



Tikrit University
College of Veterinary Medicine

Lect. 2-Immunology

Subject name: Cells and tissues of immune system

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Lecturers link

IMMUNOLOGY

Lecture 2

Junior students

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Cells and tissues of immune system

What is the purpose of this chapter?

The purpose for this chapter is to study and describe the morphology as well as the function of different Immune cells.

In the beginning of this chapter we will introduce the types of immune cells , divisions and differentiation with their normal count in the human body.

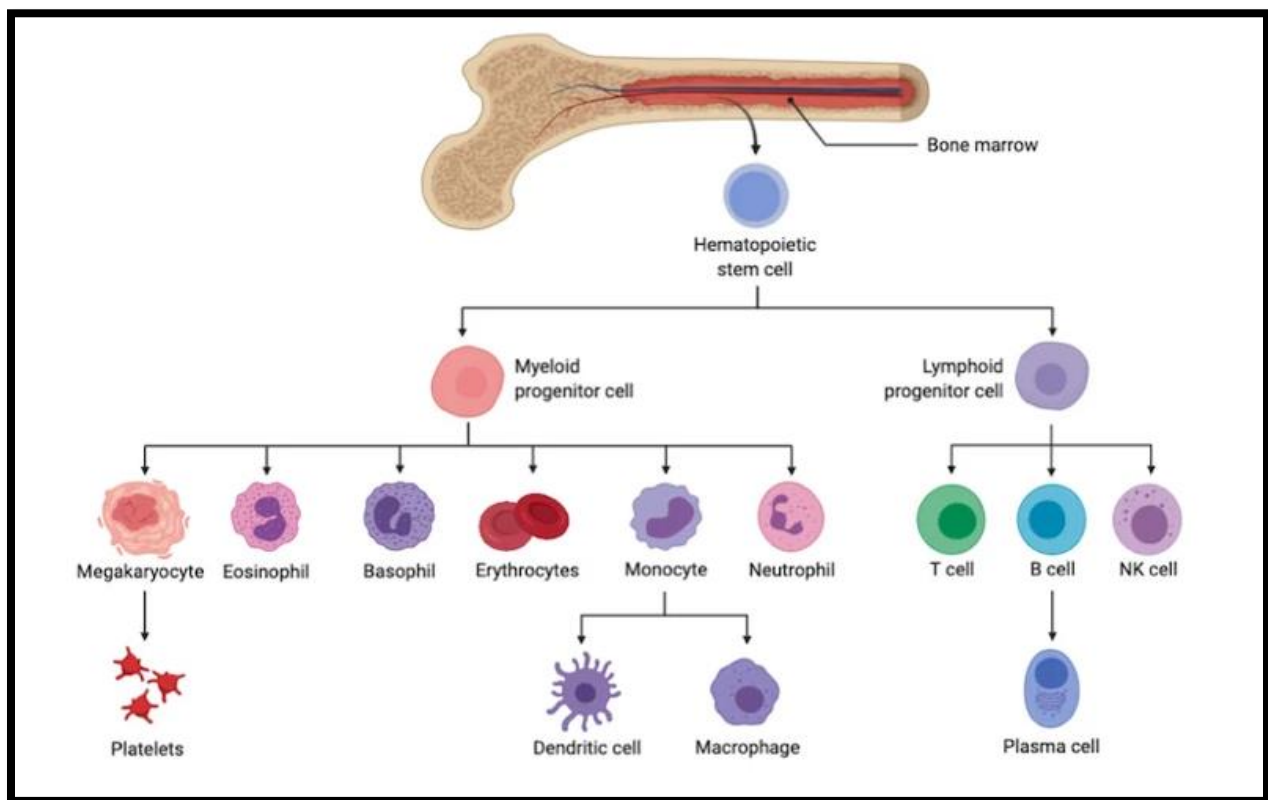


Figure 2-1: The origin, divisions and differentiation of the immune cells

TABLE 2-1 Normal Blood Cell Counts		
	Mean Number per Microliter	Normal Range
White blood cells (leukocytes)	7400	4500–11,000
Neutrophils	4400	1800–7700
Eosinophils	200	0–450
Basophils	40	0–200
Lymphocytes	2500	1000–4800
Monocytes	300	0–800

Table1: The normal count of different immune cells in normal human body

Phagocytes:

The term phagocytes including my types of cells such as neutrophil, macrophages and dendritic cells. The functional response of these cells consists of many steps

- 1- Recruitment of the cells to the sites of infection
- 2- Promoting and regulating immune response Communicating with other cells by direct contact as well as by secreting cytokines
- 3- Ingestion and destroying some microbes.

All these functions are important in the innate immunity as well as in the effector phase of adaptive immunity .

Neutrophils

These cells also called polymorphonuclear cells due to the shape of nucleus which is characterized by segmented multiple. These circular cells are considered the most abundant populations of circulating white blood cells with 12-15 μm in their diameter and they mediate the early phase of inflammation. These cells also contains granules in their cytoplasm called lysozymes which distinguish the neutrophils from other types such as basophile and eosinophils.

Neutrophils are produced in the bone marrow and this production is stimulated by **Granulocyte colony stimulated factor (G-CSF)**. They migrate to the site of infection after the entry of the microbe.



2-2 : The light micrograph of a Wright- Giemsa–stained blood neutrophil shows the multilobed nucleus, because of which these cells are also called polymorphonuclear leukocytes, and the faint cytoplasmic granules.

Mononuclear Phagocytes (Macrophages and Monocytes)

This types of cells including macrophages which are playing an important role in the innate and adaptive immune response. These cells arise from precursor cells in the bone marrow and driven by **monocytes / macrophage-colony stimulating factor (MCF)** These precursors mature into monocytes, which enter and circulate in the blood (and then migrate into tissues, especially during inflammatory reactions, where they further mature into macrophages

Monocytes are 10-15 μm in diameter and they have bean shaped nuclei with granular cytoplasm

A major function of macrophages in host defense is to ingest and kill microbes. The mechanisms of killing, , include the enzymatic generation of **reactive oxygen species(ROS)** and nitrogen species that are toxic to microbes, and have a function of proteolytic digestion.

Macrophages also ingest dead host cells, including cells that die in tissues because of trauma or interrupted blood supply and neutrophils that accumulate at sites of infection. This is part of the cleaning up process after infection or sterile tissue injury.

Macrophages also recognize and engulf apoptotic cells before the dead cells can release their contents and induce inflammatory responses Throughout the body and throughout the life of an individual, unwanted cells die by apoptosis as part of many physiologic processes, such as development, growth, and renewal of healthy tissues, and the dead cells are eliminated by macrophages.

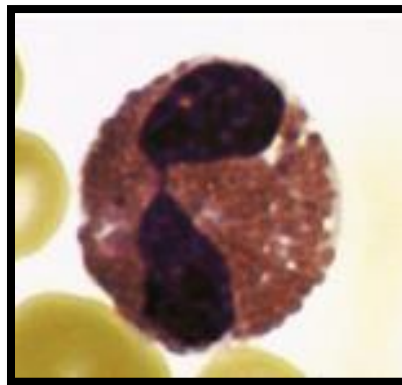
Macrophages serve as APCs that display antigens to and activate T lymphocytes. This function is important in the effector phase of T cell–mediated immune responses.

Macrophages promote the repair of damaged tissues by stimulating new blood vessel growth (angiogenesis) and synthesis of collagen-rich extracellular matrix (fibrosis). These functions are mediated by cytokines secreted by the macrophages that act on various tissue cells.

Eosinophils

Eosinophils are blood granulocytes that express cytoplasmic granules containing enzymes that are harmful to the cell walls of parasites but can also damage host tissues. Eosinophil granules contain basic proteins that bind cells to the immune system

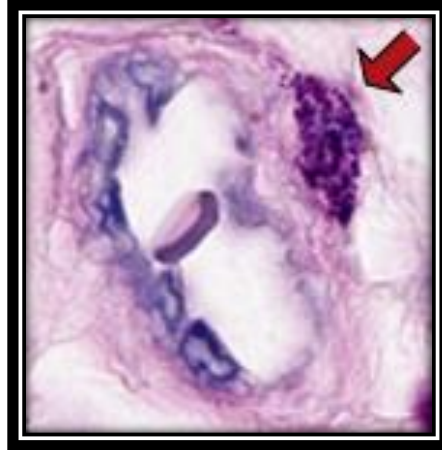
Some eosinophils are normally present in peripheral tissues, especially in mucosal linings of the respiratory, gastrointestinal, and genitourinary tracts, and their numbers can increase during the phase of inflammation.



2-3 :The light micrograph of a Wright- Giemsa–stained blood eosinophil shows the characteristic segmented nucleus and red staining of the cytoplasmic granules.

Mast Cells

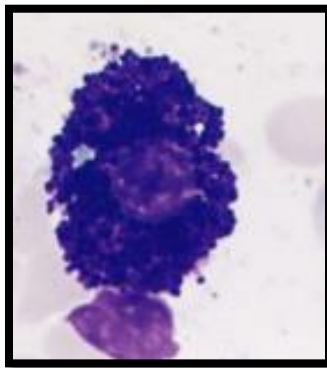
Mast cells are bone marrow–derived cells present in the skin and mucosal epithelia, which contain abundant cytoplasmic granules filled with **histamine** and other mediators. Normally, mature mast cells are not found in the circulation but are present in tissues, usually adjacent to small blood vessels and nerves. Mast cells express high- affinity plasma membrane receptors for a type of antibody called **IgE** and are usually coated with these antibodies. When the antibodies on the mast cell surface bind anti- gen, signaling events are induced that lead to release of the cytoplasmic granule contents into the extracellular space. The released granule contents, including histamine, pro- mote changes in the blood vessels that cause inflammation. Mast cells recognize microbial products and respond by producing cytokines and other mediators that induce inflammation. These cells provide defense against helminths and other microbes, but are also responsible for symptoms of allergic diseases .



2-4 : The light micrograph of a Wright- Giemsa–stained section of skin shows a mast cell

Basophils

Basophils are blood granulocytes with many structural and functional similarities to mast cells. Like other granulocytes, basophils are derived from bone marrow progenitors mature in the bone marrow, and circulate in the blood. Basophils constitute less than 1% of blood leukocytes. Although they are normally not present in tissues, basophils may be recruited to some inflammatory sites. Basophils are capable of synthesizing many of the same mediators as mast cells. Like mast cells, basophils express **IgE** receptors, bind IgE, and can be triggered by antigen binding to the IgE. Because basophil numbers are low in tissues, their importance in host defense and allergic reactions is uncertain



2-5 :The light micrograph of a Wright-Giemsa–stained blood basophil shows the characteristic blue-staining cytoplasmic granule

STAY STRONG

GOOD LUCK