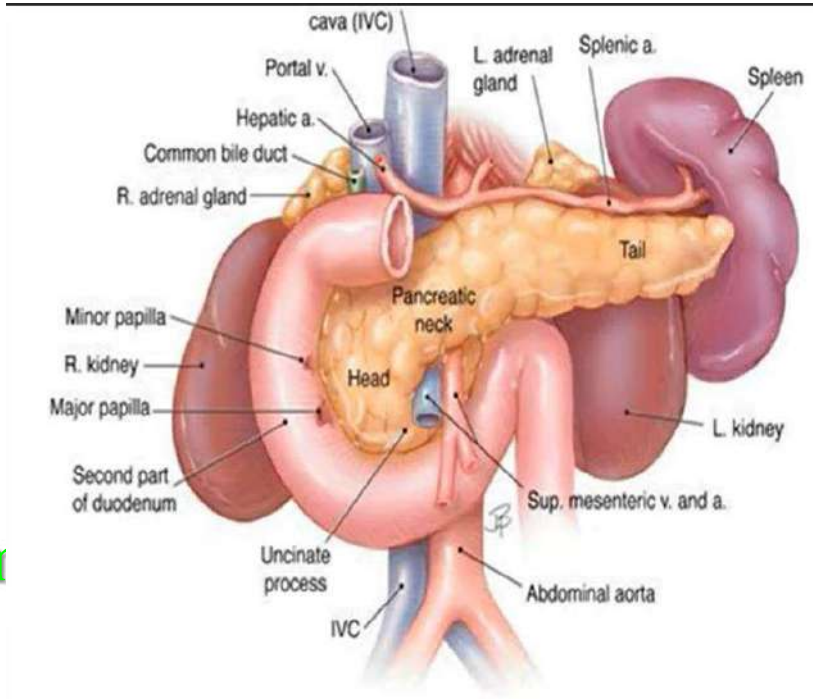
Hydrolytic enzymes → duodenum

Endocrine:

Islets of Langerhans (Insulin & Glucagon)

→ venous blood

Anatomy of Pancreas



4 parts

Head:

Disc shaped

within the concavity of the duodenum

(in close contact)

Uncinate process project from lower part of the head pos to SMV

Two struct. Infront of it T.Colon,SMV

Three struc. Behind IVC, aorta,CBD in groove in head

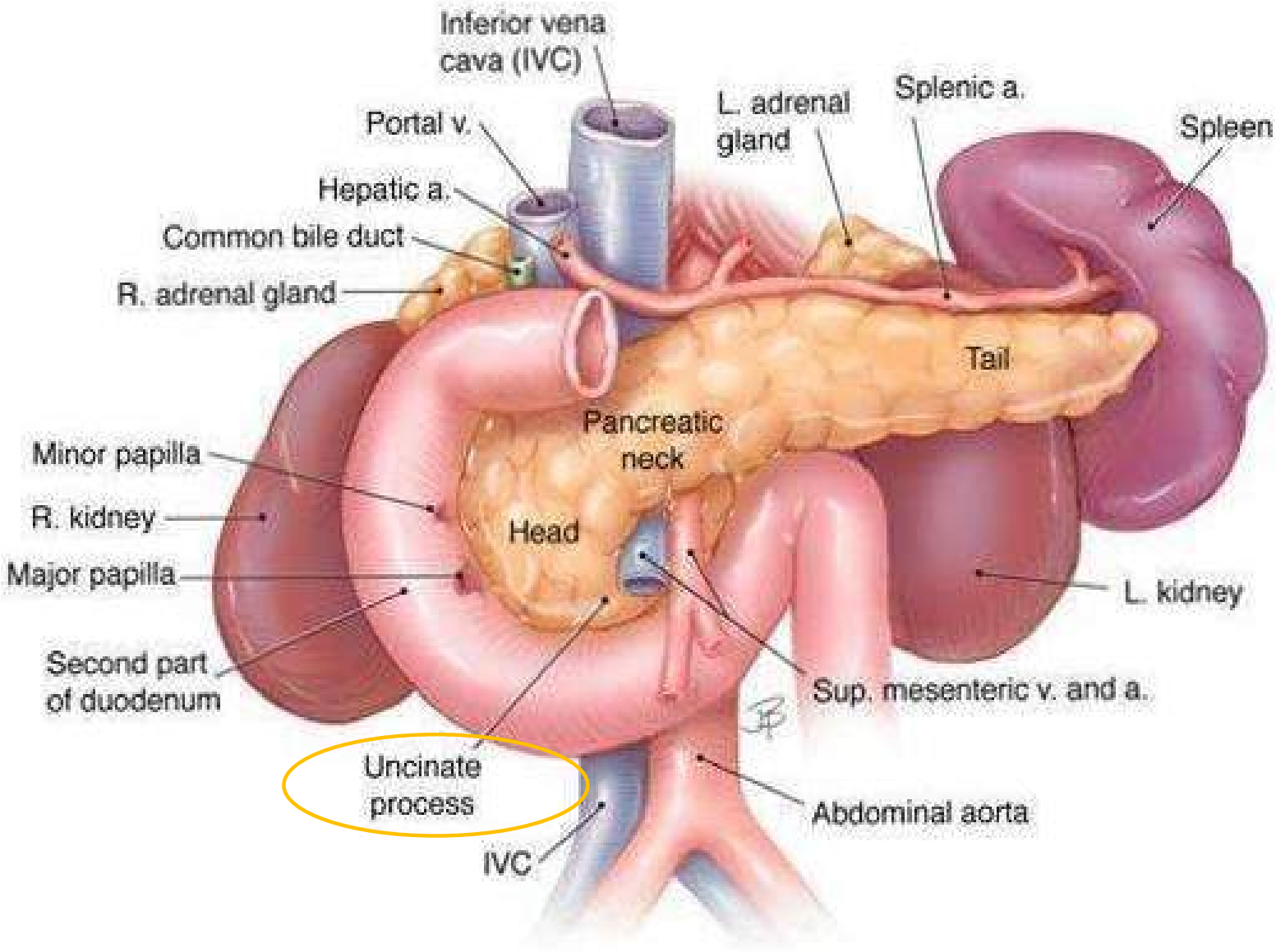
Four struct. Around D1-D2-D3-D4

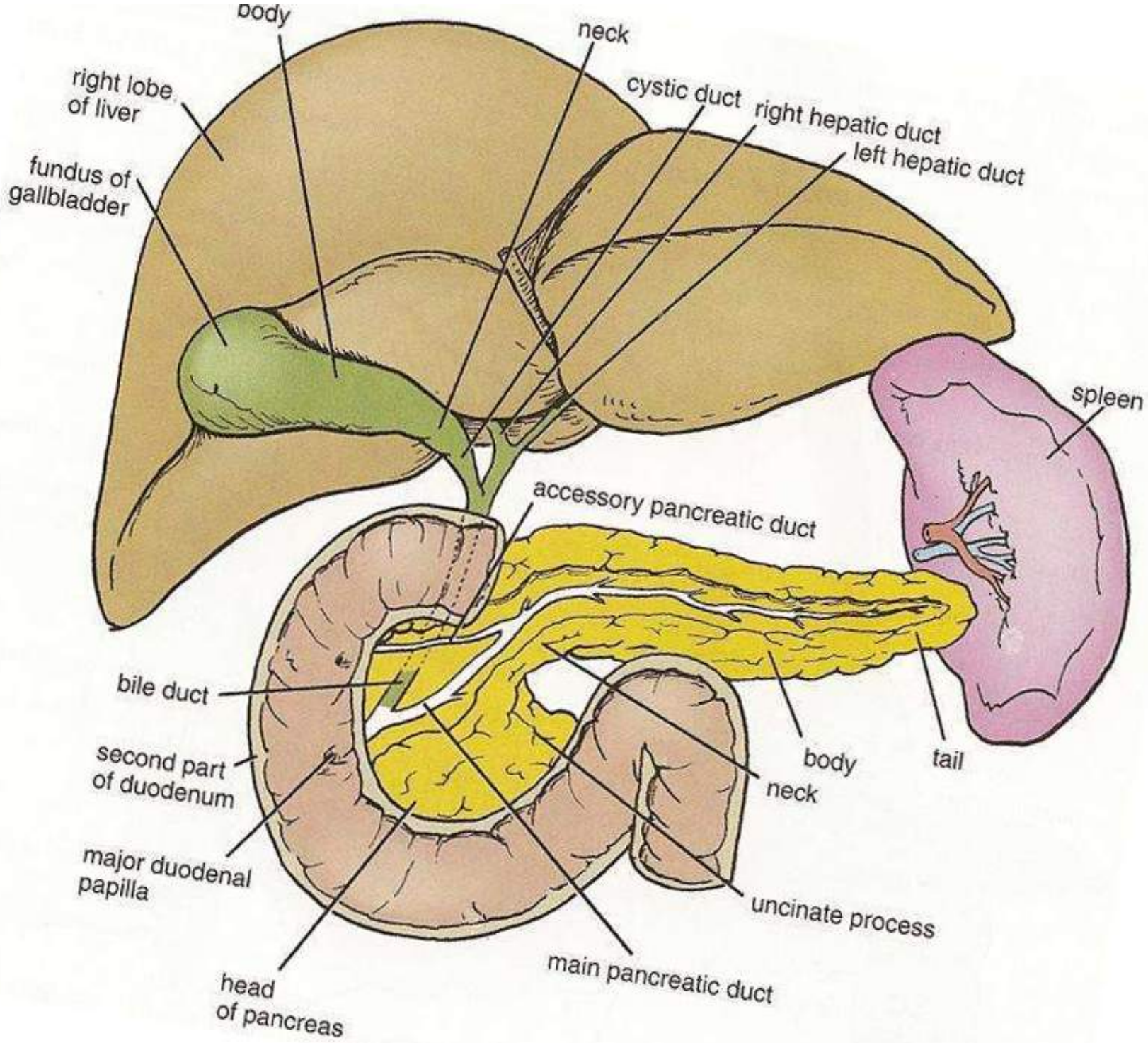
Head separated from D2 by Sup, inf PD Arteries

Neck:

Constricted portion between head & body *one inch long*

Lies anterior to it SMA, and behind it the SMV,join splenic vein to form portal v


Inferior vena cava (IVC)
Portal v.
Hepatic a.
Common bile duct
R. adrenal gland
L. adrenal gland
Splenic a.
Spleen
Tail
Pancreatic neck
Head
Minor papilla
R. kidney
Major papilla
Second part of duodenum
Uncinate process
IVC
Sup. mesenteric v. and a.
Abdominal aorta
L. kidney


body
neck
right lobe of liver
cystic duct
right hepatic duct
left hepatic duct
fundus of gallbladder
spleen
accessory pancreatic duct
bile duct
second part of duodenum
body
tail
neck
major duodenal papilla
uncinate process
head of pancreas
main pancreatic duct

Body:

largest part, Aorta and origin of SMV lie on Rt side post to body

Splenic artery run along upper border,

Transverse mesocolon is attached to lower border.

Tail:

Intraperitoneal between two layers of *Linorenal lig*

In contact with the Hilum of the Spleen just above splenic flexure

Main pancreatic duct of Wirsung : **begin in tail of panc ,pass to Rt in body then downwards in head, to join CBD,open in post medial part of D2 below middle**

Accessory pancreatic duct of santorini:drain

Uncinate process and lower part of head, open in D2 one inch above main duct.