Gastro-intestinal Module

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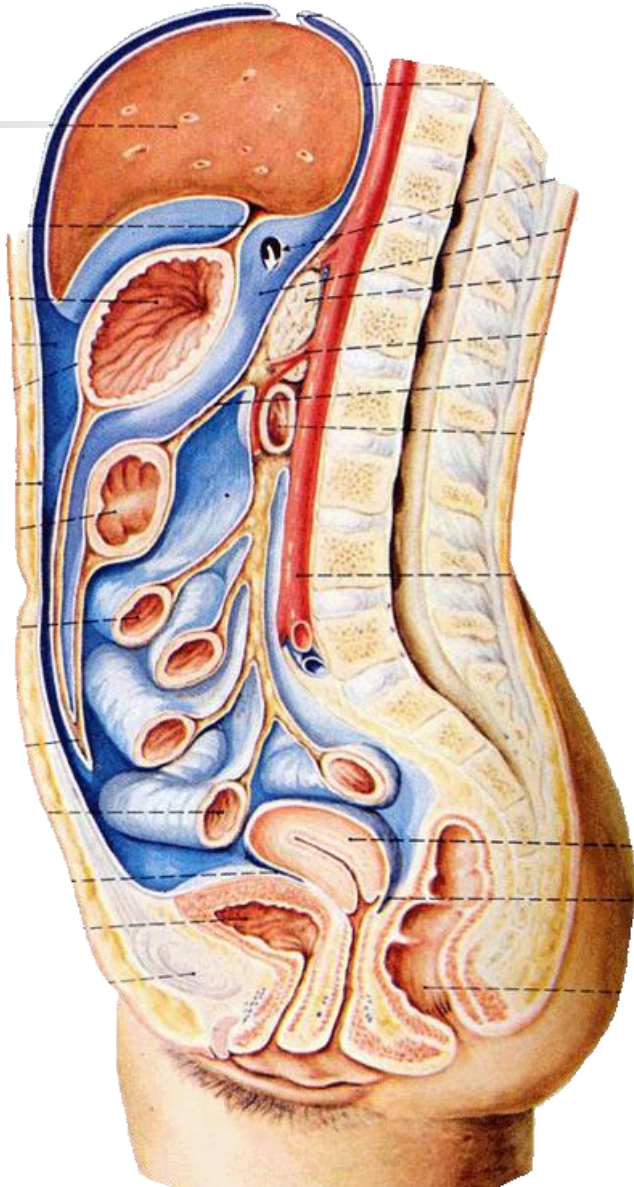
The Peritoneum and the Diaphragm

The Peritoneum

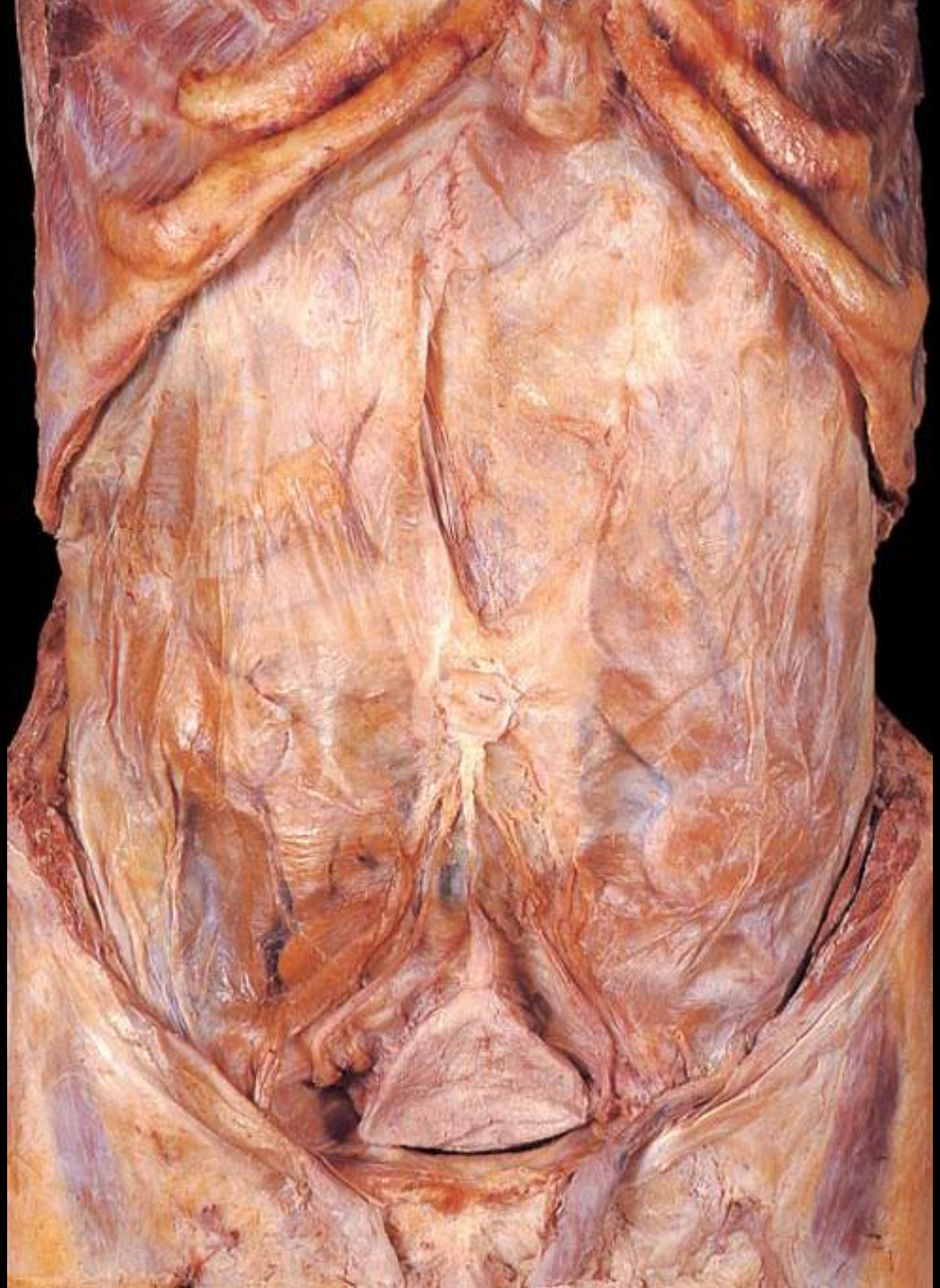


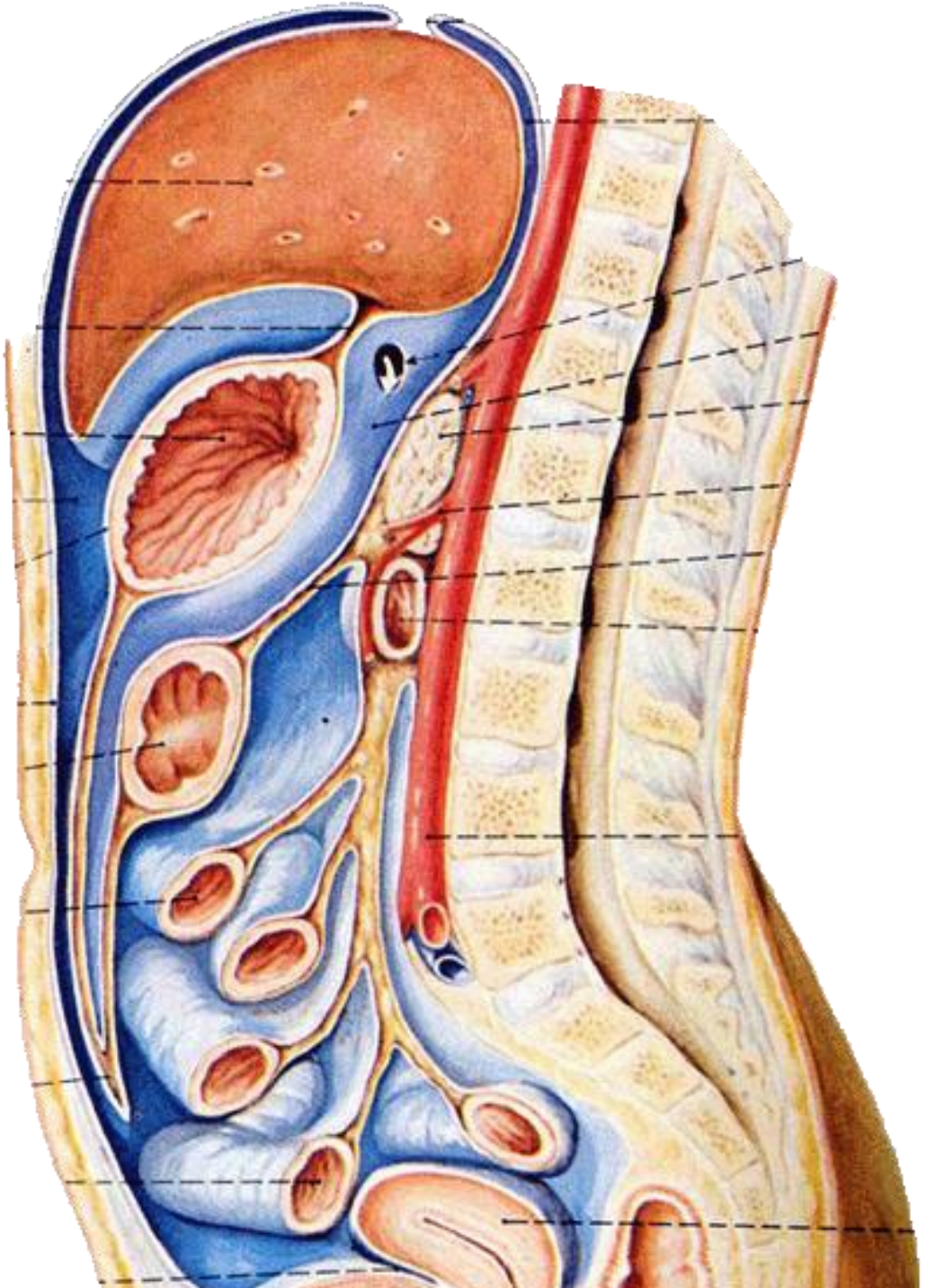
General features

- The peritoneum is a thin serous membrane that line the walls of the abdominal and pelvic cavities and cover the organs within these cavities

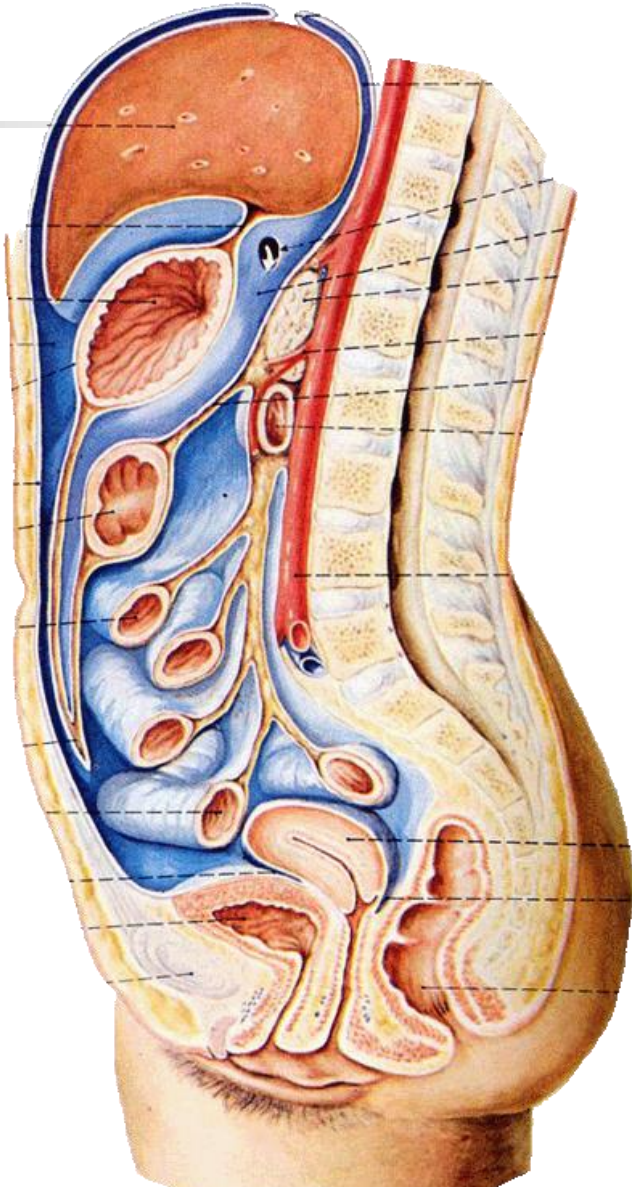
- **Parietal peritoneum** – lines the walls of the abdominal and pelvic cavities

- **Visceral peritoneum** – covers the organs





The Peritoneum



General features

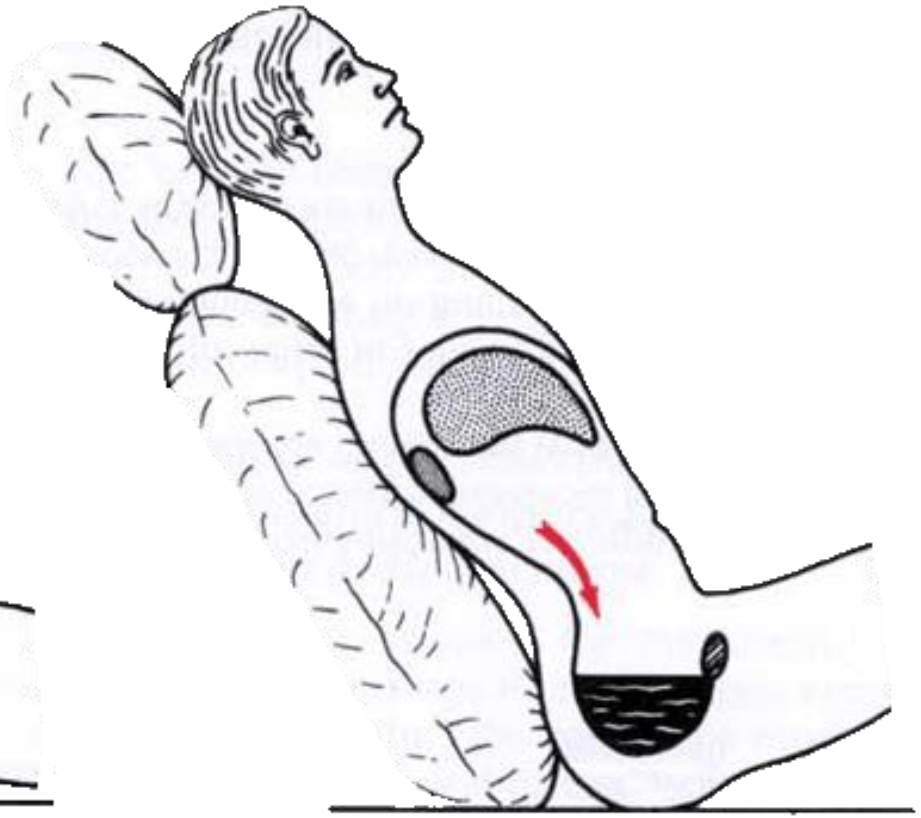
- **Peritoneal cavity** – the potential space between the parietal and visceral layer of peritoneum

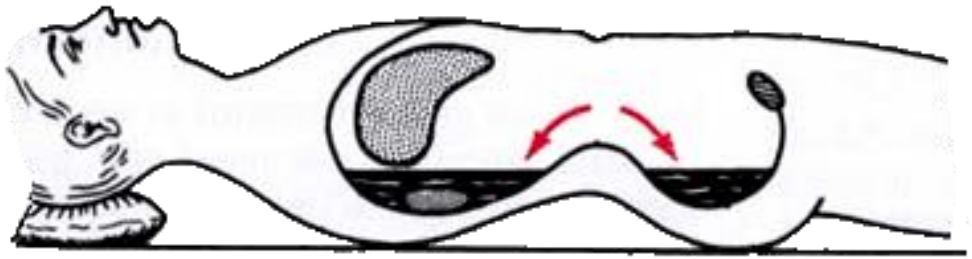
- In males, its a closed sac, but in females, there is a communication with the exterior through the ***uterine tubes, the uterus***, and the ***vagina***

The Peritoneum

Function

- Secretes a lubricating serous fluid that continuously moistens the associated organs
- Absorb
- Support viscera





The Relationship between Viscera and Peritoneum

- ***Completely covered viscera***

Viscera completely surrounded by peritoneum, example, stomach, superior part of duodenum, jejunum, ileum …etc.

- ***Partially covered viscera***

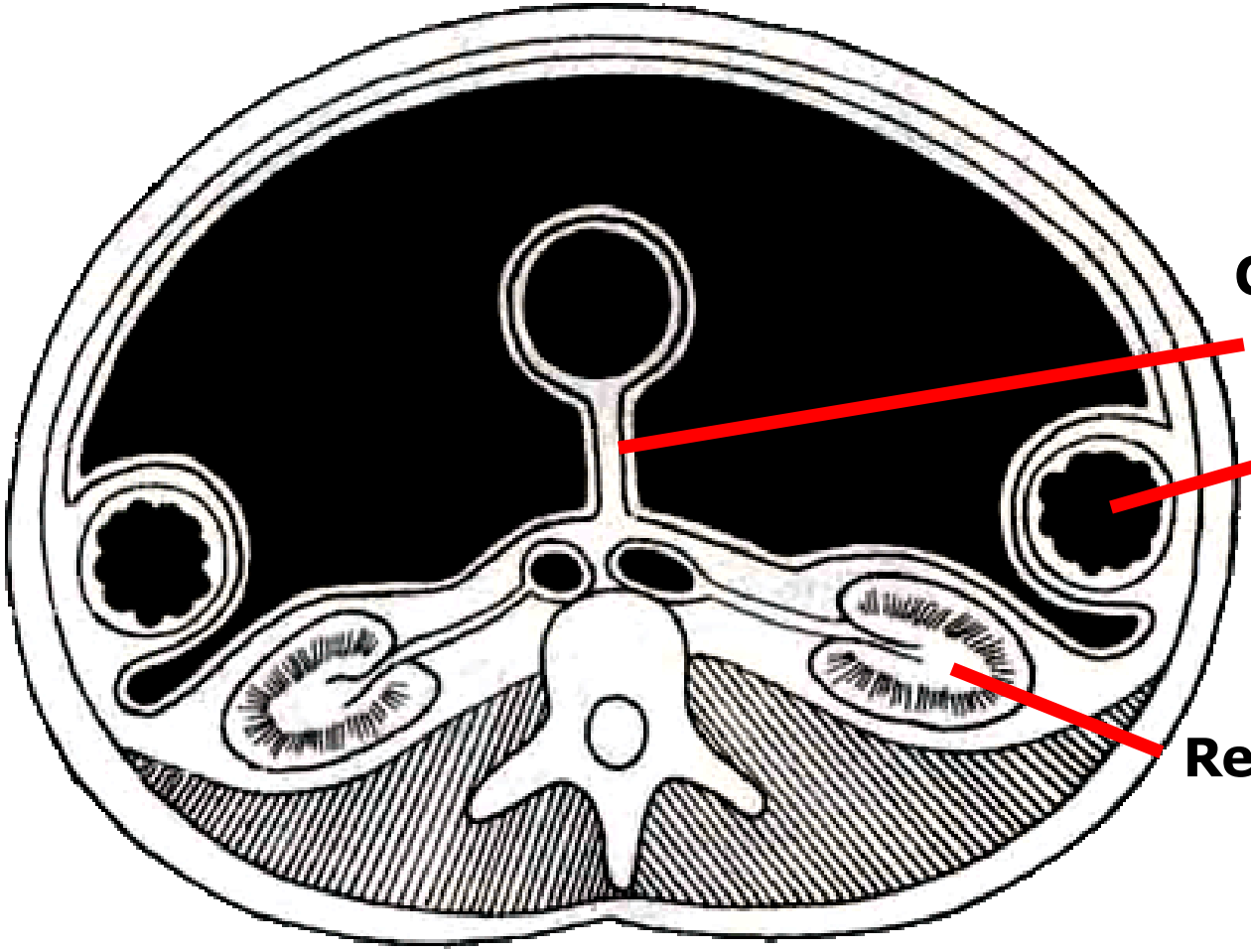
Most part of viscera surrounded by peritoneum leaving the back uncovered or leaving bare areas, example, liver, gallbladder, ascending and descending colon … etc.

The Relationship between Viscera and Peritoneum

- ***Retroperitoneal viscera*** –

Some organs lie on the posterior abdominal wall and are covered by peritoneum on their anterior surfaces only, example, kidney, suprarenal gland, pancreas … etc.

The Relationship between Viscera and Peritoneum



Completely Covered Viscera

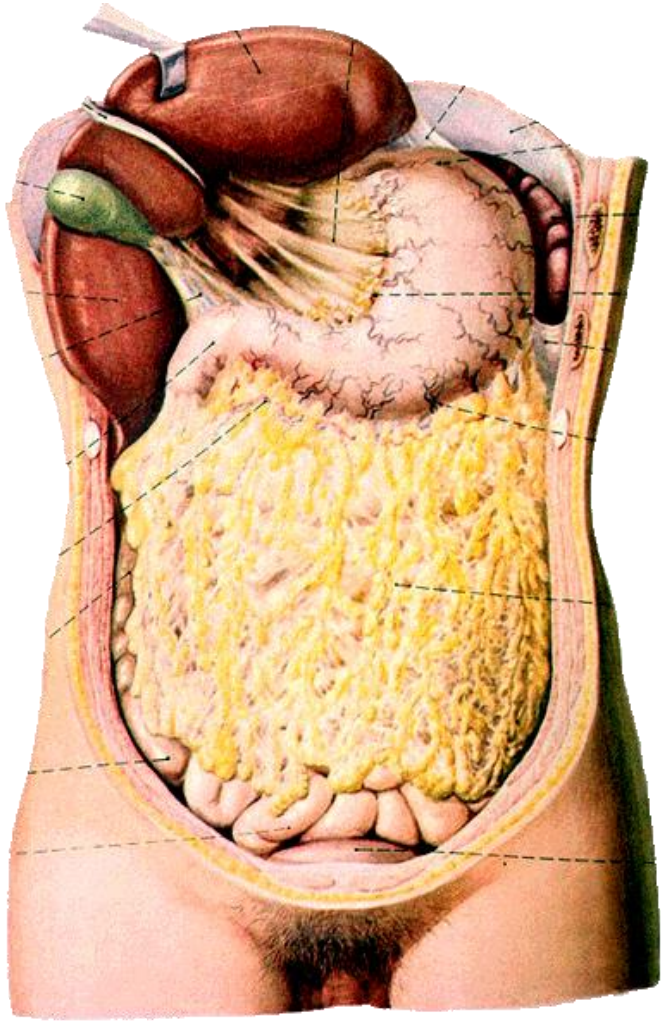
Partially Covered Viscera

Retroperitoneal viscera

Structures formed by the Peritoneum

Omentum

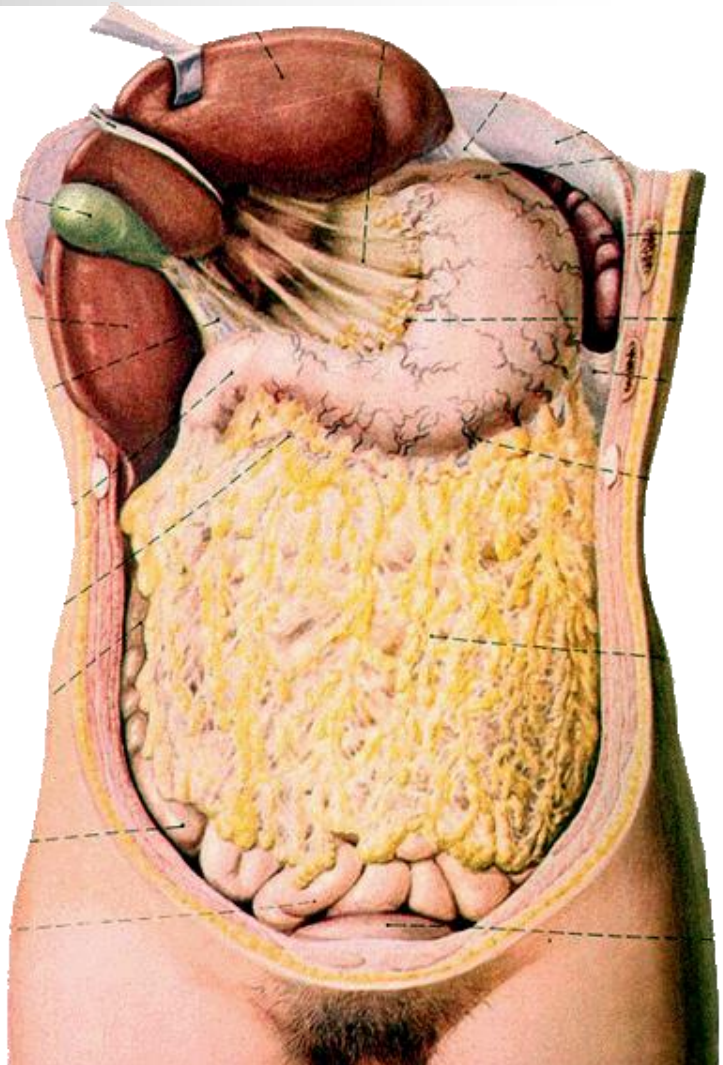
Two layered fold of peritoneum that extends from stomach to adjacent organs



Peritoneal Omenta

Lesser Omentum

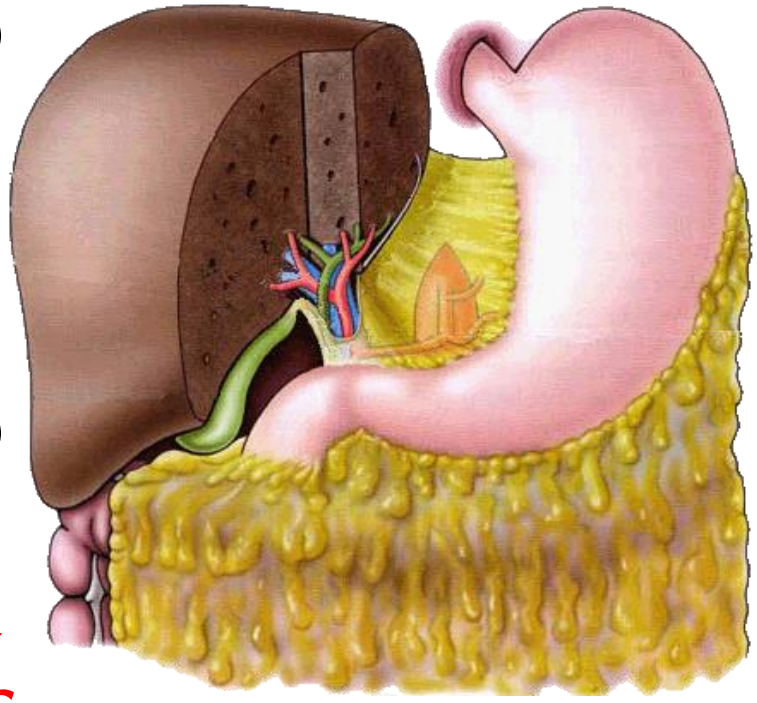
Two-layered fold of peritoneum which extends from porta hepatis of liver to lesser curvature of stomach and superior part of duodenum



Lesser Omentum

- ***Gastro-hepatic ligament***

Extends from porta hepatis to lesser curvature of stomach



- ***Hepato-duodenal ligament***

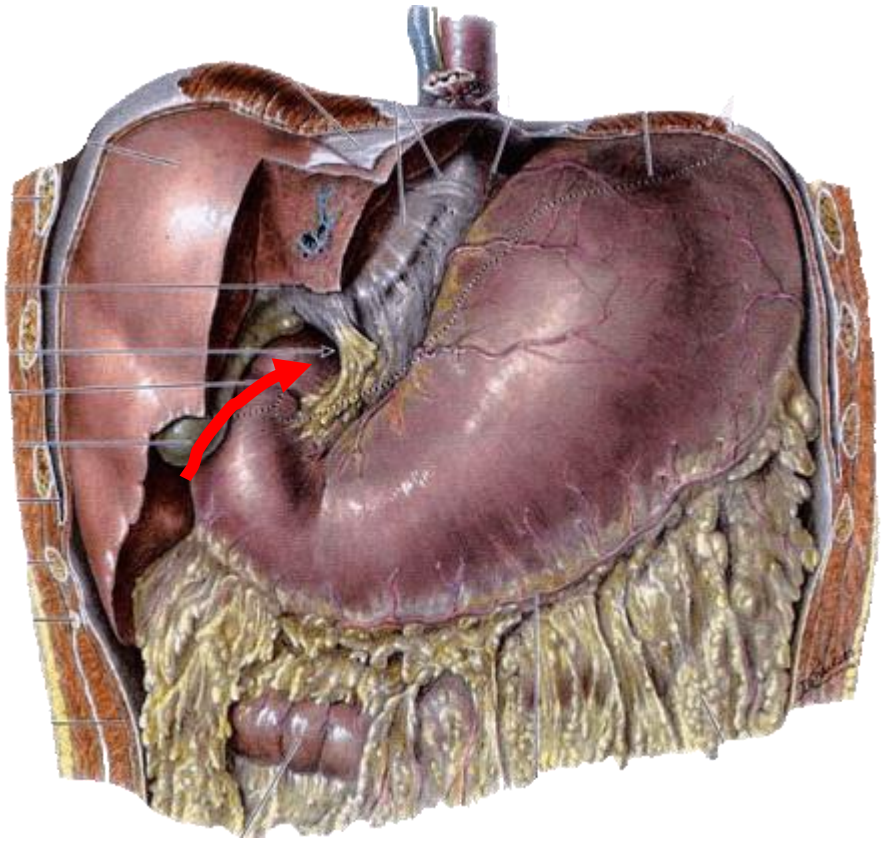
Extends from porta hepatis to superior part of duodenum

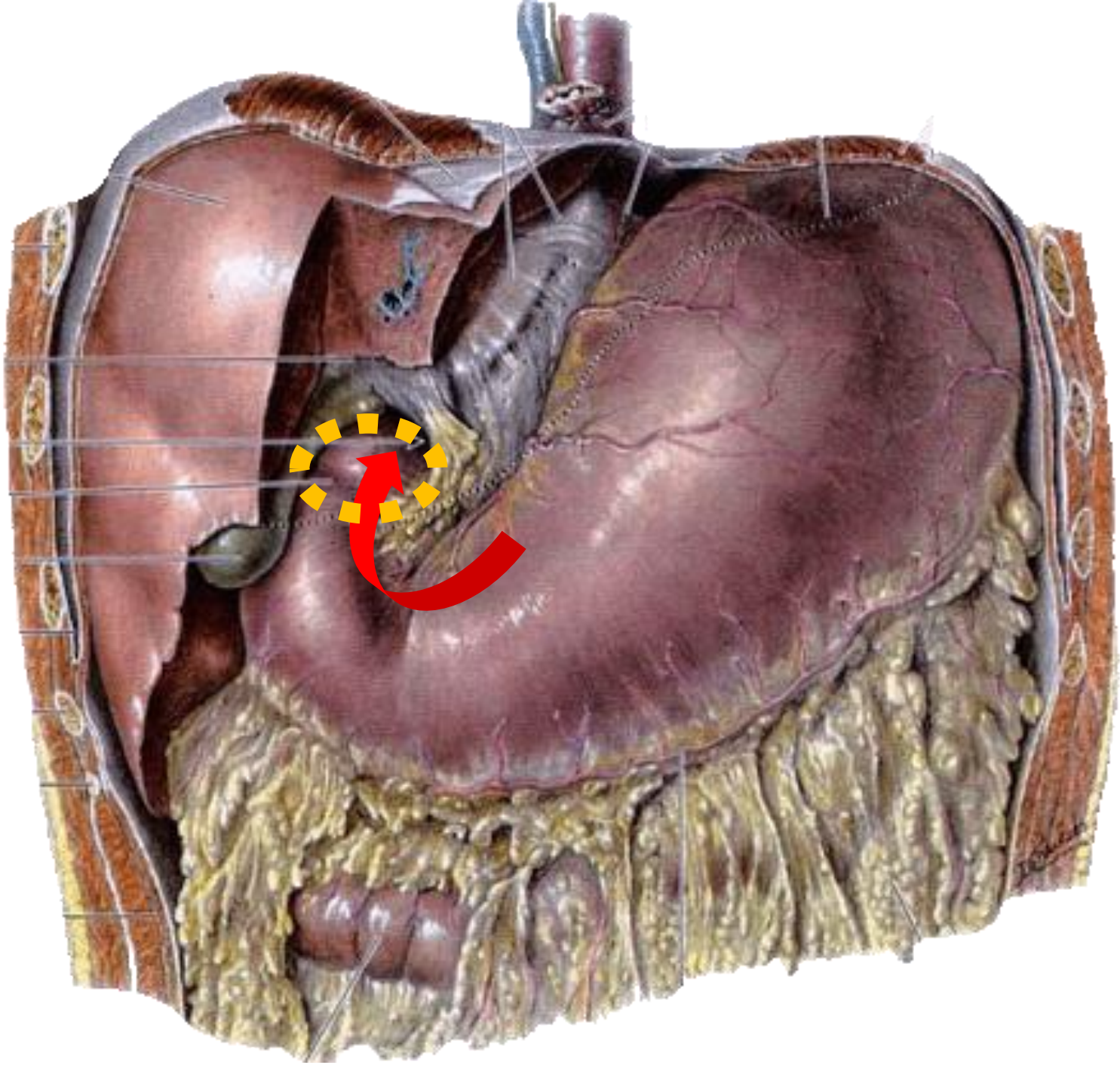
  - Contains *common bile duct, proper hepatic a. and hepatic portal v*.

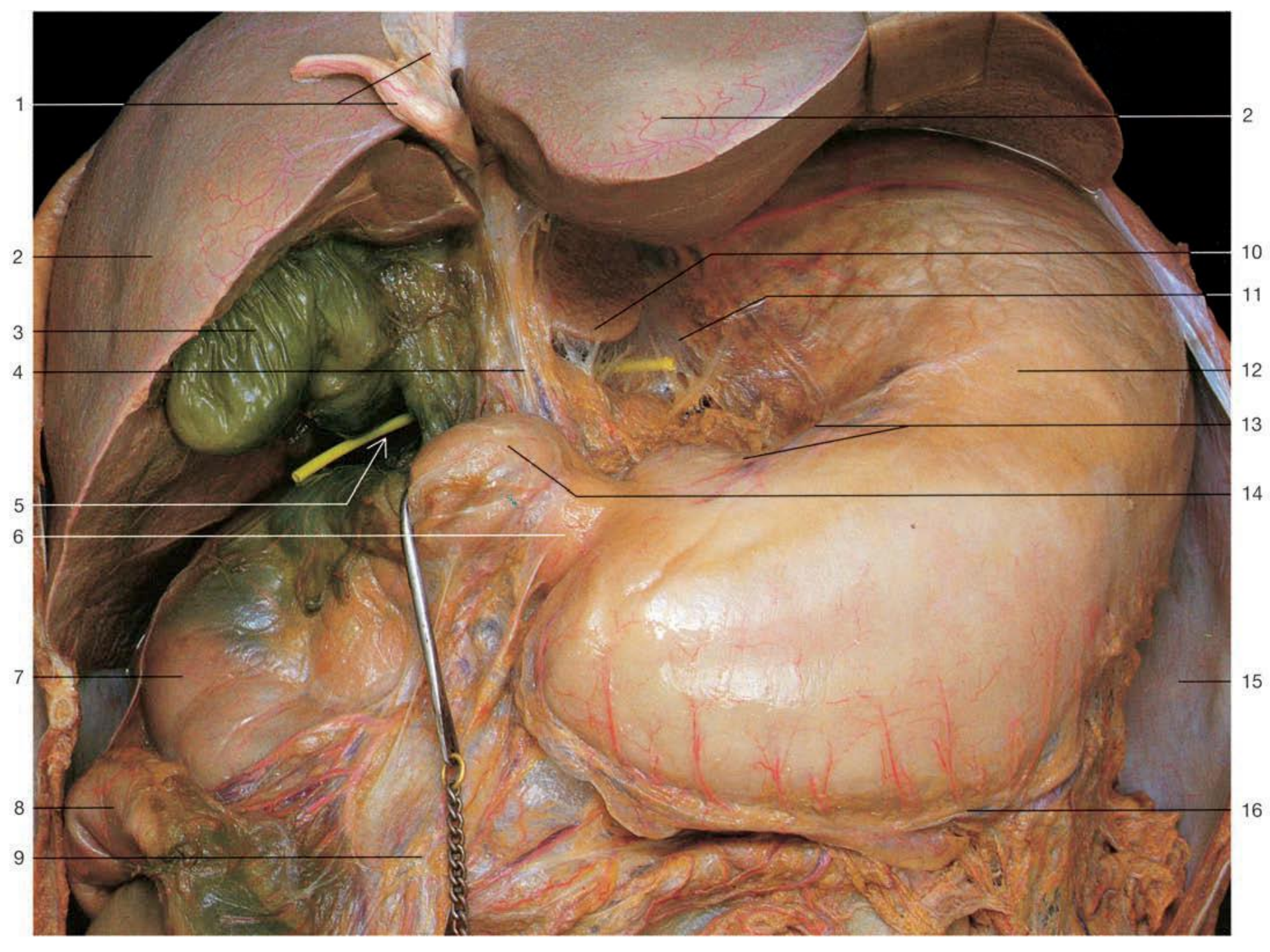
Omental Foramen / Epiploic Foramen

- Behind the right border of hepatoduodenal ligament

- Superior – caudate lobe of liver
- Inferior – superior part of duodenum
- Anterior – hepato-dudenal ligament
- Posterior – peritoneum covering the inferior vena cava



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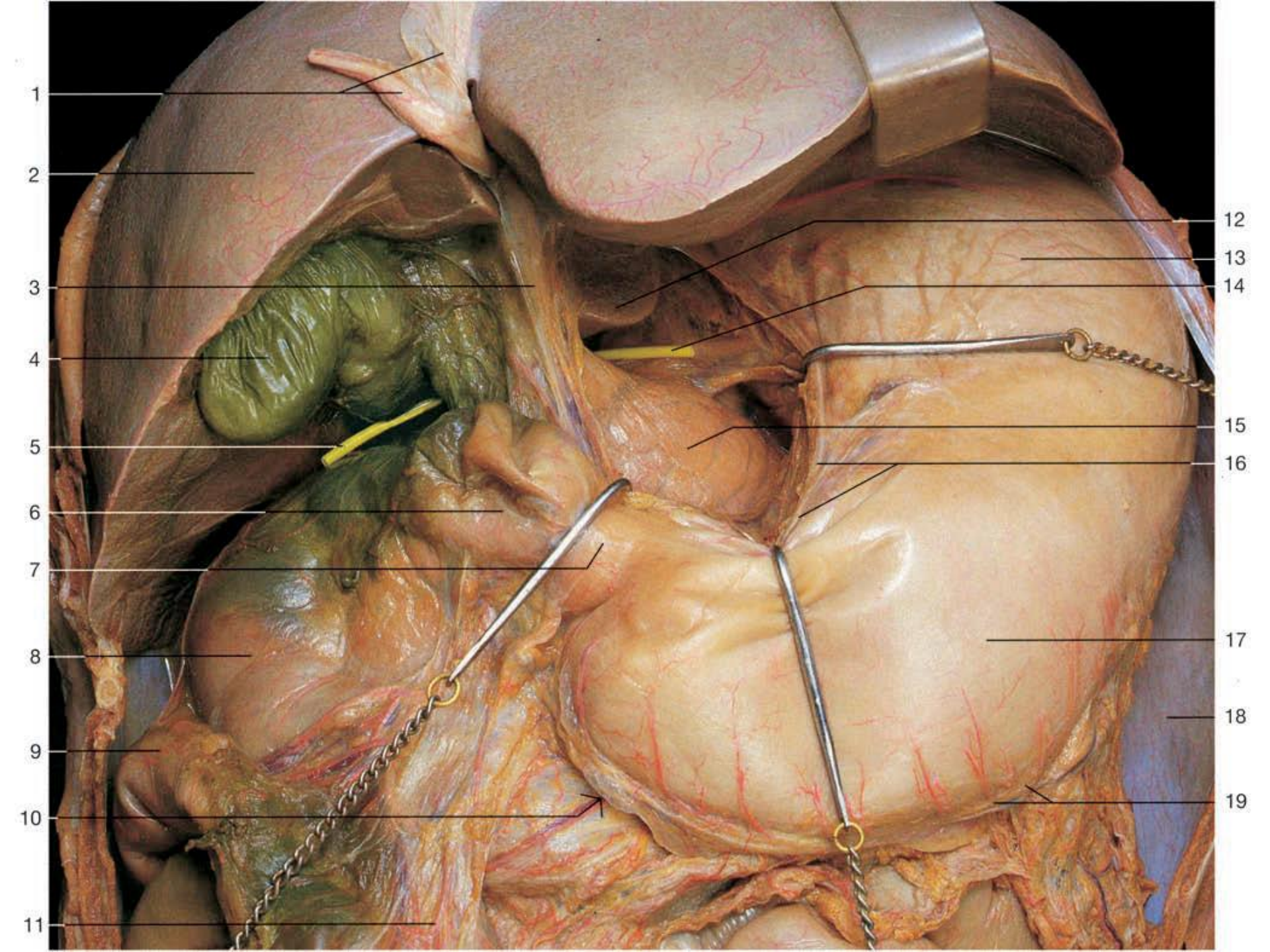
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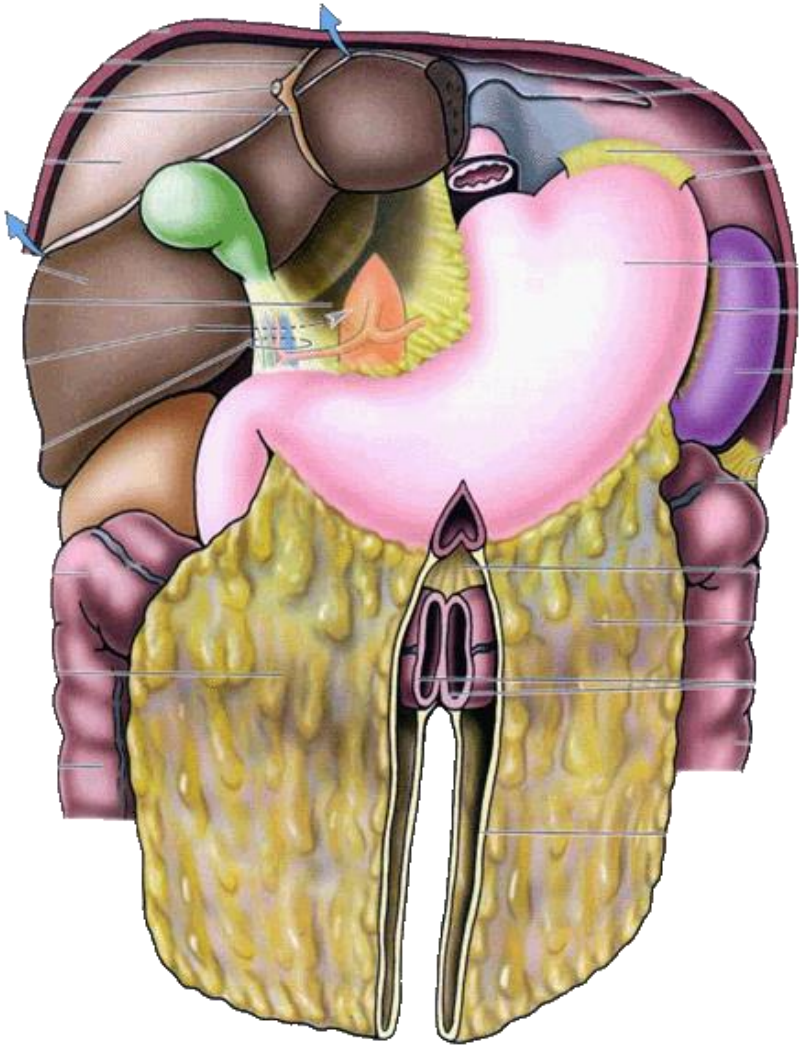
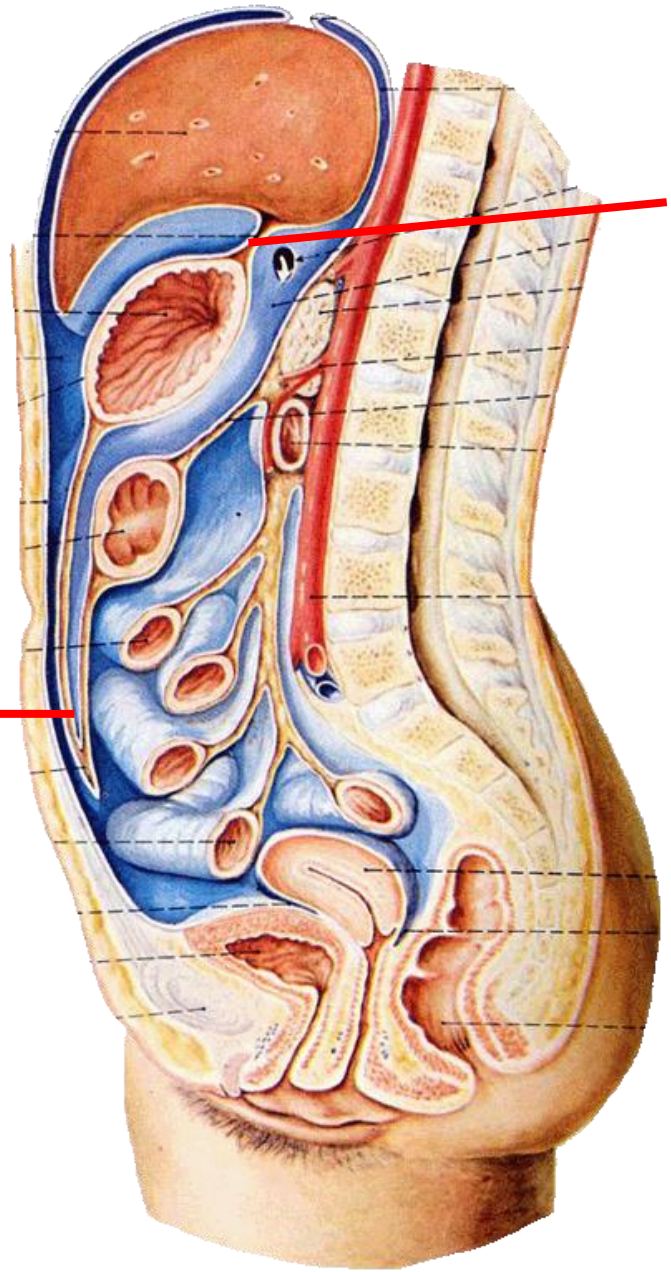
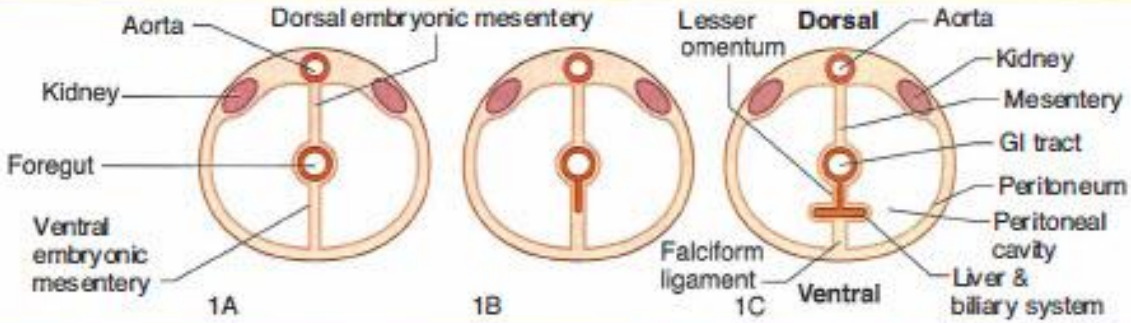
Greater Omentum

- Four-layered fold of peritoneum
- The anterior two layers descend from the greater curvature of stomach and superior part of duodenum and hangs down like an apron in front of coils of small intestine
- Then turns upward and attaches to the transverse colon.



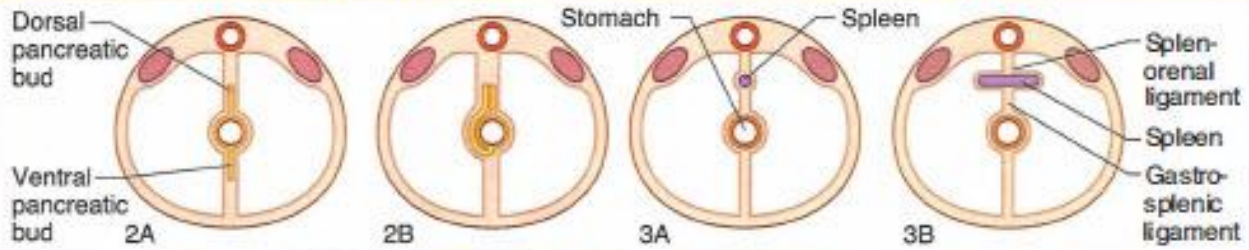

Lesser Omentum
Greater Omentum

Development of Liver

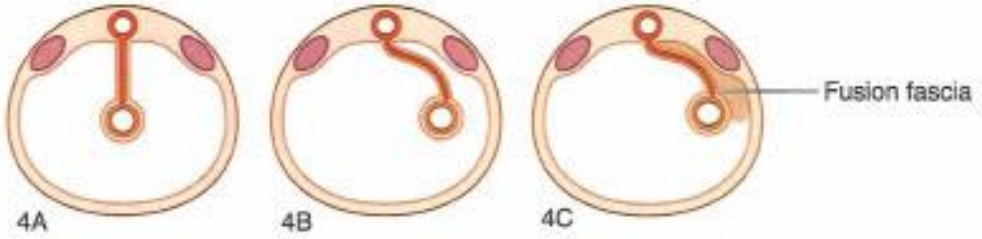


Development of Pancreas

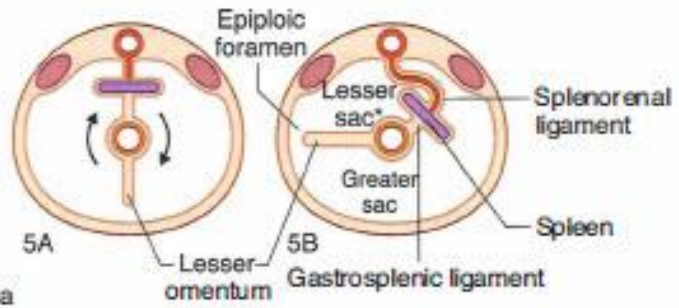
Development of Spleen



Secondary Retroperitonealization



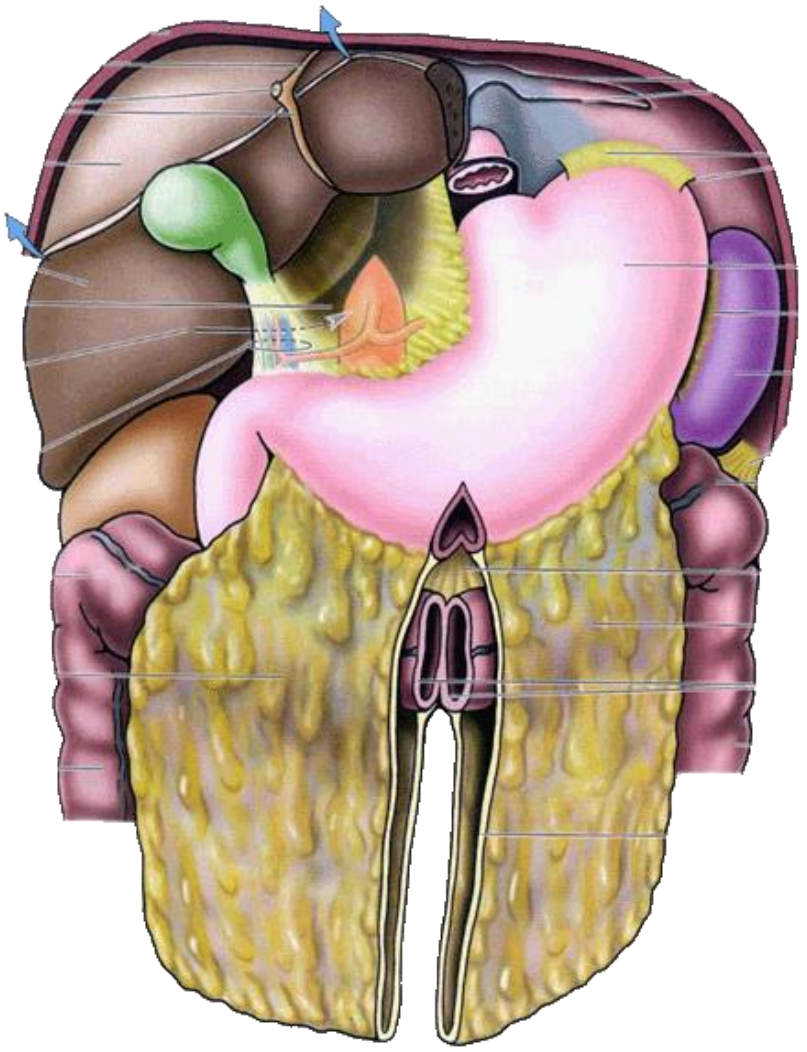
Rotation of Foregut

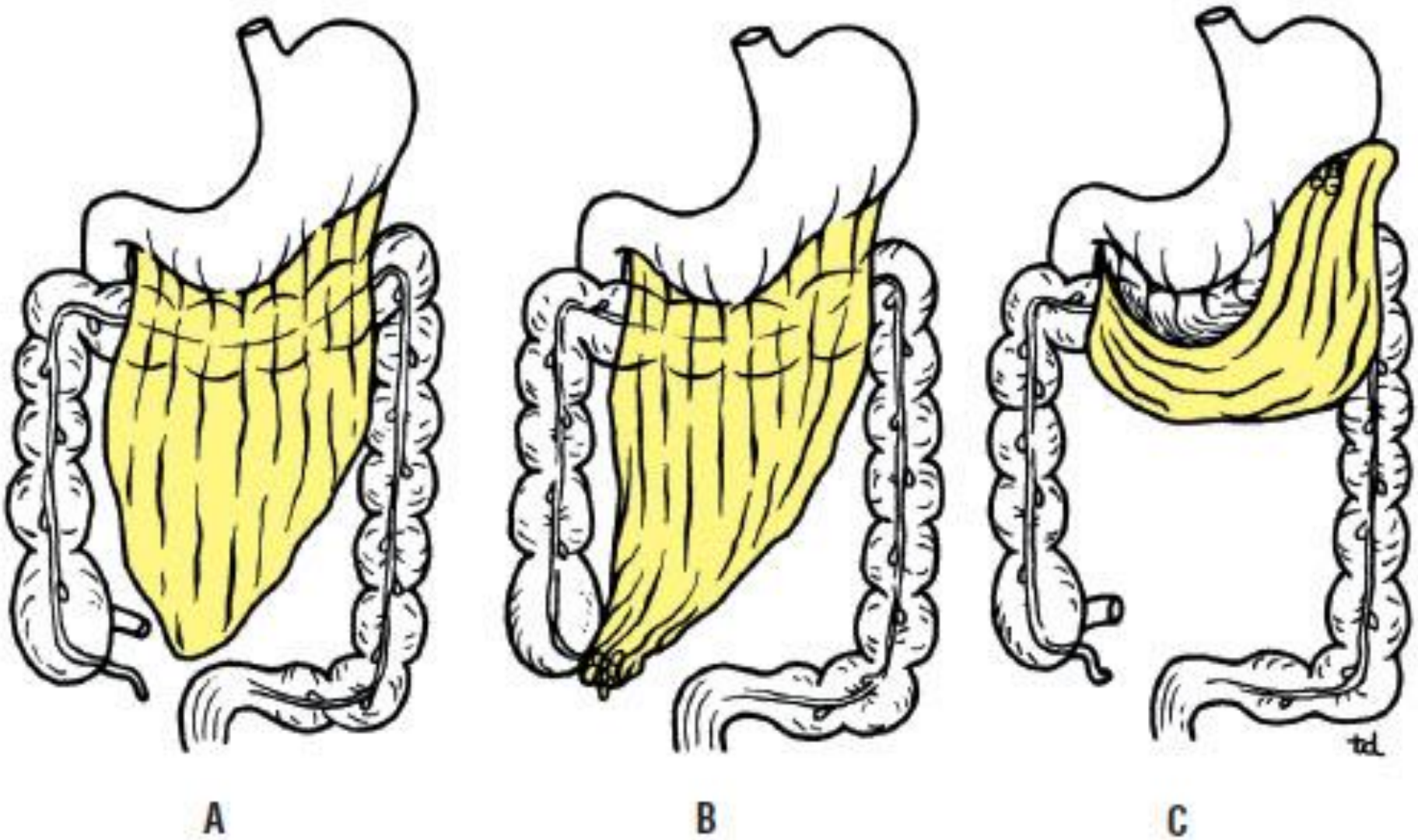


*Lesser sac = omental bursa

Greater Omentum

- If an infection occurs in the intestine, plasma cells formed in the lymph nodes spreading through the greater omentum combat the infection and help prevent it from spreading to the peritoneum.

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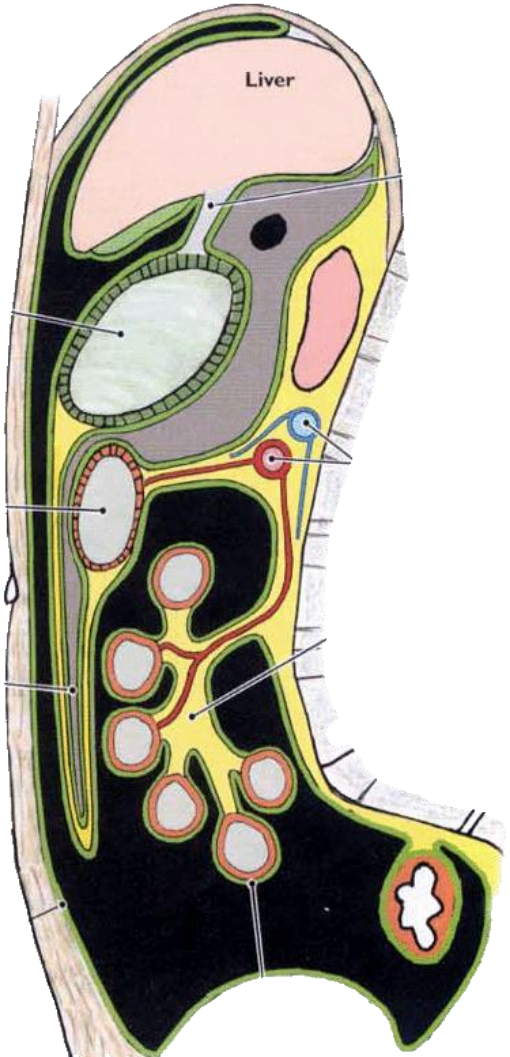
Omental Bursa – Lesser Sac

Position – situated behind the lesser omentum and stomach

Walls

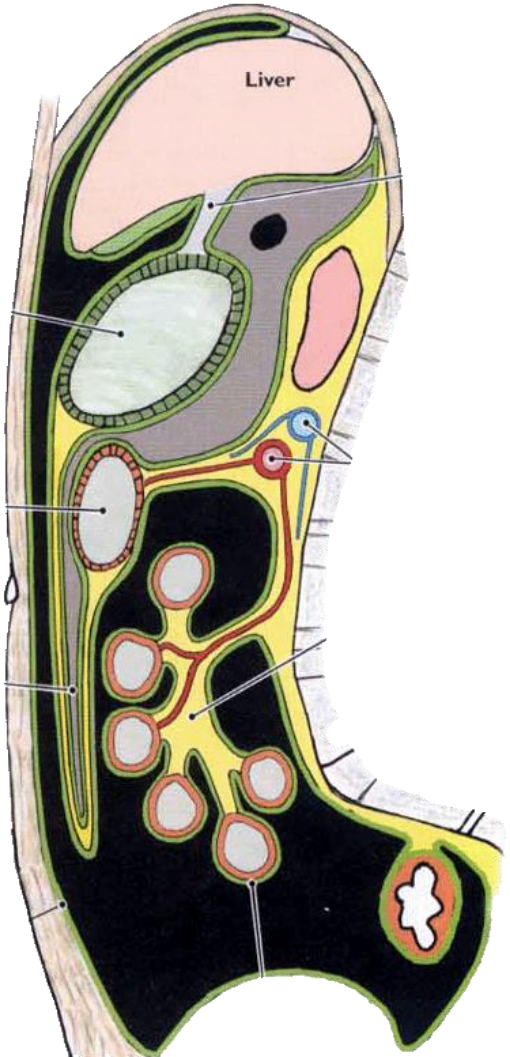
- **Superior** – peritoneum which covers the caudate lobe of liver and diaphragm
- **Anterior** – formed by lesser omentum, peritoneum of posterior wall of stomach, and anterior two layers of greater omentum

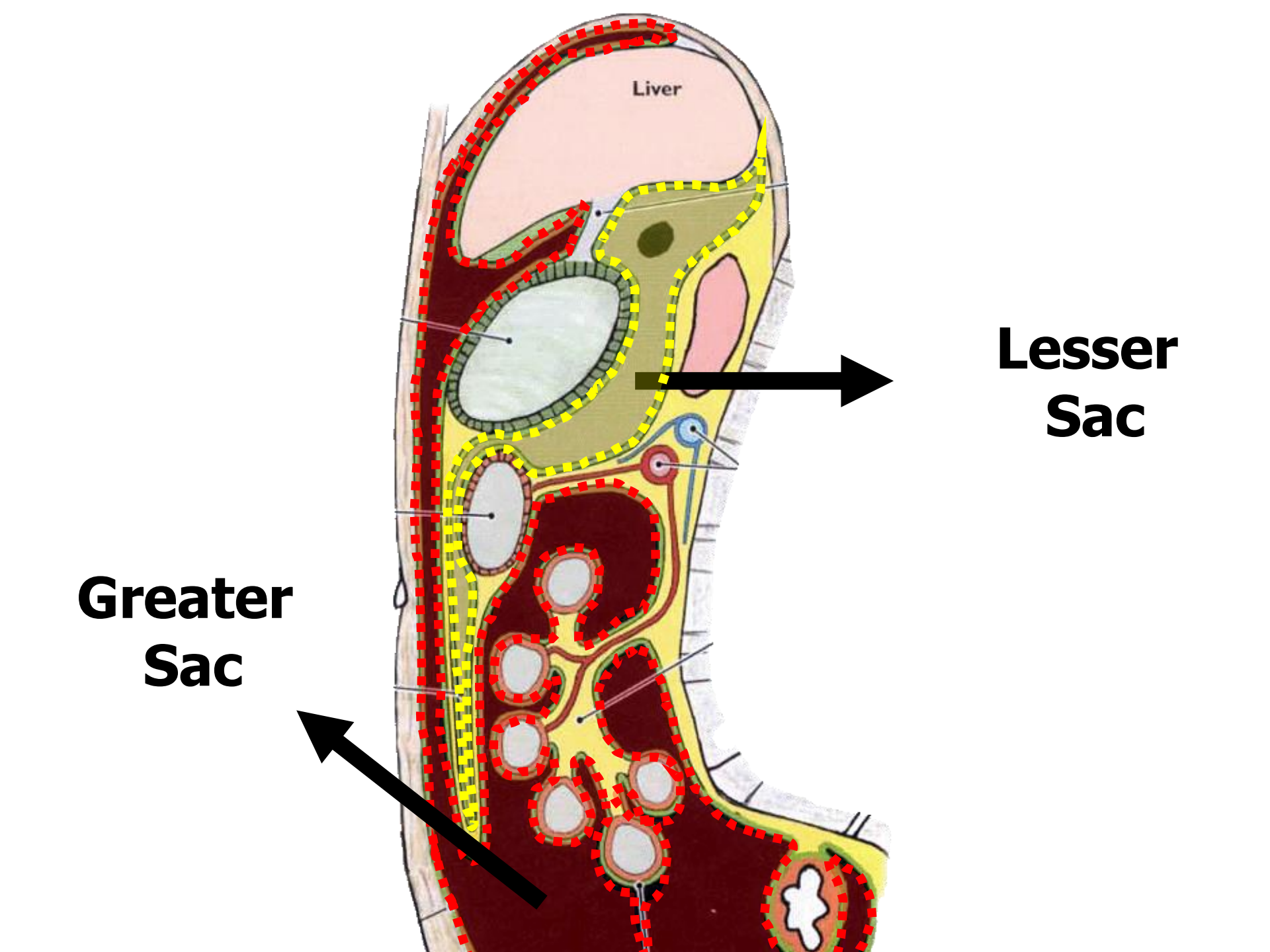


Omental Bursa – Lesser Sac

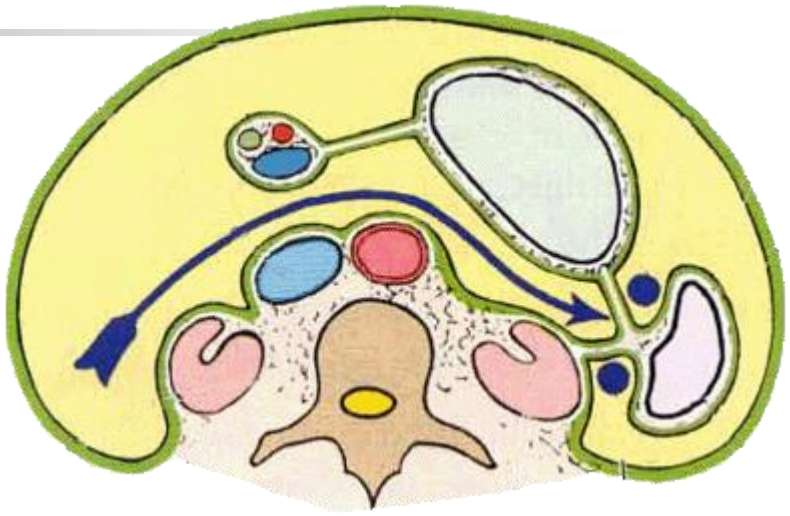
Walls

- **Inferior** – Conjoined area of anterior and posterior two layers of greater omentum
- **Posterior** – Formed by posterior two layers of greater omentum, transverse colon and transverse mesocolon, peritoneum covering pancreas, left kidney and suprarenal gland



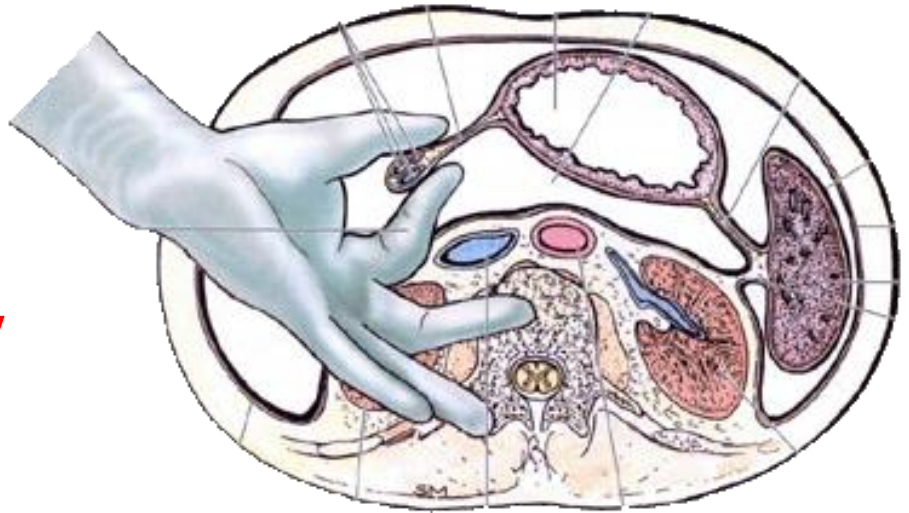

Liver
Lesser Sac
Greater Sac

Omental Bursa – Lesser Sac

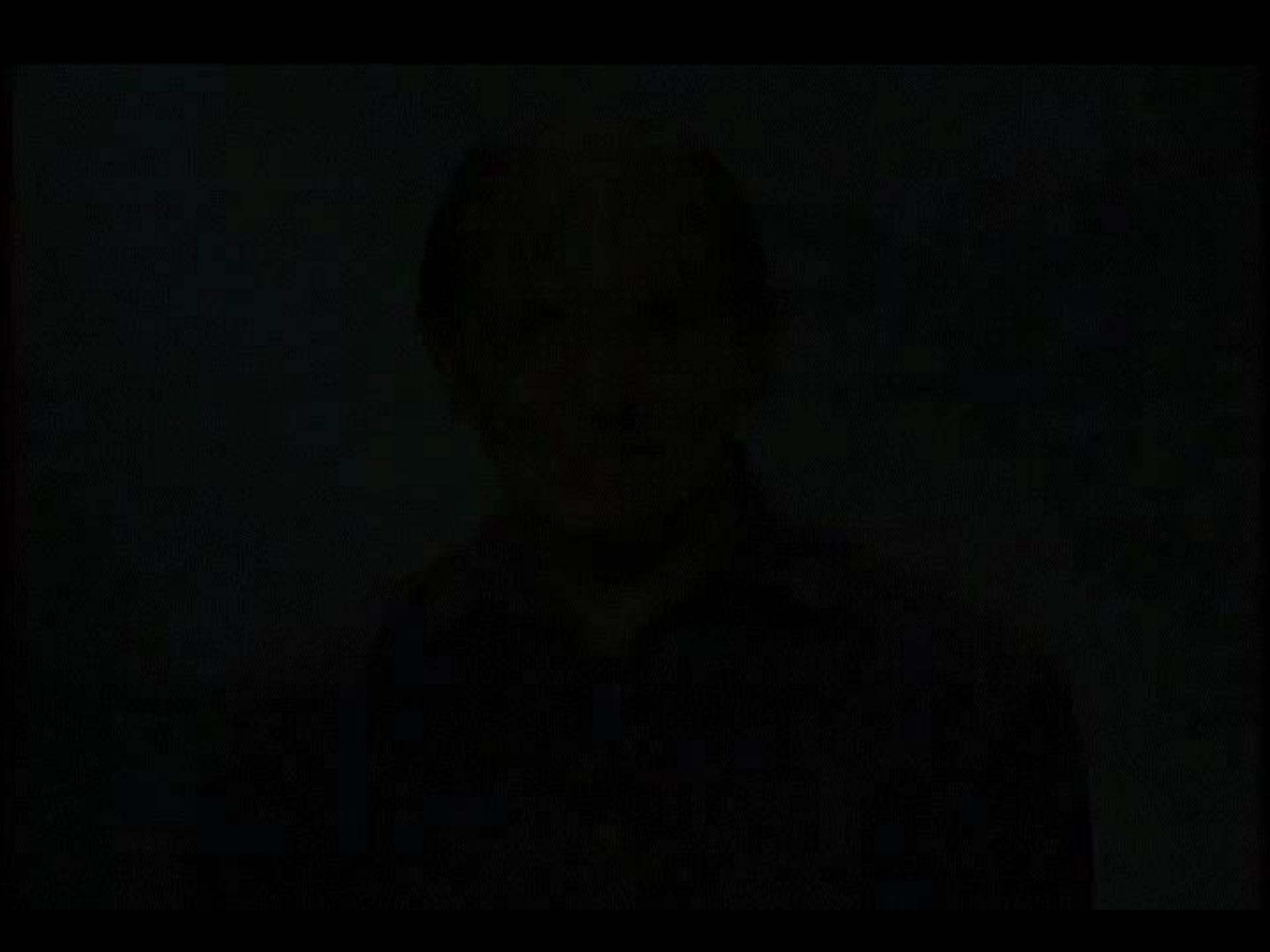


- **Left** – Formed by the spleen, gastrosplenic ligament and splenorenal ligament

- **Right** – Formed by omental foramen

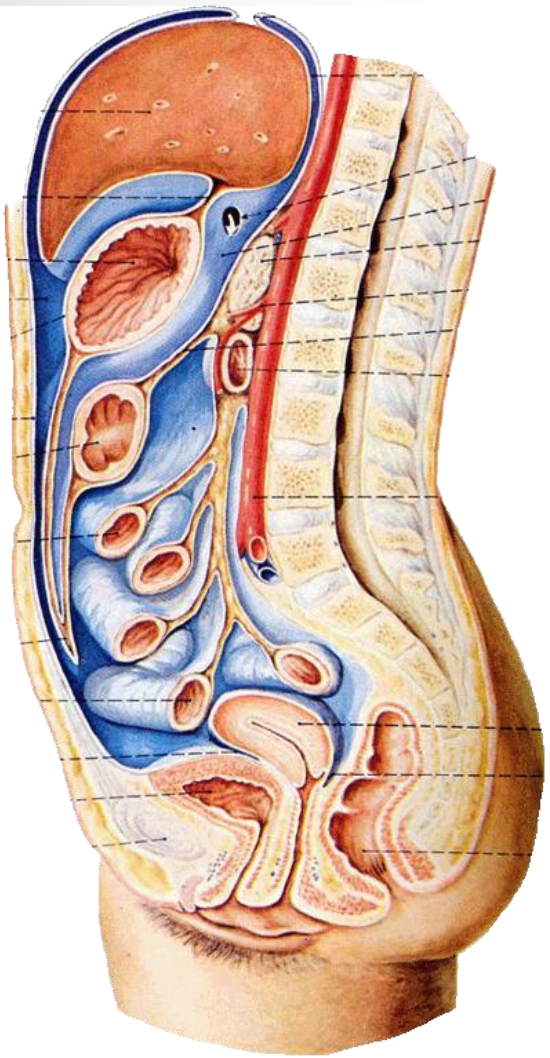


The Omental bursa (lesser sac) communicates with the greater sac through the ***Omental Foramen – Epiploic Foramen***.



Mesentery and Mesocolons

Two-layered fold of peritoneum that attach part of the intestines to the posterior abdominal wall

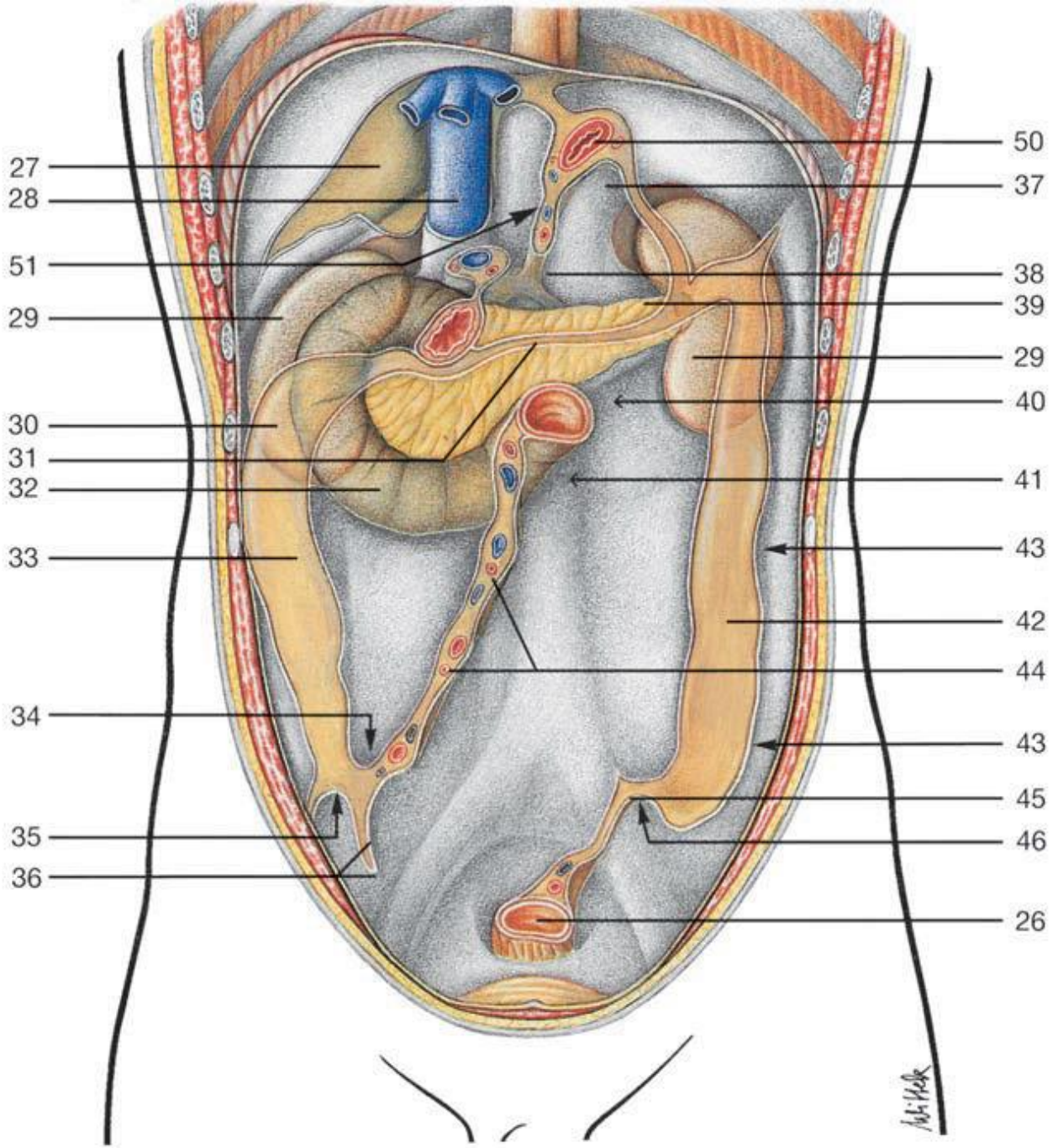


Mesentery

Suspends the small intestine from the posterior abdominal wall

- Broad and a fan-shaped
- Consists of two peritoneal layers
- Intestinal border – folded, 7 m long

- Root of mesentery
  - 15 cm long
  - Directed obliquely from left side of L2 to in front of right sacroiliac joint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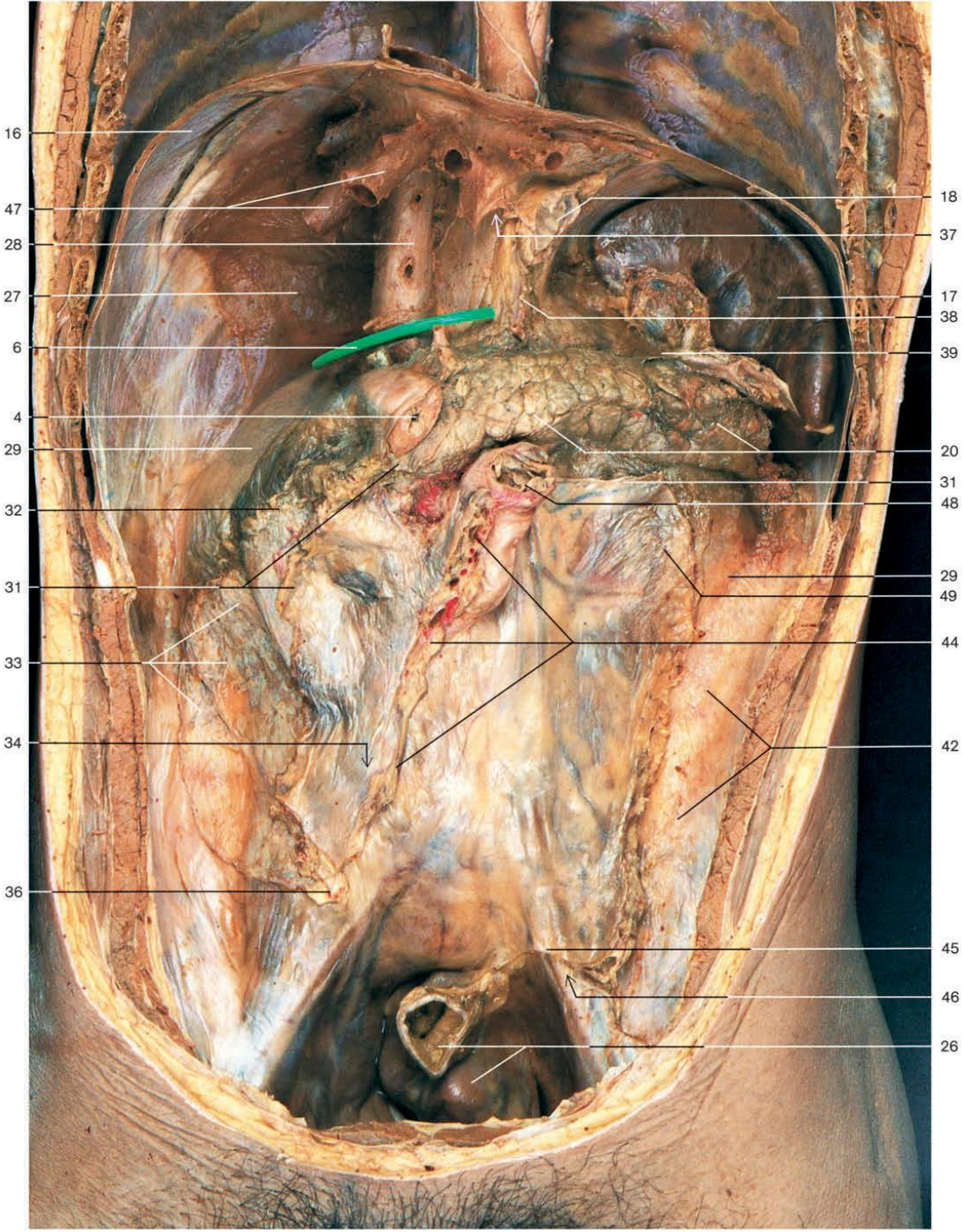
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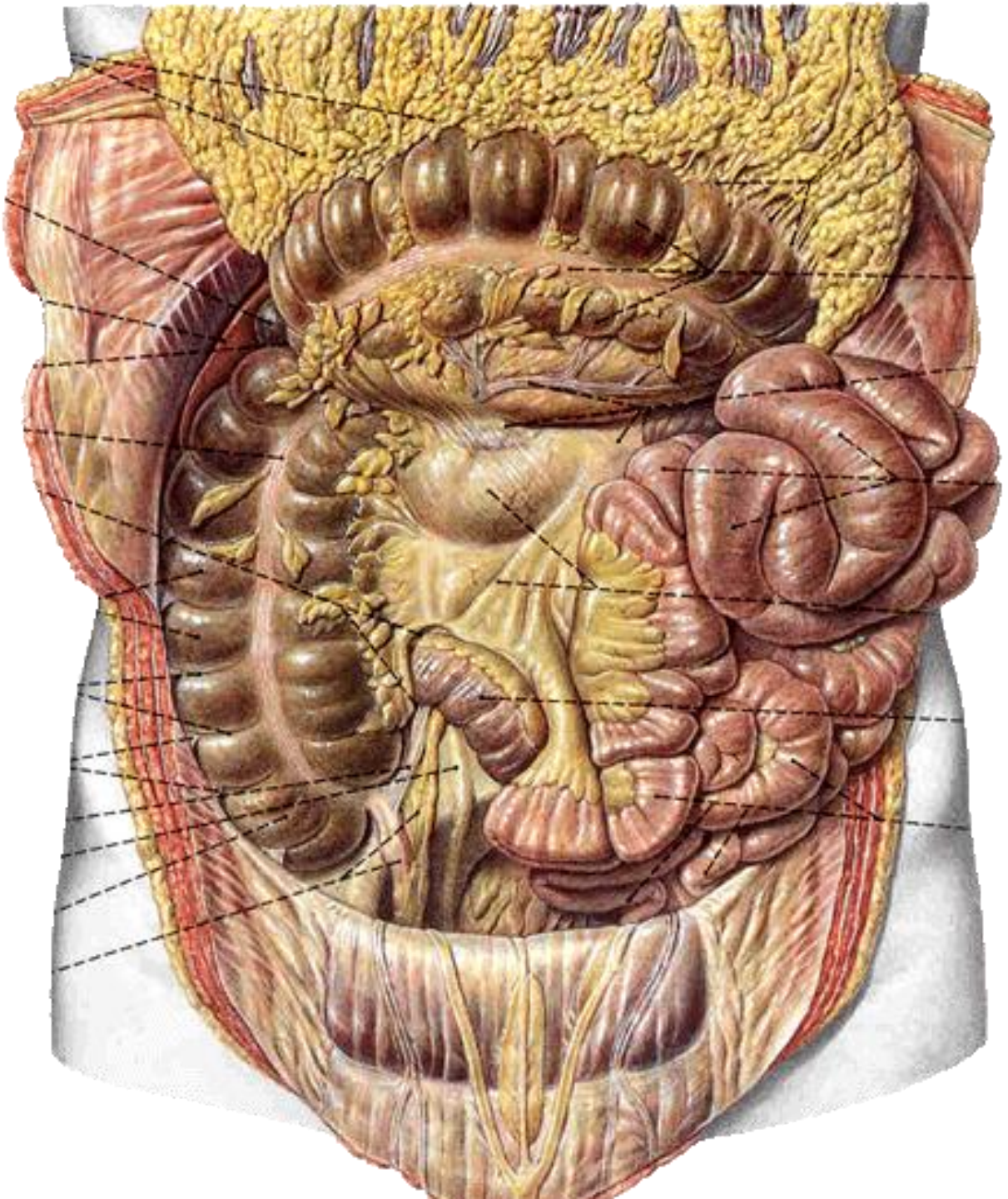
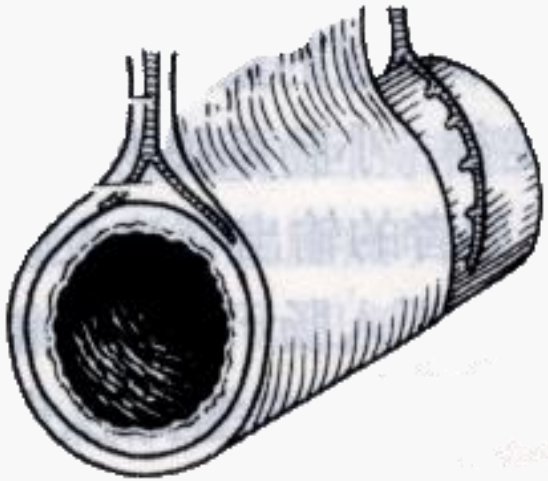
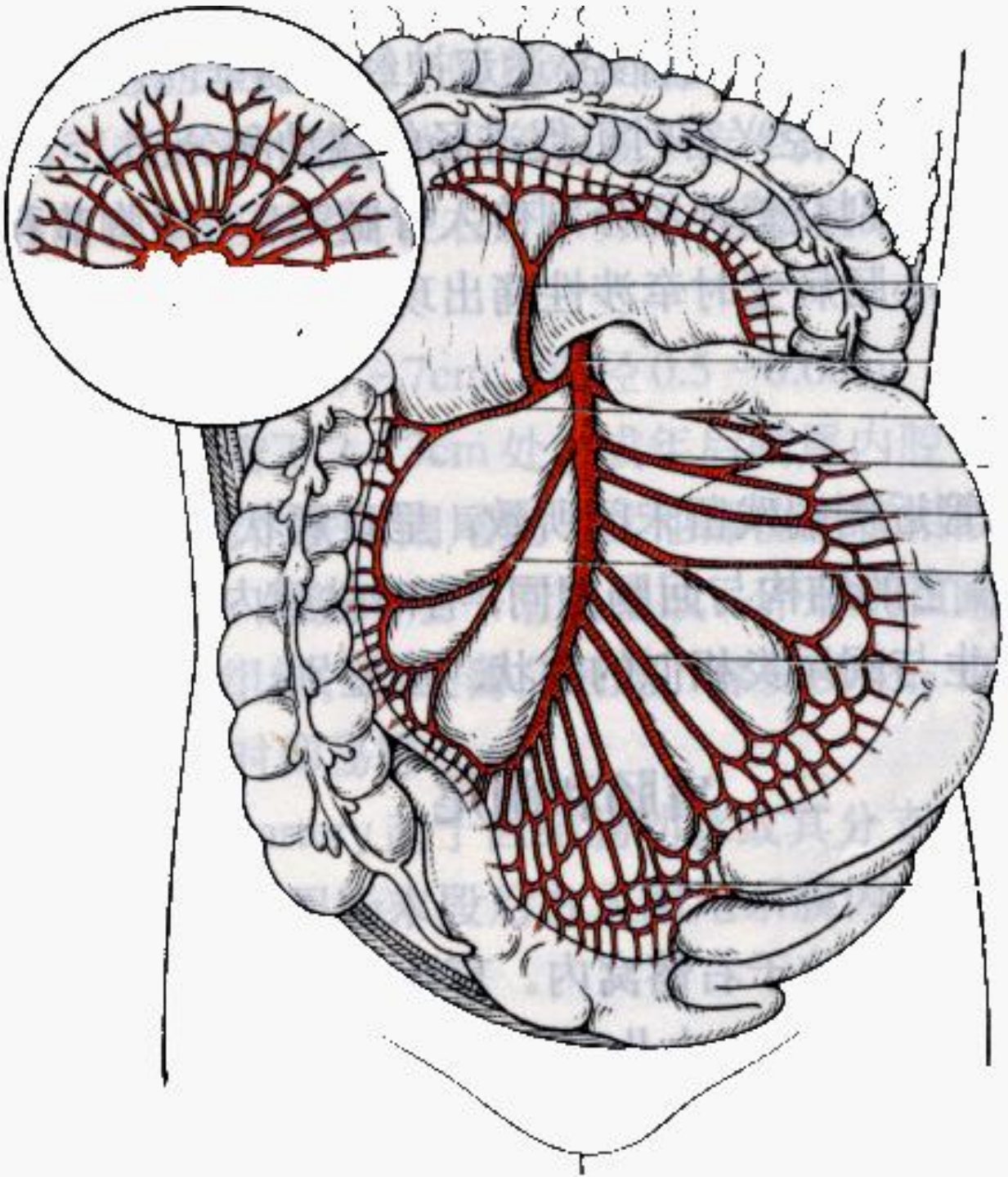






Mesentery of Large Intestine

Transverse mesocolon

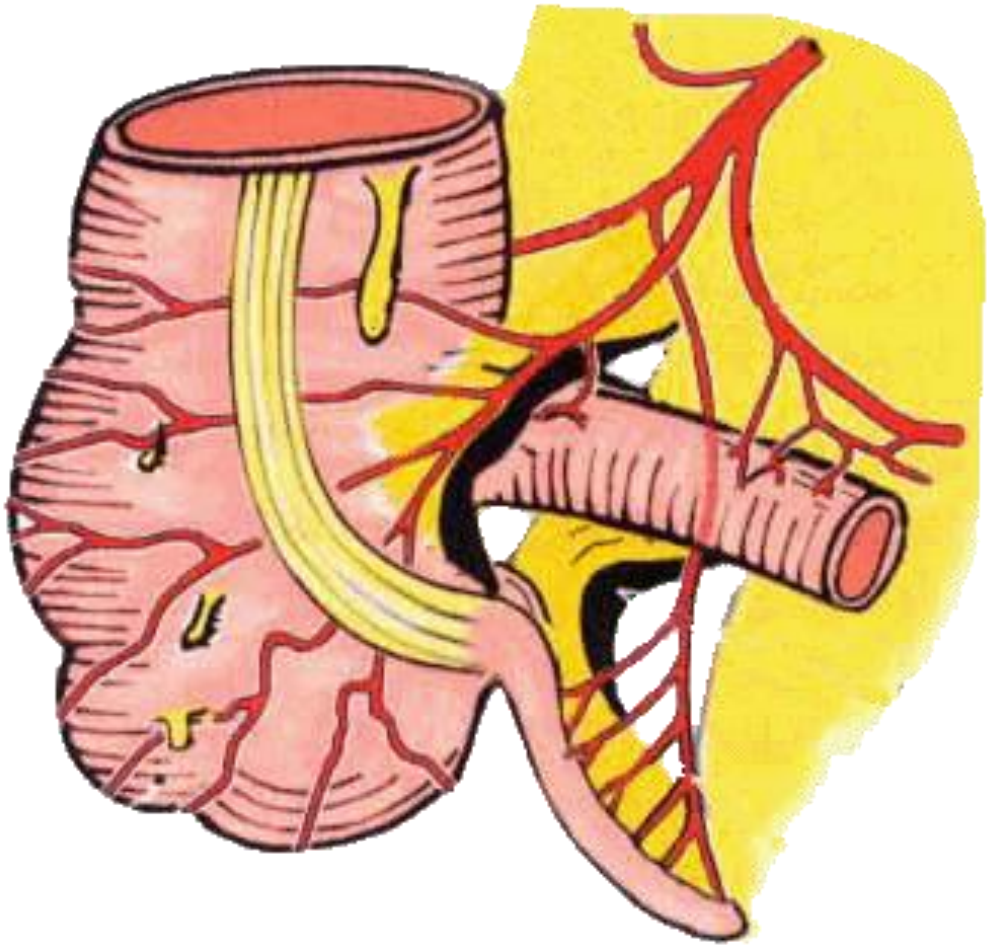
A double fold of peritoneum which connects the transverse colon to the posterior abdominal wall

Sigmoid mesocolon

Inverted V-shaped, with apex located in front of left ureter and division of common iliac artery

Mesoappendix

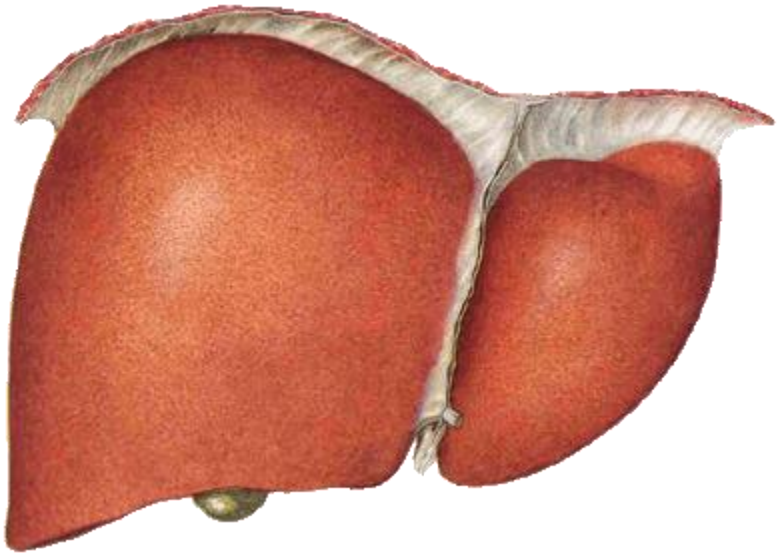
- Triangular mesentery – extends from terminal part of ileum to appendix
- Appendicular artery runs in free margin of the mesoappendix

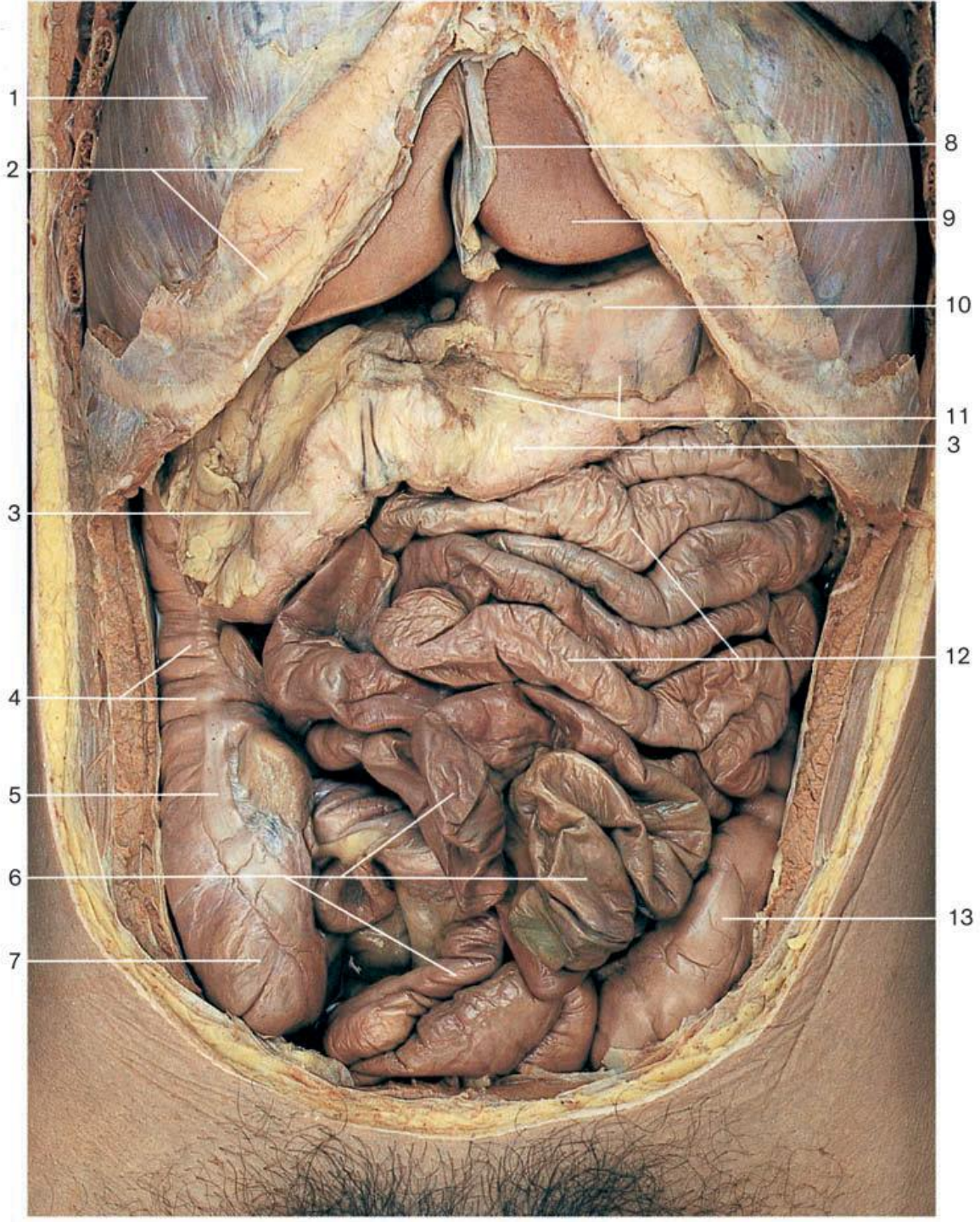


Ligaments of the Liver

Two-layered folds of peritoneum that attaches the lesser mobile solid viscera to the abdominal wall

- ***Falciform ligament of liver***
  - Consists of double peritoneal layer
  - Extends from anterior abdominal wall (umbilicus) to liver
  - Free border of ligament site of ligamentum teres

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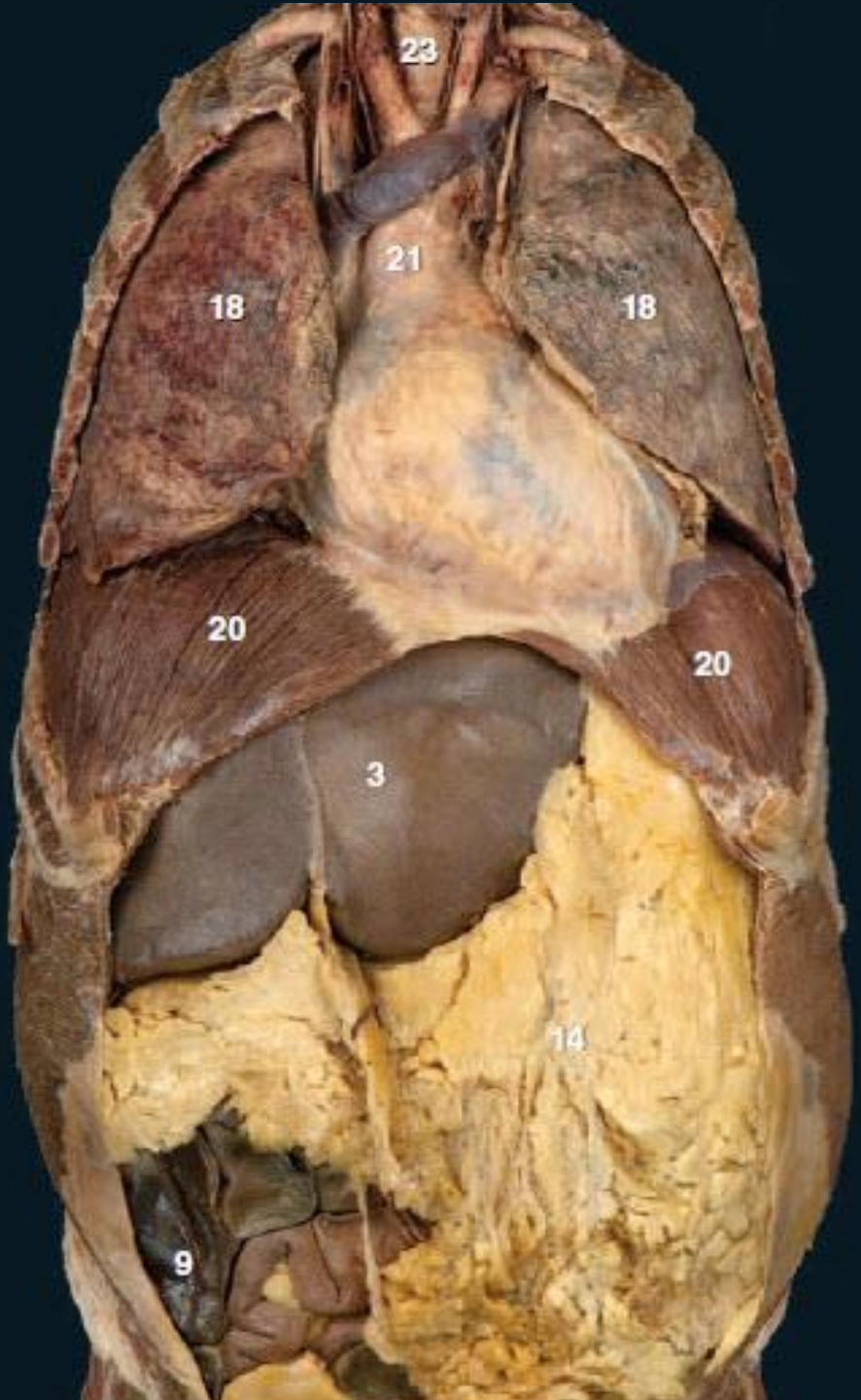
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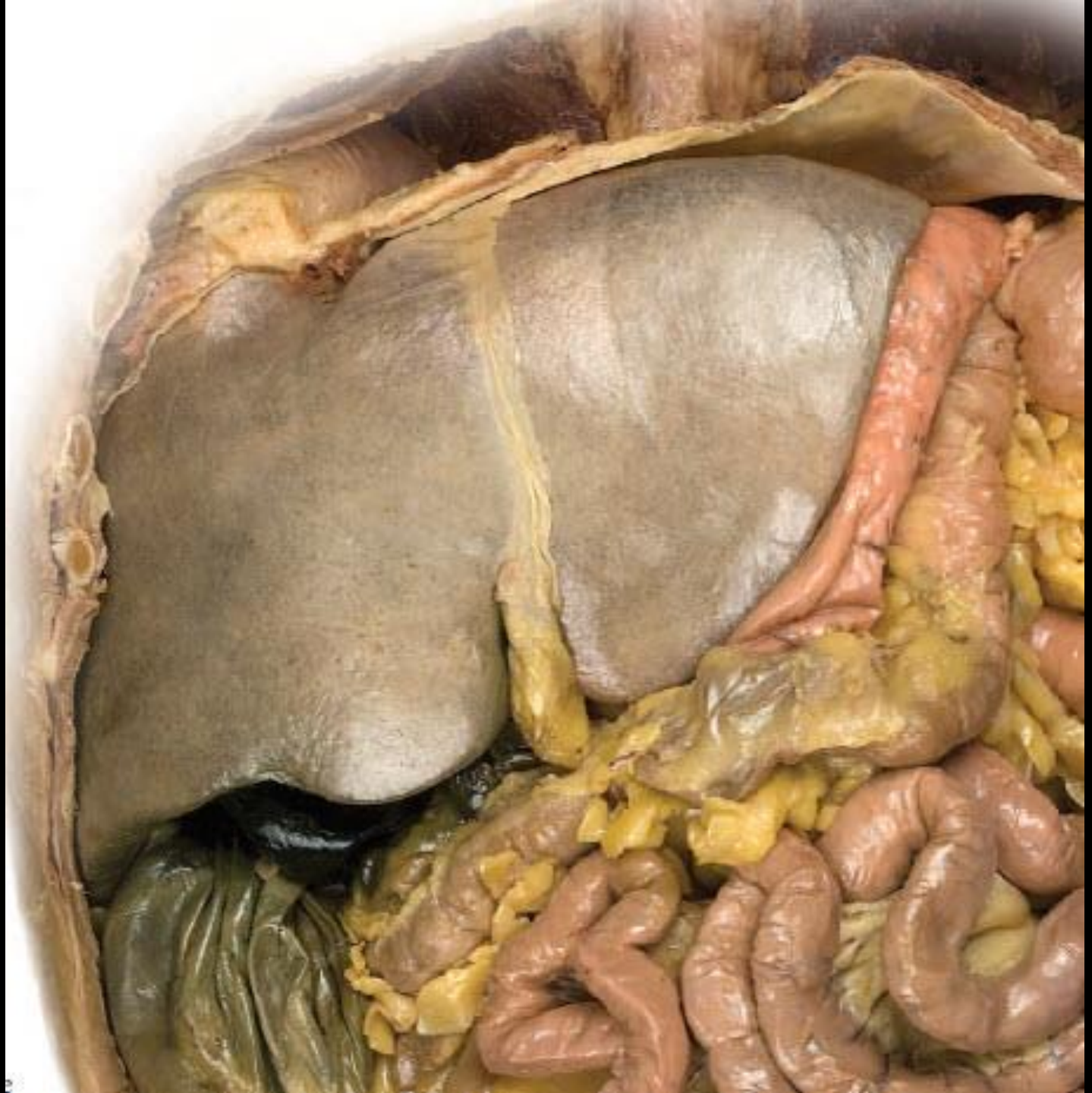

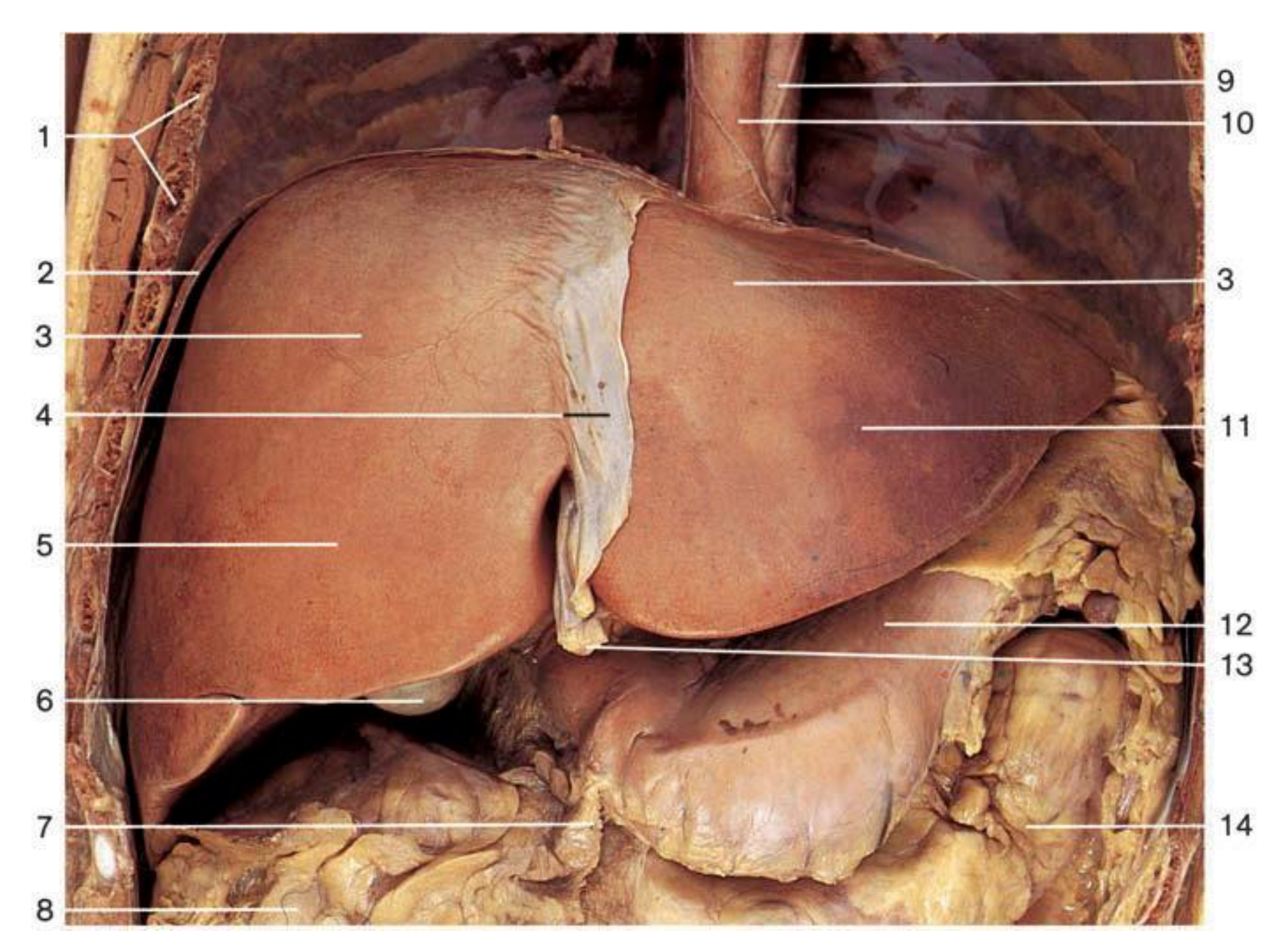
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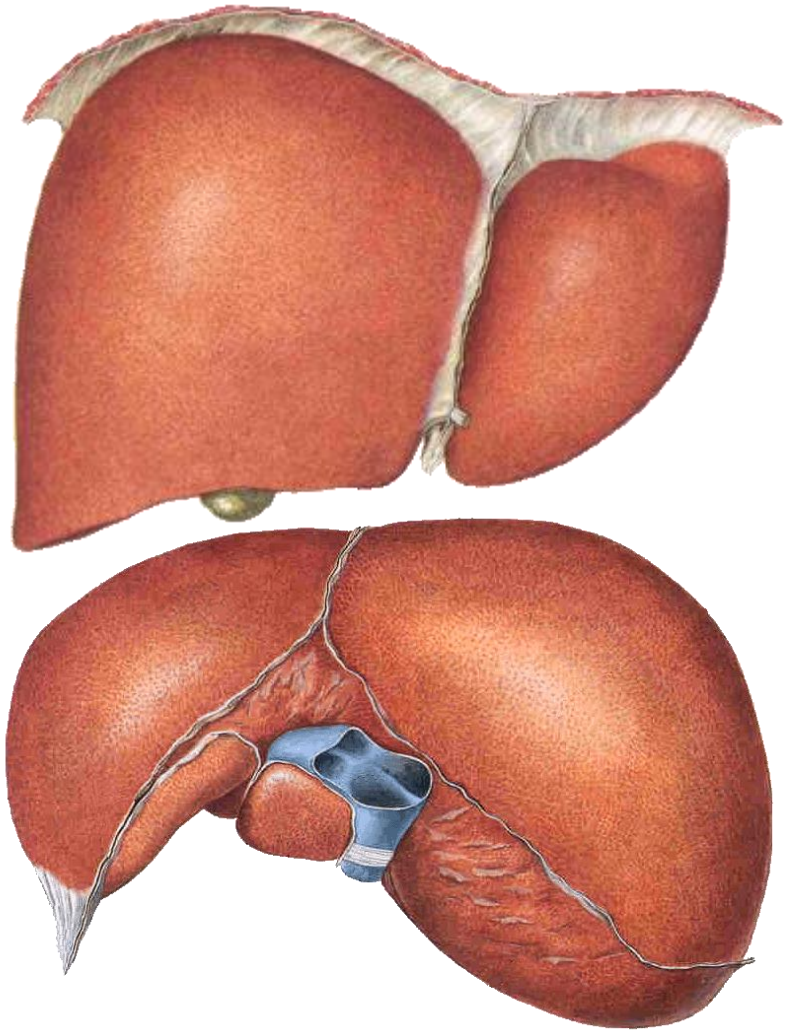
Ligaments of the Liver

- ***Coronary ligament***

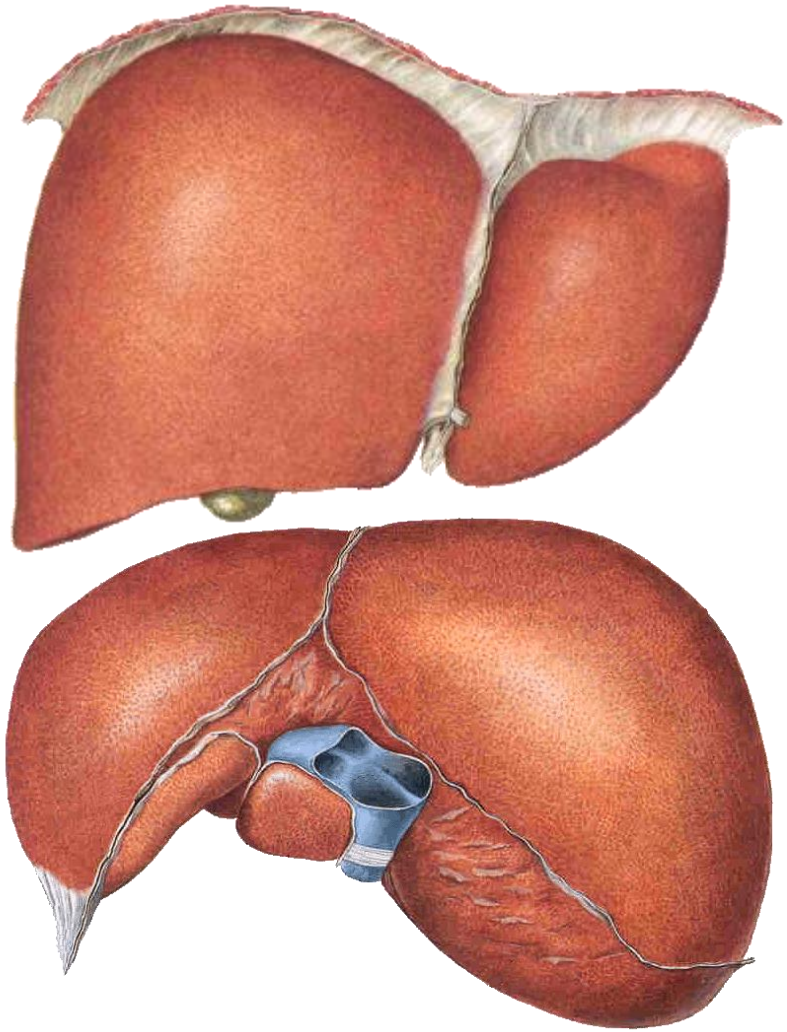
The area between upper and lower parts of the coronary ligament is the bare area of liver, this area is devoid of peritoneum and lies in contract with the diaphragm (***Bare Area***)



Ligaments of the Liver

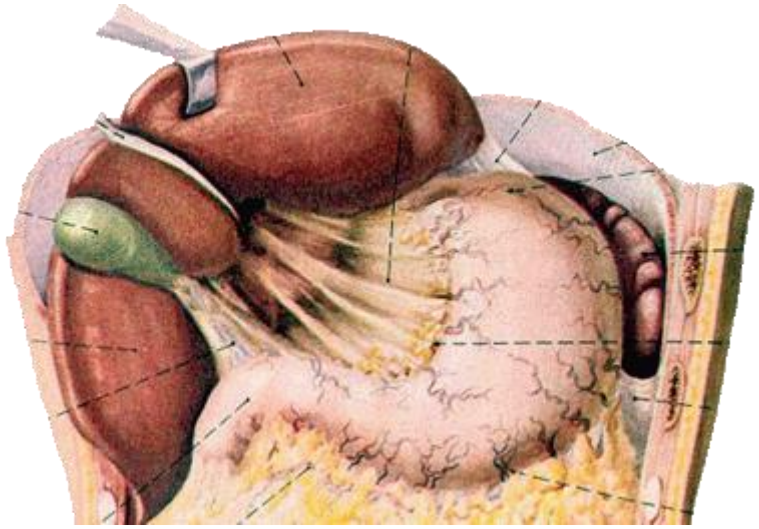
- ***Left and right triangular ligaments***

Formed by right extremity of coronary ligament and left leaf of falciform ligament, respectively



Ligaments of the Liver

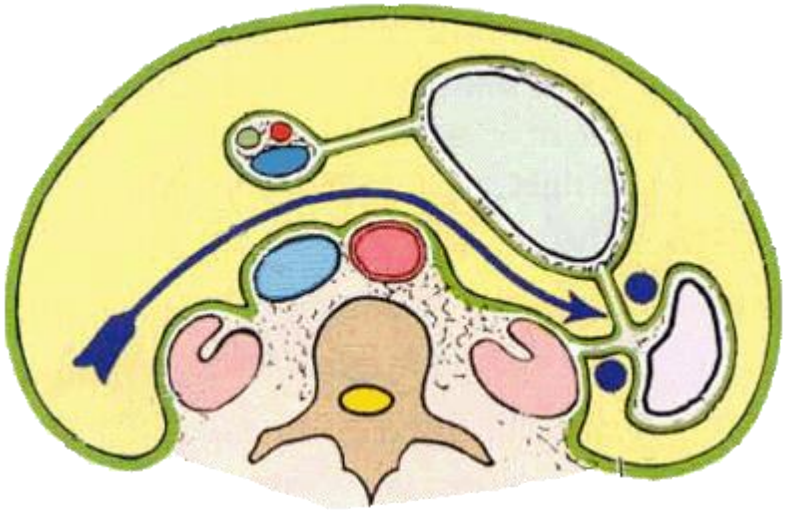
- **Gastro-hepatic ligament**
- **Hepatoduodenal ligament**
- **Ligamentum teres**



Ligaments of Spleen

- ***Gastrosplenic ligament***

A double layer of peritoneum that connects the fundus of stomach to hilum of spleen.



In this double layer of peritoneum are the short gastric and left gastroepiploic vessels

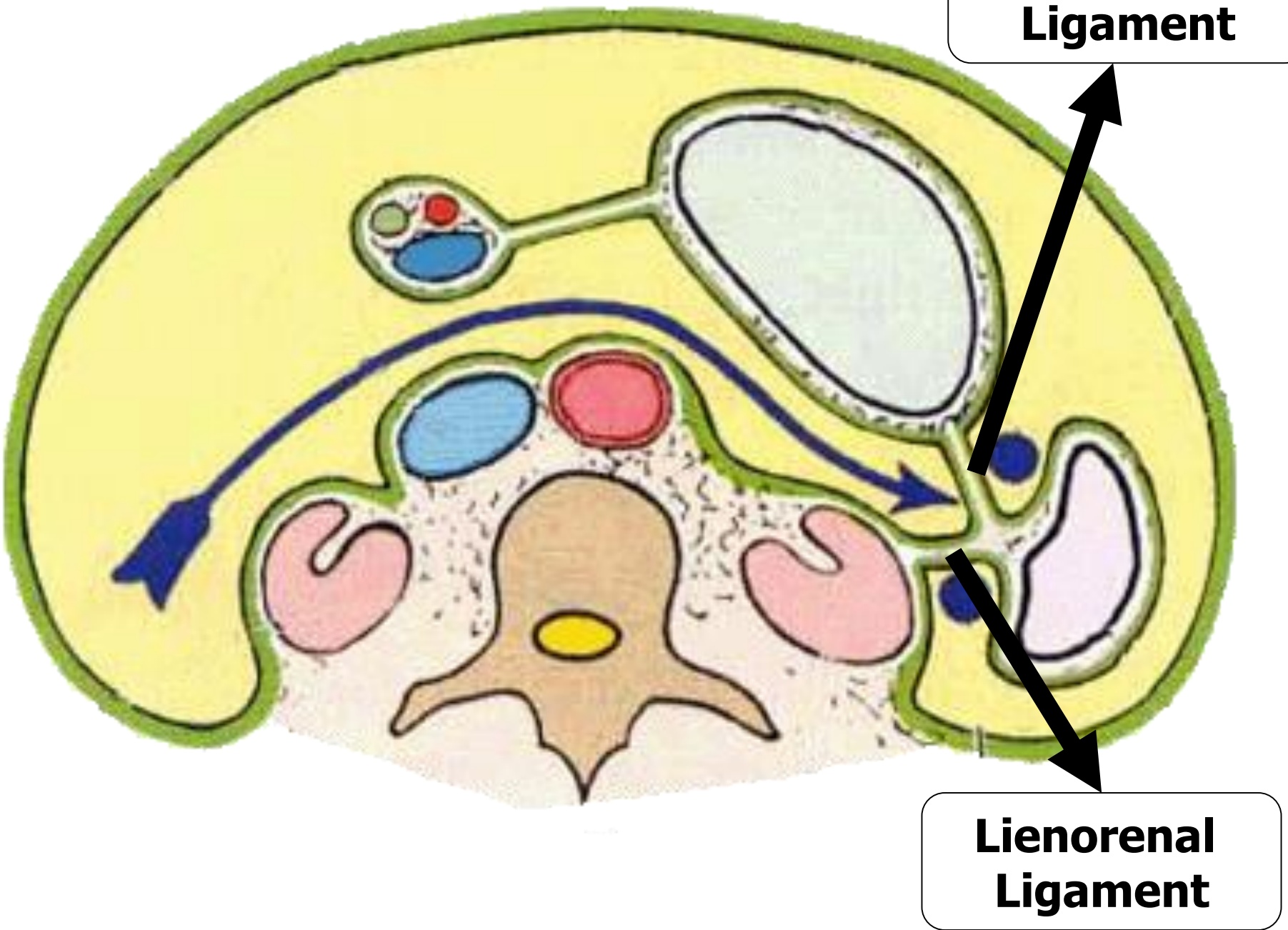
Ligaments of Spleen

- ***Splenorenal (Lienorenal) ligament***

Extends between the hilum of spleen and anterior aspect of left kidney. The splenic vessels lies within this ligament, as well as the tail of pancreas

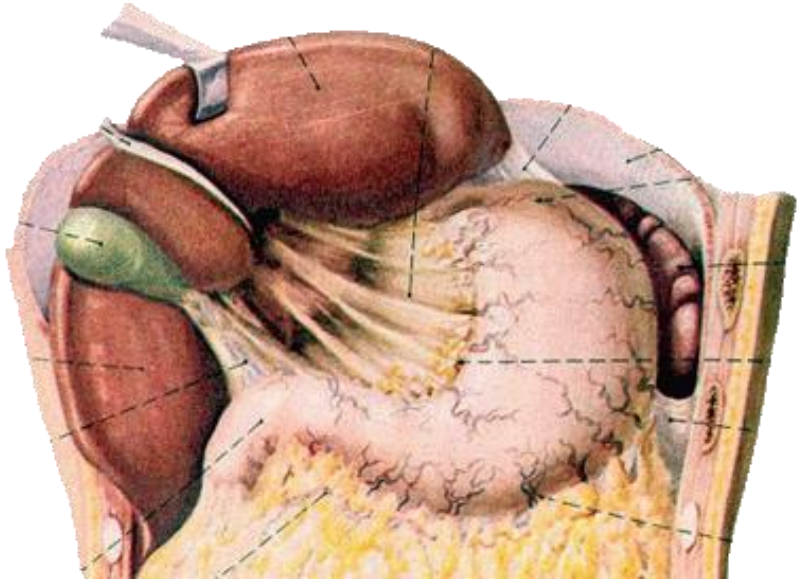
- ***Phrenicosplenic ligament***

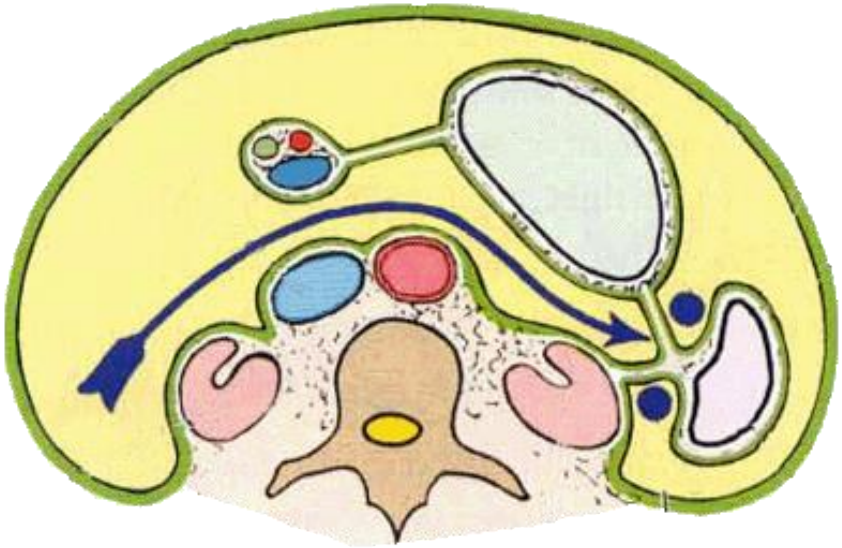
- ***Splenocolic ligament***

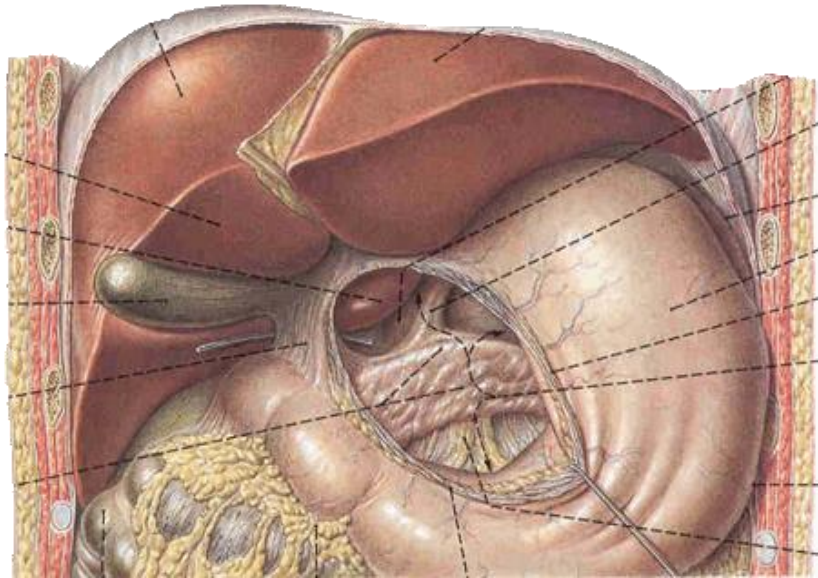

Gastrosplenic Ligament
Lienorenal Ligament

Ligaments of stomach

- Gastrohepatic ligament
- Gastrosplenic ligament
- Gastrophrenic ligament
- Gastrocolic ligament
- Gastropancrestic ligament



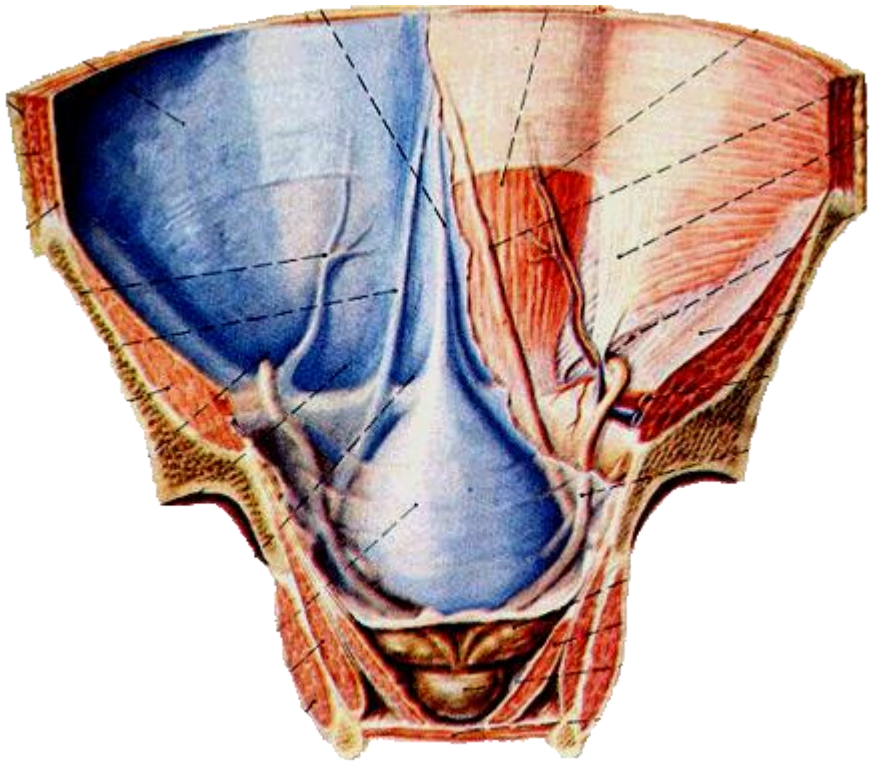




Folds and Fossae of the Abdomen

- ***Median umbilical fold***

Contain the remnant of urachus (median umbilical ligaments)



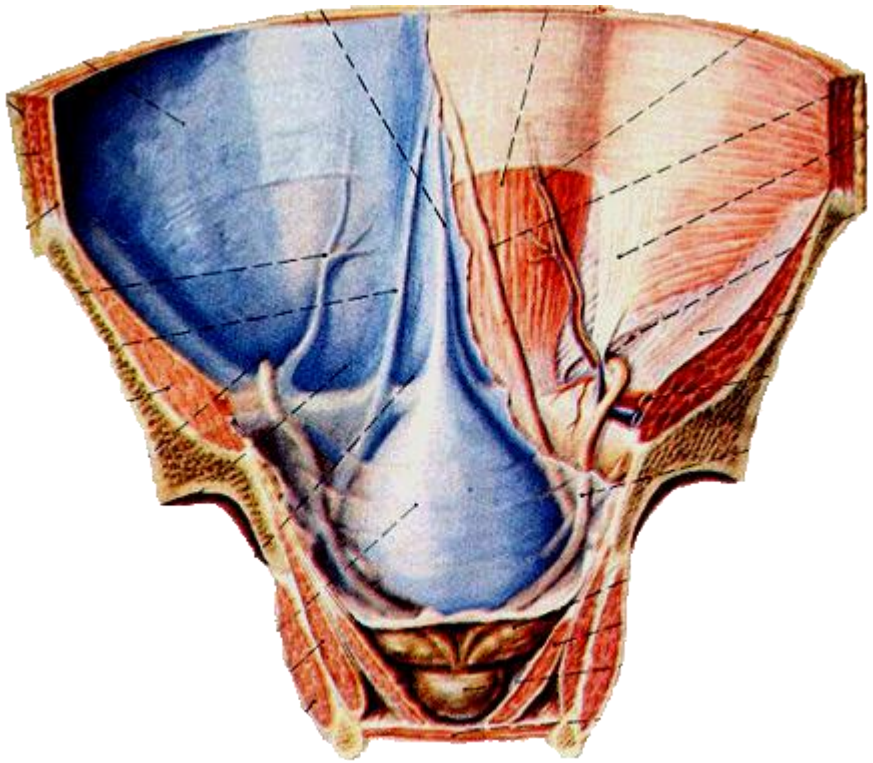
- ***Medial umbilical fold***

Contains remnants of the umbilical arteries (medial umbilical ligaments)

Folds and Fossae of the Abdomen

- ***Lateral umbilical fold***

Contains the inferior epigastric vessels

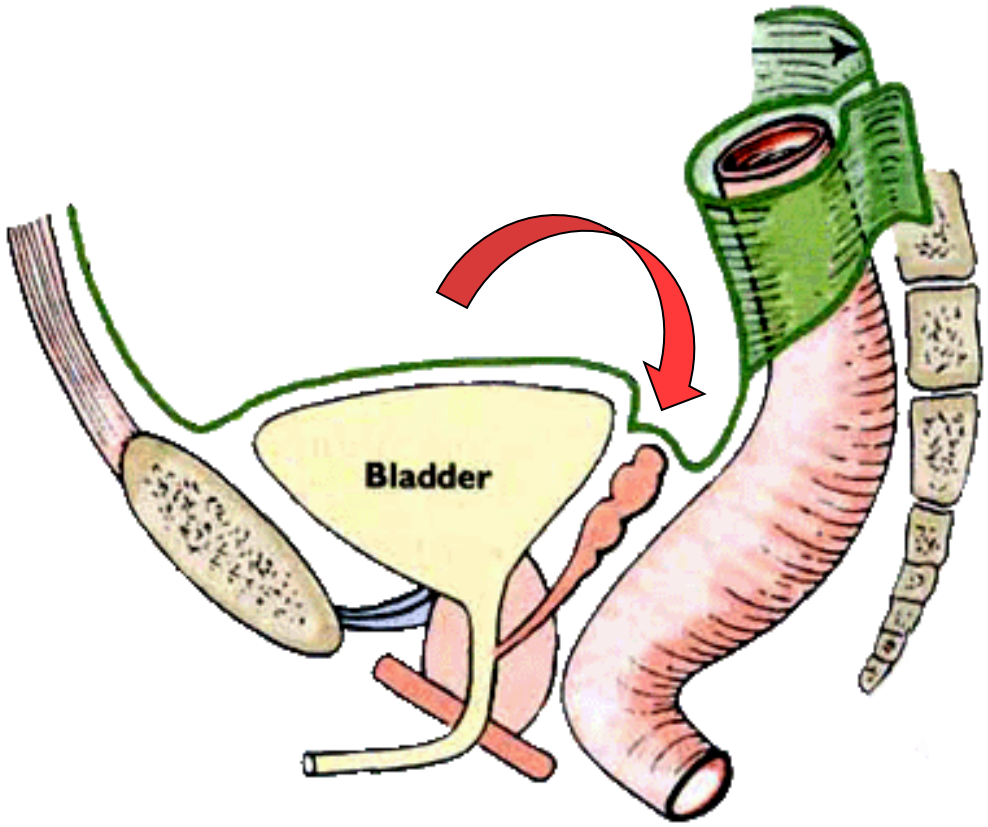


- ***Supravesical fossa***
- ***Medial inguinal fossa***
- ***Lateral inguinal fossa***

Peritoneal Pouches

- ***In male***

Recto-vesical pouch

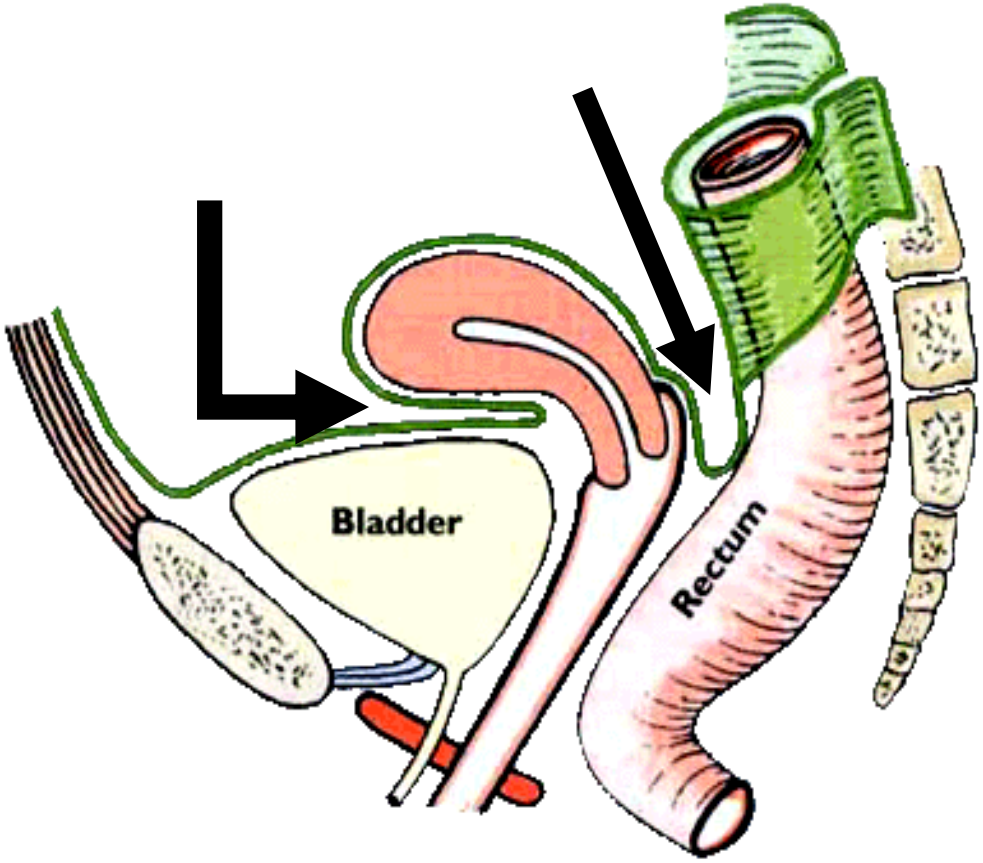


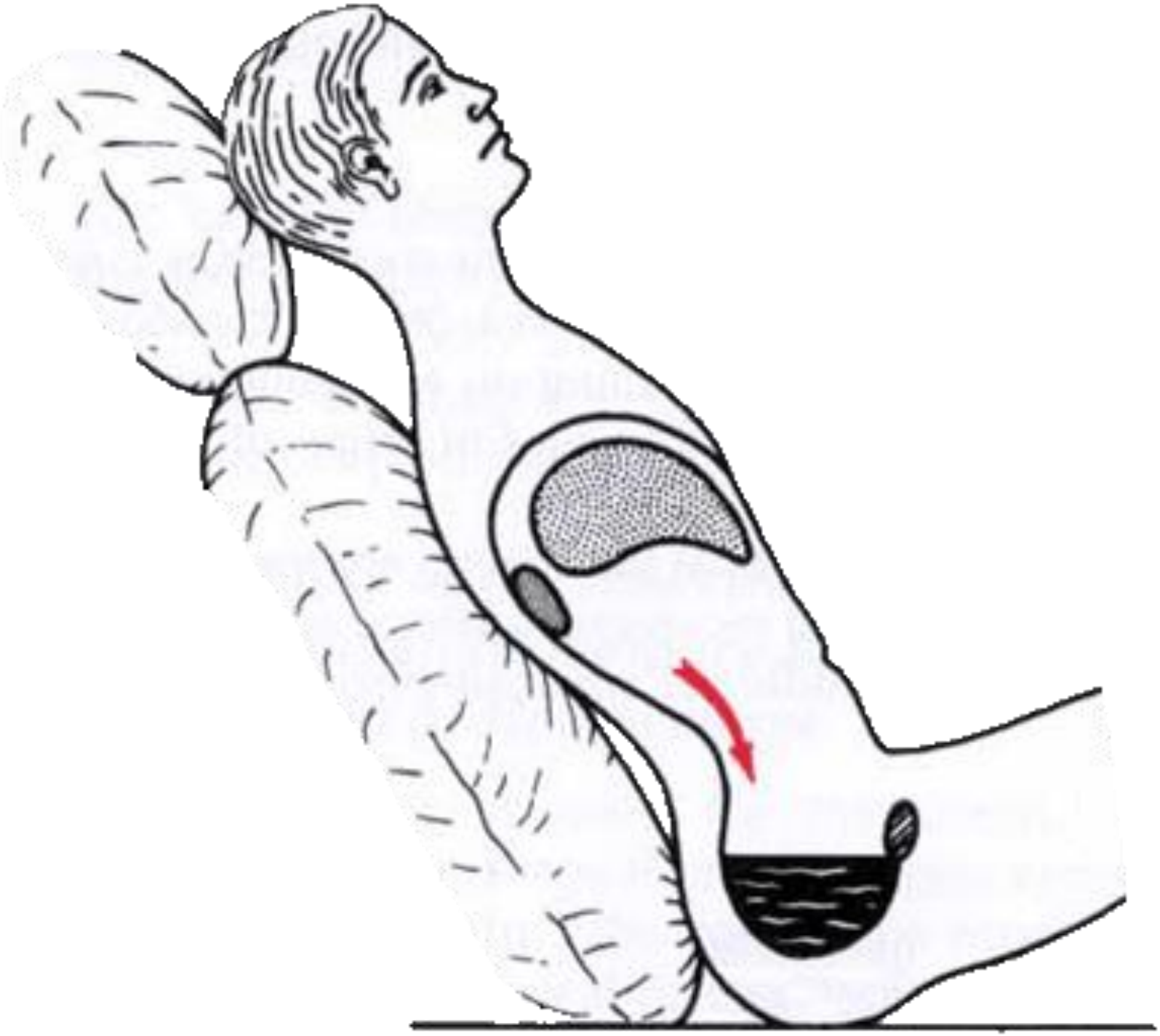
Peritoneal Pouches

- ***In female***

  - **Recto-uterine pouch (Doglas)** – between rectum and uterus

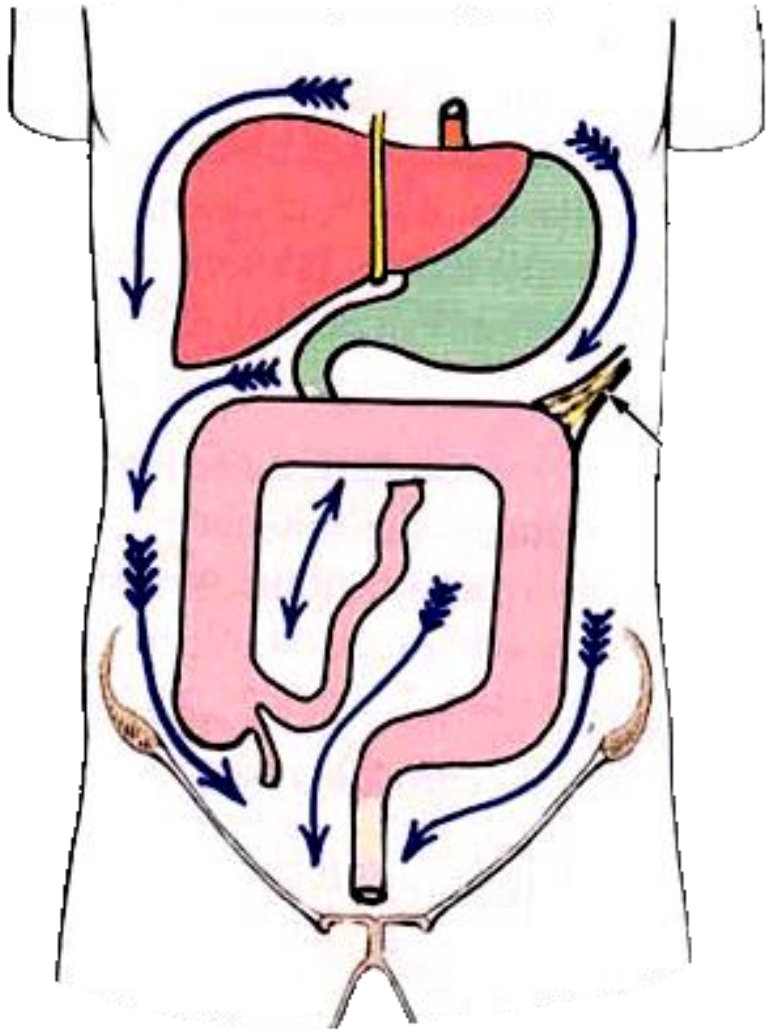
  - **Utero-vesical pouch** – between bladder and uterus





Peritoneal Subdivisions

The transverse colon and transverse mesocolon divides the greater sac into supracolic and infracolic compartments.



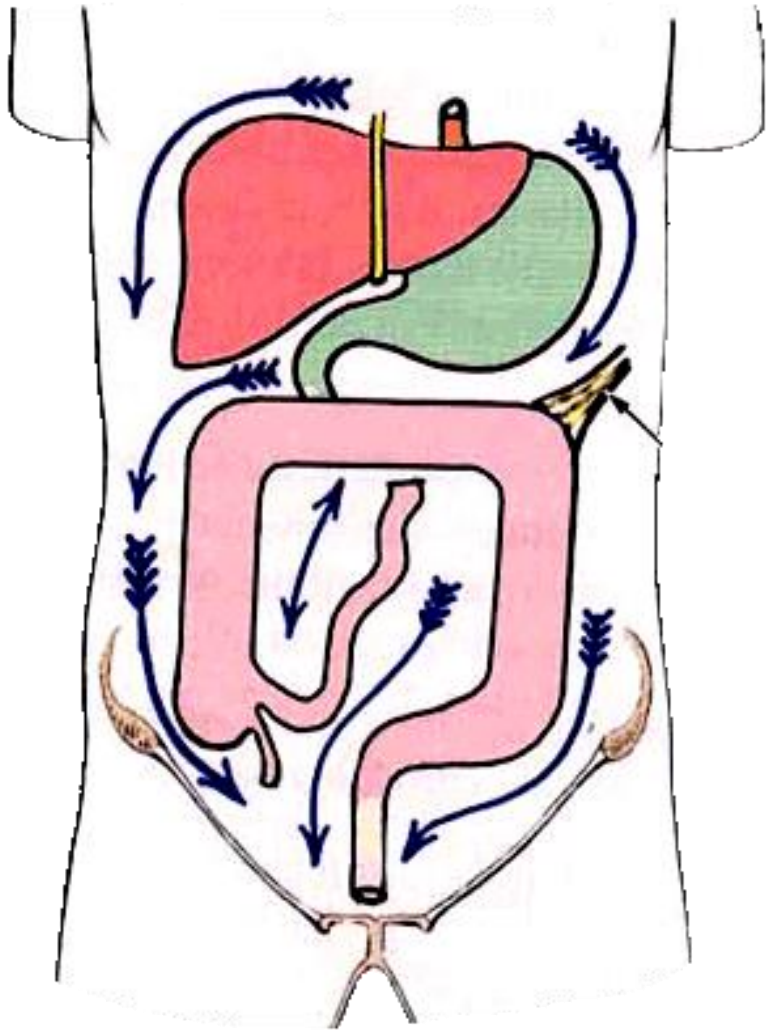
Peritoneal Subdivisions

Subphrenic Compartments

(space) – lies between diaphragm and transverse colon and transverse mesocolon

Supra-hepatic Recess

lies between the diaphragm and liver – the falciform ligament divides it into right and left supra-hepatic recesses



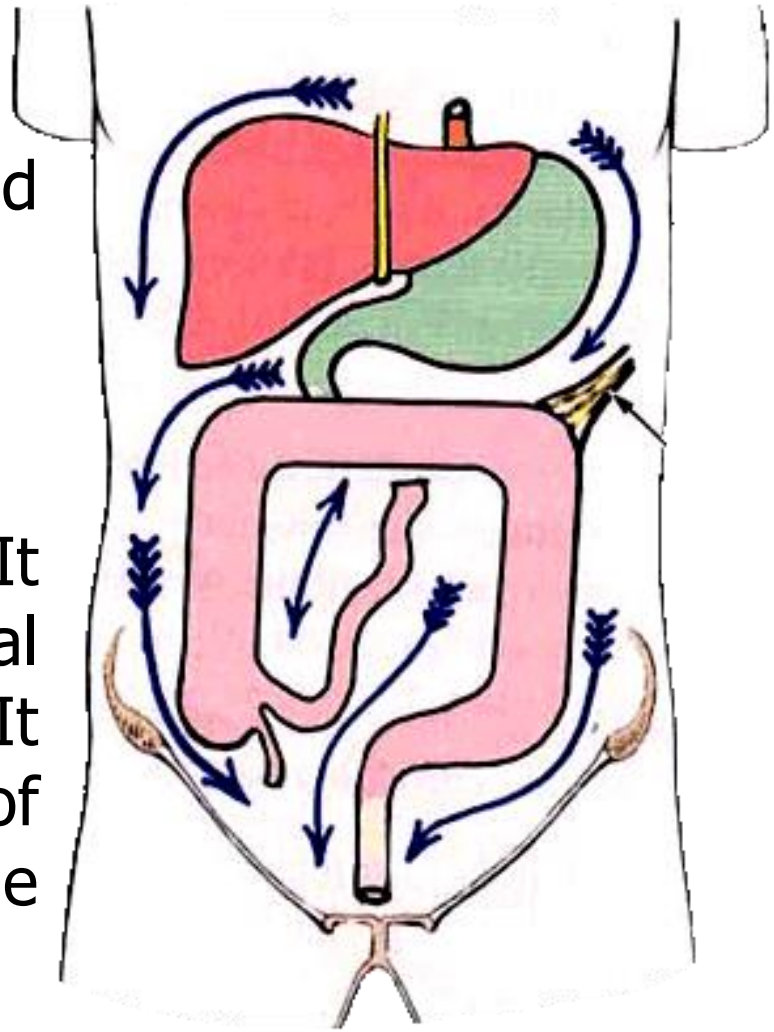
Peritoneal Subdivisions

Infra-colic compartments

Lies below the transverse colon and transverse mesocolon

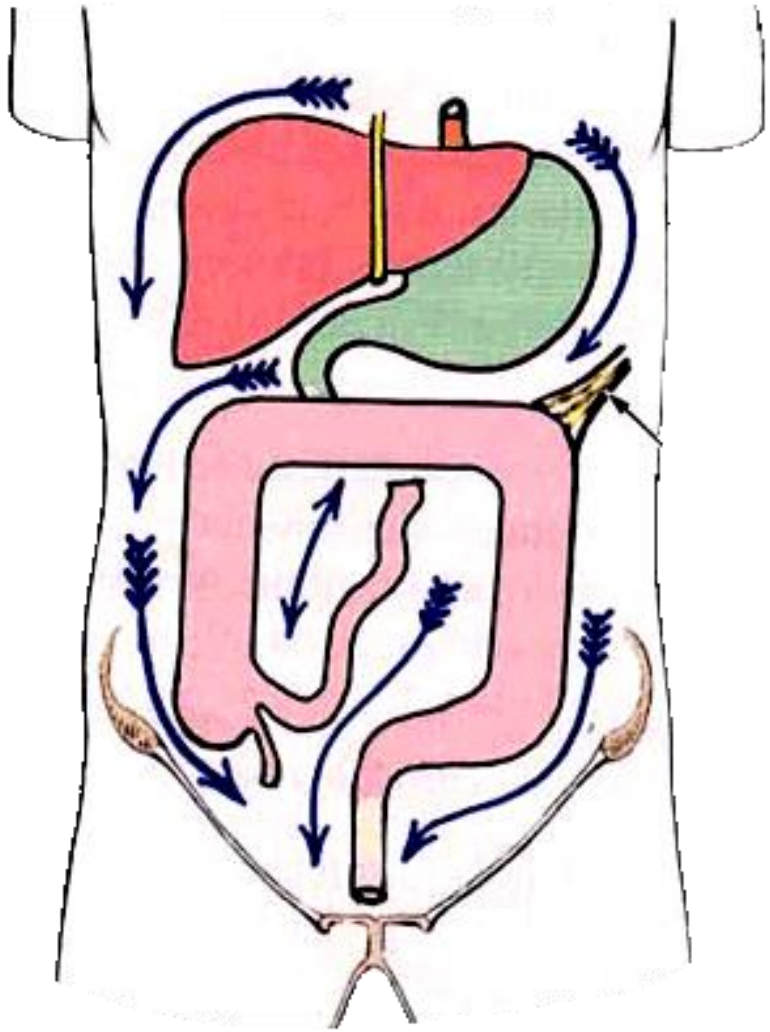
- ***Right paracolic gutter***

Lies lateral to the ascending colon. It communicates with the hepatorenal recess and the pelvic cavity. It provides a route for the spread of infection between the pelvic and the upper abdominal region.



Peritoneal Subdivisions

Infra-colic Compartments



- **Left paracolic gutter**

Lies lateral to the descending colon. It is separated from the area around the spleen by the phrenico-colic ligament

Diaphragm

- The diaphragm is a thin muscular and tendinous septum that separates thorax & abdominal cavities.

- The diaphragm is the most important muscle of respiration. It is dome shaped and consists of a peripheral muscular part, which arises from the margins of the thoracic opening, and a centrally placed tendon.

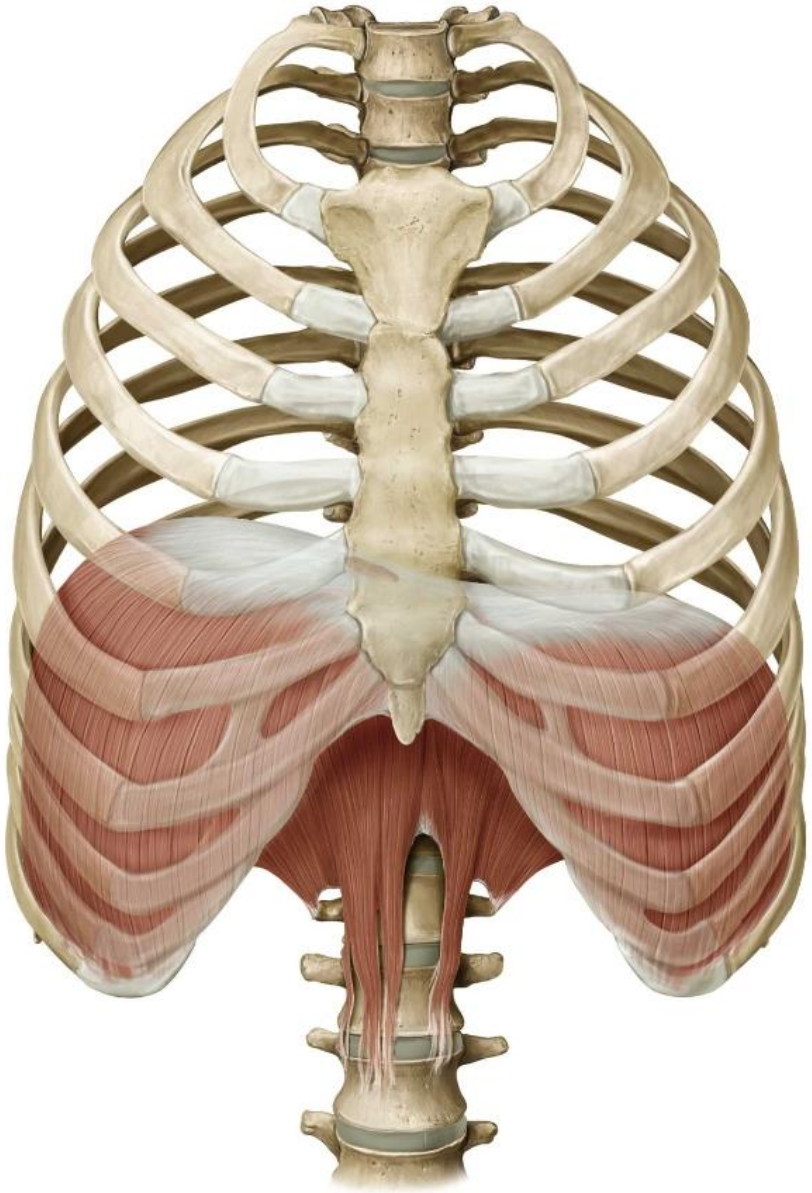


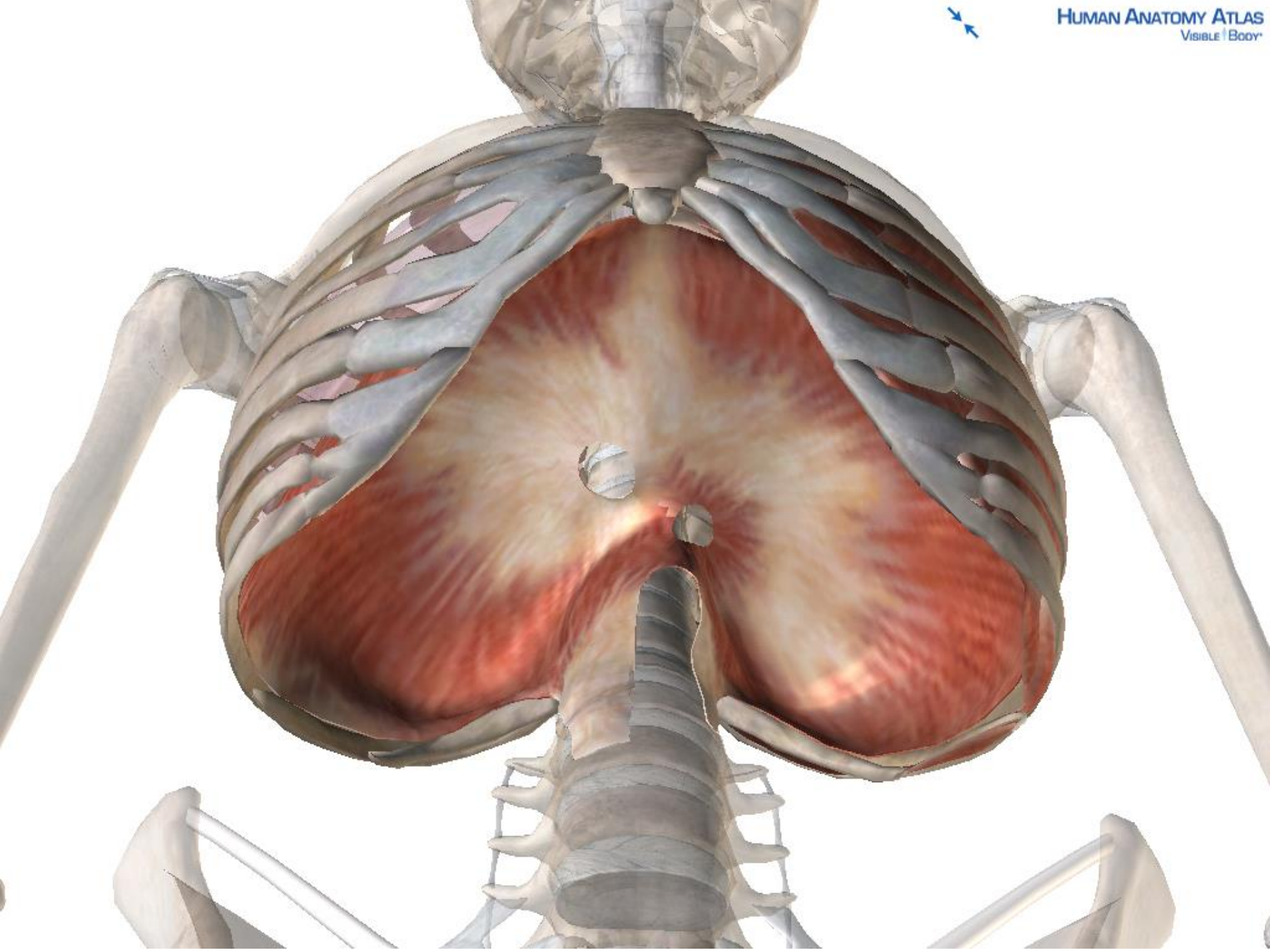
Fig. 5.12 A

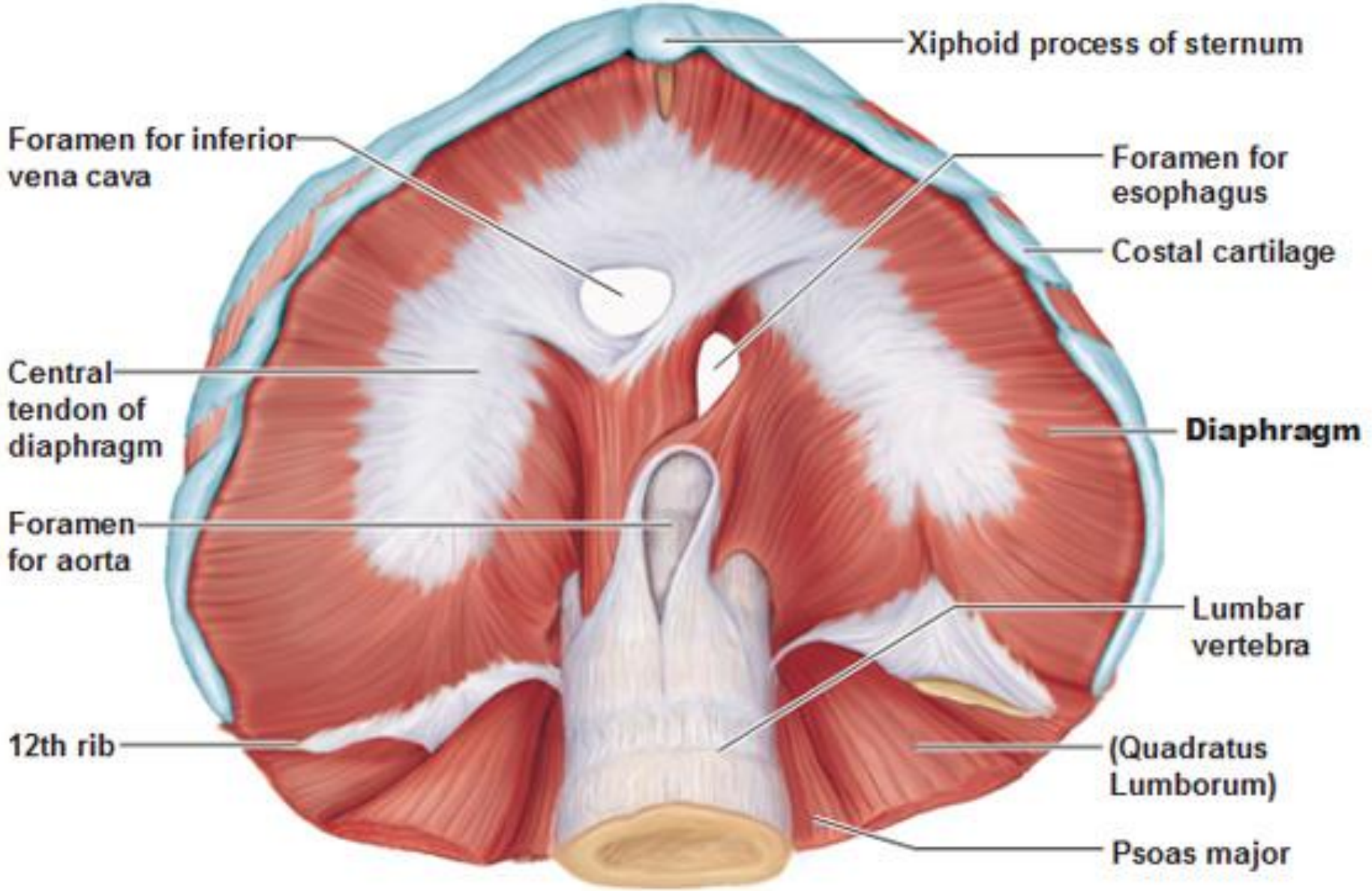
Illustrator: Karl Wesker

Diaphragm

- It is pierced by the structures that pass between the chest and the abdomen.
- The origin of the diaphragm can be divided into three parts:

1. A ***Sternal part*** arising from the posterior surface of the xiphoid process
2. A ***Costal part*** arising from the deep surfaces of the lower six ribs and their costal cartilages & forms the right & left domes
3. A ***Vertebral/Lumbar part*** arising from upper three lumbar vertebrae; forms the right & left crura & the arcuate ligaments


HUMAN ANATOMY ATLAS
VISIBLE BODY


Xiphoid process of sternum
Foramen for inferior vena cava
Foramen for esophagus
Costal cartilage
Central tendon of diaphragm
Diaphragm
Foramen for aorta
Lumbar vertebra
12th rib
(Quadratus Lumborum)
Psoas major

Diaphragm

- The right crus arises from the sides of the bodies of the ***L 1-3***; the left crus arises from the sides of the bodies of the ***L 1-2***.
- Lateral to the crura the diaphragm arises from the medial & lateral arcuate ligament.

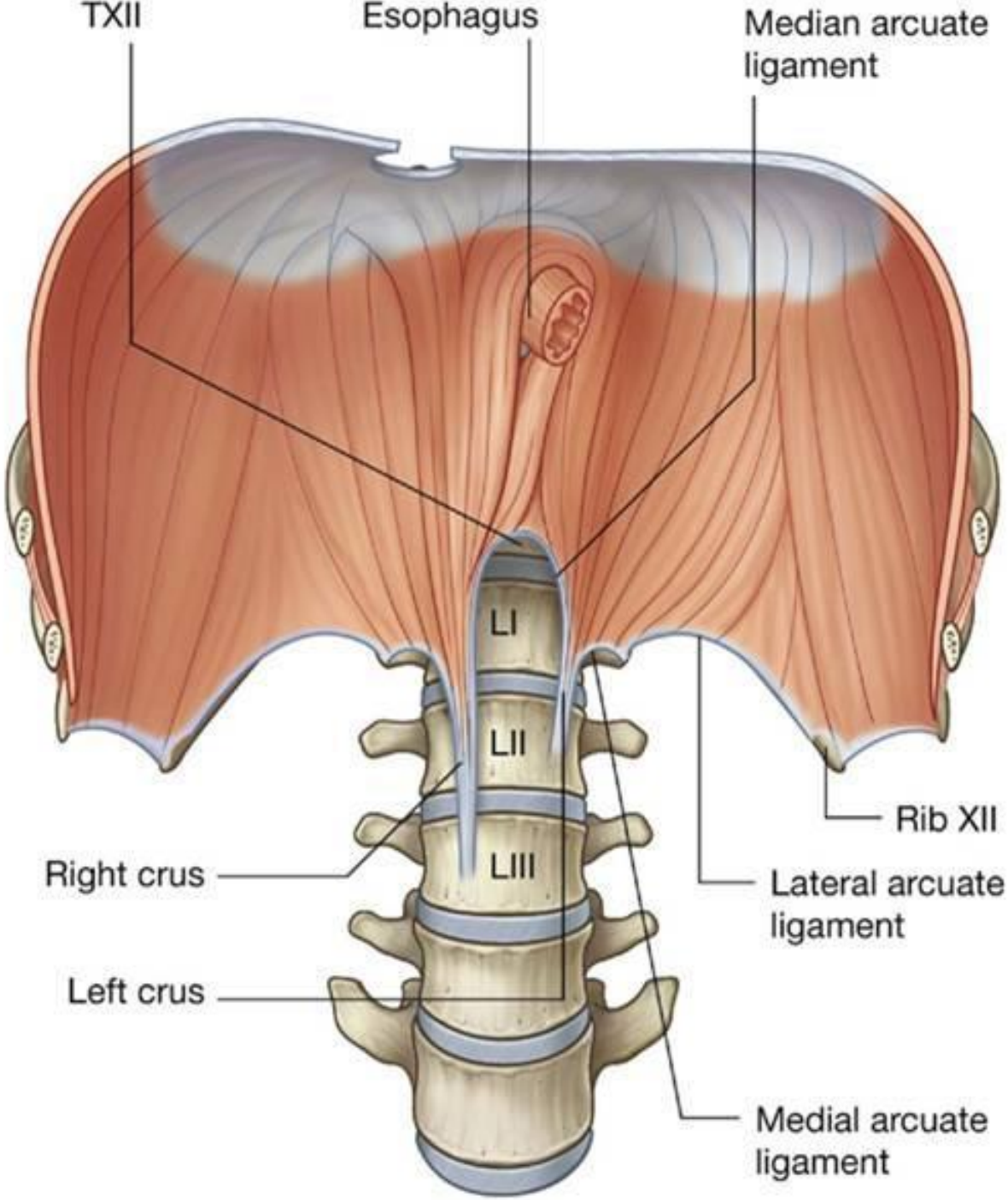
Diaphragm

- The ***Medial Arcuate Ligament*** extends from the side of the body of the second lumbar vertebra to the tip of the transverse process of the first lumbar vertebra.

Diaphragm

- The ***Lateral Arcuate Ligament*** extends from the tip of the transverse process of the first lumbar vertebra to the lower border of the 12th rib.

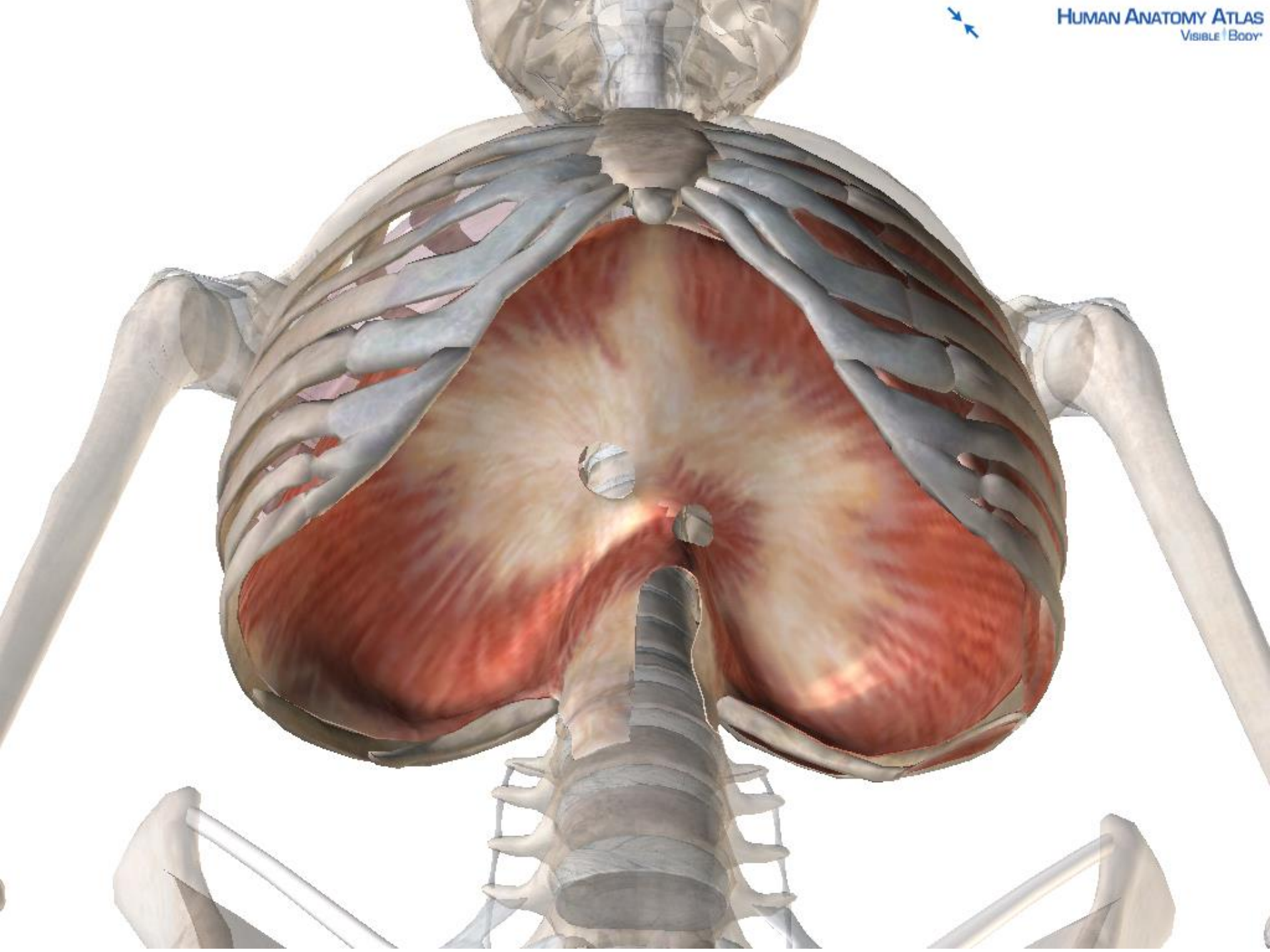
- The medial borders of the two crura are connected by a ***Median Arcuate Ligament*** which crosses over the anterior surface of the aorta


TXII
Esophagus
Median arcuate ligament
LI
LII
LIII
Rib XII
Right crus
Lateral arcuate ligament
Left crus
Medial arcuate ligament

Diaphragm

- ***Insertion of the Diaphragm:***

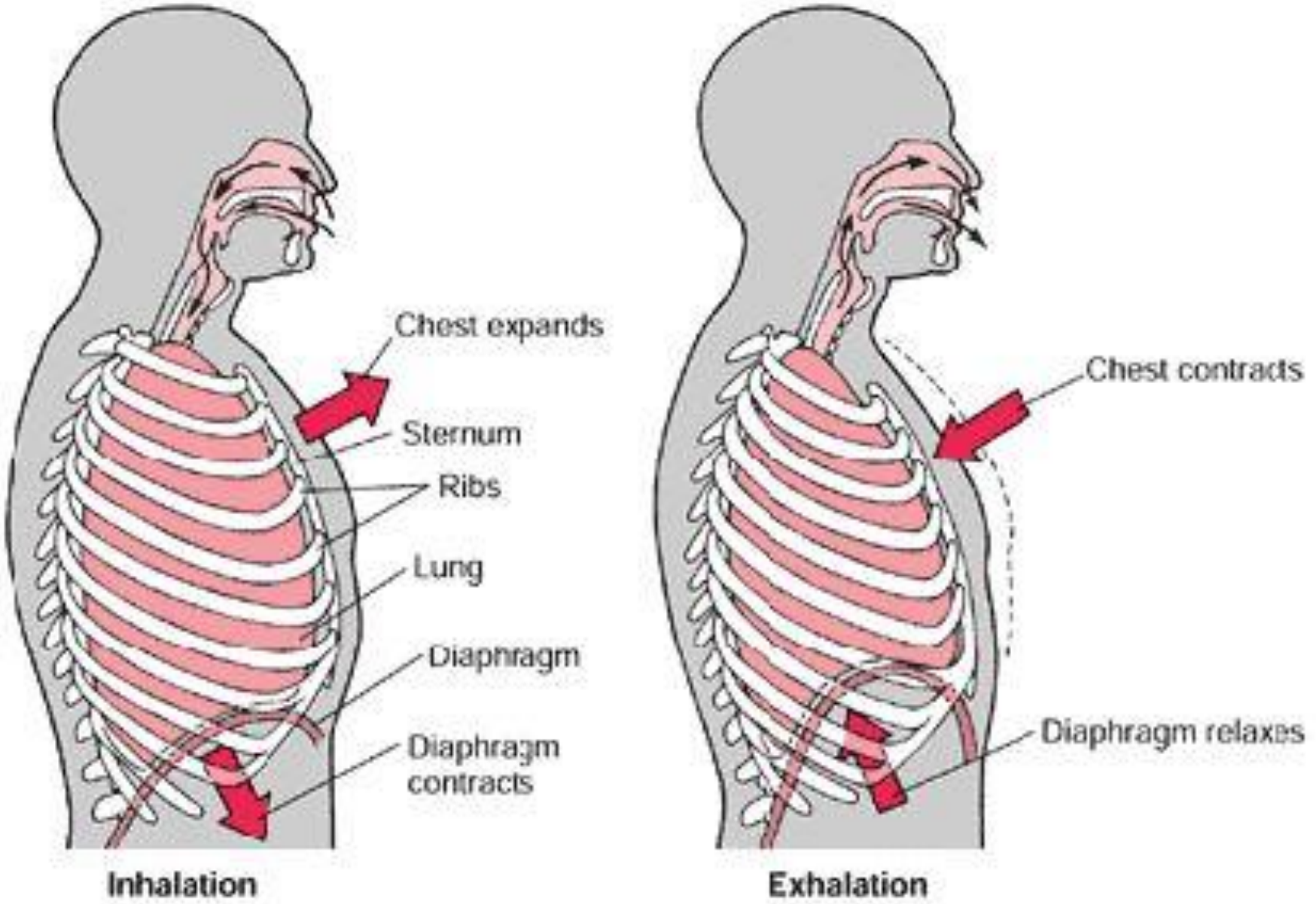
The diaphragm is inserted into a central tendon. The superior surface of the tendon is partially fused with the inferior surface of the fibrous pericardium.


HUMAN ANATOMY ATLAS
VISIBLE BODY

Functions of the Diaphragm

1. ***Muscle of inspiration.***

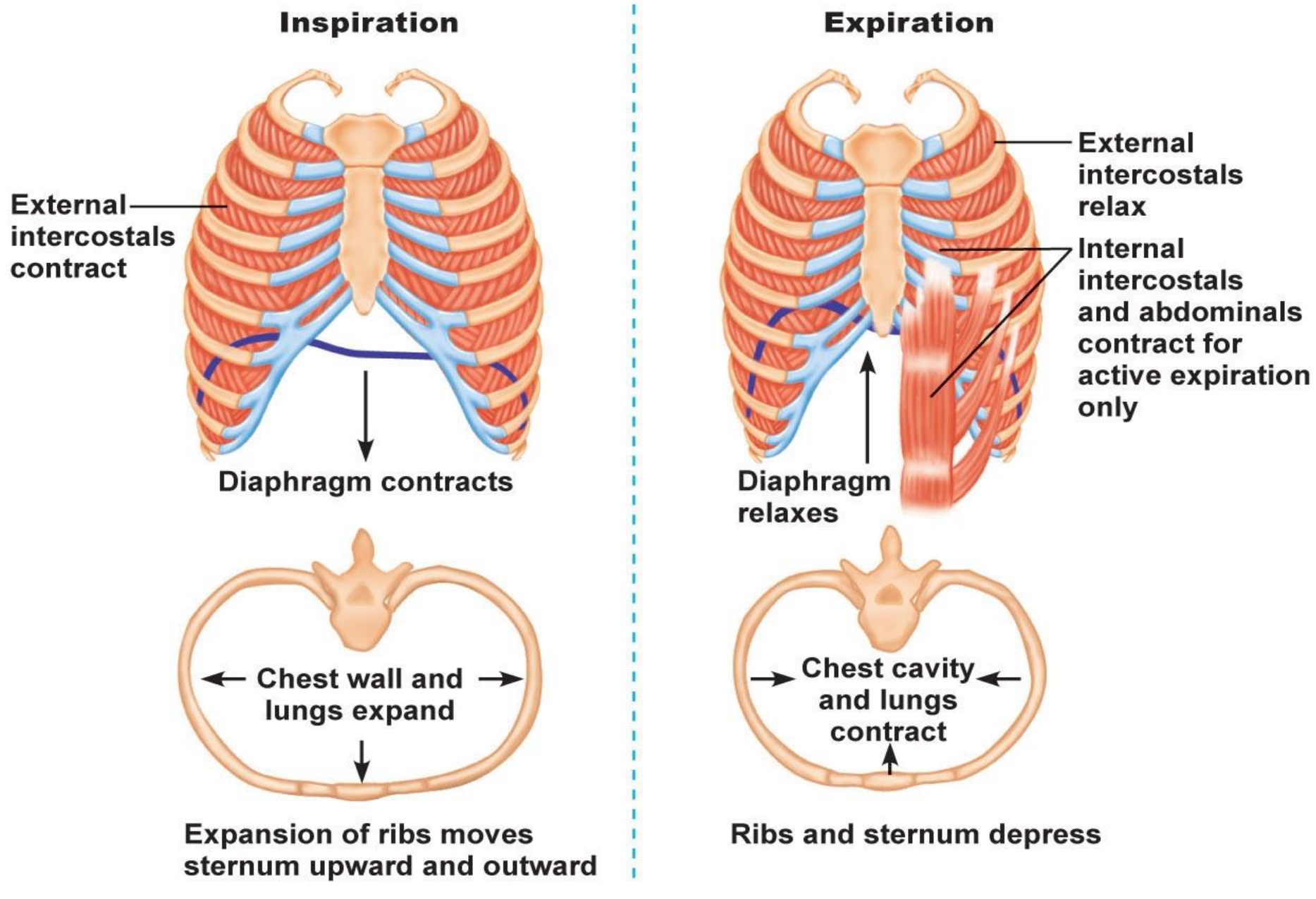
2. ***Weight lifting muscle***: In a person taking a deep breath and holding it (fixing the diaphragm), the diaphragm assists the muscles of the anterior abdominal wall in raising the intra-abdominal pressure.

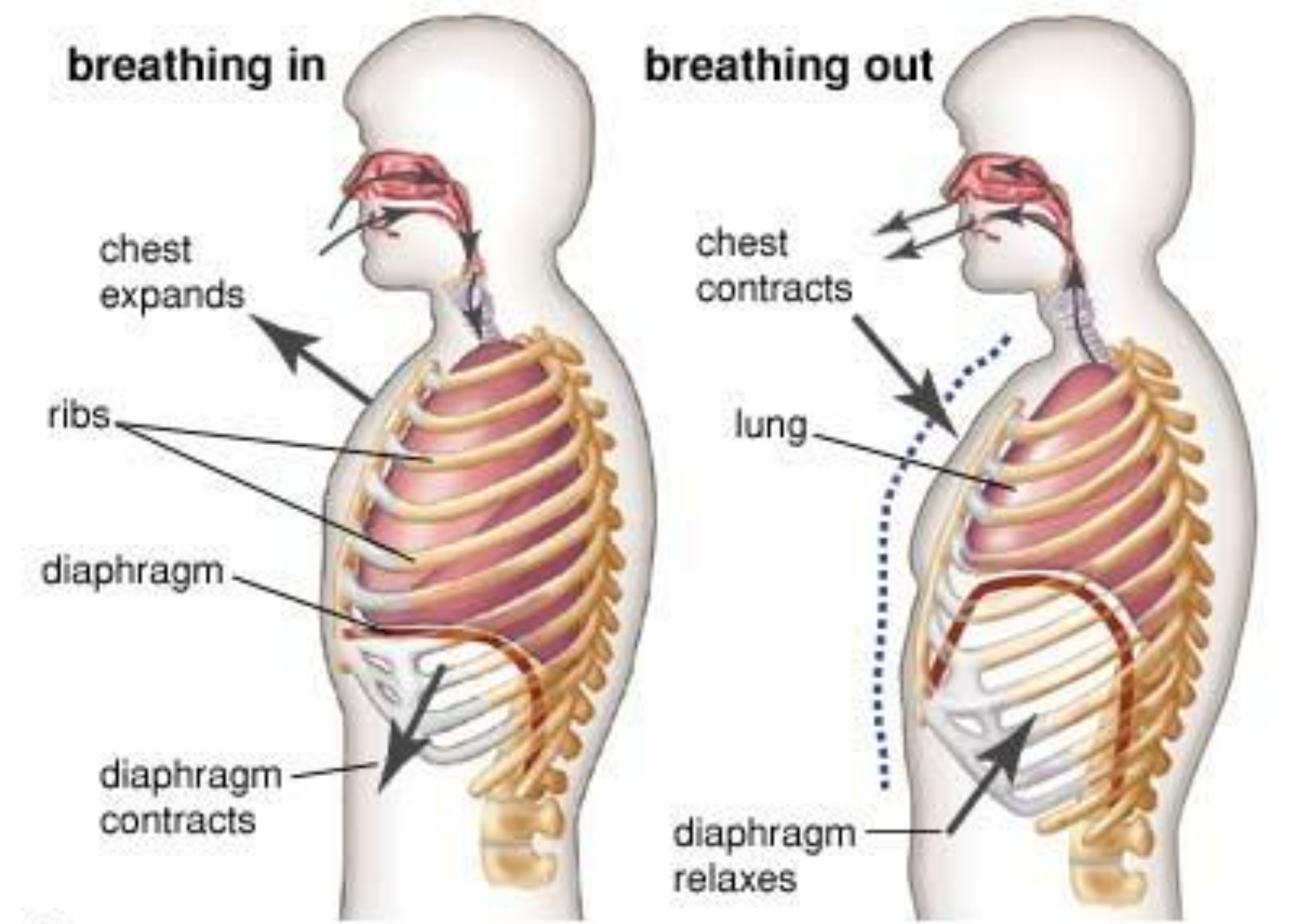

Chest expands
Sternum
Ribs
Lung
Diaphragm
Diaphragm contracts
Inhalation
Chest contracts
Diaphragm relaxes
Exhalation

Functions of the Diaphragm

3. ***Muscle of abdominal straining*** (micturition, defecation, and parturition).

4. ***Thoraco-abdominal pump***: The descent of the diaphragm decreases the intrathoracic pressure & increases the intra-abdominal pressure. This compresses the blood in the inferior vena cava and forces it upward into the right atrium of the heart.





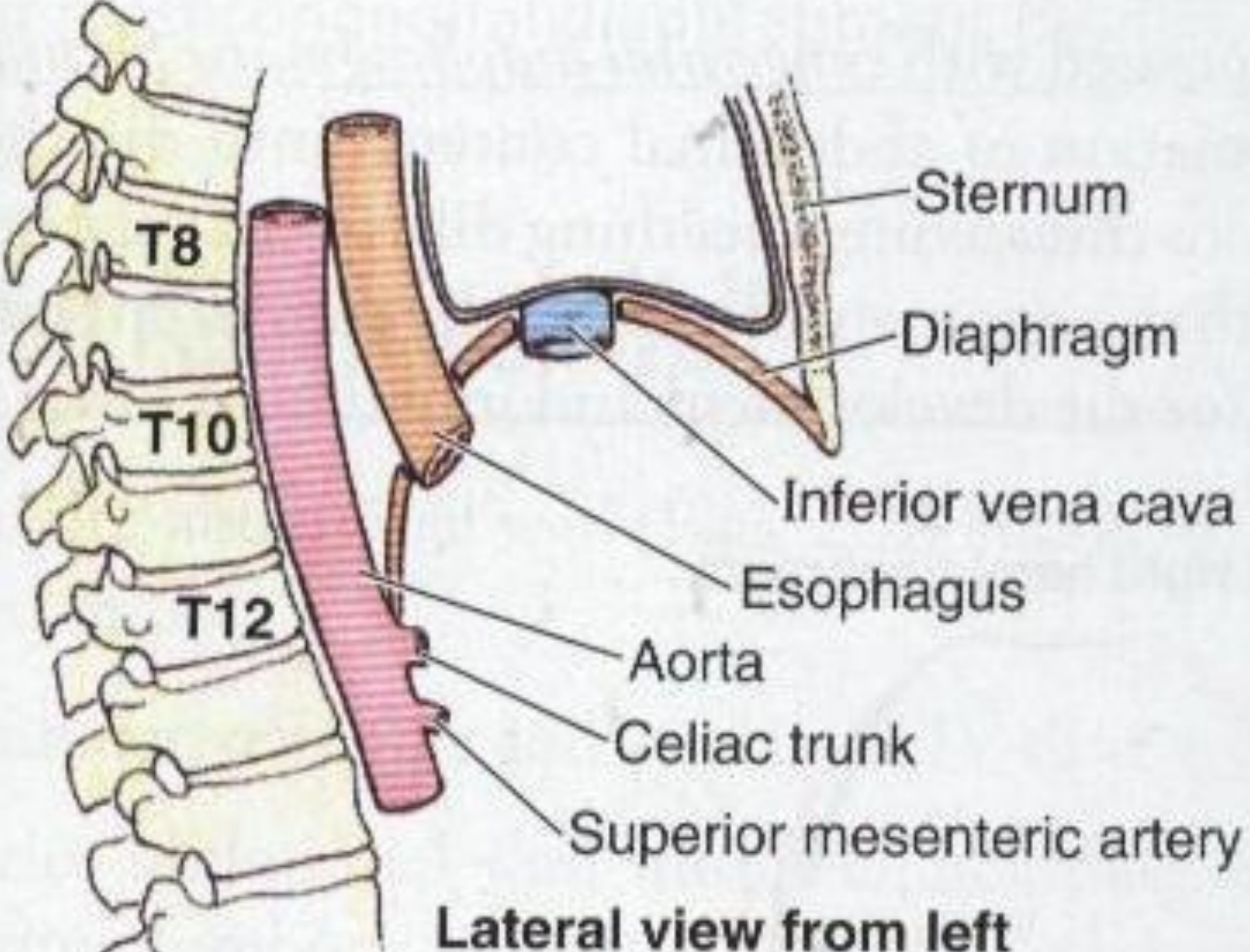
Openings in the Diaphragm

- ***The diaphragm has three main openings:***

- ***The caval opening*** lies at the level of the ***T 8*** vertebra in the central tendon for Inferior vena cava.

- ***The esophageal opening*** lies at the level of the ***T 10*** vertebra in a sling of muscle fibers derived from the right crus at the left of median plane. Plus right and left Vagus nerves

- ***The aortic opening*** lies anterior to the body of the ***T 12*** vertebra between the crura. In addition to the azygos, hemi azygos veins and the thoracic duct.



Lateral view from left

Phrenic Nerve

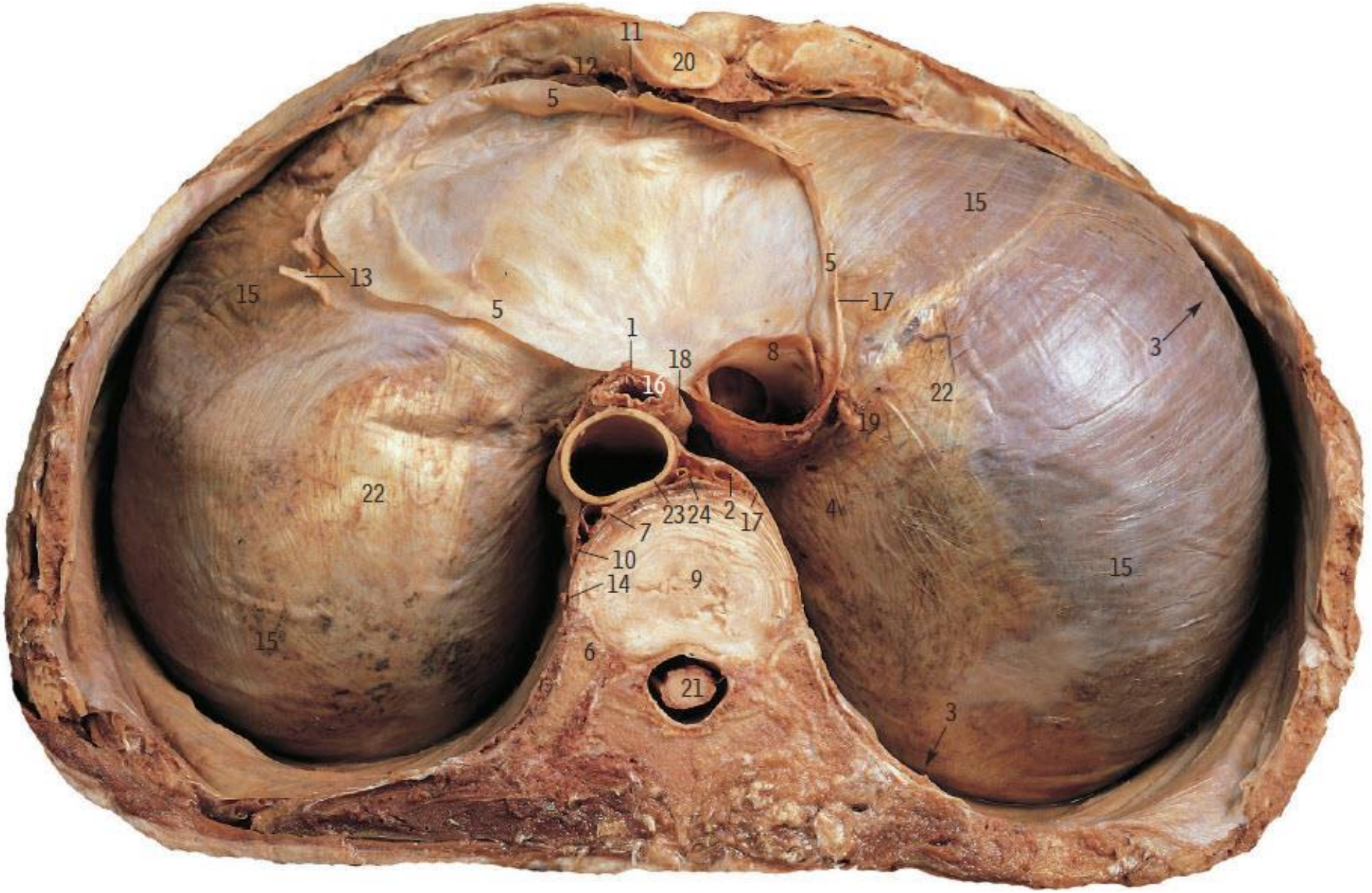
- ***Clinical Relevance: Diaphragmatic Paralysis***

- The phrenic nerve provides motor innervation to the diaphragm. If the nerve becomes damaged, paralysis of the diaphragm will result. There are numerous causes of phrenic nerve lesions

Phrenic Nerve

- ***Clinical Relevance: Diaphragmatic Paralysis***

- Paralysis of the diaphragm produces a **paradoxical movement**. The affected side of the diaphragm moves upwards during inspiration, and downwards during expiration. A unilateral diaphragmatic paralysis is usually asymptomatic, and is most often an incidental finding on x-ray. If both sides are paralyzed, the patient may experience poor exercise tolerance, orthopnea and fatigue. Lung function tests will show a **restrictive deficit**.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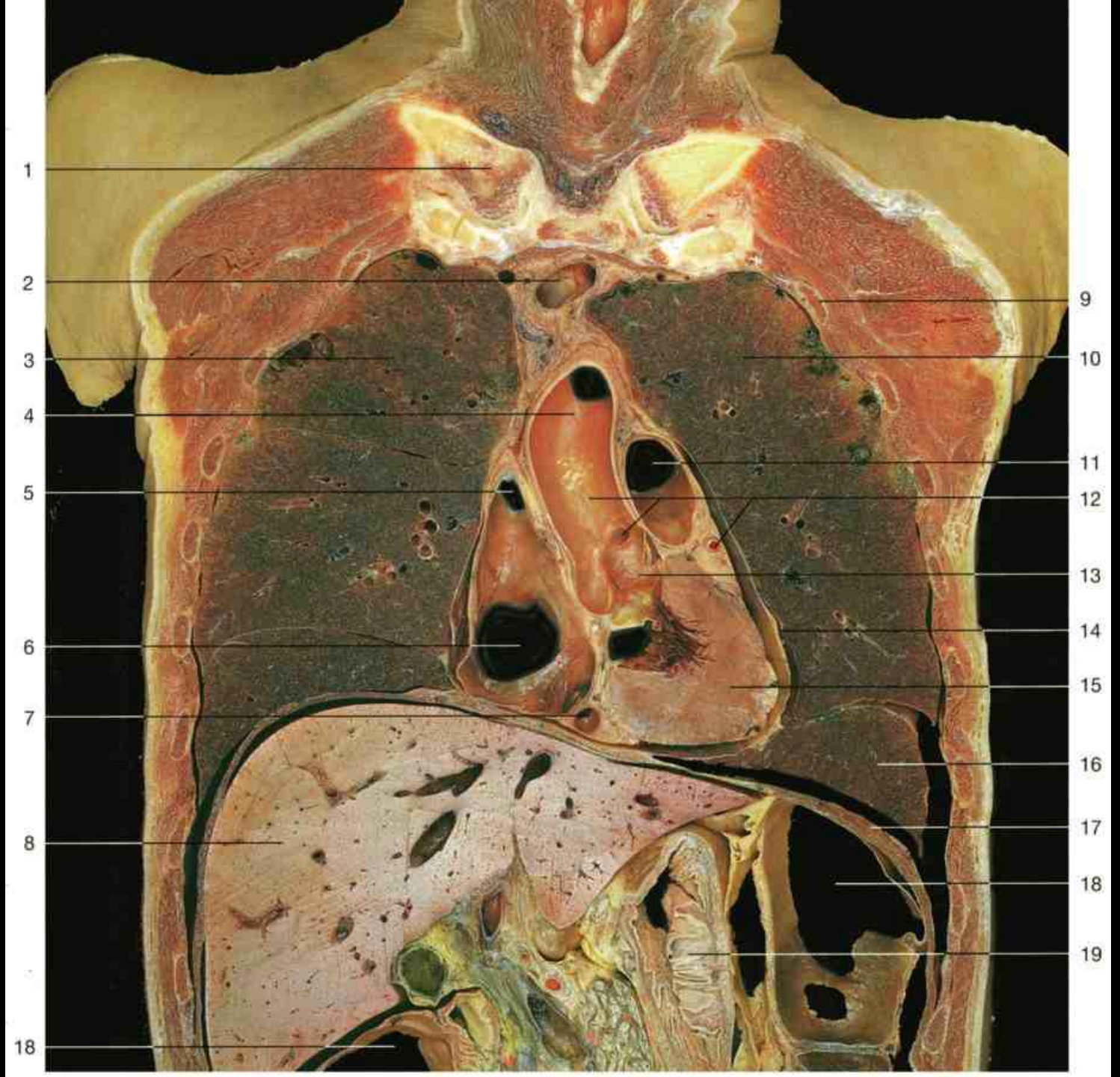
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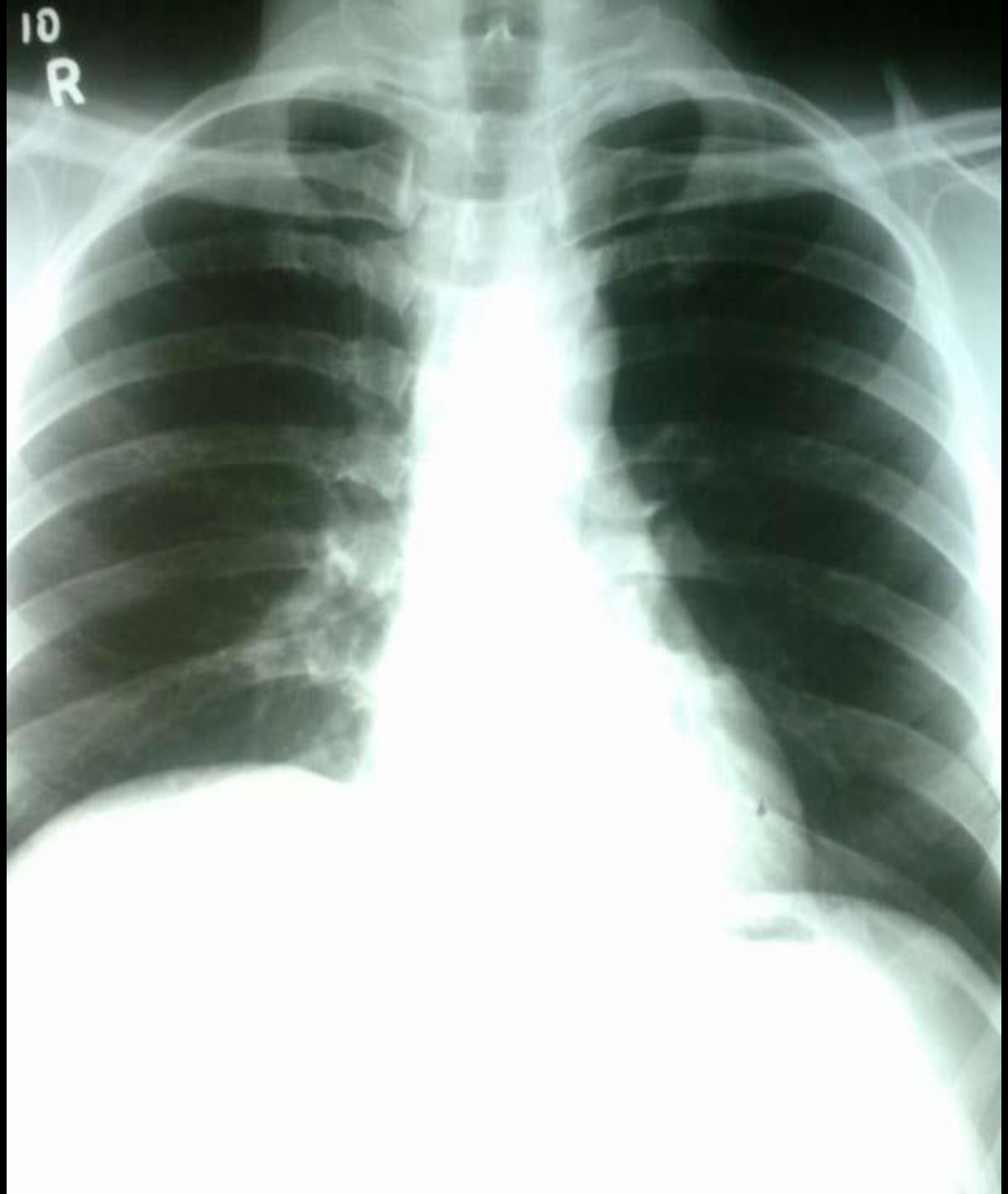
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- For further inquiries ***PLZ*** feel free to contact at any time through email

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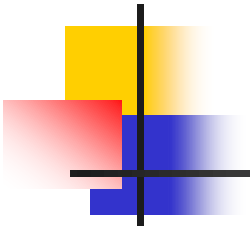
gamaltaha@med.asu.edu.eg



Thank You