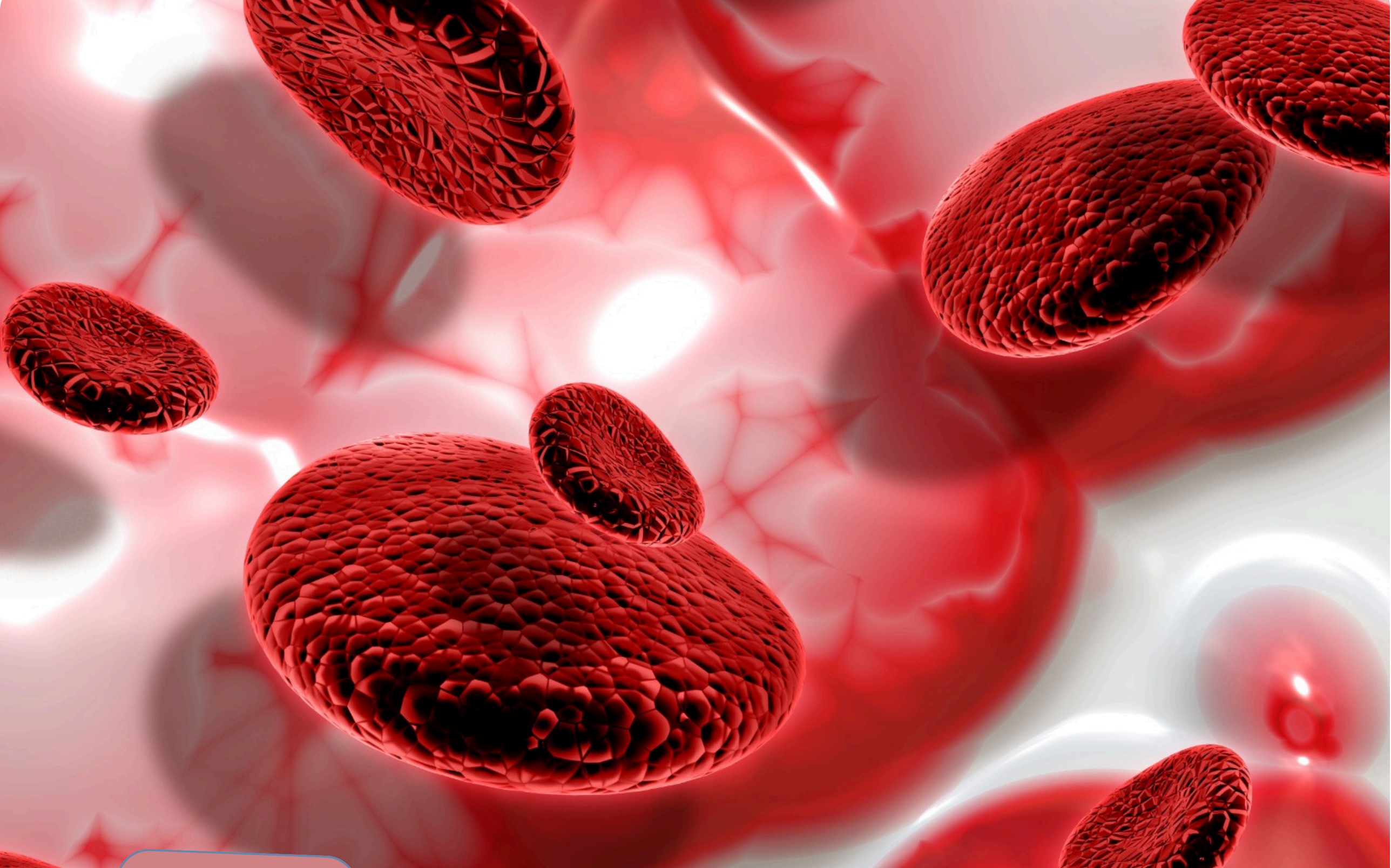

01

CHAPTER

BLOOD "I"

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TOPICS

1. Blood Functions
2. Blood Composition
3. PLASMA PROTEINS
4. Erythropoiesis
5. Erythropoietin hormone
6. Iron absorption
7. B12 absorption

Scientific content prepared by

Booknerd Team

Definition

Blood is a vital fluid circulate within Cardio Vascular System (CVS), and its volume is 5600ml.

Blood Functions

1- Transport function (glucose, O2, CO2).
2- Defensive function (WBCs, anti-bodies).
3- Hemostatic function (stop bleeding).
4- Homeostatic function (keeps the composition of the tissue fluid constant).

Blood Composition

45% cells

1- Red blood corpuscles (RBCs).
2- White blood cells (WBCs).
3- Platelets.

55% plasma

1- Water 90 %.
2- Inorganic substances (Na, Cl).
3- Organic substances (protein, lipid, glucose).
4- Gases (CO2, O2).

PLASMA PROTEINS

Concentration 7.2 gm /dl.

Composition

1- Albumin : its concentration 3.5 – 5 g/dl.
2- Globulins : its concentration 2.5 g/dl.
3- Fibrinogen : its concentration 0.4 g/dl.
4- Prothrombin: its concentration 0.01 g/dl.

Site of formation

All types of plasma protein are formed in liver except 50% of Globulins formed in plasma cells.

Functions A- Specific functions

1 Osmotic function

it is function of albumin where water withdrawn from tissue to plasma by osmotic pressure of albumin (28 mmHg).

② Defensive function

it is function of gamma globulin while alpha and beta globulin have transport function.

③ Viscosity of the blood

it is function of fibrinogen, the importance of this viscosity is to maintain arterial blood pressure.

④ Clotting of the blood

it is function of fibrinogen and Prothrombin.

Functions — B- Nonspecific functions

① act as a carrier

Plasma proteins act as a carrier for important elements of the blood (vitamins, hormones).

② Buffer function

plasma proteins adjust PH of blood at 7.4 Buffering function of plasma protein represent 15% of buffering power of blood.

③ Diet reserve

plasma proteins act as a source for rapid replacement of tissue protein.

④ Capillary permeability

plasma proteins control movement of substances across capillaries (in and out) through the pores.

RED BLOOD CORPUSCLES

RBCs are the highest concentration of cells in the body.

In male = 5.5 million/mm3.

In female = 4.8 million/mm3.

RBCs are non nucleated, biconcave shape to provide large surface area for transport and to enhance cell flexibility.

RBCs life span = 120 day.

Erythropoiesis

It is process of formation of RBCs Erythropoiesis takes place in:

Fetus → liver and spleen.

Children → bone marrow of all bones.

Adult → bone marrow of long bones.

Above 20 year → bone marrow of membranous bones.

Factors affecting erythropoiesis

① Healthy bone marrow

is essential for formation of normal RBCs as it is site of formation. Destruction of bone marrow leads to anemia known as aplastic anemia which is (normocytic normochromic anemia). Bone marrow may be destroyed by drugs, radiation, and tumors.

② Liver and kidney

are essential for formation of normal RBCs as both are site of formation of erythropoietin hormone (15% liver – 85% kidney) also liver is considered to be site of storage of iron and B12.

③ O2 supply to tissue

is one of the most important factors in formation of RBCs decrease O2 supply will lead to stimulation of formation of RBCs through increase Erythropoietin hormone. Decrease O2 supply occurs in heart and lung disease, high altitude, and haemorrhage.

④ Hormones

erythropoietin – androgen – cortisone and thyroid hormone are essential for formation of RBCs.

⑤ Diet

Diet must contain vitamins as folic acid and B12, metals as iron, copper and cobalt and protein for formation of RBCs.

Erythropoietin hormone

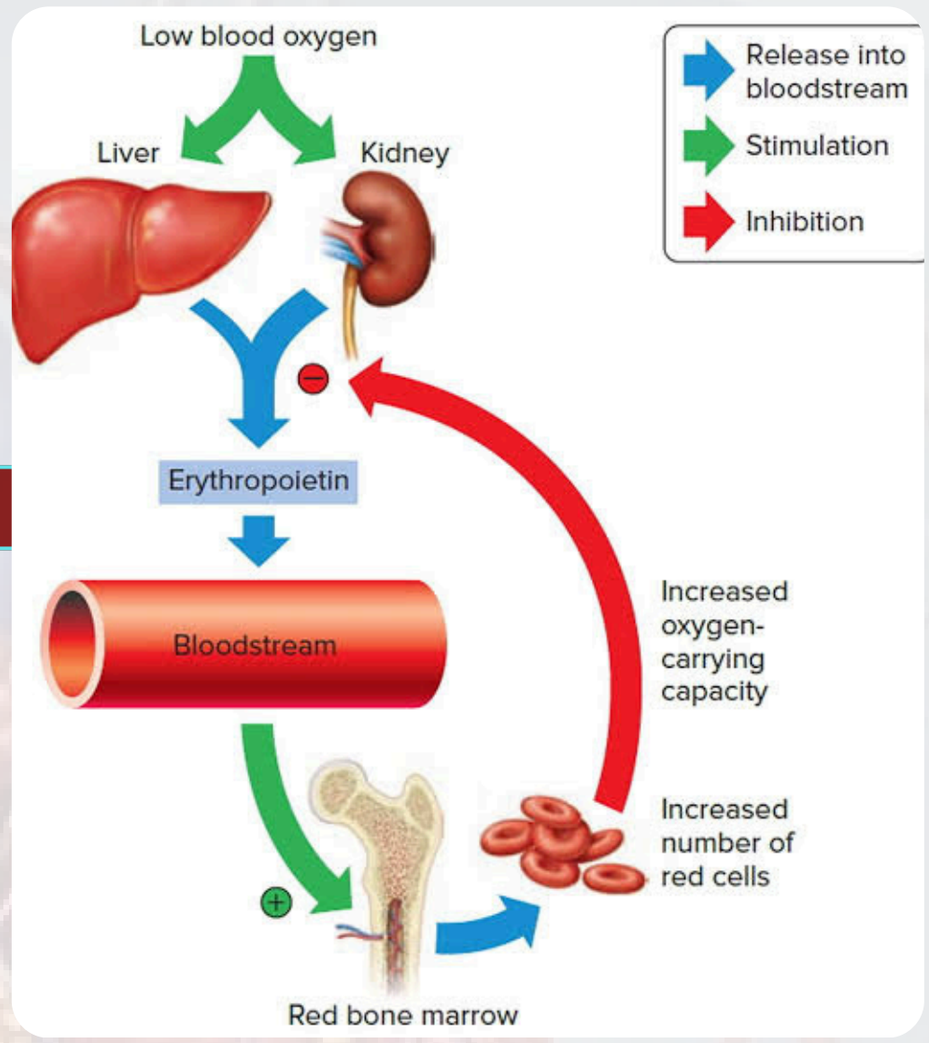
site of formation : **Fetus** > liver **Adult** > 15% liver and 85% kidney

Erythropoietin stimulated by :

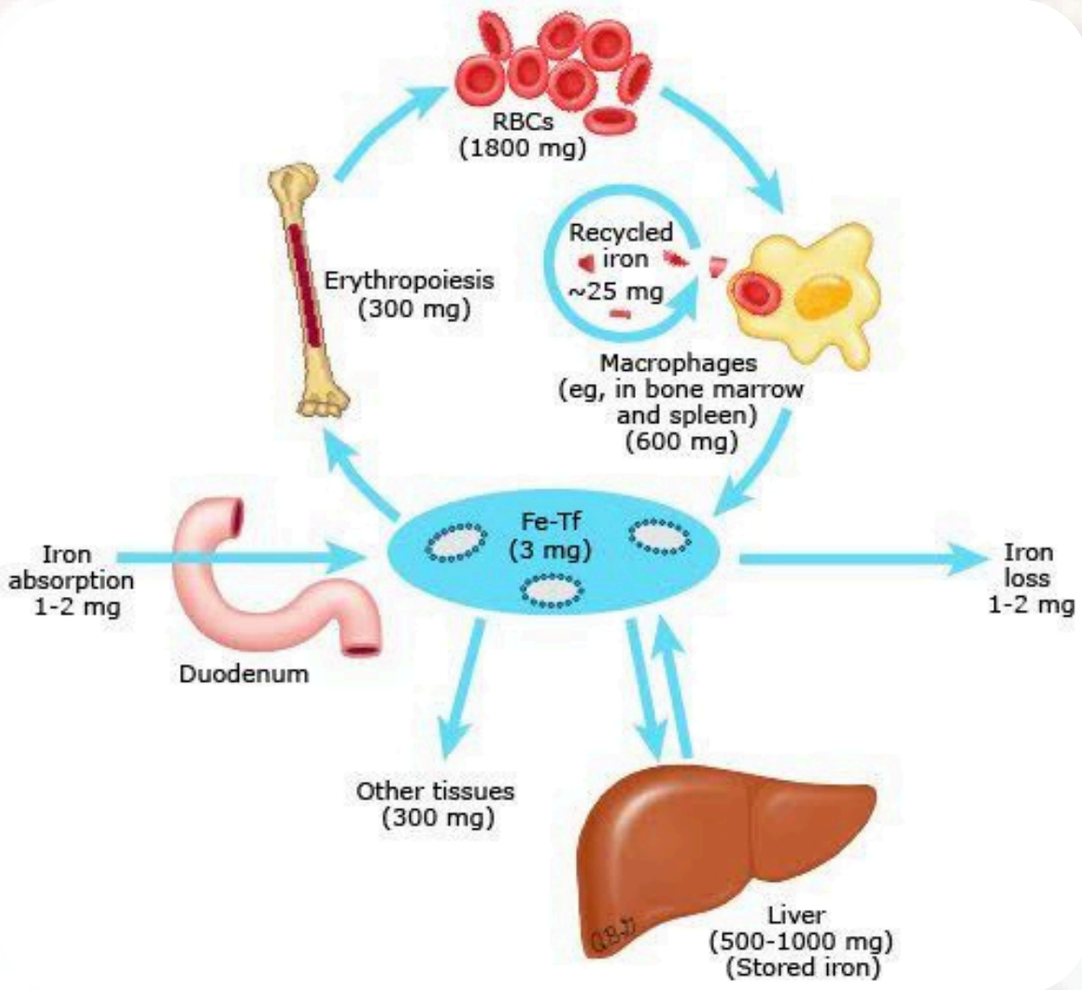
1- Hypoxia
2-Alkalosis
3- Androgen
4- Adenosine
5- Cobalt salt
6- Catecholamine

Erythropoietin hormone accelerates all stages of erythropoiesis and that is why in renal failure patient develops anemia .

Erythropoietin hormone cycle



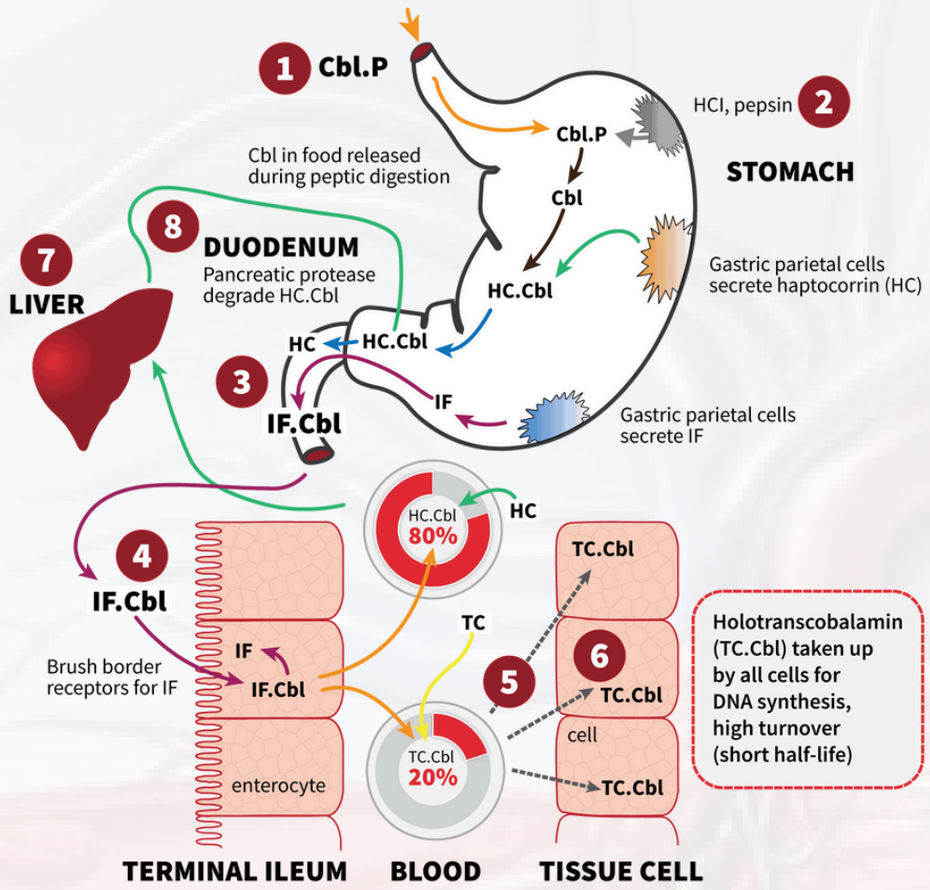
Iron absorption



1- Iron absorbed in ferrous state while iron in diet is ferric.
2- Reduction of ferric to ferrous occurs by gastric Hcl and ascorbic acid (vitamin C).
3- Iron absorbed mainly in upper part of small intestine (duodenum).
4- Part of iron is delivered to mitochondria.
5- Remaining part is either combined with apoferritin (in intestine) or carried in plasma on transferrin.
6- Iron combined with apoferritin is changed to ferritin which is main storage of iron.
7- Iron transported in blood bound mainly to transferrin to all part of body and stored in liver as ferritin.
8- Deficiency in iron is due to decrease iron intake or decrease iron absorption or chronic blood loss lead to microcytic anemia.

NB : apoferritin is present in intestine and liver

B12 absorption



1- Intrinsic factor secreted by gastric gland (parietal cell).
2- Intrinsic factor combines with vitamin B12 for protection and transport of B12.
3- Vitamin B12 absorbed from lower part of small intestine (ileum).
4- Vitamin B12 enter mucosal cell with Intrinsic factor by pinocytosis.
5- Inside cell vitamin B12 set free in order to be absorbed to blood where it bound to transcobalamineII to every part in the body and stored in liver.
6- Deficiency in vitamin B12 may be due to decrease in vitamin B12 absorption lead to anemia known as macrocytic anemia.

Comparison between Iron & B12

Iron		B12
important for formation of hemoglobin and myoglobinnction	Function	- DNA formation - Cell division - Cell maturation - Formation of myelin sheath
in liver	Storage	in liver
0.6 mg/day	Requirement	5 mg/day
upper part of small intestine	Site absorption	lower part of small intestine
Hcl and vitamin C for reduction of ferric iron to ferrous	Need	intrinsic factor for protection from Hcl
microcytic anemia	Deficiency lead to	macrocytic anemia