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Types Of Immunity

Manu Tomar

¹Department of Biotechnology, Abdul Kalam Technical University, Lucknow, India

Review Article

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*For Correspondence

Manu Tomar, Department of Biotechnology, Abdul Kalam Technical University, Lucknow, India

E-Mail:

manutomar234@gmail.com

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Abstract

As immunity is the power of our body to kill the germs or pathogenic substances entered in our body so that we can easily maintain our health. This article reviews different types of immunity and their functions. Also reviews about different types of cell which are involved in that particular immunity.

INTRODUCTION

Immunity is the capability of the body to fight against pathogenic microbes in order to prevent us from infectious diseases. Immunity involves 2 types of components i.e., specific and nonspecific components ^[1-5]. Specific components acclimate themselves to each and every types of new disease encountered and hence able to produce pathogen-specific immunity whereas nonspecific components behave as an eliminators or chemical mediators of pathogens regardless of antigenic specificity ^[6-10].

TYPES OF IMMUNITY

There are basically two types of immunity:

- 1) Innate immunity
- 2) Adaptive immunity

1) Innate immune system

This is basically a natural immunity of an individual that's why it is also called as non-specific immune system or we can say in-born immunity. It includes all the mechanisms that protect the host from pathogenic microbes. It provide prompt defense against infection but does not create any memory against a particular pathogen for future encountered ^[11-17]. Hence its response is independent for an antigen ^[18]. Functions of innate immune system are:

- Behaves as a physical and chemical boundary to pathogenic agents ^[19].
- Recognition and eradication of foreign substances present in our body with the help of leukocytes ^[20,21].
- Enrolling immune cells to the section of germs, through the secretion of chemical substances called cytokines ^[22].
- Stimulation of the adaptive immune system through a process known as antigen presentation.

- Recognition of bacteria by the stimulation of the complement cascade

Cells involved in innate immunity:

White blood cells are main source to induce innate immunity. These cells are also known as leukocytes. WBC differs from other cells of the body in that they are not associated with a specific organ and hence their function is autonomous [23]. These cells are the products of hematopoietic stem cells [24,25]. They move freely inside the plasma and capture infectious particles and invading microorganisms.

These leukocytes cells include: Natural killer cells, eosinophils, mast cells, basophils; and the phagocytic cells comprises neutrophils, macrophages, and dendritic cells, and works along with the immune system by eliminating pathogenic agents which causes infection.

NK cells are the basic part of innate immunity that does not directly attack the foreign substances. The role of NK cells is like that of cytotoxic T cells. These cells are called natural killer because they do not require any activation. They kill the microbes as soon as they produced inside the body [26-29].

Eosinophils not only digest the pathogenic organism which enters into our body but also target those foreign cells which are enlarging enough to digest. Their efficiency is low as compare to neutrophils and basophils.

Basophils play an important role in immunity. Due to activation of these cells histamine-releasing basophils are produced. They also take part in allergic reactions. For e.g.: Asthma. Toxin proteins are also released due to activation of eosinophil which are effective in killing parasites but may also damage other tissue during an allergic reaction [30].

Mast cells are associated with lesion curing and defense against pathogens. These cells are linked with allergic reactions [31-34]. After activation, mast cells rapidly produce granules which are rich in histamine along with chemokine [35]. Histamine recruits neutrophils and macrophages [36-39].

Phagocyte are immune cells that engulf pathogens. During engulfing, a phagocyte enlarge its plasma membrane, folding the membrane around the particle until it is encompassed. After that it kills and digests the pathogen.

Neutrophils are also called as granulocytes due to the existence of granules in their cytoplasm. These granules consists a mixture of toxic substances that hinders the growth of microbes [40-42]. Like that of macrophages, neutrophils also kill the pathogens through respiratory burst process [43-46].

Macrophage means large eaters. These are the most efficient phagocytes and can phagocytize large number of bacteria or microbes. Bacterial molecule binds to receptor on the surface of a macrophage and kills the bacteria through the process of respiratory burst. Bacteria also stimulate the macrophage to produce chemokine, which gathers other cell at the site of infection [47].

Cytokines operate only with that type of cells which having specific receptors on their surface. Each cytokines are pleiotropic i.e., having different effects on different cells in nature. Sometimes cytokines also considered as chemokine because both can reenergize each other.

Dendritic cells are present in tissues that comes in acquaintance with the external environment, mainly with the skin (i.e. Langerhans cells), and the inner mucosal lining of the stomach, nose and lungs [48]. Dendritic cells play an important role in the mechanism of antigen presentation, and provide a network between the innate and adaptive immune system [49].

2) Adaptive immune system

Adaptive immune system also called acquired immune system or rarely known as specific immune system. It is a subsystem of overall immune system because it composed of systemic cells and processes that inhibits pathogen growth. As this system is destructive in nature so it is essential that they are made in such a manner so that they only target to foreign particles not to it. To recognize self and non-self-components inside the body makes adaptive immunity distinctive one from other type of immunity [50-52]. Acquired immune system produces an immunological memory after early response to a specific pathogen, and leads to an enhanced response when encounters with the same pathogen next time. This process is the basis of vaccination in adaptive immune system. Adaptive immune system comprises both the components i.e., humoral and cell-mediated immunity.

Functions of the acquired immune system are:

- Pathogens are remembered by the development of immunological memory through memory B cells and memory T cells.
- Recognition of self and non- self-antigens during the process of antigen presentation.
- Activation of responses to eliminate specific pathogen-infected cells.

Cells involved in adaptive immunity

T and B lymphocytes are the major cells of the acquired immune system. These cells are derived from the same hematopoietic stem cells. B cells involved in the humoral immune response while T cells play an important role in cell-mediated immune responses [53-56].

T lymphocytes

Cytotoxic T cells also called cytotoxic T-lymphocyte or TC cells .T cells induce the death of that cells which are infected with viruses [57,58]. When T-cell receptor (TCR) strongly binds with a peptide-bound MHC class-I molecule, naive cytotoxic T cells are activated. T cells are of two types: Cytotoxic T cells and Helper T cells.

Cytotoxic T cells

Cytotoxic T cells are also called CD8+ lymphocytes [59]. These cells mainly target to those cells which are infected with virus. For e.g. HIV infected cells [60-64].

Helper T-cells

Helper T cells are also called CD4+ lymphocytes [65]. These cells cannot kill infected cells, but they can regulate the immune response of other cells to perform their functions properly [66,67].

B lymphocytes

B Cells are the primary cells involved in the formation of antibodies and hence called as humoral immunity. 5 different types of antibody produced by B-lymphocytes are: IgA, IgD, IgE, IgG, and IgM [68-70]. These Abs are evolved to handle different types of antigens. Antibodies are produced during the stimulation of B cells, which recognizing a uncommon antigen and hence neutralizing particular pathogens [71-73].

Adaptive immunity is further categorized into two type of immunity:

- i. Passive immunity
- ii. Active immunity

i) Passive immunity

Passive immunity is the transmission of active immunity, in the form of prefabricated antibodies, from one person to another person. Passive immunity appears as naturally or artificially [74-79]. When maternal antibodies through the placenta are transferred to the fetus, here passive immunity is developed naturally but when high levels of human antibodies specific for a particular pathogen are transferred to non-immune individuals, this is called artificial acquire passive immunity [80-84]. In passive immunity, the patient is at risk of epidemic by the same microbe later because body can't develop memory cells. Passive immunization is used in order to lower the symptoms of immunosuppressive diseases [85].

Naturally acquired passive immunity

Maternal passive immunity is an illustration of naturally acquired passive immunity and indicates antibody-mediated immunity which is transfer to a fetus from its mother at the time of pregnancy. These maternal antibodies are transferred to the fetus only through placental cells. This occurs during the third month of gestation. IgG is the antibody that can transfer through the placenta [86-89].

Artificially acquired passive immunity

Artificially acquired passive immunity is a type of short-term immunization which can be activated by the transfer of antibodies. These antibodies are administered into the body in several forms such as animal blood plasma in the form of monoclonal antibodies. Artificially acquired passive immunity is activated in the case of immunodeficiency diseases [90-92]. For e.g: hypogammaglobulinemia.Abnormal heartbeat, which causes fainting in rare cases

ii) Active immunity

During the entry of pathogen inside the body both B cells and T cells are stimulated and develop memory B-cells and T- cells [93-96]. These memory cells produce secondary response when encountered with the duplicate pathogen again during the life. Active immunity may also be natural or artificial.

Naturally acquired active immunity

This type of immunity develops when an individual is exposed to a live pathogen, and produces a primary immune response, and then it leads to immunological memory. This immunity is natal because it is not convinced by deliberate exposure [97,98]. Immunodeficiency and immunosuppression are the disorders of immune system operation that can affect the development of active immunity.

Artificially acquired active immunity

We can stimulate artificially acquired active immunity through vaccine. This is because of presence of antigens in vaccine. They also induce a primary response against the antigen without causing any symptoms of the disease [99, 100].

CONCLUSION

Innate immunity is the first non-specific immunity for fighting against microbes. Here, the developed immune response is very fast and is negotiated by various cells like T cells, mast cells, B cells, basophils and eosinophil. Adaptive immunity relies on the tightly organized coaction between B and T cells. This immunity also developed immunologic memory so that it can give rapid response when exposure to the same pathogen again. The remaining of this article will focus on different types of cell involved in particular immunity.

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