HISTOLOGICAL ORGANIZATION OF THE LIVER, PANCREAS AND GALL BLADDER

Obimbo MM,

LECTURE OBJECTIVES

- At the end of this practical lecture, the learner should be able to:
  - Define the concept of different liver lobules and recognize them in histological sections
  - Understand the structure of hepatic cords and liver sinusoids
  - Identify the cells of the liver tissue: hepatocytes, Kupffer cells, endothelial cells and Ito cells
  - Discuss the functions and ultrastructural features of hepatocytes
  - Discuss the production of bile
  - Describe the histological features of the gallbladder
  - Describe the histophysiology of the exocrine pancreas

Liver histology

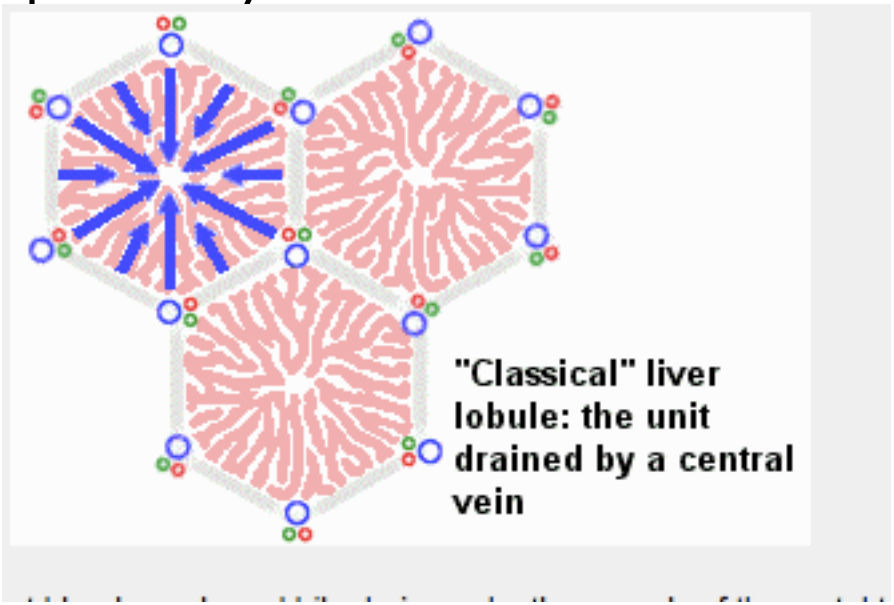
- Liver surrounded by thin connective tissue - Glisson capsule
- Septa divide the liver into lobes and lobules
- The portal vein, hepatic artery and bile duct enter the liver through the porta hepatis
- Portal triads are a key feature of the organization of the liver

Liver histology ctd..

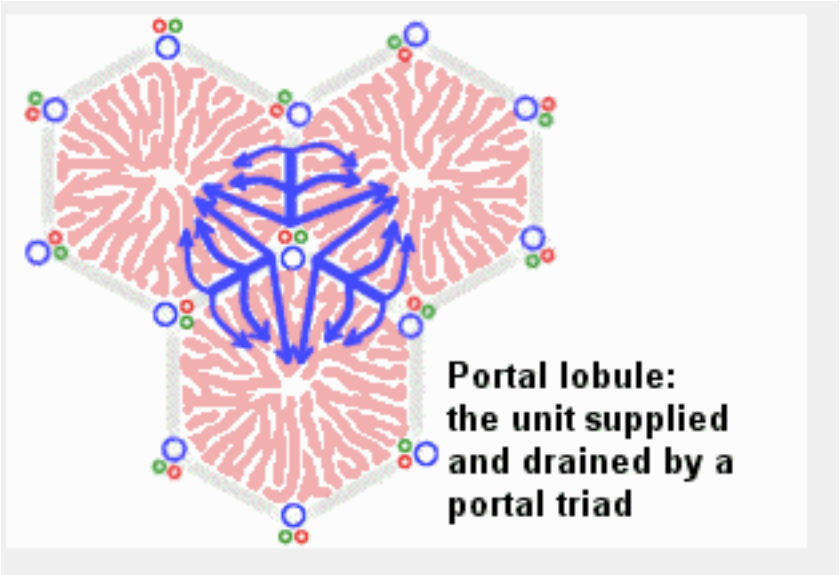
- Parenchyma, consisting of organized plates of hepatocytes, separated by sinusoidal capillaries.
- Blood vessels, nerves, lymphatic vessels, and bile ducts travel within the connective tissue stroma.
- sinusoidal capillaries (sinusoids), are found between the plates of hepatocytes.
- Perisinusoidal spaces (spaces of Disse), lie between the sinusoidal endothelium and the hepatocytes.

Liver lobule

- Described in 3 ways:
- Classic liver lobule:
  - a six-sided prism delimited by interlobular connective tissue. Portal triads in corners. In cross sections, the lobule is filled by cords of hepatic parenchymal cells, *hepatocytes*, which radiate from the *central vein* and are separated by *vascular sinusoids*.

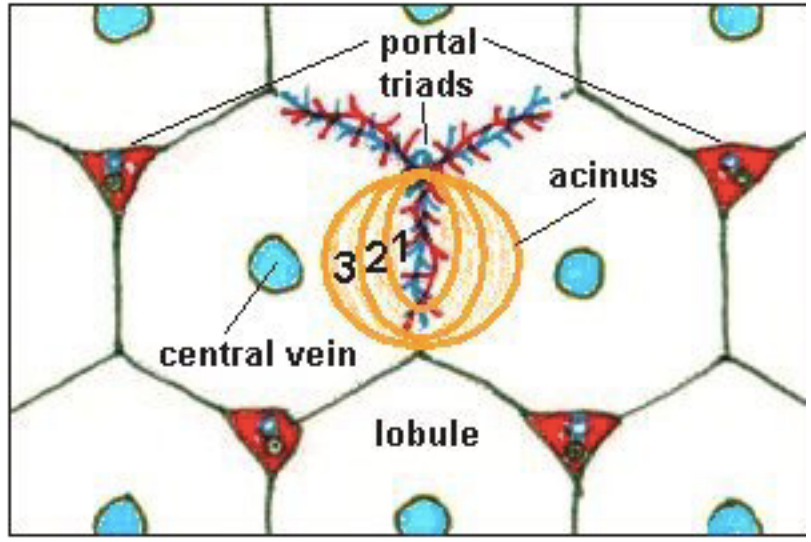


- Portal lobule
  - Based on the major exocrine function of the liver which is bile secretion.
  - Its outer margins are imaginary lines drawn between the three central veins that are closest to that portal triad



- Liver acinus
  - Represents functional unit of the liver
  - The hepatocytes in each liver acinus are arranged in three concentric elliptical zones in respect to arterial supply
    - Zone 1 is closest to the short axis and the blood supply from penetrating branches of the portal vein and hepatic artery.
    - Zone 3 is farthest from the short axis and closest to the terminal hepatic vein (central vein).

    Zone 2 lies between zones 1 and 3
- The zonation is important in the description and interpretation
  - of patterns of degeneration, regeneration, and specific toxic relative to the degree or quality of vascular perfusion of the hepatic cells.



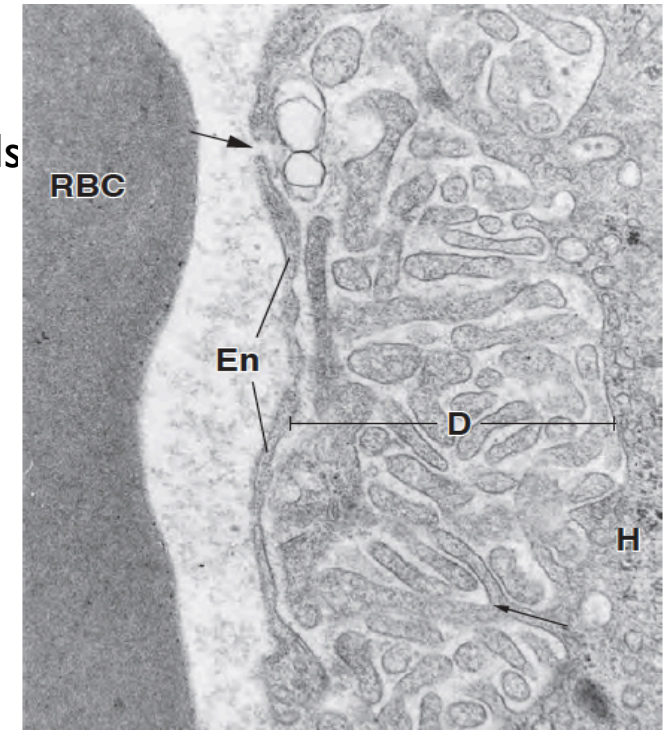
Hepatic cell types

- Hepatocytes
  - Predominant cell type in the liver.
  - An estimated 80% of the liver mass is made of these cells.
  - The hepatocytes are round in shape containing a nucleus and an abundance of cellular organelles associated with metabolic and secretory functions.
  - Ultrastructure? Relate to functions?

- Hepatic stellate cells (of Ito)
  - Lie within the space of Disse.
  - Stellate cells store vitamin A in characteristic lipid droplets.
  - In addition, many stellate cells in the normal liver express alpha-smooth muscle actin.
  - In chronic liver injury, the stellate cell differentiates into a myofibroblast-like cell

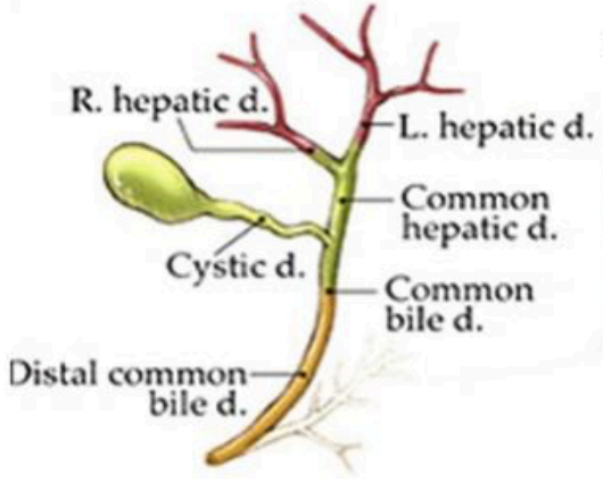
- Kupffer cells
  - critical component of the mononuclear phagocytic system and are central to both the hepatic and systemic response to pathogens.

- Capillary endothelial cells
  - The discontinuous sinusoidal endothelium has a discontinuous basal lamina that is absent over large areas.
  - The discontinuity of the endothelium is evident in two ways:
    - Large fenestrae, without diaphragms, are present within the endothelial cells
    - Large gaps are present between neighboring endothelial cells.



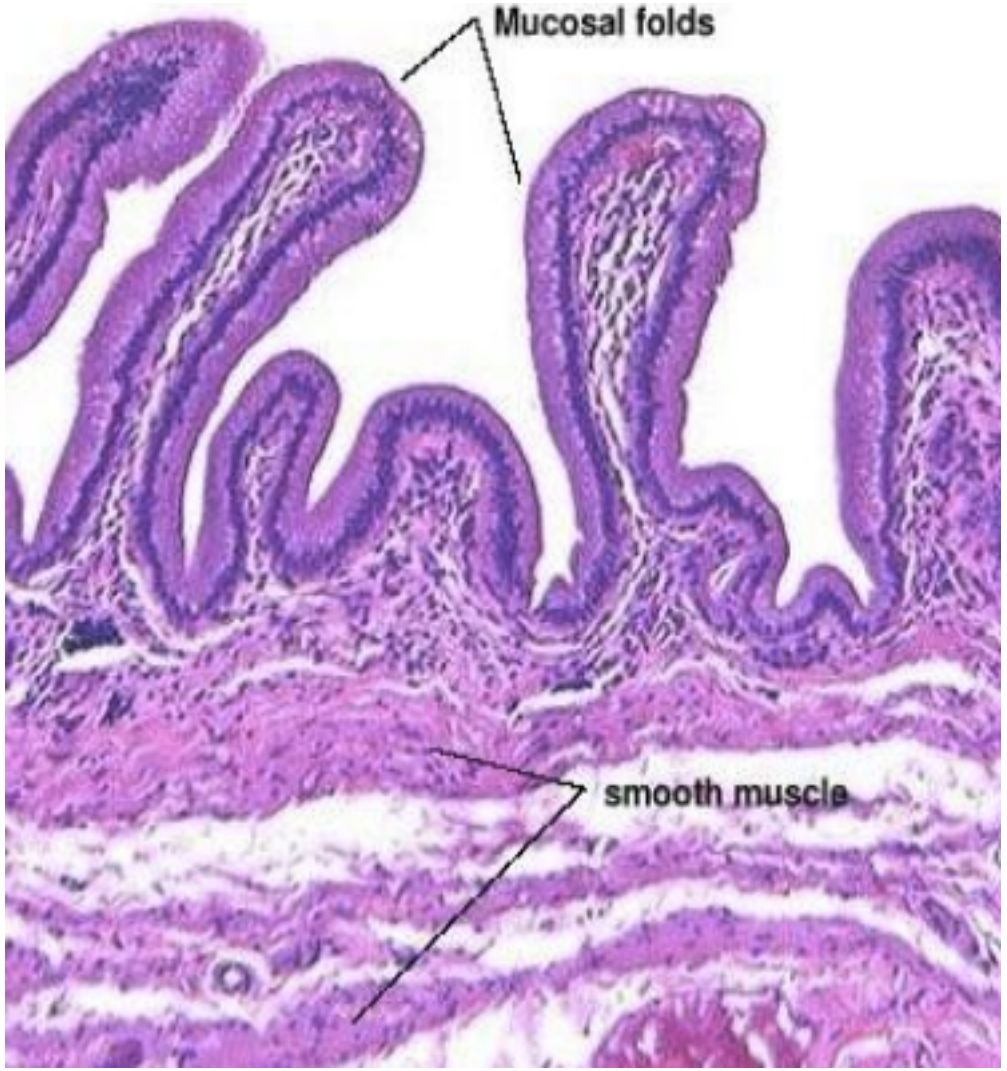
Billiary tree

- The system is lined by cholangiocytes
- Bile contains both organic components like lecithin, cholesterol and bilirubin and inorganic components (bile salts).
- The bile produced by the hepatocyte flows through the bile canaliculi, bile ductules, and bile ducts.
- The common hepatic duct, after receiving the cystic duct from the gallbladder, continues to the duodenum as the common bile duct (ductus choledochus).



Gall bladder

- Can store 30 to 50 ml of bile.
- The wall of the gallbladder consists of four layers:
  - Mucosa
  - Muscularis Externa
  - Perimuscular connective tissue
  - Serosa / Adventitia



Pancreas

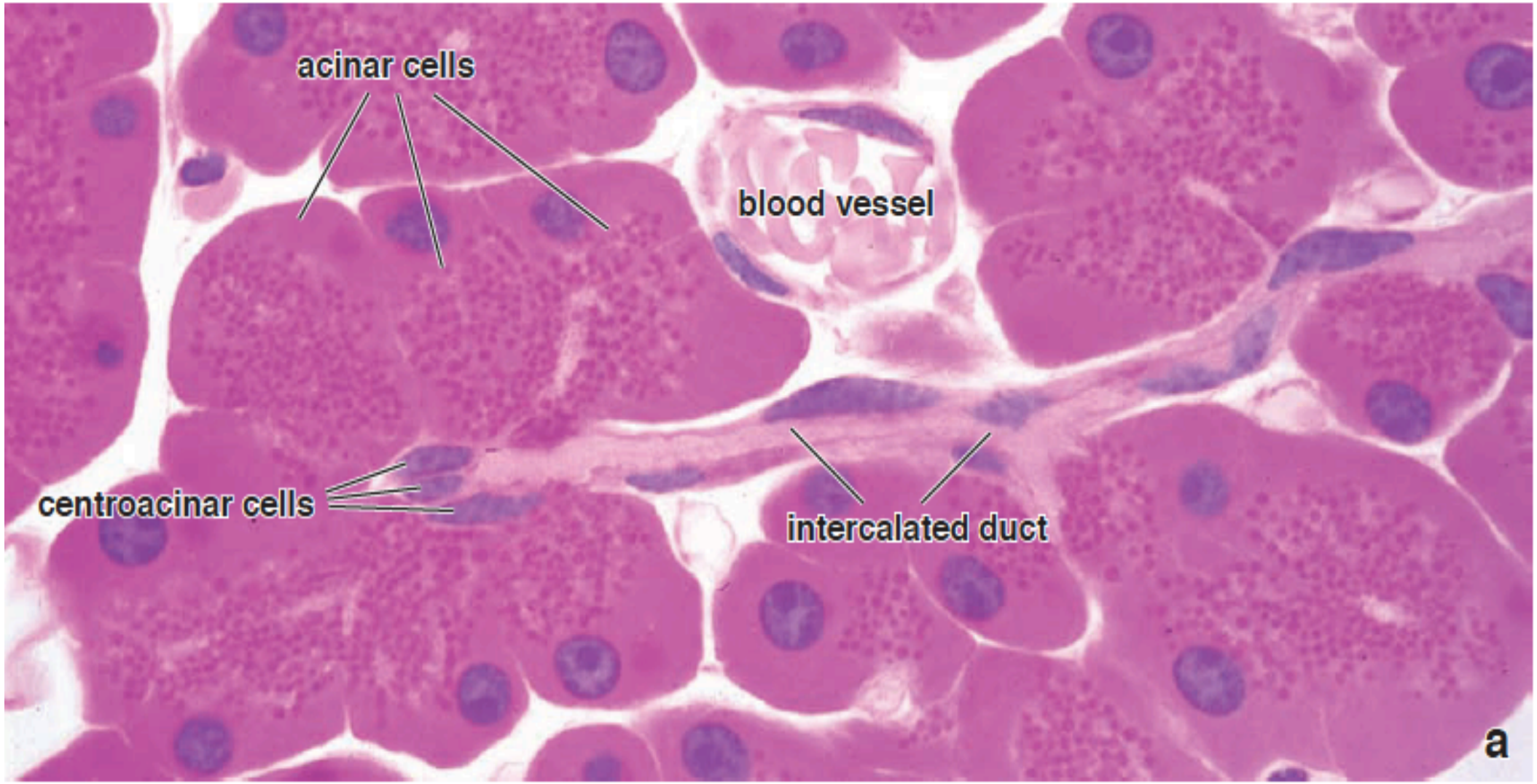
- Is both an exocrine and endocrine gland.
- The exocrine part produces about 1.5 l of pancreatic juice every day.
- The endocrine part (Islet of Langerhans), accounts for ~1% of the pancreas

Exocrine pancreas

- *tubuloacinar glands*.
- A single layer of pyramidal shaped cells forms the secretory acini.
- The apical cytoplasm is filled with secretory vesicles containing the precursors of digestive enzymes.
- The first portion of the duct system extends into the centre of the acini, lined by small *centroacinar cells*.
- These cells form the first part of *intercalated ducts*.
- Intercalated ducts empty into interlobular ducts then into the *main pancreatic duct* (of Wirsung)

Pancreatic enzymes

- Trypsin, chymotrypsin and carboxypeptidase hydrolyse proteins into smaller peptides or amino acids;
- ribonuclease and deoxyribonuclease split the corresponding nucleic acids;
- pancreatic amylase hydrolyses starch and glycogen to glucose and small saccharides;
- pancreatic lipase hydrolyses triglycerides into fatty acids and monoglycerides;
- cholesterol esterase breaks down cholesterol esters into cholesterol and a fatty acid.


acinar cells
blood vessel
centroacinar cells
intercalated duct
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