



## IMMUNITY AND IMMUNE RESPONSE

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\*Corresponding Author**ABSTRACT**

The immune system defends people against germs and microorganisms. Immunization is the way to trigger immune system while Vaccination is the administration of antigenic material to produce immunity. Humans have three types of immunity i.e. Innate, Adaptive (active), and Passive. The immune system attacks infectious organisms and substances through a series of steps called the immune response. The immune system provides three lines of defense i.e. First, second and third line of defense i.e. Non-specific barriers, leucocytes (white blood cells), the specific immune response respectively. The immune response, which occurs after initial exposure to disease or antigen is known as the primary response. The immune response to a booster dose of the same Ag is known as secondary response. The production of memory cells during the primary response helps the body to destroy the re-invading antigen before a person starts to display symptoms

**KEYWORDS** : Immunity, Immune system, Immune response**Introduction:**

Throughout life, the human body can be invaded by many disease-causing organisms known as pathogens and can trigger a specific immune response. The immune system, which is made up of special cells, proteins, tissues, and organs, defends people against germs and microorganisms.<sup>1</sup>

**Immunization** is the way to trigger immune system and prevent serious, life-threatening diseases.

**Vaccination** is the administration of antigenic material to produce immunity to a disease. Vaccines can prevent or ameliorate the effects of infection by a pathogen.<sup>2</sup>

**Antigen:**

"An antigen is a substance which when introduced into the body stimulates specific immune response". Chemically an antigen may be a protein, carbohydrate, lipid or nucleic acid and usually foreign or nonself to the body.

**Antibody:**

"An antibody is a protein substance produced in response to a specific antigen with which it combines chemically". This reaction of antibody results in neutralization and elimination of antigen.

**Types of immunity**

Immunity is the ability to resist infection by an invading pathogen. The body quickly launches an immune response and prevents the symptoms of disease occurring. This can happen in two ways – naturally or artificially. **Natural immunity** occurs without human intervention and **artificial immunity** occurs when antigens or antibodies are given to a person by artificial means, eg by injection. Humans have three types of immunity — Innate, Adaptive (active), and Passive:

**Innate immunity or natural immunity**

It is the resistance offered by the body under the normal conditions without any external stimulation. This is possessed by birth, a type of general protection. Many of the germs that affect other species don't harm us. For example, the viruses that cause leukemia in cats and distemper in dogs don't affect humans.

**Barrier:** Innate immunity also includes the external barriers of the body, like the skin and mucous membranes the first line of defense in preventing diseases from entering the body. If this outer defensive wall is broken (as through a cut), the skin attempts to heal the break quickly and special immune cells on the skin attack invading germs.

**Blood components:** The immune system includes certain types of

white blood cells. It also includes chemicals and proteins in the blood, such as complement proteins and interferon. Some of these directly attack foreign substances in the body, and others work together to help the immune system cells.

**Inflammation:** The inflammatory response (inflammation) occurs when tissues are injured by bacteria, trauma, toxins, heat, or any other cause. Chemicals including histamine, bradykinin, **serotonin**, and others are released by damaged tissue. These chemicals cause blood vessels to leak fluid into the tissues, causing **swelling**. This helps isolate the foreign substance from further contact with body tissues.<sup>3</sup>

**Active immunity**

It is the immunity which when one individual develops as a result of infection or by specific immunization and is usually associated with the presence of antibodies. The immunity produced is specific for a particular disease and is for longer period of time. In active immunity the body is being stimulated to produce antibodies via a specific immune response. It can be acquired either by a person contracting a clinical or sub-clinical infection which is referred to as **natural acquired active immunity** or via an injection of weakened (attenuated) or dead antigens. In this case an immune response is activated resulting in the production of antibodies and memory cells. This form of immunity is called **artificial acquired active immunity**.

**Passive Immunity**

Passive immunity is "borrowed" from another source and it lasts for a short time. This could **happen naturally** when a mother passes her own antibodies to her baby either through her placenta or her breast milk which give a baby temporary immunity to baby towards specific disease. Another method of gaining passive immunity is **artificially**, i.e. by administration of an antibody containing preparation (antisera, immune globulin) for example when a person is given an injection of antibodies if they suspect that they have been exposed to a disease such as tetanus or diphtheria. In this situation, immunity is established immediately. This form of immunity is short lived as no memory cells are produced.

**Herd immunity**

"Herd immunity is the level of resistance of a community or group of people to a particular disease" It provides an immunological barrier to the spread of disease in the human herd.<sup>4</sup>

**The Immune system:**

The immune system is the body's defense against infectious organisms. The immune system attacks infectious organisms and substances through a series of steps called the immune response. The immune system is made up of a network of cells, tissues, and

organs that work together to protect the body. The immune system provides three lines of defense.

**First line of defense – Non-specific barriers**

These are a combination of physical and chemical barriers that prevent all types of foreign agents from penetrating the outer layer of the body. The barriers are:

**The skin** – provides an impervious barrier to pathogens.

**Mucous membranes** – line the entrances to the body such as in the respiratory tract entrances. Mucus produced by these membranes traps foreign particles and directs them out of the body.

**Hairs and cilia** – Nasal hairs trap dust and dirt; microscopic cilia line some mucous membranes and direct foreign particles out of the body.

**Gastric juice, vaginal secretions and urine** – acidic fluids that have






a protective function.

**Tears, sweat and saliva** – body fluids which possess some anti-bacterial properties.

**Cerumen** (ear wax) – produced in the ear canal and protects the canal by trapping dirt and dust particles.

**Second line of defense – leucocytes (white blood cells)**

**Leukocytes** are called the lymphoid organs as they are produced or stored in many locations in the body, including the thymus, spleen, and bone marrow. The leukocytes circulate through the body between the organs and nodes via lymphatic vessels and blood vessels and if a pathogen penetrates the first line of defence, these cells play a role in inhibiting or destroying the pathogen before it harms the body. They are non-specific and react to the presence of any foreign organism or substance. There are two main types of leucocytes: granulocytes and agranulocytes.

Granulocytes		
Neutrophil		Phagocyte (engulf and destroy bacteria)
Eosinophil		Kills parasitic worms, destroys antigen-antibody complexes
Basinophil		Releases heparin (anti-coagulant) and histamine, which prevents inflammation.
Agranulocytes		
Lymphocyte		<b>The</b> cells that allow the body to remember and recognize previous invaders and help the body destroy them. The two kinds of lymphocytes are <b>B lymphocytes</b> and <b>T lymphocytes</b> . Lymphocytes start out in the bone marrow and either stays there and mature into B cells, or they leave for the thymus gland, where they mature into T cells. B lymphocytes and T lymphocytes have separate functions: <ul style="list-style-type: none"> <li>• B lymphocytes are like the body's military intelligence system, seeking out their targets and sending defenses to lock onto them.</li> <li>• T cells are like the soldiers, destroying the invaders that the intelligence system has identified.</li> </ul>
Monocyte		Phagocytosis. Monocytes are the chief phagocytes. They circulate in the blood for 1–2 days before entering body tissues to become macrophages.

The granulocytes are mainly involved in non-specific responses, whereas the agranulocytes can play a role in both non-specific and specific immune responses.

**Third line of defense – the specific immune response:**

If a foreign agent penetrates the non-specific barriers, there is a third line of defense available – the specific immune response. The specific immune response is a mechanism that is activated by the presence of pathogens and foreign substances. These are known as antigens. The body's immune system can determine which antigens are part of its own body structure. These antigens are known as self-antigens. These do not stimulate an immune response. Non-self antigens are the foreign substances that do stimulate an immune response.



The presence of a non-self antigen can trigger the production of specific proteins called **antibodies**. The shape of the antibody gives it the ability to combine with and inactivate the antigen. When an antibody combines with an antigen the result is an antigen-antibody complex.<sup>5</sup>

**Immune response:**

The immune response is how the body recognizes and defends itself foreign and harmful substances to the body. When an antigen (Ag) is introduced into the human body, it stimulates the production of antibodies (Ab). Micro-organisms (and their toxins) and vaccines are antigens which evoke an immune response. The immune response is two types

**The primary response:**

The immune response, which occurs after a first or initial exposure, is known as the **primary response**. When animal or human is first exposed to an antigen, the body usually takes several days to respond (there is a latent period of 3-10 days before Abs appear in the blood) and build up a large supply of antibodies entirely of IgM type. The number of antibodies titre rises steadily during the next 2-3 days or more, reaches a peak level and then begins to decline almost as fast as it developed. Meanwhile, if the antigenic stimulus was sufficient, IgG antibody appears in a few days. IgG reaches a peak in 7-10 days and then gradually falls over a period of weeks or months. An important outcome of primary immune response is education of the reticulo-endothelial system of the body. There is production of "memory cells" or "primed cells" by both B and T lymphocytes. These cells are responsible for the "immunological memory" which becomes established after immunization.

**The secondary (booster) response: :-**

The production of memory cells during the primary response results in the body being able to destroy the re-invading antigen before its numbers get to a level where a person starts to display symptoms. Memory B cells rapidly divide into plasma cells and antibody levels in the blood rise quickly and reach greater numbers. The response to a booster dose of the same Ag has shorter latent period and results in more rapid production of Antibodies in abundance and a high level of antibodies is maintained for a longer period.<sup>6</sup>

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