

## Lymphoid tissues

- Lymphocytes found in blood, but majority are either in discrete clusters or organised in specific tissues
- Components are either primary, secondary or tertiary lymphoid tissues

### Primary

- Involved in development & differentiation of lymphocytes & include:

Thymus (T cells)

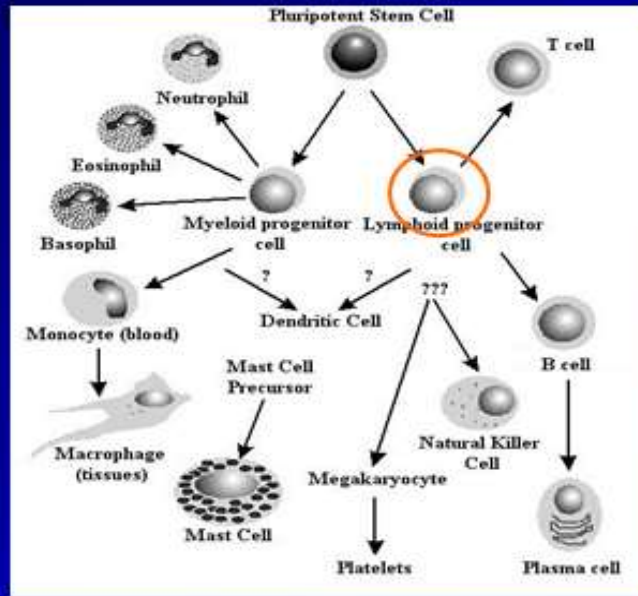
'Bursa equivalent' tissues: foetal liver & adult bone marrow in man (B cells)

### Secondary lymphoid tissues

- Allow accumulation of Antigen
- Present Antigen to both naïve & memory lymphocytes

- 1- Lymph node
- 2- Spleen
- 3- Liver in foetus
- 4- Peyer's patch in intestine
- 5- Appendix

# Cells involved in immunity

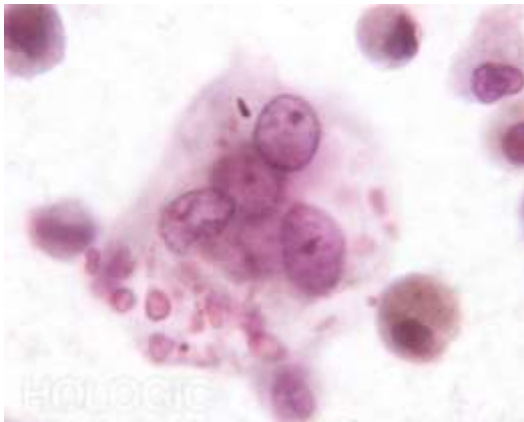


Phagocytes:  
Amyloid progenitor series

**Polymorph nuclear leucocyte (PMN) (Neutrophils , Eosinophil and Basophils.)**

The two types of circulating phagocytes, they are white blood cells that are recruited to sites of infection, where they recognize and ingest microbes for intracellular killing.

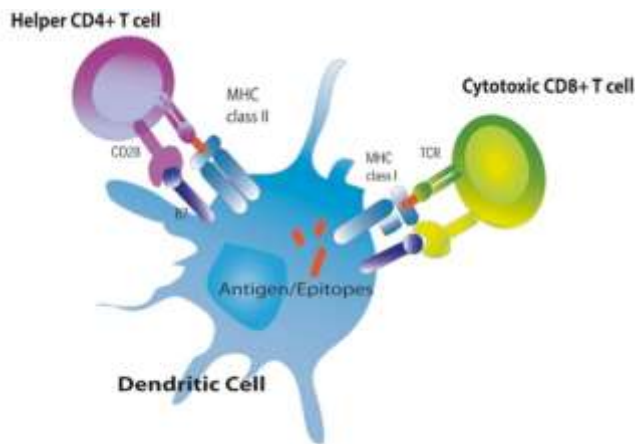
They have two mechanisms to killed pathogen 1- oxygen independent killing  
2- oxygen dependent killing.



**Dendritic Cells & Monocytes/Macrophages : Antigen presenting cells (APC)**

**APC** serve several important roles in host defense—they produce cytokines that **initiate immune response**.

**These** cells respond to microbes by producing numerous cytokines that serve two main functions: 1. **they initiate inflammation** and 2. **they stimulate adaptive immune responses**. By sensing microbes and interacting with lymphocytes, especially T cells, APC cells constitute an **important bridge between innate and adaptive immunity**. **And they are regulate inflammation, & they are clear dead tissues**.

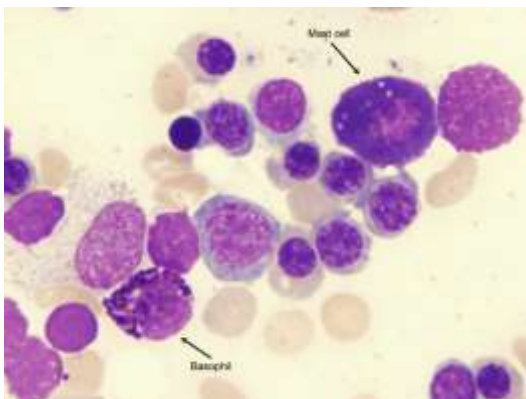


### **Natural Killer Cells**

**Natural killer (NK) cells are a class of lymphocytes that recognize infected and stressed cells and respond by killing these cells and by secreting the macrophage activating cytokine IFN- $\gamma$** . NK cells and macrophages are examples of two cell types that function cooperatively to eliminate intracellular microbes: Macrophages ingest microbes and produce IL-12, IL-12 activates NK cells to secrete IFN- $\gamma$ , and IFN- $\gamma$  in turn activates the macrophages to kill the ingested microbes.

### **Mast Cells**

Mast cells are bone marrow-derived cells with abundant cytoplasmic granules that are present in the skin and mucosal epithelium. Mast cells can be activated by microbial products binding to TLRs, as part of innate immunity, or by a special antibody-dependent mechanism. Mast cell granules contain vasoactive amines such as histamine that cause vasodilation and increased capillary permeability as well as proteolytic enzymes that can kill bacteria or inactivate microbial toxins. 1. Inflammation. 2. Hypersensitivity.



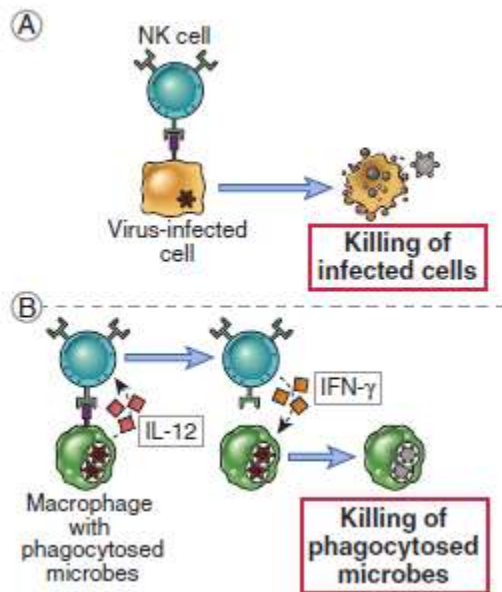
## Lymphoid progenitor series

B Lymphocytes

The **B lymphocyte (B cell)**. **Production antibodies in humoral immunity.**

derived its letter designation from its site of maturation, in the bursa of Fabricius in birds; the name turned out to be apt, as bone marrow is its major site of maturation in humans, mice, and many other mammals. Mature B cells are definitively distinguished from other lymphocytes and all other cells by their synthesis and activated B cells differentiate into effector cells known as **plasma cells**

**T lymphocytes (T cells)** derive their letter designation from their site of maturation in the thymus. Like the B cell, the T cell expresses a unique antigen-binding receptor called the T-cell receptor. T lymphocytes are divided into two major cell types—**T helper (TH) cells** and **T cytotoxic (TC) cells**—that can be distinguished from one another by the presence of either **CD4** or **CD8** membrane glycoproteins on their surfaces.



## The Thymus

- First organ to produce lymphocytes & provides environment for T cell maturation and **education**
- 2 lobes divided into lobules by trabeculae (or connective tissue walls)
- Each lobe has outer CORTEX & inner MEDULLA
- Thymocytes are surrounded by EPITHELIAL cells
- In cortex, THYMIC NURSE cells affect thymocyte development
- In medulla & corticomedullary junction where most blood vessels are found there is a special type of dendritic cell: **interdigitating** cells
- Cells pass from cortex to medulla while differentiating into T cells:  
Enter expressing neither CD4 or CD8), pass through expressing either CD4 (helper) or CD8 (cytotoxic)

## Secondary Lymphoid Tissues

### Lymph nodes

- Small, bean-shaped, tissue aggregates at junction of major lymph vessels, 1-25mm diameter, becoming much larger in infection
- Surrounded by a capsule & supported by a reticulum, 3 main areas: cortex, paracortical area, medulla
- Lymph carries Ag from tissues to lymph nodes allowing cells of the immune system to get **together** with antigen to start specific immune responses
- Cells flow to medulla & drain into efferent lymphatic at the hilus
- Blood lymphocytes enter lymph nodes at High Endothelial Venules (HEV) & return via thoracic duct



# The Spleen

## White pulp:

- cells & tissues surrounding major arterial branches – ) - & associated clusters of lymphocytes - the lymphatic follicles or nodules
- Follicles similar to those in lymph nodes
- B-dependent area consists of lymphoid follicles
- T-dependent area consists of the PALS

**Immunological role:** as for lymph nodes with germinal centres developing during immune responses

## Germ cells Associated Lymphoid tissue

