



Lecture no. 5

PERITONEUM
TOPOGRAPHY OF THE ABDOMINAL CAVITY
EMBRYOLOGIC DEVELOPMENT OF THE
ABDOMINAL VISCERA.
BURSA OMENTALIS.

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- **The foregut** is the anterior part of the alimentary canal, from the mouth to the duodenum, at the entrance of the bile duct.
- At this point it is continuous with the midgut.
- Structures of the foregut are:
 - **1. oesophagus**
 - **2. stomach**
 - **3. duodenum (1st part, 2nd part-proximal half)**
 - **4. liver**
 - **5. gallbladder**
 - **6. pancreas**
 - **7. spleen** (located in the foregut region, but is not a gut organ)

- **The midgut** is the portion of the embryo from which most of the intestines develop.
- After it bends around the superior mesenteric artery, it is called the "midgut loop".
- It comprises the portion of the alimentary canal from the end of the foregut at the opening of the bile duct to the hindgut, about two-thirds of the way through the transverse colon.

Structures in the adult midgut

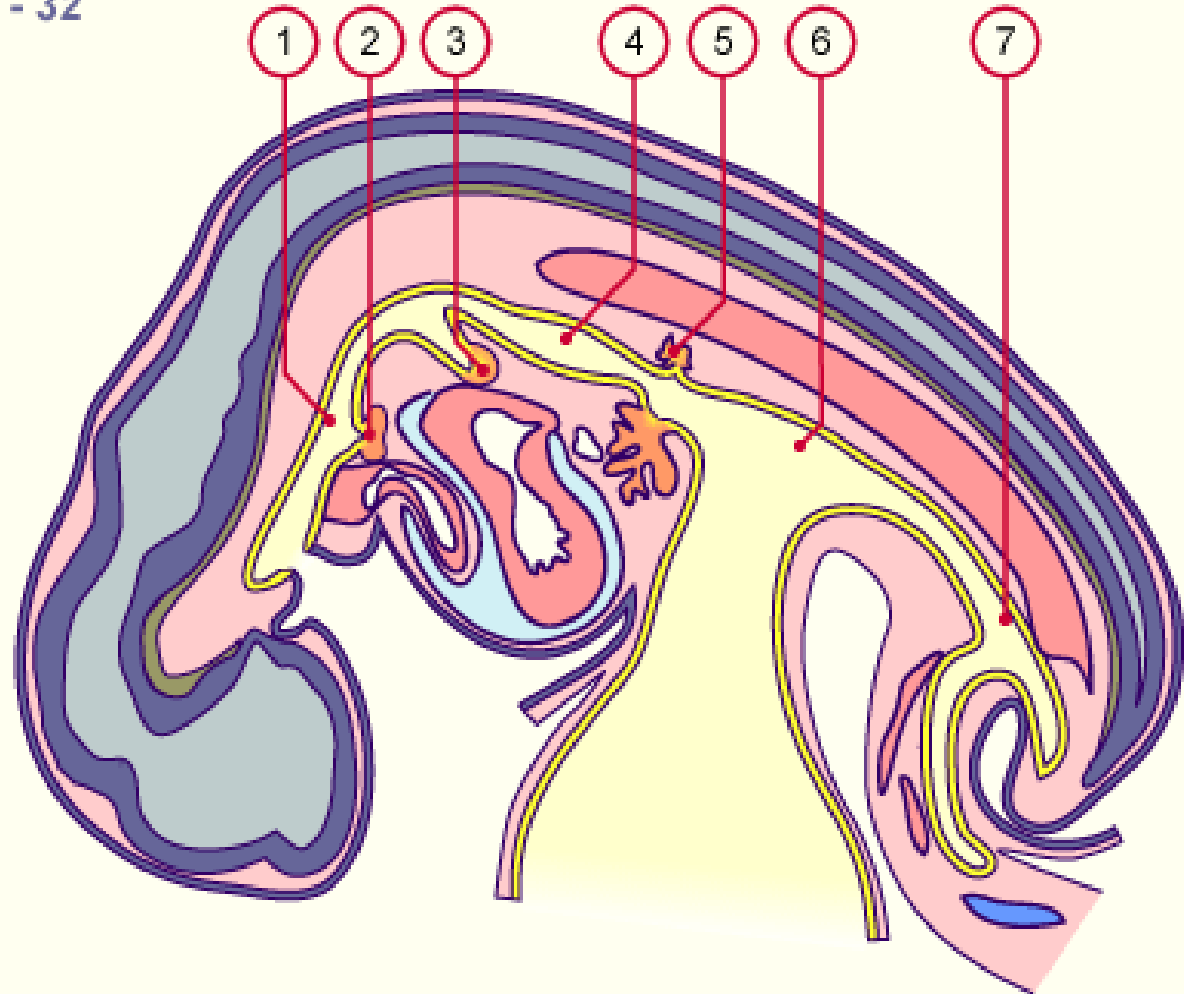
1. duodenum (distal half of 2nd part, 3rd and 4th parts)
2. jejunum
3. ileum
4. caecum
5. appendix
6. Ascending colon
7. Hepatic flexure of colon.
8. Transverse colon (proximal two-thirds)

- Arterial supply to all these structures is from the coeliac trunk, and venous drainage is by the portal venous system.
- Lymph from these organs is drained to the prevertebral **coeliac nodes** at the origin of the celiac artery from the aorta.
- The **hindgut (or epigaster)** is the posterior (caudal) part of the alimentary canal.
 - 1. **distal third of the transverse colon**
 - 2. **splenic flexure,**
 - 3. **descending colon,**
 - 4. **sigmoid colon**
 - 5. **rectum.**
- Arterial supply is by the inferior mesenteric artery, and venous drainage is to the portal venous system.
- Lymphatic drainage is to the chyle cistern.

Embryo - 32 days

13 - 32

1. Foregut
2. Anlage of the thyroid
3. Anlage of the lungs
4. Stomach
5. Anlage of the dorsal pancreas
6. Midgut
7. Hindgut

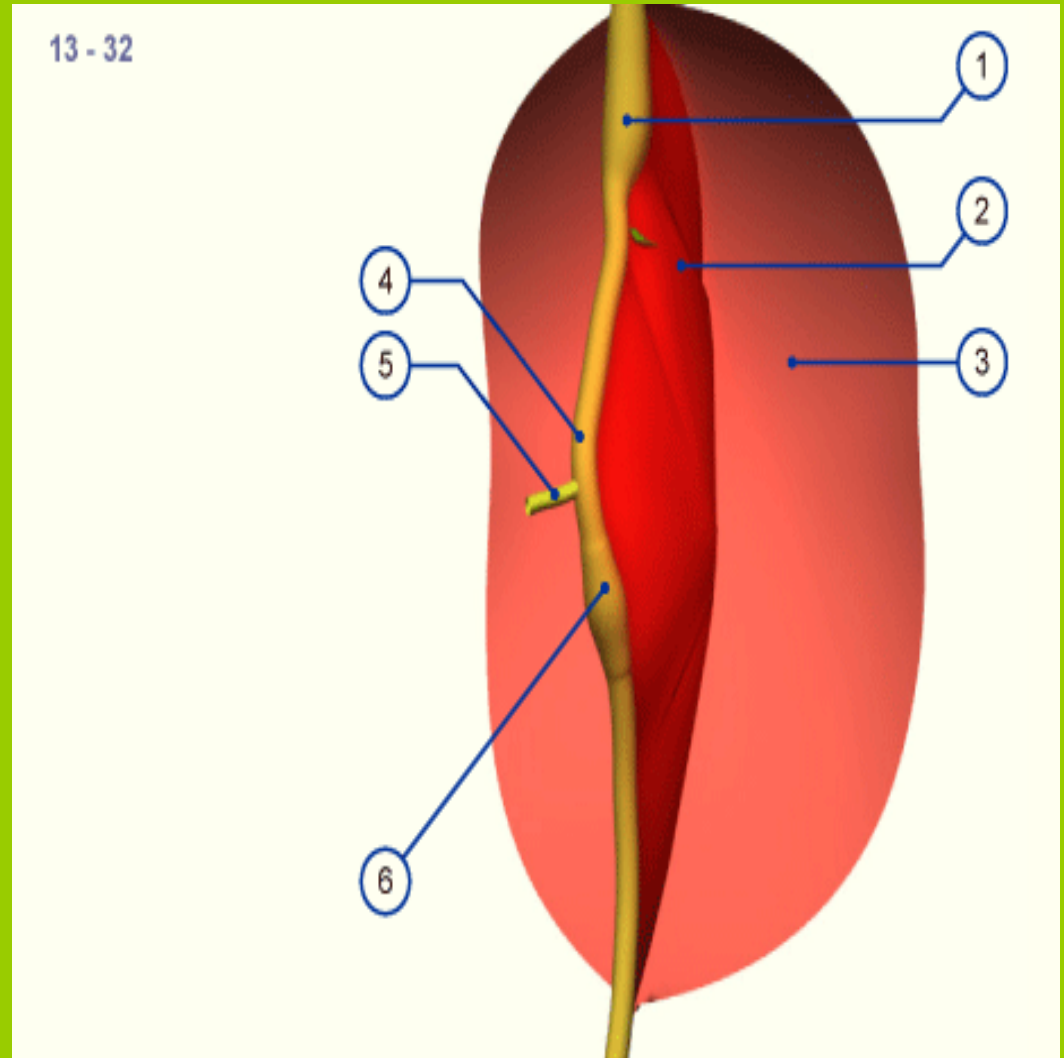


Intestinal rotation

- In the 32nd day, the midgut begins to extend into the umbilical coelom and forms the umbilical loop, whereby initially from the apex only a wide connection to the **umbilical vesicle** exists.
- In the further development this junction becomes constricted to become the omphalomesenteric duct.
- In the beginning (31st day) the umbilical loop is positioned sagittally.

Intestinal rotation: 32 days-embryo

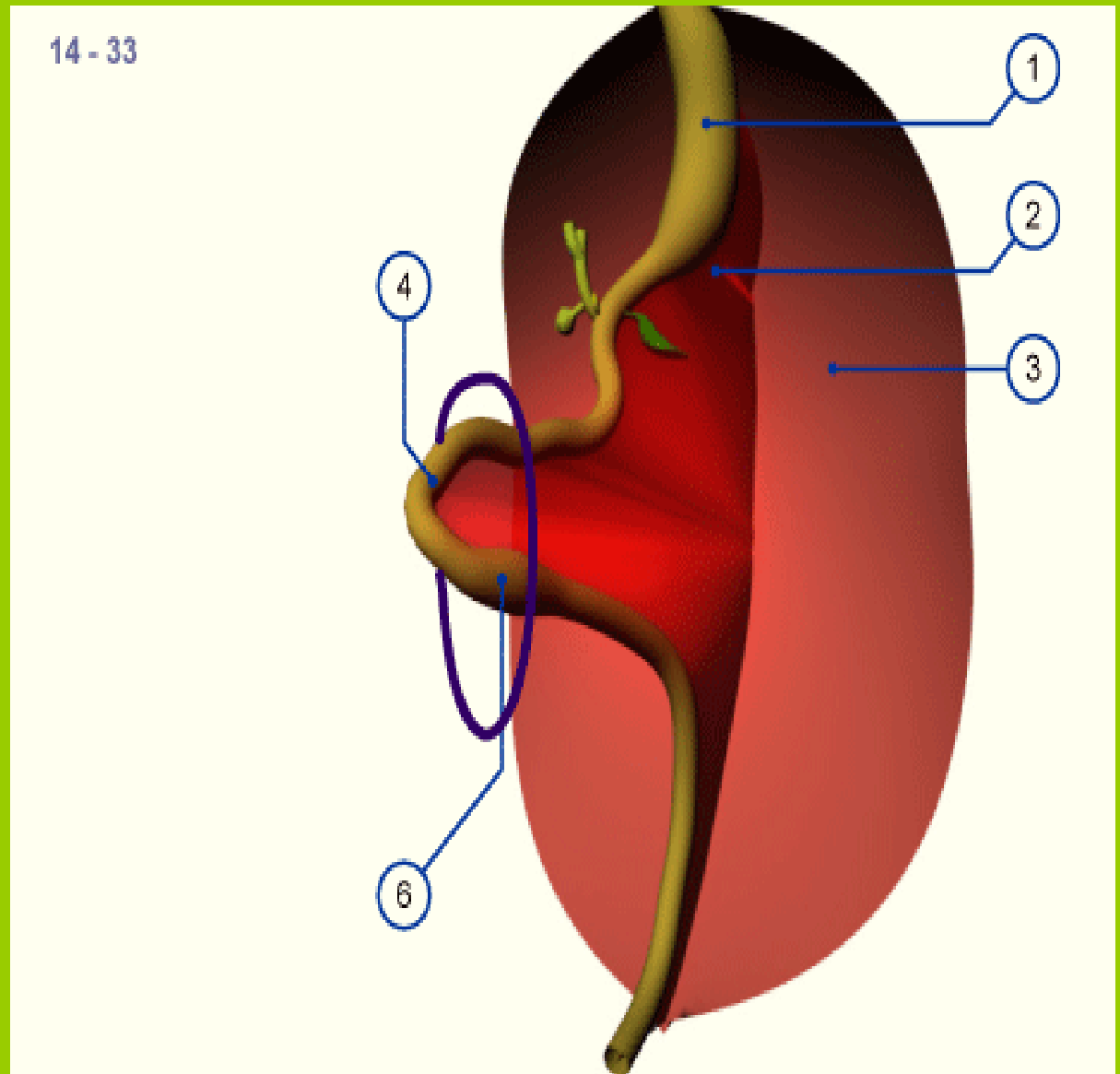
1. Stomach
2. Mesenterium
3. Parietal peritoneum
4. Intestinal loop
5. Omphalomesenteric duct
6. Caecum



- Only when the **umbilical loop** lengthens and grows into the **umbilical coelom** does it experience a **rotation of 90 degrees in a clockwise direction** as seen from the embryo.
- The cranial pedicle comes to lie to the right and the caudal to the left (33 days).
- The umbilical loop now has a **horizontal position**.
- Through the cranio-caudal growth gradient, the cranial pedicle forms first through lengthening of several loops in the umbilical coelom.

Intestinal rotation: stage 14, ca. 33 days

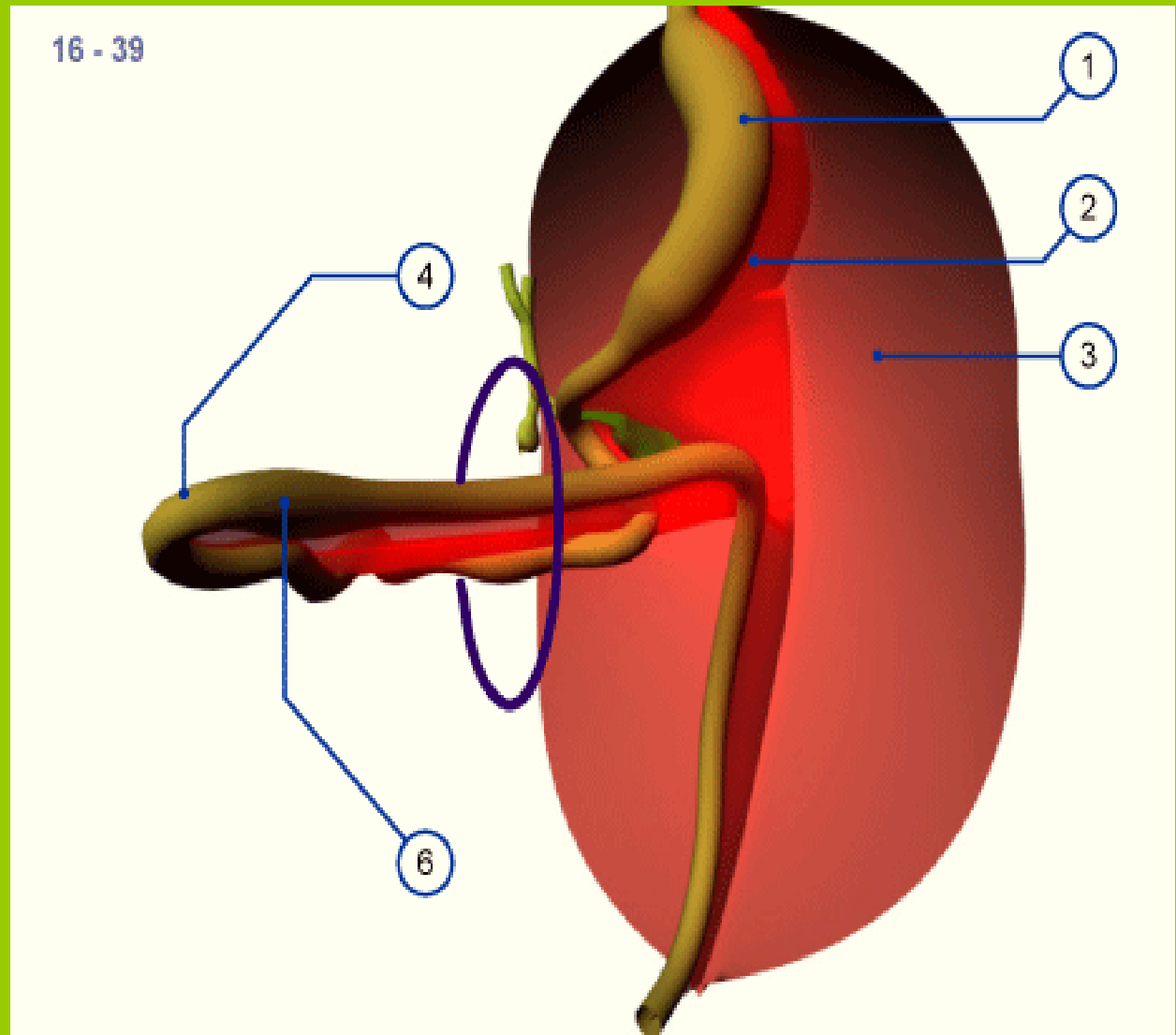
1. Stomach
2. Mesenterium
3. Parietal peritoneum
4. Intestinal loop
5. Cecum



- The developing umbilical loop extends further into the umbilical coelom because there is no more room for it within the embryo's abdominal cavity.
- It is the time of the strongest flexion of the embryo.
- Very soon a thickening in the region of the caudal pedicle of the intestinal tube is also to be seen: the **caecum**.
- Visually, it becomes an important fixed point for purposes of orientation.

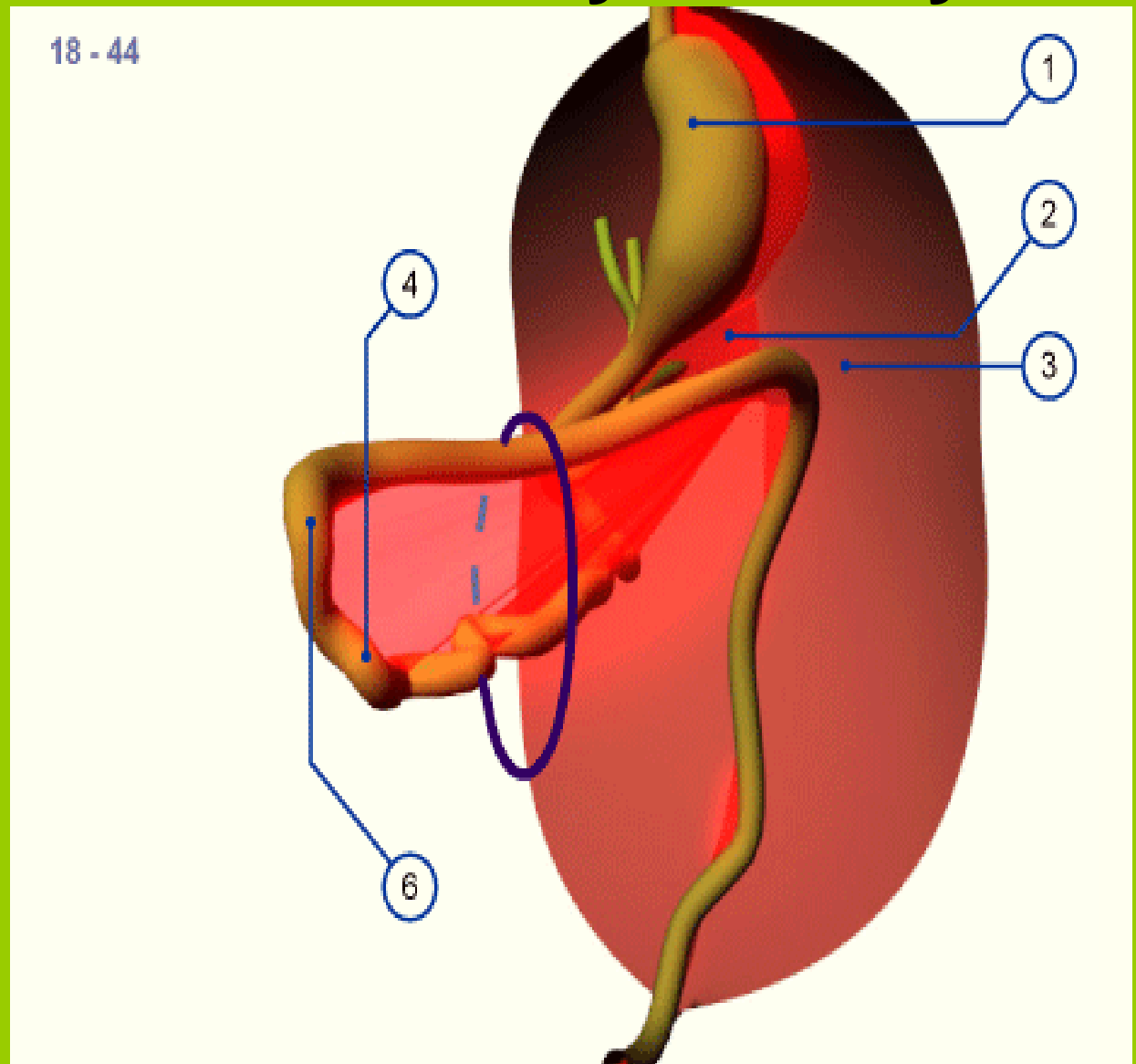
Intestinal rotation: 39 days- embryo

1. Stomach
2. Mesenterium
3. Parietal peritoneum
4. Intestinal loop
6. Caecum



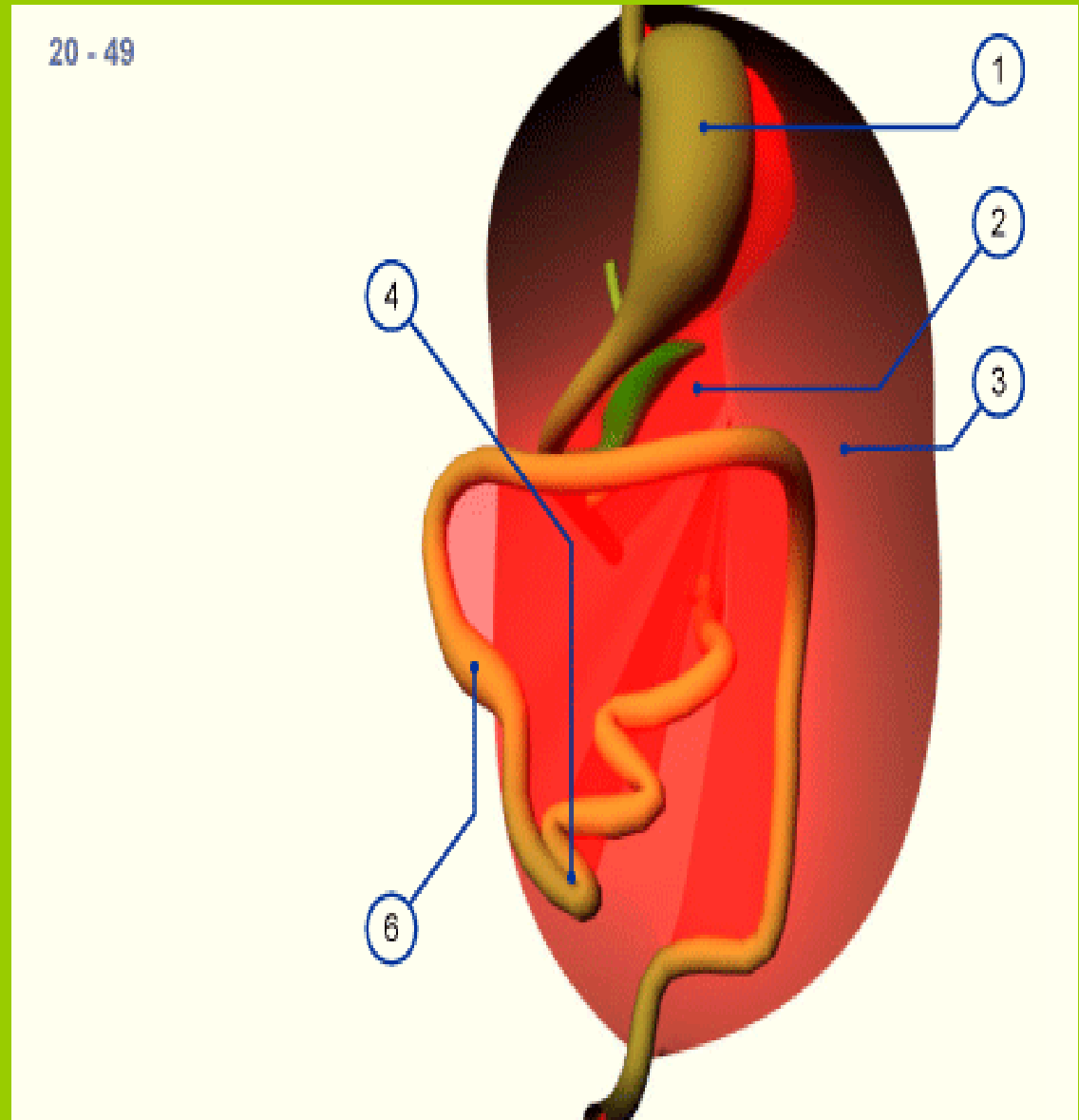
Intestinal rotation: 44 days-embryo

1. Stomach
2. Mesenterium
3. Parietal peritoneum
4. Intestinal loop
6. Caecum



Intestinal rotation: 49 days -embryo

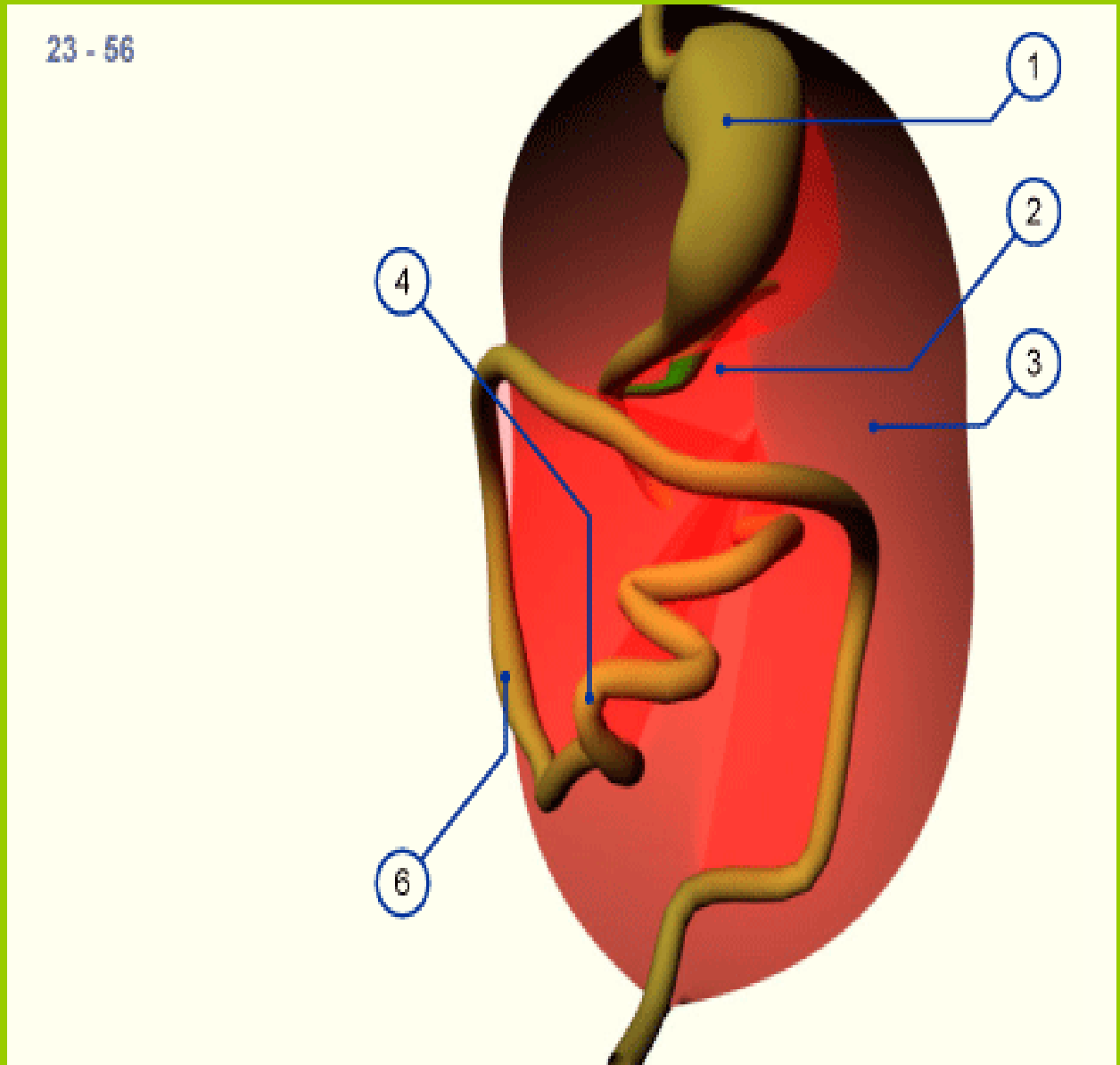
1. Stomach
2. Mesenterium
3. Parietal peritoneum
4. Intestinal loop
6. Caecum



- Thus, after the reintegration of the intestinal loops into the abdominal cavity from the physiologic umbilical hernia, the derivatives of the originally caudal pedicle occupies the **superior and anterior part of the abdominal cavity**.
- At the end of the embryonic period this part migrates downwards into the **iliac fossa**, whereby an additional rotation occurs.
- The whole rotation of the intestines thus amounts to approximately **270 degrees**.
- As a consequence, the **mesenterium** also turns with it and in its insertion it crosses over the **inferior part of the duodenum**.

Intestinal rotation: stage 23, ca. 56 days

1. Stomach
2. Mesenterium
3. Parietal peritoneum
4. Intestinal loop
5. Cecum



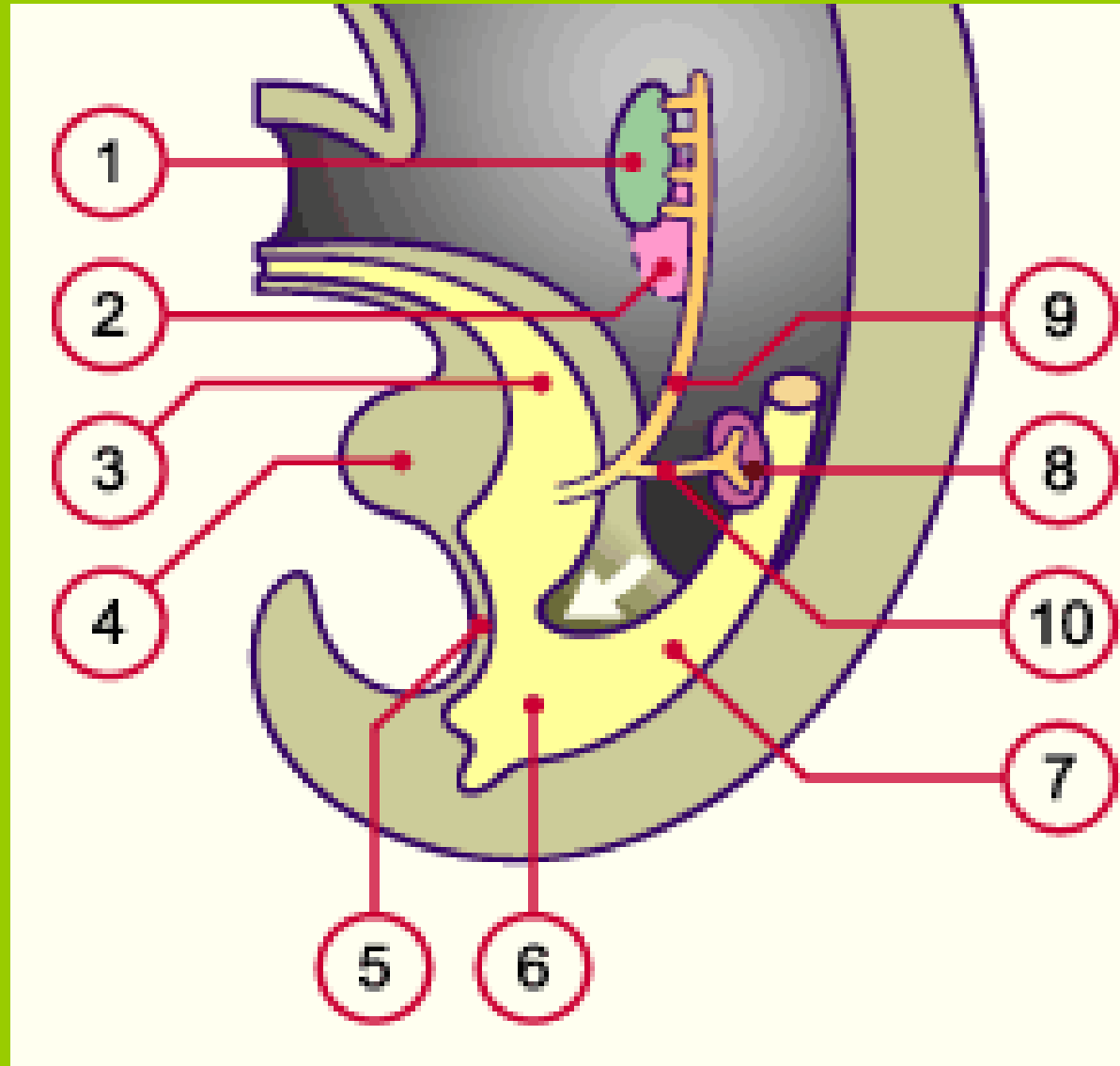
Hindgut

- The hindgut extends from the **left third of the transverse colon to the cloaca (rectum)**.
- In contrast to the midgut, no intestinal rotation occurs here but rather this part gets pushed to the left side by the midgut returning from the umbilical coelom.
- It consists of:
 - Transverse colon (left third)
 - Descending colon
 - Sigmoid colon
 - Rectum
 - Anal canal

- Initially the hindgut dead-ends in the cloaca and is separated by the **cloacal membrane** from the **ectodermal anal pit, the proctodaeum**.
- In addition, at its end, it is connected to the **allantois** and to the **mesonephric duct**.
- From 33 days-embryo, the cloaca flattens in the frontal plane and extends somewhat in the sagittal plane, whereby from the upper rear and from both sides a mesenchymal condensation, the **urorectal septum**, arises in the angle between the **allantois** and the **hindgut**.
- Through this mechanism, the cloaca is subdivided into the **urogenital sinus** (ventrally) and the **anorectal canal** (dorsally) .

Hindgut in 36 days-embryo

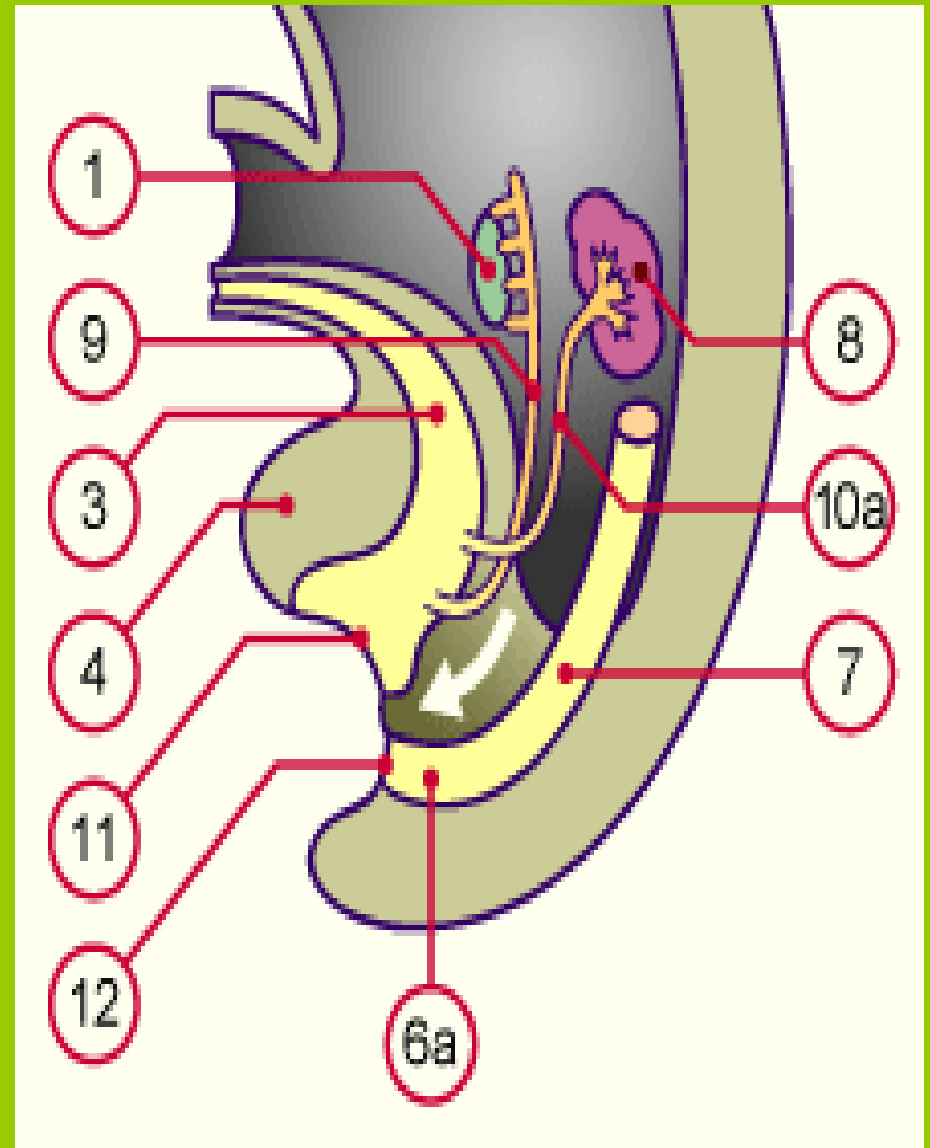
1. Gonads
2. Mesonephros
3. Allantois
4. Genital tubercle
5. Cloacal membrane
6. Cloaca
7. Hindgut
8. Metanephros
9. Mesonephric duct (Wolff's duct)
10. Ureter



- In the cloacal region the **urorectal septum** thickens still more and forms the material for the **deep perineum**.
- In the 46 days-embryo, the cloacal membrane ruptures and the endodermal part of the **anal canal** goes over into the ectodermal part of the **proctodeum**.
- During this period the **anorectal canal** is closed by an epithelial plug and is recanalized again only in the early foetal period.

Hindgut in 56 days-embryo

- 1. Anlage of the gonads
- 3. Anlage of the bladder
- 4. Genital tubercle
- 6a. Rectum
- 7. Hindgut
- 8. Metanephros
- 9. Mesonephric duc (Wolff's duct)
- 10a. Ureter
- 11. Urogenital orifice
- 12. Anal orifice



Mesenterial relationships

- In the region of the stomach and small intestine up to the liver bud exists a ventral fixation, the **ventral mesogastrium** all the way to the liver.
- Therein courses later the **portal vein**, the **hepatic artery** and the **bile duct**
- dorsal "**meso**" fixates the viscera here to the dorsal abdominal wall.

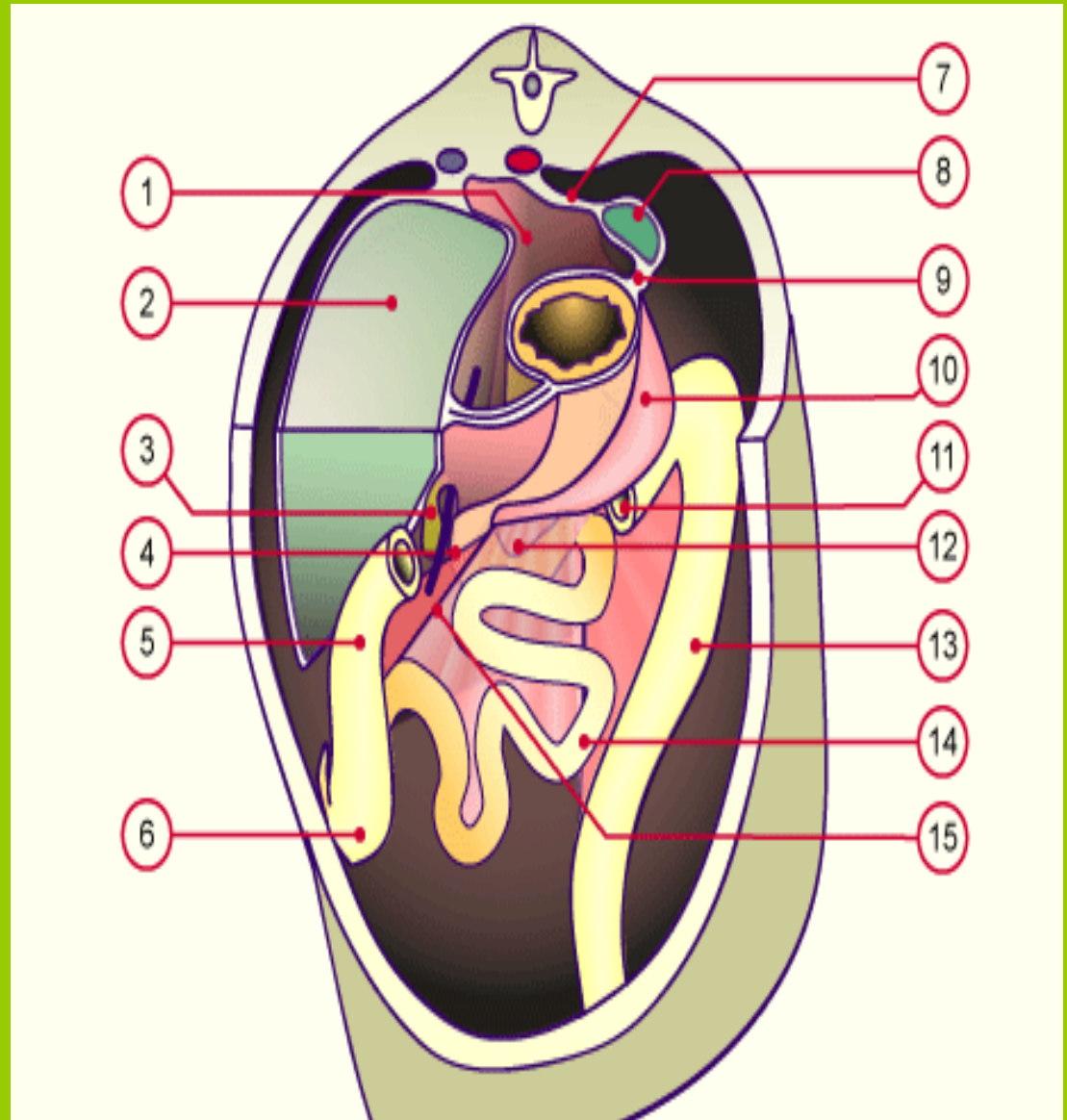
In 32 days-embryo, to the right of the intestinal tube in the region between the esophagus and lungs a niche arises, the **recessus pneumato-entericus**, that extends down into the **peritoneal cavity**.

- With the spreading of the **diaphragm** it becomes subdivided into a **supra-diaphragmatic cavity**, the **subcardiac bursa**, and an **infra-diaphragmatic cavity**, the **omental bursa**.
- On the left a similar niche arises that, however, soon atrophies or is suppressed by the rotation of the stomach.

- With the rotation of the stomach the **omental bursa** spreads further out and delimits a space behind the stomach with a small opening into the peritoneal cavity, the **epiploic foramen**.
- In the front it is bounded by the **ventral mesogastrium** or **omentum minus**.
- With the further development the **dorsal mesogastrium** extends over the large curvature of the stomach in the caudal direction and forms a **mesenterial fold**: the **greater omentum**, which in effect is nothing more than an extended omental bursa.
- With time the two layers of the **greater omentum** , adhere together and further fuse with the **transverse mesocolon**.

Abdominal plan of a foetus

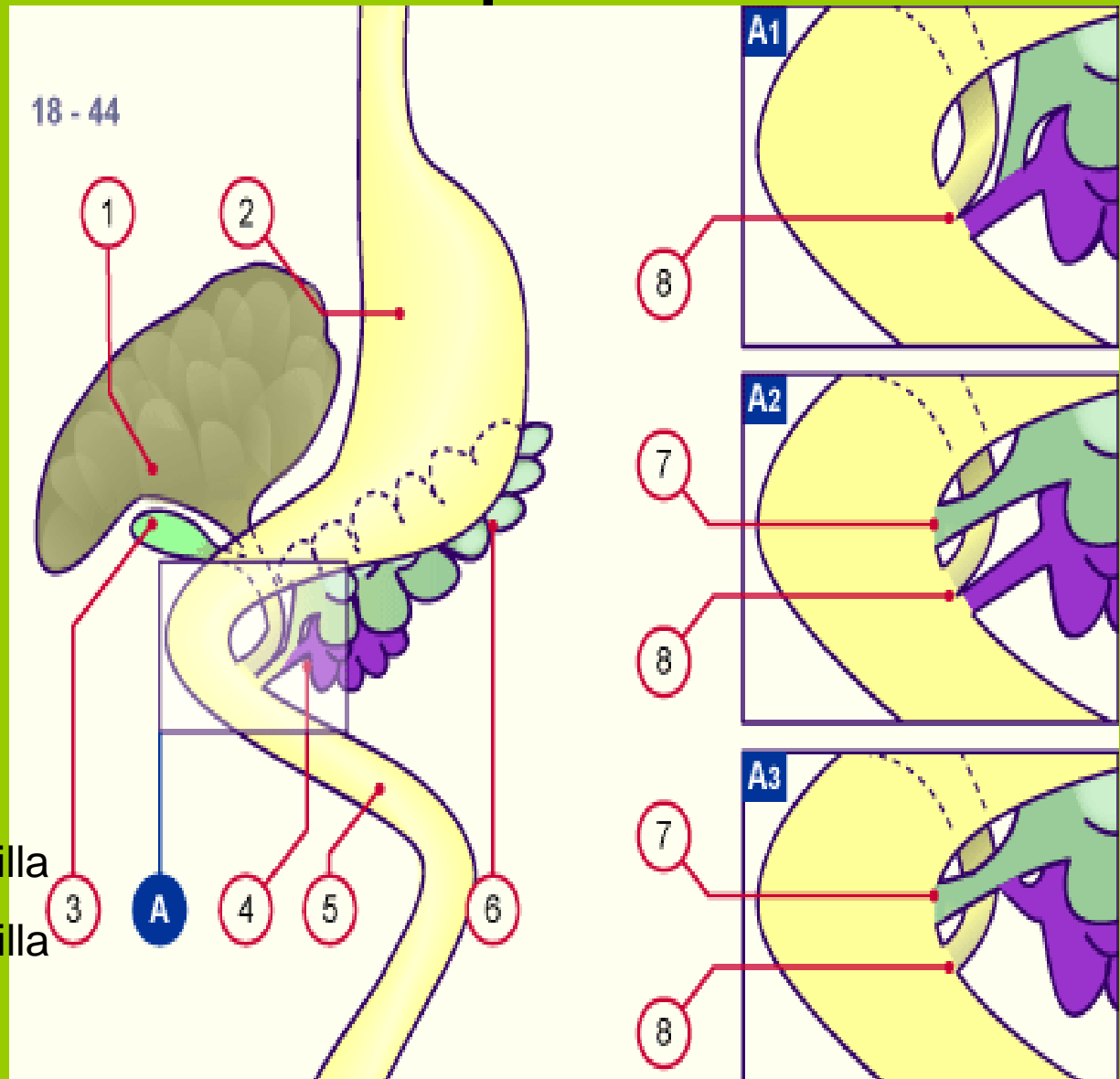
1. Omental bursa
2. Liver
3. Gall bladder
4. Duodenum
5. Ascending colon
6. Cecum
7. Lienorenal ligament
8. Spleen
9. Gastrolial ligament
10. Greater omentum
11. Transverse colon
12. Mesenterium
13. Descending colon
14. Small intestine convolution
15. Root of the mesentery



- In the region of the small intestine the mesenterial relationships are somewhat more complicated due to the intestinal rotation.
- The mesenterium of the entire small intestine appears to originate at a point that lies above the inferior part of the duodenum.
- At the level of the large intestine, the **mesenterium of the ascending and descending colon** becomes positioned on the posterior abdominal wall, adheres to it, and these two parts become **secondary retroperitoneal** in the fetal period.
- The **root of the mesentery** rises and runs transversely over the posterior abdominal wall from the **caecum** to the **duodeno-jejunal bend** and corresponds to the attachment of the part of the mesentery of the ascending colon that is fused with the posterior abdominal wall.
- Only in the region of the sigmoid flexure does the adhesion not occur and this part remains **intraperitoneal** with a **mesosigmoid**.
- The **rectum** is located **dorsal** and **caudal** to the **peritoneal cavity** and thus **retroperitoneal**.

Orifice variations of the pancreatic duct

1. Liver
2. Stomach
3. Gall bladder
4. Ventral pancreas
5. Duodenum
6. Dorsal pancreas
7. Minor duodenal papilla
8. Major duodenal papilla



Development of the pancreas

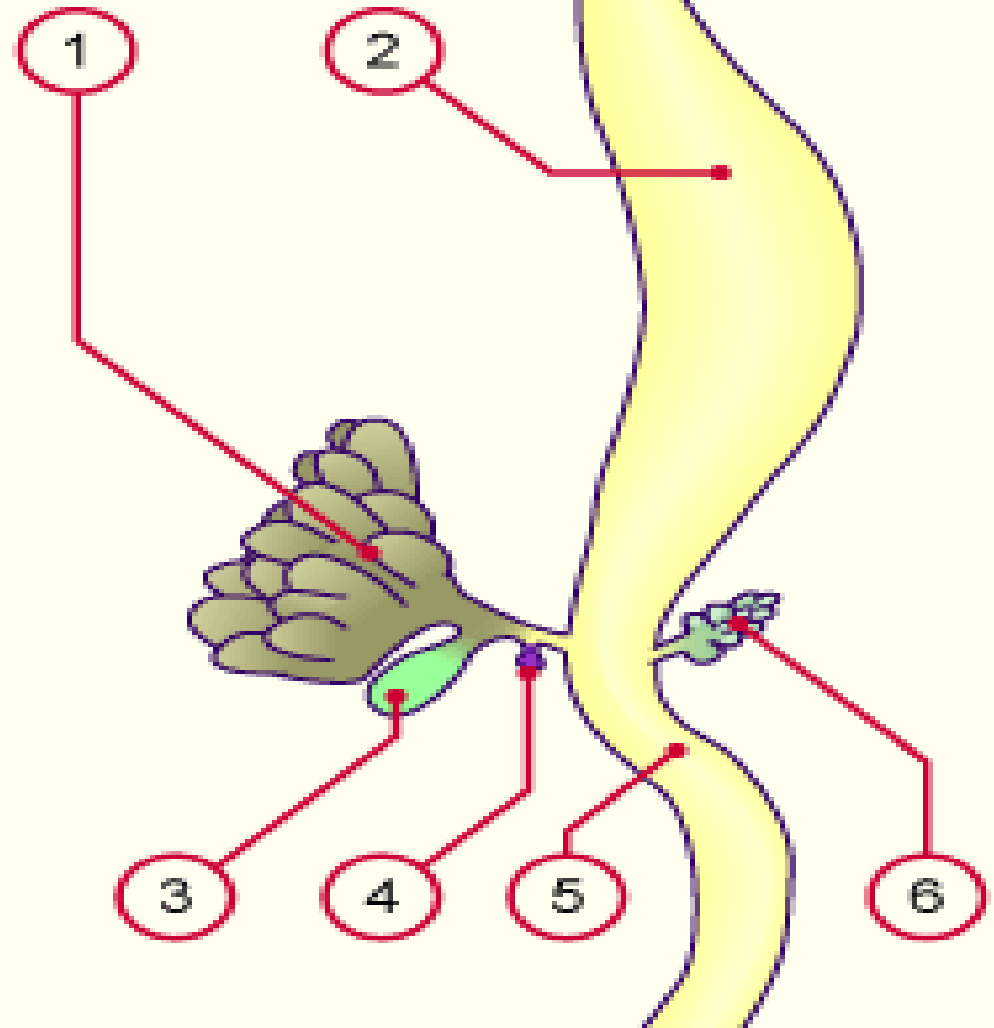
- The pancreas is developed into two parts, **a dorsal and a ventral**.
- The posterior arises as a diverticulum from the dorsal aspect of the duodenum a short distance above the hepatic diverticulum, and, growing upward and backward into *the dorsal mesogastrium*, forms a part of the head and uncinuate process and the whole of the body and tail of the pancreas.
- **The ventral part** appears in the form of a diverticulum from the primitive bile-duct and forms the remainder of the head and uncinuate process of the pancreas.
- The duct of the dorsal part (**accessory pancreatic duct**) therefore opens independently into the duodenum, while that of the ventral part (**pancreatic duct**) opens with the common bile duct.
- About the 6th week, the two parts of the pancreas meet and fuse and a communication is established between their ducts.
- After this has occurred the terminal part of the accessory duct, the part between the duodenum and the point of meeting of the two ducts, undergoes little or no enlargement, while the pancreatic duct increases in size and forms the main duct of the gland.
- The opening of the accessory duct into the duodenum is sometimes obliterated, and even when it remains patent it is probable that the whole of the pancreatic secretion is conveyed through the pancreatic duct.

Dorsal pancreas

- The dorsal pancreas bud expands relatively rapidly into the *mesoduodenum* below the large curvature of the stomach.
- It comes to lie with its tail-like part (***cauda***) near the spleen.
- Its outflow passage, which emerges from its head, normally fuses with the outflow passage of the **ventral pancreas anlage to become the major pancreatic duct**.
- These join with the **bile duct** and discharge into the **major duodenal papilla**.
- Sometimes the outflow passage of the dorsal pancreas anlage persists as an independent **minor pancreatic duct** and discharges somewhat more cranially at the **minor duodenal papilla** into the duodenum.

Dorsal pancreas anlage 32 days- embryo

13 - 32



1. Liver anlage
2. Stomach
3. Gall bladder
4. Anlage of the ventral pancreas
5. Duodenum
6. Anlage of the dorsal pancreas

Development of the spleen

- The spleen appears about the 5th as a localized thickening of the *mesoderm* in the dorsal *mesogastrium* above the tail of the pancreas.
- With the change in position of the stomach the spleen is carried to the left, and comes to lie behind the stomach and in contact with the left kidney.
- The part of the dorsal *mesogastrium* which intervened between the spleen and the greater curvature of the stomach forms the **gastro-splenic ligament**.

- **The stomach**
- Is connected with the dorsal body wall through the **dorsal *mesogastrium***, a duplicate of the peritoneum, and ventrally through the ventral *mesogastrium* with the **transverse septum**.
- The developing liver grows as a ventral budding of the intestinal tube into the transverse septum.
- The ventral *mesogastrium* is thus subdivided into a portion connecting the stomach to liver (the **hepatogastric ligament or omentum minus**) and a second portion that ties the liver and abdominal wall together (the **falciform ligament**).
- The coelomic gap in the region of the midgut (peritoneal cavity) extends towards the left cranially and to the right of the liver and forms the visceral envelope of the liver.

- The **stomach** is shifted to the **left** and turns **90 degrees**, the right wall lying dorsally.
- This results, though, more from a **substantial growth** of the left wall (later anterior wall) of the stomach and of the *fundus* than from an active rotation.
- The relatively short connective tissue bridge of the stomach to the posterior body wall stretches into a long, extended fold, the **dorsal *mesogastrium***.
- Later, the dorsal pancreas and the **spleen** anlage grow into it.
- Essential that the differing spurts of growth in the various stomach sections not only lead to shape but also to positional changes is the fact that the duodenum is fixed onto the posterior abdominal wall quite early.

Duodenum

- As a whole, the **duodenum loop** lies to the right on the abdominal wall.
- Its peritoneal layers stick and fuse to the peritoneal layer that lines the abdominal cavity wall.
- The **duodenum** thus becomes "**secondarily retroperitoneal**".
- The **transition between the foregut and midgut** are found on the vertex of the **duodenal loop**, there where the liver and pancreas anlagen arise.
- Probably no rotation of the duodenal loop occurs, rather it takes on its C-shape due to the extension of the stomach towards the left and the simultaneous relative fixation by the emerging liver and pancreas anlagen.
- This results in the **inferior horizontal portion of the duodenum** being shifted under the **superior mesenteric artery**.

- At first, the **loops of the small intestine** return into the abdominal cavity and come to lie in the left half surrounded by the **horizontal and descending part of the colon** that never left the abdominal cavity.
- The rotation now amounts to more than **180 degrees** and the colon is also shifted more and more into the abdominal space.
- The repositioning of the physiologic umbilical hernia is facilitated by the righting of the embryo's body.

Omphalocele

With an **omphalocele**, **intestinal loops** remain in the umbilical coelom and are not repositioned into the abdominal cavity.

Typically, the intestinal loops are coated with **amnion** and **peritoneum**.

An omphalocele is not to be confused with an **umbilical hernia**, which is found mainly in premature births.

The reason for an **umbilical hernia** is a **weak abdominal musculature** that is not able to hold back the intraperitoneal contents of the abdominal cavity.

In contrast to an omphalocele, an umbilical hernia is always covered with **skin**.



Regions of Abdominal Area

Right
hypochondriac
region

Epi-
gastric
region

Left
hypochondriac
region

Right
lumbar
region

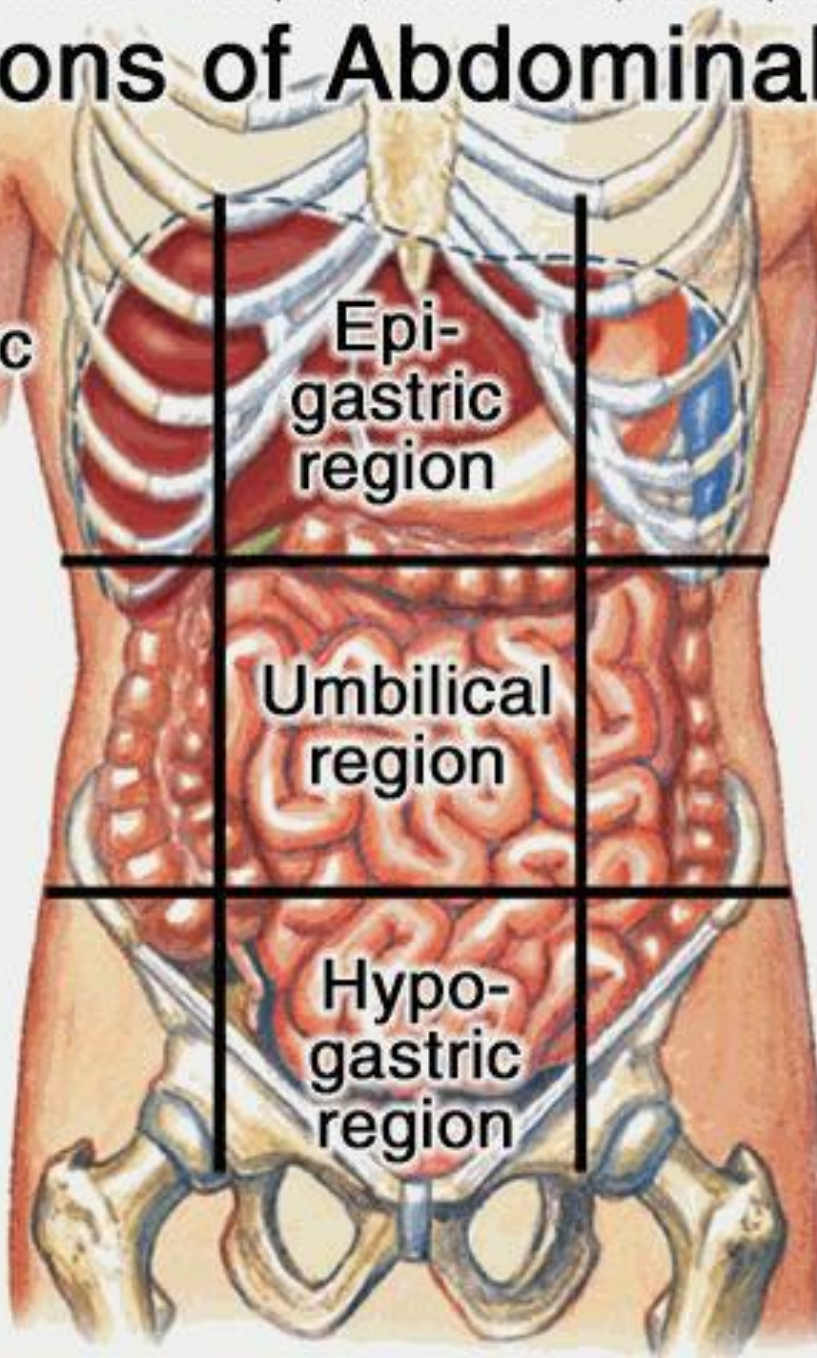
Umbilical
region

Left
lumbar
region

Right
iliac
region

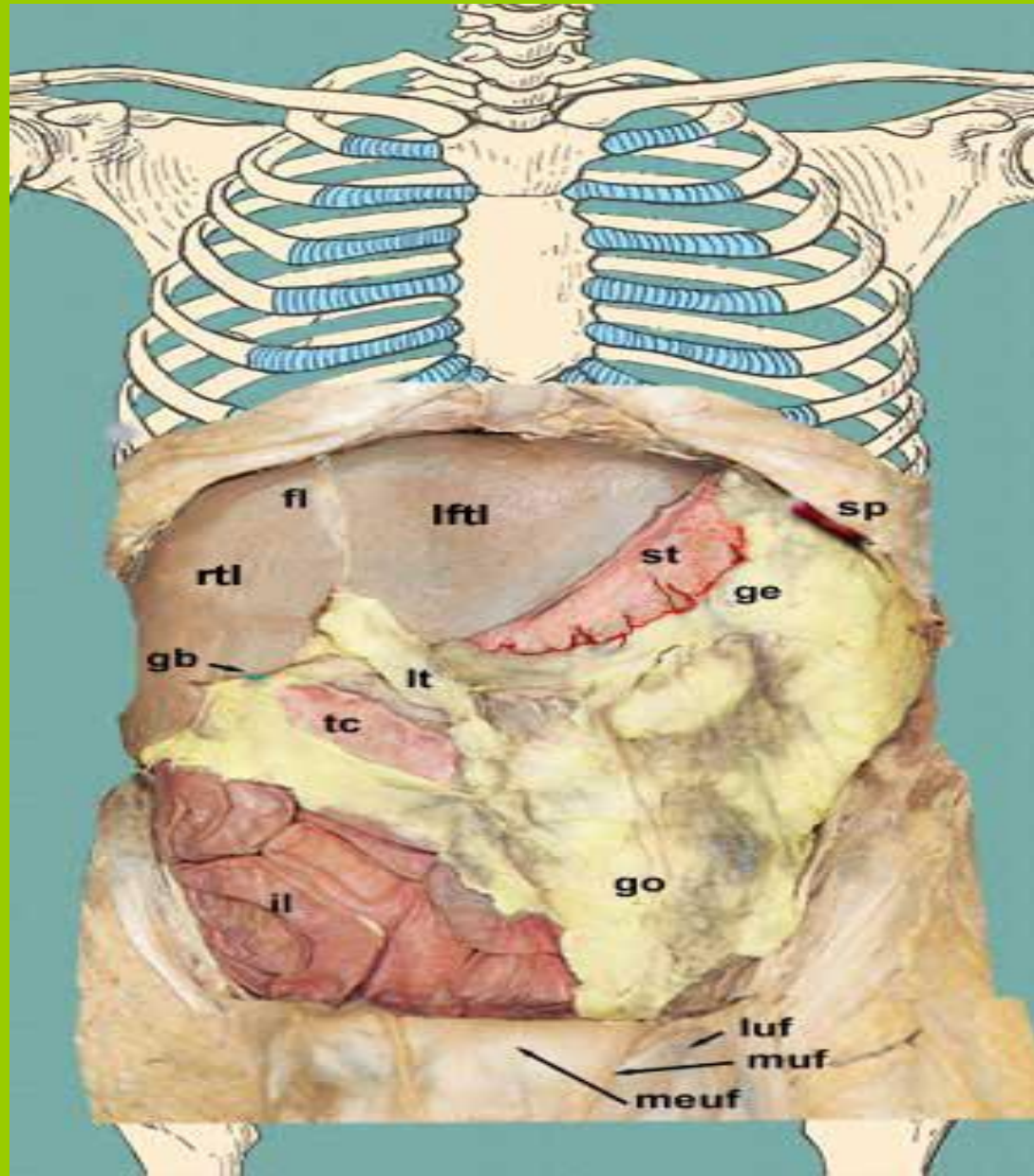
Hypo-
gastric
region

Left
iliac
region





General Inspection of the Abdominal Cavity and its Contents

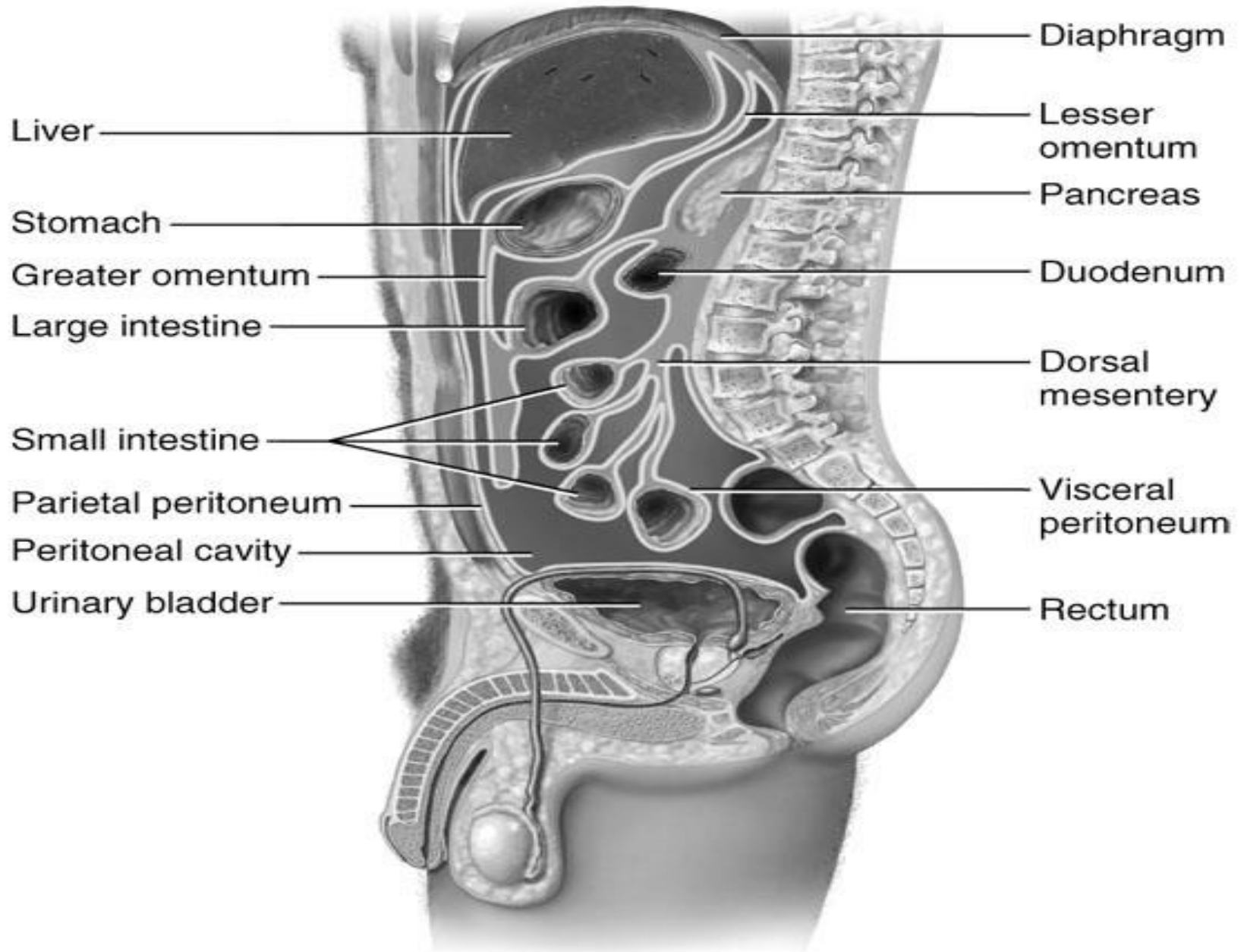


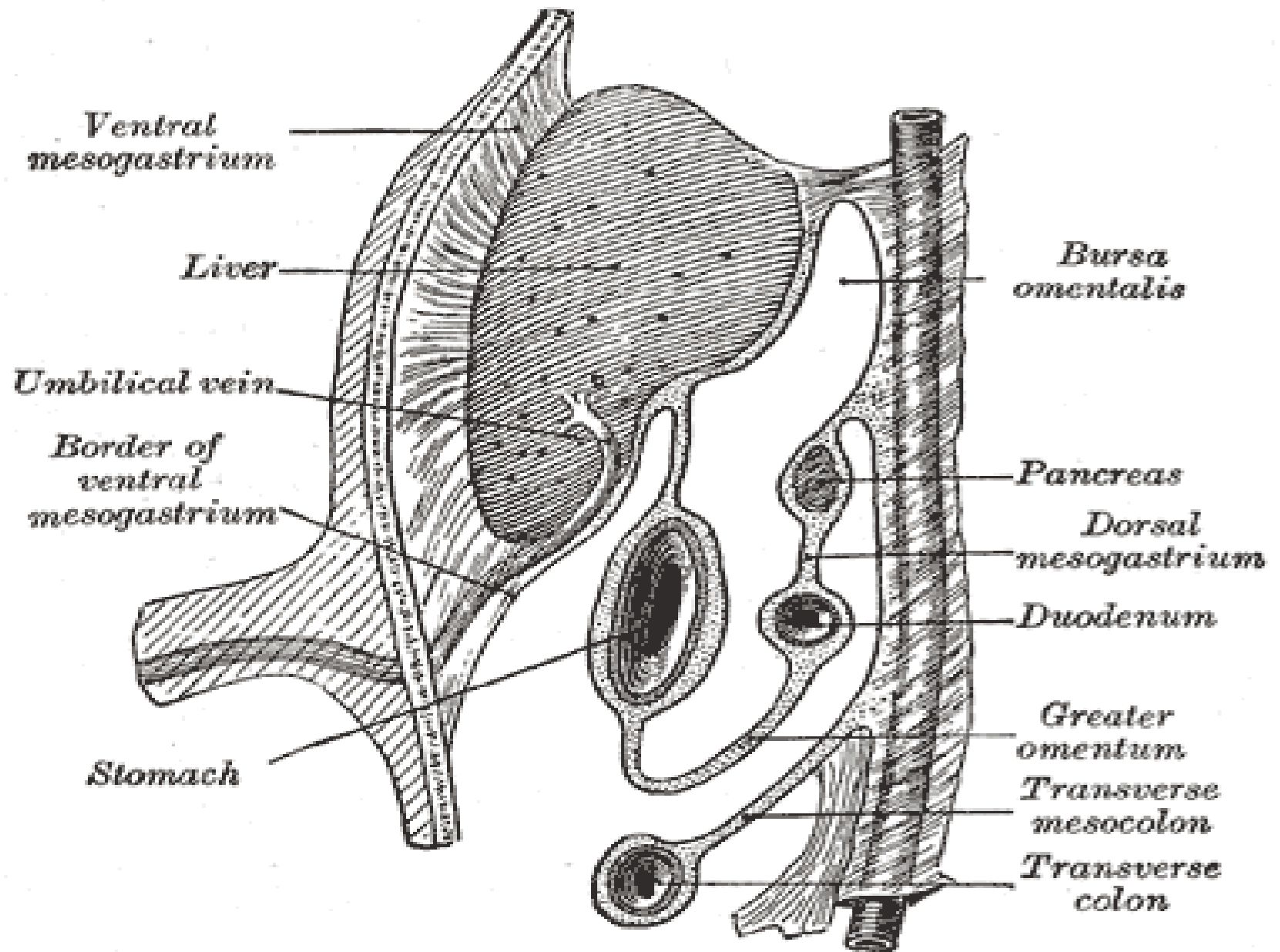
Peritoneum and Peritoneal Reflections

- The best way to try to visualize the peritoneum and its reflections is to examine sagittal and cross sections through the abdomen.
- After looking at images of these sections, students who have a cadaver available can then follow the road map that I will be giving as a way to classify various organs in the abdominal cavity before actually displaying them

The Peritoneum (*Tunica Serosa*)

- The peritoneum is the largest serous membrane in the body, and consists, in the male, of a closed sac, a part of which is applied against the abdominal parietes, while the remainder is reflected over the contained viscera.
- In the female the peritoneum is not a closed sac, since the free ends of the uterine tubes open directly into the peritoneal cavity.
- The part which lines the parietes is named the **parietal portion** of the peritoneum; that which is reflected over the contained viscera constitutes the **visceral portion** of the peritoneum.
- The *free surface* of the membrane is smooth, covered by a layer of flattened mesothelium, and lubricated by a small quantity of serous fluid. Hence the viscera can glide freely against the wall of the cavity or upon one another with the least possible amount of friction.
- The *attached* surface is rough, being connected to the viscera and inner surface of the parietes by means of areolar tissue, termed the **subserous areolar tissue**.
- The parietal portion is loosely connected with the fascial lining of the abdomen and pelvis, but is more closely adherent to the under surface of the diaphragm, and also in the middle line of the abdomen.
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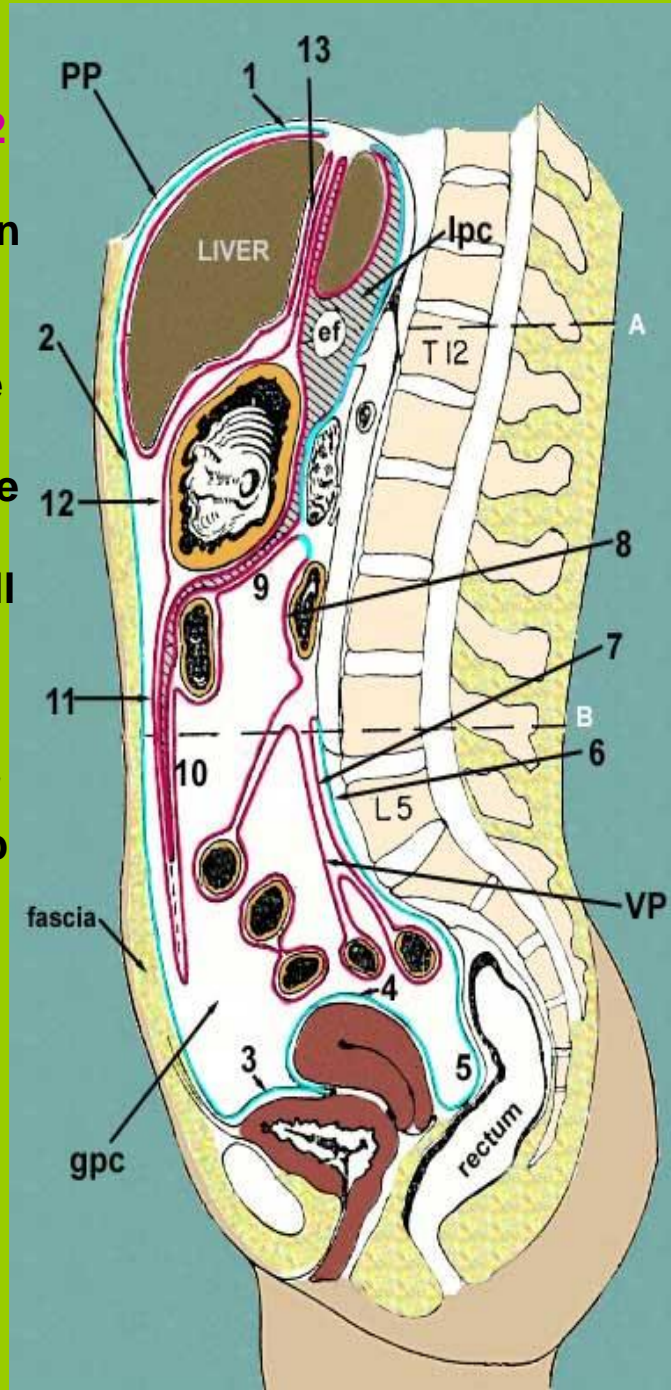
If you start by putting your finger as high as possible **1**, then run it along the inner aspect of the abdominal wall **2** until you reflect onto the superior surface of the urinary bladder **3**, then over the uterus in the female **4**, then down into the pouch of Douglas **5**, again in the female, up along the anterior surface of the rectum onto the posterior abdominal wall **6** until you reach the root of the mesentery of the small intestine.

From here you follow the mesentery of the small intestine **7** going around its coils until you reach the other side of the mesentery back down to the posterior abdominal wall where you will cross over the horizontal part of the duodenum **8**.

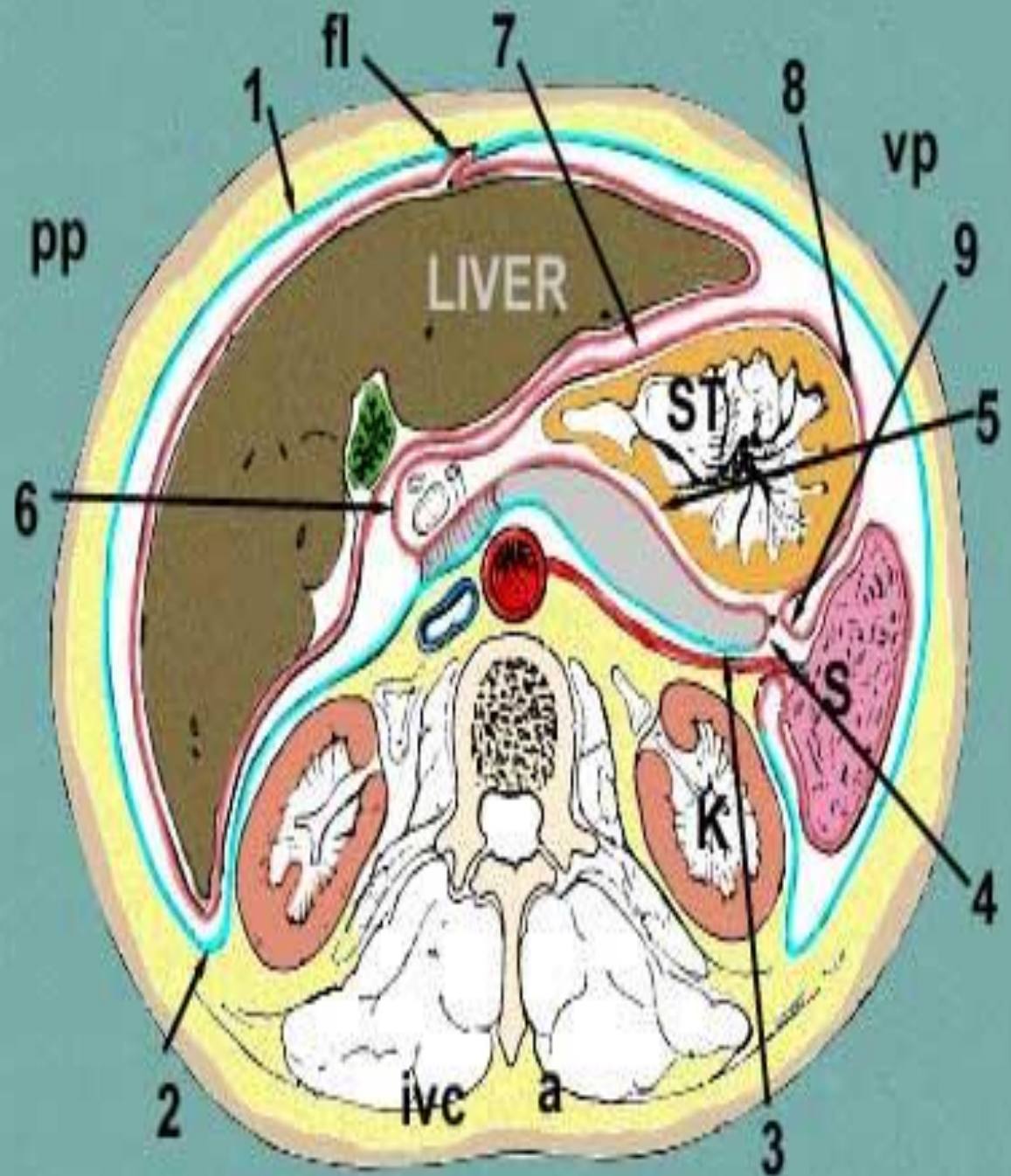
Your finger will then travel along the inferior aspect of the gastocolic ligament **9**, down the posterior surface of the greater omentum (**10**) to its lower border and back up along its anterior surface **11**.

Your finger then passes over the anterior surface of the stomach **12**, along the anterior lamina of the lesser omentum **13**.

At this time you probably couldn't continue the trip because you would have to enter the epiploic foramen (**ef**) to enter the lesser peritoneal cavity (**lpc**) where visceral peritoneum lines this space anteriorly and parietal peritoneum posteriorly.



1)one through the level of the liver, stomach and spleen and 2)another through a lower level. These levels are shown at A and B on the sagittal section above.



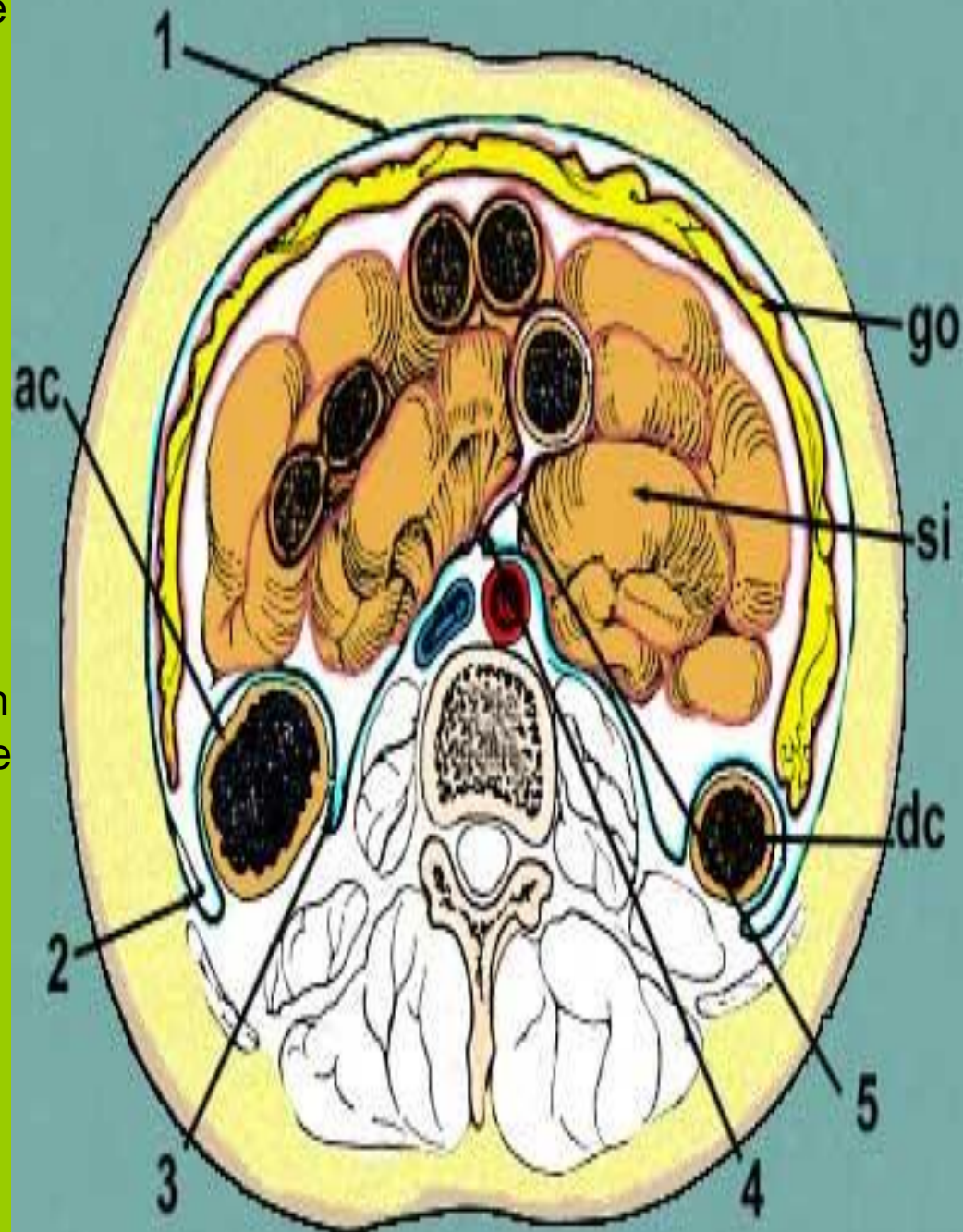
Again, start at **1** and follow around the peritoneal cavity.

Once on the back of the abdomen, **2** you will reflect onto the anterior surface of the right kidney, pass through the epiploic foramen, along the posterior wall of the lesser peritoneal cavity, **3** then up along the renal lienal ligament **4** onto the posterior surface of the stomach **5**.

Your finger will continue through the epiploic foramen again to turn around the free margin of the lesser omentum **6**, then over the anterior surface of the stomach again **7**.

Continue to follow around the greater curvature of the stomach **8** until you reflect again along the gastrolial ligament **9**.

Your finger will now pass around the spleen, onto the left kidney to the parietal peritoneum and back to the falciform ligament **fl**.

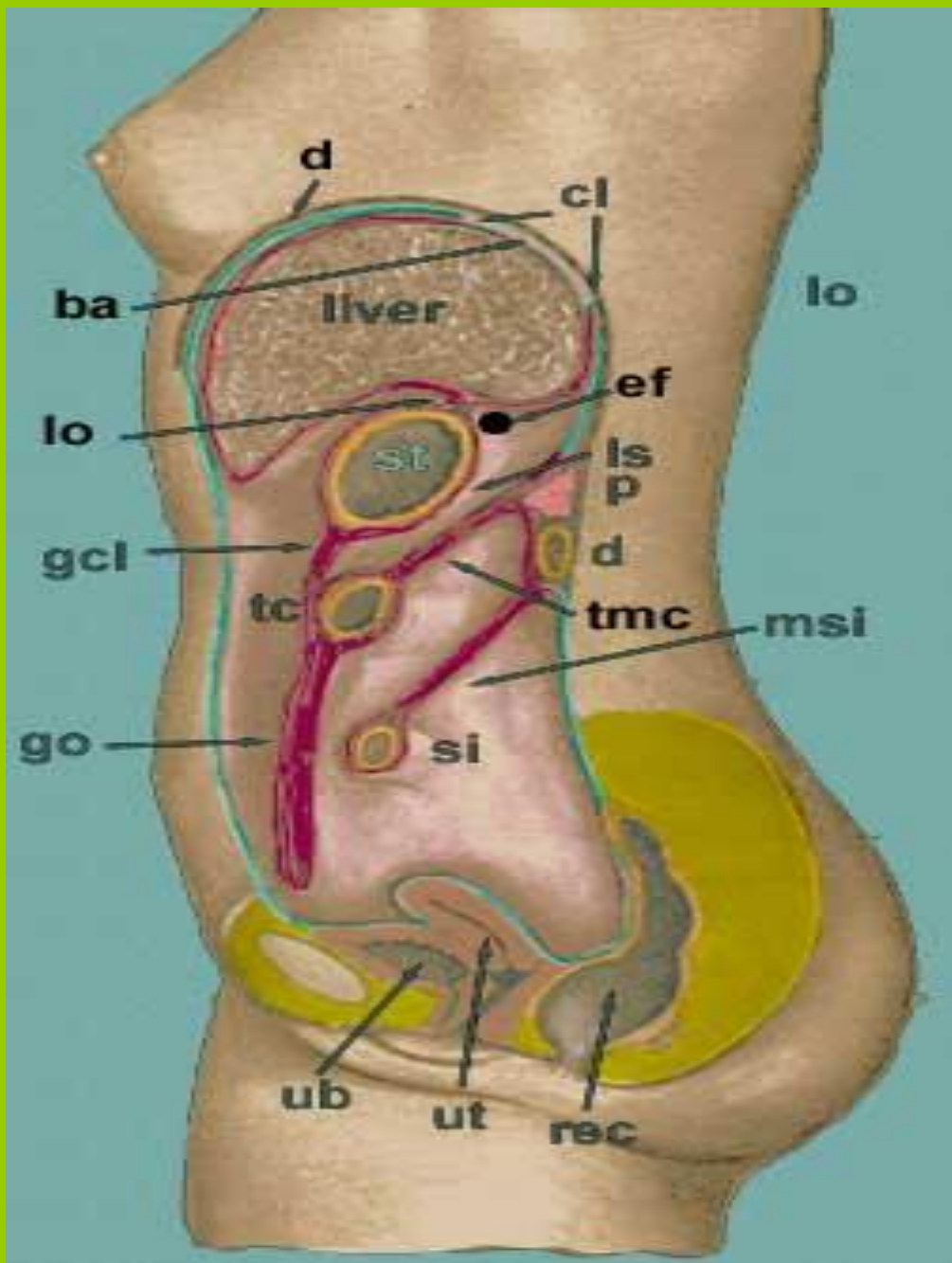


- In the second cross section, start out anteriorly in the abdomen 1.
- Trace around to the posterior abdominal wall until you reach the lateral paracolic gutter 2, over the anterior surface of the ascending colon ac, down into the medial paracolic gutter 3 then onto the large vesselsvessels posterior abdomen.
- Over the front of the vessels, your finger will travel along the right part of the mesentery of the small intestine 4.
- You then travel around the coils of the small intestine until you reach the posterior abdominal wall again 5.
- Continue along the left side, over the descending colon dc and finally, up to the anterior part of the abdominal wall.

- The peritoneum has the following properties:
 1. it becomes double in certain areas.
 2. This double layer of peritoneum is given different names: mesentery, ligament, fold, or omentum.
 3. as already mentioned, it lines the abdominal cavity
 4. it almost completely surrounds some parts of the intestinal tract.
 5. These parts are called intraperitoneal structures.
 6. it only covers the anterior part of some structures.
 7. These structures are called retroperitoneal.
 8. Retroperitoneal structures include: urinary system, ascending colon, descending colon, horizontal part of duodenum, pancreas (except for its tail), pancreas, kidneys.
 9. it produces a covering around some of the intestines.
 10. The covering is called its serous coat.
 11. peritoneal folds are usually caused by underlying blood vessels, ducts or embryonic remnants.

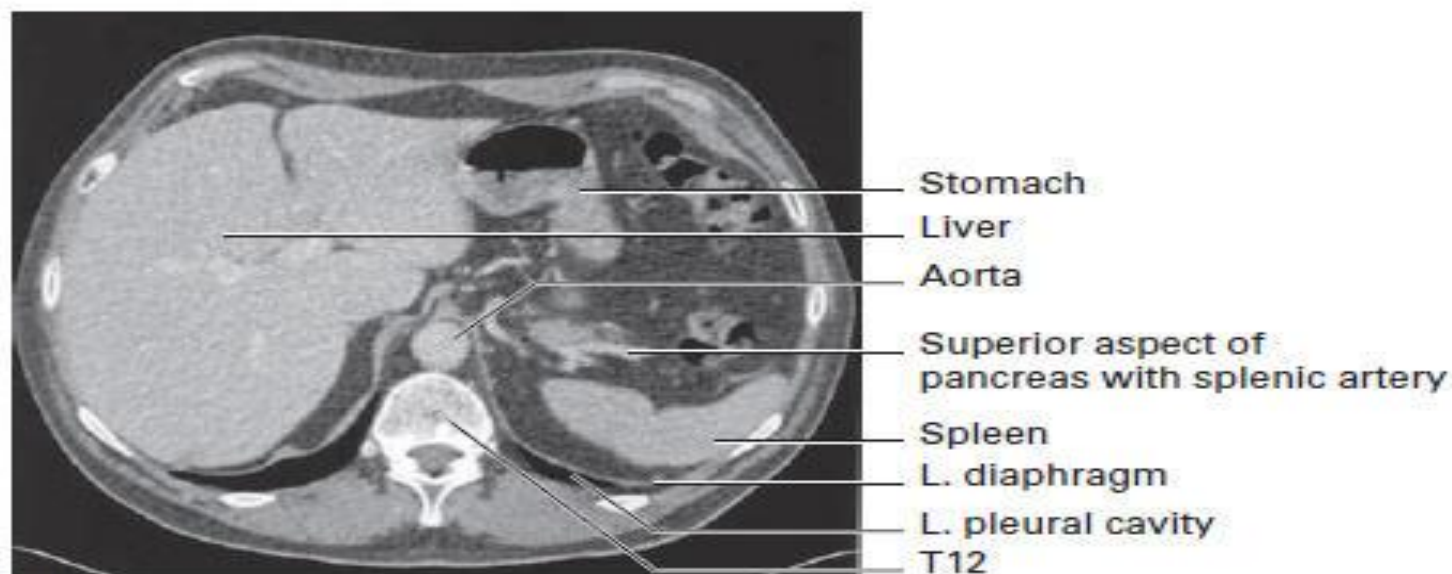
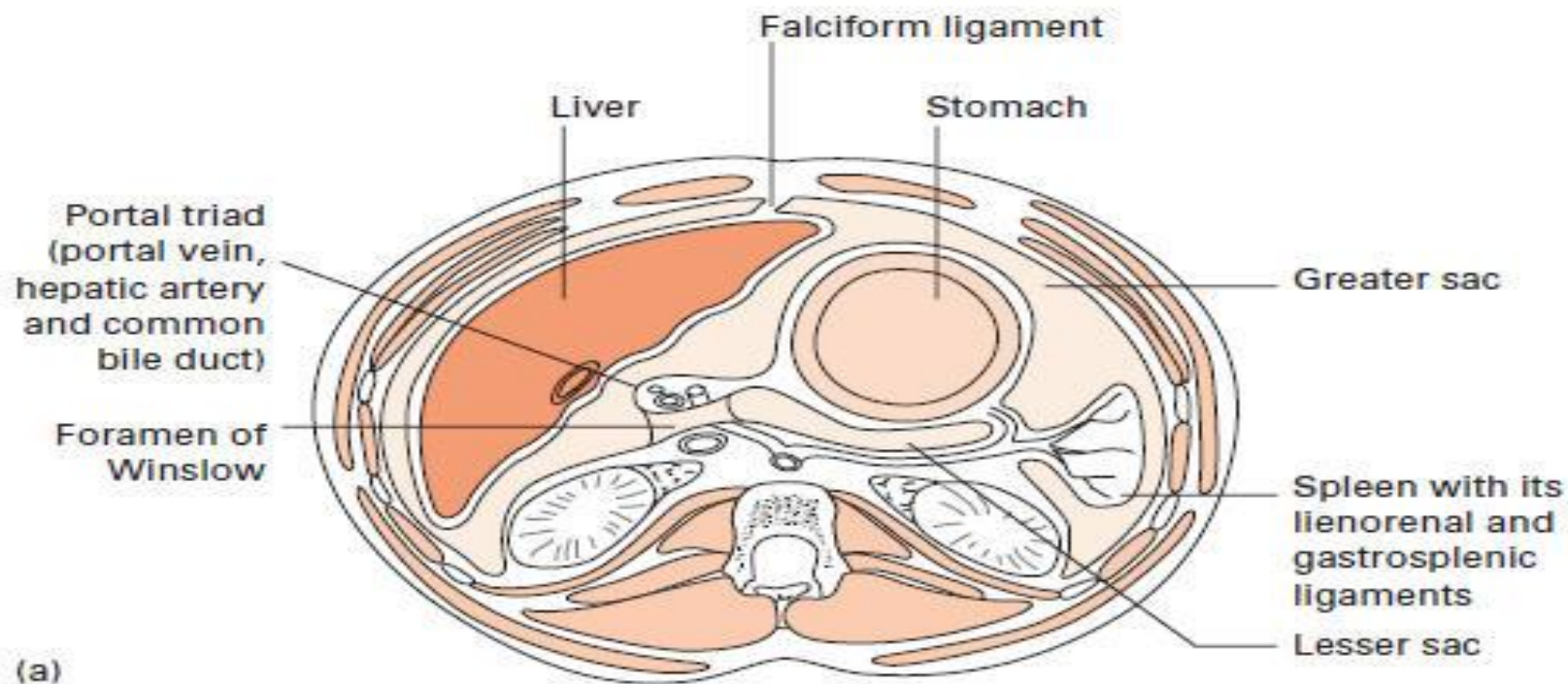
- The peritoneal folds are called ligaments.
- The embryonic urachus is **the median umbilical ligament** and the embryonic umbilical arteries are **the lateral umbilical ligaments**.
- Structures that should be identified at this stage are:
- liver in the upper right quadrant of the cavity.
- It is separated into right lobe and left lobe by **the falciform ligament fl**.
- the tip of the gall bladder **gb** hanging down under the margin of the liver
- stomach **st** in the upper left quadrant
- a small edge of the spleen **sp** in the upper left quadrant
- greater omentum **go** covering most of the abdominal structures
- small intestines (ileum) **il** in the lower right quadrant
- sometimes the transverse colon tc can be seen through a thin portion of the greater omentum.
-
- The free margin of the falciform ligament fl contains the remnant of the embryonic umbilical vein, now called **the ligamentum teres (round ligament)** It of the liver.
- The paraumbilical veins run along either side of the ligament and empty into the portal vein

- **The falciform ligament** is a double fold of peritoneum which extends from the umbilicus to the antero-superior surface of the liver.
- In its free edge, that it contains a cord-like structure which passes to the inferior border of the liver.
- This is **the round ligament of the liver**, which is formed by the remains of the left umbilical vein of the fetus.
- On the deep surface of the lower abdominal wall, there are three cord-like structures seen through the peritoneum and extending upwards towards the umbilicus.
- These are **the median umbilical ligament (or median umbilical fold), and the lateral umbilical ligaments (or medial umbilical folds)**.
- The median umbilical ligament extends from the tip of the bladder to the umbilicus and is the remnant of the foetal urachus.
- The lateral umbilical ligaments arise from the pelvis as a continuation of the internal iliac artery and extend to the umbilicus.
- These are the obliterated parts of the foetal umbilical arteries that carried blood from the foetus back to the placenta of the mother.



- Identify the:
- falciform ligament FL
- lienorenal ligament LR
- gastrolial ligament GL
- lesser omentum LO
- Also, identify the epiploic foramen EF and the relationships of the lesser sac LS (or omental bursa).





Peritoneal reflections:

- **coronary ligament**
 - superior border
 - inferior border
 - right triangular ligament - from liver to right kidney
 - left triangular ligament
- **falciform ligament** - from anterior abdominal wall to liver
 - *ligamentum teres* - in free margin of the falciform ligament
- **lesser omentum** - extends from liver to lesser curvature of stomach and first part of duodenum
 - hepatogastric part - from liver to lesser curvature of stomach
 - hepatoduodenal part - free margin of lesser omentum from liver to first part of duodenum
 - portal vein
 - bile duct
 - proper hepatic artery
- **greater omentum**
 - gastrocolic part - from greater curvature of stomach to point where transverse colon attaches to the back side of the greater omentum
 - gastrosplenic part - from greater curvature of stomach to spleen
 - gastrophrenic part - from the fundus of the stomach to the diaphragm

- **transverse mesocolon** - from transverse colon to posterior abdominal wall
- **mesentery of the small intestine** - from jejunum and ileum to the root of the mesentery on the posterior wall of the abdominal cavity.
- The root extends obliquely across the posterior abdominal wall from the beginning of the jejunum to the end of the ileum at the caecum.
- **Lienal-renal ligament** - double layer of peritoneum extending from the spleen to the anterior surface of the left kidney.
- **sigmoid mesocolon** - from sigmoid colon to posterior abdominal wall over the psoas muscle.
- **mesoappendix** - from base of appendix to its apex.

Peritoneum (*Tunica Serosa*)

- The peritoneum is the largest serous membrane in the body, and consists, in the male, of a closed sac, a part of which is applied against the abdominal walls, while the remainder is reflected over the contained viscera.
- In the female the peritoneum is not a closed sac, since the free ends of the uterine tubes open directly into the peritoneal cavity.
- The part which lines the walls is named **the parietal portion** of the peritoneum; that which is reflected over the contained viscera constitutes **the visceral portion** of the peritoneum.
- The parietal portion is loosely connected with the fascial lining of the abdomen and pelvis, but is more closely adherent to the under surface of the diaphragm, and also in the middle line of the abdomen.

- The space between the parietal and visceral layers of the peritoneum is named the peritoneal cavity;
- but under normal conditions this cavity is merely a potential one, since the parietal and visceral layers are in contact.
- The peritoneal cavity gives off a large diverticulum, the omental bursa, which is situated behind the stomach and adjoining structures; the neck of communication between the cavity and the bursa is termed the epiploic foramen (*foramen of Winslow*).
- Formerly the main portion of the cavity was described as the greater sac, and the omental bursa as the lesser sac.

Vertical Disposition of the Main Peritoneal Cavity (*greater sac*)

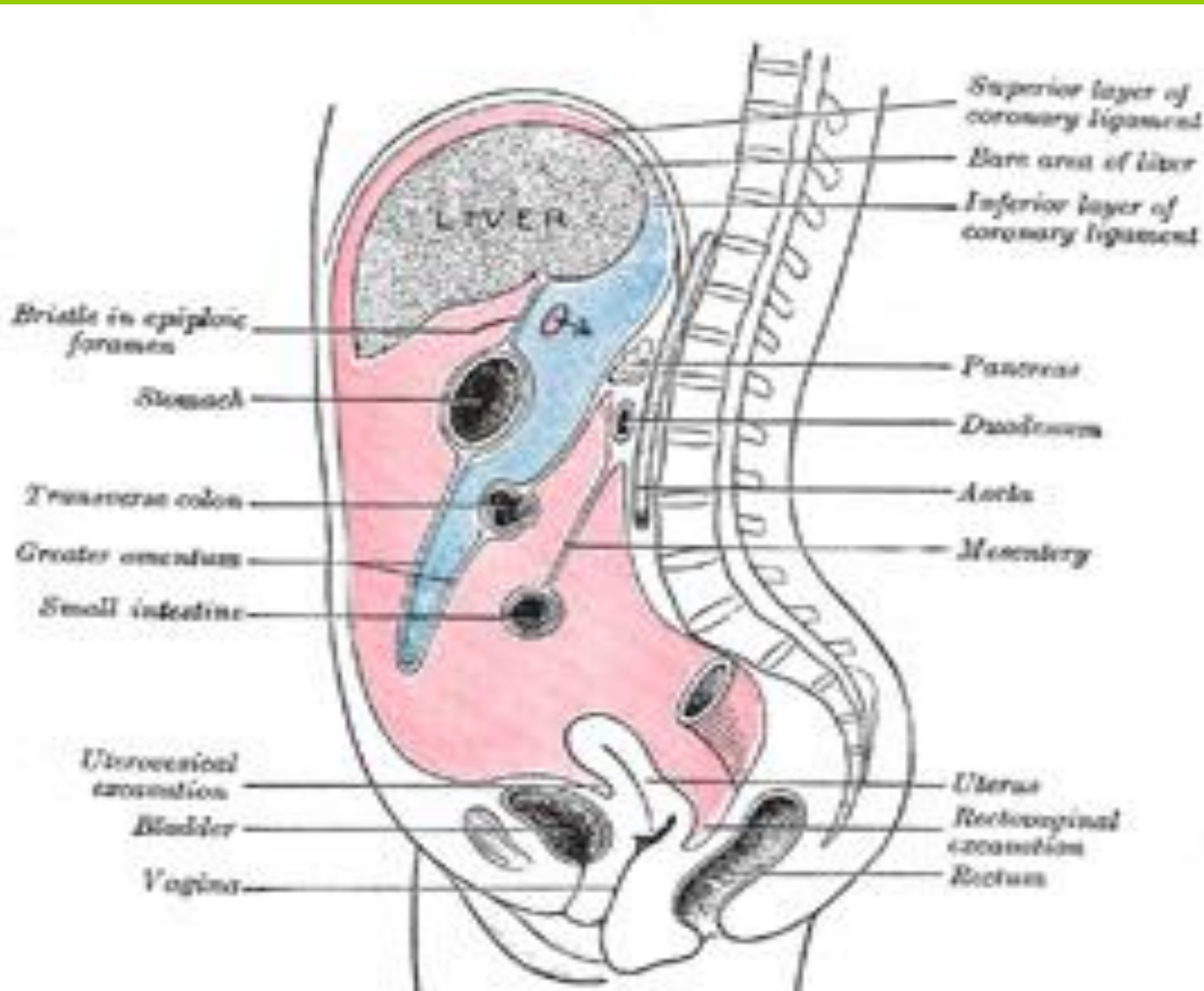
- On following the peritoneum upward from this level it is seen to be reflected around a fibrous cord, **the *ligamentum teres* (*obliterated umbilical vein*)**, which reaches from the umbilicus to the under surface of the liver.
- This reflection forms a somewhat triangular fold, **the *falciform ligament of the liver***, attaching the upper and anterior surfaces of the liver to the diaphragm and abdominal wall.
- With the exception of the line of attachment of this ligament the peritoneum covers the whole of the under surface of the anterior part of the diaphragm, and is continued from it on to the upper surface of the right lobe of the liver as **the *superior layer of the coronary ligament***, and on to the upper surface of the left lobe as **the *superior layer of the left triangular ligament of the liver***.

- Covering the upper and anterior surfaces of the liver, it is continued around its sharp margin on to the under surface, where it presents the following relations:
- (a) It covers the under surface of the right lobe and is reflected from the back part of this on to the right suprarenal gland and upper extremity of the right kidney, forming in this situation **the inferior layer of the coronary ligament**;
- a special fold, **the hepatorenal ligament**, is frequently present between the inferior surface of the liver and the front of the kidney.
- From the kidney it is carried downward to the duodenum and right colic flexure and medialward in front of the inferior vena cava.
- Between the two layers of the coronary ligament there is a large triangular surface of the liver devoid of peritoneal covering; this is named the **bare area** of the liver, and is attached to the diaphragm by areolar tissue.
- Toward the right margin of the liver the two layers of the coronary ligament gradually approach each other, and ultimately fuse to form a small triangular fold connecting the right lobe of the liver to the diaphragm, and named **the right triangular ligament of the liver**.

- The apex of the triangular bare area corresponds with the point of meeting of the two layers of the coronary ligament, its base with the fossa for the inferior vena cava.
- (b) It covers the lower surface of the quadrate lobe, the under and lateral surfaces of the gall-bladder, and the under surface and posterior border of the left lobe; it is then reflected from the upper surface of the left lobe to the diaphragm as **the inferior layer of the left triangular ligament**, and from the porta of the liver and the fossa for the ductus venosus to the lesser curvature of the stomach and the first 2.5 cm. of the duodenum as **the anterior layer of the hepatogastric and hepatoduodenal ligaments**, which together constitute **the lesser omentum**.
-

- Traced downward, it covers the antero-superior surface of the stomach and the commencement of the duodenum, and is carried down into a large free fold, known as **the gastocolic ligament or greater omentum**.
- Reaching the free margin of this fold, it is reflected upward to cover the under and posterior surfaces of the transverse colon, and thence to the posterior abdominal wall as the inferior layer of **the transverse mesocolon**.
- It reaches the abdominal wall at the head and anterior border of the pancreas, is then carried down over the lower part of the head and over the inferior surface of the pancreas on the superior mesenteric vessels, and thence to the small intestine as the anterior layer of the **mesentery**.
- It encircles the intestine, and subsequently may be traced, as the posterior layer of the mesentery, upward and backward to the abdominal wall.
- From this it sweeps down over the aorta into the pelvis, where it invests the sigmoid colon, its reduplication forming **the sigmoid mesocolon**.
- Leaving first the sides and then the front of the rectum, it is reflected on to the seminal vesicles and fundus of the urinary bladder and, after covering the upper surface, is carried along the medial and lateral umbilical ligaments on to the back of the abdominal wall to the level from which a start was made.

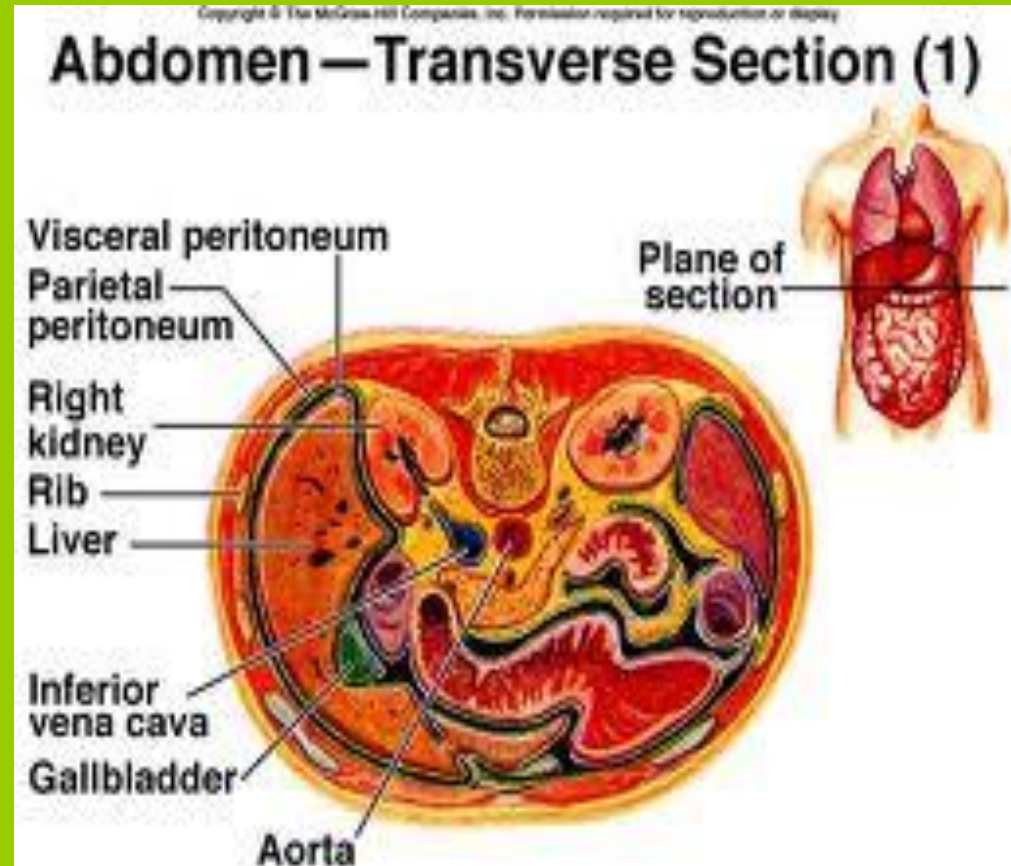
Vertical disposition of the peritoneum. Main cavity, red; omental bursa, blue.



- Between the rectum and the bladder it forms, in the male, a pouch, **the rectovesical excavation**, the bottom of which is slightly below the level of the upper ends of the vesiculæ seminales—about 7.5 cm. from the orifice of the anus.
- When the bladder is distended, the peritoneum is carried up with the expanded viscus so that a considerable part of the anterior surface of the latter lies directly against the abdominal wall without the intervention of peritoneal membrane (*prevesical space of Retzius*).
- In the female, the peritoneum is reflected from the rectum over the posterior vaginal fornix to the cervix and body of the uterus, forming **the rectouterine excavation (pouch of Douglas)**.
- It is continued over the intestinal surface and fundus of the uterus on to its vesical surface, which it covers as far as the junction of the body and *cervix uteri*, and then to the bladder, forming here a second, but shallower, pouch, **the vesicouterine excavation**.
- It is also reflected from the sides of the uterus to the lateral walls of the pelvis as two expanded folds, **the broad ligaments of the uterus**, in the free margin of each of which is the uterine tube.

Vertical Disposition of the Omental Bursa (*lesser peritoneal sac*)

- A start may be made on the posterior abdominal wall at the anterior border of the pancreas.
- From this region the peritoneum may be followed upward over the pancreas on to the inferior surface of the diaphragm, and thence on to the caudate lobe and caudate process of the liver to the fossa from the ductus venosus and the porta of the liver.
- Traced to the right, it is continuous over the inferior vena cava with the posterior wall of the main cavity.
- From the liver it is carried downward to the lesser curvature of the stomach and the commencement of the duodenum as the posterior layer of the lesser omentum, and is continuous on the right, around the hepatic artery, bile duct, and portal vein, with **the anterior layer of this omentum**.



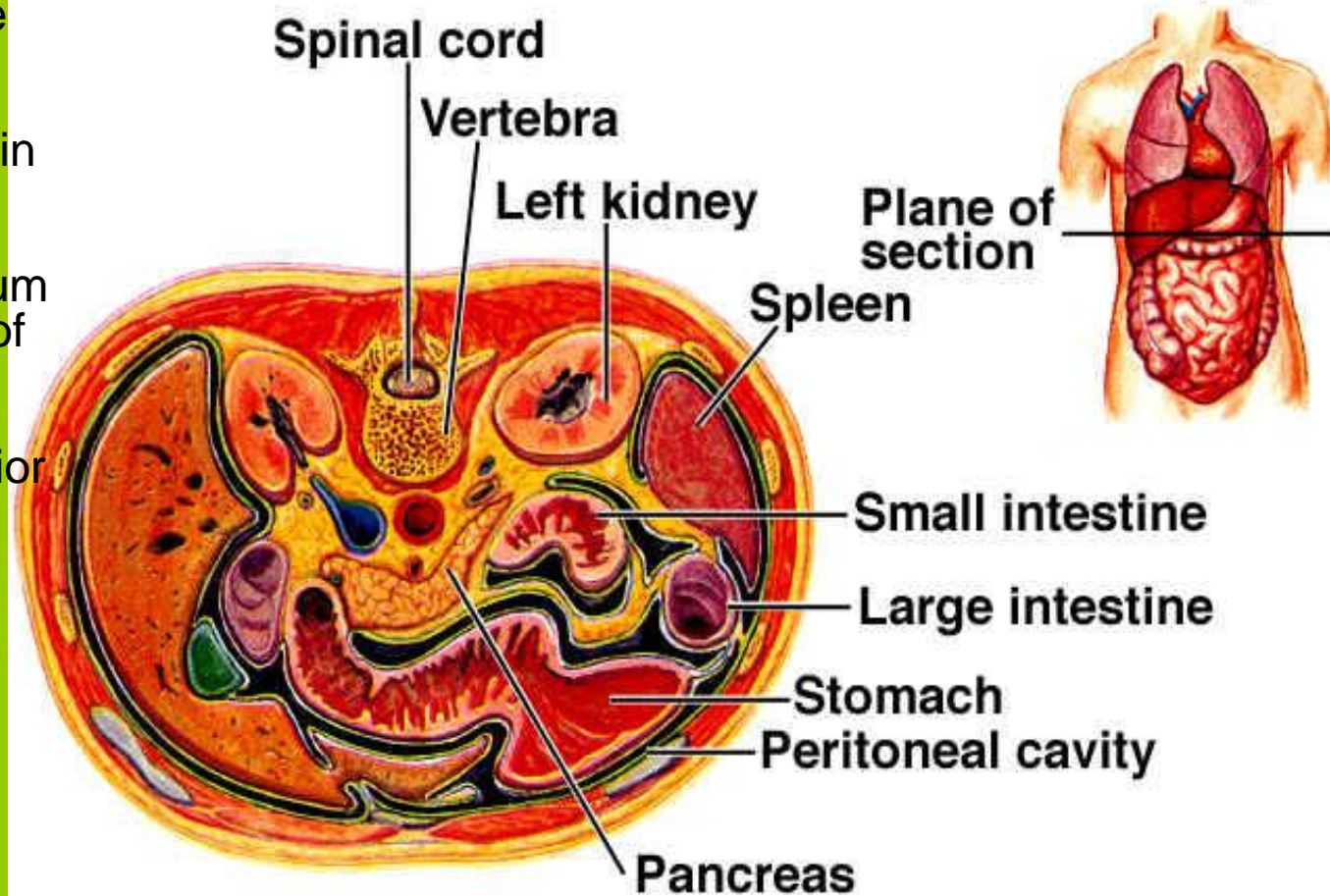
- The posterior layer of the lesser omentum is carried down as a covering for the postero-inferior surfaces of the stomach and commencement of the duodenum, and is continued downward as the deep layer of the gastrocolic ligament or greater omentum.
- From the free margin of this fold it is reflected upward on itself to the anterior and superior surfaces of the transverse colon, and thence as the superior layer of the transverse mesocolon to the anterior border of the pancreas, the level from which a start was made.

-

•It will be seen that the loop formed by the wall of the omental bursa below the transverse colon follows, and is closely applied to, the deep surface of that formed by the peritoneum of the main cavity, and that the greater omentum or large fold of peritoneum which hangs in front of the small intestine therefore consists of four layers, two anterior and two posterior separated by the potential cavity of the omental bursa.

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Abdomen—Transverse Section (2)

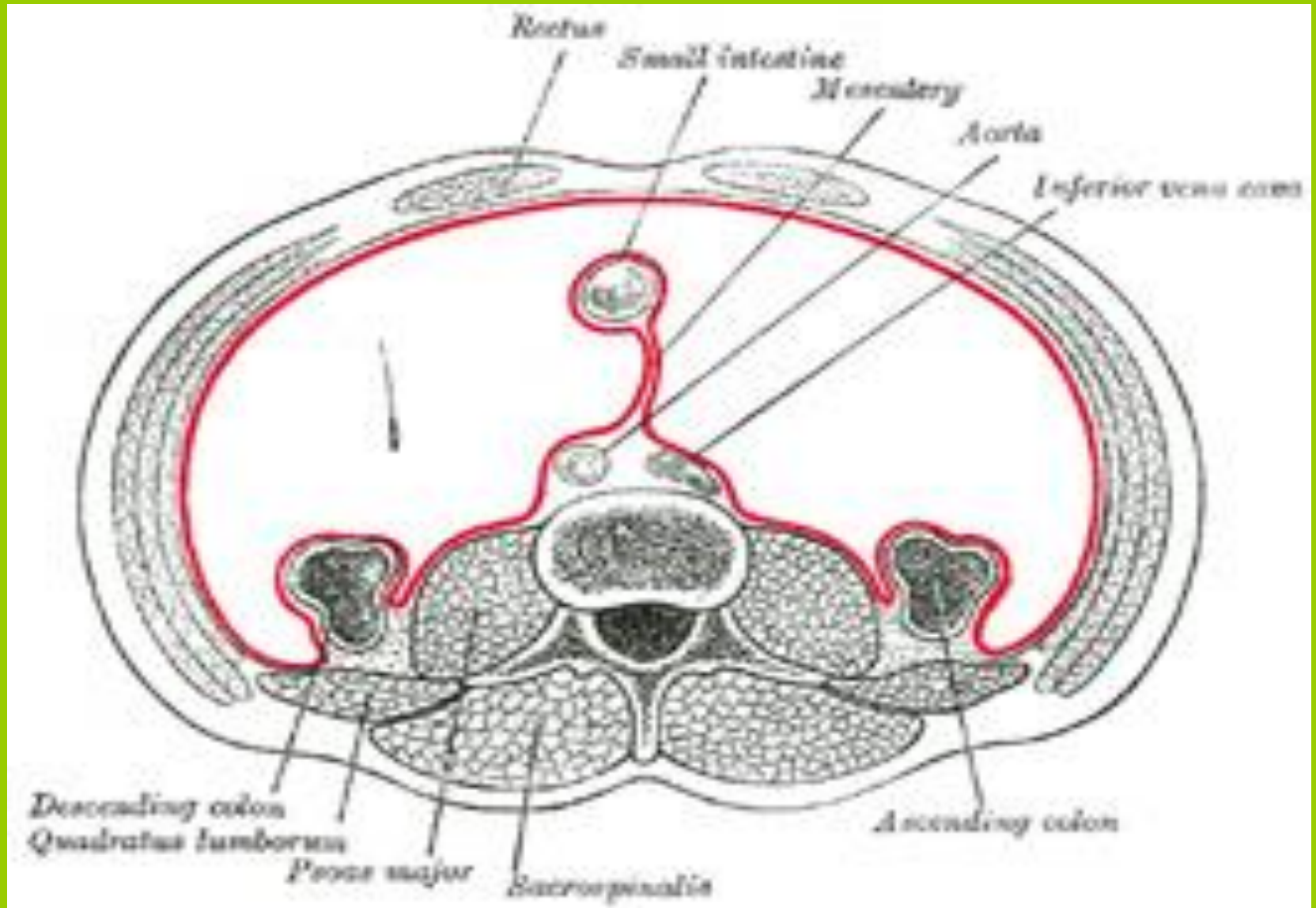


Horizontal Disposition of the Peritoneum

- Below the transverse colon the arrangement is simple, as it includes only the main cavity; above the level of the transverse colon it is more complicated on account of the existence of the omental bursa.
- Below the transverse colon it may be considered in the two regions, in the **pelvis** and in the **abdomen proper**.

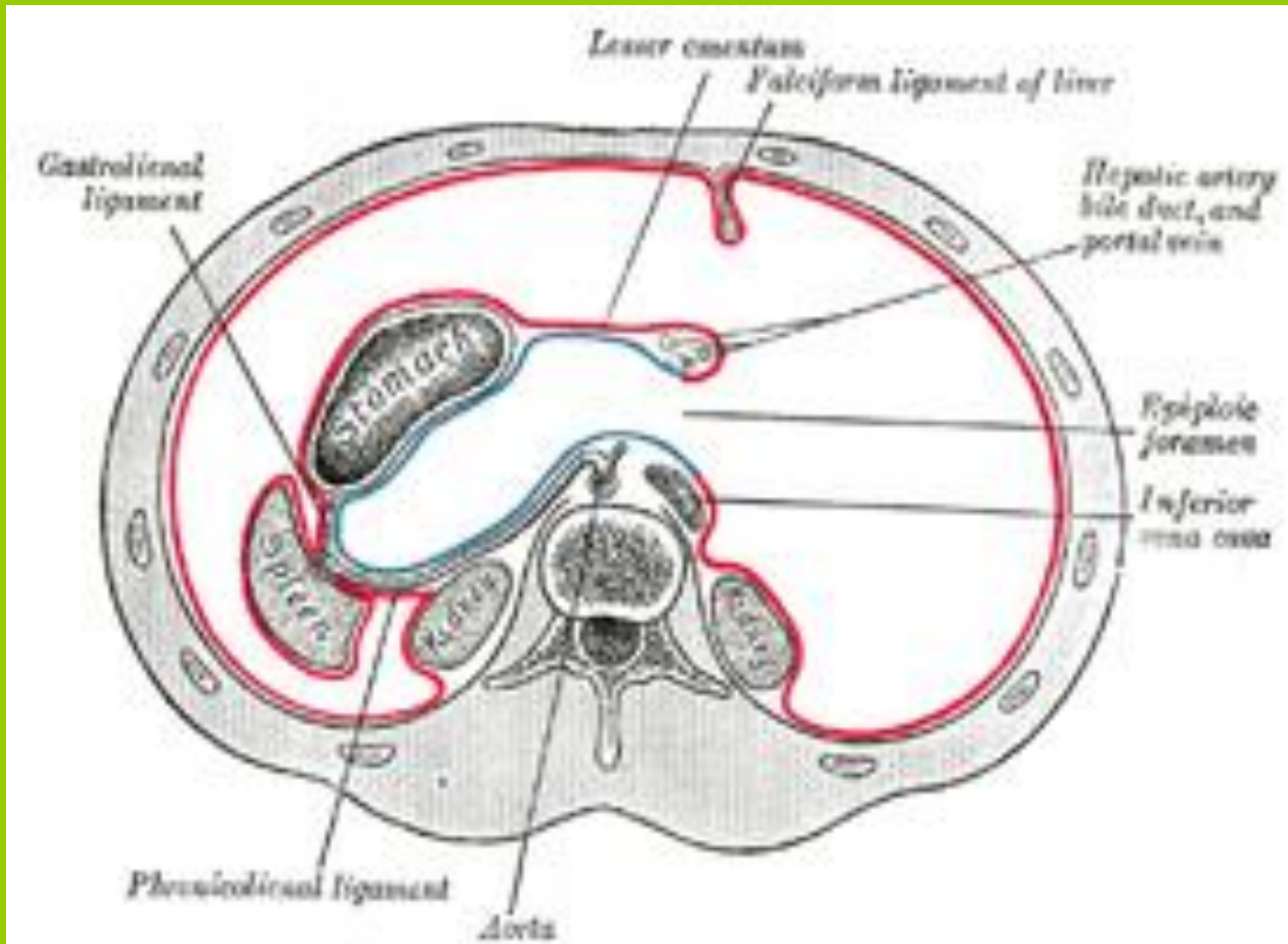
- **(1) In the Pelvis**
- The peritoneum here follows closely the surfaces of the pelvic viscera and the inequalities of the pelvic walls, and presents important differences in the two sexes.
- (a) **In the male** it encircles the sigmoid colon, from which it is reflected to the posterior wall of the pelvis as a fold, **the sigmoid mesocolon**.
- It then leaves the sides and, finally, the front of the rectum, and is continued on to the upper ends of the seminal vesicles and the bladder; on either side of the rectum it forms a fossa, **the pararectal fossa**.
- In front of the rectum the peritoneum forms **the rectovesical excavation**, which is limited laterally by peritoneal folds extending from the sides of the bladder to the rectum and sacrum.
- These folds are known from their position as **the rectovesical or sacrogenital folds**.
- The peritoneum of the anterior pelvic wall covers the superior surface of the bladder, and on either side of this viscus forms a depression, termed **the paravesical fossa**, which is limited laterally by the fold of peritoneum covering the ductus deferens.
- The size of this fossa is dependent on the state of distension of the bladder; when the bladder is empty, a variable fold of peritoneum, **the plica vesicalis transversa**, divides the fossa into two portions.

Horizontal disposition of the peritoneum in the lower part of the abdomen



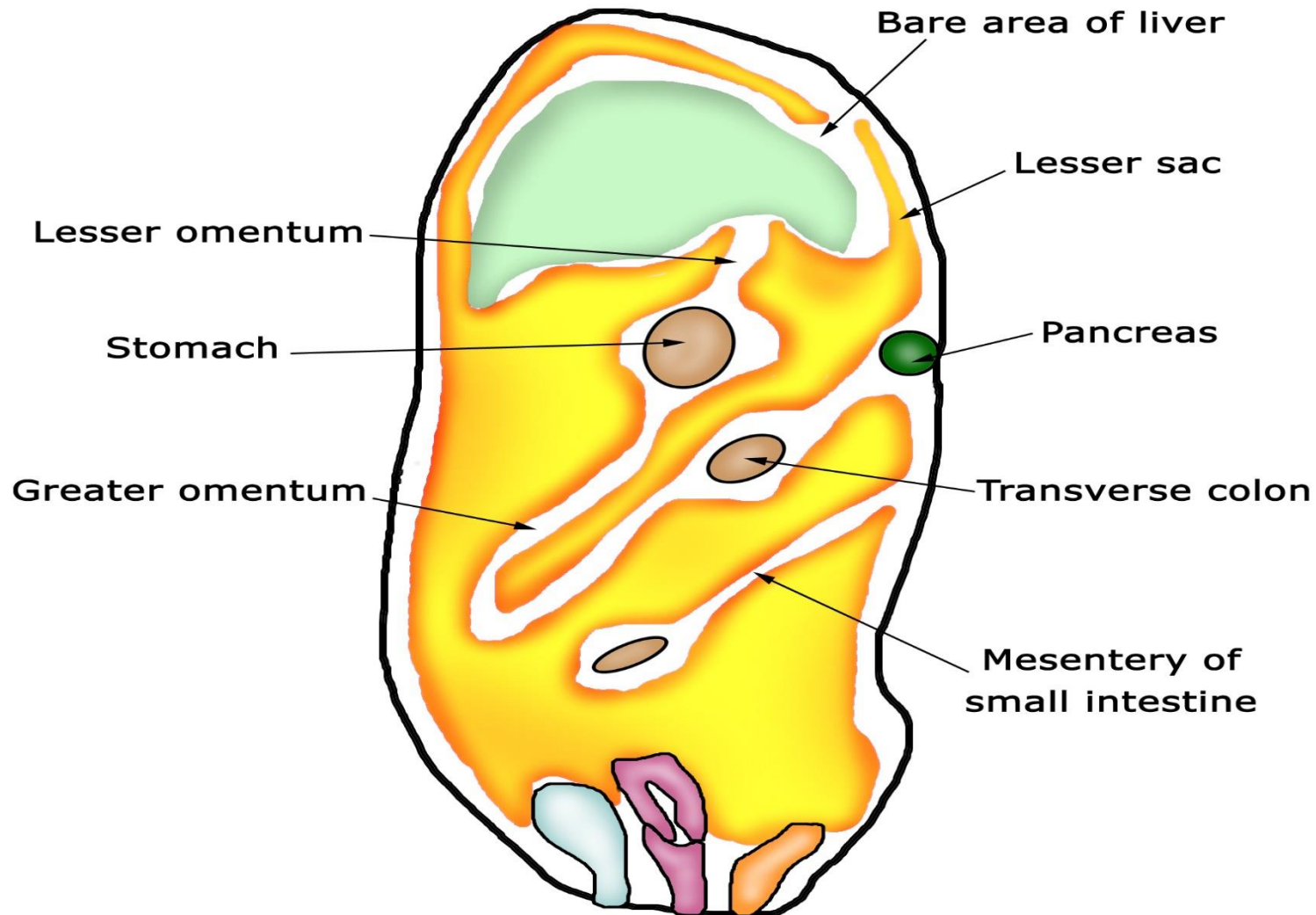
- (2) In the Lower Abdomen
- Starting from the linea alba, below the level of the transverse colon, and tracing the continuity of the peritoneum in a horizontal direction to the right, the membrane covers the inner surface of the abdominal wall almost as far as the lateral border of the Quadratus lumborum;
- it encloses the cecum and vermiform process, and is reflected over the sides and front of the ascending colon;
- it may then be traced over the duodenum, Psoas major, and inferior vena cava toward the middle line, whence it passes along the mesenteric vessels to invest the small intestine, and back again to the large vessels in front of the vertebral column, forming **the mesentery**, between the layers of which are contained the mesenteric bloodvessels, lacteals, and glands.
- It is then continued over the left Psoas;
- it covers the sides and front of the descending colon, and, reaching the abdominal wall, is carried on it to the middle line.

Horizontal disposition of the peritoneum in the upper part of the abdomen.

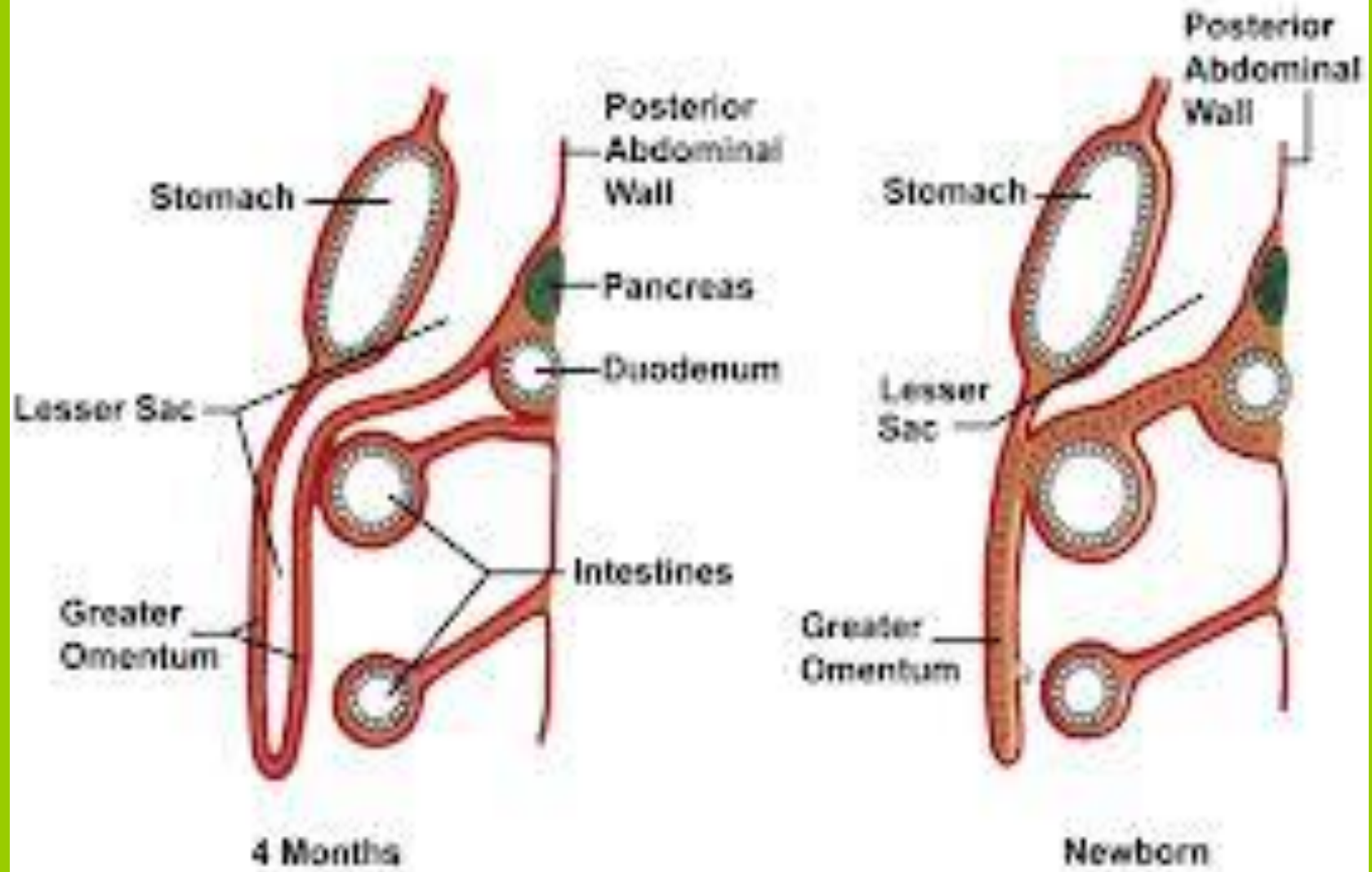


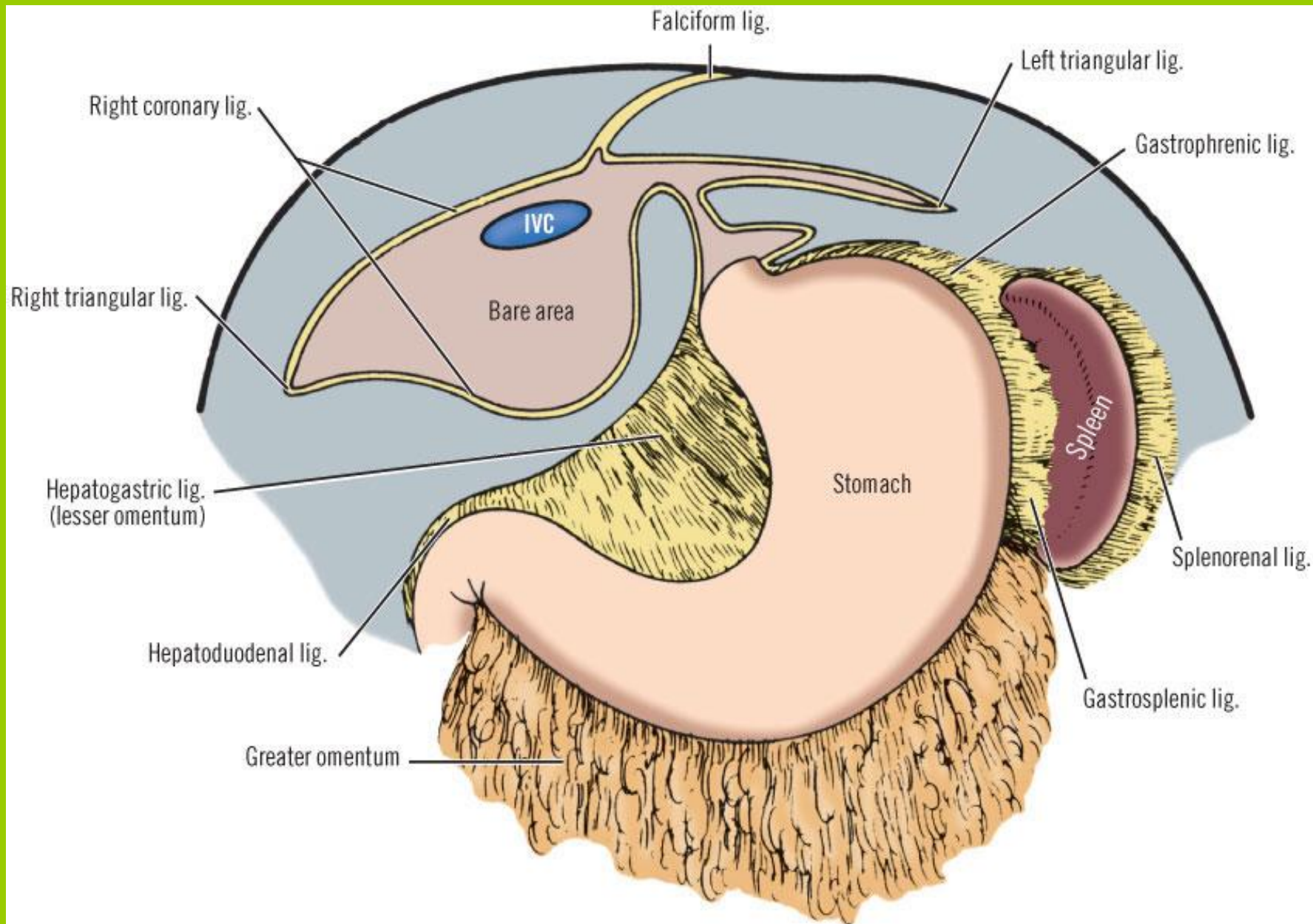
- (3) In the Upper Abdomen
- Above the transverse colon the omental bursa is superadded to the general sac, and the communication of the two cavities with one another through the epiploic foramen can be demonstrated.
- (a) Main Cavity
- Commencing on the posterior abdominal wall at the inferior vena cava, the peritoneum may be followed to the right over the front of the suprarenal gland and upper part of the right kidney on to the antero-lateral abdominal wall.
- From the middle line of the anterior wall a backwardly directed fold encircles the obliterated umbilical vein and forms **the falciform ligament of the liver**.
- Continuing to the left, the peritoneum lines the antero-lateral abdominal wall and covers the lateral part of the front of the left kidney, and is reflected to the posterior border of the hilus of the spleen as the posterior layer of **the phrenicolienal ligament**.
- It can then be traced around the surface of the spleen to the front of the hilus, and thence to the cardiac end of the greater curvature of the stomach as the anterior layer of **the gastrolienal ligament**.
- It covers the antero-superior surfaces of the stomach and commencement of the duodenum, and extends up from the lesser curvature of the stomach to the liver as **the anterior layer of the lesser omentum**.

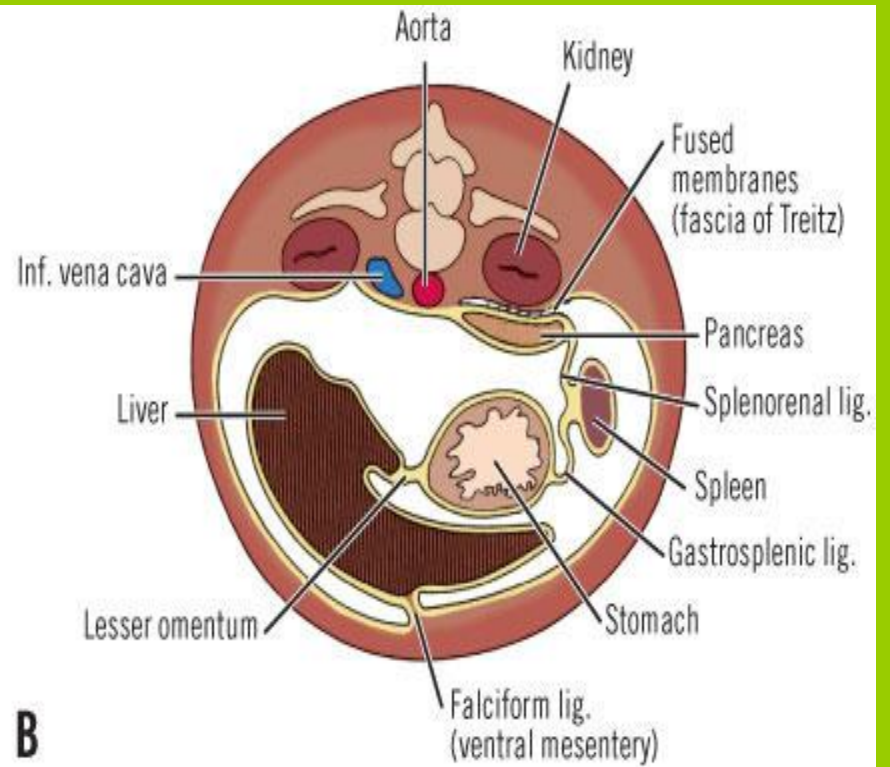
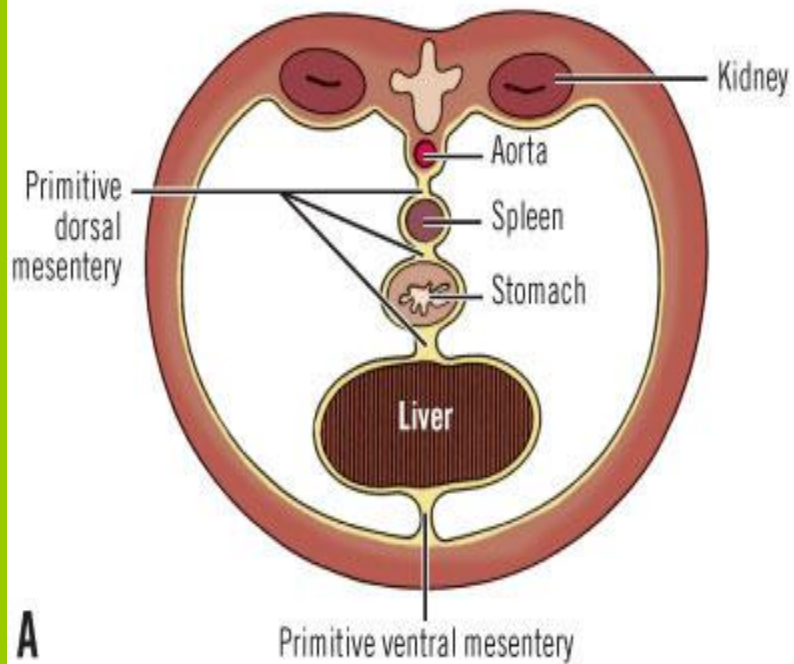
Sagittal Section of Female Abdomen and Pelvis Showing Peritoneal Reflection



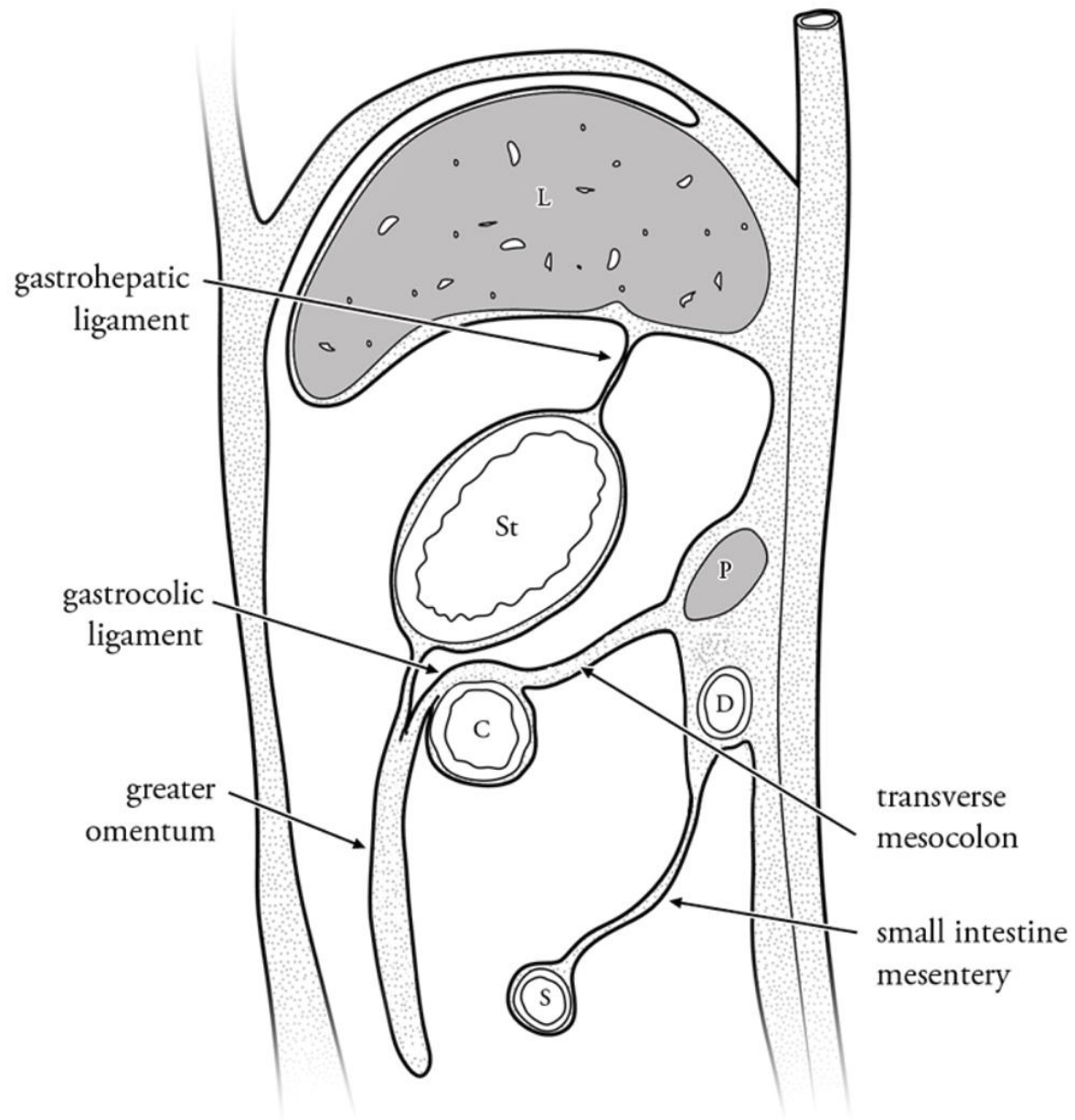
FUSION OF GREATER OMENTUM FOLDS







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- **(b) Omental Bursa (*bursa omentalis*; lesser peritoneal sac)**
- On the posterior abdominal wall the peritoneum of the general cavity is continuous with that of the omental bursa in front of the inferior vena cava.
- Starting from here, the bursa may be traced across the aorta and over the medial part of the front of the left kidney and diaphragm to the hilus of the spleen as the anterior layer of the phrenicolienal ligament.
- From the spleen it is reflected to the stomach as **the posterior layer of the gastrosplenic ligament.**
- It covers the postero-inferior surfaces of the stomach and commencement of the duodenum, and extends upward to the liver as the posterior layer of the lesser omentum;
- the right margin of this layer is continuous around the hepatic artery, bile duct, and portal vein, with the wall of the general cavity.

The epiploic foramen (*foramen epiploicum; foramen of Winslow*)

- is the passage of communication between the general cavity and the omental bursa.
- It is bounded
- *in front* by the free border of the lesser omentum, with the common bile duct, hepatic artery, and portal vein between its two layers;
- *behind* by the peritoneum covering the inferior vena cava;
- *above* by the peritoneum on the caudate process of the liver,
- and *below* by the peritoneum covering the commencement of the duodenum and the hepatic artery, the latter passing forward below the foramen before ascending between the two layers of the lesser omentum.

- The boundaries of *the omental bursa* will now be evident.
- It is bounded *in front*, from above downward, by the caudate lobe of the liver, the lesser omentum, the stomach, and the anterior two layers of the greater omentum.
- *Behind*, it is limited, from below upward, by the two posterior layers of the greater omentum, the transverse colon, and the ascending layer of the transverse mesocolon, the upper surface of the pancreas, the left suprarenal gland, and the upper end of the left kidney.
- To the right of the oesophageal opening of the stomach it is formed by that part of the diaphragm which supports the caudate lobe of the liver.
- *Laterally*, the bursa extends from the epiploic foramen to the spleen, where it is limited by the phrenico-lienal and gastro-lienal ligaments.

- The omental bursa, therefore, consists of a series of pouches or recesses to which the following terms are applied:
- (1) **the vestibule**, a narrow channel continued from the epiploic foramen, over the head of the pancreas to **the gastro-pancreatic fold**; this fold extends from the omental tuberosity of the pancreas to the right side of the fundus of the stomach, and contains the left gastric artery and coronary vein;
- (2) **the superior omental recess**, between the caudate lobe of the liver and the diaphragm;
- (3) **the lienal recess**, between the spleen and the stomach;
- (4) **the inferior omental recess**, which comprises the remainder of the bursa.

The lesser omentum (*omentum minus; small omentum; gastrohepatic omentum*)

- is the duplicature which extends to the liver from the lesser curvature of the stomach and the commencement of the duodenum.
- It is extremely thin, and is continuous with the two layers of peritoneum which cover respectively the antero-superior and postero-inferior surfaces of the stomach and first part of the duodenum.
- When these two layers reach the lesser curvature of the stomach and the upper border of the duodenum, they join together and ascend as a double fold to *the porta* of the liver.
- To the left of the *porta* the fold is attached to the bottom of the fossa for the ductus venosus, along which it is carried to the diaphragm, where the two layers separate to embrace the end of the oesophagus.
- At the right border of the omentum the two layers are continuous, and form a free margin which constitutes the anterior boundary of the epiploic foramen.

- The portion of the lesser omentum extending between the liver and stomach is termed **the hepato-gastric ligament**, while that between the liver and duodenum is **the hepato-duodenal ligament**.
- Between the two layers of the lesser omentum, close to the right free margin, are the hepatic artery, the common bile duct, the portal vein, lymphatics, and the hepatic plexus of nerves—all these structures being enclosed in a **fibrous capsule** (*Glisson's capsule*).
- Between the layers of the lesser omentum, where they are attached to the stomach, run the right and left gastric vessels.

The **greater omentum** (*omentum majus*; *great omentum*; *gastrocolic omentum*)

is the largest peritoneal fold.

It consists of a double sheet of peritoneum, folded on itself so that it is made up of four layers.

The two layers which descend from the stomach and commencement of the duodenum pass in front of the small intestines, sometimes as low down as the pelvis; they then turn upon themselves, and ascend again as far as the transverse colon, where they separate and enclose that part of the intestine.

The left border of the greater omentum is continuous with the gastrosplenic ligament; its right border extends as far as the commencement of the duodenum.

The greater omentum is usually thin, presents a cribriform appearance, and always contains some adipose tissue, which in fat people accumulates in considerable quantity.

Between its two anterior layers, a short distance from the greater curvature of the stomach, is the anastomosis between the right and left gastroepiploic vessels.

- The **mesenteries** are: the **mesentery proper**, the **transverse mesocolon**, and the **sigmoid mesocolon**.
- In addition to these there are sometimes present an ascending and a descending mesocolon.
- The **mesentery proper** (*mesenterium*) is the broad, fan-shaped fold of peritoneum which connects the convolutions of the jejunum and ileum with the posterior wall of the abdomen.
- Its **root**—the part connected with the structures in front of the vertebral column—is narrow, about 15 cm. long, and is directed obliquely from the duodenojejunal flexure at the left side of the second lumbar vertebra to the right sacroiliac articulation.
- Its **intestinal border** is about 6 metres long; and here the two layers separate to enclose the intestine, and form its peritoneal coat.
- It is narrow above, but widens rapidly to about 20 cm., and is thrown into numerous plaits or folds.
- It suspends the small intestine, and contains between its layers the intestinal branches of the superior mesenteric artery, with their accompanying veins and plexuses of nerves, and mesenteric lymph glands.

The transverse mesocolon (*mesocolon transversum*)

- is a broad fold, which connects the transverse colon to the posterior wall of the abdomen.
- It is continuous with the two posterior layers of the greater omentum, which, after separating to surround the transverse colon, join behind it, and are continued backward to the vertebral column, where they diverge in front of the anterior border of the pancreas.
- This fold contains between its layers the vessels which supply the transverse colon.
- The sigmoid mesocolon (*mesocolon sigmoideum*) is the fold of peritoneum which retains the sigmoid colon in connection with the pelvic wall.
- Its line of attachment forms a V-shaped curve, the apex of the curve being placed about the point of division of the left common iliac artery.
- The curve begins on the medial side of the left Psoas major, and runs upward and backward to the apex, from which it bends sharply downward, and ends in the median plane at the level of the third sacral vertebra.
- The sigmoid and superior haemorrhoidal vessels run between the two layers of this fold.

- In most cases the peritoneum covers only the front and sides of the ascending and descending parts of the colon.
- A fold of peritoneum, **the phrenico-colic ligament**, is continued from the left colic flexure to the diaphragm opposite the tenth and eleventh ribs;
- it passes below and serves to support the spleen, and therefore has received the name of ***sustentaculum lienis***.
- The **appendices epiploicæ** are small pouches of the peritoneum filled with fat and situated along the colon and upper part of the rectum.
- They are chiefly appended to the transverse and sigmoid parts of the colon.