



2. Reticular endothelial system (RES):

The reticular endothelial system is immune complex from blood and tissues, it mainly comprises of phagocytic cells whose engulf microbes, participate in inflammation, antigen presenting and cytokine secretions. The major phagocytic cells are:

- Polymorph nuclear leucocytes (PMNLs).
- Blood and tissue monocytes.

These phagocytic cells found in many organs as blood, liver, kidney, lung, brain, spleen, and lymph node.

Origin of reticular endothelial cells:

Myeloid progenitor is deriving from hematopoietic stem cells, which can differentiate into myeloid cells.

Myeloid cells are development into two kinds of phagocyte cells:

1. **Granulocytes cells (PMNs)** can be divided into neutrophils, basophils, and eosinophils according to cytoplasmic granules respond to different dyes.
2. **Mononuclear cells** can be divided into monocytes and macrophages cells.

Development and maturation of reticular endothelial cells:

The origin of granulocytes cells based onto development stage to :

- Early stage: **In yolk sac** , macrophages primitive derived from precursor cells; which can differentiate into macrophage like phenotypes might be distinct from the origins of these cells in adults.
- Late stage: **In fetal liver**, hematopoiesis in the liver generates large numbers of macrophages; can be dividing into local macrophage in organs and recruited peripheral monocytes.
- **In bone marrow**, granulocytes, monocytes and dendritic cells derived from pro-Myoblast and pro-Monoblast (Blood progenitor), and by cytokines as granulocyte



colony stimulating unit (G-CSU) promotes them to differentiation and maturation of granulocytes, while granulocyte macrophage colony stimulating unit (GM-CSU) with other cytokines promotes differentiation of monocytes and dendritic cells.

➤ **In tissues:** Monocytes cells migrate into various organs and tissues to become Macrophages.

Types of phagocytic cells

The phagocytic cells can be divided into:

A. Monocytes/ Macrophages.

B. Polymorph nuclear granulocytes (PMNs).

C. Dendritic cells.

D. Accessory cells: Other network cells which include:

I. Antigen presenting cells (APCs) expose antigen to T cells.

II. Platelets. **III.** Mast cells.

Characteristics of phagocytes cells Monocyte/Macrophage cells

- ① They are large than lymphocytes.
- ② Rounded or kidney in nuclei shaped with granular contains peroxidase and hydrolytic acid.
- ③ Identified either by morph or by presence of CD14 marker.
- ④ Driving from bone marrow.
- ⑤ Occupy 2-8% of total WBCs.
- ⑥ When they enter to tissue, they are called **macrophages** which have different names according to organs such as:



Location	Cells
Blood stream	Monocyte
Liver	Kupffer cells
Kidney	Mesengial cell
Lungs	Alveolar Macrophage
Brain	Microglial cell
Spleen	Sinus Macrophage
Peritoneal cavity	Serosal Macrophage

⑦ Have main functions of macrophage include:

1. Killing of microbes, infected cells, and tumor cells.
2. Secretion of cytokine.
3. Antigen processing and presentation to T cells.

⑧ They can be binding with pathogens by specialized receptors as Mannosyl-fucosyl receptors (MER), Phosphatidyl serine receptors (PSR), CD14 and CD68, Fc receptors, and complement receptors.

Neutrophils

- ① Have nucleus which is segmented into 3-5 connected lobes.
- ② Are derived from bone marrow.
- ③ Occupy 60-70% of total WBCs.
- ④ It can be identified by segmented nucleus or by CD66 marker.
- ⑤ They are called neutrophils; because their granules poorly staining with leukocytes dyes.

Eosinophils

- ① Has granules staining with acidic dyes.
- ② They comprise 2–5% of total WBCs and have bi-lobed nuclei.



- ③ Have receptors for antibodies and C3b, enabling them to bind with opsonized targets.
- ④ The main functions of eosinophil are:
 - (a) **Digestion of infectious pathogens** e.g. parasitic worms by secret granule contents.
 - (b) **Secrete granule contents as antibiotic activation** (e.g. major basic protein and eosinophil cationic protein) .
 - (c) Also **produce cytokines, prostaglandins, and enzymes** which inhibit the inflammatory products of mast cells (e.g. histaminase).

Basophils

- ① Has granules stain with basic dyes.
- ② They constitute less than 1% of total WBCs.
- ③ The main functions of basophiles are:
 - (I) Mediators which promote inflammatory responses.
 - (II) Has role in hypersensitivity reactions.

Mast cells

- ① occur in tissues in two forms mast cells and mucosal mast cells.
- ② They are **activated** by two mechanisms:
 - (I) Highly affinity to Fc receptors for IgE.
 - (II) Specific binding of antigen to multiple IgE molecules that triggers activation of mast cells.

The functions of Mast cells are including:

- I. Release of a wide range of inflammatory mediators e.g. histamine, heparin.
- II. Produce various cytokines at infection site to facilitate of immune cells movement out of the bloodstream to tissues for fight the infection.

Dendritic cells (DCs)



- ① Are so called because, when they mature, their cytoplasm extends into transient spiny dendrites and sheet-like veils.
- ② They are derived from bone marrow.
- ③ DCs are seldom found in the blood and constitute 0.1-0.5% from blood monocyte cells; their precursors migrate into skin to form Langerhans cells of the epidermis and dermal DCs.

The main functions of DCs are including:

- I. Play role of uptake, captured, processed and transport antigen from skin.
- II. Present antigen to T lymphocytes.
- III. Secret large amounts of some cytokines.

Antigen-presenting-cells (APCs)

- ① Are heterogeneous populations of leukocytes or other cells, such as **endothelial** or **epithelial** cells, have ability to “**present**” antigens when stimulated by cytokines.
- ② These are found in the skin, lymph node, spleen, and thymus.
- ③ Have class II MHC molecules, which are used in presenting antigen to TH cells and B cells.

The functions of APCs are:

- A. Important role into inducing of TH cells activity.
- B. Capture and transport protein antigen to the draining lymph node.
- C. Expression numerous co-stimulatory adhesion molecules and cytokines.
- D. Also, help to prevent T cell reactivity against the body’s own components.
- E. Other APCs communicate with other leukocytes.