PowerPoint Handout: GI Lab 2, Peritoneum, Peritoneal Cavity, & Esophagus

Updated: 2/9/2021

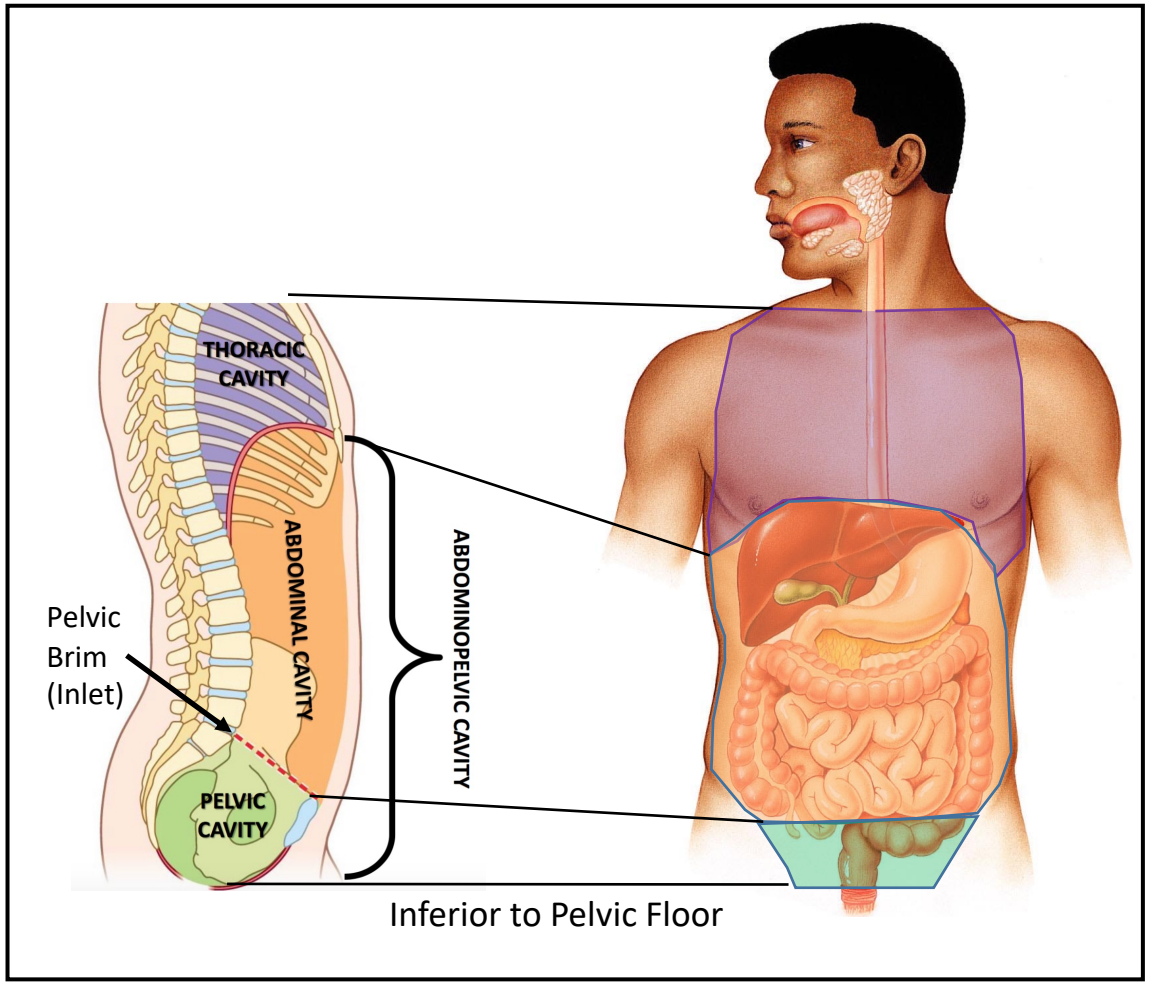
Digestive Organ Introduction

The human digestive system develops from a relatively linear embryonic duct into the highly coiled and differentiated tube in the adult called the alimentary canal, or gastrointestinal (GI) tract. The GI tract includes all of the structures with which the components of a meal come into contact as it is transported from mouth to anus. Accessory organs are not part of the GI tract, but they assist the GI tract in the mechanical and chemical digestion of food. Accessory glands release secretions into the GI tract which aid in the process of digestion. Other accessory structures manipulate the ingested food and mechanically break the food into smaller pieces.

The organs of the GI tract (alimentary canal) span several defined spaces within the trunk.

- Thoracic cavity: esophagus
- Abdominal cavity: distal esophagus, stomach, small intestine (duodenum, jejunum, ileum), cecum, appendix, ascending colon, transverse colon, descending colon, and the proximal portion of the sigmoid colon.
- Pelvic portion of the abdominopelvic cavity (pelvic cavity, lesser pelvis, true pelvis): distal portion of the sigmoid colon and the rectum
- Inferior to the pelvic diaphragm (pelvic floor): anal canal

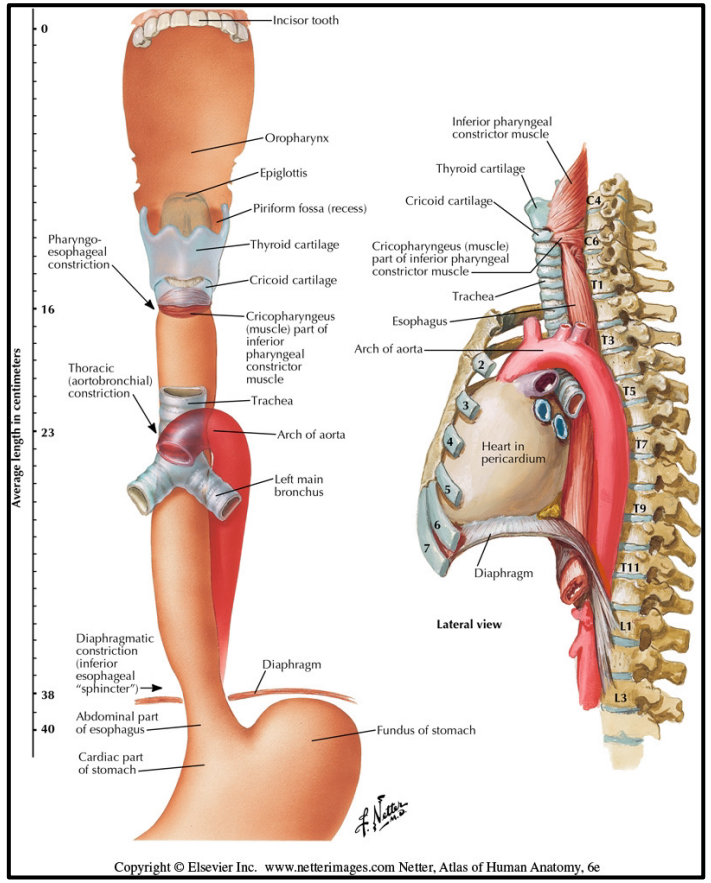
All of the *accessory glands* of the GI tract (the liver, gallbladder and pancreas), are located in the abdominal cavity. Also housed in the abdominal cavity is the spleen, which is a lymphoid organ that is anatomically and developmentally related to the foregut.

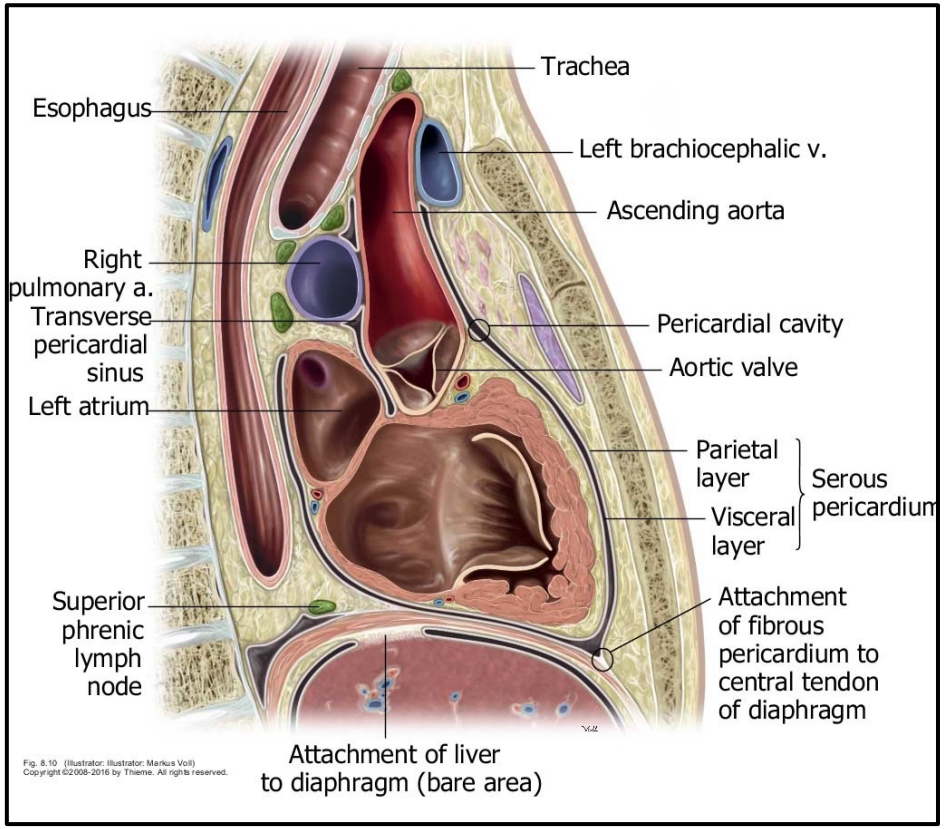


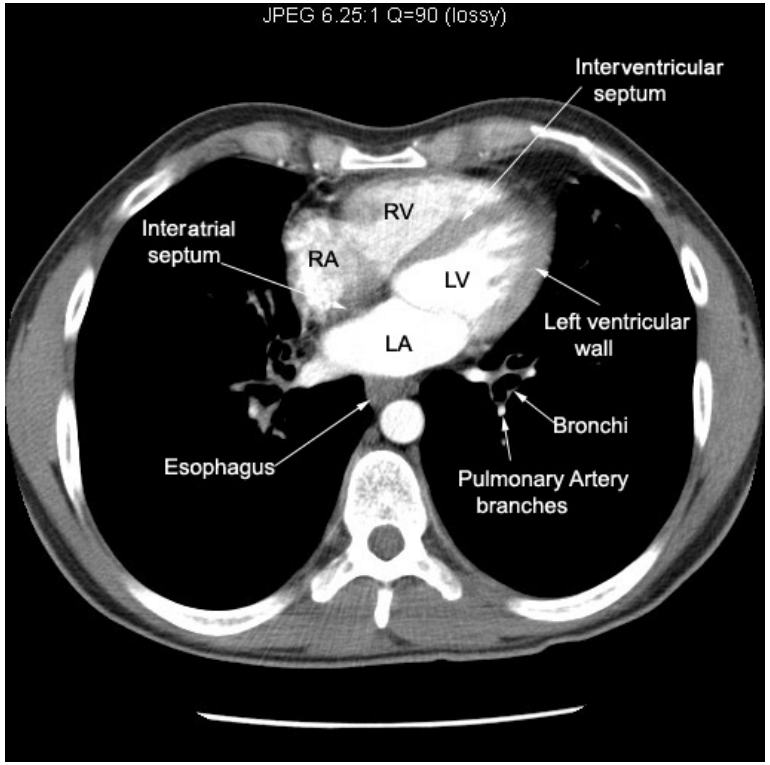
Esophagus: Path

The **esophagus** is a flattened muscular tube about 18–26 cm long that that begins in the neck and ends by joining the stomach in the abdominopelvic cavity. Its course from the neck to the abdominopelvic cavity is as follows (superior to inferior).

- It begins at the distal end of the pharynx (laryngopharynx) and descends toward the thoracic cavity posterior to the trachea.
- In the thoracic cavity, the esophagus is posterior to the ascending portion of the aortic arch. The arch crosses to the left of the esophagus, which results in the esophagus being medial to the descending portion of the aortic arch.
- As the esophagus continues its descent through the thorax, it progressively becomes anterior to the aorta. In addition, during its path in the thorax, it is located posterior to the pericardial sac of the heart (mainly left atrium, some left ventricle).
- It enters the abdomen anterior to the aorta by passing through the esophageal hiatus in the diaphragm (**T10 vertebral level)**.
- Upon entering the abdomen, it is called the abdominal part of the esophagus, which empties into stomach at the gastroesophageal junction (GEJ). The GEJ is the location of the cardiac sphincter (lower esophageal sphincter).



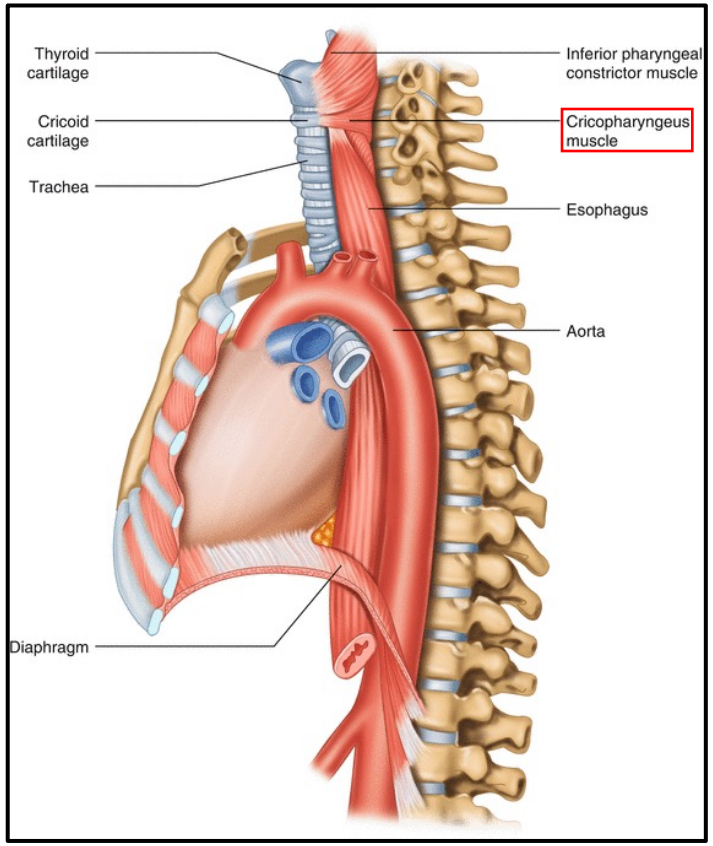


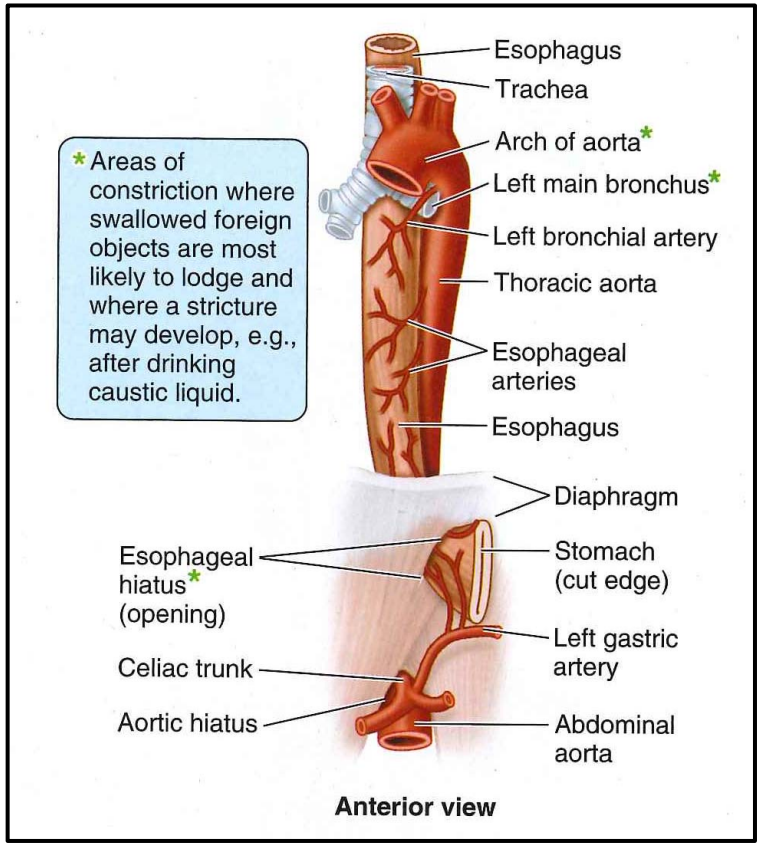


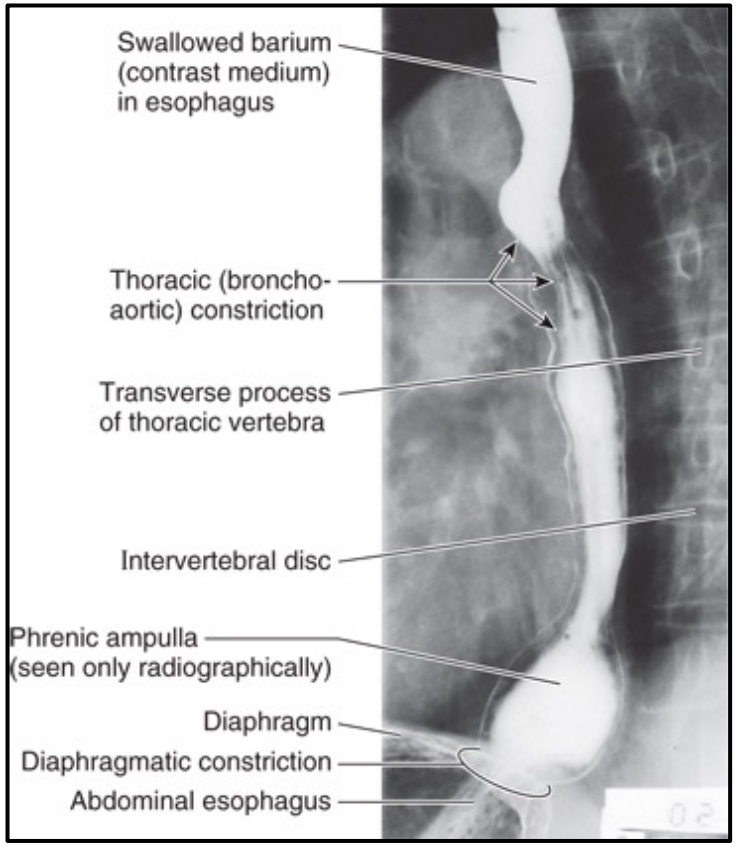
Esophagus: Constrictions

CLINICAL ANATOMY: The esophagus has three natural "constrictions," where adjacent structures press into the esophageal wall. These may be observed as narrowed regions of the lumen in oblique chest radiographs that are taken as barium is swallowed. The esophagus is compressed in the following three regions.

1. A cervical constriction occurs at the level of the cricoid cartilage by the cricopharyngeus muscle (upper esophageal sphincter)
2. A thoracic constriction occurs where the arch of the aorta and left main bronchus cross the esophagus. Sometimes these are considered as separate constrictions. When considered together, this impression is called the broncho-aortic constriction. The aortic arch compression is most evident in a postero-anterior (PA) radiograph after a barium swallow, and the bronchial impression is more evident in lateral views. No constrictions are visible in the empty esophagus; however, as it expands during filling, the structures noted above compress its walls.
3. A constriction occurs as the esophagus passes through the esophageal hiatus to enter the abdominal cavity.



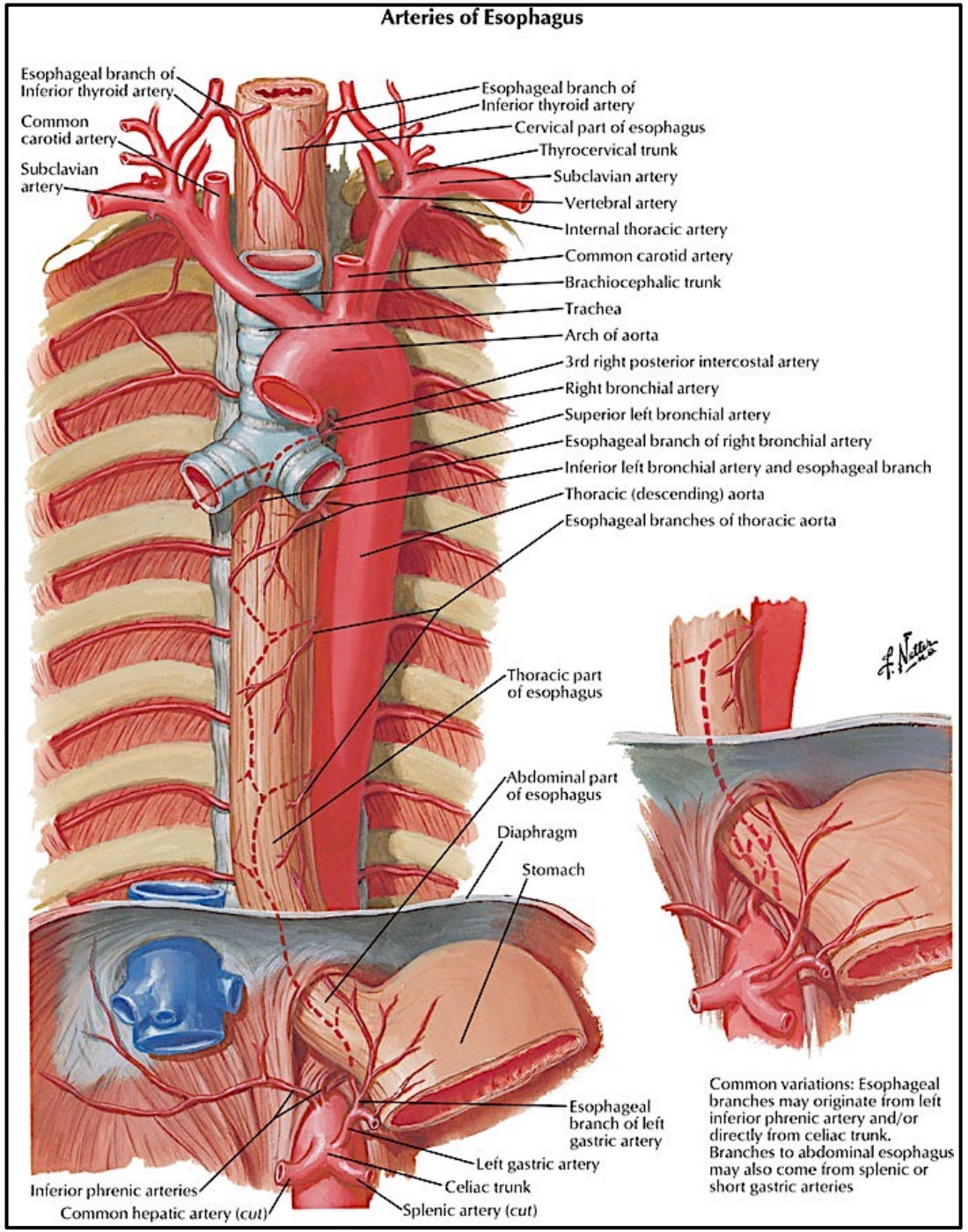




Esophagus: Arterial Supply

The arterial supply to the esophagus involves many vessels and can be separated into three areas.

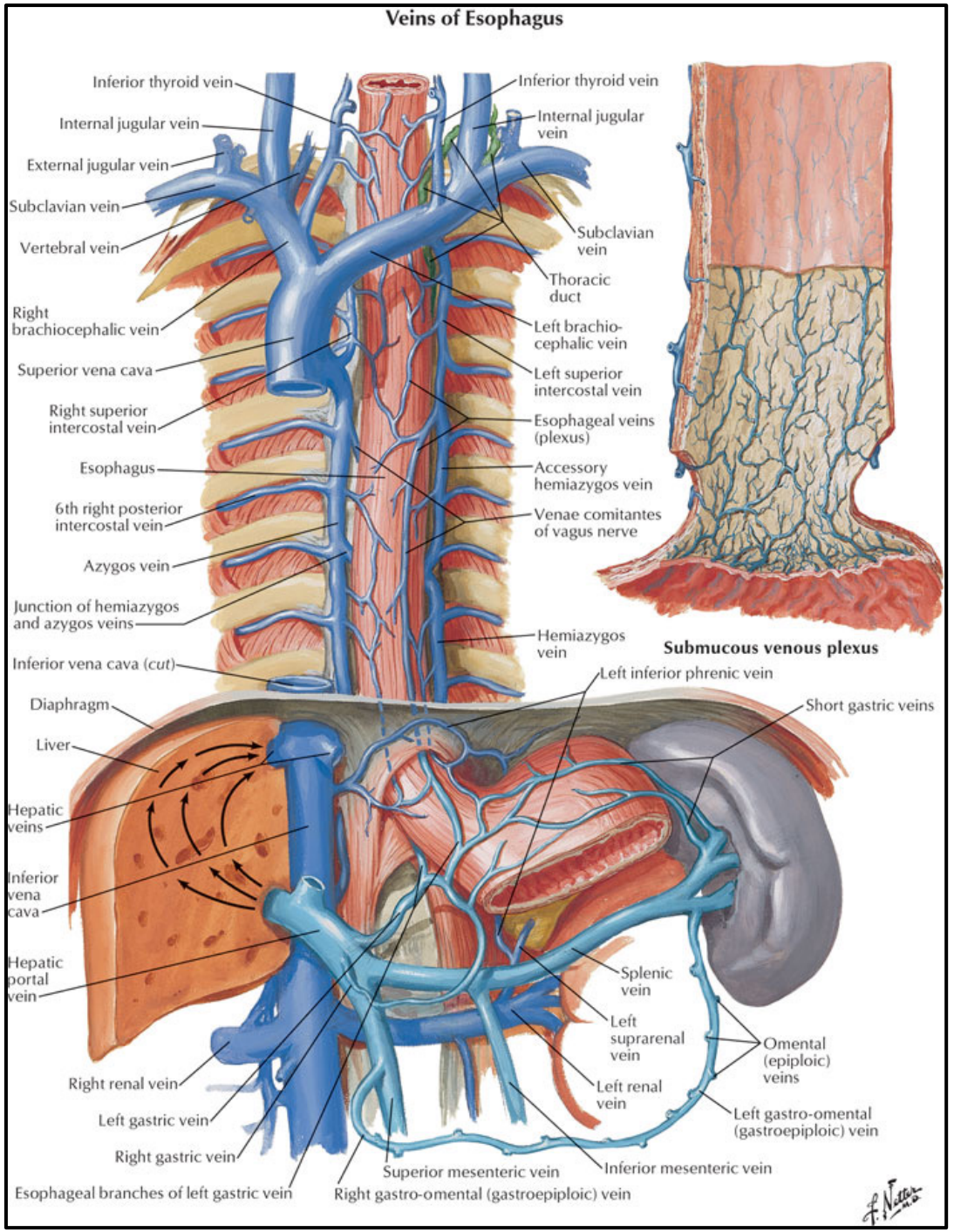
- Upper 1/3 (Upper esophageal sphincter, cervical esophagus)
  - **Esophageal branch of Inferior thyroid artery** (branch of the thyrocervical trunk)
- Middle 1/3 (thoracic esophagus)
  - **Esophageal branches of the thoracic aorta**
  - Terminal branches of bronchial arteries
- Lower 1/3 (abdominal esophagus)
  - Branches from **left gastric artery**
  - Branches of **left phrenic artery**



Esophagus: Venous Drainage

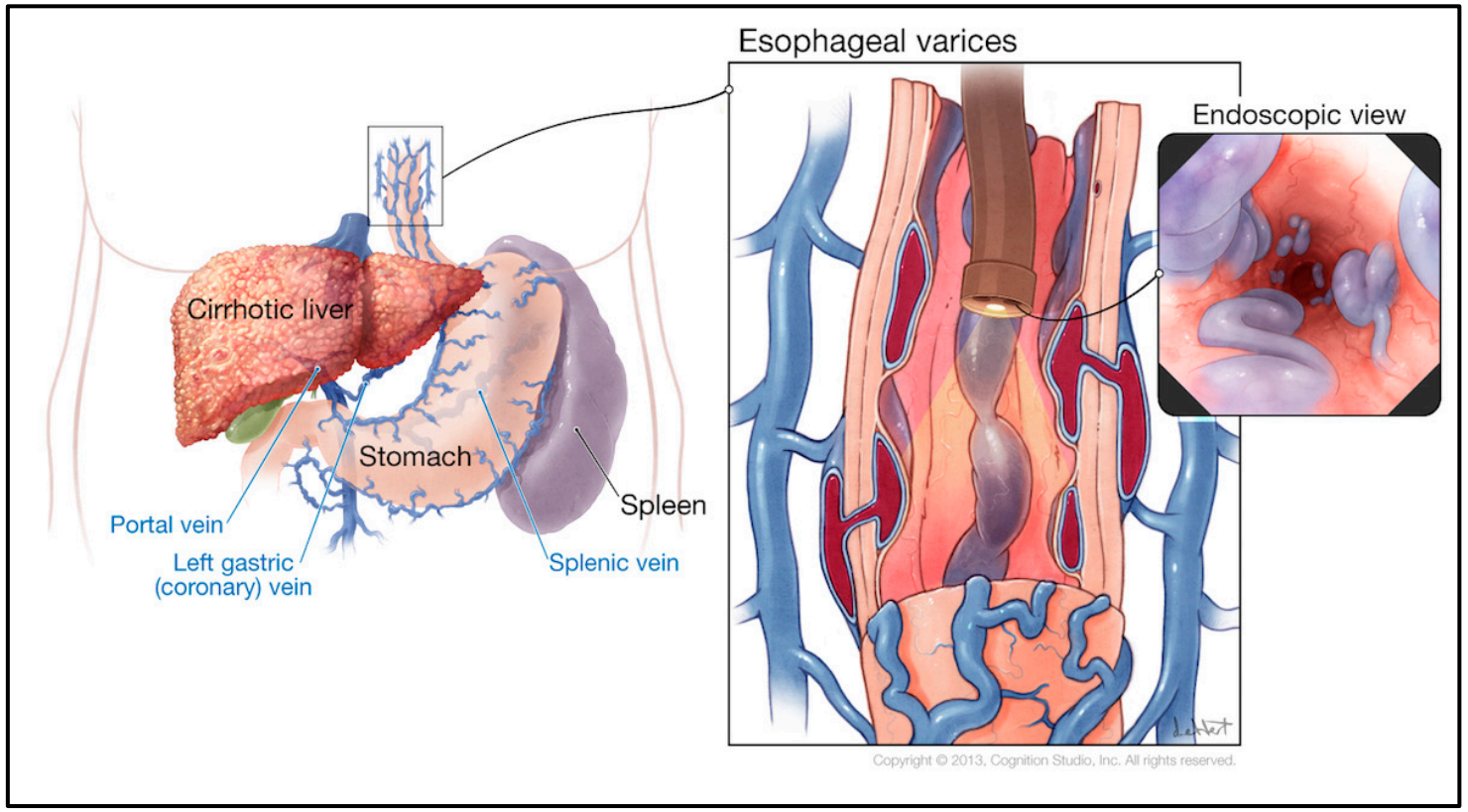
The venous drainage of the esophagus involves many vessels and can be separated into three areas.

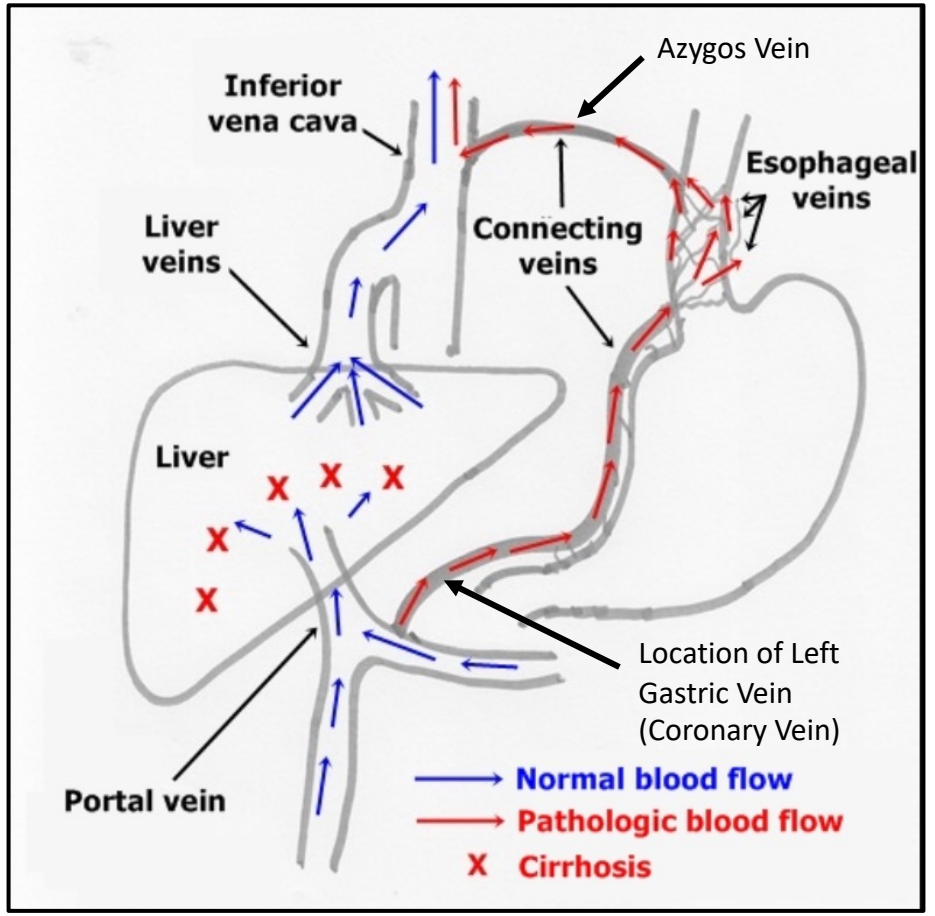
- Upper 1/3 (Upper esophageal sphincter, cervical esophagus)
  - **Inferior thyroid veins**
- Middle 1/3 (thoracic esophagus)
  - **Azygos vein**
  - **Hemiazygos vein**
  - *Bronchial veins (to a lesser extent)*
- Lower 1/3 (abdominal esophagus)
  - **Left gastric vein** (also called coronary vein)



Esophageal Varices

CLINICAL ANATOMY: Esophageal varices are a manifestation of portal hypertension which is usually caused by cirrhosis. Normally, blood in the lower 1/3rd of the esophagus drains via the left gastric vein (coronary vein) into the portal vein to be filtered by the liver. If portal hypertension is present, then blood flow through the portal system is impeded; this increased pressure is transmitted back to the veins of the lower esophagus which causes these thin-walled esophageal veins to dilate, forming esophageal varices. Because the blood from the lower esophagus cannot adequately drain through the portal system, it is redirected through collaterals that develop to the azygos vein and ultimately the inferior vena cava.



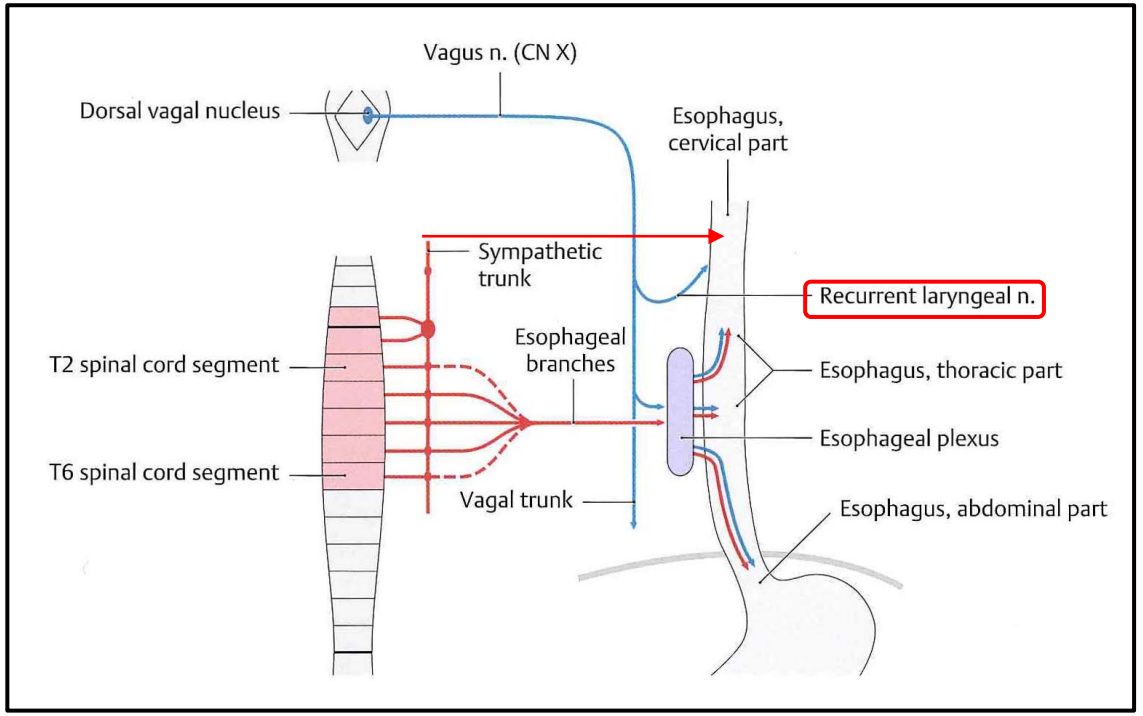


Esophagus: Innervation

Innervation of the esophagus is complex as it receives neuron fibers from both the sympathetic and parasympathetic divisions of the ANS. In addition, the cervical esophagus is innervated separately from the thoracic esophagus.

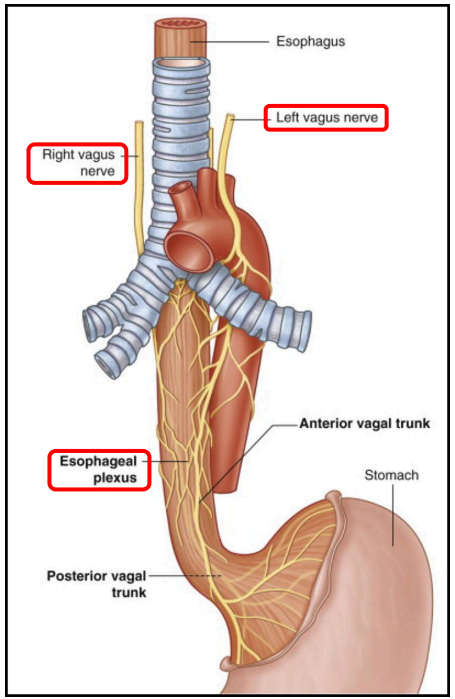
Upper 1/3: Cervical Esophagus

- Parasympathetic innervation is via the **recurrent laryngeal branch of the vagus nerve.**
  - Branchial efferent to skeletal muscle
  - Preganglionic visceral efferent fibers to myenteric plexus supplying glands
- *Sympathetic innervation from branches of sympathetic trunk are primarily vasomotor
  - Postganglionic fibers arise from cervical and T1 region of sympathetic trunk.
- Sensory:
  - Mechanosensation and chemosensation for reflexes: **recurrent laryngeal branch of vagus**
  - Pain: **axons follow path of sympathetic neurons**



Lower 2/3: Thoracic Esophagus

- A mesh-like network of neurons called the **esophageal plexus** innervates smooth muscle and glands of the inferior two-thirds of the esophagus. This network is formed by sympathetic and parasympathetic fibers.
  - Parasympathetic: **reft and right vagus nerve**
    - Preganglionic visceral efferent fibers innervate smooth muscle and glands.
  - *Sympathetic innervation from branches of sympathetic trunk are primarily vasomotor.
    - *Preganglionic* fibers to the esophagus arise from T1-T10 intermediolateral column (lateral horn) of the spinal cord.
    - *Postganglionic* fibers arise from the T2-T5(6) ganglia of the sympathetic trunk.
  - Sensory:
    - Mechanosensation and chemosensation for reflexes: **right and left vagus nerve**
    - Pain: **axons follow path of sympathetic neurons** with many synapsing on the T1-T6 spinal cord levels, which means referred pain is “felt” in the T1-T6 dermatomes.

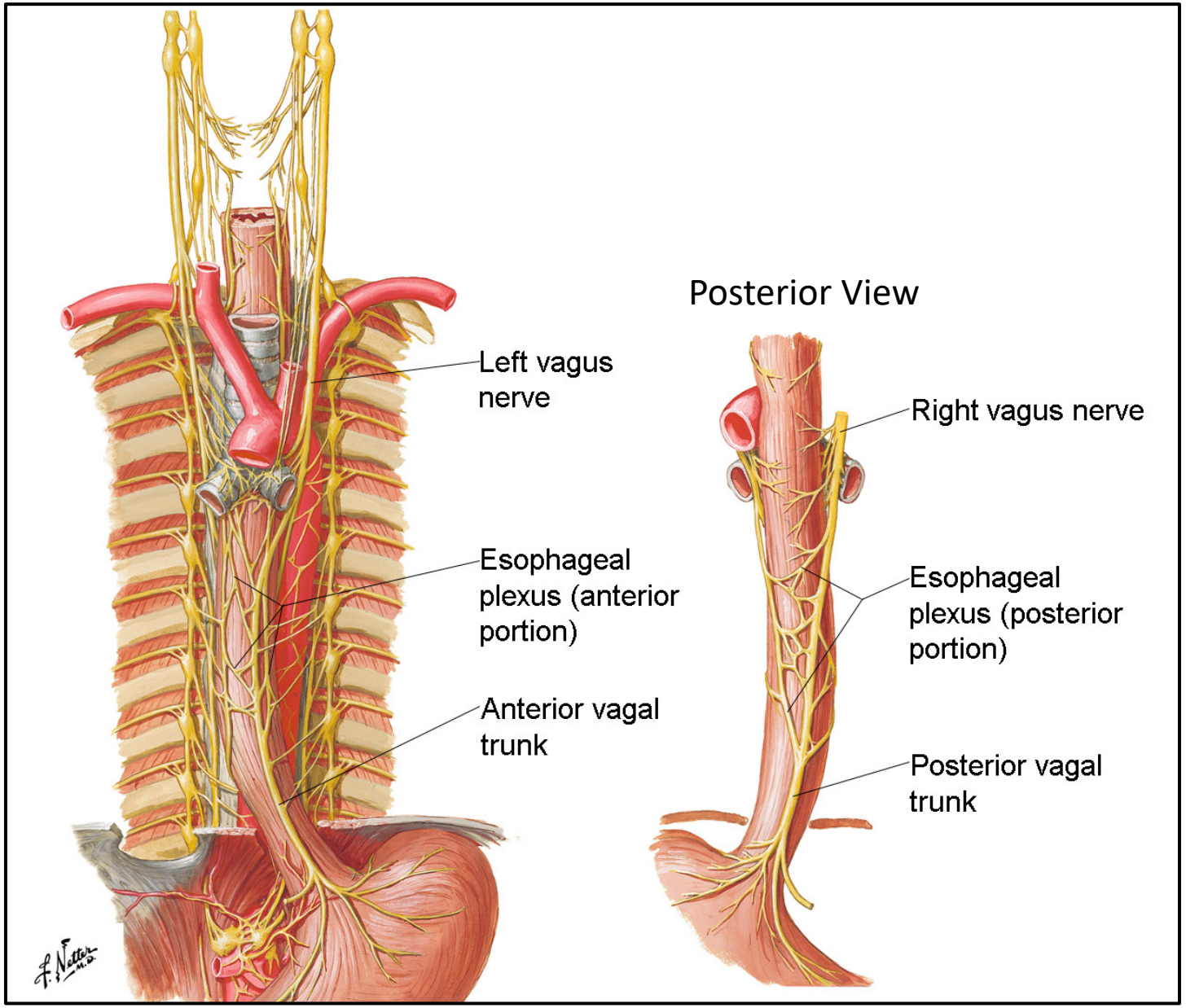


Esophageal Plexus & Vagal Trunks

FUNCTIONAL ANATOMY: Neurons upon which the parasympathetic fibers synapse within the esophageal wall are contained within the myenteric and submucosal plexuses. These plexuses give rise to significant autonomy to esophageal contraction, even when vagal and sympathetic fibers are severed. A peristaltic wave of contraction is initiated in the esophagus by the voluntary act of swallowing. Unlike other portions of the alimentary canal, the esophagus does not engage in spontaneous peristaltic contractions.

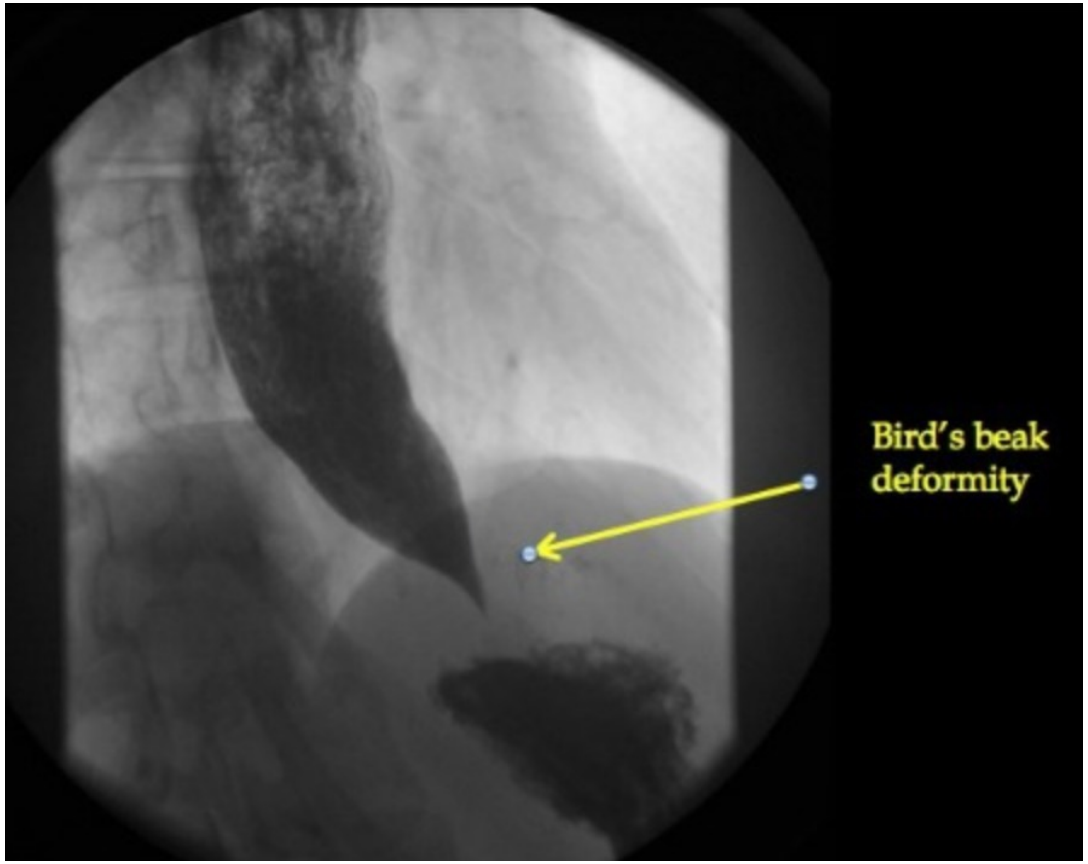
Just superior to the diaphragm, fibers in the esophageal plexus coalesce to form the anterior and posterior vagal trunks, which pass through the esophageal hiatus with the esophagus to innervate portions of the gastrointestinal tract.

- Fibers from the left vagus enter the anterior aspect of the esophageal plexus and typically predominate in the anterior vagal trunk.
- Fibers from the right vagus pass to the posterior aspect of the esophageal plexus and predominate in the posterior vagal trunk.
- A commonly used mnemonic to remember this relationship is LARP
  - Left = Anterior
  - Right = Posterior



Esophageal: Achalasia

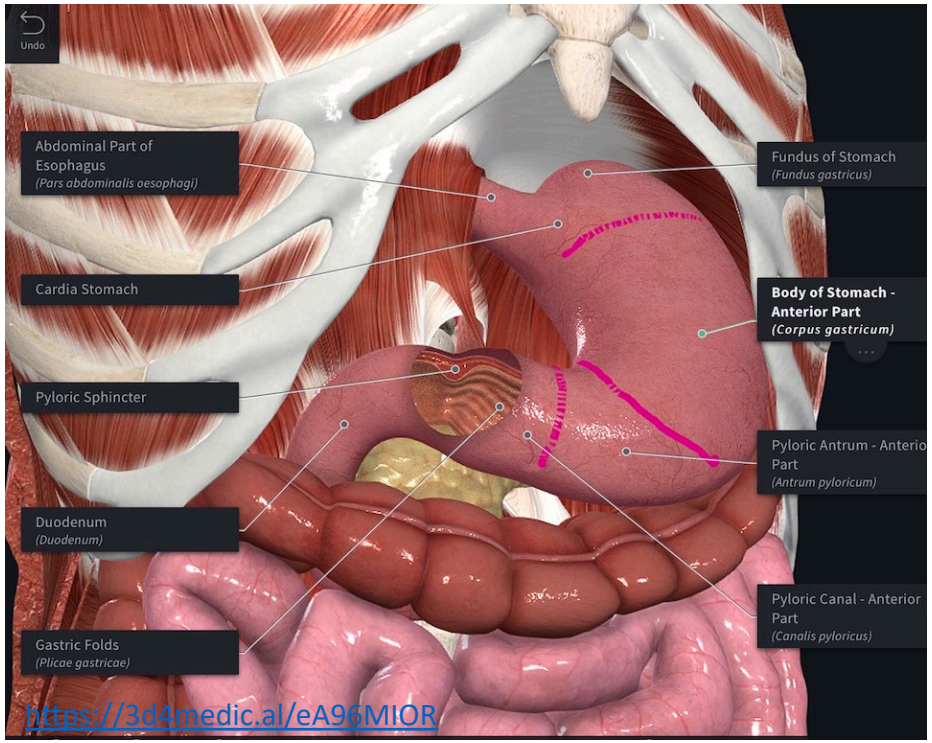
CLINICAL ANATOMY: Achalasia of the esophagus is a disorder in which the myenteric plexus and other vagal elements degenerate or are destroyed and the lower esophageal sphincter sphincter is unable to relax. This inability to relax the sphincter leads to the esophagus becoming grossly distended with food and fluid. When the upper sphincter relaxes during sleep, the contents of the esophagus may overflow into the pharynx and lungs, causing aspiration pneumonia. In other cases, incoordination between esophageal contraction and sphincter relaxation gives rise to so-called diffuse spasm, which builds up esophageal pressure and generates pain. Failure of the LES to relax results in dilation of the esophagus proximal to the area of obstruction which results in a “Bird’s beak deformity” seen on fluoroscopy.

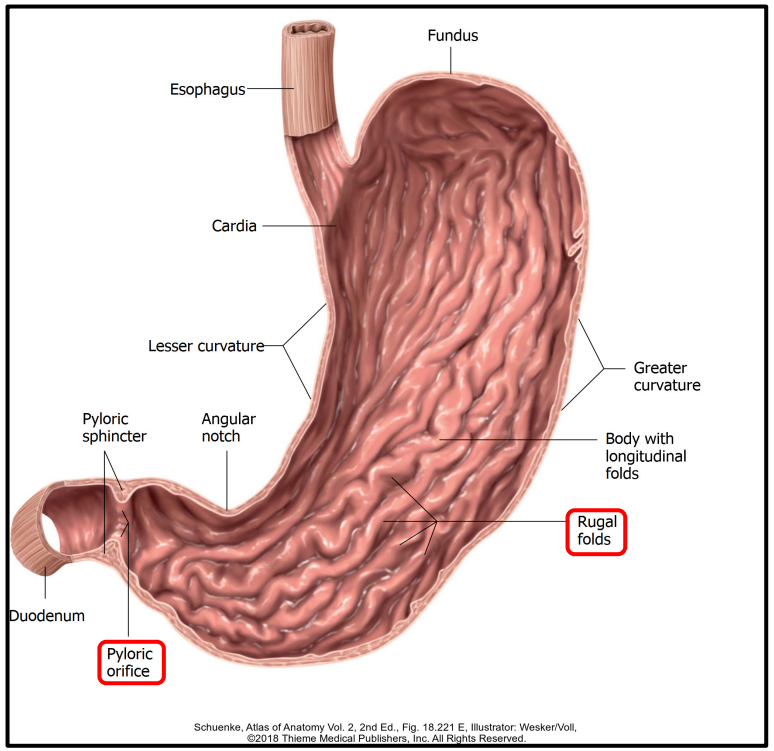


Stomach

The **stomach** is a sac-like organ whose proximal end is located at the inferior end of the esophagus. The distal end of the stomach opens into the duodenum, which is the first section of the small intestine. Its size can vary from about 50 mL when empty to as much as 4L when full.

- The **lesser curvature** of the stomach is the concave superior curve off of which the lesser omentum projects.
- The **greater curvature** of the stomach is the inferior convex curve off of which the greater omentum projects.
- The stomach is divided into four major regions.
  - The **cardia** is a small region of the stomach that joins with the distal esophagus**.** A bolus of food enters the stomach through the cardiac region.
  - The **fundus** is the dome-shaped region of the stomach above the level of the cardial orifice.
  - The **body** is the largest, centrally located portion of the stomach.
  - The body narrows at its distal end to form the **pyloric region** of the stomach. It consists of a wider **pyloric antrum** that narrows to form the **pyloric canal**. The pylorus lies at the level of the L1 vertebra. As a result, this transverse level is referred to as the transpyloric plane.
- The **pyloric sphincter** is a ring of smooth muscle that surrounds the junction point where the stomach empties into the duodenum. It regulates the emptying of stomach contents into the small intestine.
- **Rugae** are longitudinal folds of the internal wall of the stomach that allow the stomach wall to stretch during a meal. They are formed by folding of both the mucosa and submucosa.



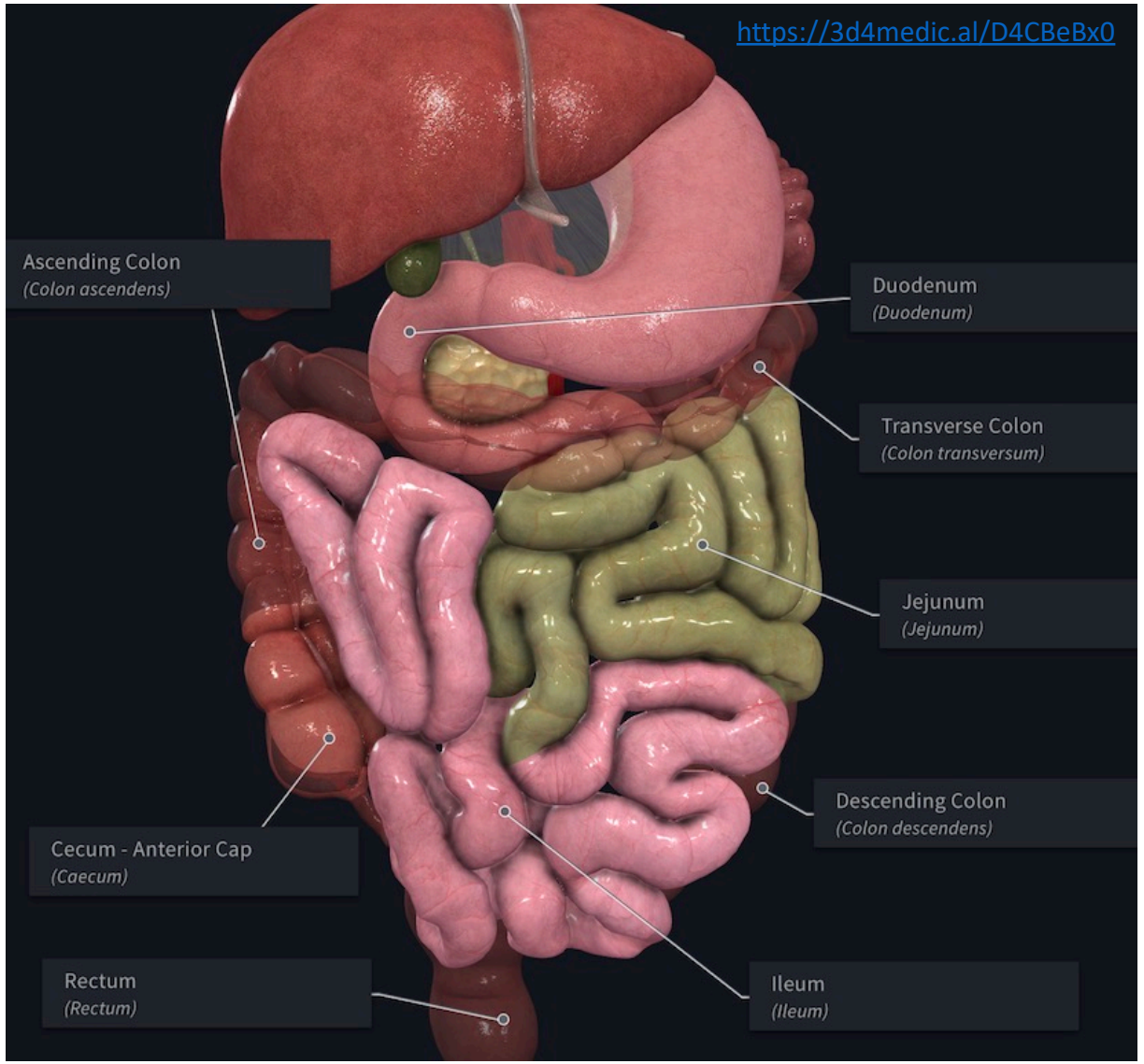


Small Intestine

The small intestine is a 20 ft long (in a cadaver), highly coiled tube. The process of digestion is completed in the lumen of small intestine, which results in nutrients that can be transported across its wall in the process of nutrient absorption.

The small intestine consists of three regions.

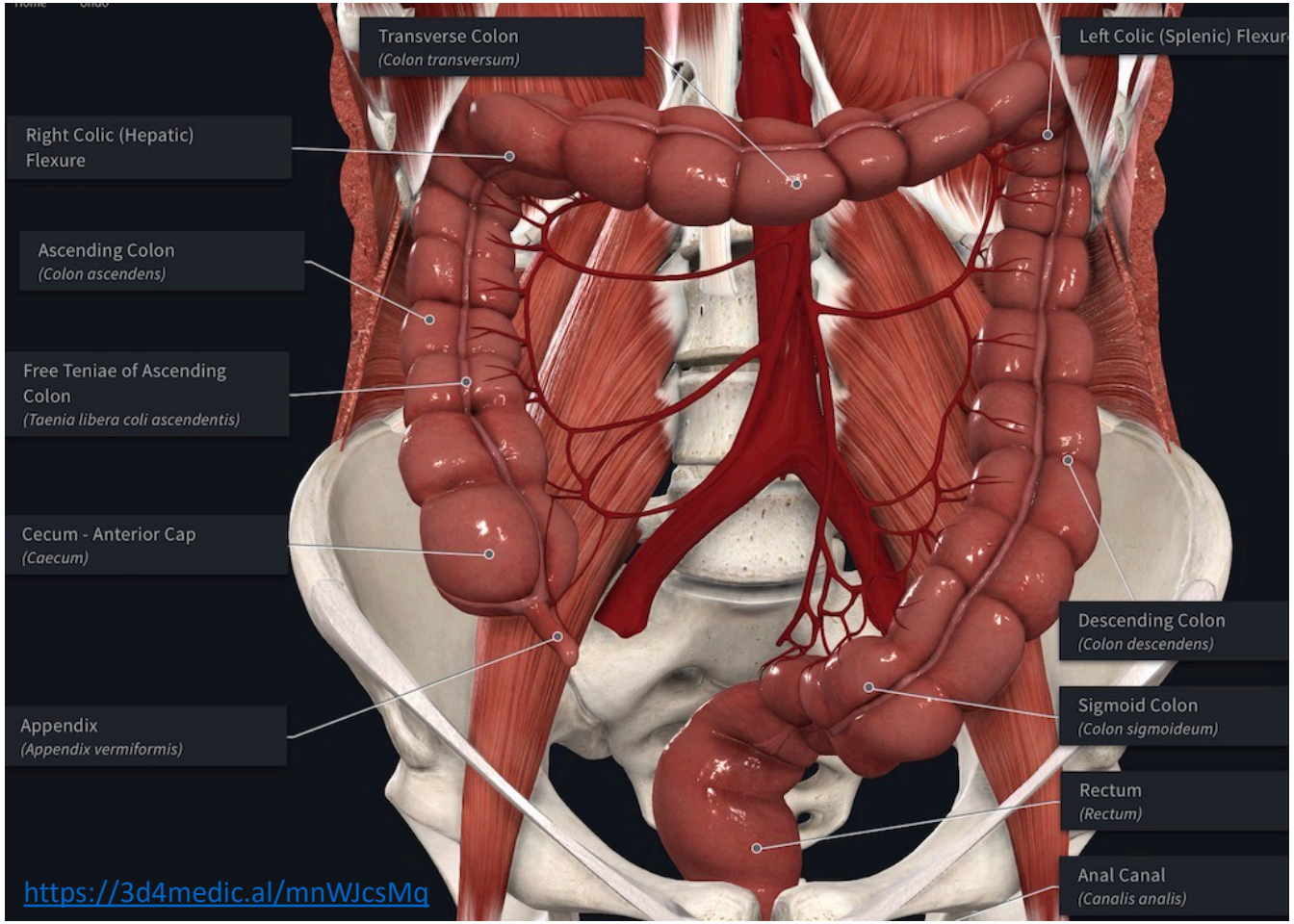
- The **duodenum** (“twelve finger widths long”) is the first 10 inches of small intestine.
- The **jejunum** (“empty”) is the middle portion of the small intestine that is 8 feet in length.
- The **ileum** (“twisted”) is the distal 12 feet of the small intestine that joins with the large intestine at the cecum.



Large Intestine

The large intestine is five feet long and surrounds the small intestine on three sides. Its major functions include water absorption from the remaining indigestible material and formation of solid waste called feces. The large intestine consists of the cecum, the colon, and the rectum.

- The **cecum** is the first part of the large intestine. It is a pouch-like cul-de-sac of the colon just inferior to the ileocecal valve.
    - •The ileocecal valve is a sphincter at the junction of the ileum to the cecum in the lower right abdominal quadrant. It controls the movement of chyme into the cecum from the small intestine.
    - •The **vermiform appendix**, is a small 'worm-like' appendage dangling from the cecum that contains immune cells.
- The colon is the largest portion of the large intestine consisting of four regions.
    - •The **ascending colon** (retroperitoneal) rises along the right abdominal wall and leads to the first bend in the colon, the hepatic flexure.
    - •The **transverse colon** (intraperitoneal) runs horizontally across the abdomen just superior to the small intestine and leads to the second bend in the colon, the splenic flexure.
    - •The **descending colon** (retroperitoneal) descends down the left abdominal wall.
    - •The **sigmoid colon** (intraperitoneal) is the S-shaped portion that leads into the fecal storage region, the **rectum** and then to the **anal canal** and anus, through which feces pass during elimination.



Foregut, Midgut, Hindgut Distinctions

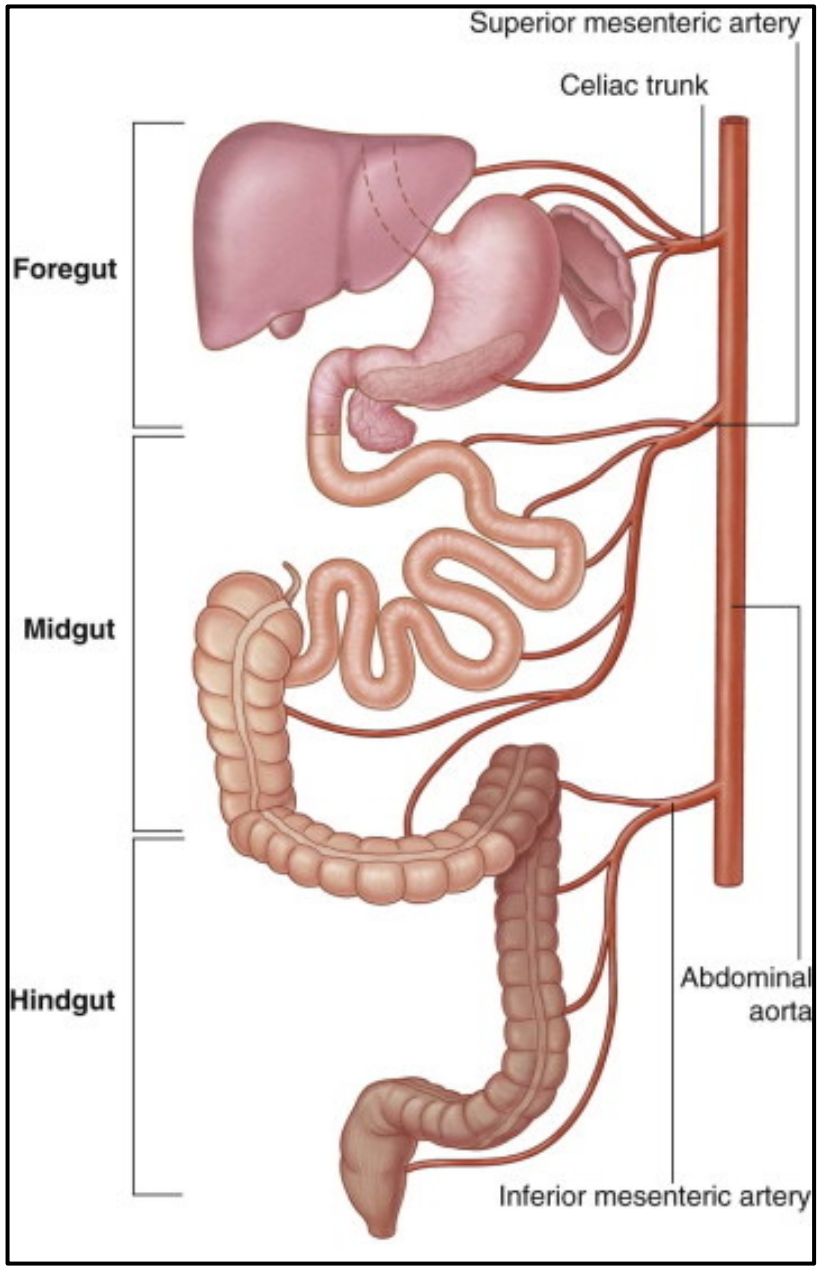
For descriptive purposes, the gastrointestinal organ system is subdivided into foregut, midgut and hindgut regions.

- Foregut: extending from the oropharyngeal isthmus of the oral cavity to the major duodenal papilla of the duodenum.
- Midgut: extending from the major duodenal papilla of the duodenum to the junction of the proximal 2/3 and the distal 1/3 of the transverse colon.
- Hindgut: extending from the junction of the proximal 2/3 and the distal 1/3 of the transverse colon to the pectineal line of the anal canal

The organs of the GI tract (alimentary canal) span several defined spaces within the trunk.

- Thoracic cavity: Esophagus
- Abdominal cavity: distal esophagus, stomach, small intestine (duodenum, jejunum, ileum), cecum, appendix, ascending colon, transverse colon, descending colon, and the proximal portion of the sigmoid colon.
- Pelvic portion of the abdominopelvic cavity (lesser pelvis or true pelvis): distal portion of the sigmoid colon and the rectum
- Inferior to the pelvic diaphragm (pelvic floor): anal canal

All of the *accessory* organs of the GI tract (the liver, gallbladder and pancreas), are located in the abdominal cavity. Also housed in the abdominal cavity is the spleen, which is a lymphoid organ that is anatomically and developmentally related to the foregut.



Peritoneum

- The **peritoneum** is a serous membrane that lines the abdominopelvic cavity. The two types of peritoneum are differentiated by the structures they cover (Figures 1 and 2).
  - **Parietal peritoneum** lines the wall of the abdominal cavity. In various places, it meets itself to project away from the abdominal cavity wall as mesentery. The mesentery then continues as visceral peritoneum to become the outermost layer of intraperitoneal organs.
  - **Visceral peritoneum** lines viscera (organs) that are considered to be intraperitoneal.

- The **Peritoneal Cavity** is a potential space located between the parietal peritoneum and visceral peritoneum. It contains a small amount of serous fluid that functions as a lubricant when the peritoneal surfaces glide against each.

- Connections between the visceral and parietal peritoneum all consist of a double-layered structure of peritoneum that can be categorized as one of the following structures.
  - **Mesenteries** connect the intestine (large and small) to the posterior abdominal wall.
  - **Peritoneal ligaments** connect organs to other organs or to the abdominal wall. These structures have ”ligament” in their name.
  - **Omenta** connect the greater and lesser curvature of the stomach to other viscera.

Figure 1

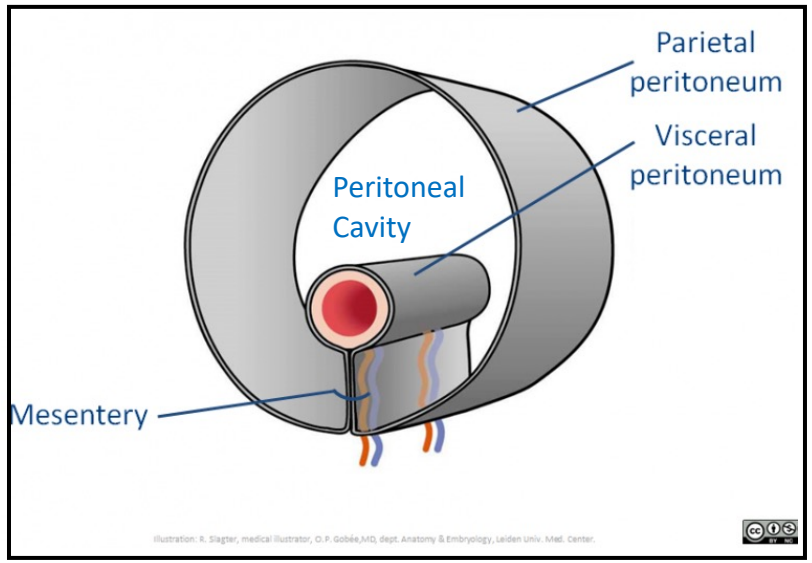


Figure 2

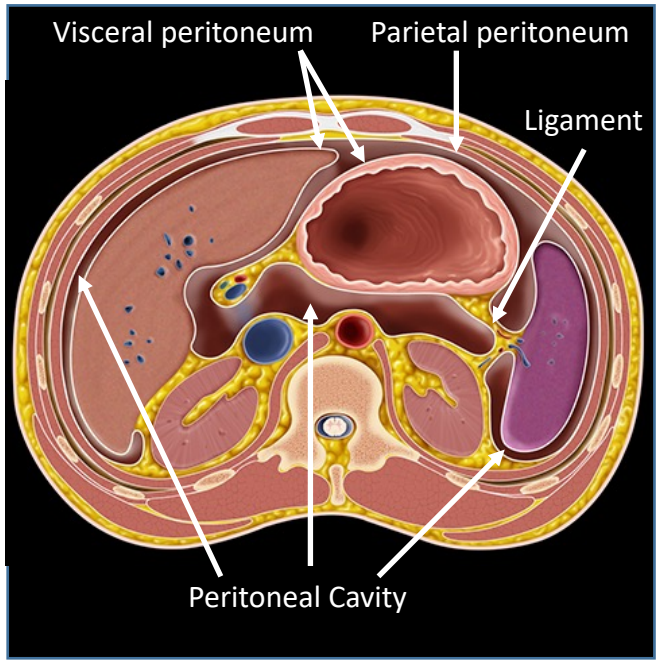
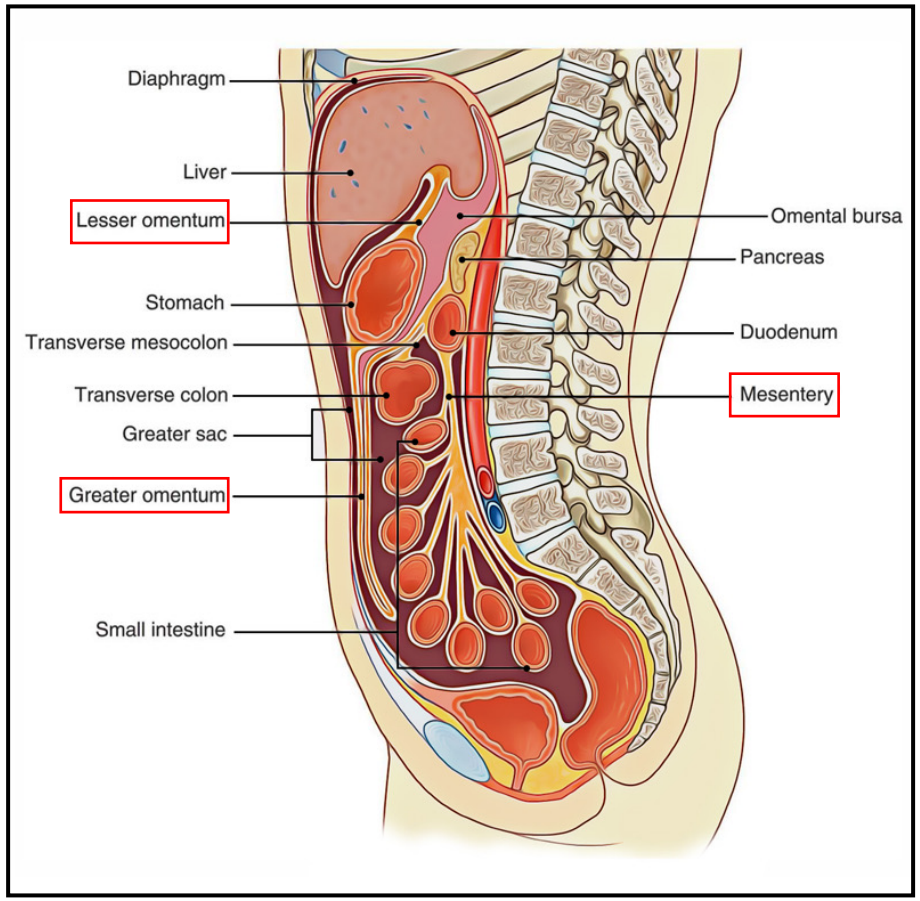


Figure 3



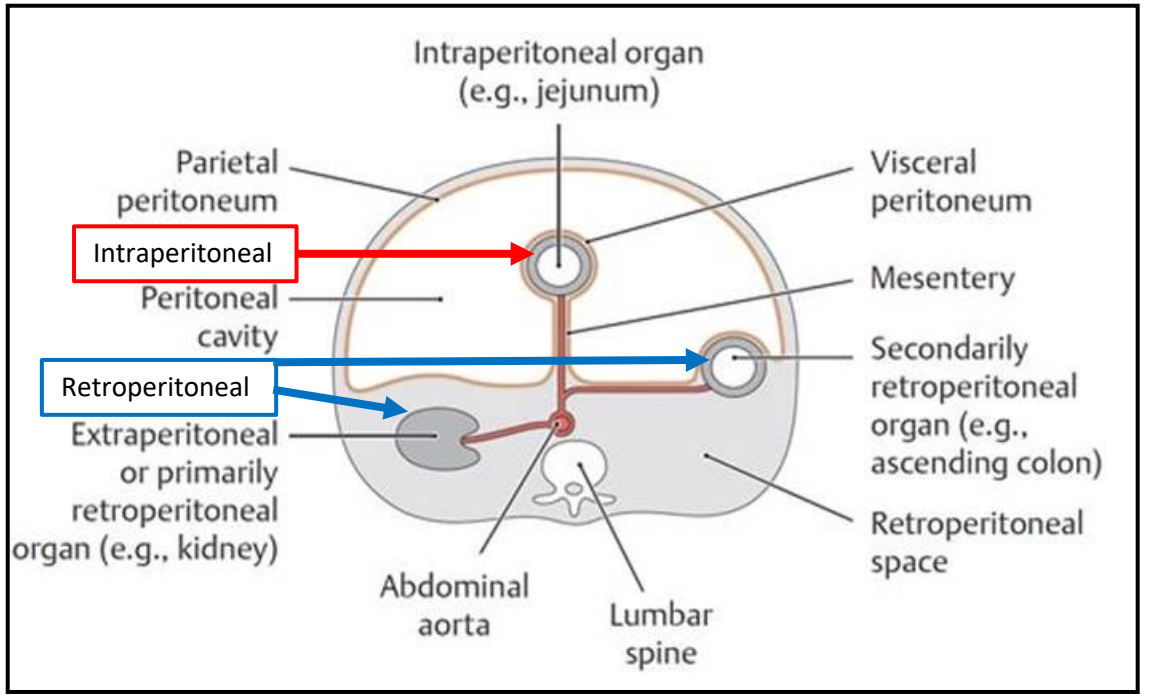
Intraperitoneal Versus Retroperitoneal

- Intraperitoneal organs versus retroperitoneal organs
  - An **intraperitoneal** organ is *completely* surrounded by visceral peritoneum and is suspended from the abdominal wall by either a mesentery or a peritoneal ligament.
  - **Retroperitoneal** organs are *not completely* surrounded and suspended by a mesentery or peritoneal ligament.
  - If an organ is located inferior to the peritoneal cavity, it is defined as *infra-* or **subperitoneal.**

Retroperitoneal Organs can be further classified into primary or secondary.

- **Primary retroperitoneal (Extraperitoneal)** organs developed outside of the parietal peritoneum and continue to remain in that location. Another name for the location of these organs is extraperitoneal. The following organs are primarily retroperitoneal.
  - Esophagus (portion in abdomen below diaphragm)
  - Rectum
  - Kidneys
  - Aorta
  - Ureters

- **Secondary retroperitoneal** organs were initially intraperitoneal (suspended by mesentery), but during embryogenesis, their mesentery fused with the posterior abdominal wall to make them retroperitoneal. Secondary retroperitoneal organs only have their anterior surface covered with peritoneum. The following organs are secondarily retroperitoneal.
  - Pancreas
  - Duodenum
  - Ascending and descending colon



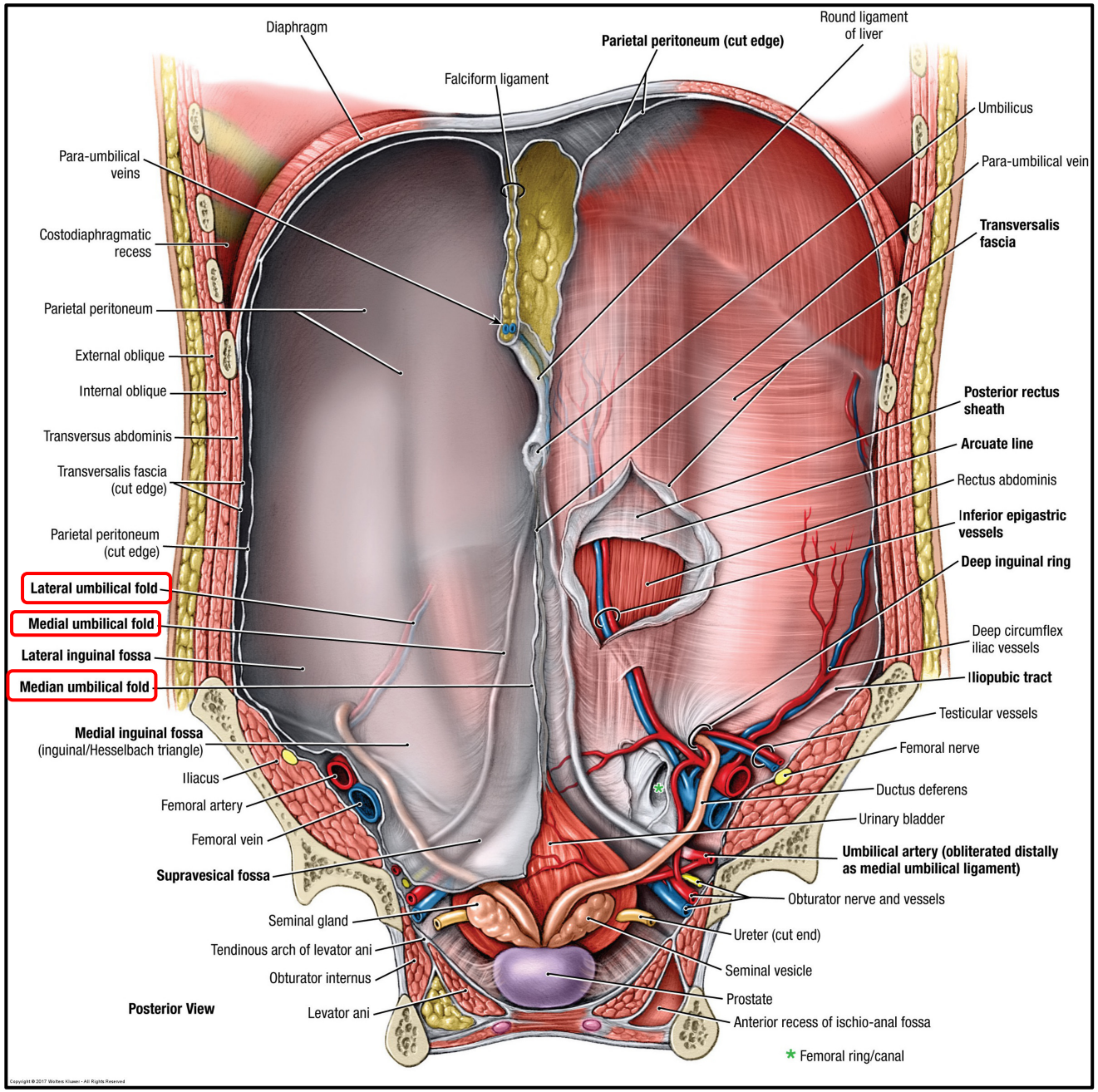
Organs that are retroperitoneal can be remembered with the mnemonic SADPUCKER.

Suprarenal (adrenal) glands
Aorta
Duodenum (2nd and 3rd parts)
Pancreas (except tail)
Ureters
Colon (ascending and descending)
Kidneys
Esophagus
Rectum

Umbilical Folds

The parietal peritoneum covers a total of five structures coursing along the the deep (*posterior*) surface of the anterior abdominal wall. The peritoneum covering these structures forms an elevated fold, which can be viewed from inside the abdominal cavity.

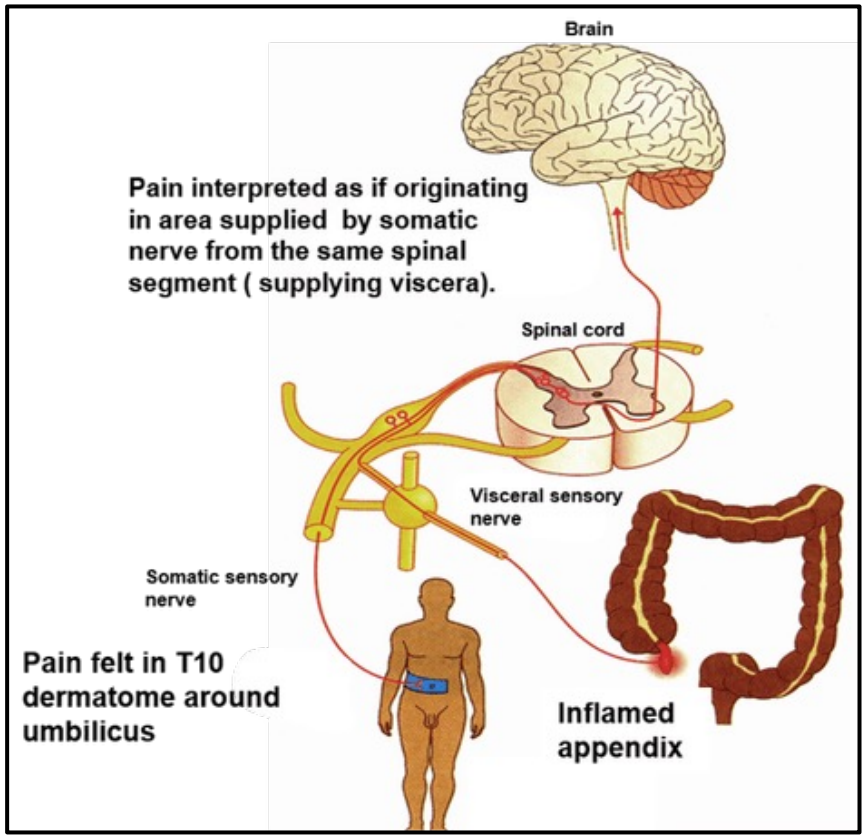
- The **median umbilical fold** is located along the midline and houses the median umbilical ligament, which is a remnant of the embryonic urachus. It extends from the apex of the bladder to the umbilicus.
- The **medial umbilical folds** are paired structures that overly the medial umbilical ligament. They are remnants of fetal umbilical arteries.
- The **lateral umbilical folds** are paired structures that house the inferior epigastric artery and accompanying veins.



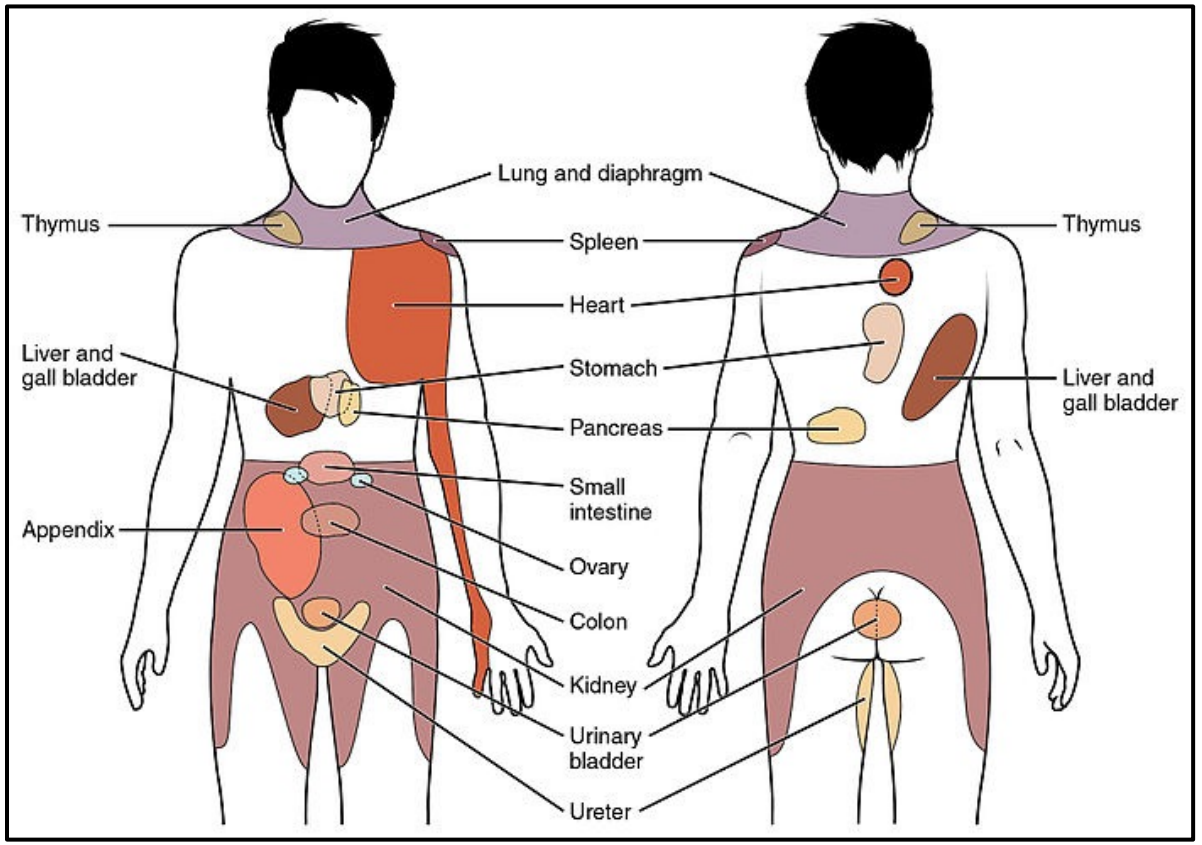
Nerve supply to Peritoneum

The parietal peritoneum and visceral peritoneum have different nerve supplies.

- The **parietal peritoneum** receives **somatic nerve** innervation from ventral primary rami The parietal peritoneum generally shares a similar nerve supply as the overlying abdominal wall. Irritation to parietal peritoneum results in a non-referred pain that can be well localized by the patient.
- The **visceral peritoneum** is innervated by visceral sensory fibers that accompany autonomic **visceral nerve** fibers. The visceral peritoneum generally shares a similar nerve supply to the organ it overlies. Irritation to this peritoneum results in a poorly localized pain which can be sensed as referred pain by the patient.
    - Referred pain occurs due to visceral afferent fibers converging and entering the spinal cord at the same level as fibers from the superficial somatic structures that are experiencing the referred pain.



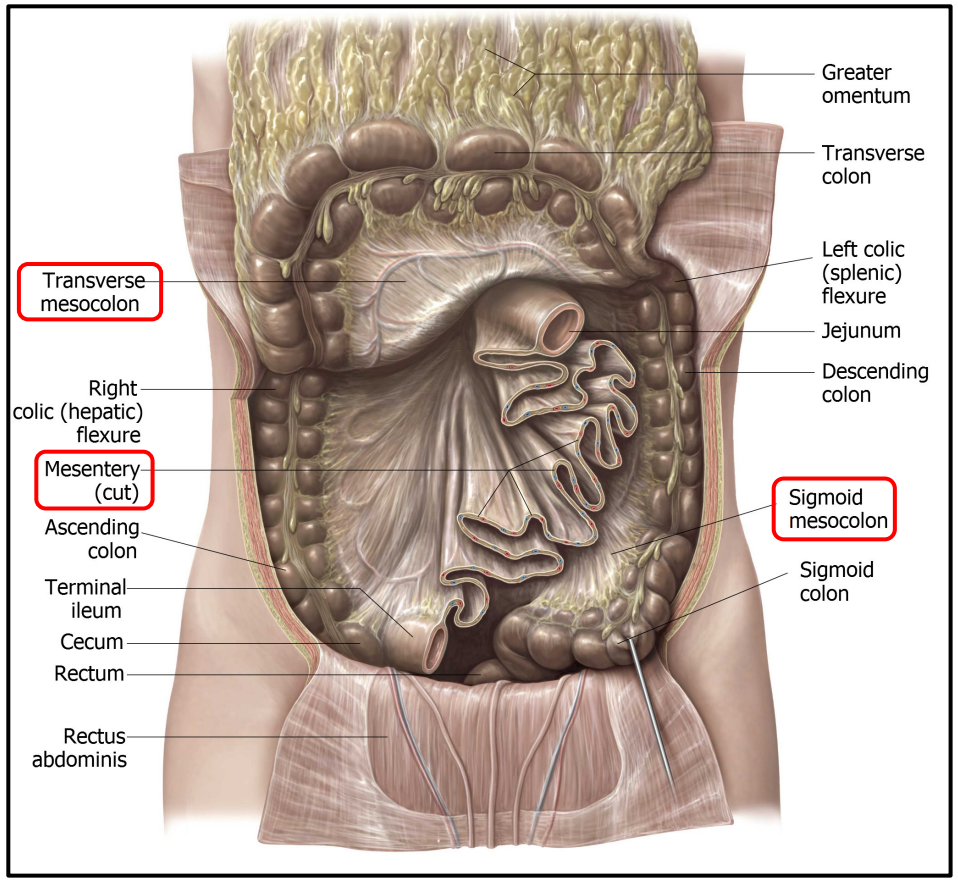
Common Sites of Referred Pain

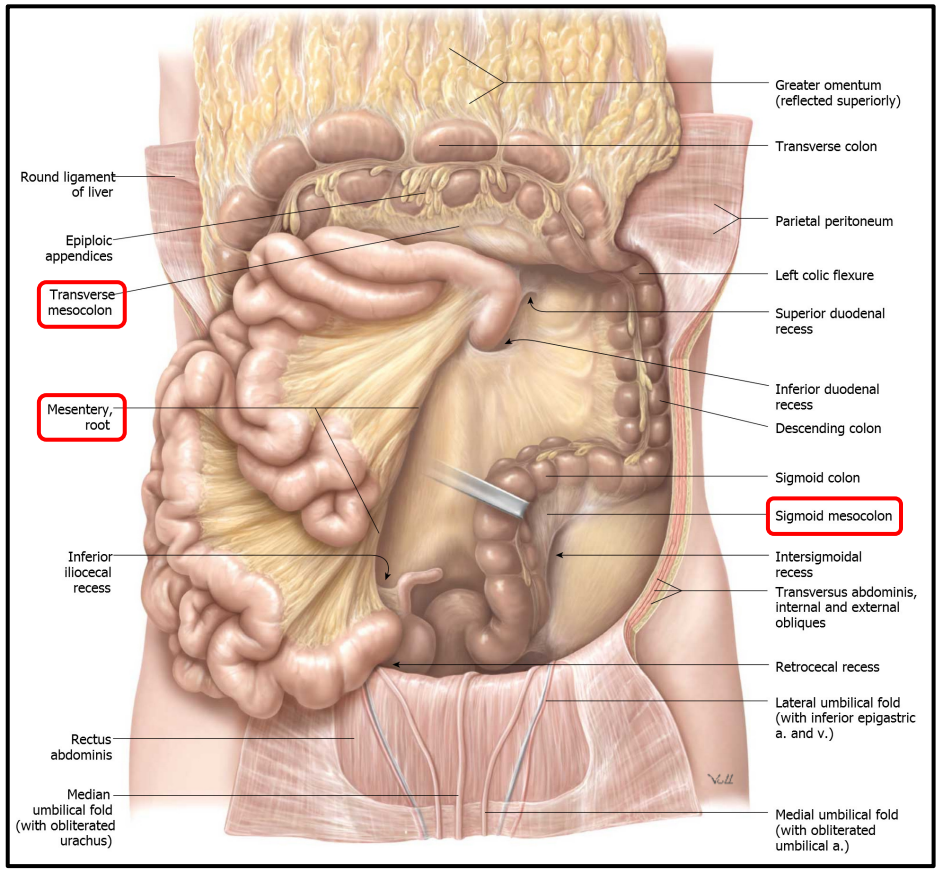


Mesentery

Mesentery is a double-layer of peritoneum that suspends the large and small intestine.

- The mesentery of the small intestine is simply called **mesentery**.
- The mesentery of the large intestine is called **mesocolon**. A region of mesocolon can be more specifically named according to the portion of the colon with which it is associated.
  - **Transverse mesocolon** suspends the transverse colon.
  - **Sigmoid mesocolon** suspends the sigmoid colon.
  - Note: The cecum is often intraperitoneal because it can be suspended by the continuation of the mesentery of the ileum. This continuation of mesentery also suspends the appendix (mesoappendix).
  - The ascending colon, descending colon, and rectum are all retroperitoneal.



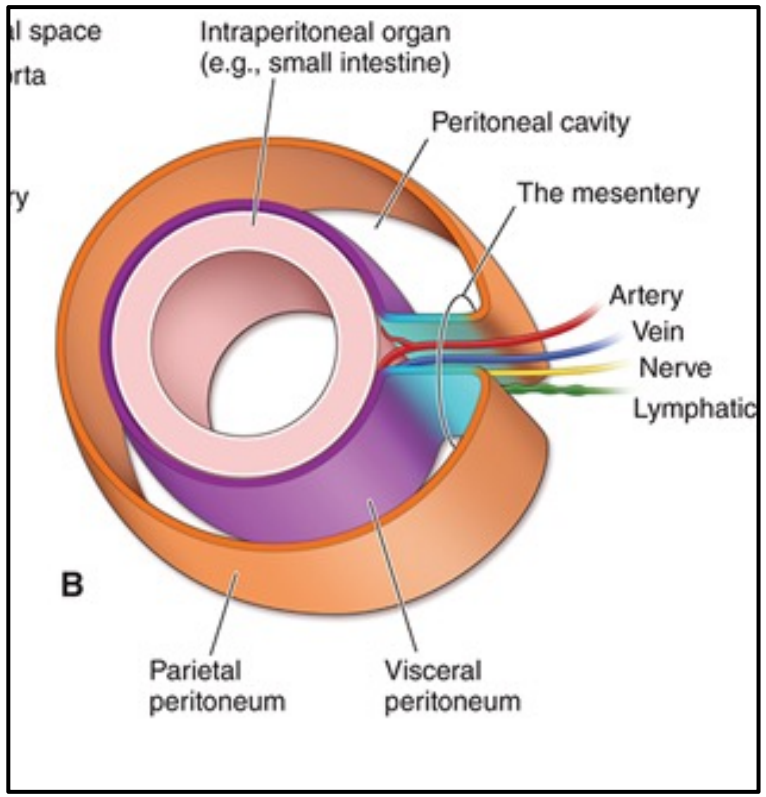


Mesentery: Contents

Mesentery and mesocolon both sandwich blood vessels, nerves, and lymphatics that pass to and from the intestine. The following table organizes the vascular, lymphatic, and neural contents of the large intestine's mesocolon and the small intestine's mesentery.

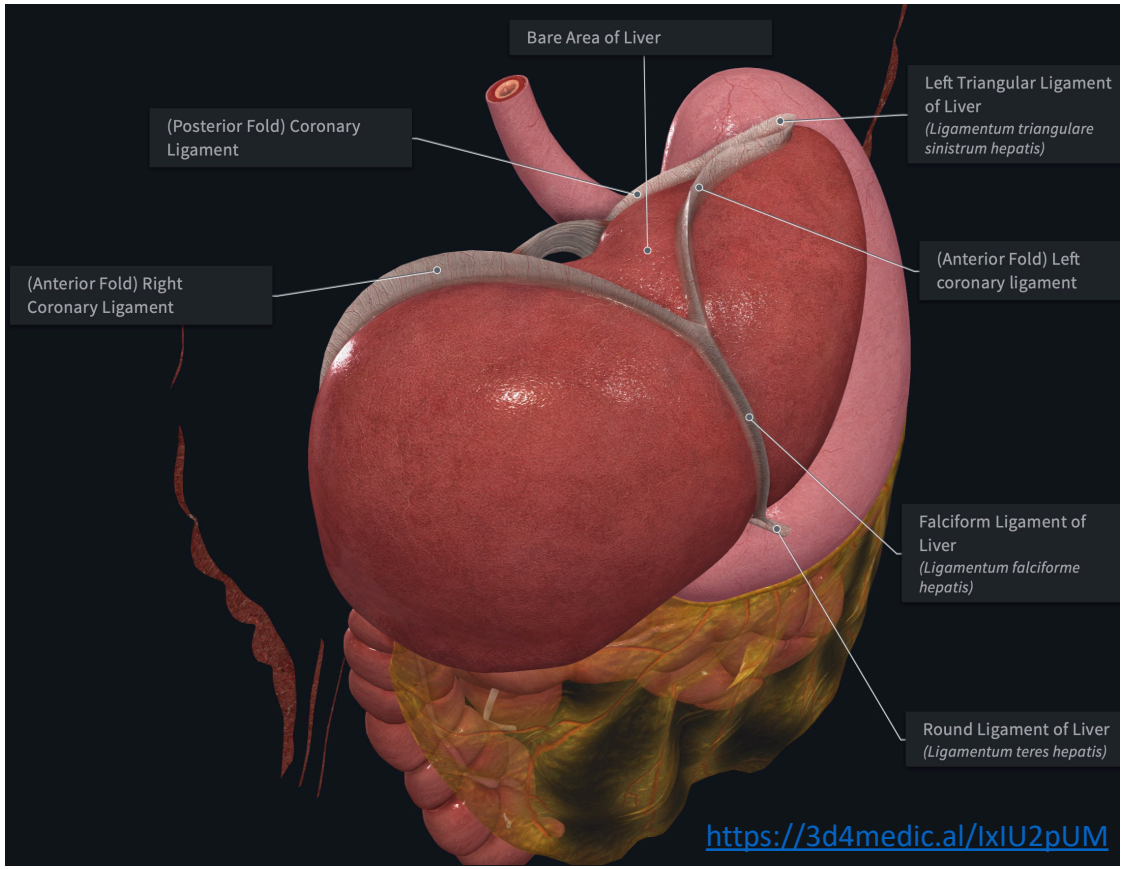
CONTENTS	SMALL BOWEL MESENTERY	LARGE BOWEL MESENTERY
Vascular	Branches of the superior mesenteric a. supplying the small bowel	Branches of superior mesenteric a. and inferior mesenteric a. supplying the colon
Lymphatic	In general, lymph nodes and lymph vessels are located within the mesentery following the vascular branching patterns	
Neural	Superior mesenteric plexus (the neural branches generally follow the blood supply)	Superior and inferior mesenteric plexuses (the neural branches generally follow the blood supply)

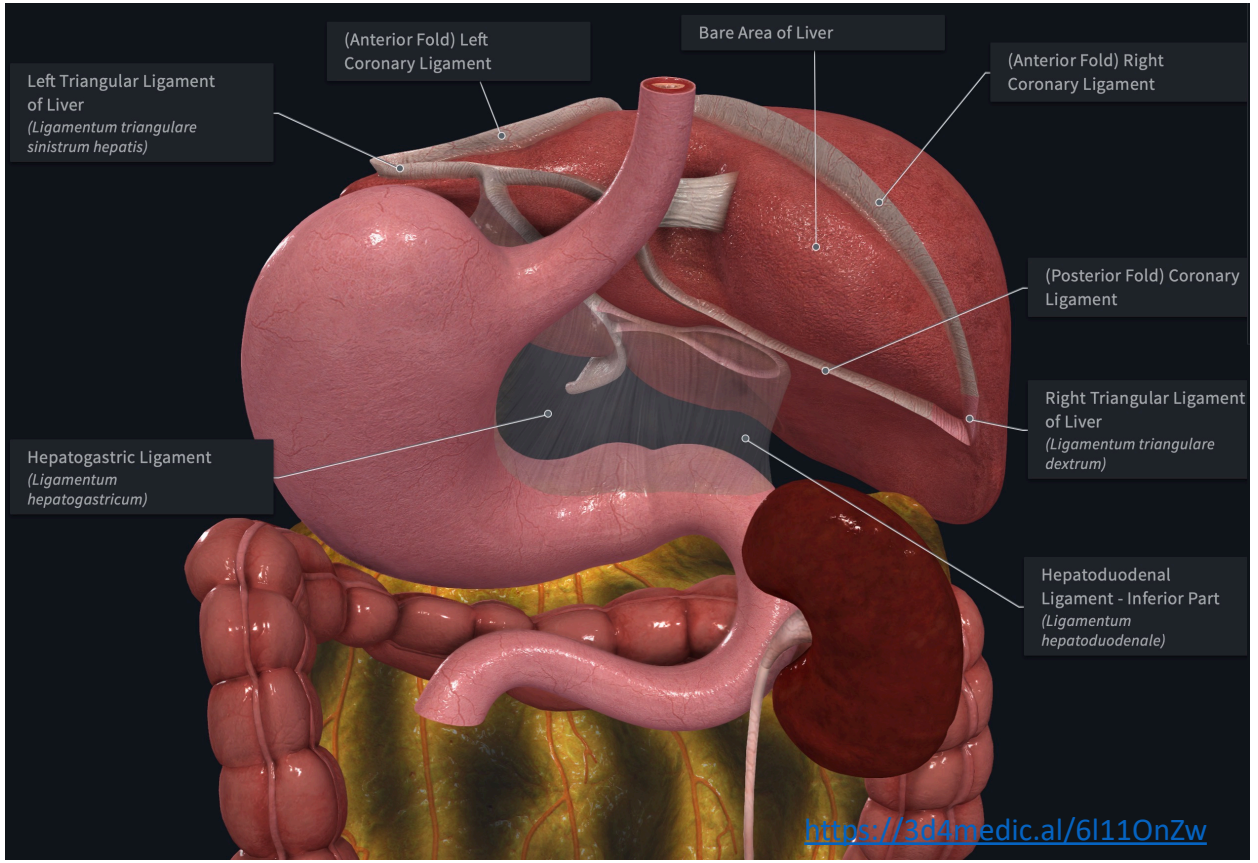
CLINICAL ANATOMY: When performing a colectomy for cancer, the blood supply to the diseased portion of colon is ligated as close to the root of the mesentery as possible (i.e. proximal) – this is called performing a "high ligation." Knowing that mesentery contains bowel lymph nodes, performing a high ligation allows you to recover as many mesenteric lymph nodes as possible which is important for staging. If you are performing a colectomy for a benign process like diverticulitis, you typically do not have to perform a high ligation and can take the blood supply more distal.



Liver Peritoneal ligaments

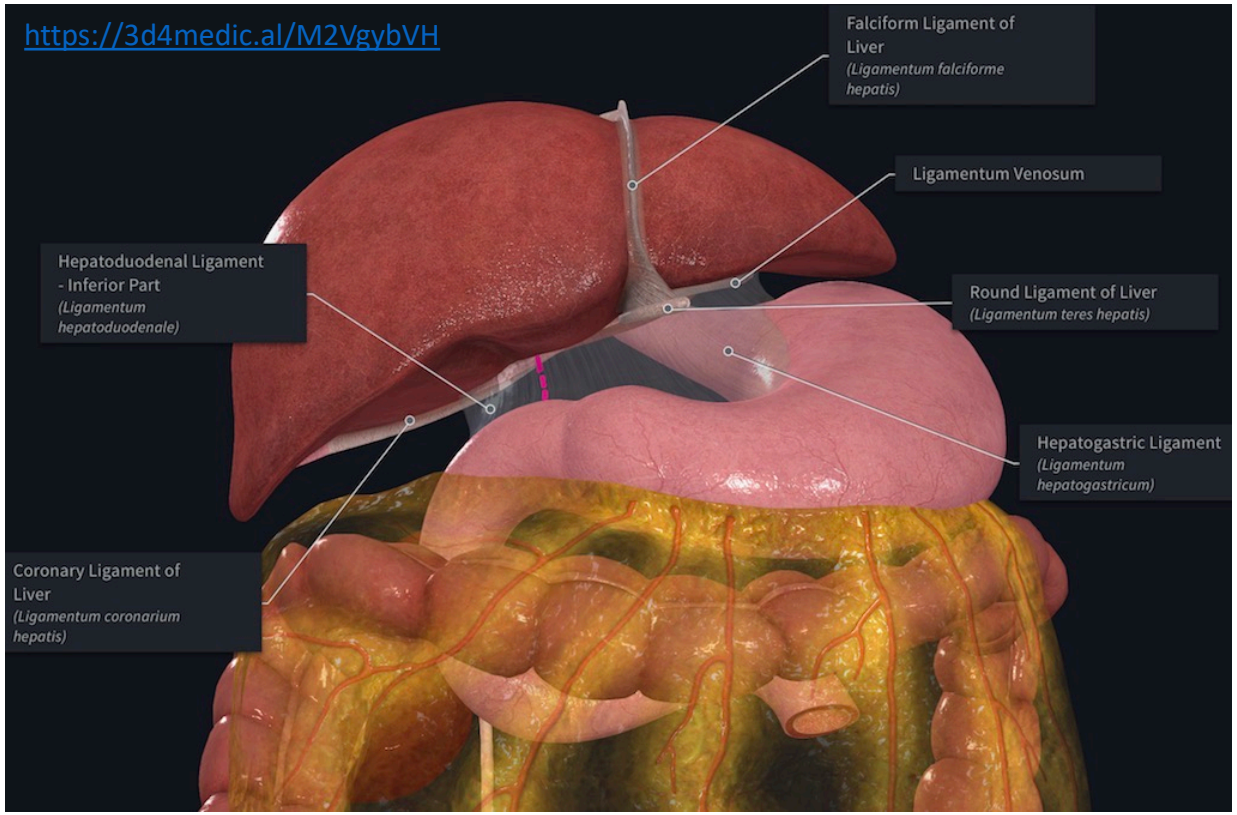
- The **falciform ligament** connects the peritoneum on the liver's anterior side to the peritoneum lining the diaphragm and the anterior abdominal wall.
  - Located at the inferior edge of the falciform ligament is the **round ligament of the liver (ligamentum teres)**, which is the fetal remnant of the umbilical vein.
- The superior portion of the falciform ligament splits into the **right and left coronary ligaments**.
  - The right coronary ligament attaches the right side of the liver's peritoneum to the peritoneum lining the inferior surface of the diaphragm.
  - The left coronary ligament attaches the left side of the liver's peritoneum to the peritoneum lining the inferior surface of the diaphragm.
  - The right and left triangular ligaments are located where the superior portion of the coronary ligament curves to join the inferior portion of the coronary ligament.
  - The space bounded by the coronary and triangular ligaments is where the liver is in direct contact with the diaphragm without intervening peritoneum. This region is called the **bare area of the liver**.

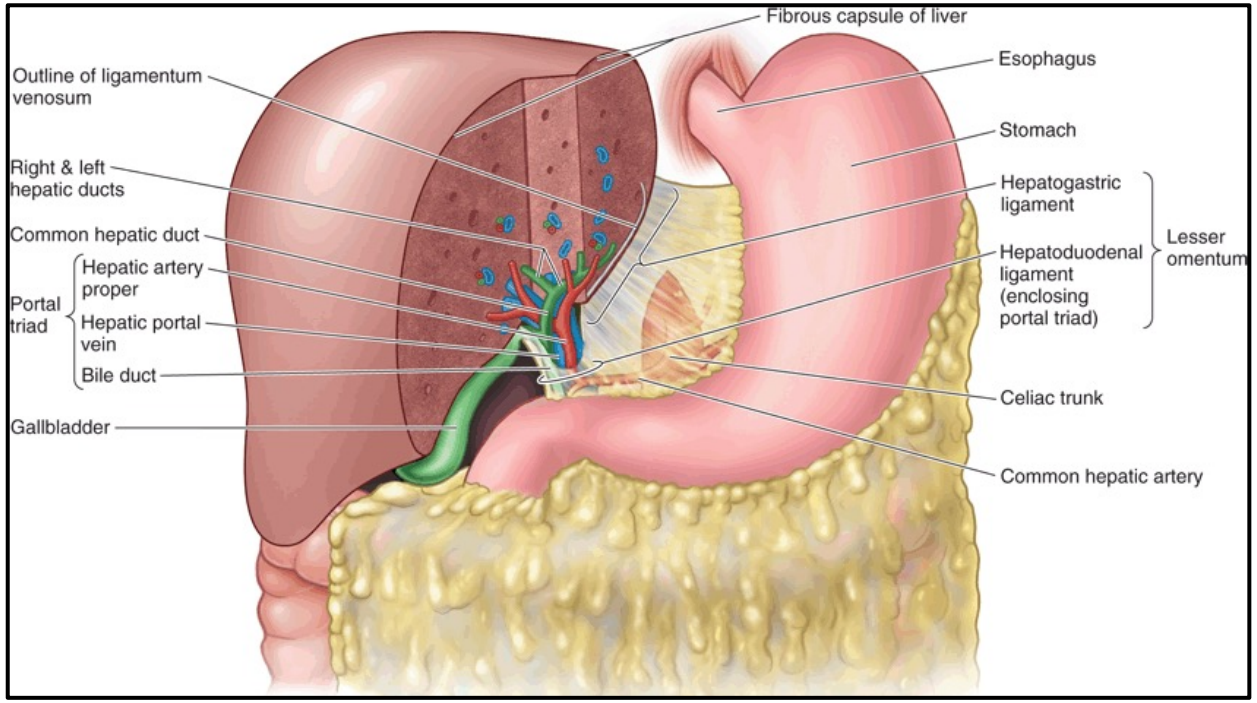




Liver Peritoneal ligaments

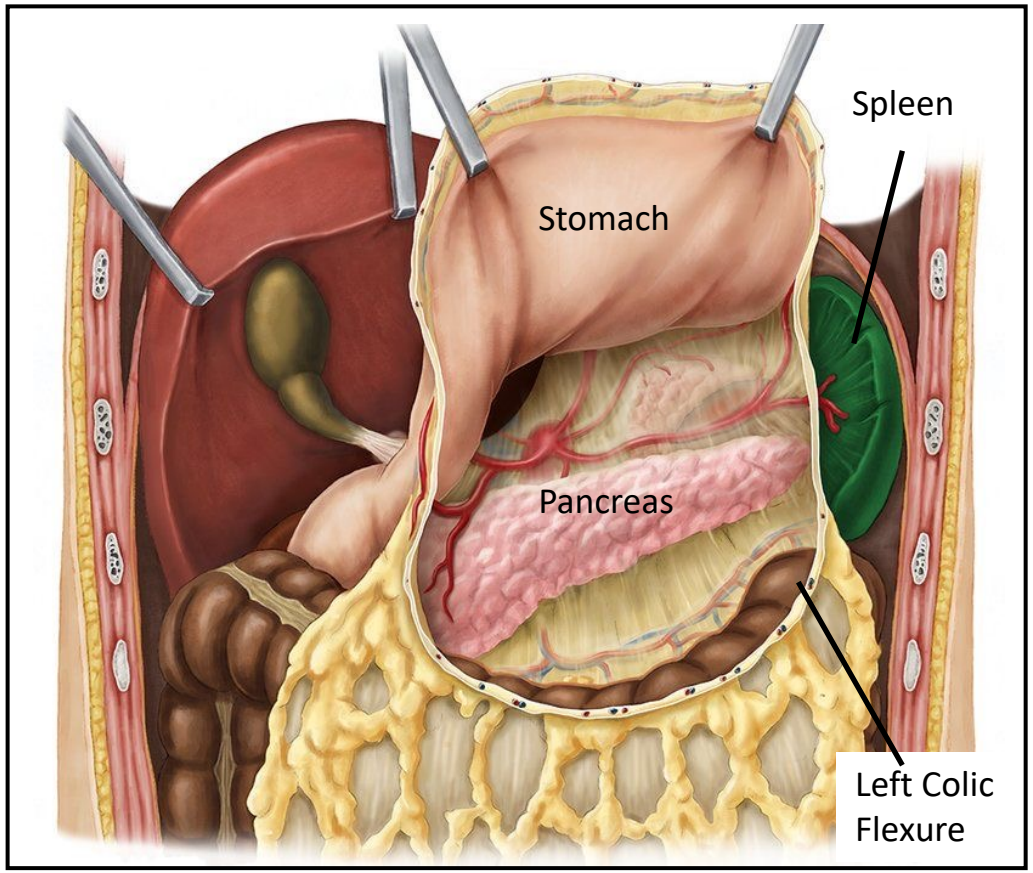
- The **hepatogastric ligament** connects the liver to the lesser curvature of the stomach and contains the right and left gastric arteries.
- The **hepatoduodenal ligament** connects the porta hepatis of the liver to the first part of the duodenum. It contains the portal triad (proper hepatic artery, portal vein, and common bile duct). In addition, it forms the anterior boundary of the opening into the lesser sac called the omental foramen (of Winslow)
- Collectively, the hepatogastric ligament, the hepatoduodenal ligament, and their contents, form the **lesser omentum**.

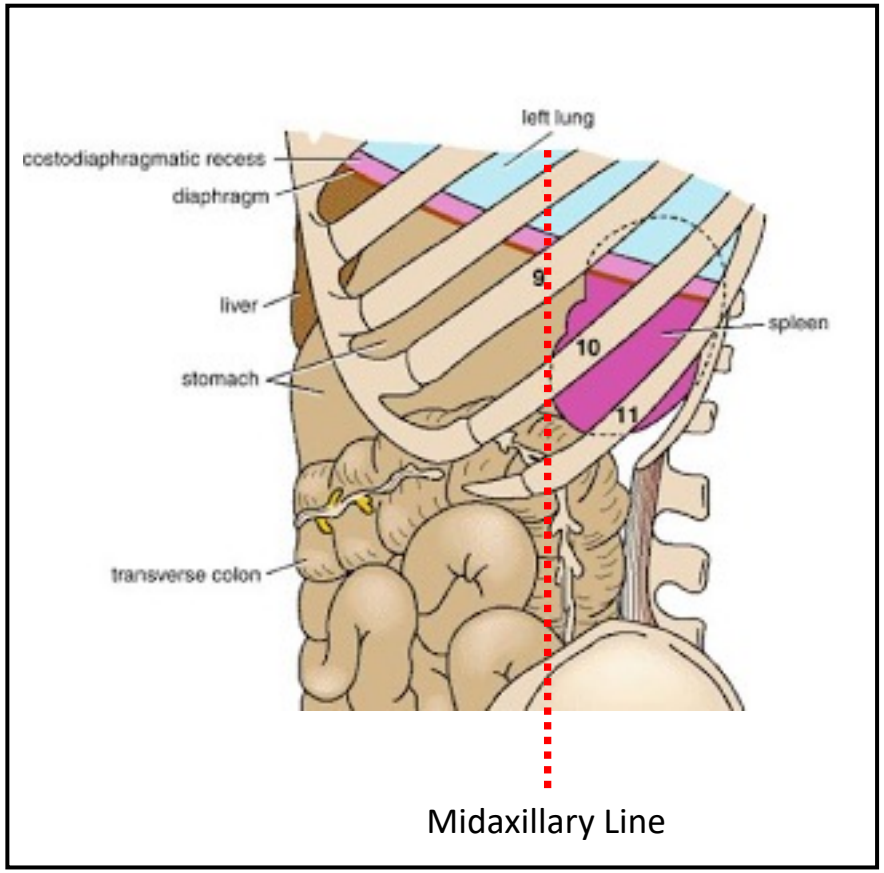




Spleen Location

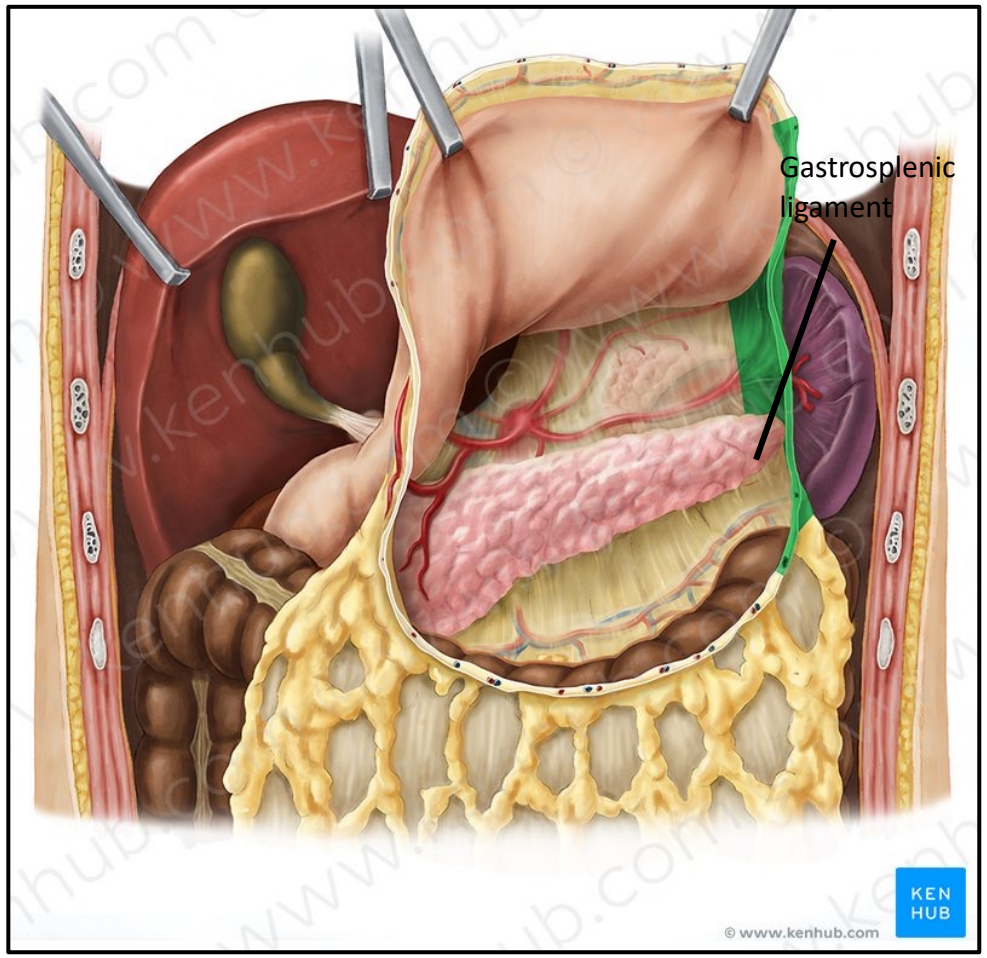
The spleen is the largest single mass of lymphoid tissue in the body. It is located in the **left upper quadrant** of the abdomen covered by the the diaphragm and the 9th-11th ribs. Its long axis lies along the shaft of the 10th rib and its inferior pole only extends to the midaxillary line. Because of its location deep to the ribs, it can only be palpated on physical exam when it is enlarged. Recall that the spleen is an intraperitoneal organ.

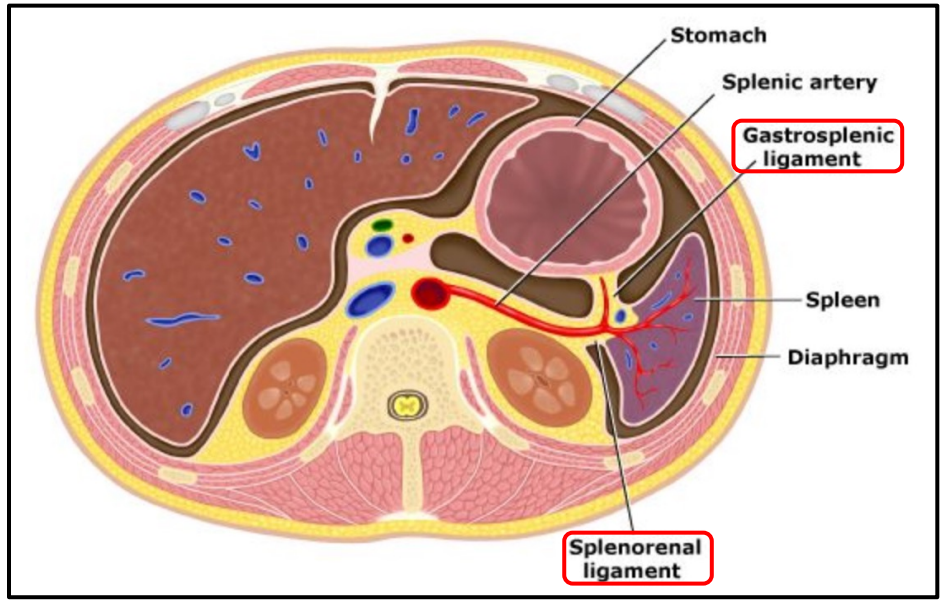


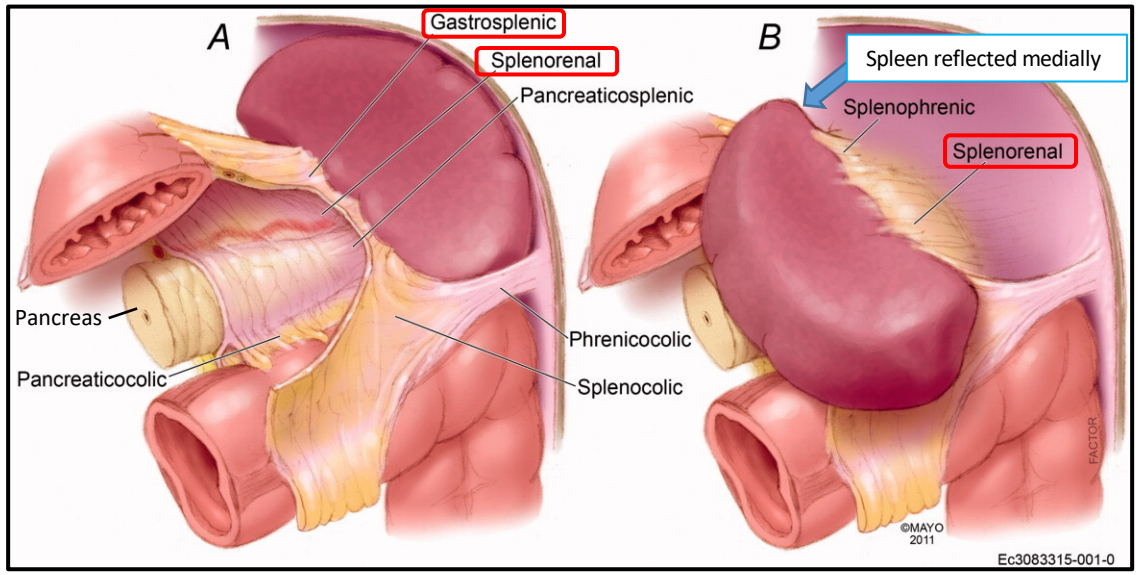


Spleen Peritoneal Ligaments

- The **gastrosplenic ligament** extends from the greater curvature of the stomach to the hilum of the spleen. It contains the **short gastric arteries**.
- The **splenorenal ligament** extends from the hilum of the spleen to the anterior surface of the left kidney. It contains the tail of the pancreas and **splenic vessels**.





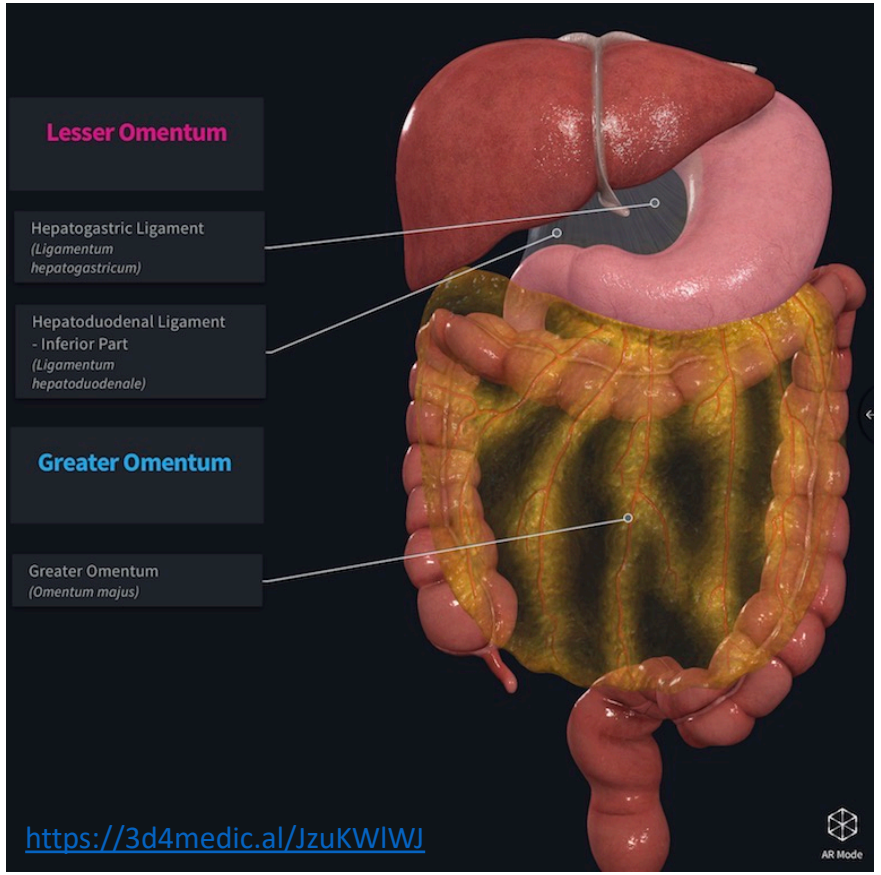


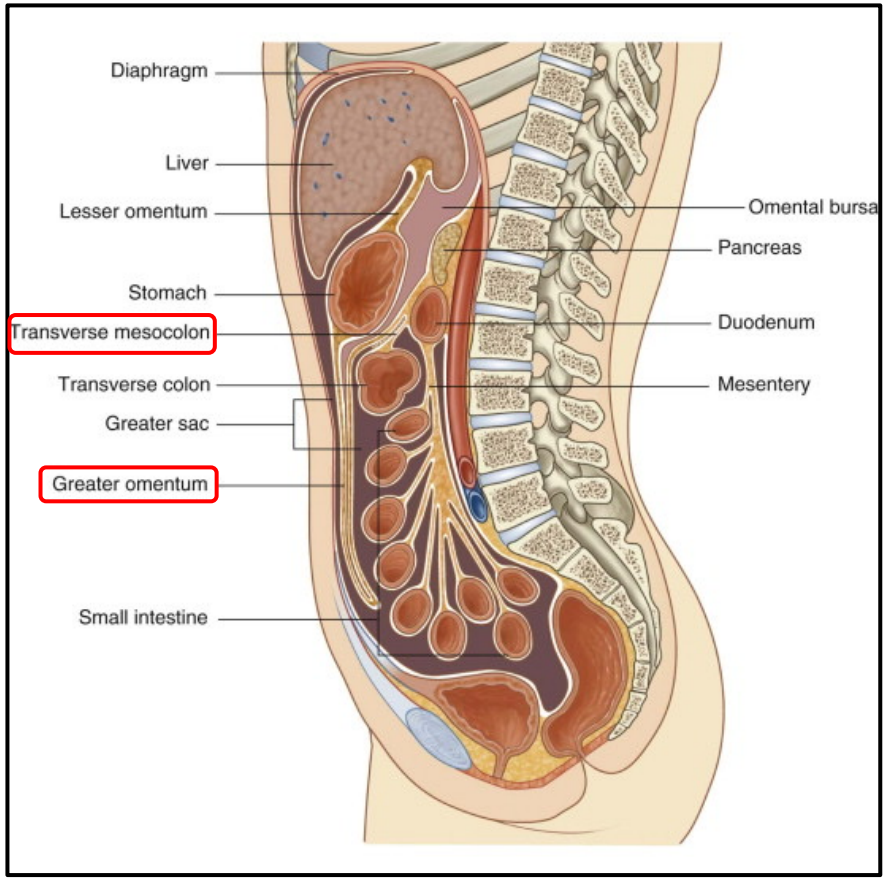
Greater and Lesser Omenta

- The **greater omentum** is a large, fat-filled fold of mesentery that descends from the greater curvature of the stomach and drapes over the ventral surface of the abdominal cavity. It reflects on itself and ascends to the transverse colon before reaching the posterior abdominal wall. The greater omentum serves several physiological functions.
  - Insulation: It is a site of adipose deposition.
  - Immunity: Its connective tissue houses collections of macrophages.
  - Infection/Inflammatory Isolation: It can isolate an infection or wound from the rest of the peritoneal cavity by adhering to areas of inflammation.

CLINICAL ANATOMY: In cases of duodenal perforation, a tongue of well vascularized omentum can be sutured to the duodenum over the site of perforation to buttress the repair. This is called a Graham Patch.

- The **lesser omentum** is a continuation of the visceral peritoneum that connects the inferior side of the liver to the lesser curvature of the stomach and the first part of the duodenum. The lesser omentum consists of two peritoneal ligaments:
  - The **hepatogastric ligament**
  - The **hepatoduodenal ligament**



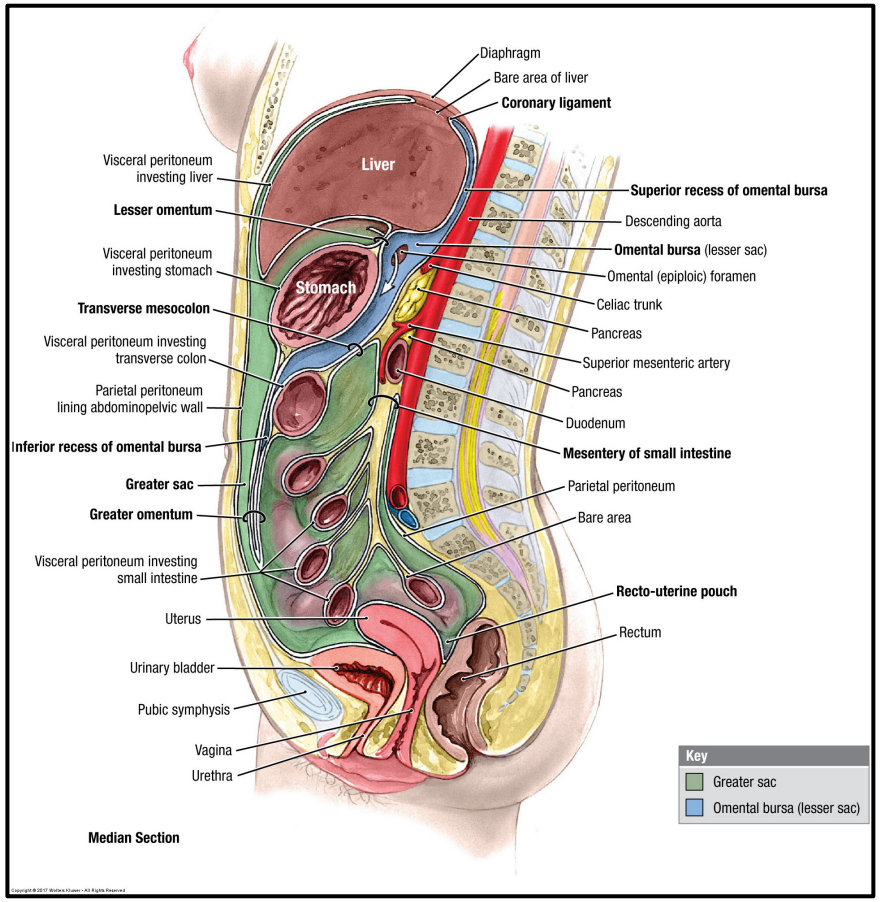


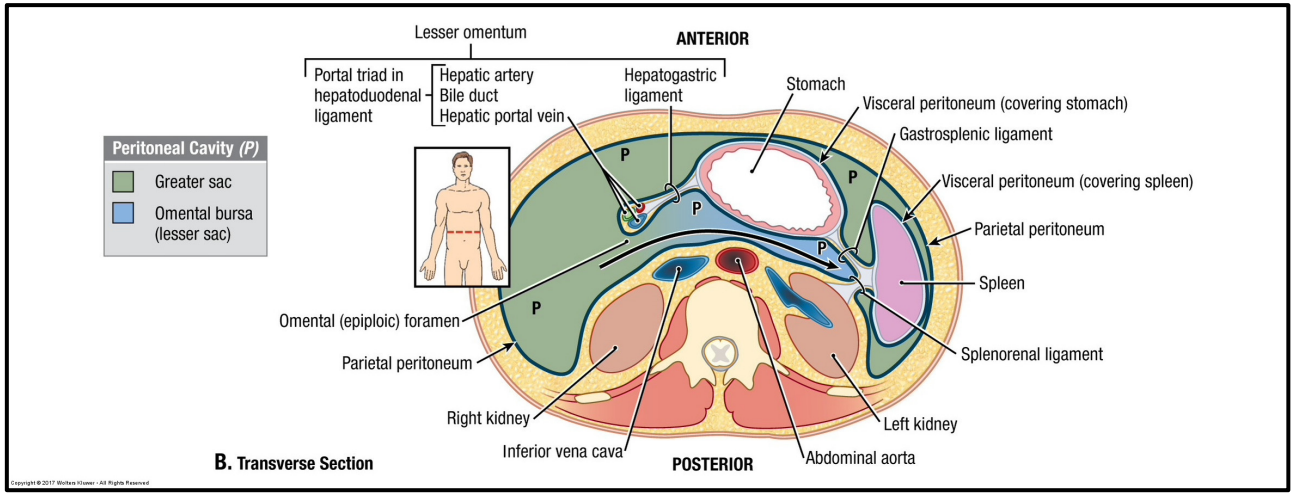
Greater and Lesser Sacs

The peritoneal cavity can be divided into two spaces: the greater sac and lesser sac.

- The **lesser sac** (**omental bursa)** is a much smaller space than the greater sac. It is an enclosed space posterior to the lesser omentum and the posterior surface of the stomach. It consists of the following boundaries.
  - Anterior: the lesser omentum and the posterior surface of the stomach
  - Posterior
    - Superior: parietal peritoneum covering posterior abdominal wall
    - Inferior: transverse mesocolon
  - Left: gastrosplenic ligament and splenorenal ligament
  - Right: The right side contains the **epiploic foramen (omental foramen of Winslow)**, which is the opening of the lesser sac into the greater sac. The boundaries of the epiploic foramen include the following structures.
    - Anterior: portal triad in hepatoduodenal ligament
    - Posterior: inferior vena cava
    - Superior: liver (caudate lobe)
    - Inferior: duodenum (first part)

- The **greater sac** is all of the remaining space of the peritoneal cavity.

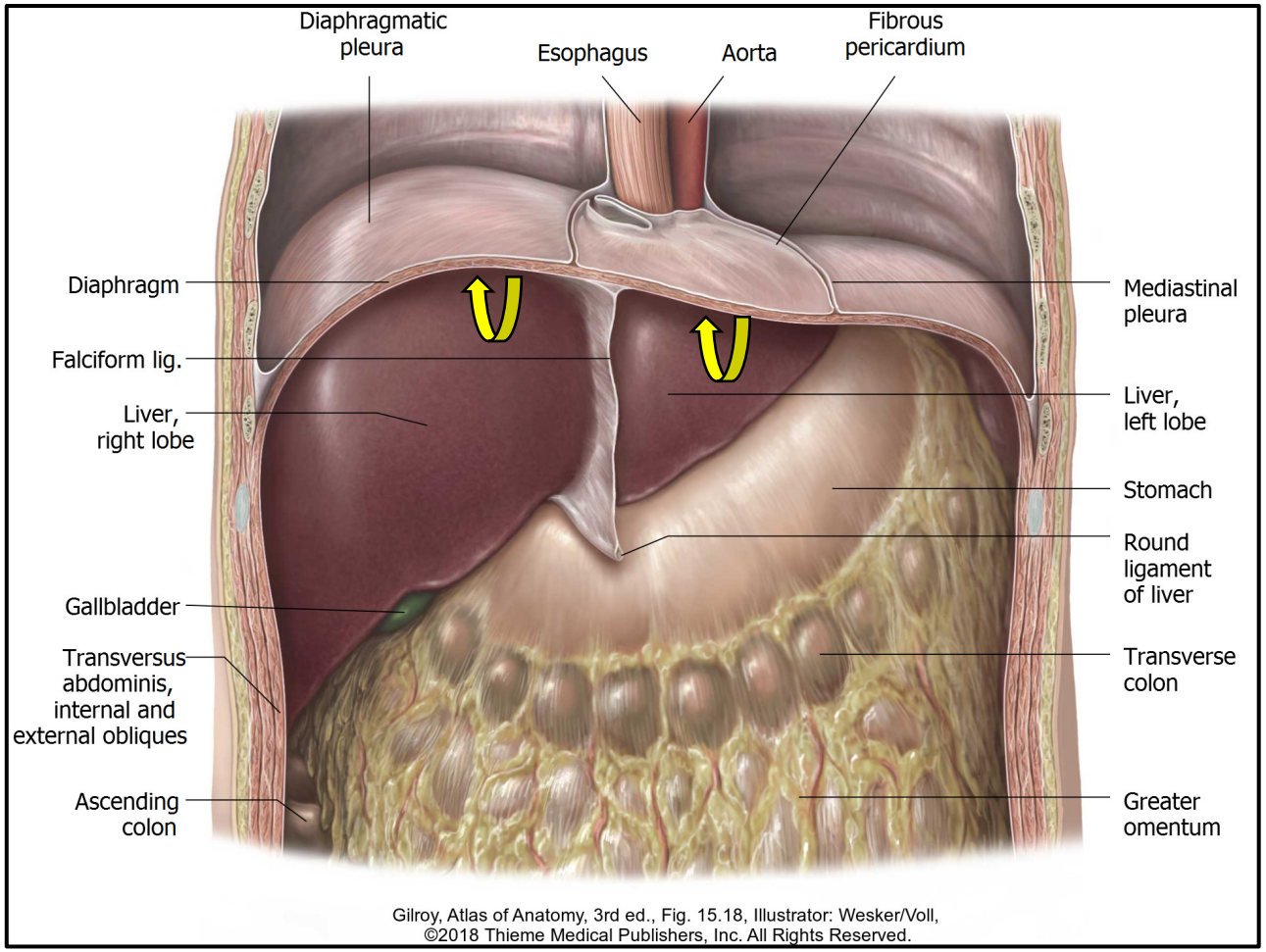




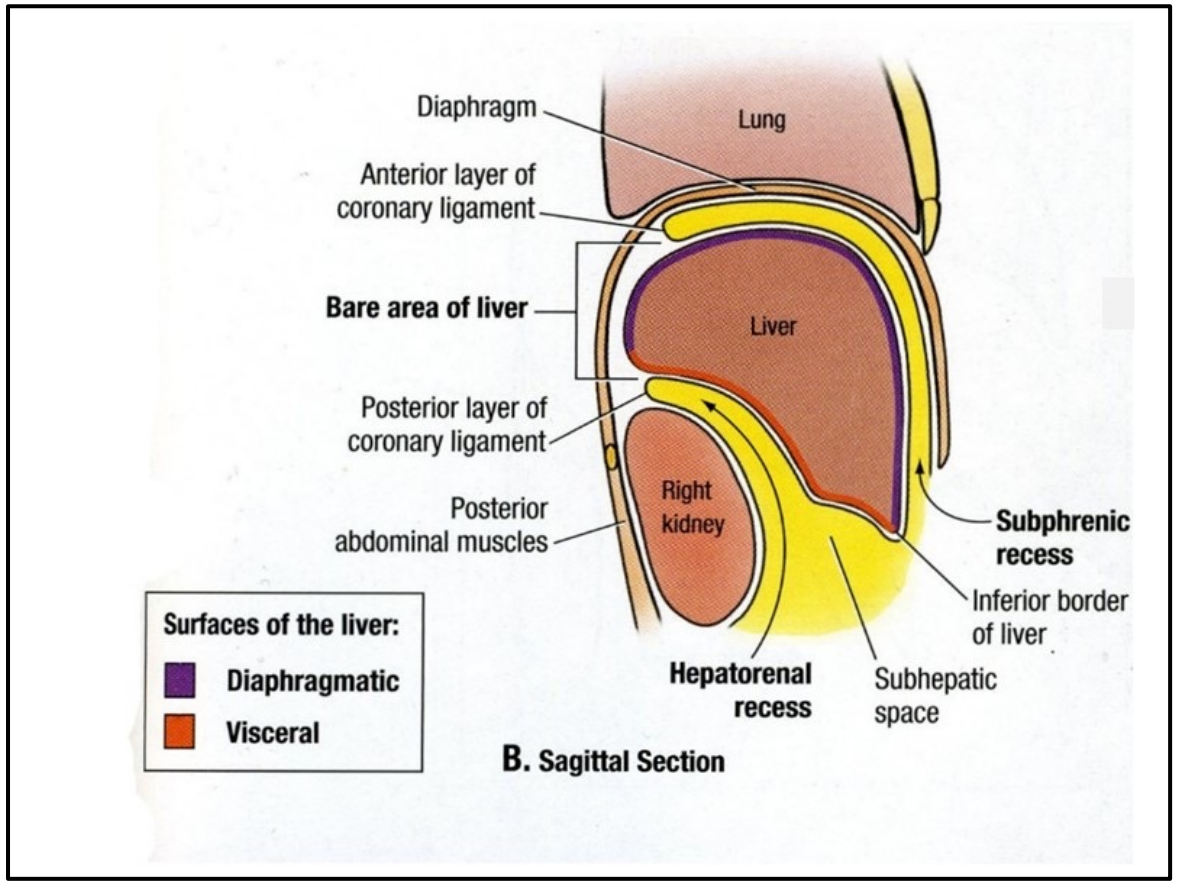
Abdominal Recesses: Subphrenic Space & Hepatorenal Recess

The peritoneal cavity contains many named spaces that are located where the peritoneum reflects upon itself to form mesentery and peritoneal ligaments. These spaces, which are described as recesses, spaces, or gutters, transmit the normal flow of peritoneal fluid throughout the peritoneal cavity. In pathological situations, they can be sites of fluid accumulation and function as conduits for the spread of fluid, infection, and neoplasms.

- **Subphrenic recesses** are located between the diaphragm and the liver.
  - The right subphrenic space is to the right of the falciform ligament.
  - The left subphrenic space is to the left of the falciform ligament.
- The **hepatorenal recess (Morrison Pouch)** is a space located between the visceral surface of the posterior liver and the *right* kidney.

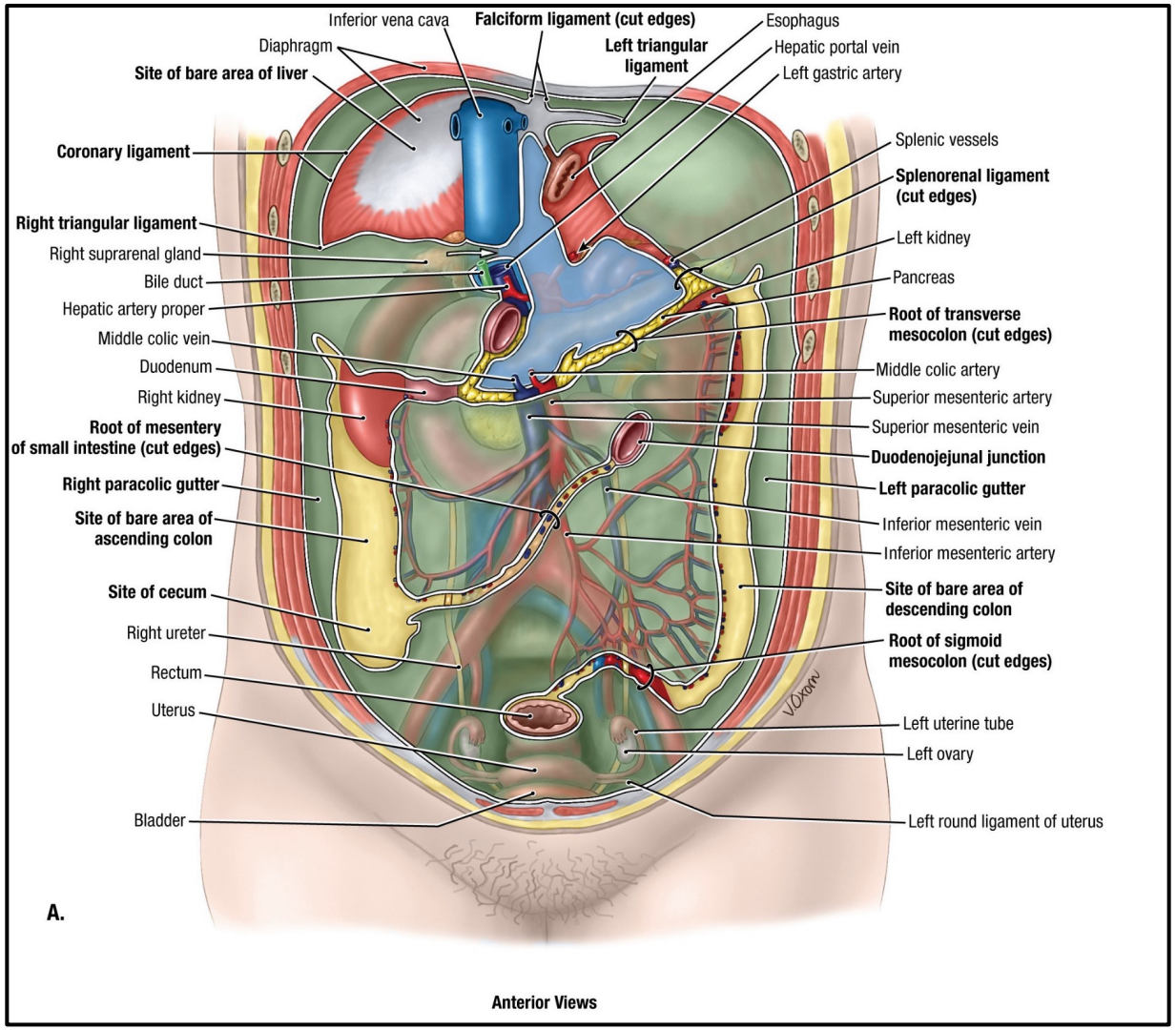


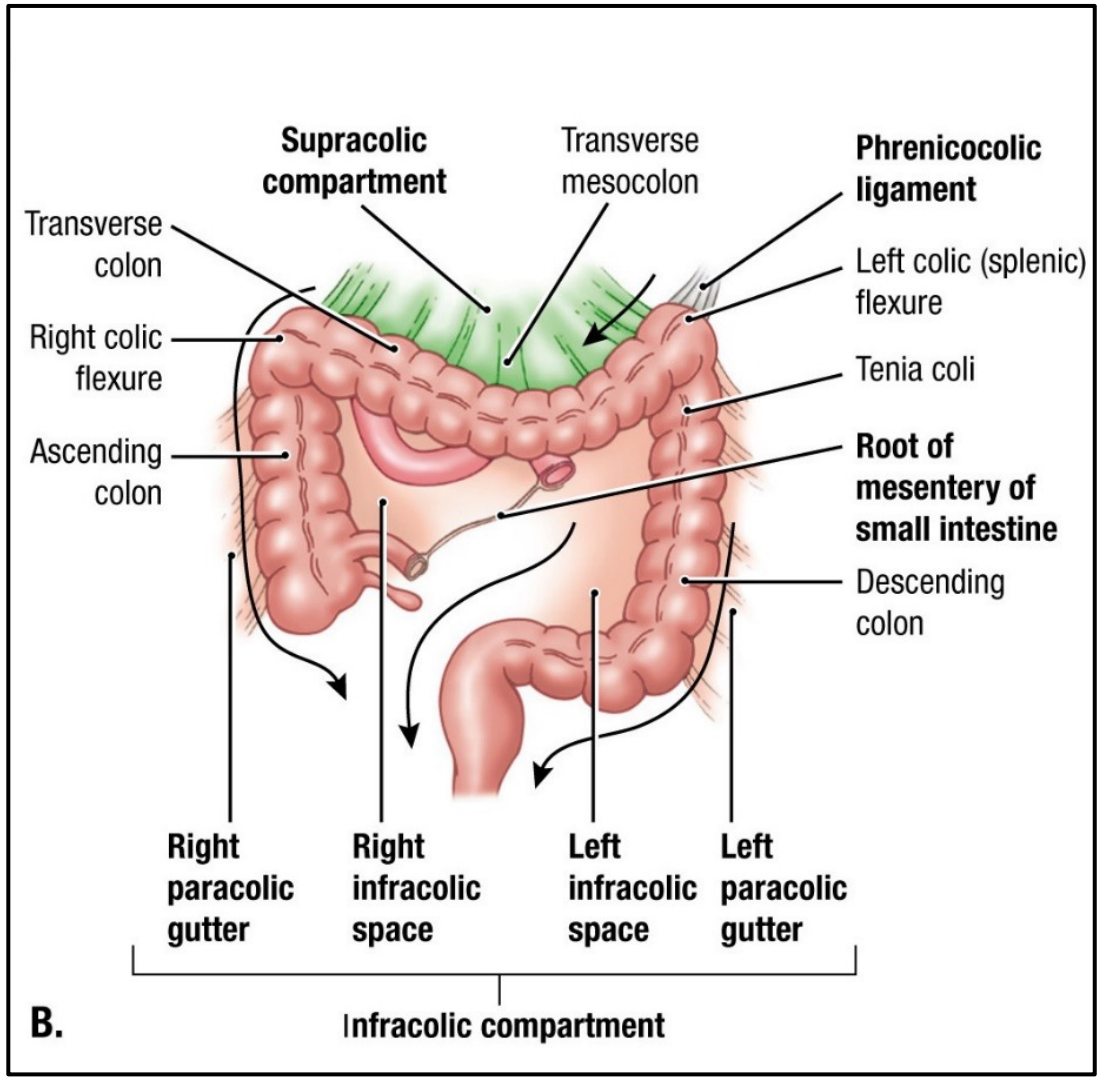
Gilroy, Atlas of Anatomy, 3rd ed., Fig. 15.18, Illustrator: Wesker/Voll,



Abdominal Recesses: Infracolic Spaces & Paracolic Gutters

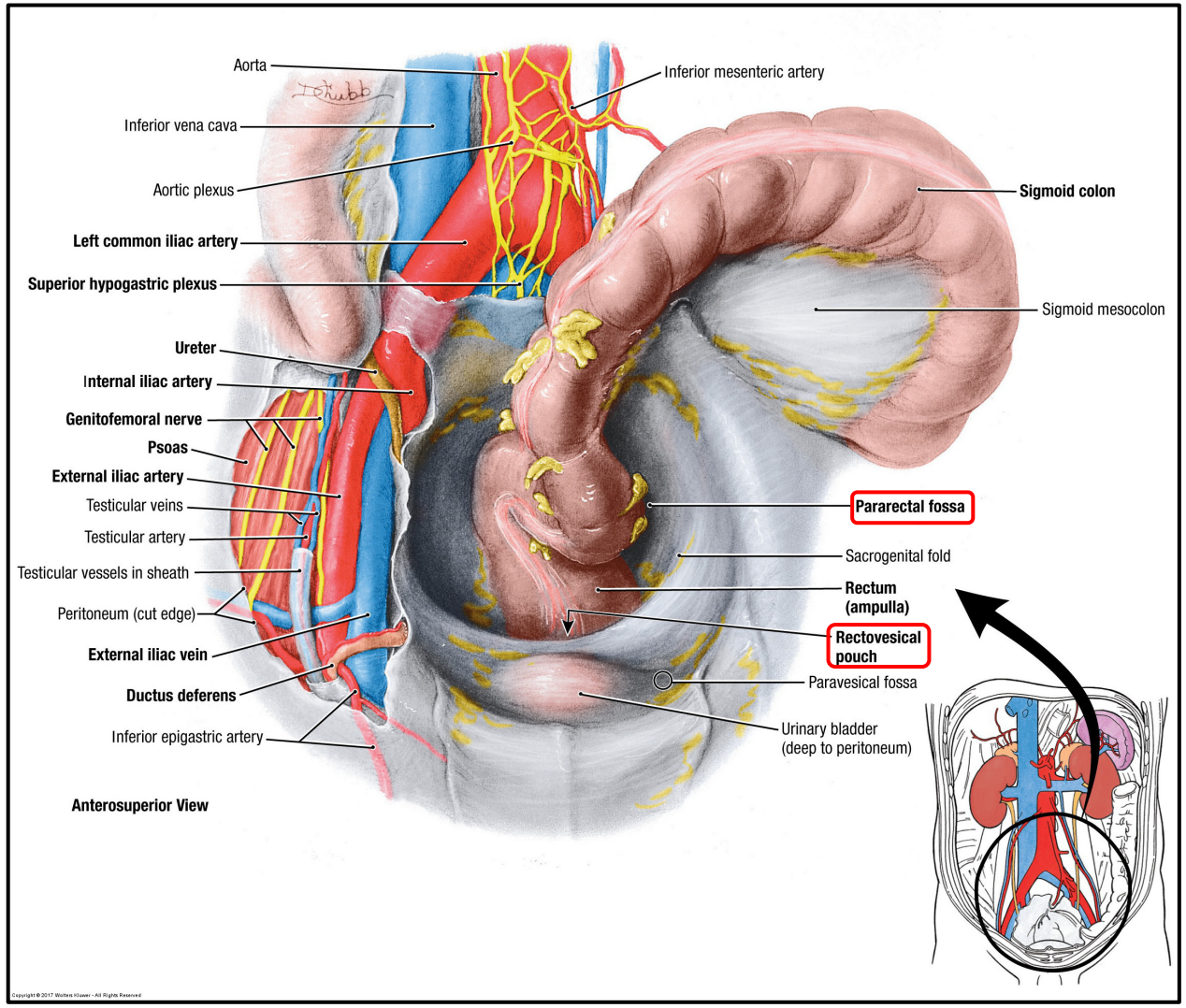
- The **right and left infracolic spaces** are located on either side of the root of the mesentery.
- The **right and left paracolic gutters** are located lateral to the ascending and descending colons.

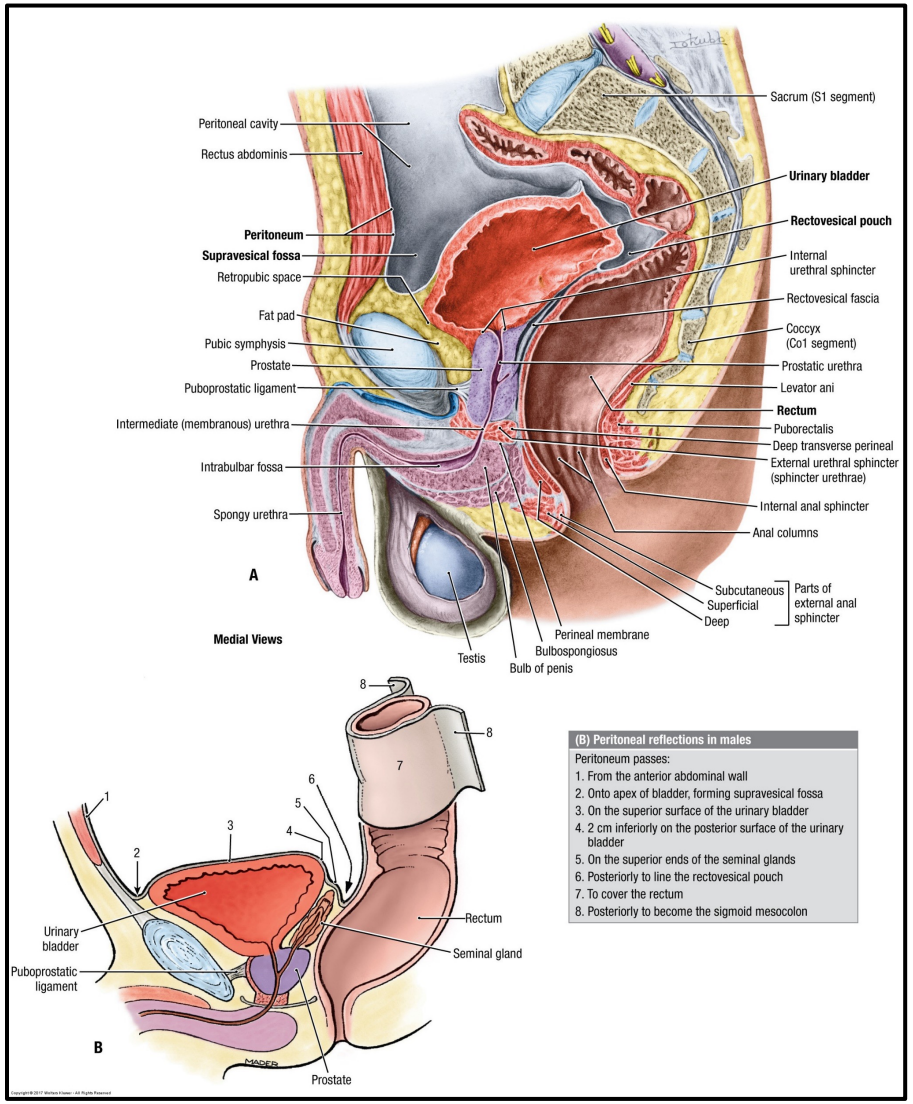




Pelvic Recesses: Rectovesical Pouch & Pararectal Fossae

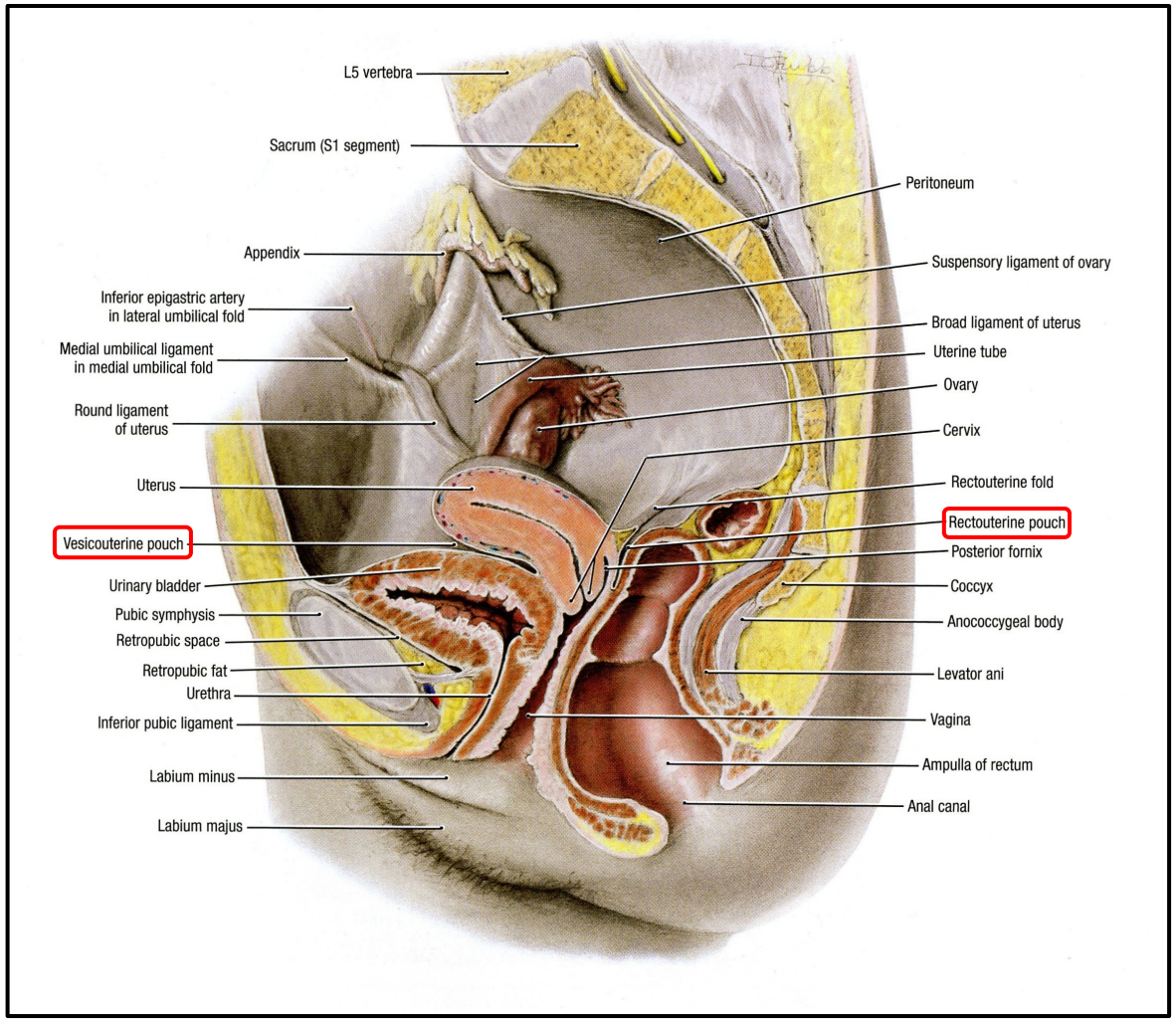
- The **rectovesical pouch (space)** is a midline space located between the posterior surface of the urinary bladder and the anterior surface of the rectum.
- The **pararectal fossae** are depressions along the lateral sides of the rectum. The pararectal fossae can be considered lateral extensions of the midline rectovesical (male) or rectouterine (female) spaces.

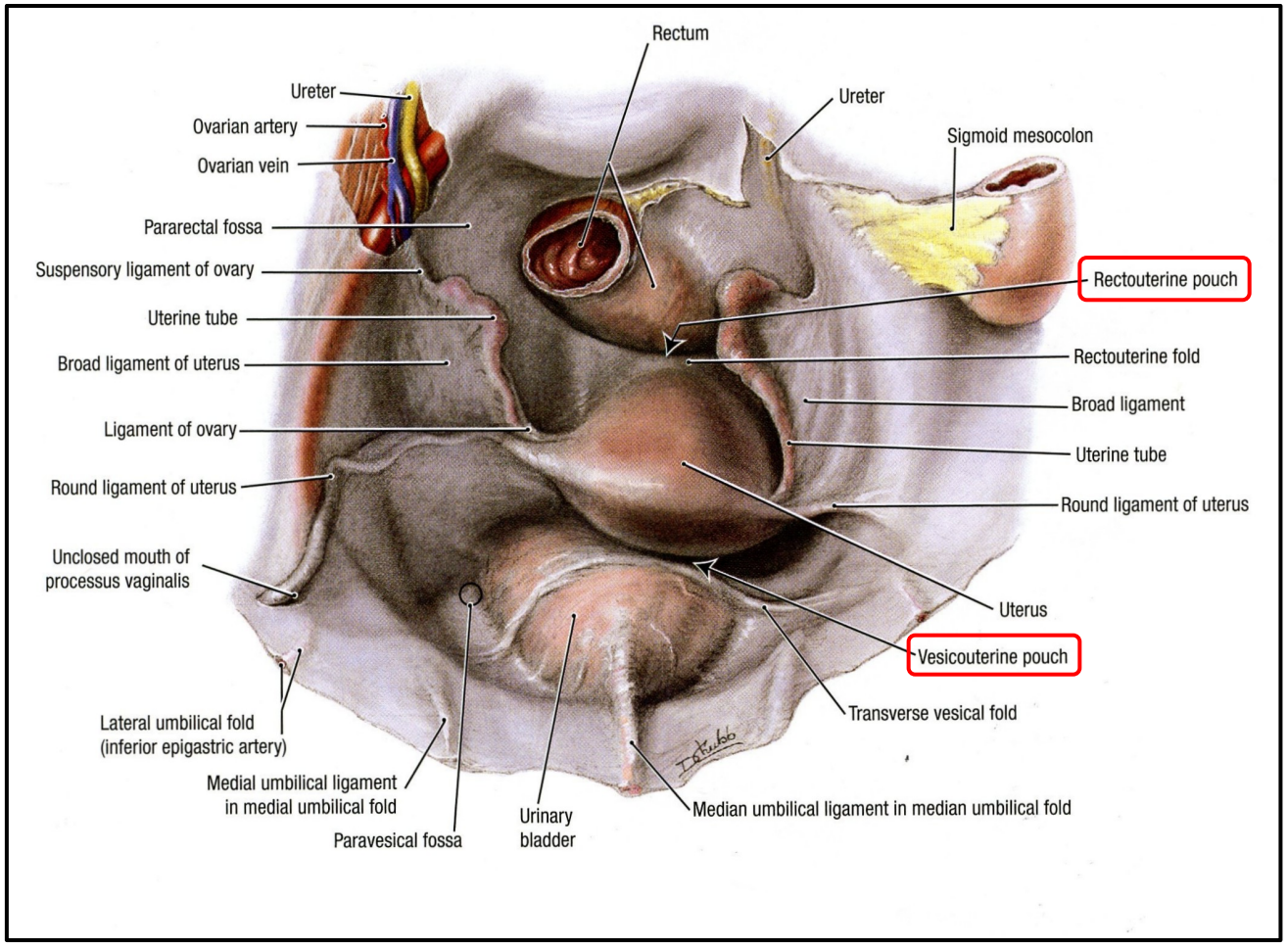




Pelvic Recesses: Vesicouterine & Rectouterine Pouches

- The **vesicouterine pouch (space)** is the midline space located between the uterus and the bladder.
- The **rectouterine pouch (of Douglas)** is the midline space located between the rectum and the uterus.





Peritoneal Fluid: Ascites

CLINICAL ANATOMY: Due to the movements of the diaphragm and peristalsis, normal flow of peritoneal fluid is in a cephalic (toward the head) direction from the paracolic gutters to the subphrenic recesses. The majority of peritoneal fluid clearance into lymphatic vessels occurs at the subphrenic space.

Ascites refers to the accumulation of fluid in the peritoneal cavity, which results from many different causes. The most common cause of ascites in the United States is liver disease, specifically cirrhosis. Other causes include fluid overload from CHF or renal failure, metastatic disease, peritonitis (malignant or infectious), ovarian neoplasms, trauma, surgery, or spontaneous hemorrhage. Fluid within the peritoneal cavity can shift and move but tends to accumulate in specific areas. In cases of excess intra-abdominal fluid (i.e. ascites), fluid can accumulate in different spaces depending on the position of the patient.

- Supine: Fluid collects in the **hepatorenal recess (Morrison pouch)**.
- Upright:
  - In men, fluid collects in the **pararectal fossa and rectovesical pouch**.
  - In women, fluid collects in the **pararectal fossa and rectouterine pouch**.