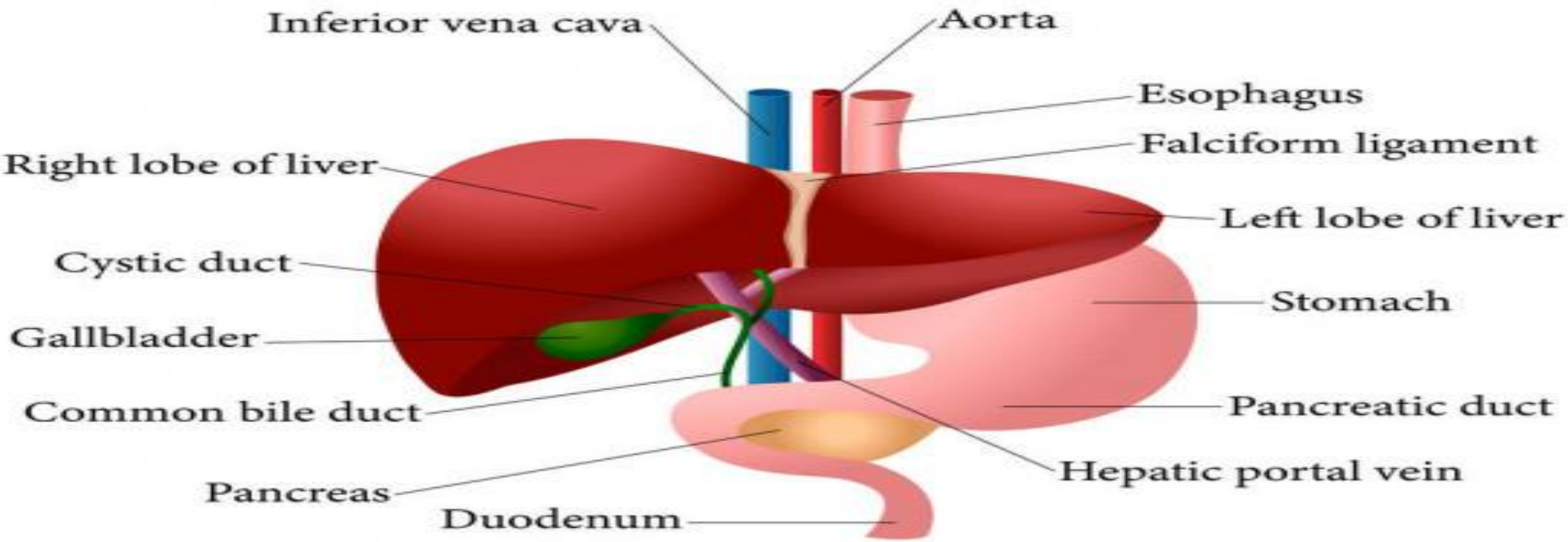
Medical Investigation


Liver Function Test
Triglyceride
Liver Function Test
Total Protein
Albumin
Globulin
Total Bilirubin
Direct Bilirubin
AST (SGOT)
ALT (SGPT)
Alkaline Phosphatase
Cardiac Enzyme
CPK

STRUCTURE OF THE LIVER



Liver Structure

- The liver is a reddish brown organ with four lobes of unequal size and shape. A human liver normally weighs 1.44 – 1.66 kg.
- It is both the largest internal organ and the largest gland in the human.
- It is located in the right upper quadrant of the abdominal cavity, resting just below the diaphragm.
- The liver lies to the right of the stomach and overlies the gallbladder.
- It is connected to two large blood vessels, one called the hepatic artery and one called the portal vein

Top 5 Functions of the Liver

Transportation

The liver produces bile, cholesterol, and other products to transport goods and waste around the body

Synthesis

The liver produces essential factors for blood clotting, nutrients for the body, and other necessary chemicals

Detox

The liver detoxifies and processes chemical waste, including alcohol and many types of medications

Energy Storage

The liver stores excess energy in the form of glycogen, a type of starch.

Waste Management

The liver recycles and disposes of waste from proteins and blood cells.

First Test
serum Albumin
(Alb)

Overview

- Human serum albumin is the most abundant protein in human blood plasma. It is produced in the liver. Albumin occupy about half of the blood serum protein.

Functions of albumin

- Albumin creates 75-80% of plasma colloid osmotic pressure, which maintains vascular volume by preventing movement of fluid from the intravascular to the extravascular space.

- Transports of substances through blood as thyroid hormones, fatty acids, unconjugated bilirubin , calcium ions and drugs.

Interpretation

- Hypoalbuminemia
- hyperalbuminemia

Causes of hypoalbuminemia

1- Liver disease

Albumin is produced exclusively in the liver. Chronic liver disease (chronic hepatitis and cirrhosis of the liver is most common cause of hypoalbuminemia

2- Kidney disease

Low albumin levels can reflect diseases in which the kidneys cannot prevent albumin from leaking from the blood into the urine and being lost.

3 –Impaired synthesis (malnutrition, malabsorption, hepatic dysfunction, cirrhosis)
Loss (ascites, protein losing-nephropathy,

Reasons for the high level of albumin (Unusual)

- Cases of dehydration, so as to have the amount of liquids such as what is happening in the continuous vomiting and severe diarrhea.

- Inject a large amount of albumin intravenously.

Transaminases

- Tests of liver injury
- Hepatocytes contain high levels of enzymes that can leak into the plasma when there is liver injury

--Enzymes found in hepatocytes are:

Cytoplasmic = LDH, AST, ALT

Mitochondrial = AST_m

Canalicular = ALP, GGT

Second Test serum AST (GOT)

Aspartate transaminase (AST)

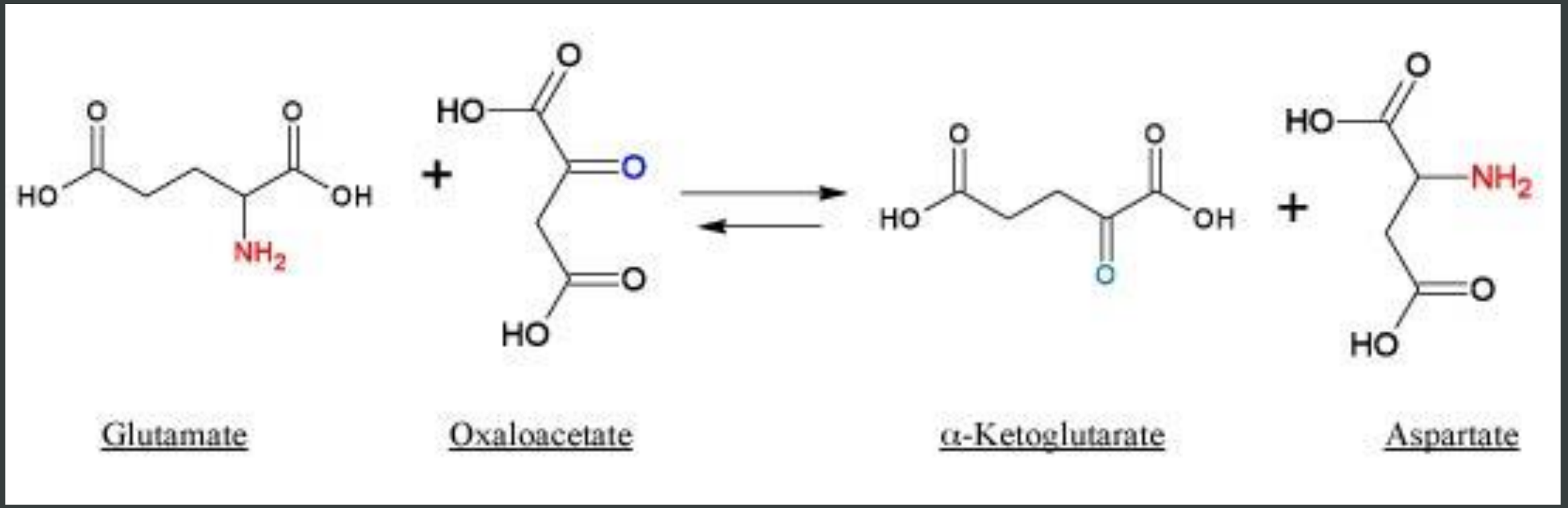
- Serum Glutamic Oxaloacetic Transaminase (SGOT)

Sites

- It is widely distributed in tissues but highest levels is found in liver, heart, skeletal muscles and RBCs.

Function

- As a member of the aminotransferase family, AST catalyses the reversible transfer of the amino group from glutamate to oxaloacetate while replacing the amino group of glutamate with a carbonyl group.


Glutamate
Oxaloacetate
α-Ketoglutarate
Aspartate

Interpretation for elevation of GOT

- Hemolytic anemia. (such as that caused by sickle cell anemia)
- myocardial infarction.
- Liver diseases.
- Skeletal muscle disease.

Third Test serum ALT (GPT)

Alanine transaminase (ALT)

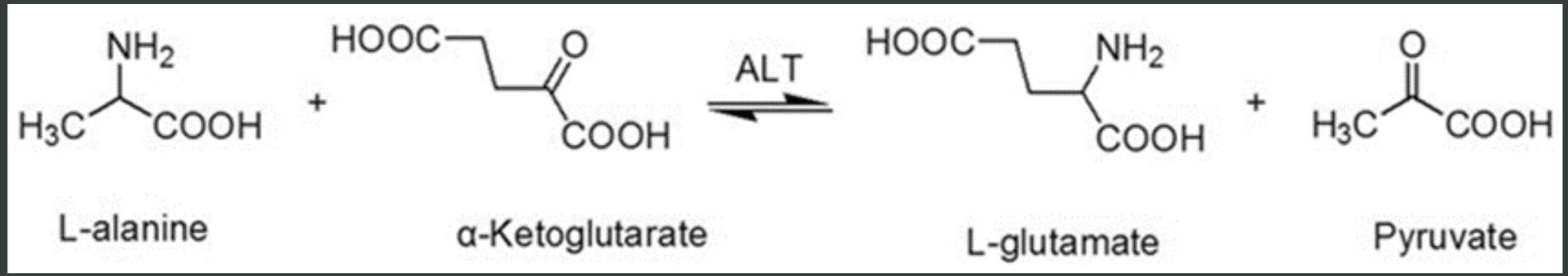
- Serum Glutamic Pyruvate Transaminase (SGPT) is an enzyme present in hepatocytes.

Sites

- Found mainly in cytoplasm of cells.
- It is widely distributed in tissues but highest levels is found in the liver

Function

- As a member of the aminotransferase family, ALT catalyses the reversible transfer of the amino group from Alanine to alpha keto glutarate while replacing the amino group of Alanine with a carbonyl group.


NH2
H3C
COOH
+
HOOC
O
COOH
ALT
HOOC
NH2
COOH
+
O
H3C
COOH
L-alanine
α-Ketoglutarate
L-glutamate
Pyruvate

Interpretation for elevation of GPT

- ALT levels can increase in response to strenuous physical exercise. Remain elevated for about two days.

- Hepatocellular disease

- Active cirrhosis (mild increase)

-Obstructive jaundice or billiary obstruction

- viral, infectious or toxic hepatitis

Interpretation for elevation of GPT & GOT

Acute hepatitis

- Liver carcinoma AST > ALT
- Toxic hepatitis ALT > AST
- Alcoholic hepatitis AST >> ALT

Why GPT is a more specific indicator of liver damage?

The difference is that ALT is found predominantly in the liver, with clinically negligible quantities found in the kidneys, heart, and skeletal muscle, while AST is found in the liver, heart, skeletal muscle, kidneys, brain, and red blood cells. As a result, ALT is a more specific indicator of liver damage than AST

Fourth Test
serum Alkaline phosphatase (ALK, ALP)

Alkaline phosphatase (ALP)

Sites

Alkaline phosphatase (ALP) is an enzyme in the cells lining the biliary ducts of the liver. ALP is also present in bone , intestine and placental tissue.

Function

- Alkaline phosphatase is a hydrolase enzyme responsible for removing phosphate groups from many types of molecules, including nucleotides, proteins, and alkaloids. The process of removing the phosphate group is called de phosphorylation.
- As the name suggests, alkaline phosphatases are most effective in an alkaline environment.

Physiological increase Interpretation

- **Age:** children usually have much higher ALP levels the adults because rapid bone growth is normal in children.
- **Pregnancy:** women in the third trimester of pregnancy have high ALP levels because the placenta produces ALP.
- **Bone healing:** normal healing of a bone fracture can raise ALP levels

Pathological increase Interpretation

- Liver disease.
- Bone disease.
- Due to drugs.

Pathological decrease Interpretation

- Cretinism
- Congenital hypophosphatasia

Alkaline Phosphatase

Phosphate monoester

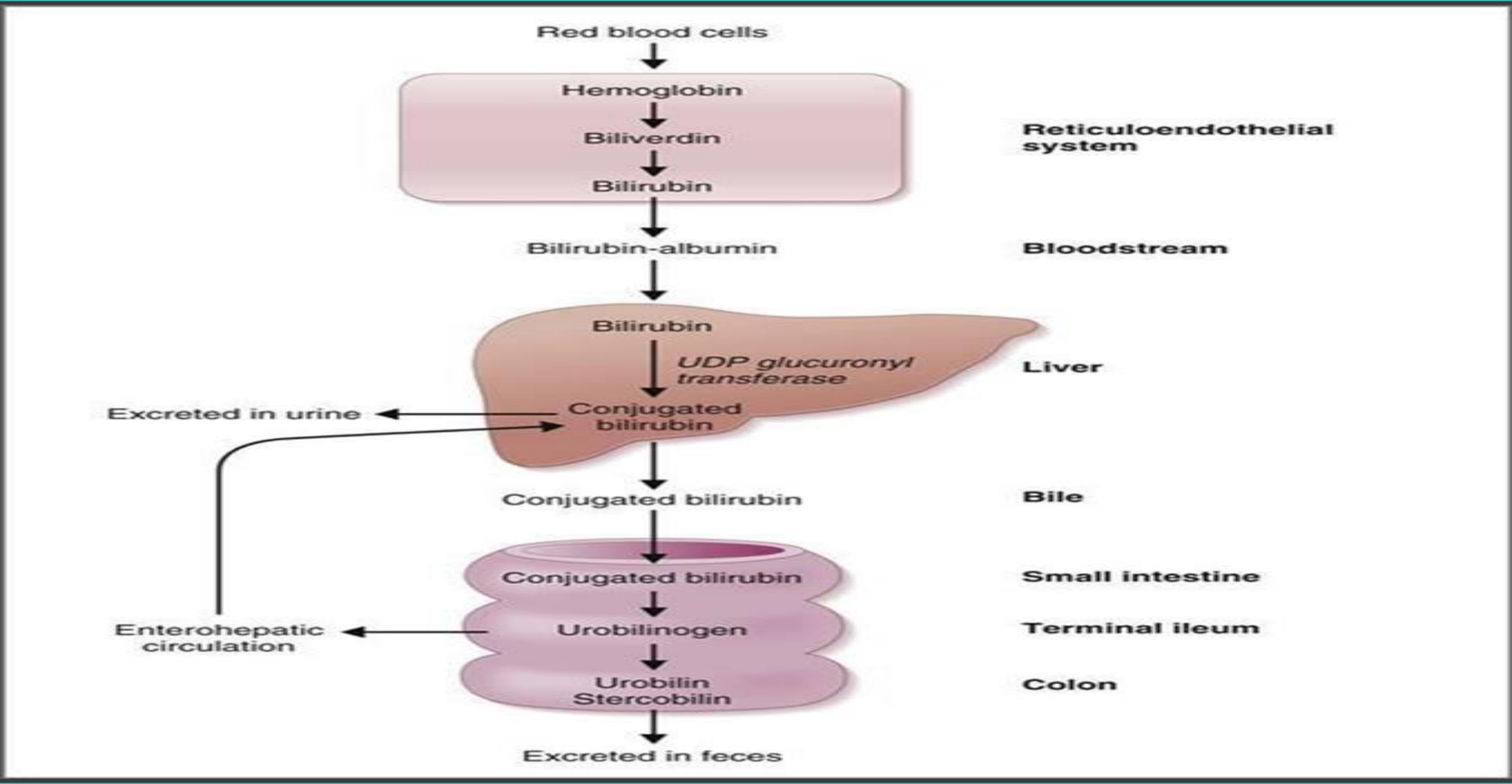
Alcohol

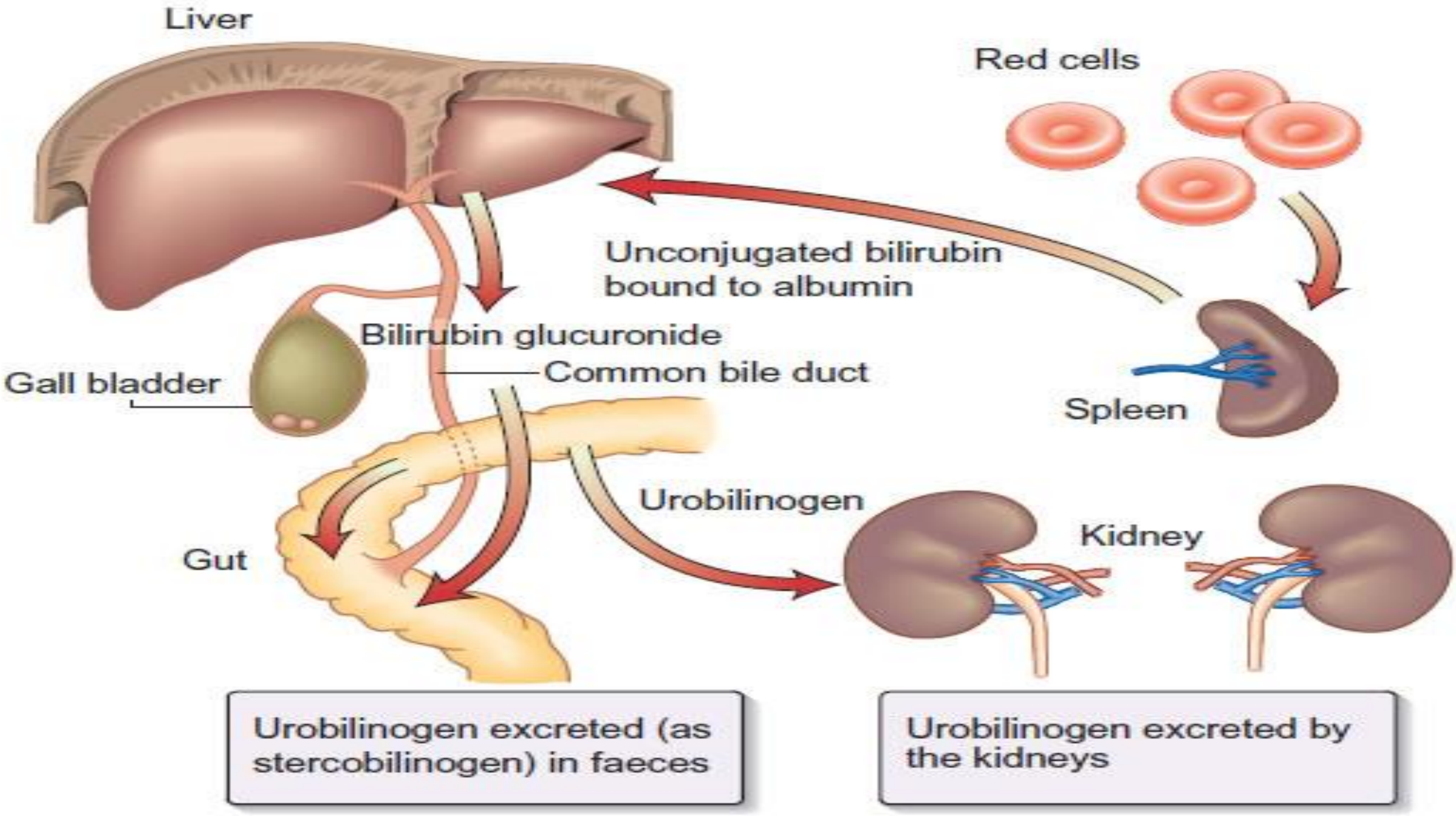
Phosphate

Gama-glutamyl Transferase

- Increased serum activities of GGT are found in both:
  - hepatocellular and
  - cholestatic disease.
- Higher activities are found in cholestasis, when levels greater than 50 times the upper limit of normal.
- Increased synthesis of GGT is induced by excessive ethanol intake.

Fifth Test
serum Bilirubin (Jaundice)
(Bili-T, Bili-D)


Red blood cells
Hemoglobin
Biliverdin
Bilirubin
Reticuloendothelial system
Bilirubin-albumin
Bloodstream
Bilirubin
UDP glucuronyl transferase
Liver
Excreted in urine
Conjugated bilirubin
Conjugated bilirubin
Bile
Conjugated bilirubin
Small intestine
Enterohepatic circulation
Urobilinogen
Terminal ileum
Urobilin
Stercobilin
Colon
Excreted in feces


Liver
Red cells
Unconjugated bilirubin
bound to albumin
Bilirubin glucuronide
Common bile duct
Gall bladder
Spleen
Urobilinogen
Gut
Kidney
Urobilinogen excreted (as stercobilinogen) in faeces
Urobilinogen excreted by the kidneys

Why Bilirubin is tested ?!

- It is measured in neonates to assess the severity of neonatal jaundice If doctor thinks that patient have signs or symptoms of liver disease, bile duct blockage

Types of bilirubin

- Direct or Conjugated: comes from liver or bone narrow.
- Indirect or Unconjugated : comes from hemoglobin break down

increase Interpretation

- Jaundice, also known as icterus is a yellowish discoloration of the skin, the conjunctival membranes over the sclera (whites of the eyes), and other mucous membranes caused by **hyperbilirubinemia**

Cause of jaundice

1- Pre-hepatic

- Pre-hepatic jaundice is caused by anything which causes an increased rate of hemolysis (breakdown of red blood cells) producing high levels of unconjugated bilirubin.

  A- Malaria In tropical countries lead to increased red cell lysis.

  B- Certain genetic diseases, such as sickle cell anaemia.

2- Hepatic

- results from injury or disease of the parenchymal cells of the liver whereby cell necrosis reduces the liver's ability to metabolise and excrete bilirubin leading to a buildup in the blood. Caused by :

  A- Acute hepatitis
  B- Alcoholic live
  C- Viral hepatitis

3- Post-hepatic

- also called obstructive jaundice, is caused by an interruption to the drainage of bile in the biliary system. The most common causes are:

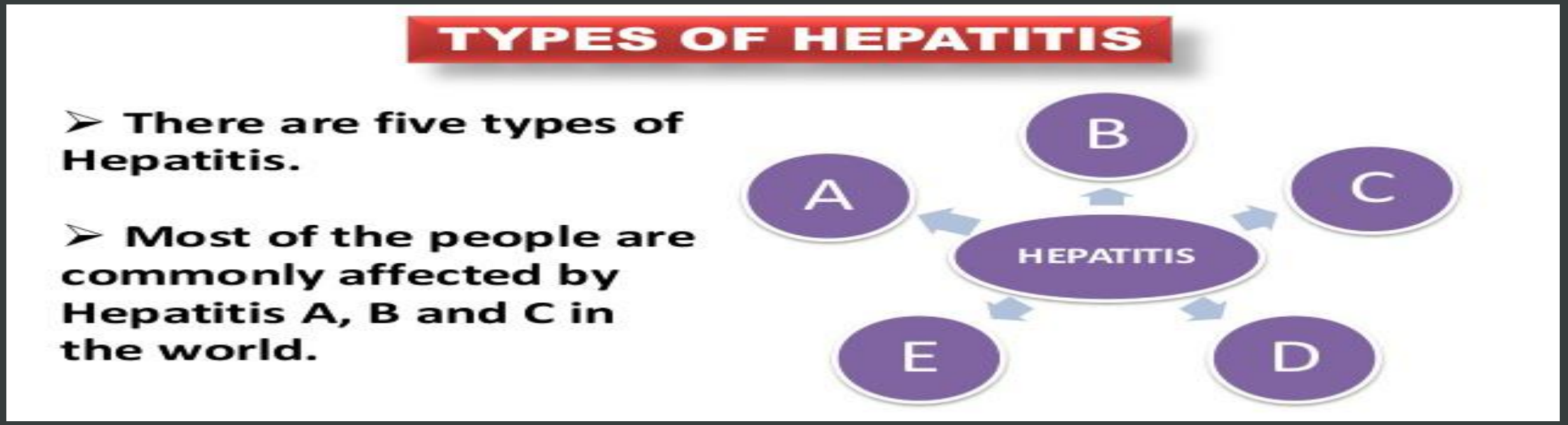
  A- Gallstones in the common bile duct
  B- Pancreatic cancer in the head of the pancreas jaundice.

Treatment of jaundice in newborns

Phototherapy bed

Hepatitis

- It is the inflammation of the liver
- Viral hepatitis means there is a specific virus that is causing your liver to inflame



PROGRESSION OF LIVER DAMAGE

HEALTHY LIVER

A healthy liver is able to perform its normal functions effectively, e.g. aiding digestion and breaking down harmful drugs and poisons.

FIBROTIC LIVER

Continuous inflammation of the liver caused by hepatitis C can lead to fibrosis – the formation of scar tissue within the liver.

CIRRHOTIC LIVE

Extensive scarring can block the flow of blood through the liver and cause liver function to deteriorate over time - this is called cirrhosis.

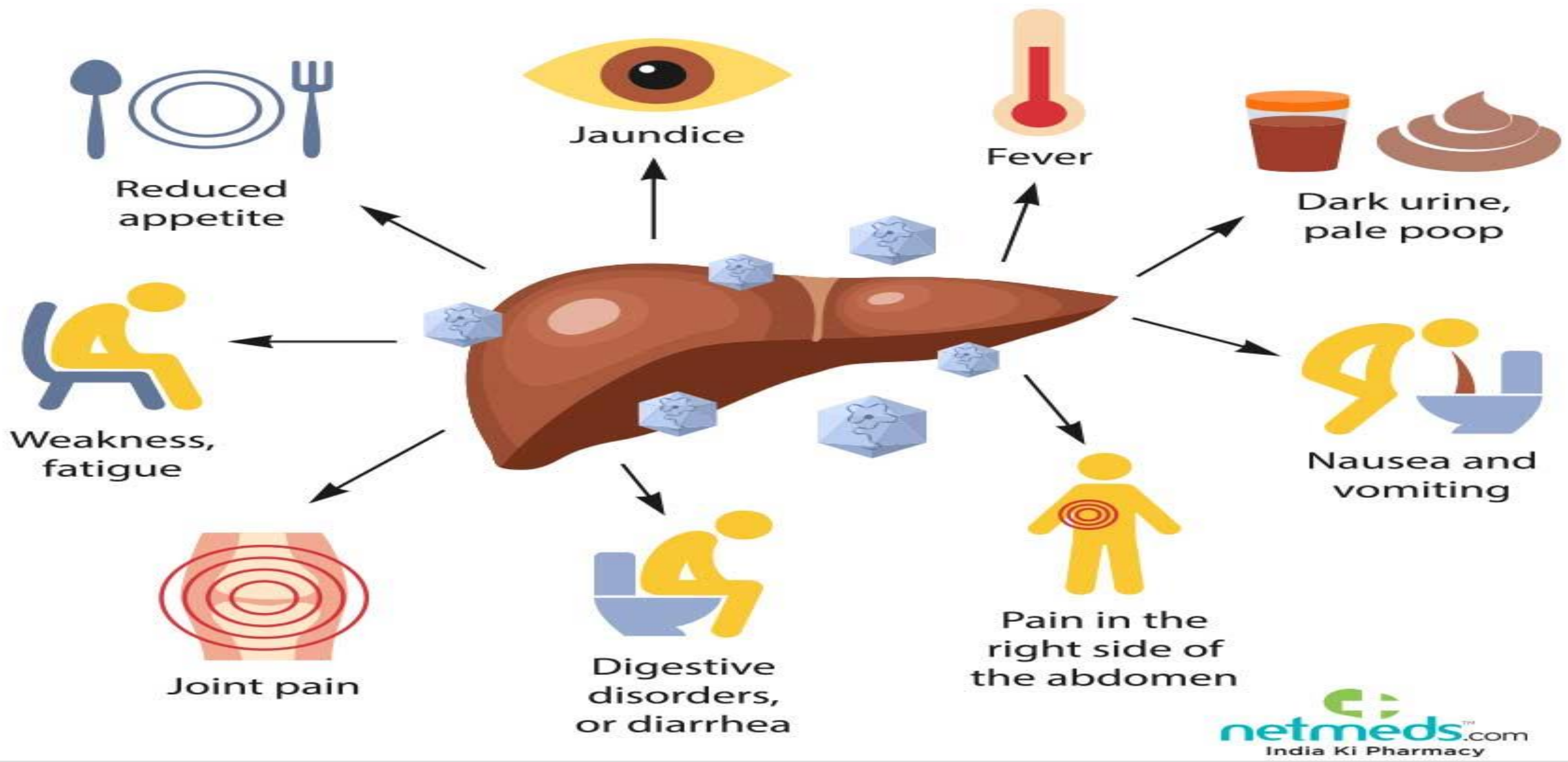
LIVER CANCER

Hepatitis C is a leading cause of liver cancer – the formation of a malignant tumour in the liver.

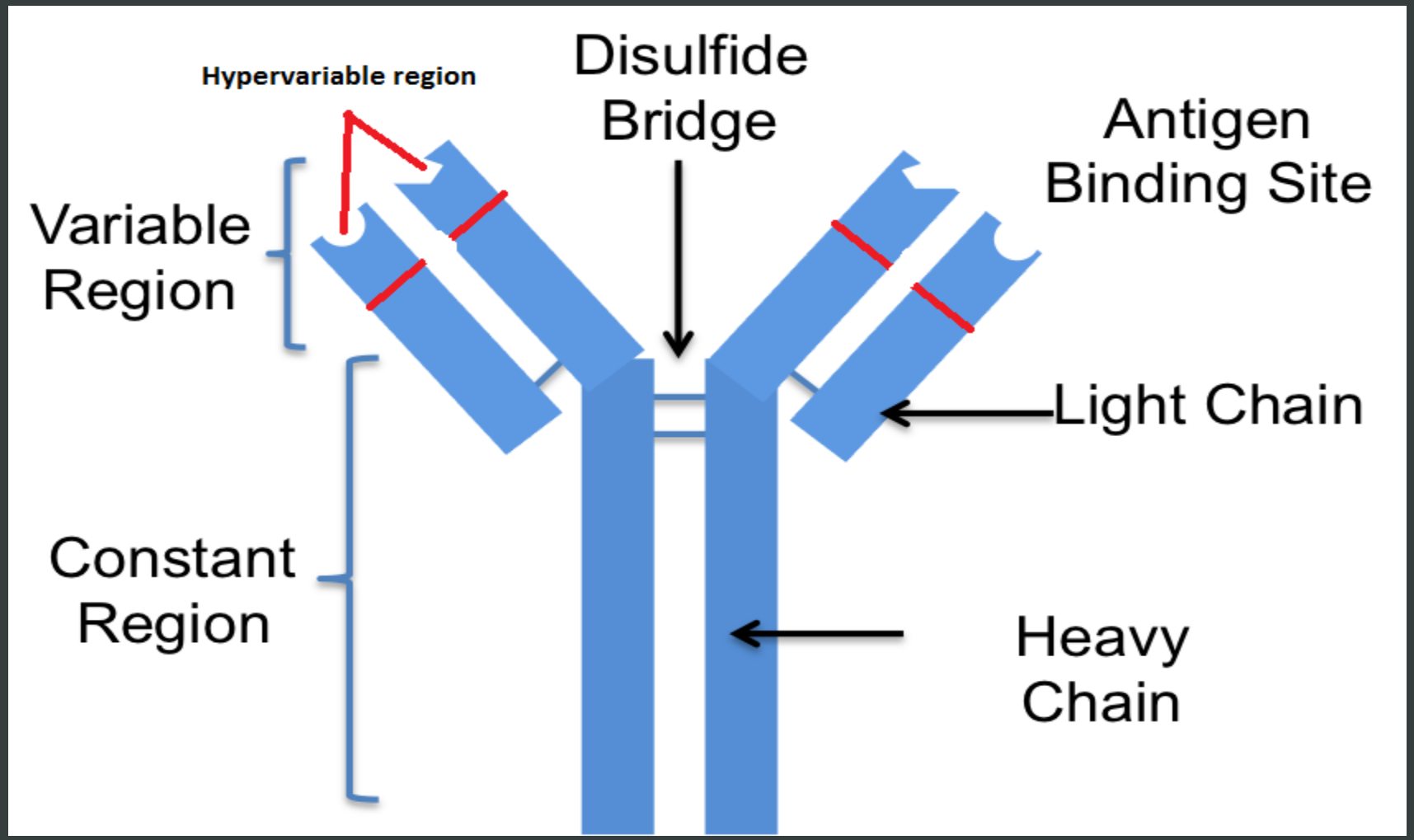
Viral Hepatitis

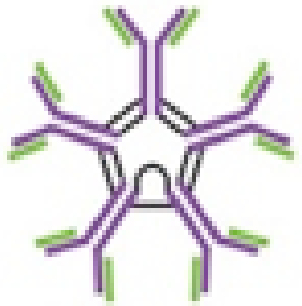
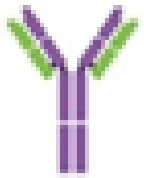
- A: fecal-oral transmission
- B: sexual fluids & blood to blood
- C: blood to blood
- D: travels with B
- E: fecal–oral transmission

SYMPTOMS OF HEPATITIS A



IMMUNOGLOBULIN



			 Secretory component		
	IgM	IgG	IgA	IgE	IgD
Heavy Chain	μ (mu)	γ (gamma)	α (alpha)	ε (epsilon)	δ (delta)
MW (Da)	900k	150k	385k	200k	180k
% of total antibody in serum	6%	80%	13%	0.002%	1%
Function	Primary response, fixes complement. Monomer serves as B-cell receptor	Main blood antibody, neutralizes toxins, opsonization	Secreted into mucus, tears, saliva	Antibody of allergy and anti-parasitic activity	B cell Receptor

Hepatitis Markers

- HAV
- HAV-IgM HAV-IgG

- HBV
- HBs Ab & HBV PCR

- HCV
- HCV IgM HCV

That’s all for today ☺

Thanks for attention