

Cells of the Immune System

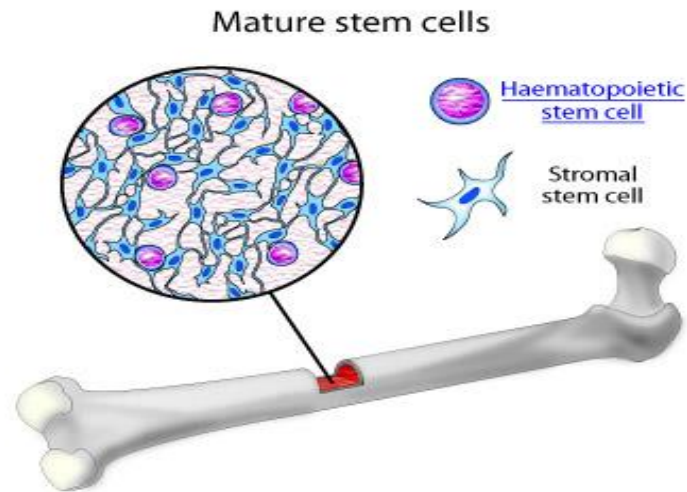
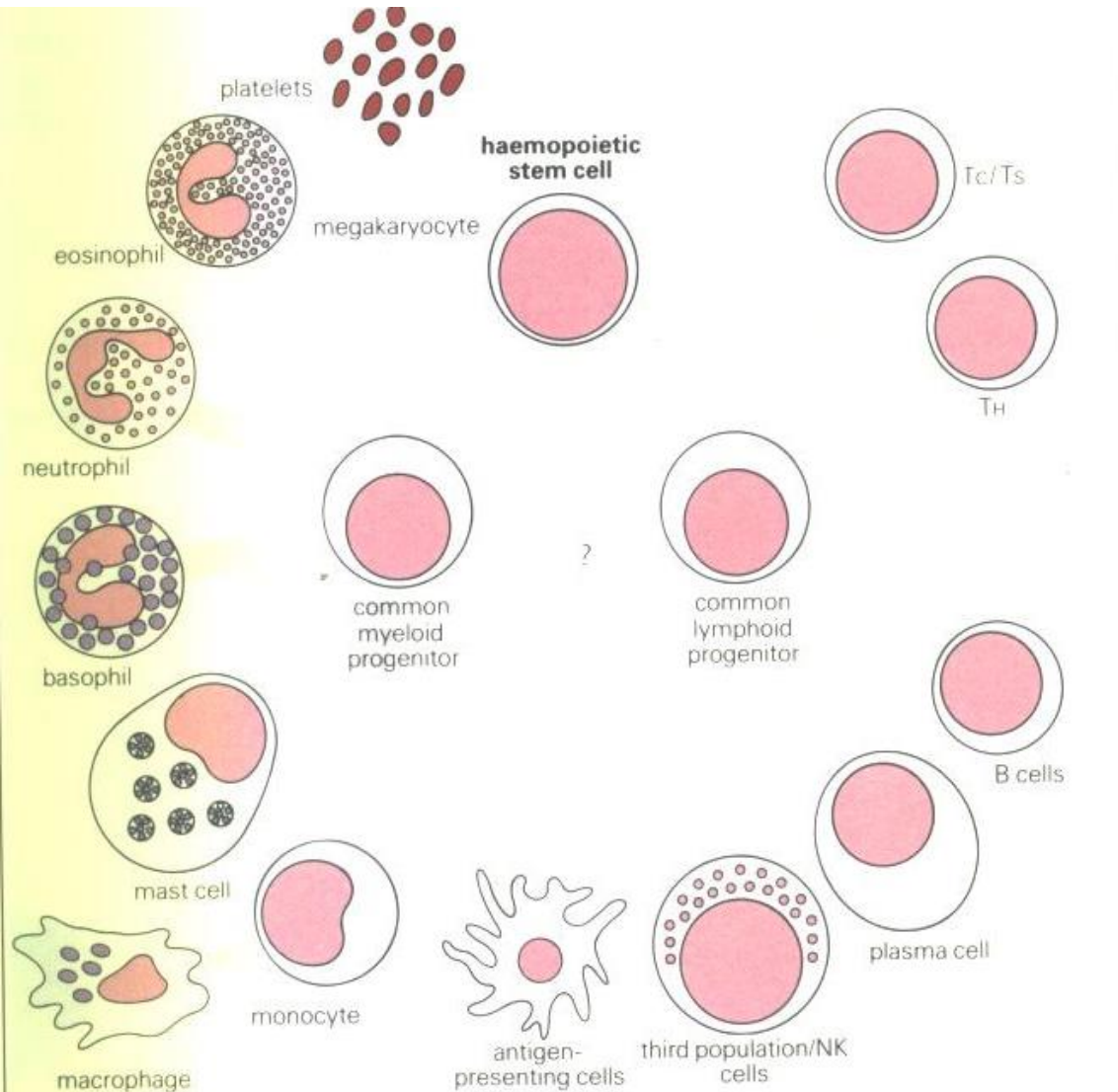


Illustration by [Cell Imaging Core](#) of the Center for Reproductive Sciences.

- All immune system cell develop from the stem cells

Cells of the Immune System



- Myeloid series cells
 - Monocyte-Macrophage
 - Neutrophils
 - Eosinophils
 - Basophils
 - Mast Cells (origin unknown)
 - Erythrocyte
 - Platelets
- Lymphoid series cells
 - B lymphocyte
 - T lymphocyte
 - NK cell



Myeloid Series Cells

- *Polymorphnuclear Series Cells*

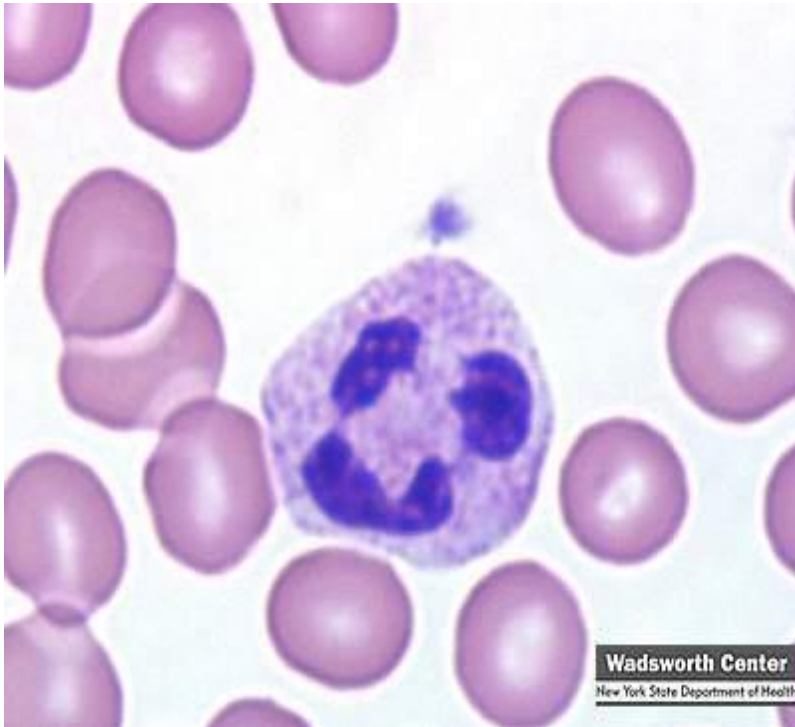
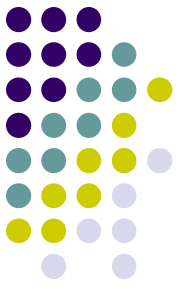
- segmented
- irregular niucleus
- there are granules in the cytoplasm
- Cells are given according to the diffrent dyes of the granules

Eosinophils –asidic dyes (eosin)

basic paints (hematoxylin)

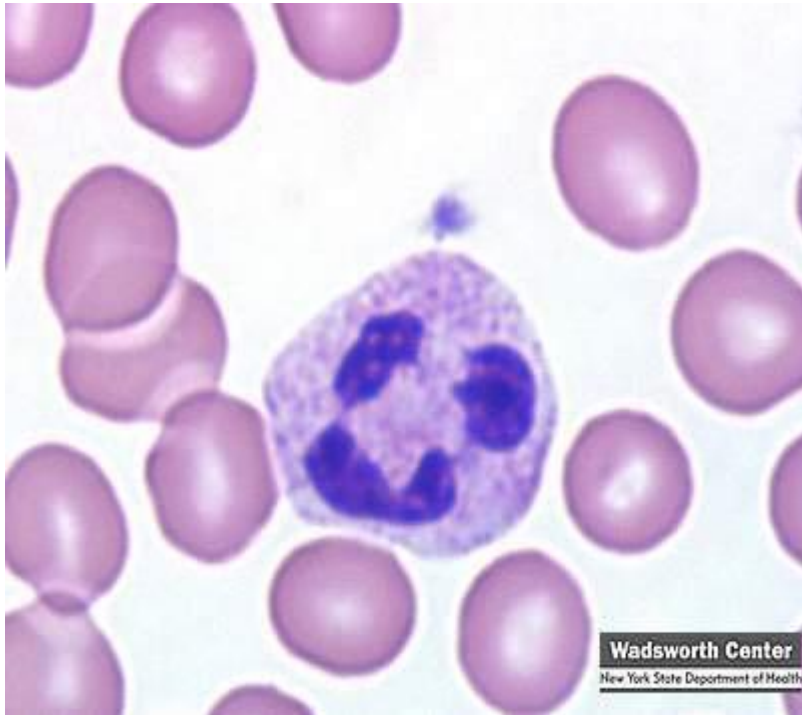
What are acidic basic dyes, neutrophils

Neutrophils



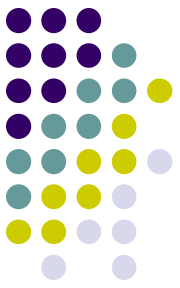
- 10-12 μm in blood
- They are the most dense cells of blood leukocytes(30-75%)
- Consists of fine granules that do not stain
- Myeloperoxidase, lysozyme, cathepsin, lactoferrin, etc. in granules. enzymes are found
- They pass from blood to tissue.
- Life expectancy is several days
- Surface molecules: immunoglobulin receptor, complement receptor, adhesion molecules, MHC molecules, cytokine receptors

Neutrophils



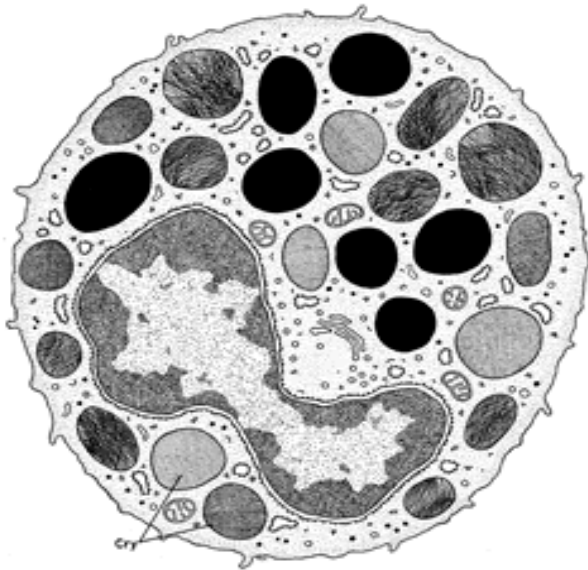
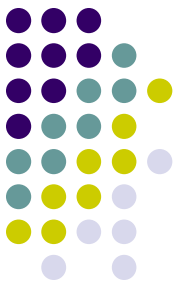
- Phagocytosis is the most important task
- The first and fastest phagocytosis of foreign molecules to the body - the first line of defense
- Low phagocytosis capacity
- Can participate in the inflammation

Eosinophils

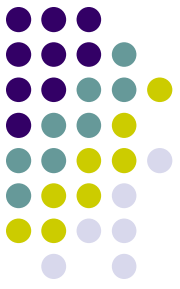


- Painted with acidic dyes(eosine)
- Diameters of 12-14 μm
- They constitute 2-10% of leukocytes in blood
- Granules contain eosinophil peroxidase and acid phosphatase enzymes
- Matures on the spleen
- Localized in skin and mucous membranes
- **More effective against parasites**
- Can participate in the inflammation
- **Can make phagocytosis**
- Half-Life : in blood 30 minnute μm
in tissue 12 day
- Surface molecules are the same as neutrophils

Basophils



- Minimum cell type (0.5%)
- Painted with basic dyes (hematoxylin)
- Diameters of 10-14 μ m
- Its not normally found outside the vein but it can migrate to the tissues.
- Can participate in the inflammation (histamin)
- But can not do phagocytosis
- Surface molecules are the same as neutrophils



Mononuclear Phagocytic Cells

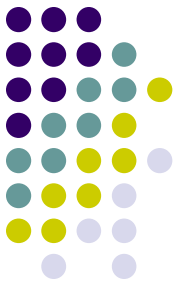
- Macrophages
- (Bone marrow) Monoblast → promonocyte → monocyte → (Blood) → transition to tissues → mature macrophage

Connective Tissue → histiocytes

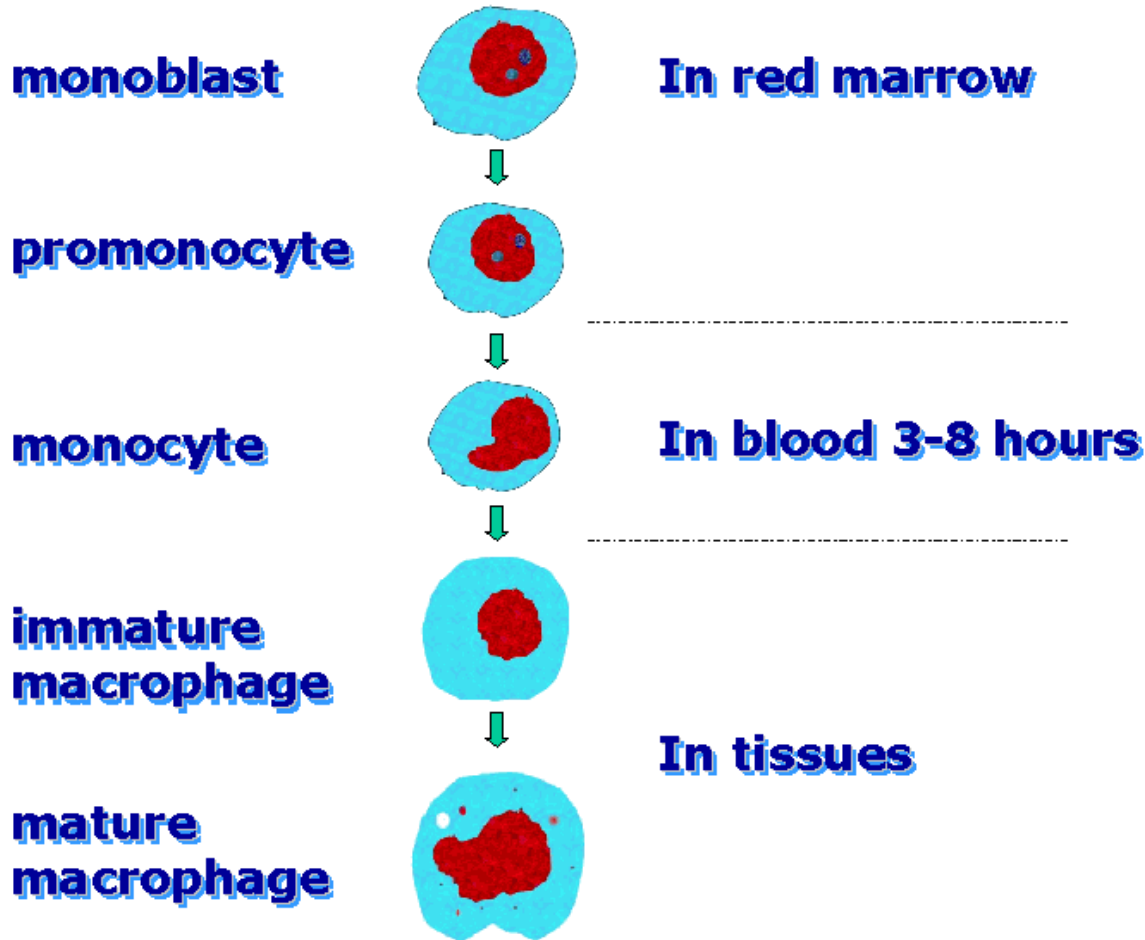
Liver → Kupffer cell

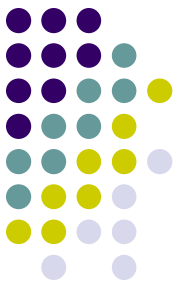
Brain → microglia

Kidney → mesengial cells



Maturation of Macrophages

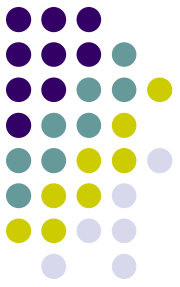




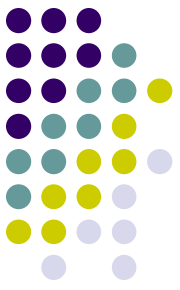
Macrophages

- Macrophages have different morphological structure and size depending on their location.
- Macrophages in liquid size $15\mu\text{m}$
- Intracytoplasmic organelles are more-protein synthesis
- Surface molecules are the same as neutrophils
- Their life is approximately 100 days

Macrophages



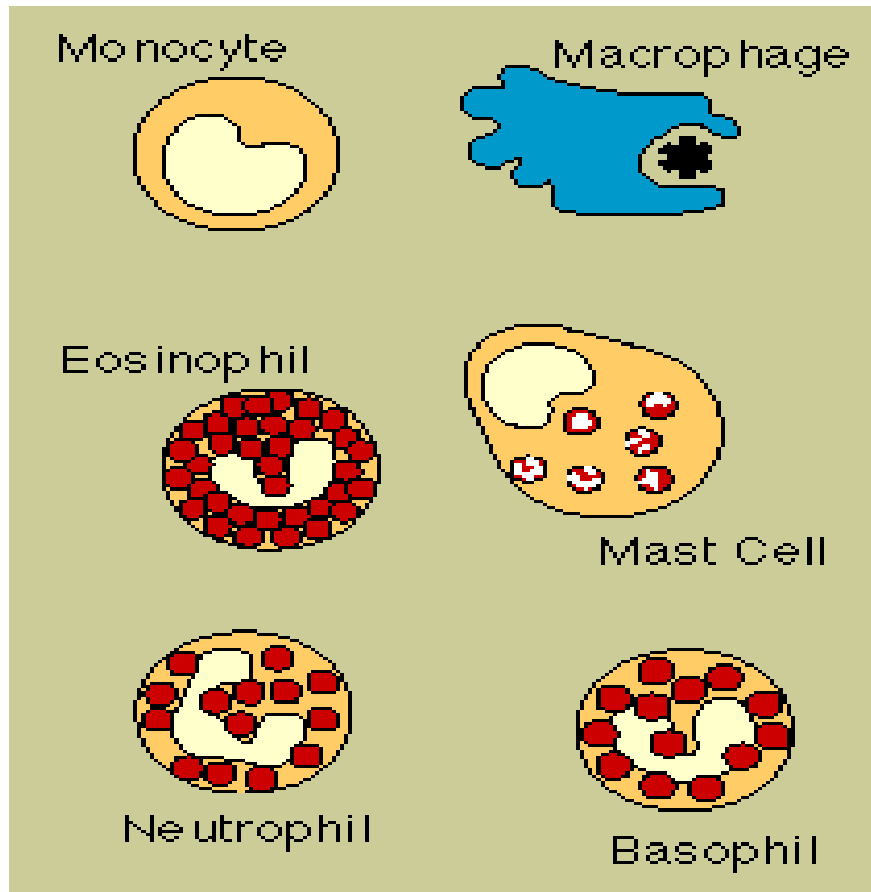
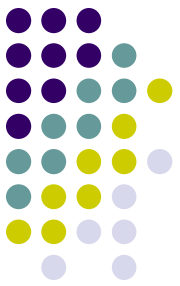
- Main Tasks:
 - Phagocytosis: They start phagocytosis later than neutrophils, but they do it repeatedly and repeatedly during their lifetime.
 - Antigen processing and presentation
 - Cytokine synthesis
 - Wound healing



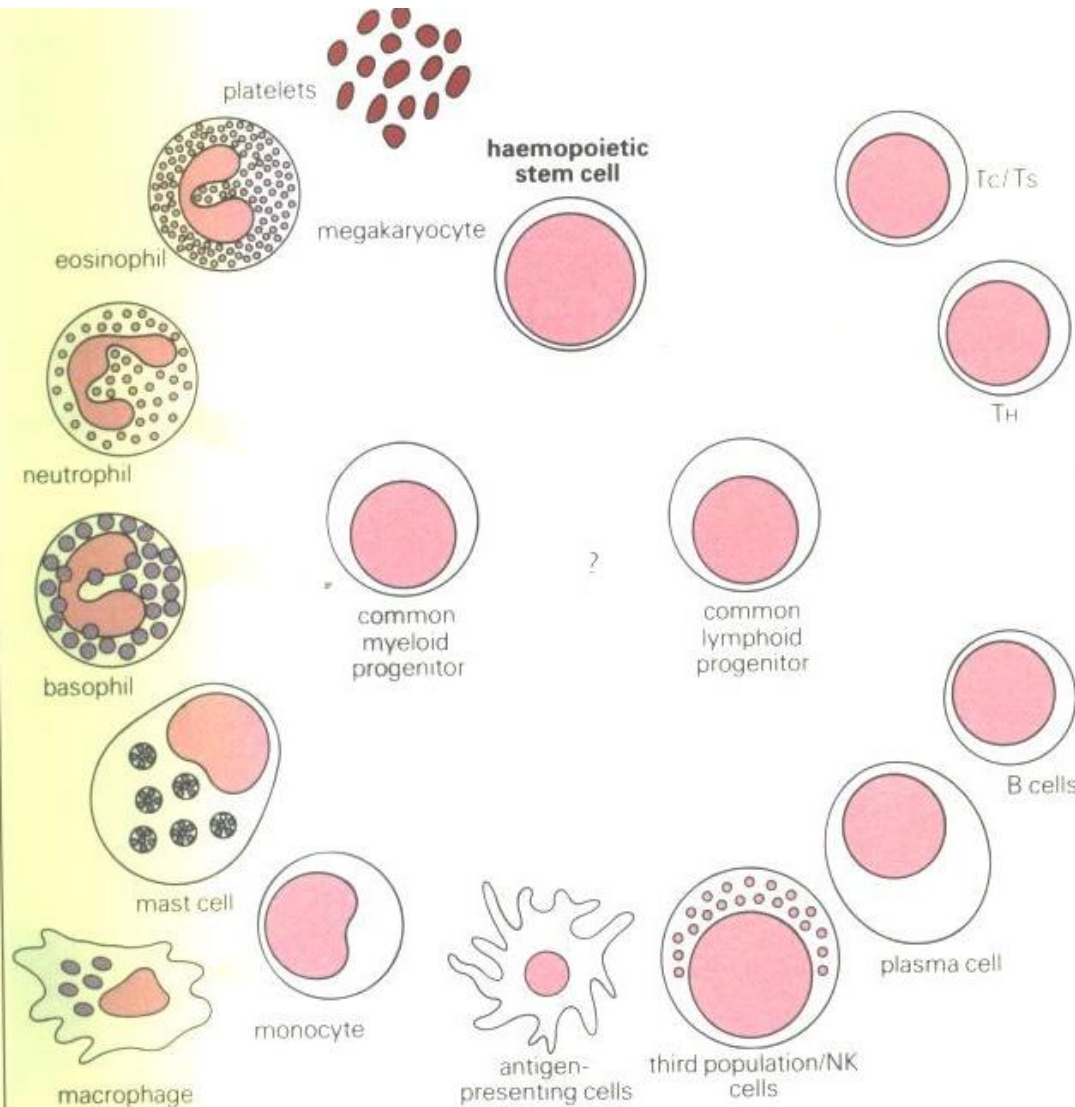
Mast Cells

- Similar to basophils but not clear in origin
- Connective tissue mast cells:
 - Diameters of 20 μm
 - Large granules (such as histamine-heparin)
 - Life span of more than 6 months
 - It acts against allergy and inflammation
- Mucosal mast cells:
 - Diameters of 10 μm
 - Lifa span of less than 40 days
 - Small number of granules (prostaglandin, leukotriene)
 - It acts against allergy and inflammation
 - IgE receptor available- it acts against parasitic

Overview



Lymphoid Series Cells



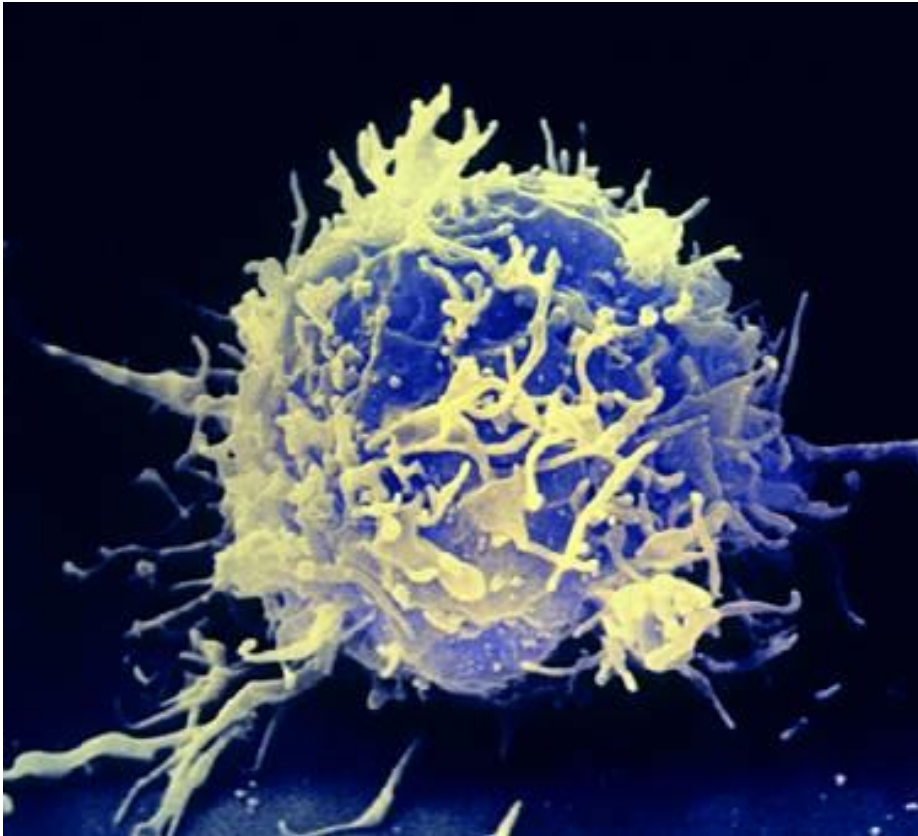
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- Lymphoid series cells

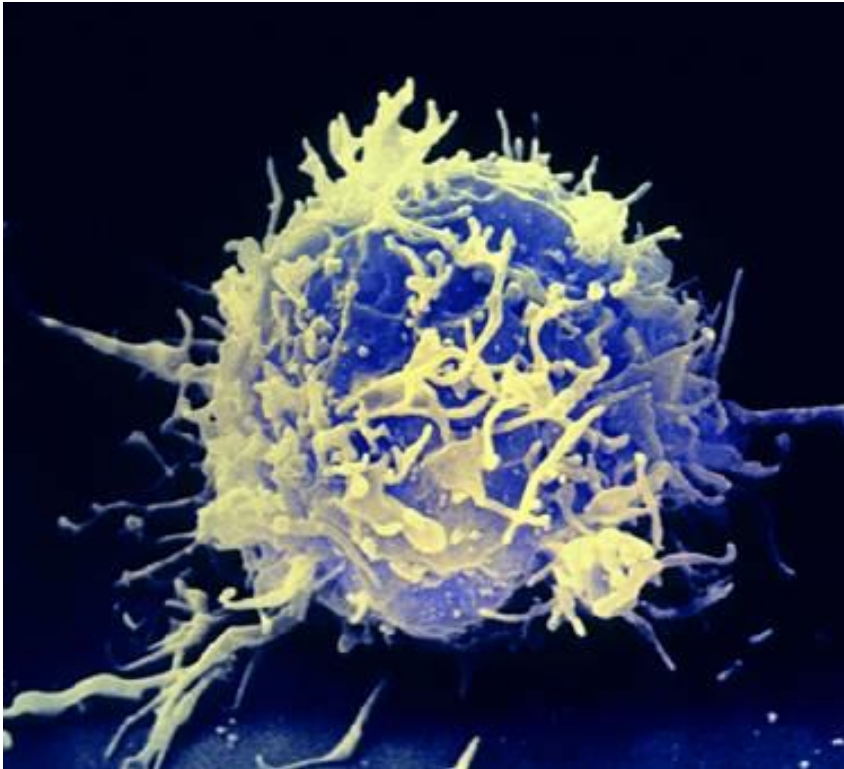
- B lymphocyte
- T lymphocyte
- NK cell

Lymphocytes

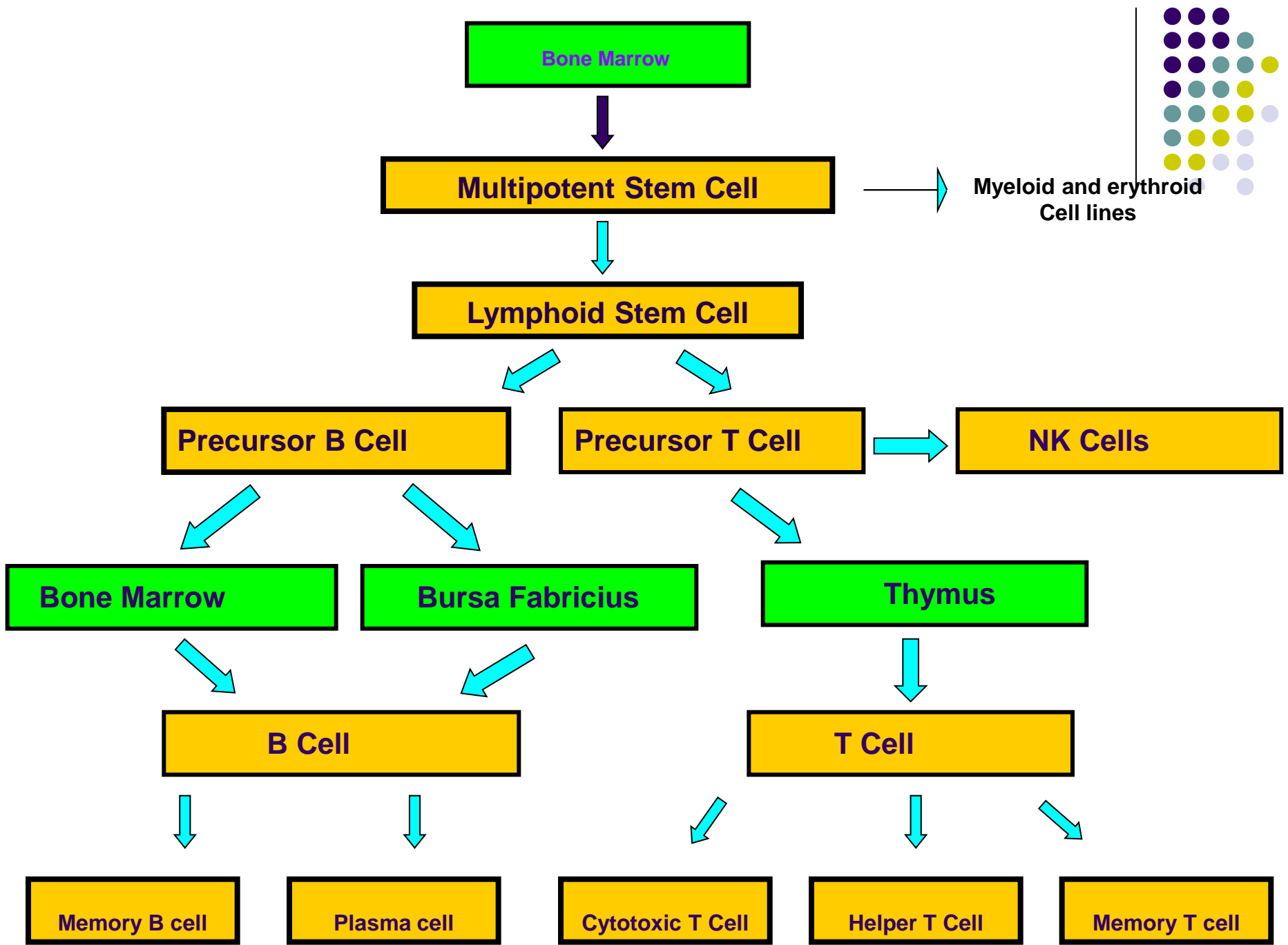


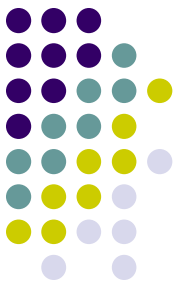
- Specific immune cells
- Diameter is 7-15 μm and spherical structures
- It is found in lymphoid organs and different tissues and organs
- There are other subgroups with B and T lymphocytes
- Lymphocyte species have no morphological differences.

Lymphocytes



- Surface Molecules
 - **Antigen Receptors**
 - Immunoglobulin Receptor
 - Complement Receptor
 - Adhesion Molecules
 - MHC Molecules
 - Cytokine Receptors





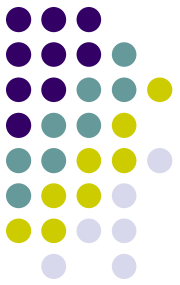
B Lymphocytes

- Cells response for hummoral immune response
- Small amount in peripheral blood
- They are localized in lymphoid tissues
- A B cell contains 200.000-500.000 antigen receptors
- Antigenic stimulation results in the activation of B cells into plasma cells

Plasma cell



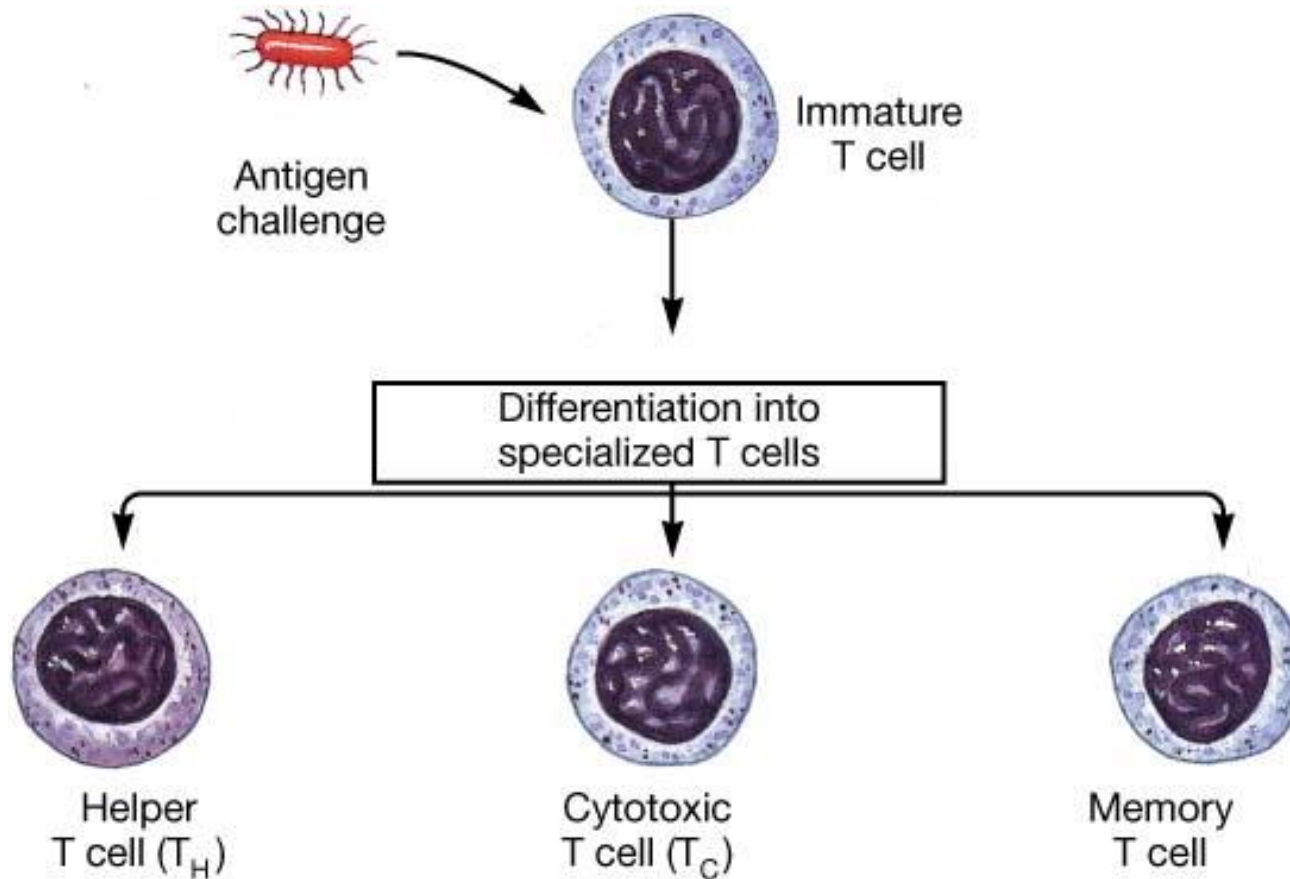
- Diameter is 8-9 μm . Their structure is ovoid.
- Rich in intracytoplasmic organelles
- Protein(Antibody) synthesis
- Can produce up to million IG in an hour
- They produce antibodies for 3 days to 4 weeks

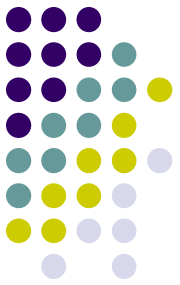


T Lymphocytes

- Effective Cellular immun response
- Up to 80% of the lymphocytes in the peripheral blood are T lymphocytes
- Different subtypes - different surface receptors(Helper T-lymphocyte CD4 + CD8-)

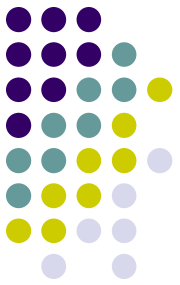
T cell Differentiation





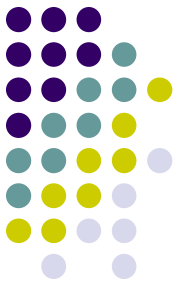
Helper T lymphocytes

- Effective in humoral and cellular immune response
- Th1 cells :- IL2, interferon gamma synthesis - initiates cellular immune response
- Th2 cells:- IL-4,IL-5,IL-10,IL-13 synthesis - initiates humoral immune response
- Th0 cells: Th1 and Th2 are precursors



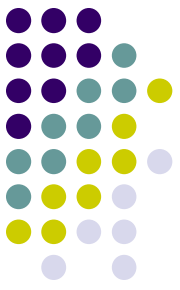
Cytotoxic T lymphocytes

- Responsible for immune response to endogenous antigens
- They are also remove foreign organ transplantations and cancer cells
- Against autoreactive T lymphocytes (suppressor cells)
- Cytoplasms contain granules containing perforin and granzyme
- Destroys target cell by apoptosis

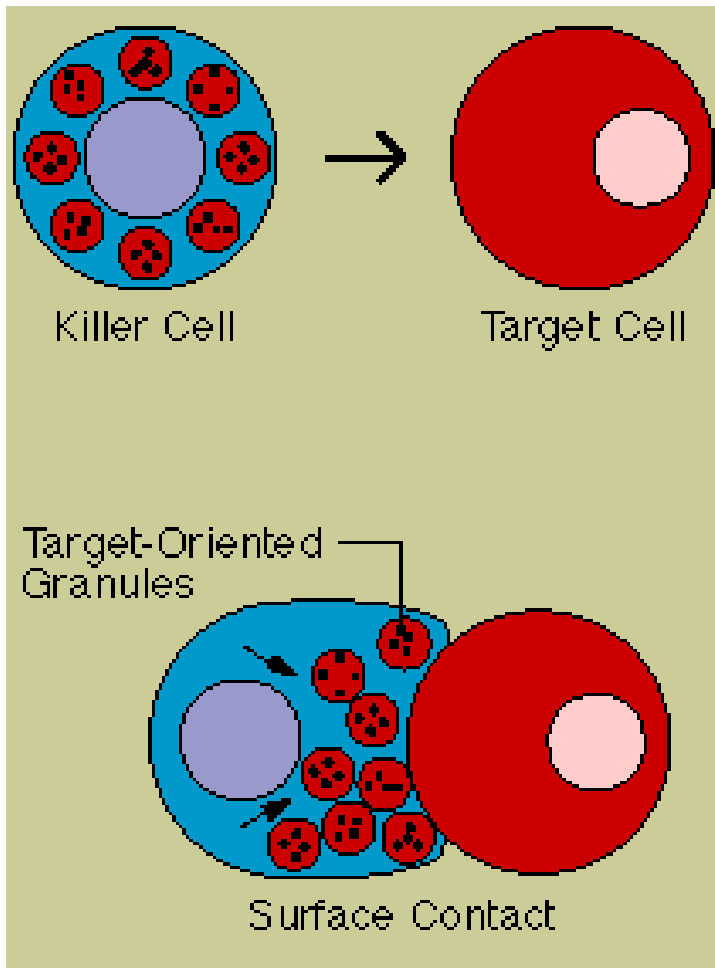


Memory B and T cells

- Long lived cells
- They are active at the second entry of the same antigen
- They have different surface molecules



Natural Killer (NK) Cells



- Lymphoid series cells
- 15% in peripheral blood
- They will not stop at Thymus
- No antigen receptors
- Intracytoplasmic granules contain granzyme and perforin
- Destroys target cell by apoptosis

**Cancer
cells**

**Body's
immune
system**

