جامعة الانبار
كلية العلوم
قسم التقنيات الأحيائية

اسم المادة: المناعة
عنوان المحاضرة :Cells of immunity
الاستاذ المساعد الدكتور صفاء عبد لطيف المعيني

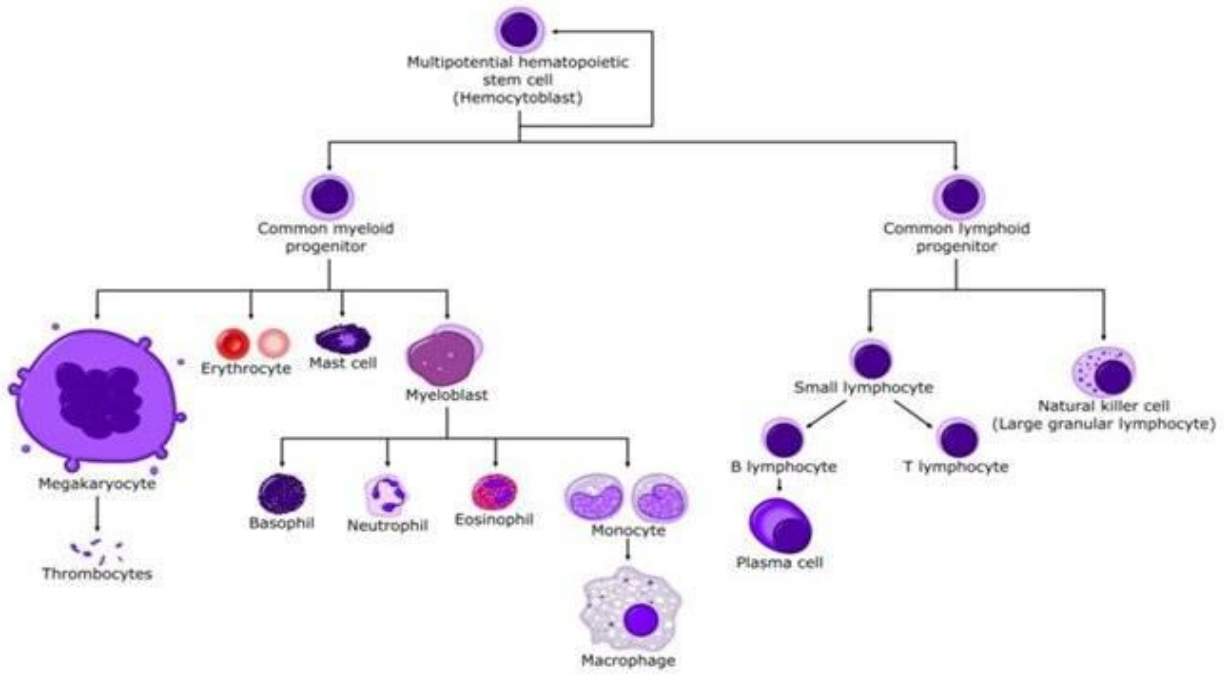
CELLS OF THE IMMUNE SYSTEM

All cells of the immune system originate from a hematopoietic stem cell in the bone marrow, which gives rise to two major lineages,

A. myeloid progenitor cell

B. lymphoid progenitor cell (Figure below).

These two progenitors give rise to the myeloid cells (**monocytes**, **macrophages**, **dendritic cells, meagakaryocytes** and **granulocytes**) and **lymphoid cells** (**T cells**, **B cells** and **natural killer** (NK) cells), respectively. These cells make up the cellular components of the innate (non-specific) and adaptive (specific) immune systems.



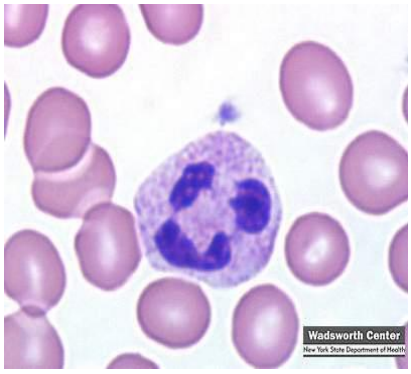
Cells of the innate immune system

Cells of the innate immune system include phagocytic cells (monocyte/macrophages and PMNs), NK cells, basophils, mast cells, eosinophiles

and platelets. The receptors of these cells are pattern recognition receptors (PRRs) that recognize broad molecular patterns found on pathogens (pathogen associated molecular patterns, PAMPS).

Neutrophil granulocytes (also known as **neutrophils** or occasionally **neutrocytes**) are the most abundant type of granulocytes and the most abundant (40% to 75%) type of white blood cells in most mammals. They form an essential part of the innate immune system. Functionality varies in different animals.

They are formed from stem cells in the bone marrow. They are short-lived and highly motile. Neutrophils may be subdivided into segmented neutrophils and banded neutrophils (or bands). They form part of the polymorphonuclear cell family (PMNs) together with basophils and eosinophils.



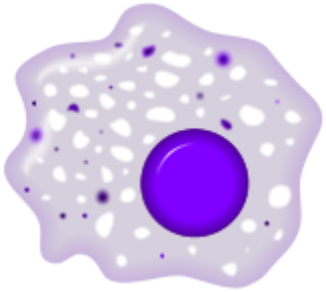
segmented neutrophils

banded neutrophils

Macrophages are important cells of the immune system that are formed in response to an infection or accumulating damaged or dead cells. Macrophages are large, specialized cells that **recognize**, **engulf** and **destroy** target cells. The term macrophage is formed by the combination of the Greek terms "makro" meaning big and "phagein" meaning eat. Macrophages are formed through differentiation of monocytes, one of the major groups of white blood cells of the

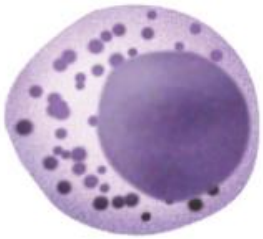
immune system. Monocytes move through the bloodstream and when they leave the blood, they mature into macrophages.

1. **brain macrophages- microglia**
2. **lung macrophages- alveolar**
3. **liver macrophages- Kupffer**



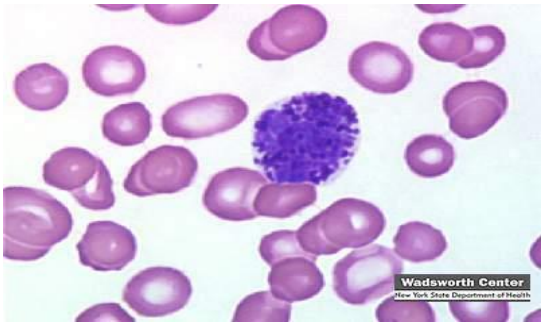
Natural killer cells (also known as NK cells, K cells, and killer cells) are a type of lymphocyte (a white blood cell) and a component of innate immune system.

NK cells play a major role in the host-rejection of both tumours and virally infected cells. NK cells are cytotoxic; small granules in their cytoplasm contain special proteins such as perforin and proteases known as granzymes.

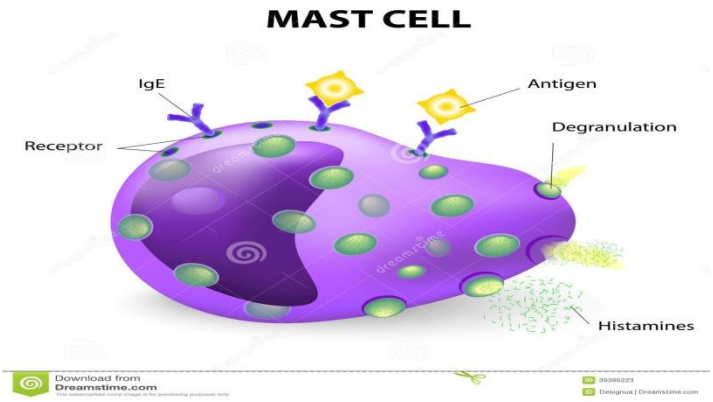


Natural killer cell

Basophil A type of immune cell that has granules (small particles) with enzymes that are released during allergic reactions and asthma. A basophil is a type of white blood cell and a type of granulocyte.

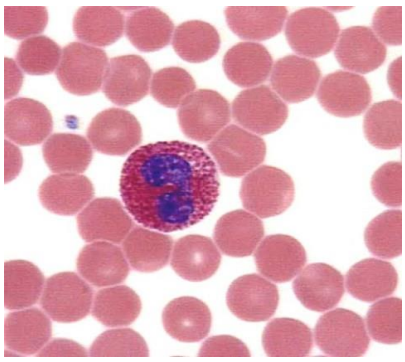


Mast cells tissue cell of the immune system of vertebrate animals. Mast cells mediate inflammatory responses such as hypersensitivity and allergic reactions. They are scattered throughout the connective tissues of the body, especially beneath the surface of the skin, near blood vessels and lymphatic vessels, within nerves, throughout the respiratory system, and in the digestive and urinary tracts. Mast cells store a number of different chemical mediators—including histamine, interleukins, proteoglycans (e.g., heparin), and various enzymes—in coarse granules found throughout the cytoplasm of the cell. Upon stimulation by an allergen, the mast cells release the contents of their granules (a process called degranulation) into the surrounding tissues. The chemical mediators produce local responses characteristic of an allergic reaction, such as increased permeability of blood vessels (i.e., inflammation and swelling), contraction of smooth muscles (e.g., bronchial muscles), and increased mucus production.



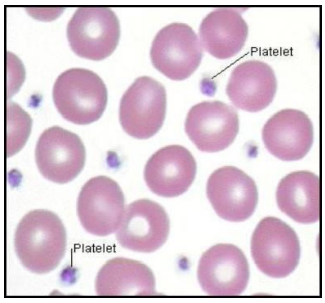
Eosinophil is a specialized cell of the immune system. This pro-inflammatory white blood cell generally has a nucleus with two lobes (bilobed) and cytoplasm filled with approximately 200 large granules containing enzymes and proteins with different functions.

Eosinophilic functions include: movement to inflamed areas, trapping substances, killing cells, antiparasitic and bactericidal activity, participating in immediate allergic reactions



Platelets, also called **thrombocytes**, are a component of blood whose function (along with the coagulation factors) is to stop bleeding by clumping and clotting blood vessel injuries. Platelets have no cell nucleus: they are fragments

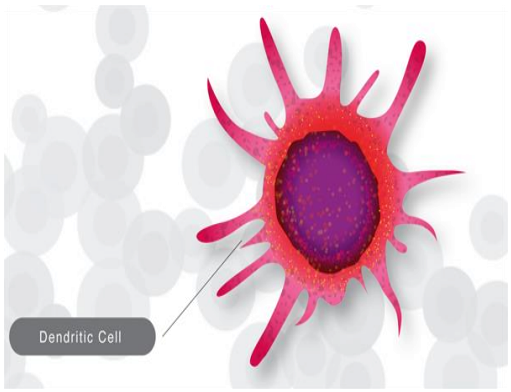
of cytoplasm which are derived from the megakaryocytes of the bone marrow, and then enter the circulation



Cells that link the innate and adaptive immune systems

A specialized subset of cells called antigen presenting cells (APCs) are a heterogenous population of leukocytes that play an important role in innate immunity and also act as a link to the adaptive immune system by participating in the activation of helper T cells (Th cells). These cells include dendritic cells and macrophages.

Dendritic cells (DCs) are professional antigen-presenting cells located in the skin, mucosa and lymphoid tissues. They act as messengers between the innate and the adaptive immune systems. Their main function is to process antigens and present them to T cells to promote immunity to foreign antigens and tolerance to self antigens. They also secrete cytokines to regulate immune responses.



References:-

1- Richard Coioco and Geoffery Sunshine (2014). Immunology.Seventh edition.Wiley Blackwell.