



# **Immunology/ Medical Students Cells and Organs of the Immune System**

## **Lecture 2**

**2024-2025**

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# Objectives

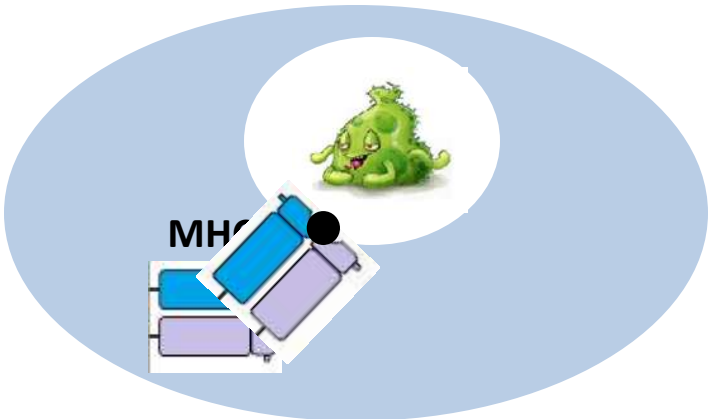
The structure and functions of the of the primary and secondary lymphoid organs

Types of white blood cell (WBC) population

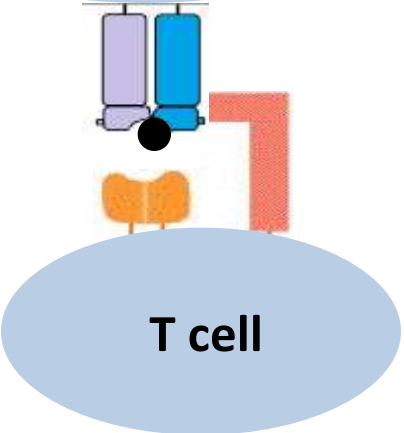
The principal functions of WBCs

Structural features of WBCs

# Principle of immune response



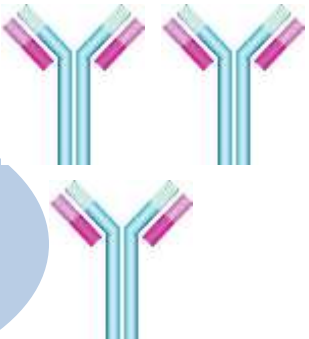
Macrophage



T cell

Activation of other types of lymphocytes

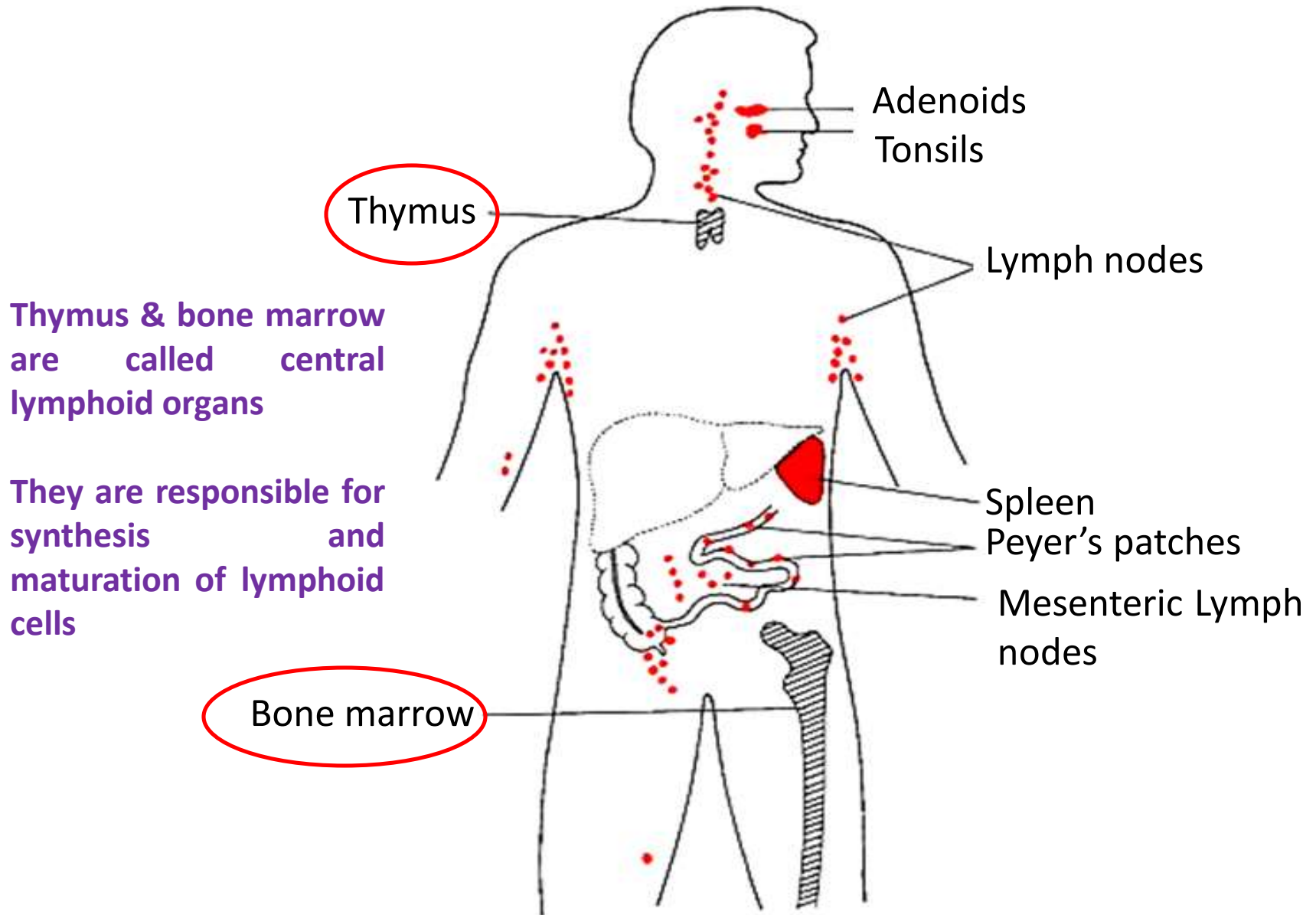
B-lymphocyte



# Lymphoid organs

## Primary Lymphoid organs

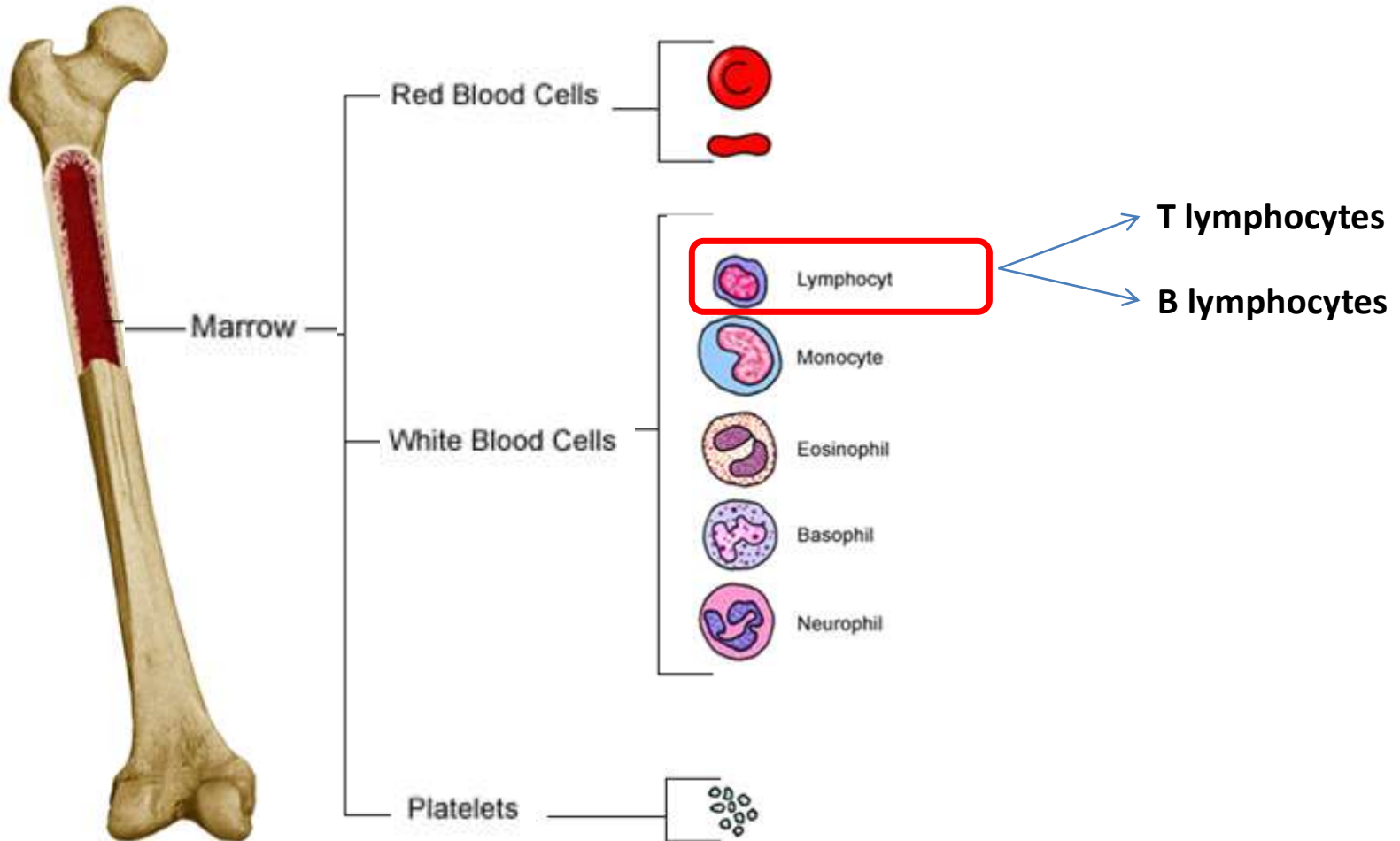
## Secondary Lymphoid organs



# Primary lymphoid organs

## Bone marrow

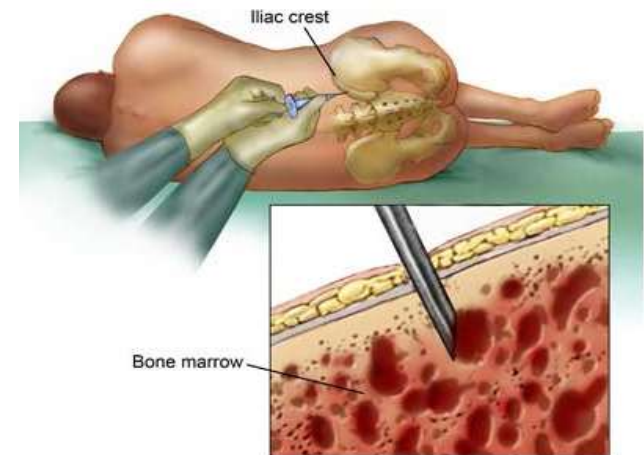
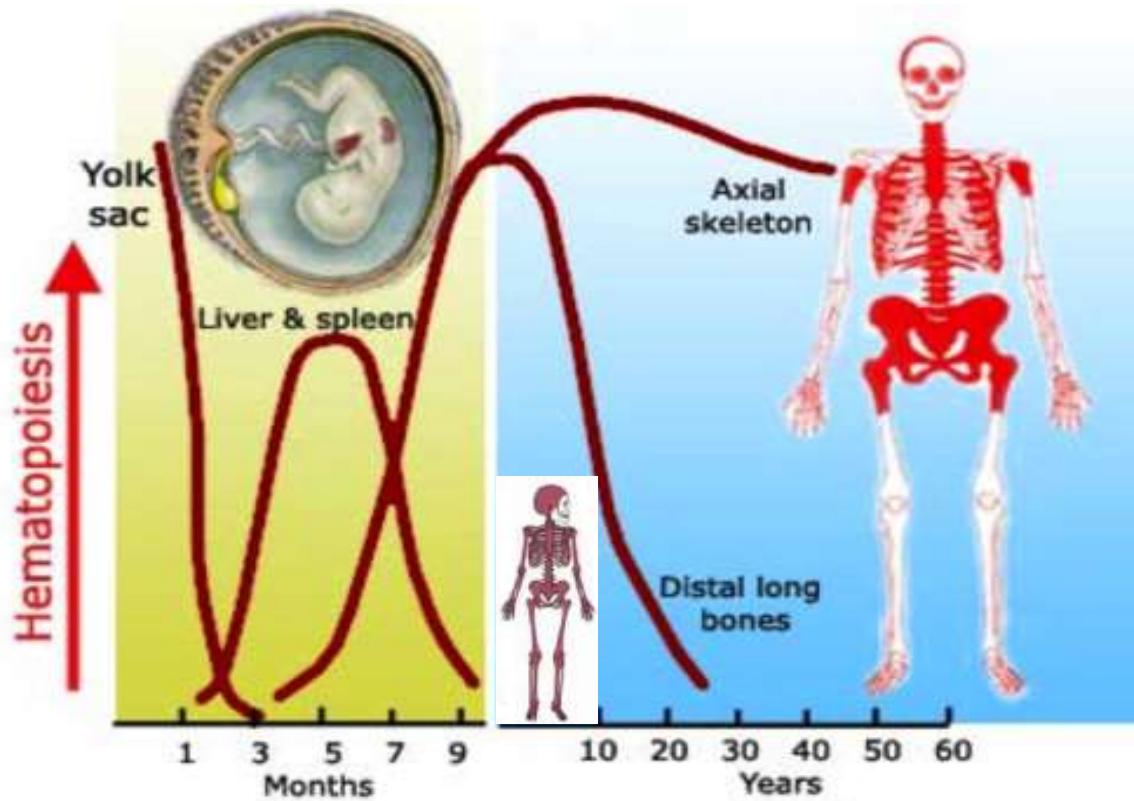
- ✓ The site of hematopoiesis
- ✓ Hematopoiesis is the formation of blood cells.



# Primary lymphoid organs

## Bone marrow

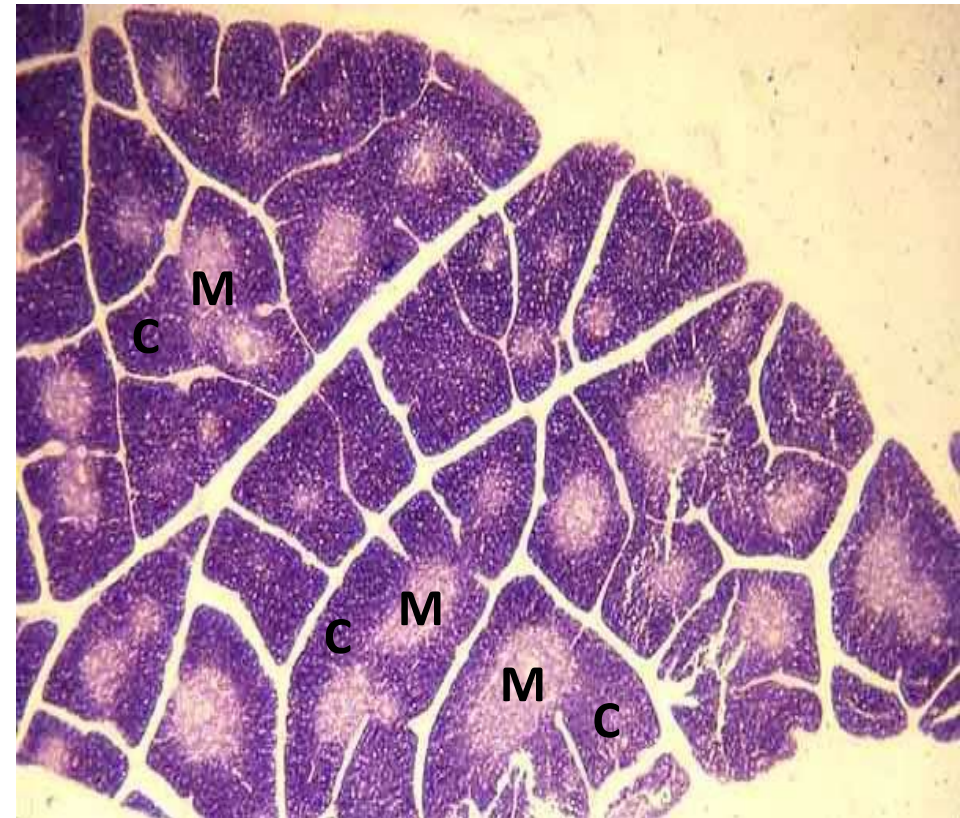
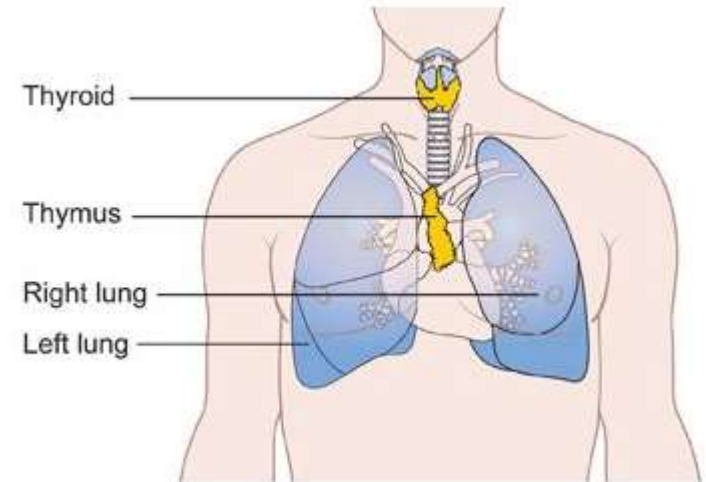
- ✓ The site of hematopoiesis
- ✓ Hematopoiesis is the formation of blood cellular components



# Primary lymphoid organs

## Thymus

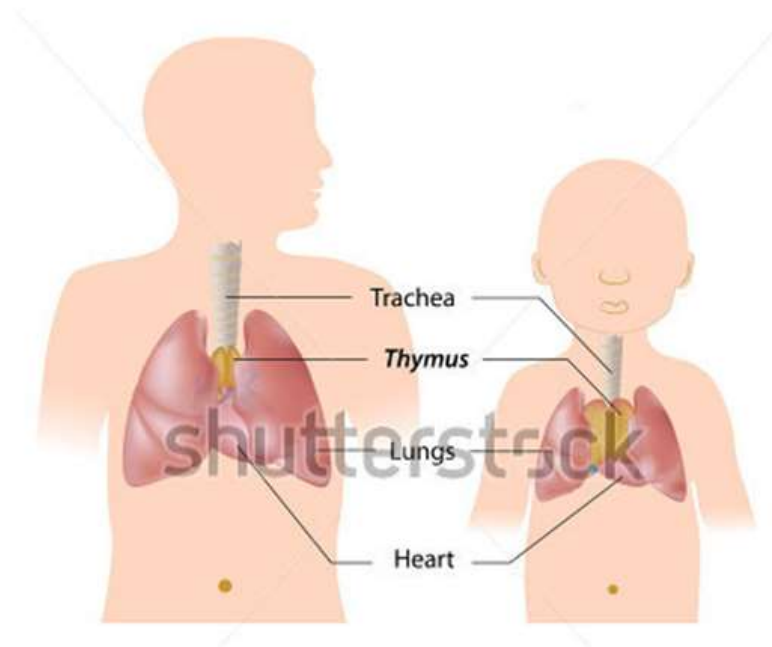
- ✓ Location: in the anterior mediastinum just above the heart
- ✓ Structure: containing lobules divided into an outer cortex (C) and an inner medulla (M)
- ✓ Function: maturation of T cells from which they are transported to the secondary lymphoid organs



# Primary lymphoid organs

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## Thymus



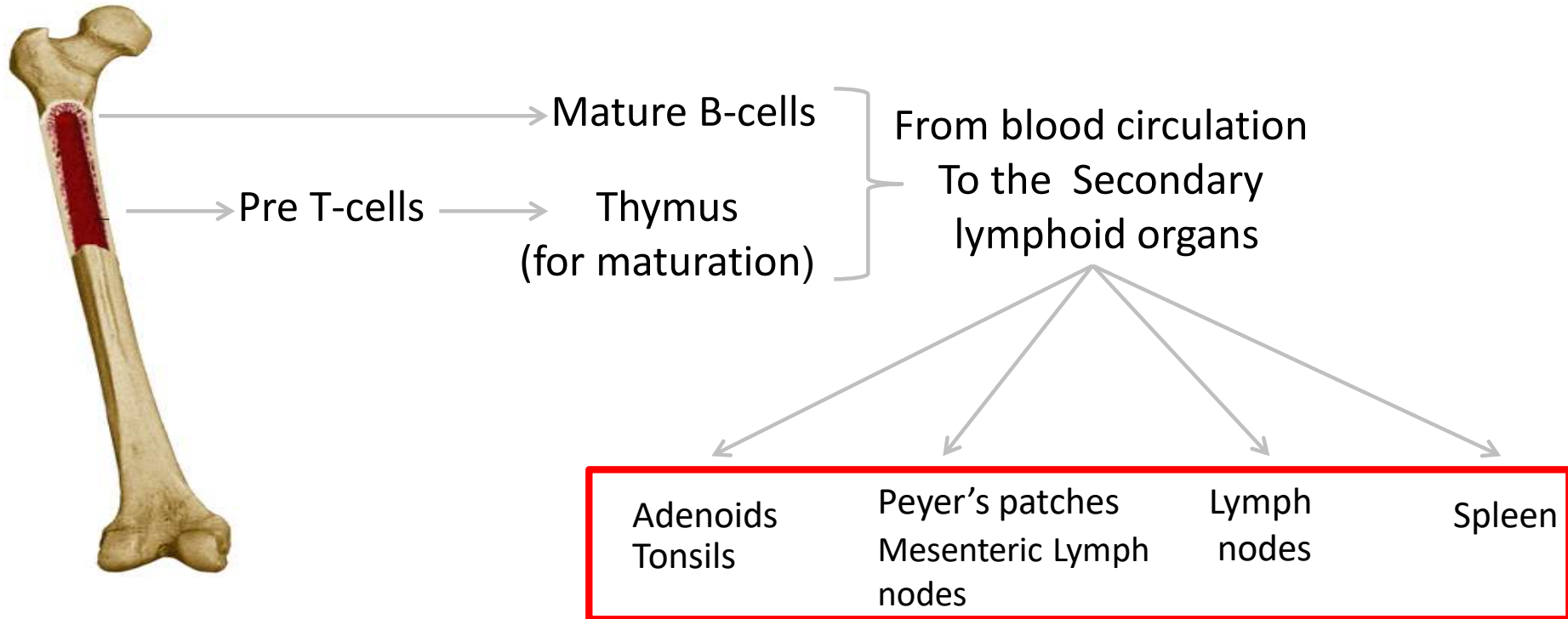
Thymus reaches its greatest size just prior to birth, then atrophies with age and the production of new T-cells in the adult thymus drops away.

**DiGeorge Syndrome:** congenital absence of the thymus. This will lead to immune disorders due to reduced T cell numbers



# Secondary lymphoid organs

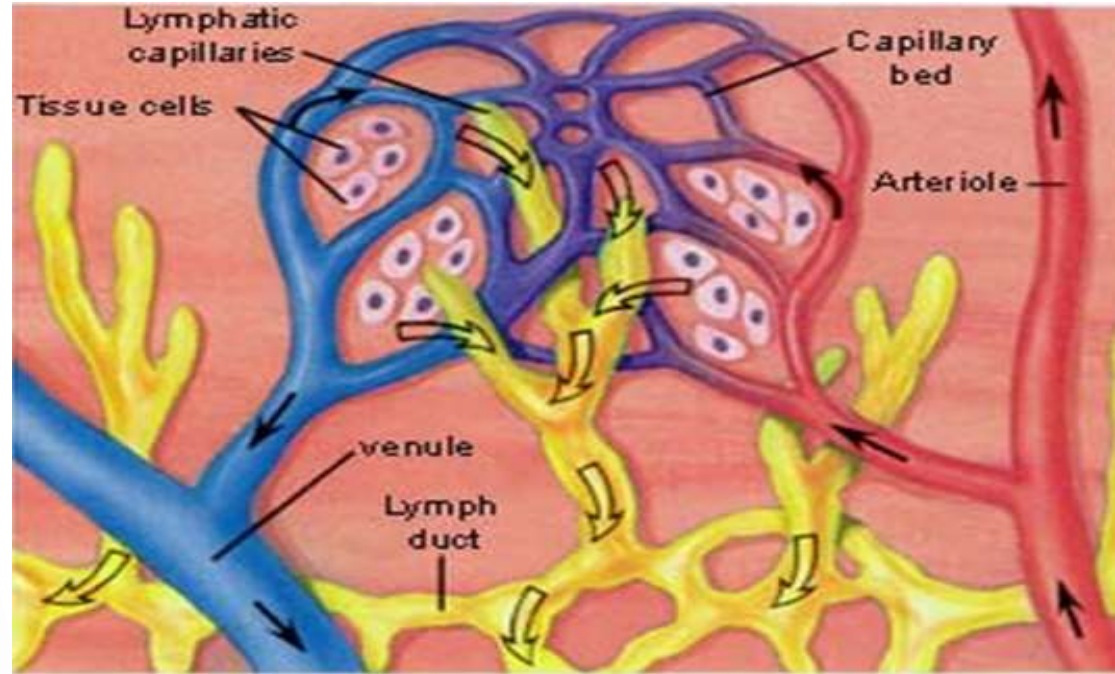
B cells leave bone marrow completely mature and start homing in the secondary lymphoid tissues, while T-cells complete their maturation in the thymus gland before settling in the secondary lymphoid tissues



**Immune response takes place in the Secondary lymphoid organs**

# Secondary lymphoid organs

## Lymph

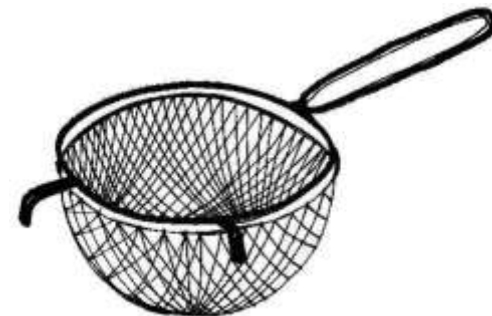


Lymph

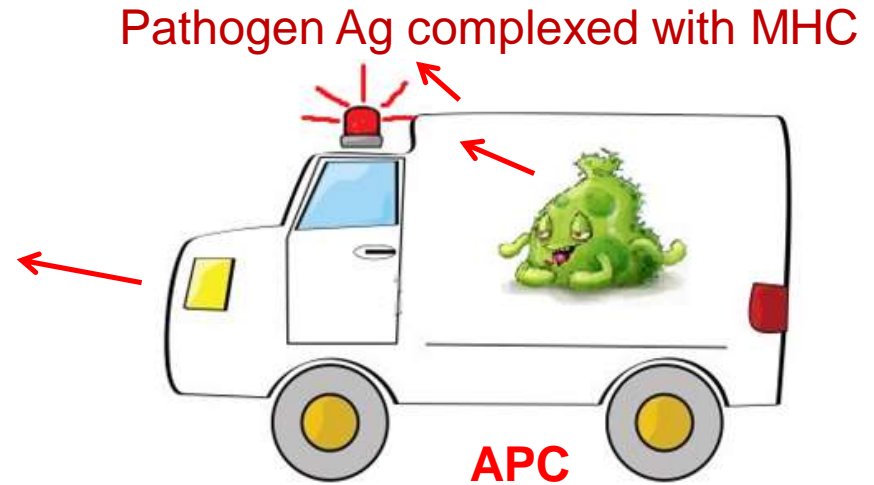
through lymphatic vessels

- Trap recognize foreign antigen
- The main sites of immune response and antibodies production

Secondary lymphoid organs



# Secondary lymphoid organs

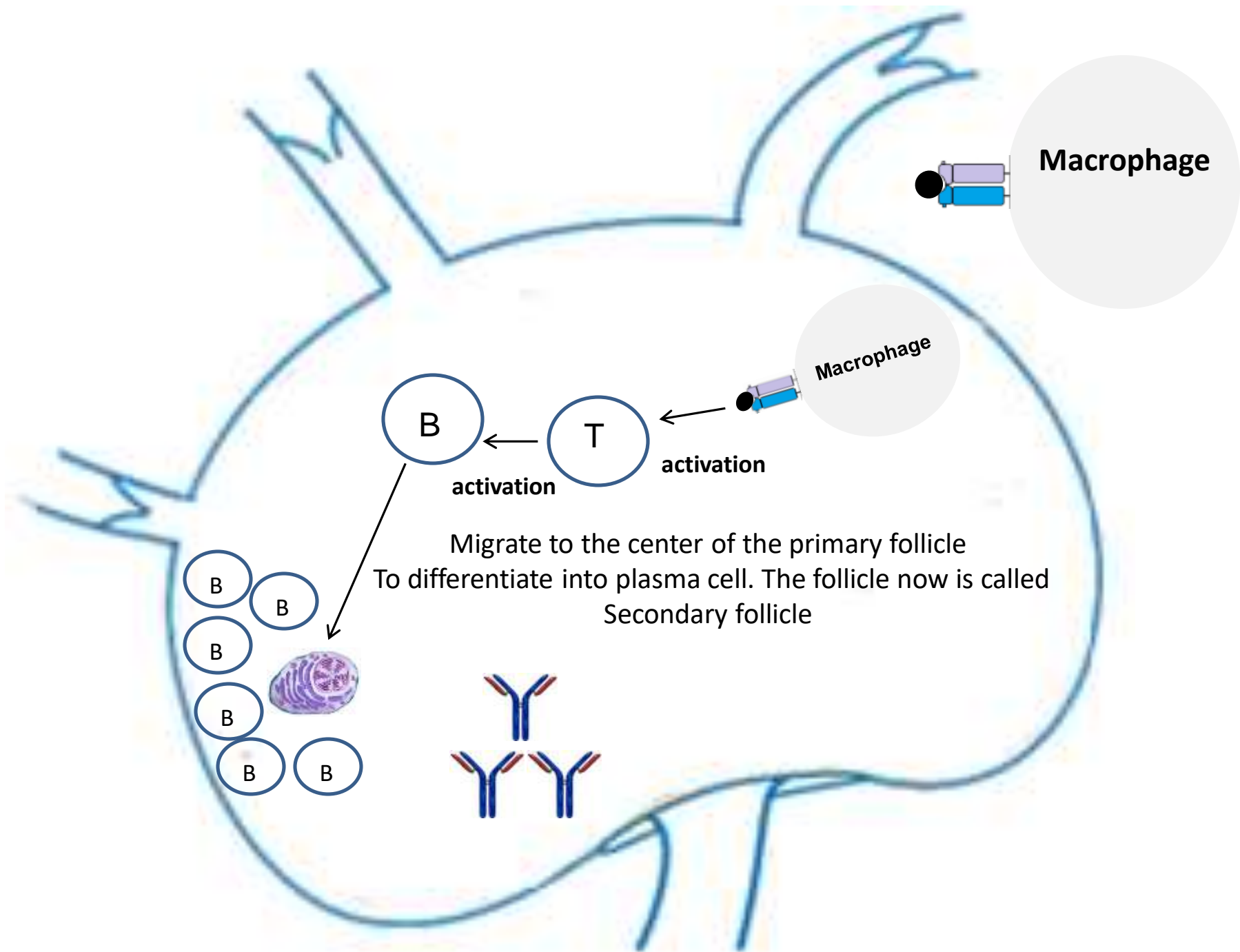


## Lymph nodes

**Location:** in the neck, axillae, groin, mediastinum and abdominal cavity



**Function:** filters antigens from the interstitial tissue

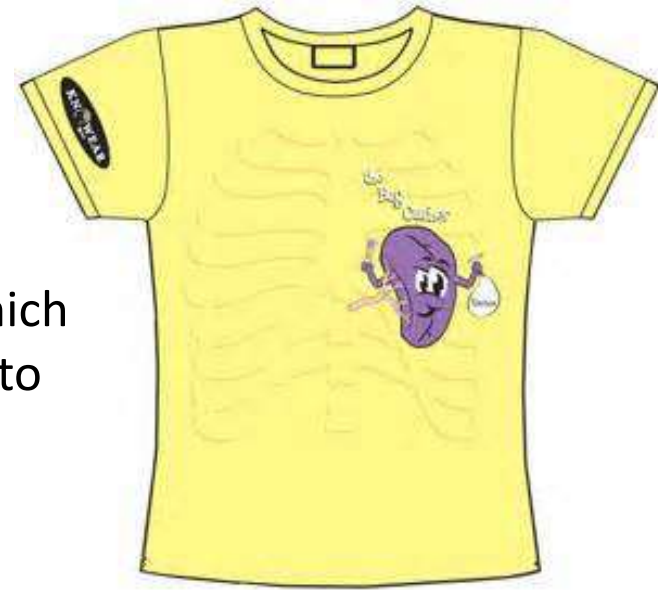


# Secondary lymphoid organs

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## Spleen

- ✓ **Location:** left upper quadrant of the abdomen and weighing about 150 grams
- ✓ **Function:** the largest single lymphoid organ in the body, therefore, it is the major organ in which antibodies are synthesized and released into circulation.



# Secondary lymphoid organs

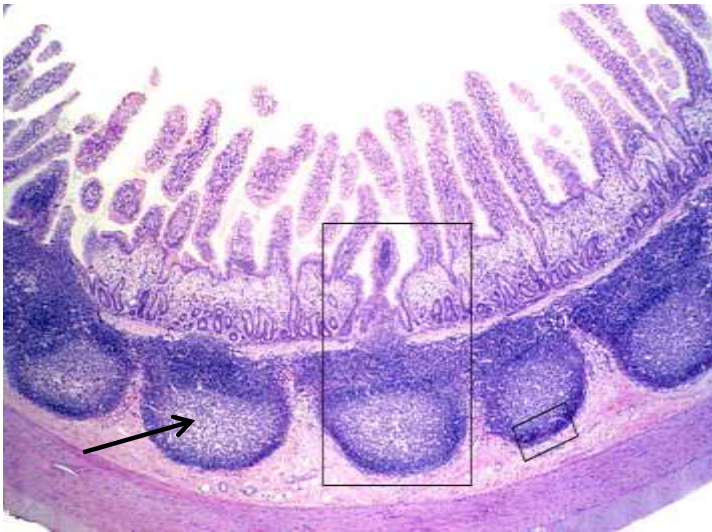
## Mucosa associated lymphoid tissue (MALT)

- ✓ **Location:** found associated with the mucosal system

gut-associated  
lymphoid tissues  
(GALT)

bronchus-associated  
lymphoid tissue  
(BALT)

lymphoid tissue lining  
the genitourinary  
tract



ileum, Peyer's patches

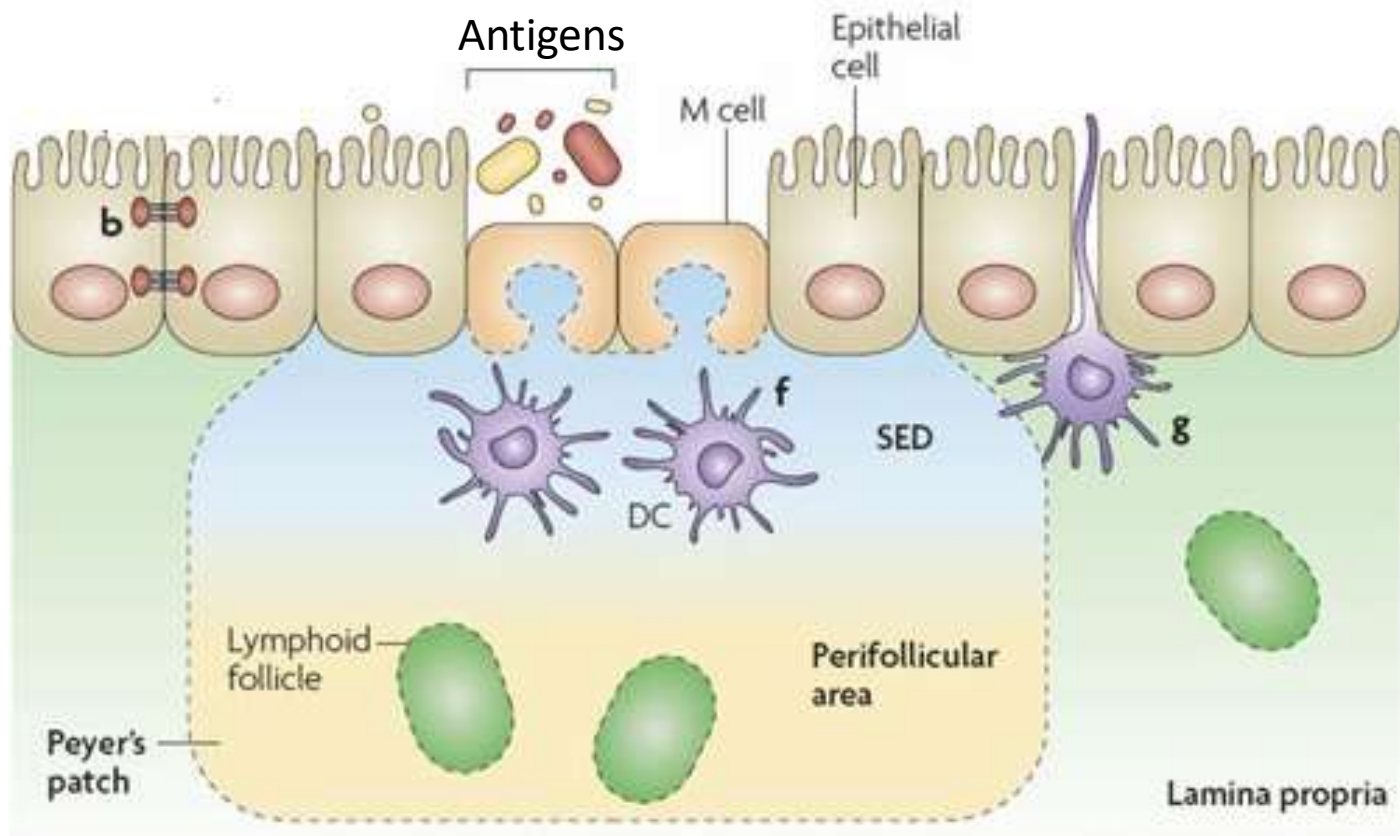


Esophagus MALT

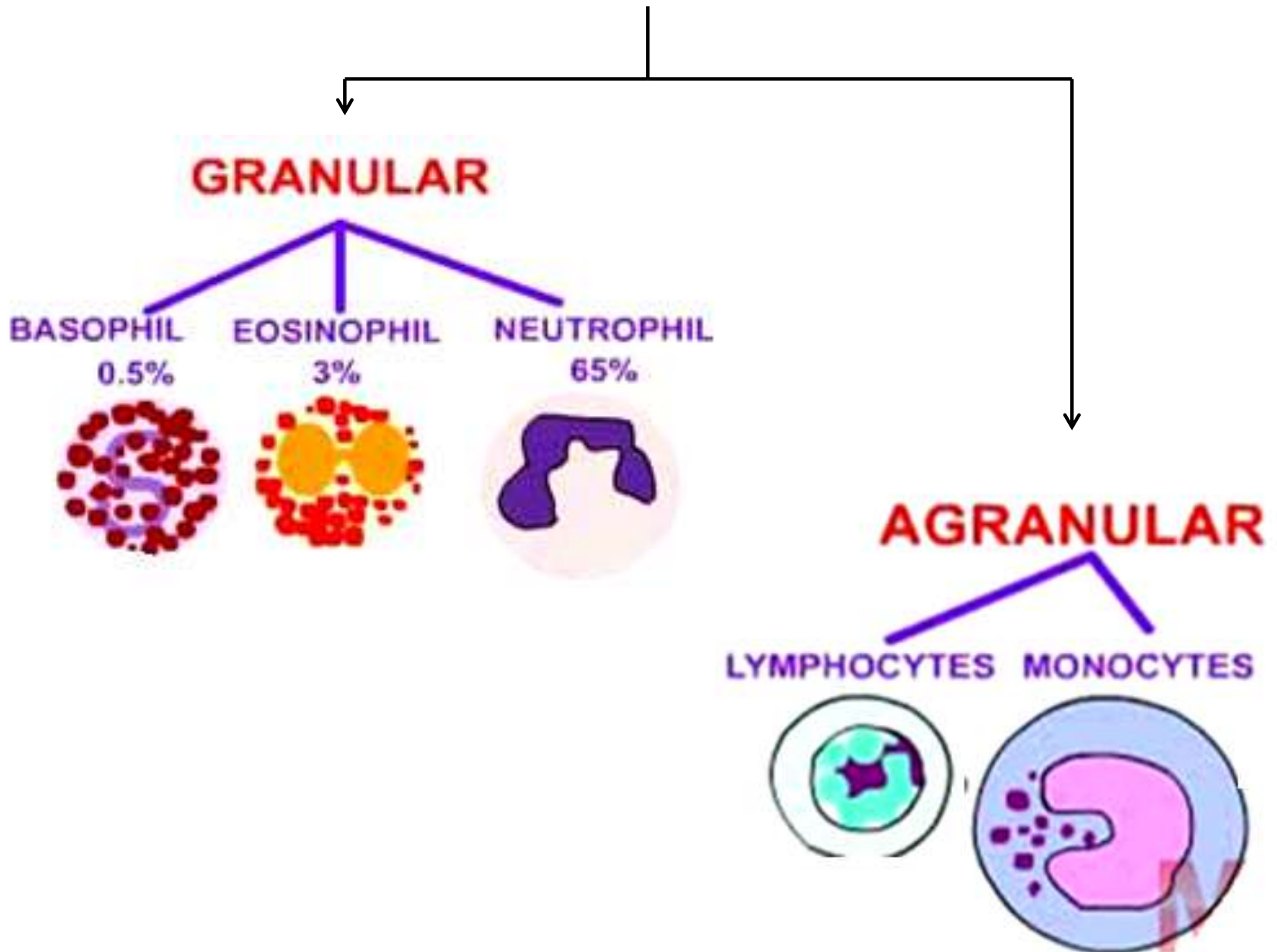
# Secondary lymphoid organs

## Mucosa associated lymphoid tissue (MALT)

- ✓ **Function:** The major function of these organs is to provide local immunity by sIgA and IgE production
- ✓ **Mode of activation:**



# Cells of the Immune System





# Cells of the Immune System

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## Neutrophils

The nucleus has 3-5 connected lobes



Containing different types of proteolytic enzymes such as lysozyme, collagenase and elastase

Have short life span (6-7 hours in blood and few days in tissue spaces and do not multiply)

They are called neutrophils because their granules stain poorly with the dyes used in staining leukocytes

**Neutrophils reach the site on infection at first**

**Why?**

# Cells of the Immune System

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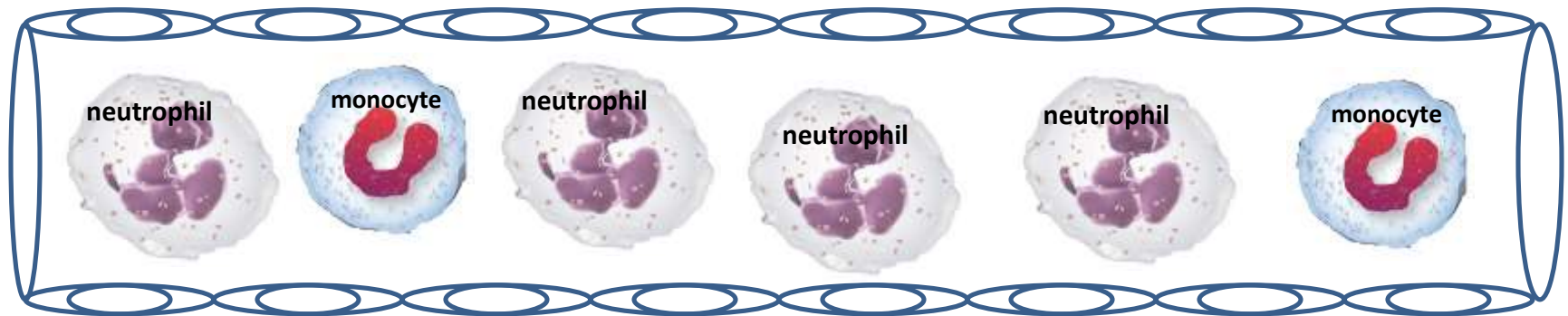
## Neutrophils

Most abundant

Highly motile

Neutrophils  
chemoattractants  
are produced at  
first

**Inflammation site**



**Neutrophils reach the site on infection at first**

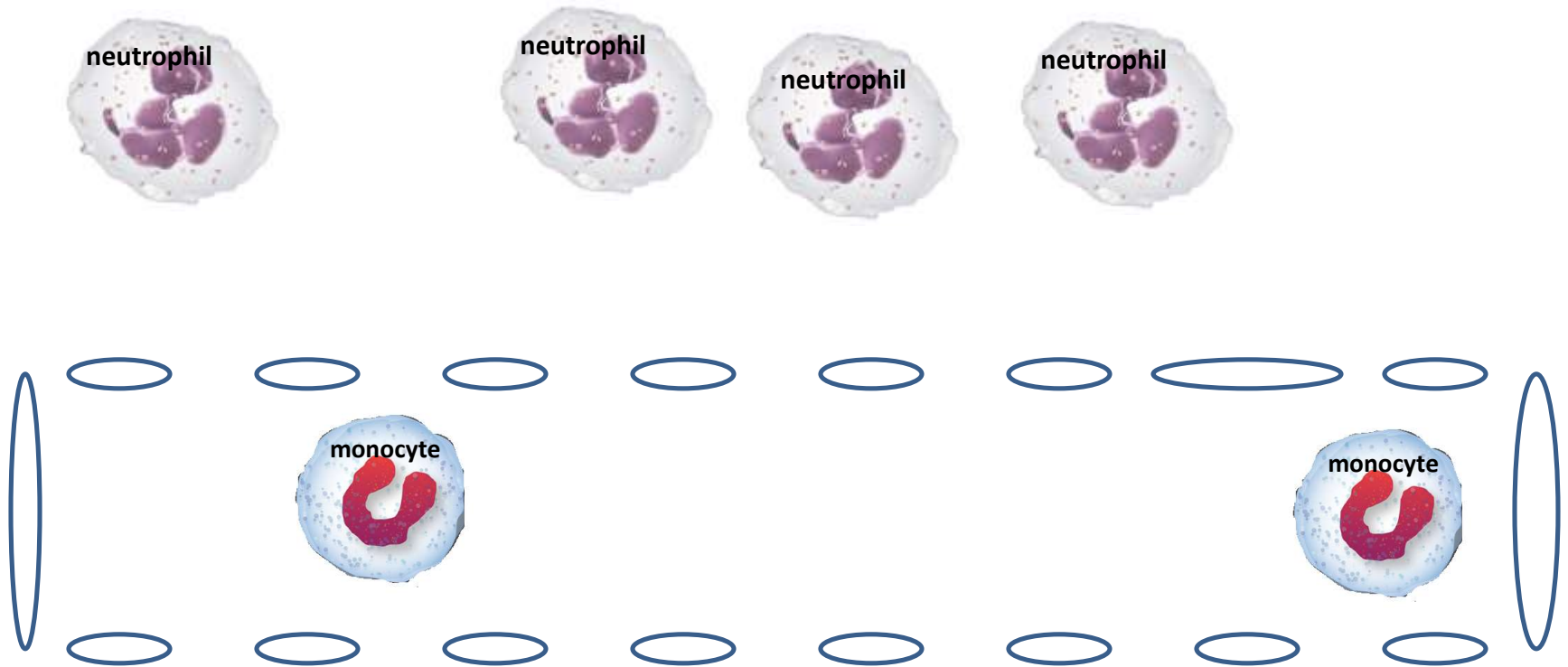
**Why?**

# Cells of the Immune System

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## Monocytes

### Inflammation site

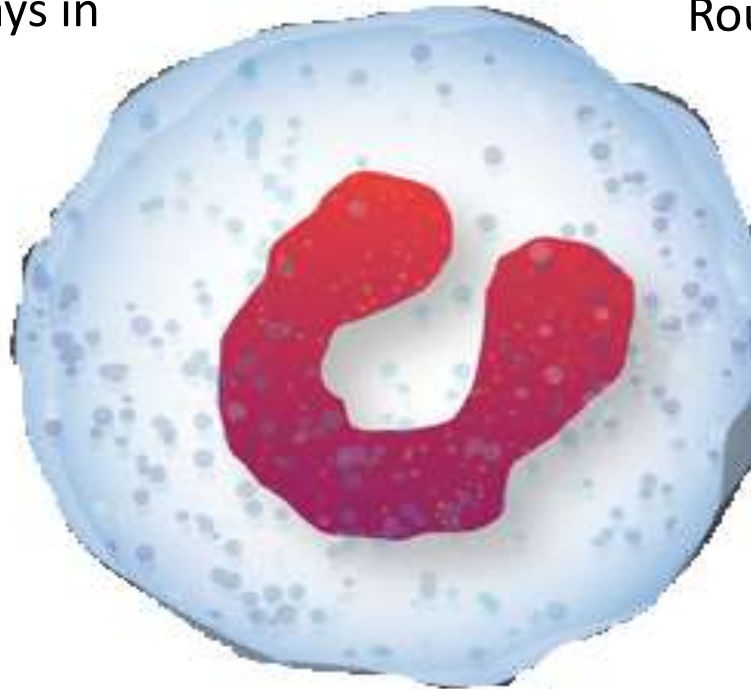


# Cells of the Immune System

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## Monocytes

Half-life of 3 days in circulation



Rounded or kidney shaped nuclei (12-15  $\mu\text{m}$ )

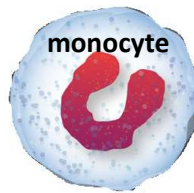
Monocytes in tissues called macrophages

# Cells of the Immune System

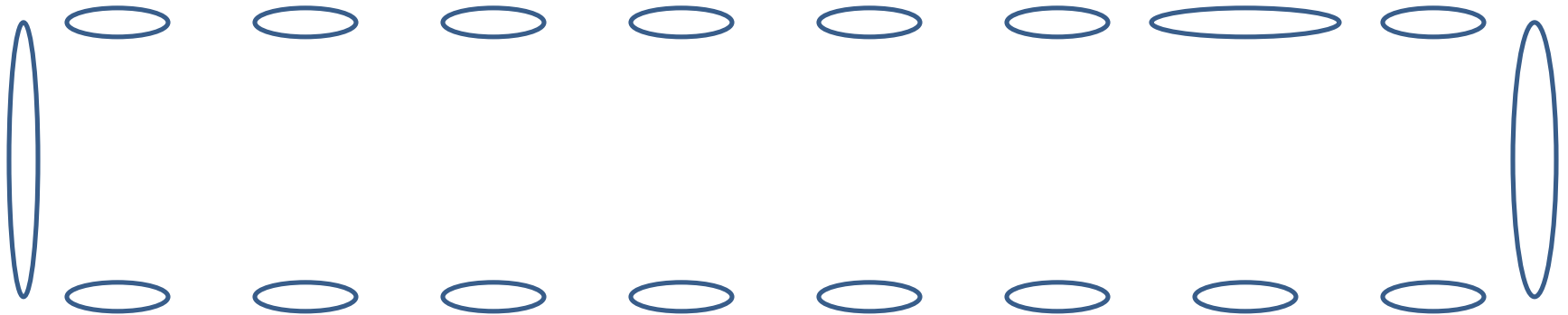
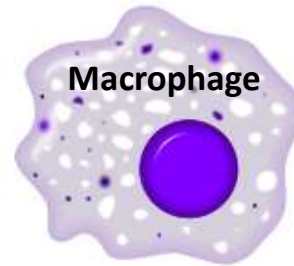
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## Macrophage

### Inflammation site



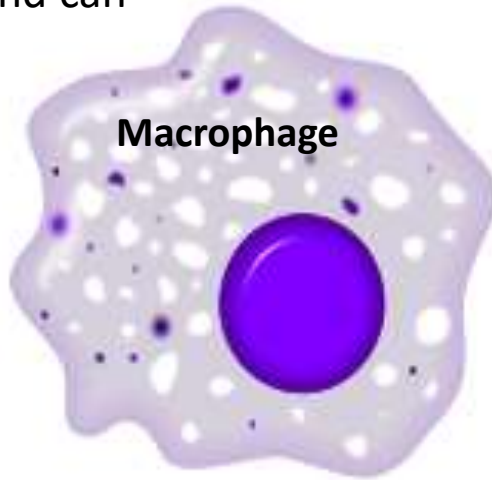
Matures into



# Cells of the Immune System

## Macrophage

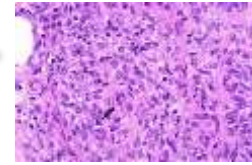
Macrophages survive for months and can multiply



Has different names in tissues

### Functions

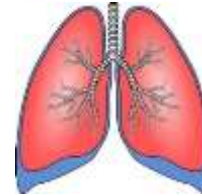
- ✓ killing of microbes, infected cells, tumor cells
- ✓ secretion of immunomodulatory cytokines
- ✓ antigen processing and presentation to T cells



Histiocytes  
(in tissue)



Kupffer cells  
(in liver)



Alveolar macrophages  
(in lungs)



Microglial cells  
(in brain)



Mesangial cells  
(in kidneys)



Osteoclasts  
(in bone)

# Cells of the Immune System

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## Dendritic cells

They are morphologically identified by spiny membranous projection on their surfaces.

Their main function is to capture and transport protein antigen to the draining lymph node acting as antigen presenting cells (APC).

