HLS
Red Cell Disorders
Anemia-I.

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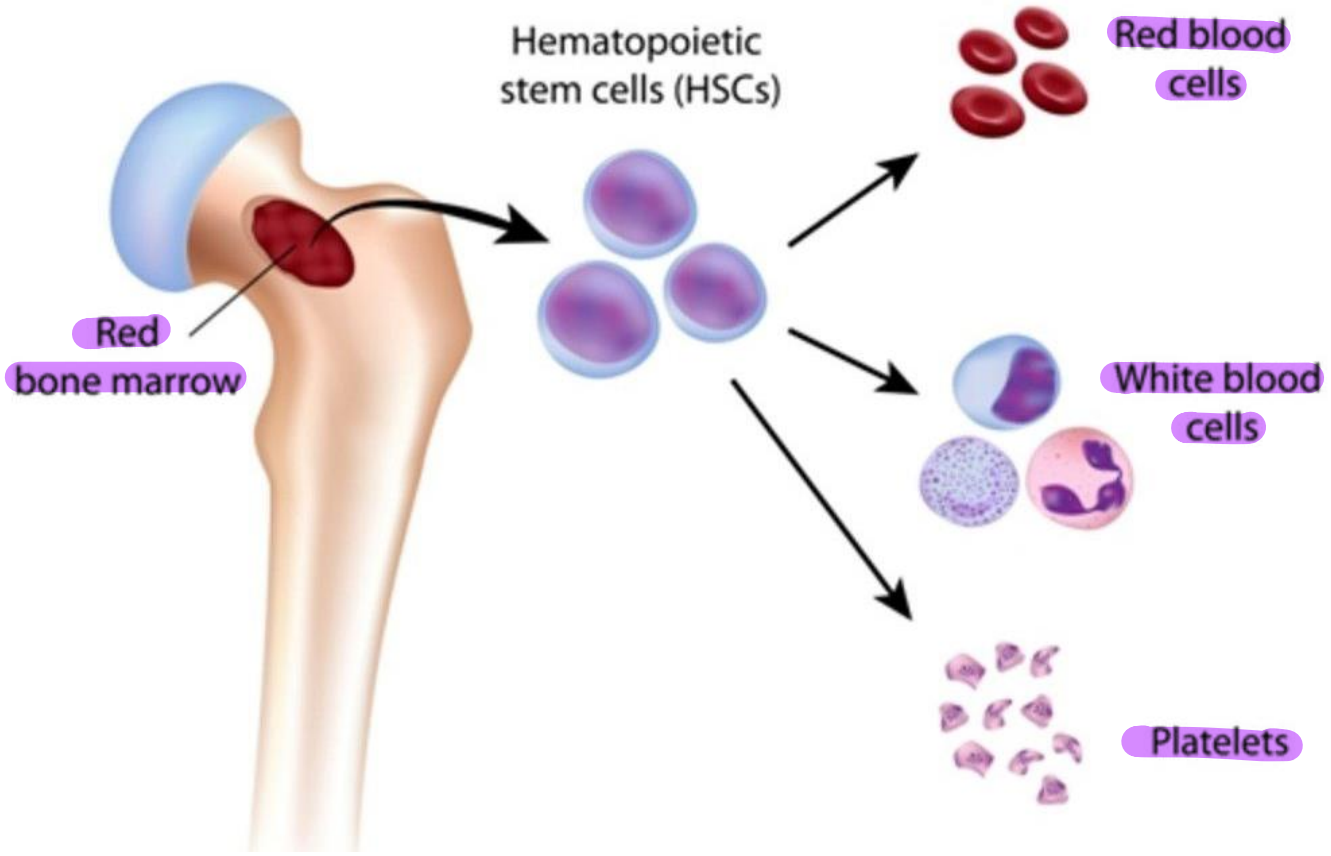
generation or production of red blood cells that exist in bone marrow. from Stem cells → they are called hematopoetic Stem cells

Hematopoiesis



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.

Medical assessment هو يعتبر البداية في أي

CBC

(complete blood count)

Test name	Initial CBC	18 months later	Unit	Reference range
White blood cells (WBC)	1.90	4.25	K/μL	4.5–11.5
Red blood cells (RBC)	3.75	2.47	M/μL	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/μL	150–450
Reticulocyte absolute	0.020	0.128	%	0.5–2

It means size of RBCs

كمية الـ Hg الموجودة في الـ RBCs

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.

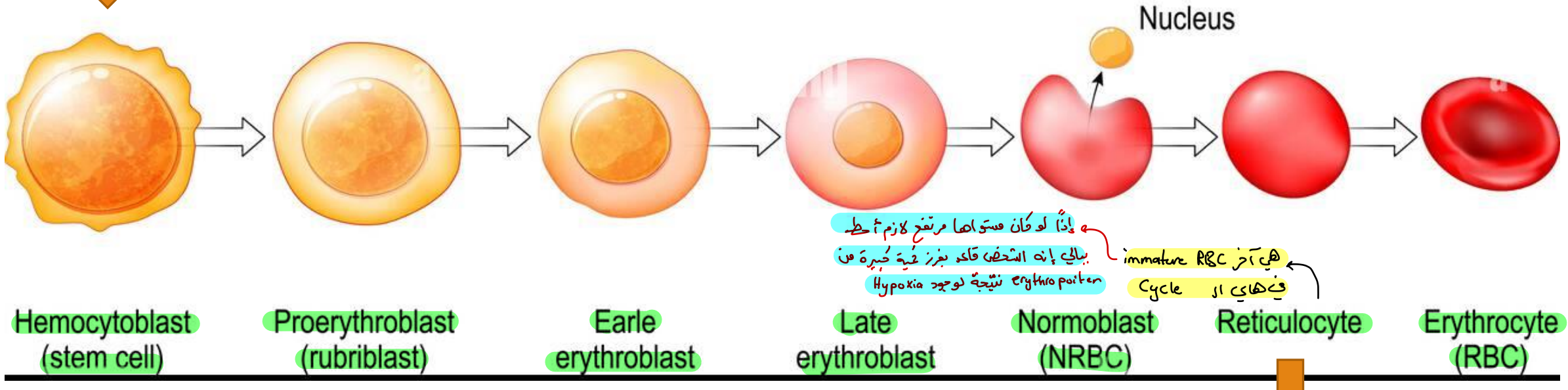
❖ The function of the RBC is to deliver oxygen from the lungs to the tissues and carbon dioxide from the tissues to the lungs. In anemia, a decrease in the number of RBCs transporting oxygen and carbon dioxide impairs the body's ability for gas exchange. ⇝ that's means $\uparrow CO_2$ $\downarrow O_2$ (hypoxia)

Kidney يحصل زيادة في إفرازه نتيجة من
due to hypoxia (stimulus)

Erythropoietin :

ERYTHROPOIESIS

(formation and life cycle of red blood cells)



إذًا لو كان مستواها مرتفع لازم أحط
ببالي إنه الشخص قاعد يفرز خميرة كبيرة من
Hypoxia نتيجة لوجود erythropoiten

immature RBC هي آخر
في هاي ال Cycle

erythroid precursors are released into circulation

Etiology

Genetic etiologies:

- Hemoglobinopathies
- Thalassemias

Nutritional etiologies :

- Iron deficiency. (The most common cause)
- Vitamin B12 deficiency.
- Folate deficiency

They cause megaloblastic anemia

Physical etiologies :

- Trauma.
- Burns.
- Frostbite

ممكن الجندي العسكري
إلي بضل لابس ال shoes
لفترات طويلة يصير عنده نوع
خاص Hemolytic anemia
Secondary to pressure and destruction of RBCs.

- Chronic disease and malignant etiologies.
- Infection.

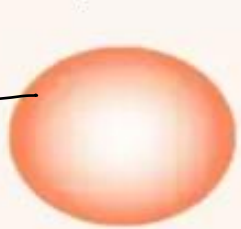
هذا ال classification بعتمد على (MCV)

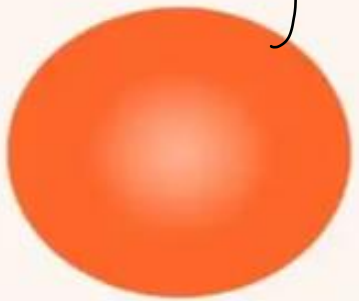
Morphological Classification of Anemia

Morphological-classification-of-anemia

Hypochromatic بكون color ال
لأنه لحمية ال Hg الموجودة قليلة.

Hyperchromatic بكون color ال

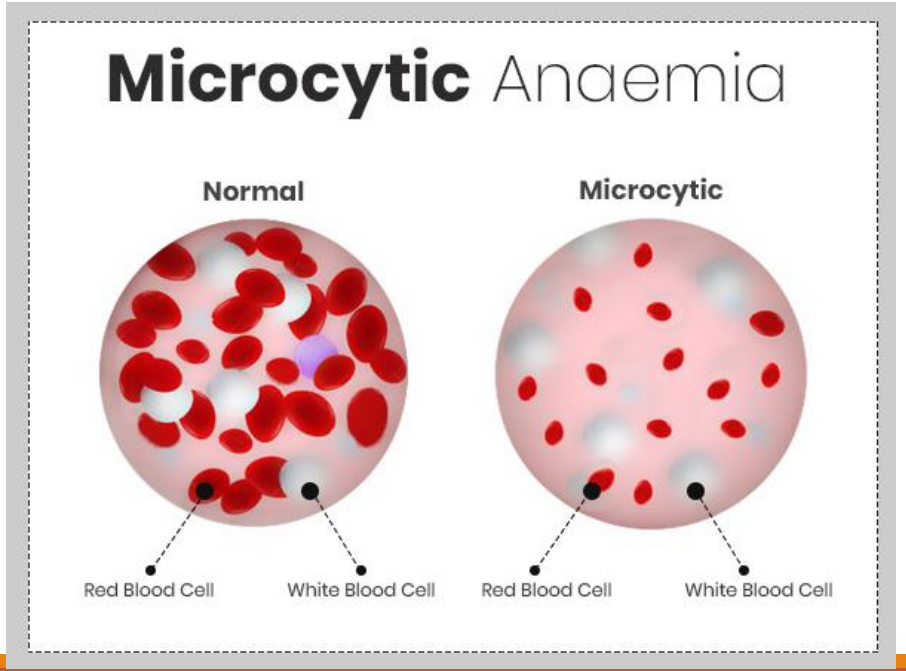




Morphology	Microcytic	Normocytic	Macrocytic
MCV (fL)	<80	80 - 100	>100
Disorders	**T**halassemia **A**nemia of chronic disease **I**ron deficiency anemia **L**ead poisoning **S**ideroblastic anemia	**H**emolytic anemia **A**nemia of chronic disease **R**enal disease **A**cute blood loss **B**one marrow failure **A**plastic anemia	**M**egaloblastic anemia **A**lcoholism **L**iver disease **M**yelodysplasia

I. Microcytic anemia

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



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)

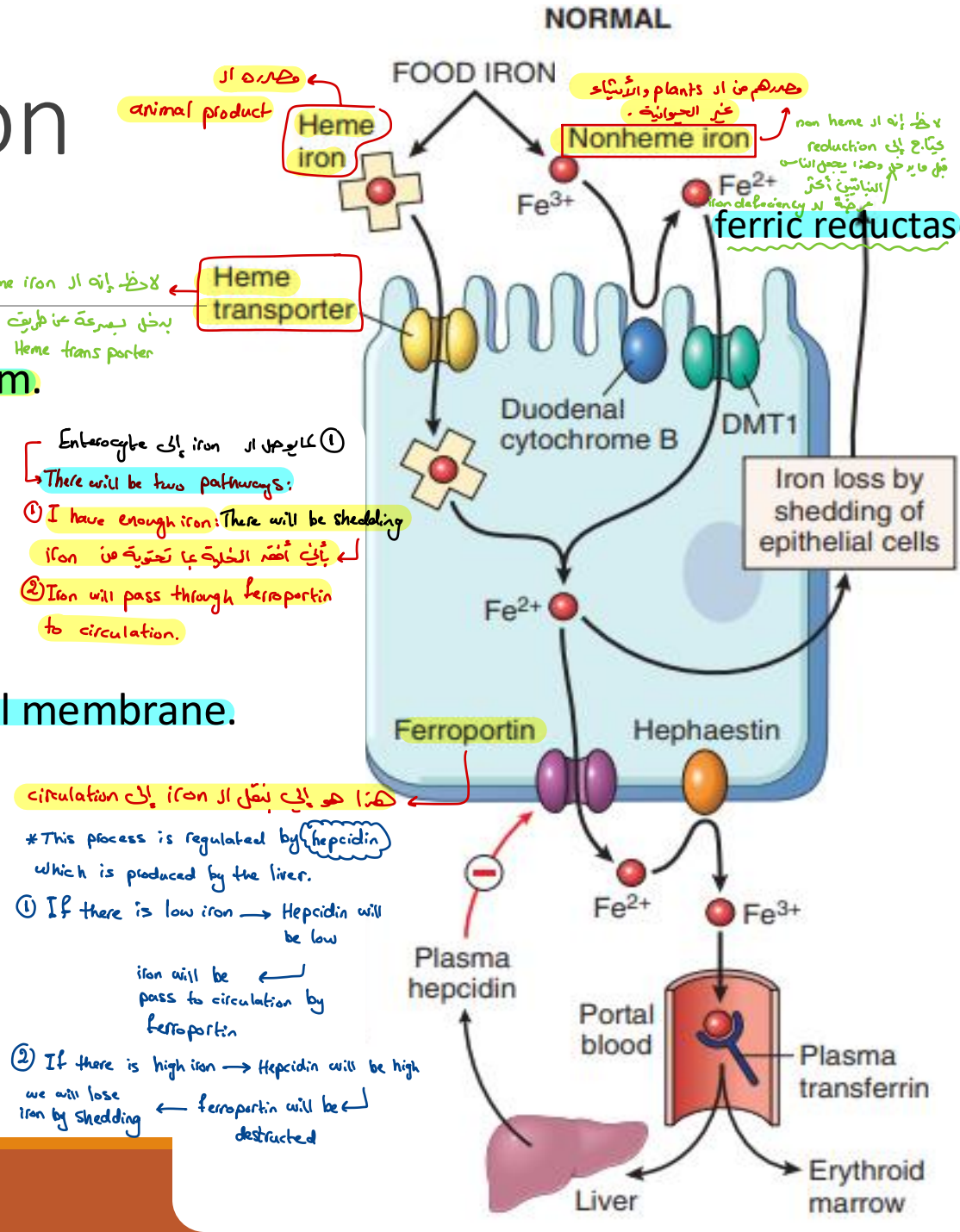
Iron storage:

1. liver
2. Spleen
3. Bone marrow
4. Skeletal muscles.

Regulation of iron absorption

- Regulation of iron absorption occurs within the duodenum.
- (Fe2+) 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 (Fe3+).
- The remainder is incorporated into cytoplasmic ferritin and is lost through the exfoliation of mucosal cells (Shedding)

This is the storage form

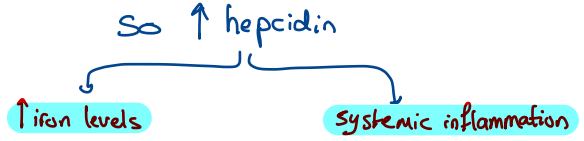


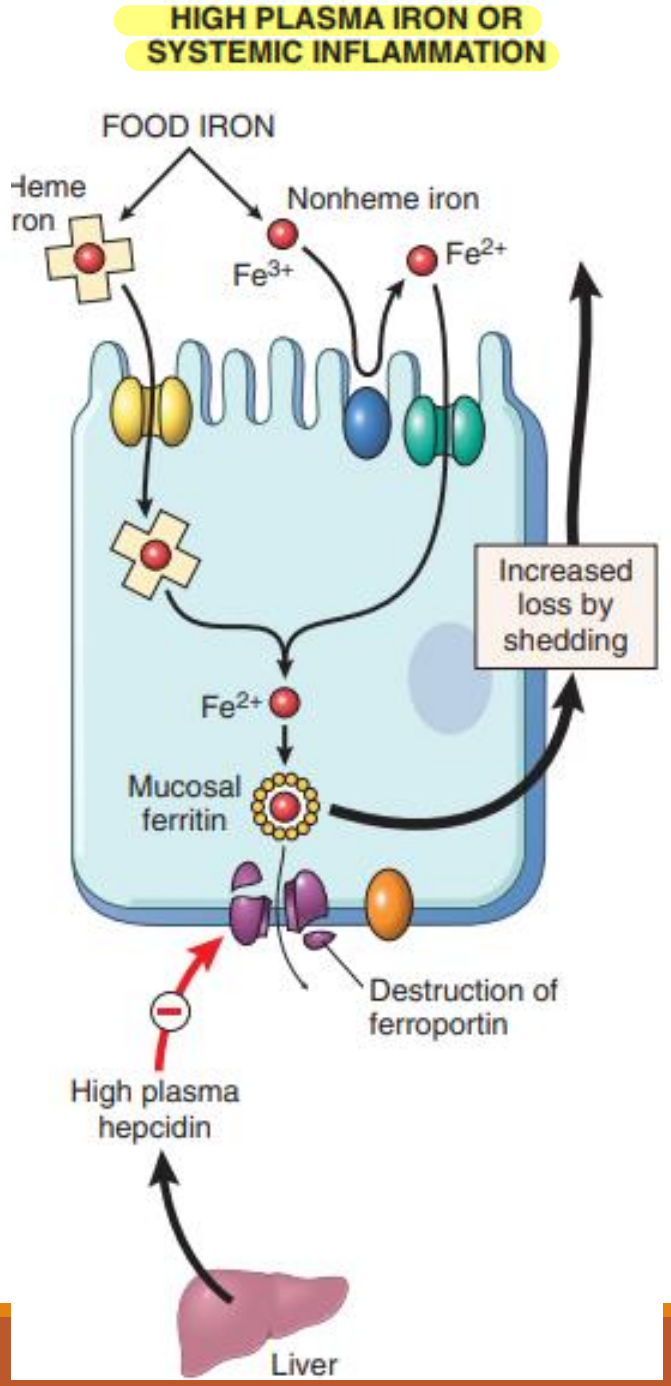
Hepcidin ??

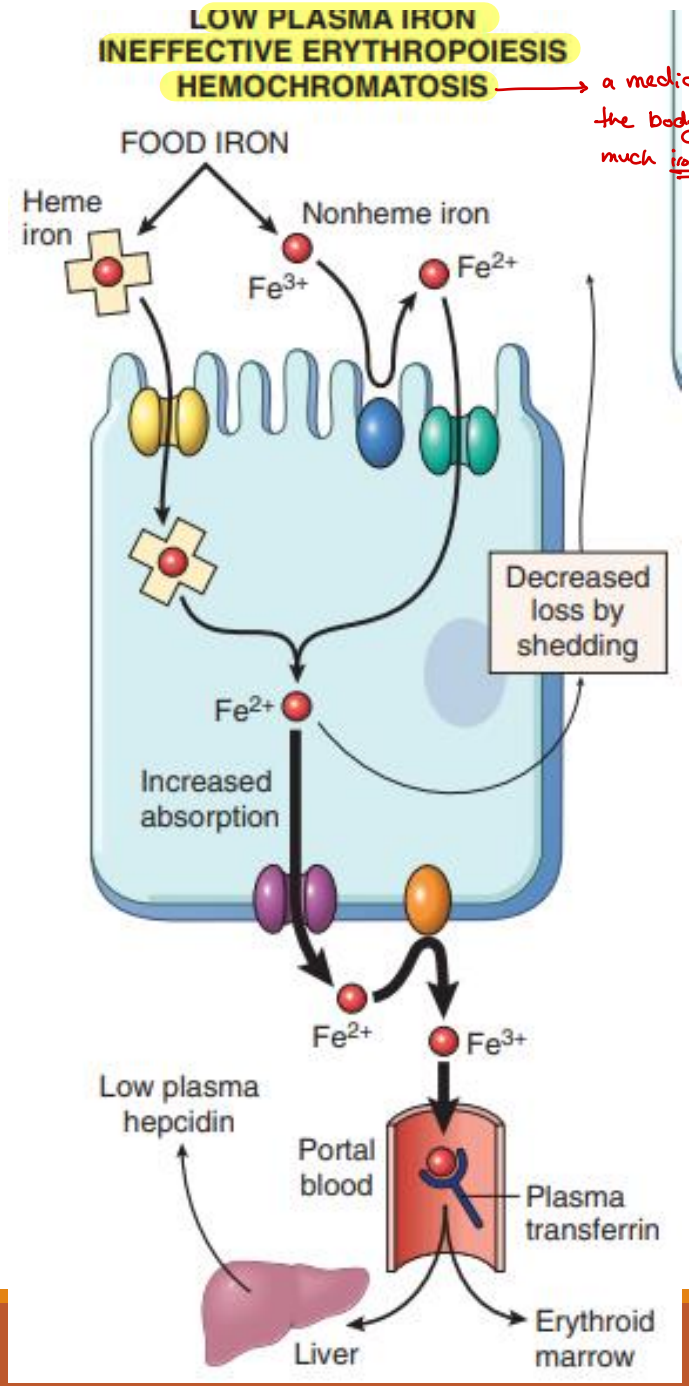
- A small peptide that is synthesized and secreted from the liver in an iron-dependent fashion.

- 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







a medical condition in which the body absorb and stores too much iron.

ETIOLOGY of iron deficiency Anemia:

- Chronic blood loss: GI bleeding (e.g., peptic ulcers, colon cancer, hemorrhoids) and the female genital tract (e.g., menorrhagia, endometrial cancer).
  - menorrhagia → heavy or prolonged menestrual bleeding.
  - endometrial cancer → cancer in endometrium which is the inner lining of uterus.
- Low intake and poor bioavailability (predominantly vegetarian diets) .
- Increased demands not met by normal dietary intake: pregnancy and infancy.
- Malabsorption: e.g.; celiac disease or after gastrectomy
  - celiac disease → an illness caused by immune reaction to eating gluten.
  - gastrectomy → عمليات قص المعدة .

Clinical manifestation

- Fatigue and diminished capability to perform hard labor. (المريض بجهد يتعب بسرعة)
- Leg cramps on climbing stairs. (بجهد يشعر بتقلصات في رجليه.)
- Cold intolerance. (ما بدفأ)
- abnormalities of the fingernails (thinning, flattening, and "spooning,") and pica

لـ بجهد يشتهي ويأكل أي اشي قذر.

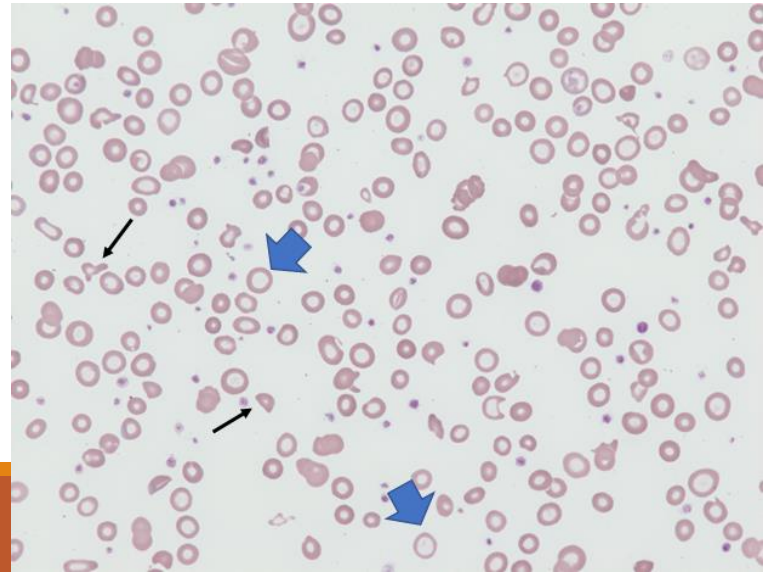
Laboratory manifestation

- Complete blood count (CBC): → we will find: low Hg, low MCV, low MCHC

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

- Low serum iron and ferritin levels

- 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).

inflammation of bones and muscles

2. Chronic immune disorders (RA).

3. Neoplasms (Carcinoma or lymphoma)

(They are both malignant)

originated from epithelial tissue as lung, breast and colon

originated from lymphoid cells.

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

لـ خصوصًا إذا كان عند الشخص
Chronic renal inflammation.

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.

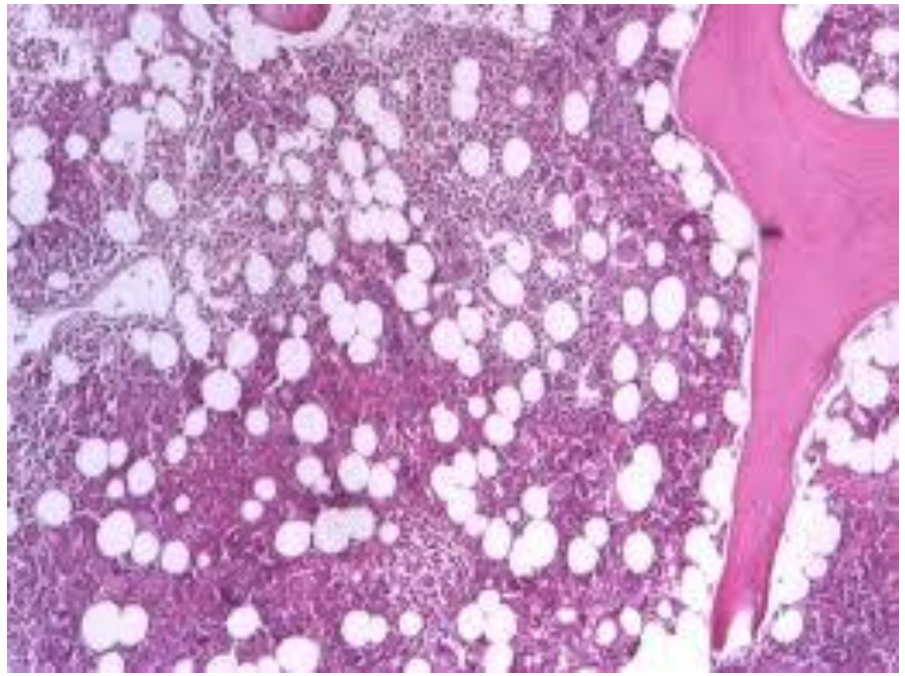
Aplastic anemia

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

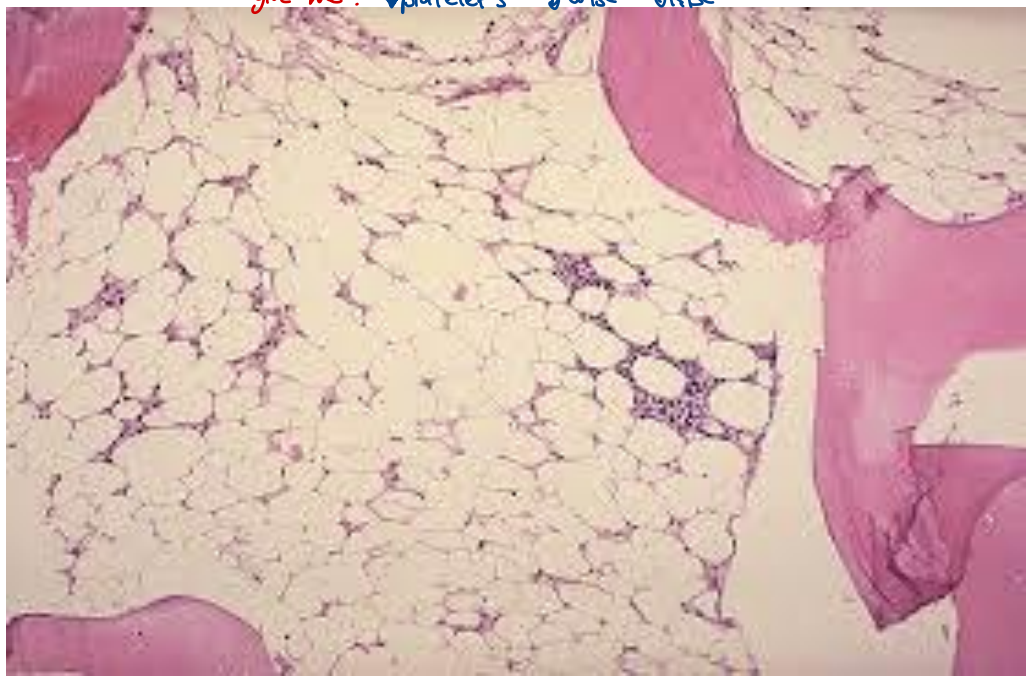
↓ blood cells

no stem cells in bone marrow.

Normal bone marrow



Abnormal → no stem cells
→ there will be fat
↳ so there will be bone marrow failure
→ CBC will give me: ↓platelets ↓WBC ↓RBC



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.

→ They are related to pancytopenia

- The clinical presentation includes signs and symptoms related to the decrease in bone marrow production of hematopoietic cells:

❖ Anemia. (Low RBCs)

❖ Bleeding. → (low platelets)

❖ Fever or infections (Low WBCs)

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

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