Systemic Module
GIT

"Anatomy"

Anatomy of the GIT-hollow Organs (Stomach and Intestines)

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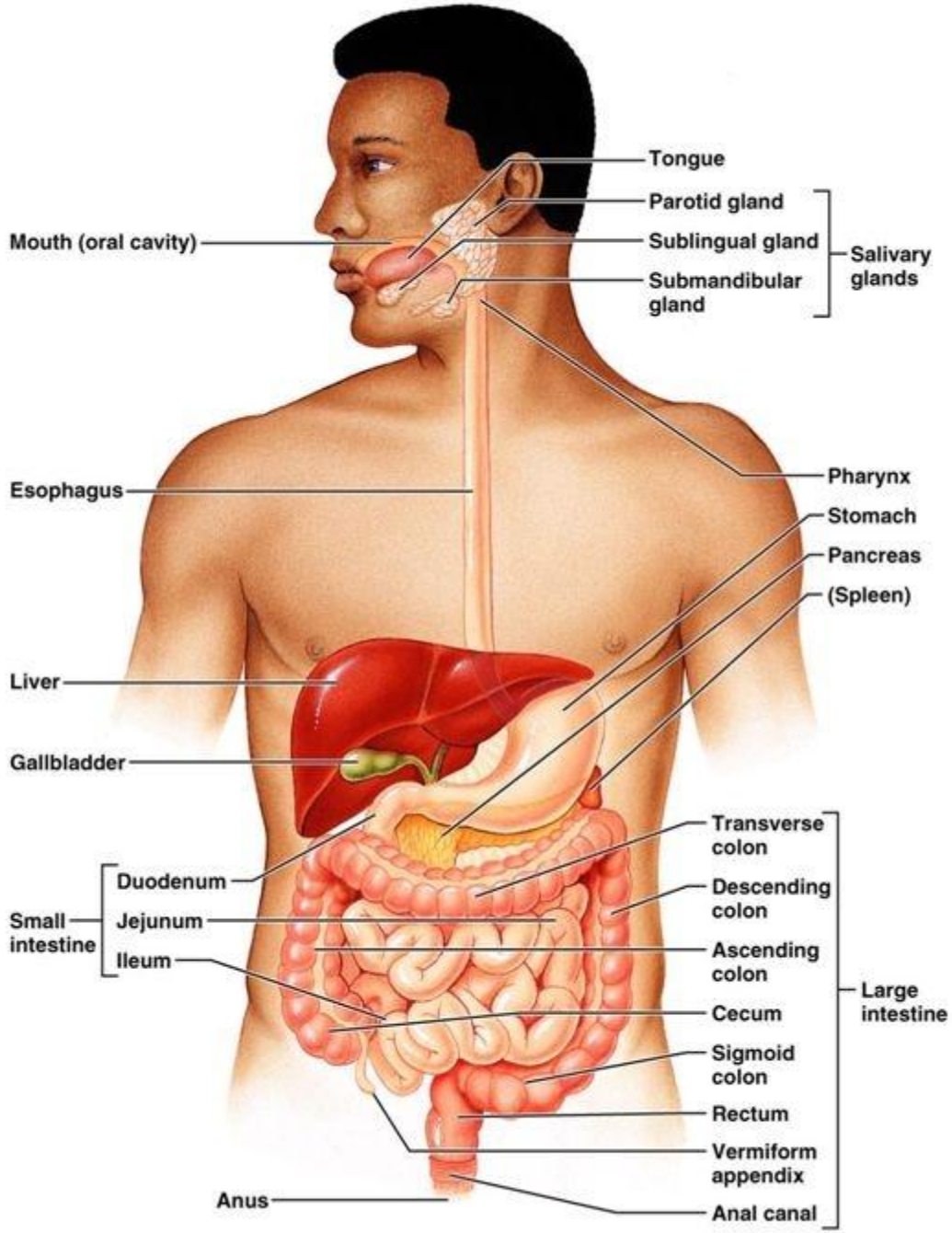
Anatomy of the Digestive System

- The digestive system is composed of two parts:
  - **The gastrointestinal (GI) tract**
  - **The accessory digestive organs.**

- The GI tract, also called **alimentary tract,** is a continuous tube that extends from the mouth to the anus through the thoracic and abdominopelvic cavities.

- The accessory organs include the teeth, tongue, salivary glands, pancreas, and liver. These organs assist in the digestion of food.

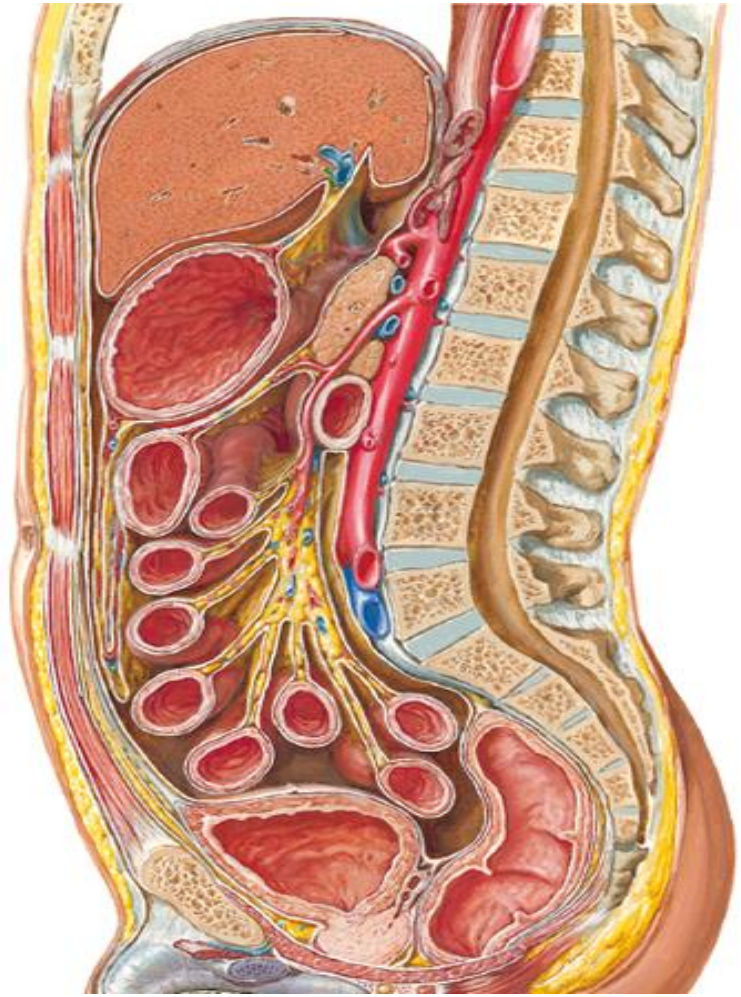

Tongue
Parotid gland
Sublingual gland
Submandibular gland
Salivary glands
Mouth (oral cavity)
Pharynx
Esophagus
Stomach
Pancreas
(Spleen)
Liver
Gallbladder
Transverse colon
Descending colon
Duodenum
Jejunum
Ileum
Small intestine
Ascending colon
Cecum
Large intestine
Sigmoid colon
Rectum
Vermiform appendix
Anus
Anal canal

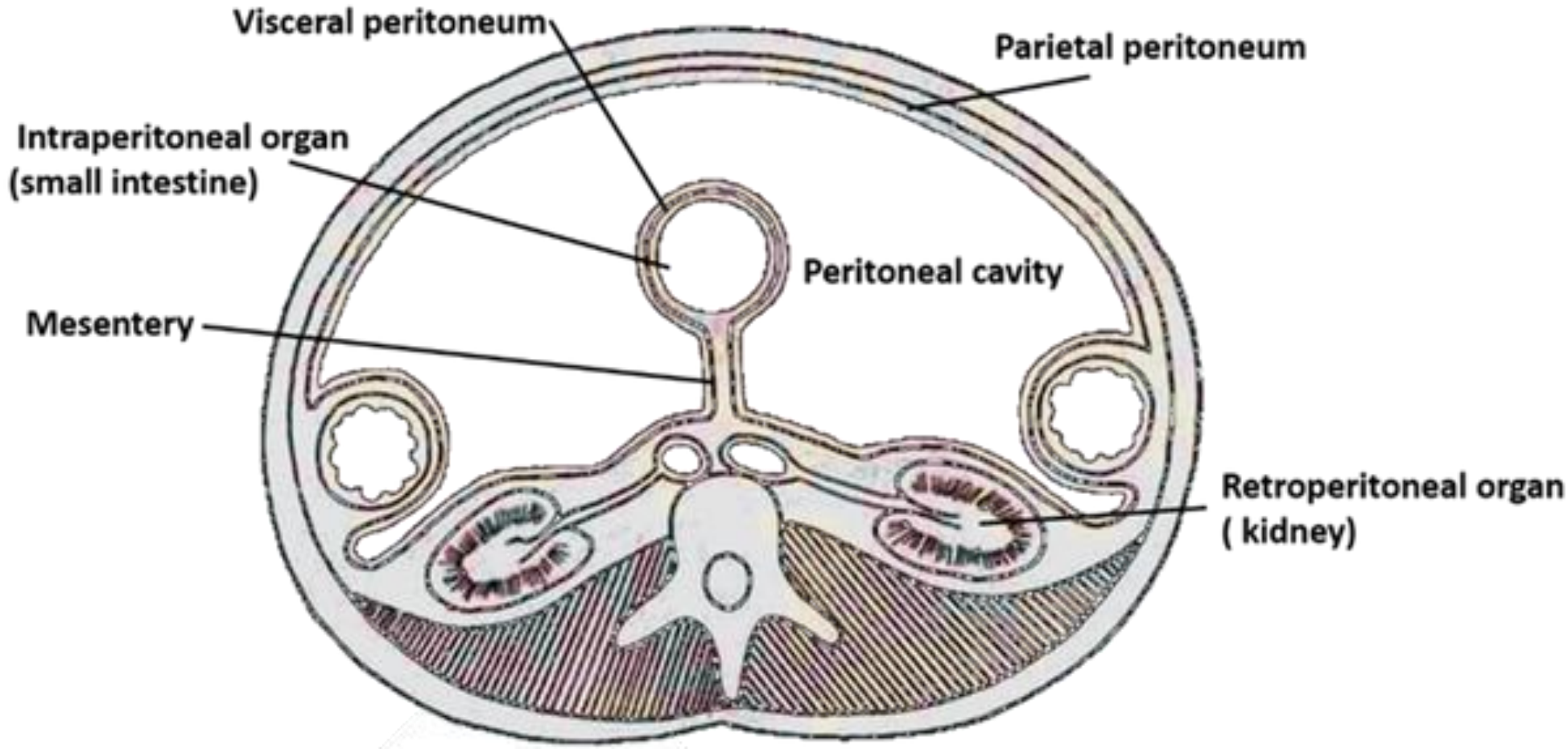
The peritoneum and peritoneal cavity

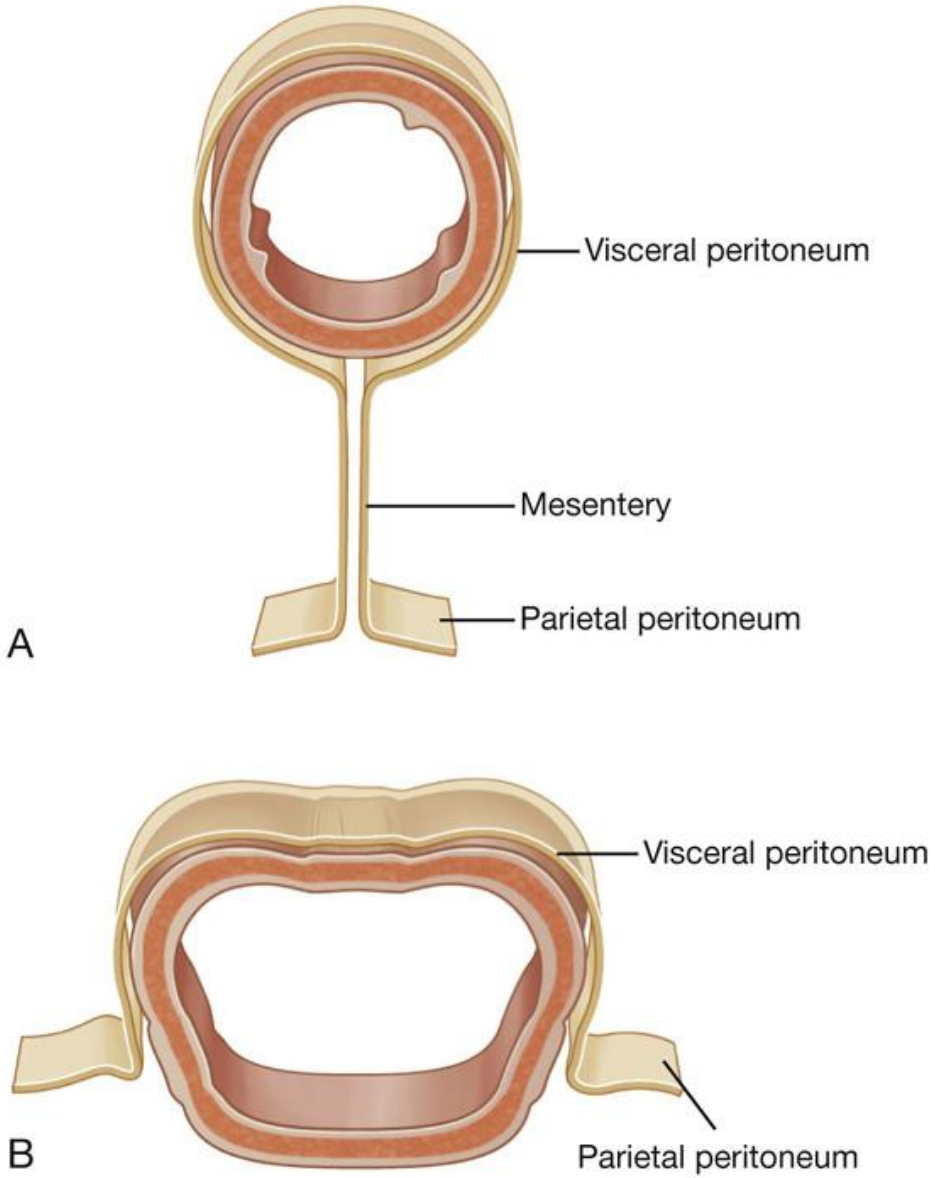
- The **peritoneum** is a serous membrane that line the abdominal wall and cover the abdominal viscera.
- It consists of:
  - **Parietal layer:** lines the internal walls of the abdominal cavity
  - **Visceral layer:** cover visceral organs.

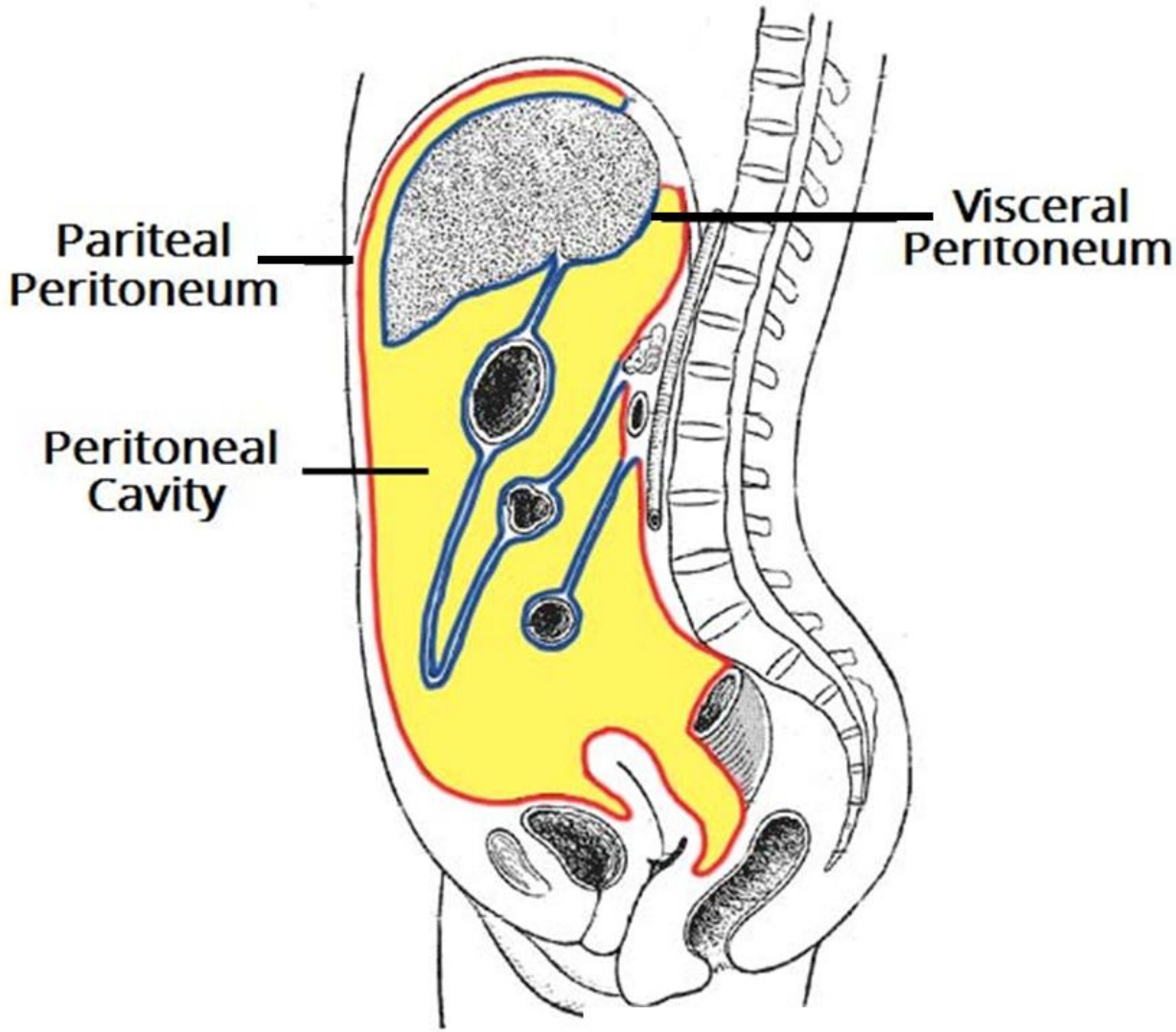
- The potential space between the parietal layer and visceral layer is called the **peritoneal cavity.**

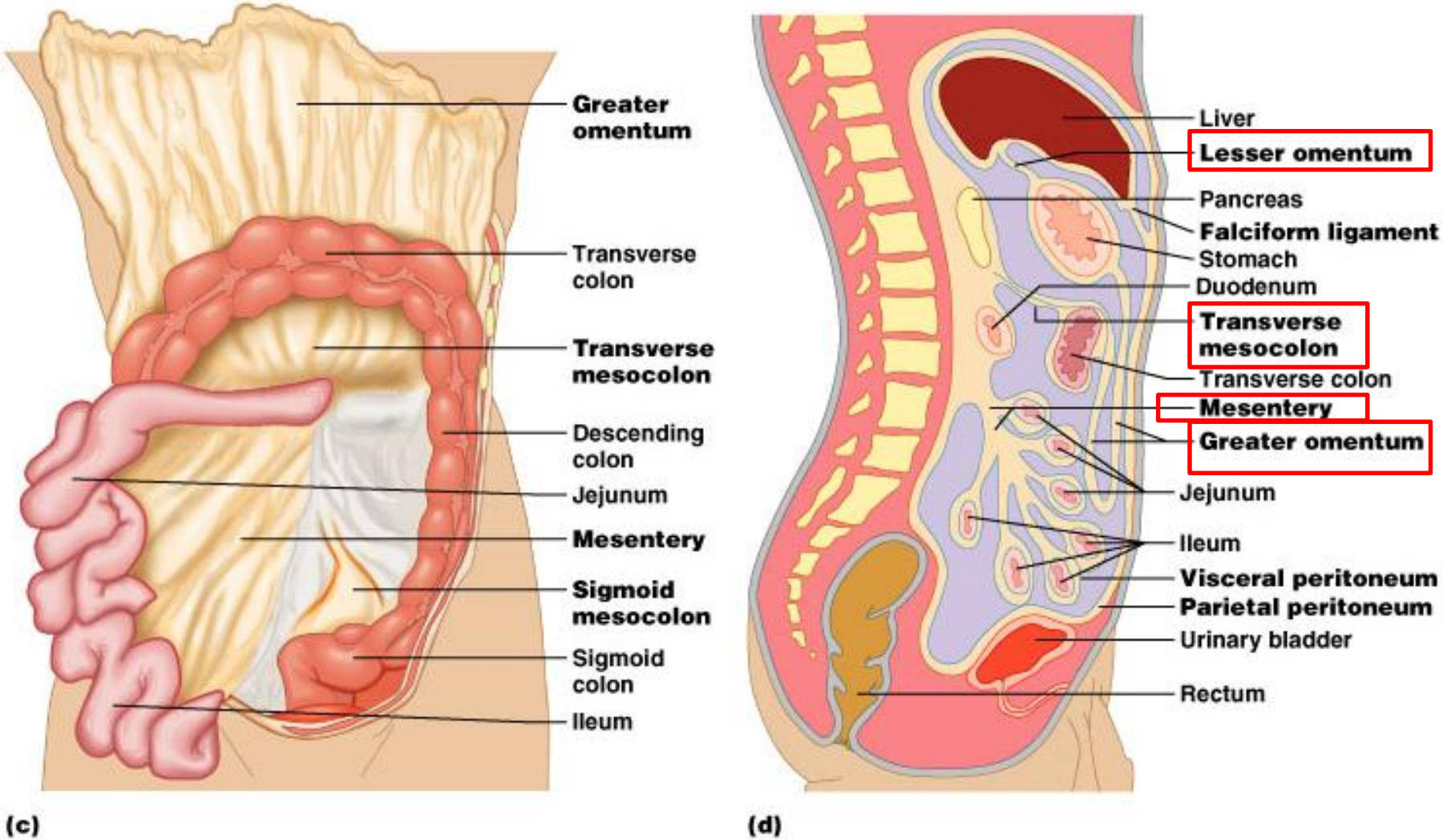
- The **Mesentery** is two-layered folds of peritoneum connecting parts of intestine with the posterior abdominal wall.




Visceral peritoneum
Parietal peritoneum
Intraperitoneal organ
(small intestine)
Peritoneal cavity
Mesentery
Retroperitoneal organ
(kidney)


Visceral peritoneum
Mesentery
Parietal peritoneum
A
Visceral peritoneum
B
Parietal peritoneum

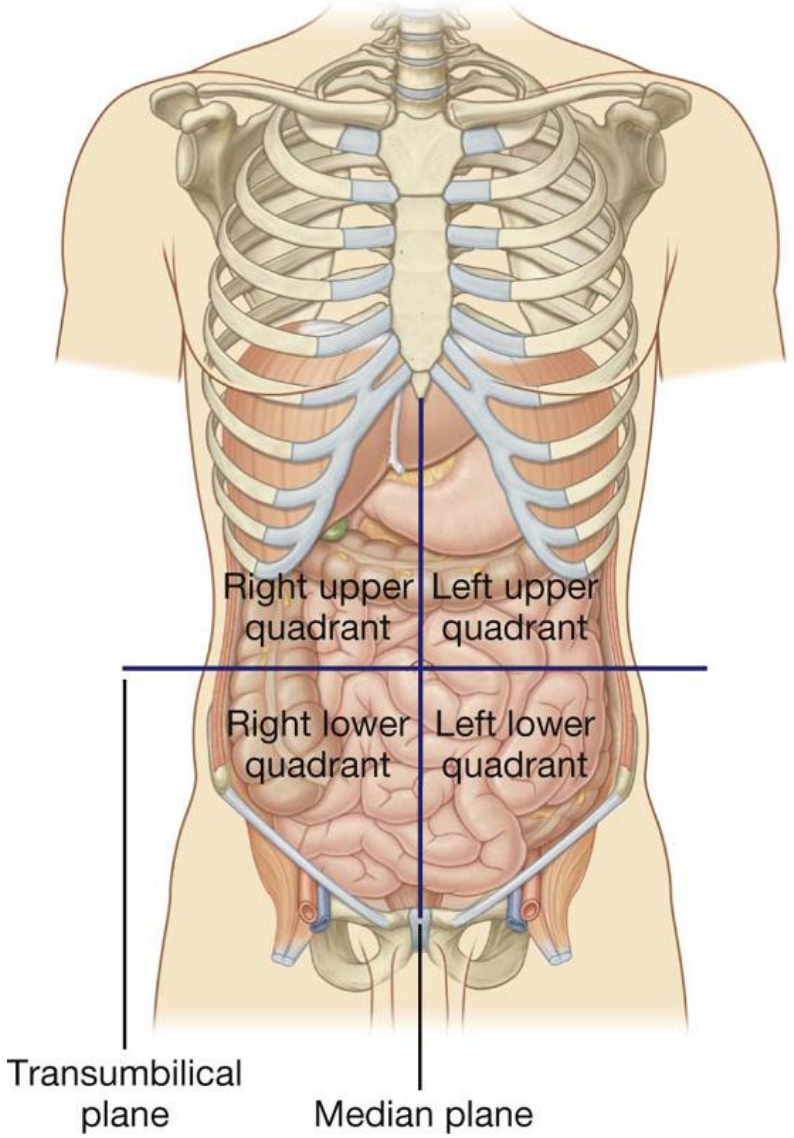

Pariteal Peritoneum
Peritoneal Cavity
Visceral Peritoneum

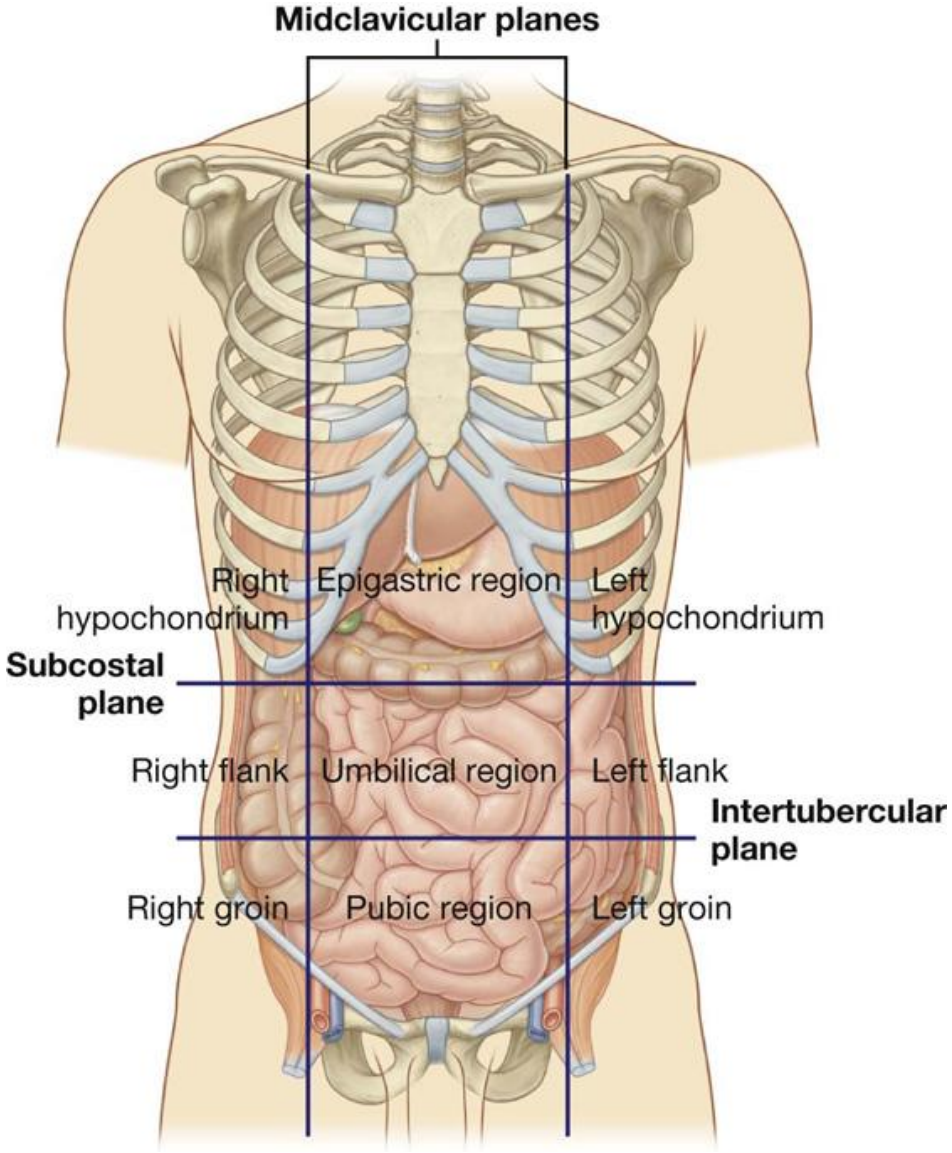

Greater omentum
Transverse colon
Transverse mesocolon
Descending colon
Jejunum
Mesentery
Sigmoid mesocolon
Sigmoid colon
Ileum
(c)
Liver
Lesser omentum
Pancreas
Falciform ligament
Stomach
Duodenum
Transverse mesocolon
Transverse colon
Mesentery
Greater omentum
Jejunum
Ileum
Visceral peritoneum
Parietal peritoneum
Urinary bladder
Rectum
(d)

The Stomach

- The stomach is **the dilated part of the gastrointestinal tract**, positioned between the abdominal esophagus and the small intestine.
- It is roughly **J shaped** organ, occupies the left upper quadrant or epigastric and left hypochondraic regions.
- It acts as a **food blender and reservoir**, its chief function is **enzymatic digestion**.
- The gastric juice (in stomach) gradually converts the mass of food into semi-liquid mixture, ***chyme***, which pass fairly and quickly into the duodenum.

Anatomical Position of Stomach





Anatomical Structure of Stomach

- It has:
  - Two opening (**cardiac** and **pyloric orifices**)
  - Two curvatures (**greater** and **lesser curvatures**)
  - Two surfaces (**anterior** and **posterior surfaces**)

- Can be divided into 5 parts:

1. **Cardia:** the part surrounding the cardiac orifice

2. **Fundus**: the dome shaped, project upward to the left of cardiac orifice.

3. **Body:** which is the largest part of the stomach, extends from the cardiac orifice to the incisura angularis

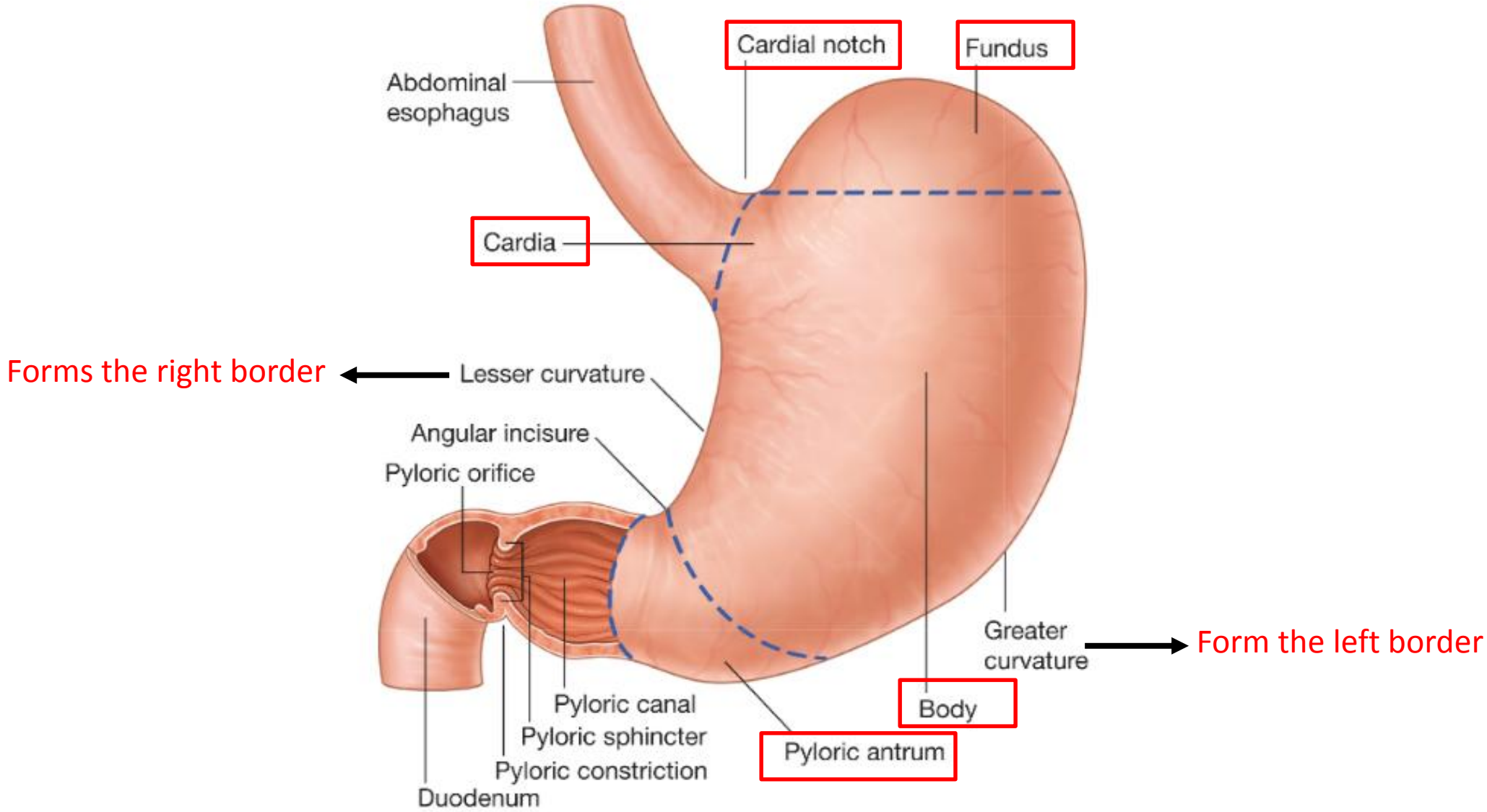
4. **Pyloric antrum**: extend from the incisura angularis to the pylorus

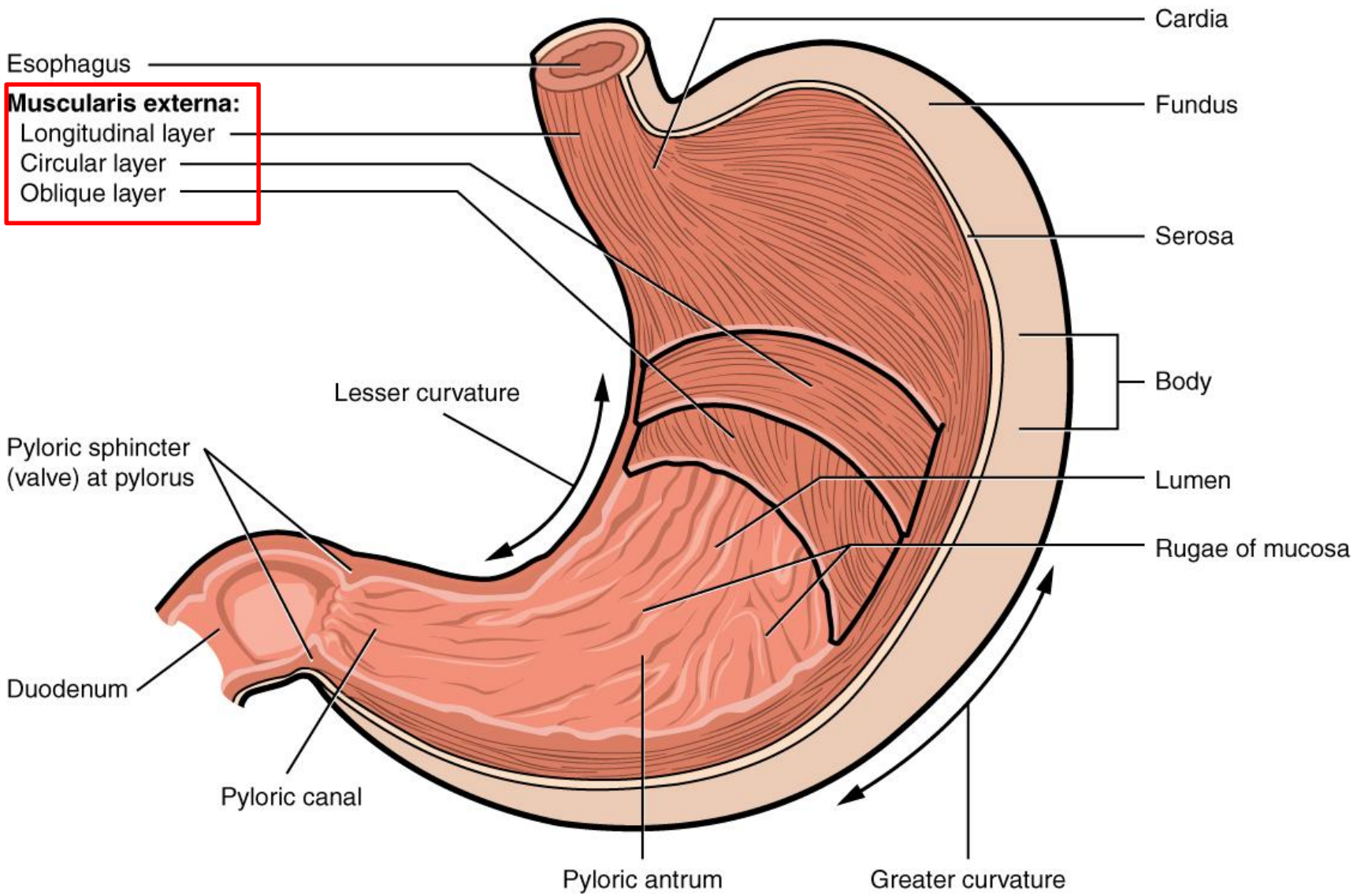
5. **Pylorus** : The most tubular part of the stomach >>>
   - Its cavity called the **pyloric canal**.
   - Its thick muscular wall called the **pyloric sphincter**

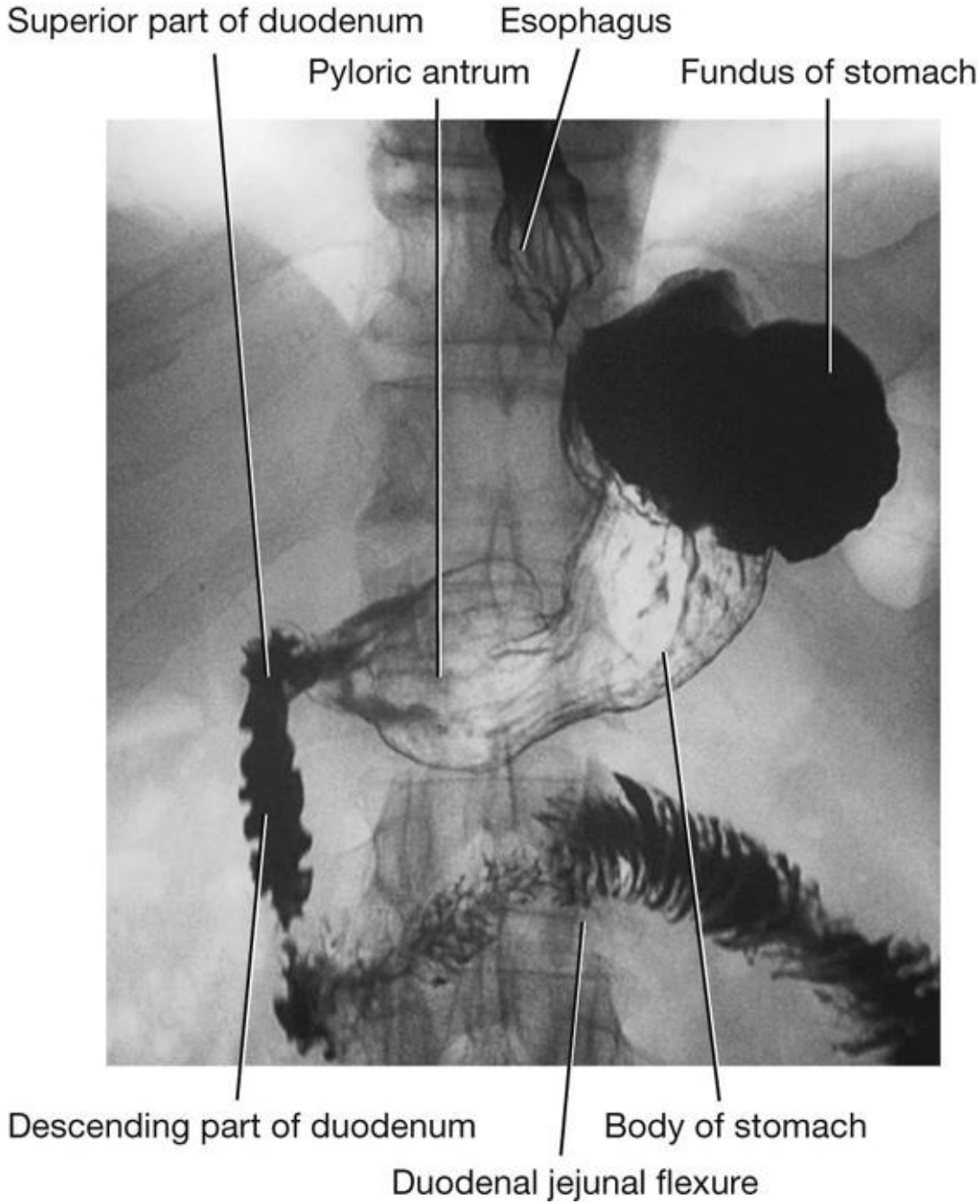
Sphincters of the Stomach

- **No anatomic sphincter at the cardiac orifice**, the contraction of the circular muscle layer at the lower end of esophagus **(physiologic sphincter)** prevents the regurgitation of stomach content into the esophagus.

- **Pyloric Sphincter:** lies between the pylorus and the first part of the duodenum. It controls the exit of chyme (food and gastric acid mixture) from the stomach into the duodenum.


Abdominal esophagus
Cardial notch
Fundus
Cardia
Forms the right border
Lesser curvature
Angular incisure
Pyloric orifice
Greater curvature
Form the left border
Body
Pyloric canal
Pyloric sphincter
Pyloric constriction
Pyloric antrum
Duodenum

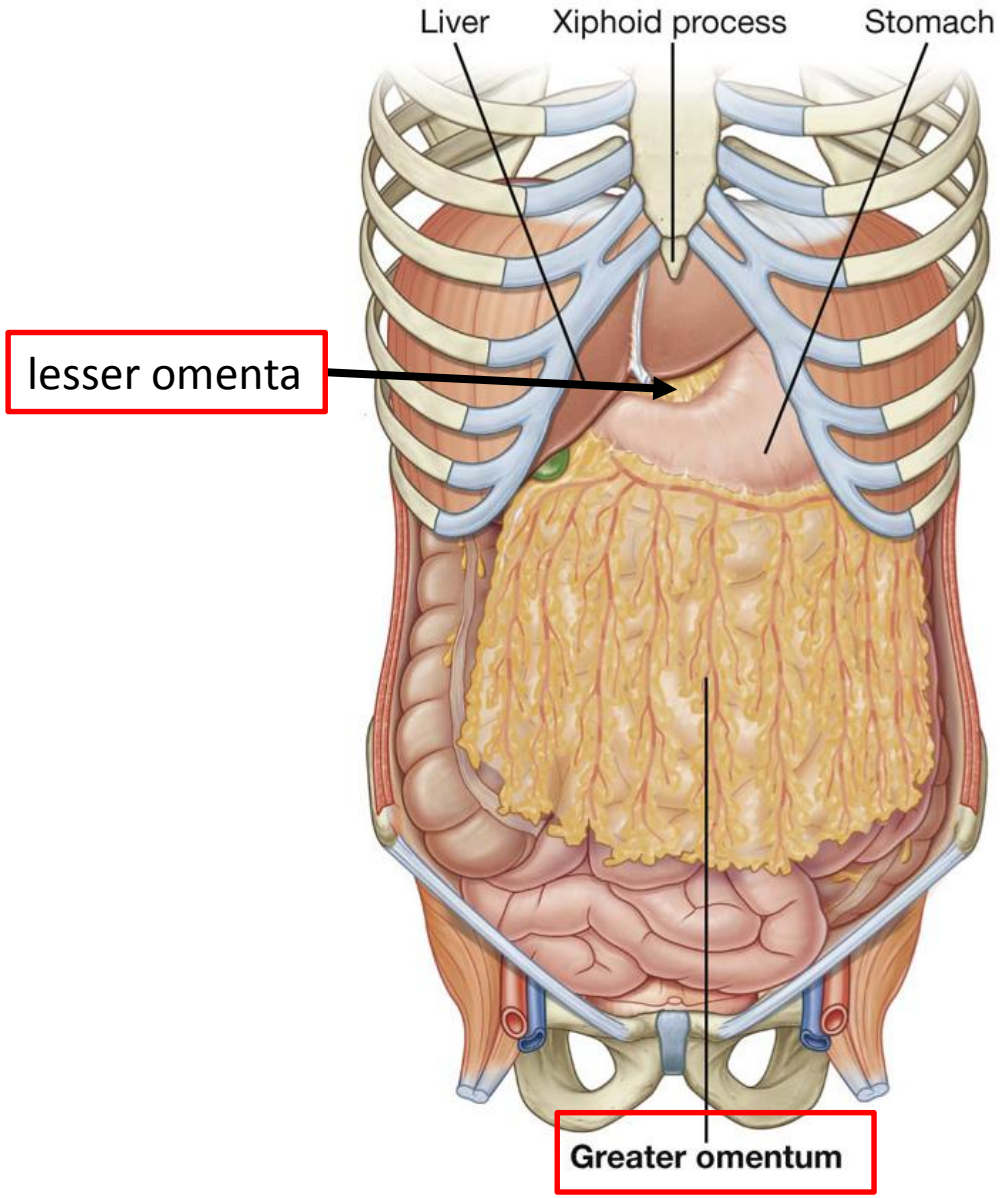

Esophagus
Muscularis externa:
Longitudinal layer
Circular layer
Oblique layer
Cardia
Fundus
Serosa
Body
Lesser curvature
Pyloric sphincter (valve) at pylorus
Lumen
Rugae of mucosa
Duodenum
Pyloric canal
Pyloric antrum
Greater curvature

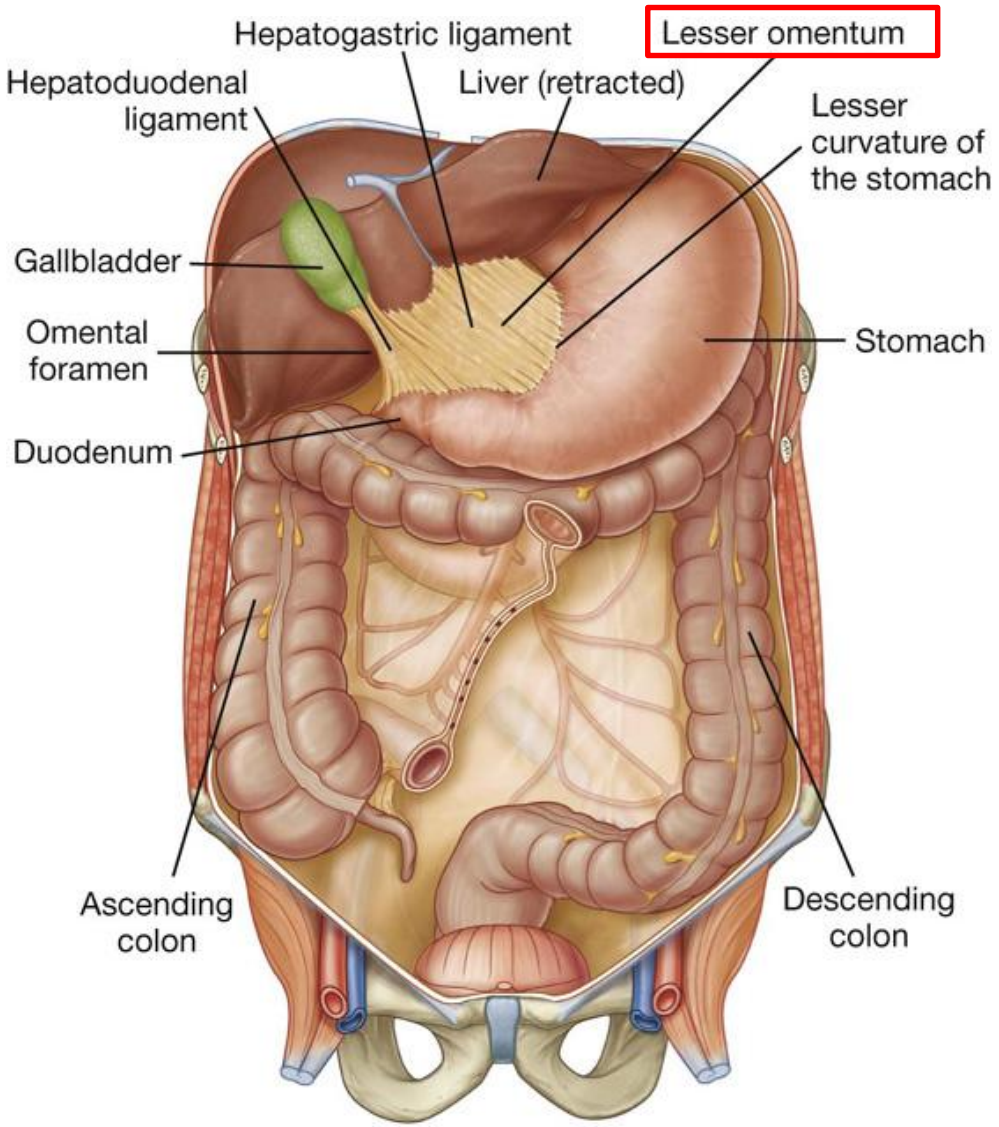

Superior part of duodenum
Esophagus
Pyloric antrum
Fundus of stomach
Descending part of duodenum
Body of stomach
Duodenal jejunal flexure

Greater and lesser omenta

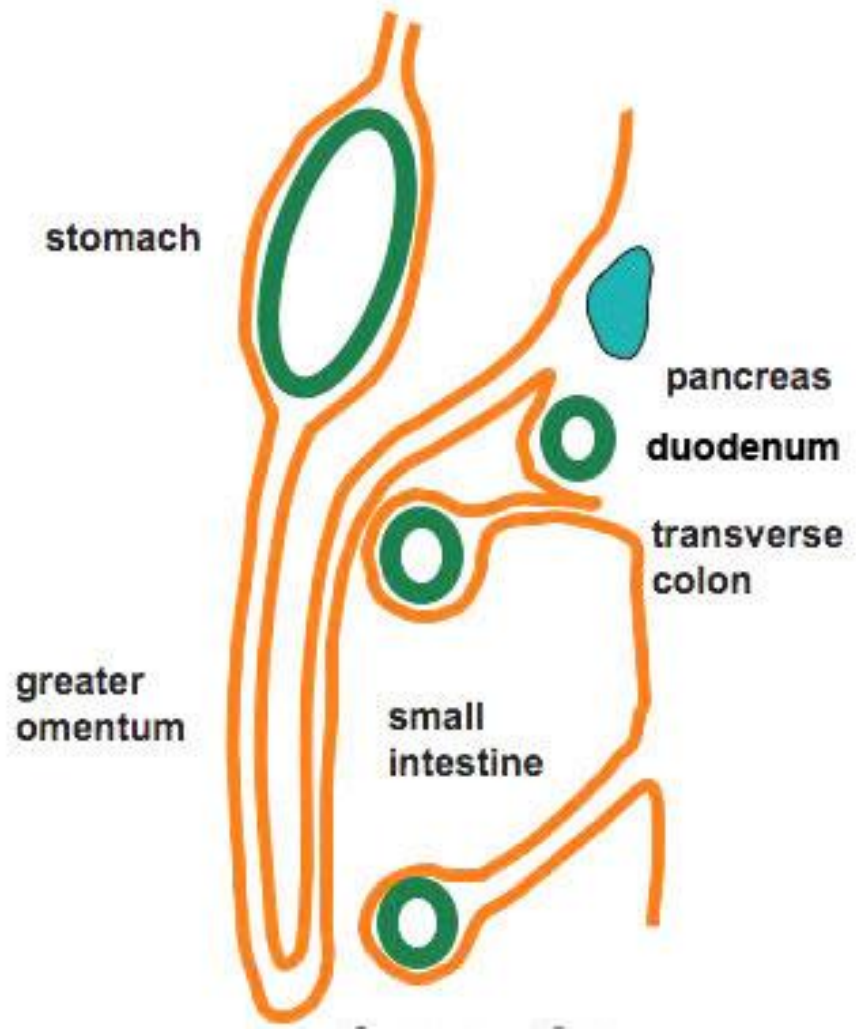
- A double layered membranes of peritoneum that support the stomach and assists with its attachment to the other organs and abdominal wall.
    - **Greater omentum:** is a large, apron-like, peritoneal fold that hangs down from the *greater curvature* of the stomach and folds back upon itself where it attaches to the transverse colon.
    - **Lesser omentum:** extends from the *lesser curvature* of the stomach and the first part of the duodenum to the inferior surface of the liver.

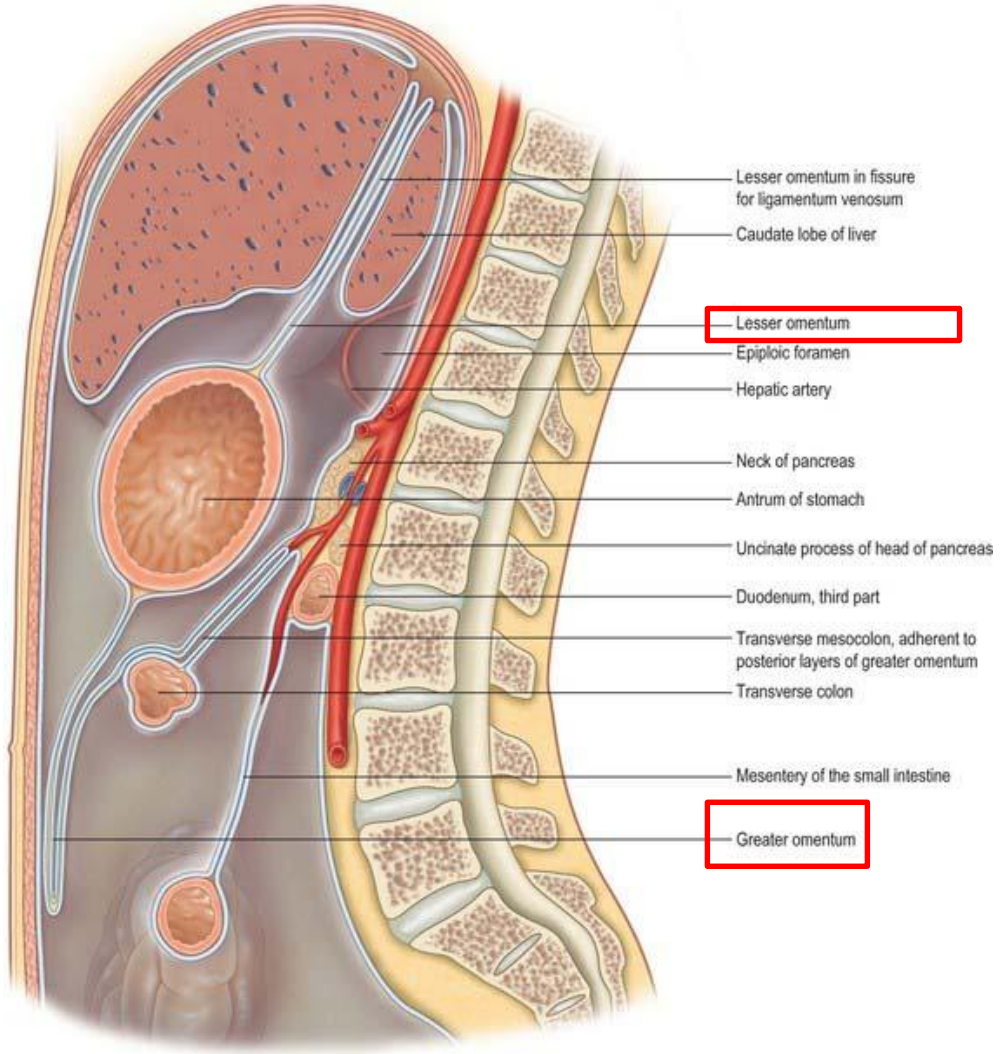
Greater and lesser omenta





Greater and lesser omenta



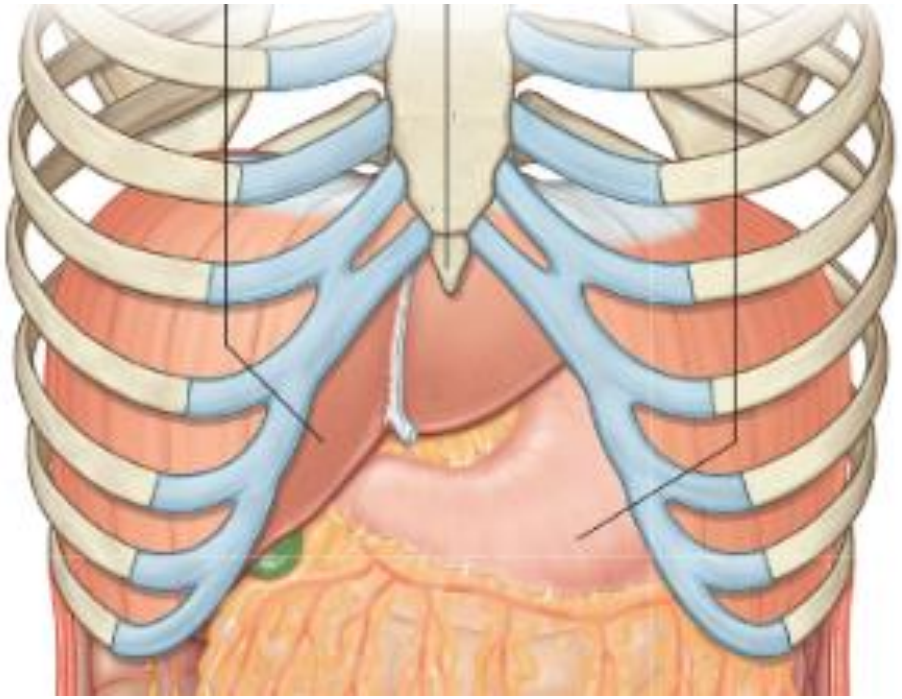


Relation of the Stomach

Anteriorly:

- *The left half:*
  - Diaphragm
  - Base of left lung
  - Left costal margin
  - Anterior abdominal wall

- *The right half:*
  - Left and quadrate lobes of the liver
  - Anterior abdominal wall



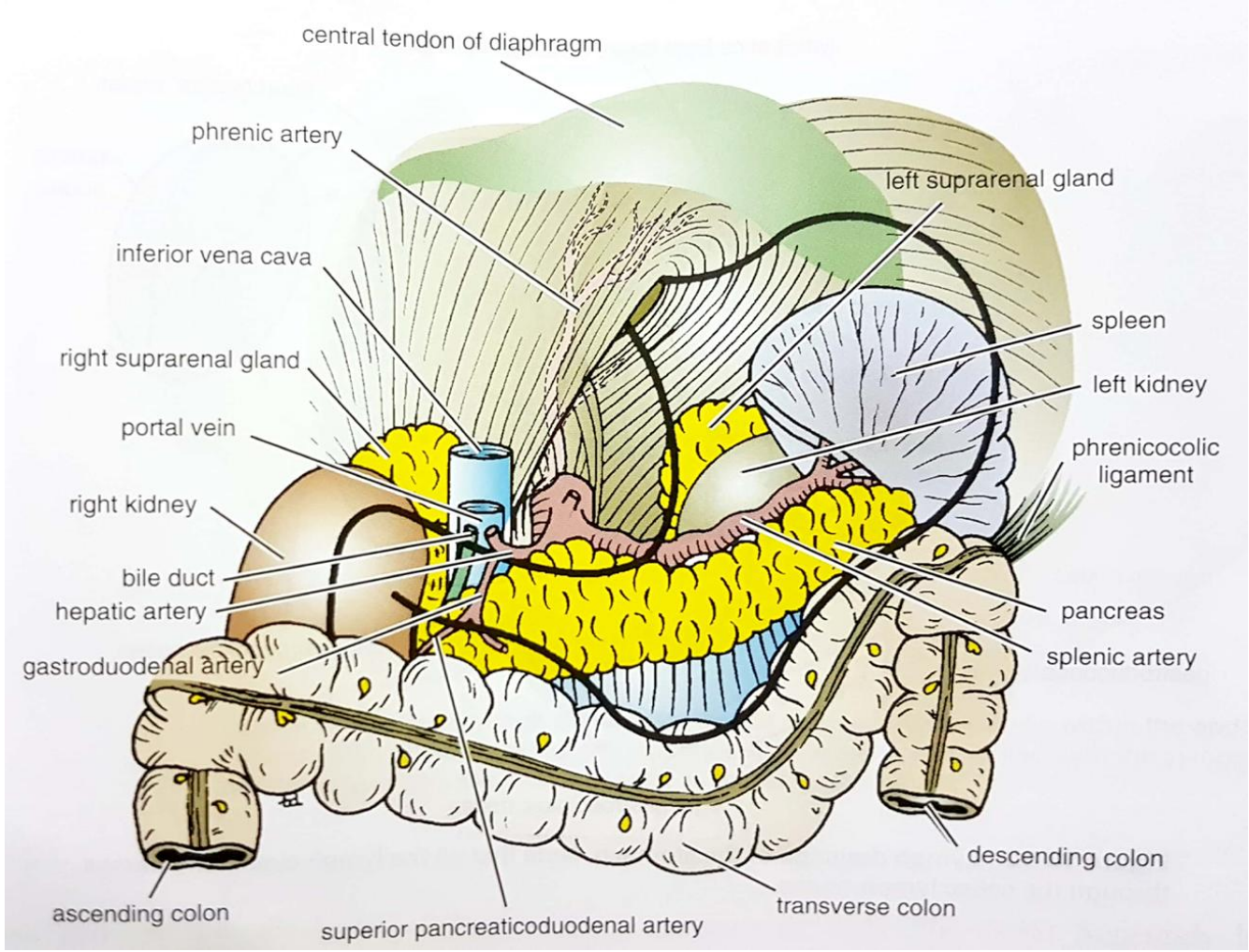
Relation of the Stomach

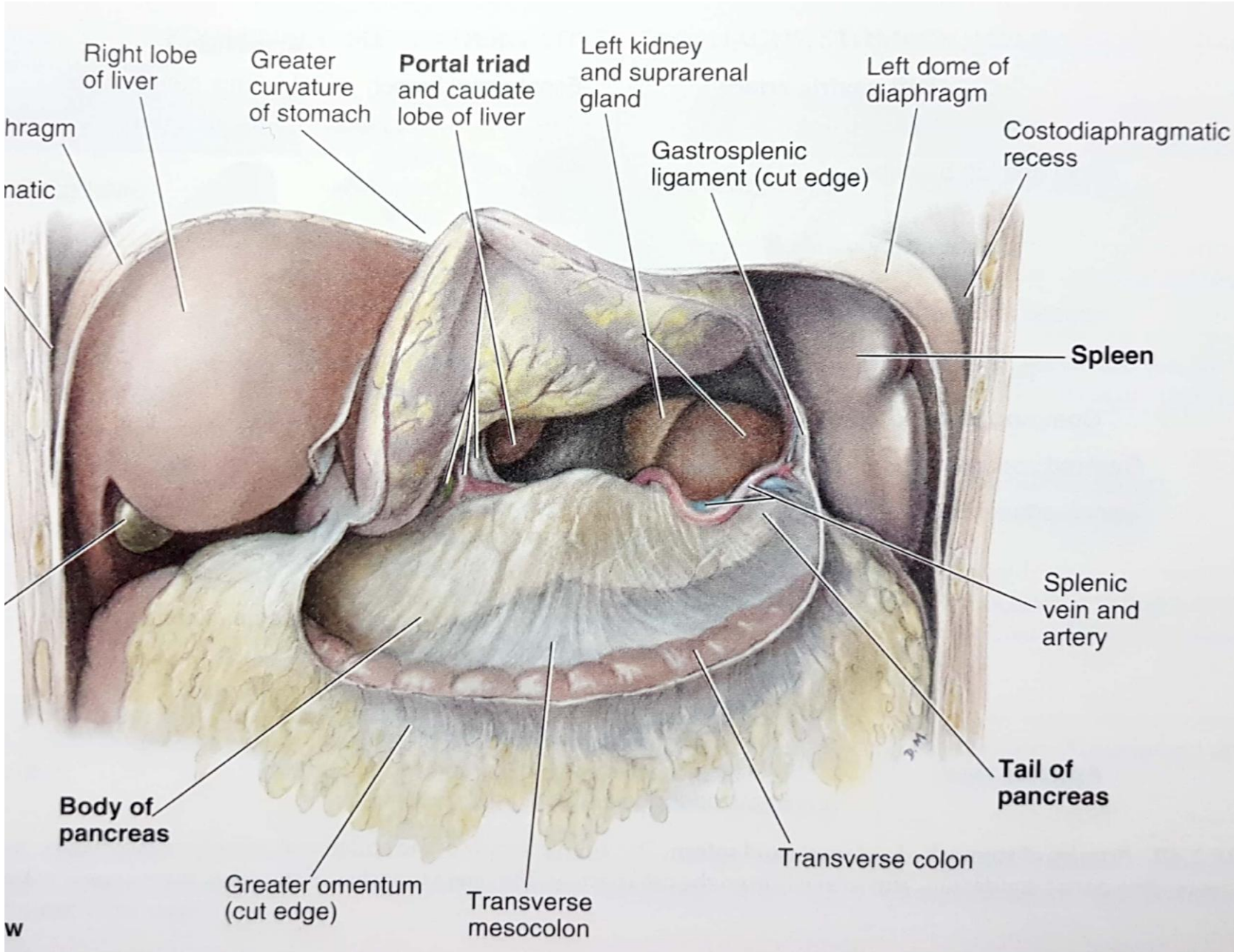
Posteriorly:

- Diaphragm
- Spleen
- Lesser sac
- Left suprarenal gland
- Upper part of left kidney
- Pancreas (body and tail)
- Transverse mesocolon

– These structures form a shallow bed, the **stomach bed**, on which the stomach rests in supine position.

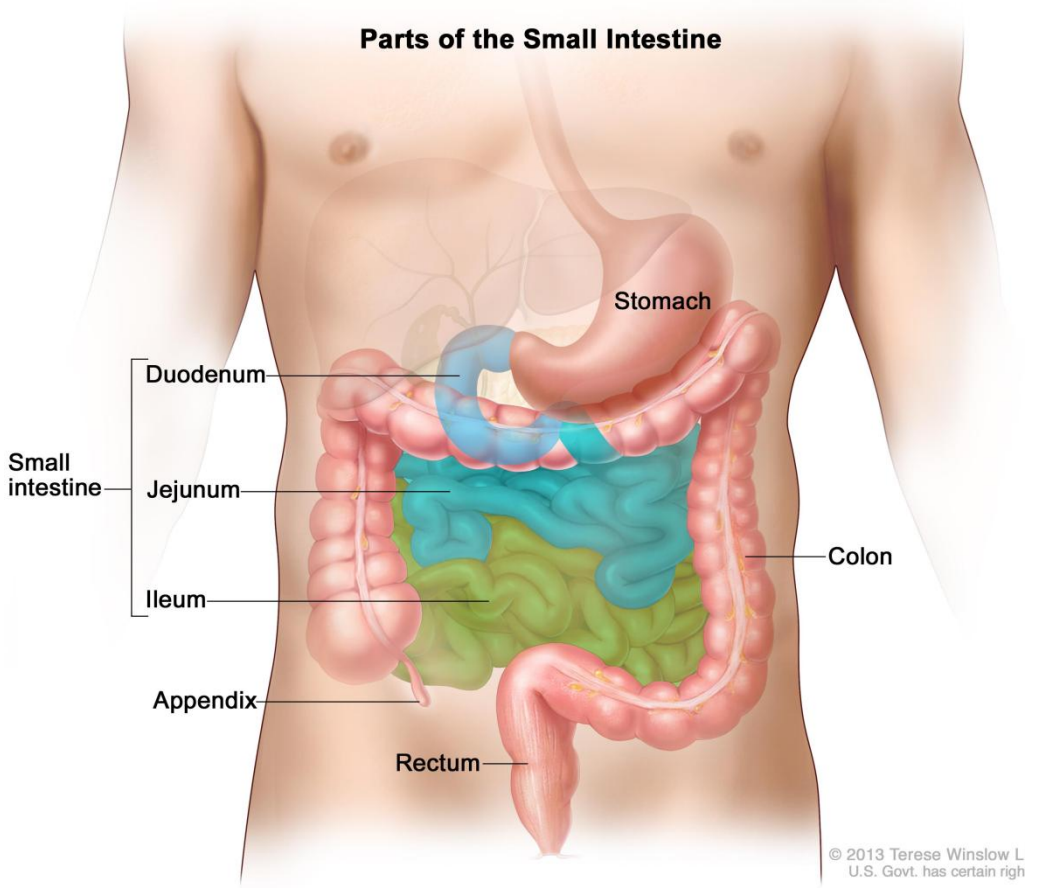
– The **transverse colon** is related **inferiorly and laterally** to the stomach as it course along the greater curvature to the left colic flexure.




hragm
natic
Right lobe of liver
Greater curvature of stomach
Portal triad and caudate lobe of liver
Left kidney and suprarenal gland
Left dome of diaphragm
Costodiaphragmatic recess
Gastrosplenic ligament (cut edge)
Spleen
Splenic vein and artery
Tail of pancreas
Body of pancreas
Greater omentum (cut edge)
Transverse mesocolon
Transverse colon
w

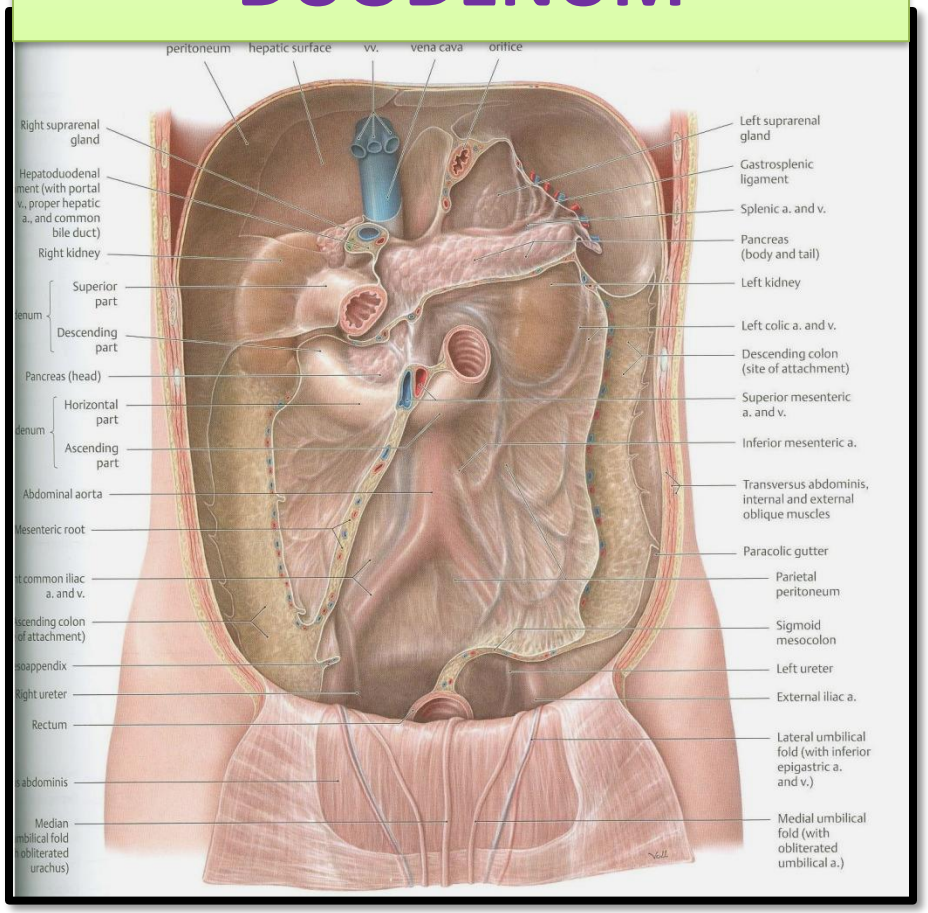
Small Intestine

- Extend from the ***pylorus of the stomach*** to the ***ileocecal junctions.***
- It is approximately **6.5m** long in the average person.
- The greater part of *digestion and food absorption* occur in the small intestine.
- It is divided into three parts:
  - Duodenum
  - Jejunum
  - Ileum



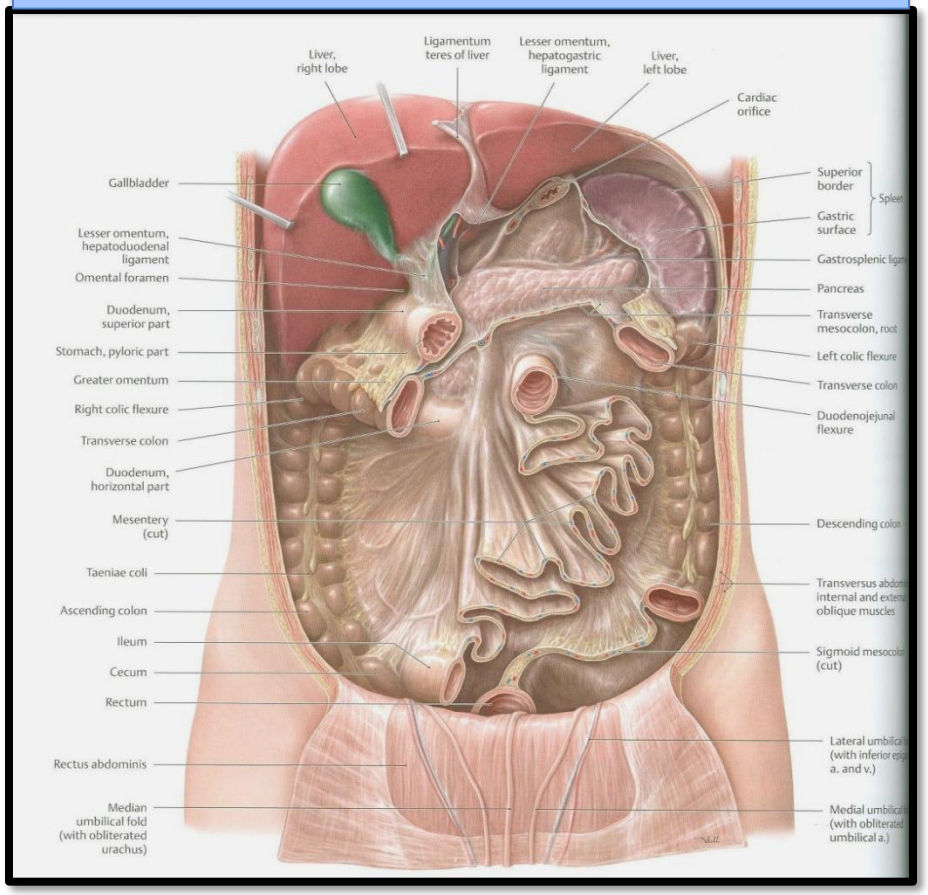
FIXED (Retro peritoneal) PART (NO MESENTERY)

DUODENUM



FREE (MOVABLE) PART (Intraperitoneal) (WITH MESENTERY)

JEJUNUM & ILEUM



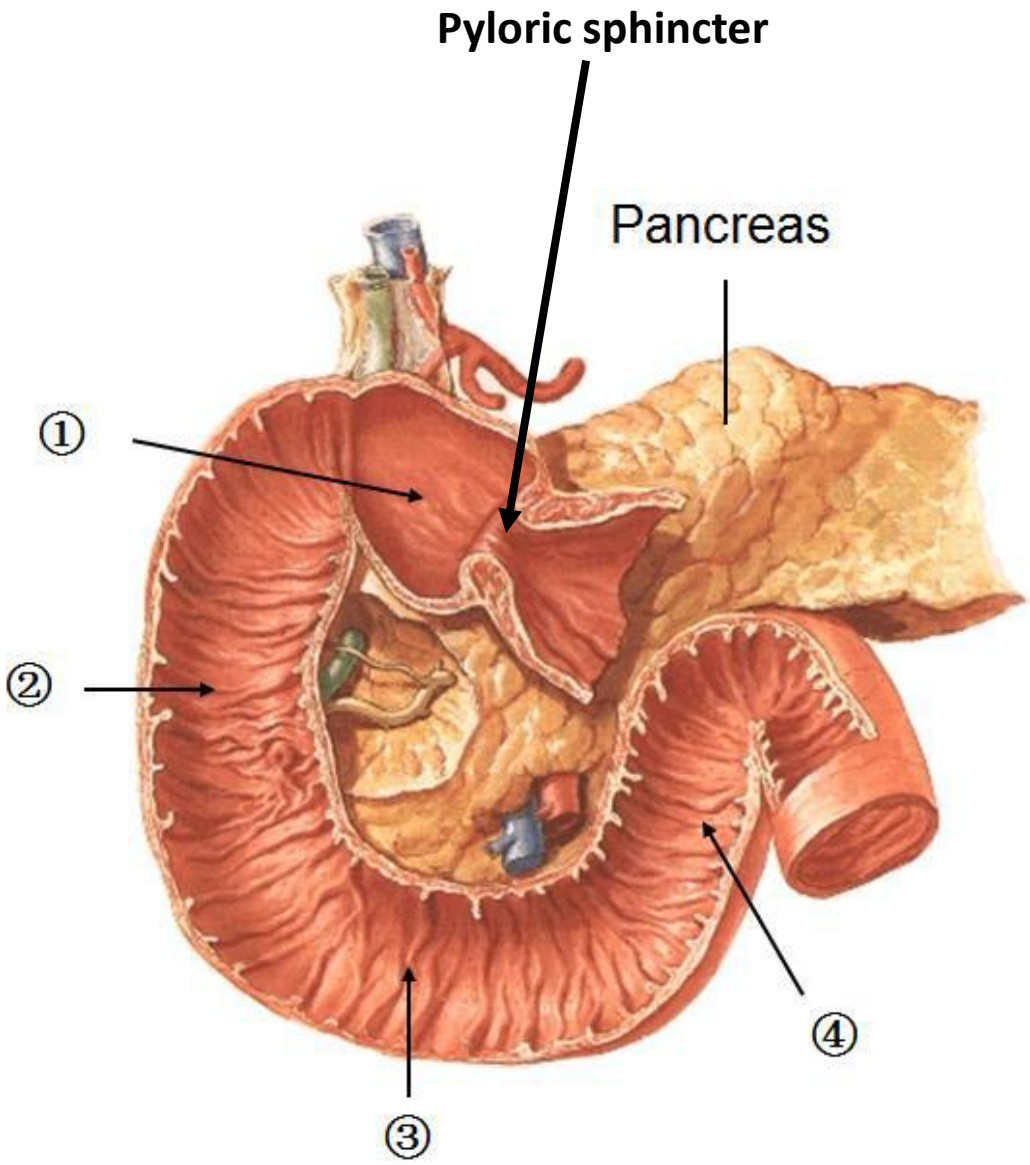
Duodenum

- The **first part** of the small intestine.
- **C-shaped** tube (20–25 cm long) *curve around the head of pancreas.*

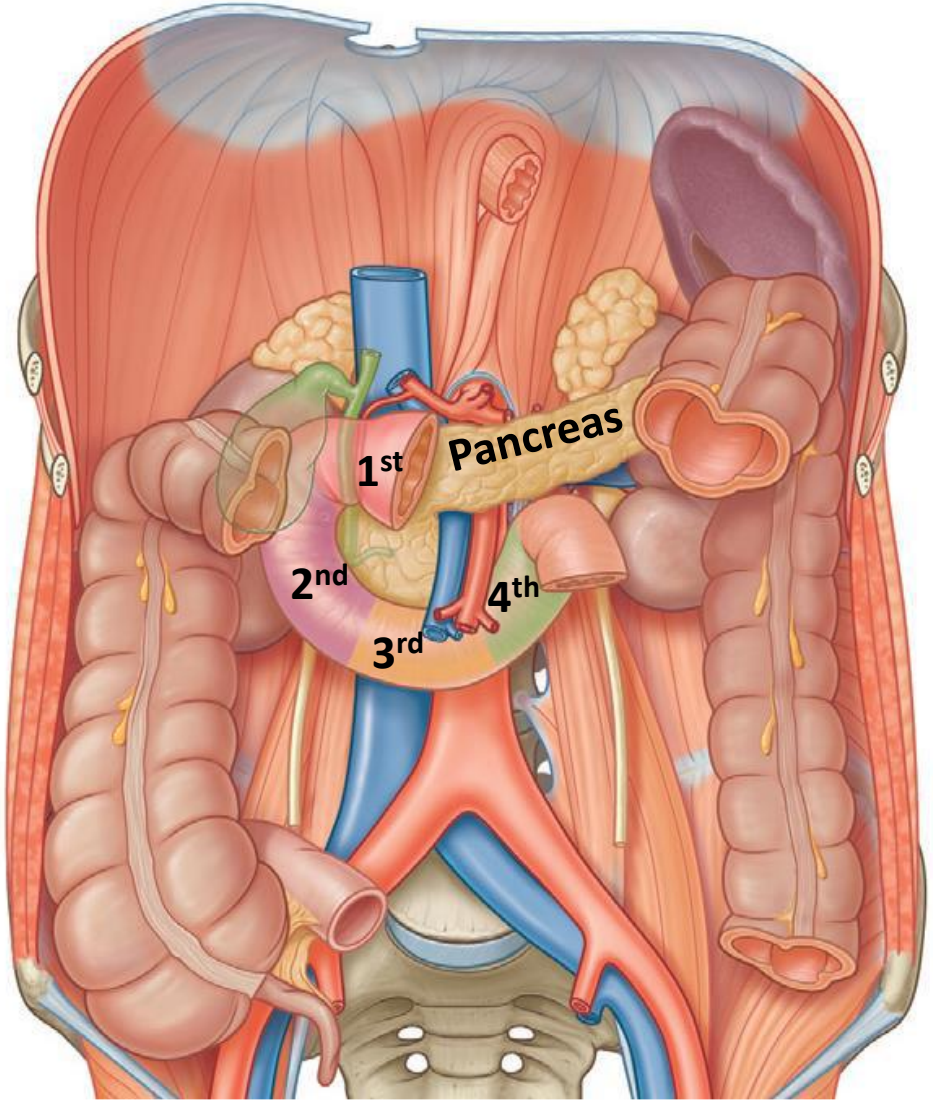
- Begins at the pyloric sphincter and terminates at duodeno-jejunal flexure.

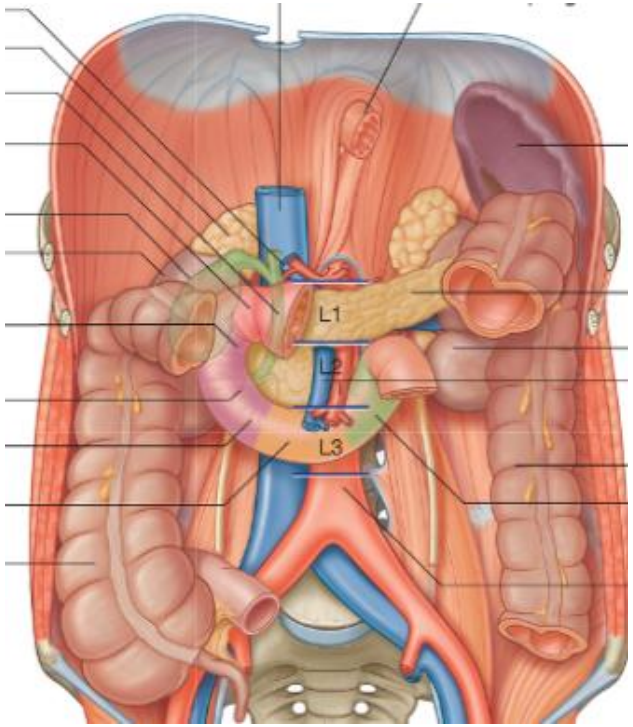
- The duodenum can be divided into (4) parts:
  - **1st : Superior.**
  - **2nd : Descending**
  - **3rd : Inferior**
  - **4th : Ascending**

- **Peritoneal covering**: it is retroperitoneal (except for the 1st inch which is covered with peritoneum).



Anatomical position of duodenum



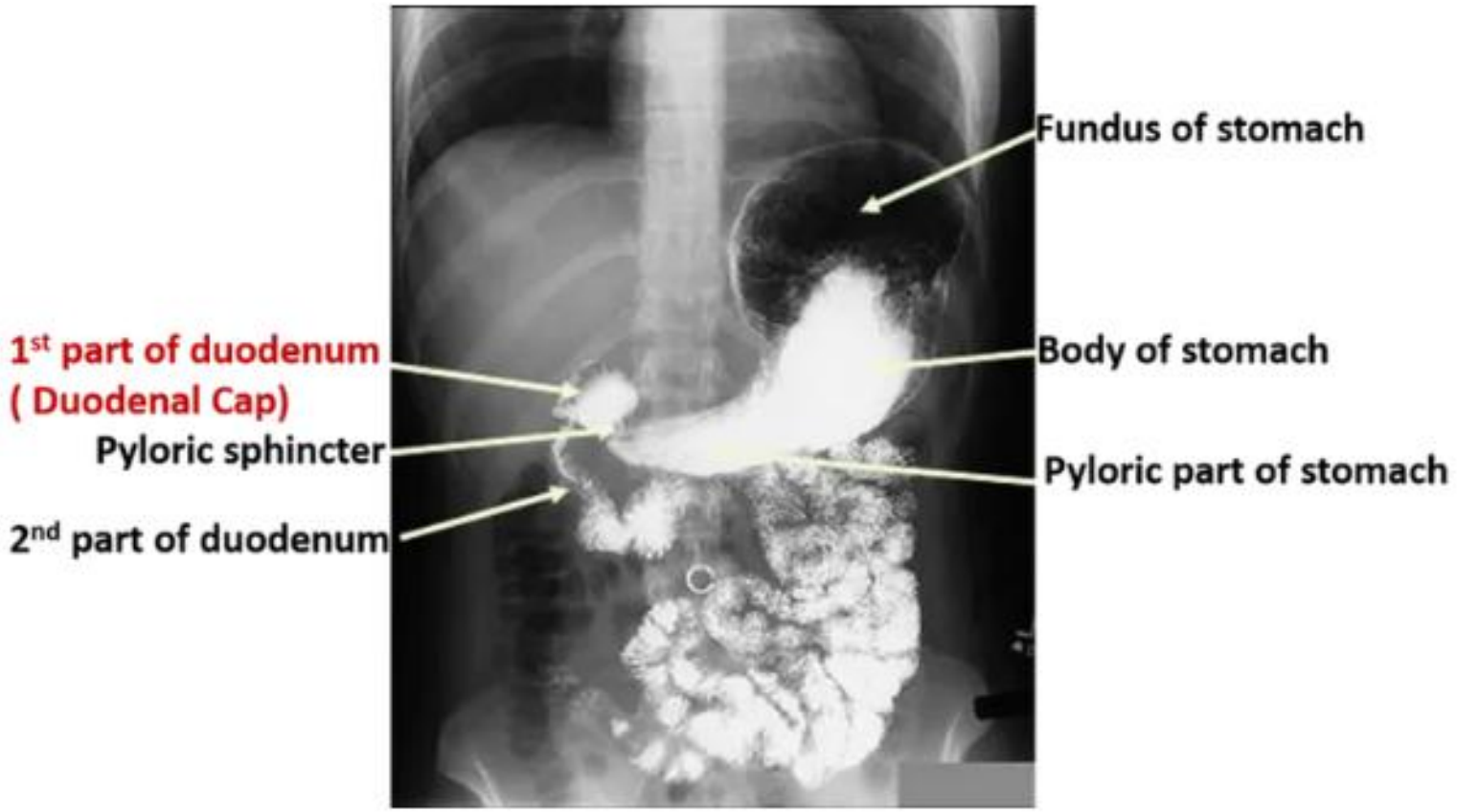


PART	LENGTH	LEVEL
FIRST PART (Superior)	5 cm	L1 (Transpyloric Plane)
SECOND PART (Descending)	10 cm	DESCENDS FROM L1 TO L3
THIRD PART (Horizontal)	7.5 cm	L3 (SUBCOTAL PLANE)
FOURTH PART (Ascending)	2.5 cm	ASCENDS FROM L3 TO L2

1st part

- Known as *‘the cap’.*
- Begins at the pylorus and runs upward and backward on the transpyloric plane at the level of the L1 vertebra
- Devoid of circular folds
- The *most common site of duodenal ulceration*.
- The initial 3cm of the superior duodenum is covered anteriorly and posteriorly by visceral peritoneum, with the remainder retroperitoneal (only covered anteriorly).

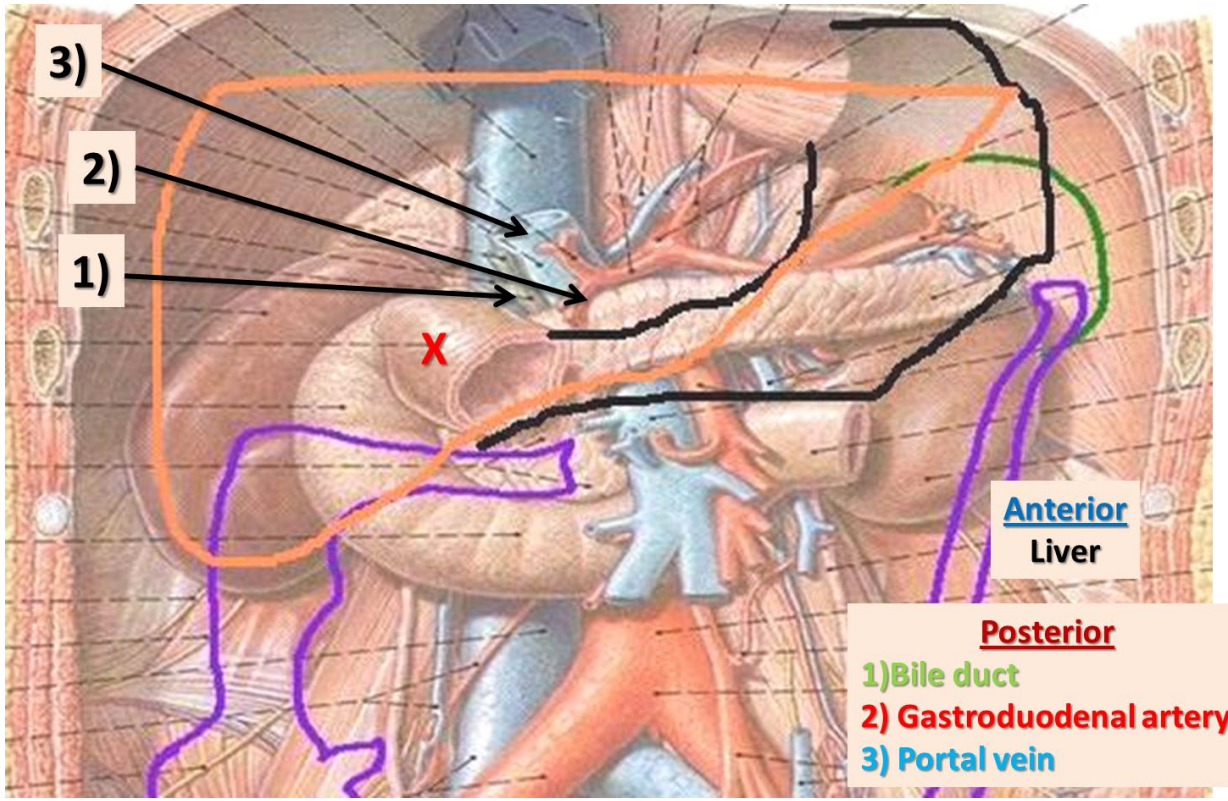
A triangular radio-opaque shadow known as duodenal cap is observed in the 1st part of the duodenum after the barium meal. It is produced because the 1st part is kept patent due to the protrusion of the pylorus and gets filled by barium meal. Moreover, this part has no circular folds, the interior is smooth. Any deformity in the duodenal cap indicates mainly ulcer.

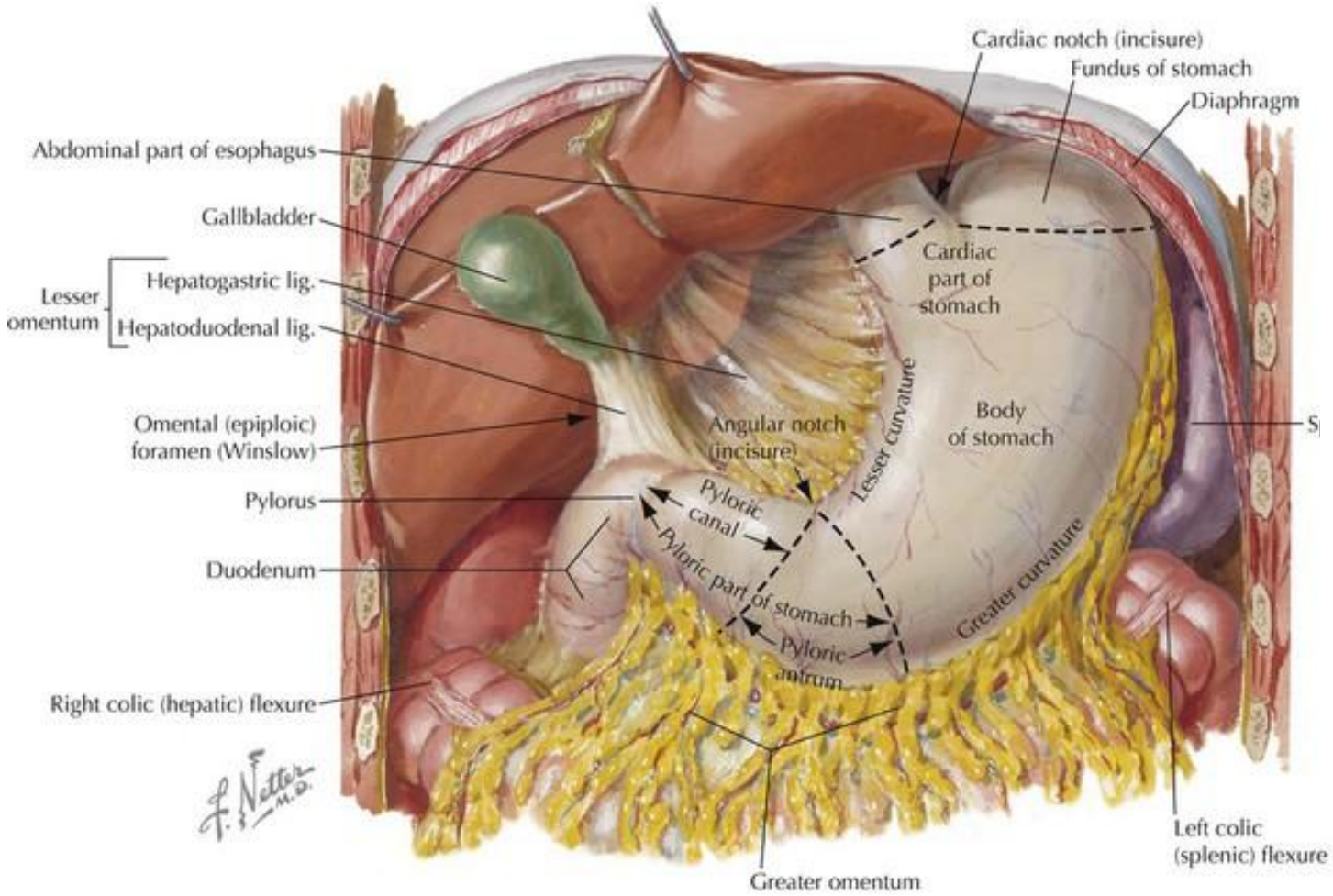


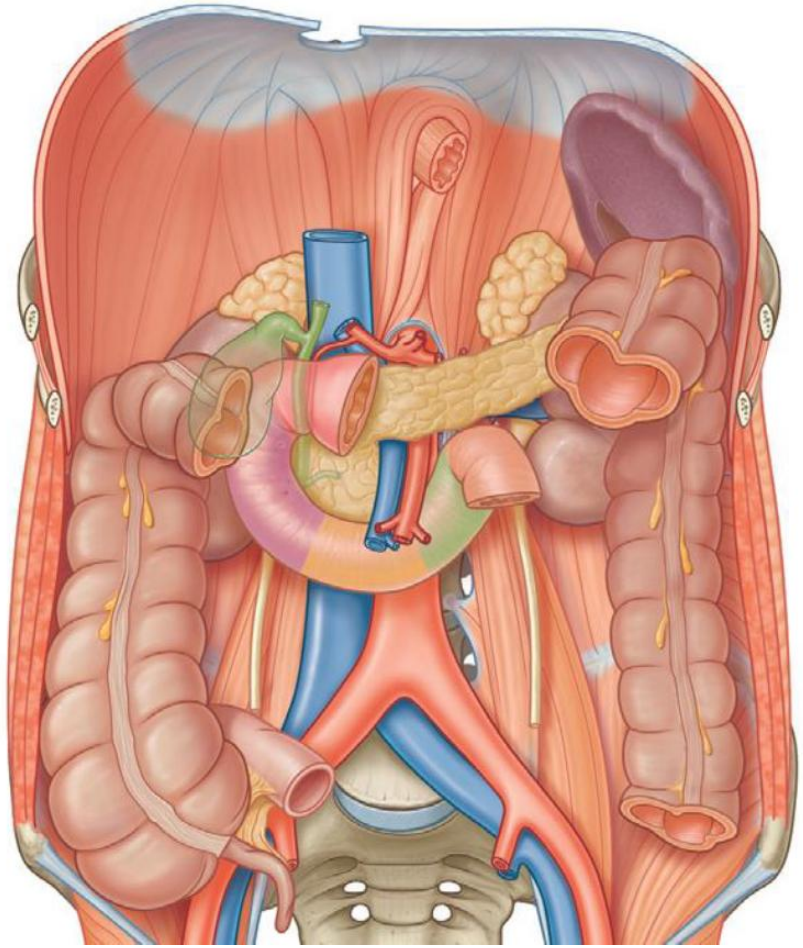
Barium Meal image

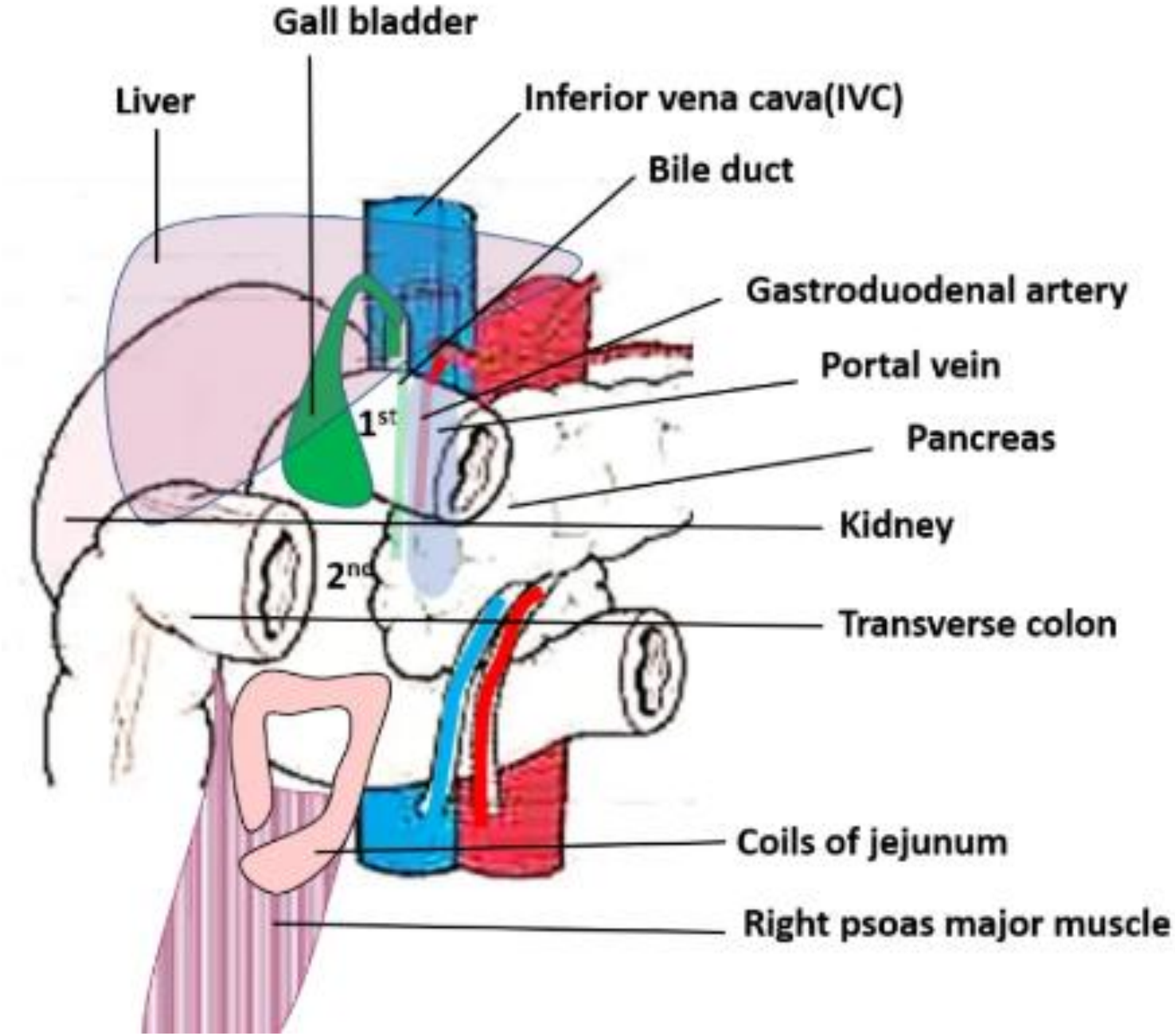
Relation of the 1st part

- Relations of the 1st part are as follows:
  - **Anteriorly:** The quadrate lobe of the liver and the body of gallbladder.
  - **Posteriorly:** The gastroduodenal artery, the bile duct, and the portal vein. Behind all these the inferior vena cava.
  - **Superiorly:** The entrance into the lesser sac (the epiploic foramen)
  - **Inferiorly:** The head of the pancreas



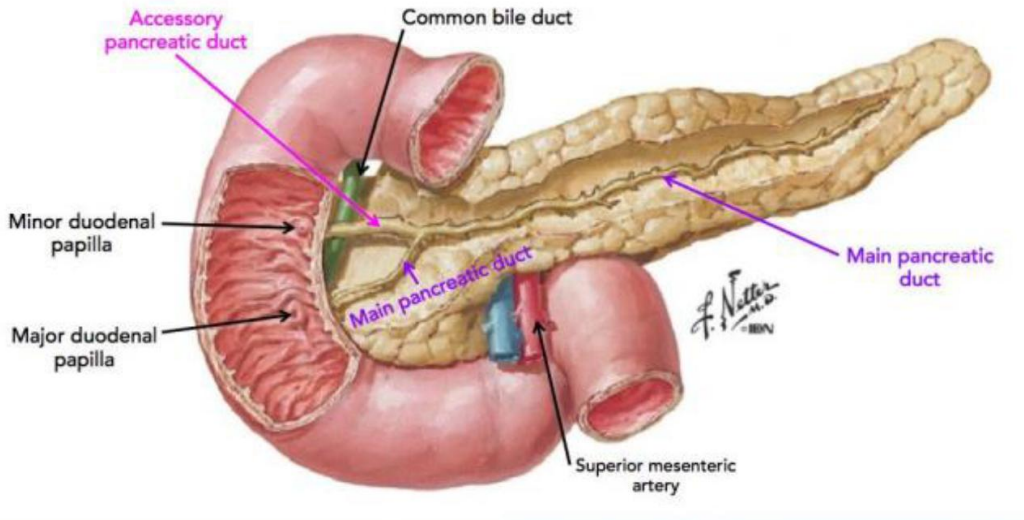

Cardiac notch (incisure)
Fundus of stomach
Diaphragm
Abdominal part of esophagus
Gallbladder
Lesser omentum
Hepatogastric lig.
Hepatoduodenal lig.
Cardiac part of stomach
Omental (epiploic) foramen (Winslow)
Angular notch (incisure)
Lesser curvature
Body of stomach
Pylorus
Pyloric canal
Duodenum
Pyloric part of stomach
Greater curvature
Pyloric antrum
Right colic (hepatic) flexure
Left colic (splenic) flexure
Greater omentum



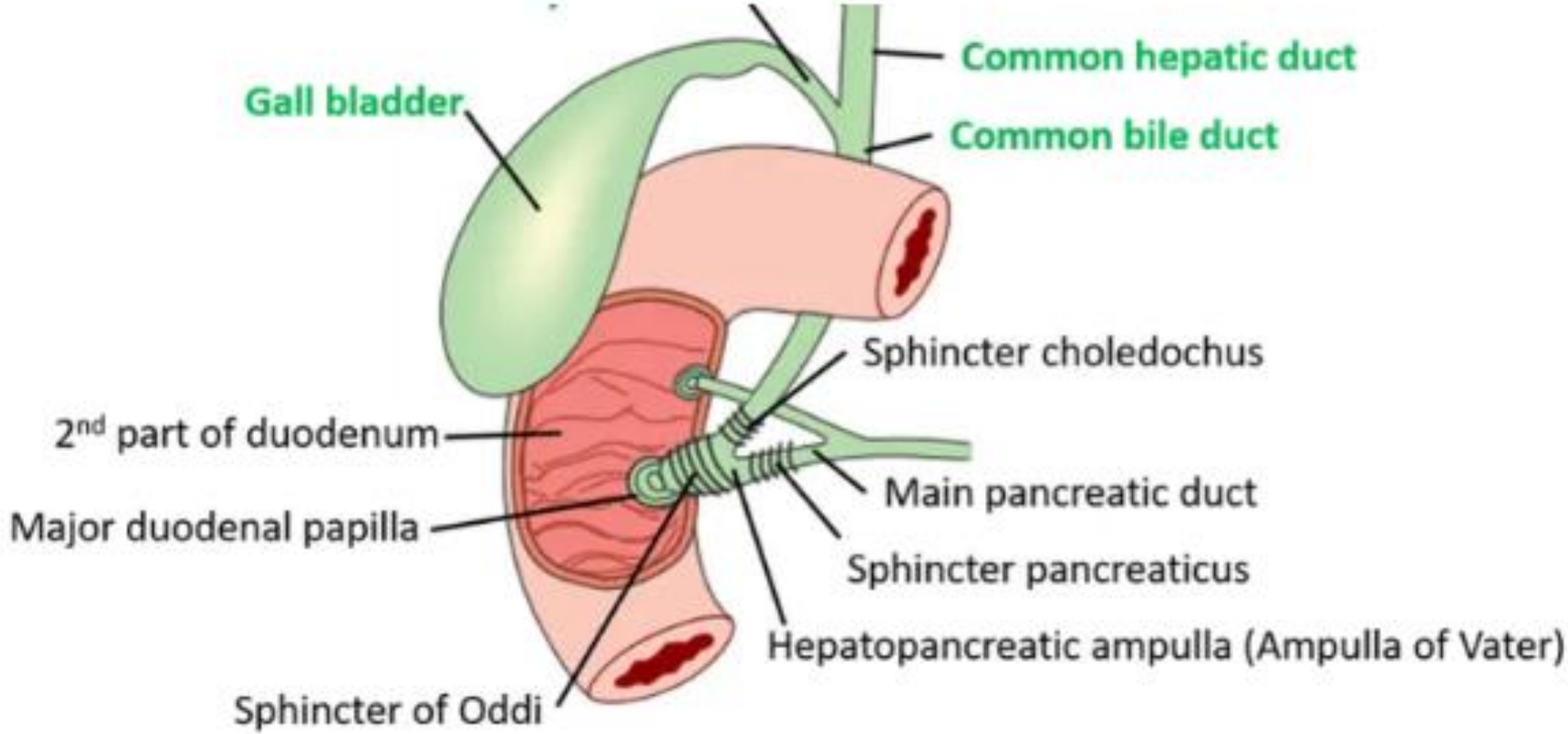

Gall bladder
Liver
Inferior vena cava(IVC)
Bile duct
Gastroduodenal artery
Portal vein
1st
Pancreas
Kidney
2nd
Transverse colon
Coils of jejunum
Right psoas major muscle

2nd (descending) part

- The descending portion curves inferiorly around the head of the pancreas.
- It lies posteriorly to the transverse colon, and anterior to the right kidney.



- Opening in the second part :
  1. **Common opening of bile duct & main pancreatic duct**: on summit of **major duodenal papilla**.
  2. **Opening of accessory pancreatic duct** (one inch higher): on summit of **minor duodenal papilla**


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

Relation of the 2nd part

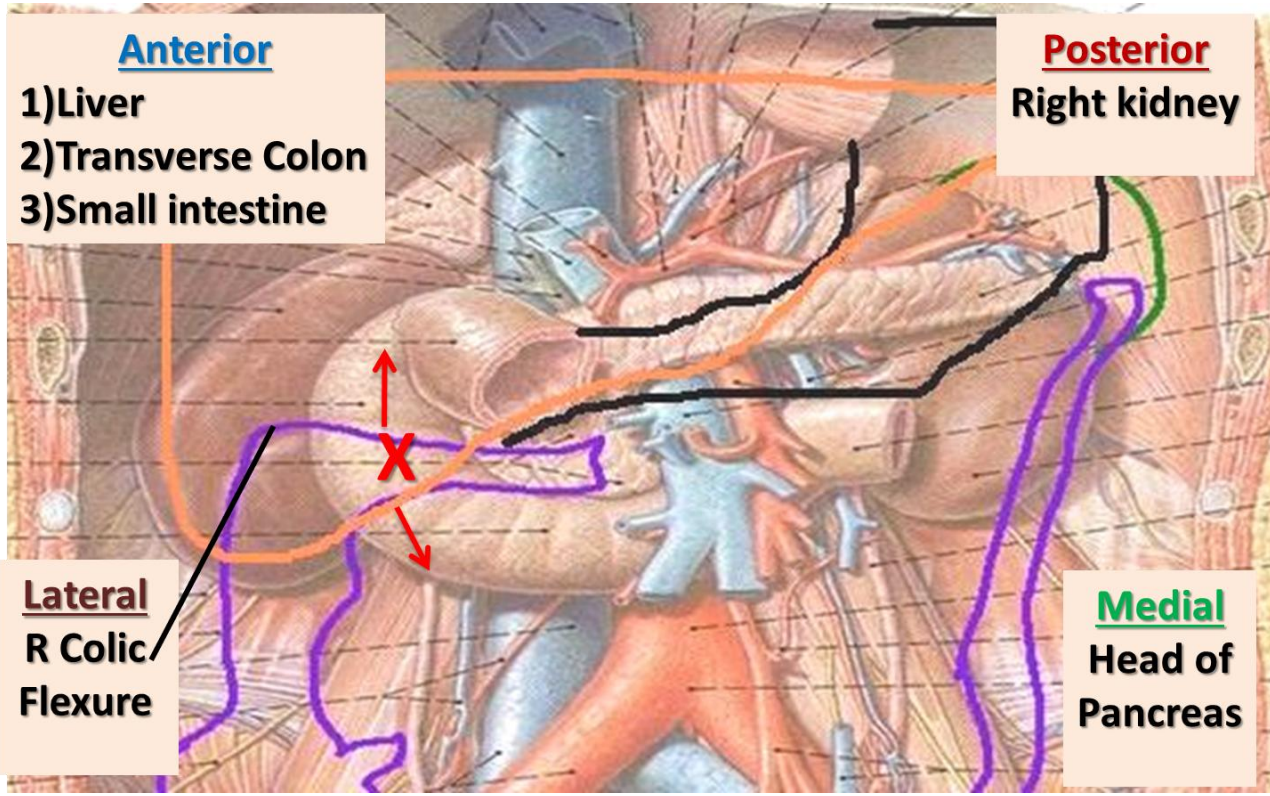
- Relations of the 2nd part are as follows:

  - **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

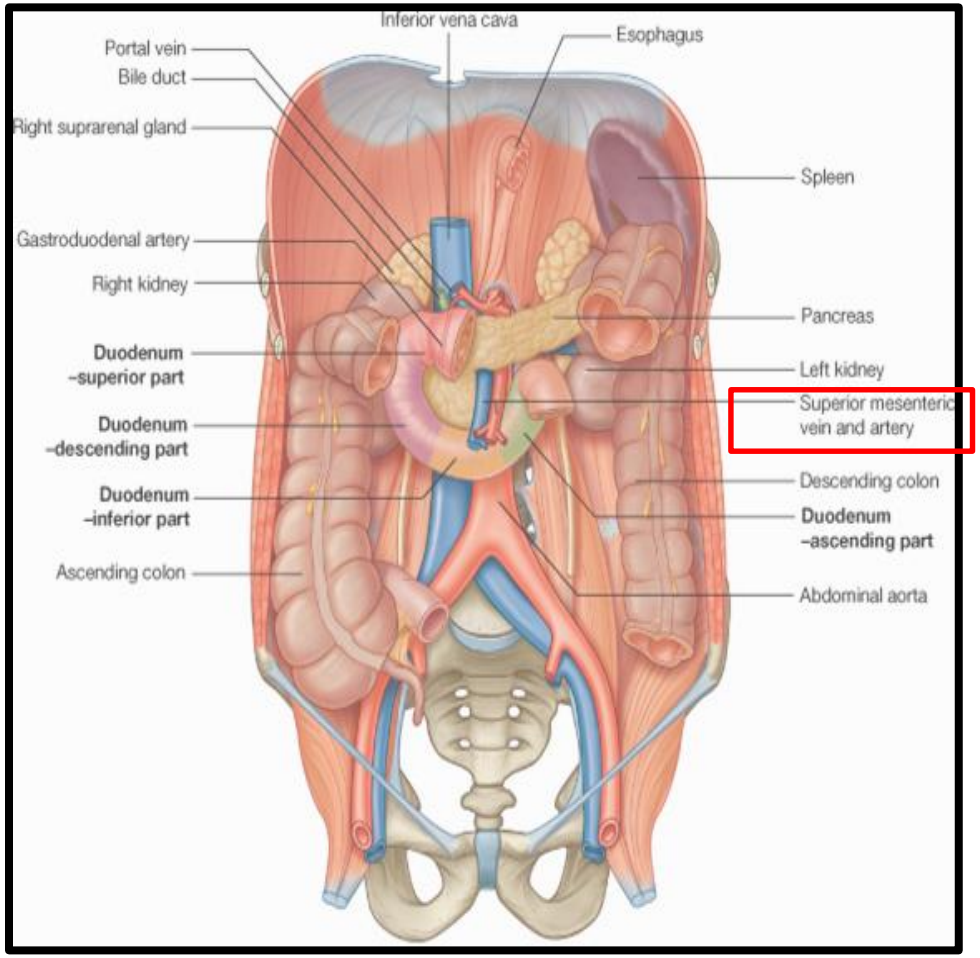
  - **Medially:** The head of the pancreas, the bile duct, and the main pancreatic duct



3rd part

- It runs horizontally to the left on the subcostal plane (L3).

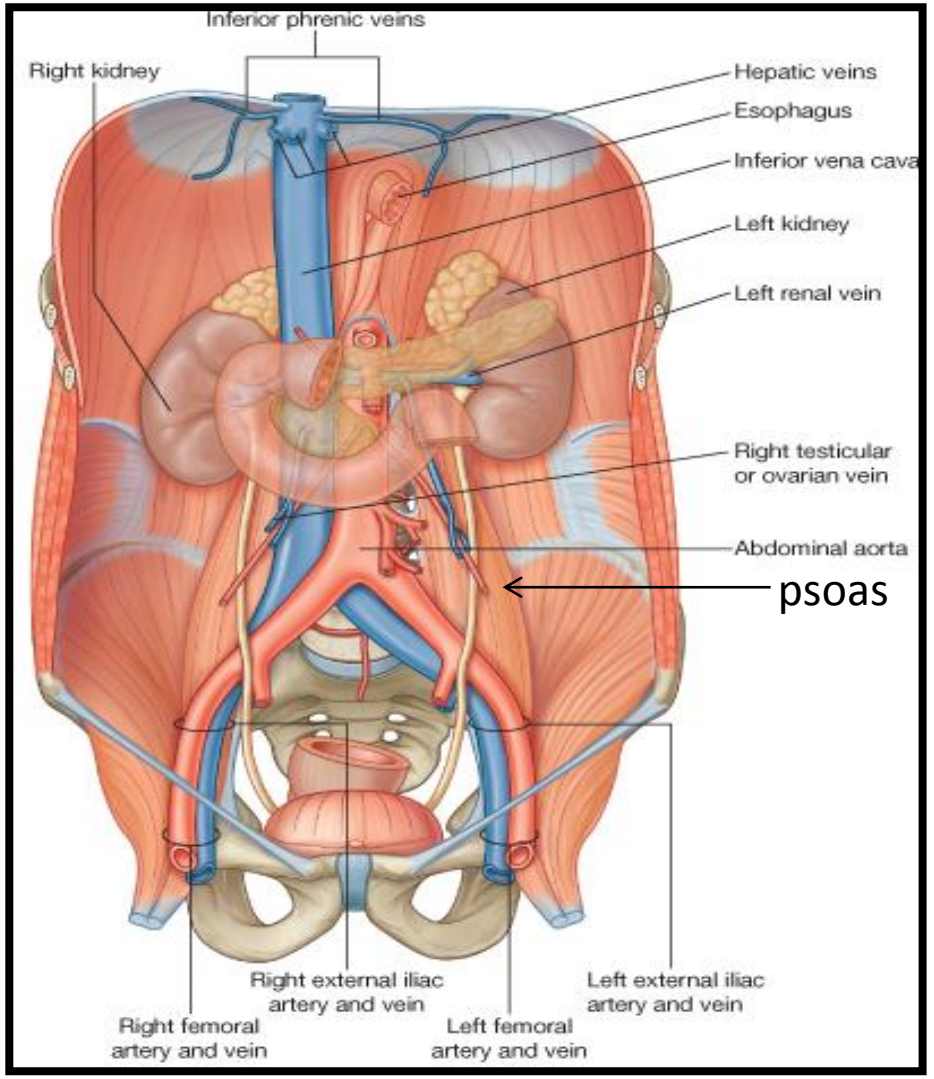
- Relations of the 3rd part are as follows:
  - **Anteriorly:** the root of the mesentery of the small intestine**, s**uperior mesenteric vessels and coils of jejunum
  - **Posteriorly:** Inferior vena cava and abdominal aorta

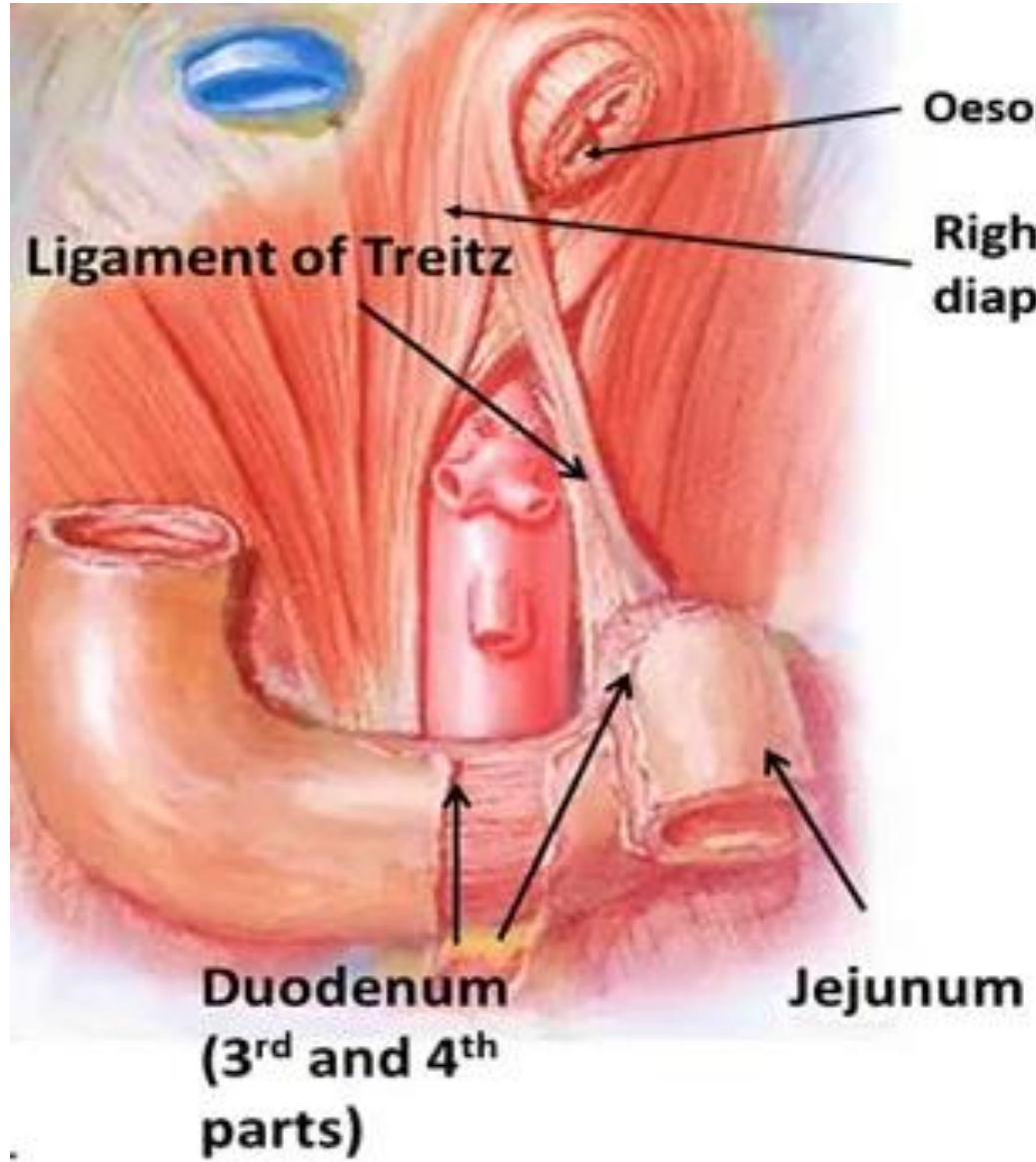


4th part

- It 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.

- The relations of this part are as follows:
  - **Anteriorly:** Coils of jejunum
  - **Posteriorly:** The left margin of the aorta and the medial border of the left psoas muscle

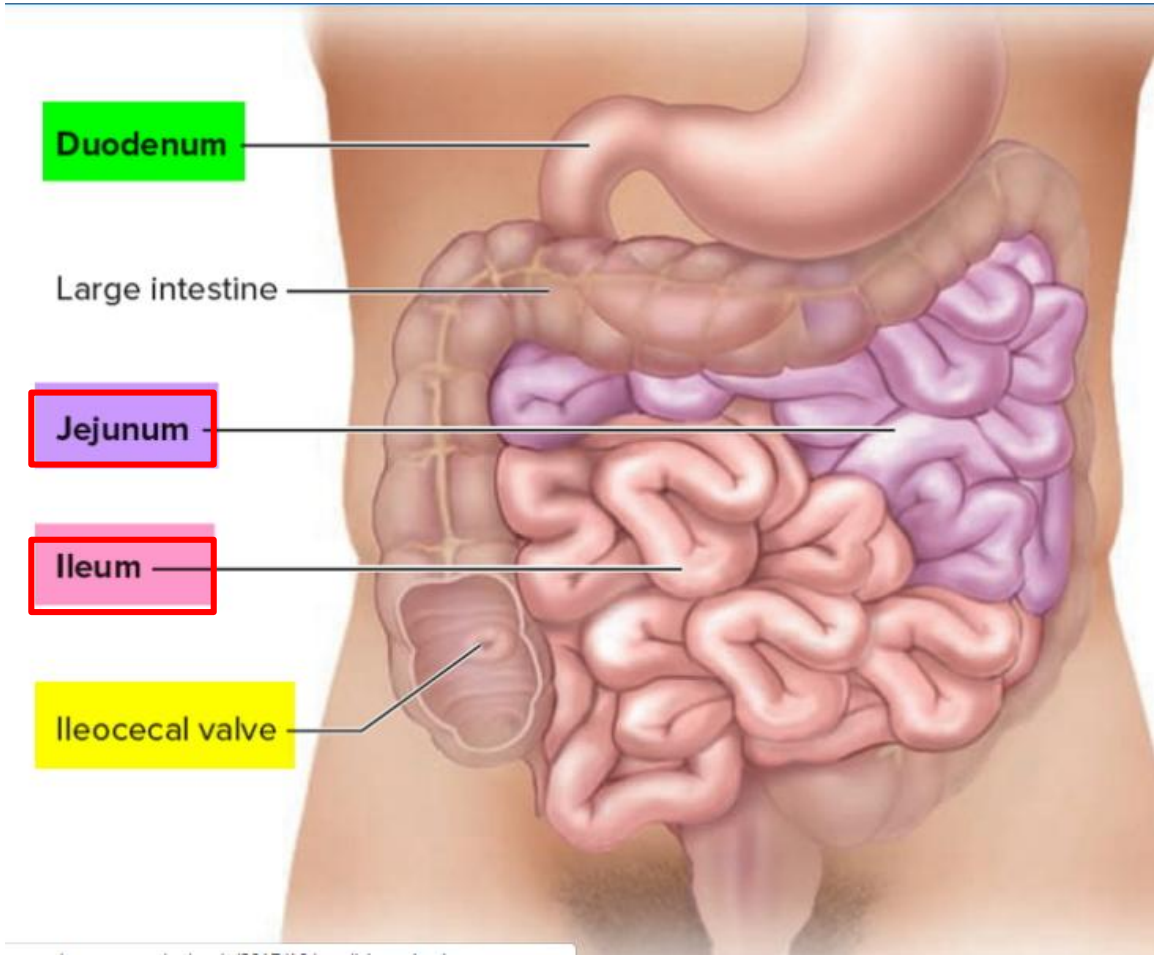



Oesophagus
Right Crus of diaphragm
Ligament of Treitz
Duodenum (3rd and 4th parts)
Jejunum

Jejunum and Ileum

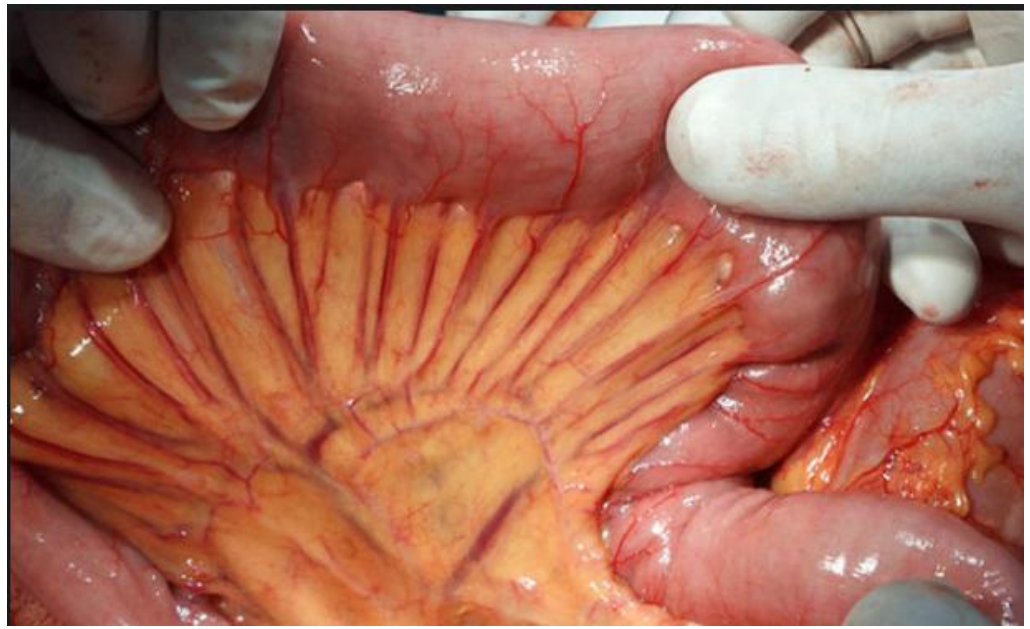
- The **Jejunum** is the second portion of small intestines.
  - Approximately **2.5m** long.
  - Mainly Occupy the **left upper part** of the abdominal cavity

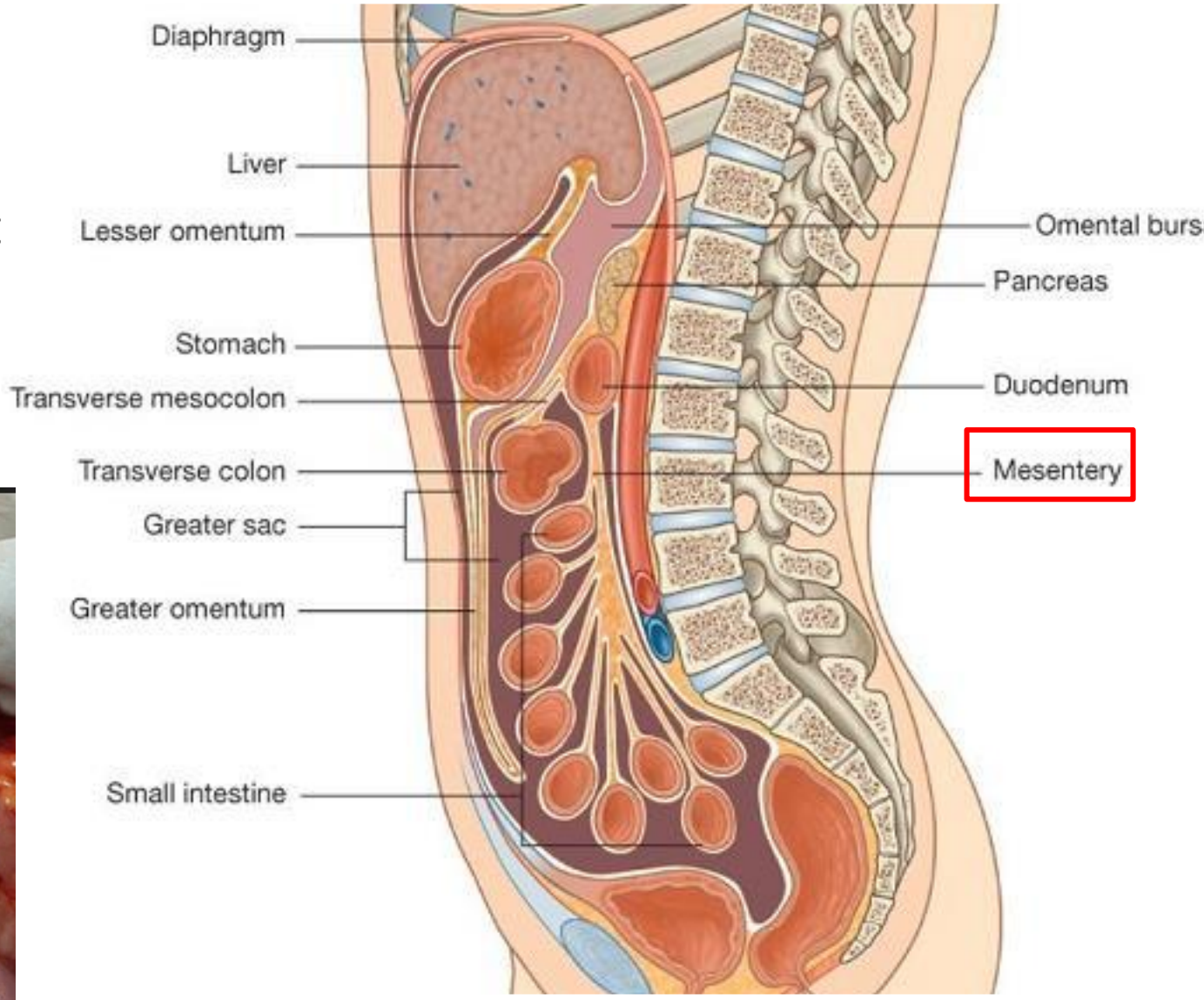
- The **ilium** is the final part of small intestines
  - Approximately **3.5m** long.
  - Mainly occupy the **right lower part** of abdominal cavity and tend to **hang down into the pelvis.**



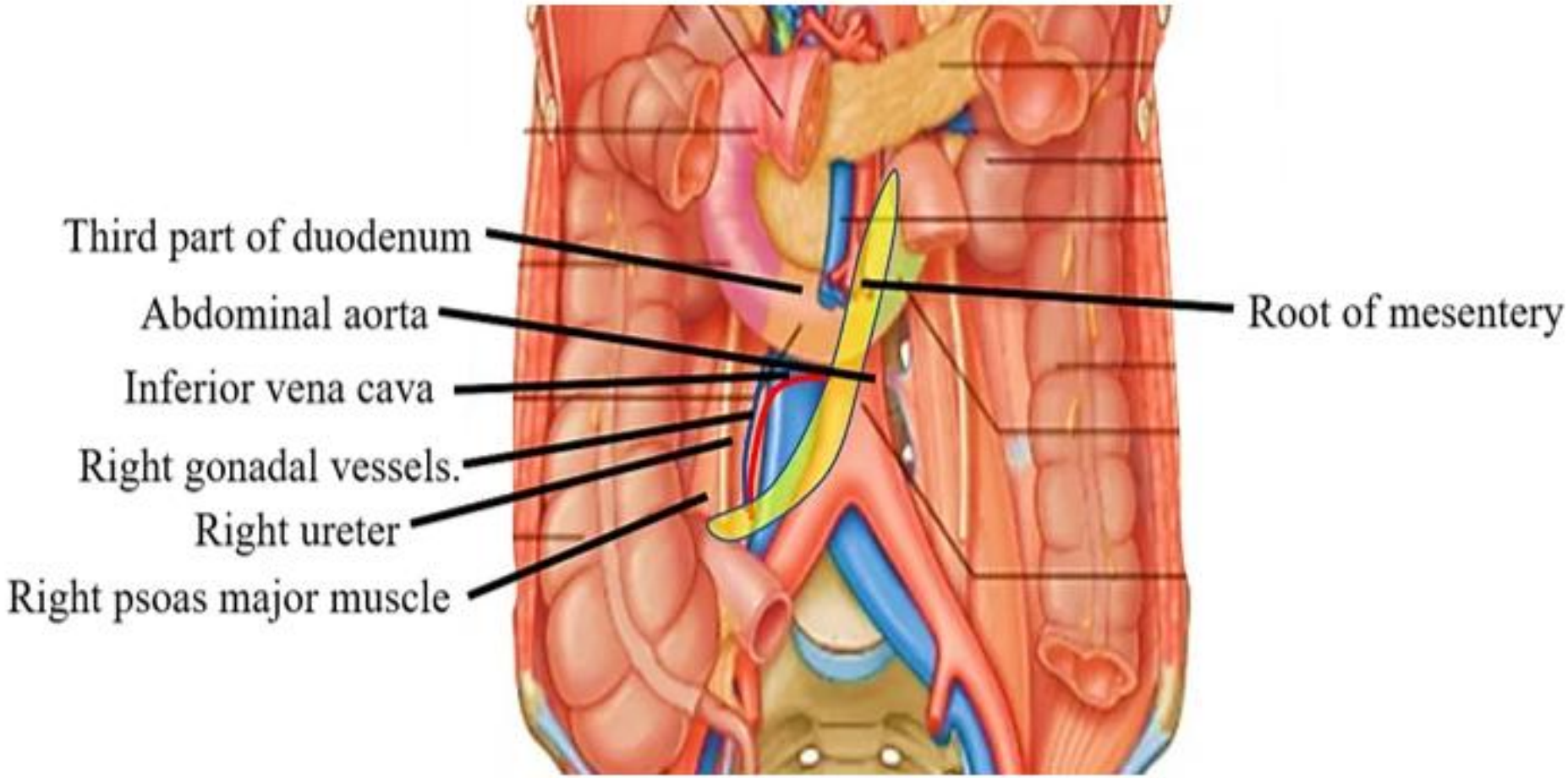
Mesentery of small intestine

The **mesentery** is a large, fan-shaped, double-layered fold of peritoneum that connects the jejunum and ileum to the posterior abdominal wall

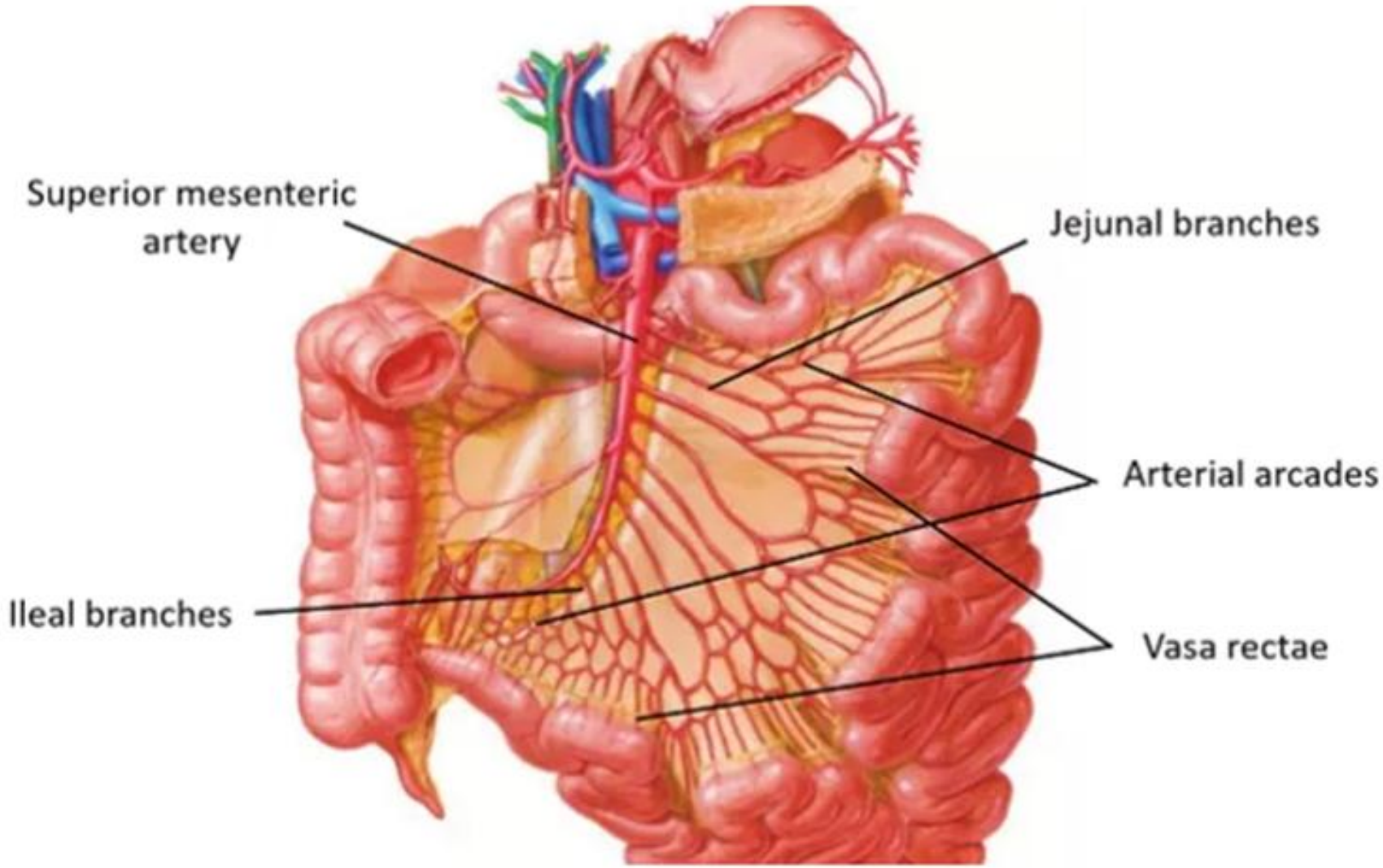


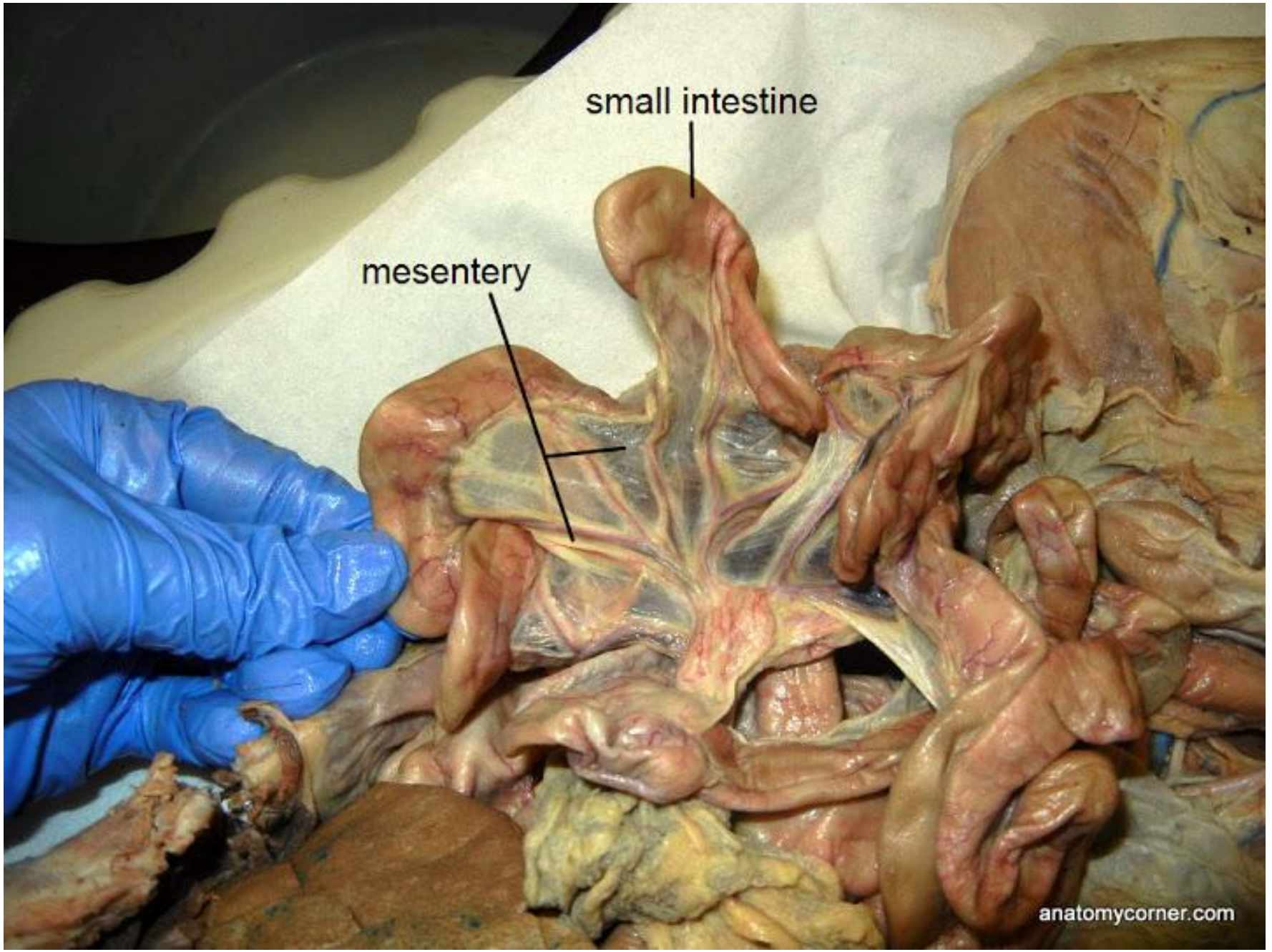


Jejunum and Ileum are freely mobile, attached to the posterior abdominal wall by the mesentery



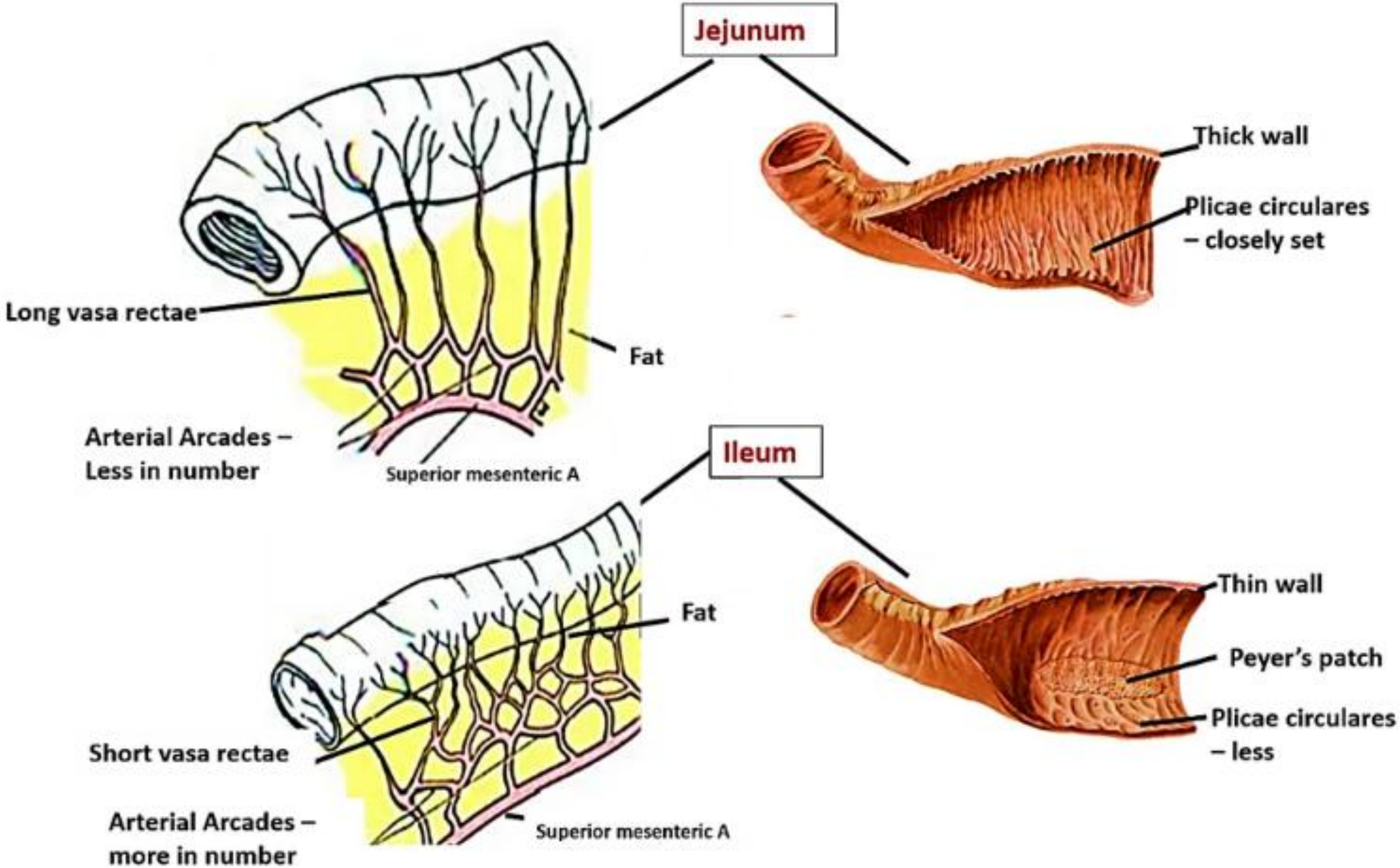
- Mesentery is a fan shaped fold of peritoneum that suspends jejunum and ileum from the posterior abdominal wall.
- Its attached margin (to posterior abdominal wall) is called **root of the mesentery**.
- The root is approx. 15 cm. long.
- It extends from the left side of the L2 vertebra to the right sacroiliac joint.


Superior mesenteric artery
Jejunal branches
Arterial arcades
Ileal branches
Vasa rectae


small intestine
mesentery
anatomycorner.com

Differences between Jejunum and Ilium

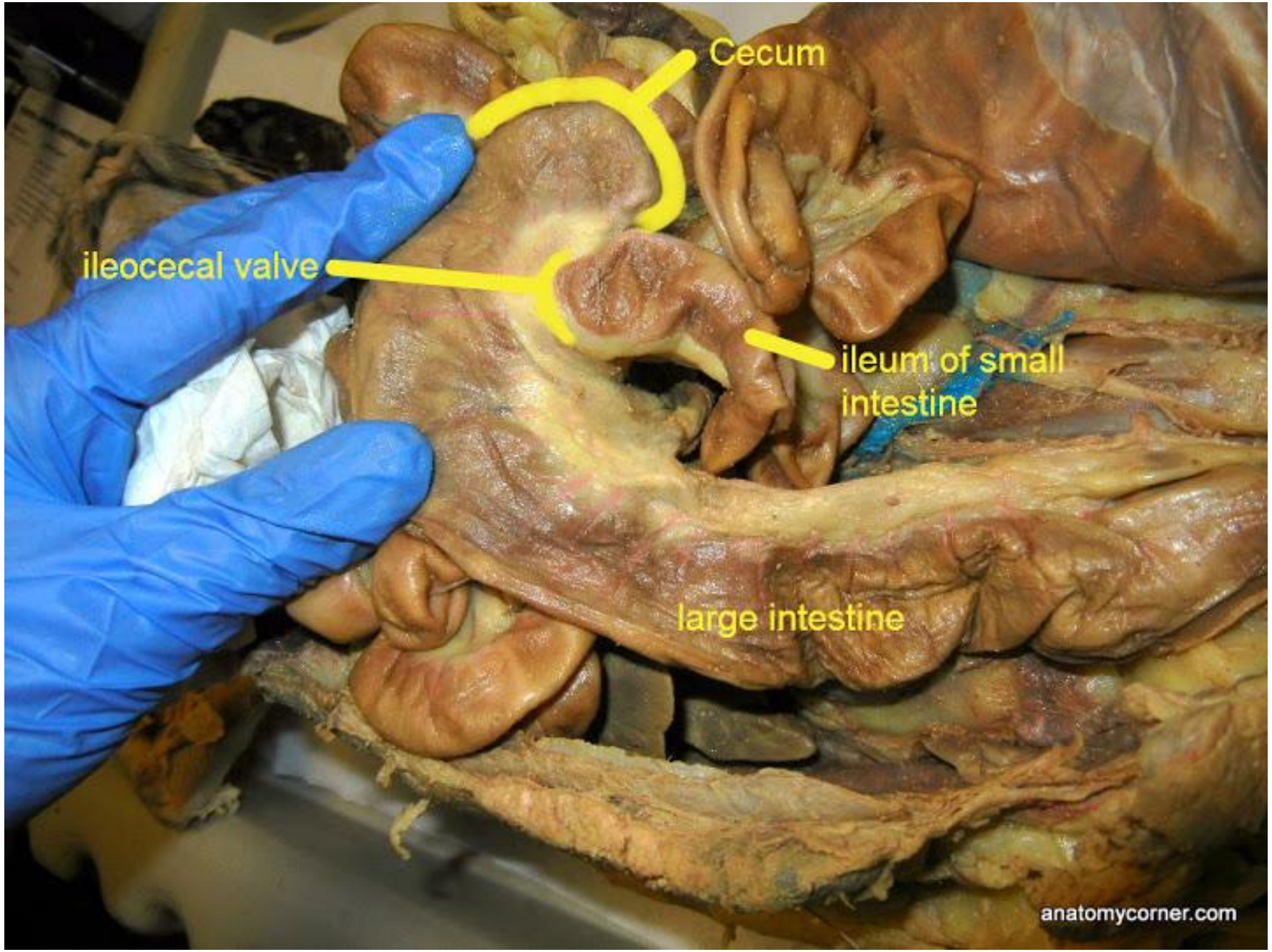
	JEJUNUM	ILEUM
LENGTH	Shorter (proximal 2/5) of SI	Longer (distal 3/5) of SI
DIAMETER	Wider	Narrower
WALL	Thicker (numerous and prominent plicae circulares)	Thinner (fewer and less prominent plicae circulares)
APPEARANCE	Redder (more vascular)	Light red (less vascular)
VESSELS	Less arterial arcades (long terminal branches)	More arterial arcades (short terminal branches)
MESENTERIC FAT	Small amount & away from intestinal border	Large amount & reach intestinal border
LYMPHOID TISSUE	Few aggregations	Numerous aggregations (Peyer's patches)


Jejunum
Thick wall
Plicae circulares – closely set
Long vasa rectae
Fat
Arterial Arcades – Less in number
Superior mesenteric A
Ileum
Thin wall
Fat
Peyer's patch
Plicae circulares – less
Short vasa rectae
Arterial Arcades – more in number
Superior mesenteric A

Jejunum and Ileum-Relations

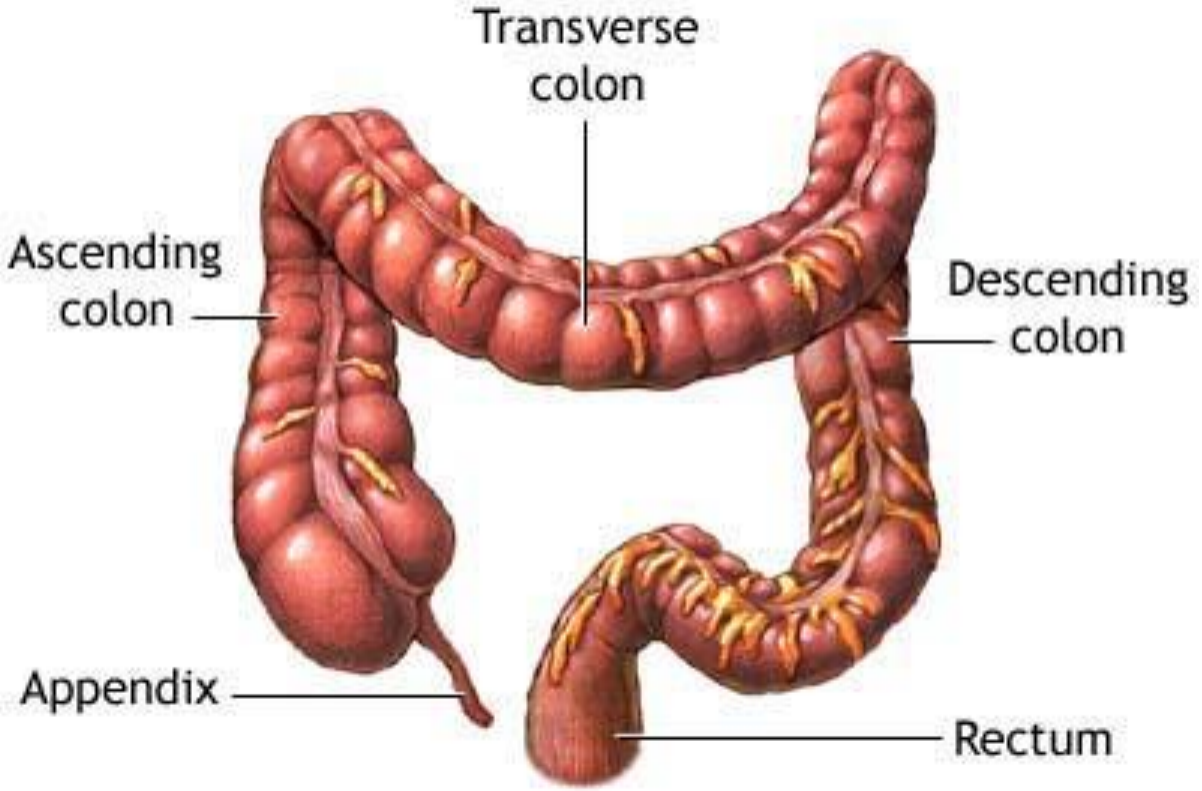
- Anterior:
  - Greater omentum
  - Anterior abdominal wall

- Posterior:
  - Retroperitoneal structures
  - Posterior abdominal wall


Cecum
ileocecal valve
ileum of small intestine
large intestine
anatomycorner.com

Large Intestine

- It is 90 cm to 150 cm long.
- Diameter is 4 to 6 cm
- Extends from the ileocecal valve to the anus and is divided into:
  - Cecum
  - The ascending colon
  - Transverse colon
  - Descending colon
  - Sigmoid colon
  - Rectum
  - Anal canal

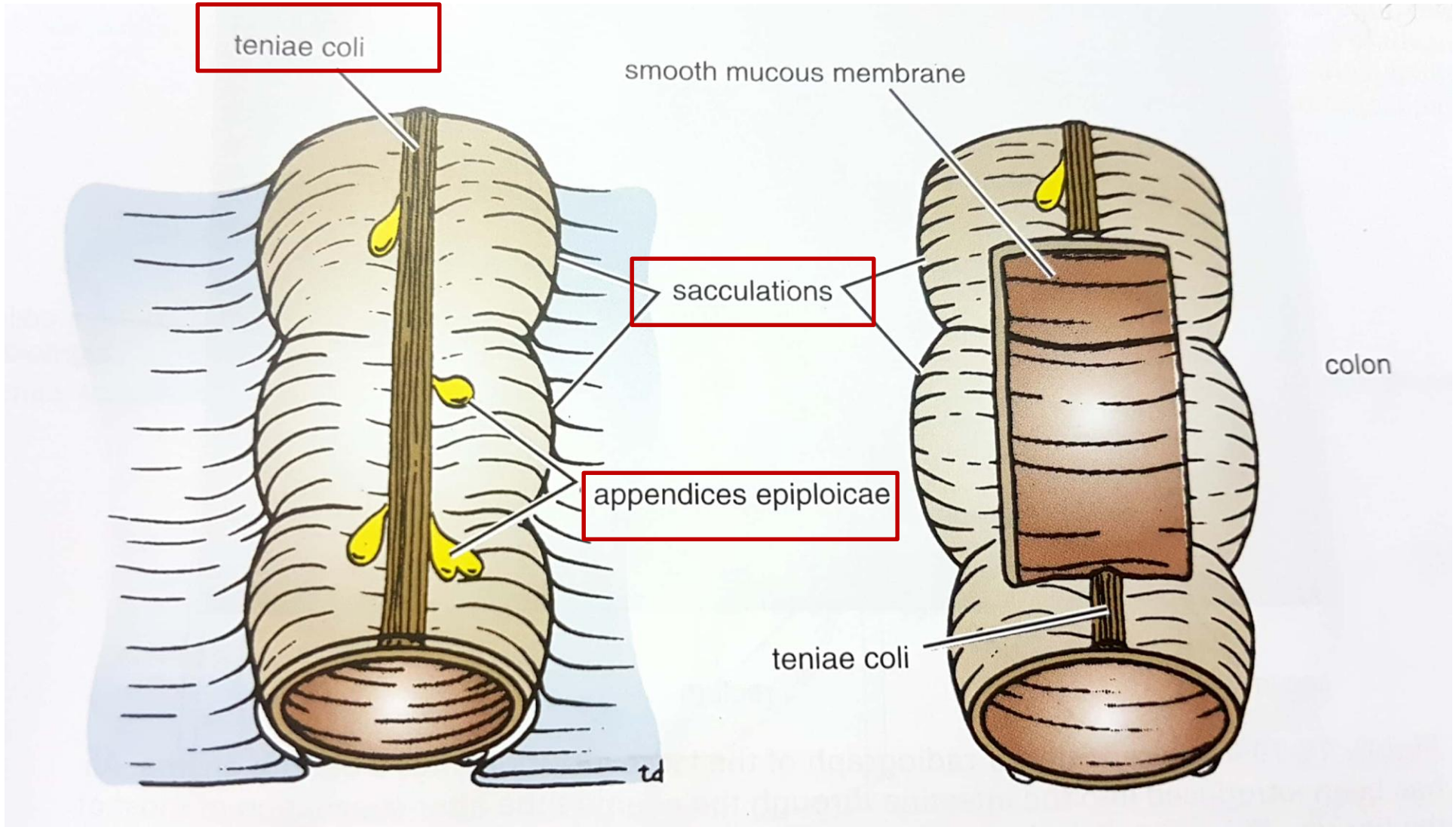


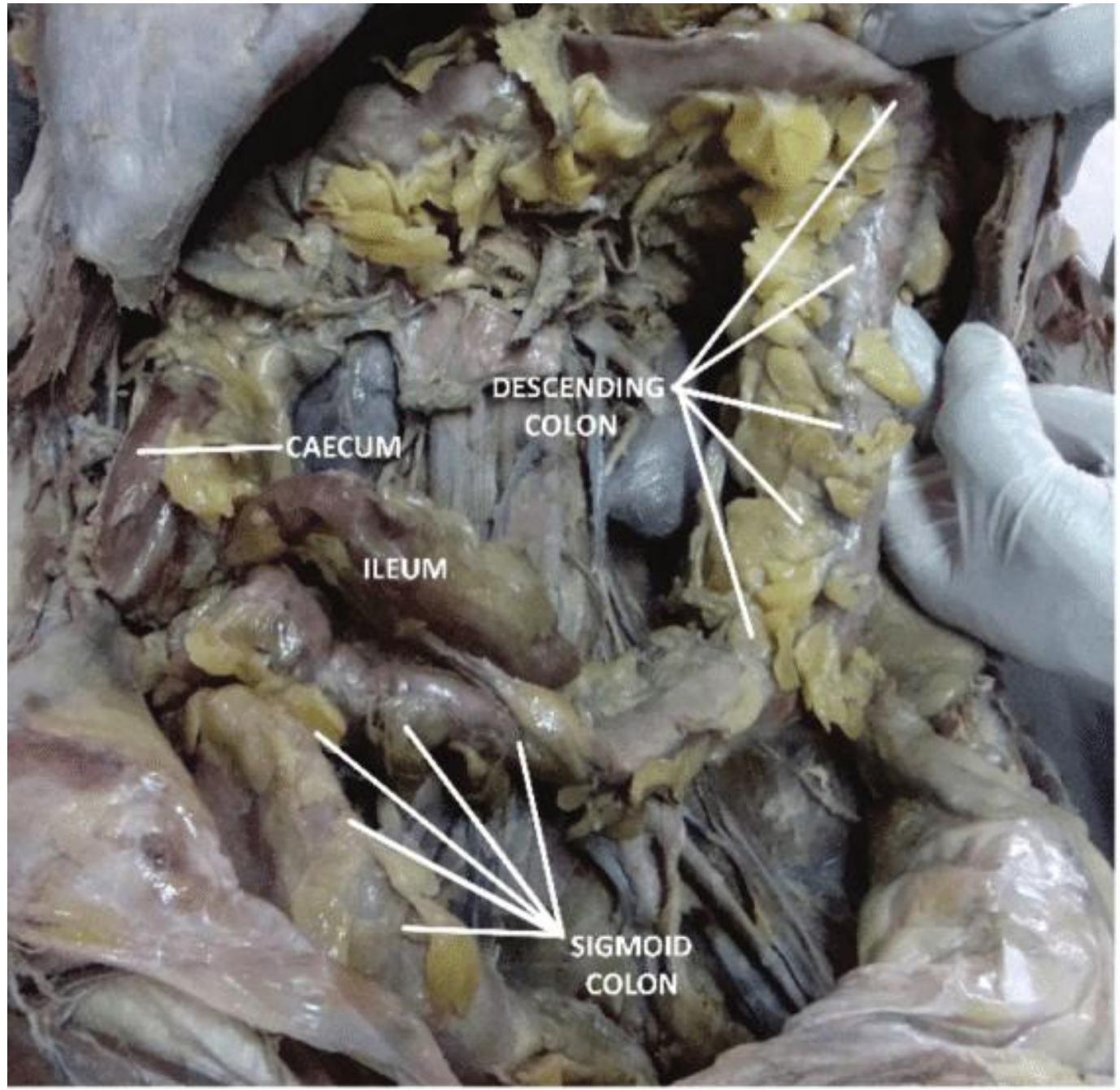
External Features of Large Intestine

- The presence of tenia coli: The longitudinal muscles of small intestine forms continuous layer around the gut, where it is collected into three bands (**the tenia coli**) in the large intestine.

- The presence of appendices epiploicae: The large intestine has fatty tags called appendices epiploicae**.**

- The presence of Sacculation/Haustration: The wall of large intestine is sacculated forming small pouches called **the haustra**


teniae coli
smooth mucous membrane
sacculations
appendices epiploicae
colon
teniae coli

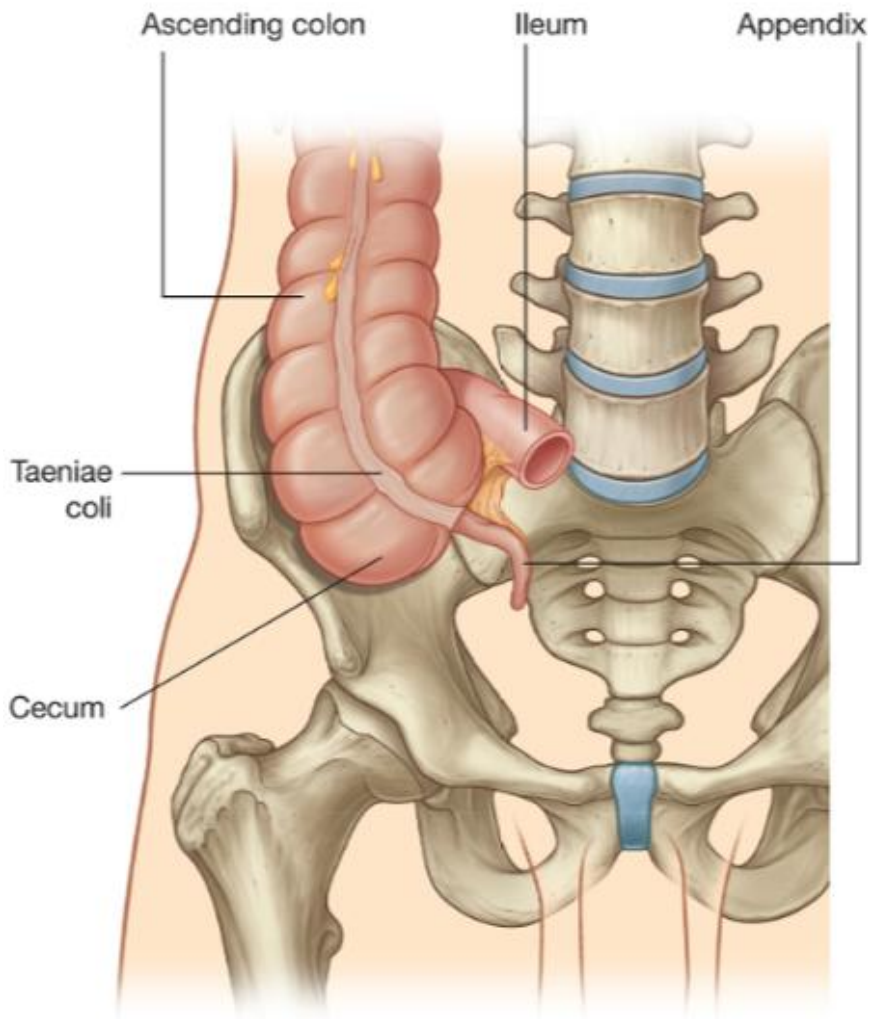

DESCENDING
COLON
CAECUM
ILEUM
SIGMOID
COLON

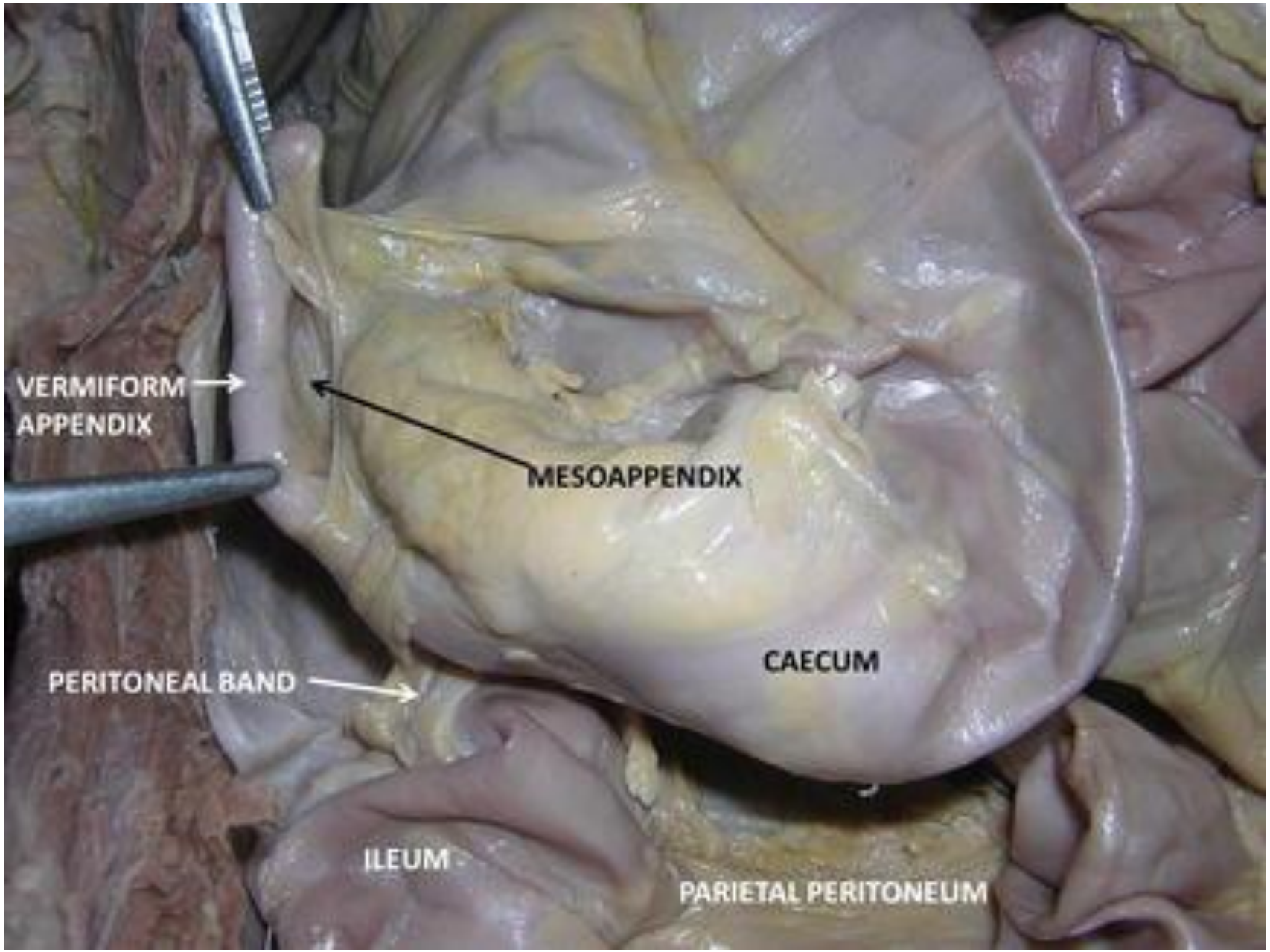
Cecum

- It is a blind-ended pouch within the right iliac fossa.
- It is about 6 cm long
- Completely covered with peritoneum

- The appendix is attached to its posteromedial surface.

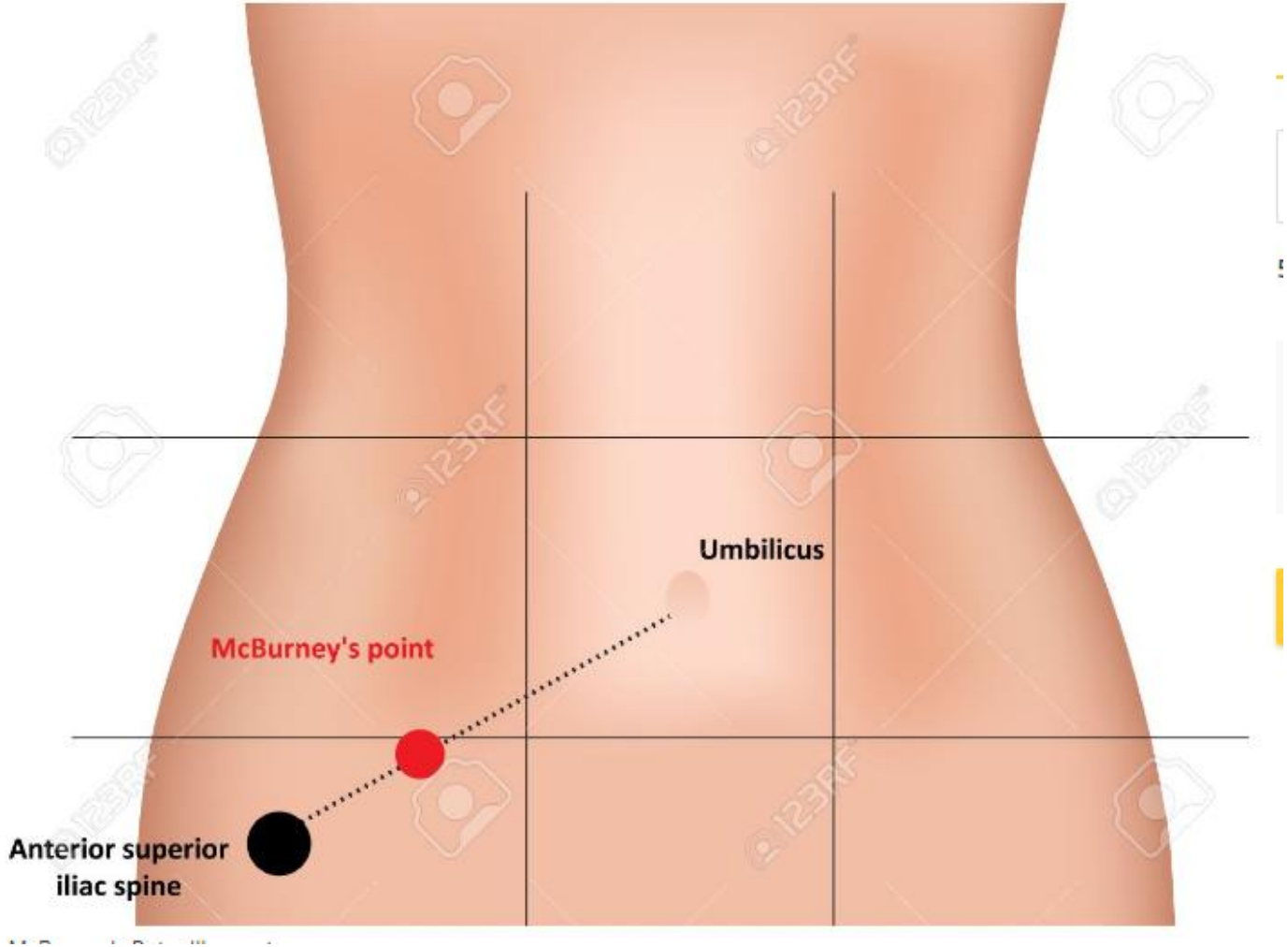
- **Appendix** is narrow muscular tube with large amount of lymphoid tissue in its wall, it has no known digestive role.




VERMIFORM
APPENDIX
MESOAPPENDIX
CAECUM
PERITONEAL BAND
ILEUM
PARIETAL PERITONEUM

- The base of appendix is situated one third up the line between the ASIS and umbilicus (**McBurney's point**).

- Tenderness pain (gentle pressure) in this point is a sign for **acute appendicitis**

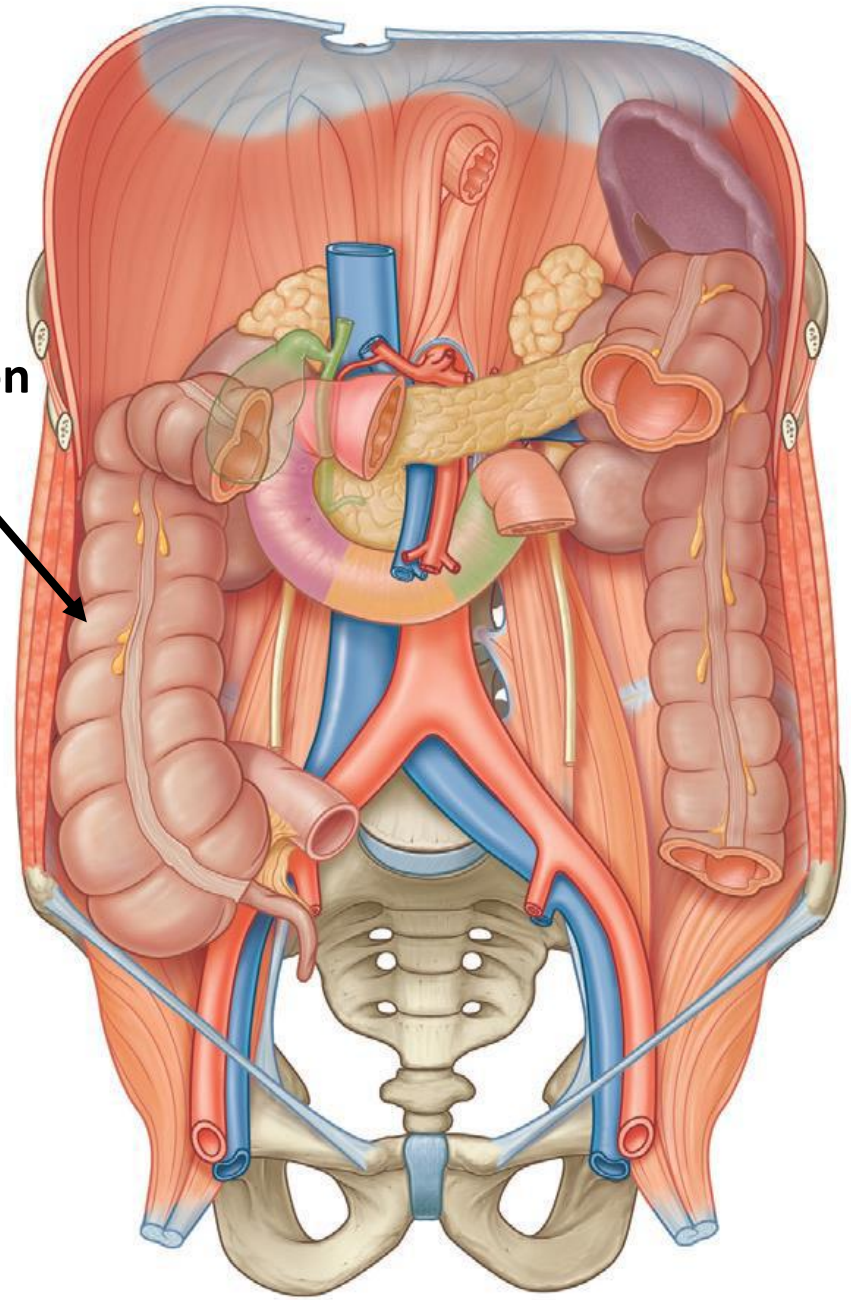


Ascending colon

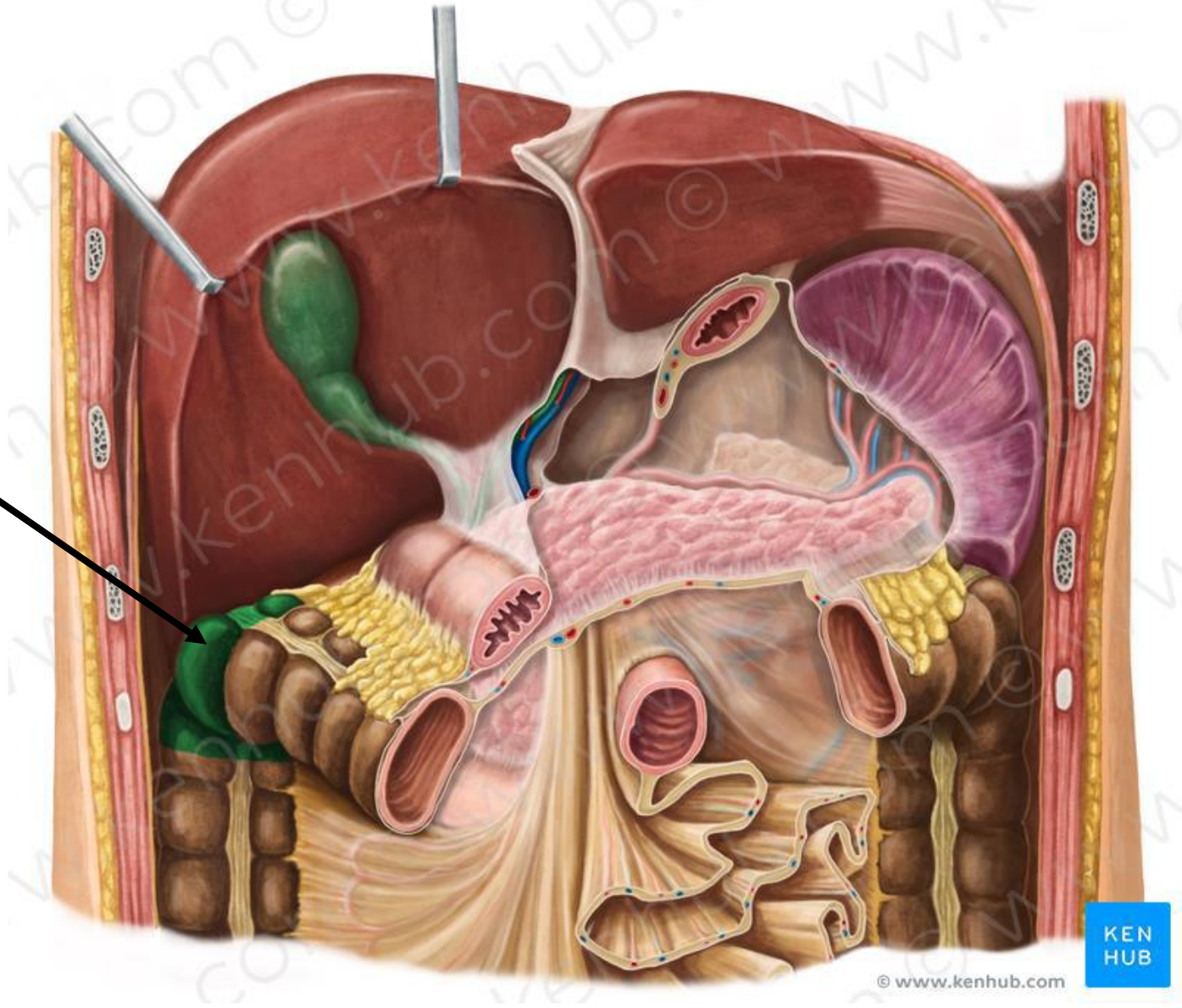
- It is about **5 inches** long.

- 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.

- **Fixed, retroperitoneal Organ:** The peritoneum covers the front and the sides of the ascending colon, binding it to the posterior abdominal wall.

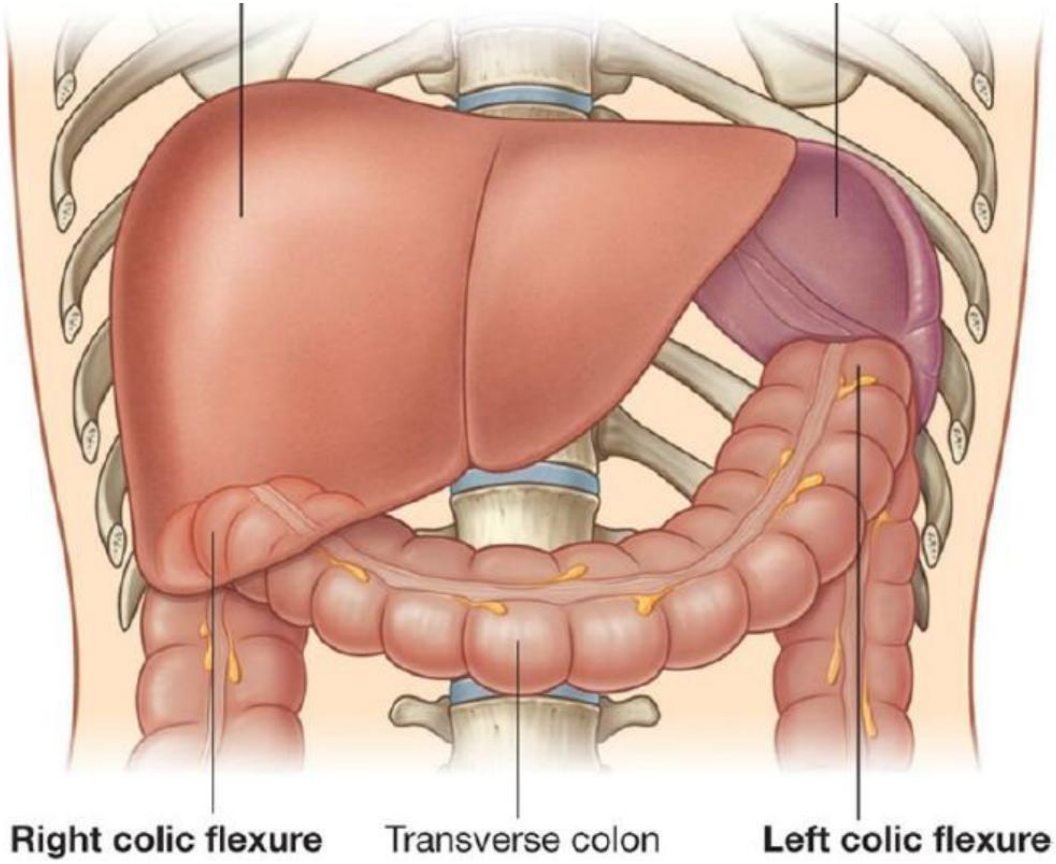


Right colic flexure (Hepatic flexure)



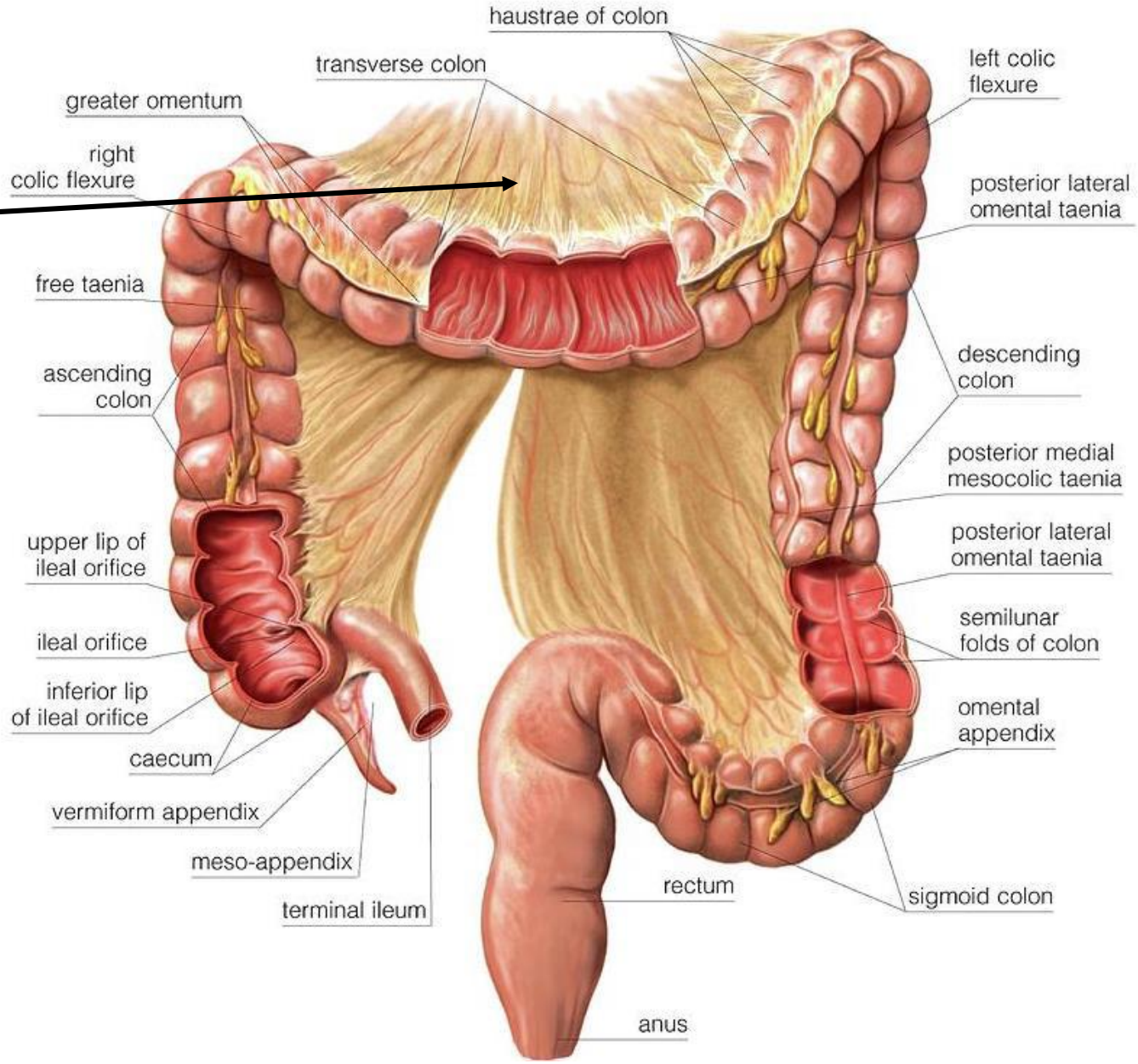
Transverse Colon

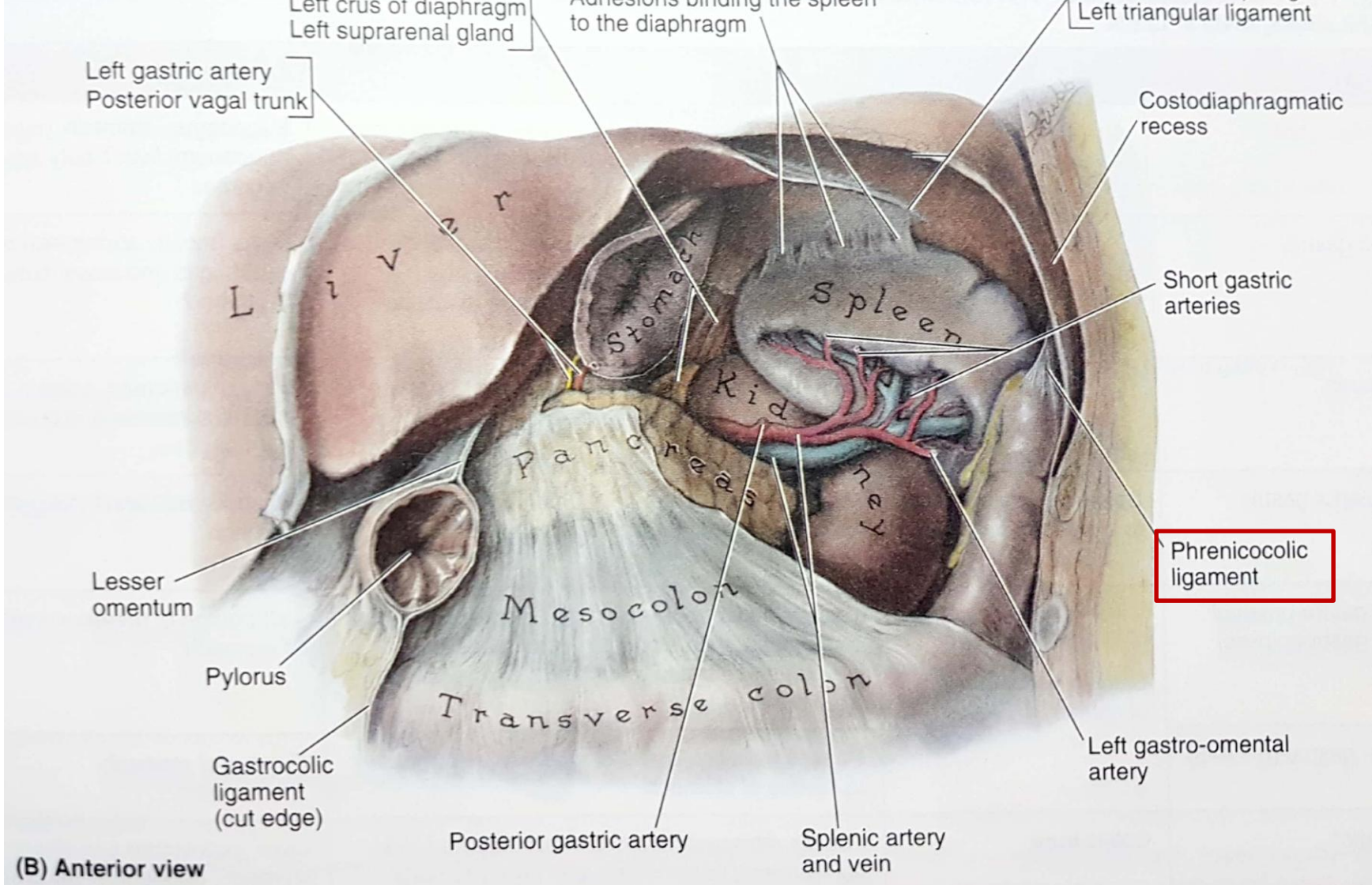
- Is about 20 inch long
- Extends across the abdomen, occupying the umbilical region.
  - Begins at the right colic flexure below the right lobe of the liver (**hepatic flexure**) and hangs downward, suspended by the transverse mesocolon from the pancreas**.**
  - It then ascends to the left colic flexure below the spleen(**splenic flexure**).
  - The left colic flexure is higher than the right colic flexure and is suspended from the diaphragm by the phrenicocolic ligament.



Transverse mesocolon

- It is completely covered by peritoneum and suspended by a peritoneal fold called transverse mesocolon.





(B) Anterior view

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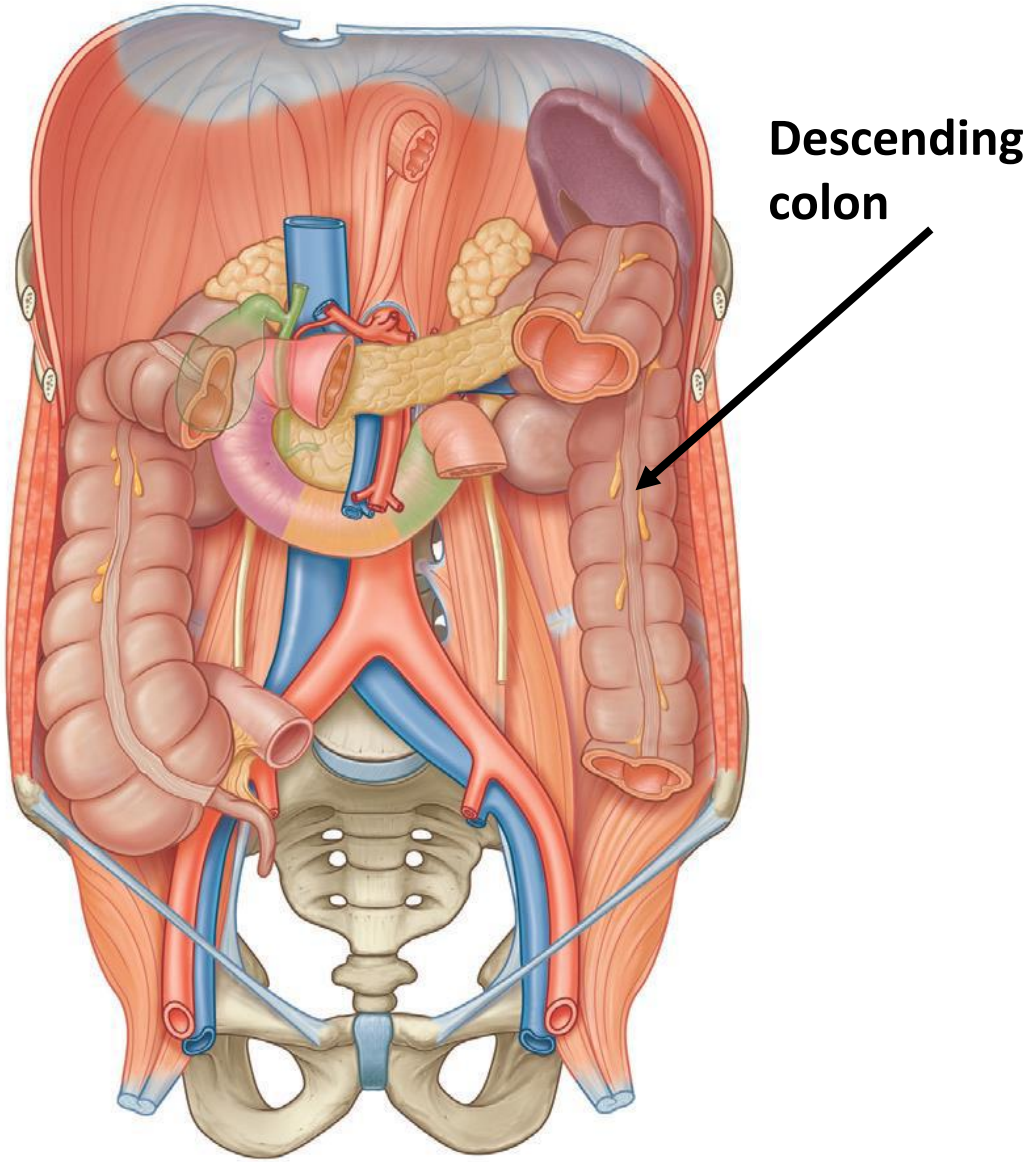
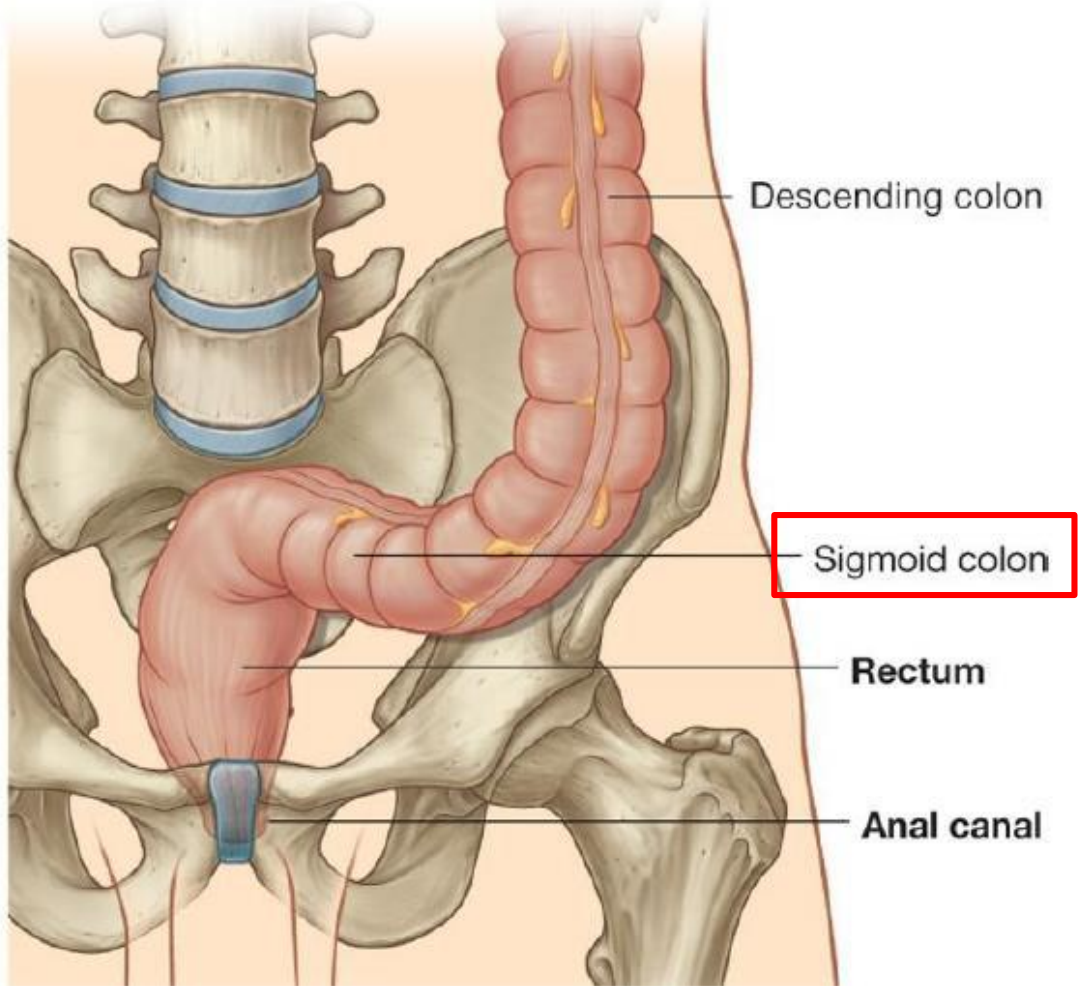
Descending Colon

- It is about **10 inches** long.
- It extends downward ***from the left colic flexure,*** *to the* ***sigmoid colon***.
- The peritoneum covers the front and the sides and binds it to the posterior abdominal wall (**retroperitoneal organ**).



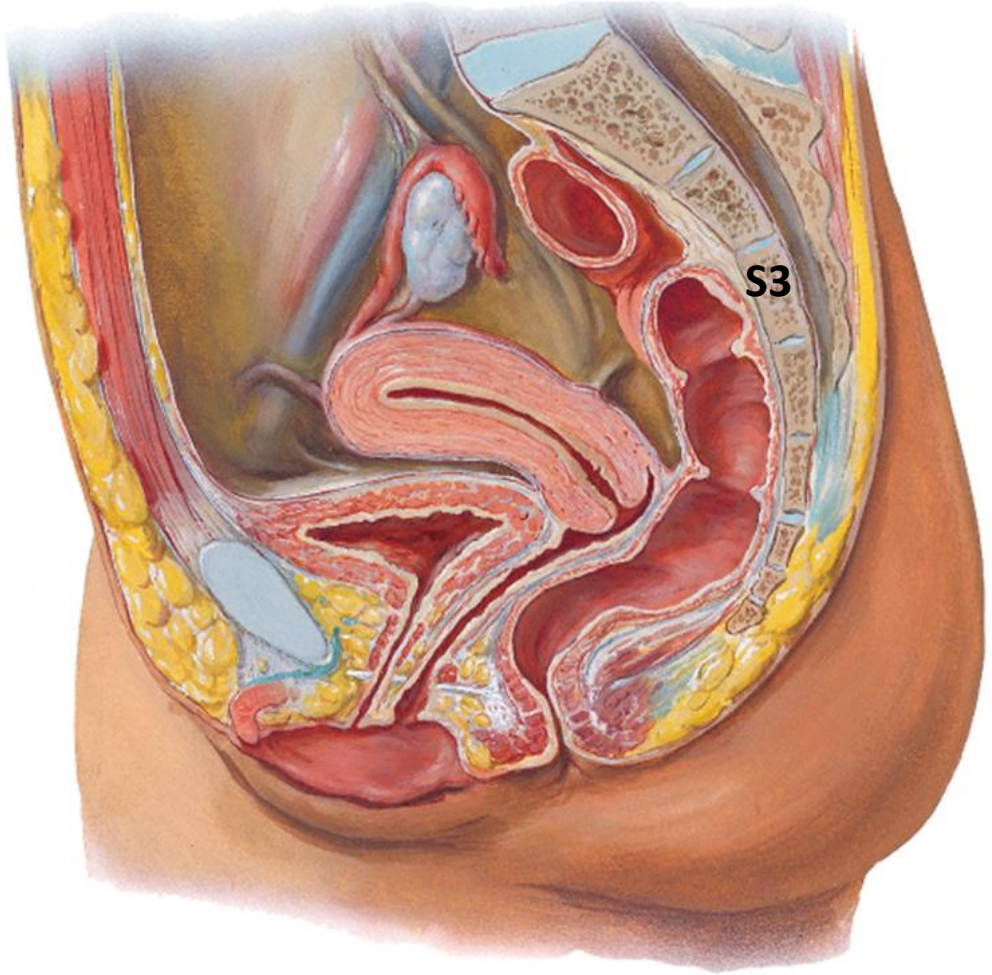
Sigmoid Colon

- It is **15 inches** long
- It extends from the end of descending colon and ends in front of the **3rd sacral vertebra** where the rectum begins.
- The sigmoid colon is attached to the posterior pelvic wall by the fan-shaped sigmoid mesocolon (**Intraperitoneal organ**)



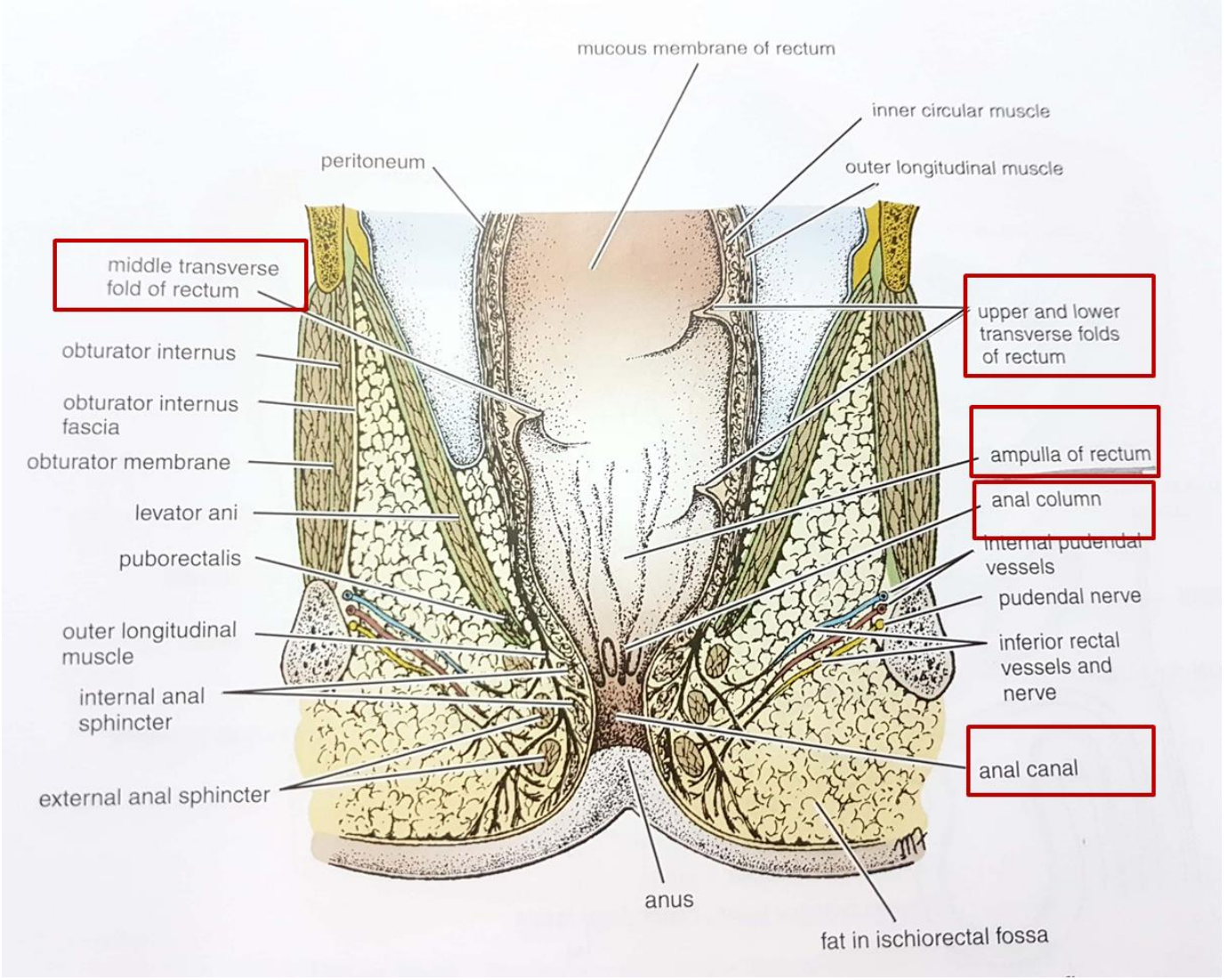
Rectum

- Begins in front of the third sacral vertebra as a continuation of the sigmoid colon.
- It passes downward, following the curve of the sacrum and coccyx, and ends in front of the tip of the coccyx by piercing the pelvic diaphragm and becoming continuous with the anal canal.
- Retroperitoneal organ



- Lower part is dilated to from the **rectal ampulla**
  - Rests on the pelvic diaphragm
  - Holds the fecal mass until defecation

- The mucus membrane of the rectum together with the circular muscle layer form three semicircular folds, two on the left and one on the right, they are called **transverse rectal folds**

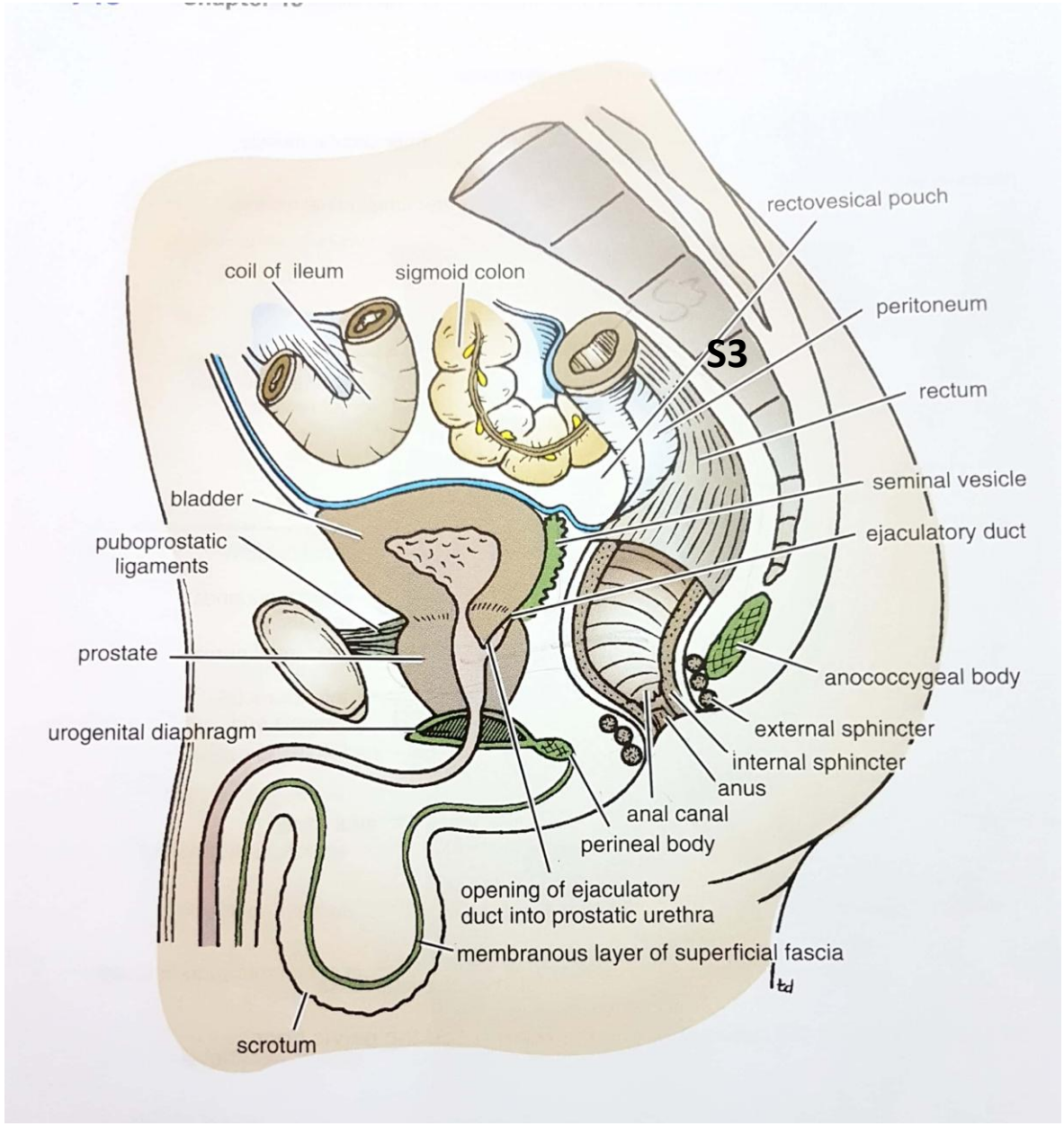


Rectum -relations

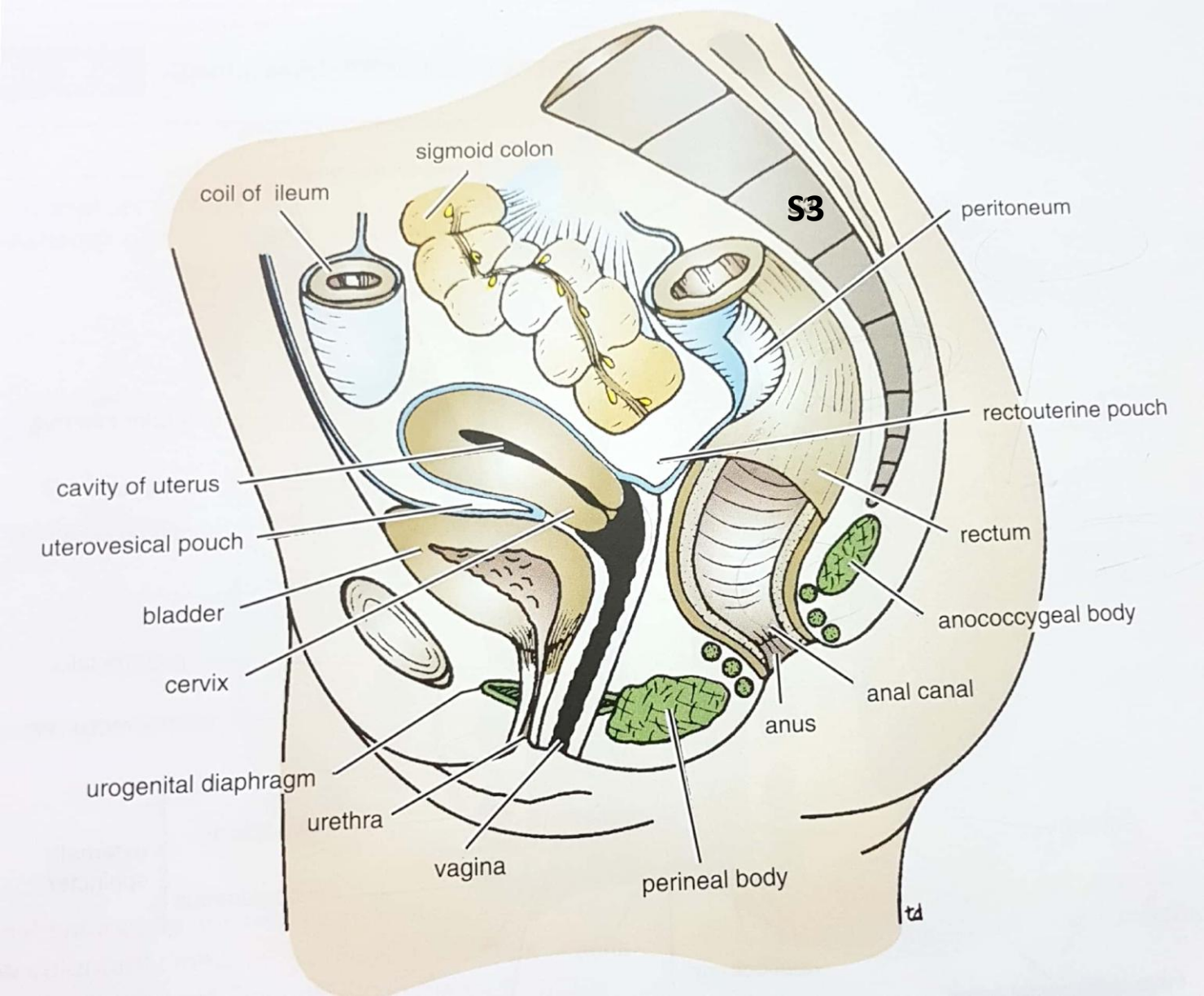
- **Anteriorly:**
  - **In male:** Rectovesical pouch, sigmoid colon , coils of ileum, bladder, termination of vas deferens, seminal vesicles, and prostate.
  - **In female :** Rectouterine pouch (pouch of Douglas) and vagina.

- **Posteriorly:** Sacrum and coccyx, piriformis and coccygeus muscles, levatores ani muscles, sacral plexus, and the sympathetic trunks

Rectum – relations in male



Rectum – relations in female

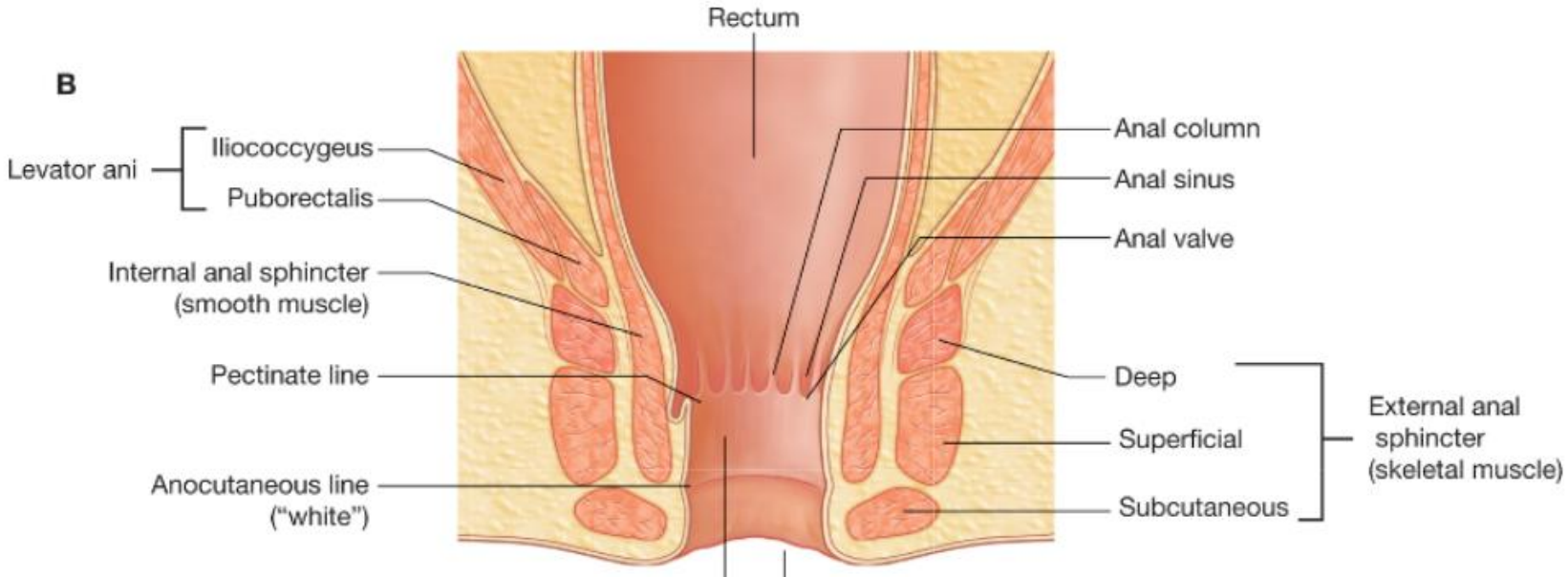


Anal canal

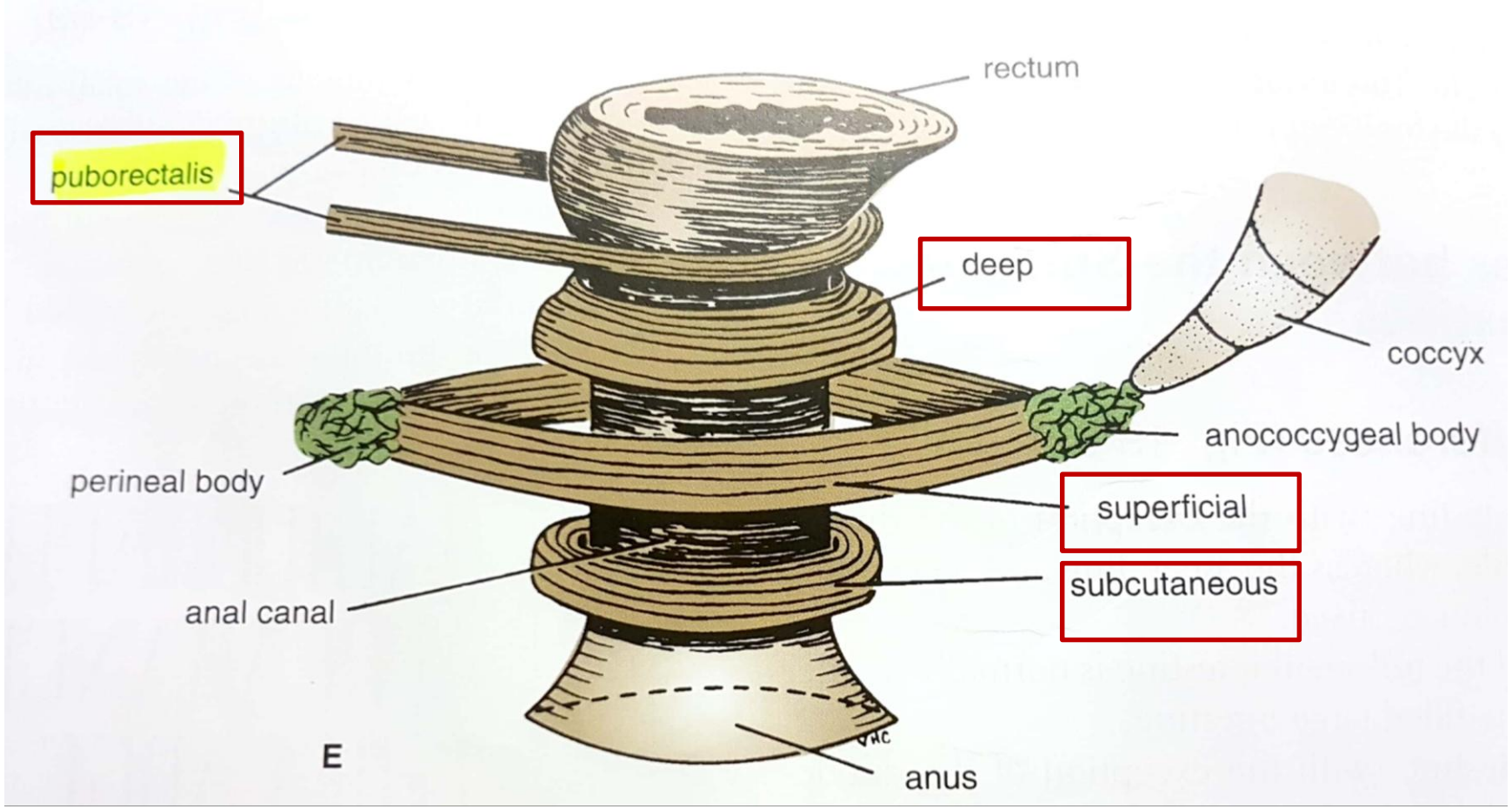
- It is about 4 cm long
- Passes **downward and backward** from the rectal ampulla to the anus .
- The mucus membrane of the upper half forms vertical folds called **anal columns**.
- The lower half is smooth and merge with the skin of anus.

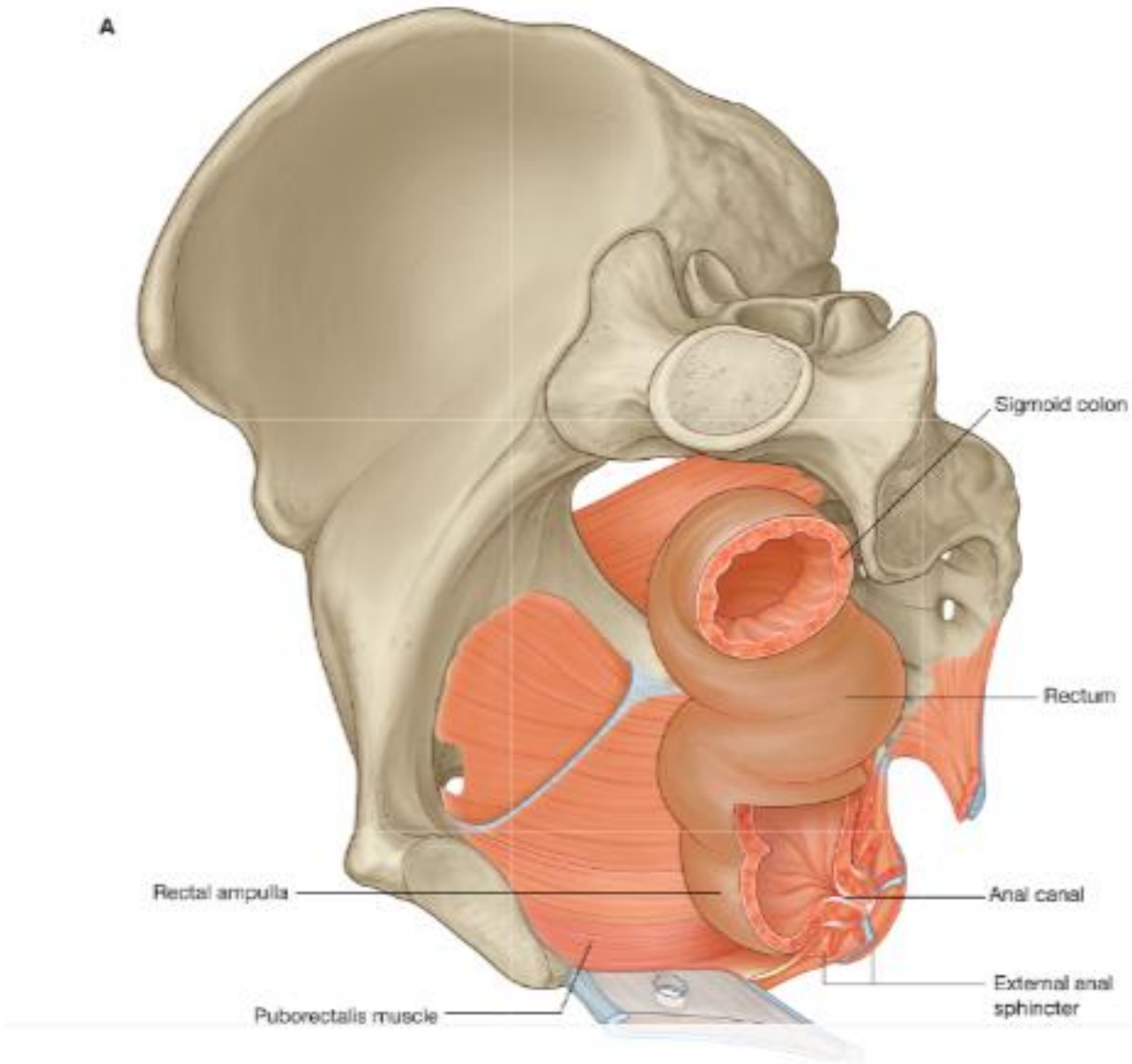
- The circular coat is thickened at the upper end of canal forming the **involuntary internal sphincter**

- The internal sphincter surrounded by a collar of skeletal muscle called **voluntary external sphincter** which is divided into three parts.



Puborectalis fibers of levatores ani muscles form sling pass backward around the junction of the rectum and anal canal pushing them forward so the rectum join the anal canal at cute angle




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

Thank you

Ayman.alzubi@yu.edu.jo