

'Laughter purifies the liver best'

Malcom de Chazal (1948)

**'Before marriage most people tend to speak from the heart,
later it becomes the liver and finally the bile'.**

Helen Vita (1968).



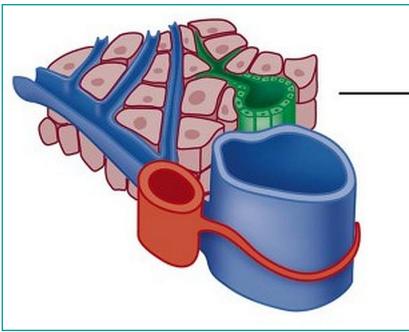
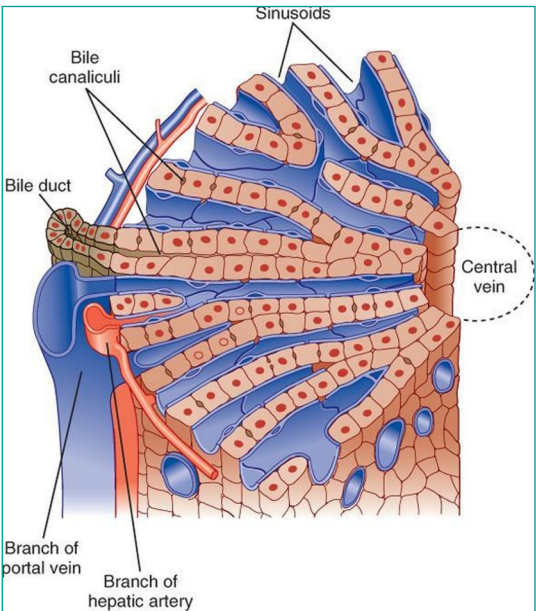
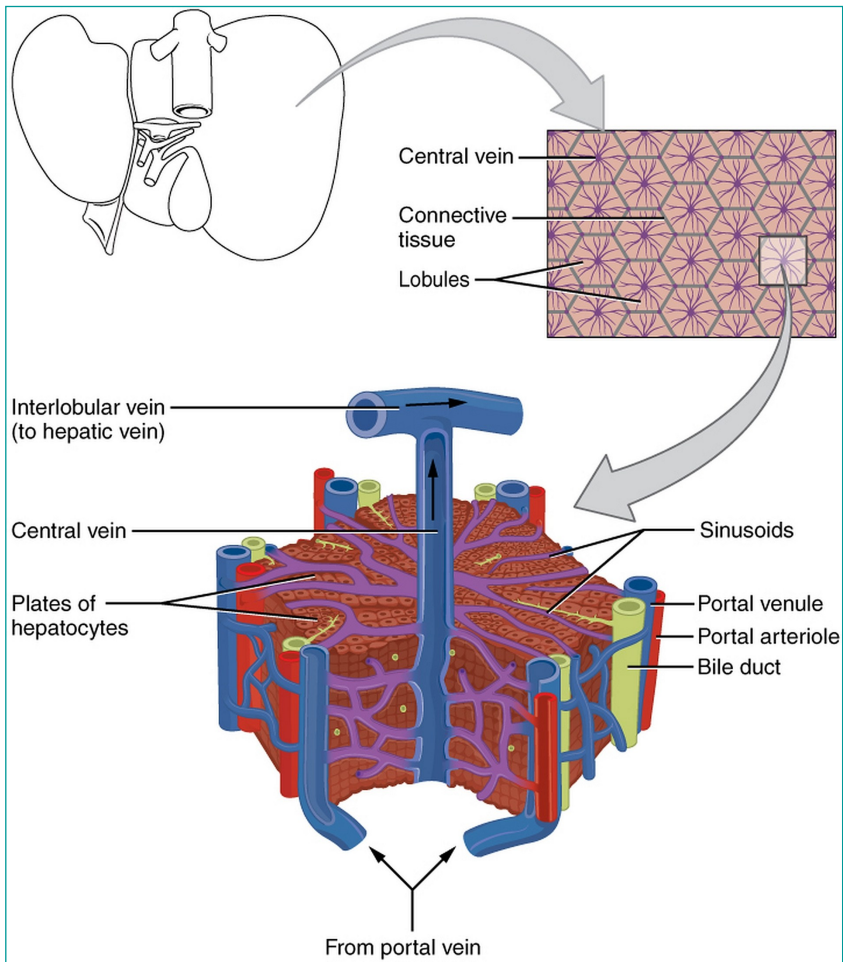
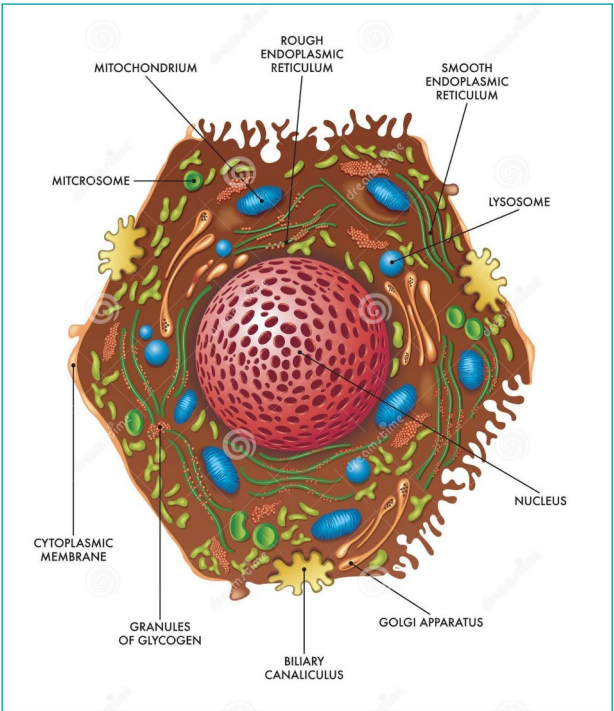
10. HEPAR & VESICA BILIARIS

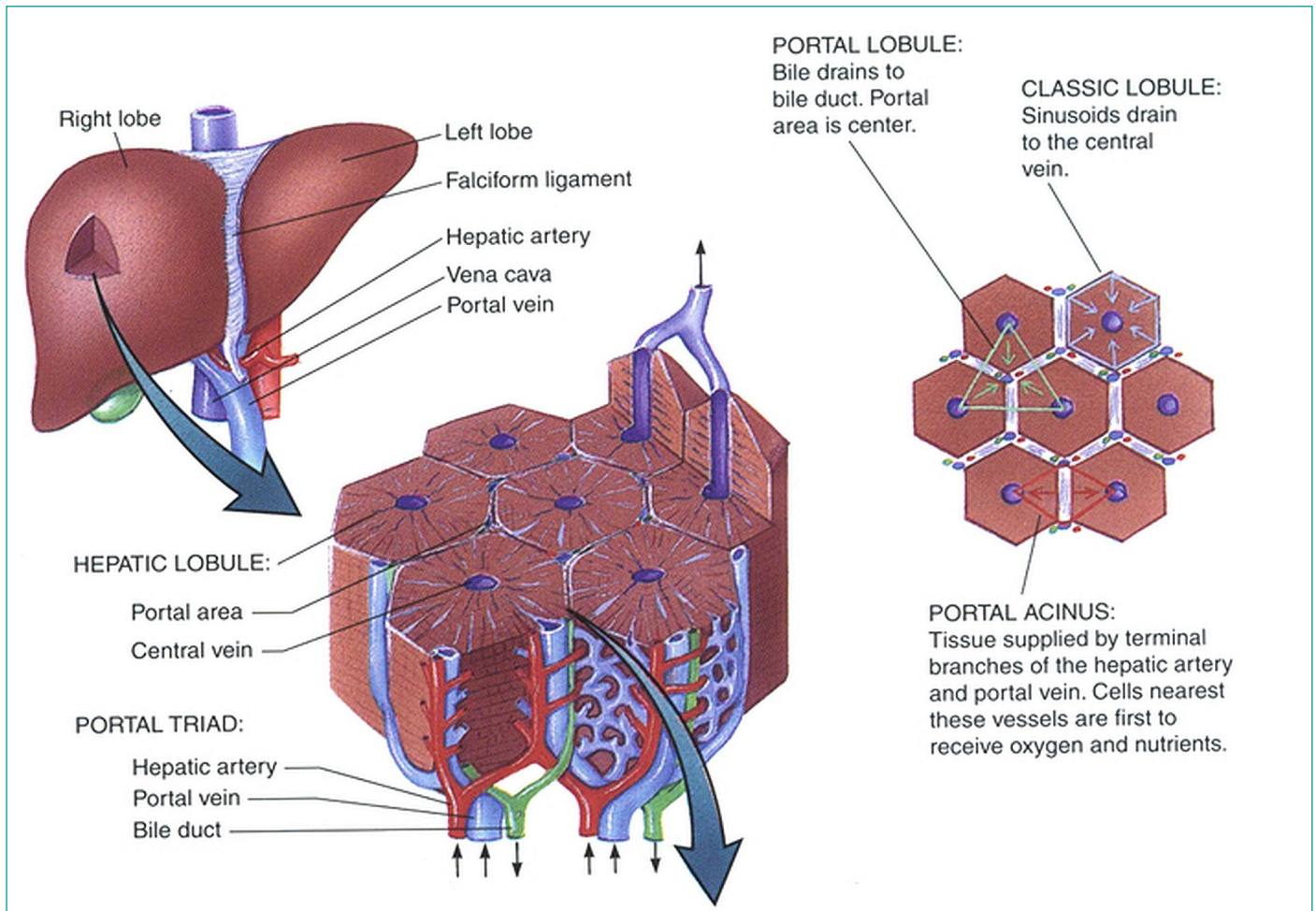
10.4. MICRO-ANATOMY HEPAR & VESICA BILIARIS

Liver lobulus

The anatomical unit of the liver is the liver lobe, lobulus Hepatis or hexagonal liver lobe of Kiernan.

- This is where the liver cells lie: Hepatocytes.
- In the middle of the lobe is the V. Centralis situated (drainage).
- The Hepatocytes are arranged radially around the V. Centralis in single-cell-thick plates (muralia).
- These muralia form a labyrinth with numerous winding and anastomosing cavities.
- In these cavities lie the sinusoids (between the Hepatocytes), through which the blood flows from the corners towards the V. Centralis.
- At each of the corners of the liver lobe lies a branch of the V. Portae, A. Hepatica and one or two interlobular bile ducts, together they form the Porta-triangle.

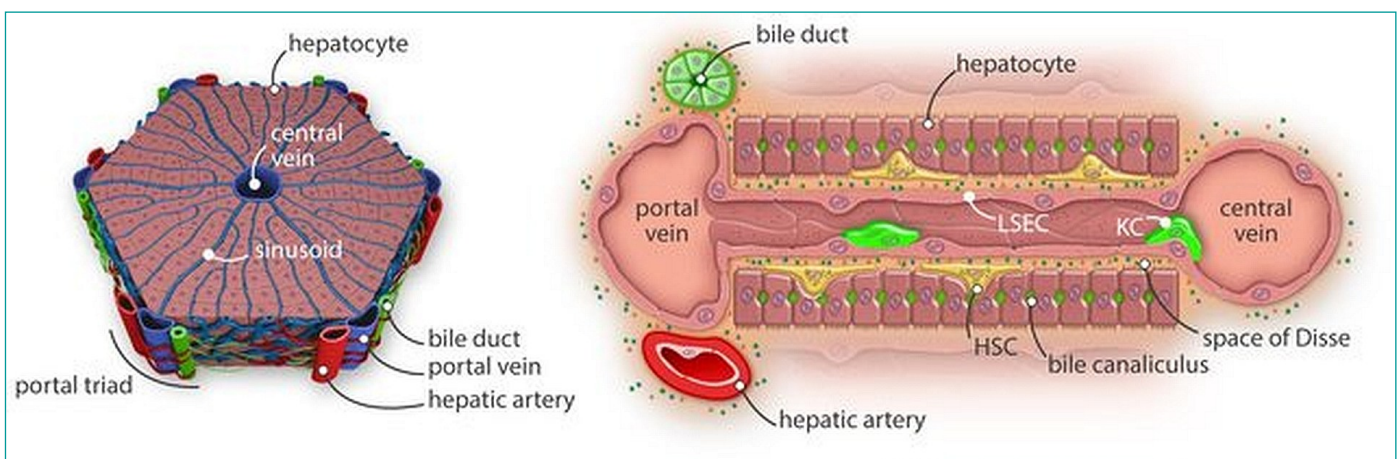




Liver-acinus

The functional unit of the liver is the liver acinus. According to this concept (Rappaport), the centre of the unit is the porta area with bile duct, while the draining venae Centralis are on the periphery.

The periportal parenchyma receives directly from the blood, which is still richly loaded with oxygen and food components. The pericentral liver cells are sprayed by blood that is already poorer in oxygen and nutrients. This zone is therefore more sensitive to the partial oxygen tension and toxic influences.



Three such acini together form a complex liver acinus, the group of parenchyma cells sprayed by a single preterminal portal vein. The acinar agglomerate forms an even larger grouping that includes a number of complex acini (i.e. supplied with blood by a larger branch of the V. Portae).

The liver can therefore be understood as a huge parenchyma mass, built in continuous continuity. The vascularization (afferent and efferent) results in this parenchyma mass, which morphologically forms one block, being divided into innumerable microunits, in which the flow takes place from 'periportal' to 'centrolobular'.

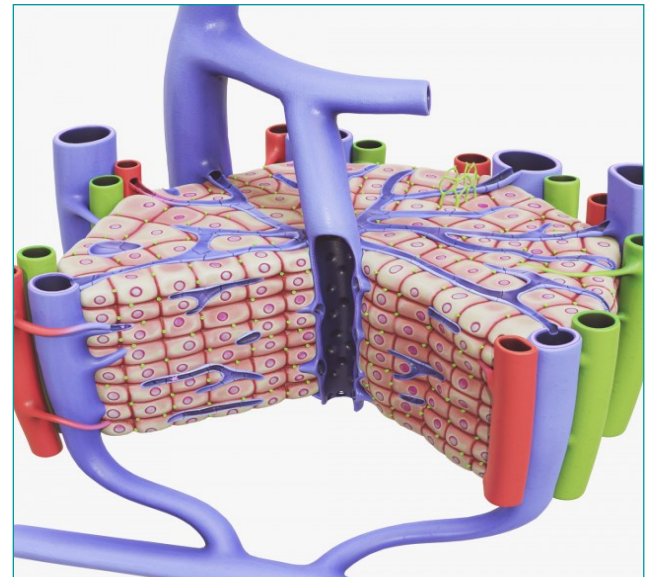
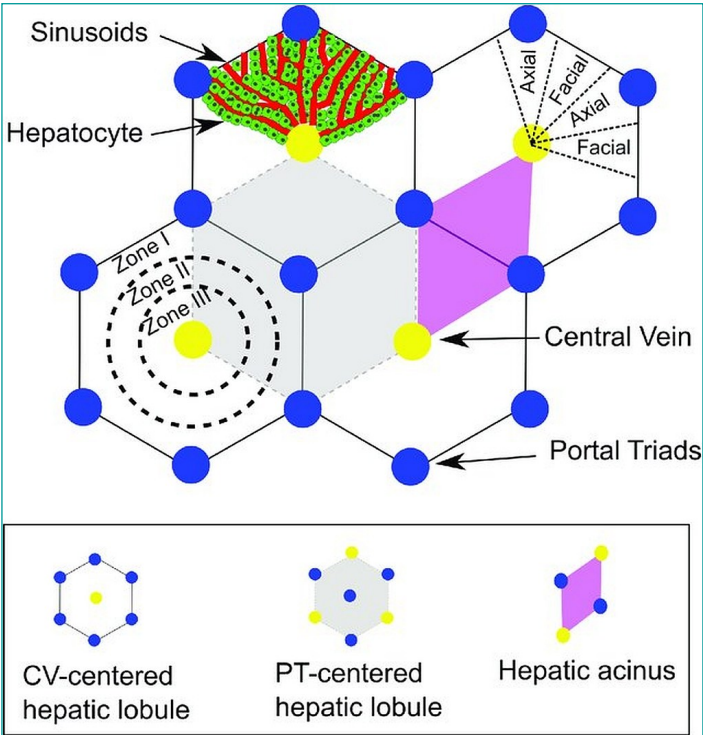
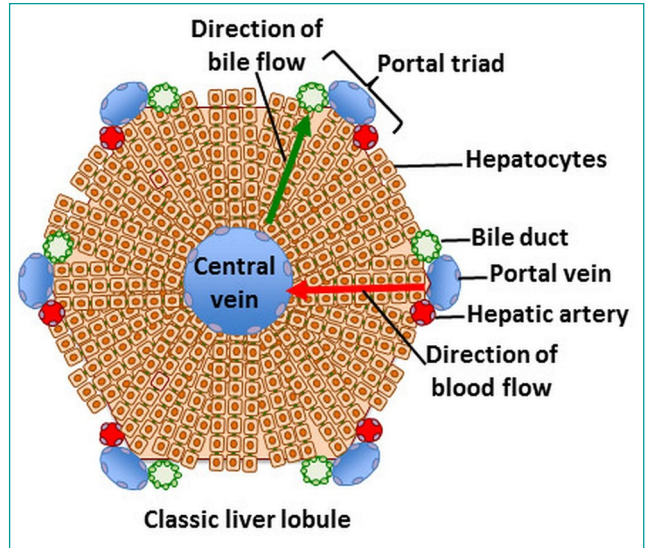
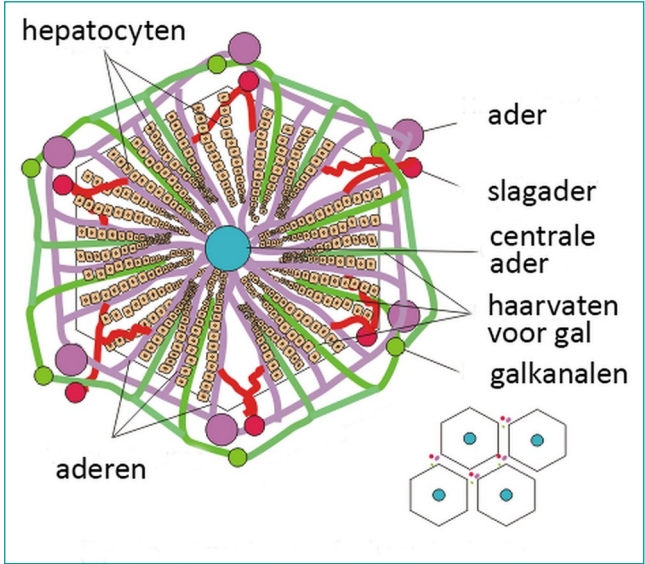
History Kiernan:

Francis Kiernan (1800 – 1874) was an anatomist and doctor. He set up a private anatomy class in England, but in the words of the British Medical Journal (BMJ), his great success as a teacher caused much jealousy, and in 1825 gave rise to the council of the College of Surgeons refusing the certificates.

He was awarded the Copley Medical in 1836 for his work on the anatomy of the liver.

Several other concepts have been proposed since Kiernan, such as Mall's lobulus, Rappaport's liver acinus, Matsumoto's lobulus, Ektaskin's cholehepaton, and others.

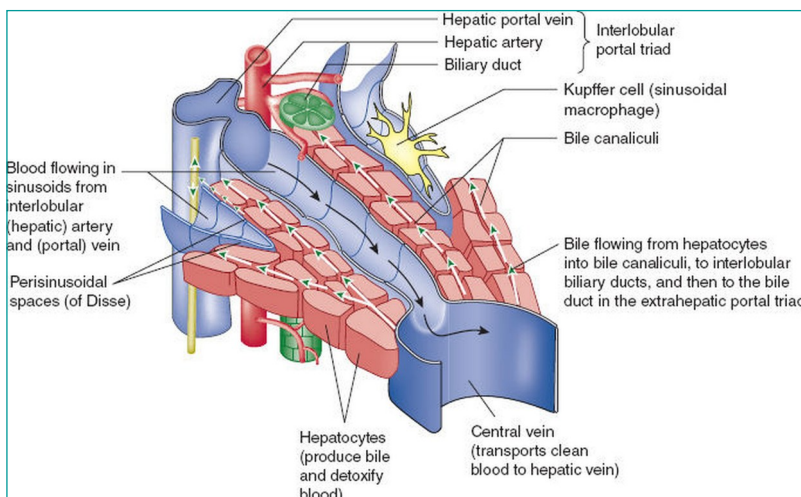
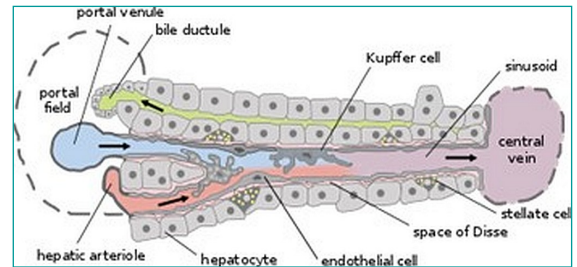
For a few decades now, however, Matsumoto's liverlobus has seemed to be closer to reality.



Sinusoides

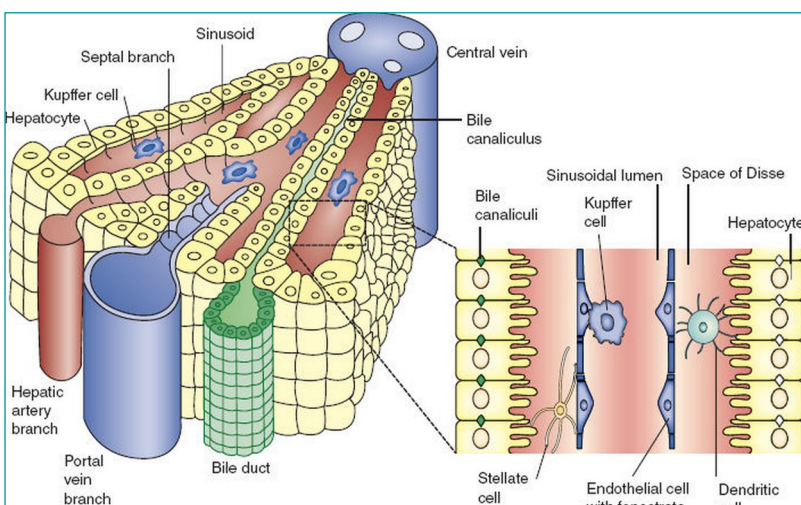
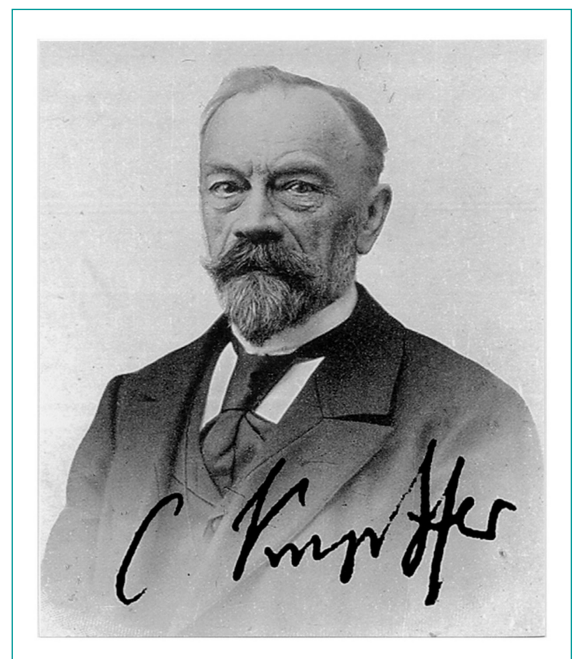
The sinusoids are mainly formed by endothelial cells, with very small sieve holes (fenestrae), which allows transport of plasma and small particles.

- The Hepatocyt has microvilli, the tips of which reach up to the sinus-endothelial cell.
- The space between the sinus wall land the Hepatocyt is called Disse's space.
- In the space of Disse we find other cell types:
 - ◇ *Kupffer-cells*: (hepatic macrophages) belong to the Mononuclear Phagocyte System (MPS, see chapter 15. Lien). Possess an irregular surface with numerous microvilli and well developed lysosomes. Function: pinocytosis and phagocytosis, detoxification, production antibodies (IG).
 - ◇ *Ito-cells*: (hepatic stellate cells) are characterized by a large fat-vacuole (storage of vitamin A, among other things) and can convert into fibroblasts, which produce collagen (cirrhosis).
 - ◇ *Pit-cells*: belong to the immunological system and are related to 'natural killer cells'. Also produce collagen.



History Kupfer:

Karl Wilhelm von Kupffer (1829 – 1902) a German anatomist, known for his work in neuroanatomy and embryology. He discovered 'his' cells in 1876, which he first placed at the pericytes of the connective tissue. Later, he classified them as macrophages.



Source: Moore KL, Agur AMR, Dalley AF. Clinically Oriented Anatomy. 7th ed. Philadelphia: Wolters Kluwer; 2013

Intermezzo Metaphor liver:

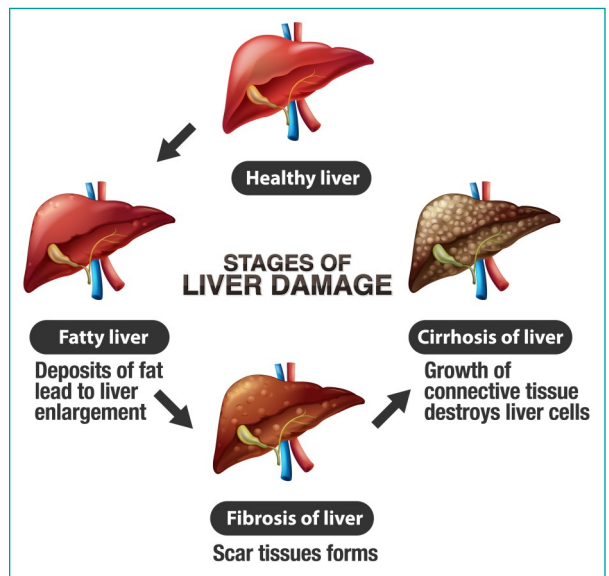
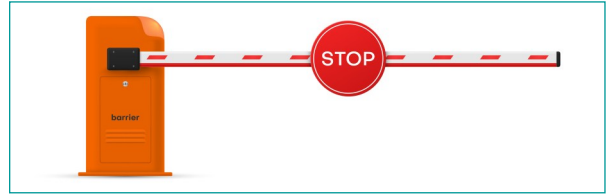
A nice metaphor is to think of the liver as a second intestine. Food particles come through the sinusoid to the Hepatocytes. Here, however, there is control at the border (space of Disse).

- *The Kupffer-cells ask for a passport (MHC-class) before letting anything through.*
- *The Ito-cells store fat-soluble products, but can transform into fibroblasts (encapsulation).*
- *The Pit-cells precipitate anything with immunologically suspect.*

Nice to see that the development of Pathology, is actually a natural salvation:

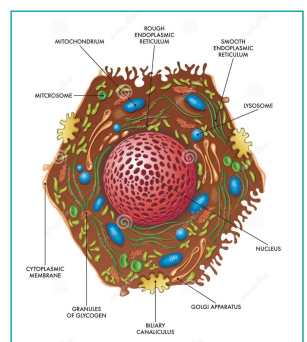
- *Macrophages (Kupffer) guard the liver, which actually makes the body's own products. Many toxins are rendered harmless or, as a salvation, stored in fat-vacuums (Ito).*
- *If the system is derailed, the Pit-cells come into action as 'Natural-Killers'.*
- *With a prolonged intoxication, a fatty liver (Ito) first arises, but eventually a lot of collagen is produced (Cirrhosis). This is to prevent toxins from spreading throughout the body.*

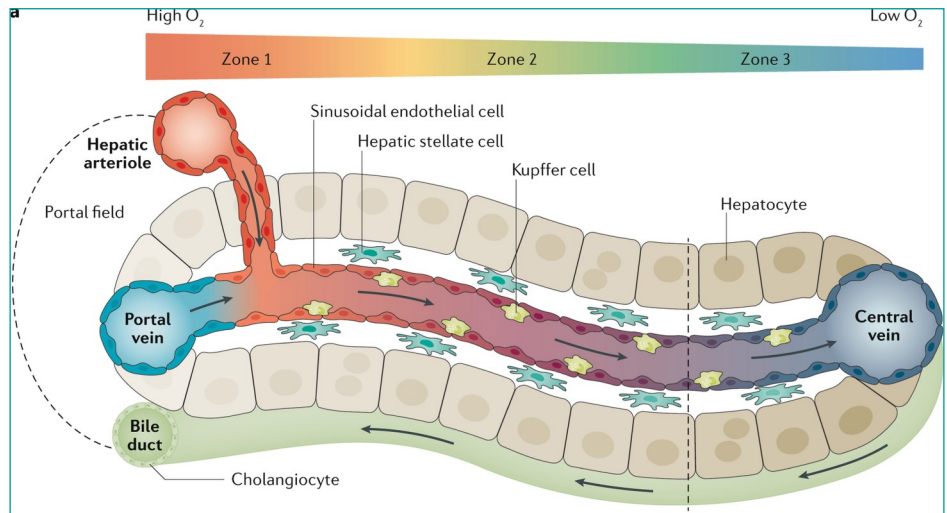
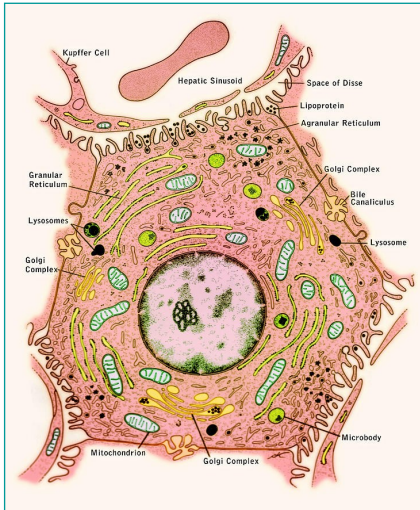
Pathology can (also) be seen as a solution of the body, not only as an 'invading disease'.



Hepatocyt

- The number of Hepatocytes is about 1 billion.
- Belongs to the polyhedral cell type with six faces.
- Very rich in mitochondria.
- Endoplasmic reticulum: granular and agranular (carrier of numerous enzymes: intermediate metabolism, detoxication, bilirubin conjugation).
- Lysosomes are mainly found in the canalicular region.
- Golgi device is also located near bile-canaliculi.
- Glycogen is a typical storage product in the hepatocyte.
- Plasma membrane has three differentiated areas:
 - ◇ *Sinusoidal surface:* turned towards the space of Disse, numerous irregular microvilli.
 - ◇ *Intercellular surface:* with this, the Hepatocytes lie against each other, also has gap-junctions.
 - ◇ *Canalicular surface:* forms the wall of the bile-canaliculi.



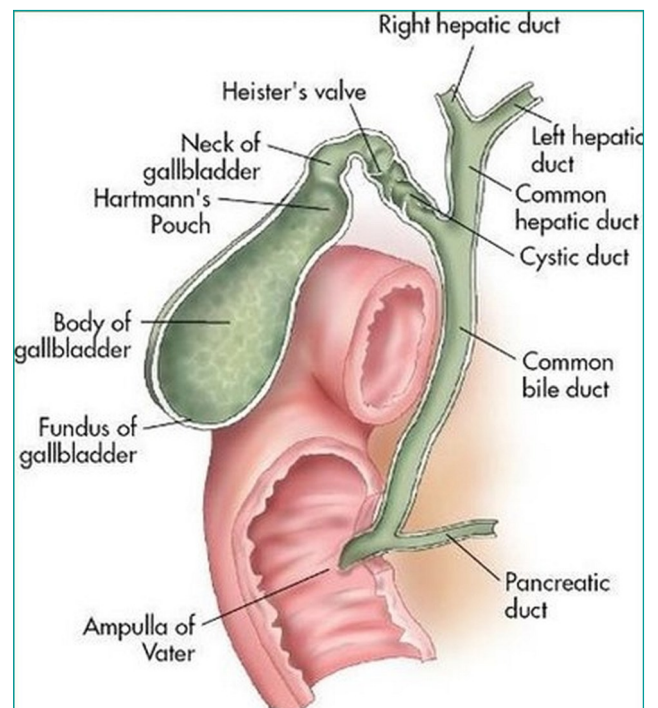
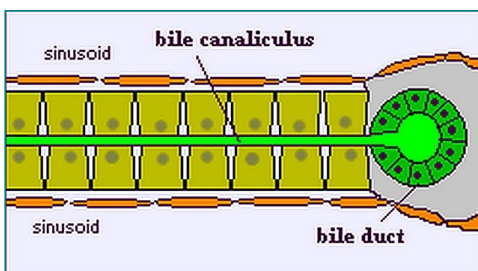
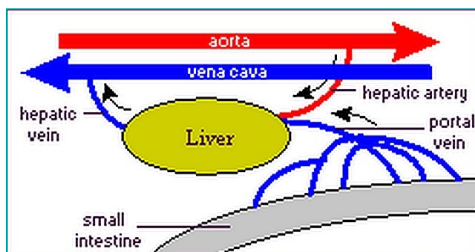


Bile-canaliculi

- Begins in the bile capillary, formed by the Hepatocytes.
- At the end of a cell plate, this passes into a bile duct (ductuli biliferi interlobularis).
- At the portal triangle, this becomes Hering's canal (ductulus biliferi periportalis).
- These flow into the ductus Hepaticus dexter et sinister, which outside the liver form the ductus Hepaticus communis, which after the connection with the ductus Cysticus continues as ductus Choledochus and leads the bile to the Duodenum (papil of Vater).

Source: Lecluyse EL, Alexandre E (2010).

- "Isolation and culture of primary hepatocytes from resected human liver tissue".
- Hepatocytes. Methods Molecular Biology. Volume. 640. pp. 57–82. ISBN: 978-1-60761-687-0)..



Intermezzo Heister & Lütken's:

In the cystic duct we find the Valvula of Heister, spiral mucous folds, which help the accessibility of the ductus.

In addition, the ductus possesses the Sphincter of Lütken's, which helps to regulate the flow of bile. This Sphincter is the receptor site for Secretin & CCK.

Source: Pina, L.N., Surgical Considerations of the Cystic Duct and Heister Valves, the Surgery Journal, 2015, Thieme Medical Publishers. PMID: 28824966.