



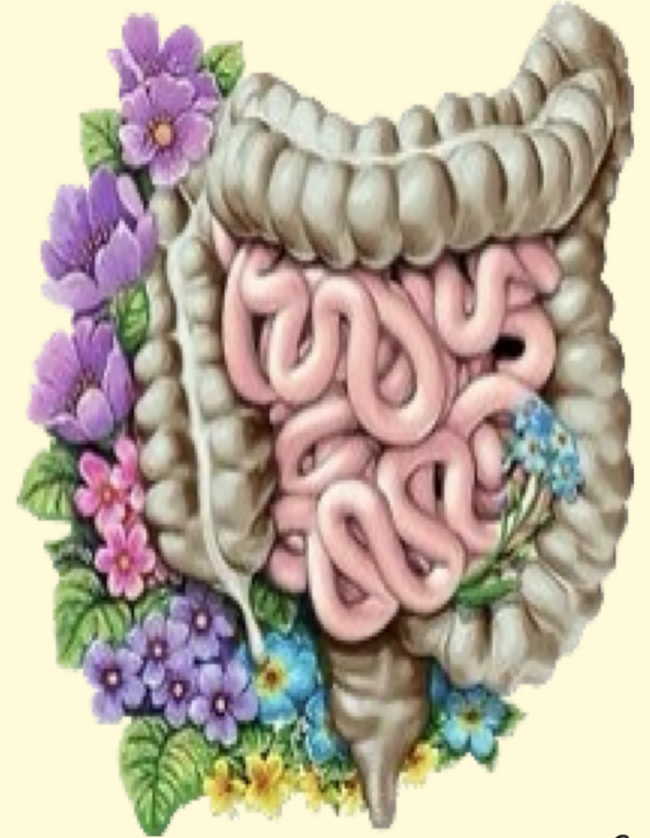
# GIT SYSTEM

**Subject :** anatomy

**Lecture :** 12

**Done by :** Nehaya

وَقُلْ هَبْرَبِّ رَبِّ الْعَالَمِينَ



انزرف (سهمي « شع »)  
امر هم الدكتور

# The Gallbladder

- A pear-shaped, muscular sac lying against the visceral surface of the liver in a fossa in the right lobe of the liver.
- It has a capacity of about 30-50ml. It stores and concentrates bile. When needed, it releases bile through the cystic duct.  
*by reabsorbing the water* ← *to duodenum lumen*
- **Relations** of the gallbladder:
  - **Anteriorly**: The anterior abdominal wall and the inferior surface of the liver.  
*ant. fundus*  
*body & neck of gallbladder*
  - **Posteriorly**: The transverse colon and the first and second parts of the duodenum. *1st/2nd*

fundus

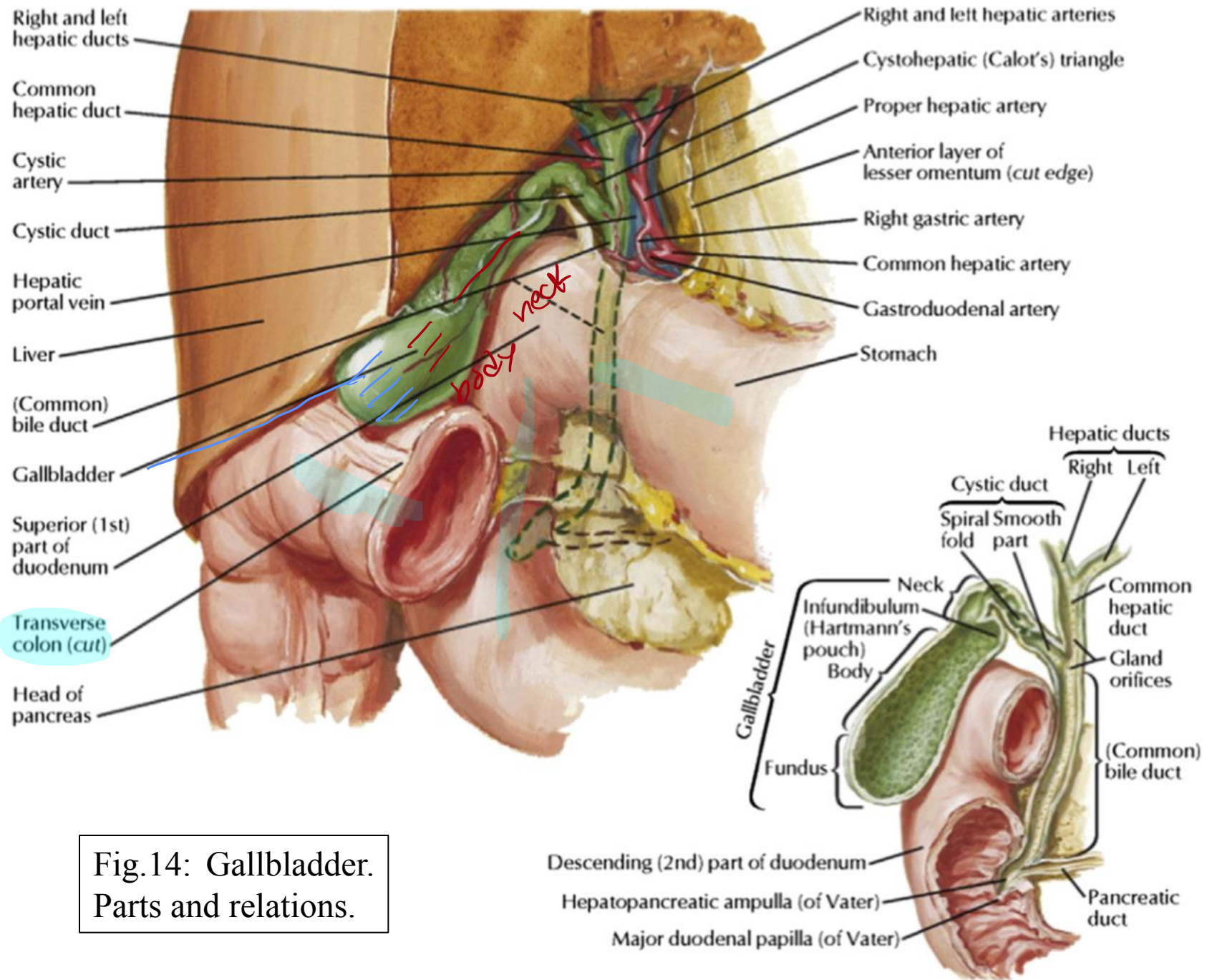


Fig.14: Gallbladder. Parts and relations.

- The gallbladder is formed of:
  1. The *fundus* is rounded and projects below the inferior border of the liver, where it *comes in contact with the anterior abdominal wall at the level of the tip of the right 9th costal cartilage (midclavicular line)*.
  2. The *body* lies in contact with the visceral surface of the liver.
  3. The narrow neck which becomes continuous with the cystic duct. *open into*
- The fundus is completely surrounded by peritoneum. The posterior surface of the body and neck are also covered by peritoneum. *→ not covered anteriorly*  
*\* fossa isn't covered*  
*=*  
*btwn liver & gallbladder x peritoneum*

## **Blood Supply**

The cystic artery, a branch of the right hepatic artery, supplies the gallbladder. The cystic vein drains directly into the portal vein. Several very small arteries and veins also run between the liver and gallbladder

## **Lymph Drainage**

The lymph drains into a cystic lymph node situated near the neck of the gallbladder. From here, lymph passes to the hepatic nodes then to the celiac nodes.

*in porta hepatis*

## **Nerve Supply**

Sympathetic and parasympathetic fibers form the celiac plexus and vagus nerve.

## Cholecystitis

gallbladder inflammation

Dx

### Murphy's sign

During physical examination, place your hand near the right costal margin at the midclavicular line. Ask the patient to take a deep breath. If the patient has cholecystitis, sharp pain will be felt by the patient as the inflamed gallbladder hits your hand.

patient breath deeply = chest ↓  
= gallbladder ↓ goes down to & : (شخص)  
if inflamed your palpation = pain

### Cholecystitis pain and deep breathing

Deep breathing may increase cholecystitis pain as the inflamed gallbladder comes in contact with the anterior abdominal wall.

can't take deep breath cuz gallbladder ↑

+ fundus related to ant. abd. wall

زي murphy يعني بدل ايدك ضاغط ال ant abd wall

### Cholecystitis referred pain

Inflammation of the gallbladder may affect the parietal peritoneum on the undersurface of the diaphragm which is supplied by root C3-C5. This may cause referred pain in the right shoulder which is supplied by the supraclavicular nerve (C3, C4).

irritation under diaphragm = RT shoulder pain

(Same nerve) roots

C3,4

# The biliary tree

<https://youtu.be/uQ7Yn40mEP0?si=VUJ1U7NZWSb2Cno8>

- Bile is produced by hepatocytes.
- It's, first, released into *bile canaliculi*. Then open into *bile ductules* which end up in *bile ducts*.
- The bile ducts converge to eventually form the *right and left hepatic ducts*, which emerge through the porta hepatis anterior to the hepatic artery. The two hepatic ducts join to form the *common hepatic duct*.
- The common hepatic duct descends within the free (right) margin of the lesser omentum where it is joined by the *cystic duct* from the *gall bladder* to form the *common bile duct*.
- The *cystic duct* is S-shaped and emerges from the neck of the gallbladder. It descends for a short distance in the free edge of the lesser omentum before joining the common hepatic duct. The cystic duct possesses a spiral fold.

- The **common bile duct** course:
  - Lies in the free margin of the lesser omentum anterior to the opening into the lesser sac. Here, it lies in front of the portal vein and to the right of the hepatic artery.

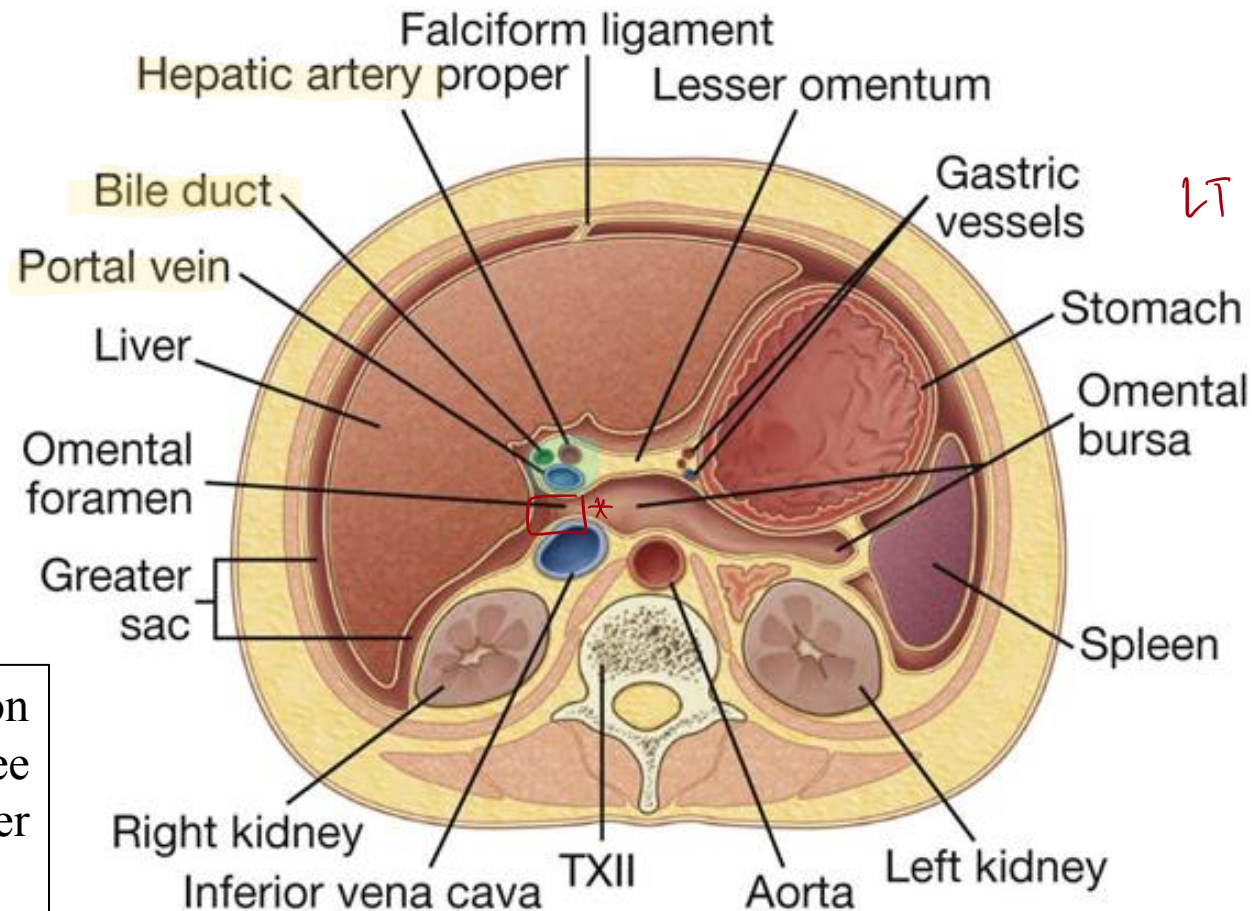


Fig.15: The common bile duct in the free margin of the lesser omentum.



2. Passes behind the first part of the duodenum to the right of the gastroduodenal artery.
3. Runs posterior to the head of the pancreas. Here, the bile duct comes into contact with the main pancreatic duct.

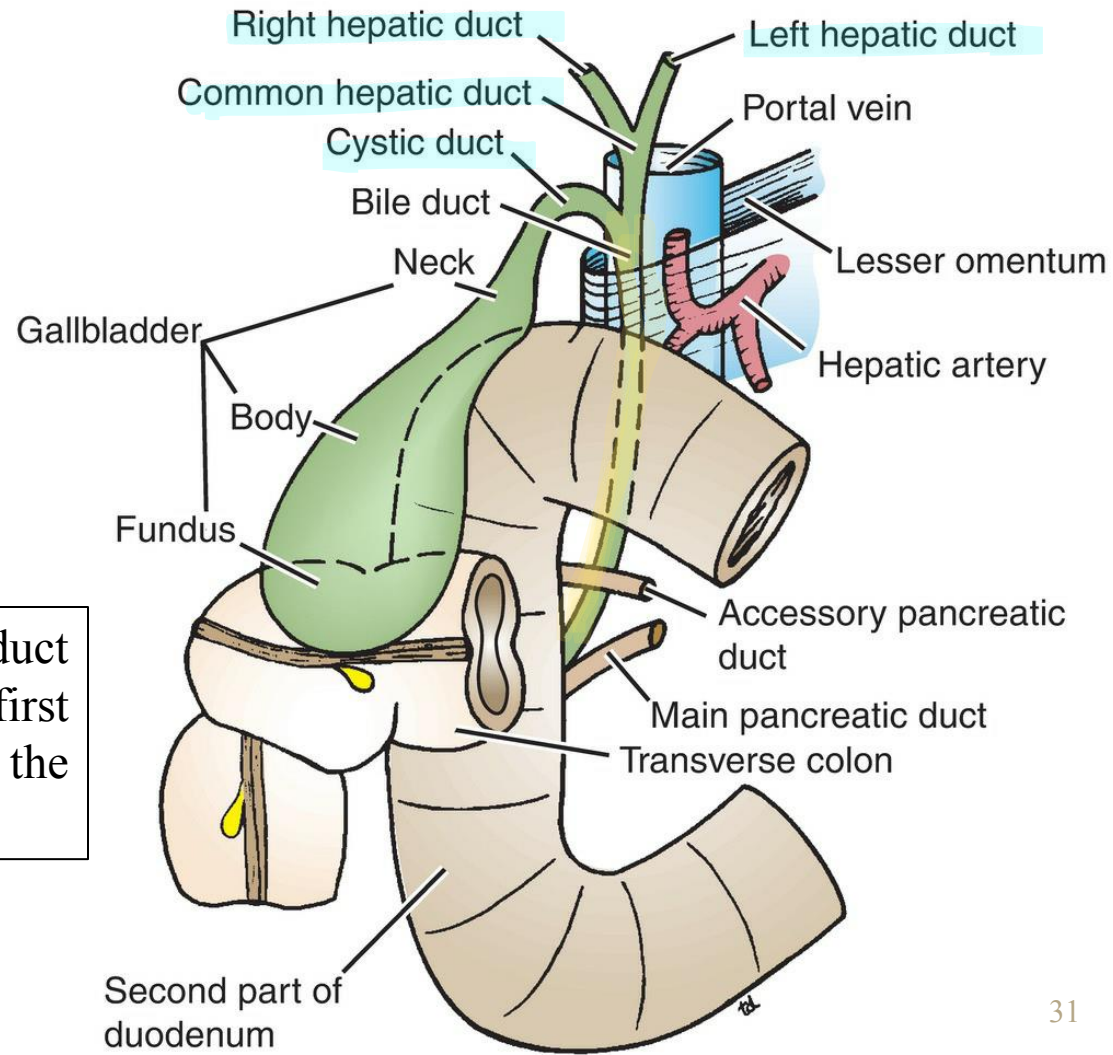


Fig.16: The common bile duct as it runs posterior to the first part of the duodenum and the head of the pancreas.

- The **common bile duct** is usually joined by the **main pancreatic duct** to form the **hepatopancreatic ampulla** (of Vater).
- The ampulla pierces the medial wall of the second part of the duodenum about halfway down its length, and opens into the lumen of the duodenum by means of the **major duodenal papilla**.
- The terminal part the ampulla is surrounded by circular muscle, known as the **sphincter of the hepatopancreatic ampulla** (sphincter of Oddi).

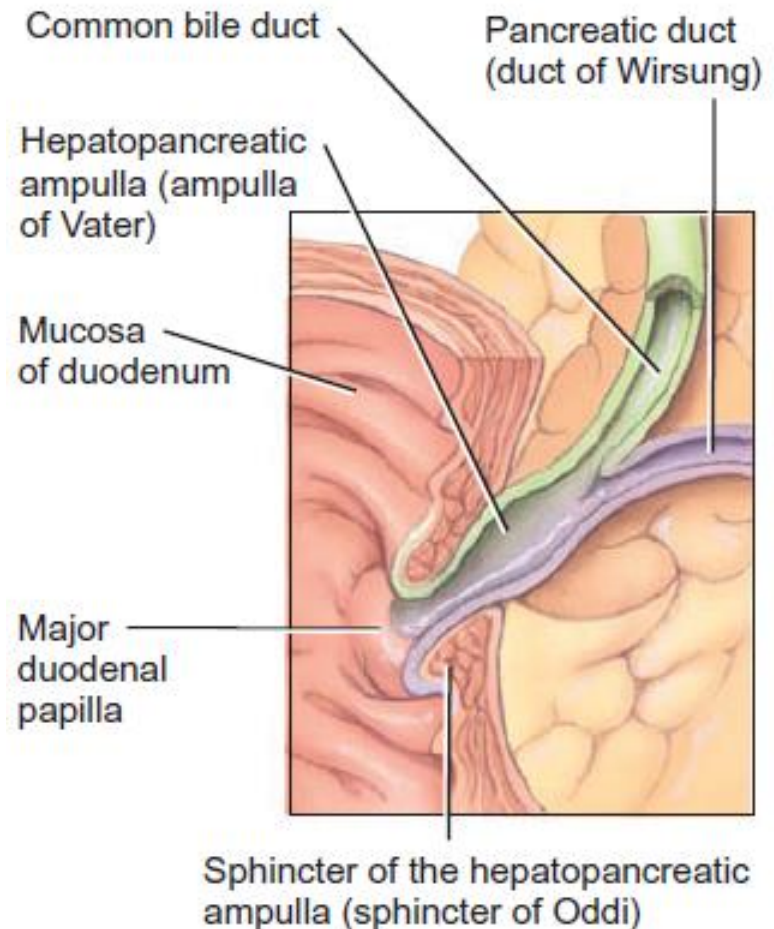


Fig.17: Terminal part of the common bile duct.

# HISTOLOGY OF THE LIVER, GALLBLADDER, AND BILIARY TREE

Dr. Mustafa Saad  
(2023)



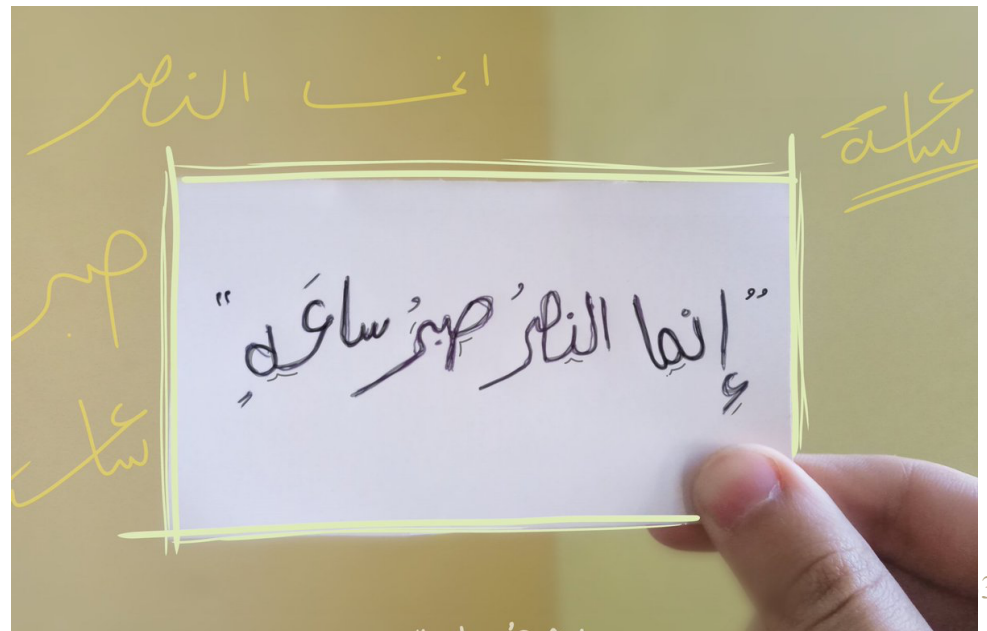
*liver Histo*  
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*lobules*

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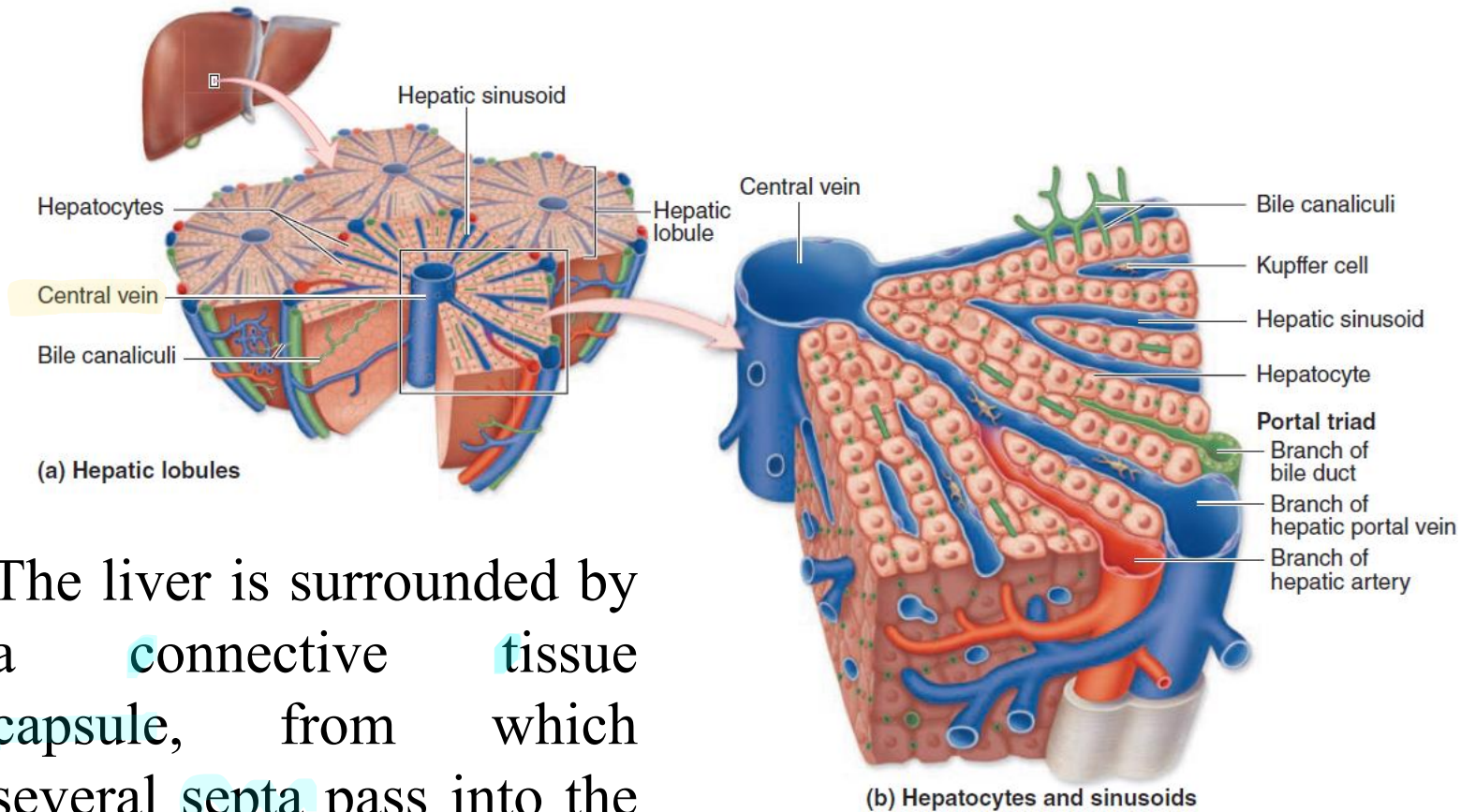
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Histo  
Features

انگلی سے  
الموظیفات

- The liver performs several metabolic, exocrine, endocrine, and immune functions; and its microanatomical structure is suitably built for the adequate performance of these functions.



- The liver is surrounded by a connective tissue capsule, from which several septa pass into the liver dividing it into lobules.

Fig.18: Histology of the liver.

# The hepatic lobule

- Basic structural unit of the liver. Usually, but not necessarily, with a hexagonal cross section.
- Each lobule contains a single *central vein* in the middle and surrounded by connective tissue (this may not be very well distinct in humans under the microscope).
- At each corner of the lobule, we have a larger space called the *portal space*. This contains:
  - Connective tissue (loose areolar)
  - Branch of hepatic artery
  - Branch of portal vein
  - Bile ductule
  - Lymphatic vessels
  - Nerves



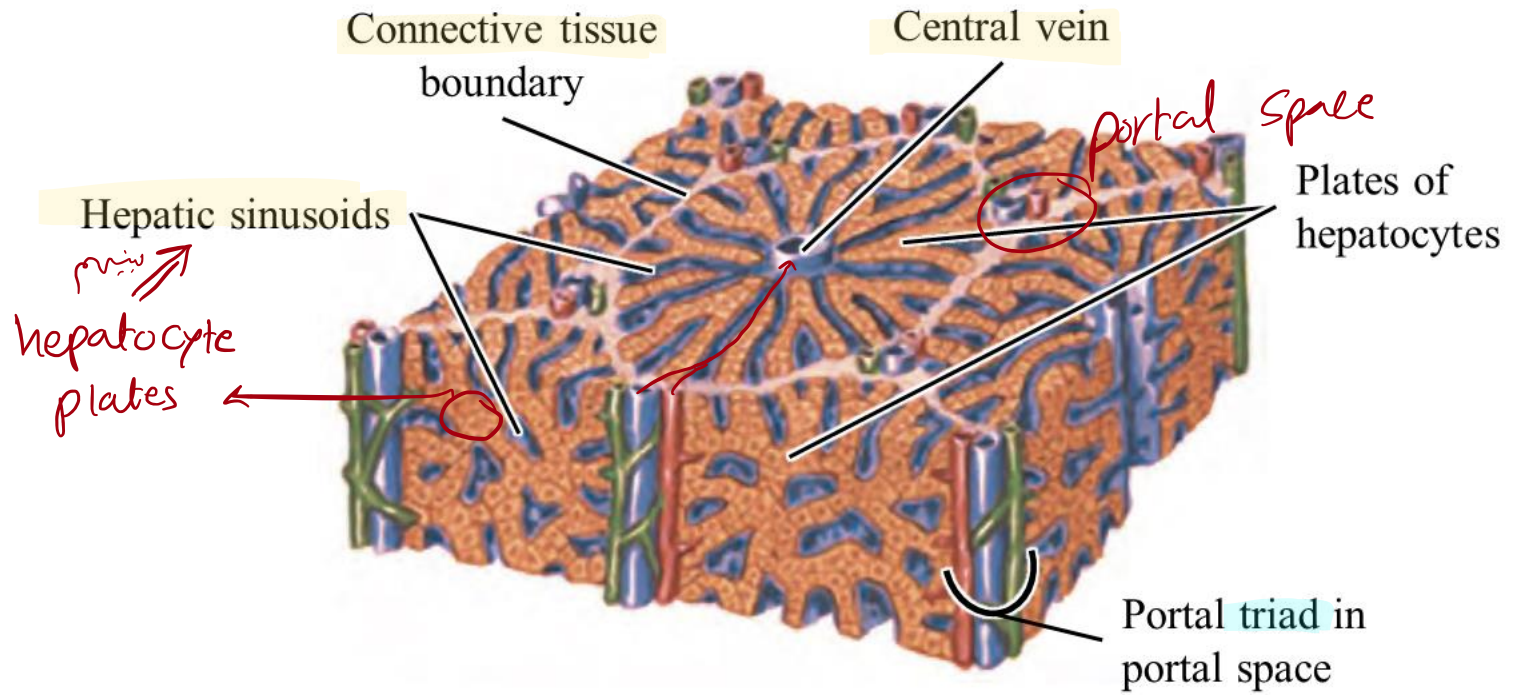


Fig.19: Hepatic lobule.

- The hepatic lobules are formed of several plates of liver cells (hepatocytes). These plates branch and anastomose freely with each other. They extend from the central vein to the periphery of the lobule and are supported by reticular fibers.

- Between the plates, we have the *hepatic sinusoids*. Branches of the hepatic artery and portal vein open into these sinusoids (thus <sup>\*</sup>mixing arterial and venous blood). The sinusoids drain into the central vein.  
*large capillaries\**

- Hepatic sinusoids are lined by discontinuous fenestrated endothelium with a <sup>قلاية وفتحات</sup> sparse basal lamina. This allows the free passage of substances (but not cells) between the sinusoids and the hepatocytes.  
*متقبة*

- Between the sinusoids and the hepatocytes, is the *perisinusoidal space* (space of Disse). Several hepatocyte microvilli extend into this space to increase the surface area.

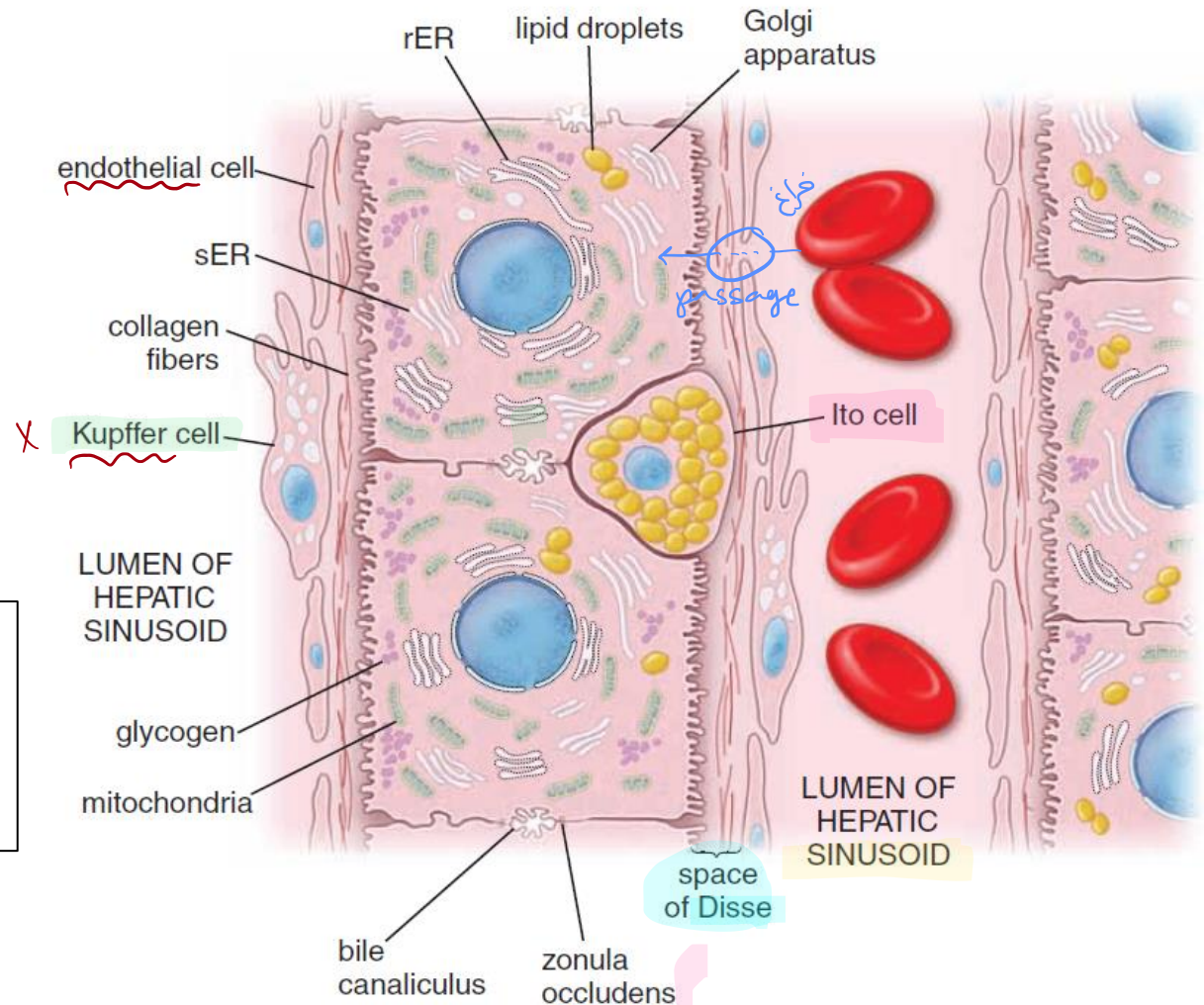


Fig.20: Hepatocytes, the perisinusoidal space, and the hepatic sinusoids.



## Kupffer cells

- These are macrophages found on the luminal side of the hepatic sinusoids as part of its lining. ✕
- **Functions:**
  - Phagocytosis of old red blood cells <sup>RBC</sup>
  - Metabolism of hemoglobin <sup>↓</sup>
  - Antigen-presenting cells <sup>APC</sup>
  - Clear blood of bacteria and debris

## Stellate (Ito) cells

- Found in the space of Disse. Contain several fat droplets.
- **Functions:**
  - Storage of vitamin A (and other fat-soluble vitamins) <sup>من كبد</sup>
  - Produce extracellular matrix (cause of fibrosis after liver injury) <sup>ECM</sup>
  - Release of cytokines

الكل ← بنجارد نقل عمل الـ Ito خلايا

# Hepatocytes

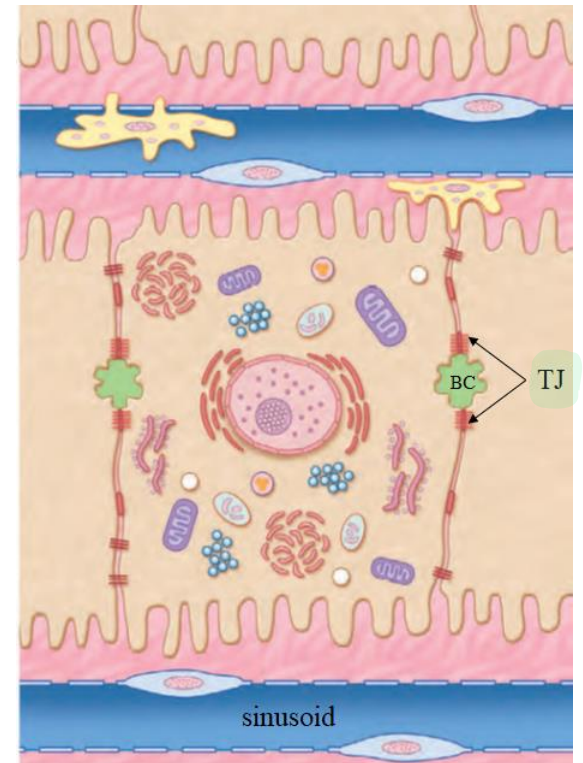
- Large polyhedral cells.
- Large, round, centrally located nucleus. Frequently, the cells are binucleated and they could polyploid (with 2-8 the normal number of chromosomes).
- Numerous mitochondria for energy production. *liver = metabolism*
- Rough endoplasmic reticula and Golgi apparatus for protein synthesis. *RER & Golgi*
- Smooth endoplasmic reticulum for detoxification. *SER*
- Peroxisomes *(metabolism & detox)*  
*generate H<sub>2</sub>O<sub>2</sub>*
- Glycogen, lipid, and ferritin granules for the temporary storage of glucose, triglycerides, and iron, respectively. *(iron)*

عارة و intracell. صبغة دكن

- Between two adjacent hepatocytes is an area of **larger** intercellular space bounded only by hepatocytes cell membrane. Into this space, **bile is excreted**. This is called **bile canaliculus**. The surface area of the canaliculus is enlarged by several microvilli protruding into it. To prevent passage of bile into the hepatic sinusoids, **tight junctions** are found on each side of the canaliculus to seal off the space. ما بين bile يروح عالم

- Although each canaliculus has a diameter of about  $1\mu\text{m}$ , their total length is  $>1\text{km}$ .

Fig.21: Adjacent hepatocytes with bile canaliculi between them. Note the tight junctions (TJ).



not lined  
it is just a space  
BTW cells  
= جابة بال  
membrance  
عوض نسيم

- The bile canaliculi form a complex **anastomosing** network of channels through the hepatocyte plates that **end** near the **portal spaces**. So, **bile** flows from the **central vein** of the **hepatic lobule** towards its **periphery** opposite to the direction of **blood flow**.

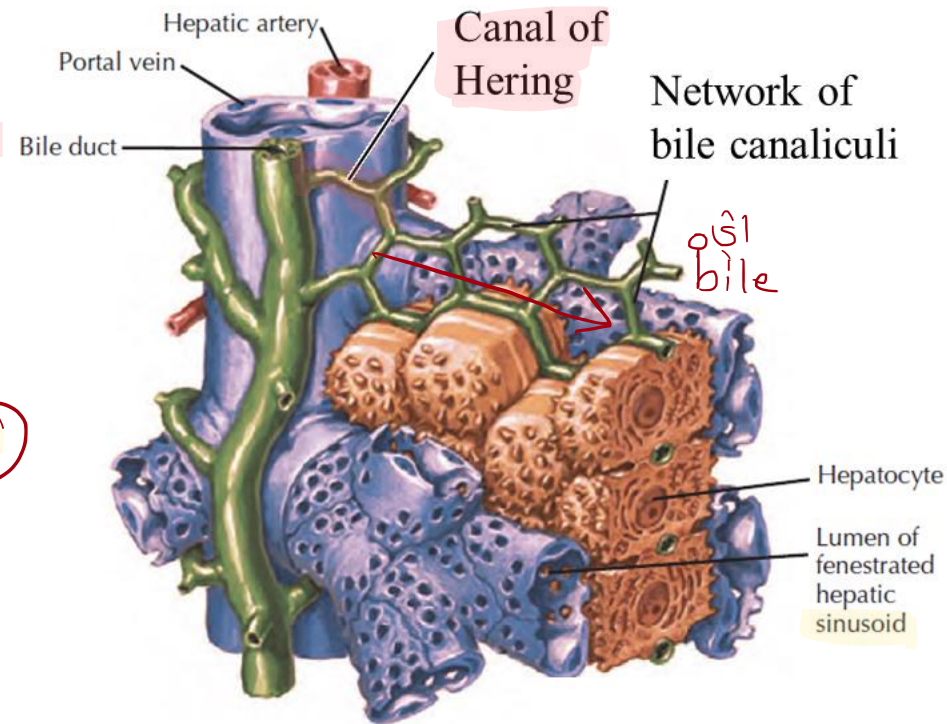
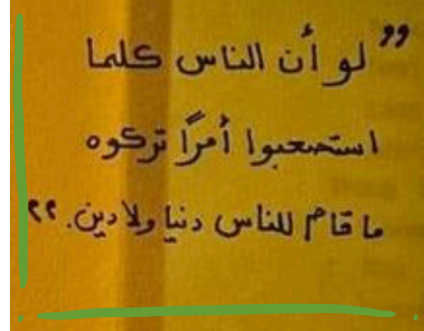


Fig.22: The network of bile canaliculi.

- Bile canaliculi open into the **bile canals of Hering** which are **lined** by **cuboidal epithelial cells** called **cholangiocytes**.
- These short bile canals quickly reach the portal spaces and **open** into **bile ductules** **lined** by **cuboidal** or **columnar** cholangiocytes.

not lined  
 كنه ال  
 canal  
 بك يقنعوا  
 منيا صه  
 ال lined

**Note:**



*What type of tissue are hepatocytes?*

**Epithelial Tissue**

keep going!

□ Epithelial features of hepatocytes:

- Closely packed cells ✓
- Cellular junctions between cells ✓
- Arranged in layers (the plates are usually one-cell thick) ✓
- Basal lamina (although it's sparse in liver tissue) ✓
- Connective tissue under hepatocytes (the perisinusoidal space) ✓
- Line cavities – Bile canaliculi open into duodenum ✓  
*↳ not lined (like a lumen lined by hepatocytes) & open into lumen*

## Where are the regions of hepatocytes?

- **Lateral region**: adjacent to other hepatocytes and where cellular junctions are located.
- **Basal region**: close to the perisinusoidal space and hepatic sinusoids where passage of substances occur.  
*صكان ال Thin Basal lamina*
- **Apical region**: close to the lumen. Correspond to the bile canaliculi (as they open into duodenum).

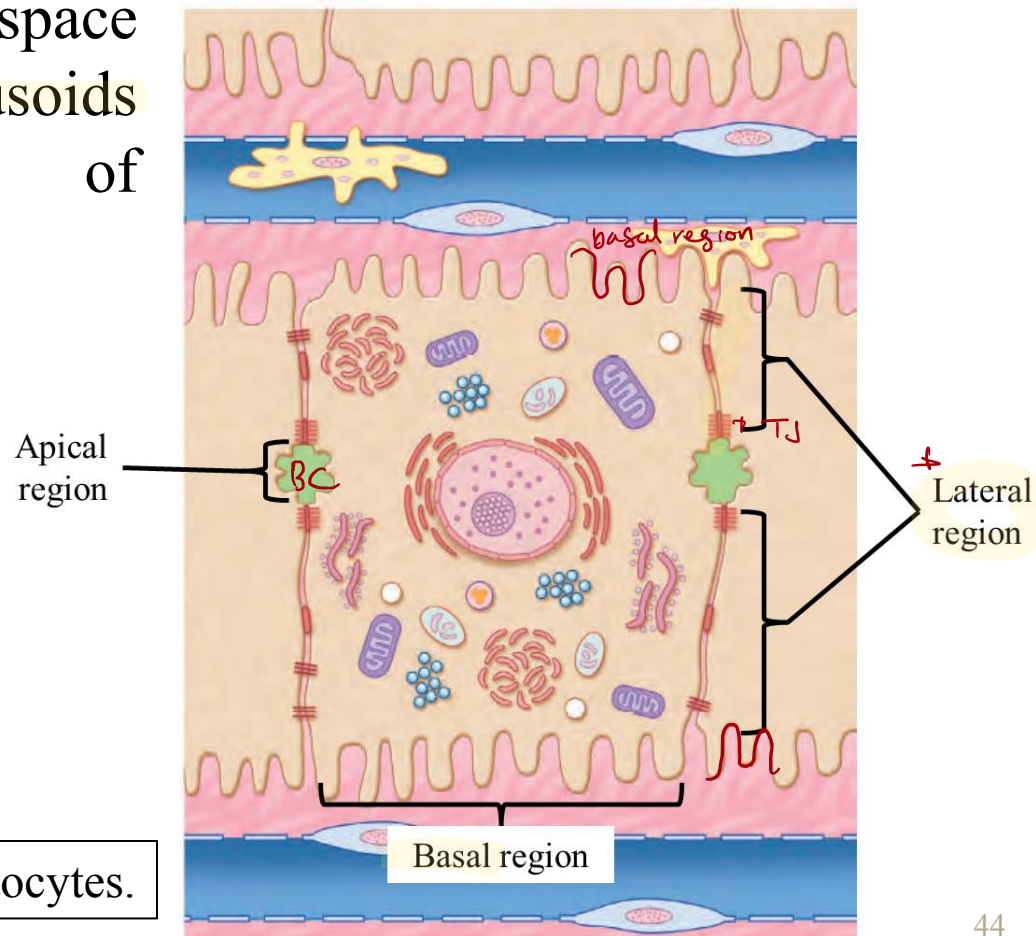


Fig.23: Regions of hepatocytes.

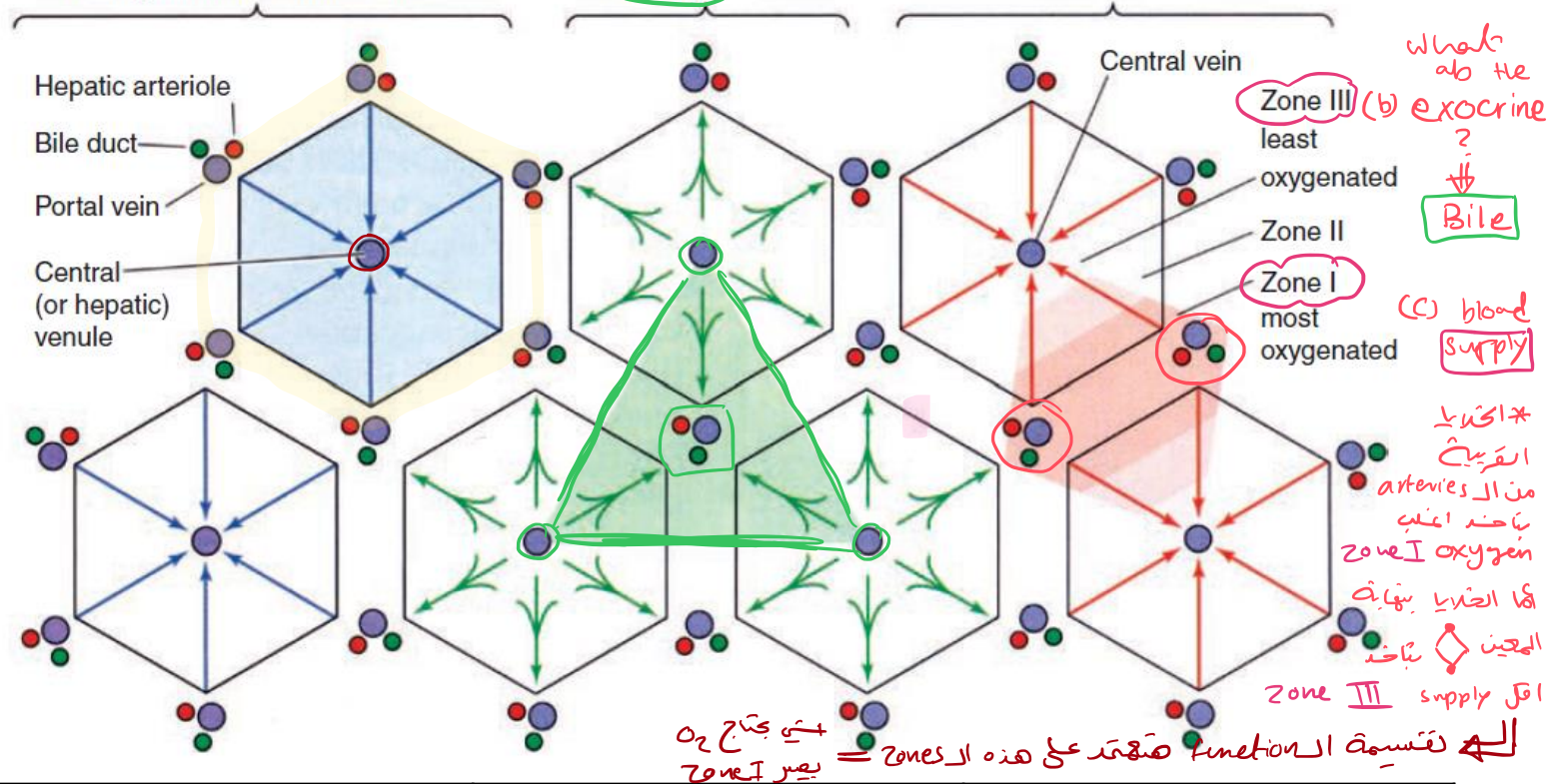
# Various liver lobules

hexagonal area from which all blood drains into same central vein → **VENOUS** drainage & **endo** drainage

(a) Classic Hepatic Lobule  
Drains blood from the portal vein and the hepatic artery to the hepatic or the central vein

(b) Portal Lobule  
Drains bile from hepatocytes to the bile duct

(c) Hepatic Acinus  
Supplies oxygenated blood to hepatocytes



<p>Blood flows through this hexagonal area into the same central vein</p>	<p>Bile from this triangular area is collected into the same bile ductule</p>	<p>Blood from two adjacent vessels supply this diamond-shaped area</p>
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## The extra-hepatic biliary tree

- The hepatic, cystic, and common bile ducts
- **Mucosa** formed of simple epithelium of columnar cholangiocytes with a thin lamina propria and no muscularis mucosae.
- **Submucosa** is also thin with mucous glands in cystic duct.
- **Muscularis** layer becomes thicker near the duodenum. Within the major duodenal papilla, it forms the sphincter of the hepatopancreatic ampulla. oddi



# The Gallbladder

## 1. Mucosa

- Characterized by the presence of several folds that are most prominent when the gallbladder is empty.
- The gallbladder is lined by simple columnar epithelium.
- The cells of this epithelium have the features of 'water absorbing cells':
  - Few short microvilli on the surface.
  - Apical tight junction between cells.
  - Mitochondria
  - Large intercellular spaces between adjacent cells.
  - Basolateral folding.

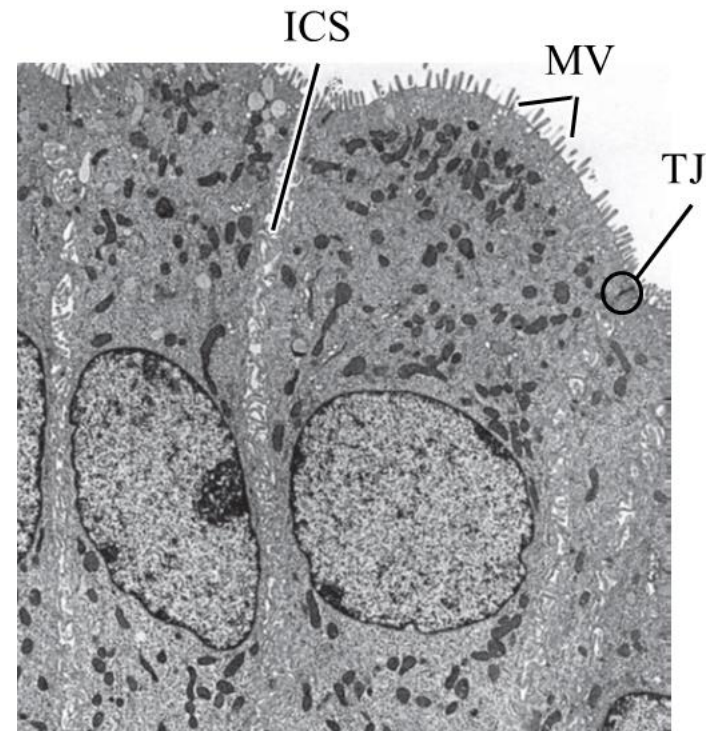


Fig.24: Columnar cells of the gallbladder. MV, microvilli; TJ, tight junctions; ICS, intercellular space.

- The lamina propria is rich in blood vessels with some mucous glands.
- There's no muscularis mucosae.

## 2. Muscularis

With smooth muscle fibers passing in different directions.

## 3. Adventitia/Serosa

Depending on whether the part of the gallbladder is covered by peritoneum or not.