



# **The Immune system**

## **Human Anatomy**



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# Objectives of this lecture

**You should be able to describe the following;**

- ❖ Functions of the system
- ❖ Anatomical structure of the system
- ❖ The components of system
- ❖ types of cells

# Introduction

Immunity or resistance is the ability to ward off damage or disease through our defences.

There are two general types of immunity

(1) Innate (2) adaptive.

- Innate (nonspecific) immunity refers to defenses that are present at birth.
- **Innate immunity** does not involve specific recognition of a microbe and acts against all microbes in the same way.
- The components of innate immunity are
  - the first line of defense (the physical and chemical barriers of the skin and mucous membranes)
  - the second line of defense (antimicrobial substances, natural killer cells, phagocytes, inflammation, and fever).
  - Innate immune responses represent immunity's early warning system and are designed to prevent microbes from entering the body and to help eliminate those that do gain access.

# Introduction

2) **Adaptive** (specific) immunity refers to defenses that involve specific recognition of a microbe once it has breached the innate immunity defenses.

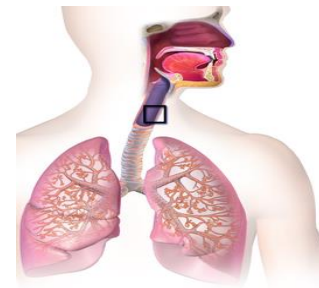
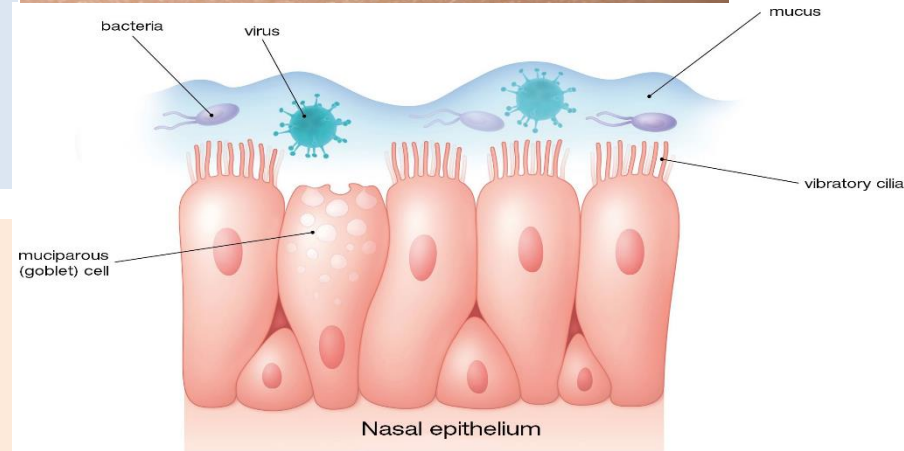
- Adaptive immunity is based on a specific response to a specific microbe; that is, it adapts or adjusts to handle a specific microbe.
- Adaptive immunity involves lymphocytes (a type of white blood cell) called T lymphocytes (T cells) and B lymphocytes (B cells).

lymphatic system is the body system responsible for adaptive immunity (and some aspects of innate immunity)

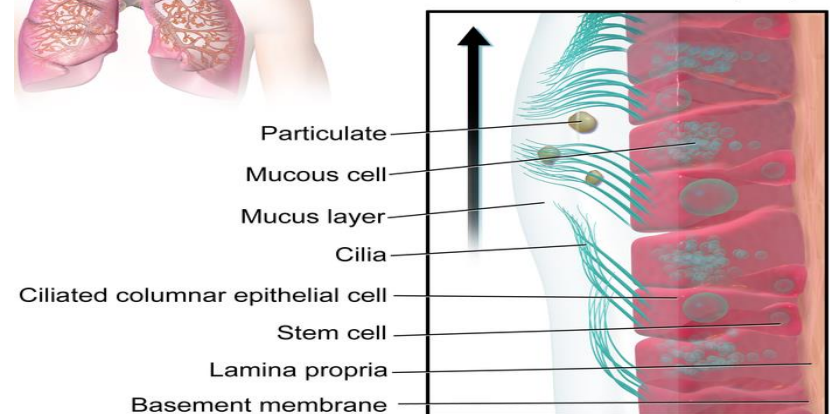
# Innate Immunity

## First Line of Defense: Skin and Mucous Membranes

- Skin layers of closely packed, keratinized cells, the outer epithelial layer of the skin, the epidermis provides a formidable physical barrier to the entrance of microbes
- Mucous Membranes; The epithelial layer of mucous membranes, which line body cavities, secretes a fluid called mucus that lubricates and moistens the cavity surface.
- Mucus is slightly viscous, it traps many microbes and foreign substances. Ex;
- The mucous membrane of the nose has mucus-coated hairs that trap and filter microbes, dust, and pollutants from inhaled air.
- The mucous membrane of the upper respiratory tract contains cilia, microscopic hairlike projections on the surface of the columnar epithelial cells.



*Movement of mucus to the pharynx*

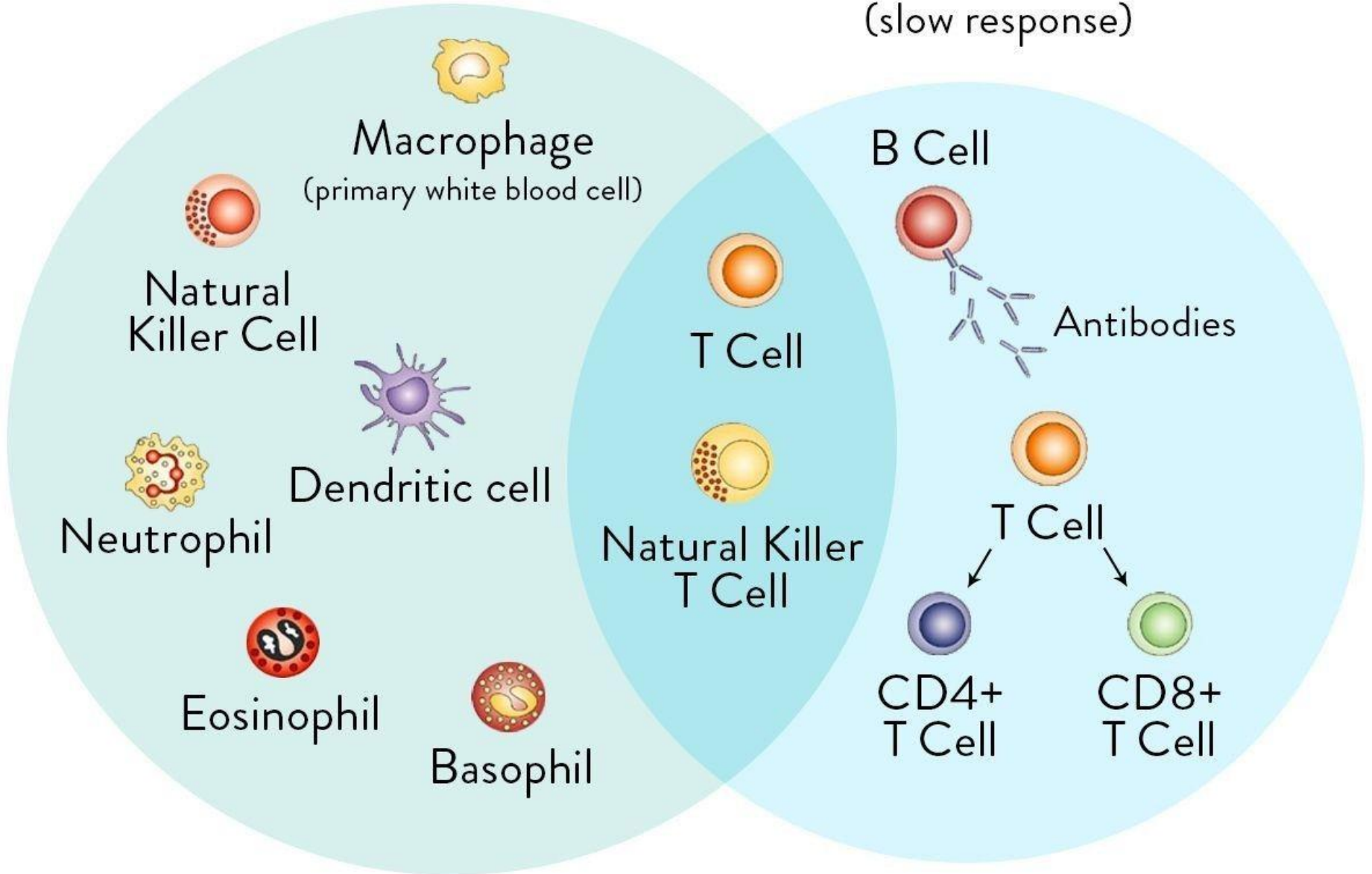


# INNATE IMMUNITY

(rapid response)

# ADAPTIVE IMMUNITY

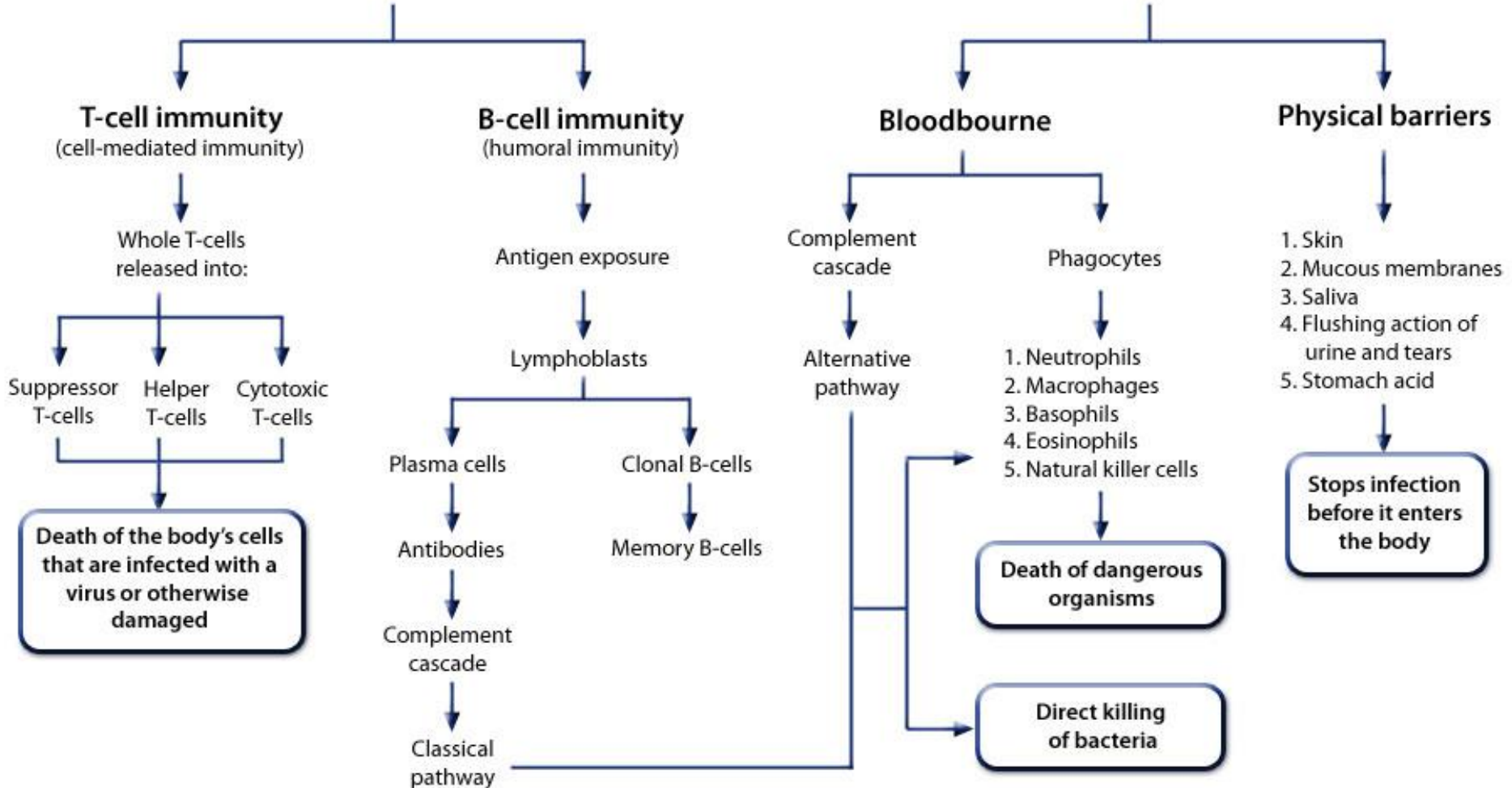
(slow response)



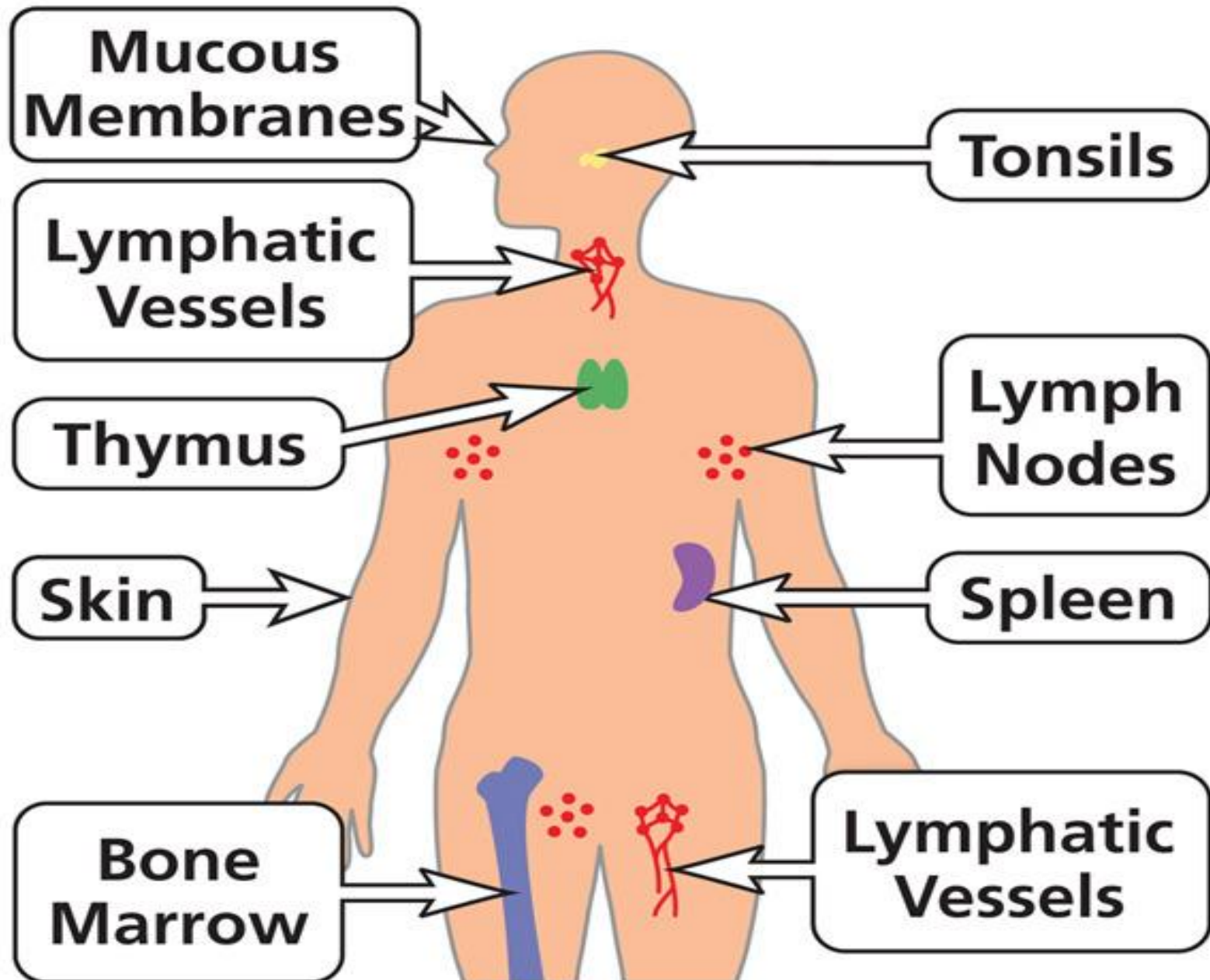
# Immune system

## Acquired

## Innate



# Immune System





# Lymphoid Organs

The lymphoid organs in the human body include the spleen, lymph nodes, bone marrow, thymus and lymph tissue.

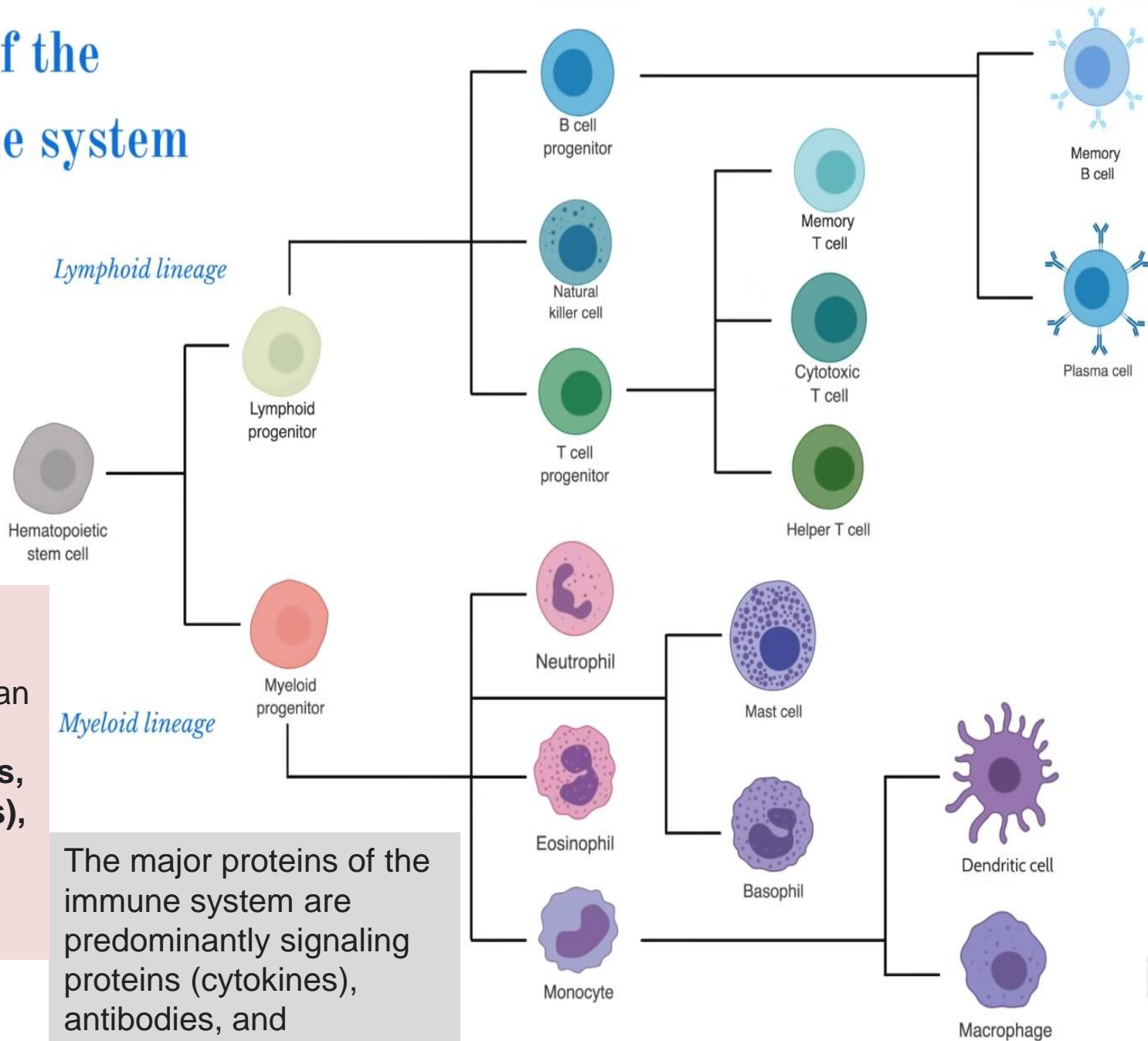
- ***Lymph nodes***- These are small, bean-shaped structures which produce and store cells, specialized in fighting infections. They are a part of the lymphatic system. Lymph nodes have lymph. When the body is in the process of fighting an infection, they are enlarged and sore.

- ***Spleen***– It is the largest lymphatic organ in the body. It has white blood cells that fight infections. The spleen is an organ that also disposes of old, damaged blood cells.

# Lymphoid Organs

- ***Bone marrow*** – The center of some bones like the hip bone, thigh bone has a yellow tissue that produces white blood cells. The spongy tissue inside these bones has the stem cells. It is the main lymphoid organ which produces the blood cells, including the lymphocytes. In the bone marrow, the immature lymphocytes differentiate into antigen sensitive lymphocytes.
- ***Thymus***- This is the organ where the T-cells mature.
- ***Lymphoid Tissue*** – the lining of major tracts such as the respiratory, digestive and urogenital tracts have lymphoid tissue called the mucosa-associated lymphoid tissue (MALT).

# Cells of the immune system



Cells of the immune system are types of white blood cells, it can be categorized as **lymphocytes (T-cells, B-cells and NK cells), neutrophils, monocytes, and macrophags.**

The major proteins of the immune system are predominantly signaling proteins (cytokines), antibodies, and complement proteins.

# Immune system

## Primitive immune system

*antigen unspecific*

*paraspecific*

### **Humoral factors**

- lysozym
- interleukines
- tumornekrosis factor (TNF alpha / beta)
- colony stimulating factors (G-CSF, M-CSF, GM-CSF)
- growth factors (TGF, EGF)
- interferones

### **Cellular factors**

- microphages
- macrophages
- NK-cells
- mast cells
- dendritic cells
- other reticulum cells

opsonin-properdin-complement system

## Specific immune system

*antigen specific*

### **T-lymphocytes**

- T - cytotoxic
- T - effector
- T - suppressor
- T - helper
- T - sensitizing
- T - feedback
- T - memory

### **B-lymphocytes**

*plasmacells*

**antibodies**

- IgM
- IgG
- IgA
- sIgA
- IgD
- IgE

# References

**For further reading please see:**

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**Human Anatomy Atlas; Comprehensive 3D reference and study platform for anatomy, physiology and pathology;**

**<https://www.visiblebody.com/anatomy-and-physiology-apps/human-anatomy-atlas>**