

BLOOD PHYSIOLOGY

White Blood Cells

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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 secrets:

- **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

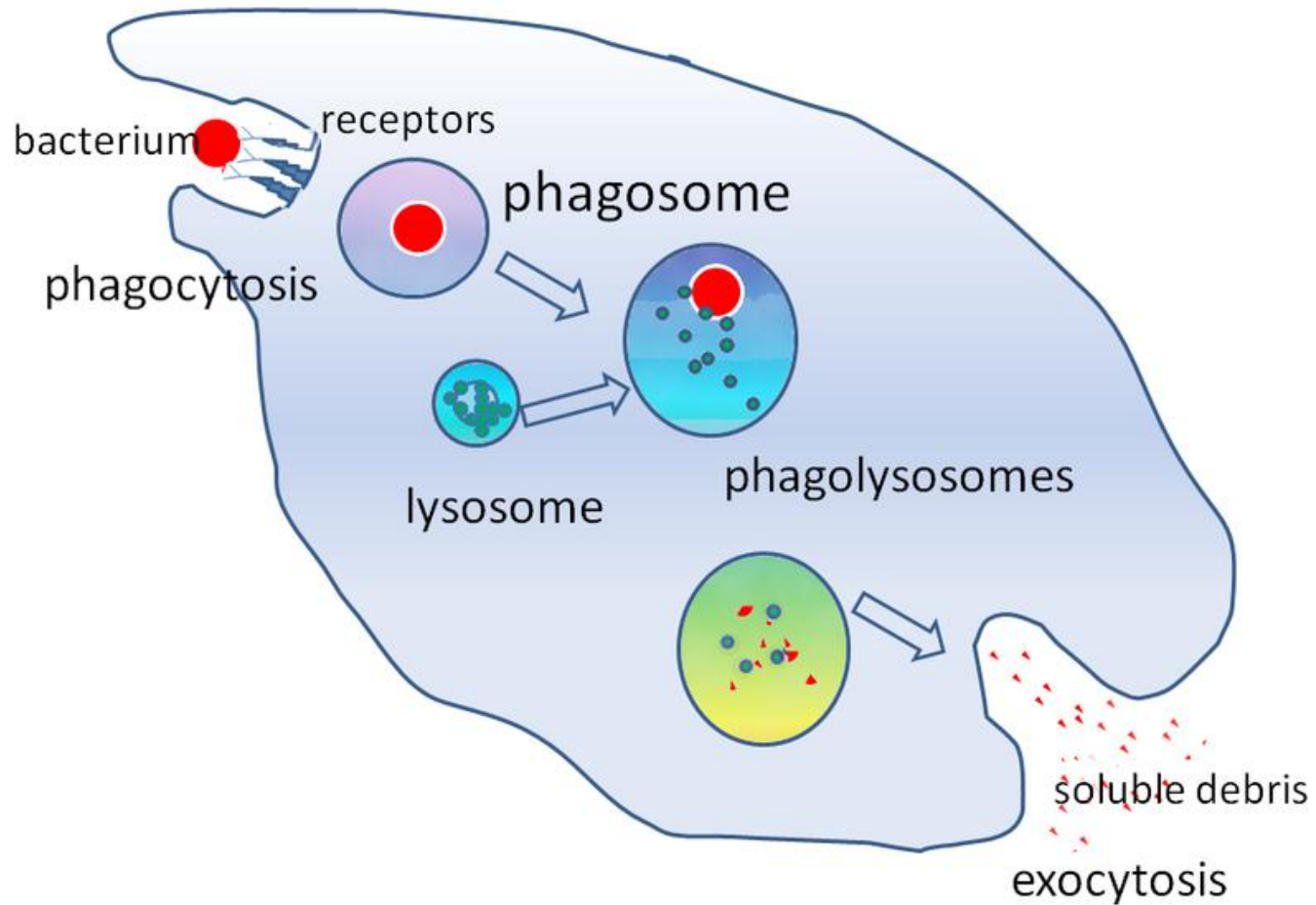
Formed in Bone Marrow

- 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**

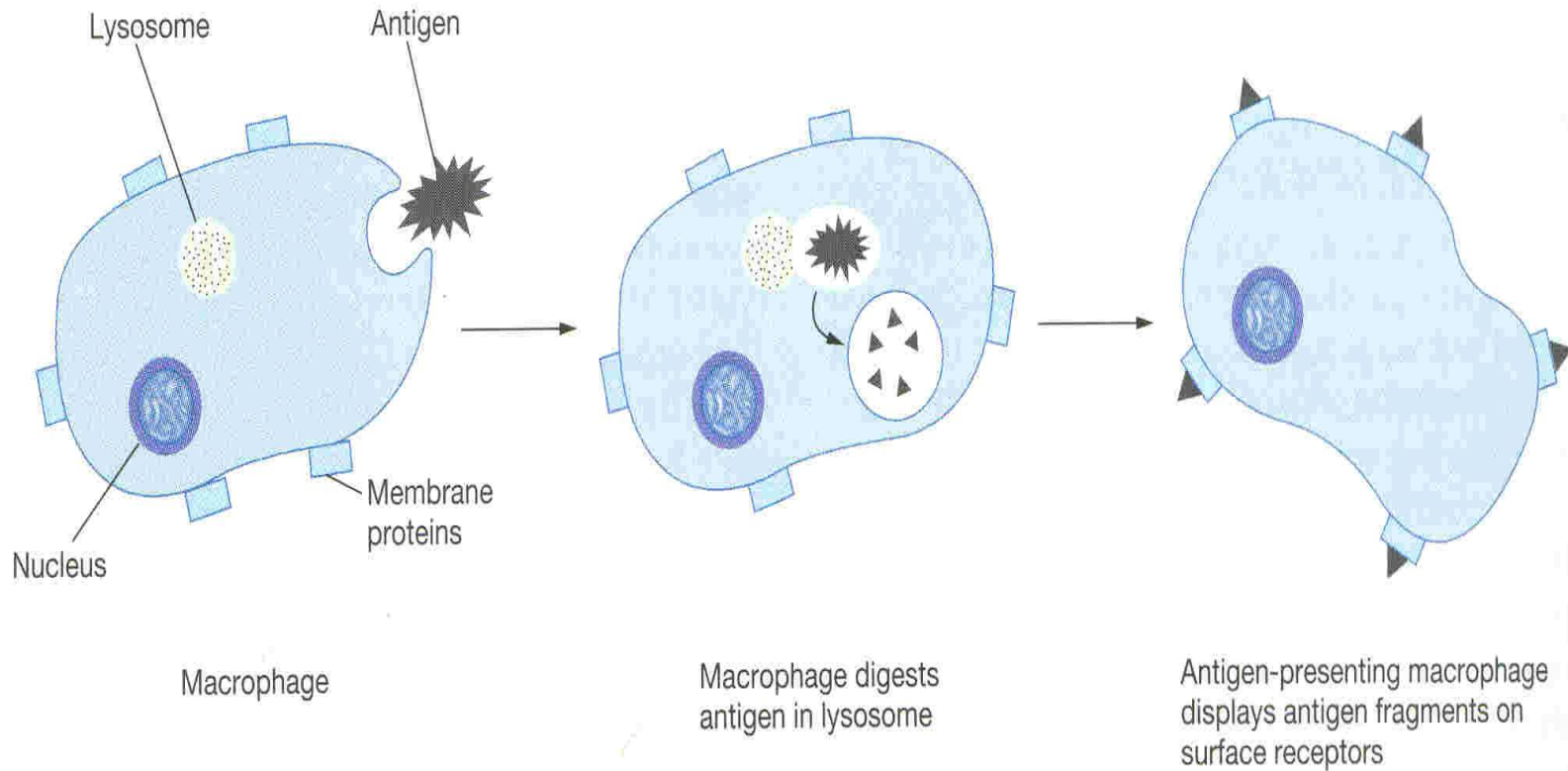
Function of Monocytes and Macrophages

- **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

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: Immunity**
- **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**
- **Stimulated by antigen transforming it into large plasma cell (produce antibody)**
- **Function: Humoral immunity.**

Leucocytosis

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

Leucopenia

- **↓ WBC**
 - **Malnutrition**
 - **Depressed bone marrow**
 - **Deficient Vit B12 or folic acid**

Leukaemia

- **Cancer of white cells due to chromosomal abnormality caused by chemicals, radiation, and viruses**
- **WBC more than 50×10^3**
- **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**