

Anemia

• **Anemia**: low O_2 carrying capacity in blood.

• Types of Anemia

Iron deficiency anemia

- **symptoms**: shortness of breath, fatigue, increase work load on heart (Tachycardia), dizziness.

- Hemoglobin composed of Globulin protein + heme $\begin{cases} \rightarrow \text{Protoporphyrin IX} \\ \rightarrow \text{iron} \end{cases}$ $\rightarrow$ low amount of iron $\rightarrow$ low amount of Hemoglobin $\rightarrow$ small RBC (since it's sac of Hemoglobin).

- **lab test**:

MCV (mean corpuscular volume) will be < 90 , we call this case **microcytic** = small RBC = small Hb = small O_2 .

- **causes**:

blood loss, ulcer, menstruation, low iron diet.

- **treatment**:

iron replacement.

Pernicious Anemia (B-12, folic acid deficiency)

• **Vit B12 (naturally)**: Parietal cell in stomach secrete intrinsic factor, B12 bind to IF, this binding important for vit B12 absorption into bloodstream.

$\rightarrow$ In case of Autoimmune disease $\Rightarrow$ vit B12 will not bind to IF $\Rightarrow$ No absorption of vit B12.

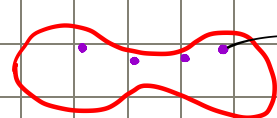
Vit B12 is needed for nuclear maturation and condensation. (DNA synthesis) (البروتين (Hb) ما يتأثر لأنه مادة RBC قبل طيها فقط الفقرة ما بتغير، مش بتؤثر على DNA)

Folic Acid $\rightarrow$ same thing!

- **lab test**:

MCV will be > 90 , we call this case **macrocytic** - large cell $\Rightarrow$ they have short life span with less surface area $\rightarrow$ less O_2 !!

Hereditary spherocytosis



$\rightarrow$ spectrin/Ankyrin Proteins. In Hereditary spherocytosis (genetic disease) include mutation in genes for these protein, so RBC become spherical! $\Rightarrow$ less O_2 !!

- **Spherical cells** can stick easily to blood vessels, so when they reach spleen (for breaking down RBC) **splenomegaly** will happen

- **lab test**:

Coombs test

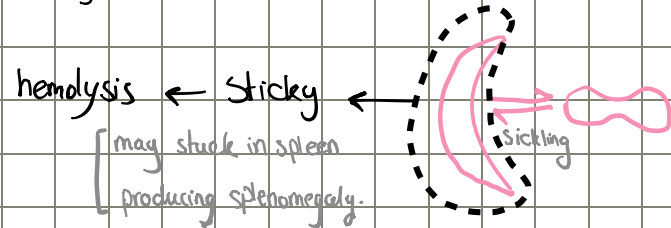
In normal red blood cell (RBC) development, the immature cells in the bone marrow undergo several divisions. During these stages, the nucleus gradually becomes smaller and more condensed, a process known as nuclear condensation, while the cytoplasm matures by accumulating hemoglobin. Eventually, the condensed nucleus is expelled, forming a mature RBC that no longer contains a nucleus. However, in vitamin B12 or folate deficiency, DNA synthesis is impaired, which slows nuclear development while RNA and protein synthesis continue at a normal rate. As a result, the nucleus remains immature and less condensed, whereas the cytoplasm appears more mature. Because DNA synthesis is defective, cell division occurs less frequently, so the developing cells remain larger than normal. This leads to the formation of megaloblasts in the bone marrow and macrocytic RBCs in the blood.

G6PDH deficiency

- RBC can't do aerobic respiration, they can do glycolysis (Glu → pyruvate) and Pentose Phosphate Pathway

Sickle cell Anemia (Hbs)

Hb A → normally we have glutamate at 6th AA, here we find valine! ⇒ Hb molecules start to bind to each other (polymerization), **Sickle shape!**
If O₂ is bind to Hb → de polymerization will happen---



Aplastic Anemia

misnomer! since all blood cells types are affected...

Cause:

bone marrow destruction because of chemotherapy... → ↓RBC, ↓Platelets, ↓granulocyte] we call this case **Pancytopenia**
↑bleeding ↑infection

Thalassemia

genetic disease, 2 types

- α Thalassemia → lose α chain
- β Thalassemia → lose β chain

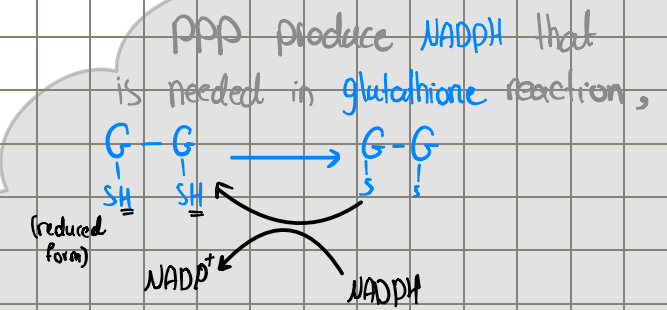
smaller Hb = smaller cell.

-lab test

MCV < 90 (microcytic)

-Ideal treatment:

stem cell transplant!



we need Glutathione in reduced form

since it reacts with ROS donating its electrons

oxidized form ← ذلك يكون المركب، حج لا ROS يتحدار

we need NADPH to keep glutathione in reduced form

we get NADPH from PPP that depend on G6PD enzyme

* طاقى از ايم ← Glutathion ← بتفرد ROS ← بتفكر (البيروكسيد)

Heinz bodies are clumps of damaged hemoglobin inside red blood cells that indicate injury

Heinz body decrease RBC flexibility → Hemolysis!

إفراج بعد 23 سنة سجن! وبصفة تبادل وإلا فالحكم مؤبد.

كم منا من كان يحمل همهم في العقدين الماضيين؟ ولا يزال بقي الكثير منهم في سجون الكيان وفي سجون غيره من شرق العالم إلى غريه؛ فكم منا من ينظر بعين المستضعفين لا بعينه فقط؟

وقد كان النبي ﷺ يقنت "اللهم نج المستضعفين من المؤمنين" ويوصي قائلاً "فكوا العاني" أي الأسير.