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

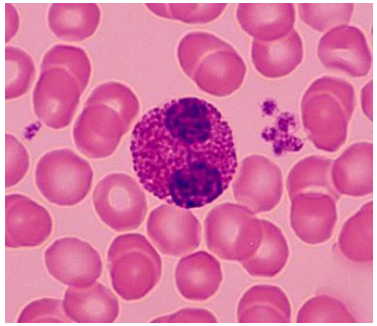
White Blood Cells

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 anzymes, superoxide*)* to kill it**

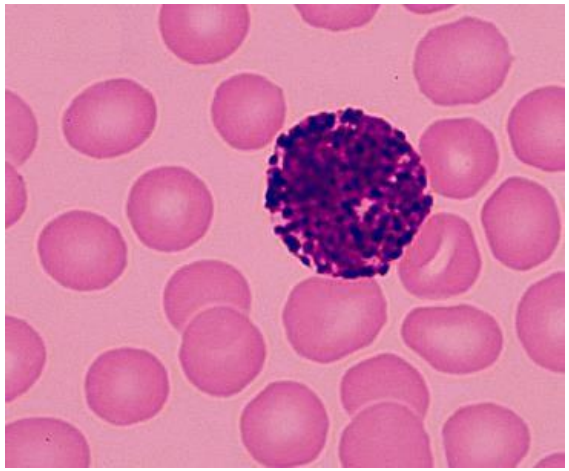
Formation and Maturation of Basophils

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 secrets:

- Heparin to prevent clotting,
- Histamine , bradykinin & serotinin 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

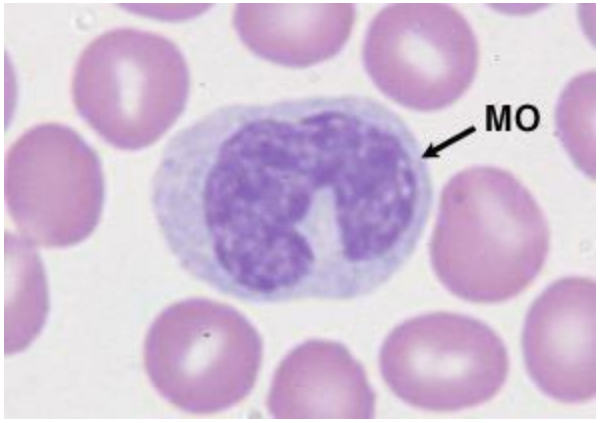
Formed in Bone Marrow

.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,**

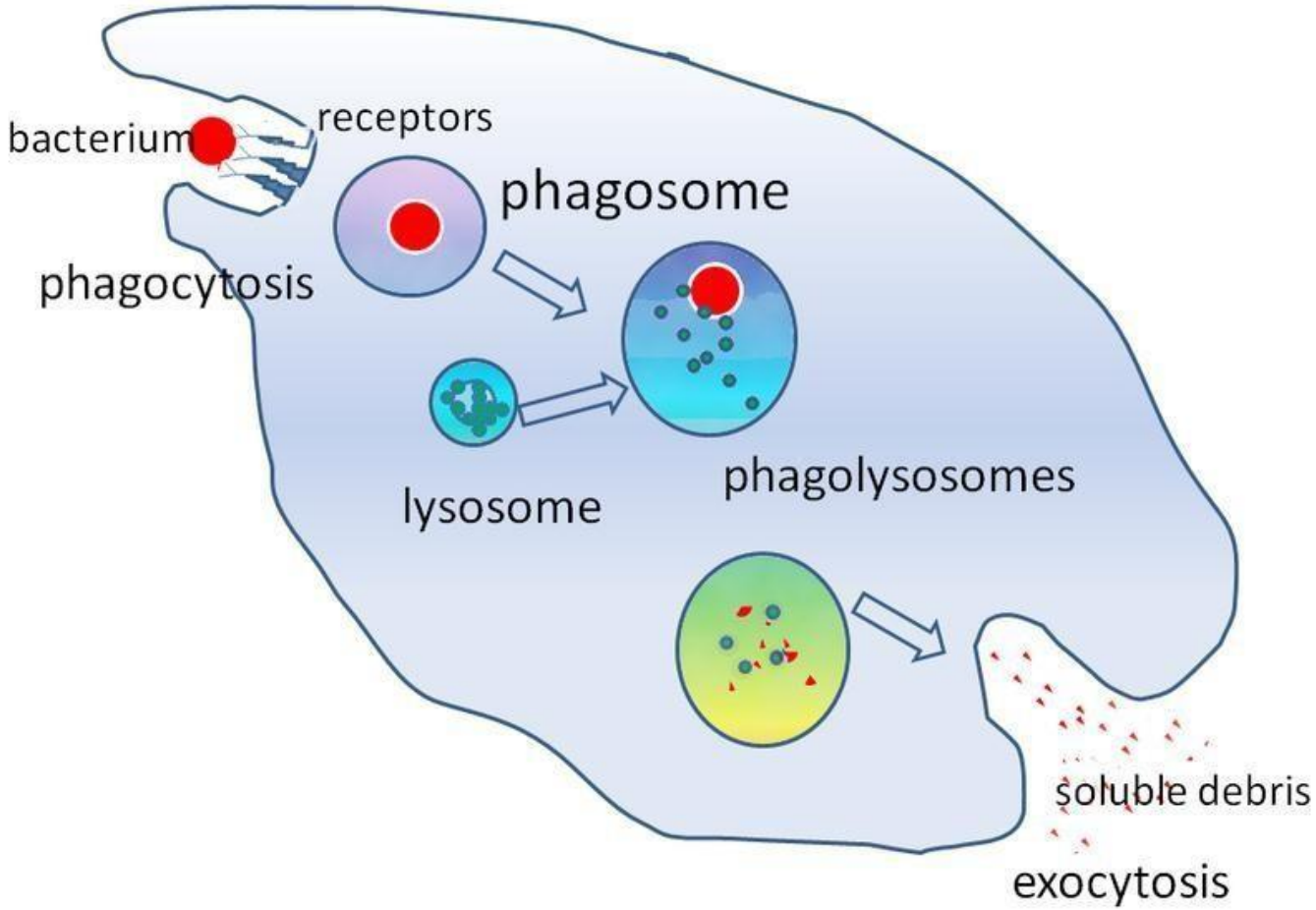
.4 **Macrophage life span is longer upto few months**



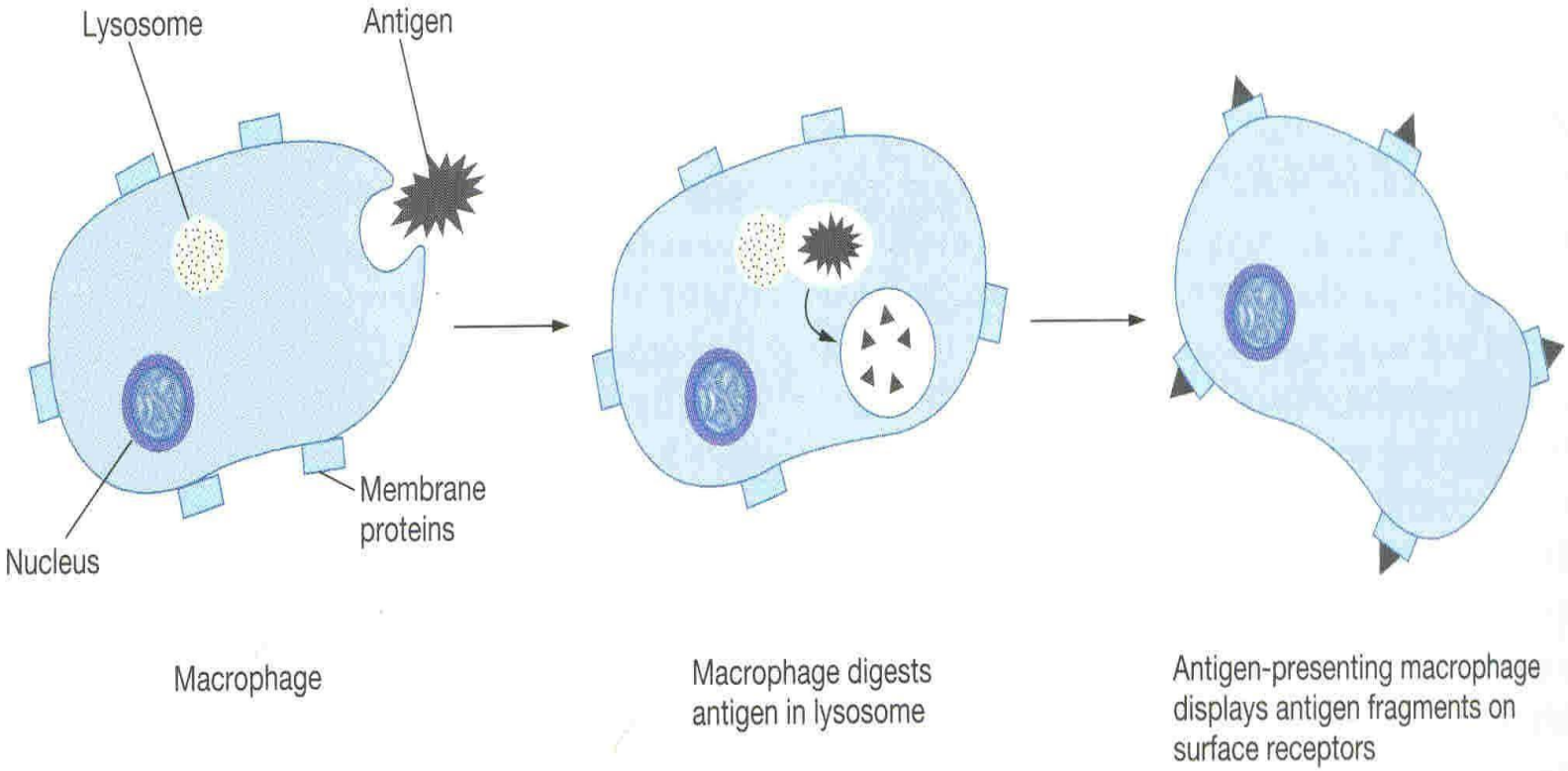
Function of Monocytes and Macrophages

- **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-inflamatory**
  - **Directly: phygocytosis of bacteria, dead cells**
  - **Indirectly cooperating with lymphocytes by recognizing foreign body (take in foreign body process it and present it to lymphocytes)**

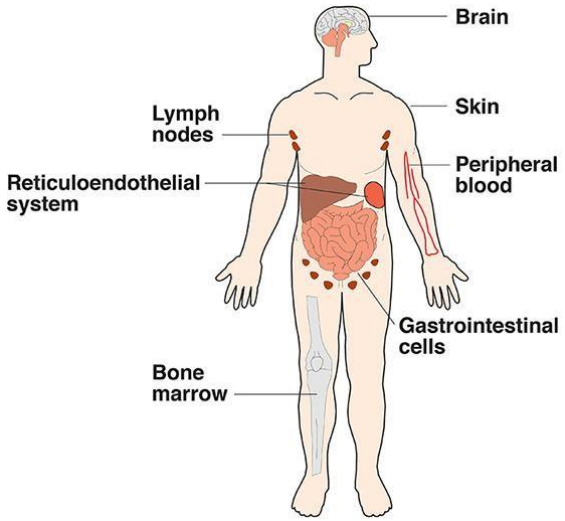
Direct anti Inflammatory



Indirect anti-inflammatory



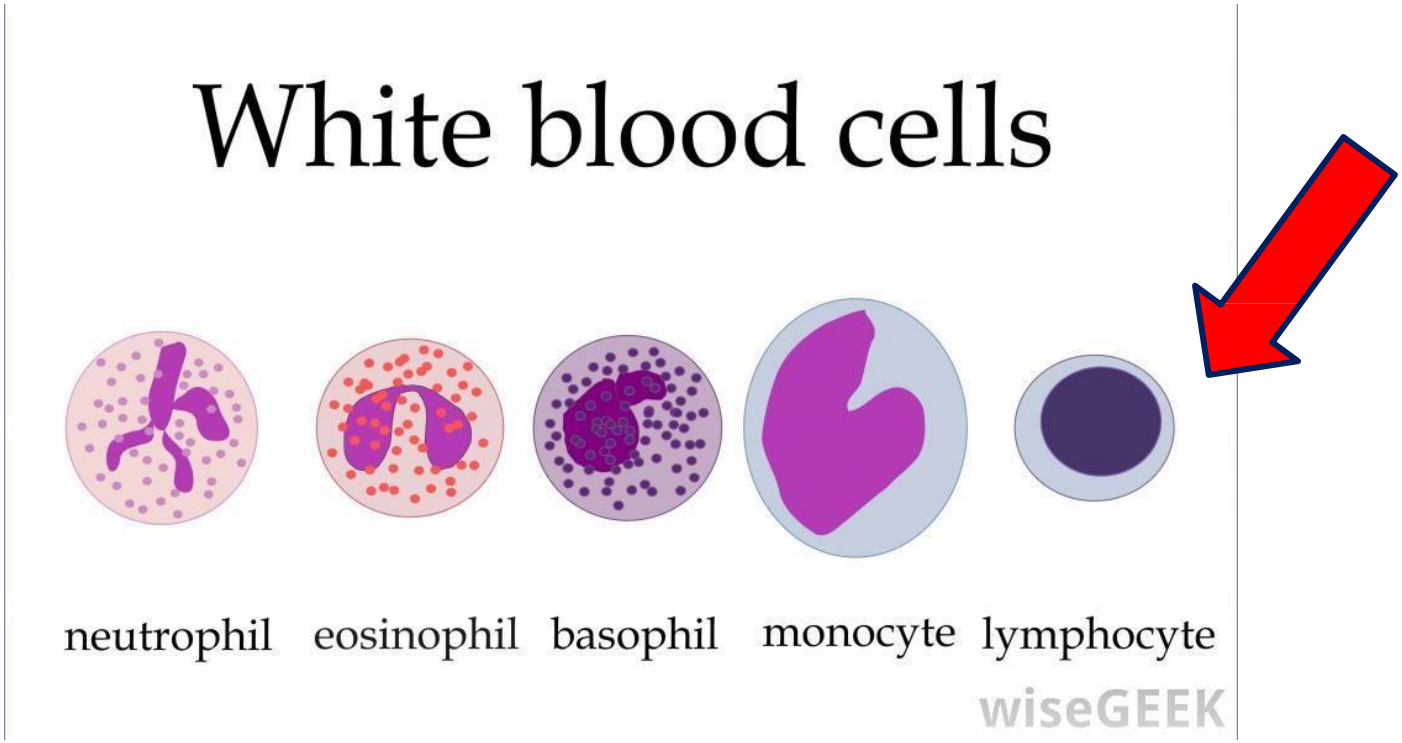
Reticuloendothelial system



- 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

LYMPHOCYTES

Lymphocytes Formation and Maturation

.1 Formed in bone marrow, thymus, lymphoid tissues

.2 Stem cell (thymus, lymphoid tissue & bone marrow) $\rightarrow$ lymphoblast $\rightarrow$ intermediate pyronophilic blast cell $\rightarrow$ lymphocytes

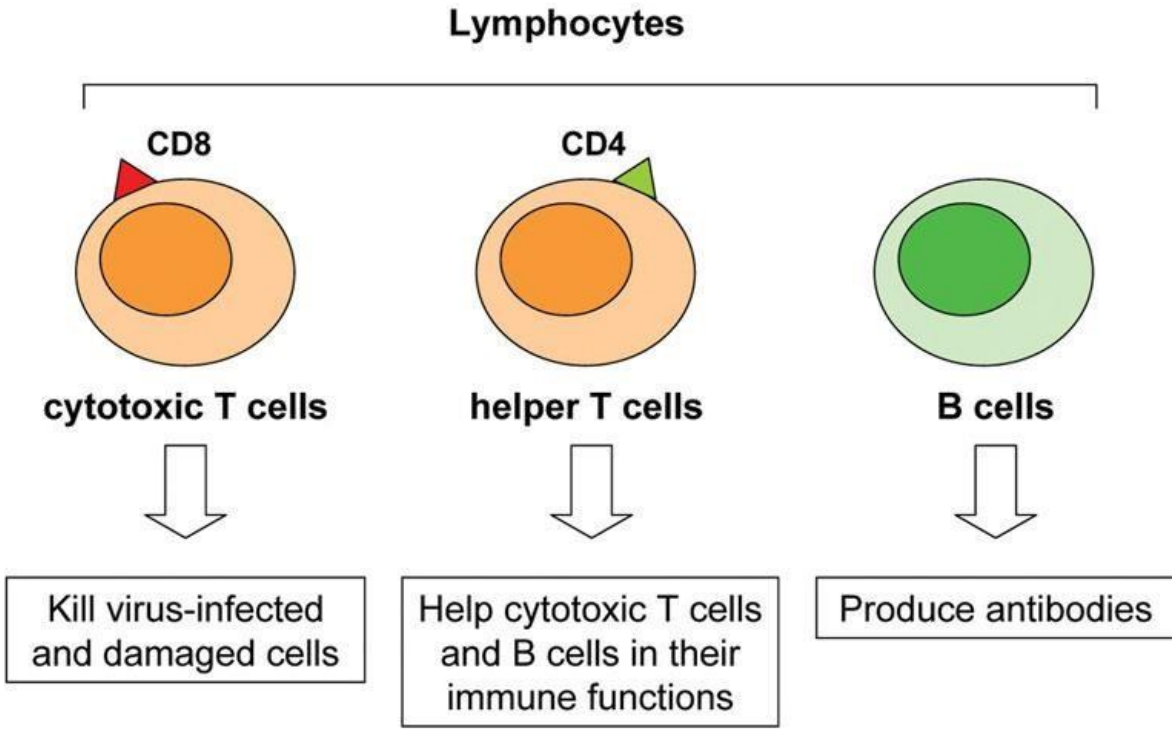
.3 Life Span Of Lymphocytes range from weeks to months according to its type

LYMPHOCYTES Function and types

- **Function:**
- **Types:**

.1 Thymus dependent (T-lymphocytes)

.2 Thymus (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 delyed 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_{12} & folic acid↓

5- radiation

Leukaemia

- Cancer of white cells due to chromosomal abnormality caused by chemicals, radiation, and viruses.
- WBC more than $50x10^3$
- 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 Esinophils formation and functions**
2. **Describe Basophils formation and functions**
3. **Describe Monocytes and macrophage formation and functions.**
4. **Describe Reticuloendothelial componants 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**