

Level of Immunity

Life Saving College Of Nursing

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Objectives

At the end of this presentation, students will

- Know about different level of immunity
- The Mechanism of immunity
- Know about inflammatory response
- Know about different Cells of immune system
- Know about Proteins that helps in immunity

Levels Of Immunity



Levels of Immune System

- When a pathogen or any antigen try to enter into the body, it is resist with different mechanism at different levels and of immunity
- Basically there are three Levels of immunity which encounter the pathogen

First Line Defense/Innate immunity

The body's first line of defense against pathogens uses mostly physical and chemical barriers. Such barrier includes:

- Skin – acts as a barrier to invasion
- Sweat – has chemicals which can kill different pathogens.

First Line Defense/Innate immunity

- Tears - have lysozyme which has powerful digestive abilities that render antigens harmless.
- Saliva – also has lysozyme.
- Mucus - can trap pathogens, which are then sneezed, coughed, washed away, or destroyed by chemicals.
- Stomach Acid – destroys pathogens

Second-Line Defenses

- If a pathogen is able to get past the body's first line of defense, and an infection starts, the body can rely on its second line of defense. This will result in a process is called ***Inflammatory response (inflammation)***

Inflammatory Response

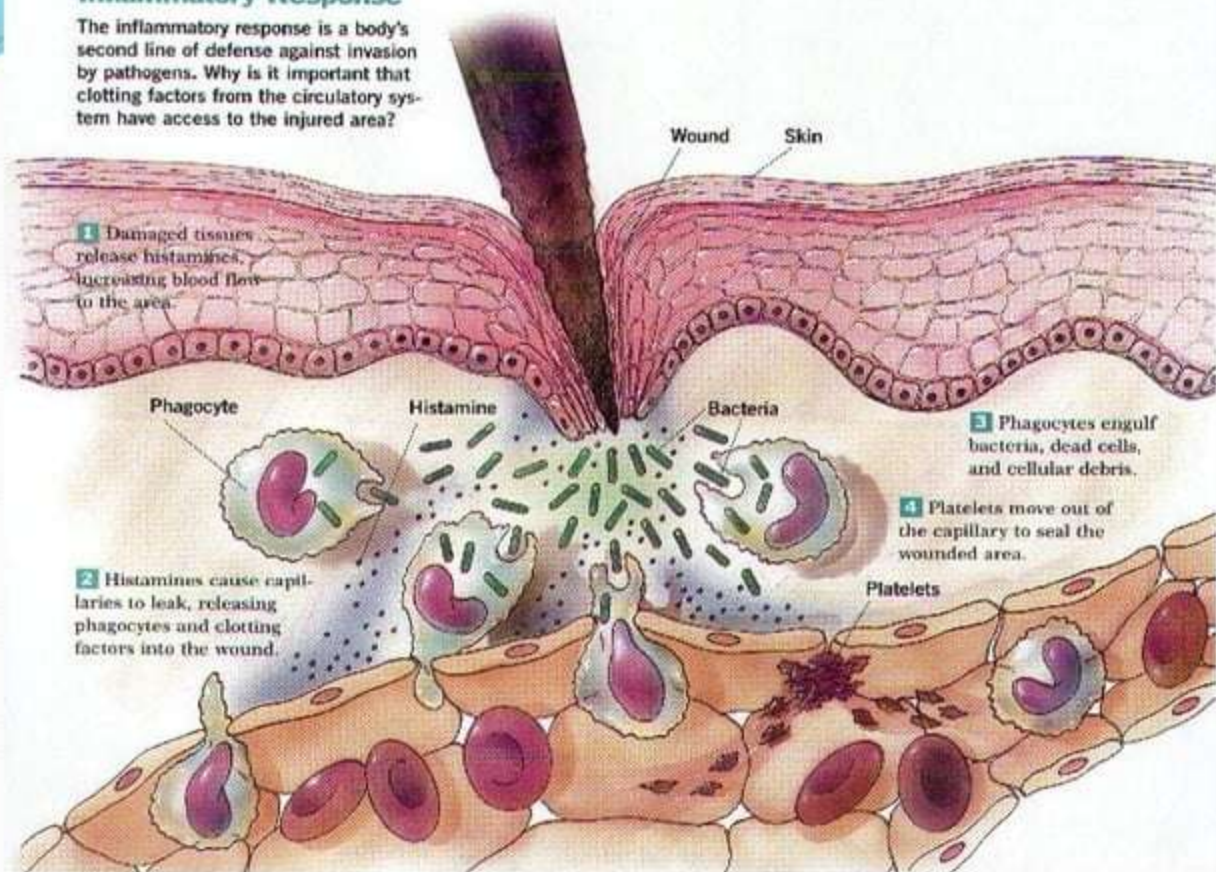
- **Inflammatory response** is a protective attempt by the organism to remove the injurious stimuli and to initiate the healing process.
- It is part of the complex biological response of vascular tissues to harmful stimuli, such as pathogens, damaged cells, or irritants.

Inflammatory response

- *Inflammatory response* causes
- **Redness** - due to capillary dilation resulting in increased blood flow
- **Heat** - due to capillary dilation resulting in increased blood flow
- **Swelling** - due to passage of plasma from the blood stream into the damaged tissue
- **Pain** - due mainly to tissue destruction and, to a lesser extent, swelling.

Steps of the Inflammatory Response

The inflammatory response is a body's second line of defense against invasion by pathogens. Why is it important that clotting factors from the circulatory system have access to the injured area?



Third-Line Defenses

- Sometimes the second line of defense is still not enough and the pathogen is then heading for the body's last line of defense, **the immune system**.
- The **immune system** recognizes, attacks, destroys, and remembers each pathogen that enters the body. It does this by making specialized cells and antibodies that render the pathogens harmless.

Third-Line Defenses

- Unlike the first line and second line defense the immune system differentiates among pathogens.
- For each type of pathogen, the immune system produces cells that are specific for that particular pathogen therefore also called Specific Immunity.

Levels Of Defense Mechanism

NONSPECIFIC DEFENSE MECHANISMS

SPECIFIC DEFENSE MECHANISMS (IMMUNE SYSTEM)

First line of defense

Second line of defense

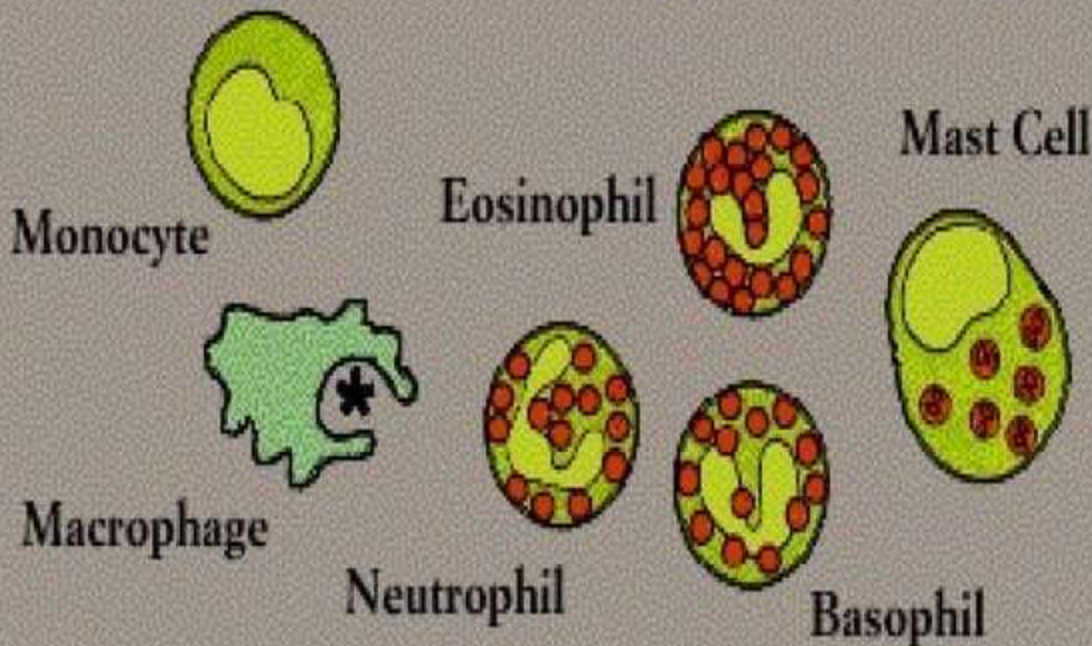
Third line of defense

- Skin
- Mucous membranes
- Secretions of skin and mucous membranes

- Phagocytic white blood cells
- Antimicrobial proteins
- The inflammatory response

- Lymphocytes
- Antibodies

Cells Of Immune System



Cells of Immune System

White Blood Cells

- Phagocytes
 - Neutrophils
 - Monocytes / Macrophages
- Eosinophils
- Basophils
- Lymphocytes

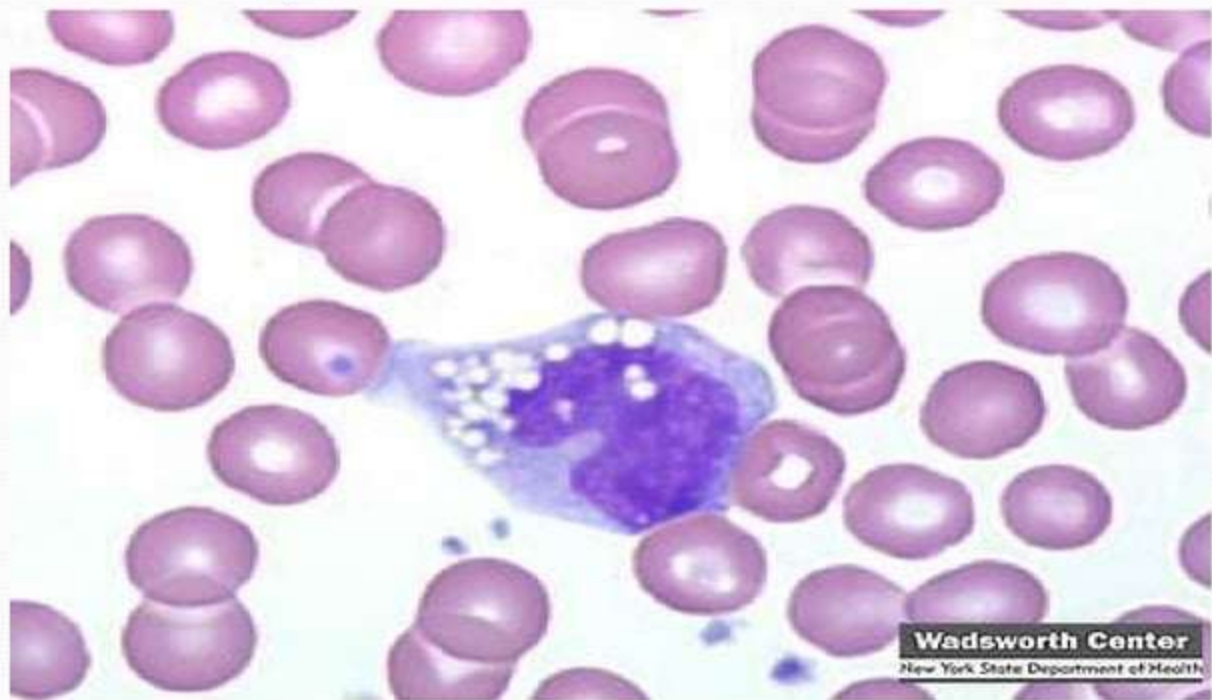
Monocytes/Macrophages

- The monocytes are larger WBCs about 10 to 18 μm in diameter (enlarge 5 to 10 times more when encounter with pathogen)
- They represent 5-8% of WBCs
- Monocytes have a horse shoe shape nucleus and contain azurophilic granules and have got well developed Golgi complexes and lysosomes.

Monocytes/Macrophages

- Phagocytic macrophages are present in many organs and are named according to their position e.g. liver macrophages are also called Kuffer cells & brain cells are also called Macrogial cells.
- They are long lived months to years
- Monocytes / Macrophages actively phagocytise organisms
- Their main role is to remove the antigens from the body

Monocytes



Wadsworth Center

New York State Department of Health

Neutrophils

- The most numerous cells of Immune system are the neutrophils also called PMNs (Polymorphs), constitute the majority of leukocytes in the blood i.e. about 60 – 70 %
- They have characteristic multi lobed nucleus and are 10 – 20 um in diameter.
- Large numbers are released during infections
- Short lived – die after digesting bacteria

Neutrophils

- Like monocytes they adhere to endothelial cell lining of the blood vessels and move toward tissues by squeezing between the endothelial cells to leave the circulation.
- This process is known as **diapedesis**. This process is promoted by chemo attractants such as chemokines.
- They are Patrol tissues as they squeeze out of the capillaries.
- Dead neutrophils make up a large proportion of puss.
- Their main role is phagocytosis .

Eosinophils

- Eosinophils comprise 2 – 5 % of the blood leukocytes in a healthy non allergic person
- Eosinophils have a bi lobed nucleus with many cytoplasmic granules that stain with acidic dye e.g. eosin
- There are many hydrolytic enzymes present in the granules responsible for the anti- helminthic activity.

Eosinophils

- Eosinophils also release histaminase and aryl sulphatase which inactivate the mast cell products e.g histamine.
- The effect of eosinophils thus dampen down the effect of inflammatory response.
- This type of action these cells can only make and only against large pathogens which cannot be phagocytosed e.g parasitic worms

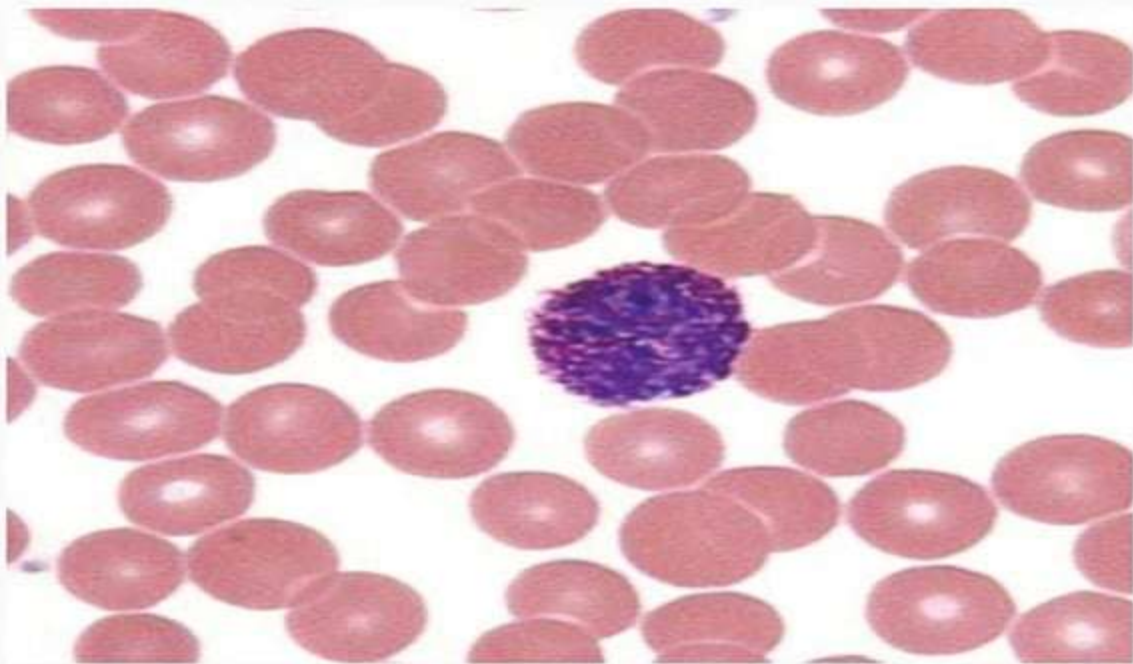
Eosinophils



Basophils

- Basophils are found in a small number in the circulation, about less than 0.2 % of leukocytes
- Basophils have membrane bounded granules.
- These granules in both basophils or mast cells contain
 - Heparin
 - Leukoterins
 - histamine etc.
- The stimulus for these cells is an allergen – an antigen causing allergic reaction.

Basophils



Lymphocytes



Lymphocytes

- Responsible for the specific immune response.
- They are agranulocytes
- Represent 20-40% of circulating WBC in blood
- Further sub divided into T lymphocytes and B lymphocytes
- Once stimulated with antigen enlarges $15\mu\text{m}$ into a blast cell.

T Lymphocytes

- These cells are mature In thymus gland therefore called T- lymphocytes.
- T-cells play major role in cell immediate immunity.

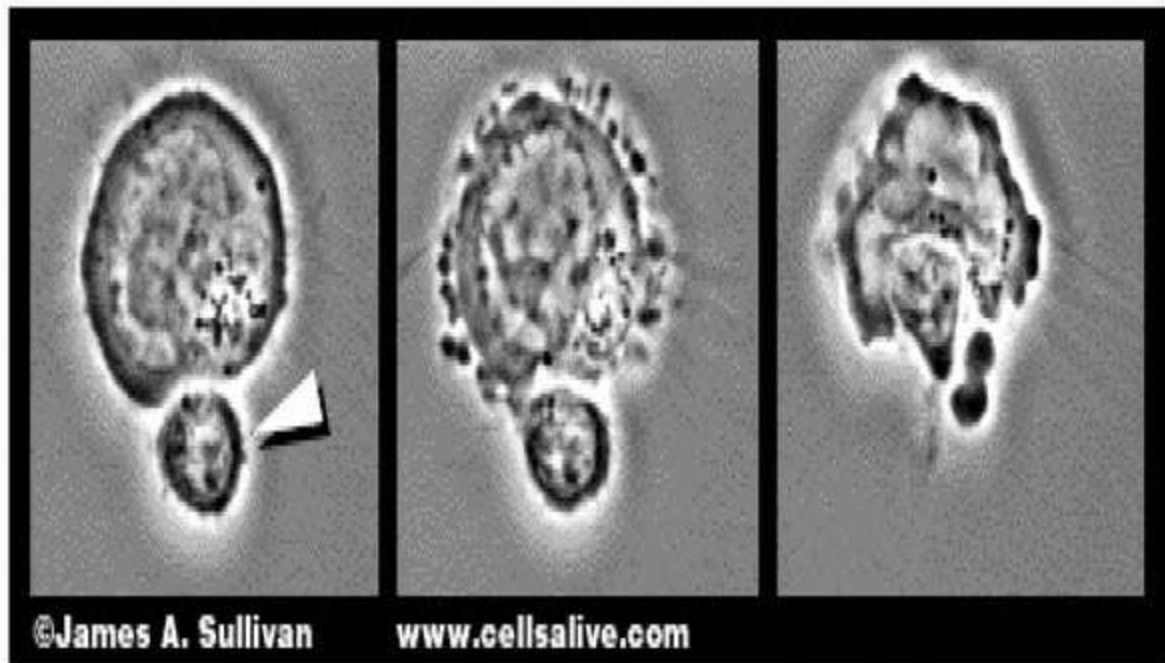
T-cells further divided in

- Killer T-cells
- Helper T-cells
- Memory T-cells

Killer T Cells

- **Killer T Cells** recognize surface markers on other cells labeled for destruction.
- Killer T Cells help to keep virus-infected or malignant cells in check.

Killer T cell in action



Helper T cells

- Helper T cells are the sub group of T Lymphocytes.
- These cells have no cytotoxic or phagocytic activity.
- Helper T cells activate and direct other immune cells and helps in maximizing bactericidal activity of phagocytes

Memory T-cells

- Memory T-cells are derived from normal T-cells
- Memory T cells have learned how to overcome an invader by 'remembering' the strategy used to defeat previous infections.
- The memory cells are long-lived cells

B Lymphocytes

- These cells are mature in bone marrow then circulate in blood and lymph.
- They produce antibodies against antigen, play major role in Humeral immunity
- There are more than 10 million different B-lymphocytes, each of which make a different antibody.
- The B- cells which produce antibodies are called plasma cells.

Thank You