

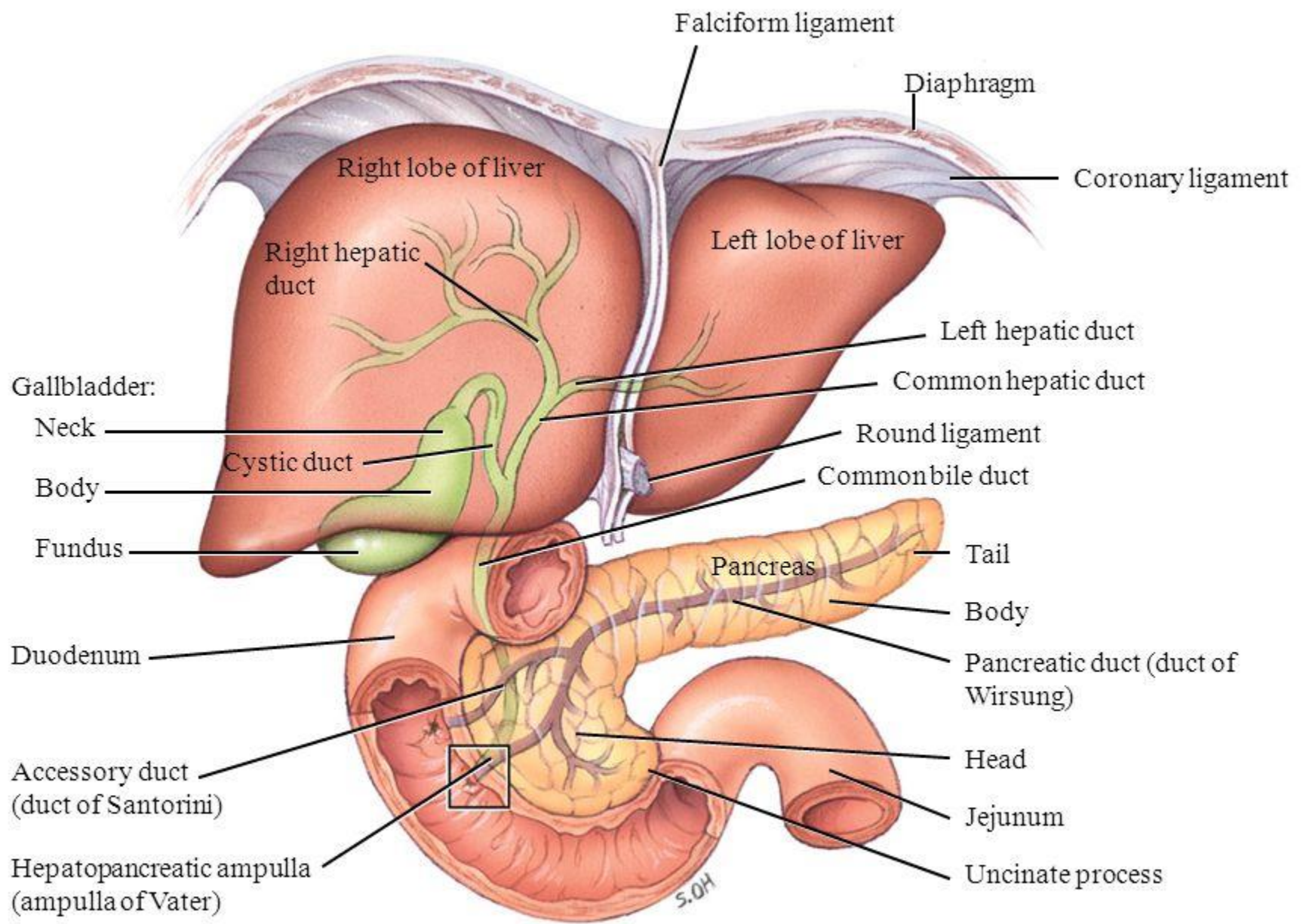


LIVER SPLEEN SMALL INTESTINE- DUODENUM

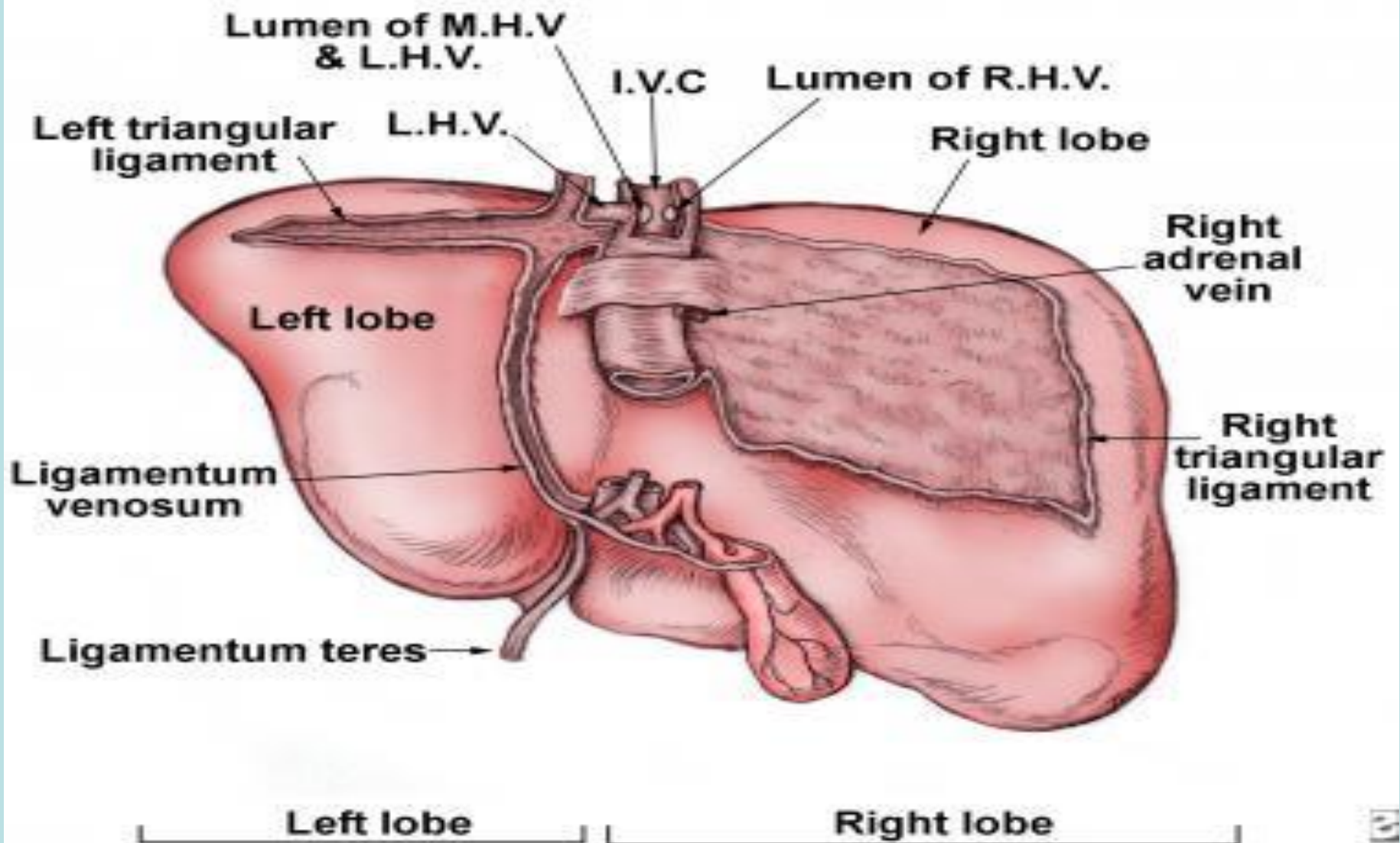
Lecture no. 7
Assoc. Prof. Şişu Alina, MD, PhD

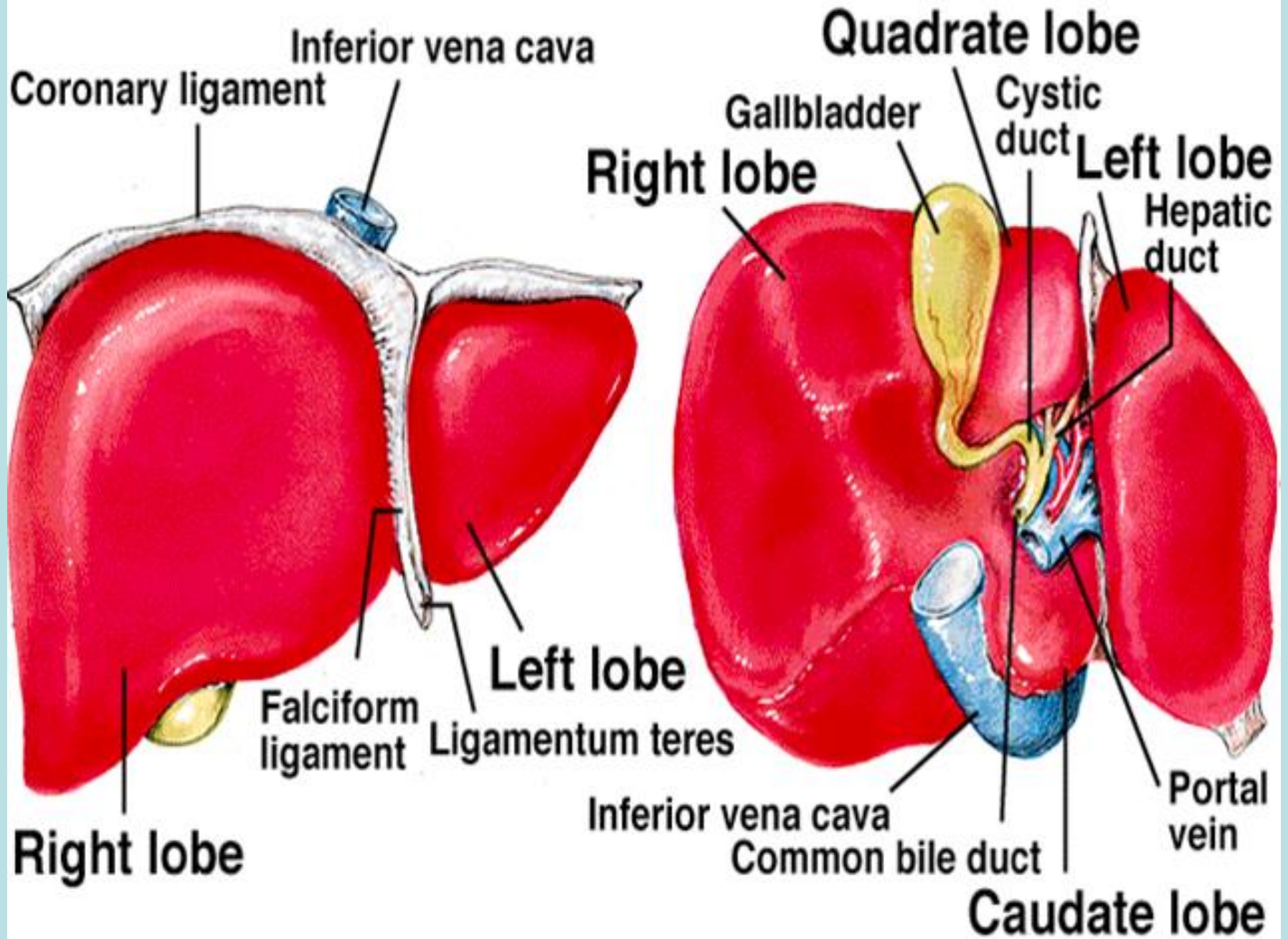
The Liver (*Hepar*)

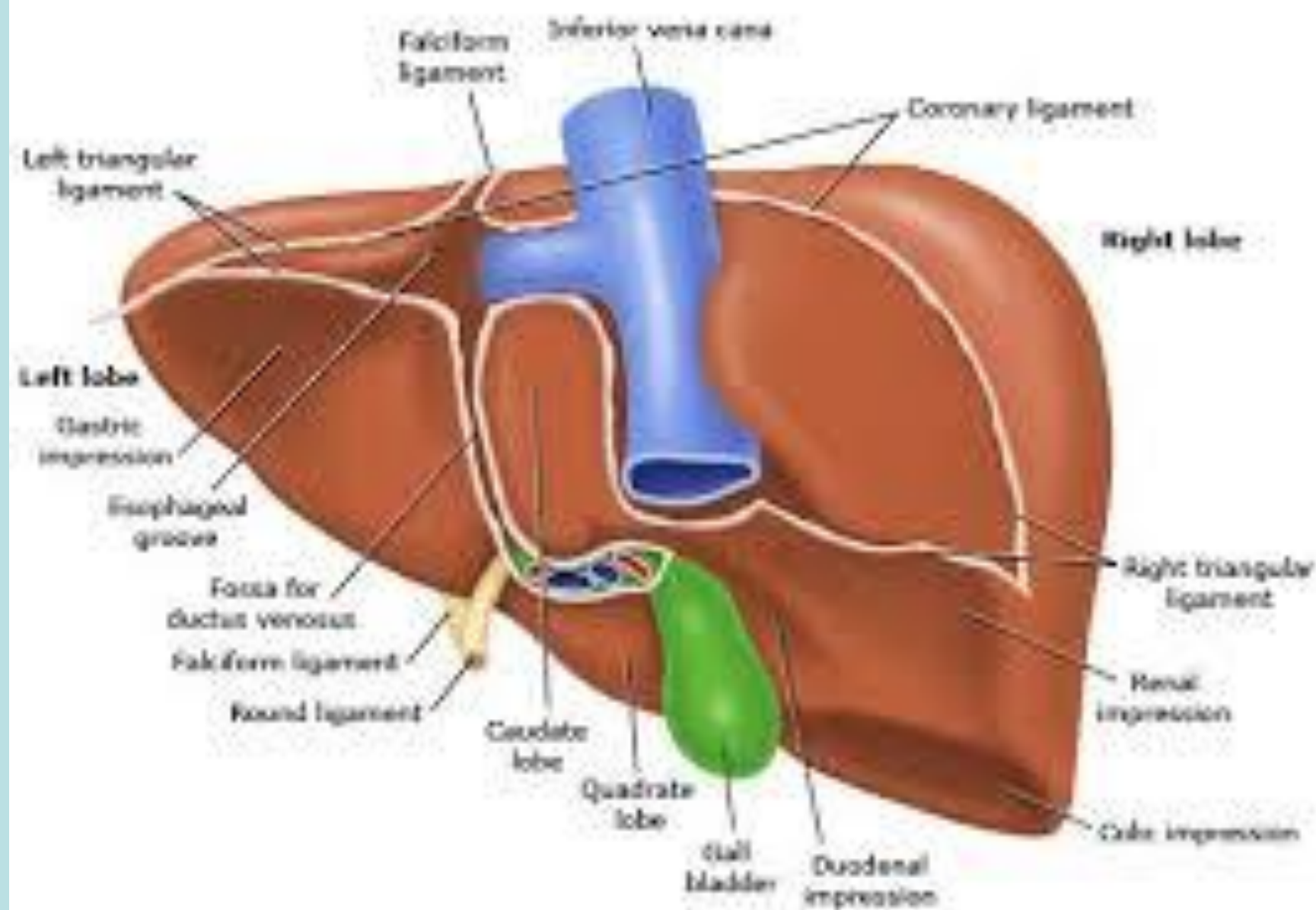
- The liver, the largest gland in the body, has both external and internal secretions, which are formed in the hepatic cells.
- Its external secretion, the bile, is collected after passing through the bile capillaries by the bile ducts, which join like the twigs and branches of a tree to form two large ducts that unite to form the hepatic duct.
- The bile is either carried to the gall-bladder by the cystic duct or poured directly into the duodenum by the common bile duct where it aids in digestion.
- The internal secretions are concerned with the metabolism of both nitrogenous and carbohydrate materials absorbed from the intestine and carried to the liver by the portal vein.
- The carbohydrates are stored in the hepatic cells in the form of glycogen which is secreted in the form of sugar directly into the blood stream.
- Some of the cells lining the blood capillaries of the liver are concerned in the destruction of red blood corpuscles.



(a) Anterior view







Right lobe of
liver

Hepatogastric ligament
(of lesser omentum)

Lesser
curvature

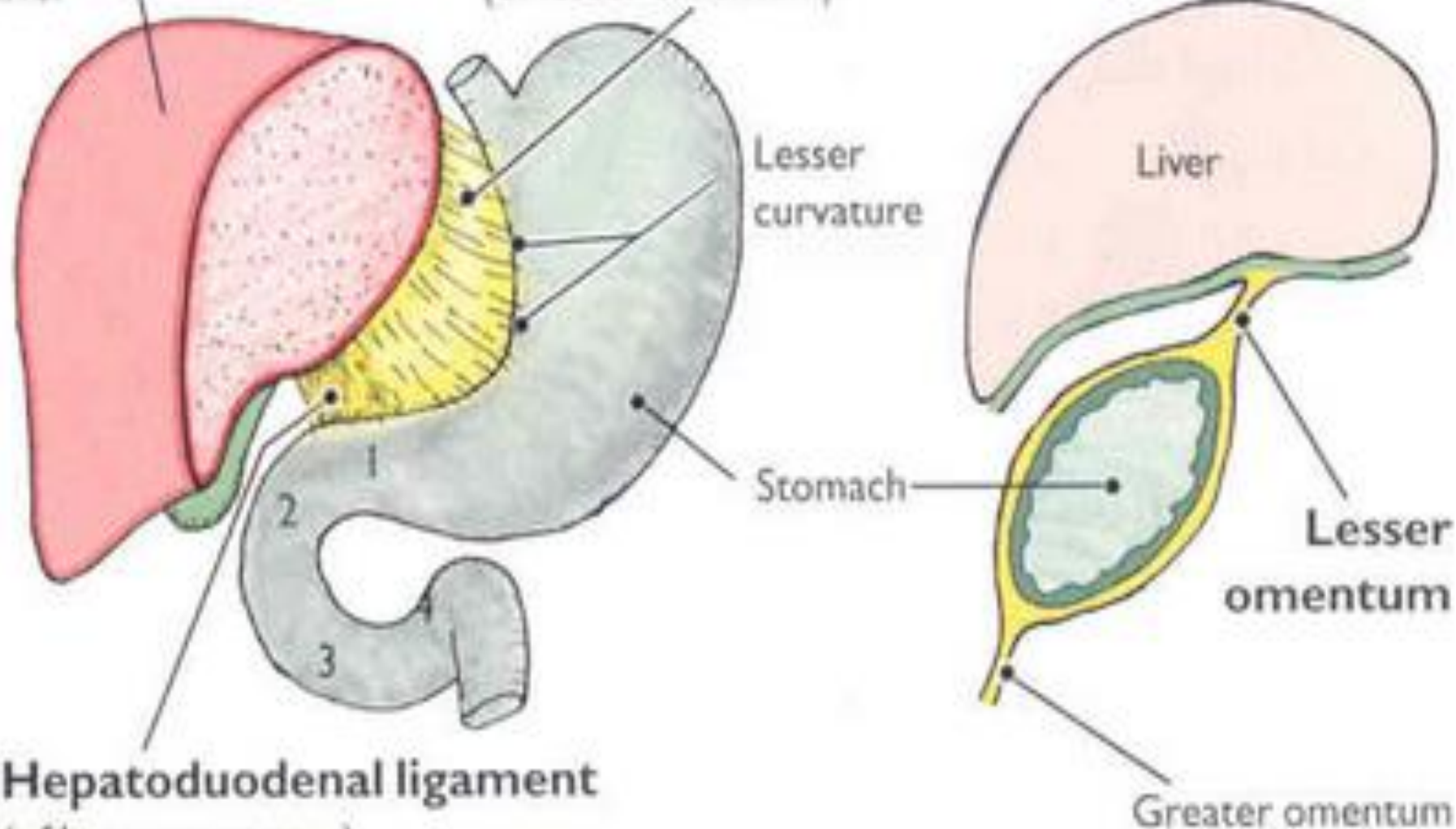
Stomach

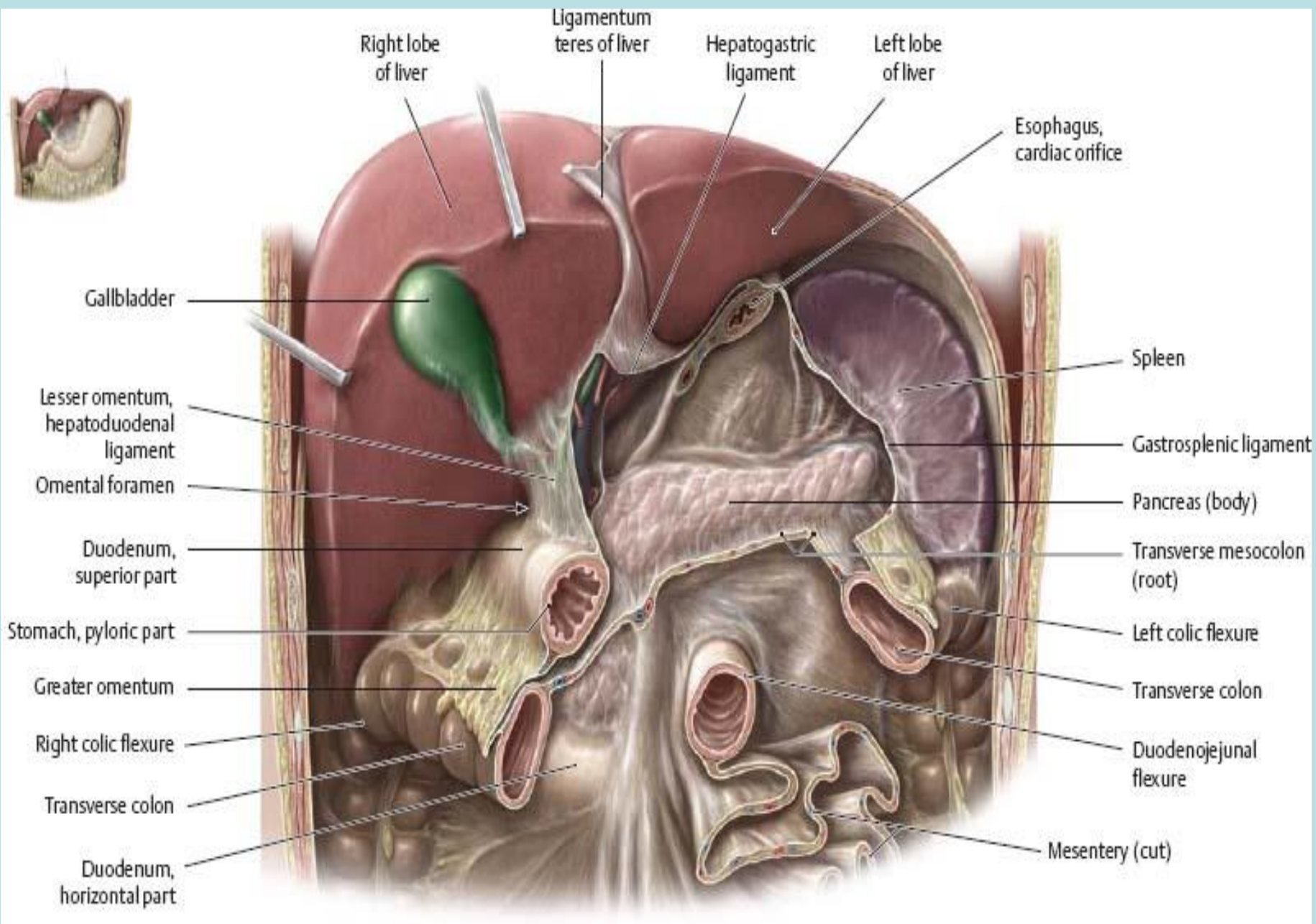
Hepatoduodenal ligament
(of lesser omentum)

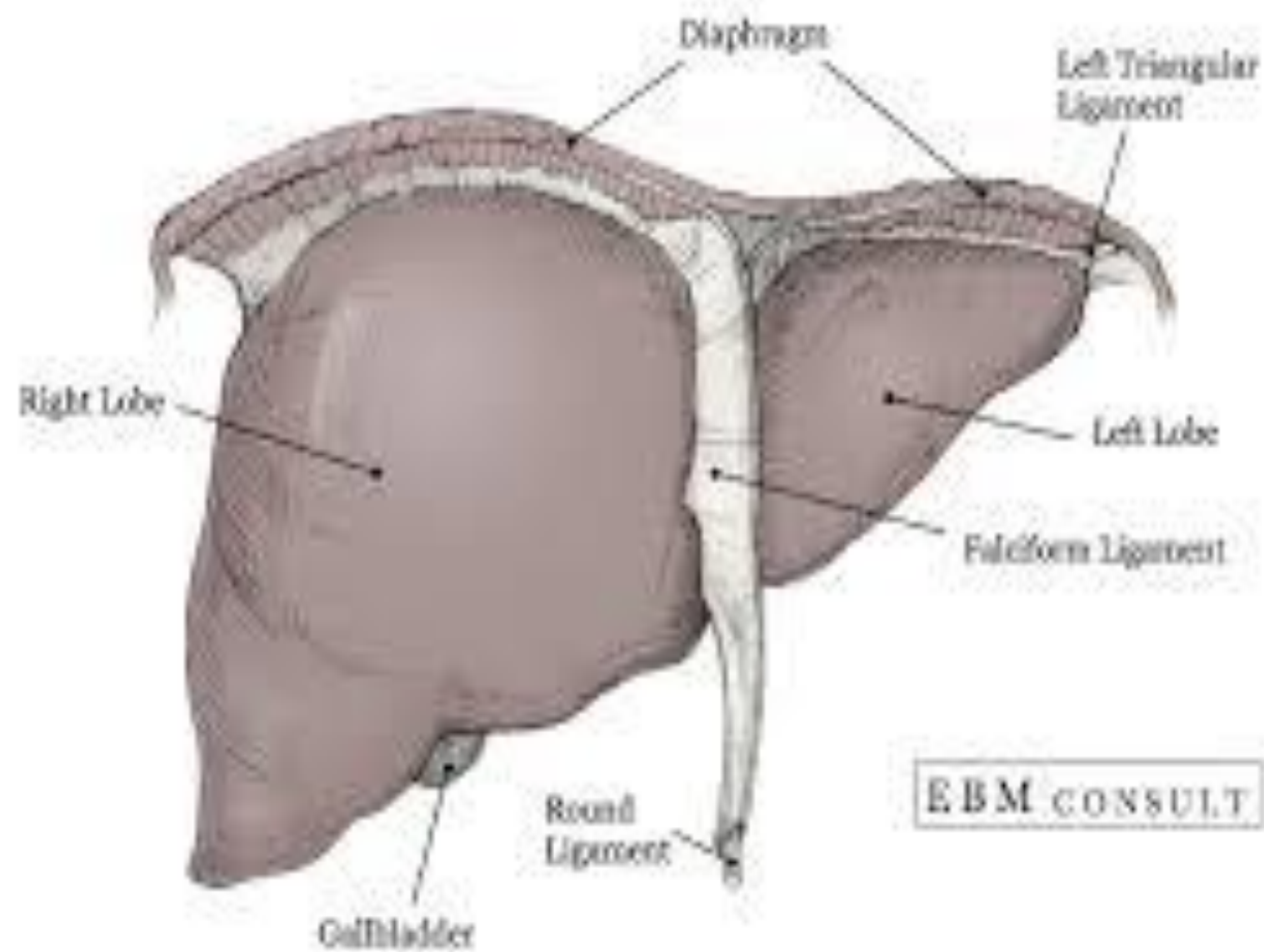
Liver

Lesser
omentum

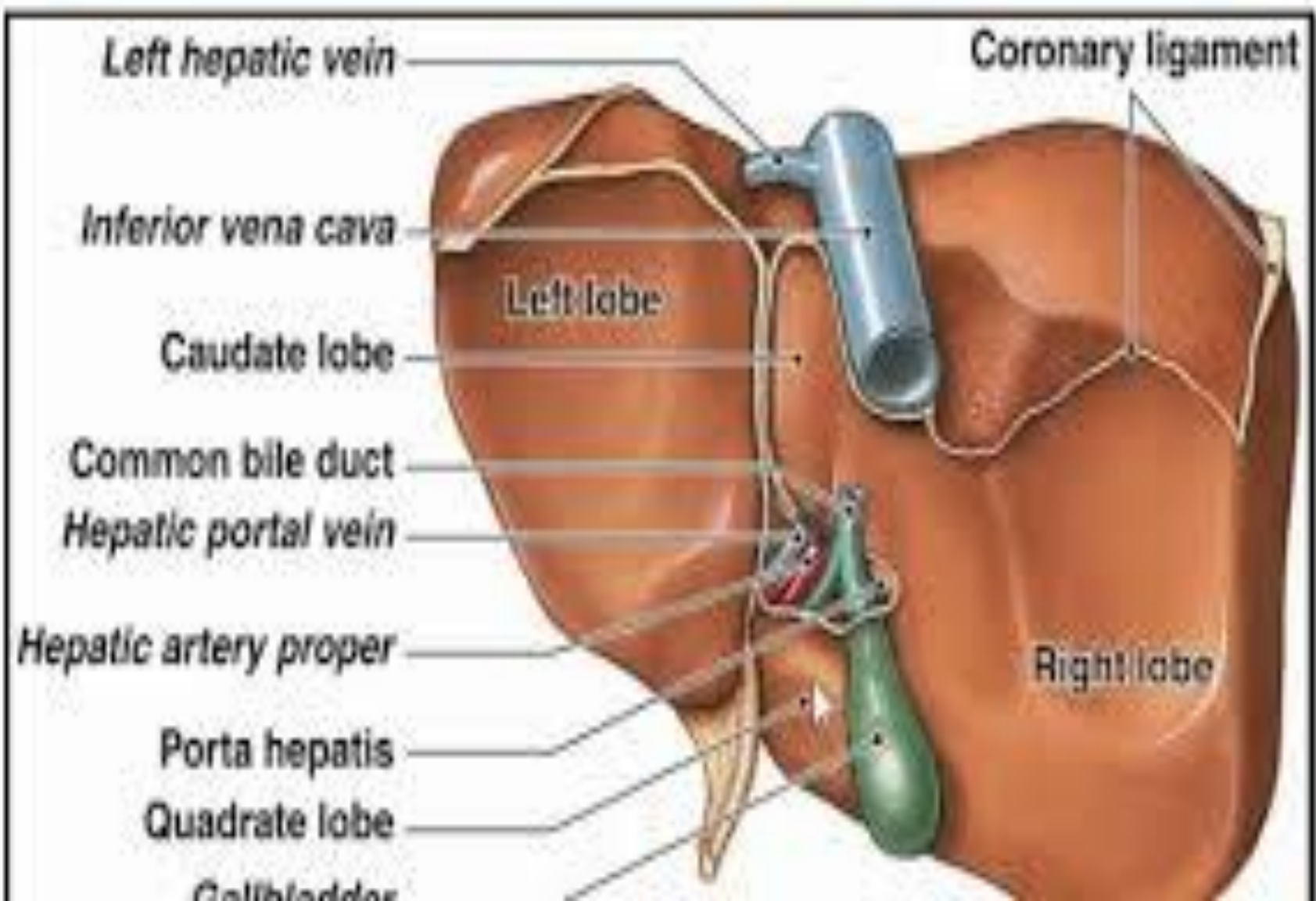
Greater omentum

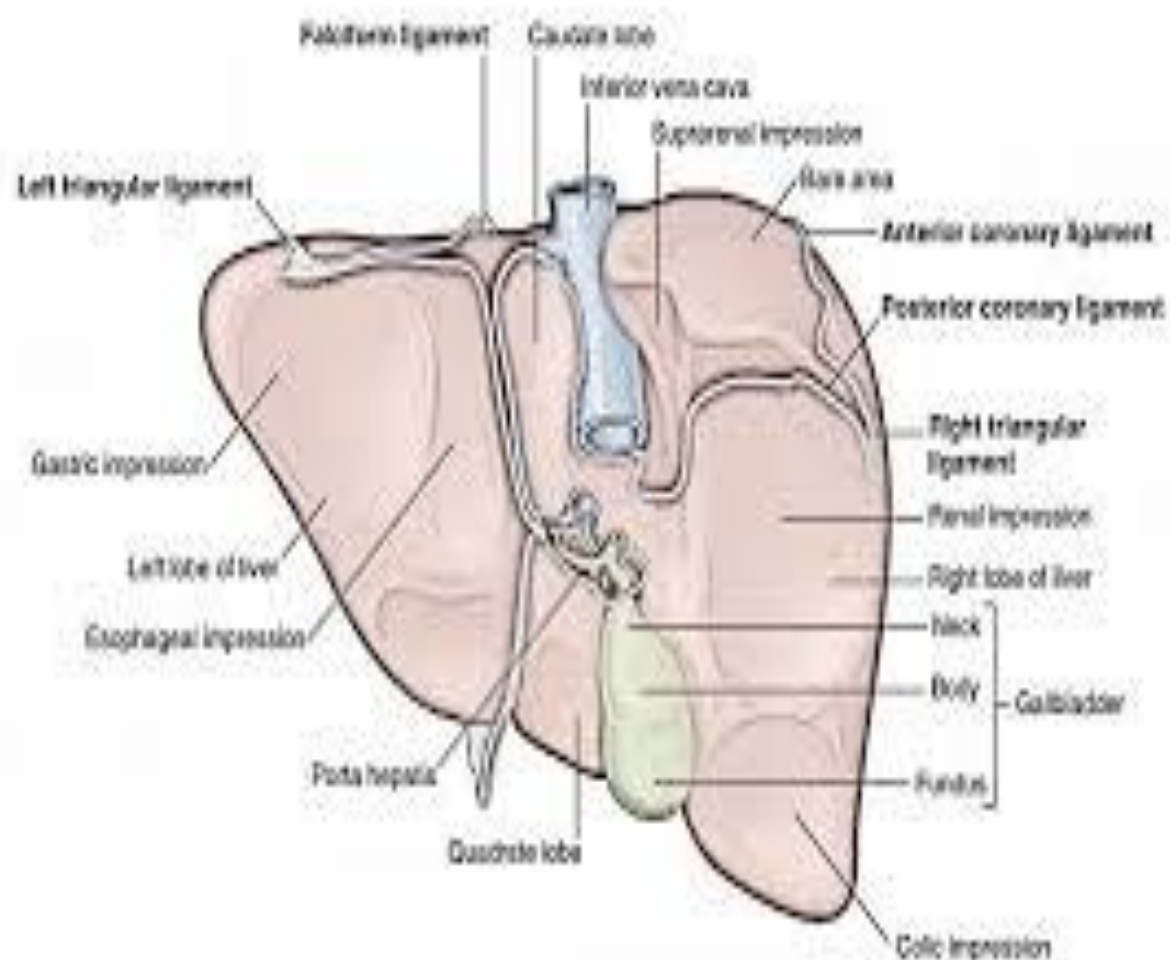


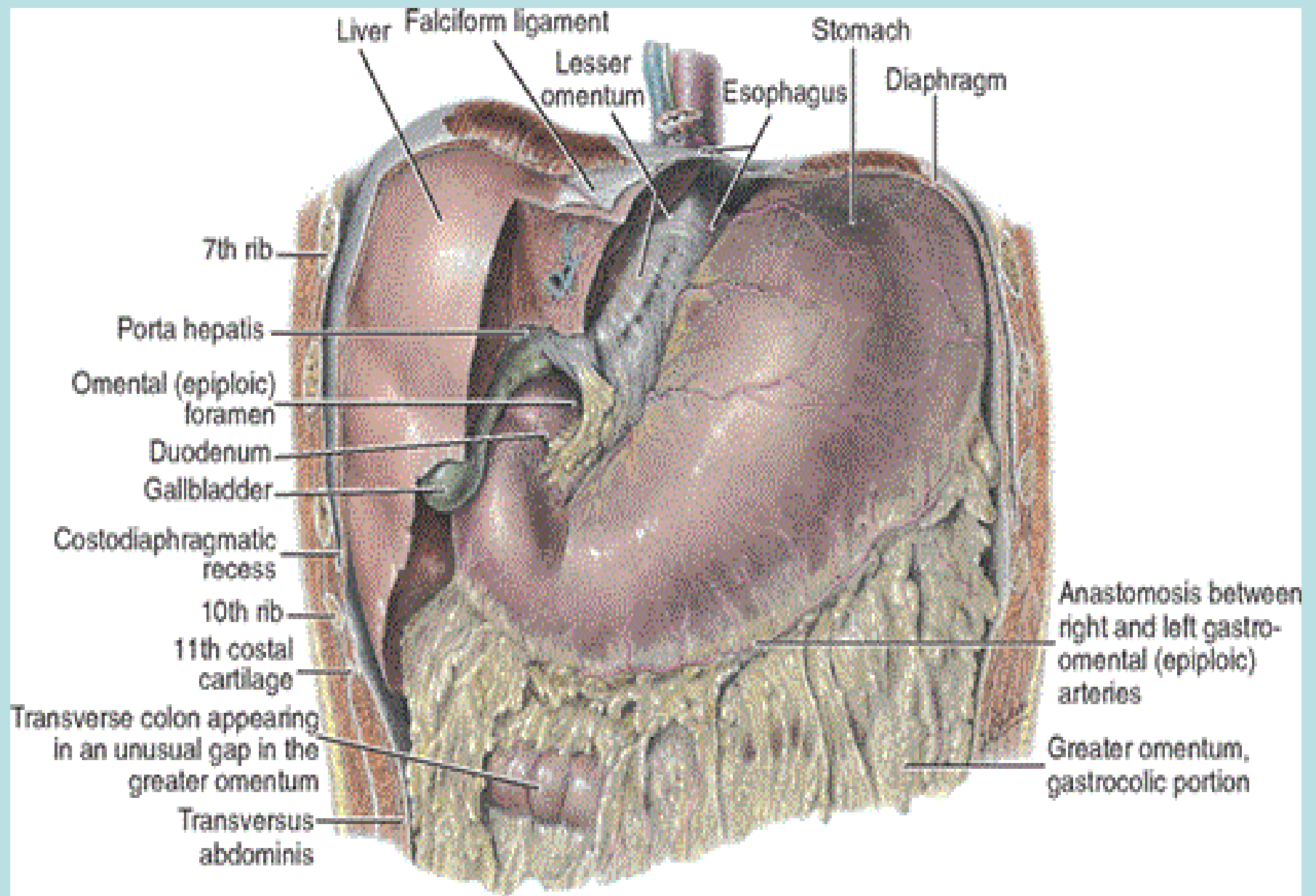


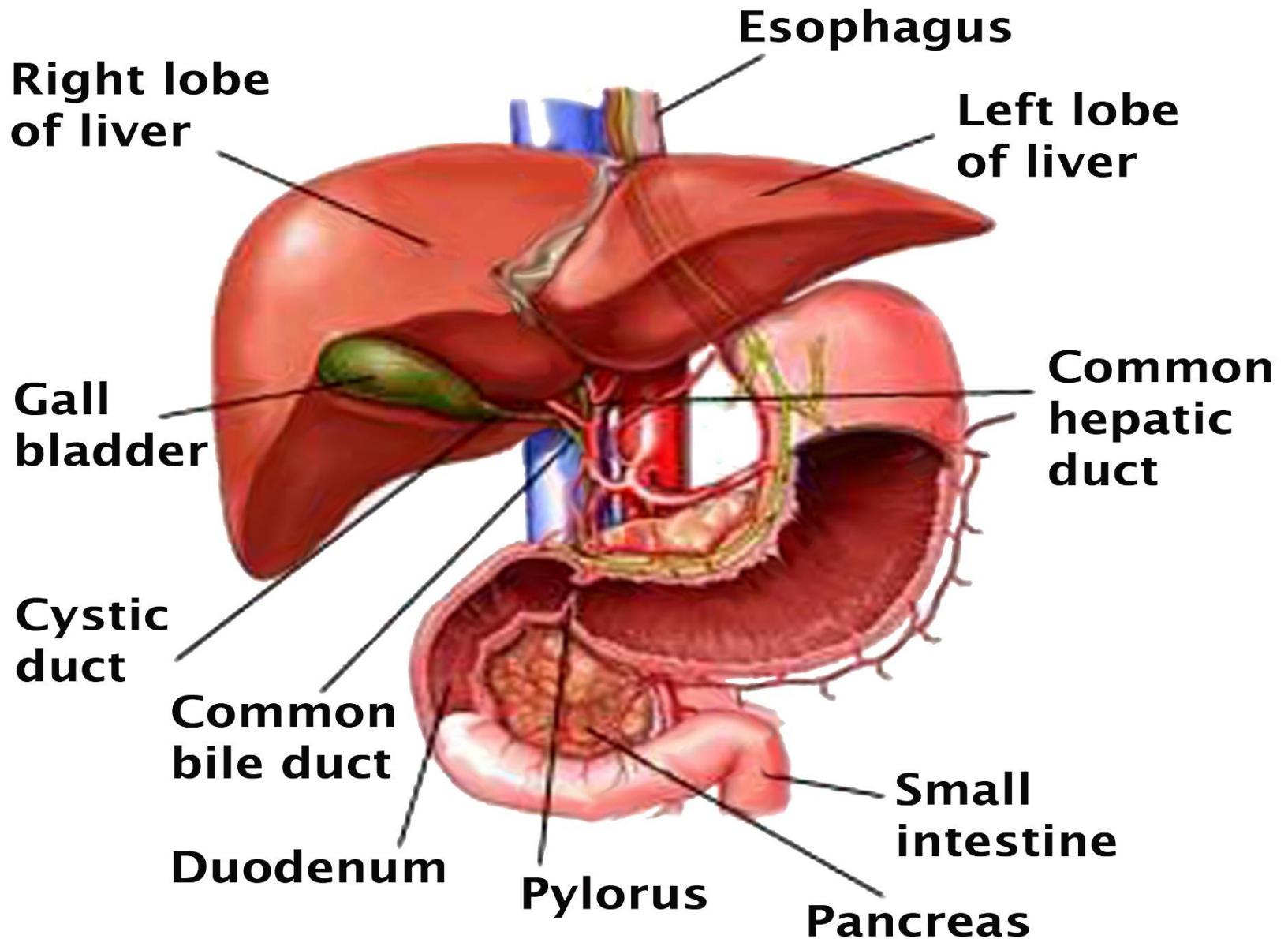


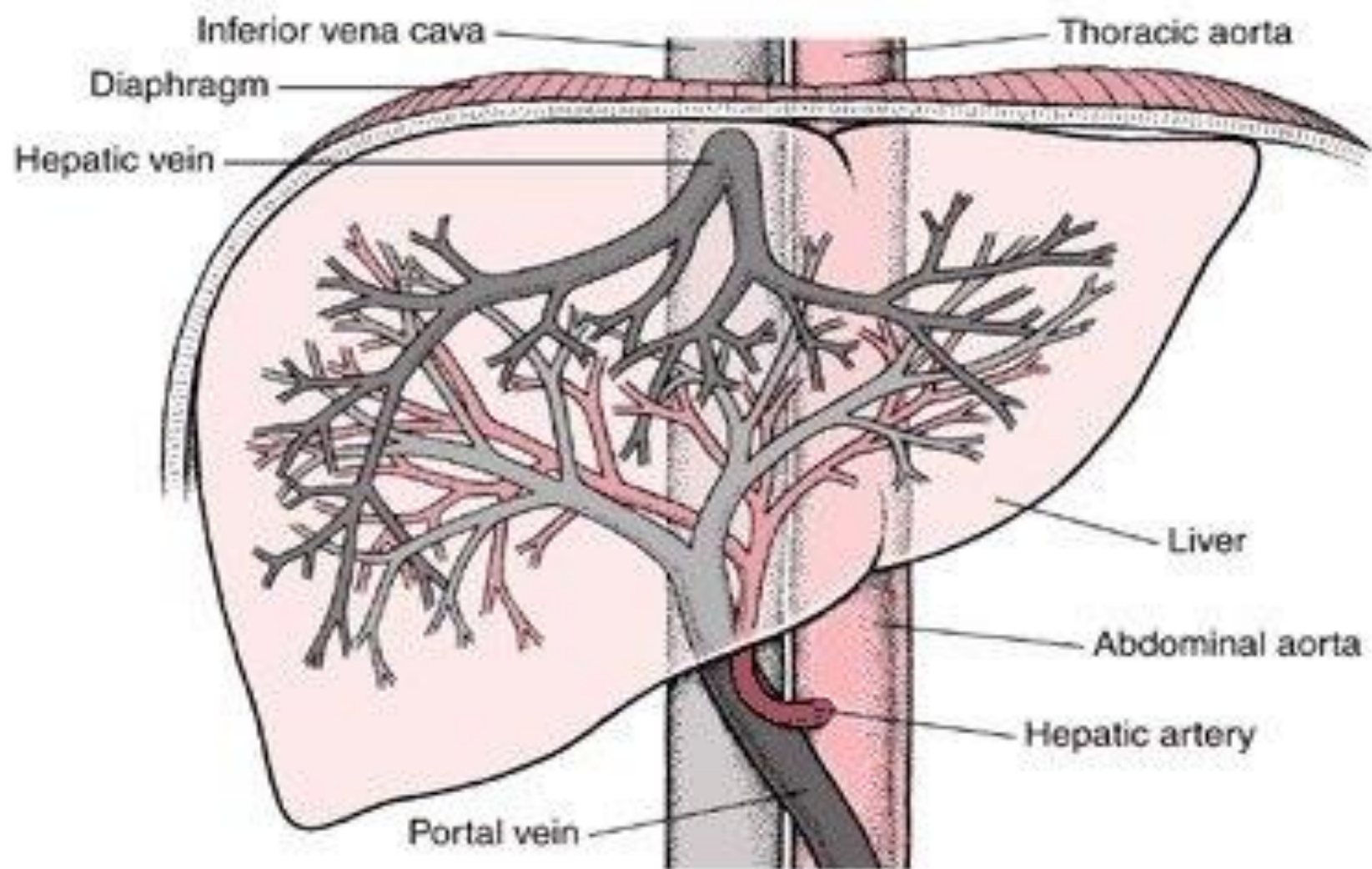
ANATOMY AND FUNCTIONAL ROLES OF THE LIVER

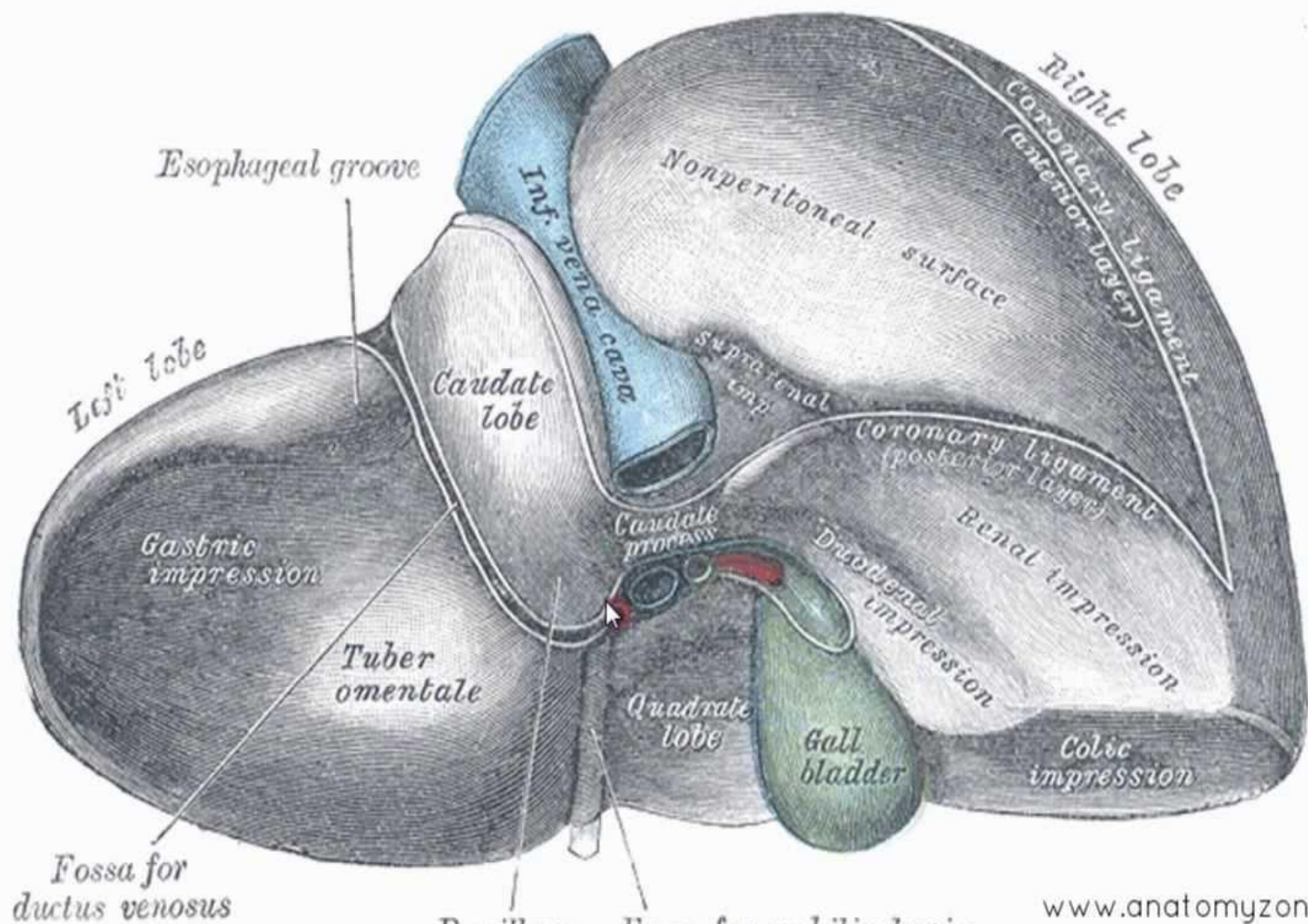




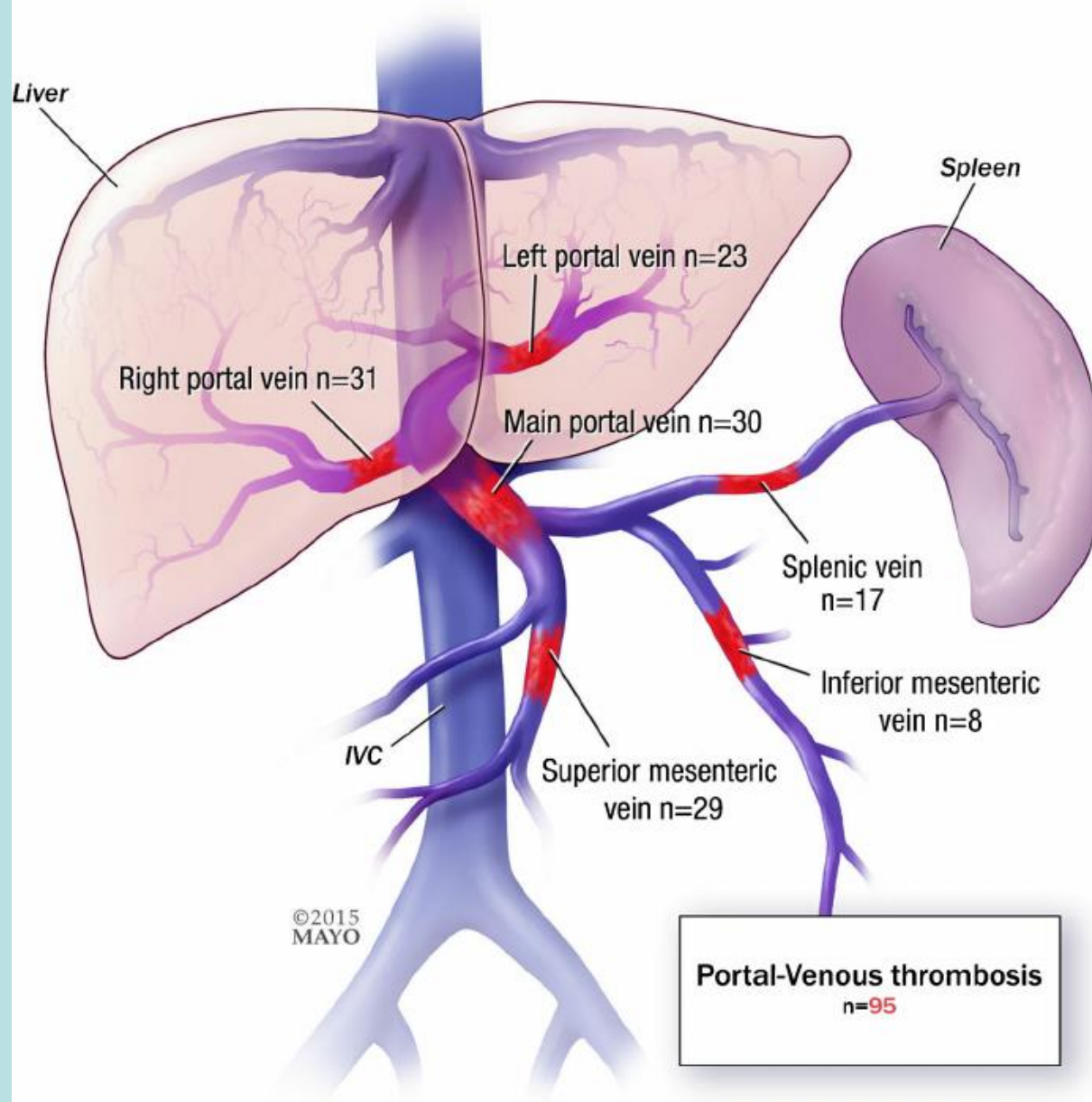


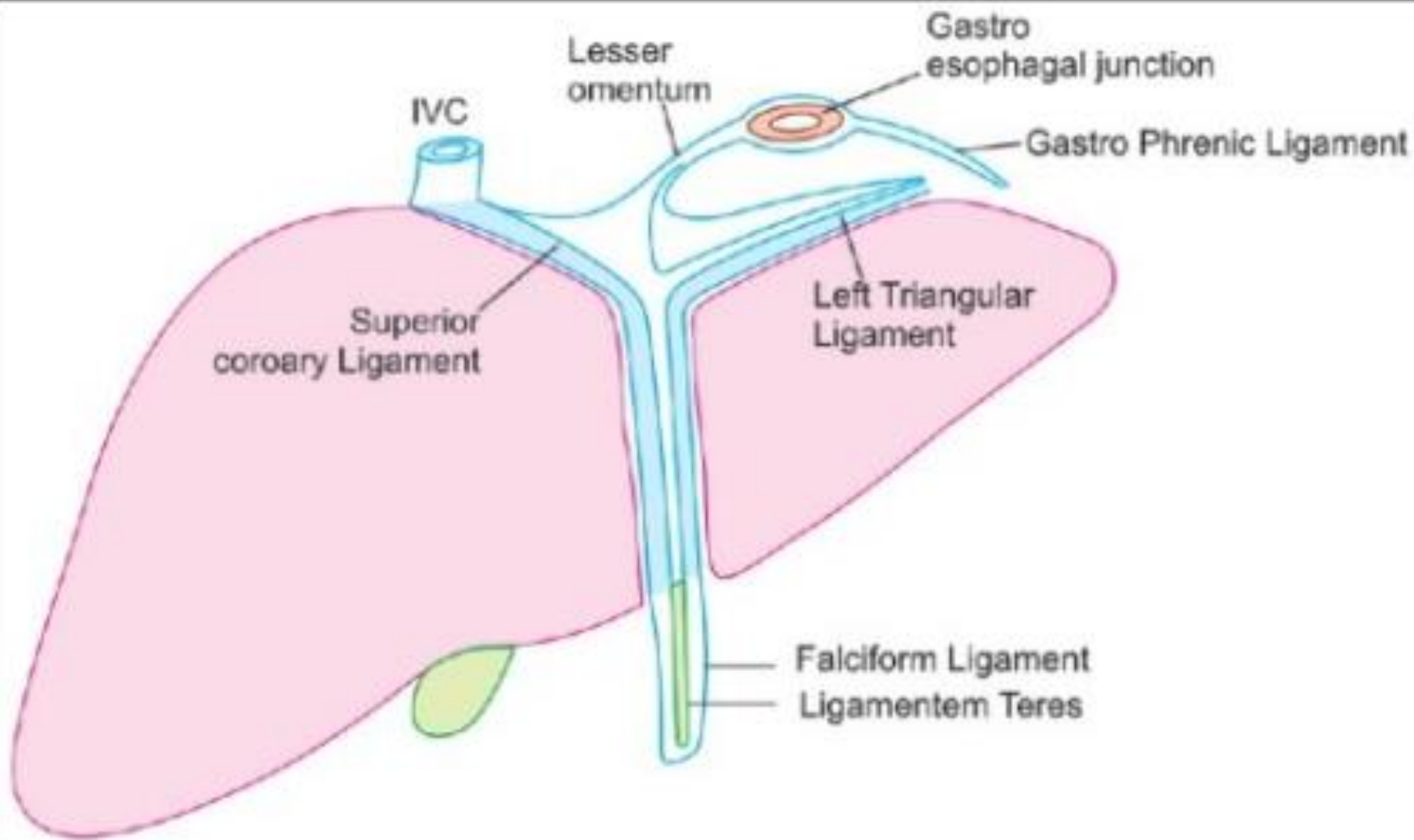




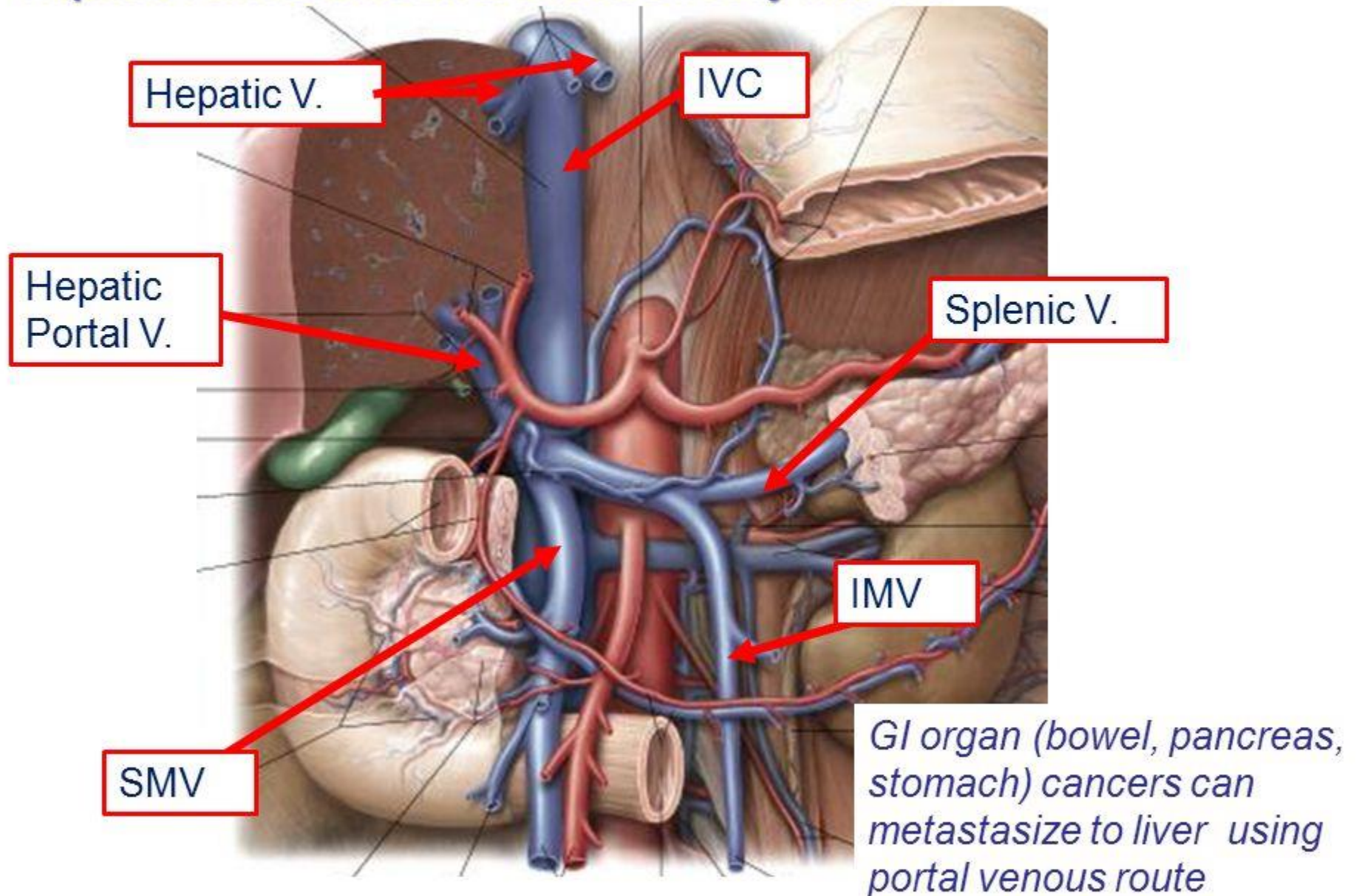


Portal Venous System

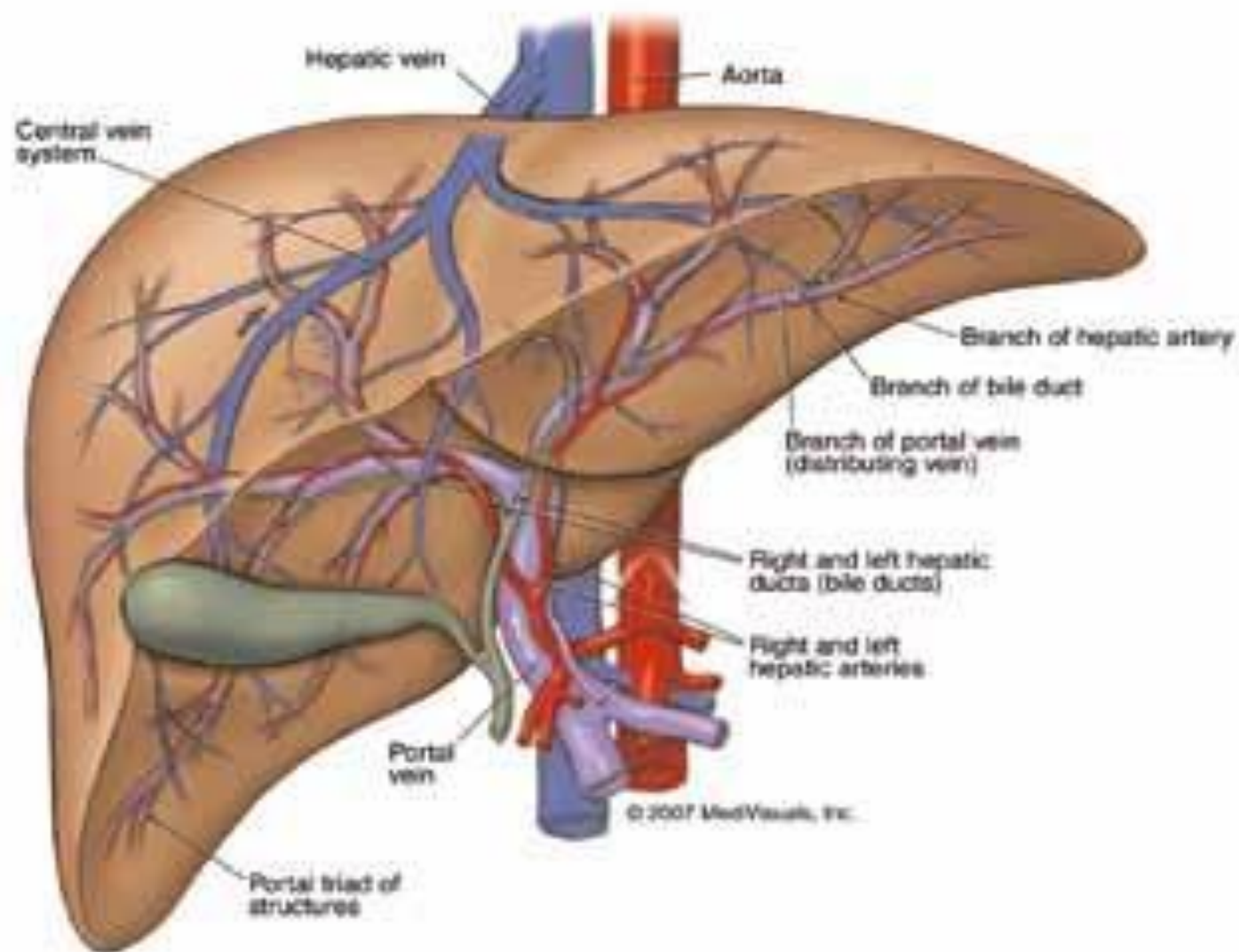




Hepatic Portal Vein: ~70-80% of Liver Blood Supply; mixes with arterial blood to supply in liver sinusoids to feed liver cells
Hepatic Vein: Drains Liver Blood Directly Into IVC



Internal Anatomy of Liver



- It is situated in the upper and right parts of the abdominal cavity, occupying almost the whole of the right hypochondrium, the greater part of the epigastrium, and not uncommonly extending into the left hypochondrium as far as the mammillary line.
- In the male it weighs from 1.4 to 1.6 kg, in the female from 1.2 to 1.4 kilogm.
- It is relatively much larger in the foetus than in the adult, constituting, in the former, about one-eighteenth, and in the latter about one thirty-sixth of the entire body weight.
- Its greatest transverse measurement is from 20 to 22.5 cm.
- Vertically, near its lateral or right surface, it measures about 15 to 17.5 cm., while its greatest antero-posterior diameter is on a level with the upper end of the right kidney, and is from 10 to 12.5 cm.

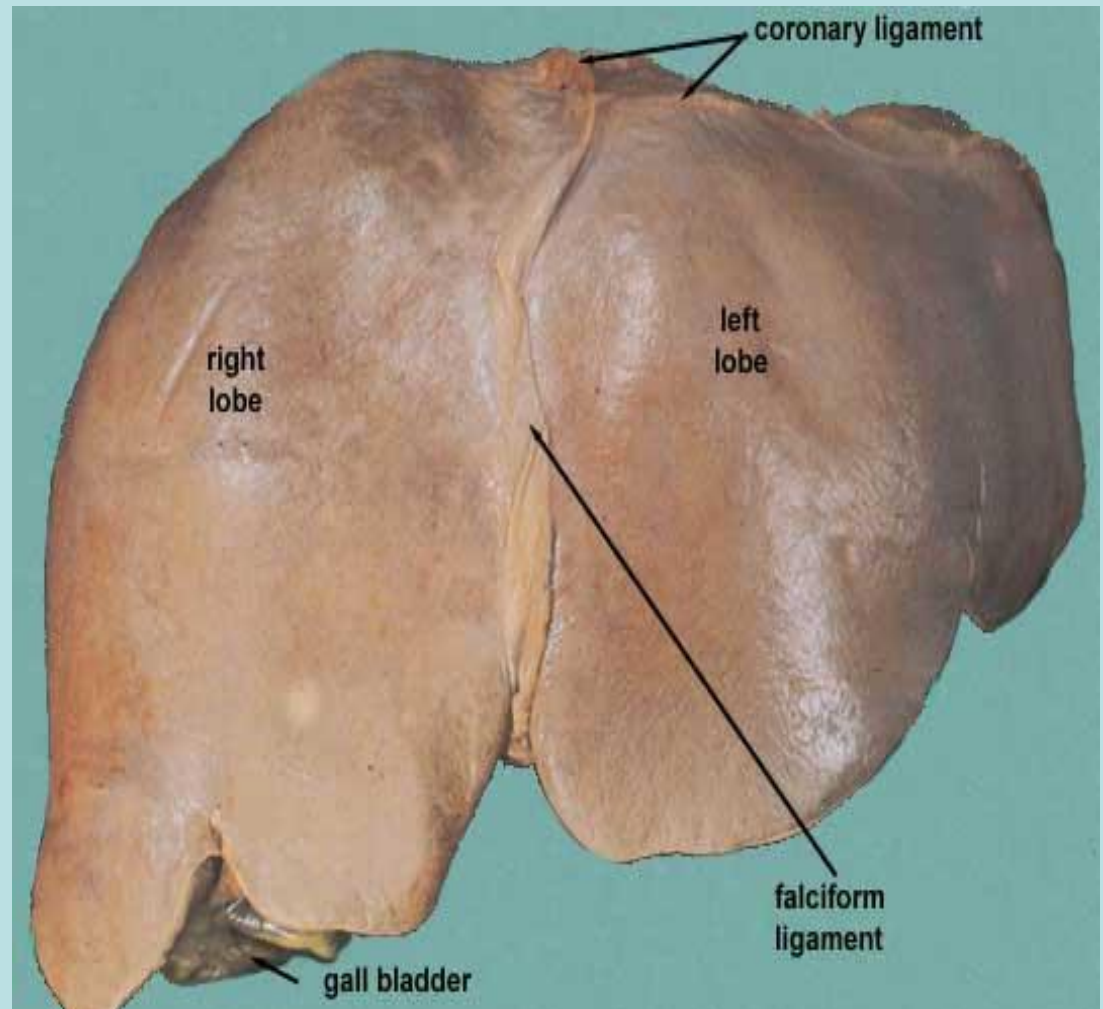
- **Surfaces**

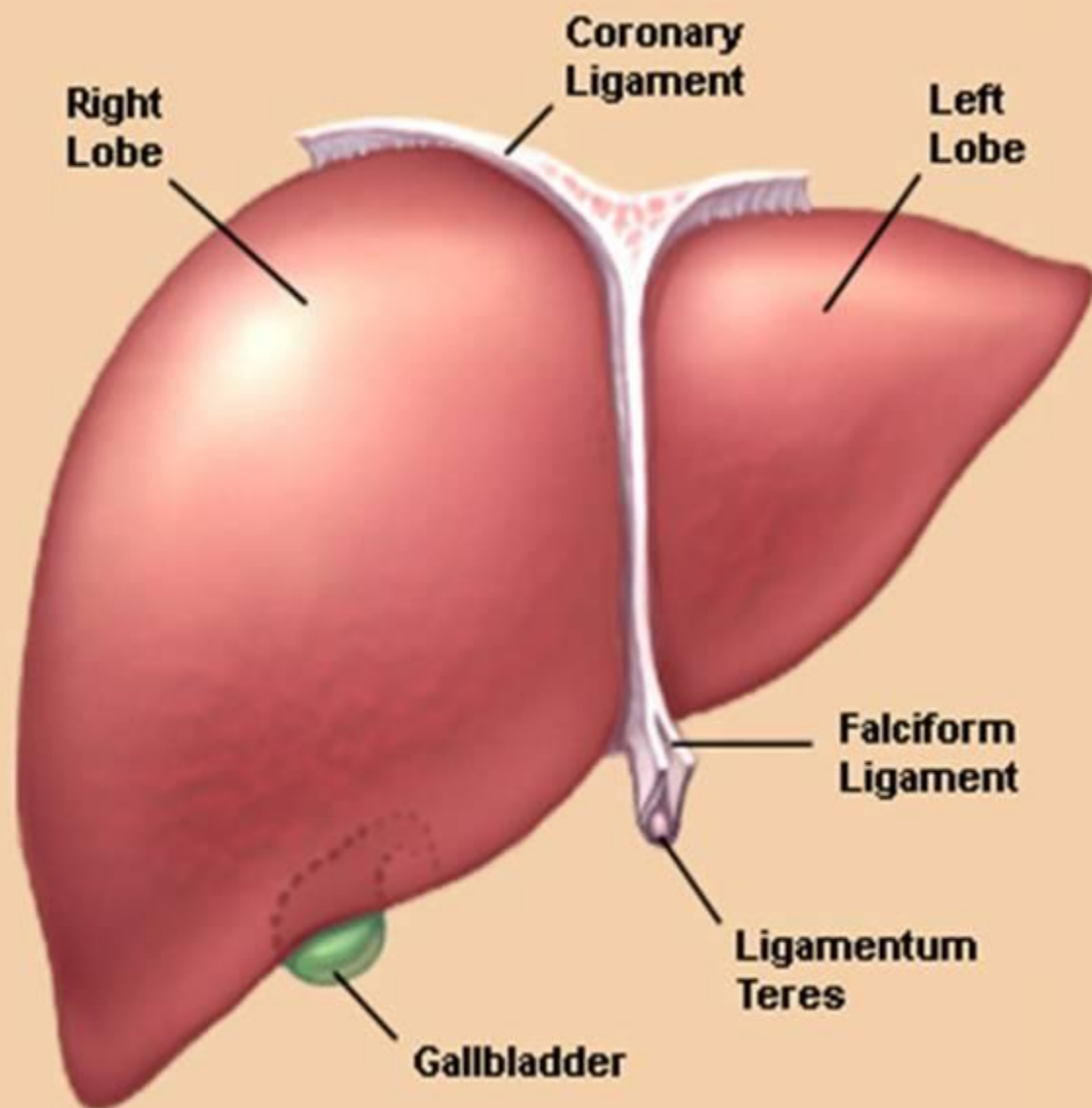
- The liver possesses three surfaces, **superior (diaphragmatic), inferior (visceral) and posterior**.
- A sharp, well-defined margin divides the inferior from the superior in front; the other margins are rounded.
- The superior surface is attached to the diaphragm and anterior abdominal wall by a triangular or falciform fold of peritoneum, **the falciform ligament**, in the free margin of which is a rounded cord, **the ligamentum teres** (*obliterated umbilical vein*).
- The line of attachment of the falciform ligament divides the liver into two parts, termed **the right and left lobes**, the right being much the larger.
- The inferior and posterior surfaces are divided into four lobes by five fossæ, which are arranged in the form of the letter H.
- The left limb of the H marks on these surfaces the division of the liver into right and left lobes; it is known as **the left sagittal fossa**, and consists of two parts, **the fossa for the umbilical vein** in front and **the fossa for the ductus venosus** behind.
- The right limb of the H is formed in front by **the fossa for the gall-bladder**, and behind by **the fossa for the inferior vena cava**; these two fossæ are separated from one another by a band of liver substance, termed **the caudate process**.
- The bar connecting the two limbs of the H is **the porta** (*transverse fissure*); in front of it is **the quadrate lobe**, behind it **the caudate lobe**.

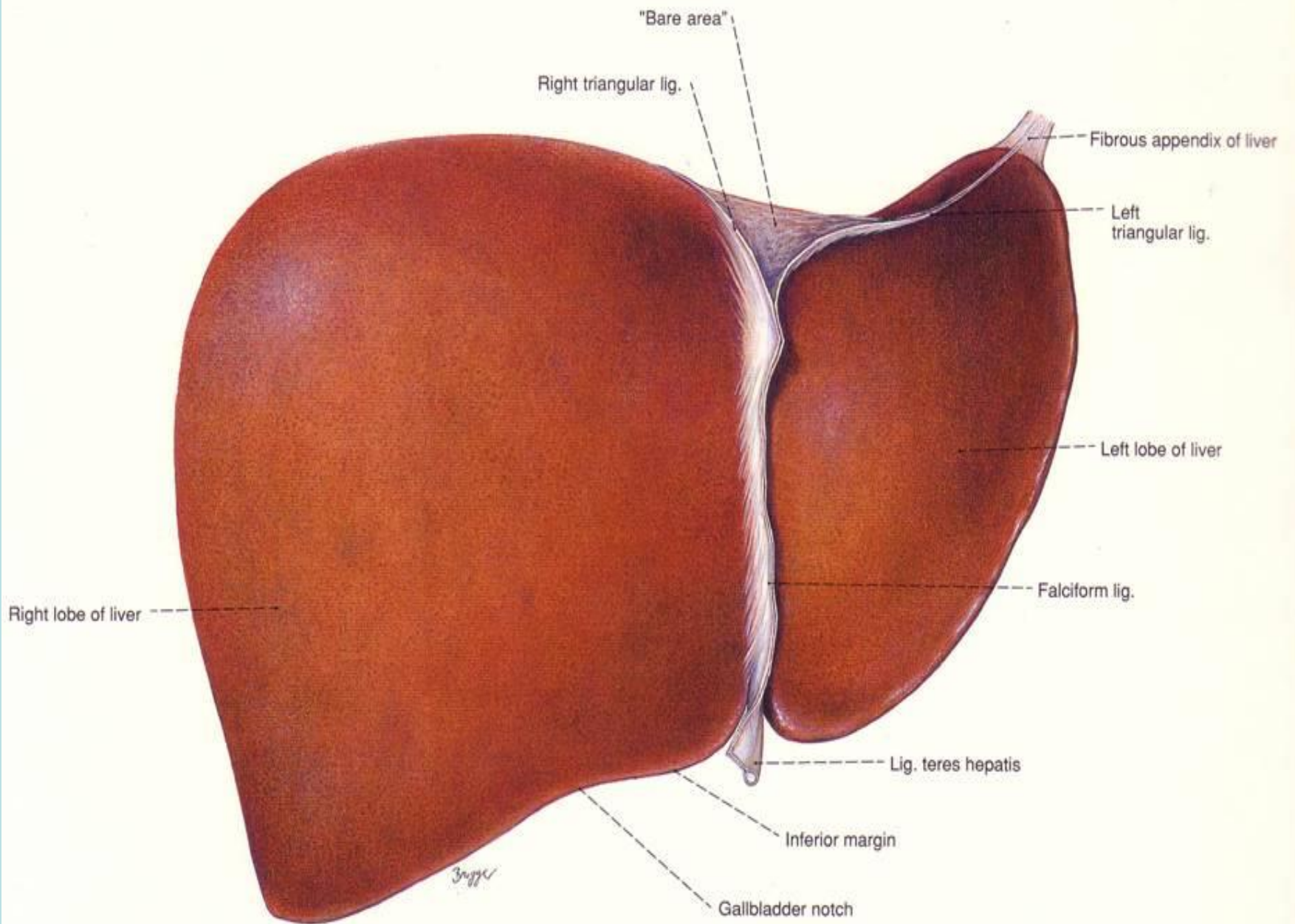
- **The superior surface** (*facies superior*) comprises a part of both lobes, and, as a whole, is convex, and fits under the vault of the diaphragm which in front separates it on the right from the sixth to the tenth ribs and their cartilages, and on the left from the seventh and eighth costal cartilages.
- Its middle part lies behind the xiphoid process, and, in the angle between the diverging rib cartilage of opposite sides, is in contact with the abdominal wall.
- Behind this the diaphragm separates the liver from the lower part of the lungs and pleuræ, the heart and pericardium and the right costal arches from the seventh to the eleventh inclusive.
- It is completely covered by peritoneum except along the line of attachment of the falciform ligament.

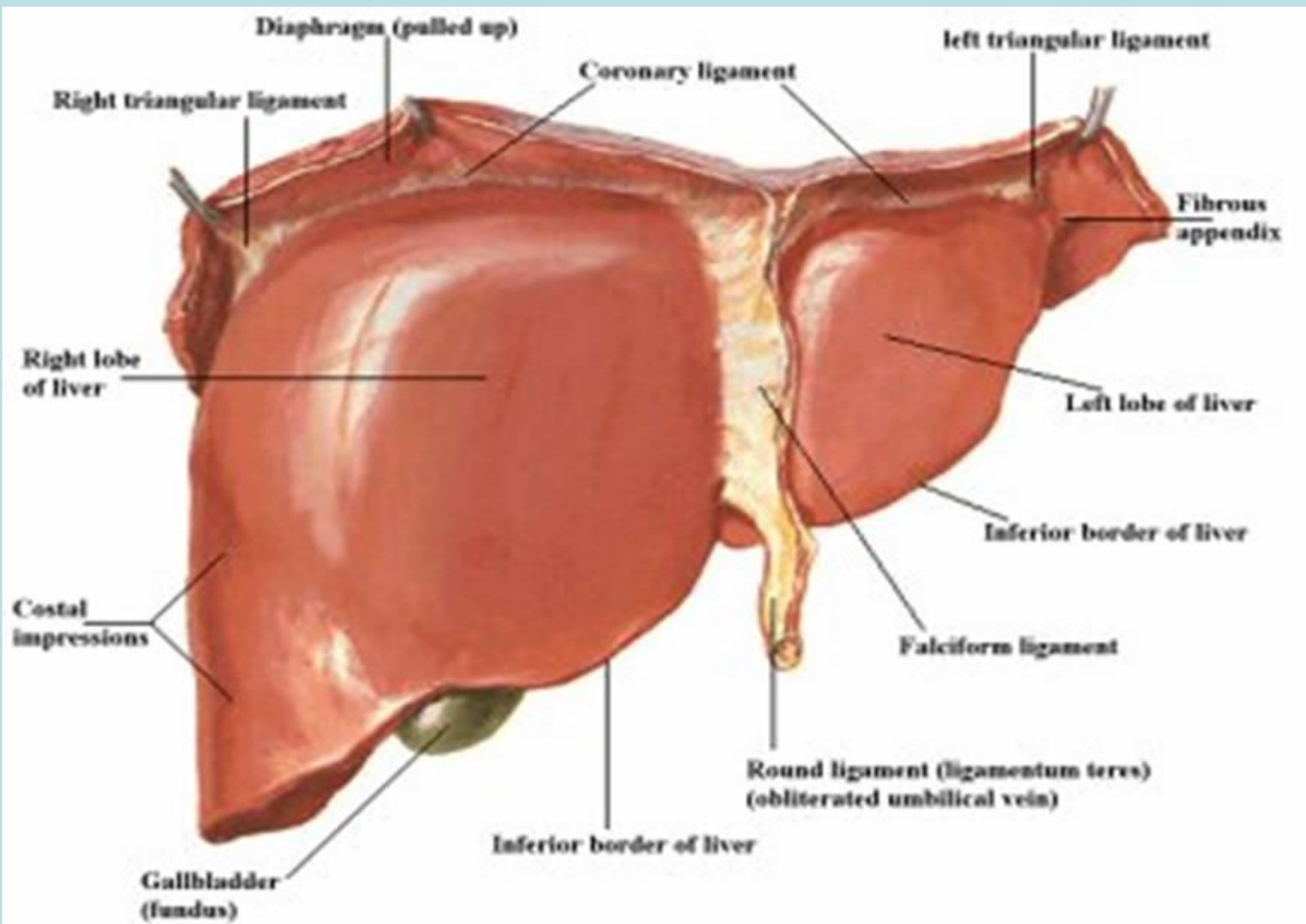
The superior (diaphragmatic) surface of the liver

1. right lobe;
2. cut edge of the falciform ligament;
3. left lobe;
4. cut edges of the superior part of the coronary ligament;
5. fundus of the gallbladder;





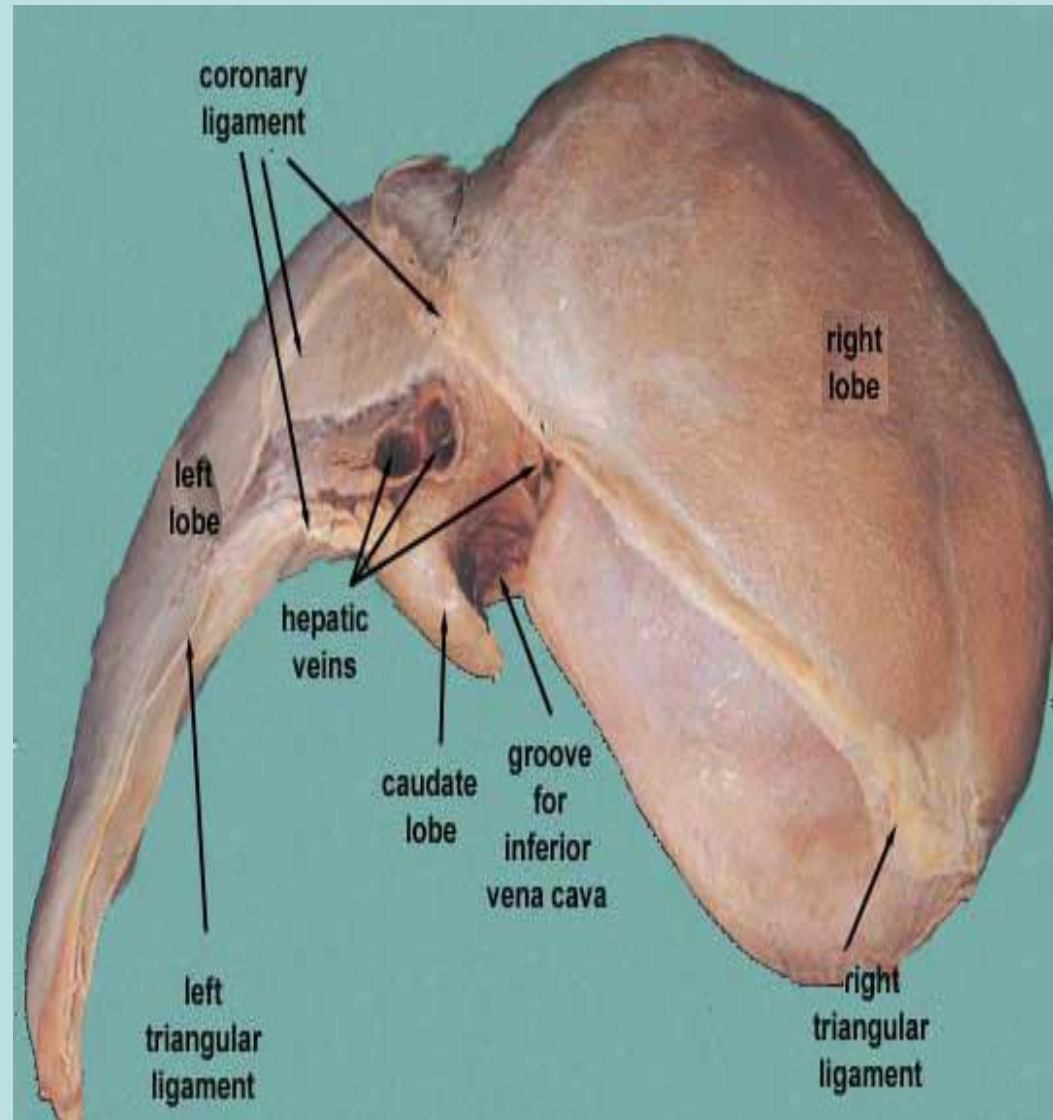


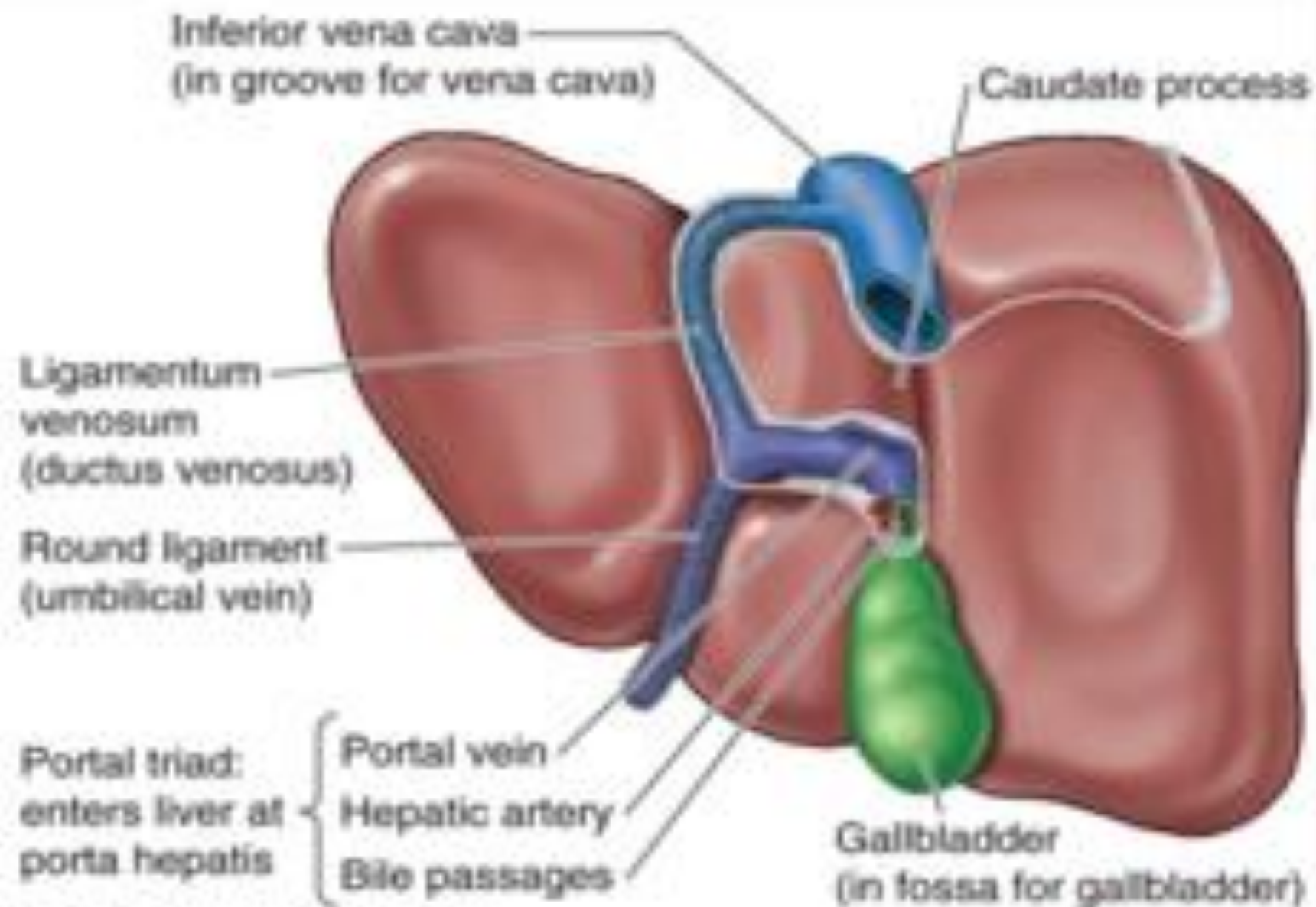


(After ADAM)

The superior surface of the liver

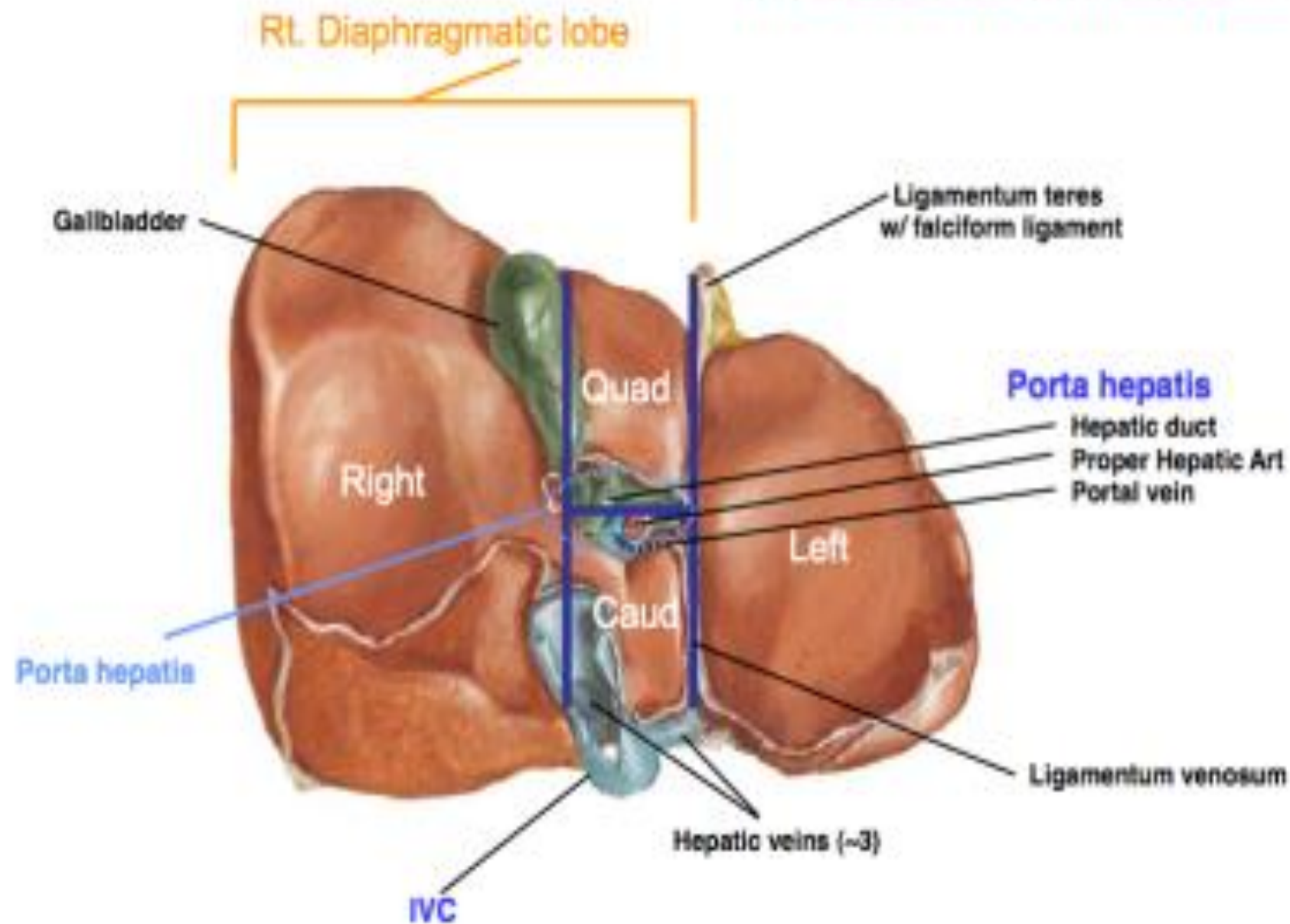
- ✓ is separated from the heart by the domes of the diaphragm.
- 1. right lobe ;
- 2. the falciform ligament;
- 3. the cut edges of the superior and inferior parts of the coronary ligament;
- 4. the left triangular ligament;
- 5. the right triangular ligament;
- 6. bare area of the liver (no peritoneum covering the liver groove for the inferior vena cava and the hepatic veins);
- 7. caudate lobe of the liver around the groove of the inferior vena cava;



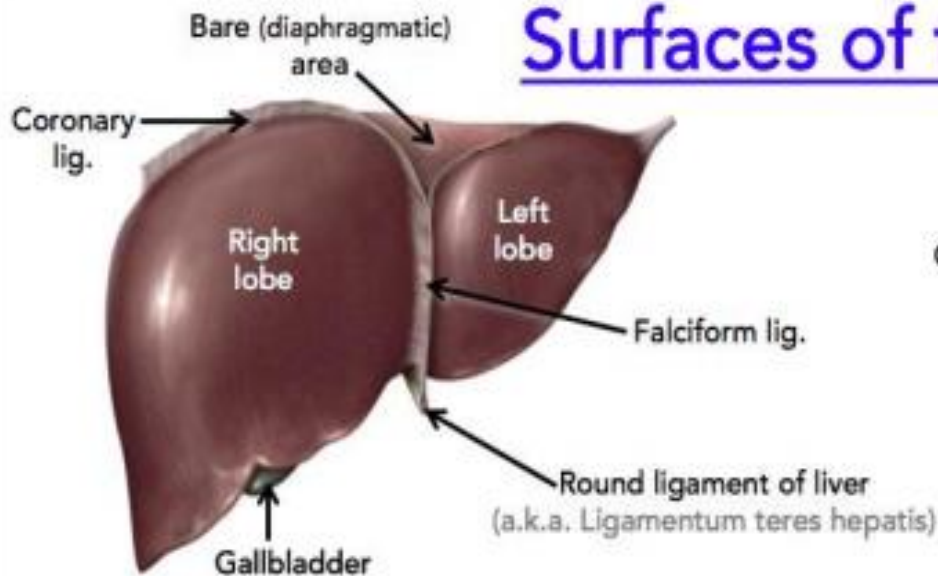


(B) Postero-inferior view

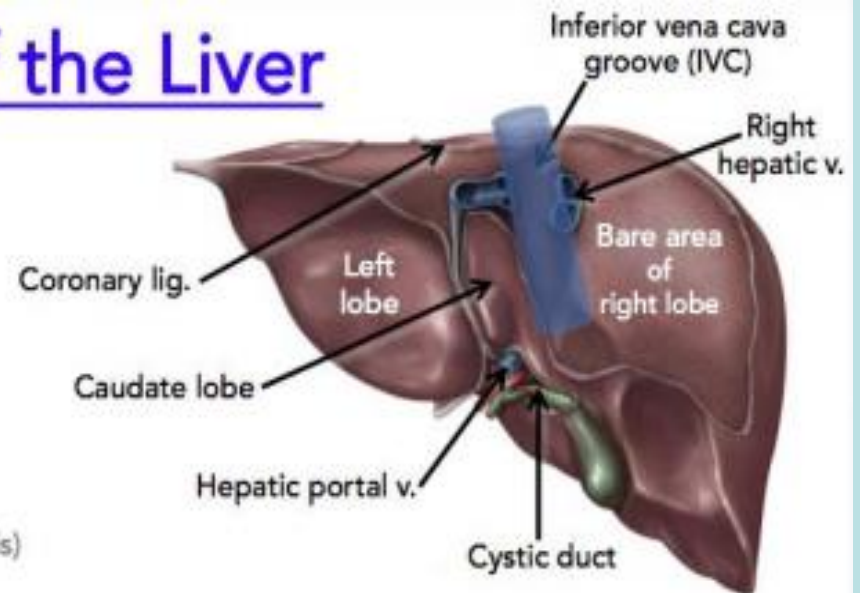
Visceral Surface of the Liver



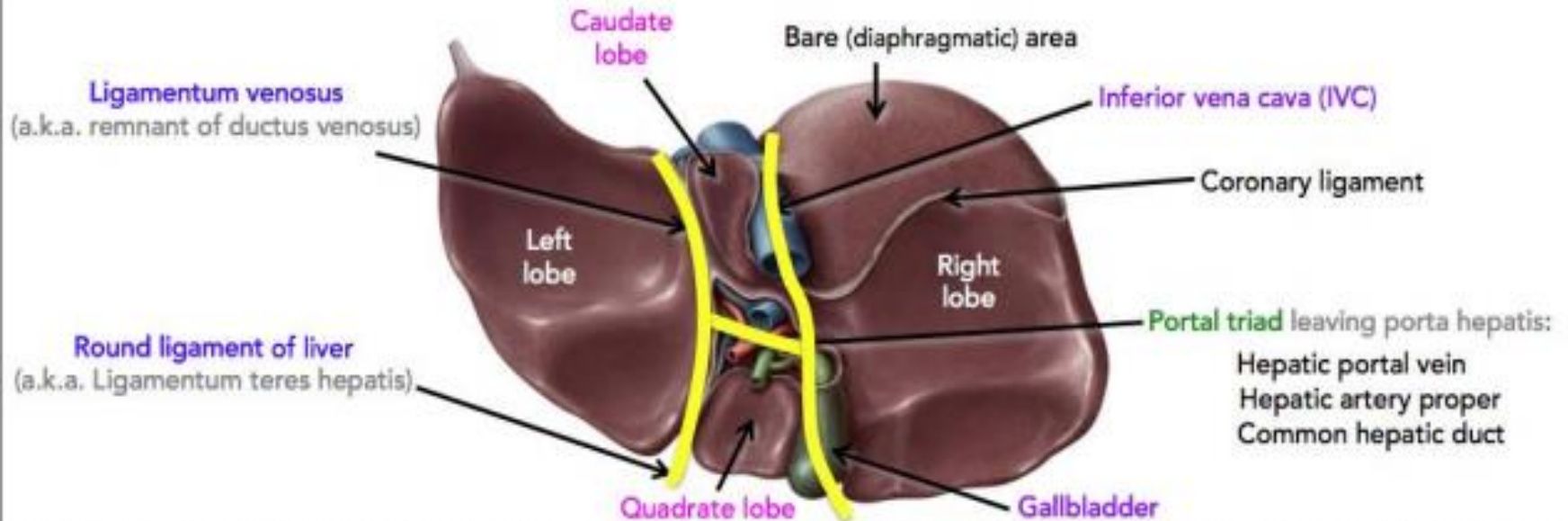
Surfaces of the Liver



Anterior View



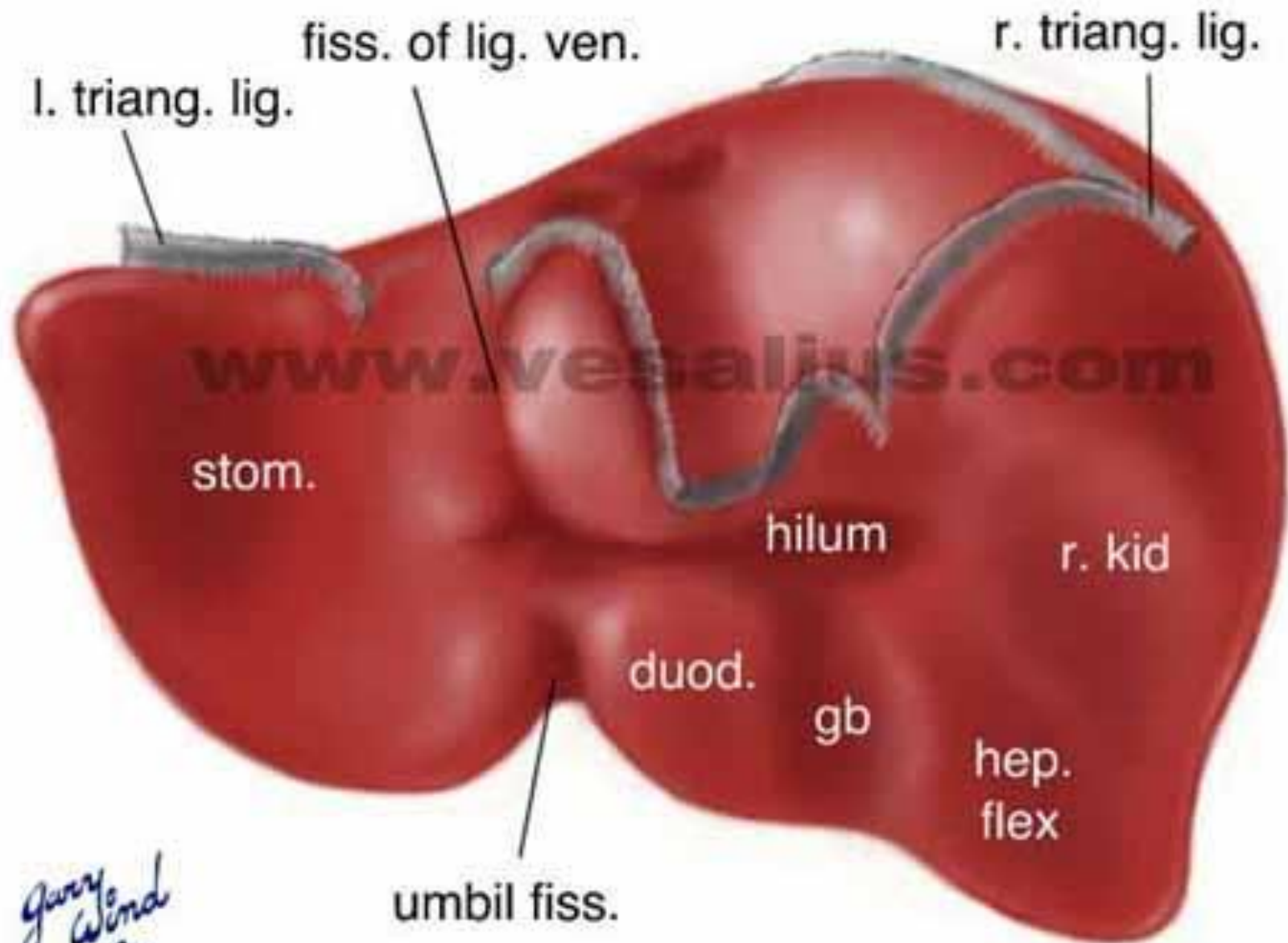
Posterior View



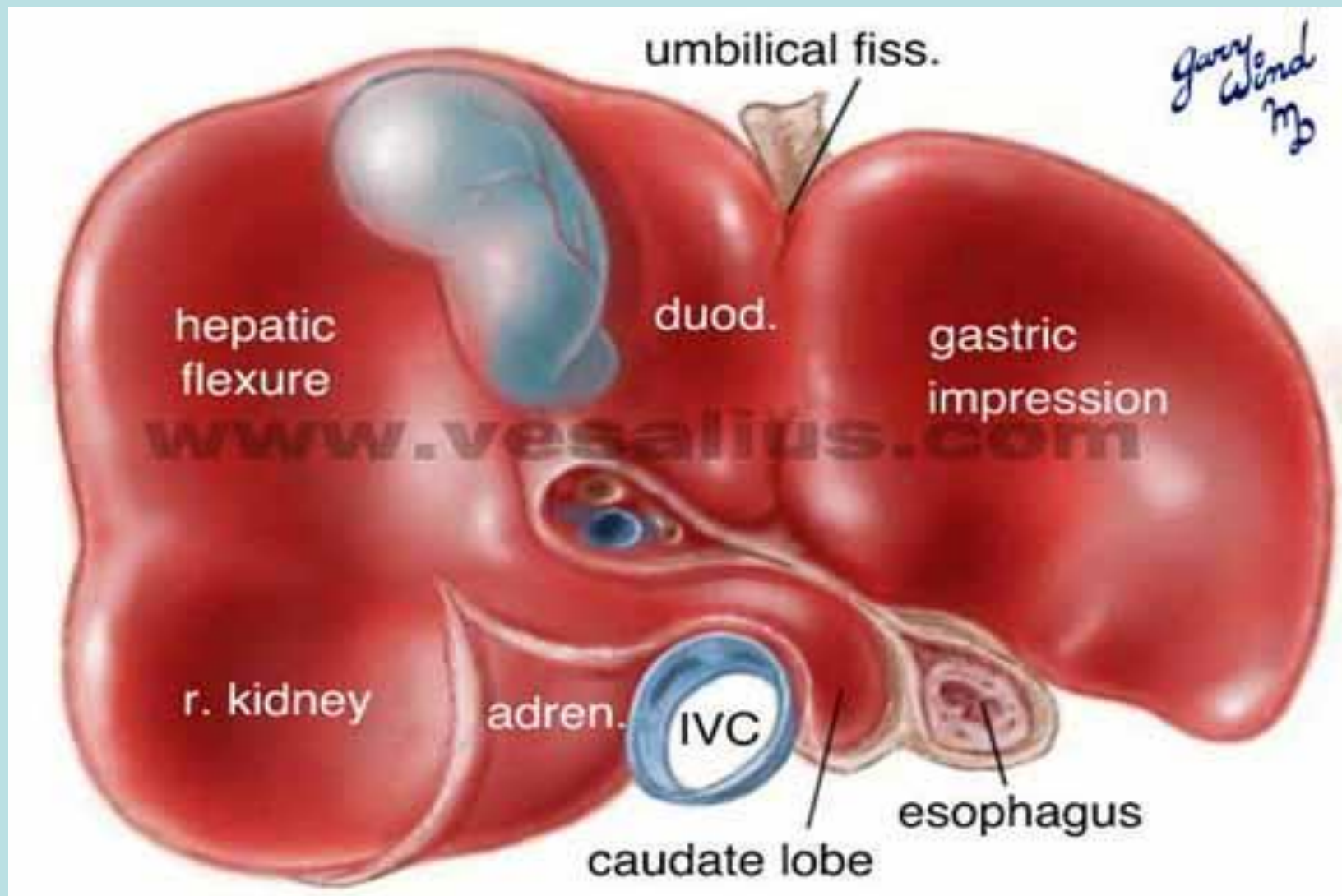
Inferior View (Visceral surface)

- **The inferior surface** (*facies inferior; visceral surface*) is concave, directed downward, backward, and to the left, and is in relation with:
 - the stomach
 - the duodenum
 - the right colic flexure
 - the right kidney and
 - suprarenal gland.
- The surface is almost completely invested by peritoneum; the only parts devoid of this covering are where the gall-bladder is attached to the liver, and at the porta hepatis where the two layers of the lesser omentum are separated from each other by the bloodvessels and ducts of the liver.

- The inferior surface of the left lobe presents behind and to the left **the gastric impression**, moulded over the antero-superior surface of the stomach, and to the right of this a rounded eminence, **the tuber omentale**, which fits into the concavity of the lesser curvature of the stomach and lies in front of the anterior layer of the lesser omentum.
- The under surface of the right lobe is divided into two unequal portions by the fossa for the gall-bladder; the portion to the left, the smaller of the two, is **the quadrate lobe**, and is in relation with the pyloric end of the stomach, the superior portion of the duodenum, and the transverse colon.



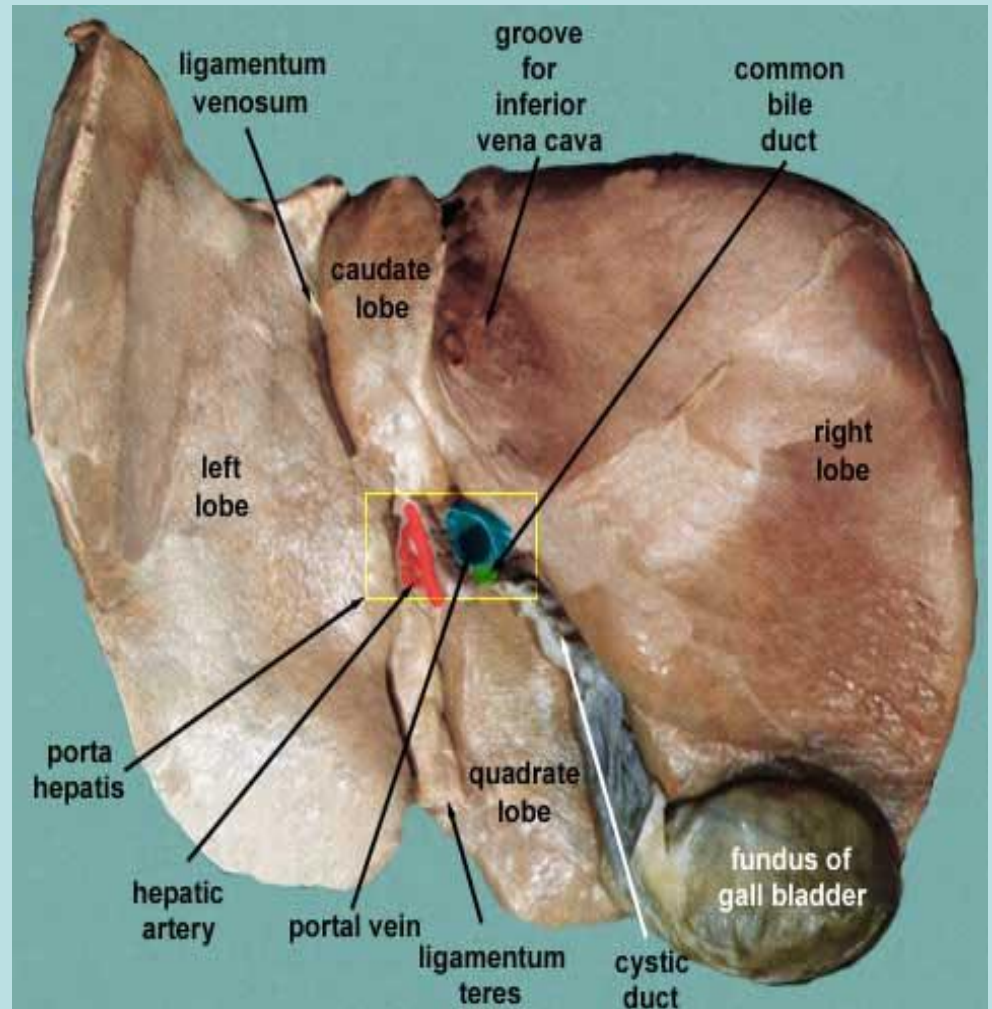
Garry Wind
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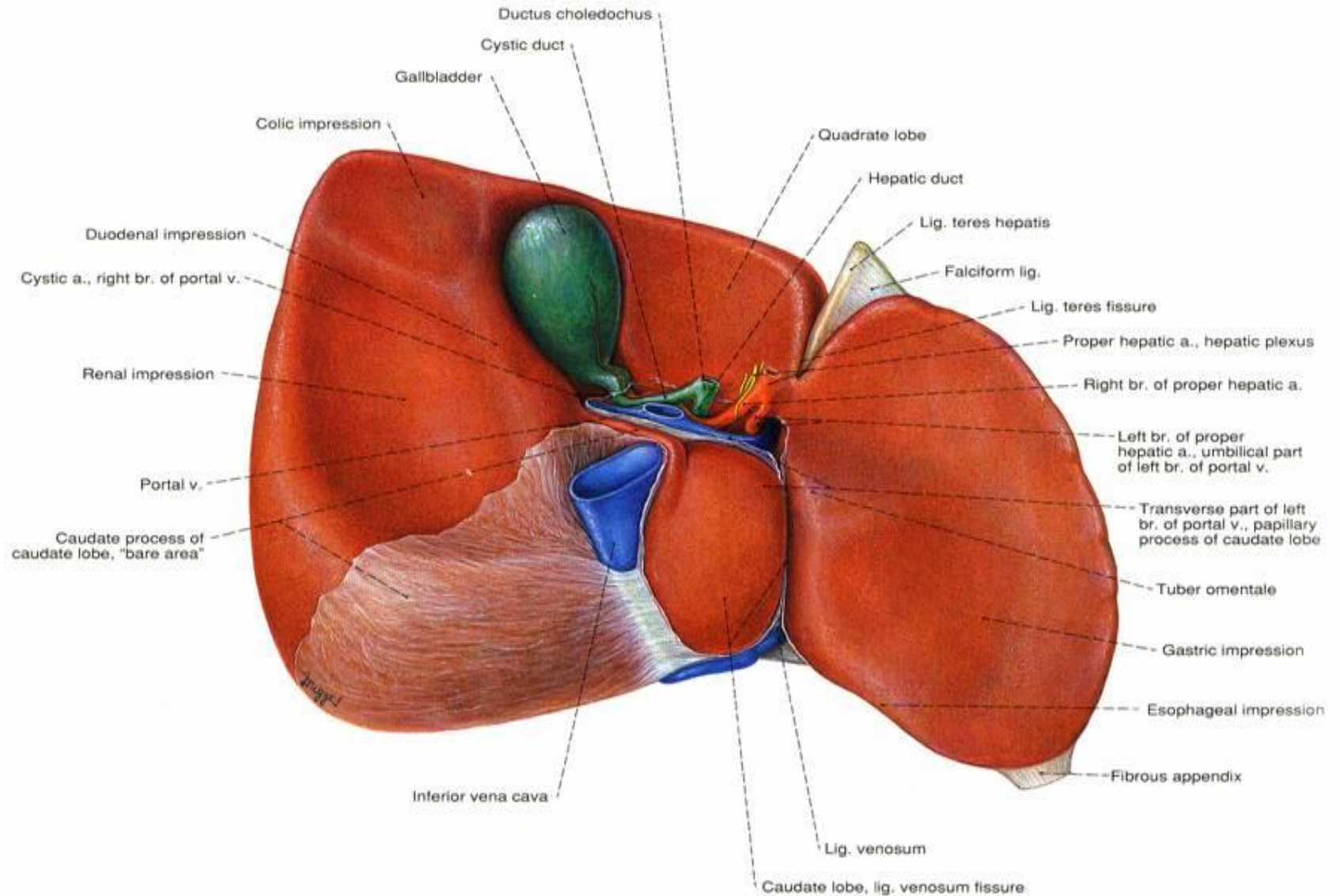
- The portion of the under surface of the right lobe to the right of the fossa for the gall-bladder presents two impressions, one situated behind the other, and separated by a ridge.
- The anterior of these two impressions, **the colic impression**, is shallow and is produced by the right colic flexure;
- the posterior, **the renal impression**, is deeper and is occupied by the upper part of the right kidney and lower part of the right suprarenal gland.
- Medial to the renal impression is a third and slightly marked impression, lying between it and the neck of the gall-bladder.
- This is caused by the descending portion of the duodenum, and is known as **the duodenal impression**.
- Just in front of the inferior vena cava is a narrow strip of liver tissue, **the caudate process**, which connects the right inferior angle of the caudate lobe to the under surface of the right lobe.
- It forms the upper boundary of the epiploic foramen of the peritoneum.

The inferior surface of the liver

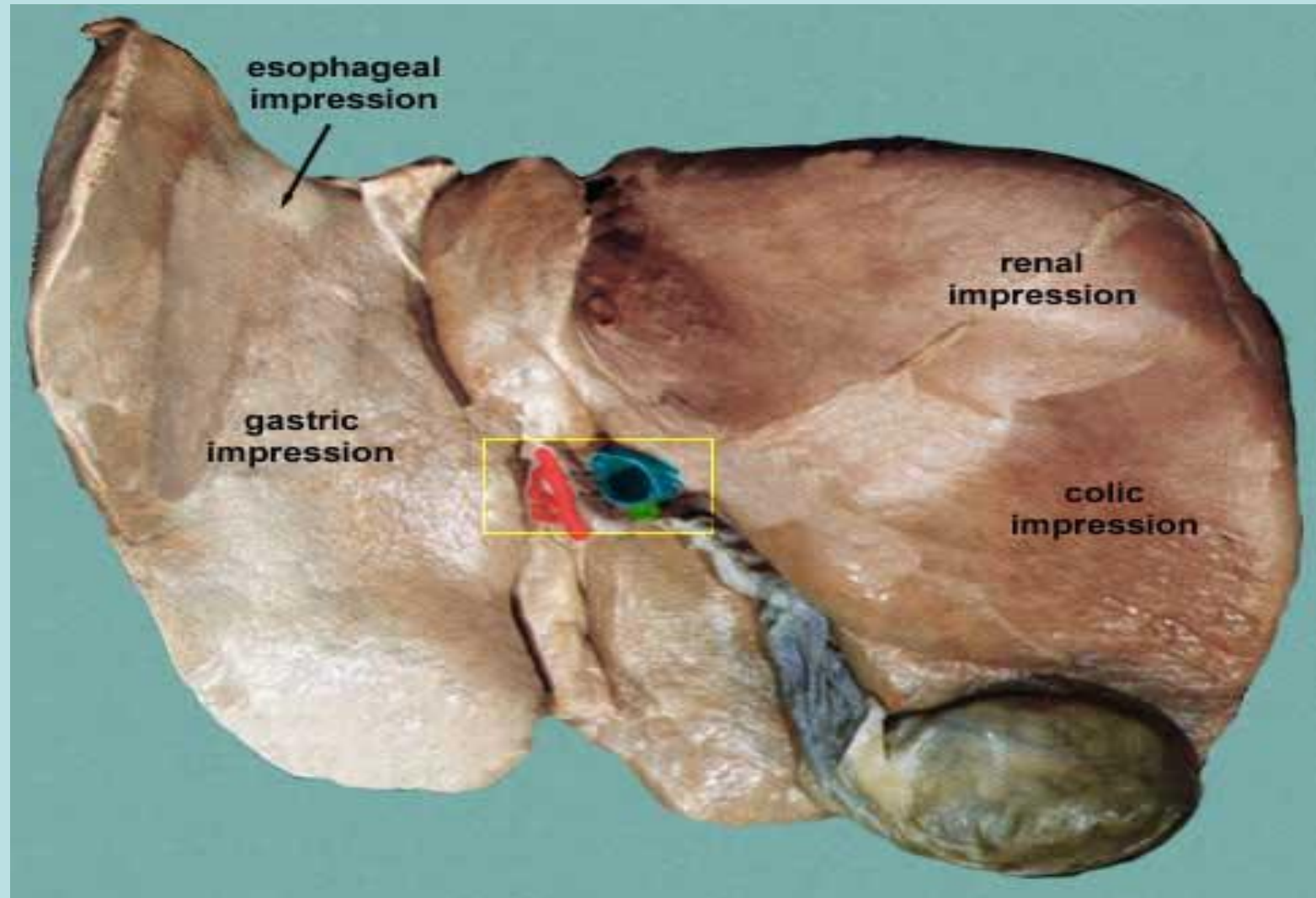
1. right lobe
2. fundus of the gall bladder
3. cystic duct
4. portal vein
5. hepatic arteries
6. common bile duct
7. quadrate lobe
8. ligamentum teres
9. left lobe
10. ligamentum venosum and its groove
11. caudate lobe
12. groove for the inferior vena cava and the cut hepatic veins within it
porta hepatis outline in yellow.
The area where the arteries, ducts and portal vein enter and leave the liver.



VISCERAL SURFACE



Relationship of the visceral aspect of the liver to other abdominal viscera



- The **posterior surface** (*facies posterior*) is rounded and broad behind the right lobe, but narrow on the left.
- Over a large part of its extent it is not covered by peritoneum;
- this uncovered portion is about 7.5 cm. broad at its widest part, and is in direct contact with the diaphragm.
- It is marked off from the upper surface by the line of reflection of the upper layer of the coronary ligament, and from the under surface by the line of reflection of the lower layer of the coronary ligament.
- The central part of the posterior surface presents a deep concavity which is moulded on the vertebral column and crura of the diaphragm.
- To the right of this the inferior vena cava is lodged in its fossa between the uncovered area and the caudate lobe.

- Close to the right of this fossa and immediately above the renal impression is a small triangular depressed area, **the suprarenal impression**, the greater part of which is devoid of peritoneum; it lodges the right suprarenal gland.
- To the left of the inferior vena cava is **the caudate lobe**, which lies between the fossa for the vena cava and the fossa for the ductus venosus.
- Its lower end projects and forms part of the posterior boundary of the porta; on the right, it is connected with the under surface of the right lobe of the liver by the **caudate process**.
- Its posterior surface rests upon the diaphragm, being separated from it merely by the upper part of the omental bursa.
- To the left of the fossa for the ductus venosus is a groove in which lies the antrum cardiacum of the oesophagus.

- **The anterior border** (*margo anterior*) is thin and sharp, and marked opposite the attachment of the falciform ligament by a deep notch, **the umbilical notch**, and opposite the cartilage of the ninth rib by a second notch for the fundus of the gall-bladder.
- In adult males this border generally corresponds with the lower margin of the thorax in the right mammillary line; but in women and children it usually projects below the ribs.
- **The left extremity of the liver** is thin and flattened from above downward.

- **Fossæ**
- The **left sagittal fossa** (*fossa sagittalis sinistra; longitudinal fissure*) is a deep groove, which extends from the notch on the anterior margin of the liver to the upper border of the posterior surface of the organ; it separates the right and left lobes.
- The porta joins it, at right angles, and divides it into two parts.
- The anterior part, or **fossa for the umbilical vein**, lodges the umbilical vein in the foetus, and its remains (the ligamentum teres) in the adult;
- The posterior part, or **fossa for the ductus venosus**, lies between the left lobe and the caudate lobe;
- it lodges in the foetus, the ductus venosus, and in the adult a slender fibrous cord, **the ligamentum venosum**, the obliterated remains of that vessel.

- **The fossa for the gall-bladder** (*fossa vesicæ felleæ*) is a shallow, oblong fossa, placed on the under surface of the right lobe, parallel with the left sagittal fossa.
- It extends from the anterior free margin of the liver, which is notched by it, to the right extremity of the porta.
- **The fossa for the inferior vena cava** (*fossa venæ cavæ*) is a short deep depression, occasionally a complete canal in consequence of the substance of the liver surrounding the vena cava.
- It extends obliquely upward on the posterior surface between the caudate lobe and the bare area of the liver, and is separated from the porta by the caudate process.
- On slitting open the inferior vena cava the orifices of the hepatic veins will be seen opening into this vessel at its upper part, after perforating the floor of this fossa.

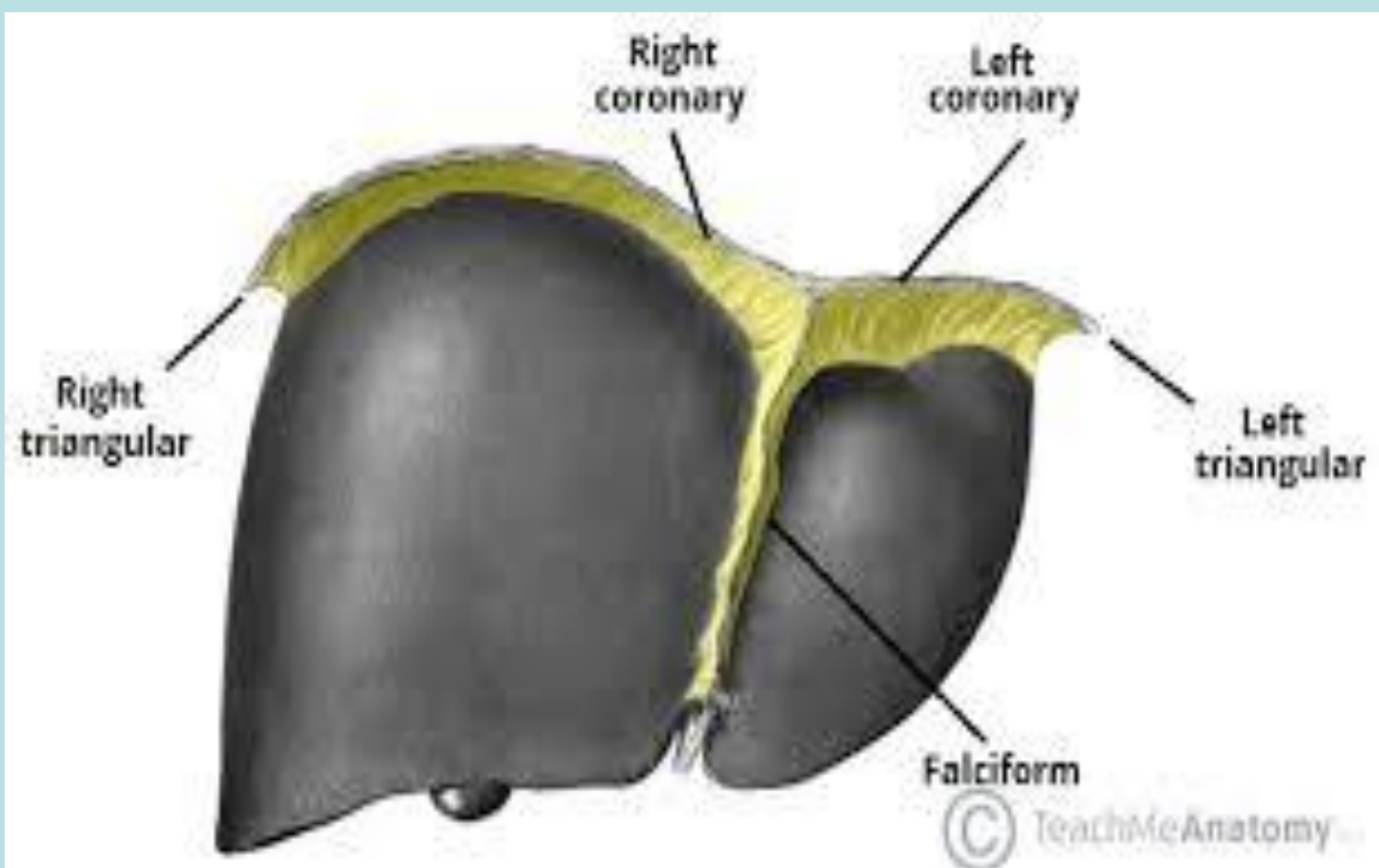
- **Lobes**
- **The right lobe** (*lobus hepatis dexter*) is much larger than the left; the proportion between them being as six to one. It occupies the right hypochondrium, and is separated from the left lobe on its upper surface by the falciform ligament;
- on its under and posterior surfaces by the left sagittal fossa; and in front by the umbilical notch.
- It is of a somewhat quadrilateral form, its inferior and posterior surfaces being marked by three fossæ: the porta and the fossæ for the gall-bladder and inferior vena cava, which separate its left part into two smaller lobes; **the quadrate and caudate lobes.**
- **The quadrate lobe** (*lobus quadratus*) is situated on the inferior surface of the right lobe, bounded in front by the anterior margin of the liver; behind by the porta hepatis;
- on the right, by the fossa for the gall-bladder; and on the left, by the fossa for the umbilical vein.

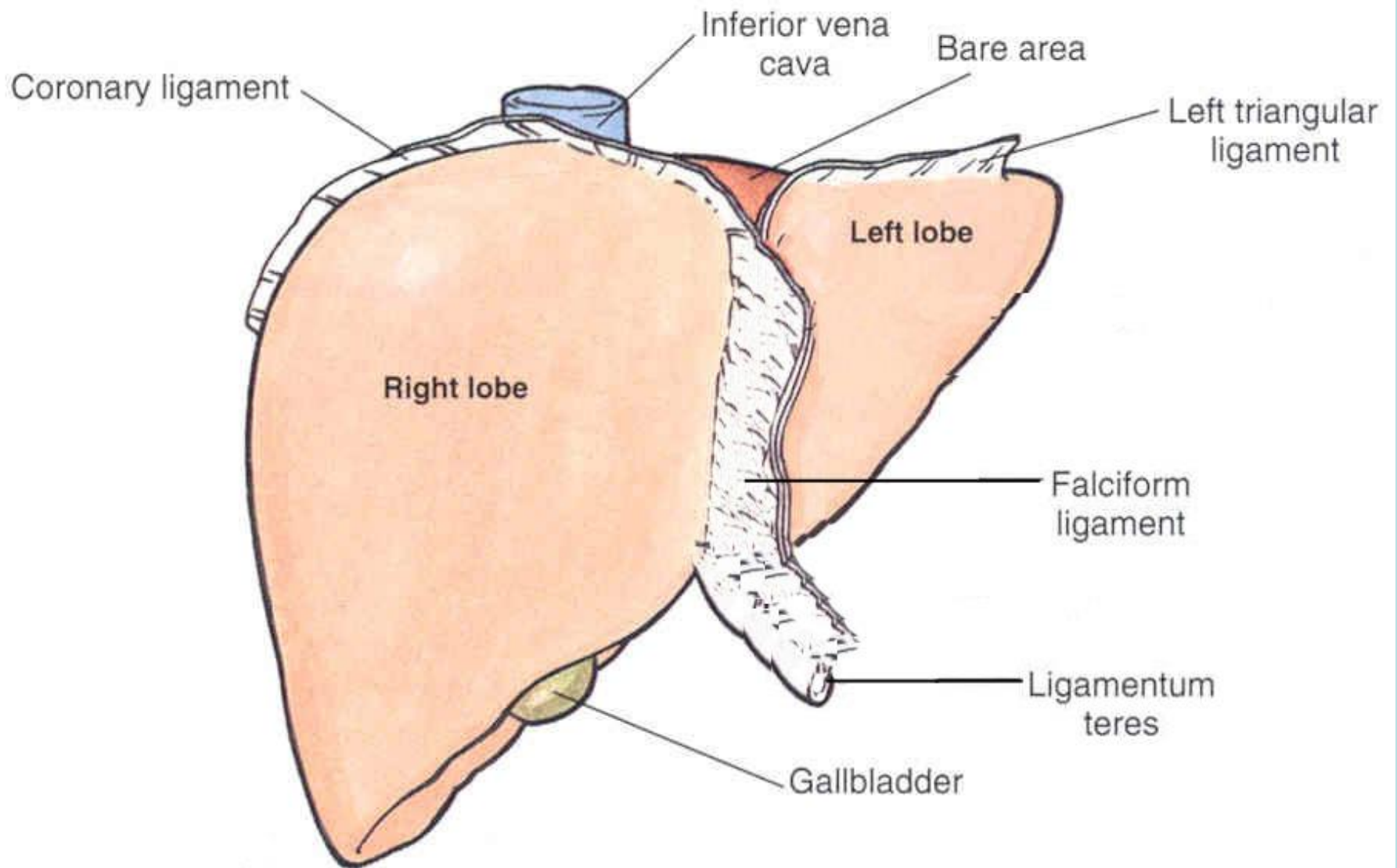
- **The caudate lobe** (*lobus caudatus*; *Spigelian lobe*) is situated upon the posterior surface of the right lobe of the liver, opposite the tenth and eleventh thoracic vertebræ.
- It is bounded, below, by the porta; on the right, by the fossa for the inferior vena cava; and, on the left, by the fossa for the ductus venosus.
- It looks backward, being nearly vertical in position; it is longer from above downward than from side to side, and is somewhat concave in the transverse direction.
- **The caudate process** is a small elevation of the hepatic substance extending obliquely lateralward, from the lower extremity of the caudate lobe to the under surface of the right lobe.
- It is situated behind the porta, and separates the fossa for the gall-bladder from the commencement of the fossa for the inferior vena cava.

- **The left lobe** (*lobus hepatis sinister*) is smaller and more flattened than the right. It is situated in the epigastric and left hypochondriac regions.
- Its upper surface is slightly convex and is moulded onto the diaphragm;
- its under surface presents the gastric impression and omental tuberosity

- **Ligaments**

- The liver is connected to the under surface of the diaphragm and to the anterior wall of the abdomen by five ligaments;
- four of these— **the falciform, the coronary, and the two lateral** —are peritoneal folds; the fifth, the **round ligament**, is a fibrous cord, the obliterated umbilical vein.
- The liver is also attached to the lesser curvature of the stomach by the hepatogastric and to the duodenum by the hepatoduodenal ligament.
- **The falciform ligament** (*ligamentum falciforme hepatis*) is a broad and thin antero-posterior peritoneal fold, falciform in shape, its base being directed downward and backward, its apex upward and backward.
- It is situated in an antero-posterior plane, but lies obliquely so that one surface faces forward and is in contact with the peritoneum behind the right Rectus and the diaphragm, while the other is directed backward and is in contact with the left lobe of the liver.
- It is attached by its left margin to the under surface of the diaphragm, and the posterior surface of the sheath of the right Rectus as low down as the umbilicus;
- by its right margin it extends from the notch on the anterior margin of the liver, as far back as the posterior surface.
- It is composed of two layers of peritoneum closely united together. Its base or free edge contains between its layers the round ligament and the parumbilical veins.





- **3. The bile ducts** commence by little passages in the liver cells which communicate with canaliculi termed **intercellular biliary passages** (*bile capillaries*).
- These passages are merely little channels or spaces left between the contiguous surfaces of two cells, or in the angle where three or more liver cells meet and they are always separated from the blood capillaries by at least half the width of a liver cell.
- The channels thus formed radiate to the circumference of the lobule, and open into the interlobular bile ducts which run in Glisson's capsule, accompanying the portal vein and hepatic artery.
- These join with other ducts to form two main trunks, which leave the liver at the transverse fissure, and by their union form **the hepatic duct**.

- **Excretory Apparatus of the Liver**
- The excretory apparatus of the liver consists of
- (1) the **hepatic duct**, formed by the junction of the two main ducts, which pass out of the liver at the porta;
- (2) the **gall-bladder**, which serves as a reservoir for the bile;
- (3) the **cystic duct**, or the duct of the gall-bladder;
- and (4) the **common bile duct**, formed by the junction of the hepatic and cystic ducts.

- **The Hepatic Duct (*ductus hepaticus*)**
- Two main trunks of nearly equal size issue from the liver at the porta, one from the right, the other from the left lobe;
- these unite to form the hepatic duct, which passes downward and to the right for about 4 cm., between the layers of the lesser omentum, where it is joined at an acute angle by the cystic duct, and so forms the common bile duct.
- The hepatic duct is accompanied by the hepatic artery and portal vein.

- **The Gall-bladder** (*vesica fellea*)
- The gall-bladder is a conical or pear-shaped musculomembranous sac, lodged in a fossa on the under surface of the right lobe of the liver, and extending from near the right extremity of the porta to the anterior border of the organ.
- It is divided into a fundus, body, and neck.
- **The fundus**, or broad extremity, is directed downward, forward, and to the right, and projects beyond the anterior border of the liver;
- **the body and neck** are directed upward and backward to the left.
- The upper surface of the gall-bladder is attached to the liver by connective tissue and vessels.
- The under surface is covered by peritoneum, which is reflected on to it from the surface of the liver.

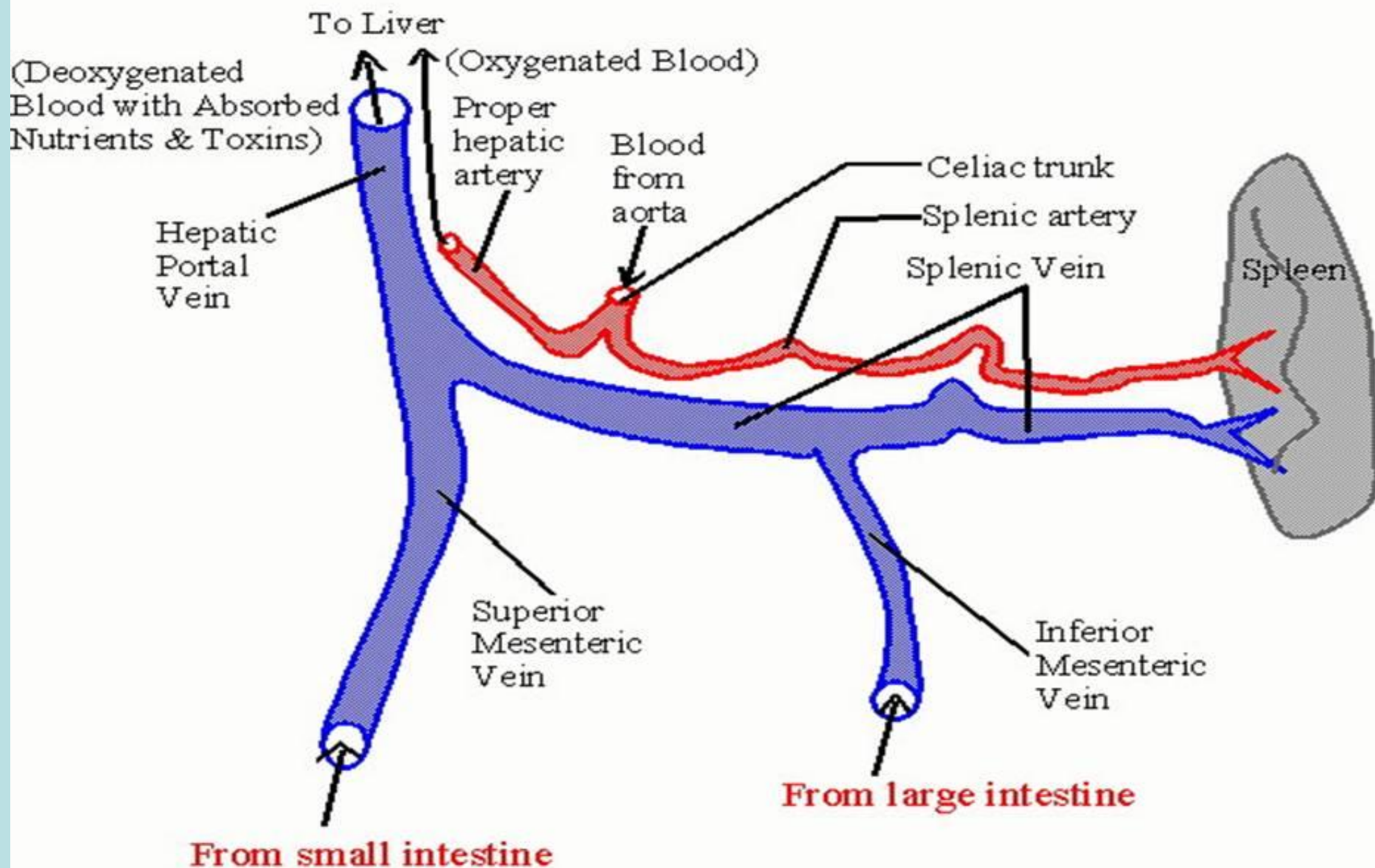
- **Relations**
- **The body** is in relation, by its upper surface, with the liver;
- by its under surface, with the commencement of the transverse colon;
- with the upper end of the descending portion of the duodenum, but sometimes with the superior portion of the duodenum or pyloric end of the stomach.
- **The fundus** is completely invested by peritoneum;
- it is in relation, in front, with the abdominal wall,
- **The neck** at its point of connection with the cystic duct it presents a well-marked constriction.

- **Structure**
- The gall-bladder consists of three coats: **serous, fibromuscular, and mucous.**
- The **external or serous coat** (*tunica serosa vesicæ felleæ*) is derived from the peritoneum;
- it completely invests the fundus, but covers the body and neck only on their under surfaces.
- The **fibromuscular coat** (*tunica muscularis vesicæ felleæ*),
- The **internal or mucous coat** (*tunica mucosa vesicæ felleæ*)

- **The Cystic Duct** (*ductus cysticus*)
- The cystic duct about 4 cm. long, runs backward, downward, and to the left from the neck of the gall-bladder, and joins the hepatic duct to form the common bile duct.

- **The Common Bile Duct** (*ductus choledochus*)
- The common bile duct is formed by the junction of the cystic and hepatic ducts;
- It descends along the right border of the lesser omentum behind the superior portion of the duodenum, in front of the portal vein, and to the right of the hepatic artery;
- it then runs in a groove near the right border of the posterior surface of the head of the pancreas; here it is situated in front of the inferior vena cava, and is occasionally completely imbedded in the pancreatic substance.
- At its termination it lies for a short distance along the right side of the terminal part of the pancreatic duct and passes with it obliquely between the mucous and muscular coats.
- The two ducts unite and open by a common orifice upon the summit of the duodenal papilla, situated at the medial side of the descending portion of the duodenum, a little below its middle and about 7 to 10 cm. from the pylorus.
- The short tube formed by the union of the two ducts is dilated into an ampulla, **the ampulla of Vater.**

Major Vessels of the Hepatic Portal System



LIVER

Left branch

Right branch

Short gastric veins

SPLEEN

Left gastric vein

PANCREAS

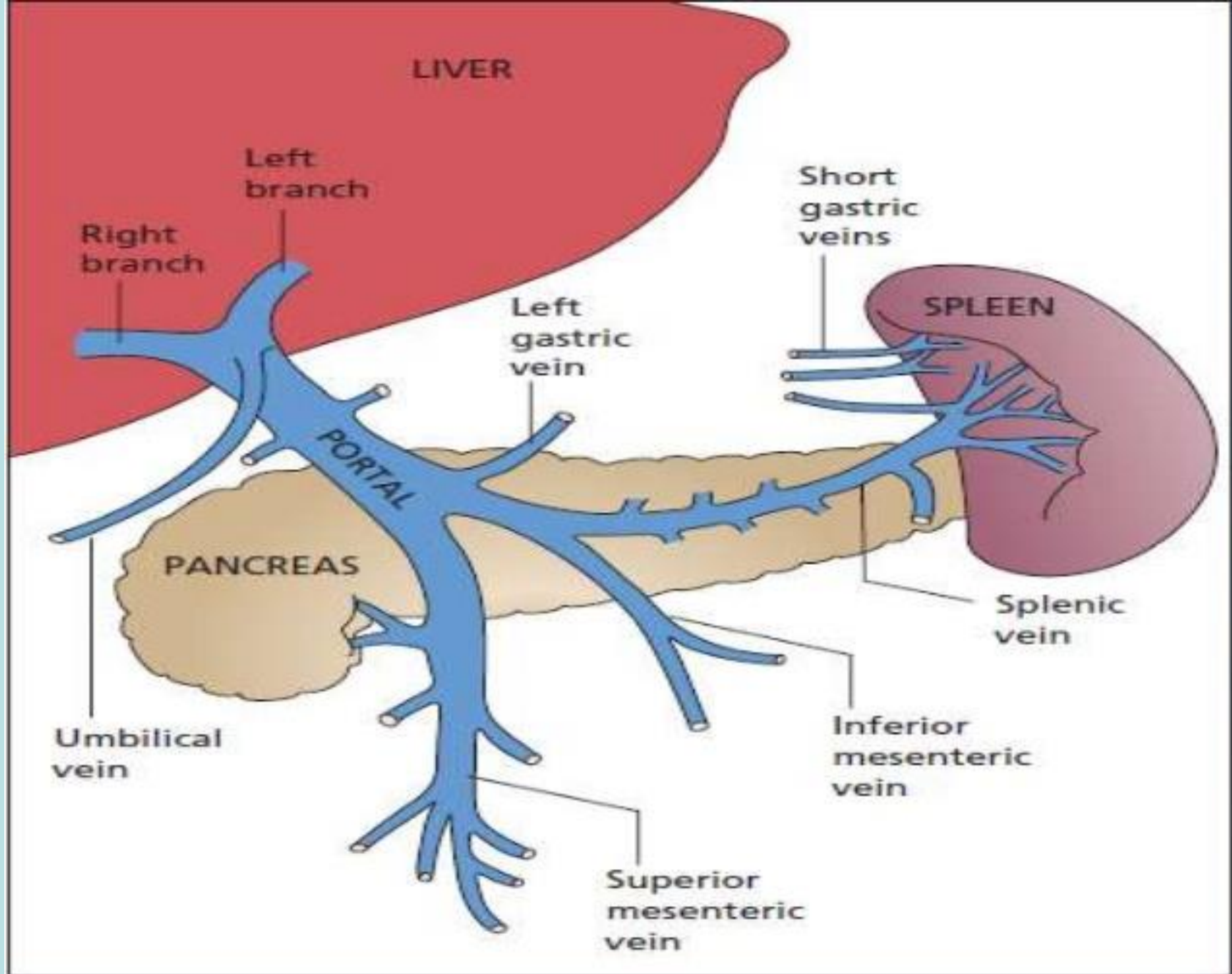
Splenic vein

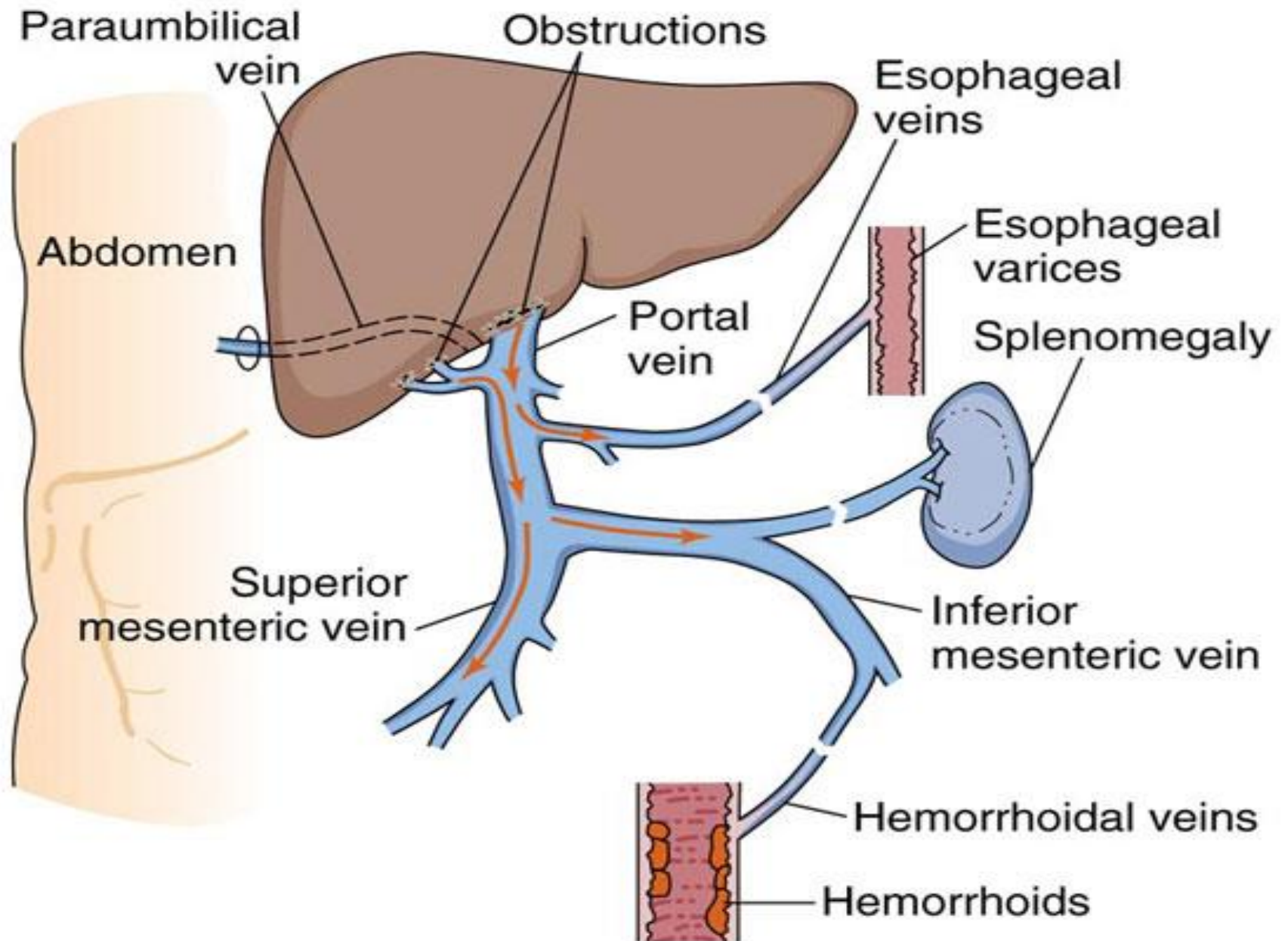
Inferior mesenteric vein

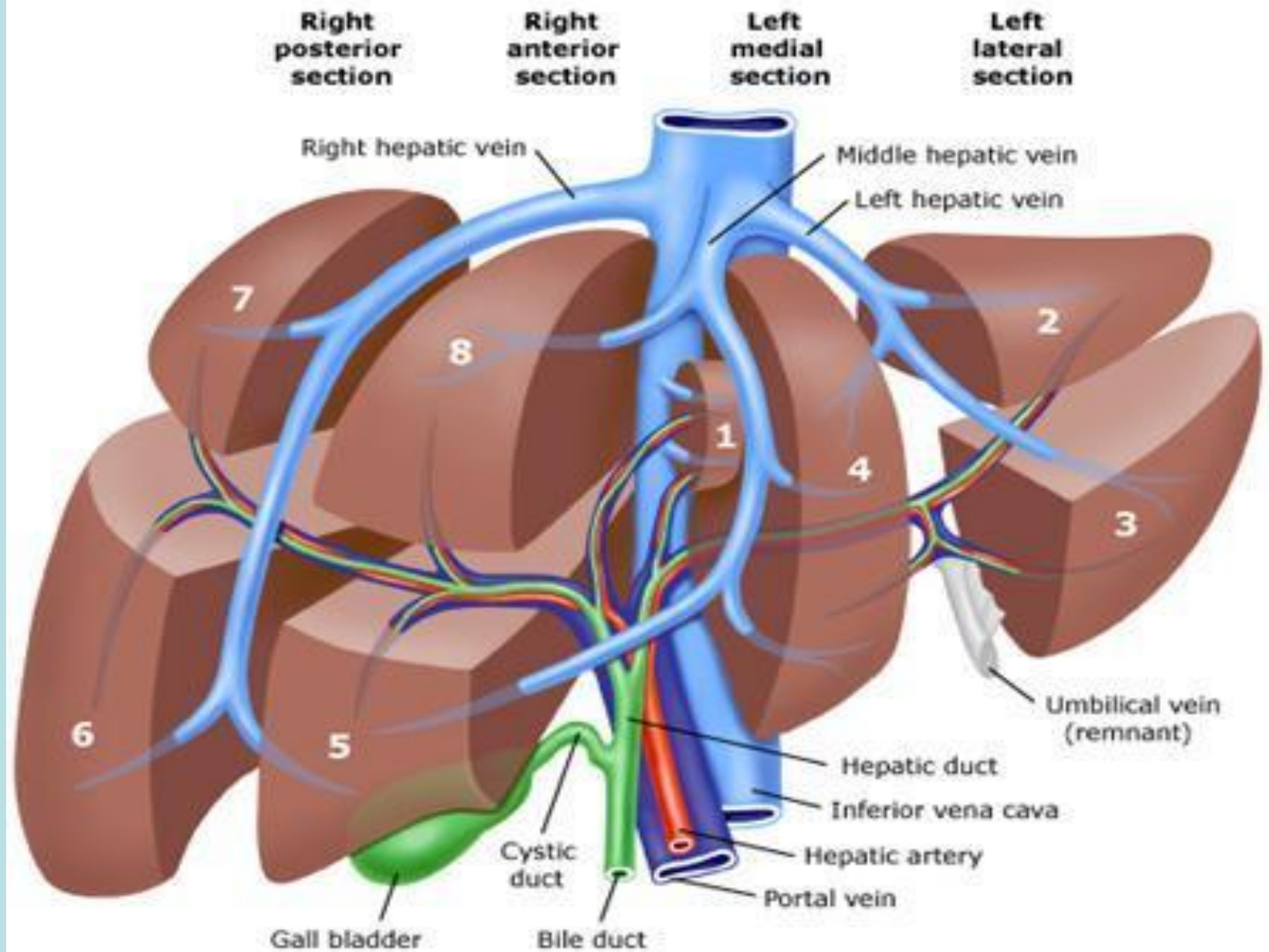
Umbilical vein

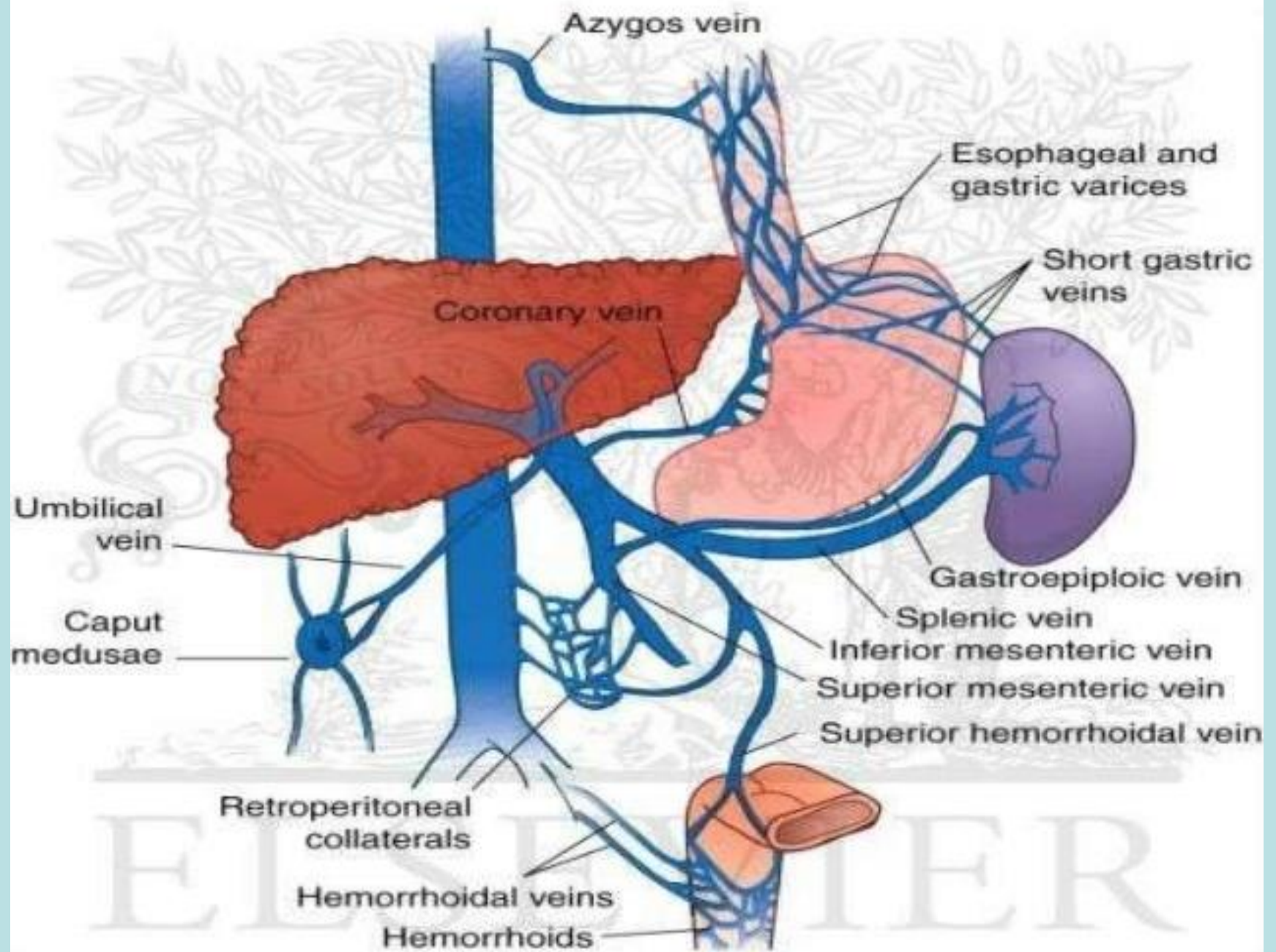
Superior mesenteric vein

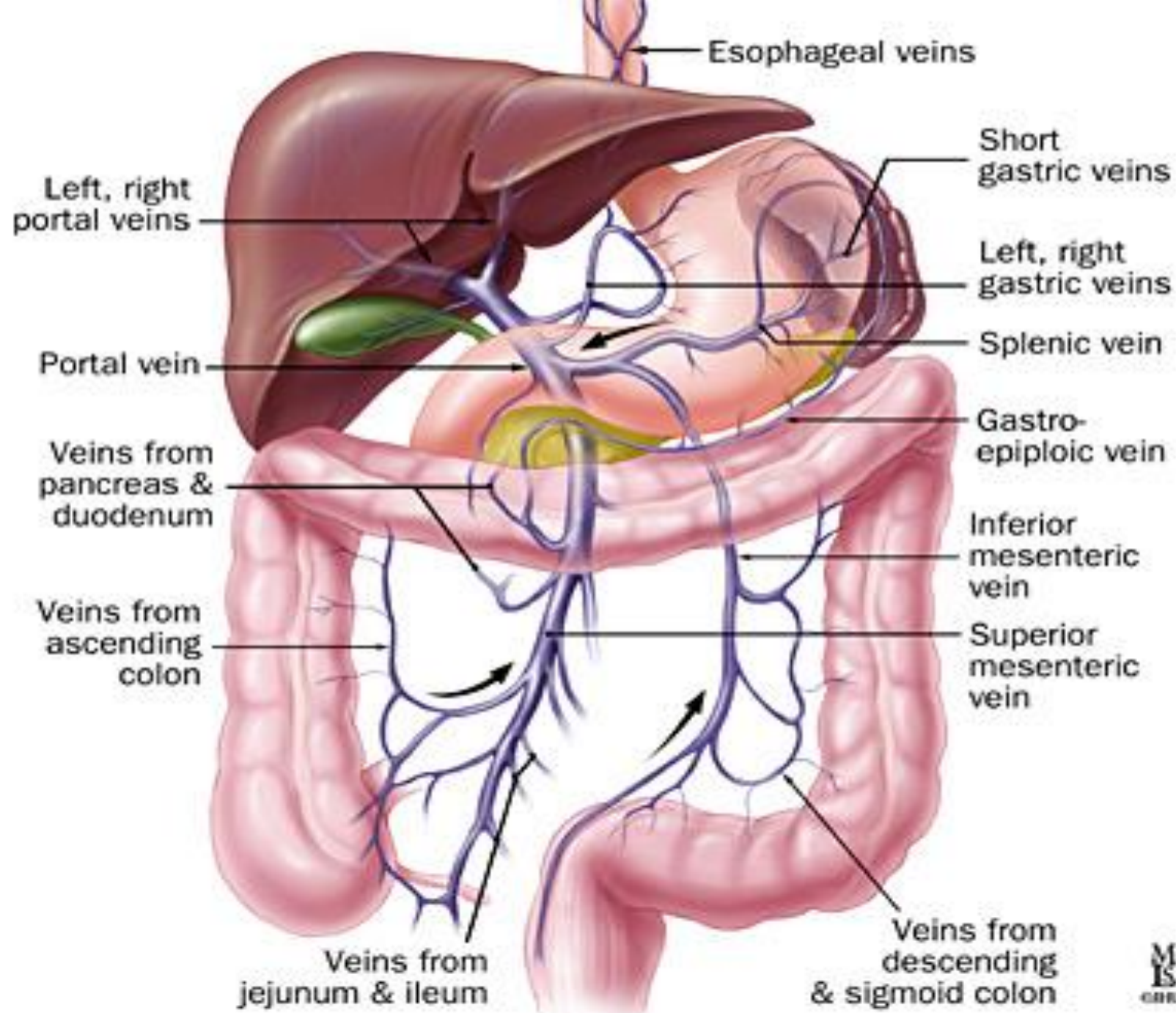
PORTAL









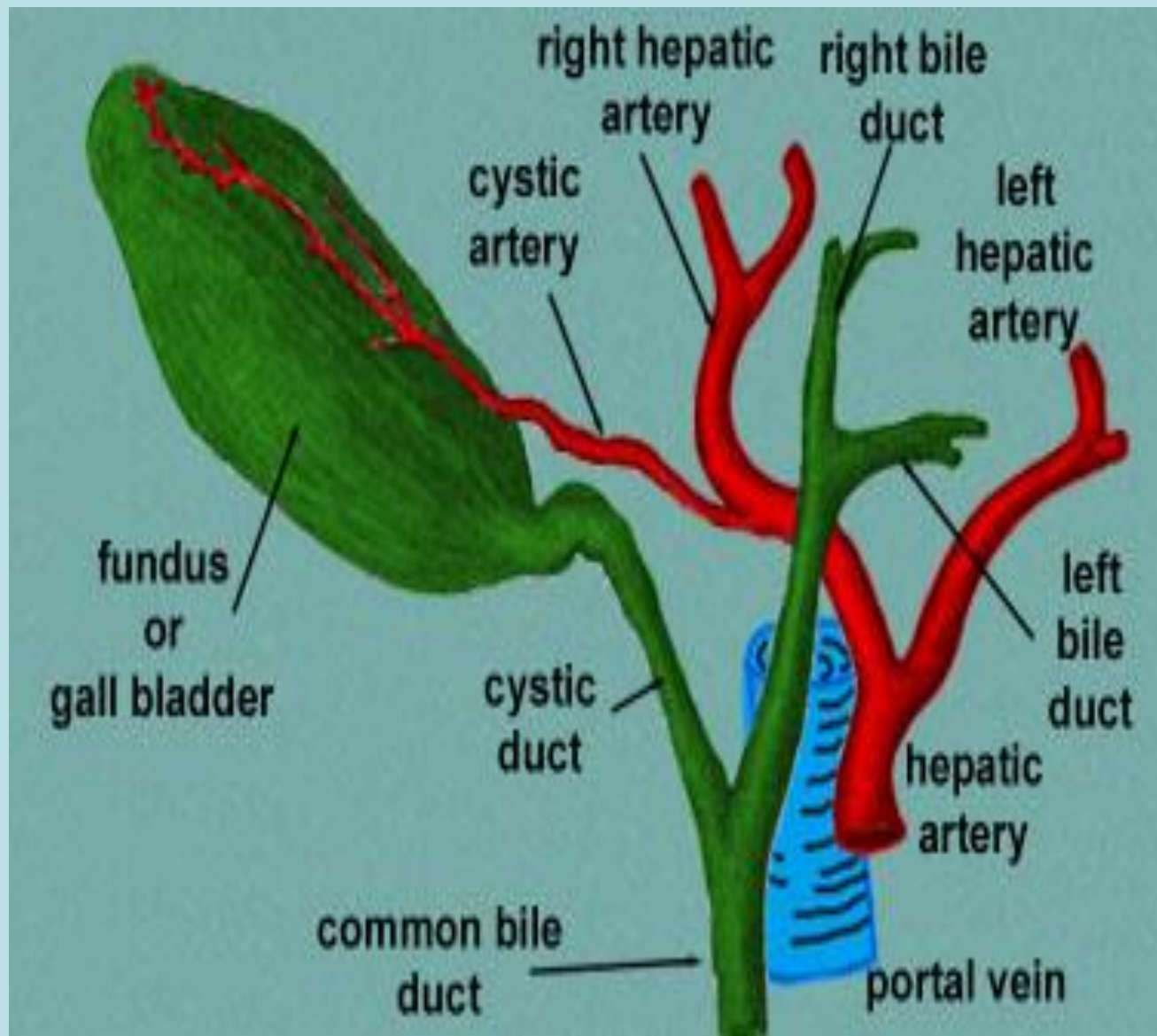


The liver nervous supply

- The **hepatic plexus**, the largest offset from the celiac plexus, receives filaments from the left vagus and right phrenic nerves.
- It accompanies the hepatic artery, ramifying upon its branches, and upon those of the portal vein in the substance of the liver.
- Branches from this plexus accompany all the divisions of the hepatic artery.
- A considerable plexus accompanies the gastrooduodenal artery and is continued as the inferior gastric plexus on the right gastroepiploic artery along the greater curvature of the stomach, where it unites with offshoots from the lienal plexus.

- The liver and its capsule are innervated by sympathetic and parasympathetic nerves via the hepatic plexus, whose fibers enter the liver surrounding the hepatic artery, portal vein and bile duct at the porta hepatis and run with the vessels within the liver structure to the portal triads.
- The sympathetic fibers arise from the thoracic sympathetic chain and reach the liver via the greater and lesser splanchnic nerves and the coeliac plexus.
- The parasympathetic fibers derive from the right and left vagus nerves.

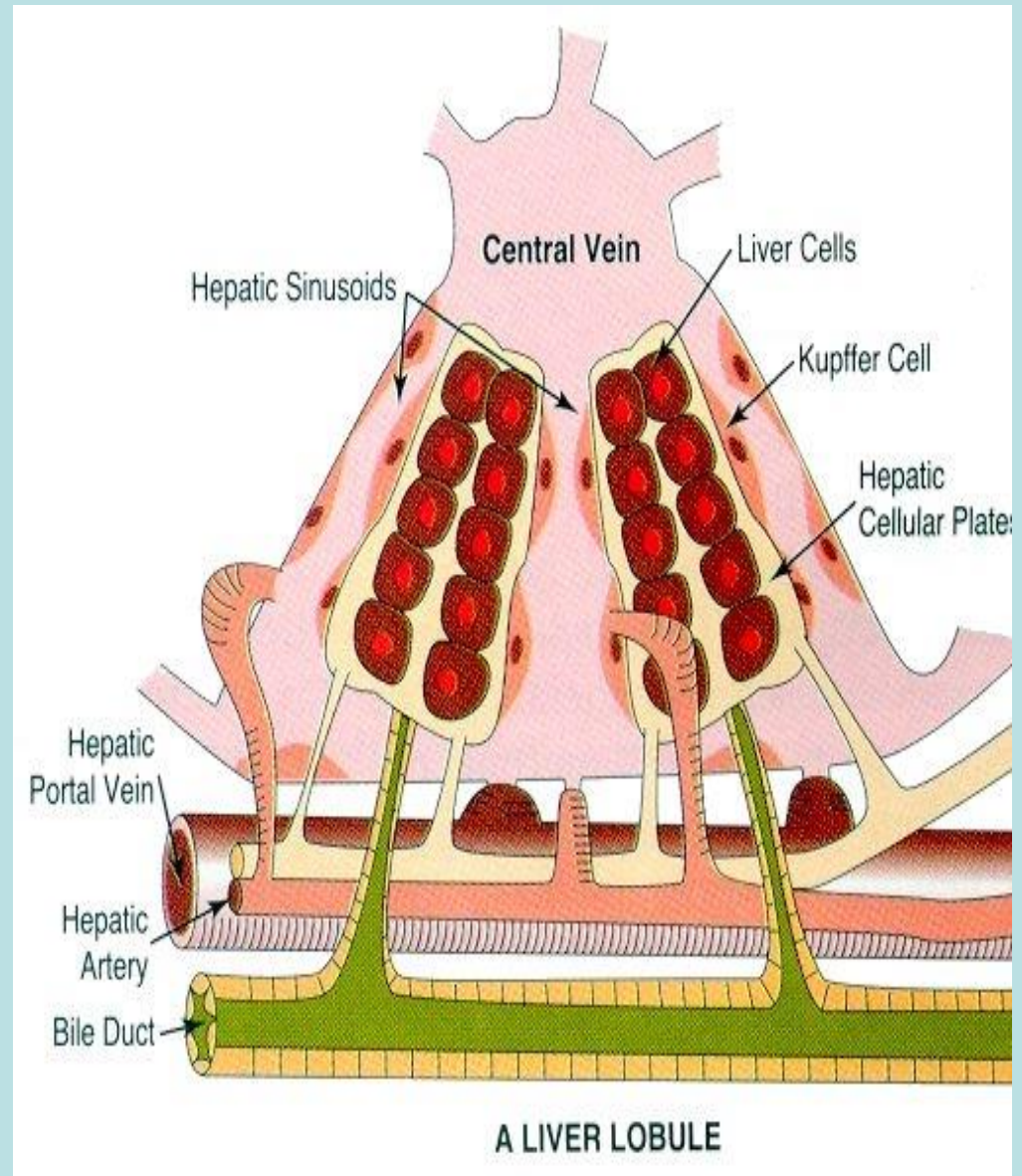
Biliary System



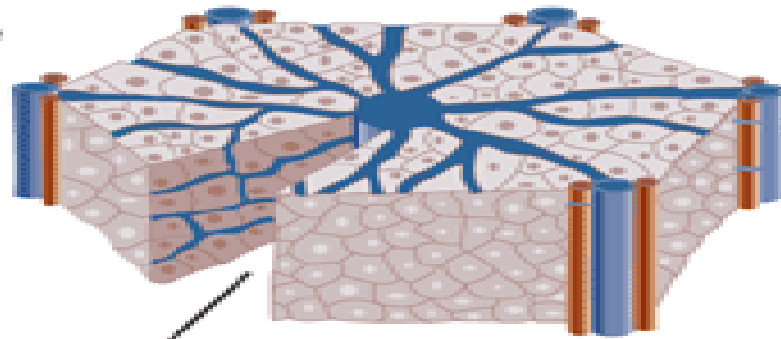
The hepatic lobule

The liver is composed of about 100,000 liver lobules. A lobule is made of plates that contain a number of liver cells. Between these plates of liver cells are the passageways that allow blood to flow around the liver cells. Between the passages and cells are special cells called 'Kupffer' cells, that can digest bacteria and other foreign matter found in the blood.

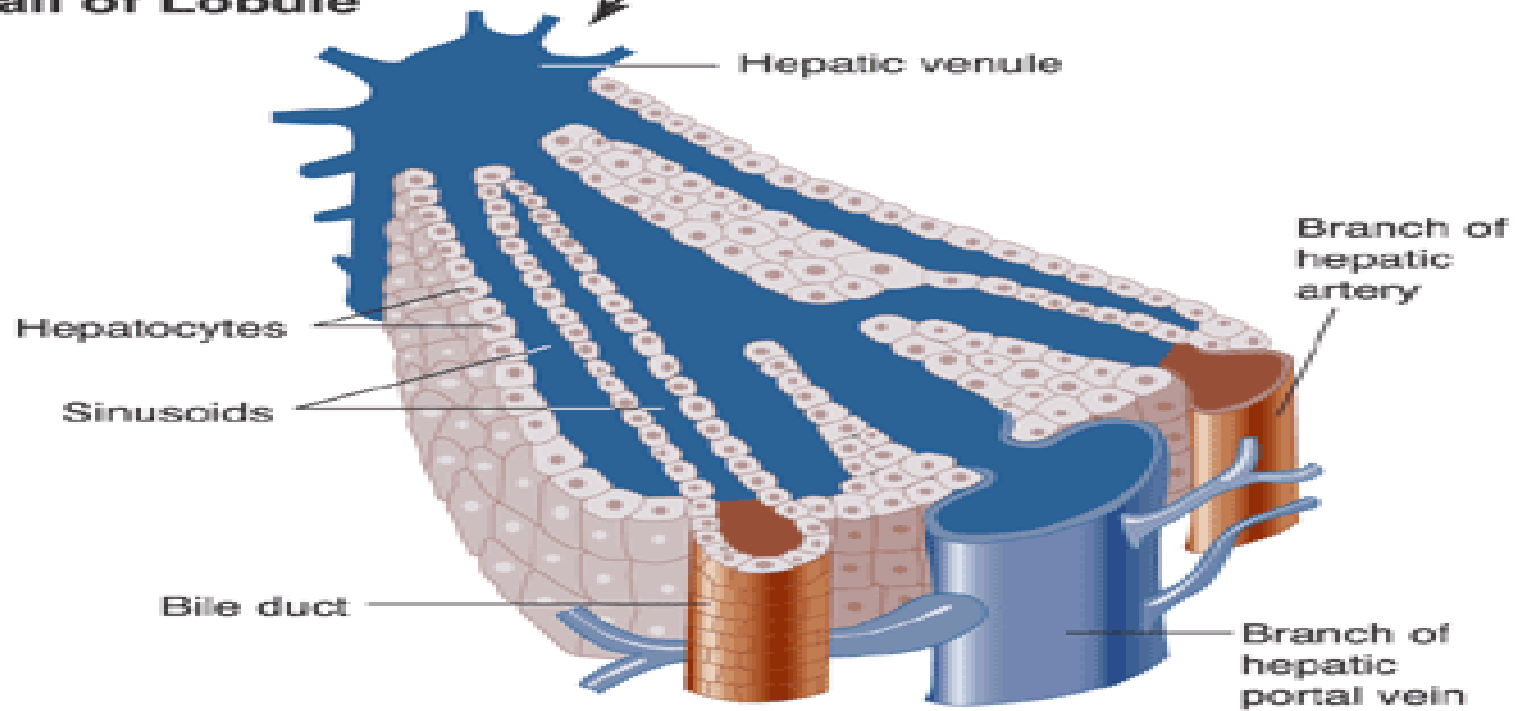
(After WebMD, LLC, 2005-2010)



Liver Lobule

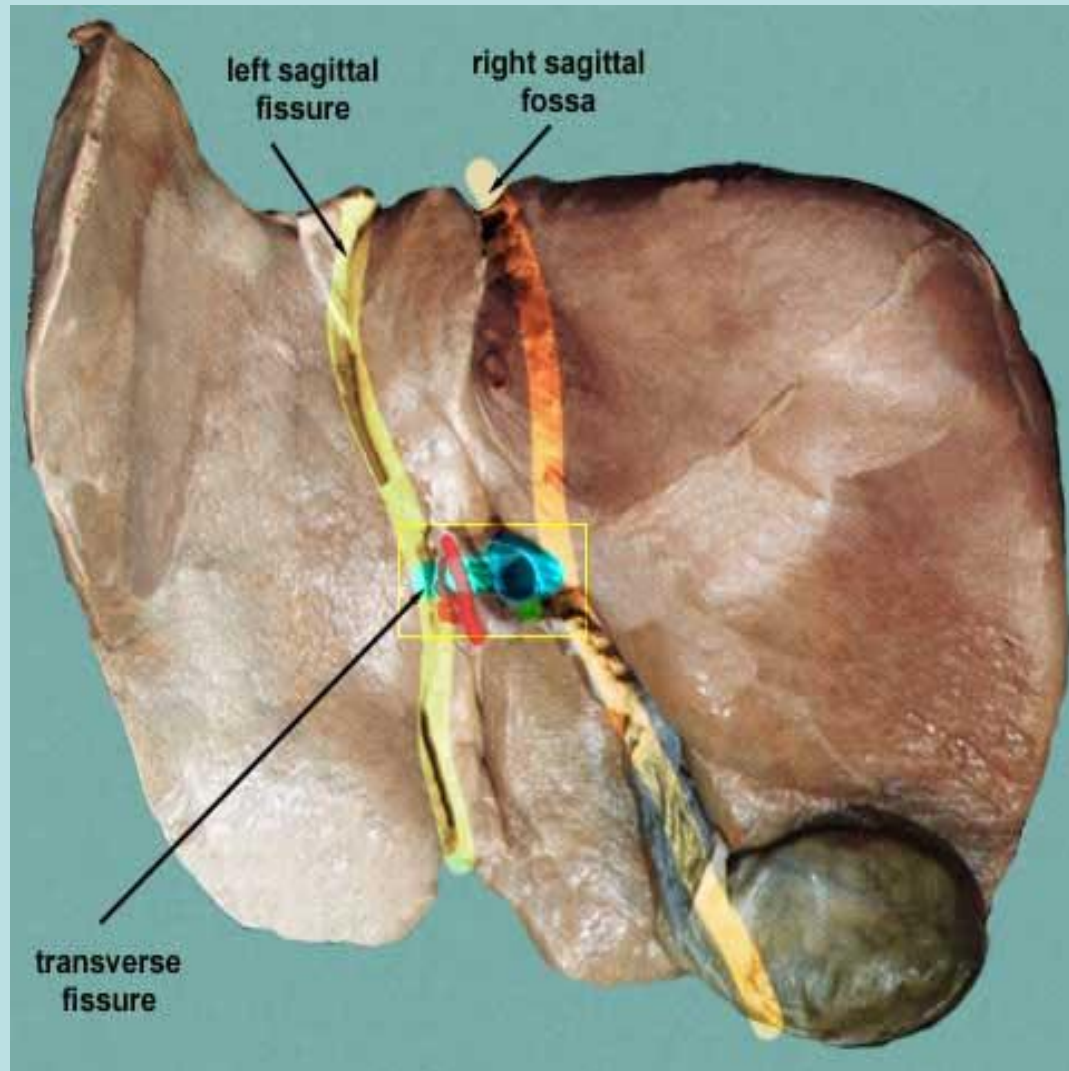


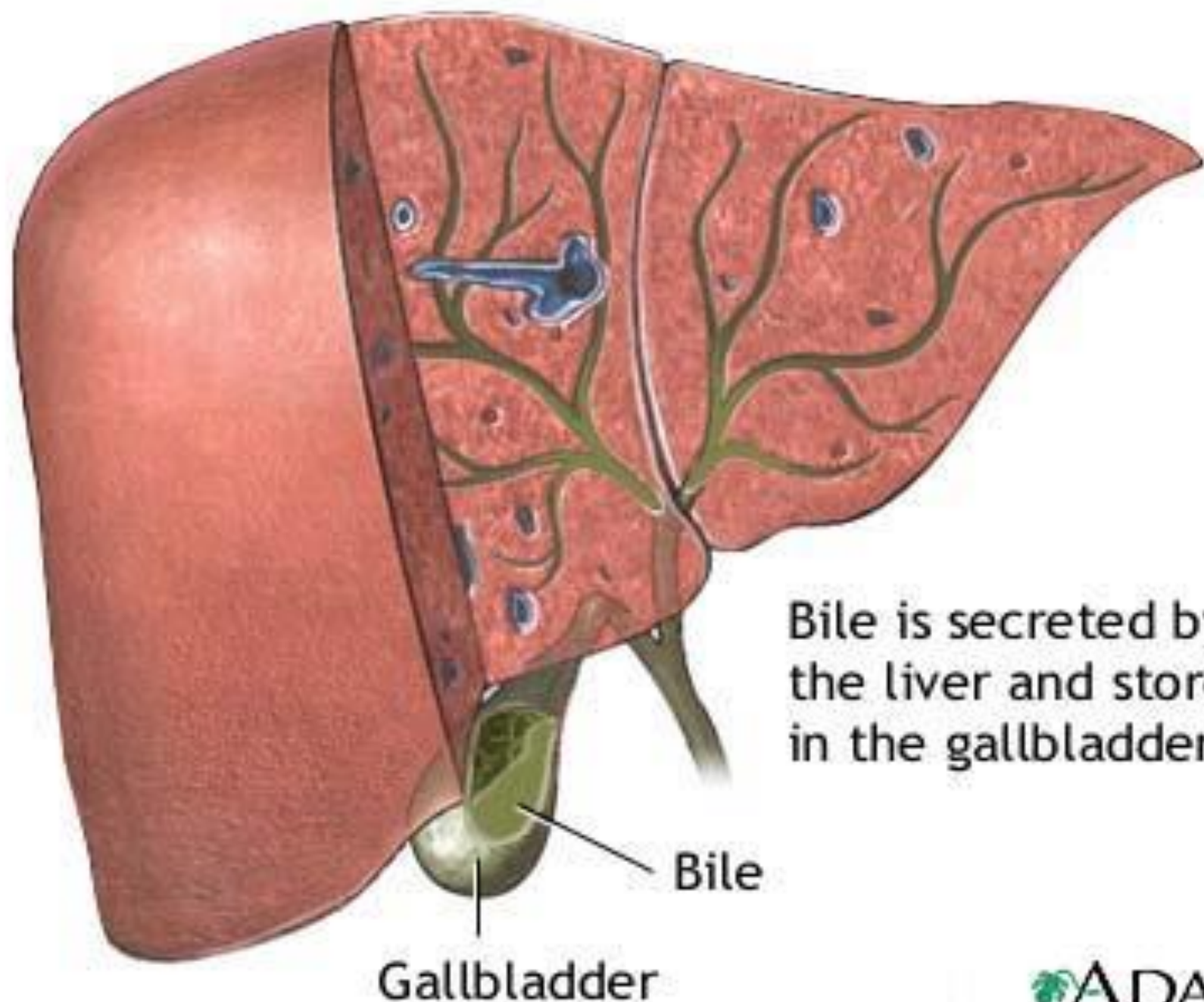
Detail of Lobule



(After WebMD, LLC, 2005-2010)

Lobes of the liver





Bile is secreted by the liver and stored in the gallbladder

Gallbladder

Bile

Anatomy of the Gallbladder

Right lobe
of liver

Left lobe
of liver

Right and
left hepatic
ducts

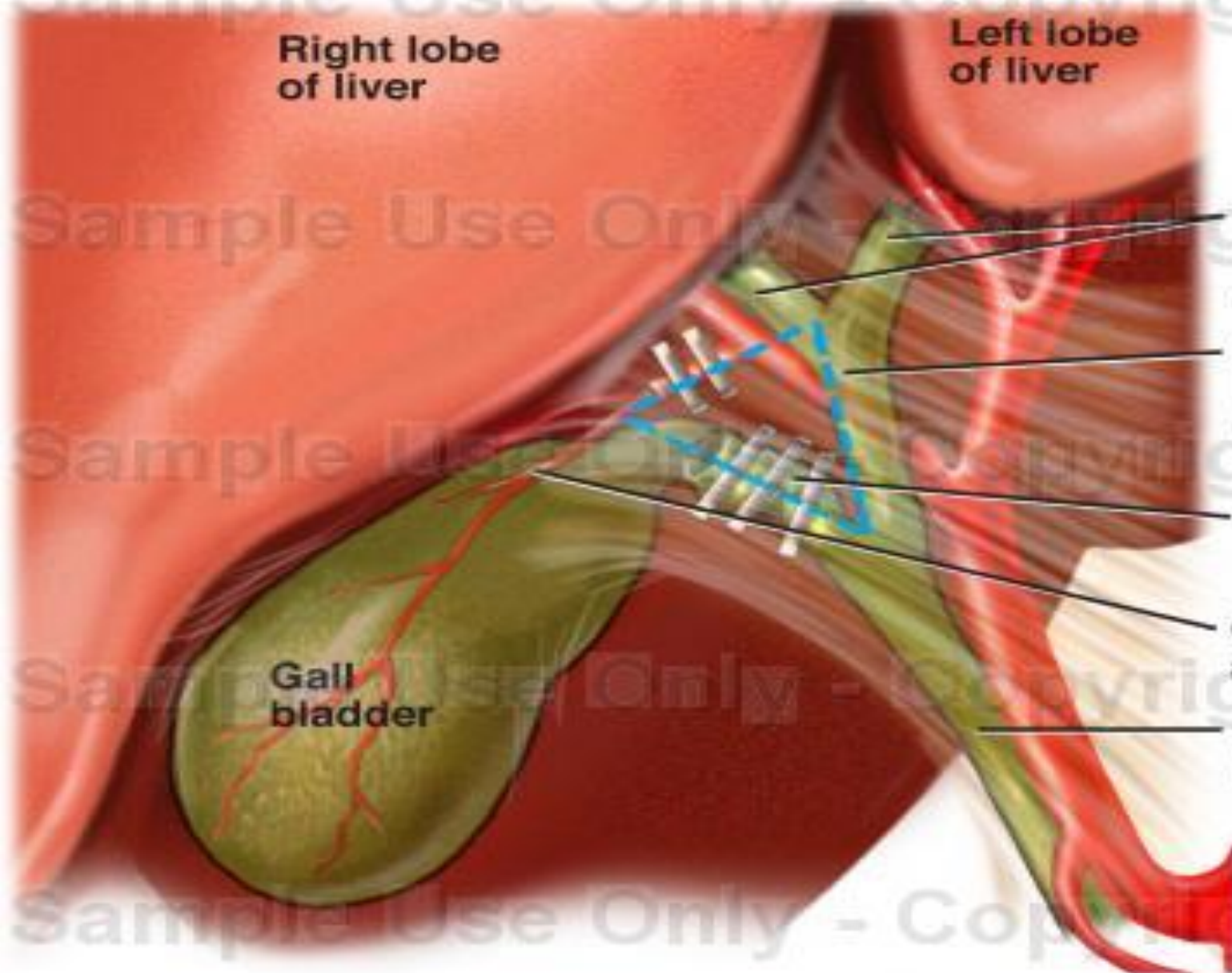
Common
hepatic
duct

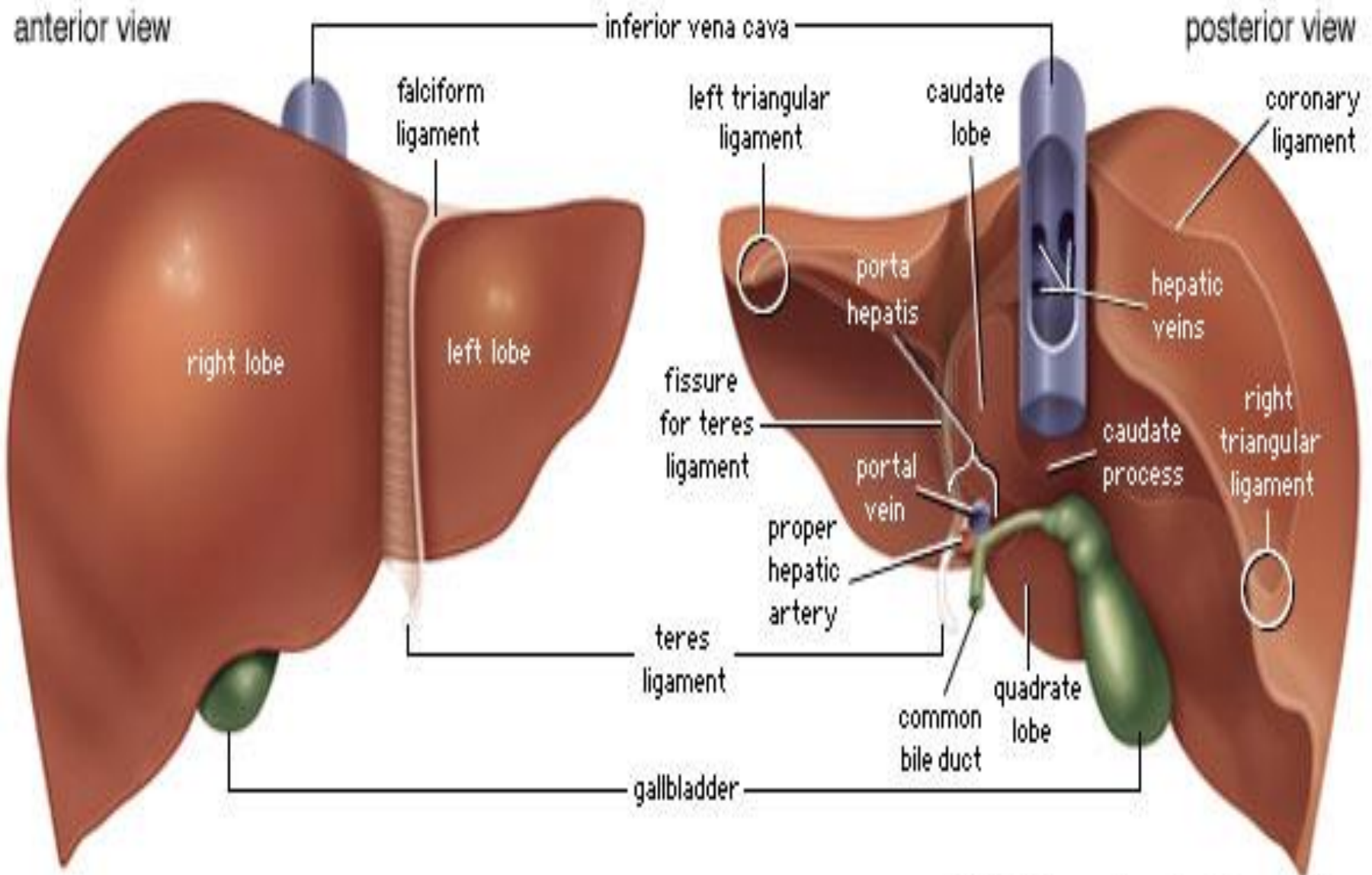
Cystic duct

Cystic
artery

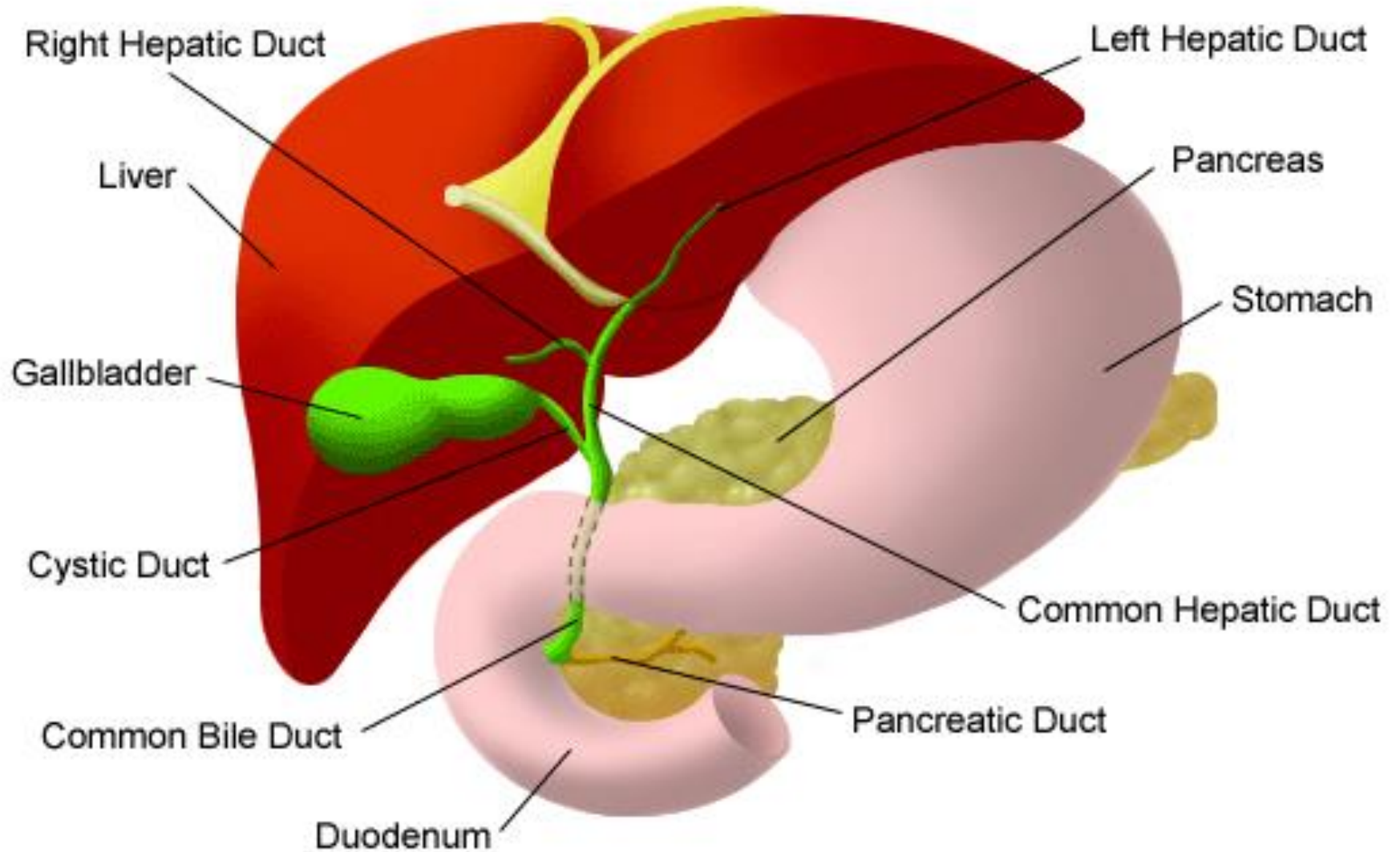
Common
bile duct

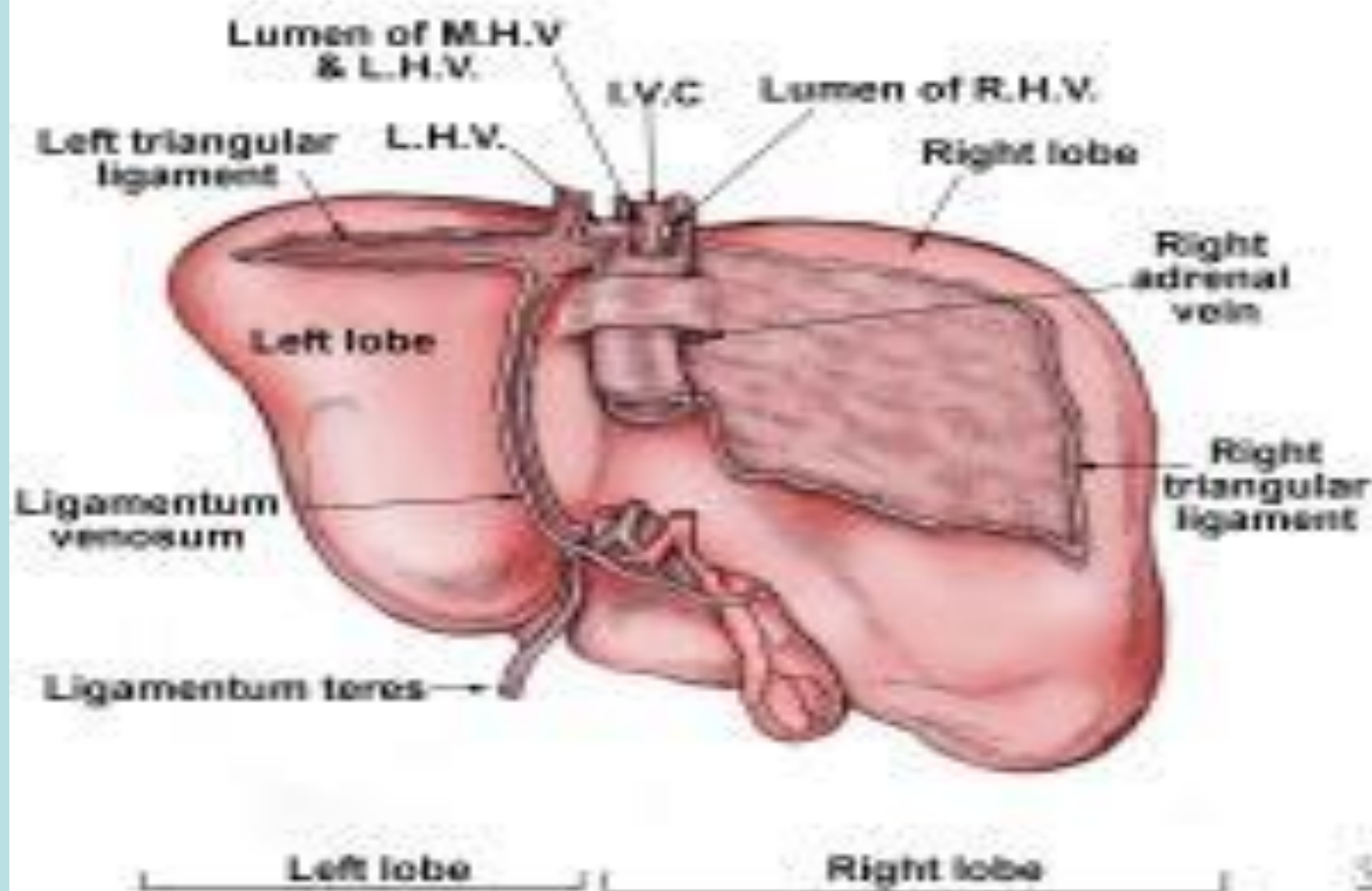
Gall
bladder





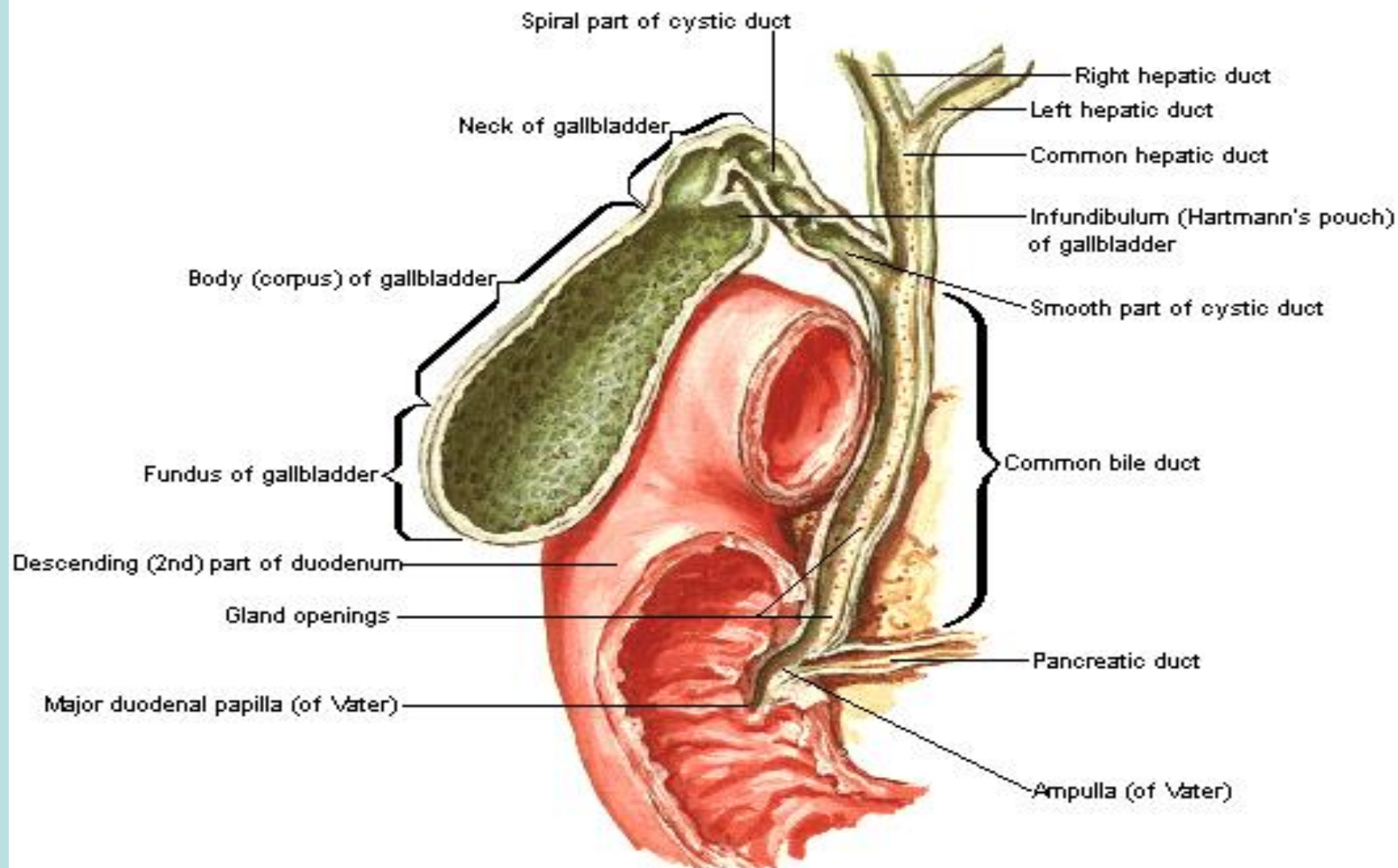
Biliary System

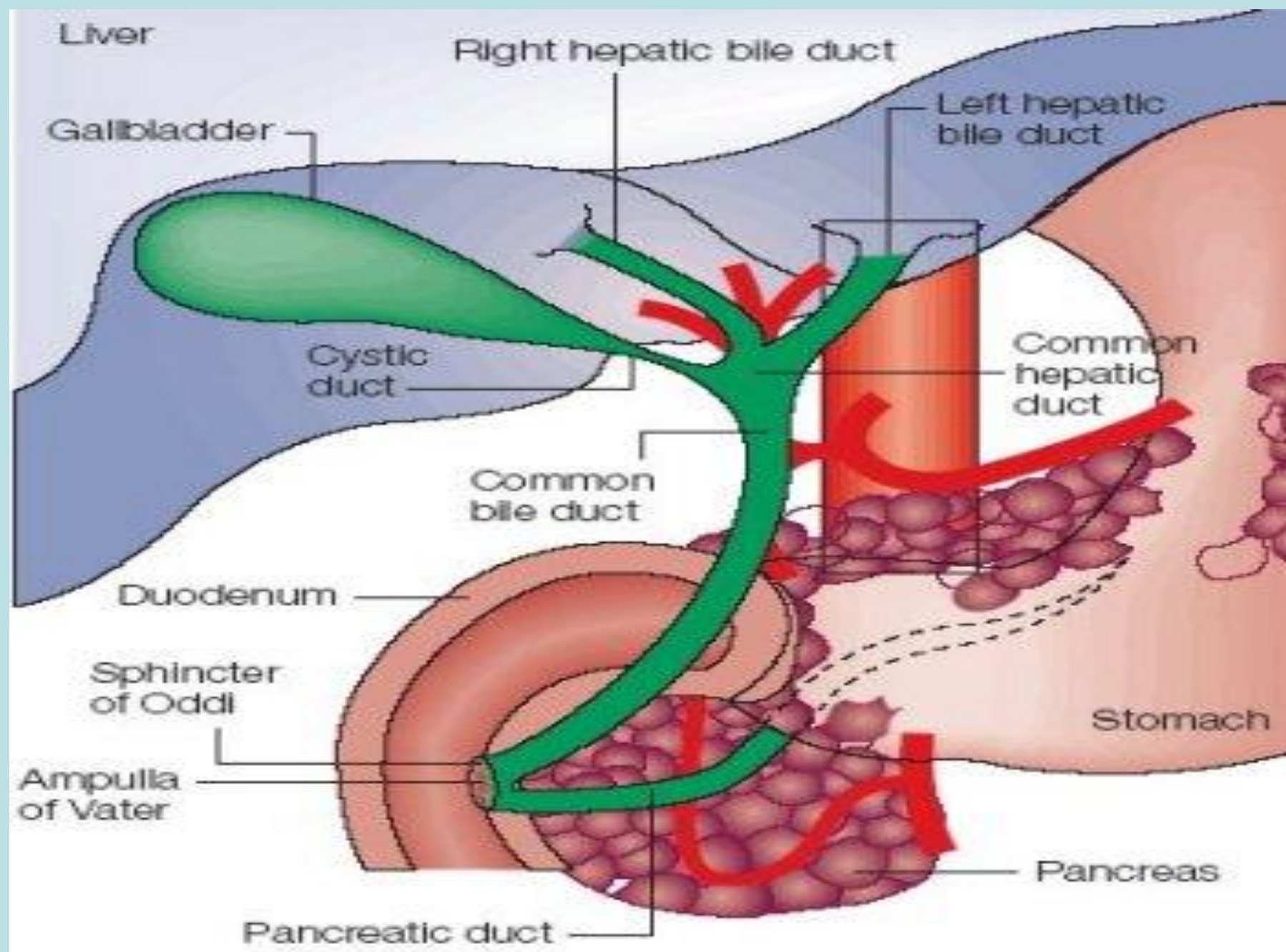


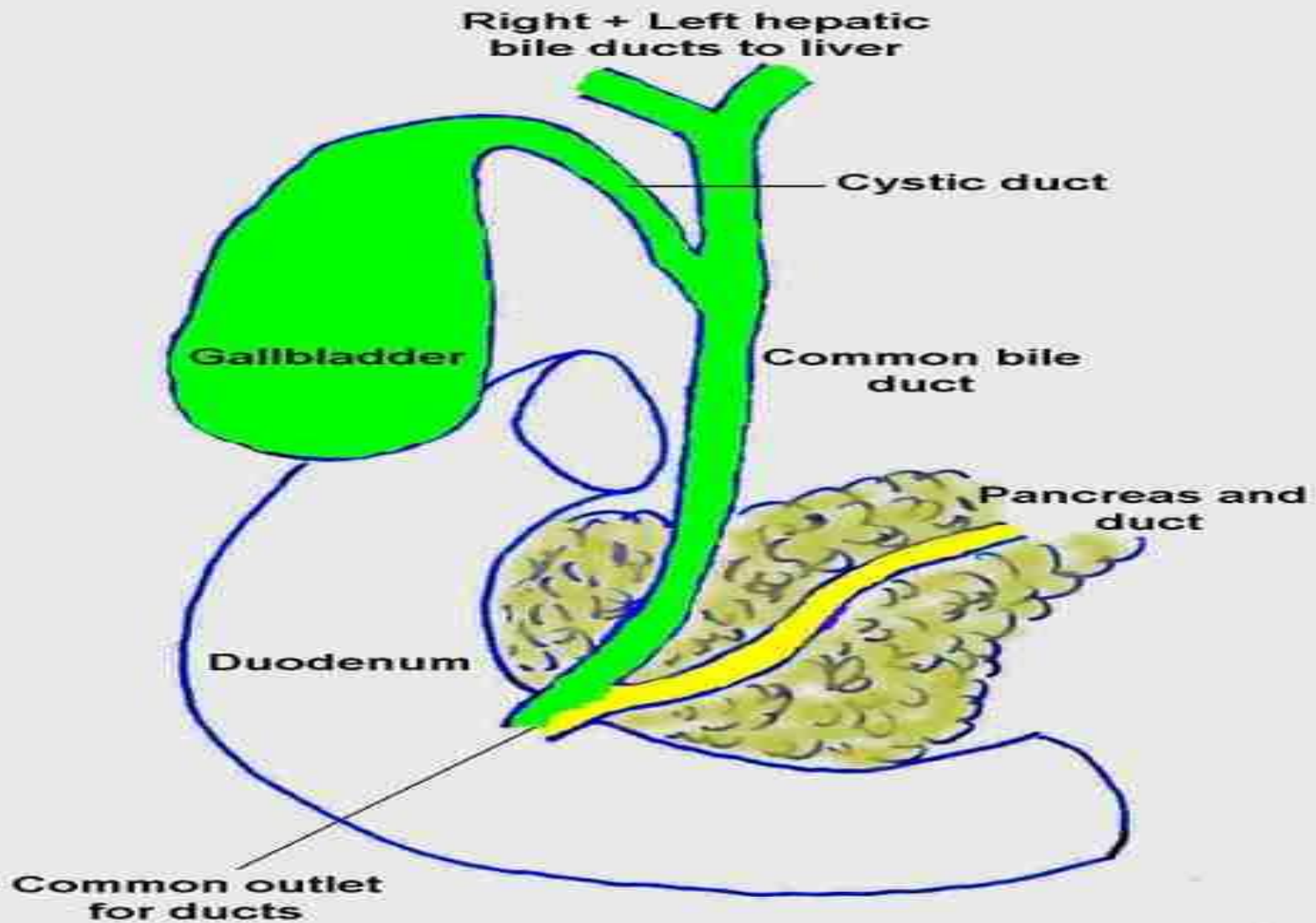


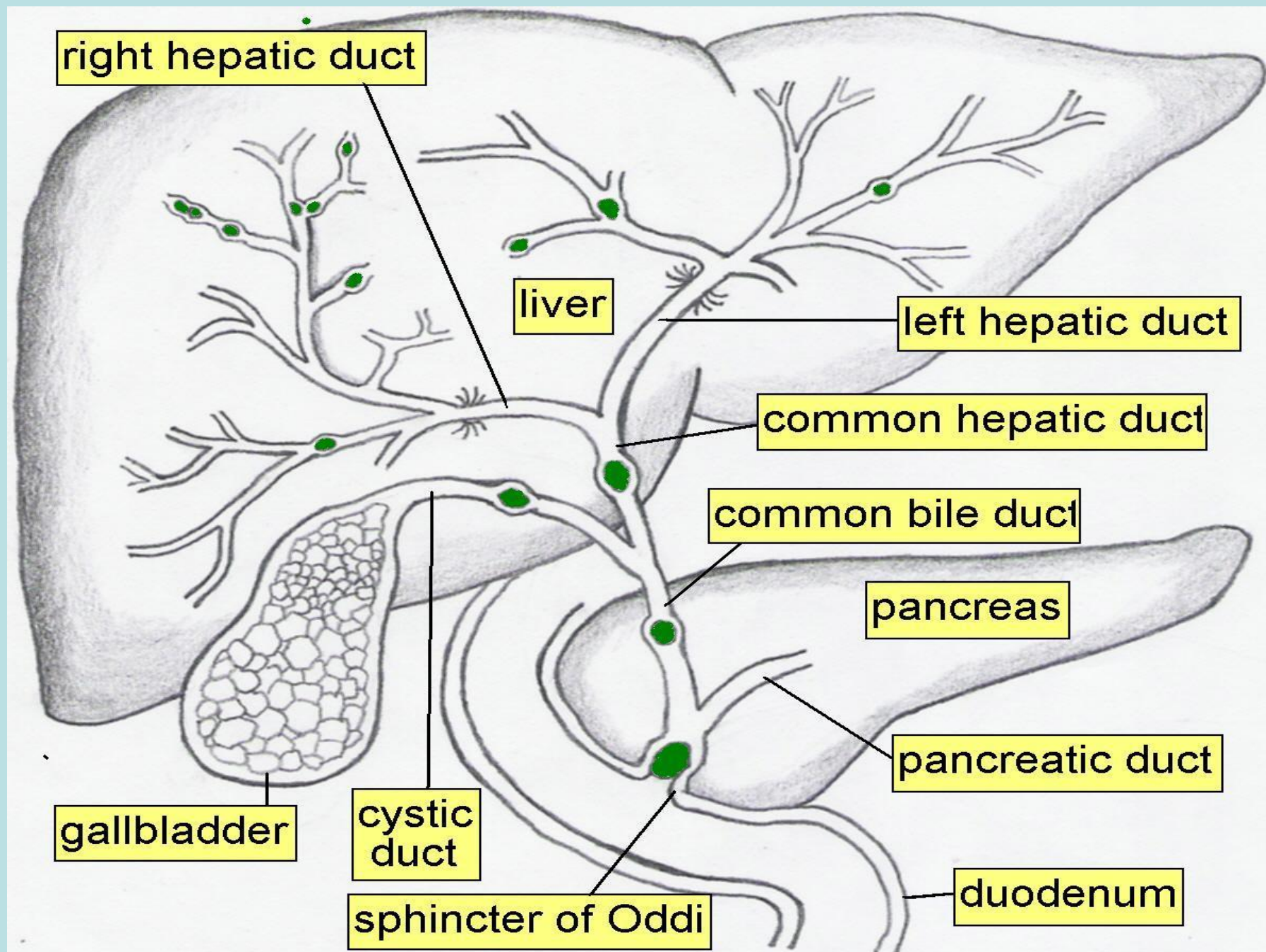
Gallbladder and Extrahepatic Bile Ducts

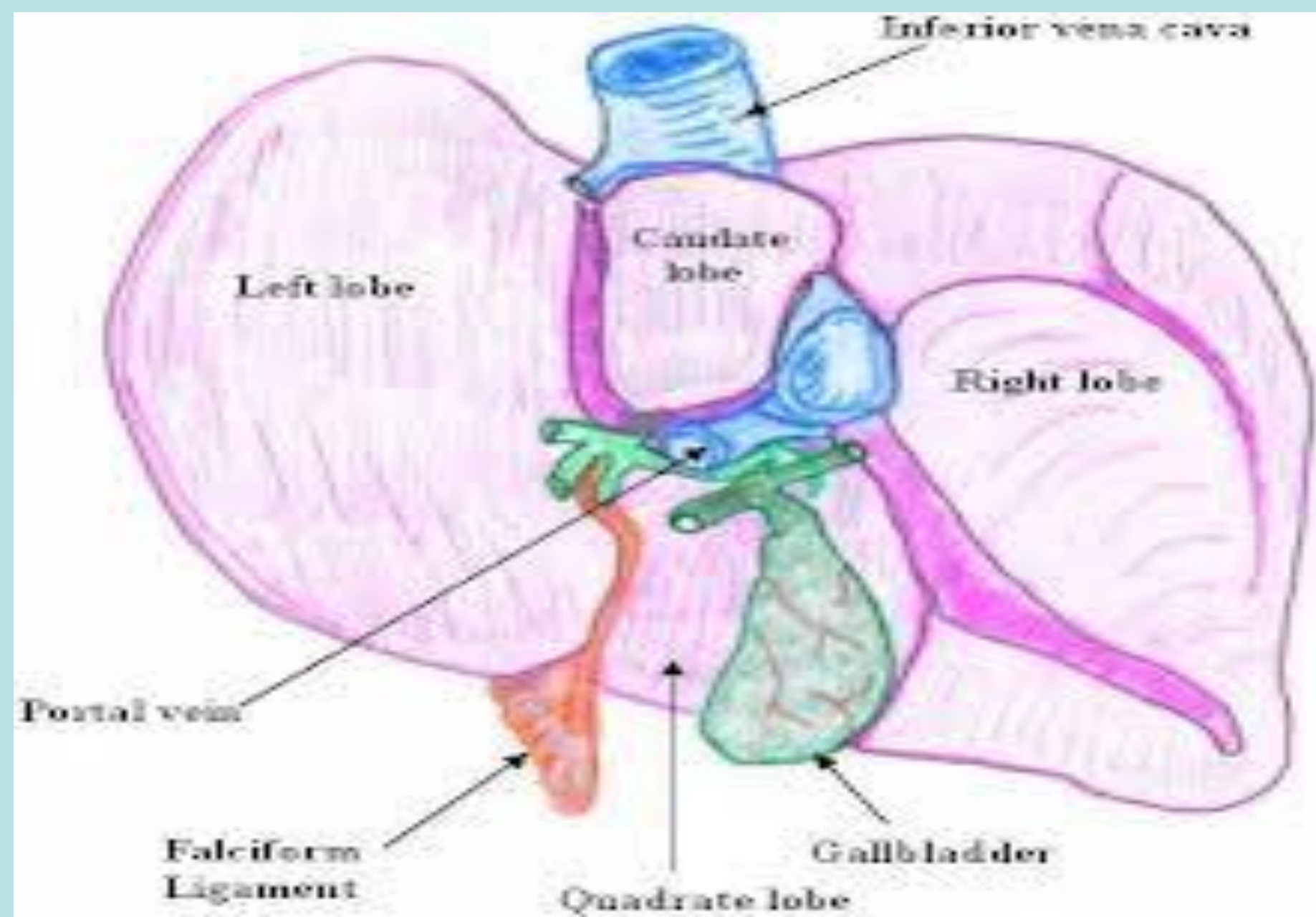
Sectioned

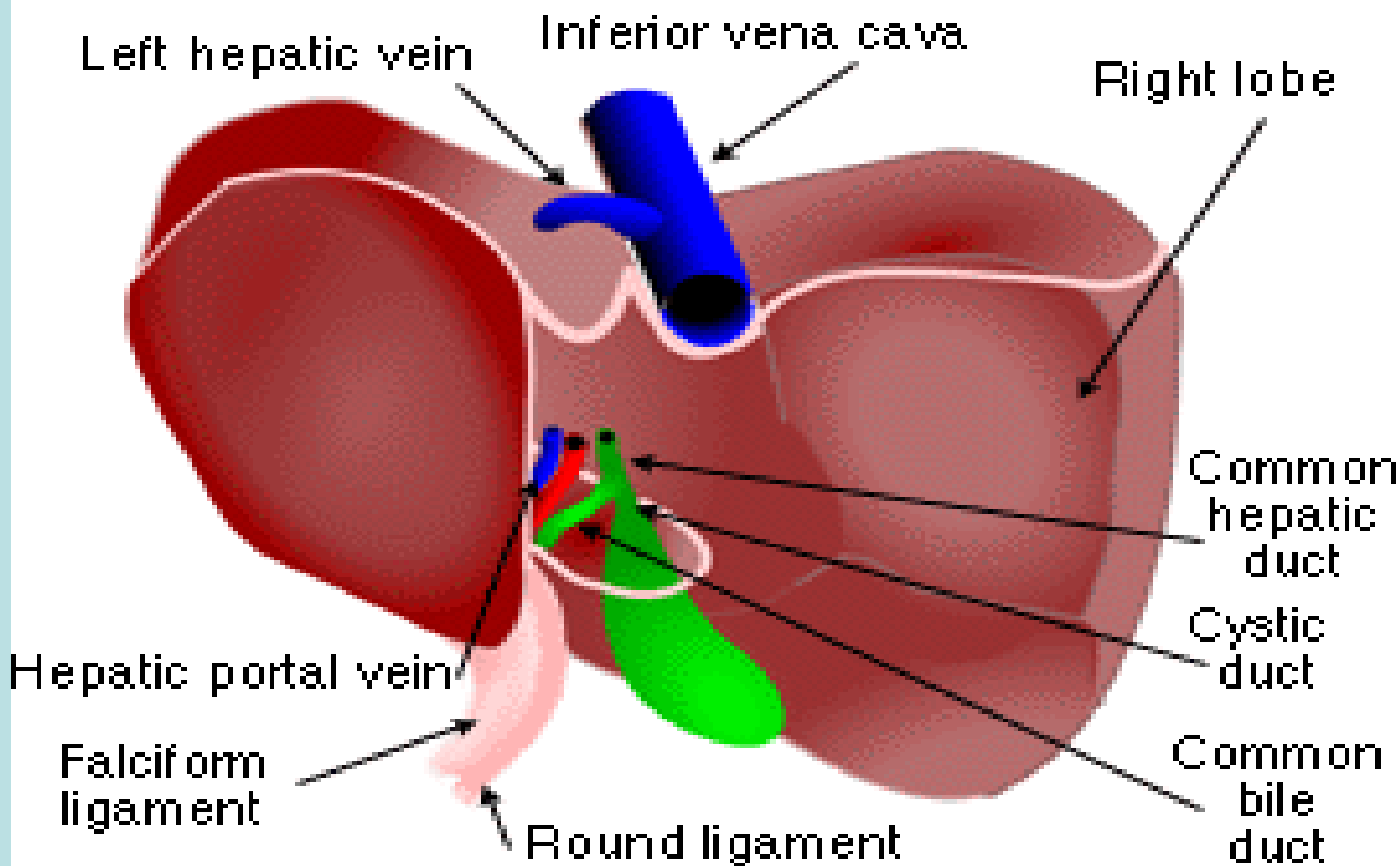








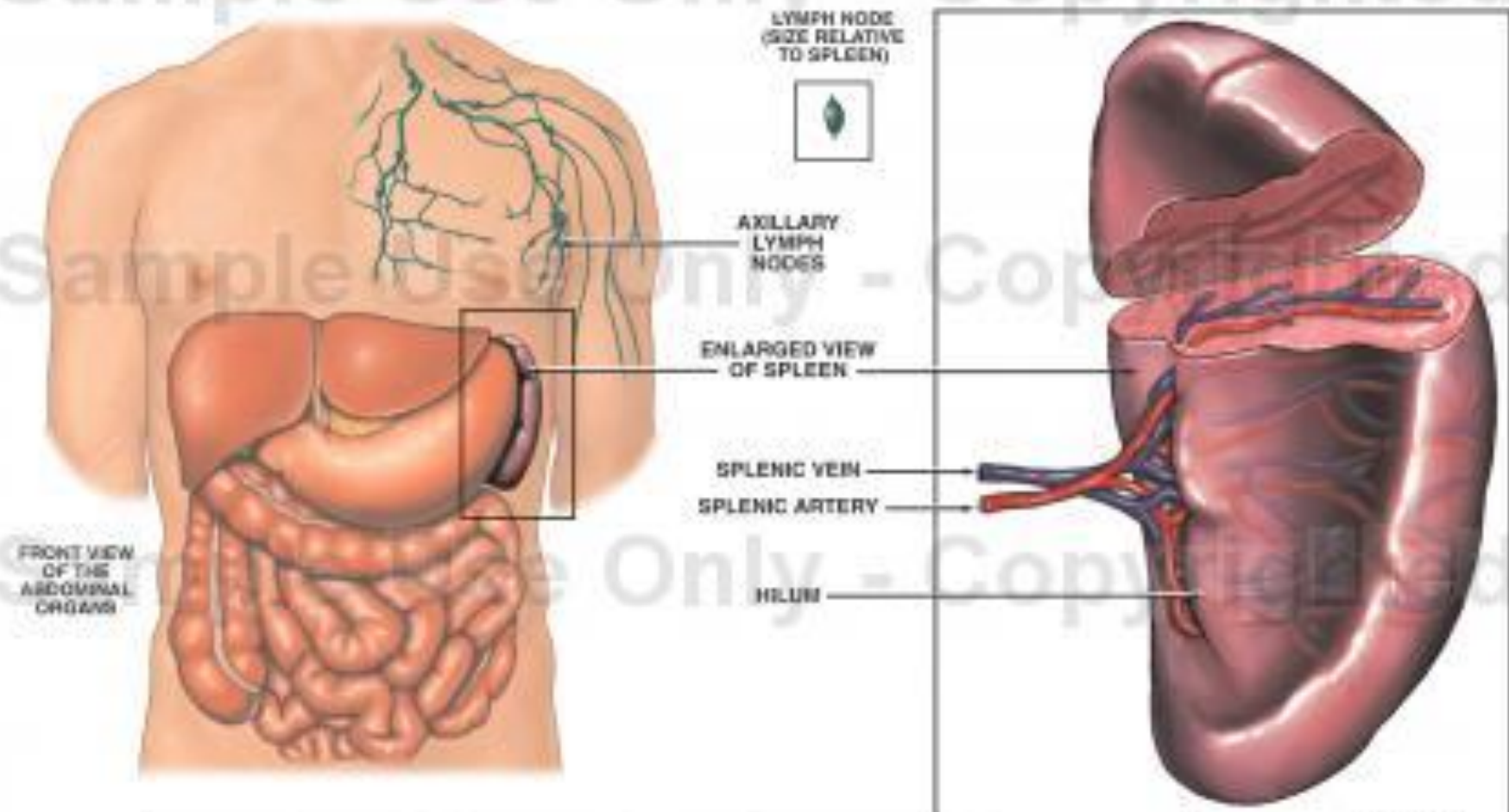




The Spleen (*Lienis*)

- The **spleen** is situated principally in the left hypochondriac region, but its superior extremity extends into the epigastric region;
- it lies between the fundus of the stomach and the diaphragm.
- It is the largest of the ductless glands, and is of an oblong, flattened form, soft, of very friable consistence, highly vascular, and of a dark purplish color.

Anatomy of the Spleen



THE SPLEEN IS THE LARGEST ORGAN IN THE LYMPHATIC SYSTEM.
THE LYMPHATIC SYSTEM IS COMPOSED OF THE SPLEEN,
LYMPH NODES, LYMPH VESSELS AND THE THYMUS GLAND.
THIS SYSTEM HELPS THE BODY TO FIGHT INFECTIONS.

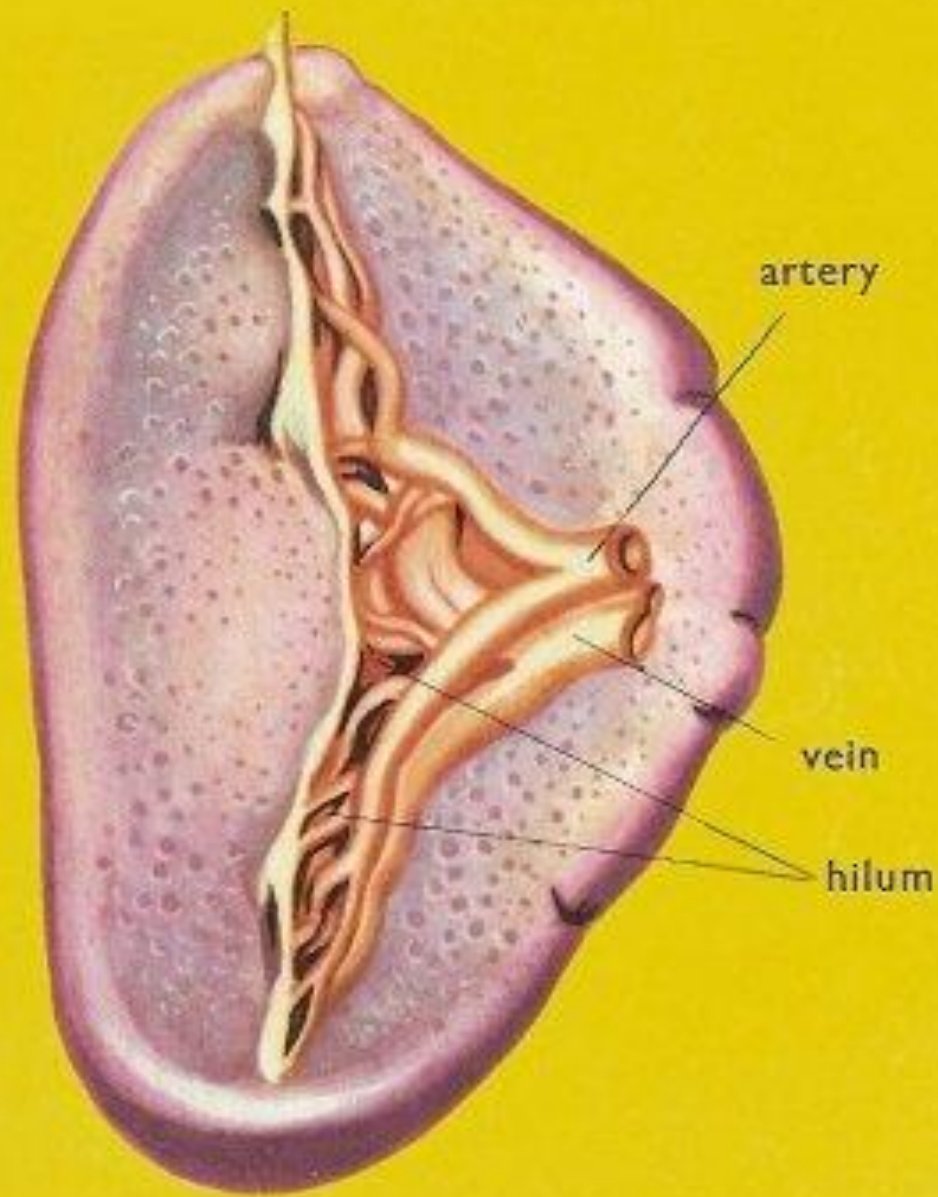
FRONT VIEW
OF THE SPLEEN

- **Relations**
- The **diaphragmatic surface** (*facies diaphragmatica; external or phrenic surface*) is convex, smooth, and is directed upward, backward, and to the left, except at its upper end, where it is directed slightly medialward.
- It is in relation with the under surface of the diaphragm, which separates it from the ninth, tenth, and eleventh ribs of the left side, and the intervening lower border of the left lung and pleura.

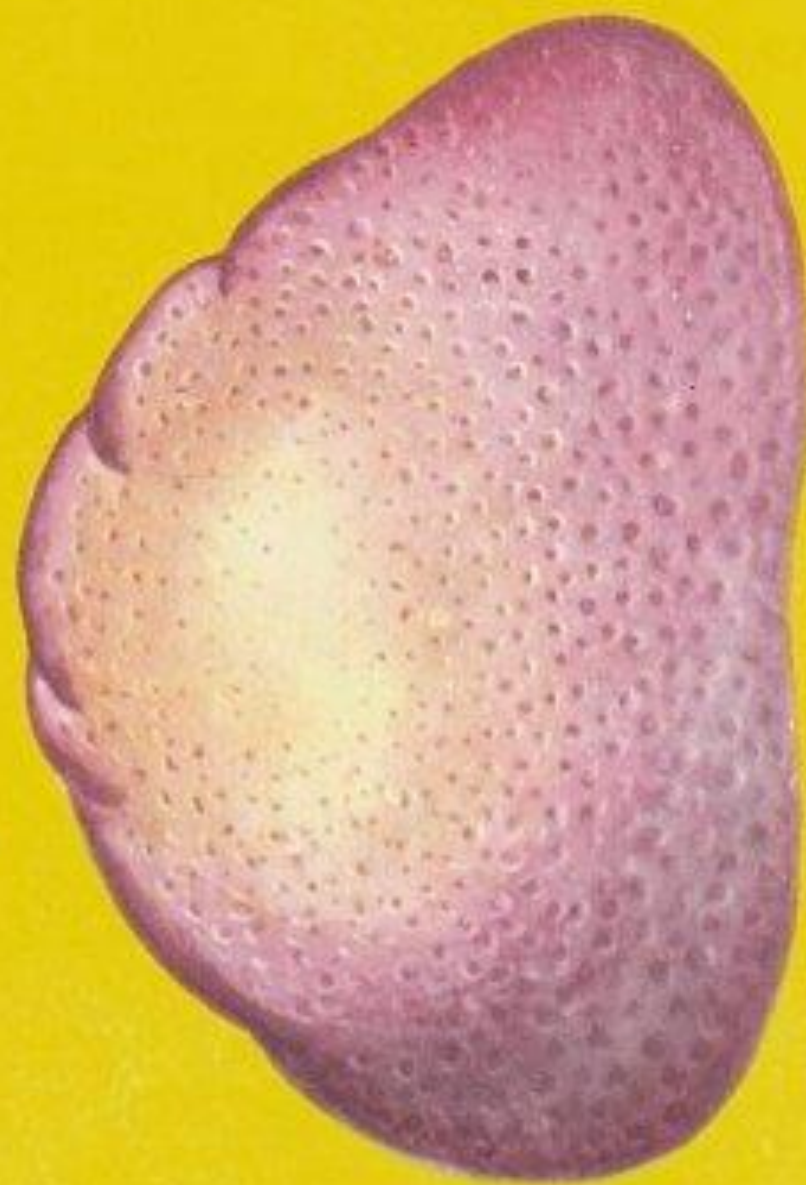
- The **visceral surface** is divided by a ridge into an **anterior or gastric** and a **posterior or renal portion**.
- The **gastric surface** (*facies gastrica*), which is directed forward, upward, and medialward, is broad and concave, and is in contact with the posterior wall of the stomach; and below this with the tail of the pancreas.
- It presents near its medial border a long fissure, termed the hilum.
- This is pierced by several irregular apertures, for the entrance and exit of vessels and nerves.
- The **renal surface** (*facies renalis*) is directed medialward and downward.
- It is somewhat flattened, is considerably narrower than the gastric surface, and is in relation with the upper part of the anterior surface of the left kidney and occasionally with the left suprarenal gland.

- The **superior extremity** (*extremitas superior*) is directed toward the vertebral column, where it lies on a level with the eleventh thoracic vertebra.
- The **lower extremity or colic surface** (*extremitas inferior*) is flat, triangular in shape, and rests upon the left flexure of the colon and the phrenicocolic ligament, and is generally in contact with the tail of the pancreas.
- The **anterior border** (*margo anterior*) is free, sharp, and thin, and is often notched, especially below;
- it separates the diaphragmatic from the gastric surface.
- The **posterior border** (*margo posterior*), more rounded and blunter than the anterior, separates the renal from the diaphragmatic surface;
- it corresponds to the lower border of the eleventh rib and lies between the diaphragm and left kidney.
- The intermediate margin is the ridge which separates the renal and gastric surfaces.
- The **inferior border** (*internal border*) separates the diaphragmatic from the colic surface.

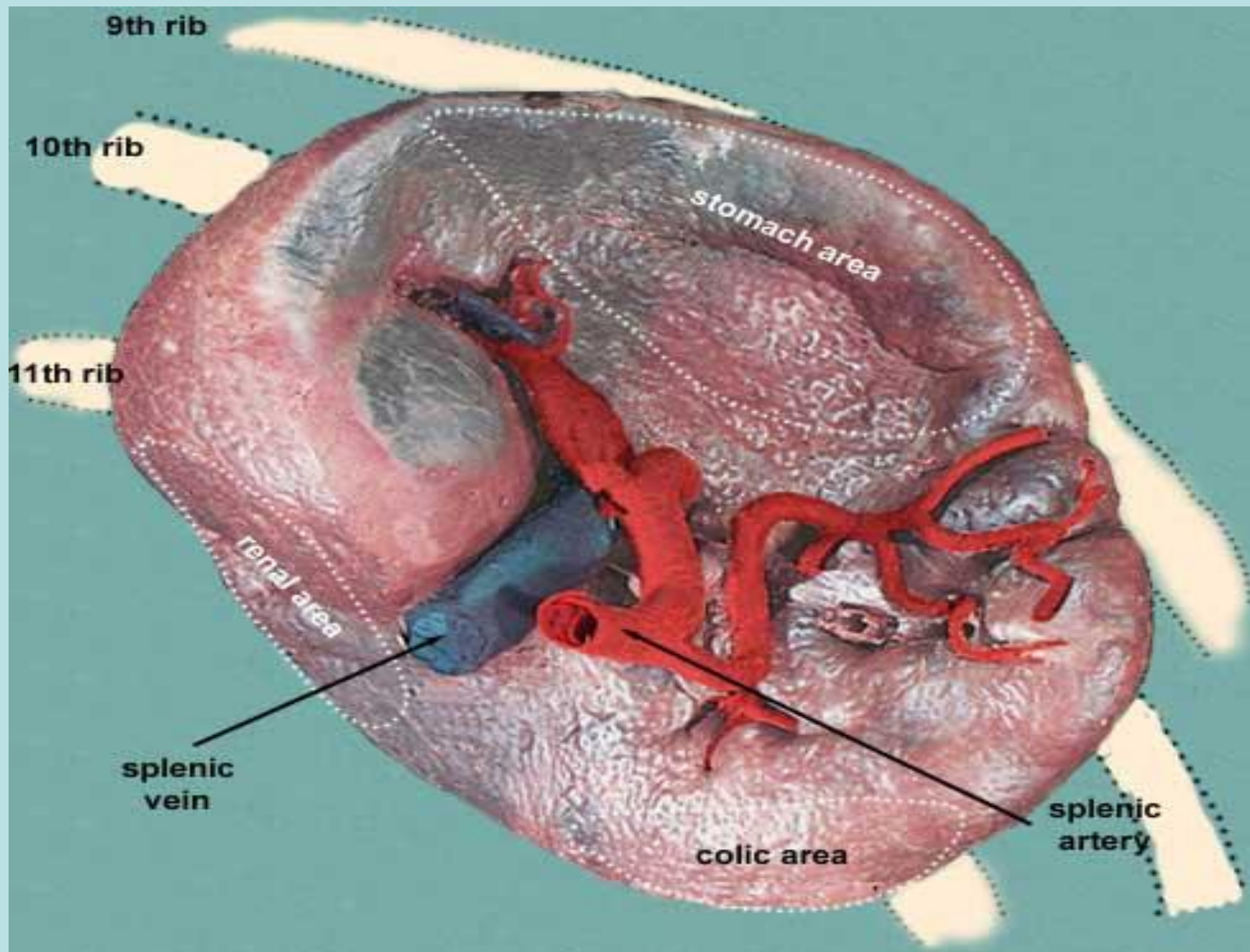
- The spleen is almost entirely surrounded by peritoneum, which is firmly adherent to its capsule.
- It is held in position by two folds of this membrane.
- One, **the phrenicolienal ligament**, is derived from the peritoneum, where the wall of the general peritoneal cavity comes into contact with the omental bursa between the left kidney and the spleen;
- the lienal vessels pass between its two layers .
- The other fold, **the gastrolienal ligament**, is also formed of two layers, derived from the general cavity and the omental respectively, where they meet between the spleen and stomach;
- the short gastric and left gastroepiploic branches of the lienal artery run between its two layers.
- The lower end of the spleen is supported by the phrenicocolic ligament.



spleen seen from the inner side



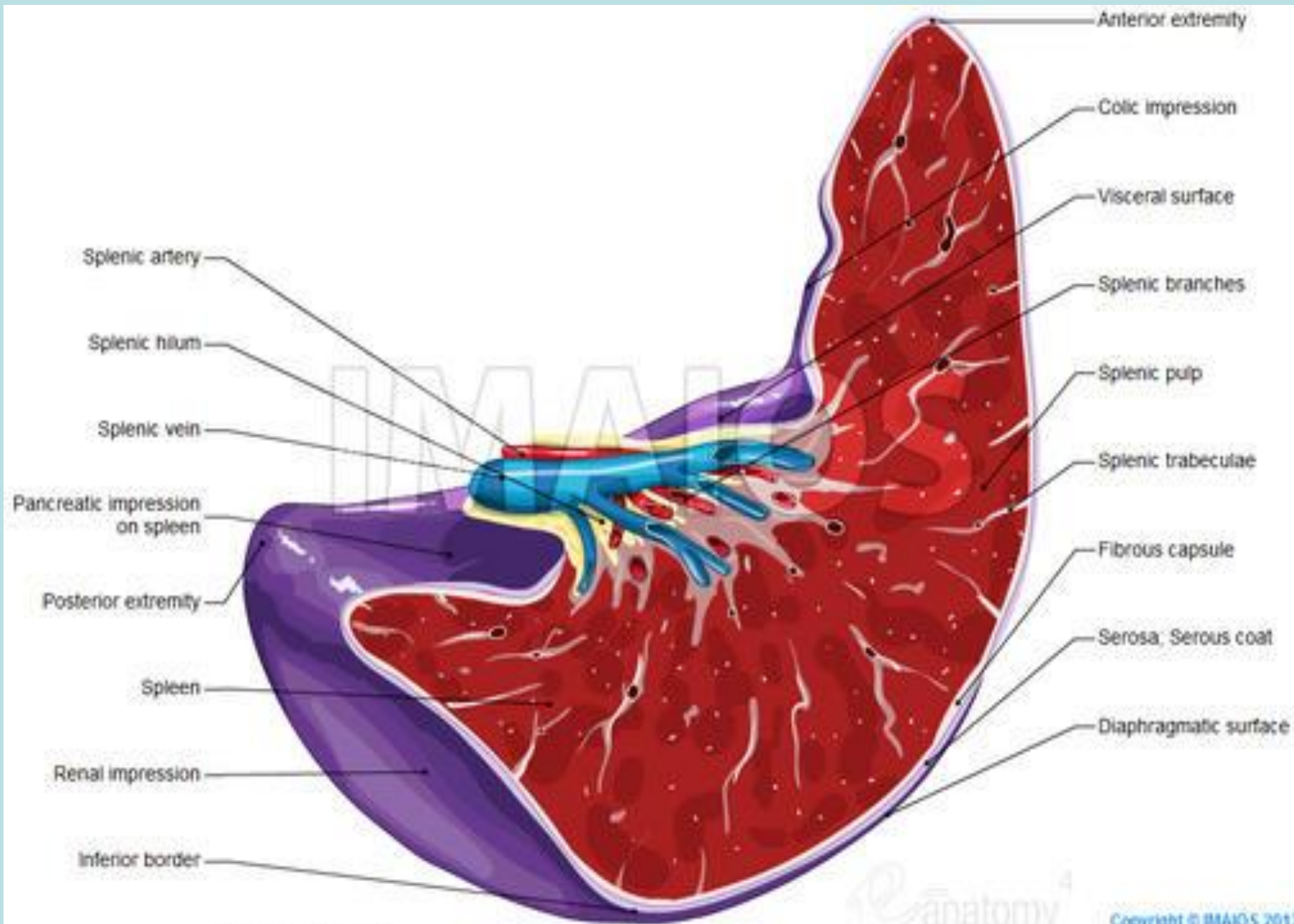
spleen seen from the outer side



- Frequently in the neighborhood of the spleen, and especially in the gastrosplenic ligament and greater omentum, small nodules of splenic tissue may be found, either isolated or connected to the spleen by thin bands of splenic tissue.
- They are known as **accessory spleens** (*lien accessorius; supernumerary spleen*).
- They vary in size from that of a pea to that of a plum.
- **Structure**
- The spleen is invested by two coats: **an external serous and an internal fibroelastic coat.**
- **The external or serous coat (*tunica serosa*)** is derived from the peritoneum; it is thin, smooth, and in the human subject intimately adherent to the fibroelastic coat.
- It invests the entire organ, except at the hilum and along the lines of reflection of the phrenocolic and gastrosplenic ligaments.

- The **fibroelastic coat** (*tunica albuginea*) invests the organ, and at the hilum is reflected inward upon the vessels in the form of sheaths.
- From these sheaths, as well as from the inner surface of the fibroelastic coat, numerous small fibrous bands, **trabeculæ** are given off in all directions; these uniting, constitute the frame-work of the spleen.
- The spleen therefore consists of a number of small spaces or **areolæ**, formed by the trabeculæ;
- in these areolæ is contained **the splenic pulp**.
- The fibroelastic coat, the sheaths of the vessels, and the trabeculæ, are composed of white and yellow elastic fibrous tissues, the latter predominating.
- It is owing to the presence of the elastic tissue that the spleen possesses a considerable amount of elasticity, which allows of the very great variations in size that it presents under certain circumstances.

- The **splenic pulp** (*pulpa lienis*) is a soft mass of a dark reddish-brown color, resembling grumous blood; it consists of a fine reticulum of fibers, continuous with those of the trabeculæ, to which are applied flat, branching cells.
- The meshes of the reticulum are filled with blood, in which, however, the white corpuscles are found to be in larger proportion than they are in ordinary blood.
- Large rounded cells, termed **splenic cells**, are also seen; these are capable of ameboid movement, and often contain pigment and red-blood corpuscles in their interior.



- **Bloodvessels of the Spleen**
- **The lienal artery** is remarkable for its large size in proportion to the size of the organ, and also for its tortuous course.
- It divides into six or more branches, which enter the hilum of the spleen and ramify throughout its substance receiving sheaths from an involution of the external fibrous tissue.
- Similar sheaths also invest the nerves and veins.
- Each branch runs in the transverse axis of the organ, from within outward, diminishing in size during its transit, and giving off in its passage smaller branches, some of which pass to the anterior, others to the posterior part.
- These ultimately leave the trabecular sheaths, and terminate in the proper substance of the spleen in small tufts or pencils of minute arterioles, which open into the interstices of the reticulum formed by the branched sustentacular cells.
- Each of the larger branches of the artery supplies chiefly that region of the organ in which the branch ramifies, having no anastomosis with the majority of the other branches.

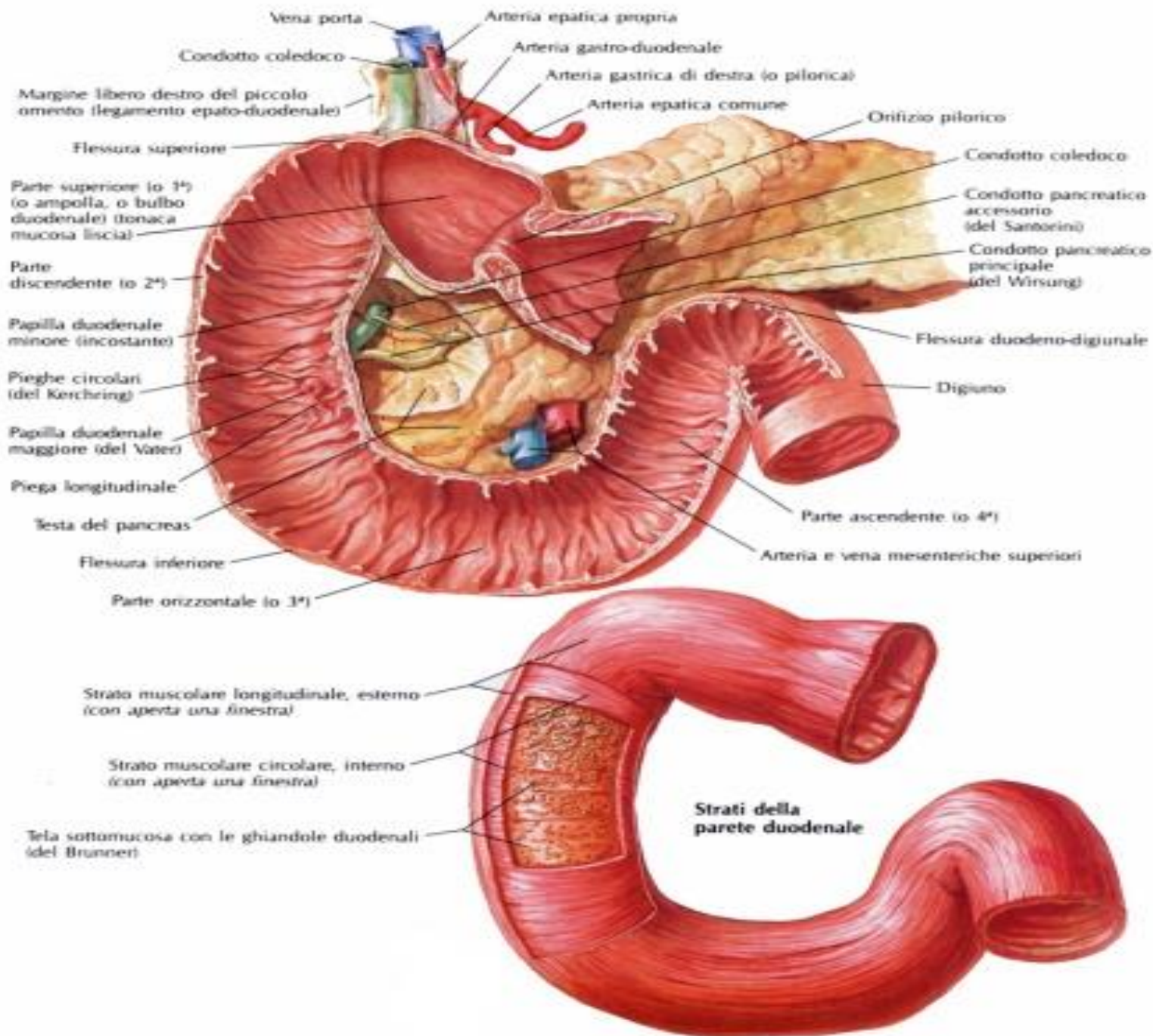
The Small Intestine (*Intestinum Tenue*)

- The small intestine is a convoluted tube, extending from the pylorus to the colic valve, where it ends in the large intestine.
- It is about 5-7 meters long, and gradually diminishes in size from its commencement to its termination.
- It is contained in the central and lower part of the abdominal cavity, and is surrounded above and at the sides by the large intestine; a portion of it extends below the superior aperture of the pelvis and lies in front of the rectum.
- The small intestine is divisible into three portions: the duodenum, the jejunum, and the ileum.

The Duodenum

- has received its name from being about equal in length to the breadth of twelve fingers (25 cm.).
- It is the shortest, the widest, and the most fixed part of the small intestine, and has no mesentery, being only partially covered by peritoneum.
- Its course presents a remarkable curve, somewhat of the shape of an imperfect circle, so that its termination is not far removed from its starting-point.

- In the adult the course of the duodenum is as follows: commencing at the pylorus it passes backward, upward, and to the right, beneath the quadrate lobe of the liver to the neck of the gall-bladder, varying slightly in direction according to the degree of distension of the stomach: it then takes a sharp curve and descends along the right margin of the head of the pancreas, for a variable distance, generally to the level of the upper border of the body of the fourth lumbar vertebra.
- It now takes a second bend, and passes from right to left across the vertebral column, having a slight inclination upward; and on the left side of the vertebral column it ascends for about 2.5 cm., and then ends opposite the second lumbar vertebra in the jejunum.
- As it unites with the jejunum it turns abruptly forward, forming the duodenojejunal flexure.
- From the above description it will be seen that the duodenum may be divided into four portions: **superior, descending, horizontal, and ascending.**



Relations

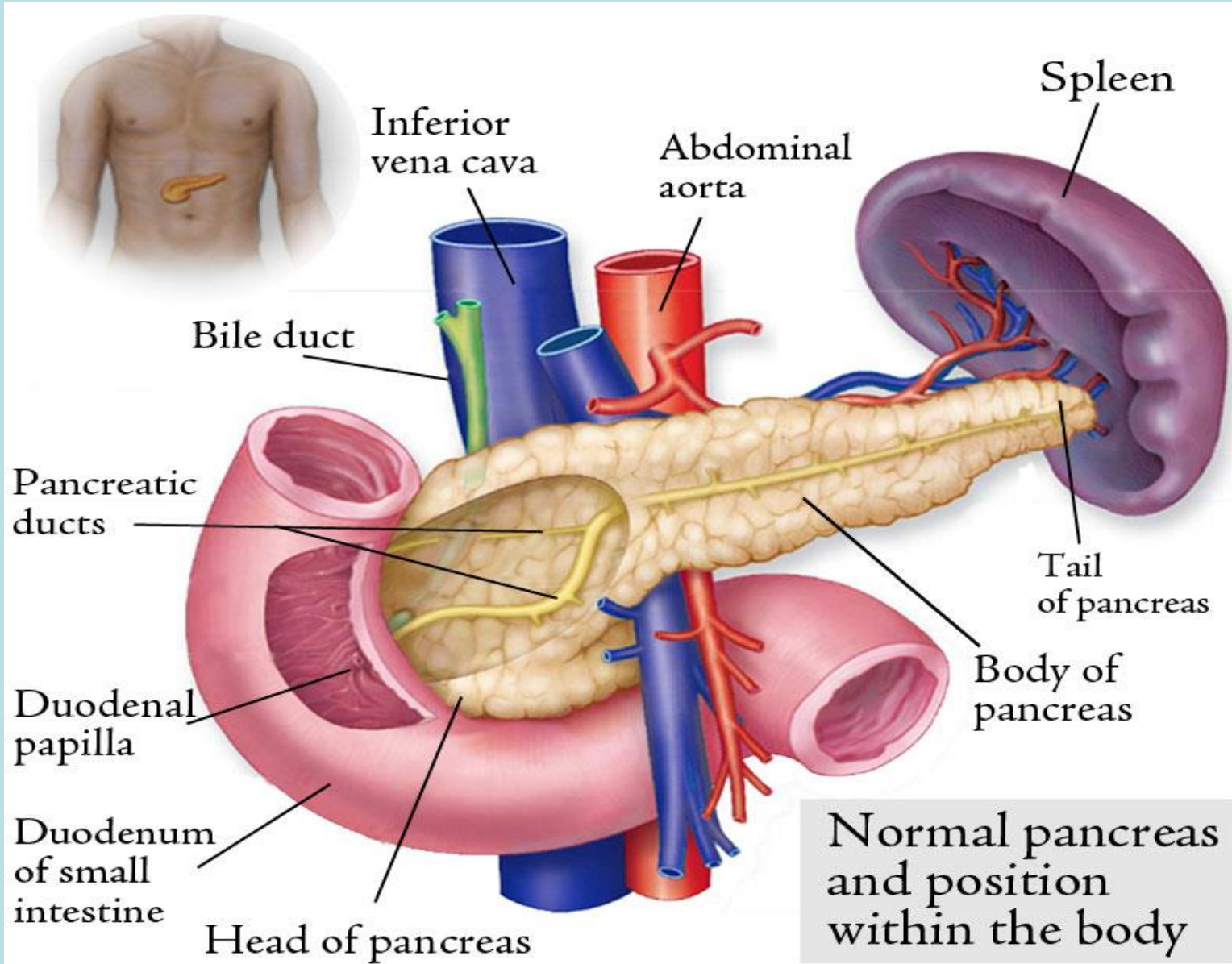
- The superior portion (*pars superior*, first portion) is about 5 cm. long.
- Beginning at the pylorus, it ends at the neck of the gall-bladder.
- It is the most movable of the four portions.
- It is almost completely covered by peritoneum, but a small part of its posterior surface near the neck of the gall-bladder and the inferior vena cava is uncovered; the upper border of its first half has the hepatoduodenal ligament attached to it, while to the lower border of the same segment the greater omentum is connected.
- It is in such close relation with the gall-bladder that it is usually found to be stained by bile after death, especially on its anterior surface.
- It is in relation above and in front with the quadrate lobe of the liver and the gall-bladder; behind with the gastroduodenal artery, the common bile duct, and the portal vein; and below and behind with the head and neck of the pancreas.

- The descending portion (*pars descendens*; second portion) is from 7 to 10 cm. long, and extends from the neck of the gall-bladder, on a level with the first lumbar vertebra, along the right side of the vertebral column as low as the upper border of the body of the fourth lumbar vertebra.
- It is crossed in its middle third by the transverse colon, the posterior surface of which is uncovered by peritoneum and is connected to the duodenum by a small quantity of connective tissue.

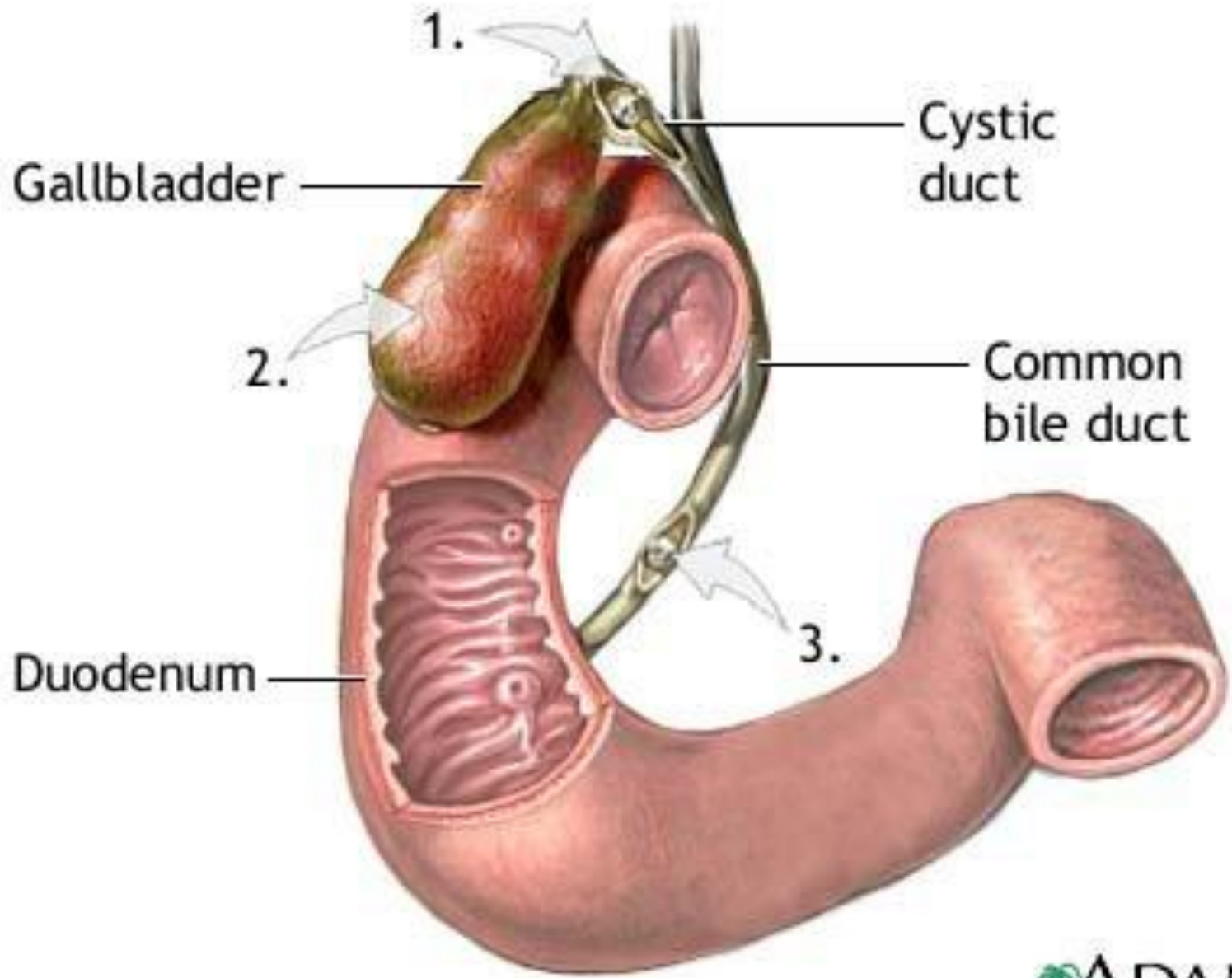
- The supra- and infracolic portions are covered in front by peritoneum, the infracolic part by the right leaf of the mesentery.
- Posteriorly the descending portion of the duodenum is not covered by peritoneum.
- The descending portion is in relation, in front, from above downward, with the duodenal impression on the right lobe of the liver, the transverse colon, and the small intestine; behind, it has a variable relation to the front of the right kidney in the neighborhood of the hilum, and is connected to it by loose areolar tissue; the renal vessels, the inferior vena cava, and the Psoas below, are also behind it.

- At its medial side is the head of the pancreas, and the common bile duct; to its lateral side is the right colic flexure.
- The common bile duct and the pancreatic duct together perforate the medial side of this portion of the intestine obliquely , some 7 to 10 cm. below the pylorus; the accessory pancreatic duct sometimes pierces it about 2 cm. above and slightly in front of these.

- The horizontal portion (*pars horizontalis*; third or preaortic or transverse portion) is from 5 to 7.5 cm. long.
- It begins at the right side of the upper border of the fourth lumbar vertebra and passes from right to left, with a slight inclination upward, in front of the great vessels and crura of the diaphragm, and ends in the ascending portion in front of the abdominal aorta.
- It is crossed by the superior mesenteric vessels and the mesentery.
- Its front surface is covered by peritoneum, except near the middle line, where it is crossed by the superior mesenteric vessels.
- Its posterior surface is uncovered by peritoneum, except toward its left extremity, where the posterior layer of the mesentery may sometimes be found covering it to a variable extent.
- This surface rests upon the right crus of the diaphragm, the inferior vena cava, and the aorta.
- The upper surface is in relation with the head of the pancreas.



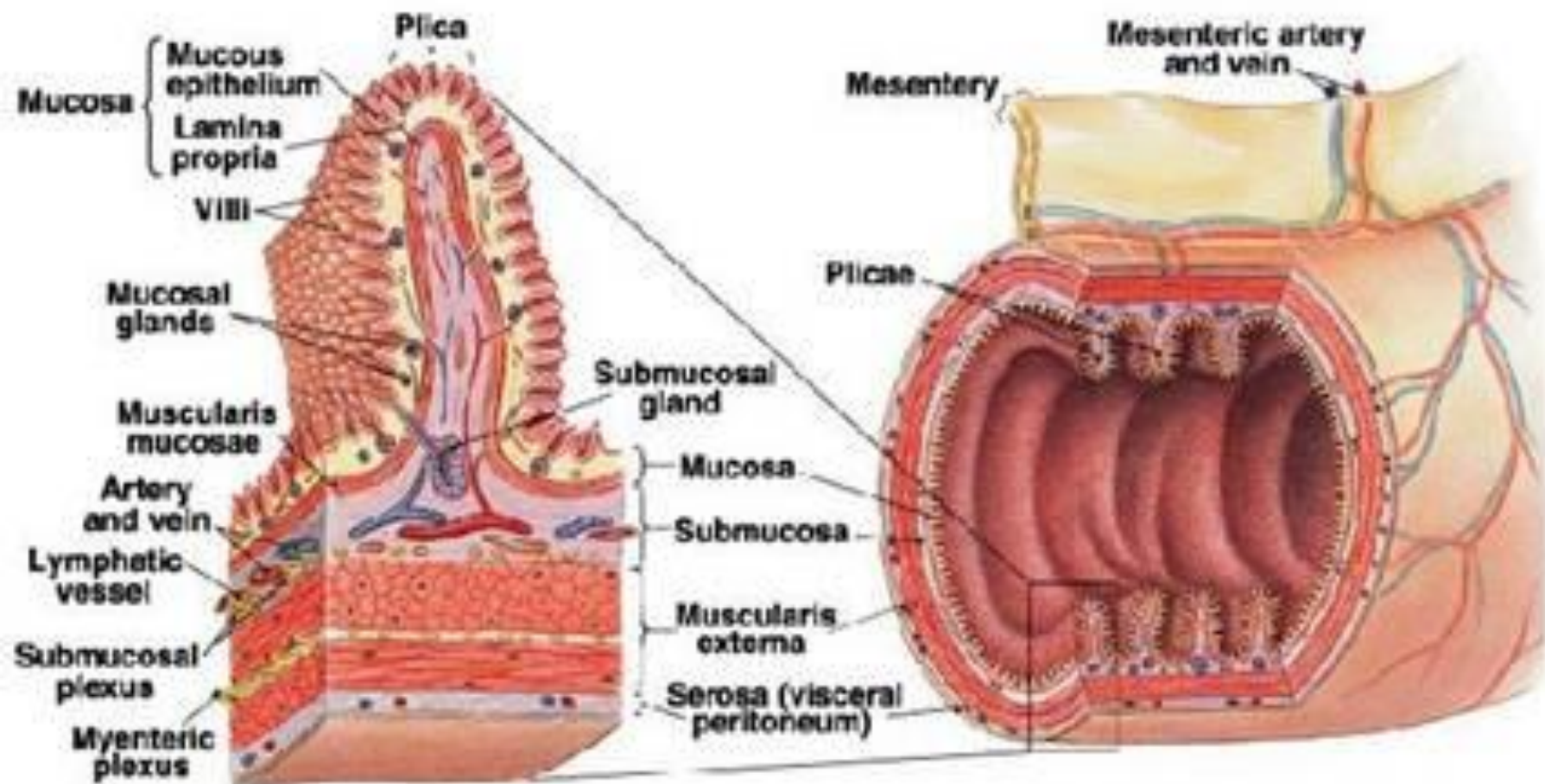
- The ascending portion (*pars ascendens*; fourth portion) of the duodenum is about 2.5 cm long.
- It ascends on the left side of the aorta, as far as the level of the upper border of the second lumbar vertebra, where it turns abruptly forward to become the jejunum, forming the duodenojejunal flexure.
- It lies in front of the left Psoas major and left renal vessels, and is covered in front, and partly at the sides, by peritoneum continuous with the left portion of the mesentery.



- The superior part of the duodenum, as stated above, is somewhat movable, but the rest is practically fixed, and is bound down to neighboring viscera and the posterior abdominal wall by the peritoneum.
- In addition to this, the ascending part of the duodenum and the duodenojejunal flexure are fixed by a structure to which the name of Musculus suspensorius duodeni has been given.

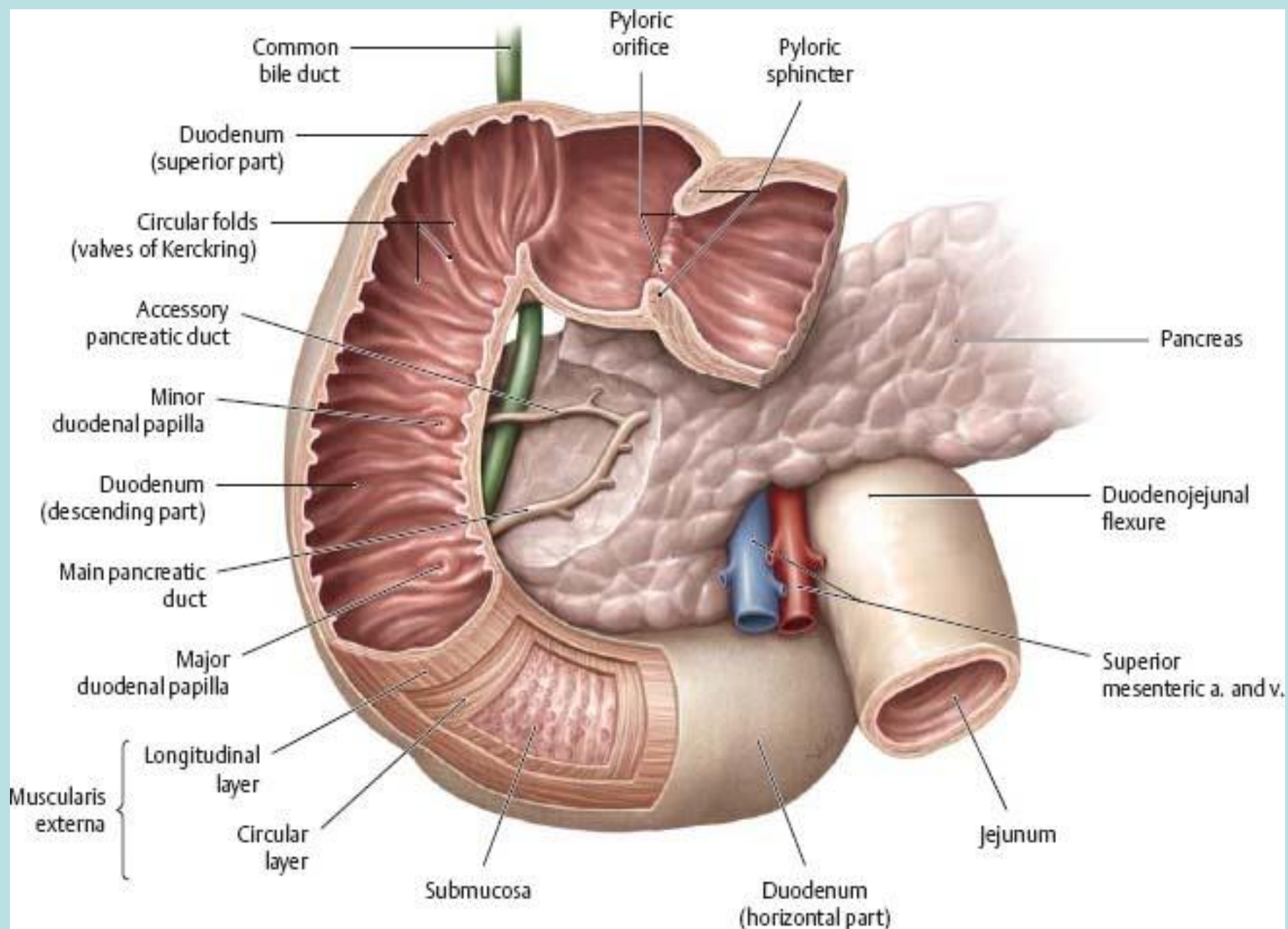
- This structure commences in the connective tissue around the celiac artery and left crus of the diaphragm, and passes downward to be inserted into the superior border of the duodenojejunal curve and a part of the ascending duodenum, and from this it is continued into the mesentery.
- It possesses, according to Treitz, plain muscular fibers mixed with the fibrous tissue of which it is principally made up.
- It is of little importance as a muscle, but acts as a suspensory ligament.

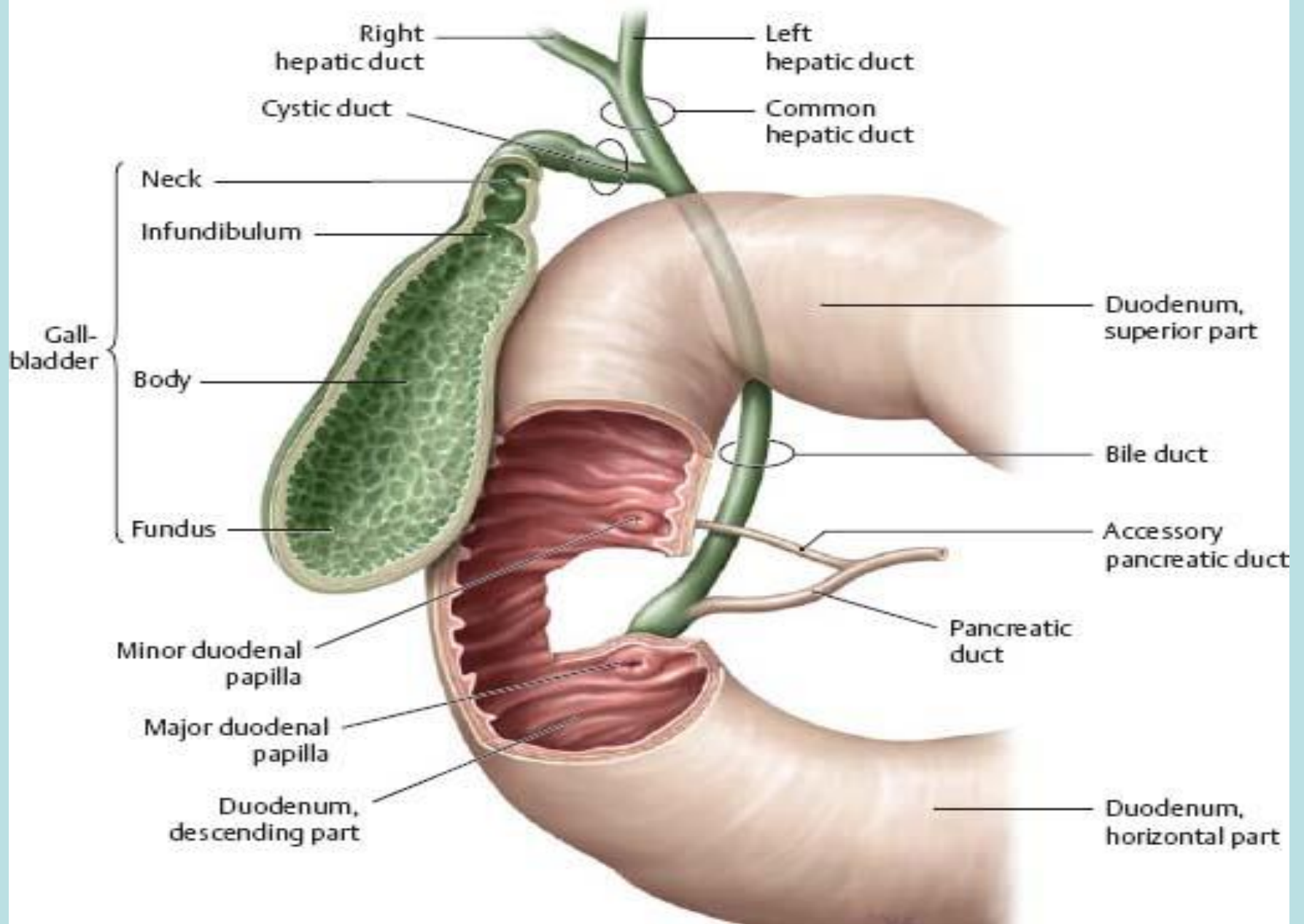
Structure of the Digestive Tract

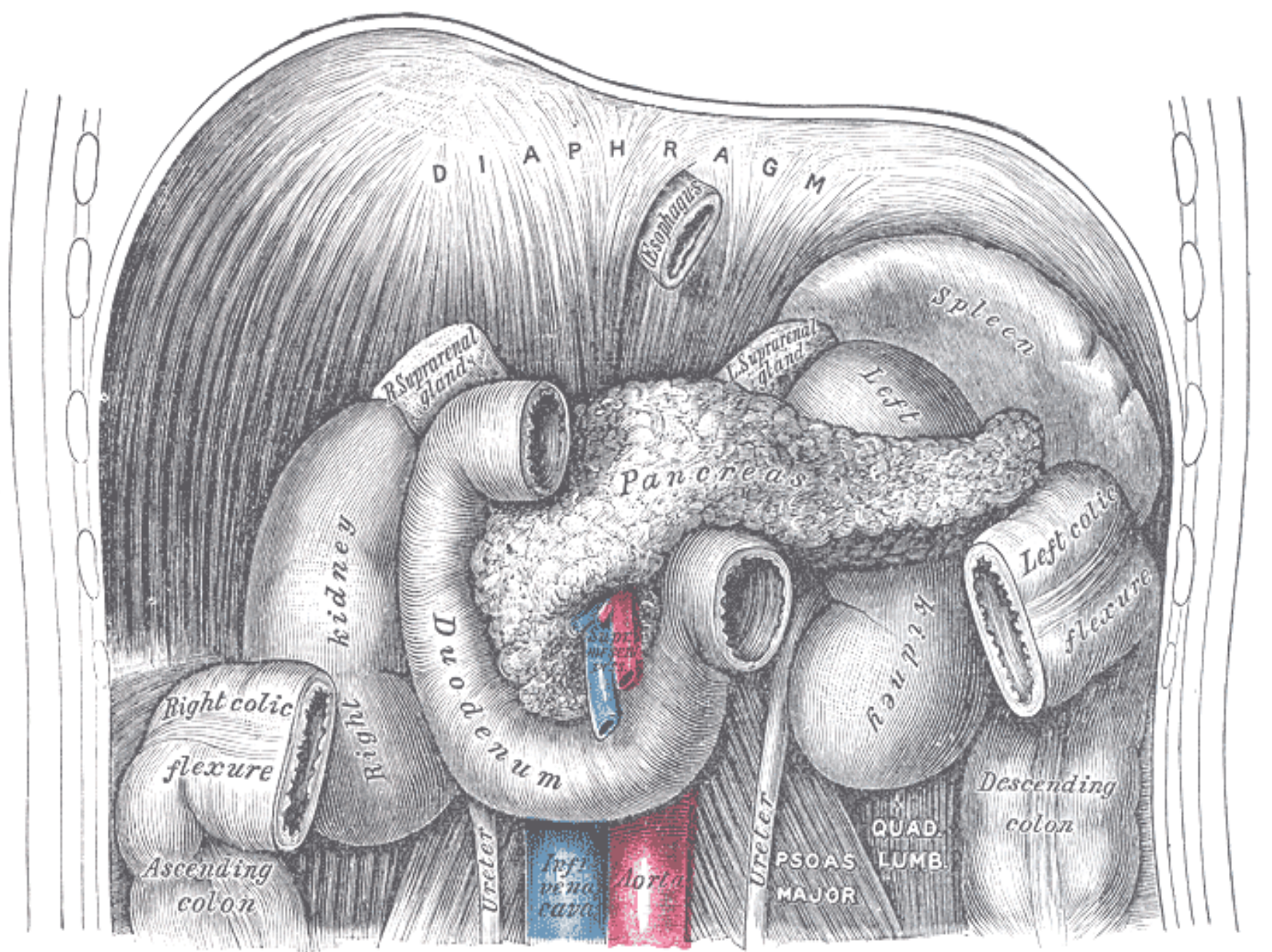


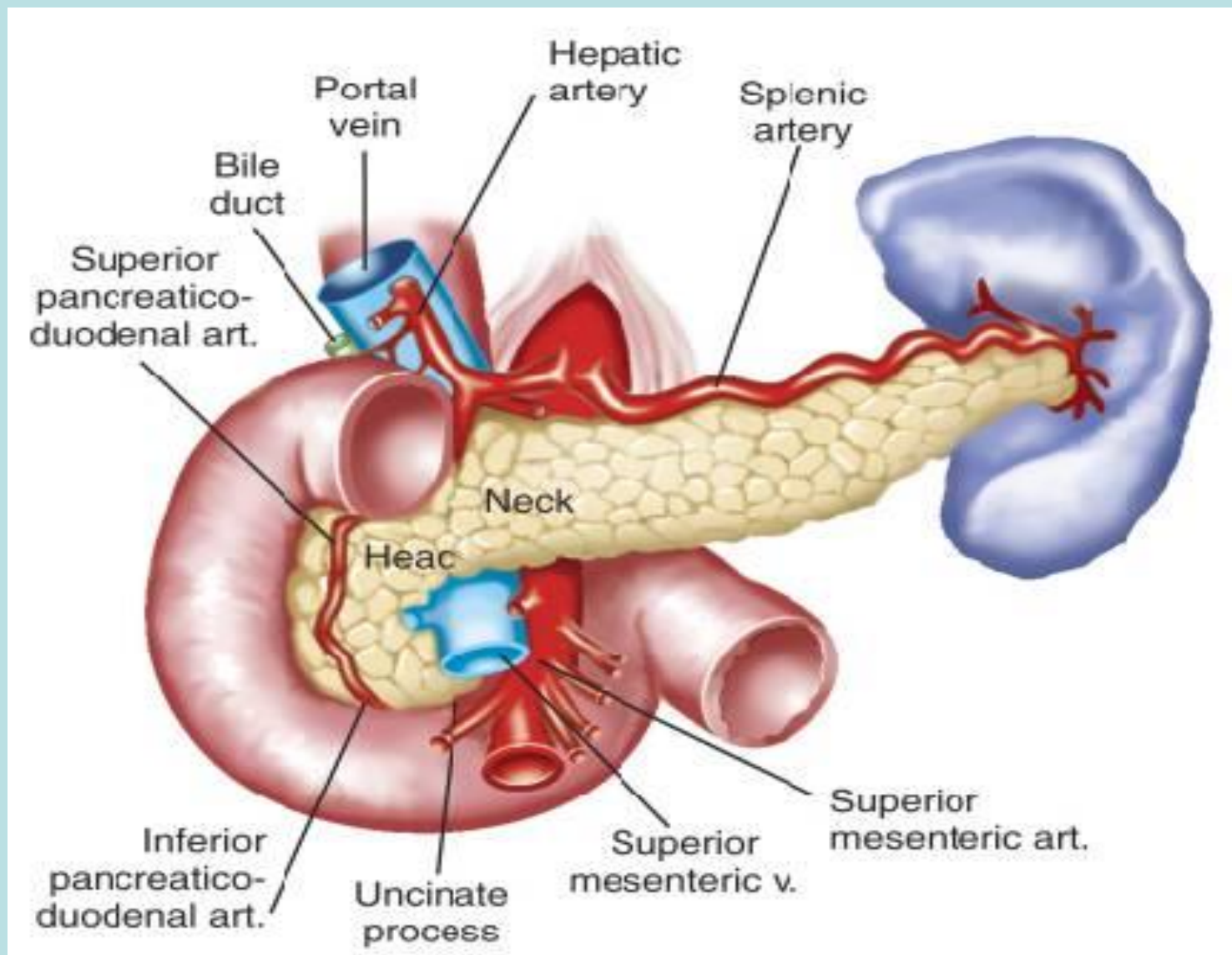
Vessels and Nerves

- **The arteries** supplying the duodenum are the right gastric and superior pancreaticoduodenal branches of the hepatic, and the inferior pancreaticoduodenal branch of the superior mesenteric.
- **The veins** end in the lienal and superior mesenteric.
- **The nerves** are derived from the coeliac plexus.









HAVE A NICE DAY!

