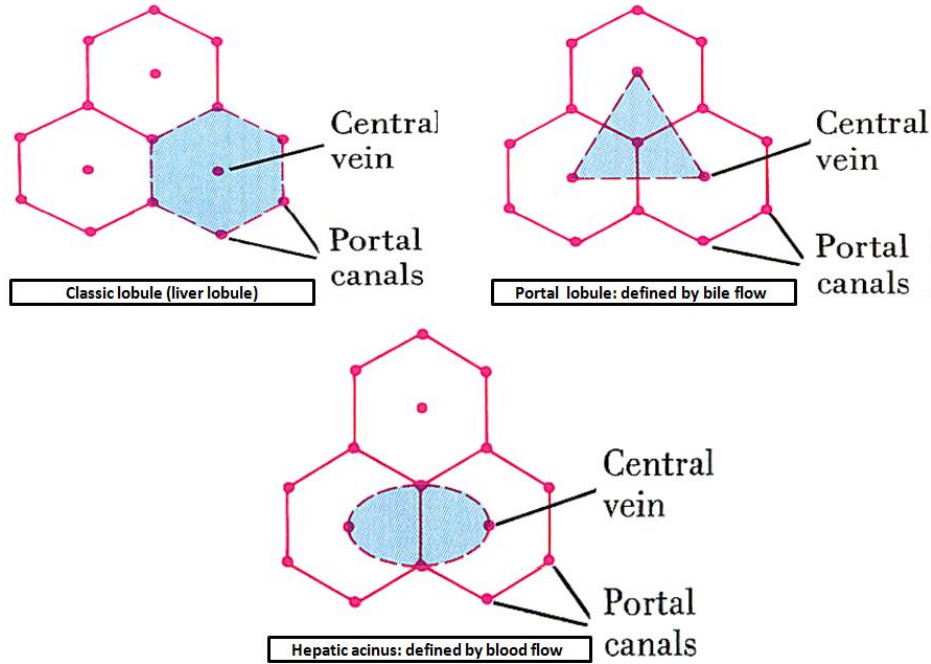




- What are some functions of the liver?

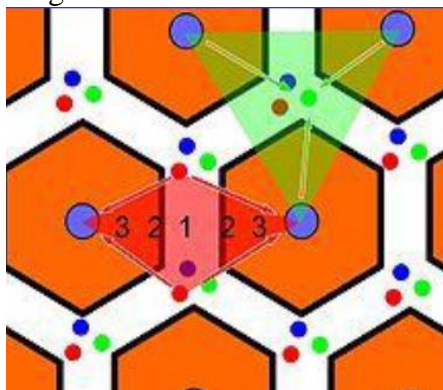
- Receiving blood from two sources (portal vein and hepatic artery) and serves as a blood reservoir (450 ml to 1 L).
- Cleaning blood via liver macrophages (Kupffer cells).
- Production of 50% of lymph.
- The liver regenerates at a high rate.

- Morphofunctional element:



- Liver structure (structure of the lobule): there are three zones

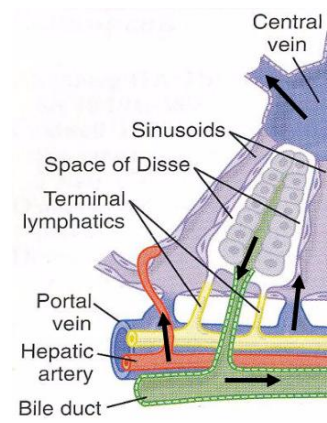
- **Periportal zone (1):** oxidative liver functions
 - ✓ Gluconeogenesis.
 - ✓ Ureagenesis.
 - ✓ β -oxidation of fatty acids.
 - ✓ Cholesterol synthesis.
 - ✓ Bile formation.
- **Transition zone (2).**
- **Centrilobular zone (3):**
 - ✓ Glycolysis.
 - ✓ Glycogenesis.
 - ✓ Lipogenesis.
 - ✓ Ketogenesis.
 - ✓ Glutamine formation.
 - ✓ CYP-450 based drug detoxification.





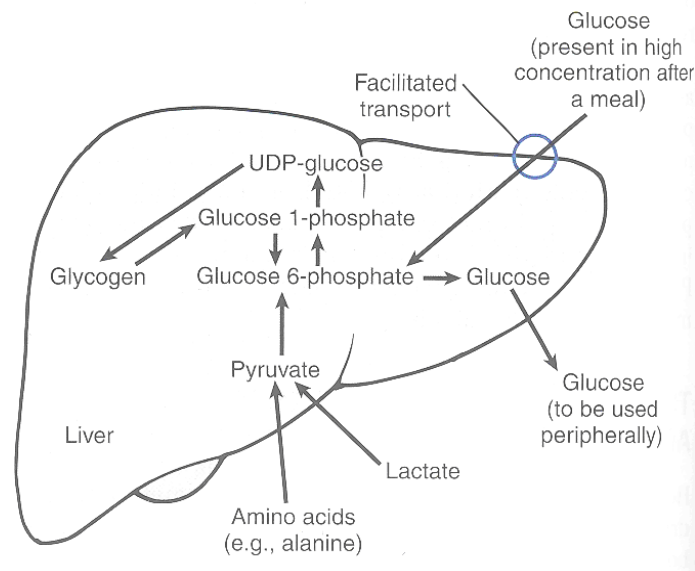
- Blood flow in liver lobule:

- The liver gets 65% of total oxygen supply from hepatic artery.
- Blood is flowing from portal vein and hepatic artery to sinusoids and then to the central vein which drains into the inferior vena cava.
- **Pressure gradients (as blood is flowing toward the central vein):**
 - ✓ 80-120 mmHg in hepatic artery.
 - ✓ 3-5 mmHg in sinusoids.
 - ✓ 1-3 mmHg in central vein.



- Liver functions:

- **Carbohydrate metabolism:** glucose buffer, glycogenesis, glycogenolysis and gluconeogenesis (from lactate, glycerol and amino acids).
 - ✓ After having a meal, glucose will be present in high level in blood → transported to the liver via active Na^+ -glucose co-transport → glucokinase will add a phosphate group to the 6th carbon position in glucose molecule to generate glucose-6-phosphate which can be converted to UDP-glucose and then used to synthesize glycogen.
 - ✓ Lactate is generated from glycogen breakdown in muscles and then transported to liver to be converted into pyruvate and then used in gluconeogenesis (which is stimulated by glucagon & NE and inhibited by insulin).

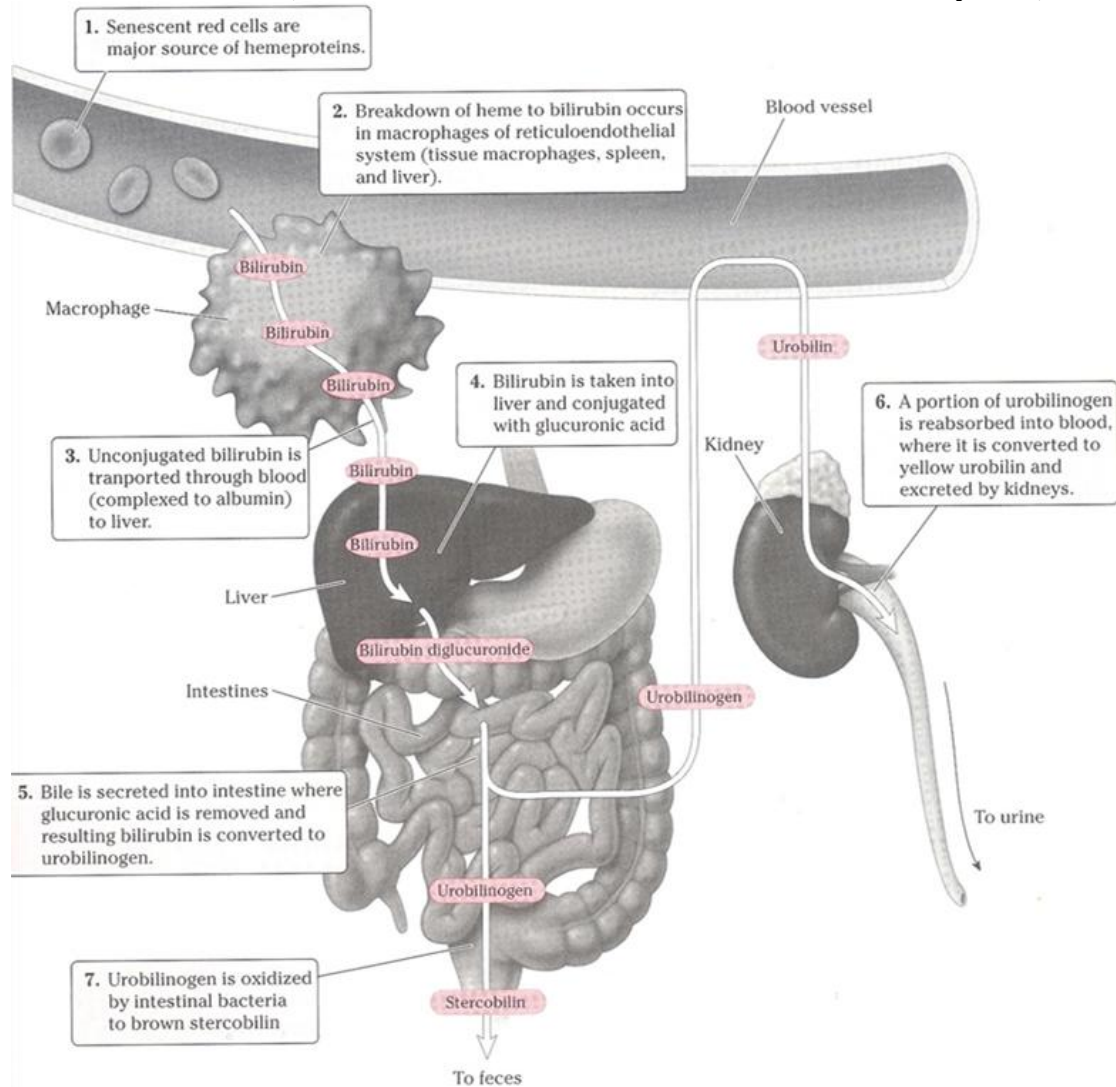


- **Fat metabolism:** β -oxidation of fatty acids; cholesterol, phospholipid and lipoprotein synthesis; synthesis of triglycerides
 - ✓ β -oxidation generates acetyl-CoA → if present in excess → acetyl CoA is used to generate ketone bodies:
 - ❖ *Acetoacetic acid.*
 - ❖ *β -hydroxybutyric acid.*
 - ❖ *Acetone.*
 - ✓ In the liver, fatty acids are used to synthesize triglycerides which will be packed into VLDL and then transported to adipose tissue to be stored there.
- **In the liver, amino acids will enter the urea cycle and will be used in the synthesis of plasma proteins.**
- **Bile secretion and storage:**
 - ✓ 600-1000 ml is produced per day.
 - ✓ Bile acids serve as emulsifiers and form micelles.
 - ✓ Bile is used for excess cholesterol excretion.



- ✓ Bile is composed of:
 - ❖ Water.
 - ❖ Bile salts.
 - ❖ Bilirubin.
 - ❖ Cholesterol.
 - ❖ Fatty acids.
 - ❖ Lecithin.

- **Bilirubin formation (this was discussed in more details in biochemistry note):**



- **Coagulation proteins:**
 - ✓ Fibrinogen; prothrombin; factors V, VII, IX, X, XI; proteins C and S; antithrombin.
- **Detoxification and degradation of:**
 - ✓ Drugs (CYP-450 family).
 - ✓ Hormones: thyroxine, steroids (estrogen, aldosterone and cortisol).
 - ✓ Ca^{2+} excretion.
 - ✓ Activation of vitamin D (with kidneys).
 - ✓ Synthesis of somatomedins.