

# **BLOOD PHYSIOLOGY**

## **White Blood Cells (WBC)**

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# Lecture content

- .1 Eosinophils and Basophilophils formation, maturation and function**
- .2 Monocytes and macrophage formation, maturation and function**
- .3 Reticuloendothelial system component and function**
- .4 Lymphocytes formation, maturation and function**
- .5 Leucocytosis, leucopenia and leukemia**

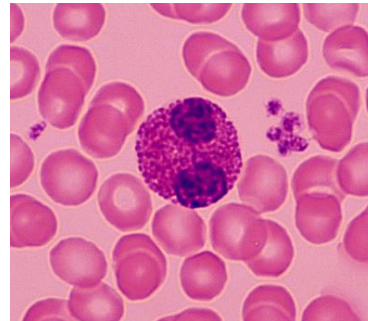
**White Blood Cells**

**EOSINOPHILLS &  
BASOPHILS**

# Formation and Maturation of **Eosinophils**

**Formed in Bone Marrow:**

- .1 Stem cells → Myeloblast → Promyelocytes →**
- .2 Eosinophil myelocytes →**
- .3 Eosinophil metamyelocytes →**
- .4 polymorphnuclear eosinophil )Mature  
Eosinophil released to blood(**



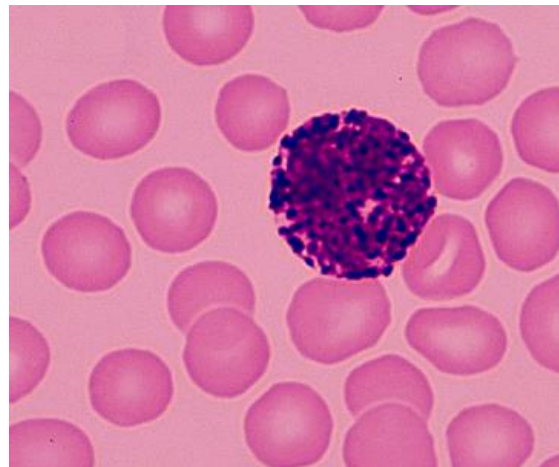
# Eosinophil Function

- **Phagocytosis**
- **High eosinophil count:**
  - **Parasitic (hook worm, ascaris, bilharzia)**
  - **Allergic (asthma, rhinitis, drug reaction)**
- **Eosinophil attach themselves to parasites and releases substances (hydrolytic enzymes, superoxide) to kill it**

# Formation and Maturation of Basophils

## Formed in Bone Marrow

- .1 Stem cells → Myeloblast → Promyelocytes →
- .2 Basophil myelocytes →
- .3 Polymorphnuclear Basophil )Mature Basophils released to blood(



# Basophils

Similar to mast  
cells both secrete:

- Heparin to prevent clotting,
- Histamine , bradykinin & serotonin contribute to inflammation response
- The release of those substances cause local and vascular reactions characteristic of allergic manifestation

**White Blood Cells**

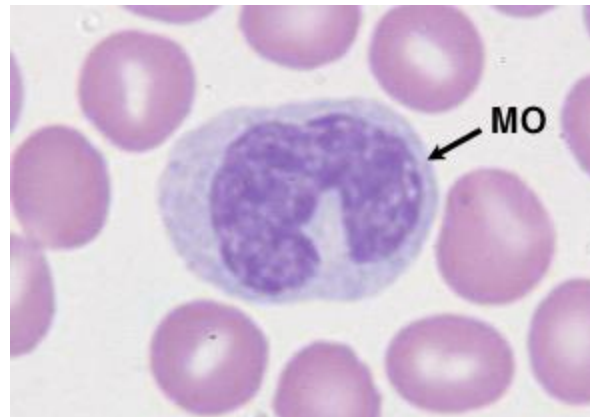
**MONOCYTES &  
MACROPHAGES**



# Monocytes and Macrophages

## Formed in Bone Marrow

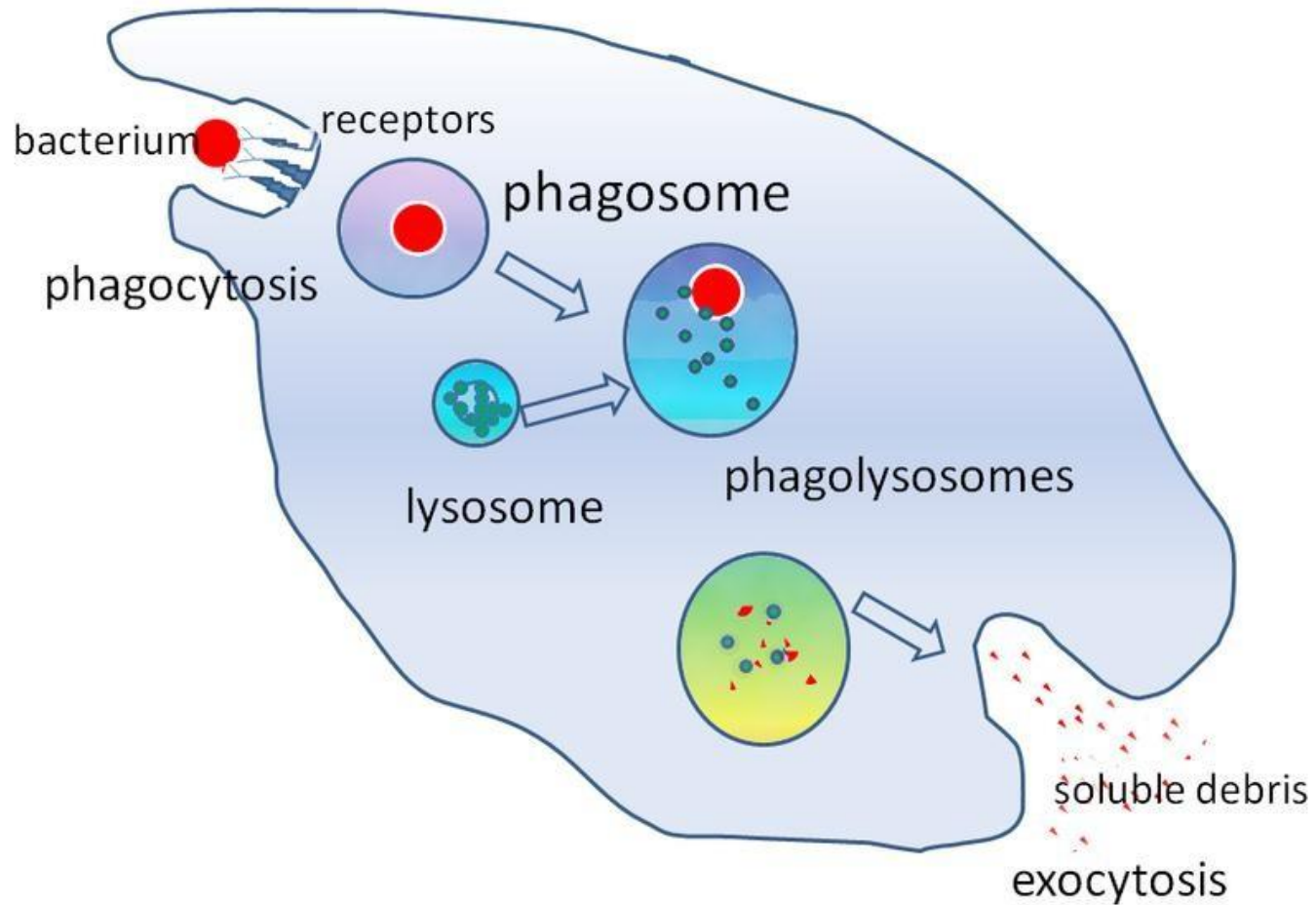
- .1 Stem cell → monoblast → promonocyte → mature monocytes released into blood**
- .2 Stay for 10-20 hours in circulation**
- .3 Then leave blood to tissues transforming into larger cells macrophage,**
- .4 Macrophage life span is longer upto few months**



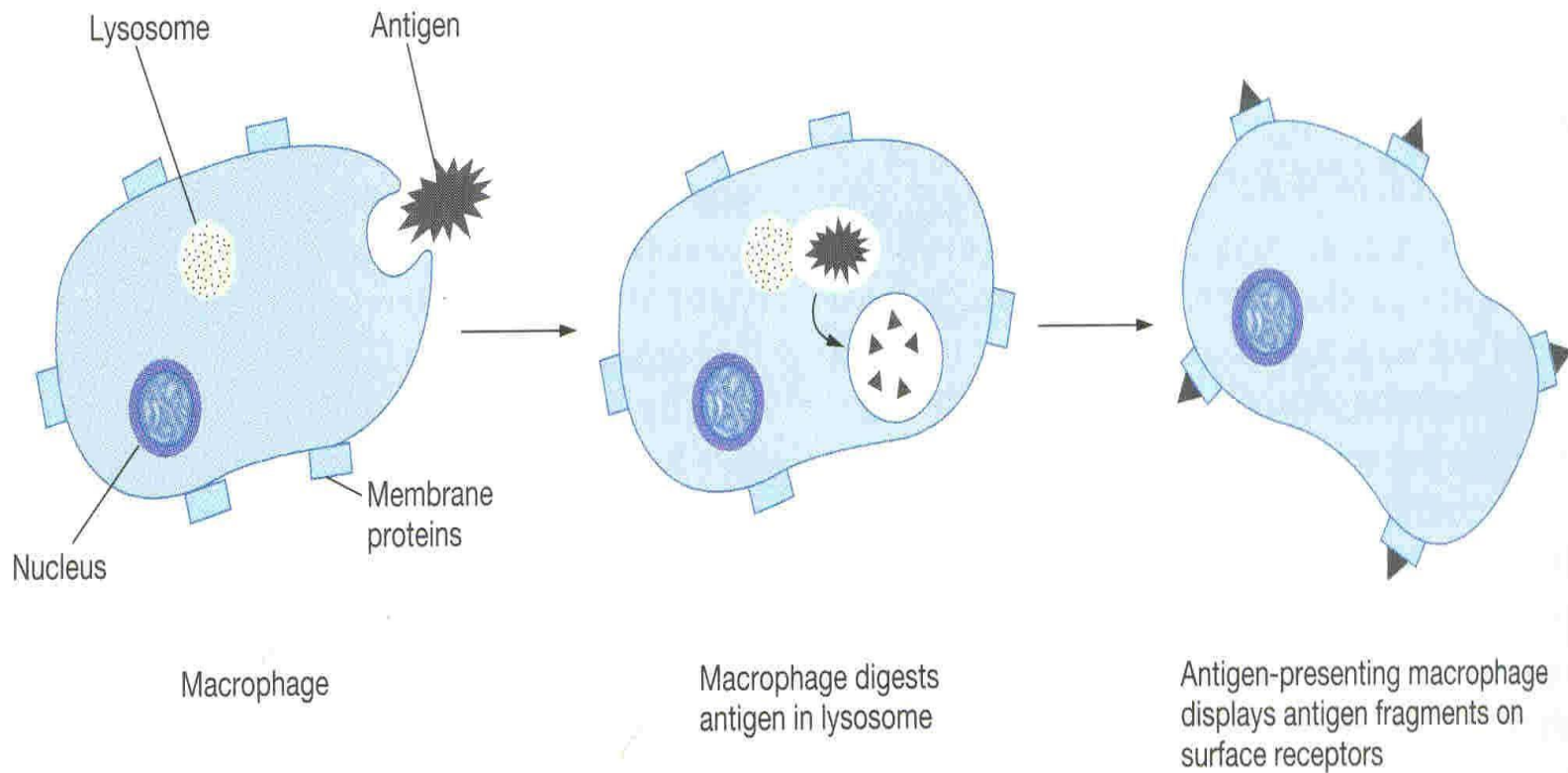
# Function of Monocytes and Macrophages

- **Macrophages are a powerful phagocytic cells; first line of defense**
  - **Ingest up to 100 bacteria,**
  - **Ingest larger particles as old RBC**
  - **Get rid of waste and survive**
- **Functions: anti-inflammatory**
  - **Directly:** phagocytosis of bacteria, dead cells
  - **Indirectly** cooperating with lymphocytes by recognizing foreign body (take in foreign body process it and present it to lymphocytes)

# Direct anti Inflammatory

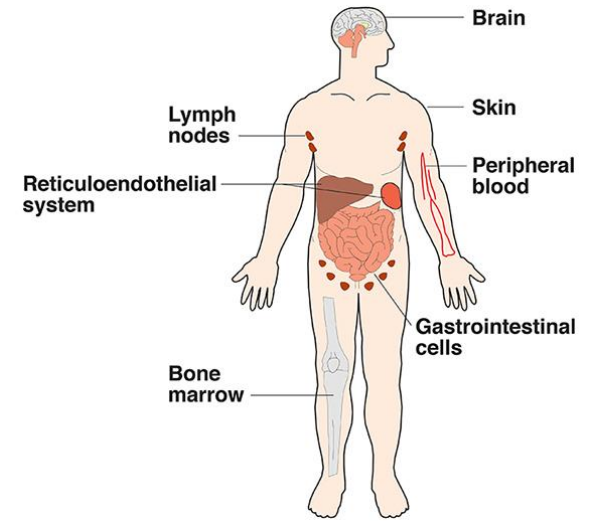


# Indirect anti-inflammatory



# Reticuloendothelial system

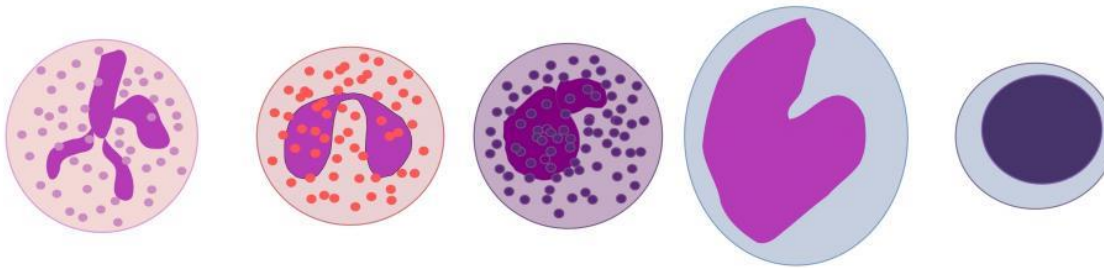
- **Consist of:**
  - **Monocytes**
  - **Macrophage**
  - **Endothelial cells (bone marrow, spleen, lymph node)**
- **Located in all tissues especially: skin (histocytes), liver (kupffer), spleen, bone marrow, lymph nodes, lung**



# **Functions of Reticuloendothelial system**

- 1. Phagocytosis: Bacterial, dead cells, foreign particles**
- 2. Breakdown of Hb**
- 3. Immune function: processing antigen and antibodies production (indirect)**
- 4. Storage of iron**

# White blood cells



neutrophil eosinophil basophil monocyte lymphocyte

wiseGEEK

## White Blood Cells

# LYMPHOCYTES

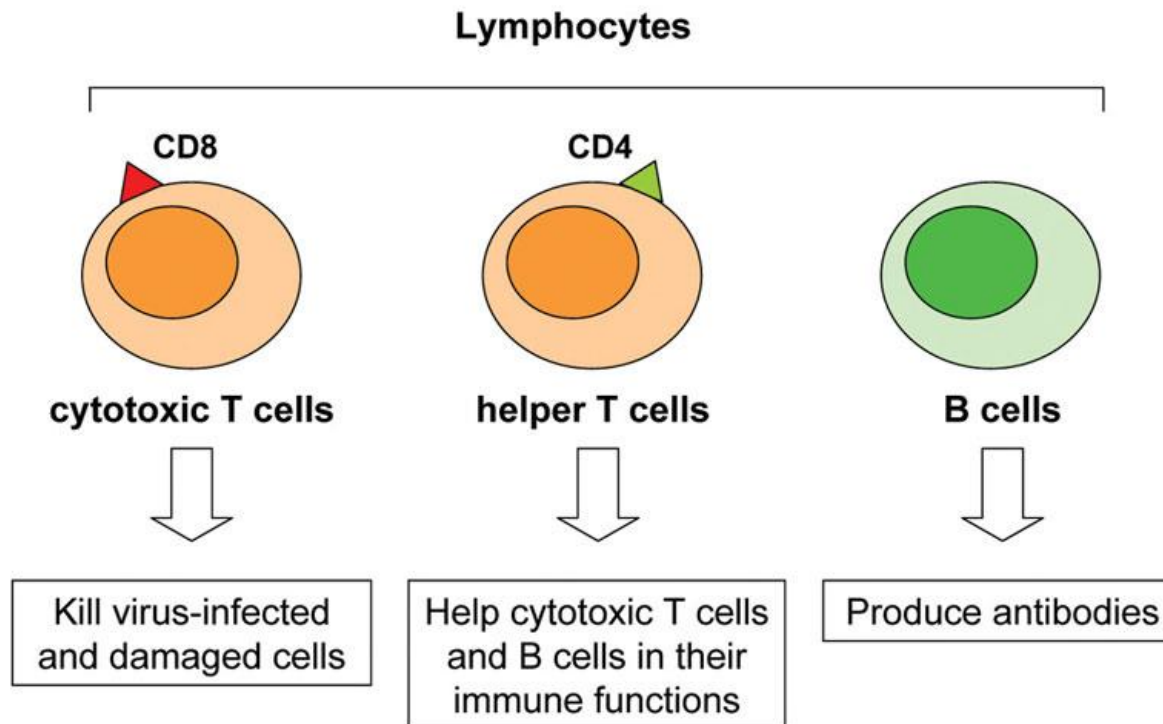
# **Lymphocytes Formation and Maturation**

- .1 Formed in bone marrow, thymus, lymphoid tissues**
- .2 Stem cell (thymus, lymphoid tissue & bone marrow) → lymphoblast → intermediate pyronophilic blast cell → lymphocytes**
- .3 Life Span Of Lymphocytes range from weeks to months according to its type**



# LYMPHOCYTES Function and types

- **Function:**
- **Types:**
  - .1 Thymus dependent (T-lymphocytes)
  - .2 Thymus independent (B-lymphocytes)



# **T-Lymphocytes (Thymus dependent)**

- **Formed in bone marrow or lymphoid tissue migrate to thymus for maturation**
- **Life spans 100-130 days.**
- **Circulate between blood, tissues, lymph.**
- **Types of T-lymphocytes**
  - **T-helper**
  - **T-cytotoxic**
  - **Natural killer**
- **Functions**
  - **Cellular immunity (graft rejection delayed hypersensitivity.)**
  - **Role in antibody secretion.**

# **B- Lymphocytes (thymus-independents)**

- **First discovered in Bird Bursa**
- **Formed in: Bone marrow, germinal layer of lymph node, red pulp of spleen**
- **Life span 2-7 days**

- **It transforms into large plasma cell (produce antibody)**
- **Function: Humoral immunity.**

**Stimulated by antigen transforming**

# Leucocytosis

## Increased WBC

- 
- **Physiological**
  - **Diurnal** ↓ morning ↑ evening
  - **After physical exercise**
  - **Stress or Adrenaline injection**
- **Disease**
  - **Bacterial infection** (tonsillitis, Appendicitis)
  - **Worm infection**

# Leucopenia

- ↓ **WBC**

## Causes;

1- malnutrition.

2- typhoid fever.

3- drugs.

4- B<sub>12</sub> & folic acid ↓

5- radiation

# Leukaemia

- **Cancer of white cells due to chromosomal abnormality caused by chemicals, radiation, and viruses.**
- **WBC more than  $50 \times 10^3$**
- **Types of leukaemia**
  - **Myeloblast leukaemia → myeloid cells**
  - **Lymphoblast leukaemia → lymphocytic cells**
- **Acute or chronic onset**
- **Accompanied with anaemia, bleeding**

# Objectives

**At the end of this lecture student should be able to:**

- .1 Describe Eosinophils formation and functions**
- .2 Describe Basophils formation and functions**
- .3 Describe Monocytes and macrophage formation and functions.**
- .4 Describe Reticuloendothelial components and functions**

# Objectives

**At the end of this lecture student should be able to:**

- .5 Describe lymphocytes formation and maturation.**
- .6 Describe the functions of the different types of lymphocytes.**
- .7 Recognise leucocytosis and leucopenia.**
- .8 Recognize type of leukaemia**