

HLS Red Cell Disorders Anemia-I.

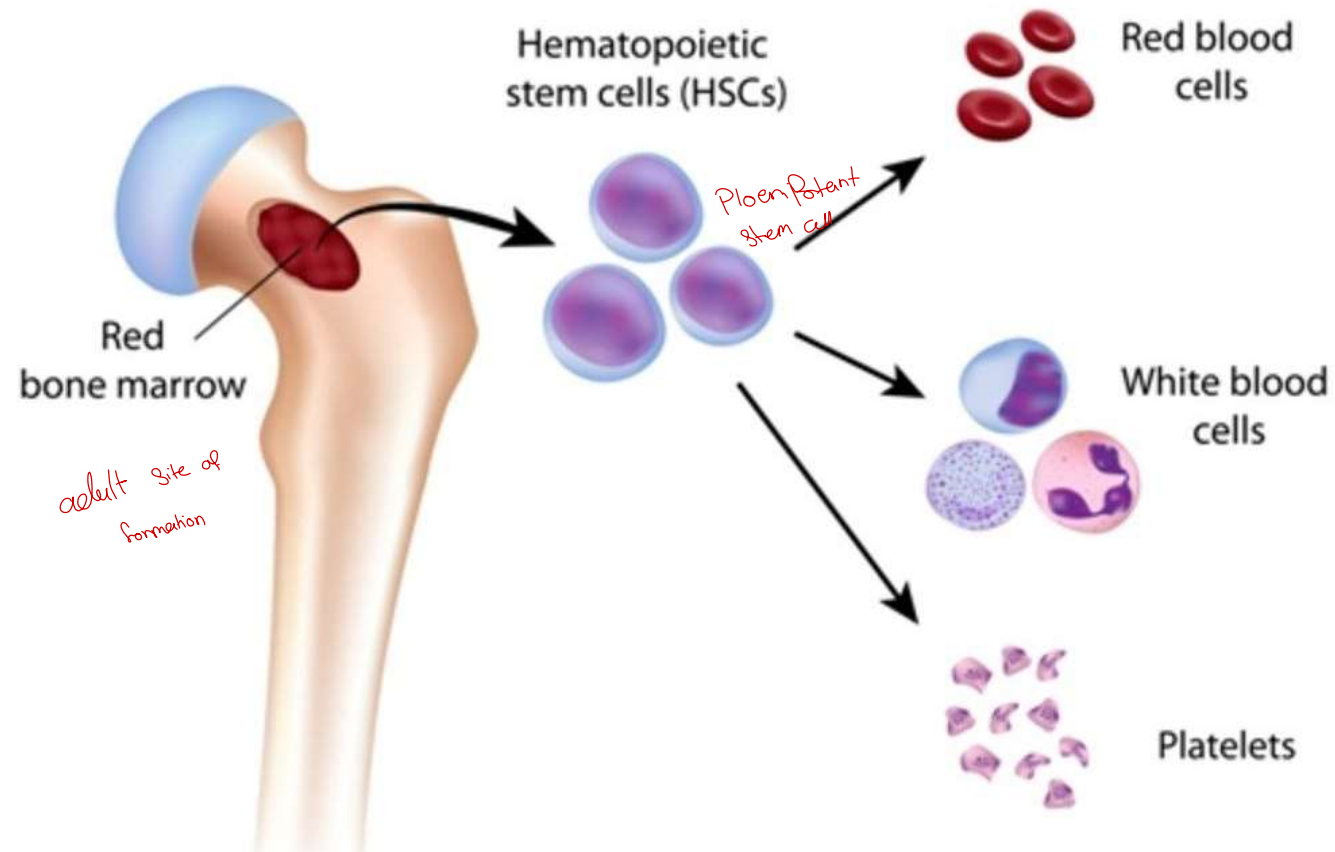


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Hematopoiesis

→ Process of formation of all blood cell



Lecture titles

1. Introduction to anemia, classification and strategies for diagnosis and nutritional anemias.
2. Introduction to anemia, classification and strategies for diagnosis and nutritional anemias II.
3. Thalassemia and hemoglobinopathies and hemolytic anemias.
4. Congenital bleeding disorders, DIC and thrombophilic disorders.
5. ITP, TTP and inherited disorders of platelets functions.
6. White blood cell and lymph node disorders. Non-neoplastic.
7. Lymphoid neoplasms I.
8. Lymphoid neoplasms II.
9. Plasma cell neoplasms and related entities.
10. Acute myeloid leukemia.
11. Myeloproliferative neoplasms I.
12. Myeloproliferative neoplasms II and MDS.
13. Histiocytic neoplasms.

CBC

Complete blood Count



		<i>normal range</i>	<i>to us</i>		
★ White blood cells (WBC)	1.90	4.25	K/ μ L	4.5–11.5	
Red blood cells (RBC)	3.75	2.47	M/ μ L	4–5.40	
★ Hemoglobin (Hb)	11	8.8	g/dL	12–15	
Hematocrit (Hct)	30.6	26.9	%	35–49	
→ Mean cell volume (MCV)	81.6	108.9	fL	80–94	
→ Mean cell hemoglobin (MCH)	29.3	35.6	pg	32–36	
★ Platelets	12	51	K/ μ L	150–450	
Reticulocyte absolute	0.020	0.128	%	0.5–2	

First step

Second step for identify type of anemia

Anemia

- Anemia is strictly defined as a decrease in red blood cell (RBC) mass.

The decrease may result from:

- ❖ blood loss.
- ❖ increased destruction of RBCs (hemolysis).
- ❖ decreased production of RBCs.

- ❖ The function of the RBC is to deliver oxygen from the lungs to the tissues and carbon dioxide from the tissues to the lungs. In anemia, a decrease in the number of RBCs transporting oxygen and carbon dioxide impairs the body's ability for gas exchange.

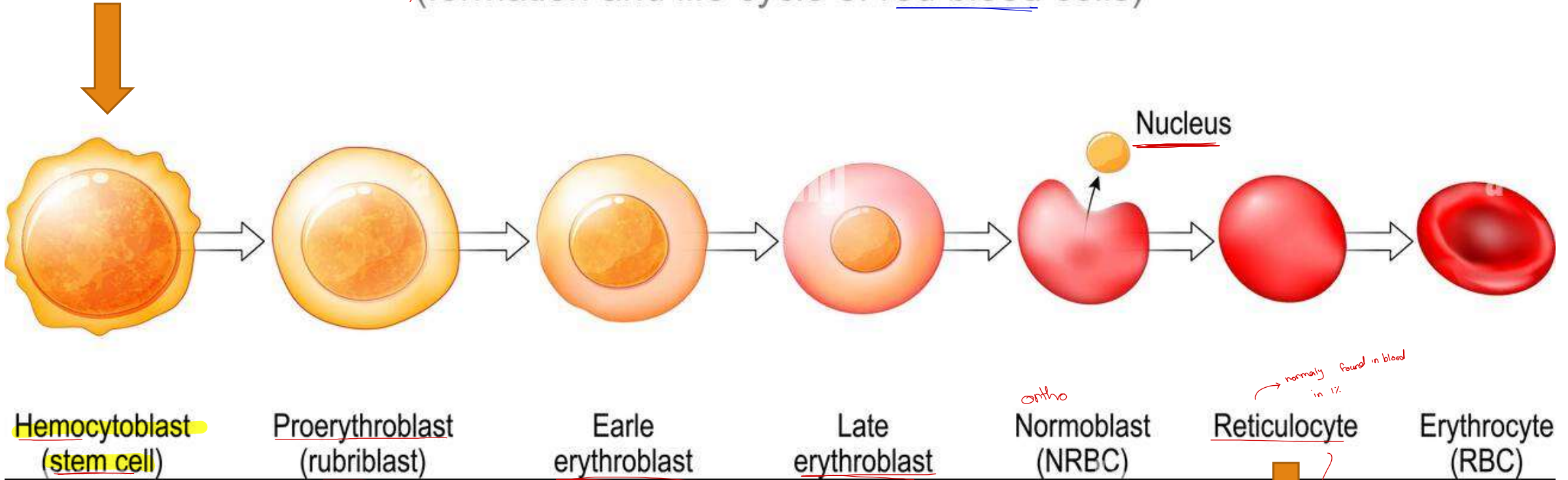
ERYTHROPOIESIS

Erythropoietin :

main hormone related for this process

from kidney

(formation and life cycle of red blood cells)



Hemocytoblast
(stem cell)

Proerythroblast
(rubriblast)

Earle erythroblast

Late erythroblast

Normoblast
(NRBC)

Reticulocyte

Erythrocyte
(RBC)

normally found in blood in 1%

ایسا کان میں نسبتاً زیادہ بننے پر ہوتا ہے
high production often in bleeding

erythroid precursors are released into circulation

Etiology

MC

Genetic etiologies:

- Hemoglobinopathies
- Thalassemias

Nutritional etiologies :

- Iron deficiency.
- Vitamin B12 deficiency.
- Folate deficiency

Physical etiologies :




- Trauma.
- Burns.
- Frostbite

في الحاسر الا يتكون
بالوقت فيهه نغم
دها لايسن المراد جمع جزي
مخلف هههههه RBC
تتكر

- Chronic disease and malignant etiologies.
- Infection.

Morphological Classification of Anemia

Morphological-classification-of-anemia

			
Morphology	<u>Microcytic</u>	<u>Normocytic</u>	<u>Macrocytic</u>
<u>MCV (fL)</u>	<u><80</u>	<u>80 - 100</u>	<u>>100</u>
Disorders	<ul style="list-style-type: none">ThalassemiaAnemia of chronic diseaseIron deficiency anemiaLead poisoningSideroblastic anemia	<ul style="list-style-type: none">Hemolytic anemiaAnemia of chronic diseaseRenal diseaseAcute blood lossBone marrow failureAplastic anemia	<ul style="list-style-type: none">Megaloblastic anemia <i>MC</i>Alcoholism <i>↳ B₁₂ Deficiency</i>Liver diseaseMyelodysplasia

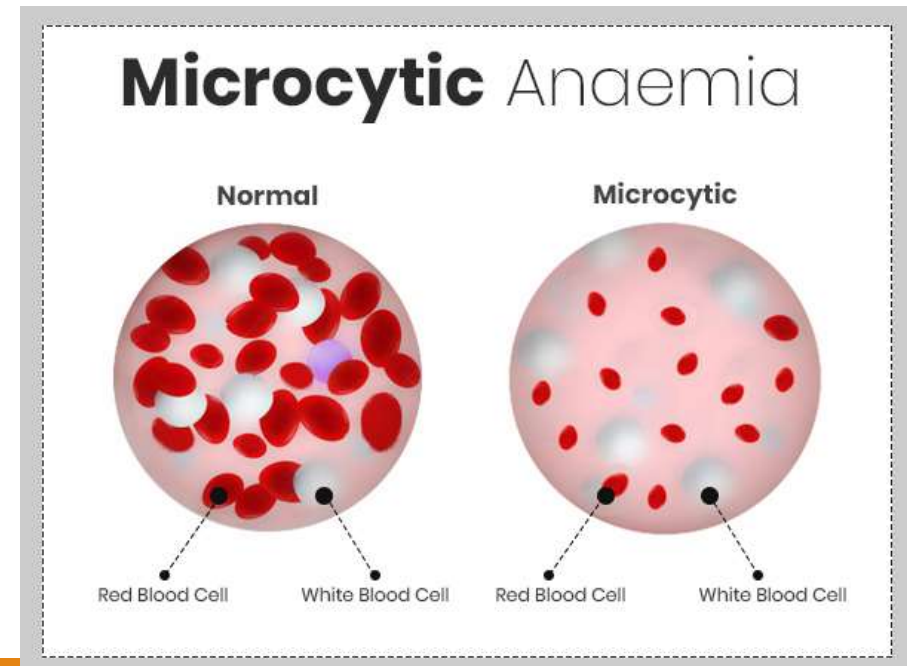
*low Hb
normal shape + volume*

*MC
↳ B₁₂ Deficiency*

I. Microcytic anemia

- **Small**, often **hypochromic**, red blood cells in a peripheral blood smear and is usually characterized by a **low MCV** (< 80 fl).
↓ Hb *Sample ٤٠-٤١*
- **Iron deficiency** is the **most common cause of microcytic anemia**
ضعف الحديد

MC



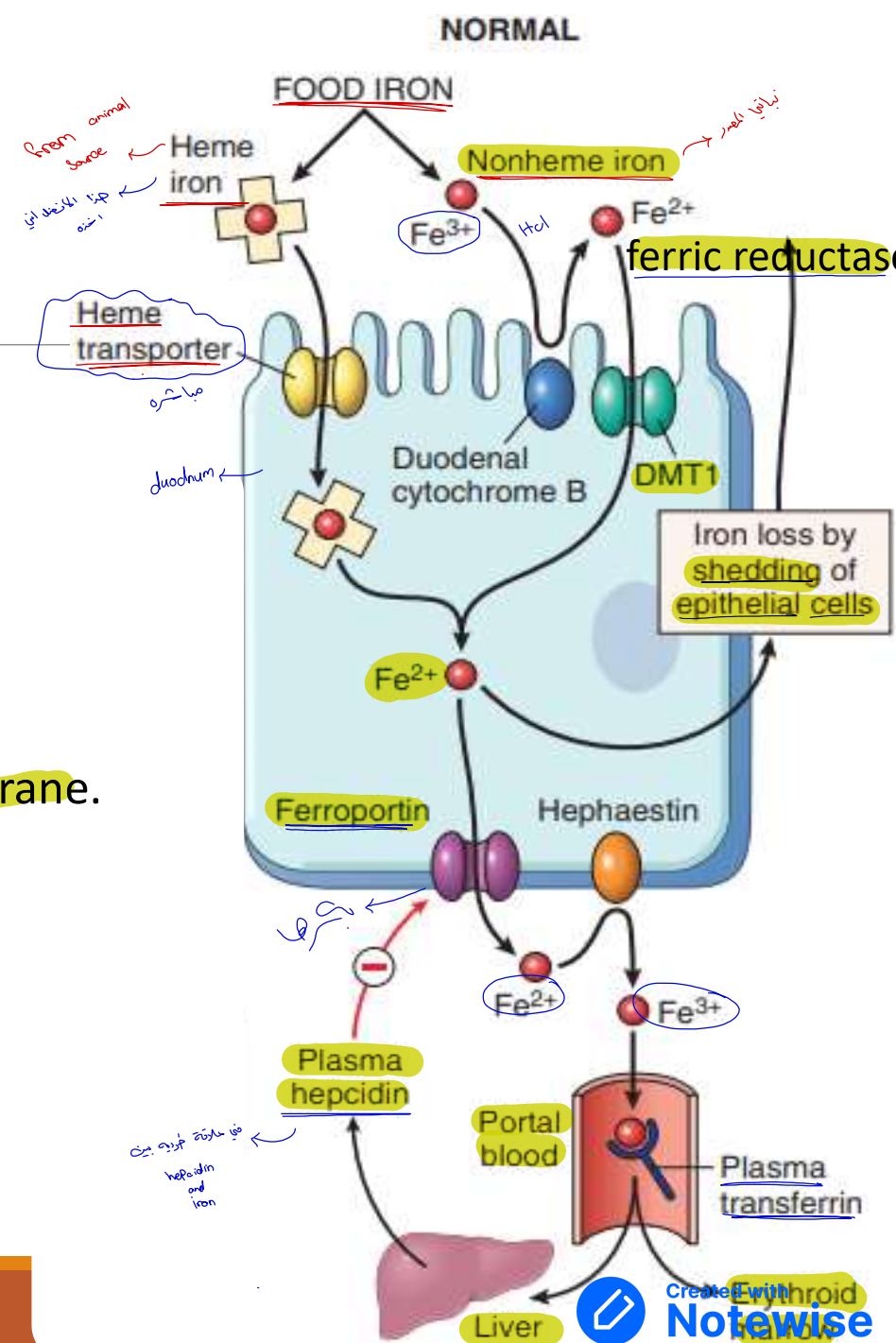
A. Iron Deficiency Anemia

- The most common **nutritional** deficiency in **the world**
- **80%** of functional body **iron** is present in **hemoglobin**, and **20%** in the iron **storage pool** (**hemosiderin** and **ferritin-bound iron** in the cells in the **liver**, **spleen**, **bone marrow**, and **skeletal muscle**)

Regulation of iron absorption

- Regulation of **iron absorption** occurs within the **duodenum**.
- (Fe^{2+}) is **transported** across the **apical membrane** by **divalent metal transporter-1 (DMT1)**.
- A second **transporter, ferroportin**, then moves **iron** from the **cytoplasm** to the **plasma across the basolateral membrane**. In the form of (Fe^{3+}) .
- The **remainder** is **incorporated into cytoplasmic ferritin** and is lost through the **exfoliation of mucosal cells**

Shedding



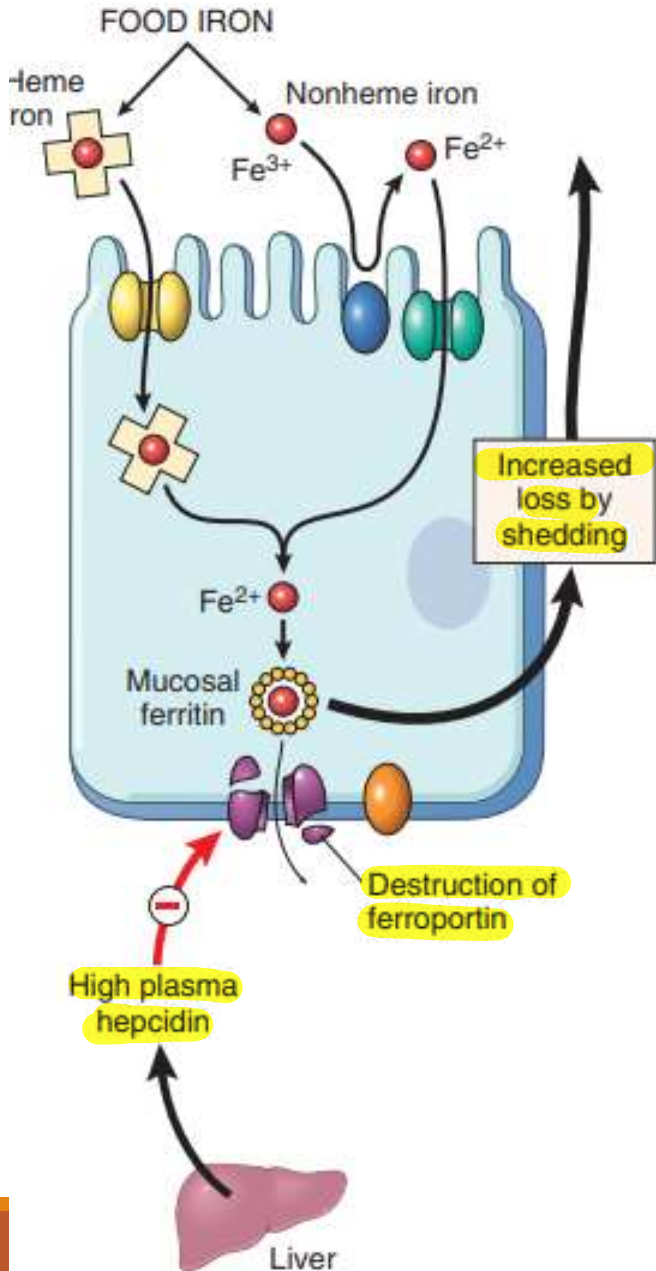
Hepcidin ??

- A small peptide that is synthesized and secreted from the liver in an iron-dependent fashion.
- high iron levels in the plasma enhance hepcidin production, whereas low iron levels suppress it.
- Hepcidin levels rise in the face of systemic inflammation because of the direct effects of inflammatory mediators such as IL-6 on hepatocytes

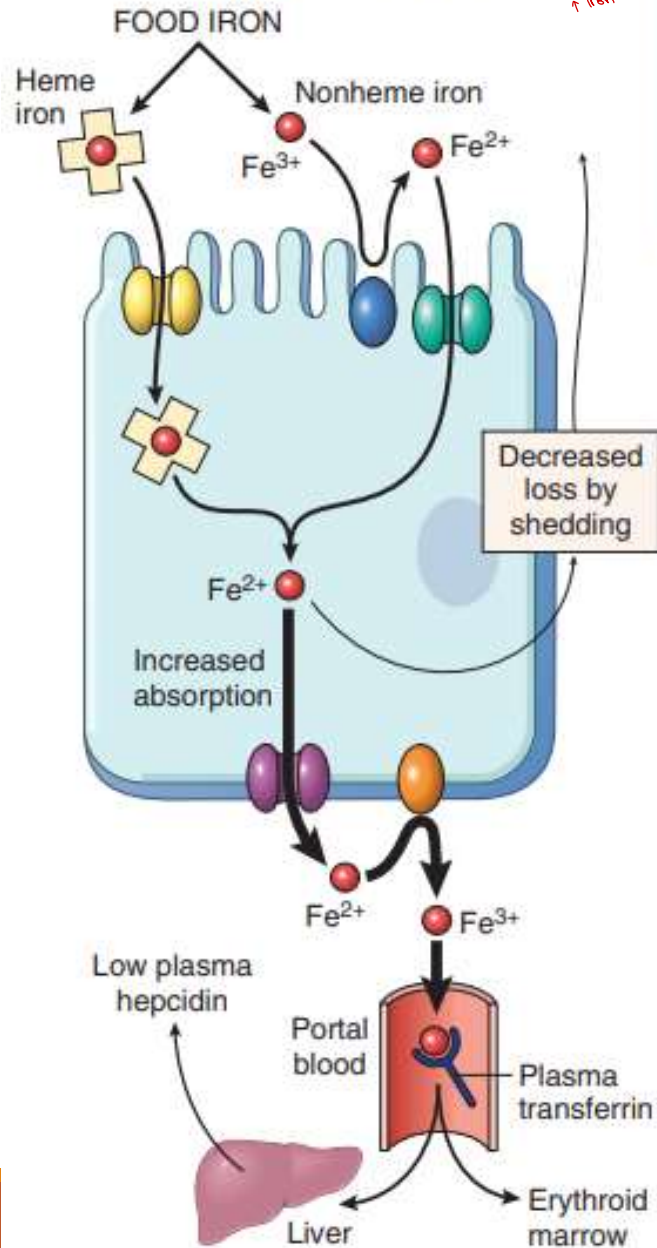
iron ↓ liver ←
high Fe = high hepcidin

infection → ↑ IL-6 in hepatocyte → ↑ hepcidin → ↓ iron transport to the plasma

HIGH PLASMA IRON OR SYSTEMIC INFLAMMATION



LOW PLASMA IRON INEFFECTIVE ERYTHROPOIESIS HEMOCHROMATOSIS



gentic disease
↑ iron
↑ hepcidin
low
→ due to impair of liver function
لا يستطيع الكبد إنتاج الهيبكدين

ETIOLOGY

- **Chronic blood loss:** GI bleeding (e.g., peptic ulcers, colon cancer, hemorrhoids) and the female genital tract (e.g., menorrhagia, endometrial cancer).

↳ excessive menstruation

- **Low intake** and **poor bioavailability** (predominantly vegetarian diets).

- **Increased demands not met** by normal dietary intake: pregnancy and infancy.

الكثير الى ما يحتاجه اول من الى يحتاجها

- **Malabsorption:** e.g.; celiac disease or after gastrectomy

أغلب الحالات التي ترفع
بسبب celiac disease
Animeen يكون

* الناس التي فوق 50 لازم انزل الدم screen على النحو التالي

Breast cancer ← Mammogram ⊕ ← female ←
Cervical " ← Pap smear ⊕ ← female ←
Prostate " ← PSA ⊕ ← male ←
Colon " ← colonoscopy ⊕

Clinical manifestation

- Fatigue and diminished capability to perform hard works.
- Leg cramps on climbing stairs. → تشنجات
- Cold intolerance.
- abnormalities of the fingernails (thinning, flattening, and “spooning,”) and pica

← unusual food
→ پیکو پیکو
اشکیار مویز
ملا زایه حسب



Laboratory manifestation

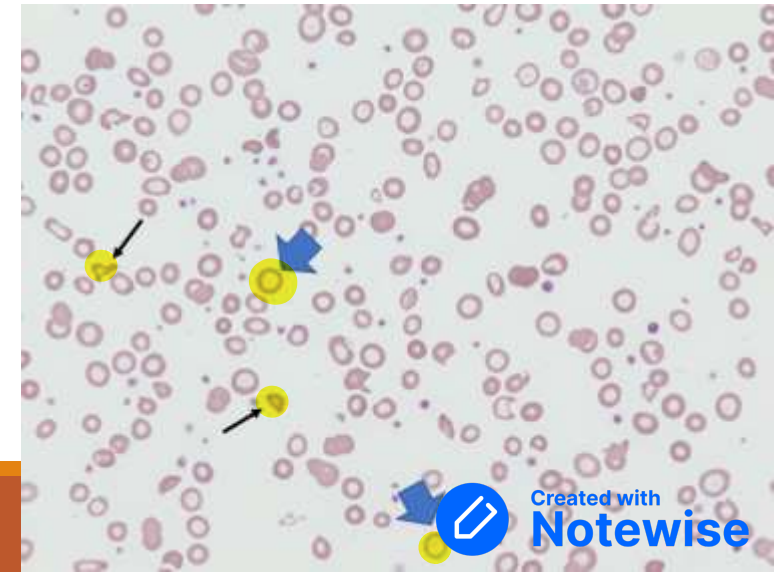
□ Complete blood count (CBC):

microcytic and hypochromic erythropoiesis, decrease in both mean corpuscular volume (MCV) and the mean corpuscular hemoglobin concentration (MCHC).

□ Low serum iron and ferritin levels

↳ iron
work up

□ Peripheral Smear: microcytic and hypochromic red blood cells



B. Anemia of chronic inflammation

Arises from the suppression of erythropoiesis by systemic inflammation:

1. Chronic microbial infection (osteomyelitis, endocarditis).
2. Chronic immune disorders (RA).
3. Neoplasms (Carcinoma or lymphoma)

Anemia of chronic inflammation stems from:

1- High levels of plasma hepcidin, which blocks the transfer of iron to erythroid precursors by downregulating ferroportin in macrophages and duodenum.

**The elevated hepcidin levels are caused by proinflammatory cytokines such as IL-6 (increase hepatic hepcidin synthesis) .

2-Chronic inflammation blunts erythropoietin synthesis by the kidney

block ←

II. Normocytic anemia

- Normocytic normochromic anemia is a type of anemia in which the circulating red blood cells (RBCs) are the same size (normocytic) and have a normal red color (normochromic).
- Normocytic anemia is further divided into 2 broad categories:
 - * anemia with primary bone marrow involvement, include:
 - Aplastic anemia.
 - Myelophthisic anemia.
 - * anemia secondary to underlying disease.

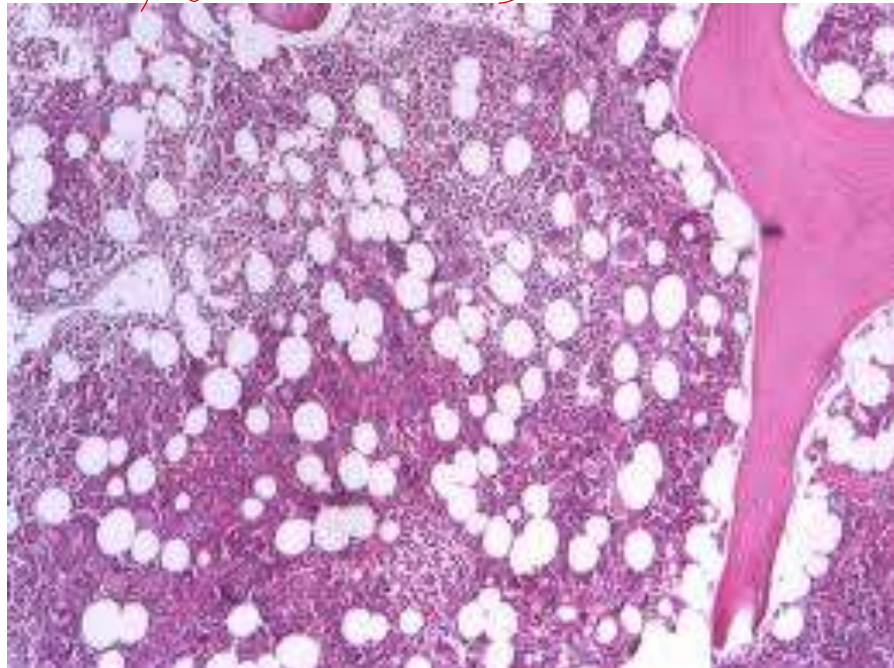
Aplastic anemia

Aplastic anemia is a syndrome of bone marrow failure characterized by peripheral pancytopenia and marrow hypoplasia

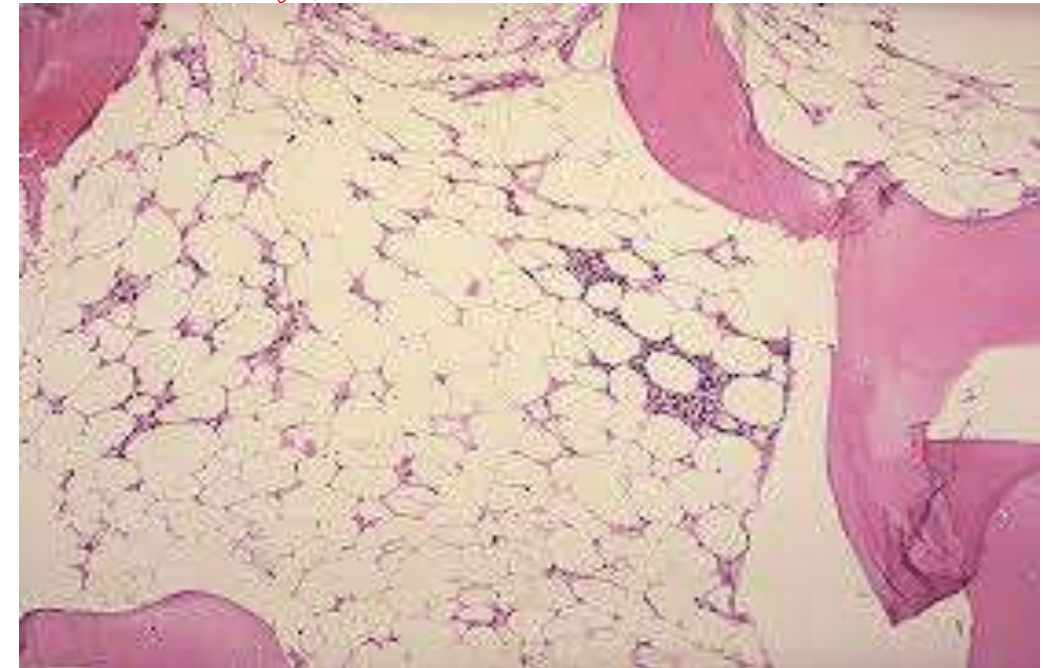
+
low immunity

Normal

high cell



low



Aplastic anemia

- Characterized by marrow failure due to **primary defects** or **damage** to the **stem cell** or the marrow **microenvironment**.
- Mostly (more than **80% of cases**) are **acquired**.
- The clinical presentation includes **signs and symptoms related to the decrease in bone marrow production of hematopoietic cells**:
 - ❖ **Anemia**. → ↓ RBC
 - ❖ **Bleeding**. → ↓ Platelet
 - ❖ **Fever or infections** → ↓ WBC

Myelophthisic anemia

- Myelophthisis is a form of bone marrow failure that results from the destruction of bone marrow precursor cells and their stroma.
- Generally, in myelophthisic anemia, a form of fibrosis, occurs secondary to injury by nonhematopoietic cells or pathogens, which destroys the normal hematopoietic cells and their supportive stromal cells