



Lecture 2: Functions of cellular elements of blood

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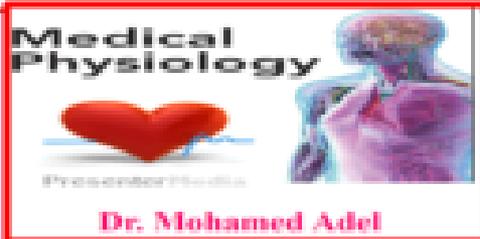
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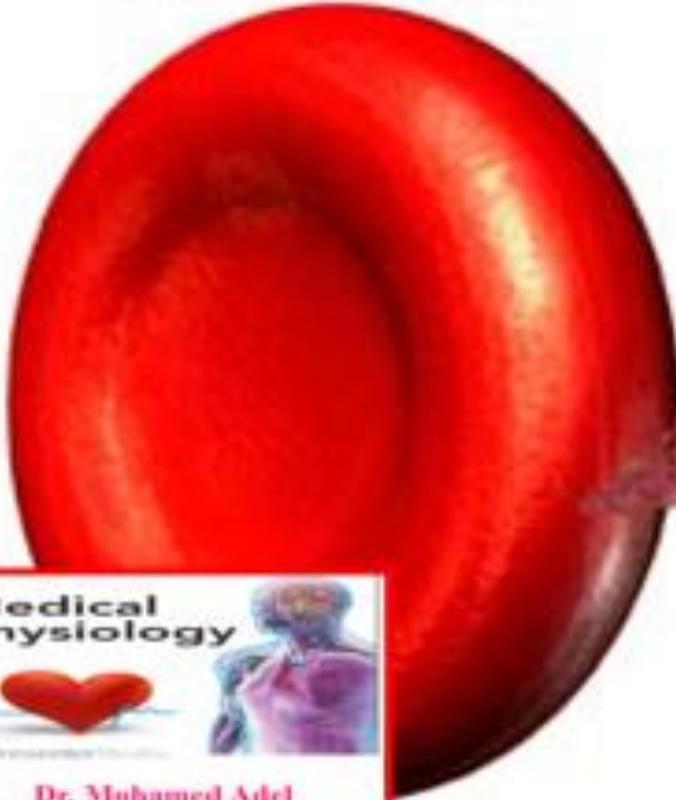
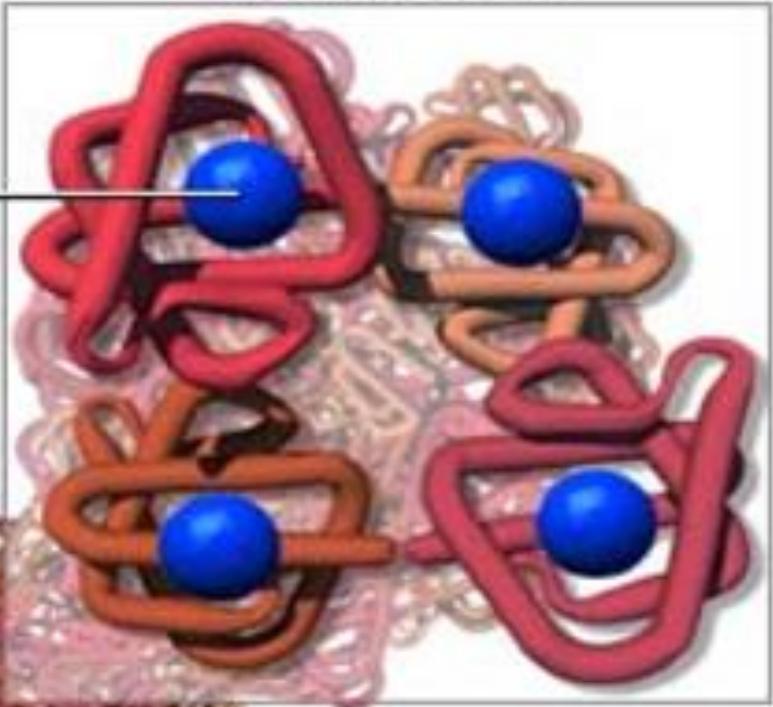
Red blood corpuscles (RBCs)

- They are not true cells, because they have no nuclei, so they are called corpuscles.



Hemoglobin

Oxygen molecule
Red blood cell



Hemoglobin carries oxygen throughout the body

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RBCs count

In adult male

5→5.5 million/mm³

In adult female

4.5→5 million/mm³

In newborn

6→8 million/mm³

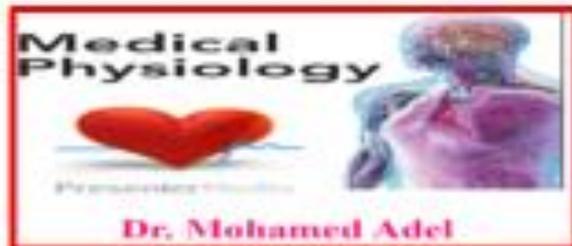
In children

3.5→4.5 million/mm³



Red Blood Corpuscles (RBCs) count

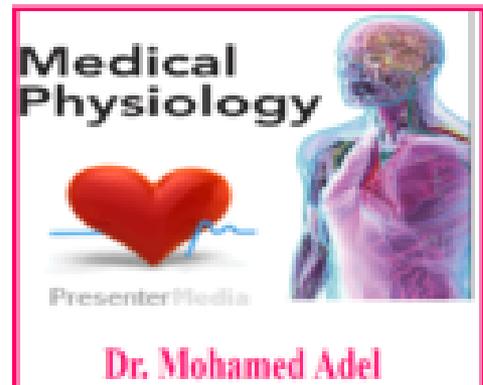
- Persons living at high altitudes have greater number of RBCs (2ry polycythemia) due to low oxygen in atmosphere.



Red Blood Corpuscles (RBCs)

Structure of RBCs:

- ❑ RBCs are not true cells, because they have no nuclei, so called corpuscles.

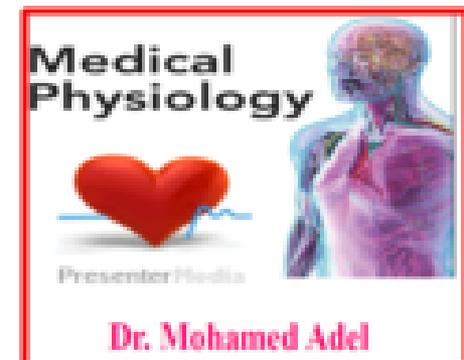


Red Blood Corpuscles (RBCs)

□ Structure of RBCs

The cell membrane

- ❖ Is plastic semipermeable membrane.
- ❖ Has large surface area.



RBCs, Contents:

1) Hemoglobin:

2) K^+ :



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3) Carbonic anhydrase enzyme:

No mitochondria:

Red Blood Corpuscles (RBCs)

□ Structure of RBCs:



b) Contents:

❖ **Hb** (34% of RBC) is the main constituent.



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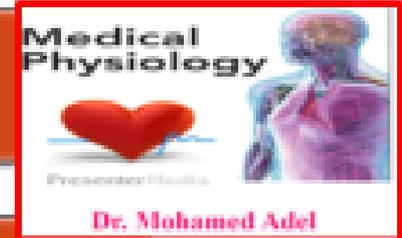
❖ **K⁺** is the chief intracellular cation.

❖ **Carbonic anhydrase enzyme.**

❖ **No mitochondria**, so they obtain energy from anaerobic glycolysis.

Functions of RBCs

1- Functions of membrane:



2- Functions of Hemoglobin:

3- Functions of carbonic anhydrase enzyme:

4 – Blood viscosity:

Functions of RBCs membrane

It has a large surface area:

Plastic:

It keeps Hb inside RBCs

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Presented by



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Functions of RBCs

1) Functions of membrane:

a) It has a **large surface area:**

- Gives RBCs its **biconcave shape**.
- Allows **easy diffusion of gases** through cell membrane.

Red Blood Corpuscles (RBCs)

b) Plastic → enhances **cell flexibility**
→ allow RBCs to be squeezed in small capillaries **without rupture of it.**



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c) It keeps Hb inside RBCs → prevent its loss in urine.

2) Functions of Hb

Transport of O₂ to tissues:

Transport of CO₂ from tissue.

HB is excellent acid-base buffer



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Red Blood Corpuscles (RBCs)

2) Functions of Hb:

a. Transport of O_2 to tissues.

b. Transport of CO_2 from tissue.

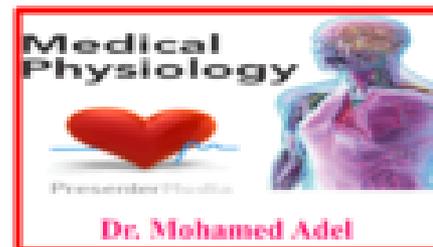
c- **HB is excellent acid-base buffer.**

Functions of RBCs

3) Functions of carbonic anhydrase enzyme

Catalyze the reaction between CO₂ and H₂O

- ❑ It helps in transport of CO₂.



Functions of RBCs

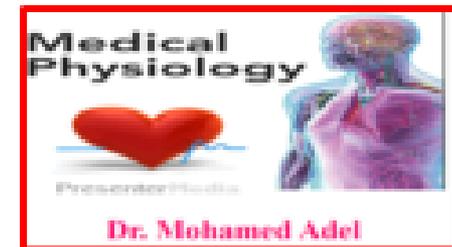
4- RBCs maintains blood viscosity.



Erythropoiesis

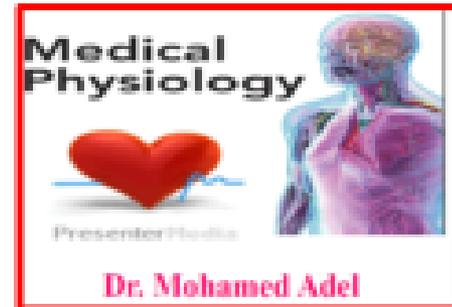
Def:

□ Erythropoiesis is the process of new RBCs formation.



Erythropoiesis

- ❑ In the adult, RBCs are produced in The bone marrow.



Sites of Erythropoiesis

Early weeks of embryonic life:

Yolk Sac

Middle trimester of gestation:

**Liver
Spleen
Lymph Nodes**

Last trimester
 After birth

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Red bone marrow
(Bone marrow of all bones)

After 20:

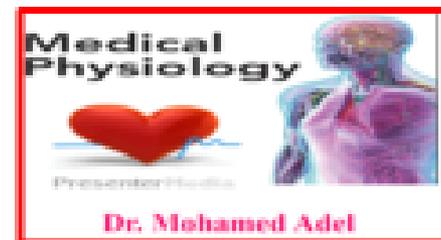
Membranous bones:

**Vertebrae
Sternum
Ribs
Iliac**



Factors affecting erythropoiesis

- 1) Tissue oxygenation & role of erythropoietin.
- 2) Healthy bone marrow:
- 3) Healthy liver:
- 4) Hormones:
- 5) Nutritional factors:



Factors affecting erythropoiesis

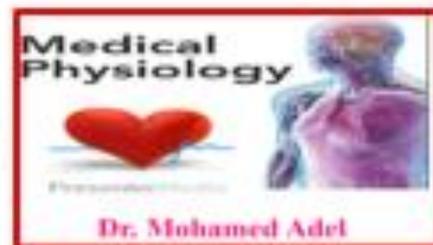
1) **Tissue Oxygenation**

5) **Diet**
(Proteins,
vitamins and
Minerals)

Erythropoiesis

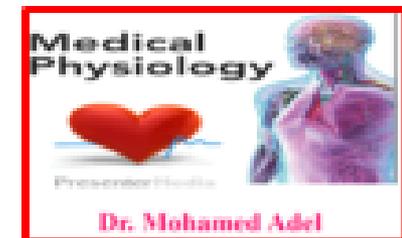
2&3) **Healthy Organs** (liver,
and bone
marrow)

4) **Hormones**
(Thyroid,
androgens and
glucocorticoids)



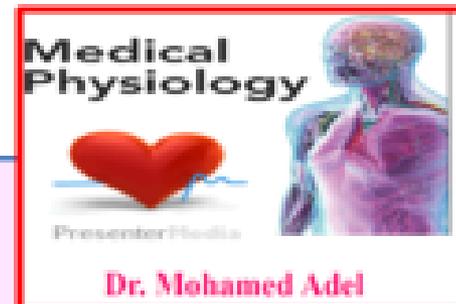
1) Tissue oxygenation & role of erythropoietin

- Any condition that causes ↓ in quantity of O₂ transported to the tissues → ↑ rate of RBCs formation.



1) Tissue oxygenation & role of erythropoietin

- ❑ The principal factor that stimulate erythropoiesis in low O₂ states is the ↑ release of erythropoietin hormone.



Tissue Oxygenation

Hypoxia

(e.g. High altitude, athletes and hemorrhage)



Increase **RBCS** formation via **erythropoietin (EPO)** secretion (90% from kidneys and 10% from liver)



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- a) EPO ++ transfer of **stem cells** in bone marrow to **proerythroblasts**
- b) EPO accelerates all the stages of development of **mature RBCs** from **proerythroblasts**

Thanks!