

Anatomy and Physiology

For

The First Class

2nd Semester

LYMPHATIC SYSTEM AND IMMUNITY

Immune System

Specific Defense Mechanisms (Acquired immunity = Adaptive immunity)

- The system responsible for this kind of body defense mechanisms is called **Immune System**. And the science that deals with this device (immune system) is called **immunology**.
- Immunity possesses two key attributes not seen with non specific defenses **Specificity** and **Memory**.
- **Specificity**: An immune response is directed against one antigen and no more. i.e. immune response against antigen₁ is different than immune response against antigen₂.

Antigen (Ag): any molecule has ability to provoke immune response is called an antigen.

- **Memory**: means when immune response occurs against one antigen (particular antigen) will usually generate immunological memory of that antigen. That means the immune response on subsequent exposures to the same antigen is faster and more powerful.

Organs of Immune System

- **Primary Organs:**
 - Bone Marrow
 - Thymus
- **Secondary Organs:**
 - Lymph Nodes
 - Spleen
 - Mucosa Associated Lymphoid tissues

Cells of Immune System

The main cells or primary cells of immune system are **Lymphocytes** but **macrophages** play an important role in many immune responses.

Types of Immune responses

There are 2 types of immune responses:

- 1. Cell Mediated Immunity (Cellular Immunity)**
- 2. Humeral Immunity (Antibody- Mediated immunity)**

Cell-Mediated Immunity (Cellular Immunity)

- The responder cells in this type of immunity are **T lymphocytes**.
- T lymphocytes are processed by thymus which leads to the formation of specialized, mature and functional T lymphocytes.
- T lymphocyte has been programmed to recognise only one type of antigen. i.e. T lymphocyte which can recognise Ag1 cannot react with Ag2 and that react with Ag2 cannot react with Ag1 or Ag3 and so on.
- Thus the T lymphocyte which has ability to recognise Influenza virus has no ability to recognize measles virus or cancer cell or tuberculosis bacterium (T.B).
- Some antigens need macrophages or neutophils to presented them to the T lymphocytes.
- When Ag activates T lymphocyte, that leads to divide and proliferation of the activated T cell. Four main types of specialised T lymphocytes are produced, each of which is still directed against the original Ag.

Types of T- Lymphocytes

1. **Memory T- Cells:** these are long lived cells. They are very important in providing cell-mediated immunity by responding rapidly when the body exposes to the same antigen (Ag) at the second time.
2. **Cytotoxic T Cells (CD8 = T8).** These type of cells have ability to attach to the target cell and kill it by releasing powerfull toxins.
3. **Helper T Cells (CD4 = T4):** these cells are essential for both cell mediated immunity and humeral immunity.

Functions:

1. Production of special chemicals called Cytokines, like interferon, interleukins which support and promot cytotoxic T lymphocytes.

Cytokines are protein substances produced either by lymphocytes or macrophages. They act to enhance and regulate immune responses.

2. stimulate B cells to produce antibodies.

4. **Suppressor T Cells:** these cells act as brakes turning off activated T and B lymphocytes

Humoral Immunity (Antibody Mediated Immunity)

- The responder cells for this type of immunity are **B lymphocytes**.
- Stimulation of B lymphocytes by antigen leads these cells begins to divide and produce two types of cells, **Plasma Cells** and **Memory B- Cells**.
- **Plasma Cells** these cells have ability to produce (manufacture) and secret a large number of antibodies into the blood.
- **Antibodies** are proteins in nature also called immunoglobins. These immunoglobins have ability to bind with specific antigen that stimulate their production. There are five types of immunoglobins (IgA, IgM, IgD, IgG, and IgE).
- Antibodies bind to specific antigen one of three step may occurs:
 - 1- Neutralising the antigen.
 - 2- Activate Cytotoxic T lymphocytes or macrophages.
 - 3- Activate complement.
- **Memory B- Cells:** these cells remain in the body for long time after the foreign body (Ag) has been remove and rapidly respond to another exposure to the same Ag by stimulating the production of antibody secreting plasma cells.

Acquired Immunity = Adaptive Immunity

- **Primary immune response (primary immunity):** occurs when exposure to the antigen at first time.
- **Secondary Immune response (Secondary immunity)** occurs when subsequent exposures to the same antigen (i.e. at the second time, third time, fourth time and so on). Secondary immunity characterized by the immune response is *much faster* and *more powerful*.
- Immunity may be acquired **naturally** or **artificially** and both forms may be **active** or **passive**.
- **Active naturally acquired immunity:** in this type the immunity occurs due to exposure the body to the antigen by disease or subclinical infection.
- **Active naturally acquired immunity:** means the immunity develops in response to the administration of dead or live artificially weakened pathogens (vaccine).
- **Passive naturally acquired immunity:** occurs before birth by the passage of maternal antibodies to the fetus. And after birth to the baby in breast milk.
- **Passive artificial acquired immunity:** in this type the antibodies prepared in the human or animal and then inject to other person (recipient).