Histology of the liver

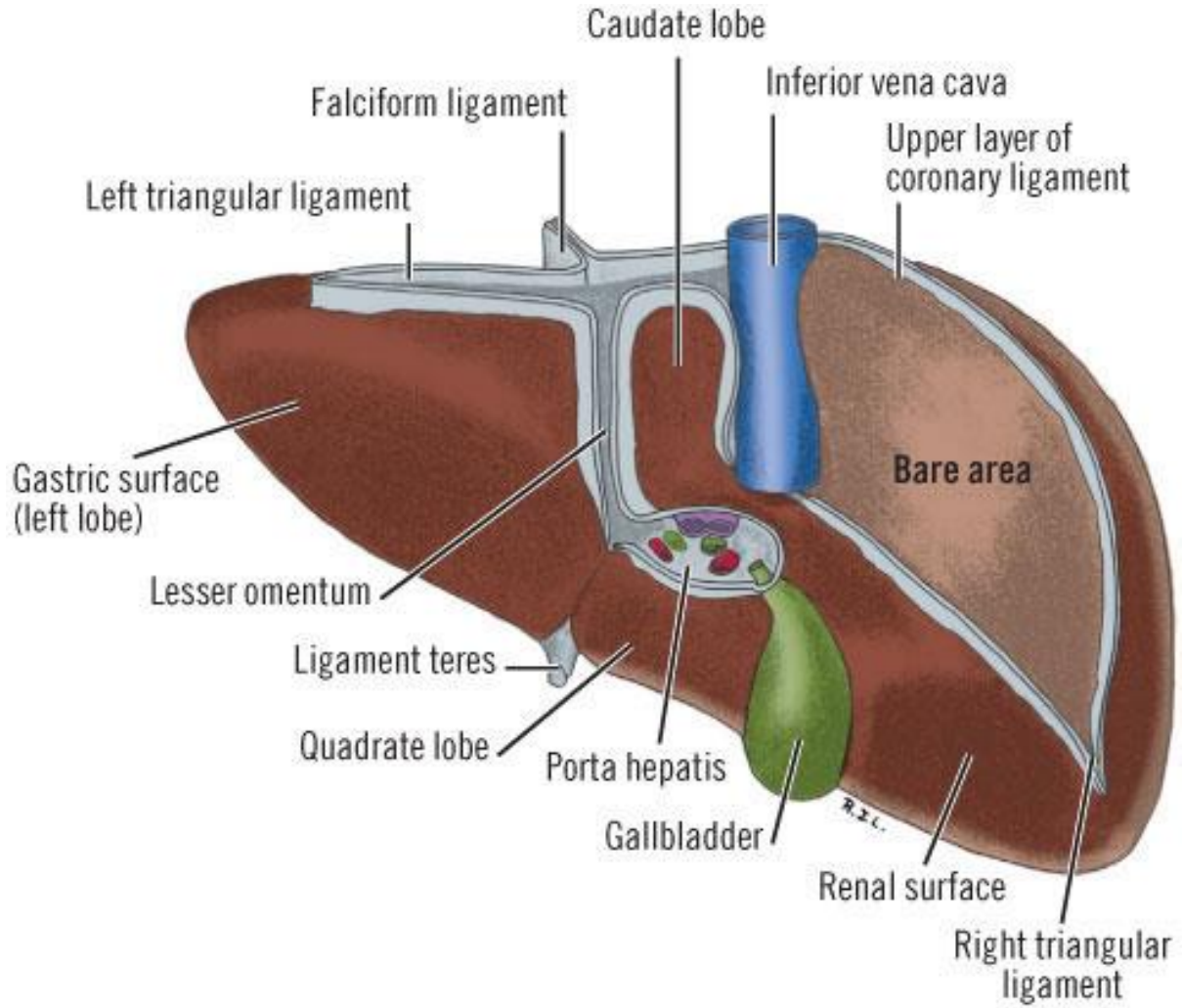
Dr Shirom Rajeev Siriwardana
Senior Lecturer and Consultant Radiologist
Faculty of Medicine,
Ragama

Objectives

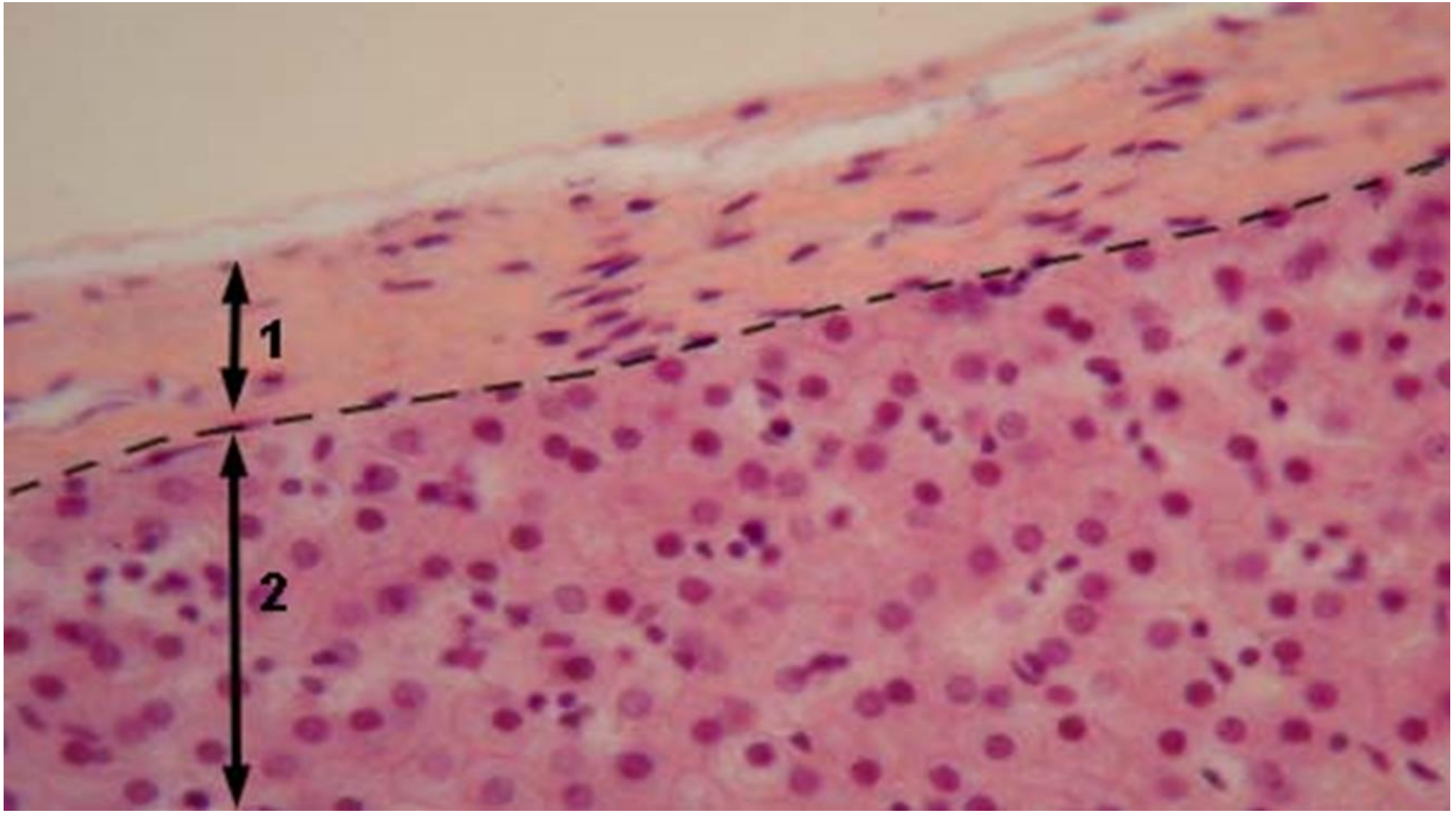
- Define the concept of the classic liver lobule and recognize it in histological tissue sections
- Learn about the structure of portal triads and identify its components
- Understand the structure of hepatic cords and liver sinusoids
- Learn about and identify the cells of the liver tissue: hepatocytes, Kupffer cells, endothelial cells and Ito cells
- Discuss the functions and ultrastructural features of hepatocytes
- Understand the concept of the Acinus of Rappaport

Introduction

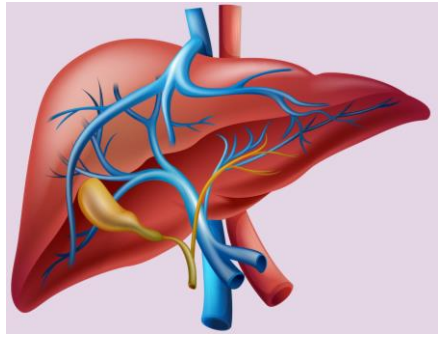
- Largest internal organ in the body
- Average Wt-1500 mg
- 2% of the body weight
- Has 2 major lobes – right and left
- Covered by thin capsule and mesothelium of the visceral peritoneum.
- Capsule thick at hilum (Porta hepatis) – at inferior aspect of the liver
- Hepatic portal vein and hepatic artery (Dual blood supply) enter at hilum
- Hepatic vein, lymphatics, CBD exits at hilum



Liver Capsule

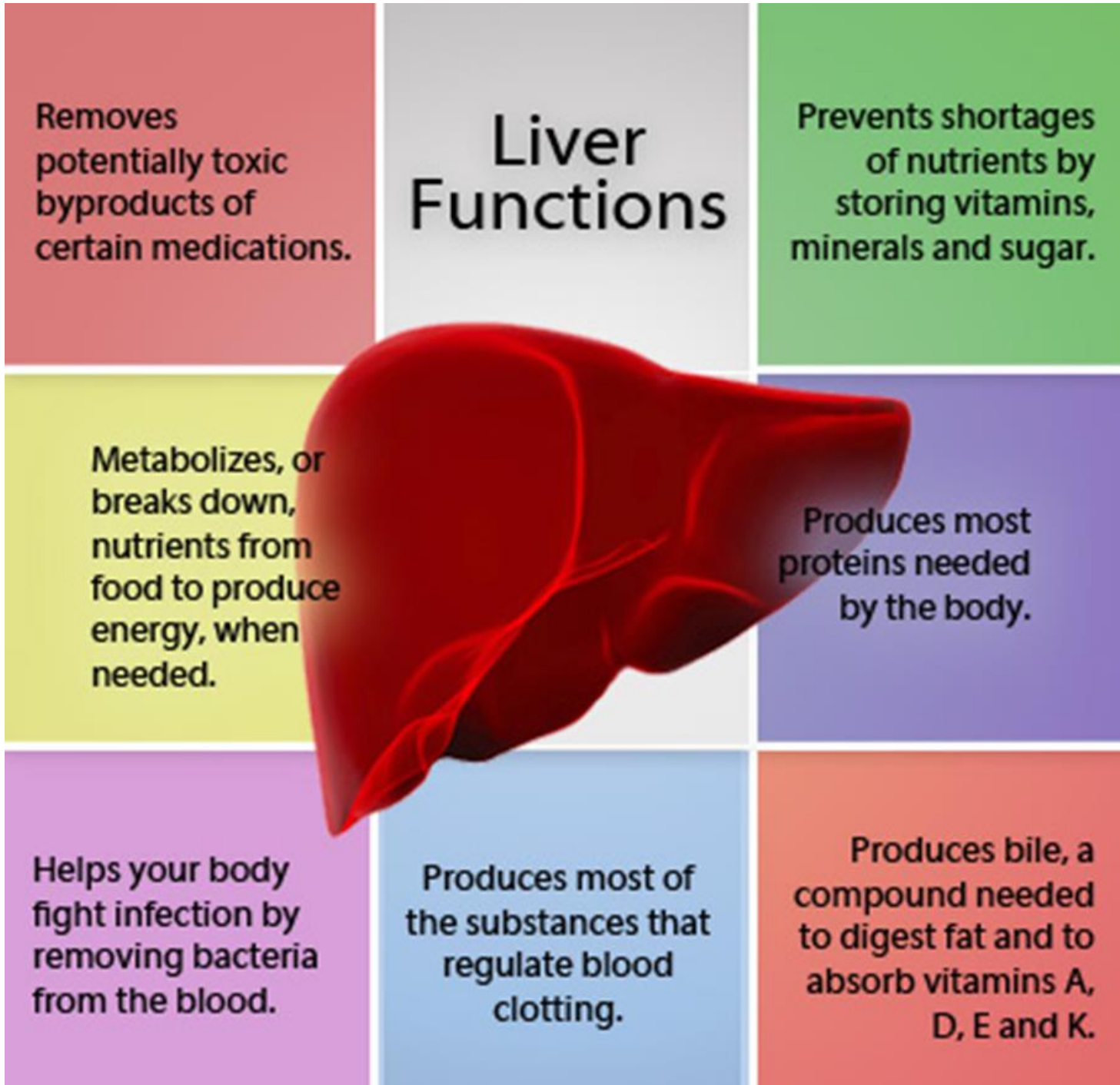


- Major organ between GI system and blood
- 75% of blood to the liver from intestines (Portal vein)-O2 poor /Nutrient rich
- 25% of blood to the liver from hepatic artery -O2 rich /Nutrient poor



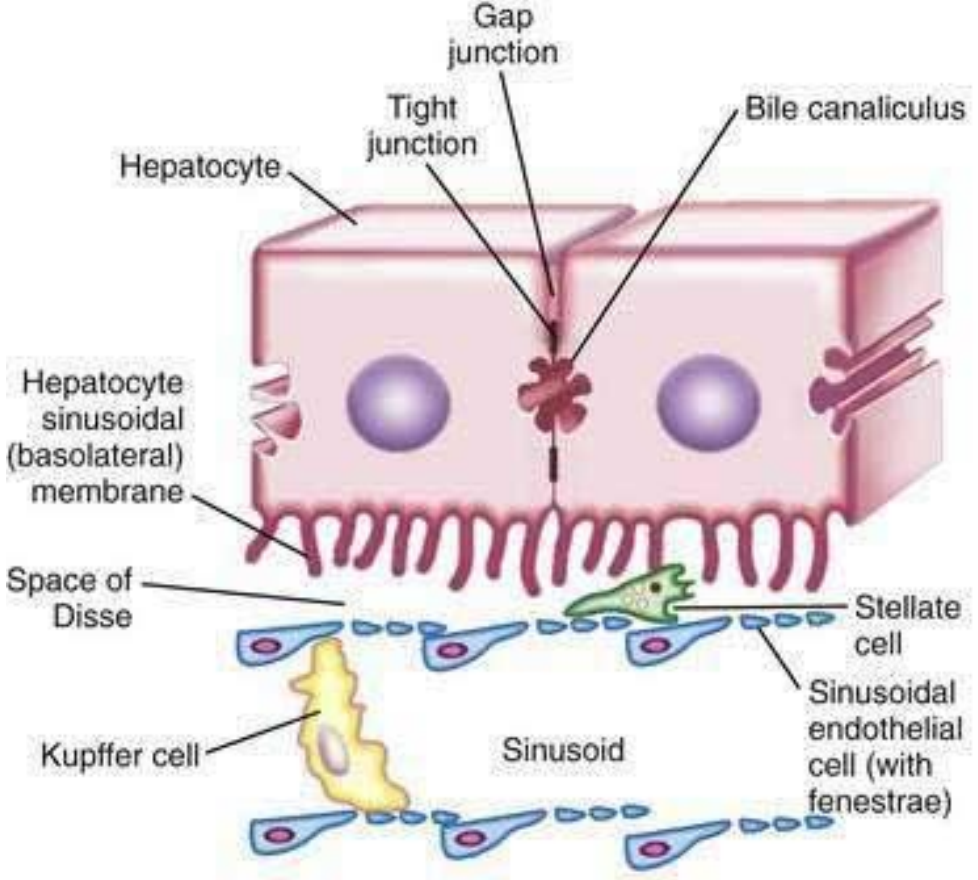
Function of the liver

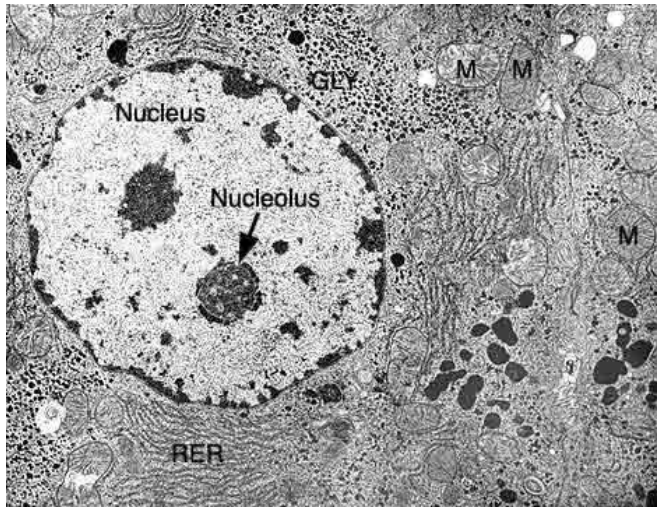
- > 500 functions
- Hepatocyte- key cell
- Has unique histological adaptation.



Hepatocyte

- Large
- Cuboidal/polyhedral
- Nucleus –Large ,round and central
- Nucleus –Frequently binucleated
- Eosinophilic cytoplasm-Rich Mitochondria
- Arrange radially around a central vein to form <u>“hepatic lobule”</u>

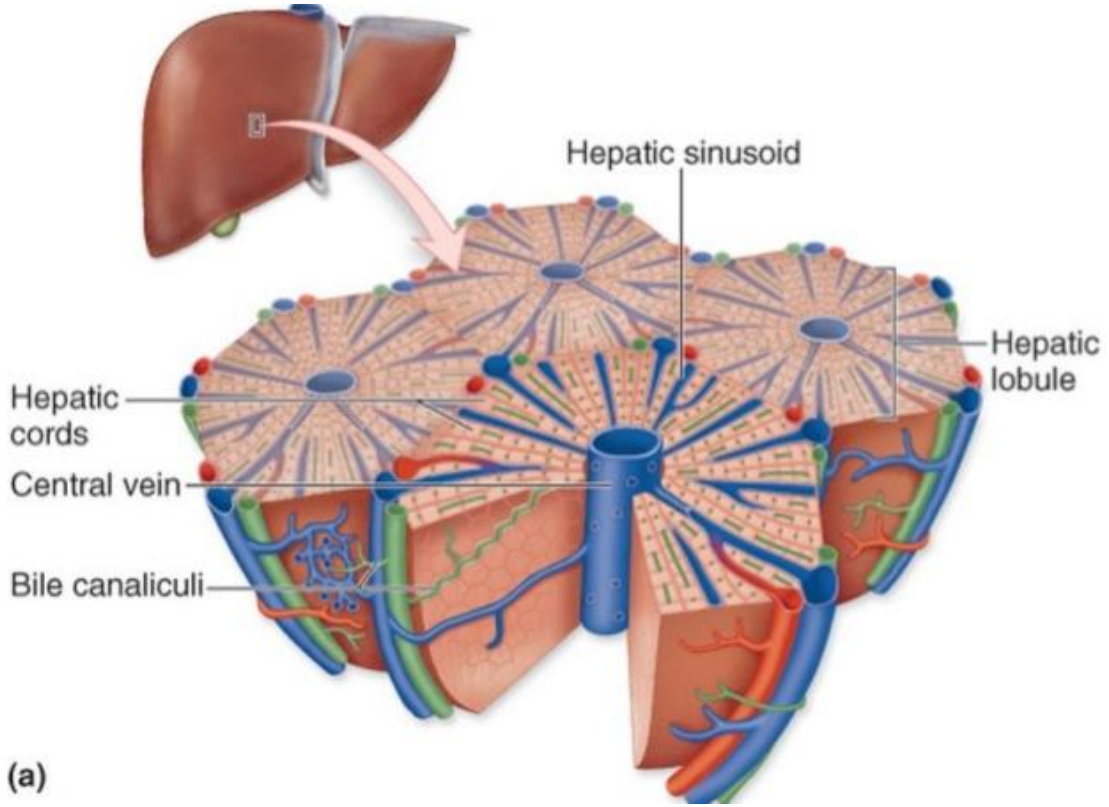


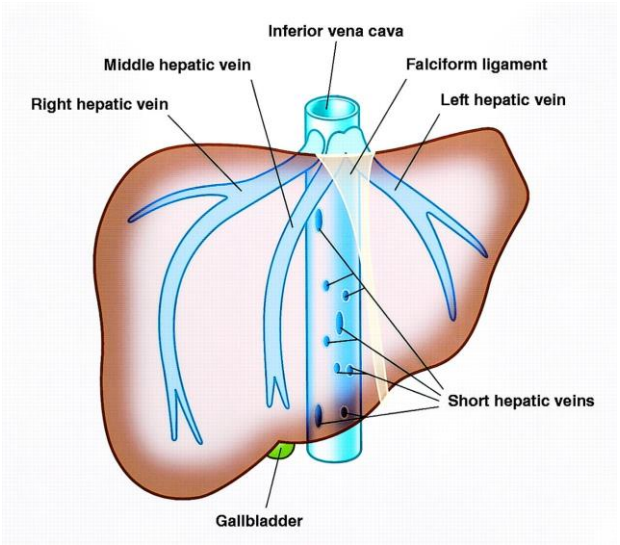


(Def : Polyhedral- Having many sides or facets)

Hepatic lobule

- Structural and functional unit of the liver
- It is a roughly hexagonal in shape.
- Responsible for metabolic, endocrine and exocrine functions.
- Liver contain thousand of hepatic lobules
- In a lobule- Hepatocytes arranged as radial sheets around a small central vein
- Central vein ➡ ➡ ➡ Hepatic vein
- Hepatocytes are supported by surrounding stroma of reticulin fibers.
- Periphery of each lobule contain 3-6 portal areas called Portal triad

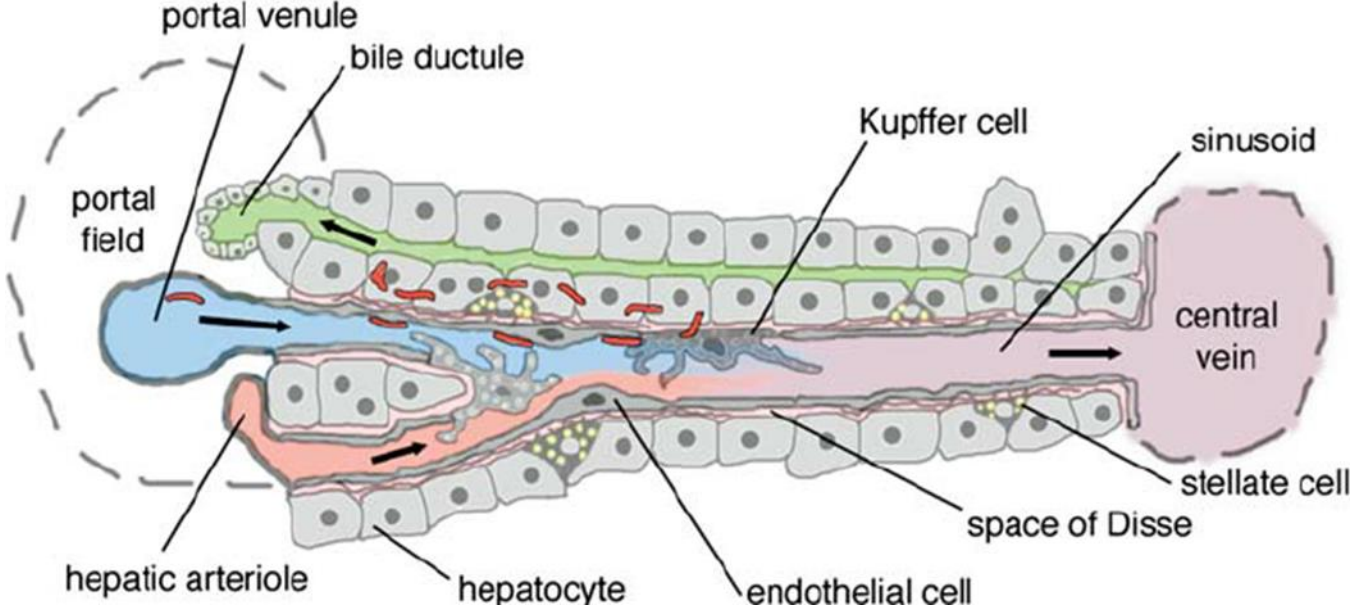


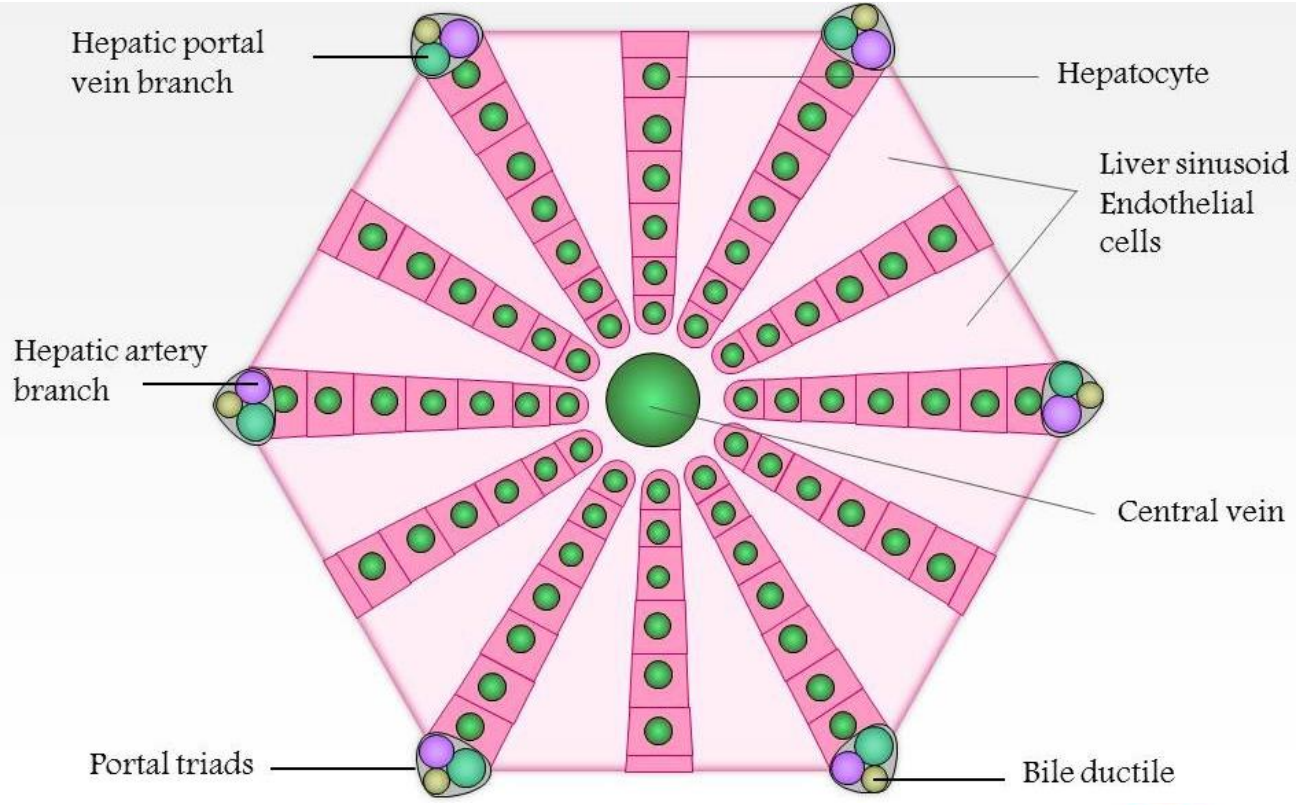


Portal triad

Contain:

- Venule-
  - Branch of <u>portal vein</u>
  - Rich in nutrients
  - Low in O_2
- Arteriole-
  - Branch of hepatic artery
  - High O_2
- 1-2 small bile ductules-
  - Contain cuboidal epithelium
  - Continue as intra hepatic bile duct





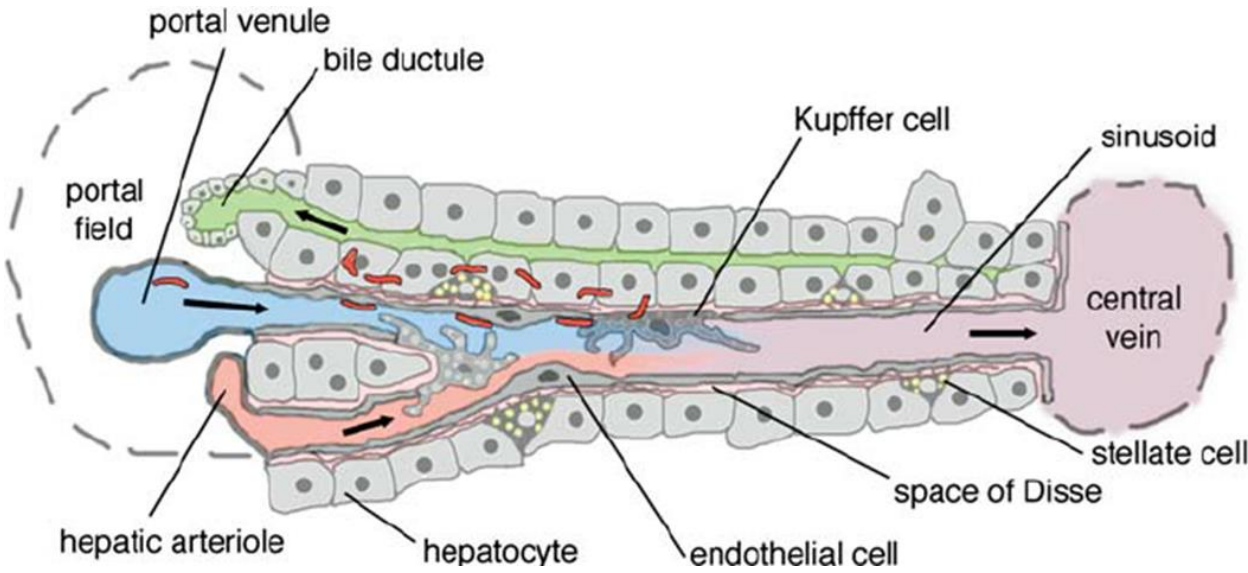
Hepatic Sinusoids

- Stars from most terminal portion of portal venule and hepatic artery
- Forms a common irregular space – Hepatic sinusoid
- Exiting blood from arteriole and portal venule run through the sinusoidal capillaries

Terminal hepatic venule

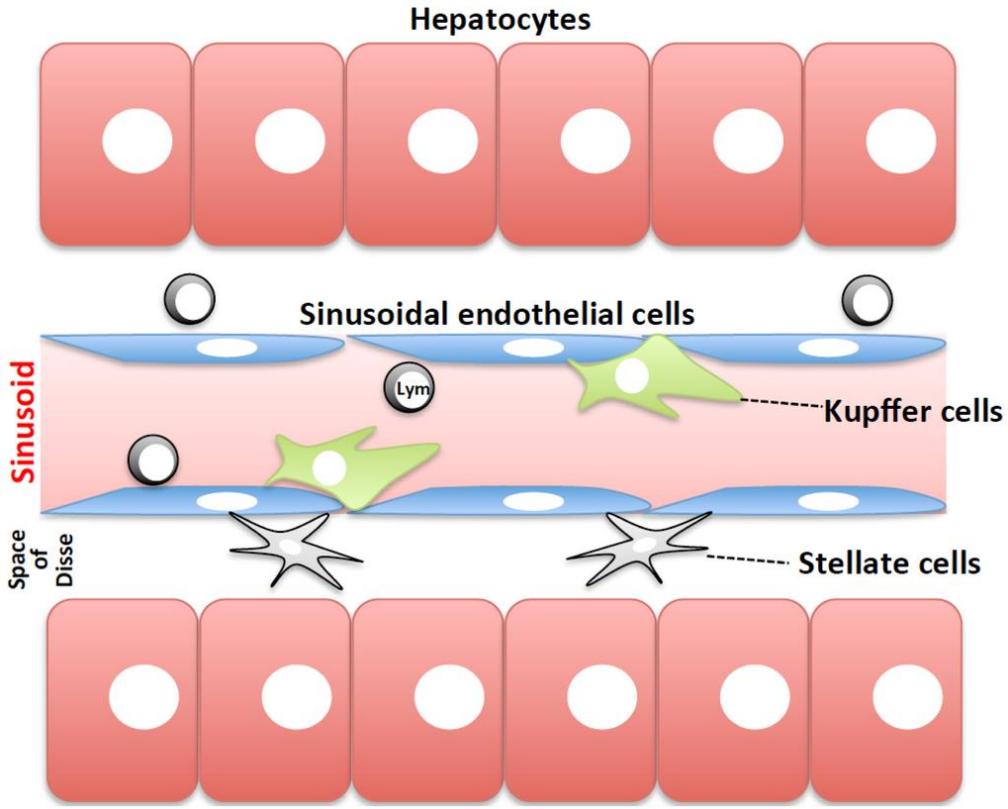
(Central vein)

- Blood mixes within hepatic sinusoids



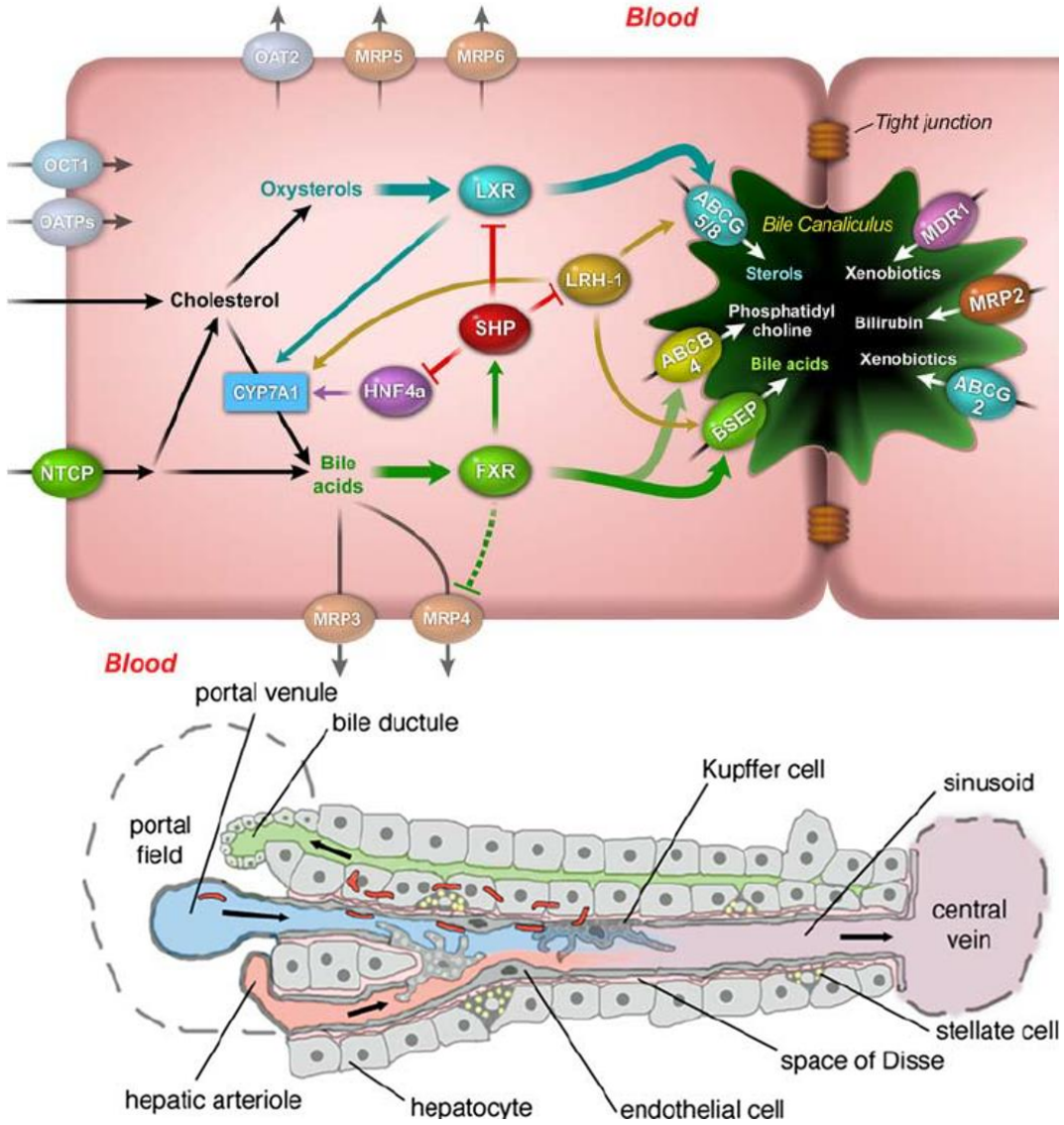
Hepatic Sinusoids

- Lined by thin discontinuous fenestrated endothelial cells.
- Between endothelial lining and hepatocytes space called-Space of Disse
- Having discontinuous fenestrated nature allow sinusoidal fluid to creep in to Space of Disse.
- Microvilli in hepatocytes have direct contact with “Disse”
- Help to uptake and release nutrients and toxins

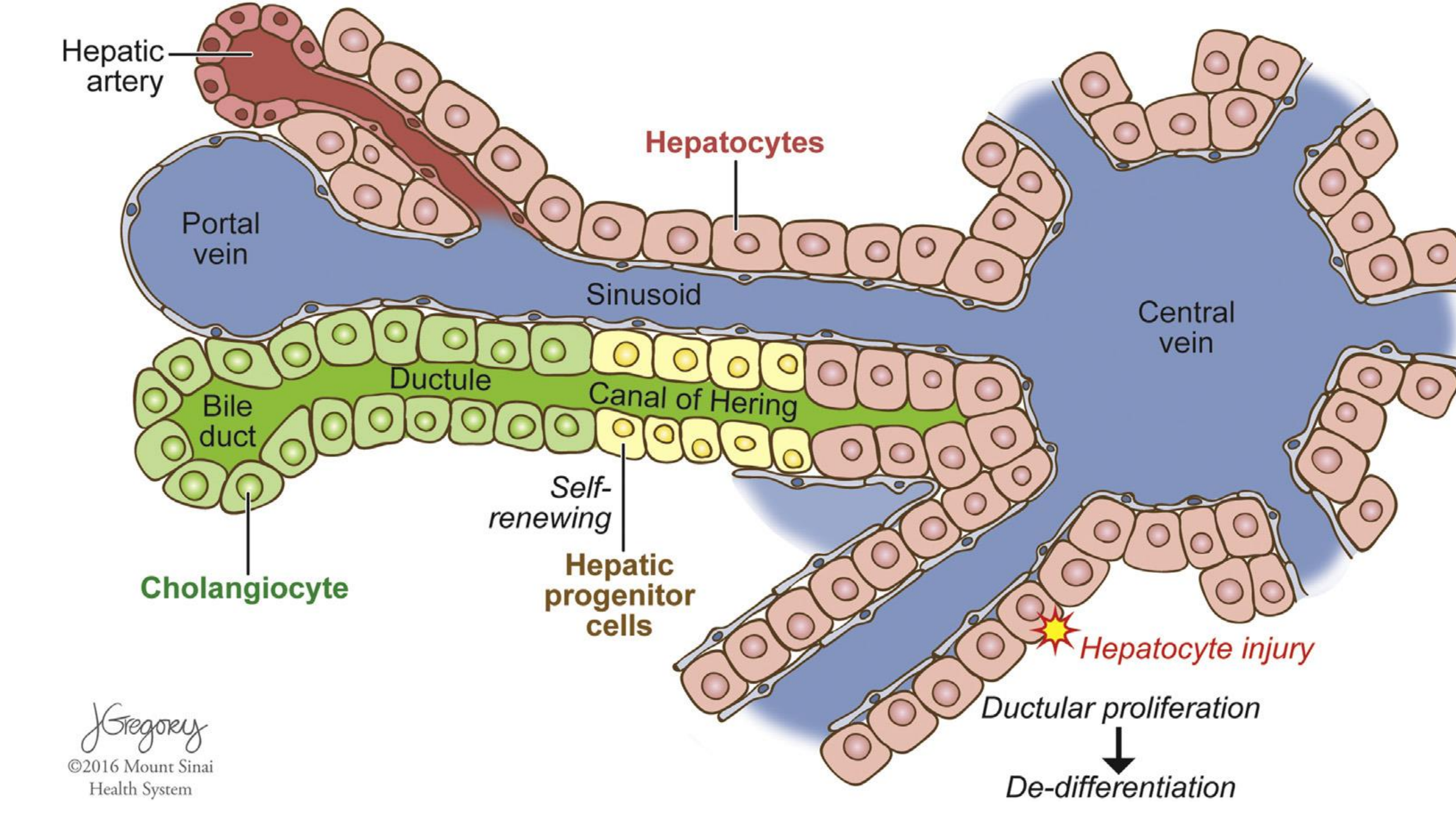


Hepatic Sinusoids

- Blood flow from periphery to center of the lobule
- Therefore peripheral cells first absorb most of nutrients and O2
- Have active protein synthesis and aerobic metabolism.
- More central cells expose to low nutrients and O2
- Central hepatocytes forms bile canaliculi
- Open in to canals of Hering (Cuboidal eithelium)
- Drain in to bile ductule at portal triad.
- Bile drain central to periphery.(opposite direction to blood)



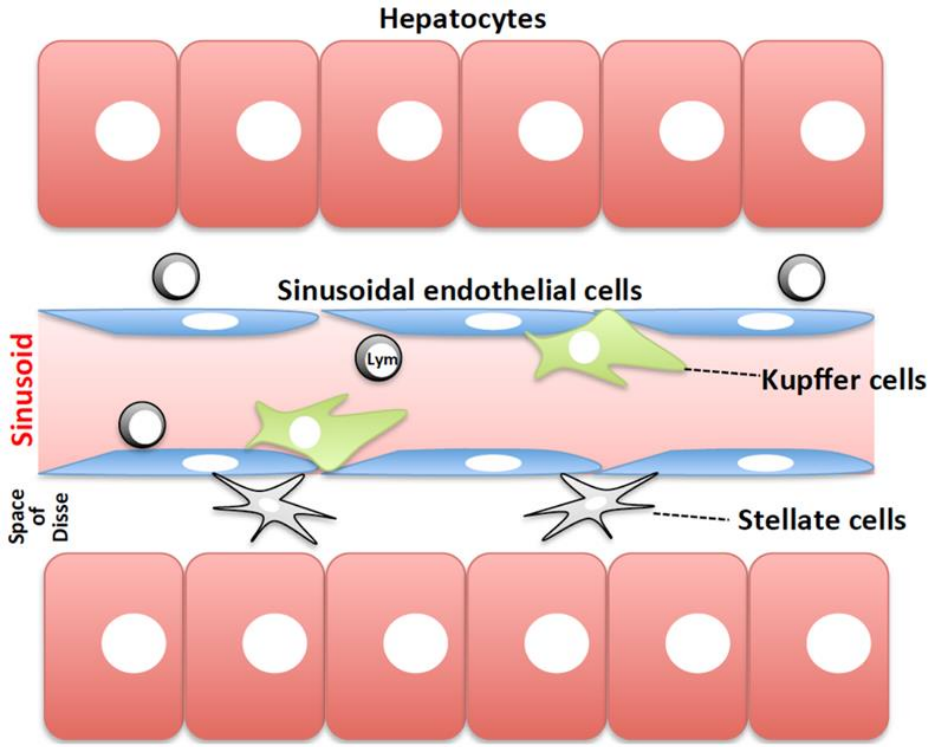
- Other cells in sinusoids ?



Other cells in the sinusoids

Kupffer cells-

- Are specialized stellate macrophages
- Numerus
- Phagocytes-Old RBC (recycle Heam and Iron)
- Are antigen presenting cells (APC)-Remove bacteria/debris in the blood

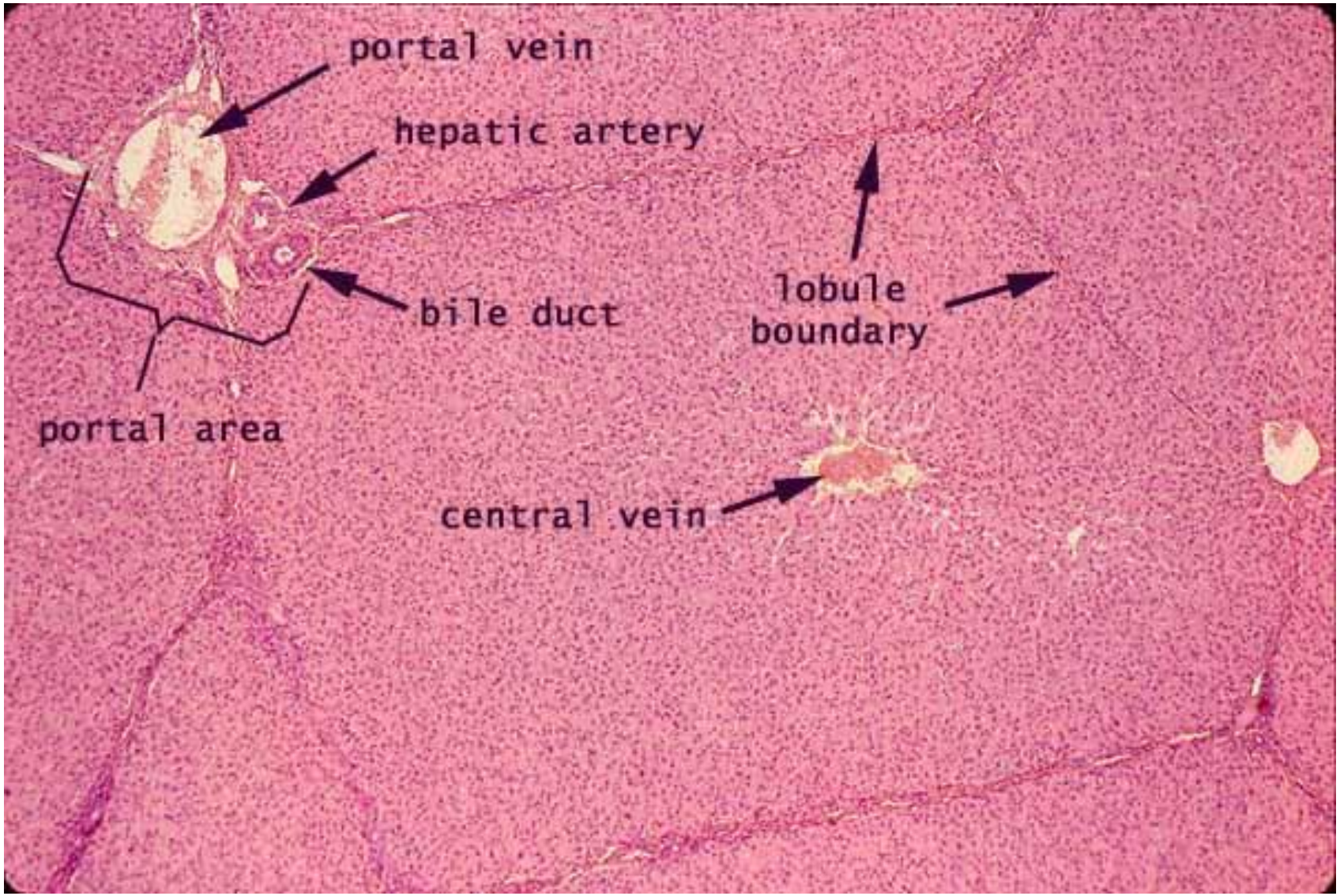


Hepatic Stellate cells (Ito cells)-

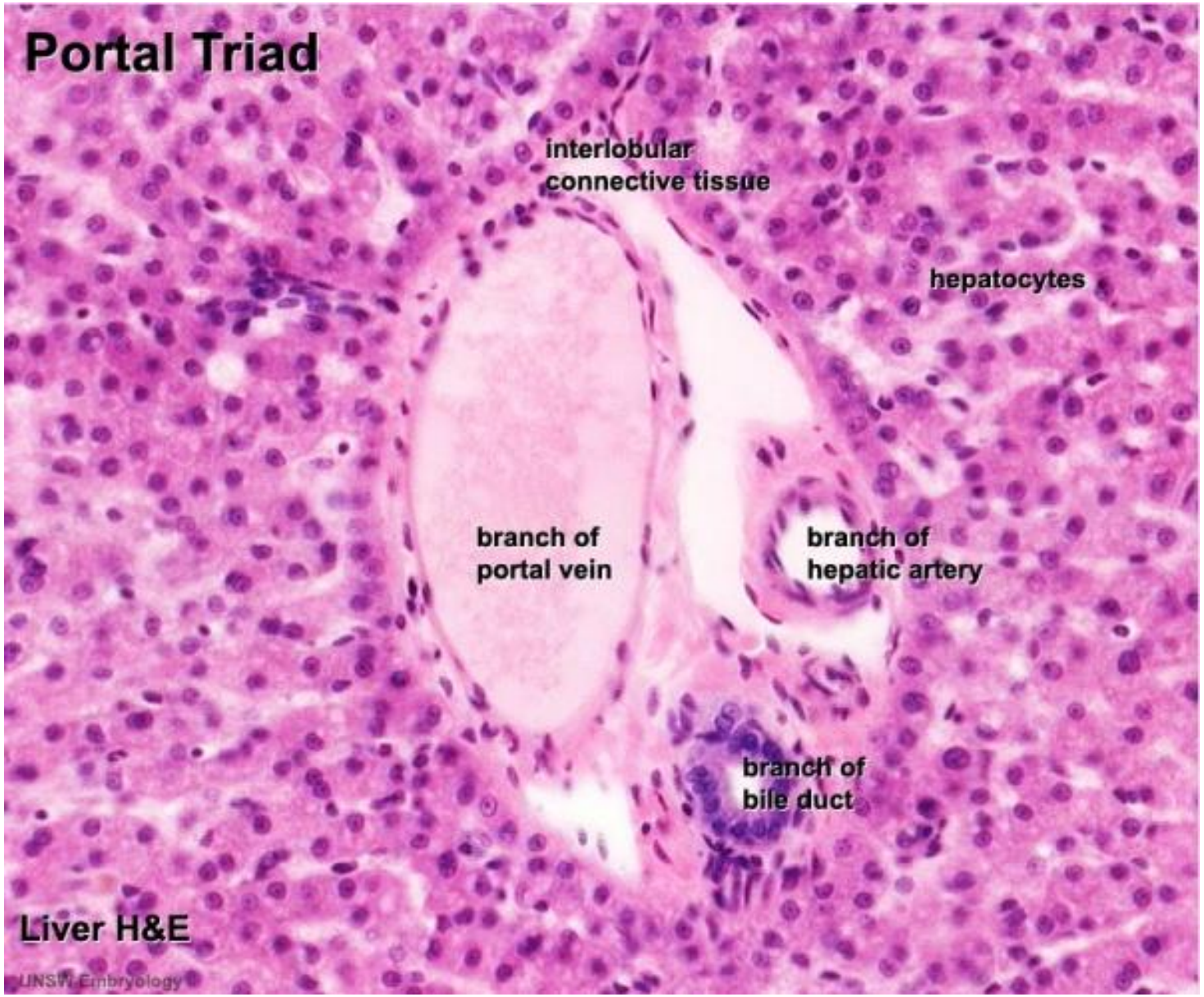
- Store Vit A and fat soluble vitamins.
- Produce extracellular matrix and cytokines

Liver Lobule H & E

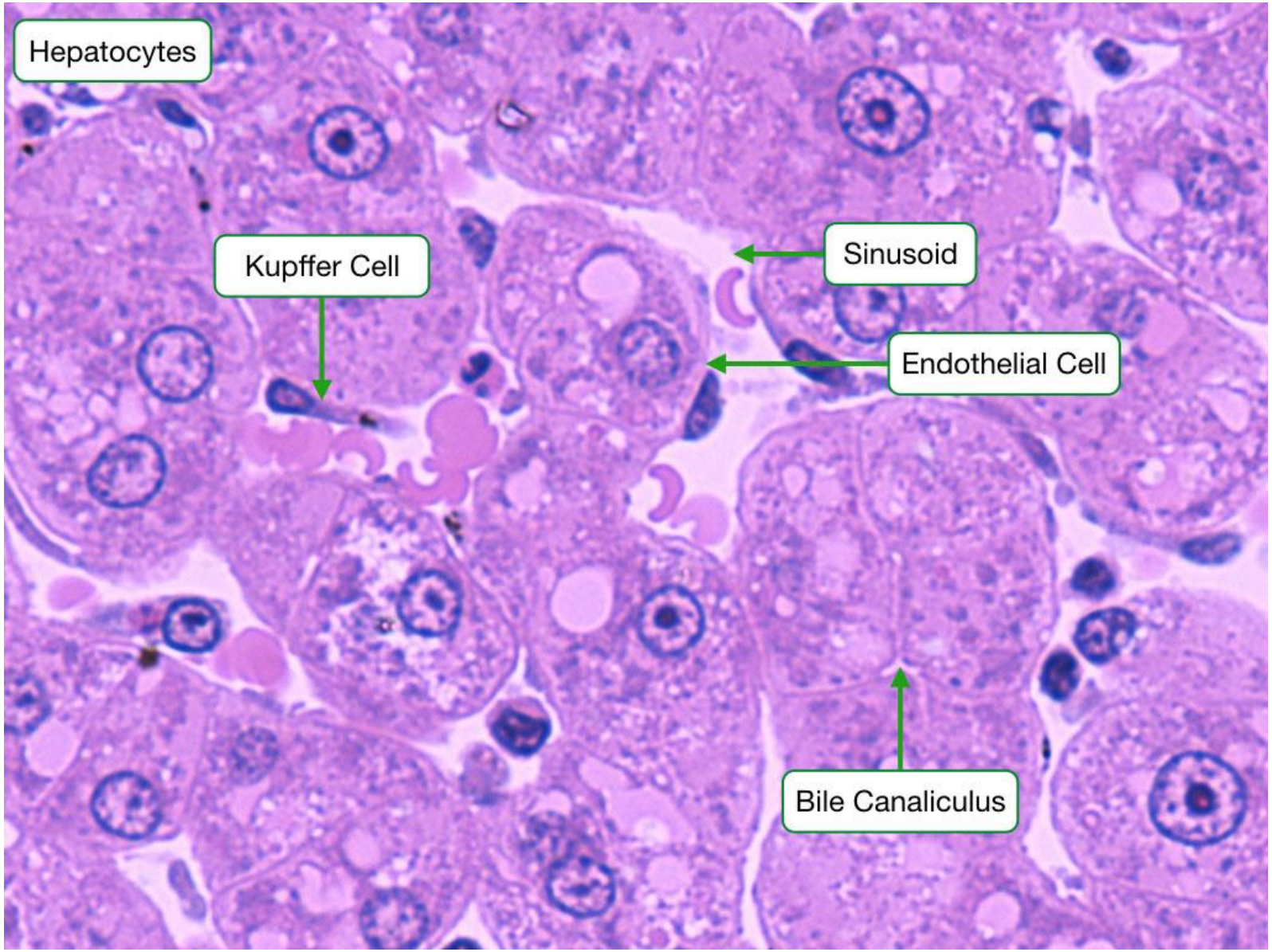
Liver Lobule H & E



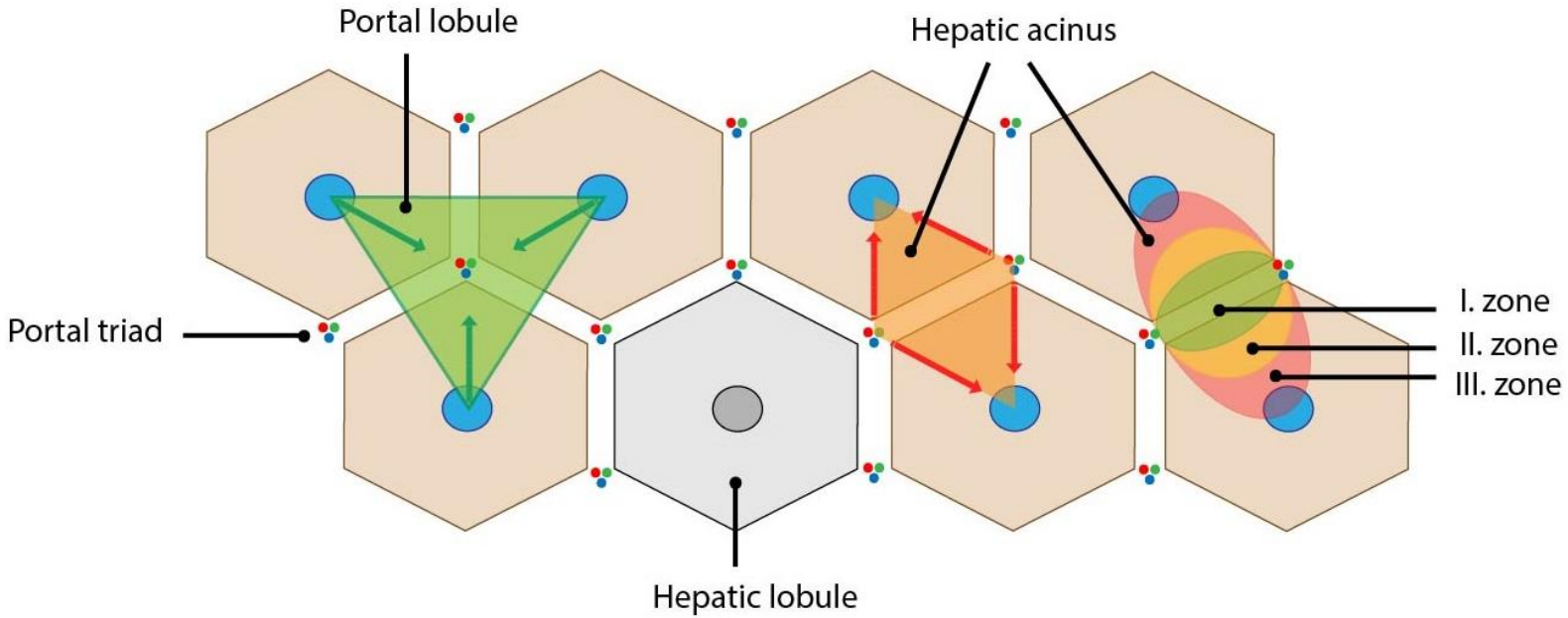
Liver Lobule H & E



Liver Lobule



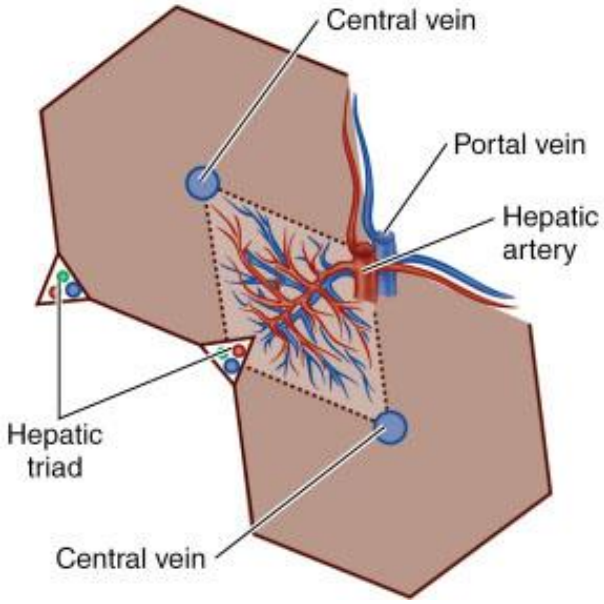
Portal lobule

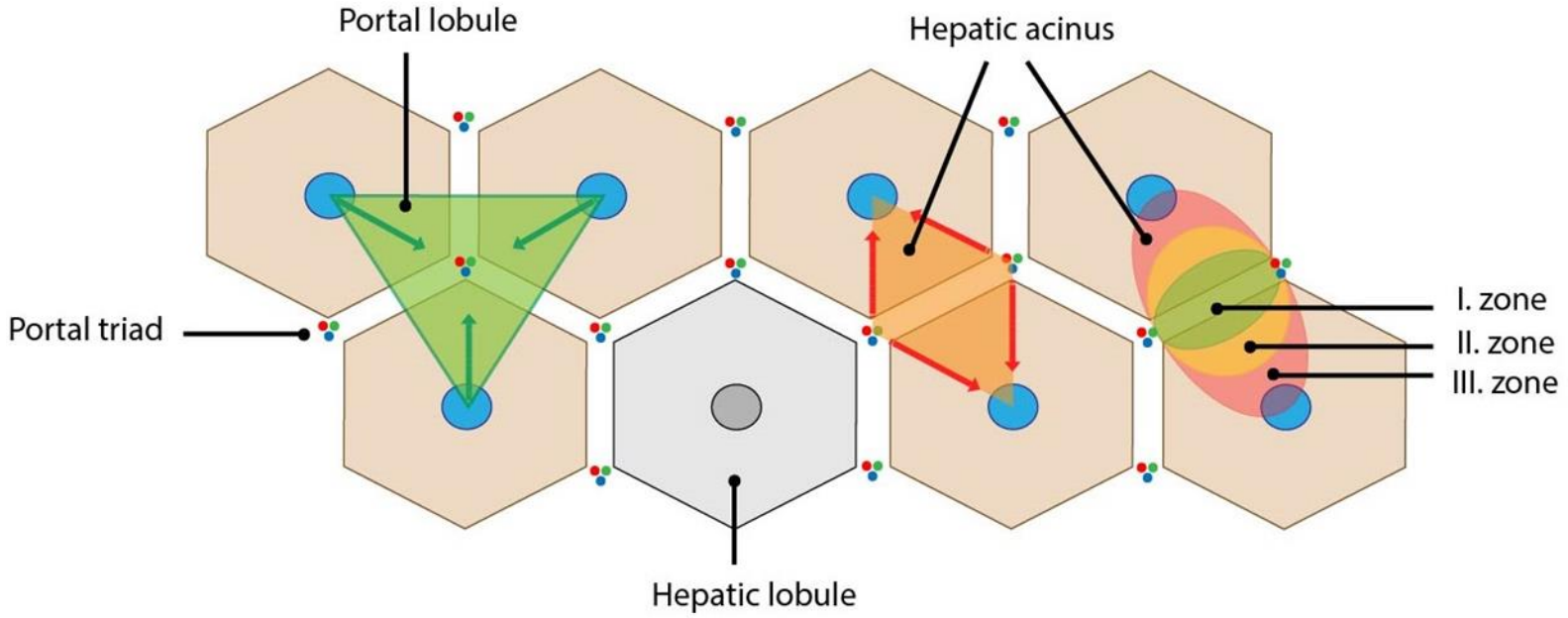


- Demonstrate bile exertion function.
- Bile drain from central to periphery.
- Therefore triangular in shape.
- 3 classic lobules in each angle.

Liver Acinus

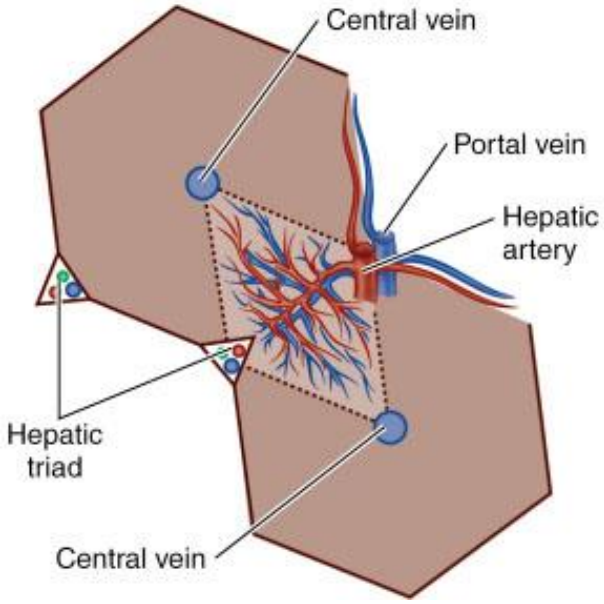
- Highlight the nature of blood supply to the hepatocytes
- Shows O2 gradient from hepatic artery branch to central venule
- Roughly oval or diamond shape
- Connecting adjacent portal triad.
- Extend towards 2 closest central veins.

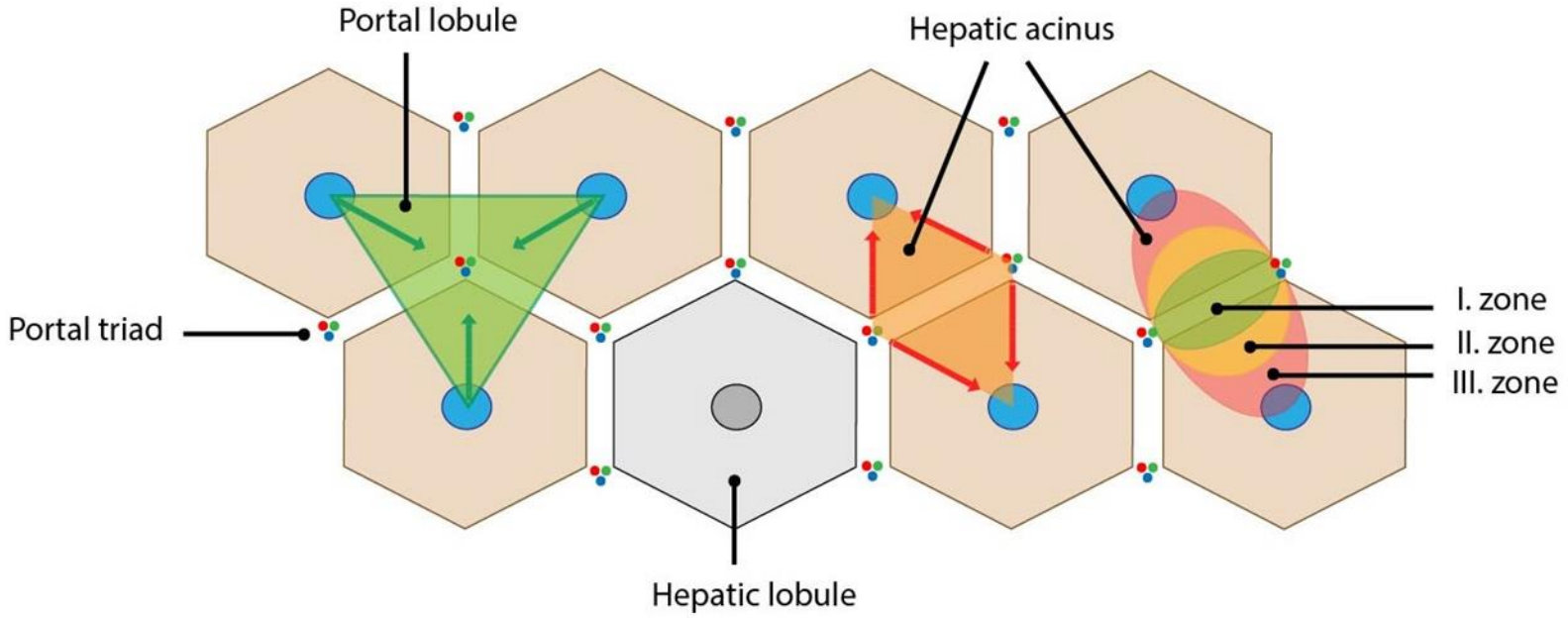




Liver Acinus

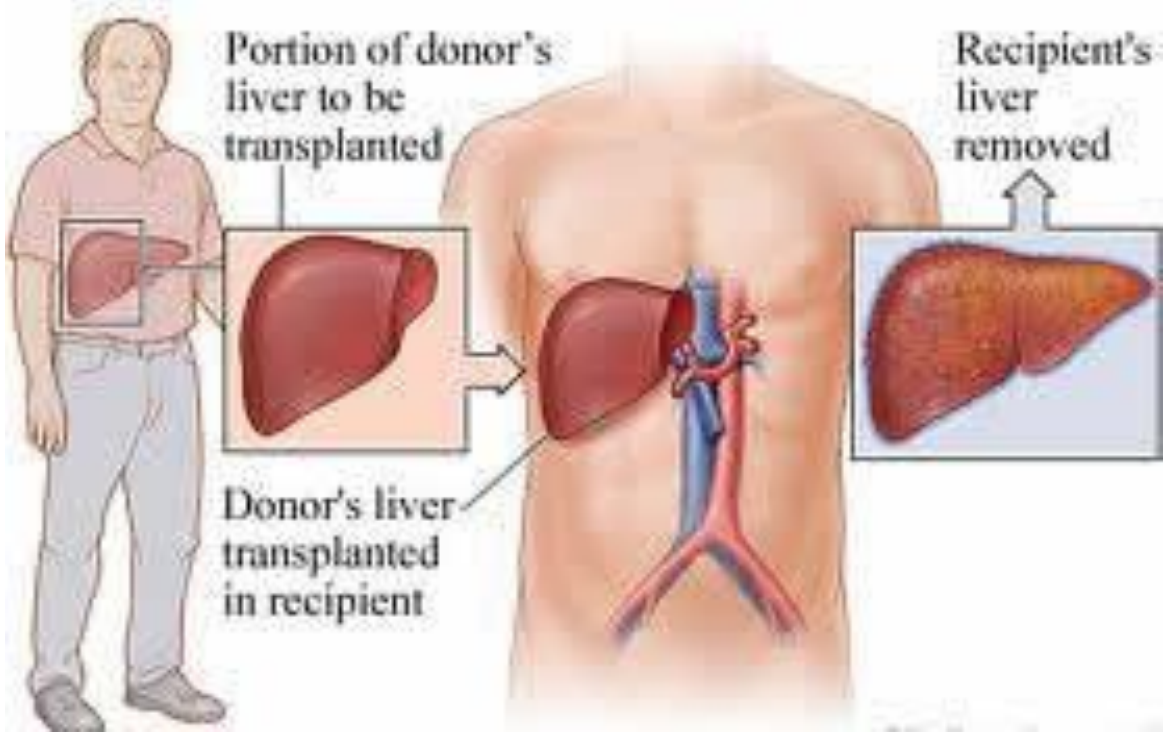
- Periportal hepatocytes nearest hepatic arteriole – Zone -1 (Get more O2/nutrients)
- Zone III -More periphery – near central vein(Least O2/nutrients)
- Zone III- Preferred area to lipid formation-
- Zone III-First hepatocytes to undergo fat accumulation and hepatic necrosis





Medical Applications

- Unlike salivary glands /pancreas/ renal - Hepatocyte has a strong capacity for <u>regeneration</u>
- Hepatocytes loss due to toxic substance stimulate mitosis of normal hepatocytes
- <u>Compensatory hyperplasia</u> occurs.
- Regeneration of liver fallowing liver transplantation.
- Full liver function restored in both recipient and donor.

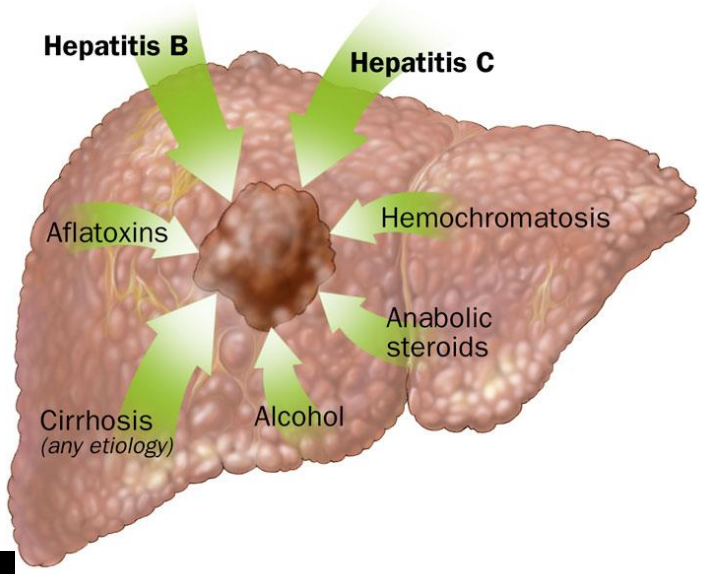


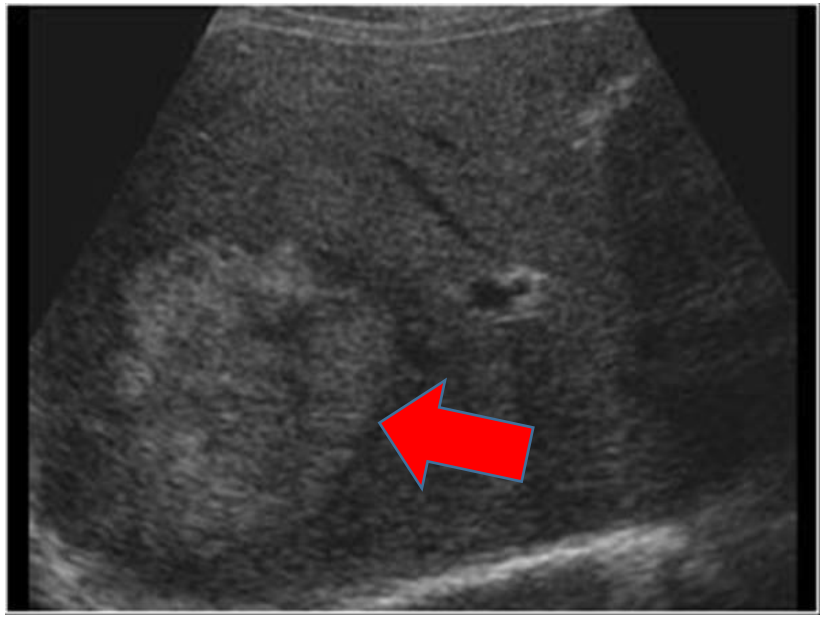
Fatty Liver Disease

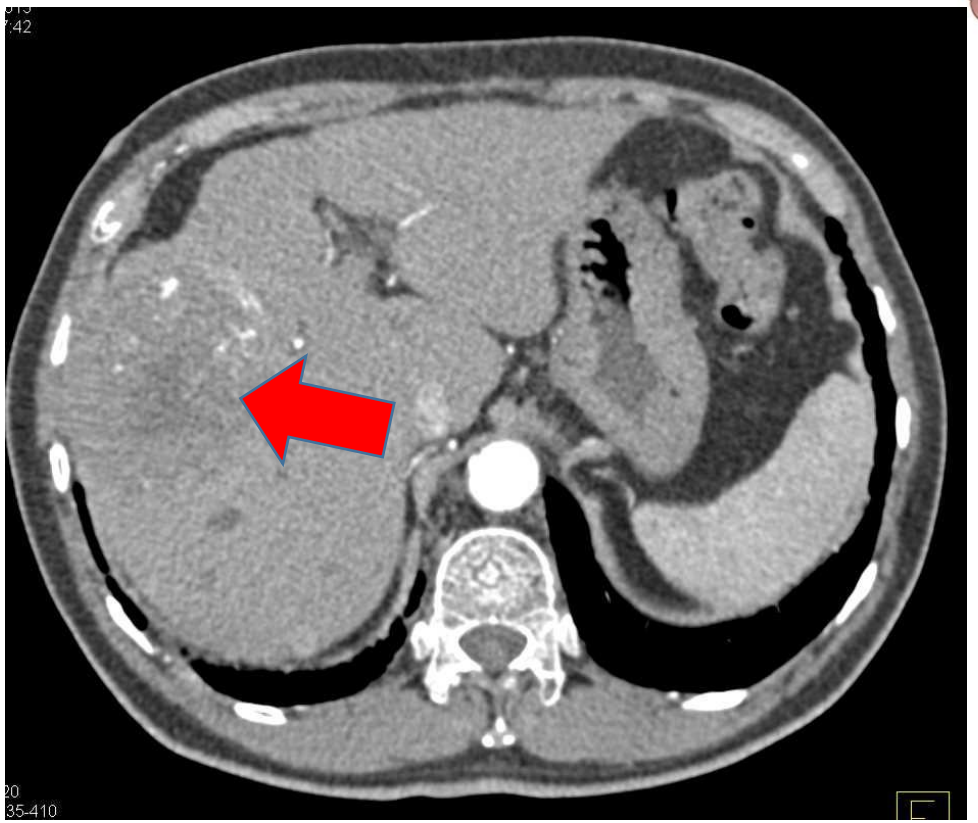
- Triglyceride lipid droplets accumulate in hepatocytes
- Process called steatosis
- May produce progressive inflammation
- Called Steatohepatitis
- Can lead to Cirrhosis
- Common causes –Alcoholism/Obesity/DM

Hepatoma

- Primary malignant tumor of the liver
- Arise from hepatocytes.







Liver Structure
and the
Flow of Blood & Bile

Describe how bile leaves the liver .

- Bile is secreted into bile canaliculi (minute spaces between apposed hepatocytes formed by tight junctions)
- Bile flows from bile canaliculi into bile ductules (aka cholangioles; lined by low simple cuboidal epithelium, aka cholangiocytes)
- Ductules connect into interlobar bile ducts lined by simple cuboidal or columnar epithelium
- Interlobar bile ducts connect into intrahepatic and then hepatic ducts