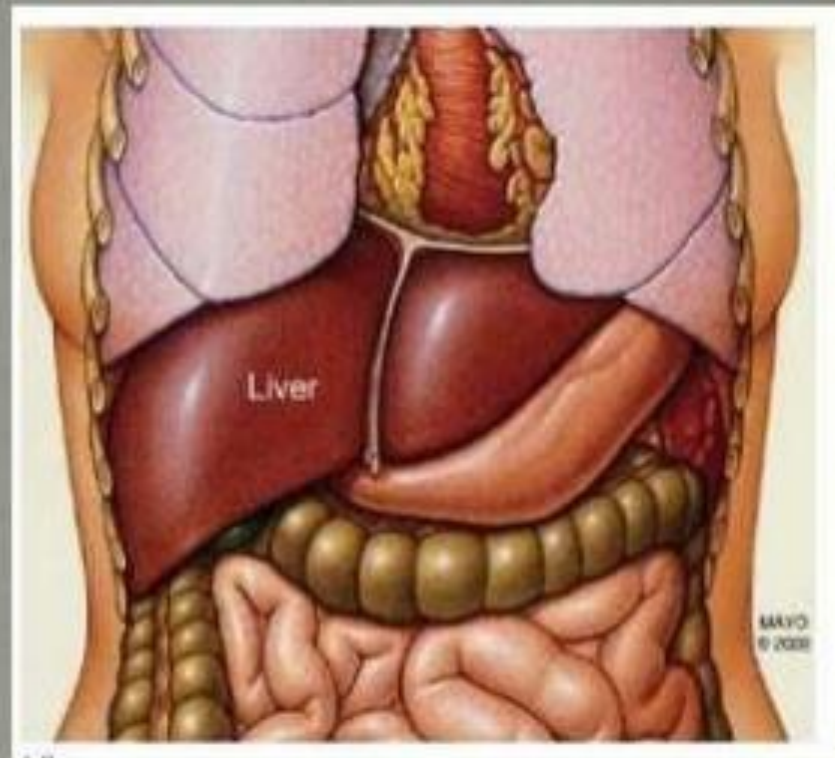


HEPATO PORTAL CIRCULATION

Liver is one of the largest organ in the body and weighs about 1200-1500g. It is a wedge shaped organ which lies just beneath the diaphragm, with its base to the right and apex to the left.



2 anatomical lobes -right and left

Right lobe further divided into caudate lobe on the posterior surface and quadrate lobe on the inferior surface.

A fold of peritoneum called falciform ligament separates the right and left lobe anteriorly.

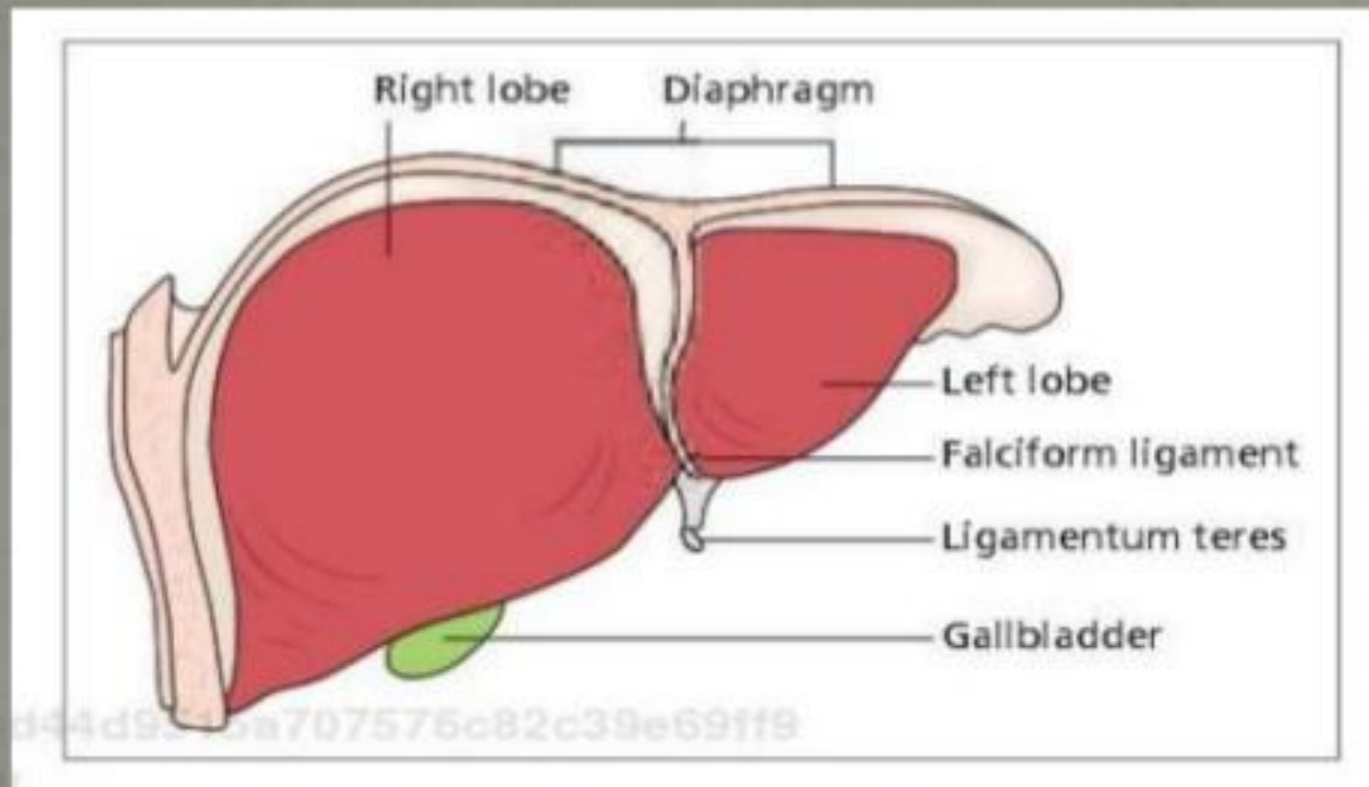


Image source: Sherlock, S., & Dooley, J. (2008). Diseases of the Liver and Biliary System. Chichester, GBR: Wiley. Retrieved from <http://www.ebrary.com>
<http://site.ebrary.com/lib/eduni/reader.action?ppg=19&docID=10236665&tm=1427937381757>

Liver is separated posteriorly by a fissure for ligamentum venosum.

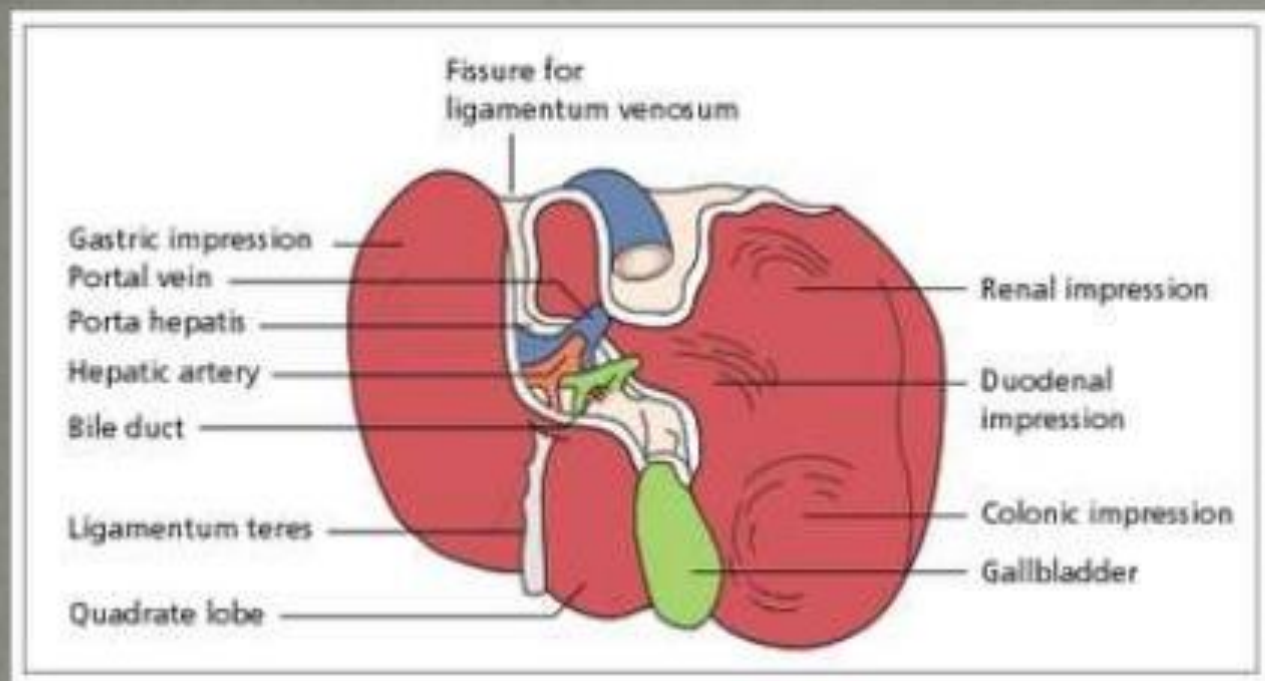


Image source: Sherlock, S., & Dooley, J. (2008). *Diseases of the Liver and Biliary System*. Chichester, GBR: Wiley. Retrieved from <http://www.ebrary.com>
<http://site.ebrary.com/lib/cduni/reader.action?ppg=19&docID=10236665&tm=1427937381757>

Porta hepatis is the fissure on the inferior surface of the right lobe through which the portal triad which are portal vein, hepatic artery and bile duct enter the liver.

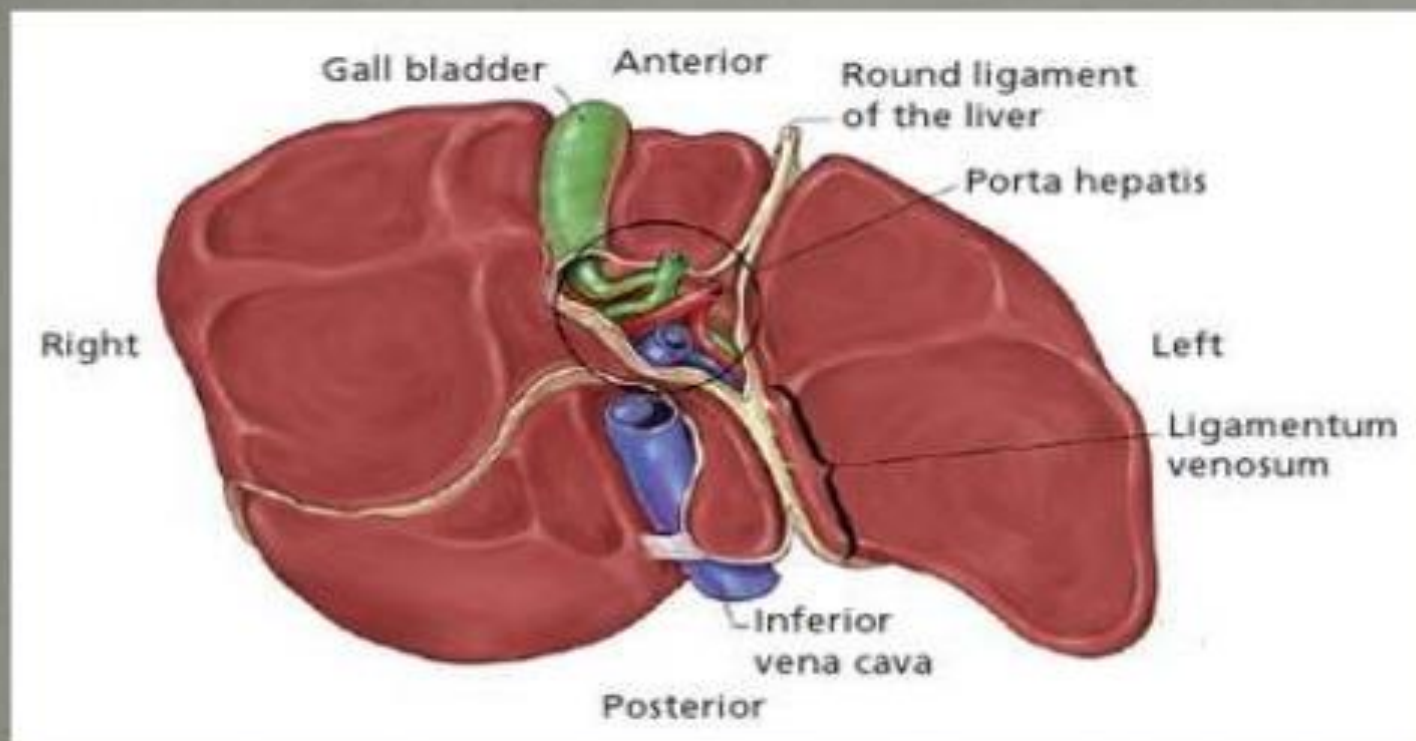
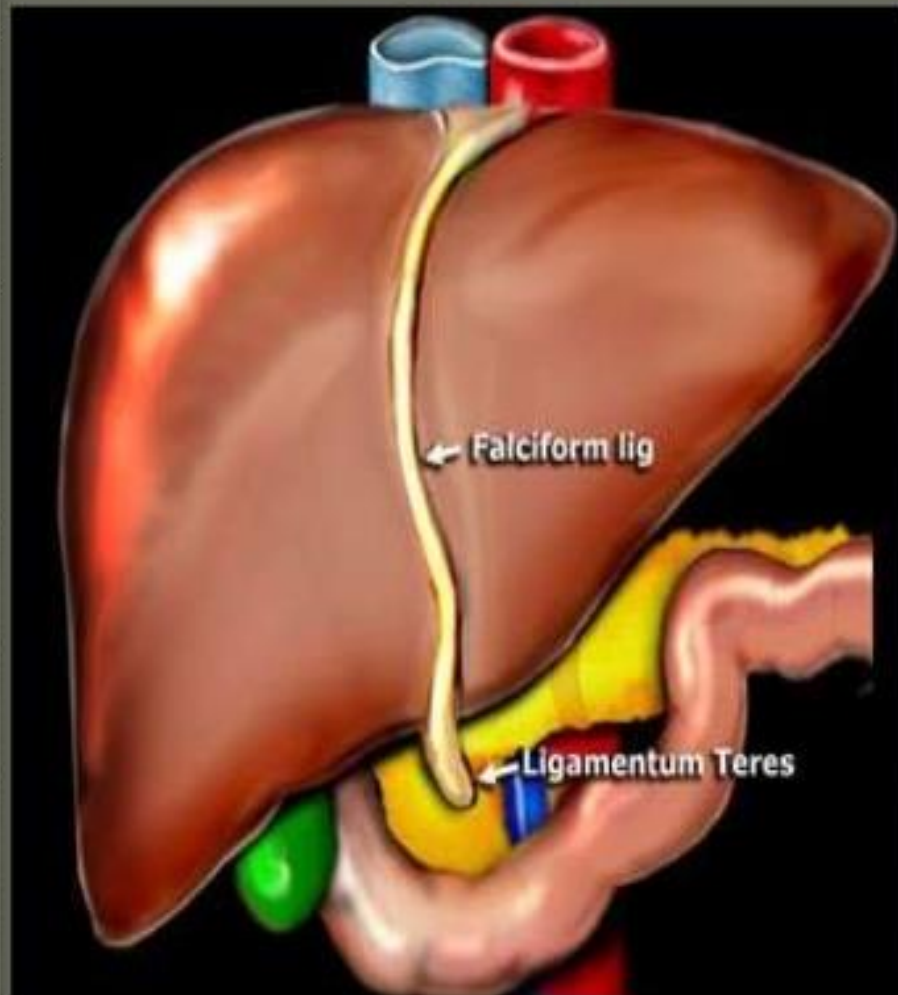
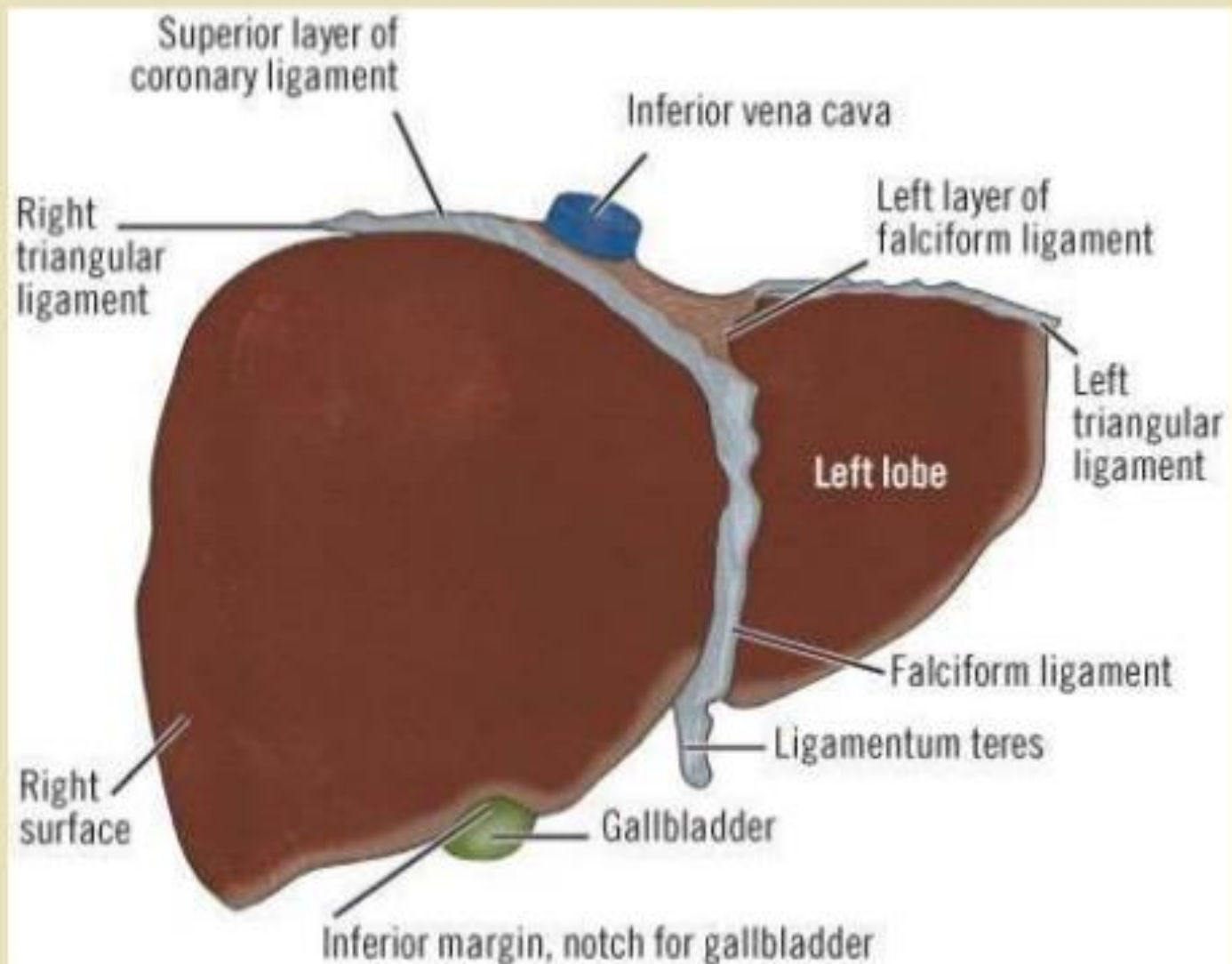


Image source: Lindor, K. D., & Vargas, H. E. (2010). *Practical Gastroenterology and Hepatology: Liver and Biliary Disease*. Hoboken, NJ, USA: Wiley-Blackwell. Retrieved from <http://www.ebrary.com>
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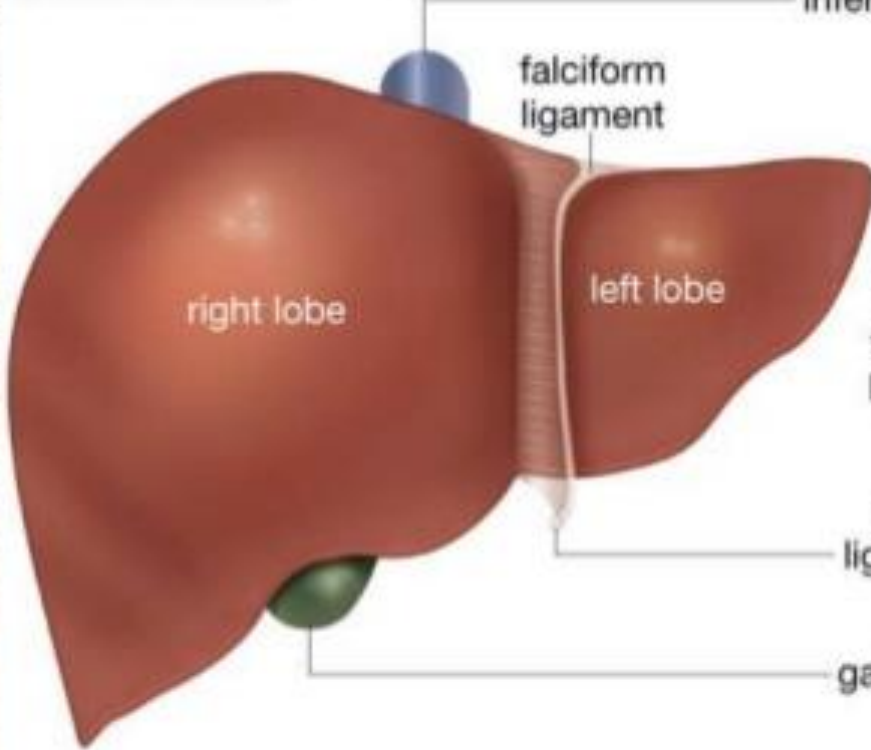


- On the diaphragmatic surface, the ligamentum falciforme divides the liver into the right and left anatomic lobes, which are very different from the functional right and left lobes (or right and left hemiliver).

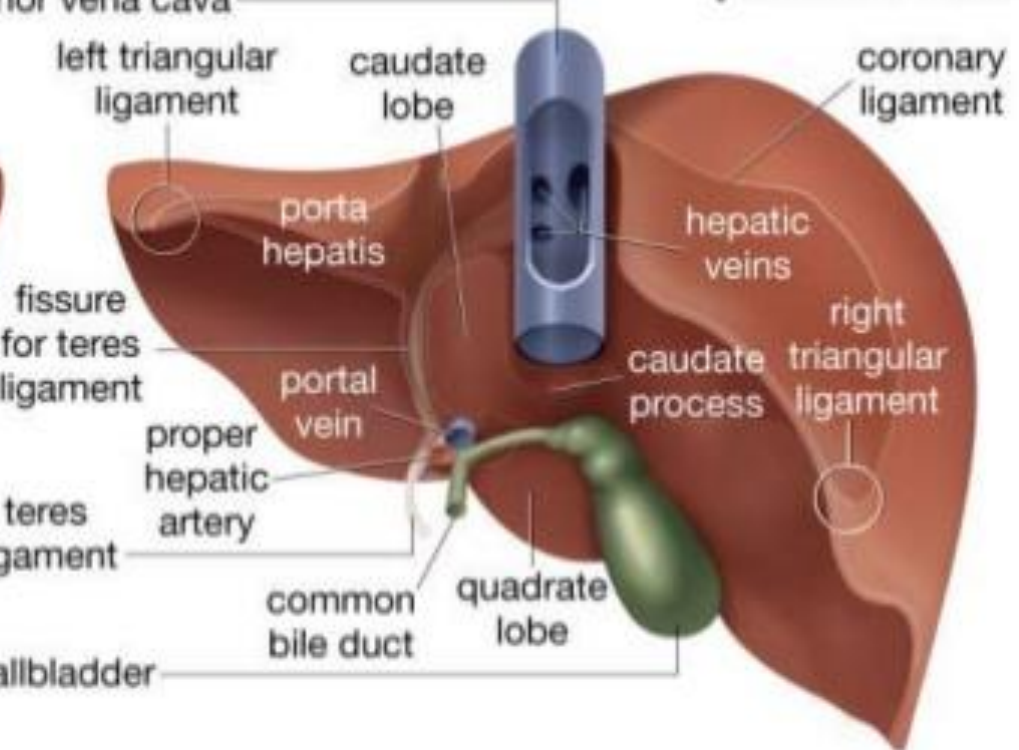
Lobes - Diaphragmatic Surface



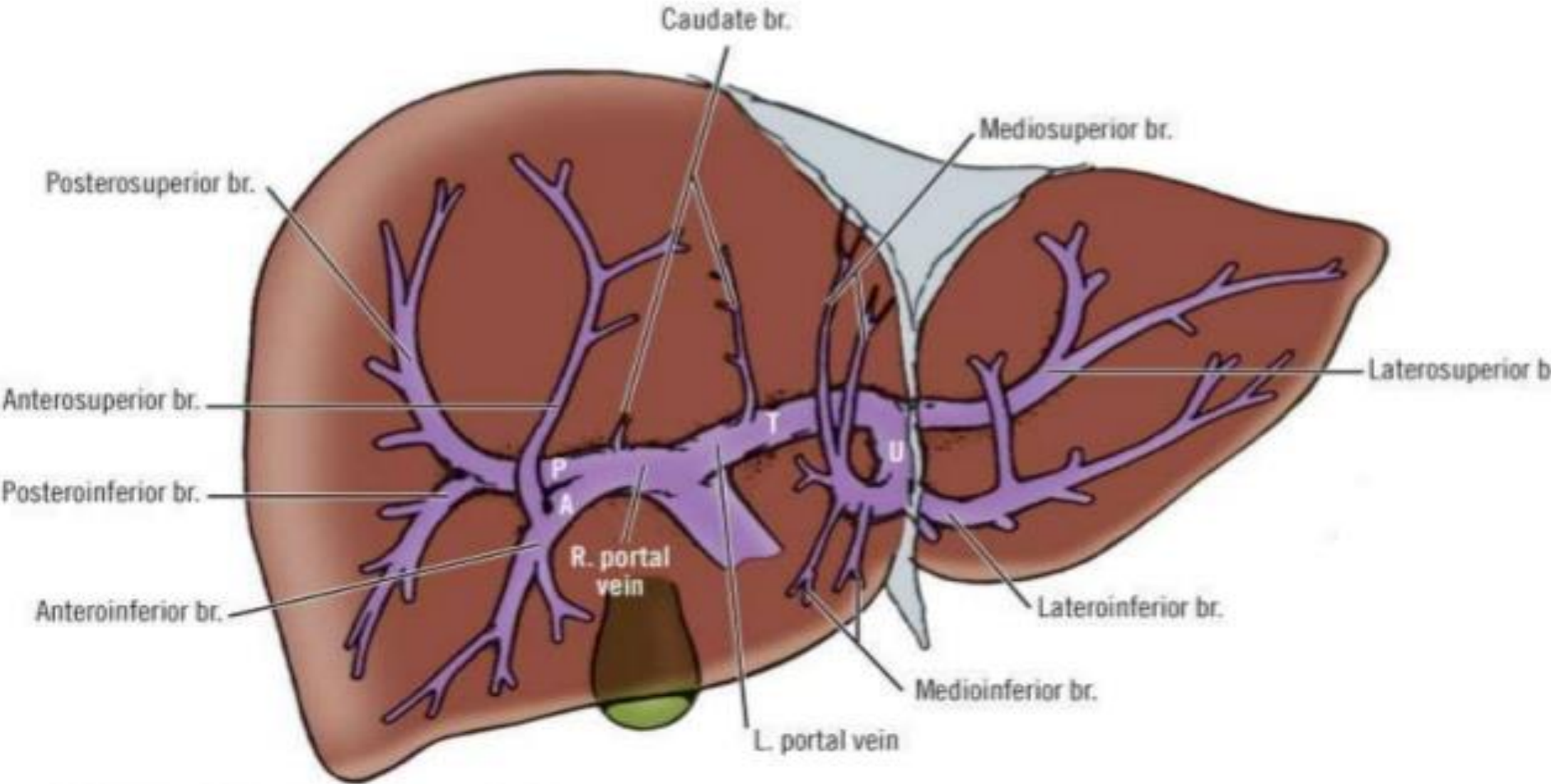
anterior view



posterior view



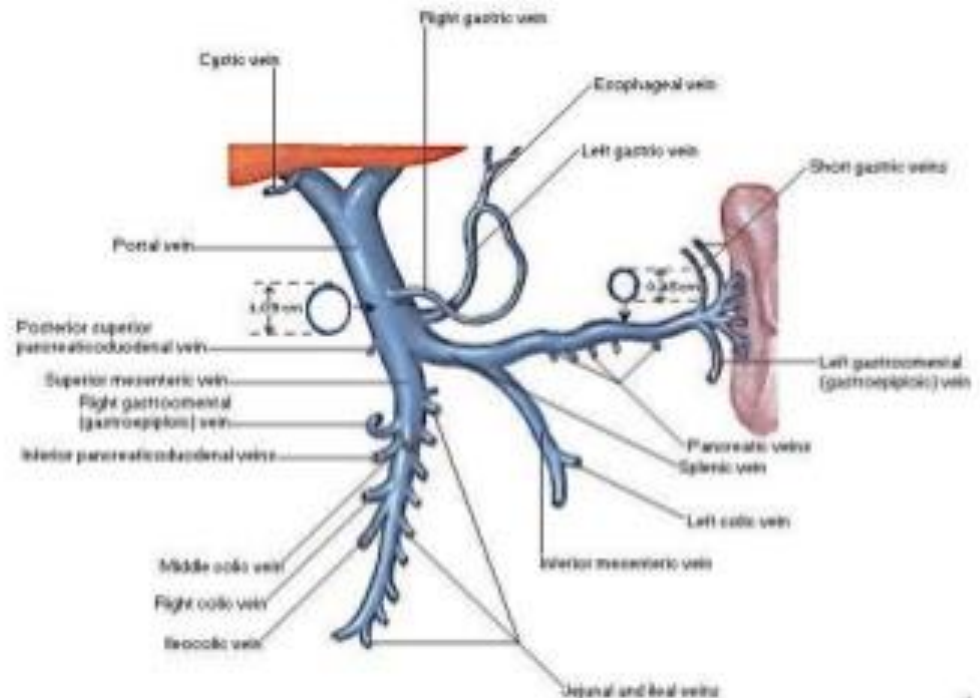
PORTAL VEIN



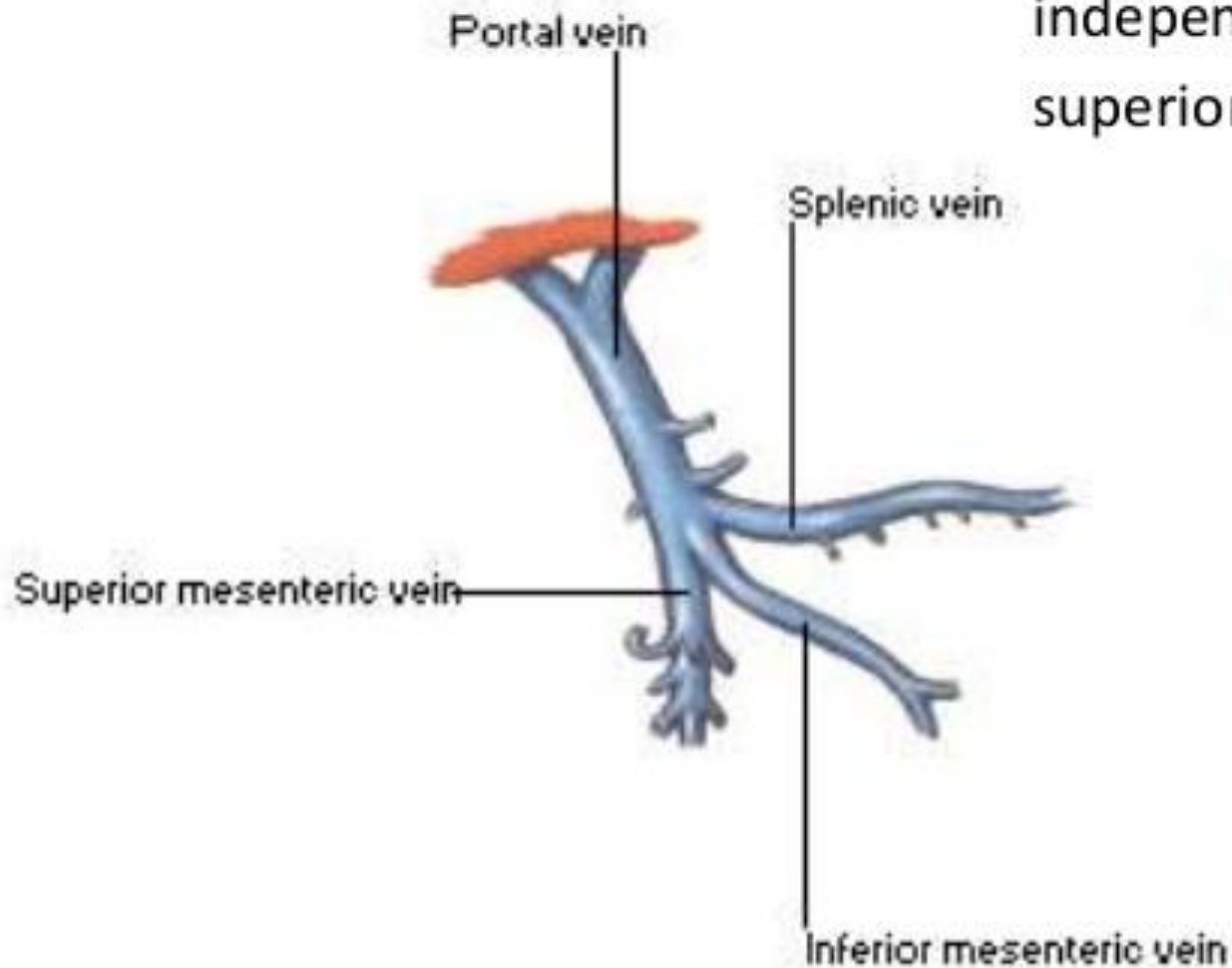
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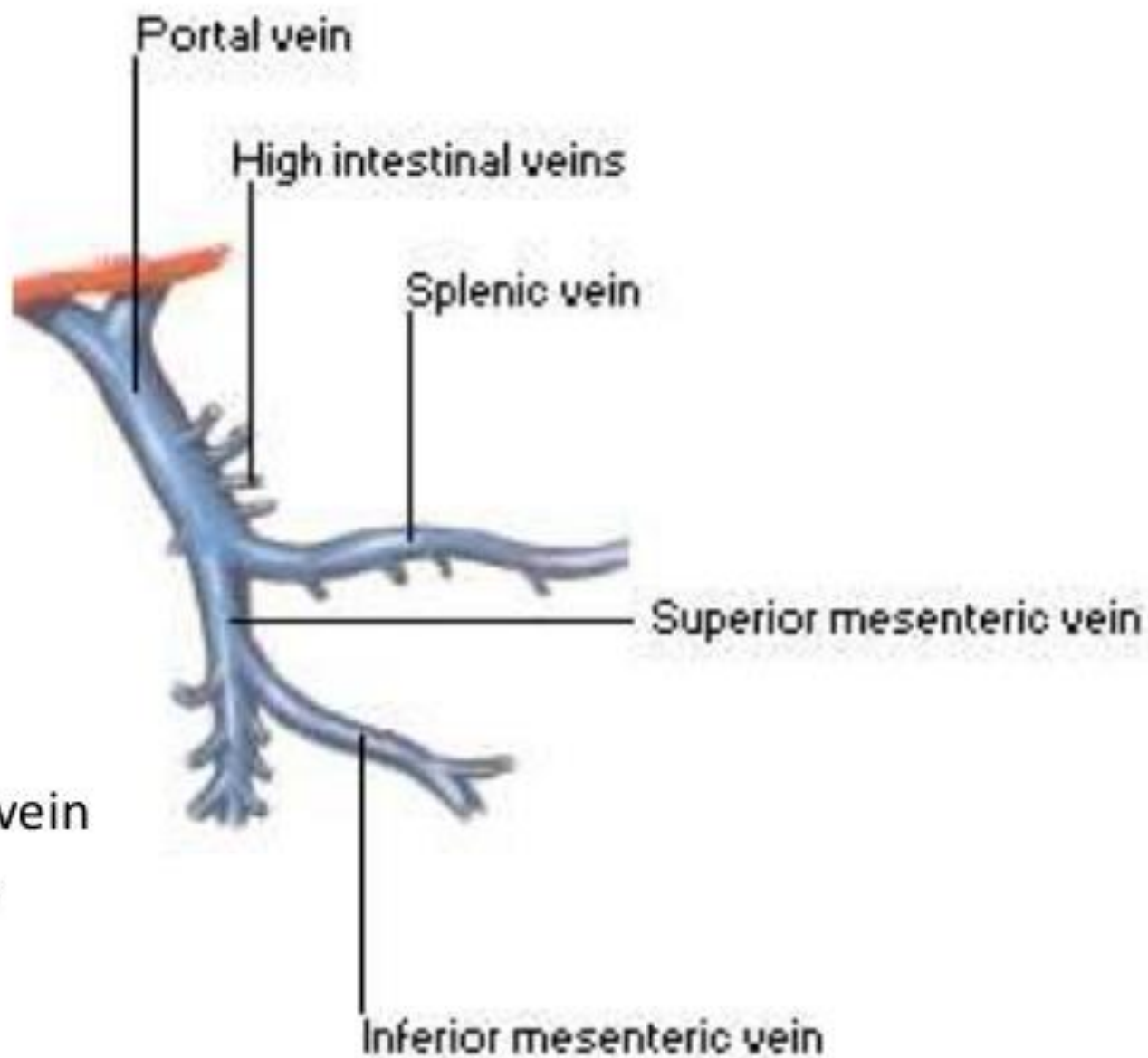
Tributaries

- Formative
 - Sup Mesenteric vein
 - Splenic vein
- Received by Trunk
 - Rt & Lt Gastric veins
 - Superior PD vein
- Received by branches
 - Cystic vein
 - Paraumbilical veins
- Occasional
 - Inf mesenteric
 - Rt gastro-epiploic
 - Pre-pyloric vein.



Splenic vein & inferior mesenteric vein open independently into superior mesenteric vein

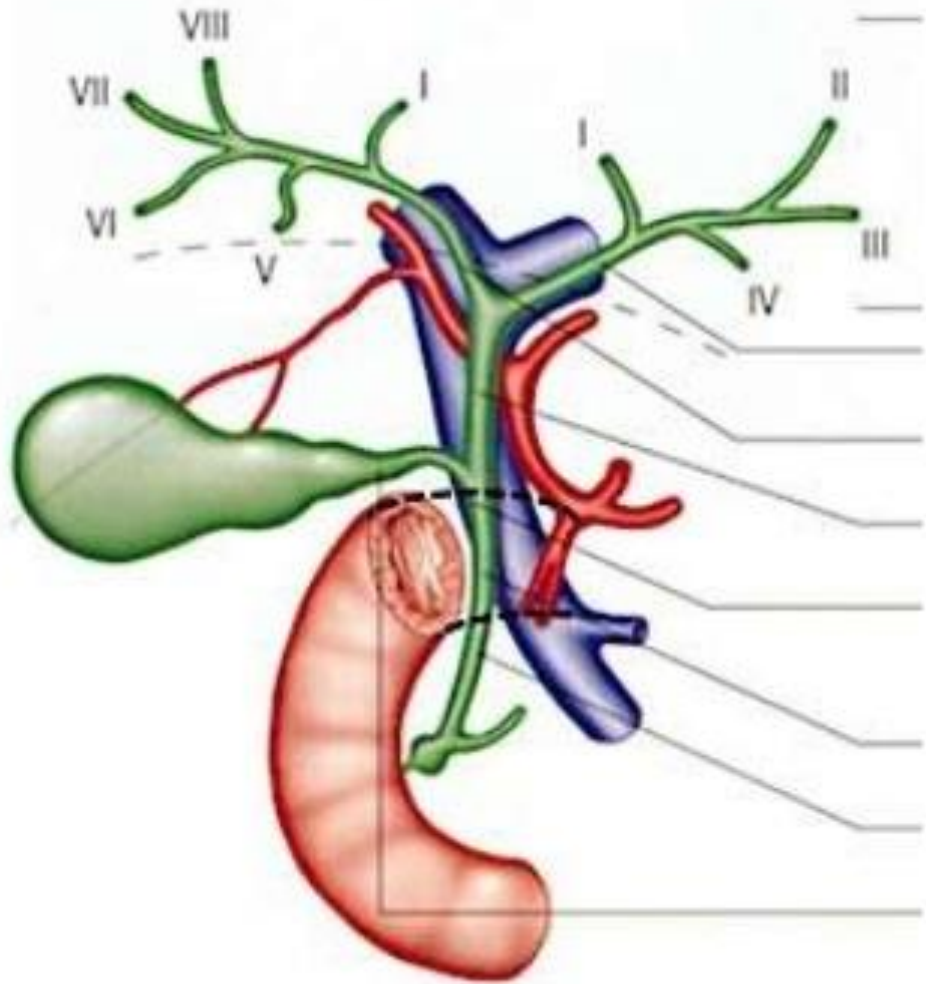




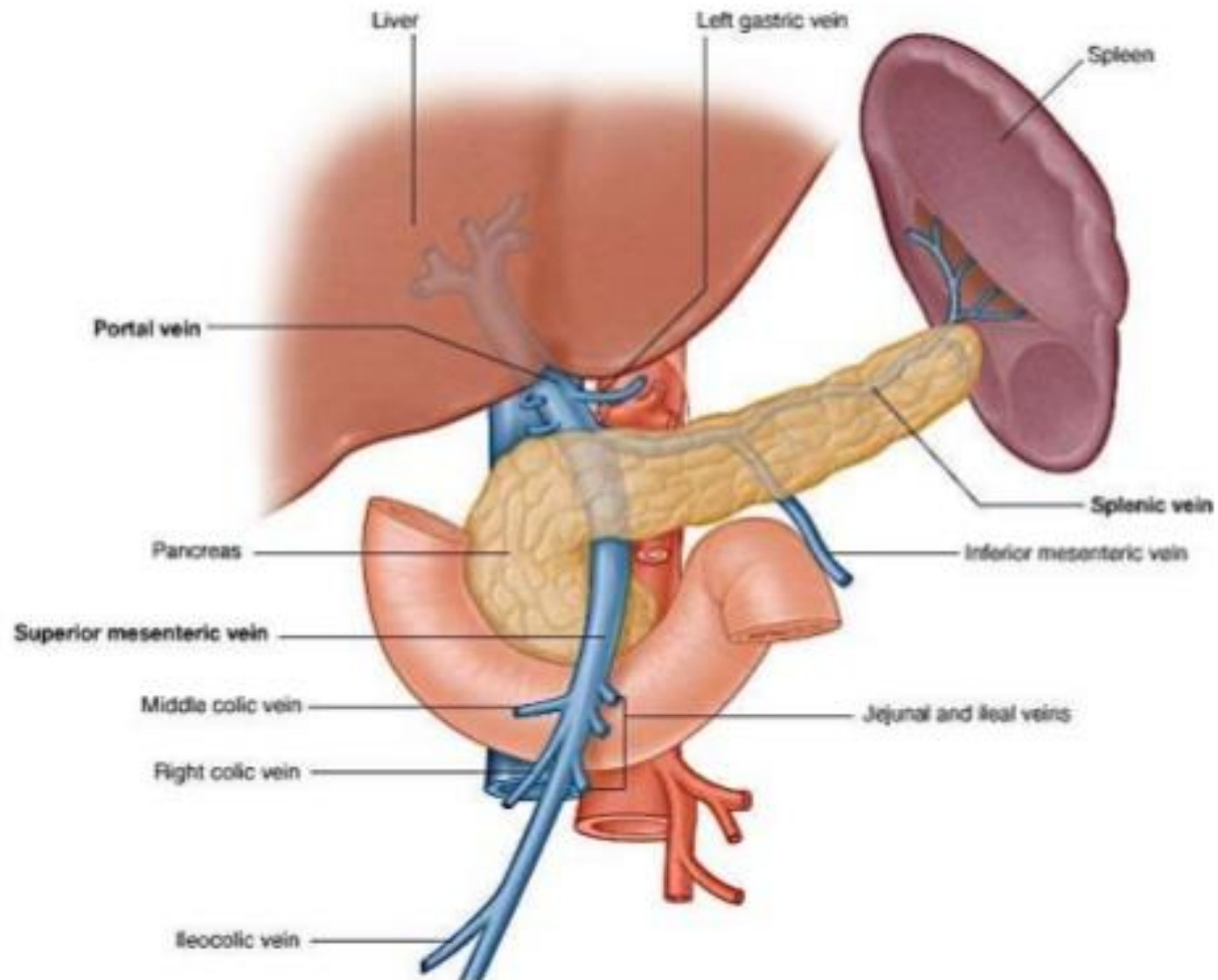
Inferior mesenteric vein
Opens into superior
mesenteric vein

Course: Extrahepatic part

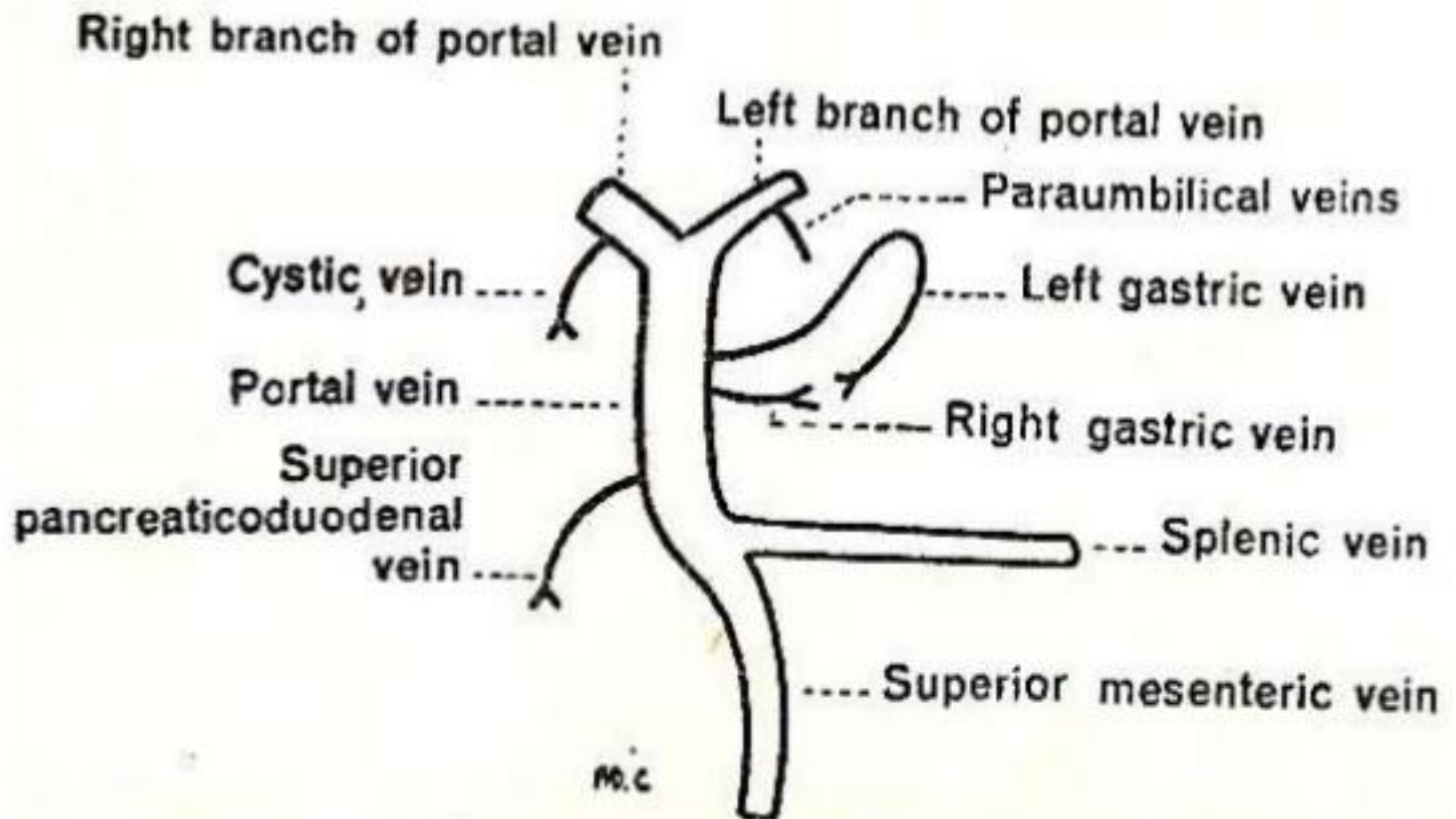
- Passes upwards & Rt, behind neck of pancreas & 1st part of duodenum
- Enters rt free margin of lesser omentum in front of epiploic foramen with BD & HA
- Reaches porta hepatis & divides into rt & Lt branches.



Relations

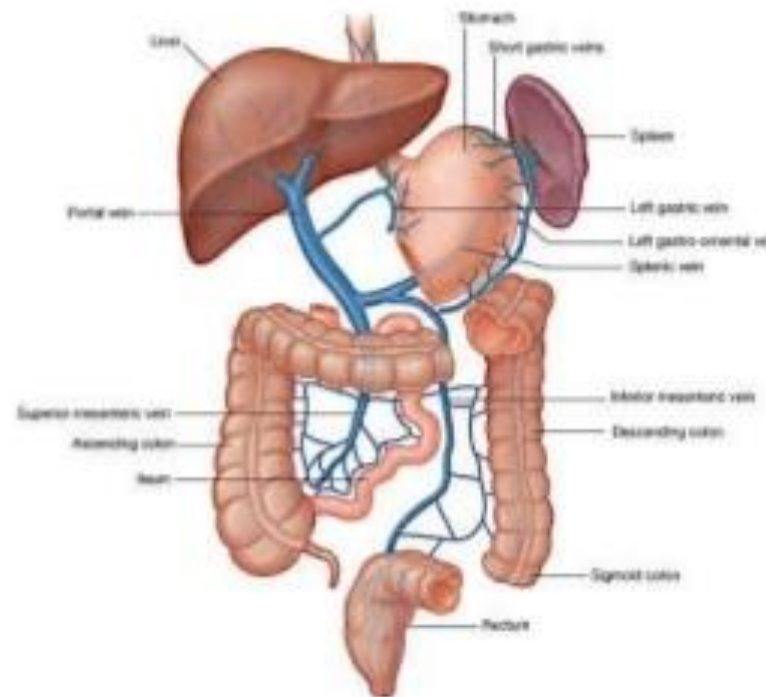


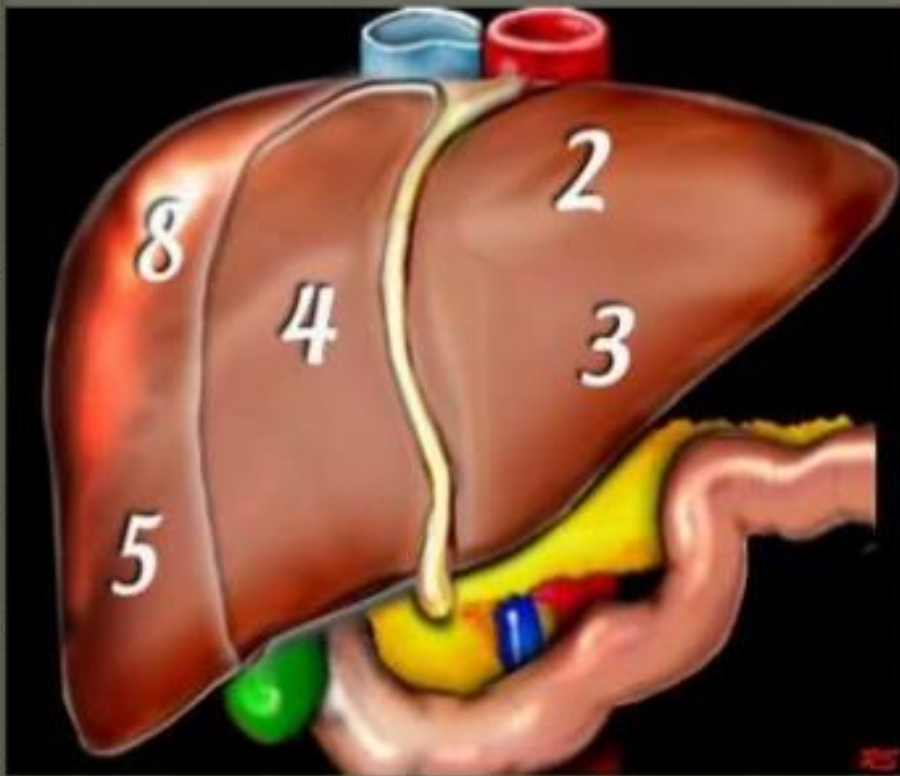
Tributaries



Hepatic Portal Vein

- Origin & end in capillaries / venous sinusoids
- Size: 8cm X 1 cm
- Drains
 - Abdominal part of alimentary tract (except lower part of anal canal)
 - Spleen & Pancreas
- Conveys absorbed products of digested food to liver
- Devoid of valves
- Reservoir of blood : 1200 ml / min

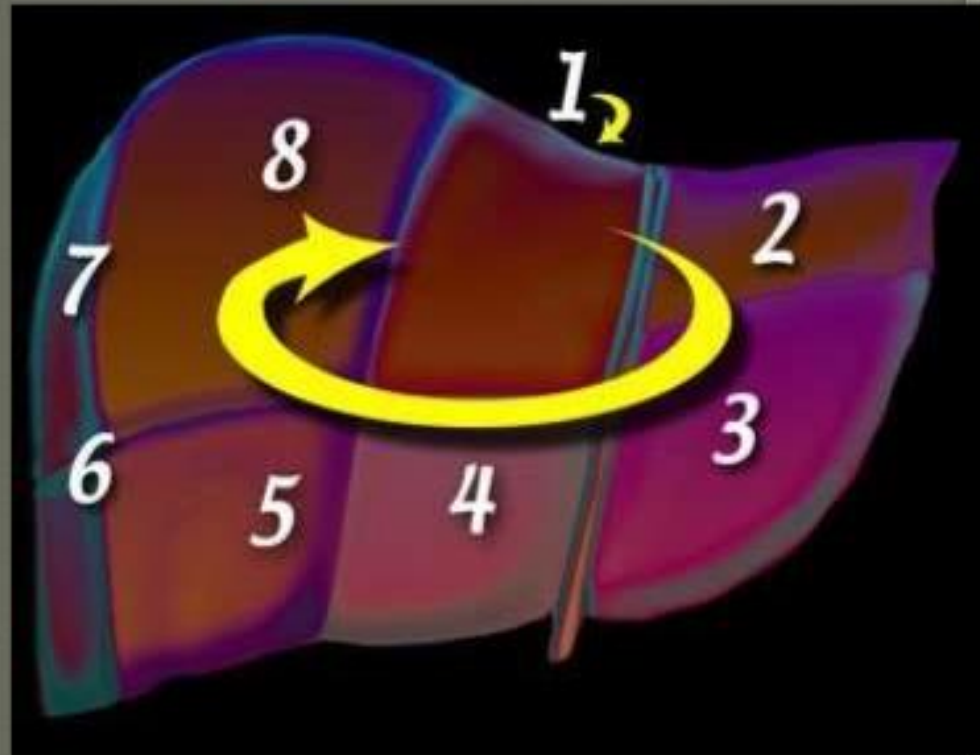




- Couinaud divided the liver into a functional left and right liver by a main portal scissurae containing the middle hepatic vein.
- This is known AS **CANTLIE'S LINE**.
- Cantlie's line runs from the middle of the gallbladder fossa anteriorly to the inferior vena cava posteriorly.

Segments numbering

- There are eight liver segments.
- Segment 4 is sometimes divided into segment 4a and 4b according to Bismuth.
- The numbering of the segments is in a **CLOCKWISE MANNER**
- Segment 1 (caudate lobe) is located posteriorly. It is not visible on a frontal view.

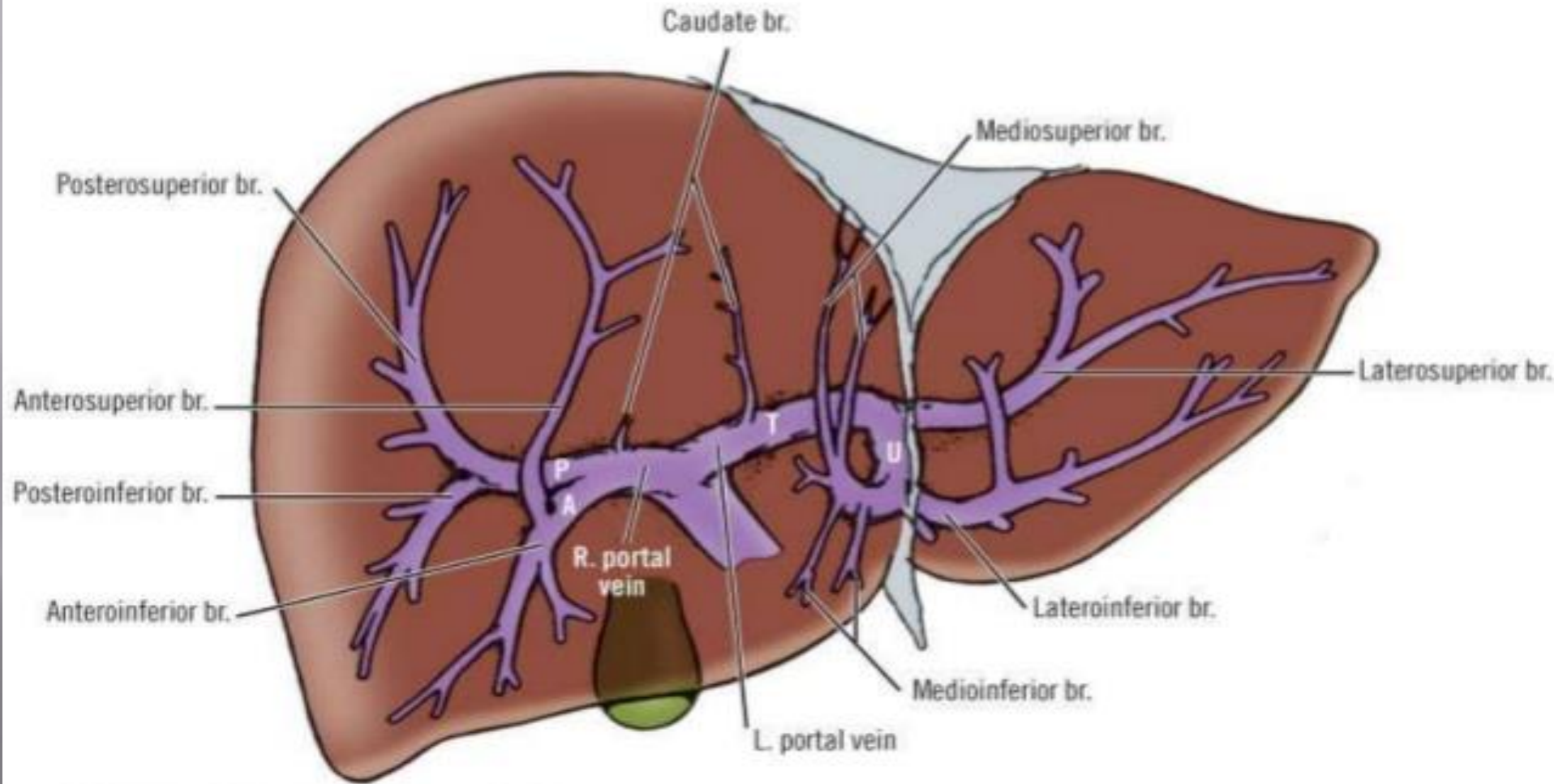


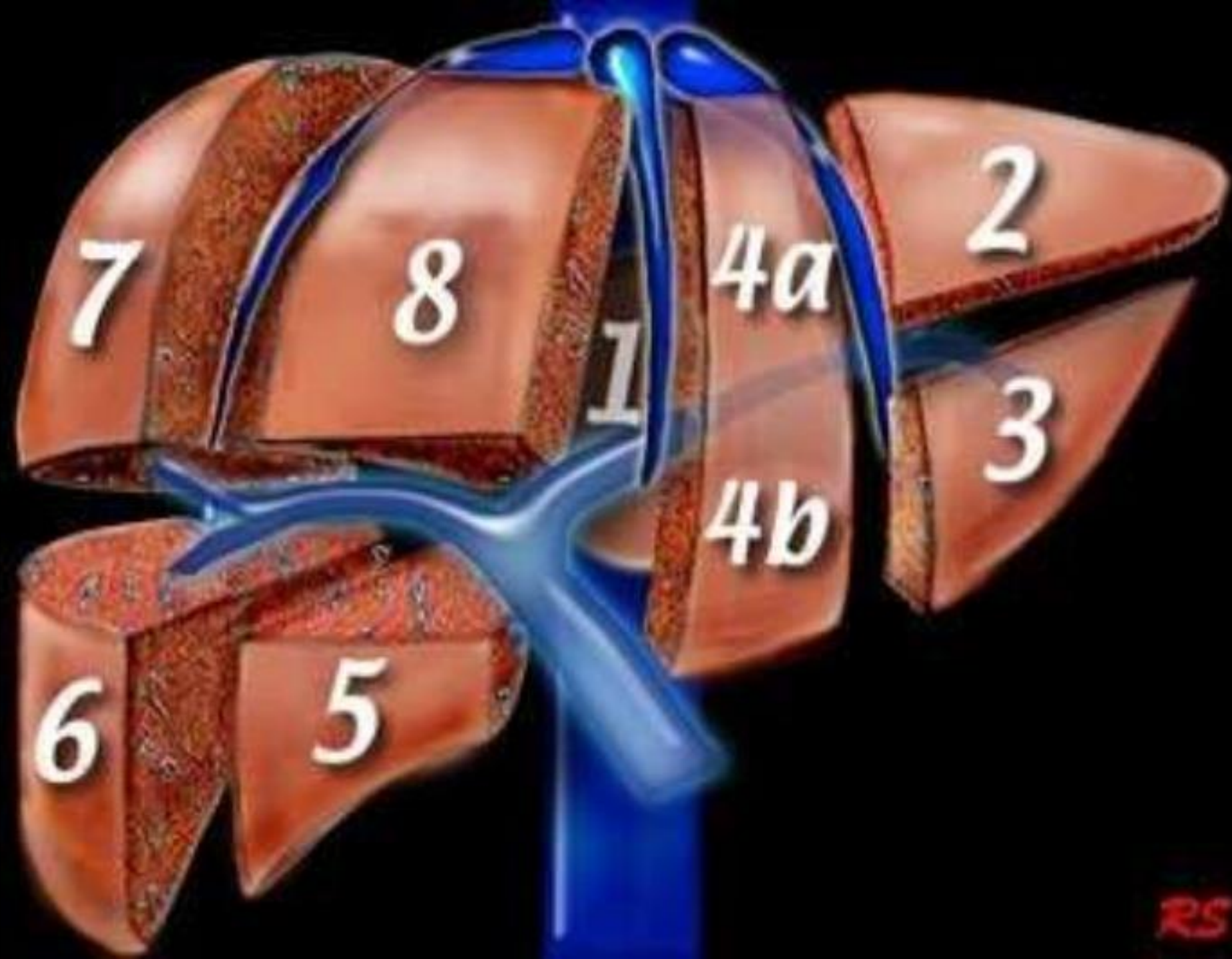
- **Right hepatic vein** divides the right lobe into **anterior and posterior segments**.

- **Middle hepatic vein** divides the liver into right and left lobes (or right and left hemiliver). This plane runs from the inferior vena cava to the gallbladder fossa.
- **Left hepatic vein** divides the left lobe into a medial and lateral part.

-
- **Portal vein** divides the liver into upper and lower segments.
 - The left and right portal veins branch superiorly and inferiorly to project into the center of each segment.

PORTAL VEIN



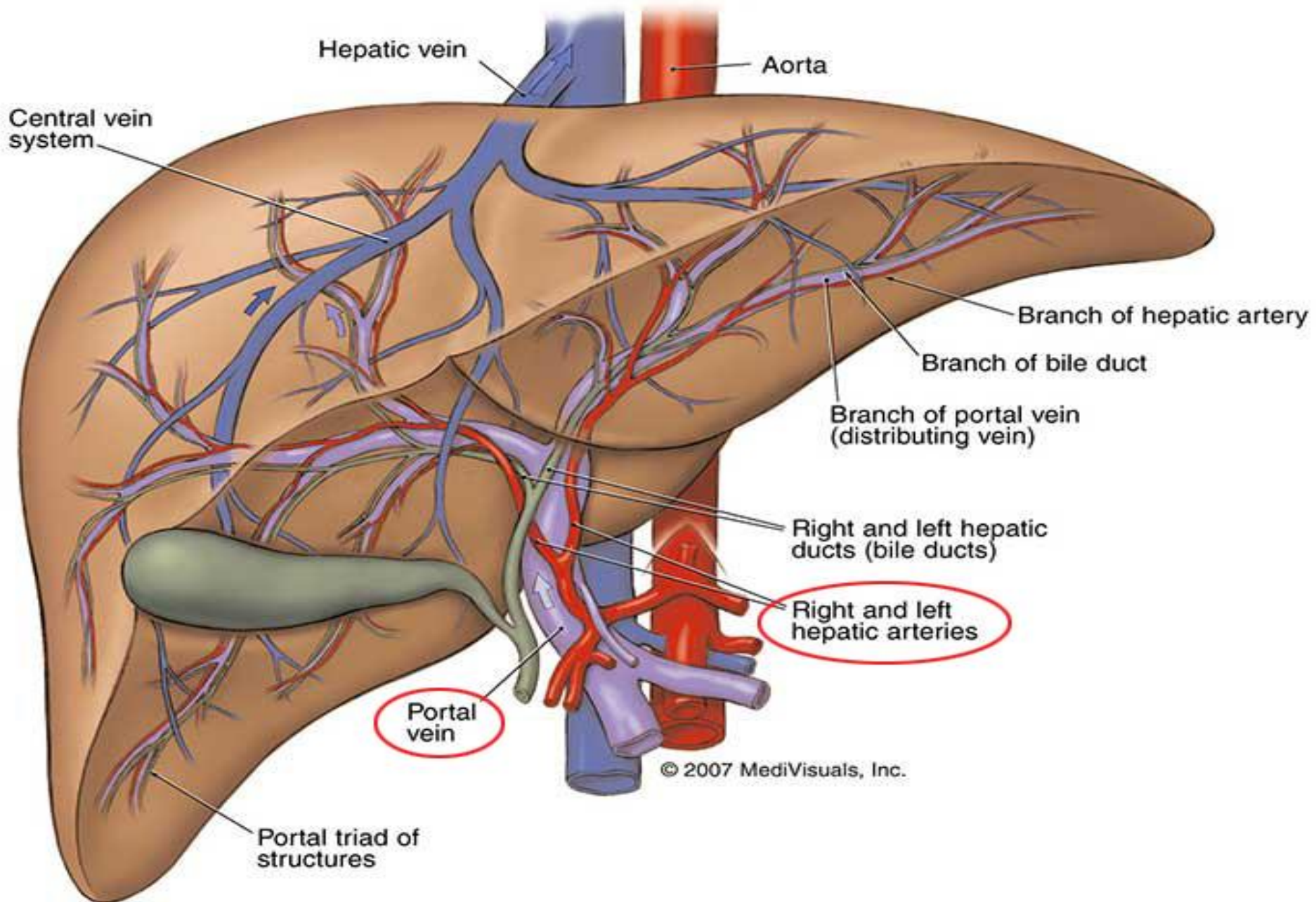


HEPATIC VEIN

- **Right hepatic vein** divides the right lobe into **anterior and posterior segments**.

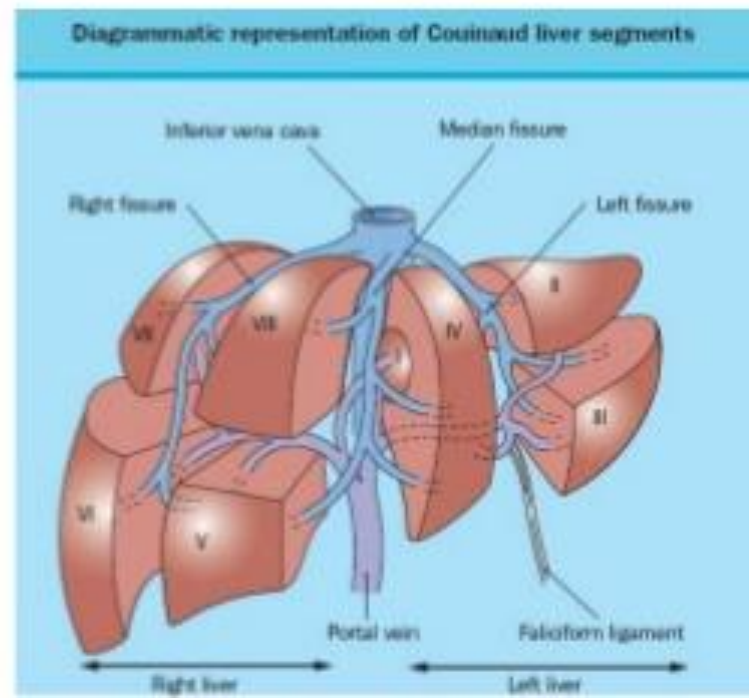
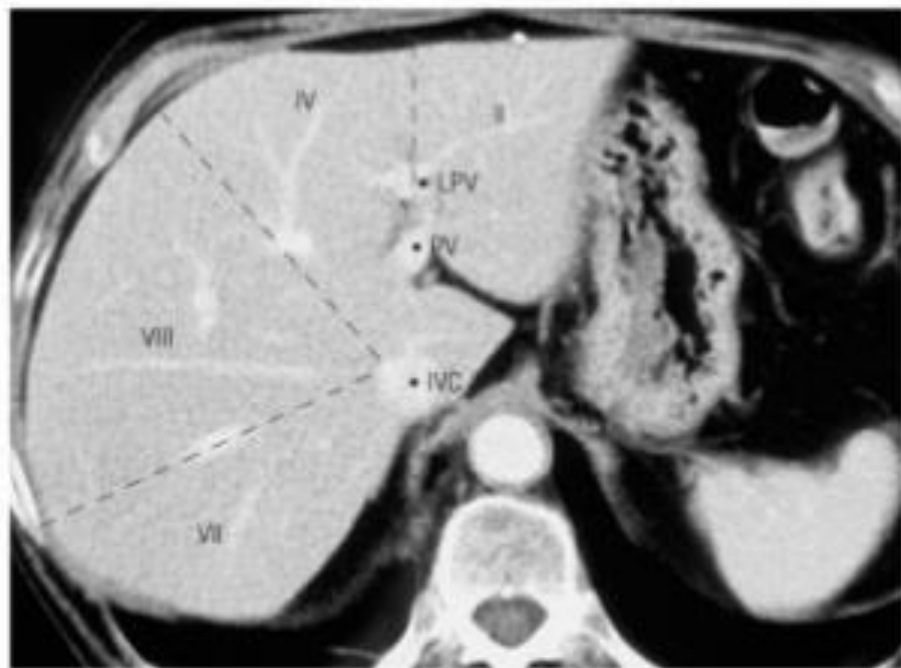
- **Middle hepatic vein** divides the liver into right and left lobes (or right and left hemiliver). This plane runs from the inferior vena cava to the gallbladder fossa.
- **Left hepatic vein** divides the left lobe into a medial and lateral part.

Internal Anatomy of Liver



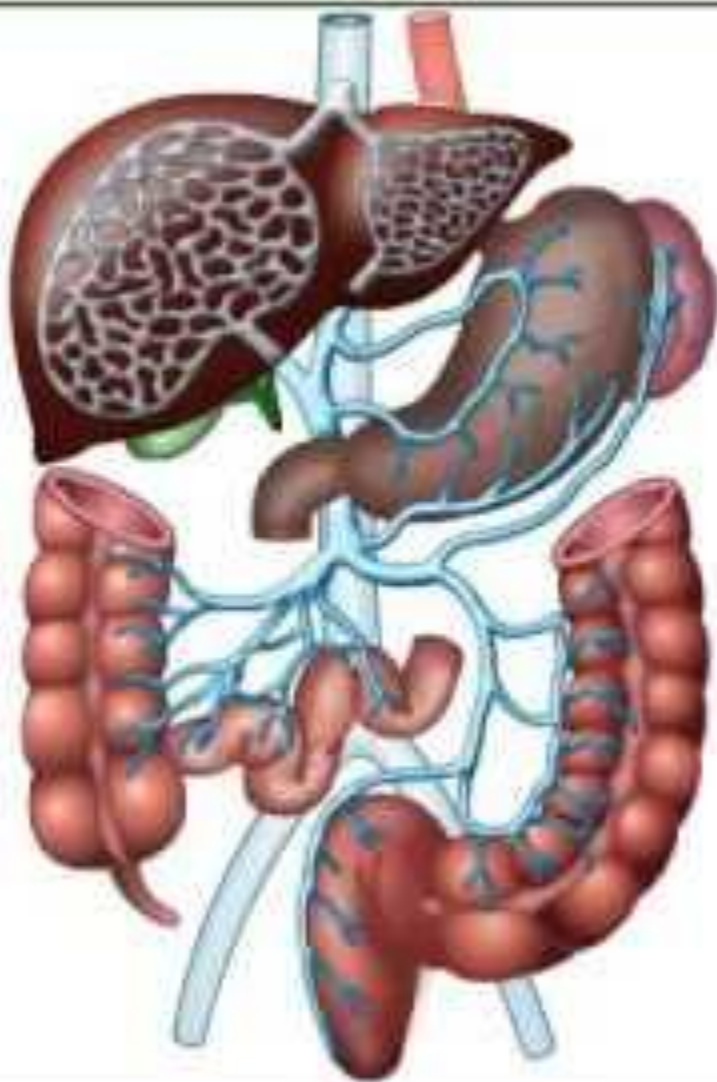
Couinaud segments

- 8 'functional segments'
- According to vascular supply.
- Each has its own vascular inflow, outflow and biliary/ lymphatic drainage.

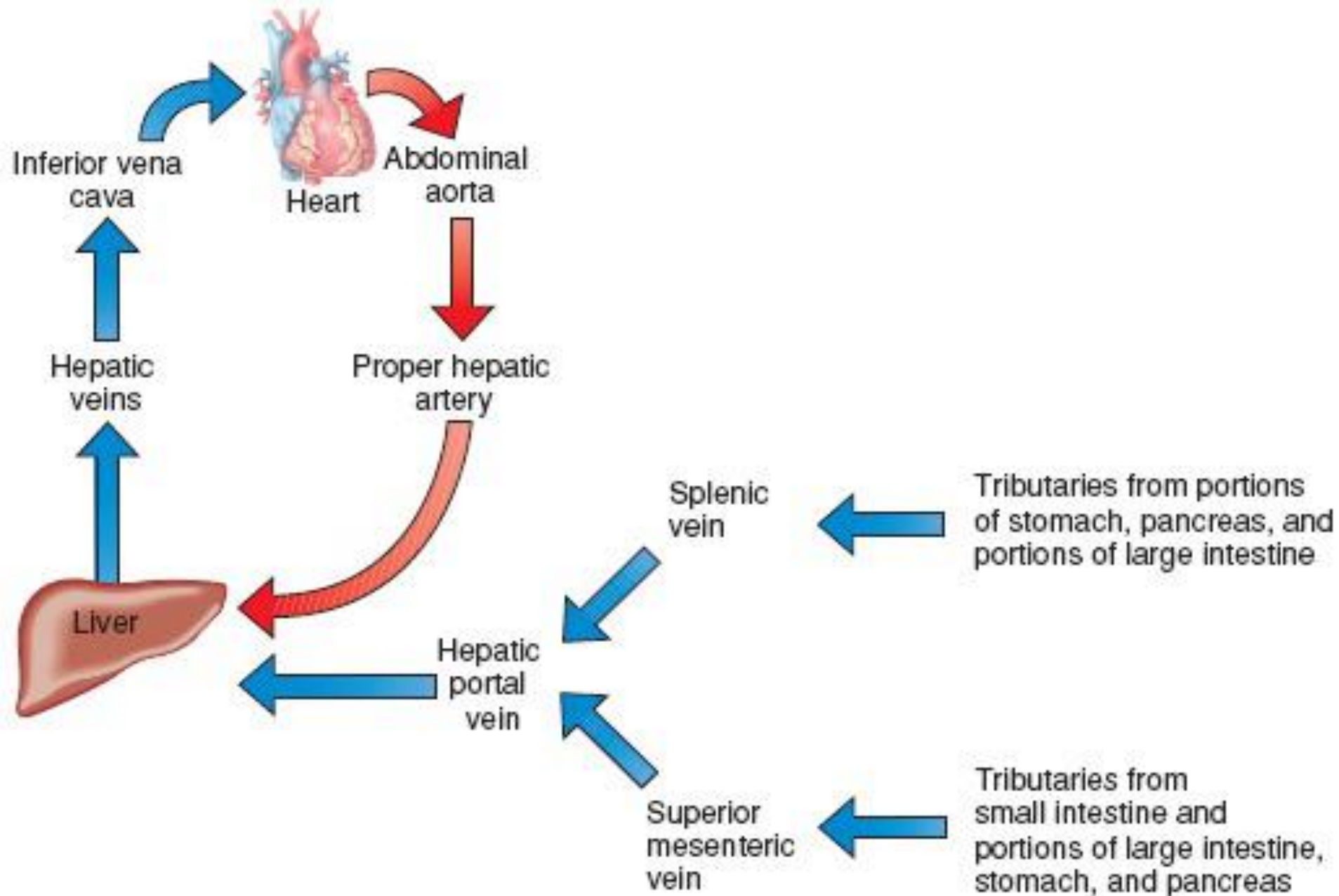


Clinical significance

- Each segment can be resected without damaging those remaining.
- For the liver to remain viable, resections must proceed along the vessels that define the peripheries of these segments.
- Liver resections [anatomic resections] are done according to these vascular segments
- The liver has the unique capacity of regeneration, and will regrow to its original size some 6-12 months after resection.
- As much as 80% of the liver mass can be removed safely.



Specifically, blood from the capillaries of the spleen, stomach, pancreas, gallbladder, and intestines flows into the superior mesenteric vein and the splenic vein. These veins converge to form the portal vein. Blood from the left and right gastric veins empties into the hepatic portal vein.



(b) Scheme of principal blood vessels of hepatic portal circulation and arterial supply and venous drainage of liver

FACTORS AFFECTING HEPATIC BLOOD FLOW

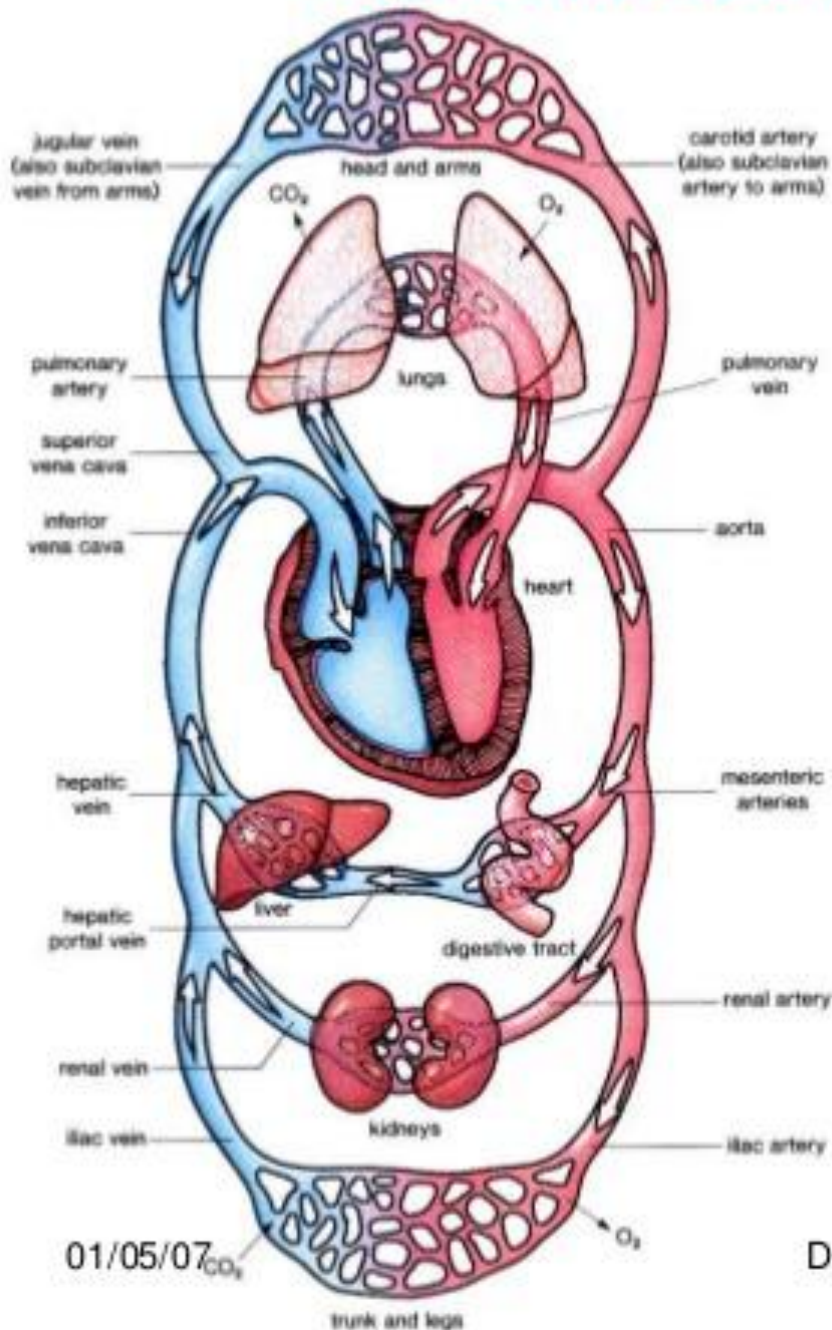
➤ INCREASE IN HEPATIC BLOOD FLOW

- Hypercapnia
- Acute hepatitis
- Supine posture
- Food intake
- Drug: Beta Agonist
Phenobaritone
- Enzyme inducers

➤ DECREASE IN HEPATIC BLOOD FLOW

- IPPV
- Hypocapnia
- Hyhpoxia
- Cirrhosis
- alpha Stimulation
- Beta blocker
- Halothane, volatile & anesthetics
- Vasopressin

Hepatic Circulation and Blood Supply.



•Key points:

- Liver receives blood via *two routes*: high oxygen blood from the hepatic artery (30%) and low oxygen blood from the portal vein (70%).

- Blood leaves the liver *only* by the hepatic vein.

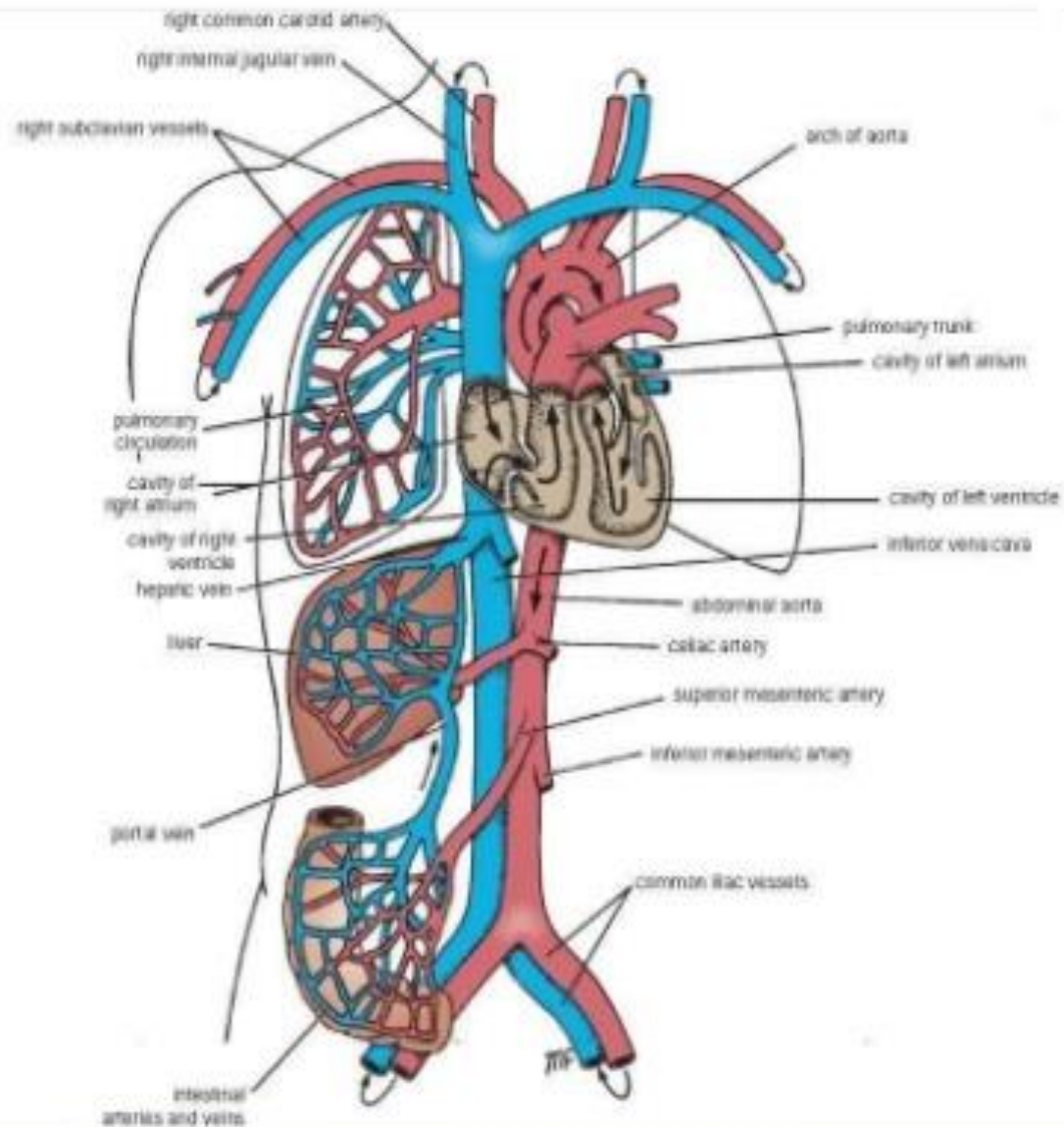
- Liver is placed between venous blood returning from the bulk of the GI and peritoneal cavity and the venous arm of the systemic circulation.

- WHAT ARE THE TOXICOLOGICAL CONSEQUENCES OF THIS?***

General Plan of Blood Circulation

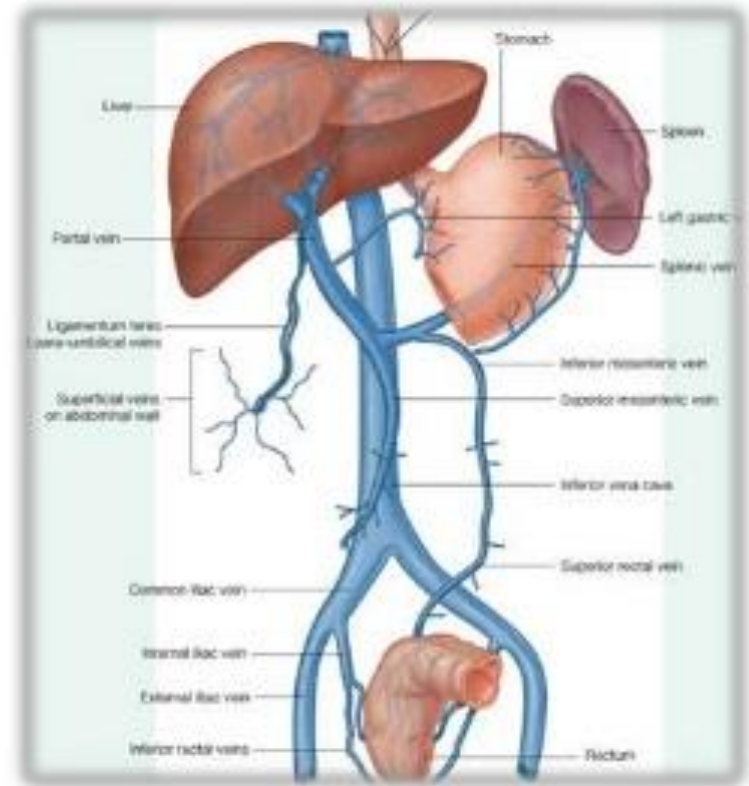
PORTAL CIRCULATION

Blood is collected from one set of capillaries and is passed to a larger vessel which then again divides into capillaries before the blood is returned to systemic circulation.



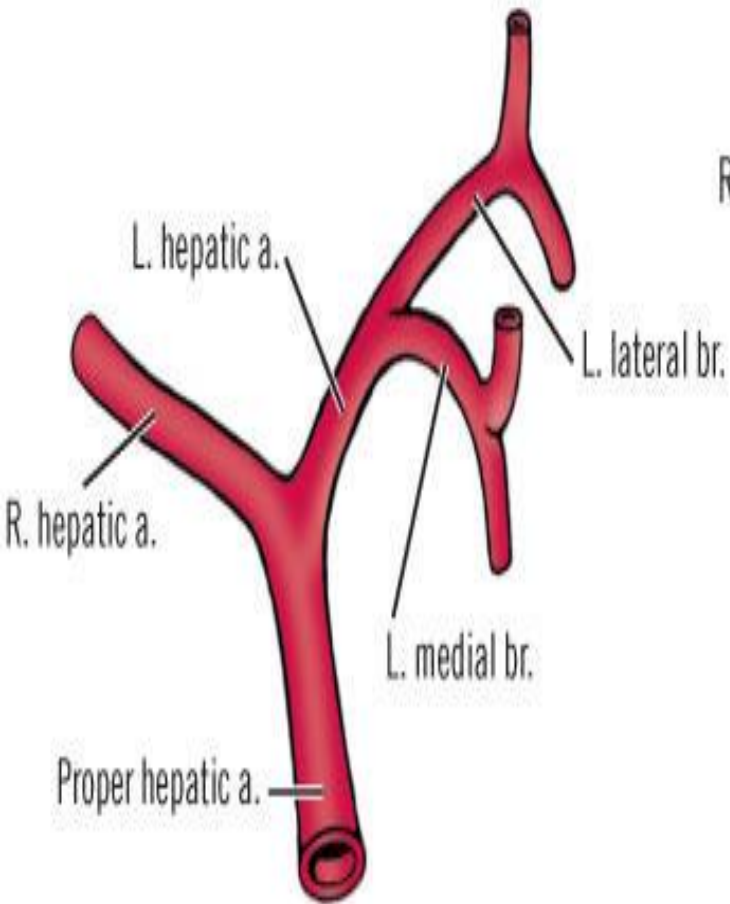
Inferior Vena Cava

- ❖ Drains most of the blood from the body below the diaphragm to the right atrium.
- ❖ Formed by the union of the 2 common iliac veins behind the right common iliac artery at the level of the 5th lumbar vertebra.
- ❖ Ascends on the right side of the aorta
- ❖ Pierces the central tendon of diaphragm at the level of the 8th thoracic vertebra.



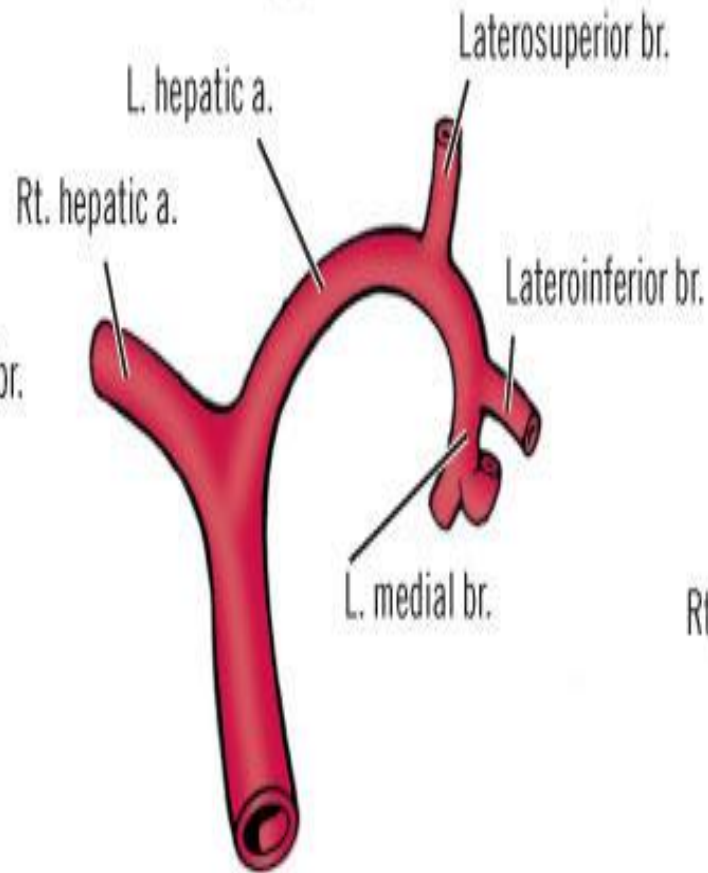
HEPATIC ARTERY

40%



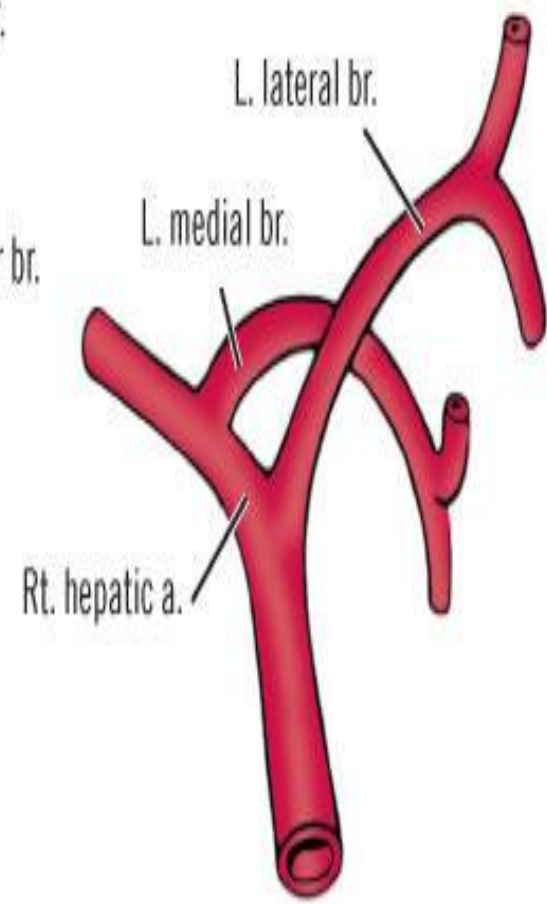
A

35%

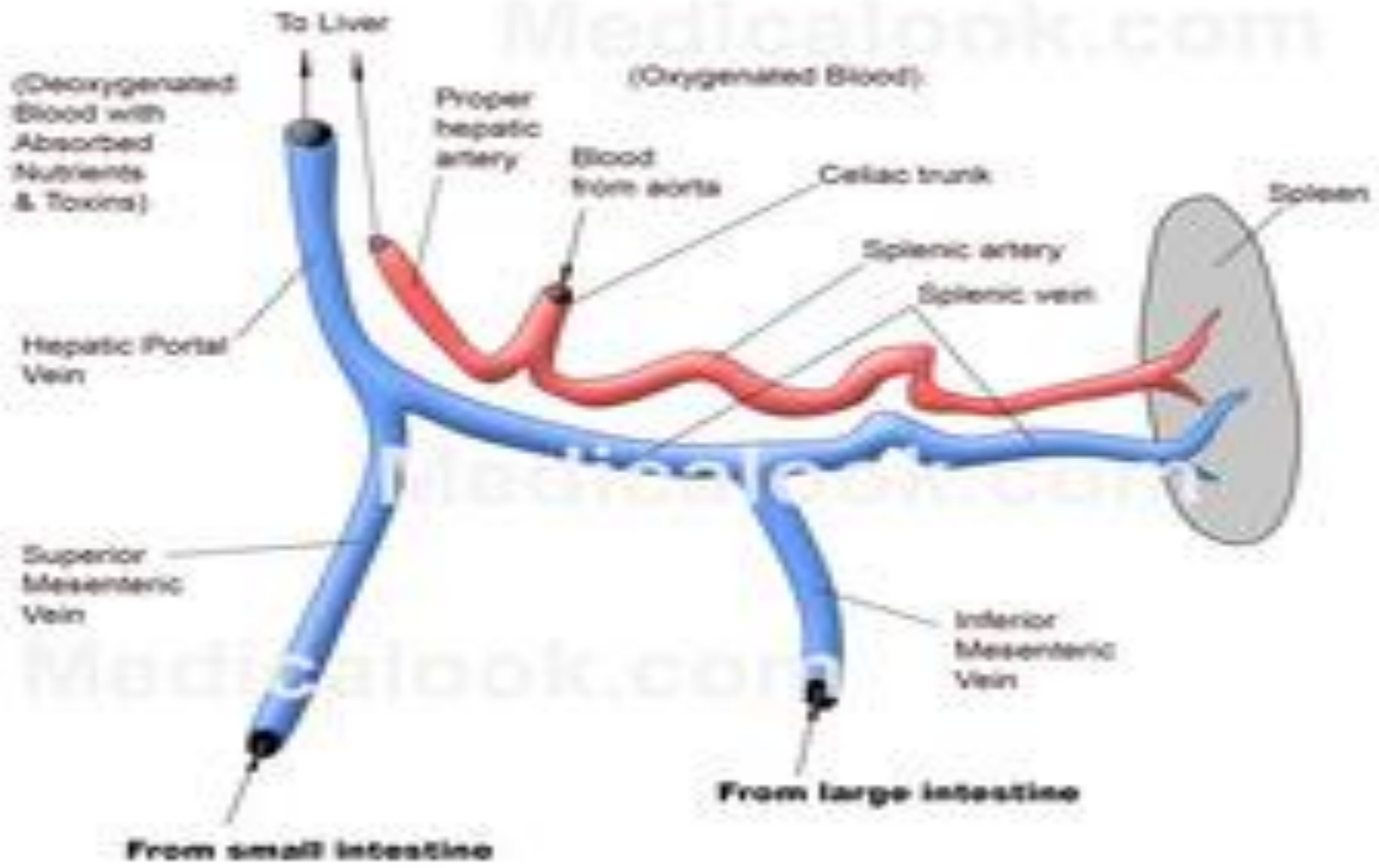


B

25%



C

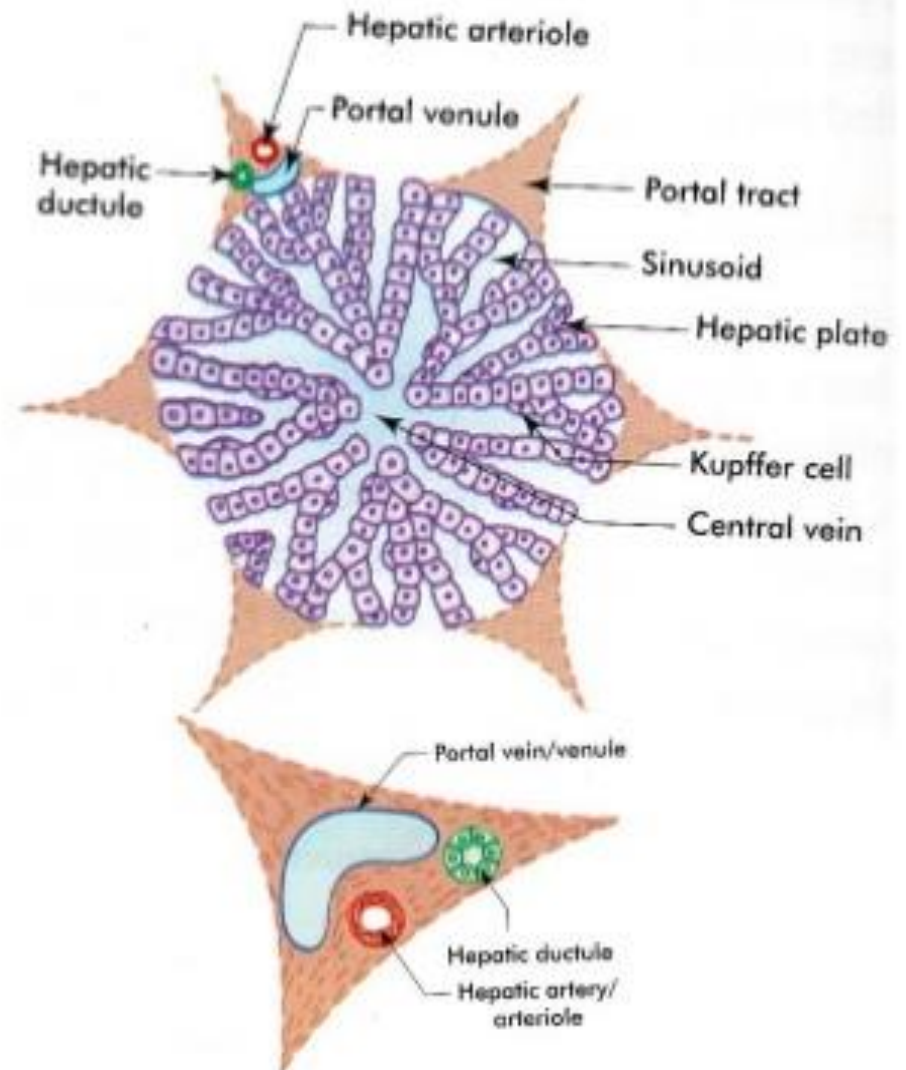


Structure

- Liver is completely invested by a fibrous capsule called **GLISSON'S CAPSULE**
- Glisson's capsule is thickened at the porta hepatis and sends trabeculae into the interior dividing the parenchyma into incomplete lobules.

Classic lobule

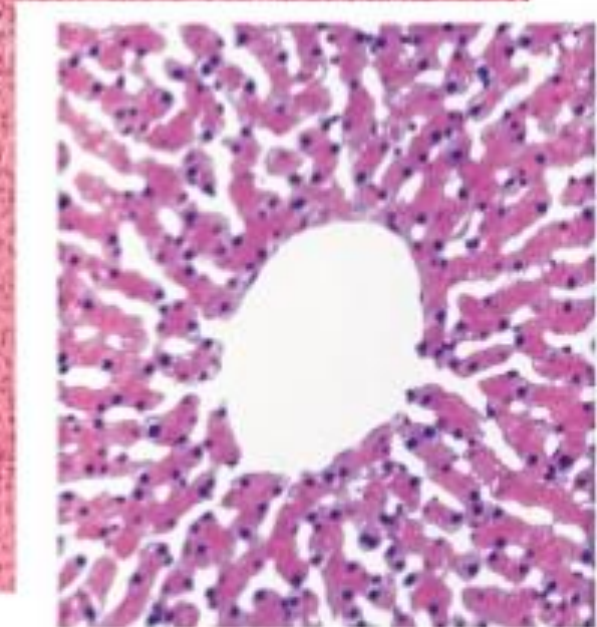
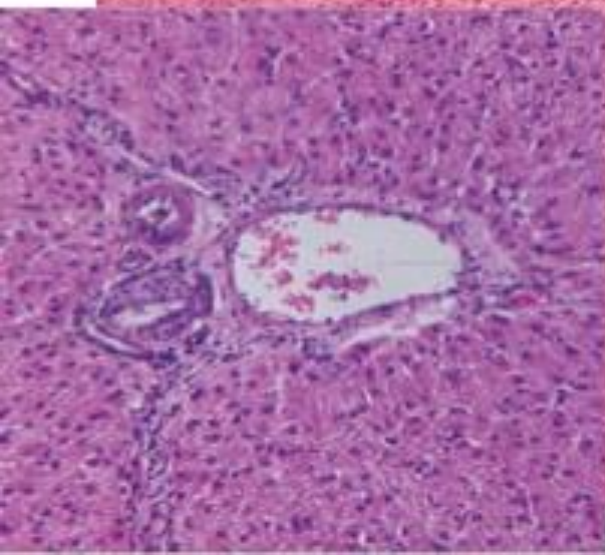
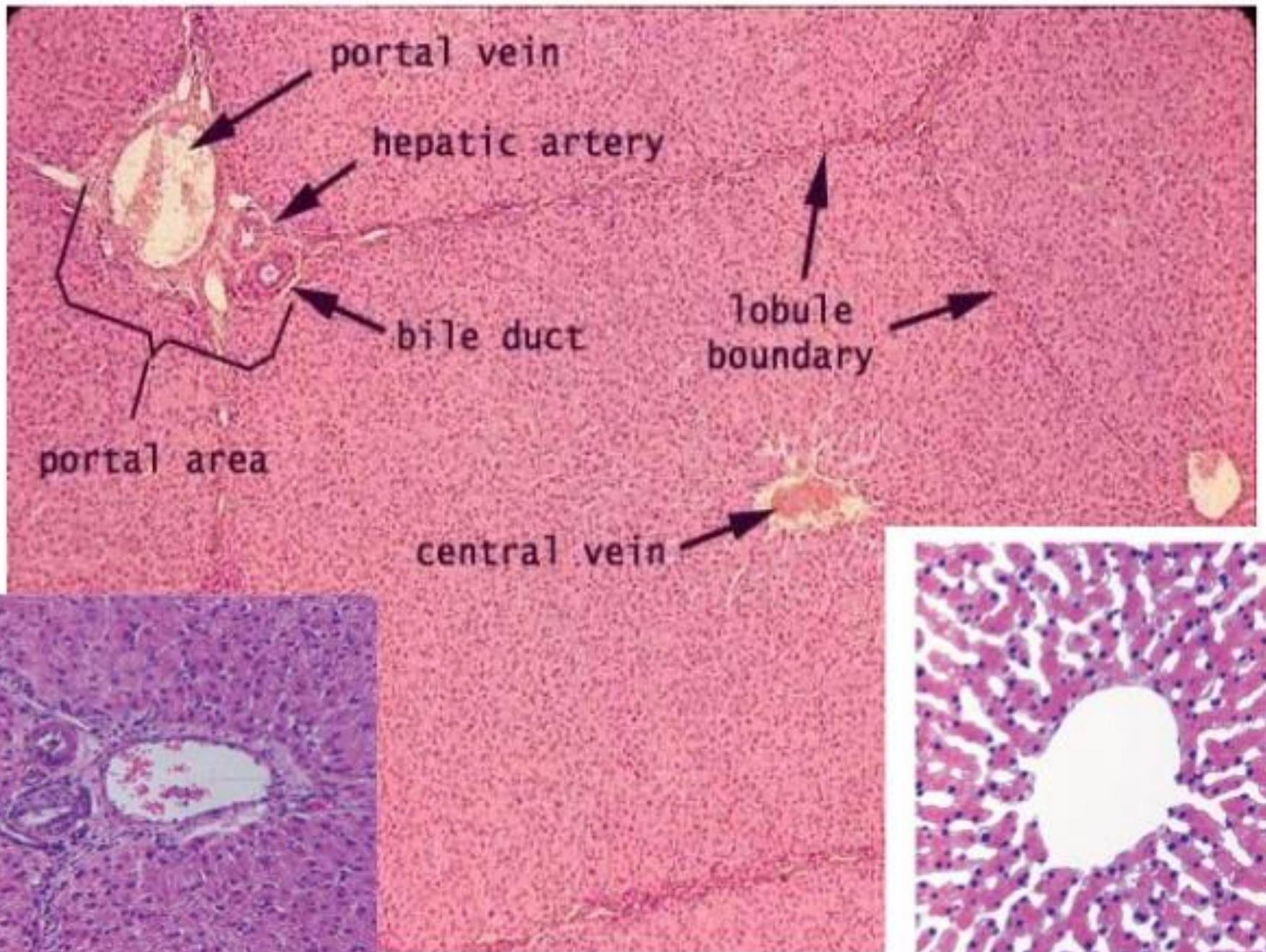
- It forms the structural and functional unit of the organ
- Hexagonal in shape
- It has a **vein** at the **centre**, the central vein
- **Portal tracts** in the **periphery**



Liver lobule (contd..)

- Hepatocytes are arranged in **one cell thick plates** radiating from the central vein towards the periphery of the lobule.
- The irregular spaces between the hepatic plates are occupied by **liver sinusoids** lined by fenestrated endothelial cells.

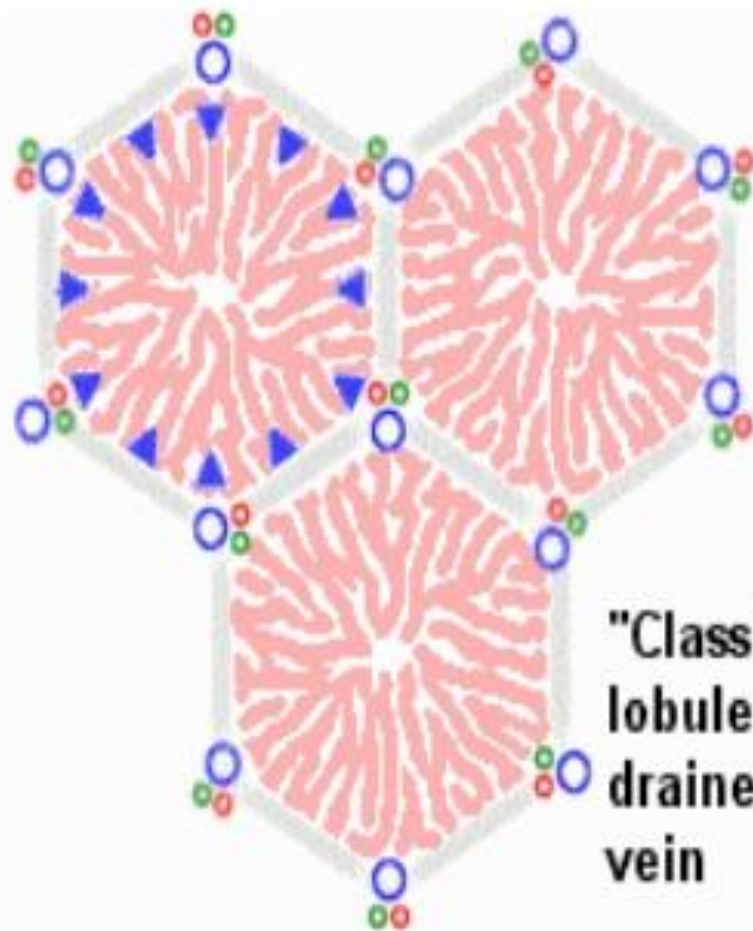




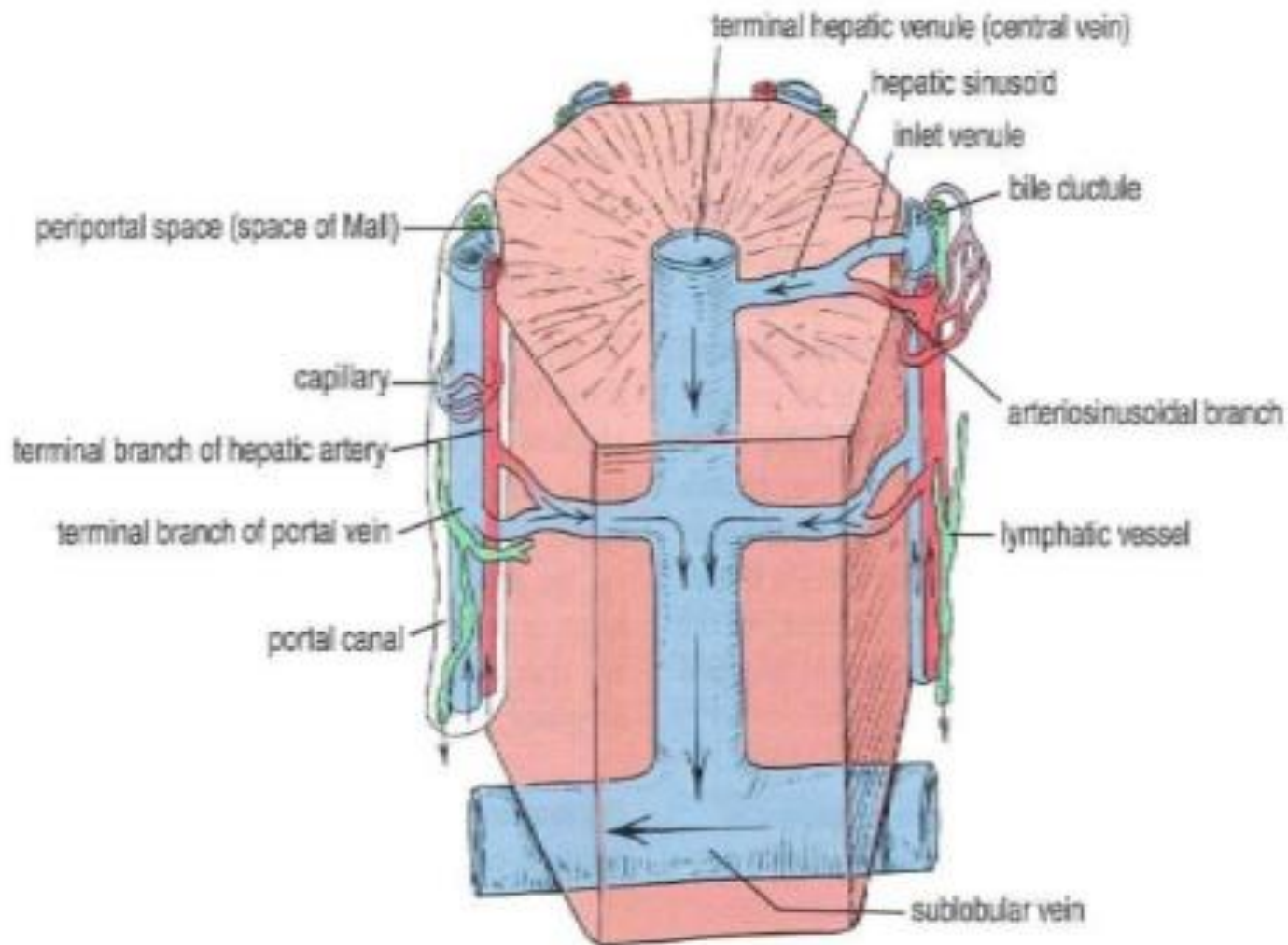
Liver lobule (contd..)

The blood flows from
periphery to centre.

Bile flows from
centre to periphery.

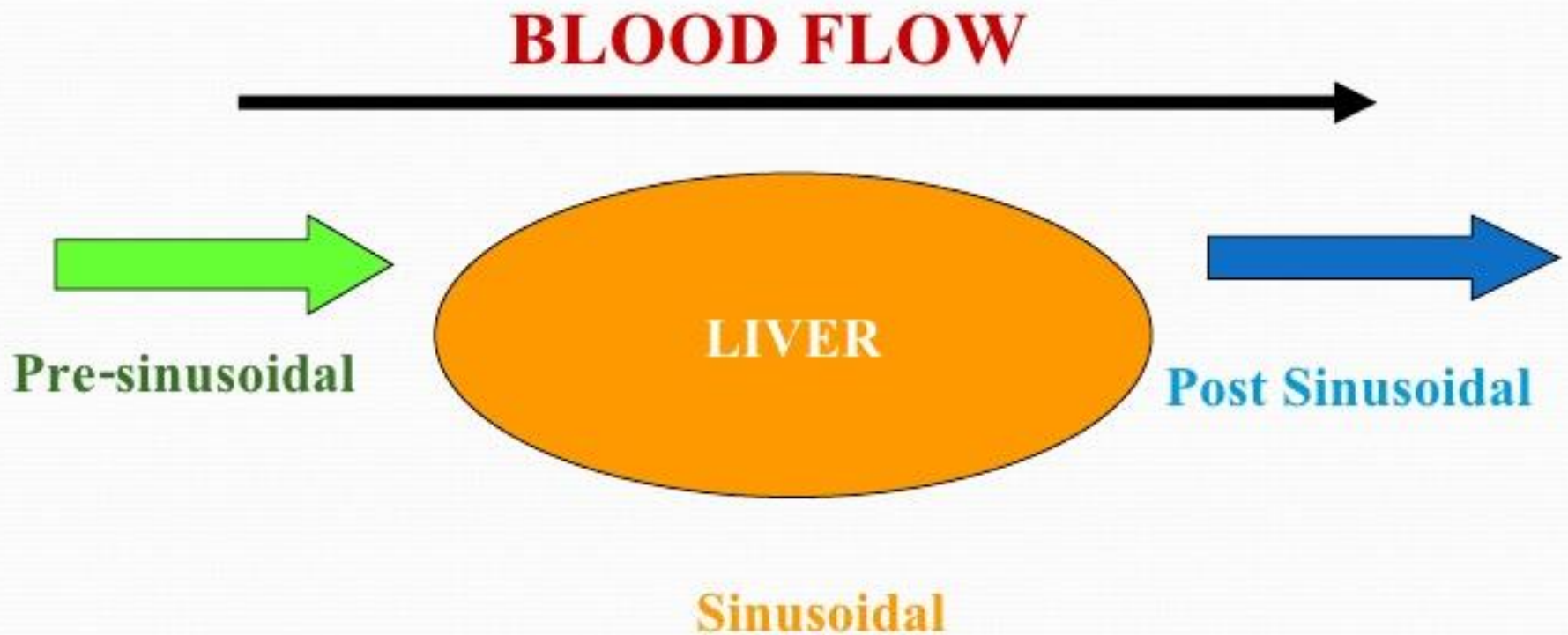


"Classical" liver
lobule: the unit
drained by a central
vein



The sinusoids are irrigated by mixed arterial blood from hepatic artery and venous blood from portal vein. The blood then flows towards central vein — sublobular vein — hepatic vein — IVC.

Causes of Portal Hypertension



SITES OF PORTAL HYPERTENSION

1. Lower third of the Esophagus

The esophageal branches of the left gastric vein (portal tributaries) anastomose with the esophageal veins draining the middle third of the esophagus into the azygos veins. (systemic tributaries)

2. Paraumbilical Area

They connect the left branch of the portal vein with the superficial veins of the anterior abdominal wall. (systemic tributaries)

3. Anal canal

The superior rectal veins (portal tributary) draining the upper half of the anal canal anastomose with the middle and inferior rectal veins (systemic tributaries), which are tributaries of the internal iliac and internal pudendal veins, respectively.

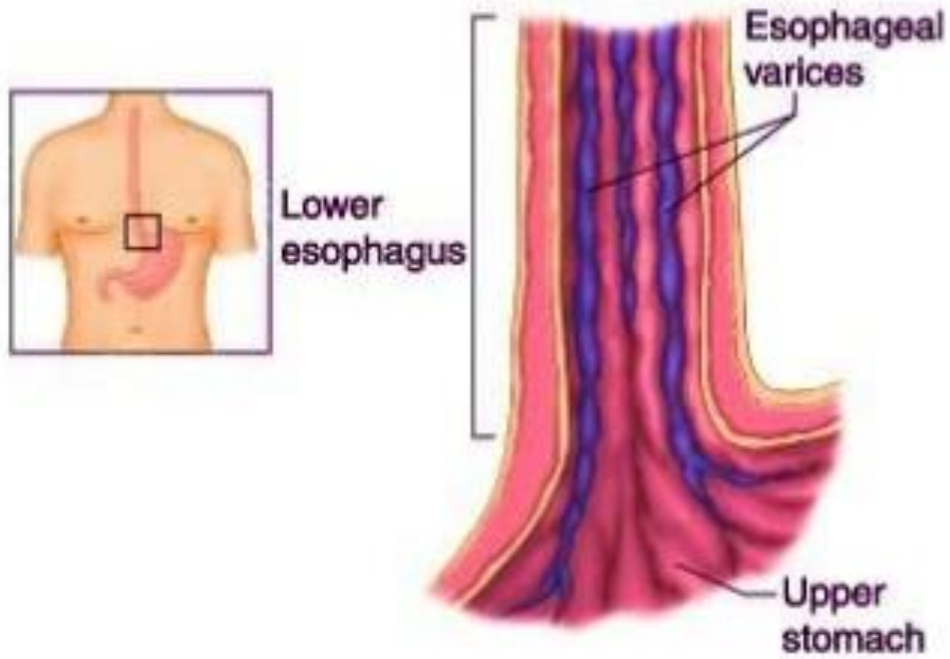
4. Retroperitoneal

The veins of the ascending colon, descending colon, duodenum, pancreas, and liver (portal tributary) anastomose with the renal, lumbar, and phrenic veins (systemic tributaries).

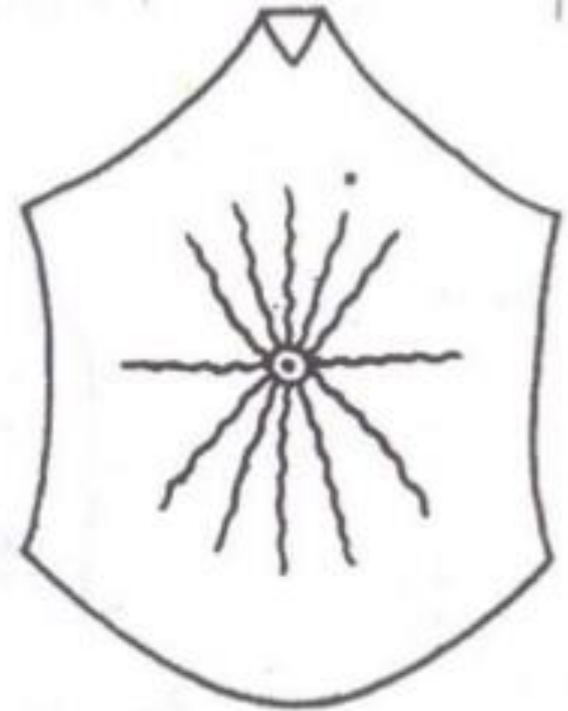
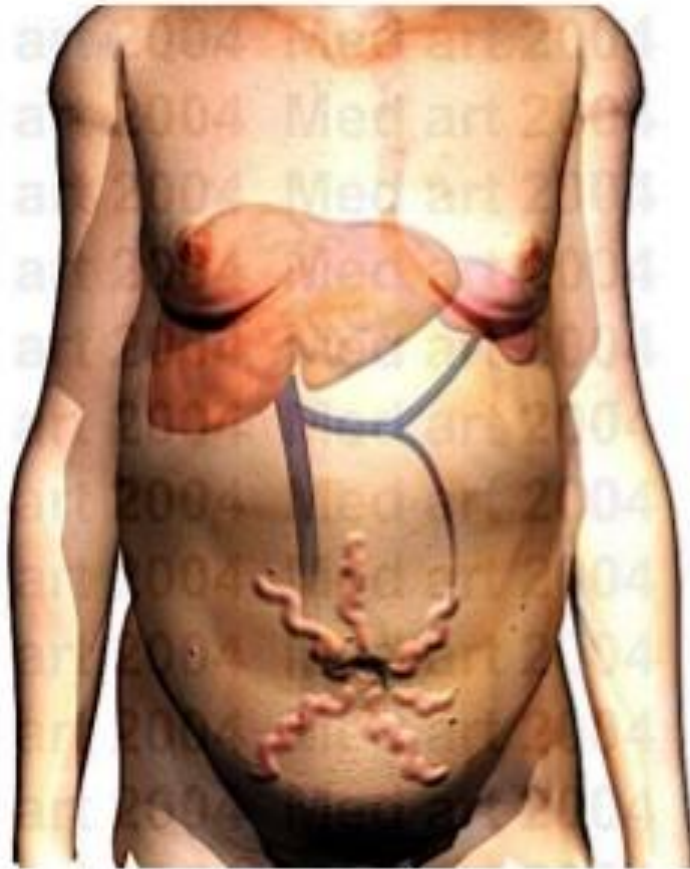
5. Bare area of liver

There is some anastomosis between portal venous channels in the liver and azygous system of veins above the diaphragm across the bare area of liver.

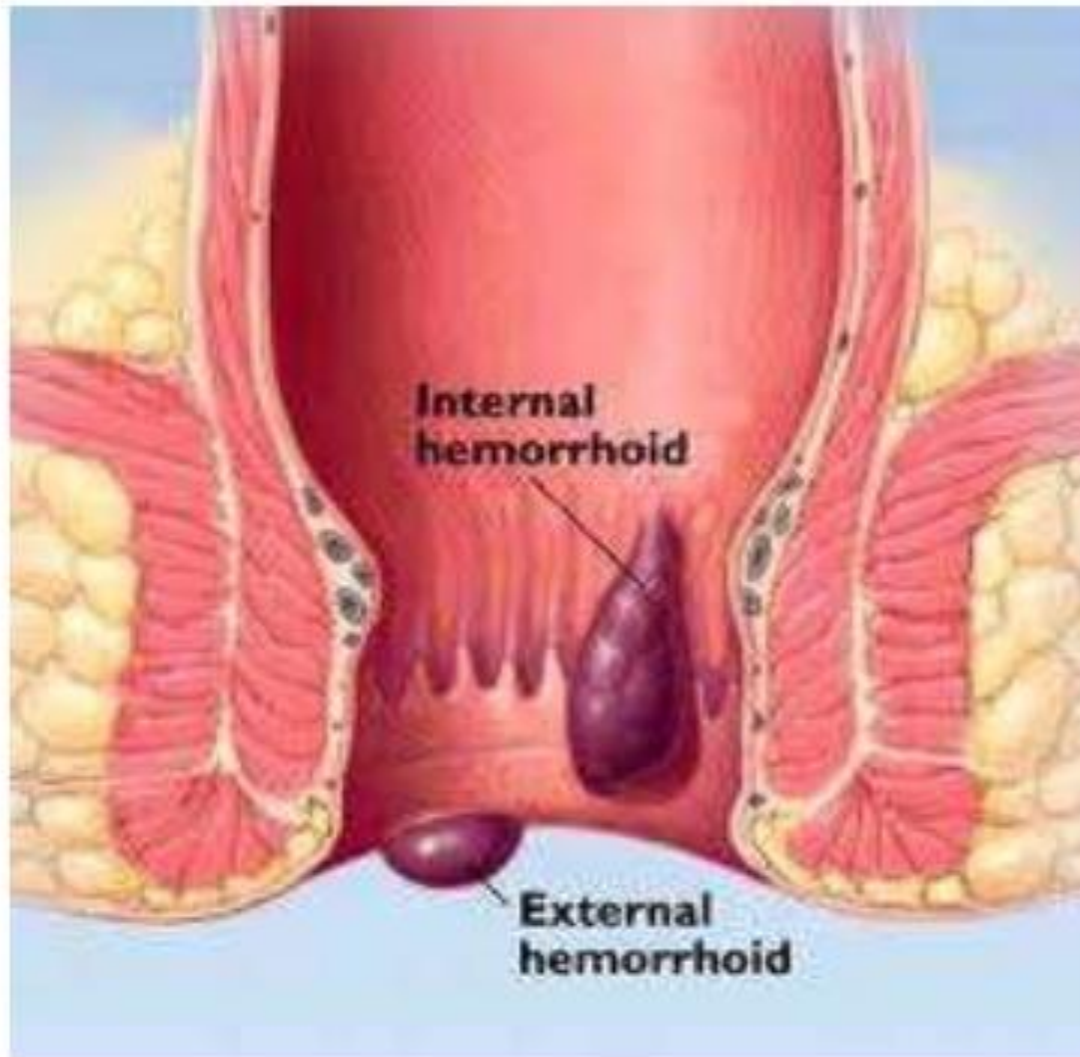
Esophageal varices



Caput Medusae



Internal piles (Hemorrhoids)



THANK YOU