



PresenterMedia

**Functions of cellular elements of
blood and regulation of
hematopoiesis**

Dr. Mohamed Adel

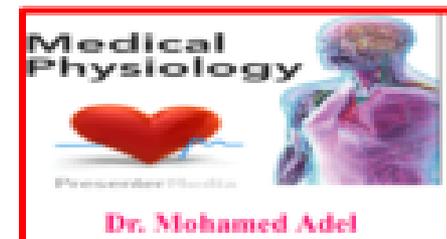
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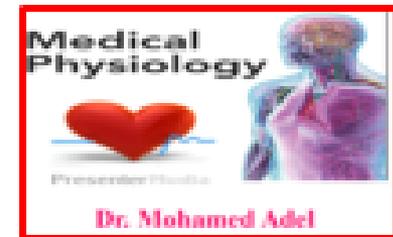
Factors affecting erythropoiesis

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



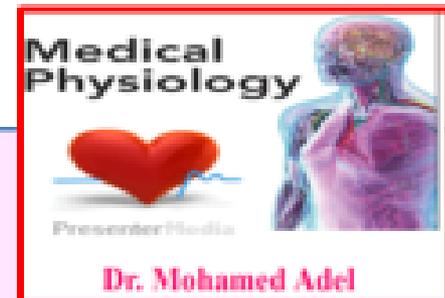
1) Tissue oxygenation & role of erythropoietin

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

Erythropoietin

Nature: glycoprotein hormone.

Sources of Erythropoietin

During fetal life

**100 % formed in
liver**

In normal adult

**90% formed in
kidney**

10% formed in liver



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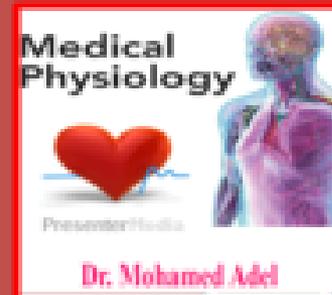
2) Healthy bone marrow

- Healthy bone marrow is essential for normal erythropoiesis.



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Irradiation, chemicals,
drugs and bacterial
toxins



Destruction of bone
marrow



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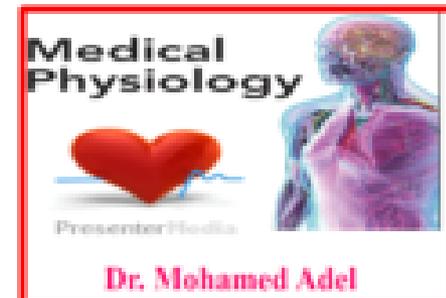
Deficiency of all blood
cells a condition called
aplastic anemia

3) Healthy liver

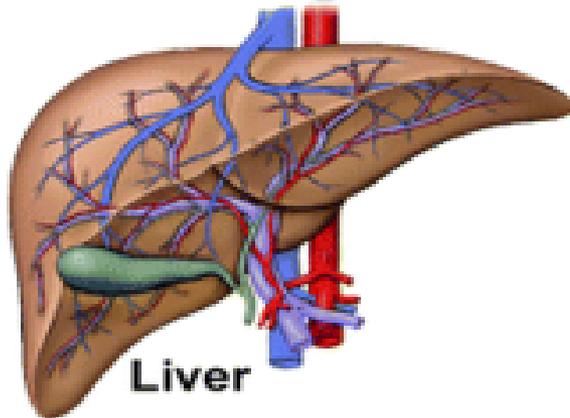
- ❑ Is essential for RBCs formation.
- ❑ Liver disease causes anemia.



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3) Healthy liver



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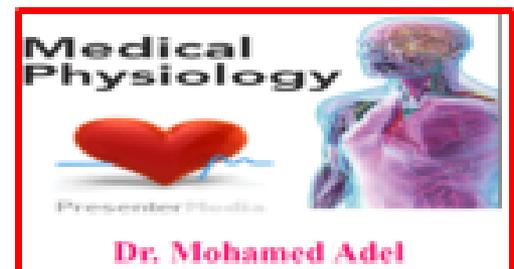
Red blood cells



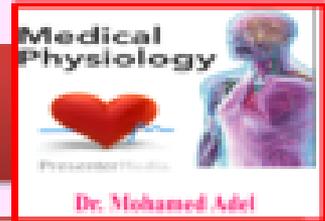
Healthy Liver

1. Store Fe and Vitamin B12
2. 10% of erythropoietin.

RBCs formation



4) Hormones



- Thyroid hormones, androgens & glucocorticoids are needed, in addition to, **erythropoietin** to perfect erythropoiesis.



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Nutritional factors:

□ Proteins:

□ of high biological value.



□ Minerals:

□ Iron, copper & cobalt.

□ Vitamins:

□ Especially Vitamin B12 and folic Acid.

5) Nutritional factors

- e.g Proteins, minerals (iron & cobalt) & vitamins (B12 & folic acid) are important for formation & maturation of RBCs.

a) Proteins

❑ **Proteins of high biological value** (contain more essential amino acids) that present in **liver, kidney and muscle** are essential for **erythropoiesis.**



b) Minerals

1. Iron: Important for the formation of Hb
2. Copper: Cofactor in Hb synthesis.
3. Cobalt: Cofactor in Hb synthesis.



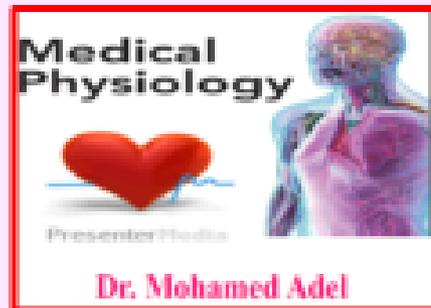
c) Vitamins

- ❑ All vitamins are needed for **erythropoiesis**

Deficiency of
Vitamin B12 or Folic
acid



Megaloblastic
anemia



Anemia

- Def.: A deficiency of hemoglobin, which can be caused by either decreased number of RBC's or too little hemoglobin in the cells.

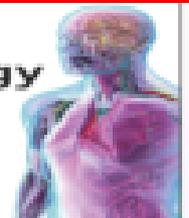


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Anemia

1- Blood loss anemia:

- Acute blood loss.
- Chronic blood loss.



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Anemia

2- Aplastic anemia:

- Due to lack of functioning bone marrow.



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Anemia

3- Megaloblastic anemia:

- Due to deficiency of either, vitamin B12, folic acid or the intrinsic factor from the stomach mucosa.



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Anemia

4- Hemolytic anemia:

□ Due to excessive destruction of RBCs.

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Presenter Profile



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White blood cells (leukocytes)

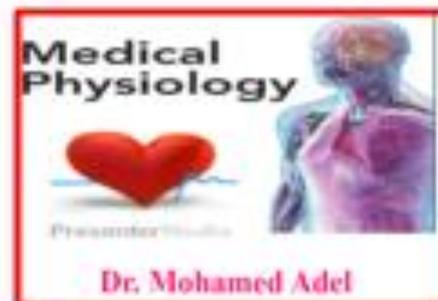
- ❑ The leukocytes are the mobile units of the immune system.
- ❑ Number: 4000 - 11,000 /mm³





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Leukocytes



Granular

A granular

Neutrophil

Eosimophils

Basophils

Lymphocytes

Monocytes

60-70%

1-5%

0-1%

20-30%

3-8%

Neutrophil

60 - 70% of leukocytes

- Higher values are called **neutrophilia** and occurs in **bacterial infection**

-Lower values are called **neutropenia**

Eosinophils



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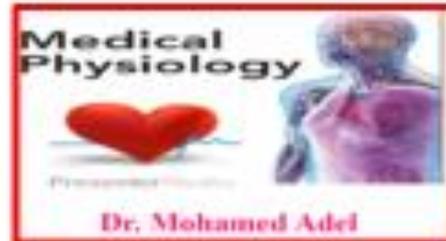
1 - 5% of leukocytes

-Higher values $> 5\%$ are called **esinophilia** and occur in **allergy** and **parasitic infection**

-Lower values are called **esinopenia**

Basophils

0 - 1 % of leukocytes



Higher values are called **basophilia** that occur in cases of allergy

Lower values are called **basopenia**

Monocytes

3-8% of leukocytes.



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- Higher values are called **monocytosis** that occurs in chronic infections.



- Lower values are called **monocytopenia**.

Lymphocytes

20-30 % of leukocytes.

- Higher values are called **lymphocytosis** that occurs in viral infection and lymphoma and leukemia.

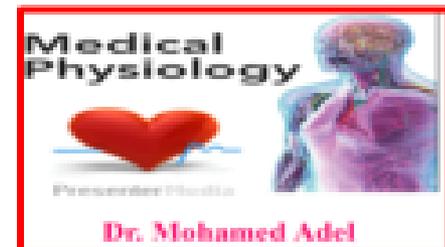
- Lower values are called **lymphopenia**.

Platelet count

- ❑ Normally from 150,000 to 400,000 /mm³.
- ❑ Higher values $> 400,000$ are called thrombocytosis.
- ❑ Lower values $< 150,000$ are called thrombocytopenia.



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Thanks!