

# METABOLIC FUNCTIONS OF LIVER

# FUNCTIONS OF LIVER

- 1) Secretion of bile
- 2) Storage of glycogen
- 3) Metabolism of fats
- 4) Deamination of amino acids
- 5) Production of the plasma proteins.
- 6) Storage & transport of vitamins & minerals.
- 7) Storage of iron .
- 8) Production of clotting factors .
- 9) Production of heat .
- 10) Detoxification.
- 11) Acts as filter

# Carbohydrate Metabolism

- **Glycogenesis:**excess glucose convert into glycogen in liver stored around 100g and in skeletal muscles 300g.It is stimulated by insulin release.
- **Glycogenolysis:**Depolarization of glycogen and export of glucose back into blood e.g, during exercise(skeletal muscle stores)and in fasting (liver stores)
- **Gluconeogenesis:** amino acids and glycerol from triglycerides converted into glucose. . It is stimulated by cortisol and glucagon, and inhibited by insulin.

# Metabolic Functions of the Liver

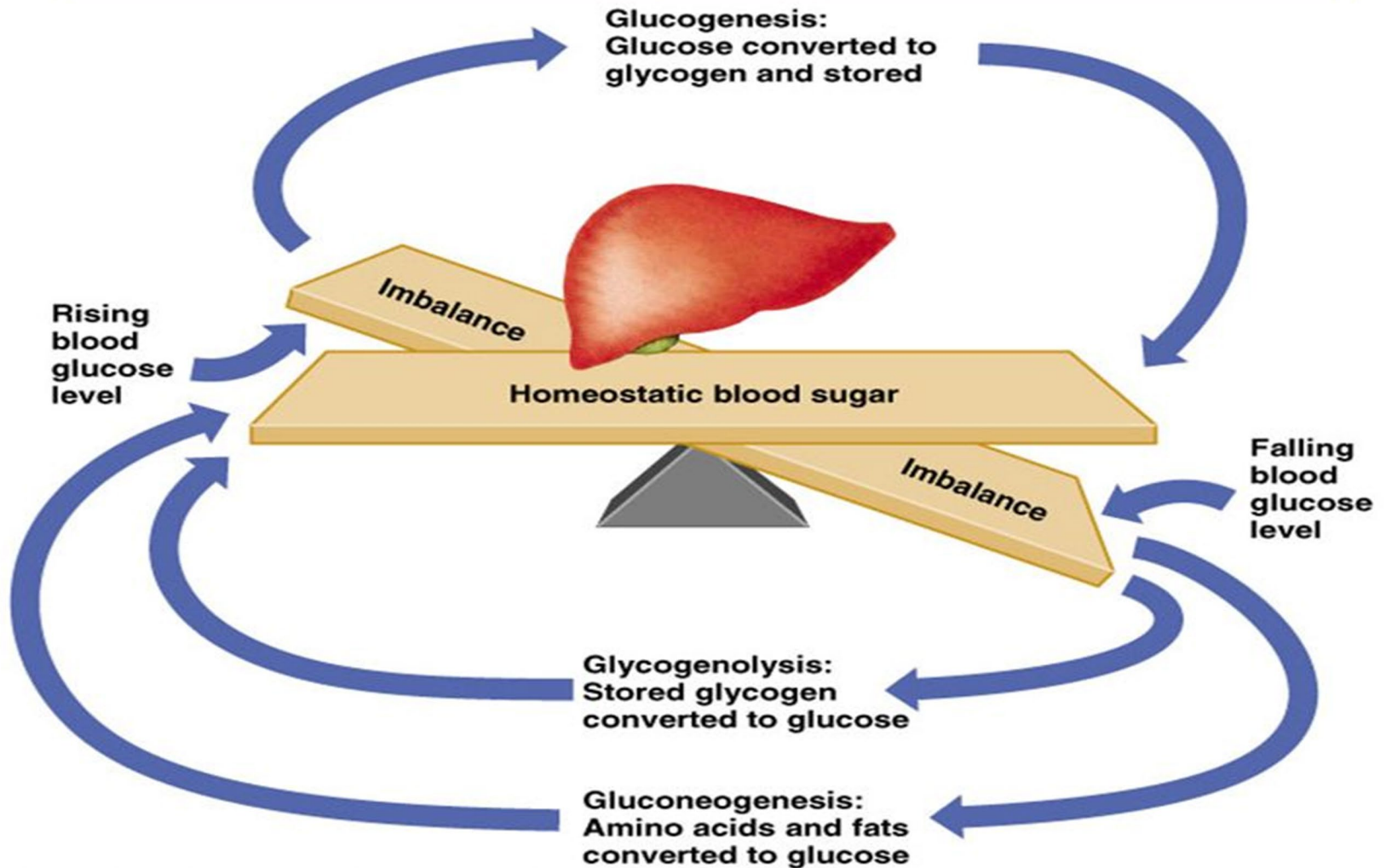


Fig: carbohydrate metabolism

# Fat Metabolism

- **Lipolysis** occurring:
- Fats split into glycerol and fatty acids.
- Fatty acids split by beta oxidation in hepatic cells that form acetyl-CoA.
- **Acetyl –CoA** can enter into krebs cycle and be oxidized to liberate energy.
- Condensation of 2 molecules of acetyl-CoA form acetoacetic acid.
- **Glucagon** and **adrenaline stimulate** the process of lipolysis whereas it is inhibited by insulin.

- **Lipogenesis:**
- Fatty acids are synthesised from Acetyl-CoA.
- The reaction requires ATP and NADPH.
- Firstly, Acetyl-CoA is converted to **Malonyl-CoA** by acetyl carboxylase.
- Fatty acid synthase then adds (malonyl-CoA) to a growing fatty acid. This fatty acid is then linked to a **carrier protein**.
- Lipogenesis is stimulated by the presence of insulin and inhibited by glucagon and adrenaline.

# Cholesterol

- 80% of cholesterol synthesized in liver is converted into bile salts.
- Which is secreted into bile.
- 20% is transported in the lipoprotein and carried by the blood to tissue cells of body.

# Phospholipids

- It is synthesized in the liver and transported in lipoproteins.
- Cholesterol and phospholipids used by cells to form membranes, intracellular structures, and multiple chemical substances.



# Impact of a meal rich in saturated fatty acids

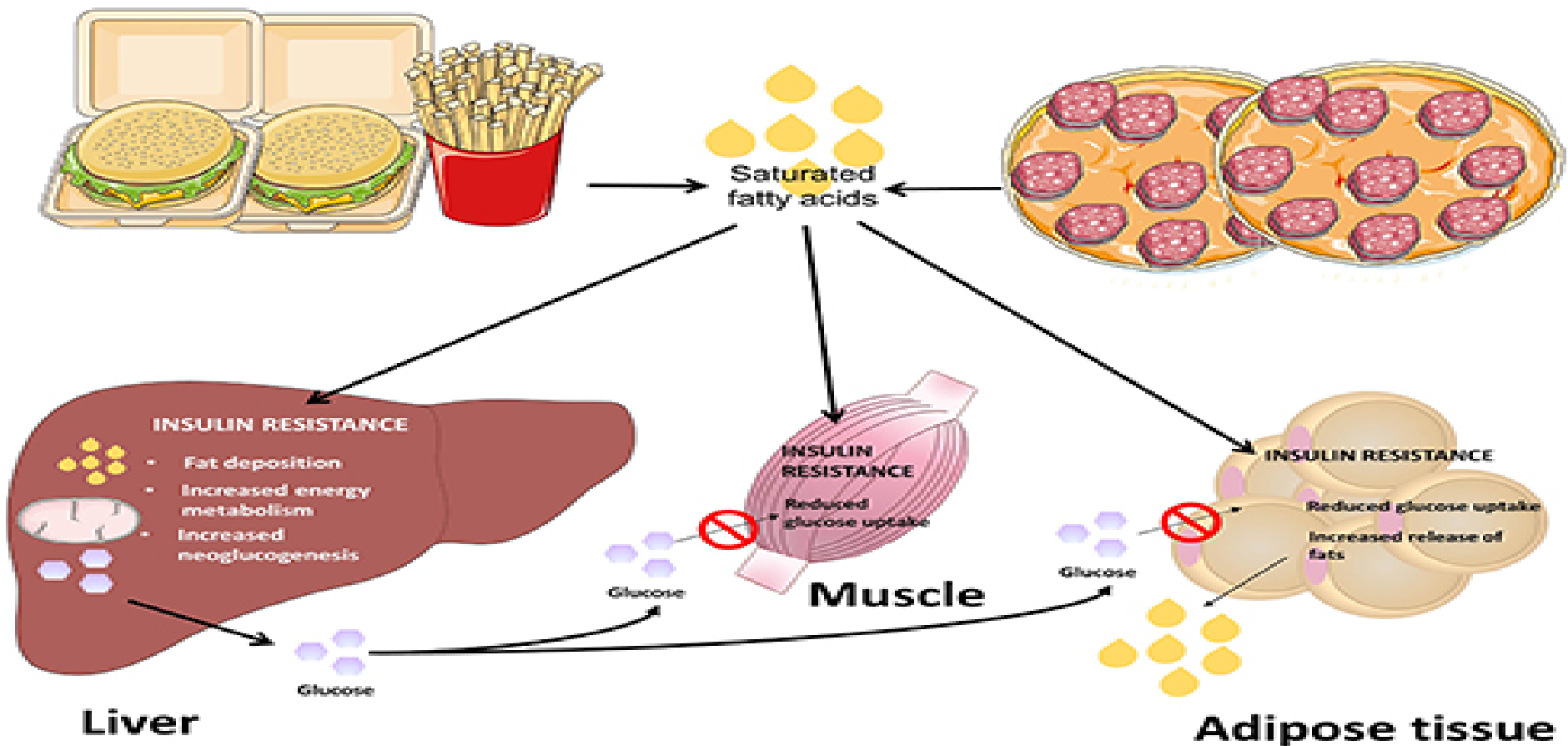


Fig: Fat metabolism

<http://www.vivo.colostate.edu/hbooks/pathphys/digestion/liver/metabolic.html>

- Synthesis of fats from carbohydrates and proteins occurs in the liver.
- After fat is synthesized in the liver. It is transported in the lipoproteins to the adipose tissue to be stored.

# Protein Metabolism

- **Deamination** requires (amino group) from amino acids so can use left as energy source.
- Converts resulting toxic **NH<sub>3</sub>** into **urea** for excretion by the kidney.
- It synthesis so called non essential amino acids and plasma proteins such as
  - **Albumin**
  - **CRP**
  - Blood **clotting** factors – Factors II, VII, IX and X are Vitamin K dependent
  - **Thrombopoietin**
  - **Angiotensinogen**

# Diseases

- It causes **hepatic coma** in which liver does not form urea and plasma protein concentration rise.
- with **chronic liver disease** Albumins may fall to very low level causes **edema and ascites**.

# Liver as Vitamins storage site

- **Vitamin A** can be stored to prevent vitamin A deficiency as long as **10 months**.
- **Vitamin D** can be stored to prevent deficiency for **3 to 4 months**.
- **Vitamin B12** can be stored to prevent deficiency for about **1 year**.

# Iron storing site

- Apoferritin combines with iron to form ferritin.
- In liver iron stores as ferritin and it act as blood iron buffer.
- When needed in body fluids iron detaches from apoferritin and transport into blood.

# Role in coagulation

- Fibrinogen, prothrombin, accelerator globulin, factor VII formed in liver that used in coagulation.
- Vitamin K is required for metabolic processes of these substances formation in liver.

# Detoxification

- In Liver **toxic metabolic products** produced elsewhere in the body and converting them to chemical forms that can be excreted.
- **Drugs** excreted into bile such as sulfonamides, penicillin, ampicillin, and erythromycin.
- **Hormones** such as thyroxine and steroid chemically altered and excreted by liver.
- **Calcium** secreted by liver and then enter into gut and is lost in the feces.



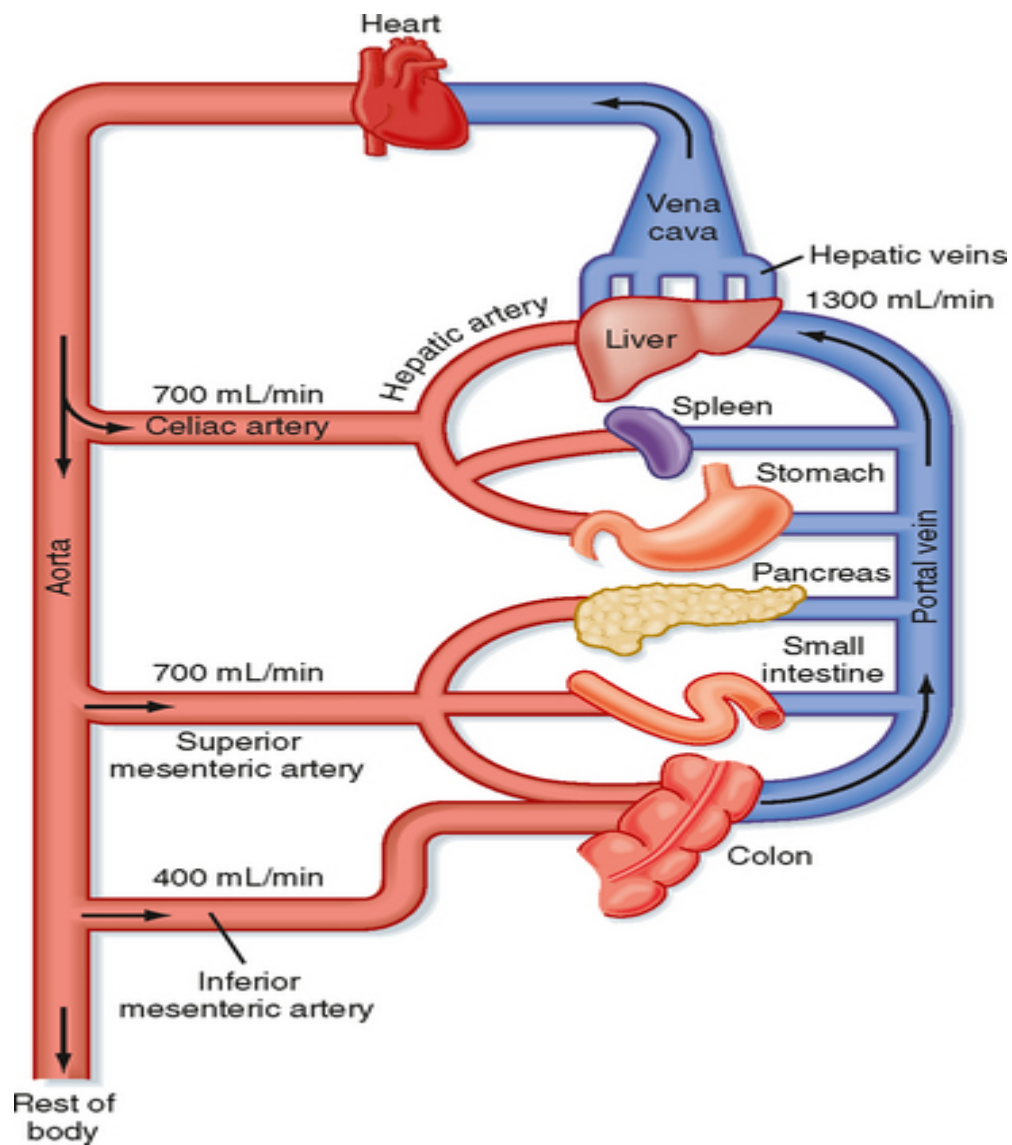


Fig: Typical blood flow through splanchnic circulation in a fasting adult human

[https://www.ncbi.nlm.nih.gov/core/lw/2.0/html/tileshop\\_](https://www.ncbi.nlm.nih.gov/core/lw/2.0/html/tileshop_)

# Bilirubin

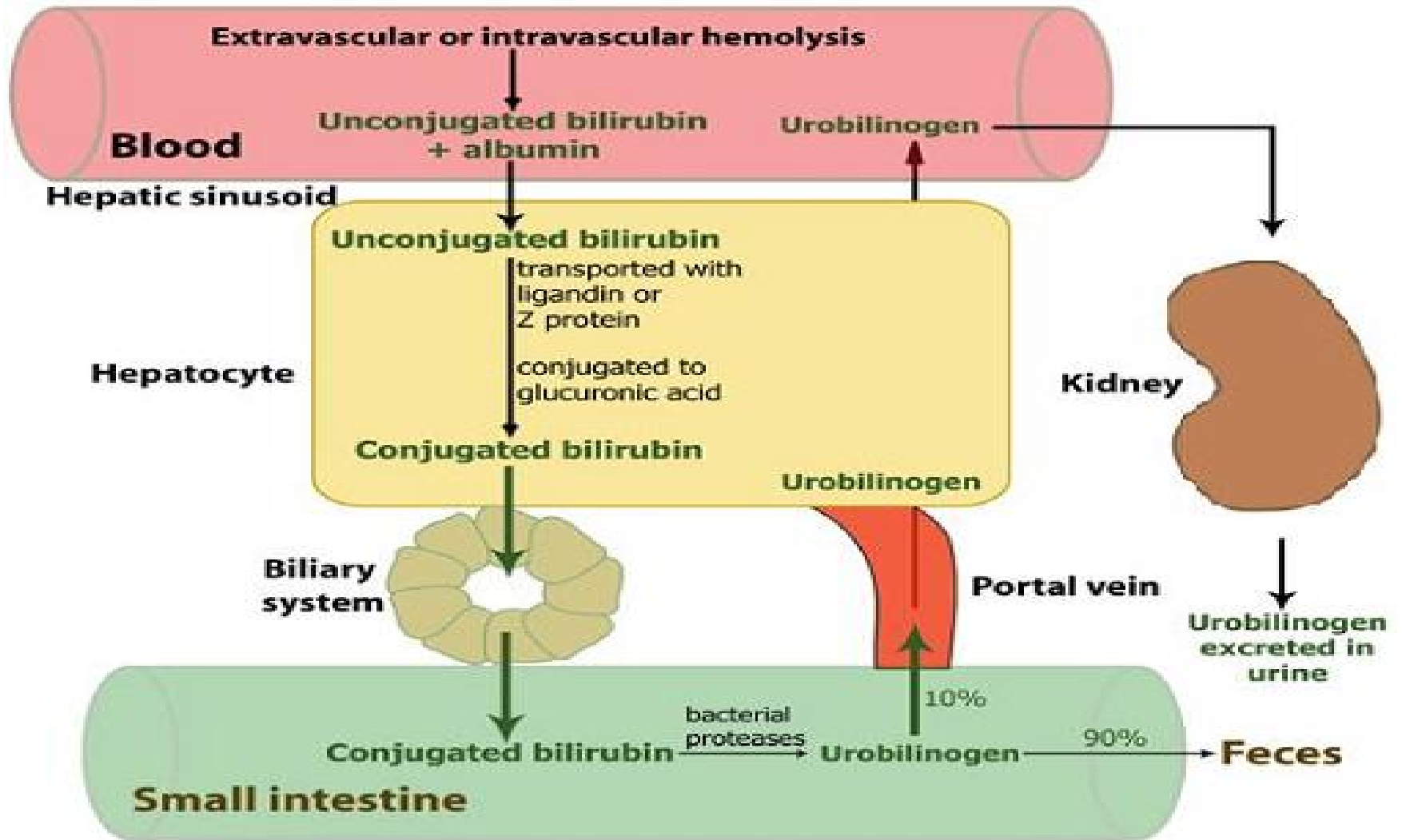


Fig: Bilirubin formation and excretion