

Blood indices

1) MCV = Mean corpuscular volume.

Normal value = 78 – 94 μm^3

i) If MCV is normal ---- **Normocytic.**

ii) If MCV is **< 78 μm^3**

- RBCs are known as **Microcytic.**

- **Iron defi. Anemia.**

- **Globin defi. Anemia.**

iii) If MCV is **> 94 μm^3 ----- Macrocytic.**

Vitamin B12 & folic acid deficiency.

MCHC

- Average Hb concentration per RBC.
- **Normal value = 32 – 38 %**
- Importance
 - i) If MCHC is normal ----- **Normochromic.**
 - ii) If MCHC is less than normal ----- **Hypochromic.**
- # MCHC is never more than normal. (38 %)**
 - It is the metabolic upper limit of the cell's Hb forming metabolism, so cell can not hold Hb beyond its limit.
 - So anemia can never be hyperchromic.

3) MCH = Mean corpuscular Hb.

= Normal value – **28 -32 pg**

Anaemia

- Definition –

- Decrease O₂ carrying capacity of blood

due to

1) RBC count < 4 millions / mm³ of blood

or

2) Hb is < 12 gm %

or

3) Both (1) and (2).

Grading of anaemia

- 1) Mild - Hb is 8 – 12 gm %
- 2) Moderate – Hb is 5 – 8 gm %
- 3) Severe – Hb is < 5 gm %

Classification

1) Morphological classification (Wintrobe's)

a) Normocytic normochromic anemia

- Acute hemorrhagic anemia
- Aplastic anemia

b) Macrocytic normochromic anemia

- All Megaloblastic anemia

c) Microcytic hypochromic anemia

- Iron deficiency anemia
- Chronic post- hemorrhagic anemia

2) Etiological classification (Whitby's)

- Decrease production of RBC

1) Nutritional deficiency anemia

- a) Iron deficiency anemia
- b) Vit. B12 deficiency anemia
- c) Folic acid deficiency anemia
- d) Vit. C & protein deficiency anemia

2) Aplastic anemia

- a) Irradiation
- b) Anticancer drugs

3) Anemia of chronic diseases

- a) Disturbance in iron metabolism
- b) Resistance to erythropoietin action

4) Hemolytic anemia

- **Increased destruction of RBC**

1) Corpuscular defect

- Sickle cell anemia**
- Thalassaemia**
- G 6 PD deficiency**
- Congenital spherocytosis**
- Erythroblastosis foetalis**

2) Extra corpuscular defect

- a) Antigen – antibody reaction**
- b) Liver failure**
- c) Renal disorders**
- d) Hypersplenism**
- e) Drugs /poisons – quinine, aspirin, snake venom**
- f) Infections – Malaria, septicemia**

5) Haemorrhagic anaemia

- Anemia due to blood loss

1) **Acute** – due to sudden loss of blood

2) **Chronic** – slow loss of blood

e.g. Worm infestation, peptic ulcer.

Anemia

- **Definition**
- **Causes**
- **Clinical features** – **specific features**
 - **General features of anemia**
- **Laboratory findings** – **blood picture**
 - **bone marrow findings**
 - **other investigations**
- **Treatment**

Iron deficiency anemia

- **Definition** – It is the anemia which occurs due to deficiency of iron in the body.
- **Causes** –
 - 1) **Decreased intake**
 - old age, pregnancy
 - 2) **Decreased absorption**
 - GI tract disorders
 - 3) **Increased loss of iron**
 - acute & chronic hemorrhage
 - 4) **Increased demand**
 - infancy, childhood, pregnancy

- **Clinical features-**

1) Skin – Thin, dry, loosing its elasticity.

2) Hair – Loss of hair, thinning & early grayness.

3) Nails – Dry , soft, spoon shaped (koilonychia)
later develop longitudinal striations.

4) Tongue – Angry red (glossitis)

5) Prolonged iron deficiency

- Atrophy of epithelium in oral cavity & esophagus – dysphasia

- Atrophy of gastric epithelium

 - Decreased absorption of iron

 - Achlorhydria

- General features –

6) Muscle – generalized muscle weakness, tiredness, easy fatigability

7) Skin & mucous membrane – pallor ness

8) RS – breathlessness

- increased rate & force of respiration

9) CVS – tachycardia, palpitation, murmurs

- In severe anaemia

a) Decreased blood viscosity

- decreased resistance to blood flow

- **increased venous return to the heart**

b) Hypoxia – peripheral vasodilatation

- **increases venous return**

- Due to (a) & (b) **increased cardiac output**

& increased pumping workload of the heart.

- When the same person ---exercise ---hypoxia.

heart is not capable of pumping more blood,

----- Acute heart failure -----

10) CNS – due to hypoxia

- headache, faintness on exertion,
lack of concentration, confusion.

11) GIT – anorexia , nausea, constipation.

12) Kidney – disturbance in renal function

Laboratory findings

1) **Blood picture & red cell indices**

- Hb content decreases.
- RBC – **Microcytic hypochromic** .
- MCV, MCHC, MCH decreases
- life span normal.
- WBC & platelet count normal.
- Peripheral smear – anisocytosis, Poikilocytosis

2) **Bone marrow** – Normoblastic hyperplasia

3) Investigations-

- a) Serum iron decreases.
- b) Serum ferritin is low --- poor tissue iron stores
- c) Total iron binding capacity increases.
- d) Serum bilirubin < 0.4 mg%

- **Treatment**

- Oral iron tablets.
- Vit.C & Vit.E
- Correction of causative factor

Megaloblastic Anemias

Impaired DNA  Synthesis

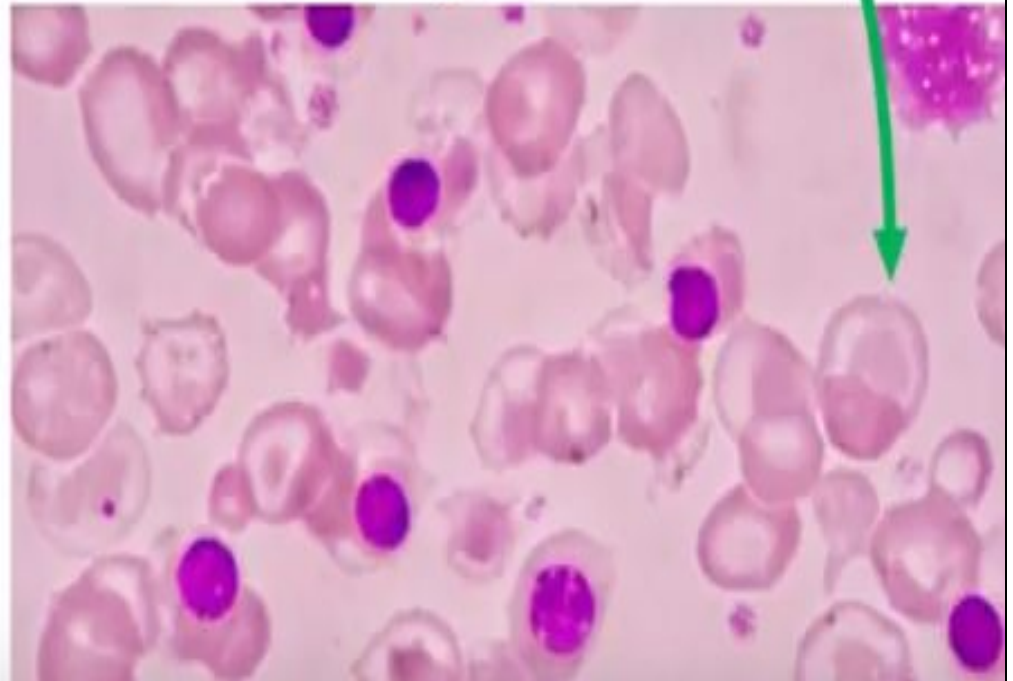
Results in

Enlarged Red Blood Cells

2 Main causes

Folic acid deficiency

Vitamin B₁₂ deficiency



Vit. B12 deficiency anaemia

- Causes – 1) Inadequate dietary intake
- 2) Malabsorption of Vit. B12 due to
 - a) Gastric causes
 - Defi. of intrinsic factor
(Pernicious anemia)
 - Congenital lack of I.F.
 - Gastrectomy
 - b) Intestinal causes
 - decreased absorption of B12
 - intestinal disorders

Essential for

Vitamin B₁₂

“AKA”

Cobalamin

DNA

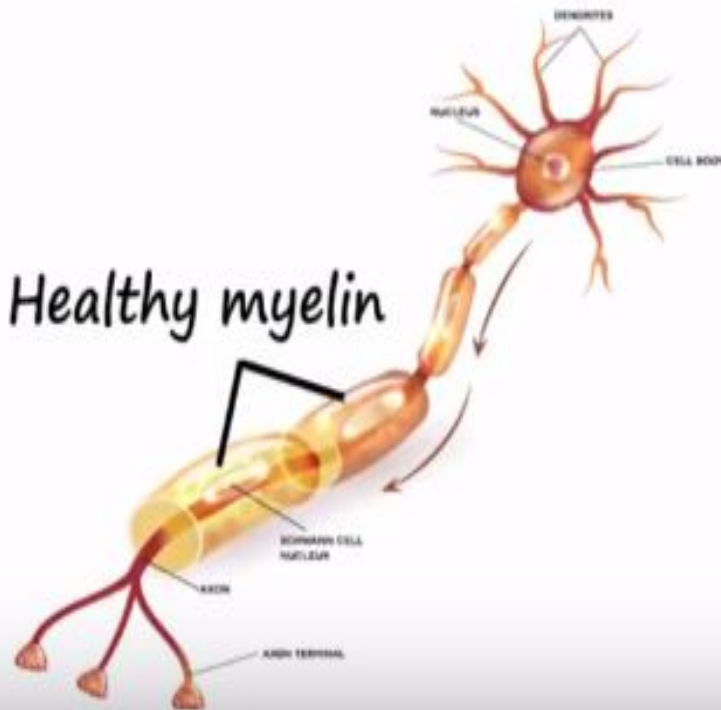


Synthesis

Nuclear maturation



Healthy myelin



Maturation factors

1) Vitamin B12 – (Extrinsic factor)

- Functions :

- a) Helps in maturation of RBCs.
(conversion of pro erythroblasts-----mature RBC)
- b) They are essential for the synthesis of DNA.
- c) Increases WBC & platelet count.
- d) Maintains normal activity of CNS.
- e) Helps in myelination of nerve fibers.

Vitamin B12 Deficiency

- **Vitamin B12 deficiency -----**



- **Decrease DNA synthesis**



- **Failure of nuclear maturation & division**



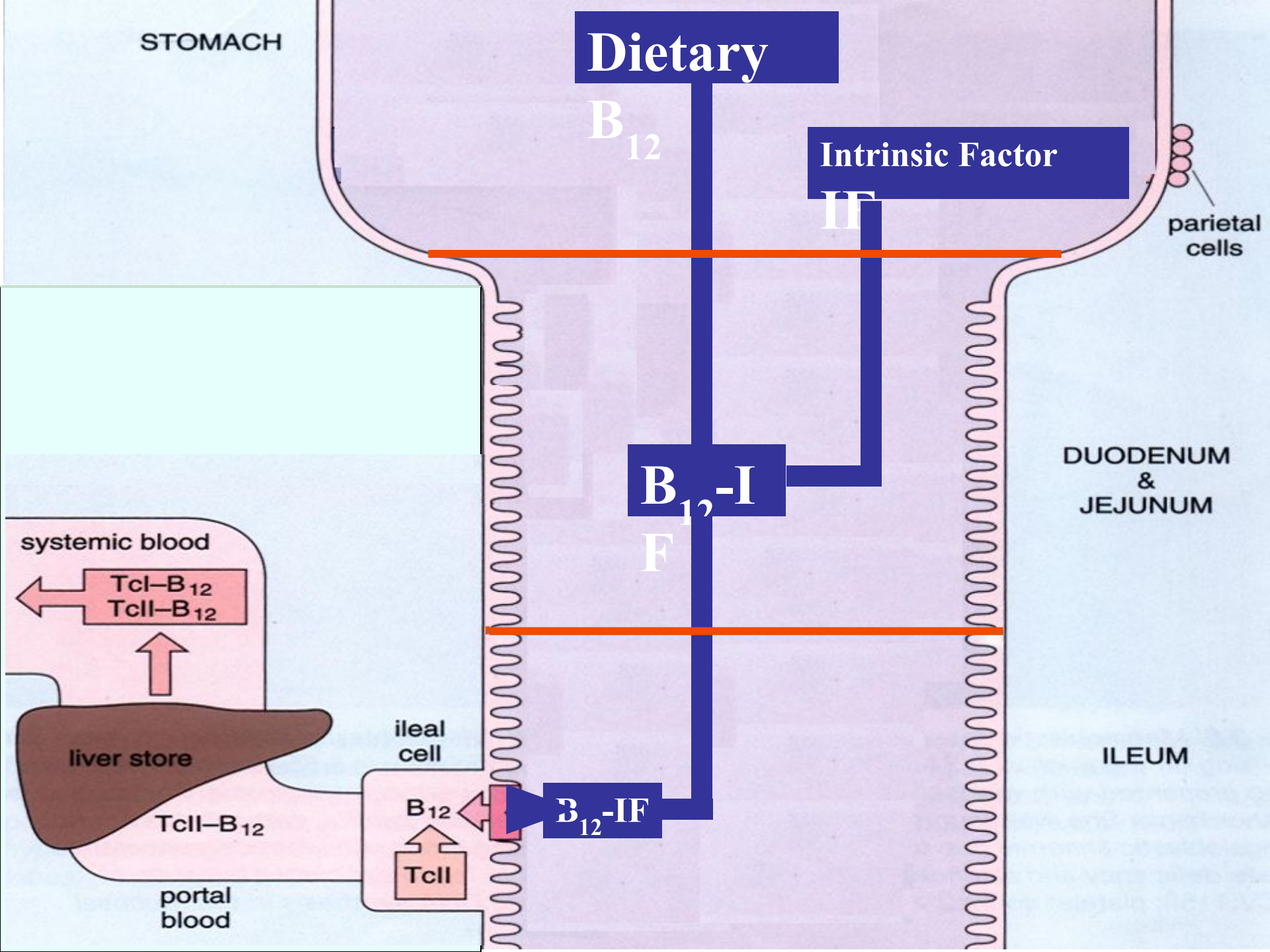
- **Slow reproduction of cells & abnormality of DNA**

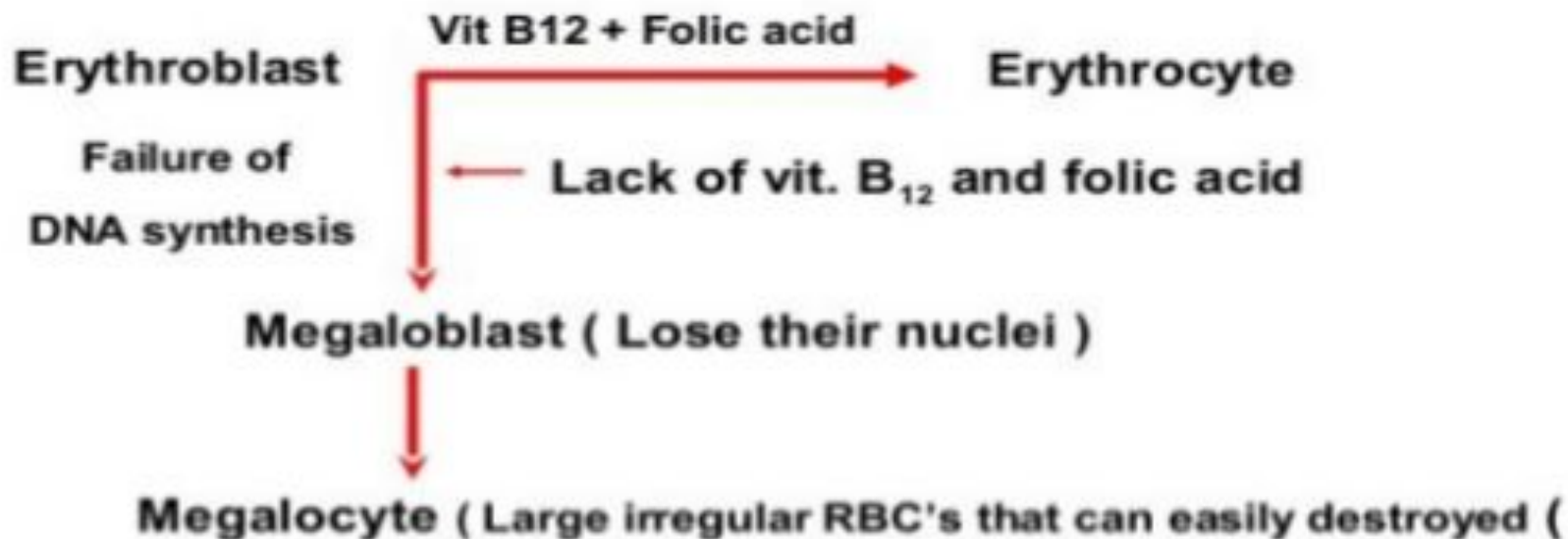


- **Formation of large cells, cell membrane fragility**



- **Maturation failure ---- Megaloblastic anemia**





LIFE SPAN OF MEGALOBLAST IS 40 DAYS

- **Clinical features**

- 1) Changes in GIT**

- Defi. Of I.F.
- Atrophy & destruction of gastric mucosa
- Achlorhydria
- Soreness & inflammation of the tongue.
- Loss of appetite
- Diarrhea

2) Changes in nervous system

- In advance cases -----

demyelination of white fibers of the spinal cord

- Sub acute combined degeneration of spinal cord.

- Tingling & numbness in hands & feet.

- Motor & psychological disturbances.

3) General features

- **Laboratory findings**

- a) **Blood picture & indices**

- 1) **RBC** – Macrocytic normochromic.

- 2) **MCV** – more than 94 cmm.

- 3) **MCH** – increases

- 4) **MCHC** – usually normal.

- 5) **Peripheral smear** – nucleated RBC with
anisocytosis & Poikilocytosis.

- 6) **WBC & platelet count** decreases.

- 7) **Reticulocyte count** increases.

- 8) **Excessive destruction of RBC.**

- **Bone marrow findings**

- Megaloblastic hyperplasia of BM.

- **Investigations**

- a) Serum bilirubin > 1mg%**

- low grade hemolytic jaundice.

- increased urine urobilinogen excretion.

- (Due to excessive destruction of RBC)

- b) Serum iron level increases.**

- c) Plasma level of vit.B12 decreases.**

d) Vit.B12 excretion in faeces increases.

e) Urinary excretion of Vit B12 decreases, due to poor absorption of vit.B12 from intestine.

- **Treatment –**

- Regular administration of vit.B12 by **intramuscular route.**


Addison's pernicious anaemia

(pernicious = destructive or injurious)

- **Definition** – Defi. of vit.B12 due to lack of I.F.
leads to anaemia which is known as pernicious anaemia.
- **Cause** – Autoimmune atrophy of gastric mucosa
 - failure of secretion of I.F.-----
 - failure of absorption of vit.B12-----
 - vit B12 deficiency-----
 - Megaloblastic anaemia-----
 - occurs mainly between 45 – 65 yrs.

Vitamin B₁₂-Deficiency Anemia

Lack of  Intrinsic Factor

 Pernicious anemia

Antibodies against



 Parietal cells

Other Causes:

Ileal resection

Cancer in the ileum

Gastrectomy

Specific features

- Features of B12 deficiency
- Anti – intrinsic factor antibodies in serum
- Abnormal vit.B12 absorption test (schilling test)
- Vit.B12 excretion in faeces increases.
- Urinary excretion of Vit B12 decreases, due to poor absorption of vit.B12 from intestine.
- **Treatment –**
 - Regular administration of vit.B12 by **intramuscular route.**

Folate deficiency anemia

- **Definition** – It is the anemia which occurs due to deficiency of folate in the body.
- **Causes** –
 - 1) **Decreased intake**
 - old age, pregnancy
 - 2) **Decreased absorption**
 - GI tract disorders
 - 3) **Increased demand**
 - infancy, childhood, pregnancy

Specific features

- Low serum folate level
- Low red cell folate levels