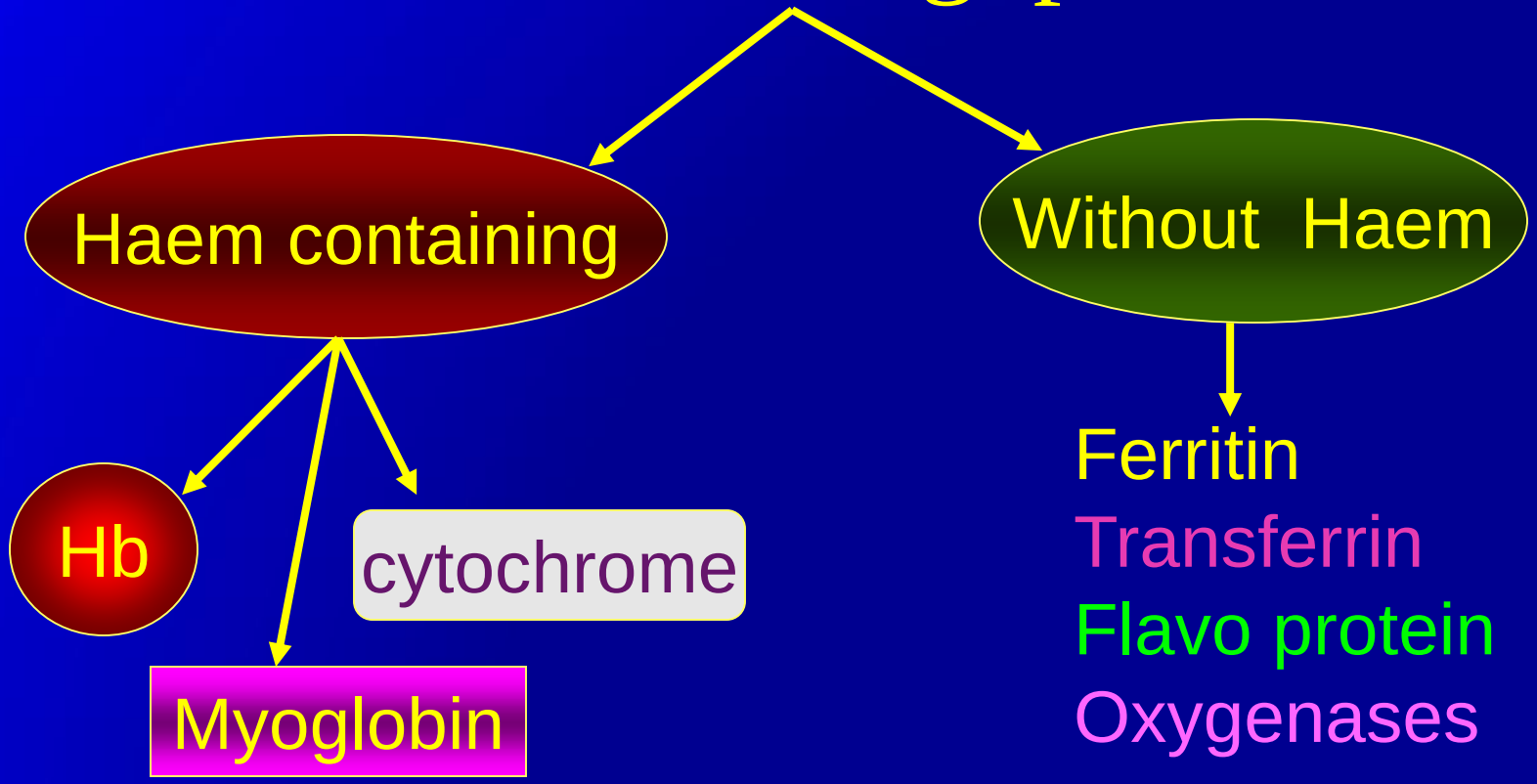
Iron Deficiency Anaemia

Senani Williams

Iron

- 1/3 rd of the earth’s crust
- No physiological mechanism of excretion.
- Free iron is toxic.
- Therefore is bound to proteins

Iron containing proteins



Central role in O_2 transport and energy metabolism

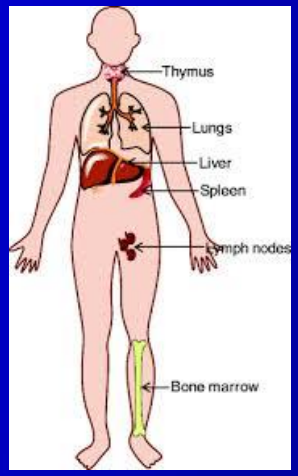
Iron homeostasis

Diet - 1mg

Enzymes
Cytochromes
Catalase
Oxydases
300mg

Plasma
4mg

Body stores
1000mg

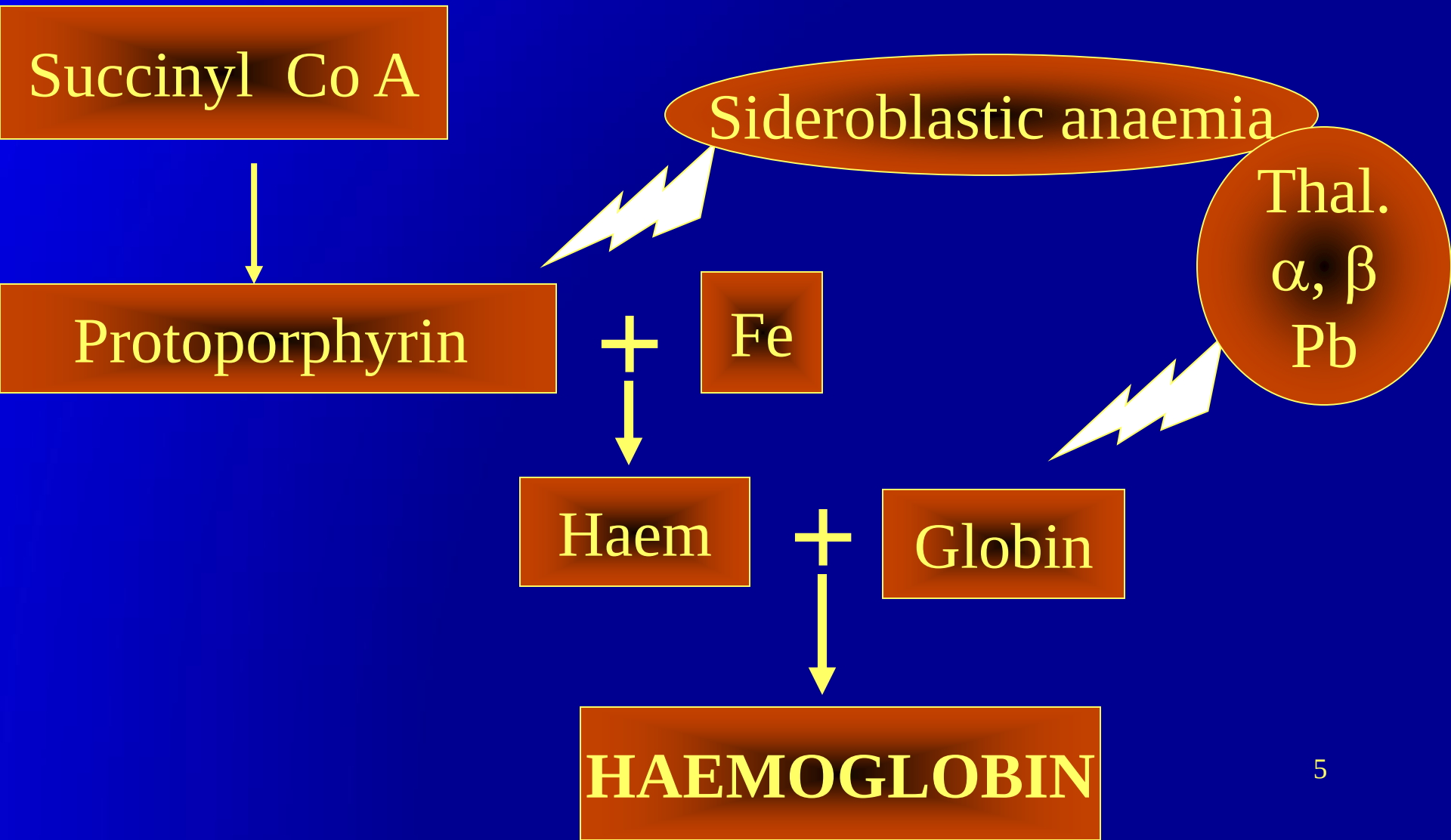


Erythropoietic tissue

Erythrocyte mass
2500mg

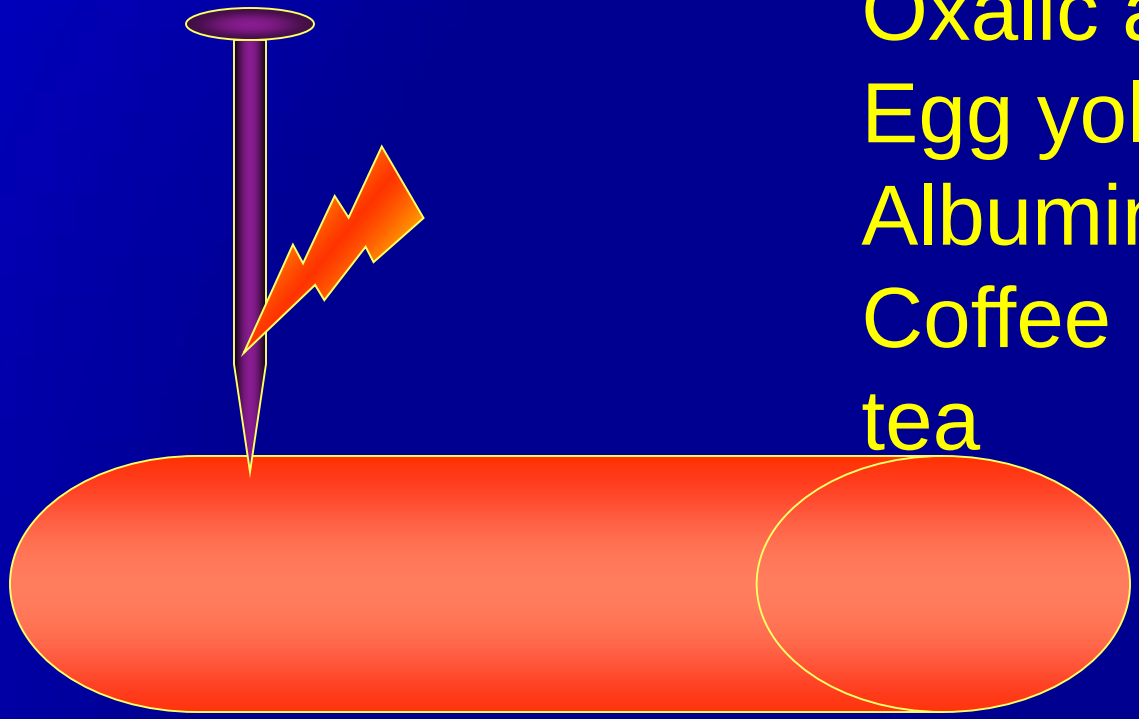
Loss – epithelial cells erythrocytes

Synthesis of Haemoglobin



Iron absorption

Facilitated by
H^+
HCL
Vit C
Fish
Poultry
meat



Inhibited by
Phytates
Phospho proteins
Oxalic acid
Egg yolk
Albumin
Coffee
tea

Iron absorption

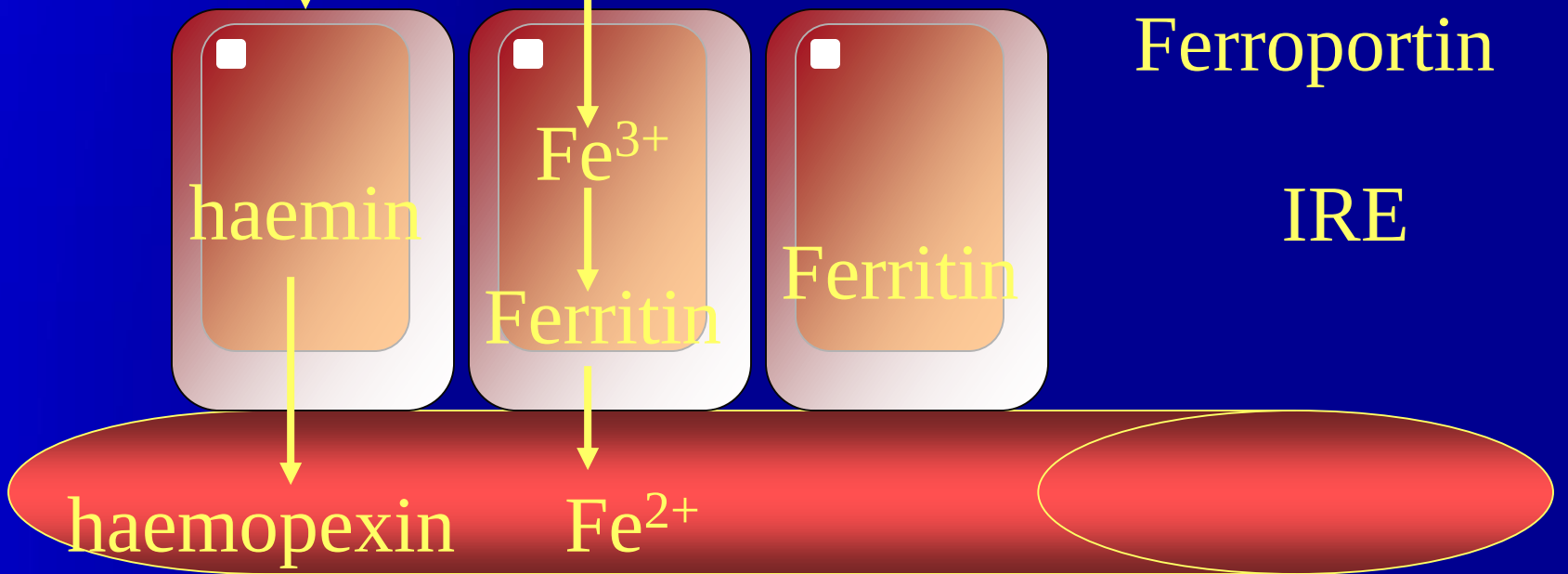
Non -haem

Hepcidin

haem

Fe^{2+}

DMT1



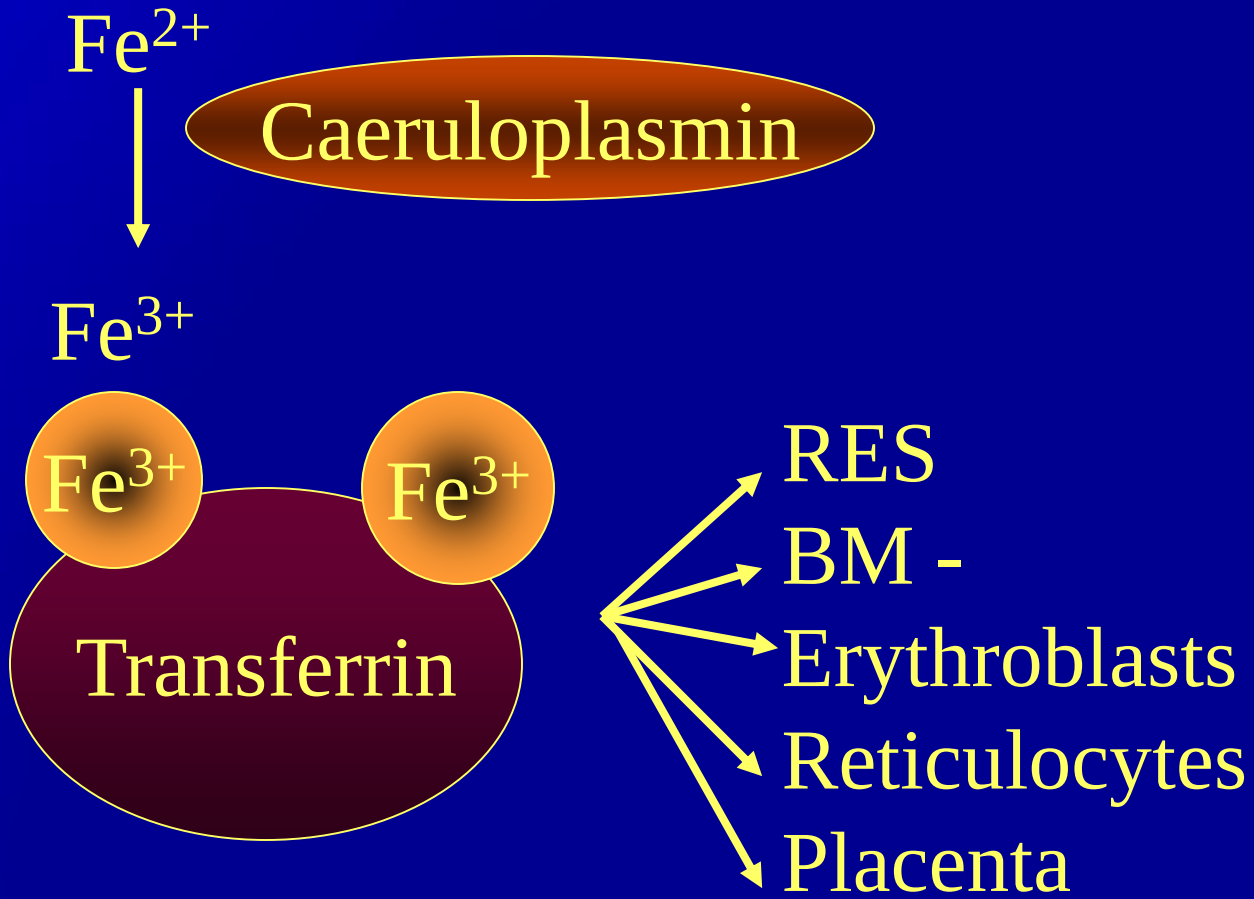
Ferroportin

IRE

Iron Transport

- Transferrin = Siderophyllin
- β globulin
- Synthesized in the liver
- T 1/2 - 8 - 10 days
- 1/3 saturated
- Diurnal variation - highest - morning
- When saturated liberates Fe to parenchymal organs

Iron Transport



Free Fe is NOT found in blood except in overload.

Plasma iron

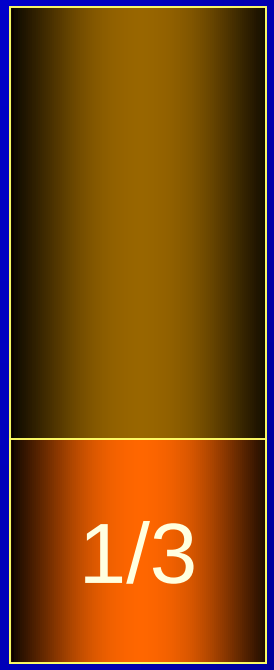
- Reduced in chronic disease despite normal stores

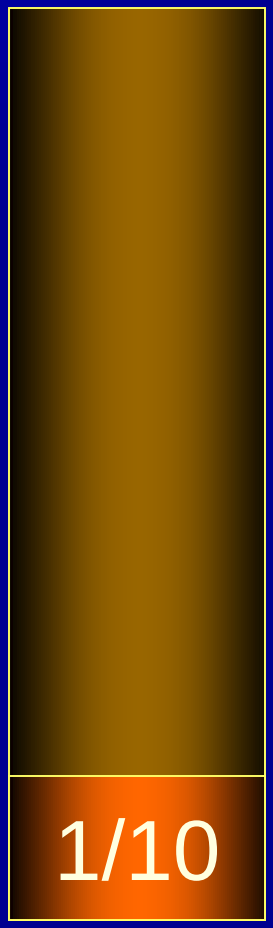
- Increased in acute liver disease
- In haemolytic crisis – released from iron stores

Total iron binding capacity (TIBC)

Normal

30%





Deficiency

<10% saturation

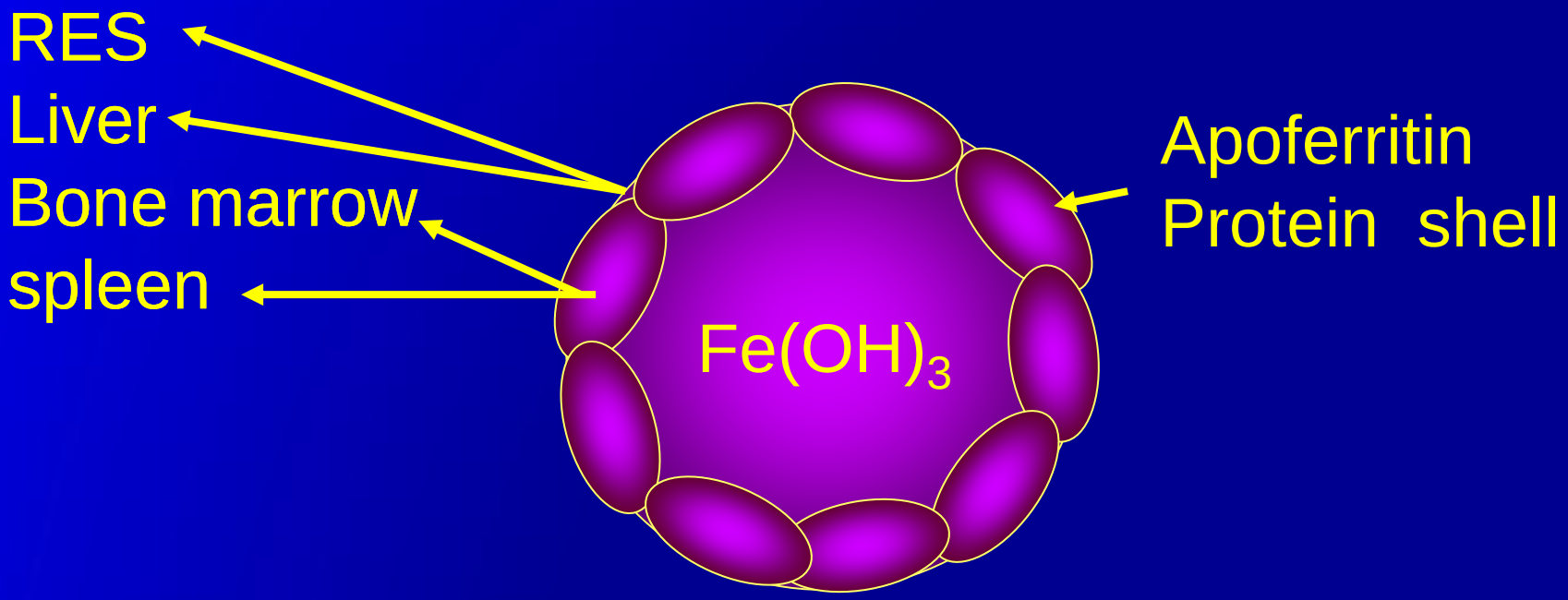
Increased synthesis
Of transferrin

Iron stores

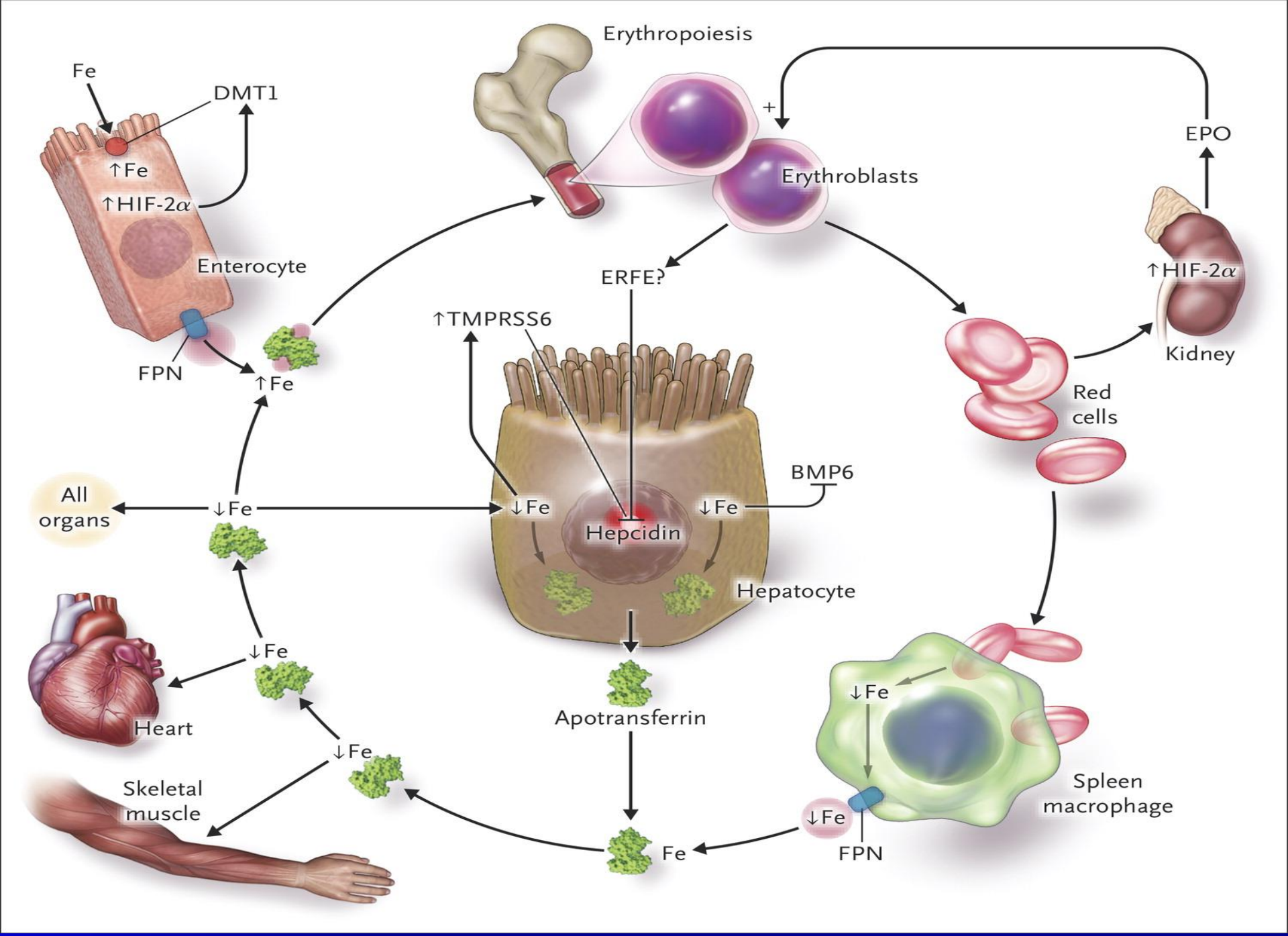
- **Ferritin**
- Water soluble
- Fe - protein complex
- Not visible by light microscopy

- **Haemosiderin**
- Water insoluble
- Denatured Ferritin
- Visible by Perls reaction

Ferritin



Reflects tissue stores
Also an acute phase protein


Erythropoiesis
Fe
DMT1
↑Fe
↑HIF-2α
Enterocyte
FPN
↑Fe
+
Erythroblasts
EPO
ERFE?
↑HIF-2α
Kidney
↑TMPRSS6
Red cells
BMP6
All organs
↓Fe
↓Fe
Hepcidin
↓Fe
Hepatocyte
↓Fe
Heart
Apotransferrin
↓Fe
↓Fe
Spleen macrophage
Skeletal muscle
↓Fe
FPN
Fe

Iron deficiency anaemia

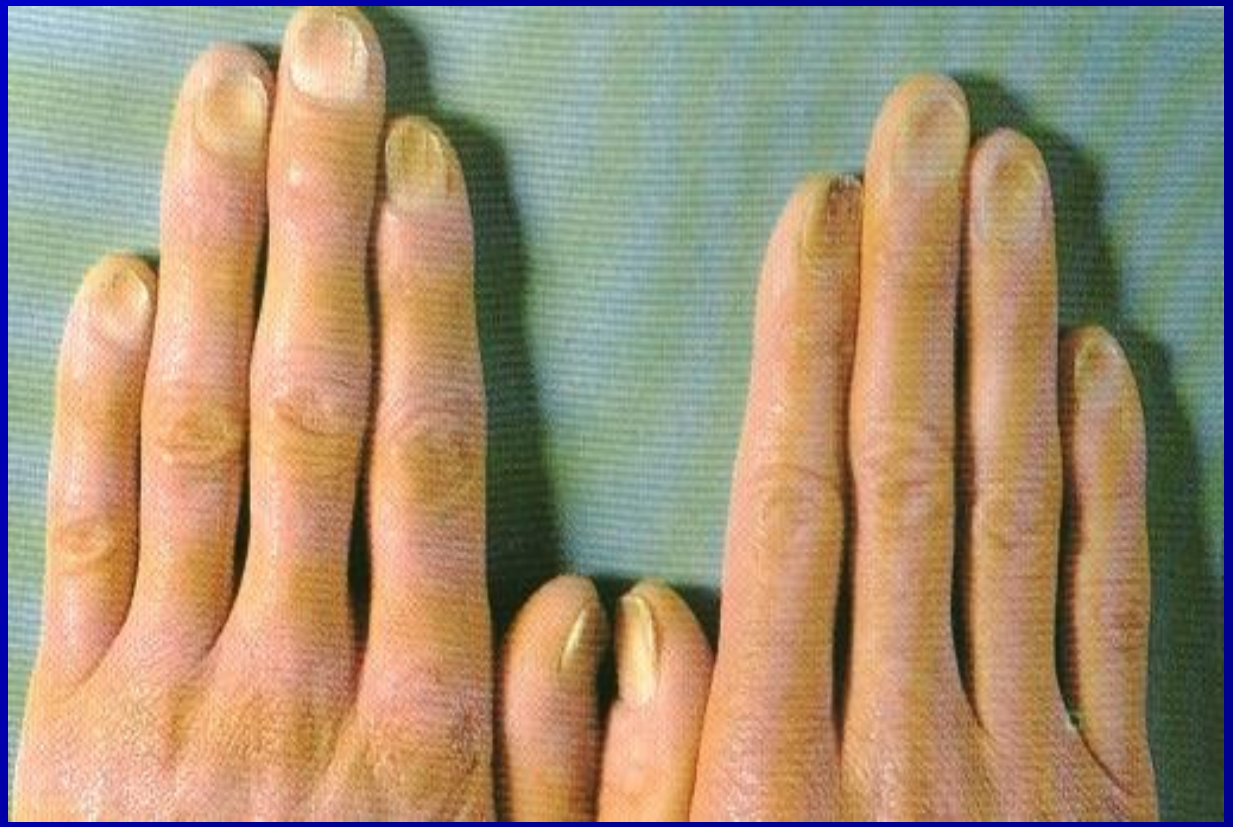
Blood loss → Acute
Blood loss → Chronic

↓ Intake - poor diet

Malabsorption - Gastrectomy, Coeliac disease
Tropical sprue, Worm infestation

↑ Demand - Prematurity, Growth, Child bearing

Koilonychia

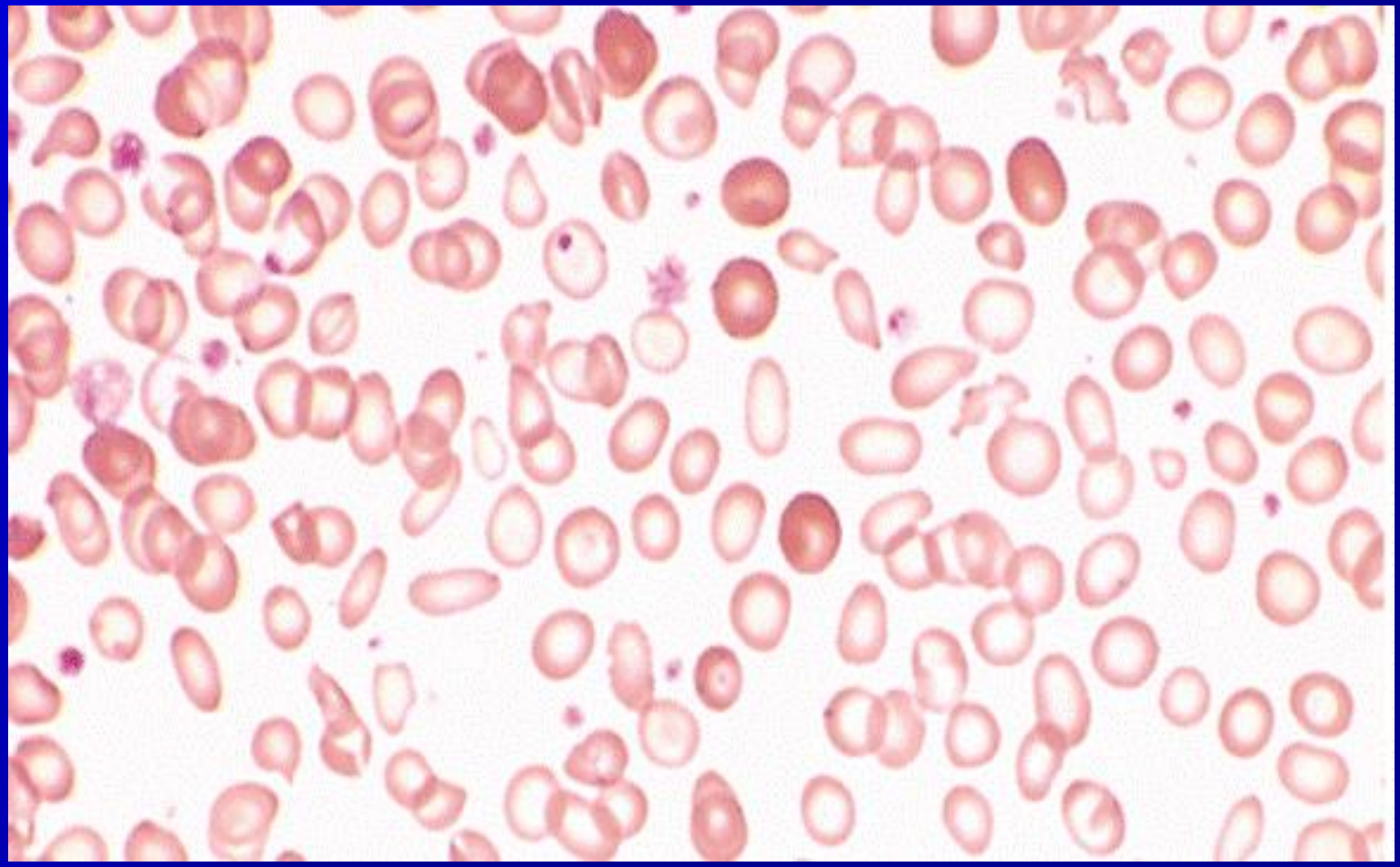


Angular stomatitis

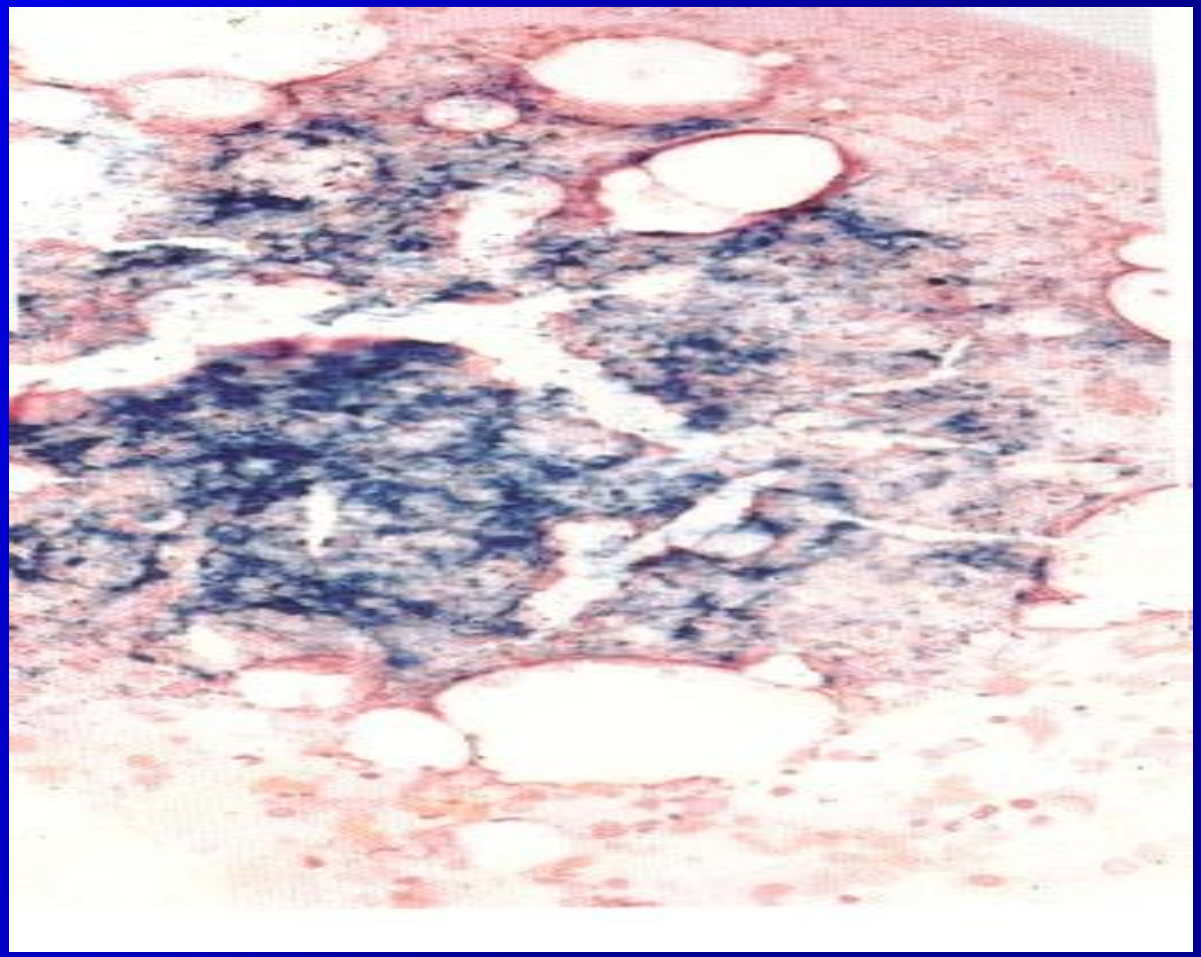
Haematological findings

- Haemoglobin less than that is appropriate for age and sex of the individual
- MCH < 27 pg
- MCV < 75 fl
- MCHC < 32 %
- Blood picture

Blood Picture



Marrow iron stores



Perls stain
Prussion blue
Iron deposits

Biochemical findings

- ↓ Hepcidin
- ↓ Serum Ferritin (can be normal)
- ↑ TIBC
- ↓ percentage saturation
- ↓ Serum iron (Transferrin bound Fe)
- ↑ Free Erythrocyte Protoporphyrin
- ↑ Soluble transferrin receptors

Investigation of Cause

- Pre menopausal - Menorrhagia, Pregnancy
- Males & post menopausal - GI h'age
- Occult blood Endoscopy
- XR, AOC

Exclude Malignancy

Treatment

- Cause + Iron therapy for 4/12
- Therapeutic trial -
- Hb should increase 1 g in 1 week
- 2 g in 3/52
- Retic count increases in 7 - 10 days
- Stores replenished in 6/12

No response

- Check compliance
- Continued bleeding
- Wrong diagnosis

Iron Restricted Erythropoiesis

- Delivery of iron to erythroid precursors is impaired
- Iron stores may be normal or increased.
- Occurs in anemia of chronic inflammation,
- Autoimmune disorders,
- Cancer,
- Infections,
- Chronic kidney diseases.