النادي الطبي MC راضي

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&
Anonymous member

لا تنسونا من دعائكم بالتوفيق

(male & female) الدكتورة ركزت على الفرق تاعت الـ

مهم

P1

- The most important content of RBCs is Hb. K^+ is the principal intracellular cation, and carbonic anhydrase (CA) is an enzyme present in RBCs, which is essential for the transport of CO_2.

+ جزء النقطة مهمة

Characteristics of human red cells.

حفظ

		Male	Female
Hematocrit (Hct) (%)		(40-50) 47	42 (37-47)
Red blood cells (RBC) ($10^6/\mu L$)		(4.5-6) 5.4	4.8 (4-5.5)
Hemoglobin (Hb) (g/dL)		(15-16) 16	14 (13-14)
Mean corpuscular volume (MCV) (fL)	$=\frac{Hct \times 10}{RBC\ (10^6/\mu L)}$	87	87
Mean corpuscular hemoglobin (MCH) (pg)	$=\frac{Hb \times 10}{RBC\ (10^6/\mu L)}$	29	29
Mean corpuscular hemoglobin concentration (MCHC) (g/dL)	$=\frac{Hb \times 100}{Hct}$	34	34

كمية Hb في 100 ml blood

(M C V) (RBC) كم حجم الـ

one single RBC كمية Hb في

M C H — average of (Hb) in a single RBC

M C H

RBCs Indices (reflect the functional characteristics of RBCs)

Plasma Proteins

P1

- (Albumin) عند أعلى تركيز و أقل حجم
- النسبة (A/G) بتختلف لو صار في مشكلة في الكبد أو الكلى بالنسبة لـ (A) أو التهاب أو حمى بالنسبة لـ (G) تحديداً Gamma (γ) وقتها بتقل هاي النسبة

Sites of Formation of Plasma Proteins:

-Albumin, fibrinogen, and prothrombin are synthesized in the liver.

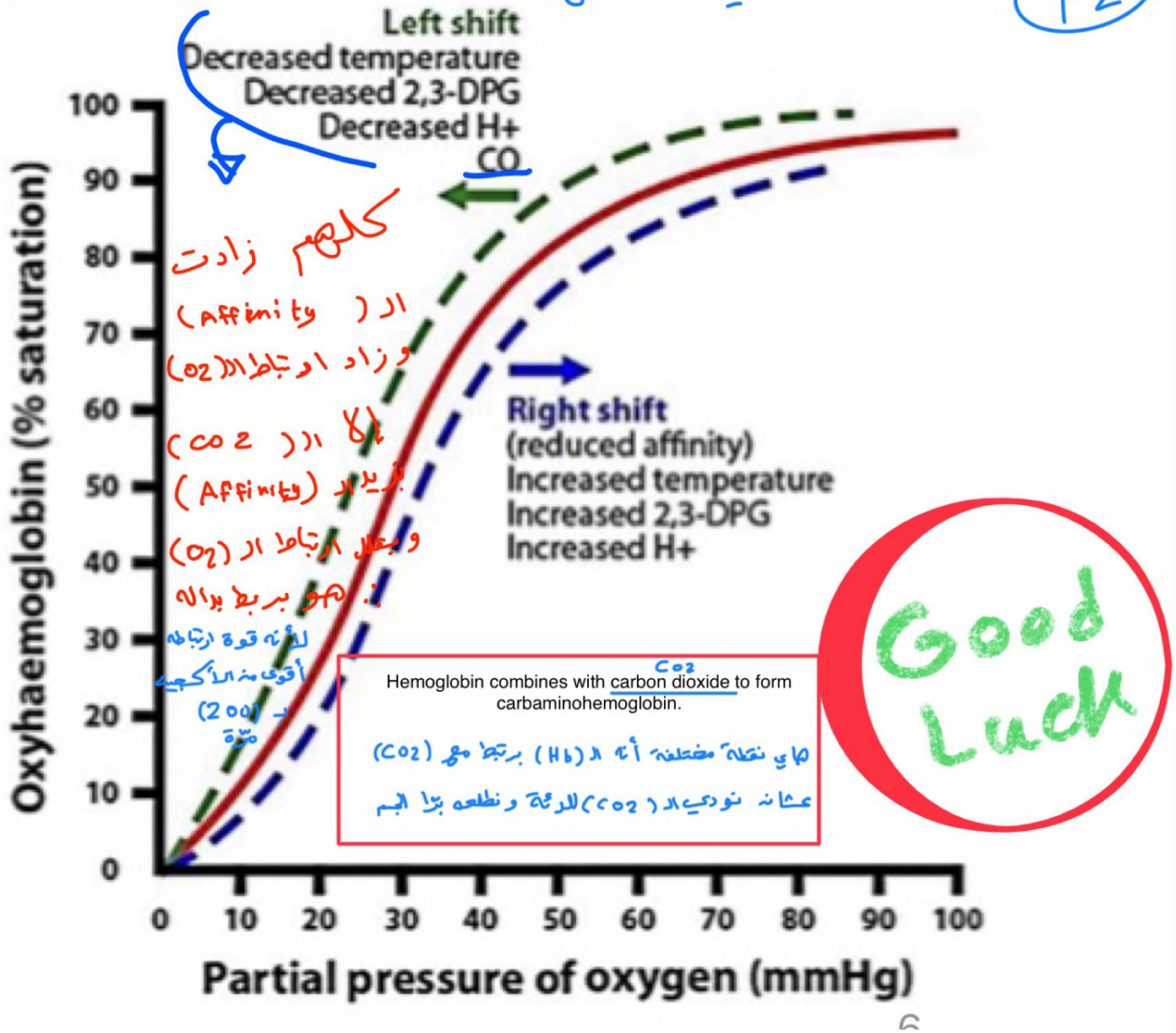
-Globulins: 50% are synthesized in the liver, and 50% (γ globulin) are synthesized in the plasma cells of the reticuloendothelial system (RES), a diffuse system of cells presents in the liver, spleen, lymph nodes, and bone marrow.

Albumin/Globulin Ratio (A/G):

The A/G ratio is 1.5 to 2.5:1.

العوامل اللي بتأثر على الـ (Affinity of Hb Binding)

P2



3-Hemoglobin reacts with carbon monoxide (CO) to form carboxyhemoglobin. CO combines with iron and displaces oxygen; thus, it prevents hemoglobin from carrying oxygen. The affinity of hemoglobin for CO is 200 times that of oxygen.

P 2

- Adult Hb (HbA) : 2α : 2β

P2

- ↓ 3% HbA2 : 2α : 2δ

- HbA1c : glucose attached to the terminal valine in each B chain (يستعمل لقياس استجابة الجسم لعلاج السكري)

- Fetal Hb (HbF) : 2α : 2γ (its affinity is more than HbA affinity)

- in young embryos : Gower 1 Hb & Gower 2 Hb

- وأخيرا بدي اياك تحوش أنه الـ (RBCs) بالأجنة بتكون بال (yolk sac and then liver+spleen) وبالجوف بالـ (BM) زينا

Erythropoietin hormone:

Sources: In adults: 85% are produced in the kidneys and 15% in the liver. Therefore, anemia develops in kidney diseases and nephrectomy, as the liver cannot compensate for the erythropoietin deficiency.

P3

Hematopoietic growth factor (EPO)

-Stimulation of secretion of EPO

-Hypoxia is the main stimulus.

-Conditions that increase Oxygen hemoglobin affinity increase Erythropoietin secretion like Alkalosis or other causes of oxy-Hb dissociation curve to be shifted to the left.

-Cobalt salts and androgens.

-Beta-adrenergic agonists and adenosine.

P3

B. Iron:

-Most dietary iron is ferric (Fe^{3+}), which is reduced by **stomach HCl** & **vitamin C** (ascorbic acid) to ferrous (Fe^{2+})→ more readily absorbed.

Vitamin B_{12} (Cyanocobalamine = Extrinsic Factor)

Causes of vitamin B_{12} deficiency:

a. absence of intrinsic factor due to atrophy of the gastric mucosa. The anemia, which develops due to the absence of intrinsic factors, is known as *pernicious anemia*.

b. Liver diseases: as they result in defective storage of the vitamin.

c. disease or surgical resection of the terminal ileum.

d. Very rarely, there is deficient vitamin B_{12} in the diet.

to ferrous the anemia, which develops due to vitamin B_{12} deficiency, is also called *megaloblastic* or *Macrocytic anemia*

E. Hormones:

Several hormones increase the rate of erythropoiesis, including_Thyroxin, Androgens, and Glucocorticoids.

P4

Erythroblastosis Fetalis: (hemolytic disease of the newly born).

لما يكونه عند الأم دم زمره Rh^-

ويكونه زوجها Rh^+ ويطلع الجنين Rh^+ عندها الأم رح توخذ (Ab for Rh) ولو تكرر الحمل بجنين (Rh+) أوكانت ماخذه نقل دم من شخص عندو (Rh+) عندها الـ (Ab) بتخترقه المشيمة وبتتفاعل ماد التفاعل وبتسبب مشاكل خطيرة للجنين منها الصفرة والأنيميا و اختراق الـ (Billiro bin) للـ (B . B . B) Blood Barrier Brain والتسبب تؤثر على الدماغ (Kernicterus) و بتخترقه المشيمة بسهولة لأنها IgG صغيرة وبتخترقه بسهولة

hemolytic disease of the newborn (HDN) in ABO incompatibility

أقل خطورة و بتحدث لما يصير اختلاف بين زمره دم الأم و الجنين وهي أقل خطورة عشان ① IgM أكبر من IgG فصعب تخترقه

② الـ (Ab) اللي بيجوا من الأم قلال ③ الـ (Ag) اللي على سطح الكريات الحمر تبعت الجنين قلال

acute hemolytic transfusion reaction. Caused by: →

incompatible blood is transfused, By (mismatched transfusion), By

agglutination of the donor's red cells followed by their hemolysis.

Classification of Anemia

P4

1. **Microcytic Hypochromic Anemia (Iron Deficiency Anemia)**: In this type of anemia, the size of RBCs is smaller than normal (Microcytic), and their hemoglobin content is less than normal (hypochromic). It is caused by iron deficiency.
2. **Macrocytic Anemia (Megaloblastic Anemia):** In this type of anemia, the size of RBCs is larger than normal. It is caused by vitamin B_{12} or folic acid deficiency.
3. **Normocytic Normochromic Anemia:** In this type of anemia, the size of RBCs and their Hb content are normal, but their number is decreased.

-Causes of normocytic normochromic anemia:

Acute Blood Loss (Hemorrhagic Anemia): In sudden and rapid hemorrhage, the body replaces plasma within 1-3 days, but bone marrow cannot replace RBCs that quickly. Therefore, RBCs become diluted in plasma. RBCs count returns to normal within 3-4 weeks.

Bone Marrow Depression (Aplastic Anemia): Depression of the bone marrow will decrease all blood elements (RBCs, WBCs, and platelets). It may be due to : exposure to X-rays and atomic irradiation, malignancy or viral infection and drugs.

Excessive Breakdown of RBCs (Hemolytic Anemia): may be due to intrinsic or extrinsic factors.

- *Intrinsic factors: as in sickle cell anemia and G6PD deficiency.*
- *Extrinsic factors: as in*

a. Infections, e.g., streptococci and malaria
b. Chemical poisons, e.g., benzene derivatives
c. Incompatible blood transfusion
d. Snake venom.

Good Luck

PLATELETS (THROMBOCYTES)

P5

HEMOSTASIS

The Hemostatic process consists of the following:

D. **Limitation Reaction to Dissolve Clot** after wound healing.

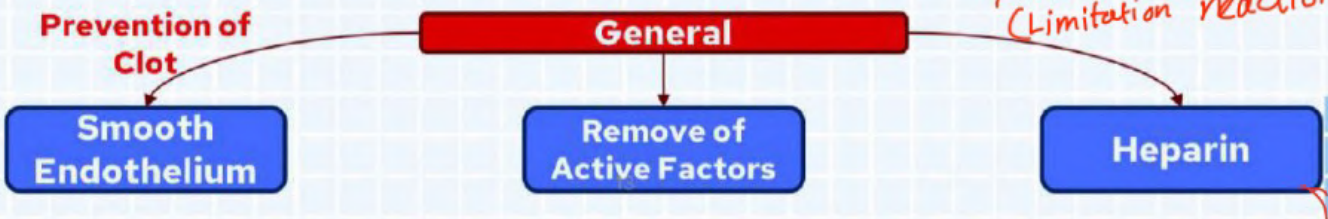
Anticlotting Mechanisms = Limiting Reactions

The Tendency of blood to clot is balanced in Vivo by limiting reactions that prevent blood clotting in healthy Blood vessels and break down any clots already formed.

A. **General Limiting Reactions:**

1. **Smooth Vascular Endothelium** prevents activation of platelets & factor XII.
2. **Rapid Blood flow Removes Activated Clotting Factors and inactivates them in the liver.** So, slow blood flow favors Intravascular Thrombosis.
3. **Heparin** is a natural Anticoagulant present in the blood.

Anti Clotting mechanism (Limitation reaction)



HEMOSTASIS

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B. Specific limiting reactions:

1. **Thromboxane A2 and Prostacyclin:** The formation of **Thromboxane A2** at the site of Blood vessel injury allows clot formation, while the synthesis of **Prostacyclin** by healthy Endothelium prevents the spread of the blood clot to neighboring healthy areas and obstruction of the lumen of blood vessels.
2. **Antithrombin III:**
   This Circulating Inhibitor of Blood Coagulation binds to active factors **II, IX, X, XI,** and **XII**, blocking their activity. This binding is facilitated by Heparin.
3. **The Fibrinolytic System:**

- **Thrombomodulin** is produced by most Endothelial cells. This protein binds Thrombin to form the Thrombomodulin-Thrombin complex, which activates protein C.
- **Activated protein C** (APC) causes:
  - Inactivation of factors Va and VIIIa, and
  - Inactivation of the inhibitor of tissue Plasminogen activator (tPA)=(TPA-I), increases the formation of plasmin.
- **Plasmin** (fibrinolysin) lyses **Fibrin** and **Fibrinogen**, forming **Fibrinogen Degradation Products** (FDP), inhibiting **Thrombin**.

PLATELETS (THROMBOCYTES)

P5

Anticoagulants:

B. In Vivo Anticoagulants:

They prevent Blood clotting inside the body.

	Heparin	Dicumarol
Origin	Mast Cells & Basophils.	Plants
Mode of Action	Facilitates action of Antithrombin III (Inactivates II, IX, X, XI, XII)	Competitive Inhibition of Vitamin K on its receptors in the liver → inhibits the formation of II, VII, IX, X.
Site of Action	In Vivo and in Vitro	Only in Vivo
Onset	Rapid	Slow
Duration	Short	Long
Administration	Intravenous (IV) and Subcutaneously (SC)	Orally
Antidote	Protamine Sulfate 1% Fresh Blood transfusion	Vitamin K Fresh Blood transfusion

Clotting Factors

P5

1. **Fibrinogen Group :**
   - I , V, VIII & XIII (13 = 8+5 ,1) .
   - Activated by Thrombin.
   - Not present in Serum.
2. **Prothrombin Group :**
   - II, VII, IX & X (1972) .
   - Need Vitamin K for synthesis
   - Prothrombin is Not present in serum.
3. **Contact Group :**
   - XI and XII.
   - Present in serum

Leukocytes

A - 1

Divided into:

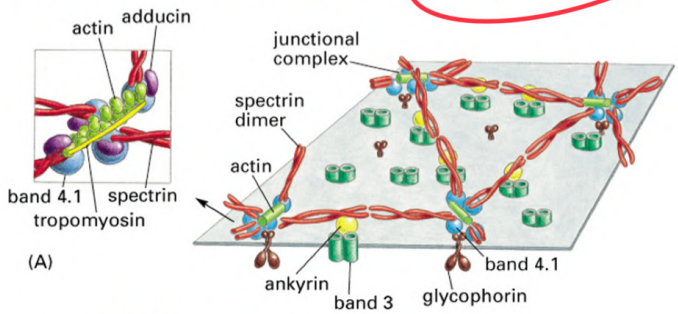
(Granulocytes possess **Azurophilic granules** (Lysosomes))

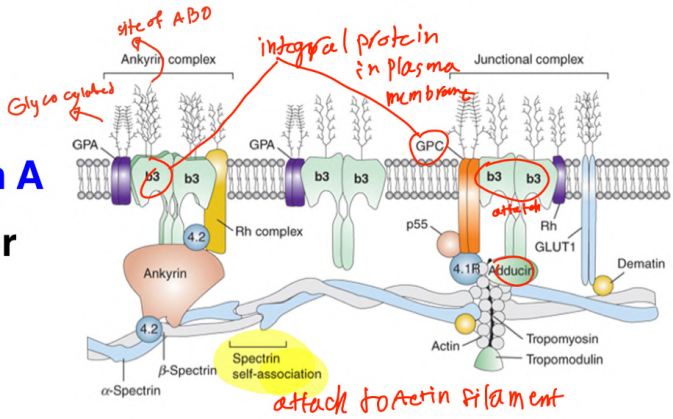
- **Granulocytes containing specific granules**
- **Agranulocytes containing no specific granules**
- **Granulocytes include:**
  - **Neutrophils**: Constitute 60-70% of leukocytes in blood / Nucleus with 2-5 lobes / Secrete many chemokines (to attract) other leukocytes and cytokines
  - **Eosinophils**: 1-4% leukocytes / Nucleus with 2 lobes / Internum (Arginine Rich) (Basic Protein) / Removal of antigen-antibody complex
  - **Basophils**: <1% of leukocytes / irregular lobes / obscuring the nucleus / Contain histamine, heparin (Metachromasia)
- **Agrnulocytes include:**
  - **Lymphocytes**: Constitute 30% of leukocytes / 6-8 : small, more than 9 : Medium, 18 : large / B-lymphocytes / T-lymphocytes (CD_4, CD_8, CD_{25})
  - **Monocytes**: 2-8% of leukocytes / Oval, horse-shoe, or kidney-shaped nucleus (connective tissue) (macrophage)

Red Blood Cell Membrane Skeleton

A-1

- **Glycophorin A** and **Band 3** act as ion channels and anion transport
- **Ankyrin**, **Adducin**, and **Band 4.1** anchor **spectrin** to **glycophorin C** and **band 3** proteins
- **Spectrin** forms a lattice and bound to **actin filaments**
- **Glygocylated** domains of **Glycophorin A** and **Band 3** includes **antigenic** sites for **ABO** blood typing





Thymus

A-2

مهم Q

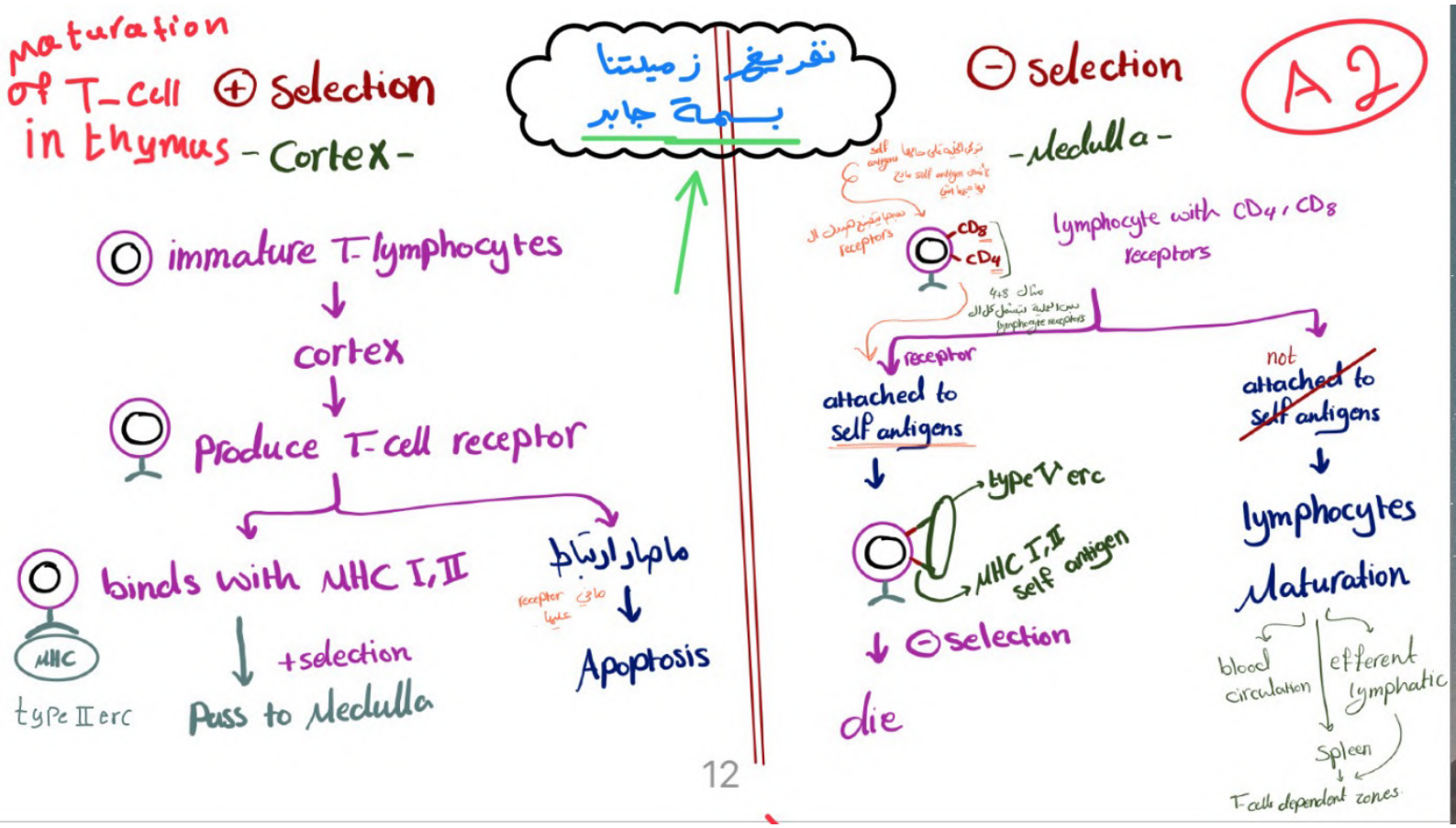
- Location : in the mediastinum , retrosternally
- Development : from the third pharyngeal pouch
- growth :

الدكتور ممكن أجيب سؤال عنها بطريقة أو بأخرى

مهم Q

thymus has no B-cells

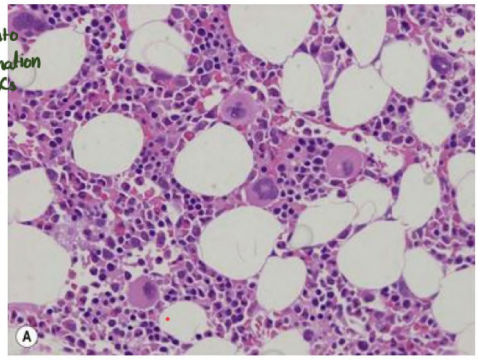
- when T-cells become mature (just 2% will reach maturity) they will inter medulla (98% will die) → the medulla color is lighter


maturation
of T-cell ⊕ selection
in thymus - Cortex -
immature T-lymphocytes
cortex
produce T-cell receptor
binds with MHC I, II
MHC
type II erc
+selection
Pass to Medulla
ماطار ارتباط
Apoptosis
نفريغ زميلتنا
بسمة جابر
⊖ selection
- Medulla -
A2
lymphocyte with CD4, CD8
receptors
CD8
CD4
receptor
attached to
self antigens
not
attached to
self antigens
type V erc
MHC I, II
self antigen
⊖ selection
die
lymphocytes
Maturation
blood
circulation
efferent
lymphatic
spleen
T-cells dependent zones

Bone Marrow

A-3

- Bone marrow is found in medullary canals of long bones and cavities of cancellous bone
- Yellow bone marrow : it's a reservoir for Red bone marrow - we need more red B.M → the yellow B.M change into red B.M and start formation of RBCs
- Red bone marrow : production of different types of elements



Stroma made of reticular cells and fibers (support)

Hematopoietic cords or islands of cells (blood elements in the blast form and immature cells)

Sunusoidal capillaries

Matrix:

1. Collagen type I, 2. Proteoglycan, 3. Fibronectin, macrophages and 4. Laminin binds to integrins

(Reticular cells has a star like shape) and is one of the components of stroma

هي الوحيدة اللي بتعرقد بمرحلة (Band Cell) (Maturation from stem) لما يصير لها

Neutrophils

A-3

→ there's a certain amount that it's not circulating, like in bone marrow

Vast majority of granulocytes are neutrophils

Developing and mature neutrophils are found in:

1. Granulopoietic component in bone marrow
2. Stored as mature neutrophil in bone marrow
3. Circulating neutrophils
4. Marginating neutrophils adhering to the endothelium of venules and small veins (most important)

we can find it in (1,2,3,4) 4 is very imp

Diapedesis: neutrophils move to the connective tissue

- Process by which the WBCs leaves the circulation to C.T from the capillaries -

WBCs الـ Neutrophils هي أكثر نوع من

* if we are attacked by bacteria, many neutrophils are exhausted and disappear because of antigen-antibody reactions, so it's must be replaced from the other source, and the main source for replacing these neutrophils, those which are marginating neutrophilis