

ADVANCED MEDICINE

LECTURE TWO : IMMUNE SYSTEM

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Fourth Stage

المرحلة الرابعة

Lecture two

Theoretical

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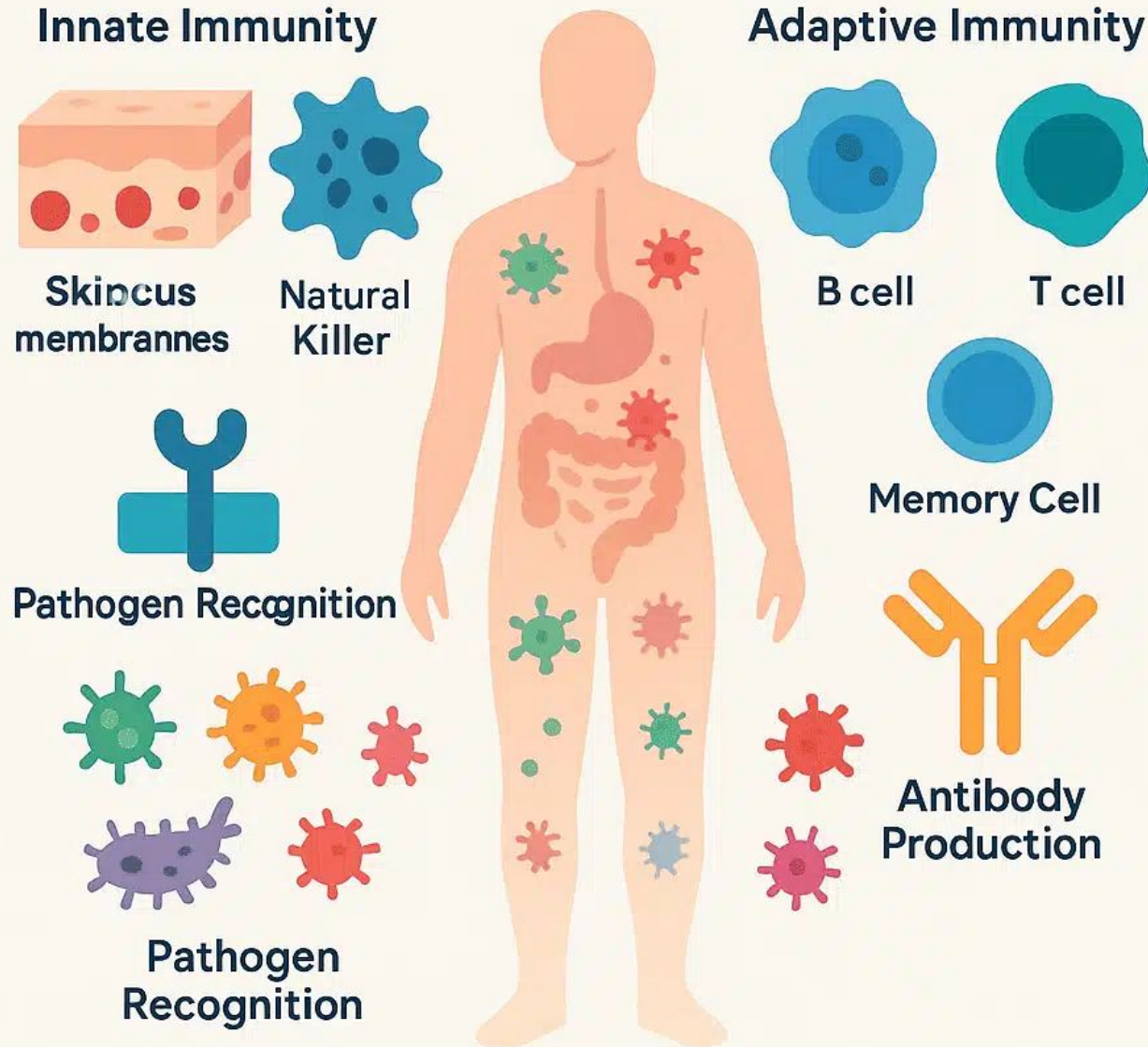
M.Sc. medicine

IMMUNE SYSTEM

The immune system is our body's internal defense mechanism, designed to protect us from infections, harmful substances, and abnormal cells. It operates through a complex and dynamic network of specialized cells, tissues, and organs that interact to detect and neutralize threats.

This biological system is not only essential for survival but also plays a central role in maintaining health and balance throughout the body. As scientific understanding of immunology continues to grow, so does its relevance in fields like cancer treatment, vaccine development, and chronic disease management

Understanding the Immune System



COMPONENTS OF THE IMMUNE SYSTEM

The immune system is organized into two main branches: innate immunity and adaptive immunity. These systems work in concert to provide both immediate and long-term protection.

A. Innate Immunity

Innate immunity serves as the body's first barrier against infections. It responds rapidly and non-specifically to a wide range of pathogens.

B. Adaptive Immunity

Adaptive immunity provides a tailored and long-lasting defense, capable of recognizing specific pathogens and building immunological memory.

A. INNATE IMMUNITY

1. Physical Barriers

These are the most immediate lines of defense, including the skin and mucous membranes found in the respiratory, digestive, and urogenital tracts.

2. Cellular Components

- a) Phagocytes such as macrophages and neutrophils recognize, engulf, and destroy pathogens.
- b) Natural Killer (NK) cells identify and eliminate infected or abnormal cells without prior sensitization.
- c) Dendritic cells function as sentinels, capturing antigens and initiating communication with the adaptive immune system.

B. ADAPTIVE IMMUNITY

1. B Lymphocytes (B Cells)

These cells produce antibodies that specifically bind to antigens, neutralizing them or marking them for destruction.

2. T Lymphocytes (T Cells)

a) Helper T cells (CD4⁺) assist in orchestrating the immune response by activating other immune cells.

b) Cytotoxic T cells (CD8⁺) directly attack and destroy infected or malignant cells.

3. Memory Cells

KEY FUNCTIONS OF THE IMMUNE SYSTEM

A. Pathogen Recognition

To detect potential threats, the immune system must distinguish between the body's own cells and foreign invaders. This recognition is mediated by specialized molecules such as major histocompatibility complex (MHC) proteins, which display cellular content on the cell surface for inspection by immune cells.

B. Response to Infection

Once a threat is identified, the immune system activates appropriate defense mechanisms. These include:

- a) The recruitment of immune cells to the site of infection,**
- b) The release of inflammatory mediators to contain and control the spread of pathogens,**
- c) The production of antibodies that neutralize or eliminate invaders,**
- d) The destruction of infected or abnormal cells by cytotoxic immune cells.**

C. Immunological Memory

After the initial exposure to a pathogen, the immune system creates memory cells that persist long-term. These cells allow for a faster and more effective response if the same pathogen is encountered again, forming the biological basis for long-term immunity and vaccination

INNATE IMMUNE RESPONSE

The innate immune response is the body's immediate reaction to infection. It provides a broad, non-specific defense and plays a crucial role in controlling infections during the early stages, before the adaptive immune system is activated.

A. Pathogen Detection

Innate immune cells rely on pattern recognition receptors (PRRs) to identify common molecular patterns found in pathogens, known as pathogen-associated molecular patterns (PAMPs). Among the most studied PRRs are Toll-like receptors (TLRs), which detect structural components like bacterial cell walls or viral RNA.

B. Activation of Immune Cells

Once a pathogen is recognized, immune cells such as macrophages, neutrophils, and dendritic cells become activated. These cells release cytokines and chemokines that trigger inflammation and attract more immune cells to the site of infection.

C. Phagocytosis and Inflammation

Activated phagocytes engulf and digest pathogens through a process called phagocytosis. At the same time, inflammation is induced to contain the infection and facilitate tissue repair. Signs of inflammation—redness, swelling, heat, and pain—reflect increased blood flow and immune activity in the affected area.

ADAPTIVE IMMUNE RESPONSE

The adaptive immune response is highly specialized and develops over time following exposure to specific antigens. It provides long-lasting protection and is capable of refining its response through repeated encounters.

A. Antigen Presentation and Activation

B. Helper T Cell Coordination

C. Antibody Production

D. Targeted Cell Destruction

E. Establishment of Memory

QUIZ



What is the types of immune system

Any questions?

*Thank
You*