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Review Article

A Potential Review on Various Immune Responses and Role of Pathogens in Activation of Cellular and Molecular Immunity

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Abstract

Many of the immune cells are involved to protect the body against the specific microbes and thus inhibiting their chemicals by binding to the specific surfaces of pathogens. Human body has different cells particularly important in defending the body against the pathogens. Different cells are involved in protecting the body as part of innate immunity. This innate immunity includes the external barriers of the body as the first line of defense against pathogens such as the skin. Molecules on the pathogens surface may be recognized directly by the PRRs of resident macrophage. Natural killer cells also involved in immune response by killing the cancerous cells or viral proteins by attaching on their surface. The main mechanism of the innate immune response to eradicate bacteria is activation of the complement system, phagocytosis, and inflammatory response. *Listeria monocytogenes is the pathogenic form of bacterial species that causes disease transmitted through the infected foods.* Interferons tightly bind to the viral proteins and inhibit their production. Different vaccines have been used to treat the number of diseases and each vaccine works for against the specific diseases in order to make the immunity.

Keywords: Cellular immunity, microbial attack, interferons, cytotoxic cells, adaptive immunity.

INTRODUCTION

Immune systems comprised of those cells that are involved in recognition of foreign invaders in the form of pathogenic microbes such as virus, bacteria and parasites. They start killing them as most protective barriers such as skin that possess the certain cells and glands that releases in responses to pathogens entry into the host cells [1, 2]. Many of the immune cells are involved to protect the body against the specific microbes and thus inhibiting their chemicals by binding to the specific surfaces of pathogens. The most important cells of the immune system that involved in activation of immune cells induced by pathogens are B cells. These cells are particularly important to the production of antibodies against specific pathogen [3, 4].

Antibodies that produced in response of B cells targeted the antigen of specific pathogen. These are involved in mediation of humoral immunity by the formation of antibodies such as IgG and IgE. Neutralization by antibodies is an important classical effector mechanism against viruses [5]. Human body has different cells particularly important in defending the body against the pathogens. Different cells are involved in protecting the body as part of innate immunity. This innate immunity includes the external barriers of the body as the first line of defense against pathogens such as the skin and mucous membranes of the throat and gut [6].

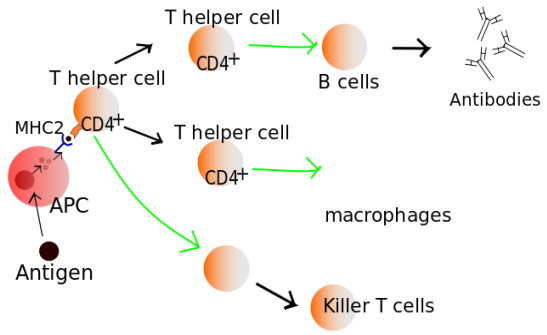

Fig-1: Shows the mechanism of pathogens entry and activation of immune cells

Animals and other vertebrates also rely on cells of the immune system that induced the specific responses evoked by more pathogenic environment. This type of response developed through adaptive immunity can recognize and destroy specific substances [7]. This involves the defensive reaction of the adaptive immune system. Antigens are recognized by particular cells in the form of foreign invaders, toxins may be endotoxin, exotoxin, toxic chemicals and xenobiotics. Immune responses are normally directed against the antigen that provoked them and are said to be antigen-specific [8].

There are many different aspects about the type of immunity in response to the foreign invasion. One of the immunity is active while on the other hand, other one is passive immunity. Active immunity is more important in protein the body against the diseases. Hence, the knowledge of particulary type of immunity leads to potential improvement for clinical experimental that to be carried to track the different status of diseases [9, 10].

Table-1: Shows the type of system, target and biological responses for activation of cellular immunity

System/Pathogen Cells/Proteins involved	Target Action	Biological Responses	References
Immune system	Foreign invaders	virus, bacteria and parasites	[1, 2]
Antibodies production	Humoral immunity	IgG and IgE.	[5]
First Line of Defense	Skin	Provides most of protection	[11, 12]
Immune cells	Macrophages and natural killer cells	Kills the pathogens and produces various immune responses	[9, 11, 13]
Listeria Strains	*Pathogenic form of bacterial* species	*Causes the disease transmitted through the infected foods. It resulted the fever, chilling and vomiting.*	[5, 9]
MHC	To sense the foreign antigens	Presence of 'foreign' proteins and involved in immune responses.	[19, 20]
Interferon's	Group of proteins that provide cellular protection	Inhibit the replication of many of viruses. Interferon's tightly bind to the viral proteins and inhibit their production	[24, 25]
Pathogens entry routes	Food, air, blood	Cellular responses	[29, 30, 31]
Foods allergens	*salmonella. clostridium perfringens. Campylobacters· staphylococcus aureus*	Causes food spoilage and serious heath diseases	[31, 32]
Blood borne pathogens	HIV, Hepatitis B,C	Early responses	[32]
Target sites of blood pathogens	Liver, immune cells	Causes destruction of liver cells and immune cells	[29, 31]

Various cellular responses evoked to pathogenic environment

Different pathogens have different entry routes into the human body as exposed area or wound provides way to attack on the skin cells. Once the pathogens enter into the wound, different types of immune cells show response in response to pathogens. These are macrophages and natural killer cells. Molecules on the pathogen surface may be recognized directly by the PRRs of resident macrophages [11, 12]. Natural killer cells also involved in immune response by killing the cancerous cells or viral proteins by attaching on their surface. Different types of pathogens elicit the production of different classes of chemokines that facilitate the inflammatory response. These responses modulate the immune cells to take action against the pathogens. Therefore, human body has complex cells that activate in response to pathogens entry into the specific cells as foreign invaders [13, 14].

Sometime, infectious viral particles or bacterial cells entry into the living surface due to exposed area. Chances of attacking of these pathogens would be decrease in response to immune cells. Innate response to the bacterial cells arise due to detection of specific receptors on surfaces [15]. After recognition, immune cells produced antibodies in order to evoke the immune mechanism. The main mechanism of the innate immune response to eradicate bacteria is activation of the complement system, phagocytosis, and inflammatory response. Several receptors in the phagocytes activated due to phagocytosis that leads to inflammation by recruiting leukocytes to the site of infection. These reactions in the specific cells leads to inflammation and releasing different proteins [16].

Membrane of gram positive bacteria primarily comprised of lipids as in gram-positive bacteria employ both the Tat and Sec pathways to transport proteins across the cytoplasmic membrane. *Listeria monocytogenes is the pathogenic form of bacterial species that causes disease transmitted through the infected foods. It resulted the fever, chilling and vomiting.* These bacteria possess the surface proteins that involved in immune responses by binding to the membrane receptors. This bacterial surface protein InlB binds to and activates the receptor tyrosine kinase Met on host cells [5, 9]. It leads to series of inflammatory reactions across the wall of membrane.

Viral proteins are also targeted the host cells by binding to the specific surfaces. When virus enters into the specific tissues, immune cells show response in order to tack action against them. The most important response arise is class is the major histocompatibility complex proteins [17, 18]. The cell is infected with a virus; these pieces of peptide will include fragments of proteins made by the virus. Major histocompatibility complex, or MHC, is a molecule on the outside of immune cells such as white blood cells. It is coded for by a large gene family in all vertebrates. The function of is MHC molecules to sense foreign antigens, and hence the presence of 'foreign' proteins. Sometimes, viral proteins cannot be detected due to autoimmune response. Abnormal response arise in such kind of conditions leads to borne of certain disorders that ultimately attack on immune cells [19-21].

Role of interferon's for targeting the viruese

Certain actions have been taken into consideration in order to make the synthetic proteins against viruses. But some proteins that artificially synthesized in laboratory can be functional when passes through different clinical trials [22, 23]. Group of proteins that provide protection are the interferons, which inhibit the replication of many of viruses. These are classified on the basis of structure and functional properties. Alpha interferon is produced by white blood cells that particularly targeted the viral proteins causing the tumor formation in the specific cells. Beta interferon produced by fibroblasts that preventing the inflammation and work against damage to brain cells. Gamma interferon by natural killer cells works against the specific antigens in response to foreign invaders. This type of interfere with multiple functions marked as biomakres for detection of cancer based diseases [24, 25].

Interferons tightly bind to the viral proteins and inhibit their production. They are involved inactivation of cellular immune response by enhancing the T-lymphocyte activity. Interferon is secreted by cells in response to stimulation by a virus or other foreign substance to stimulate the infected cells and those nearby to produce proteins that prevent the virus from replicating within them. All types of interferon's are acting by secreting the proteinous secretions in order to increase the survival rate of cells of body. They are also eliciting the transcription of hundreds of interferon-stimulated genes with anticancer activity and antitumor to inhibit their action on normal cells. Sometimes, excess secretions of interferon's leads to abnormally targeting viral proteins to the site of action [22, 25].

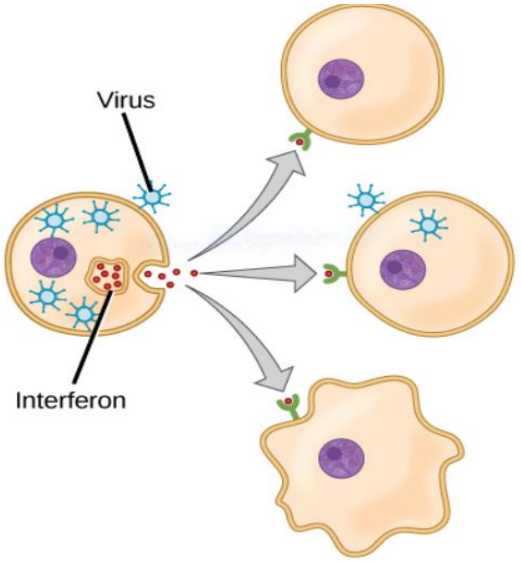

Fig-2: Shows the role of interferon's in target the viruses

Different routes of pathogens entry into body

There are many infections that spread by pathogen found in the natural environment. These infections taken into the body in the form of foods or water and other infected source in case of wound in which pathogens can easily be entered to the punctured surface [26]. It resulted in activation of immune cells that migrated to the attacking area and seals the wound by activation of different factors such as fibrinogen. Monocyte-derived macrophages are most activating cells of immune system in the context of wound

healing, and are often considered to be the most important immune cell type in this process. Sometimes, due to compromised immune system, body cells fail or slowing the process of healing process. There are different sources of pathens entry into the body [27, 28].

There are many infections that cause infections in blood, body fluids that cause the severe infections in liver and invade the cells of immune system. The most important ones are hepatitis B,C and HIV can be spread through sexual intercourse or sharing used syringe needles contaminated with infected blood. A cold or the flu can be caught from the saliva of an infected person. Measles, mumps and tuberculosis can be spread by coughing or sneezing. A cough or a sneeze can release millions of microbes into the air in droplets of mucus or saliva which can then infect somebody else if they breathe in the infected particles. Different organs such as liver can be damaged if rate of infection increase due to more colonization of pathogens in specific cells of liver [28-30].

Foods also contain the lot of vitamins, minerals and dietary fiber supplements in order to increase the nutritional value of foods. While on the other hand, spoiled foods comprised of pathogenic microbes that increase the food poisoning. Therefore great care must be taken at every stage of food production to ensure that harmful microbes are not allowed to survive and multiply. Once the taking foods that are spoiled with microbes [31, 32]. Leads to borne of diseases. It also causes the unpleasant symptoms of food poisoning such as sickness and diarrhoea when the contaminated food is eaten. The most common food poisoning microbes are *salmonella. clostridium perfringens. Campylobacters· staphylococcus aureus.*

Different vaccines have been used to treat the number of diseases and each vaccine works for against the specific diseases in order to make the immunity. A vaccine contains the antigens of a pathogen that causes disease [33]. For example, polio vaccine comprised of antigen work particular work to polio disease. Those individuals who have been vaccinated with against the polio, immune system activate the antibody-producing cells that are capable of making polio antibodies. Similarly, smallpox vaccine comprised of antigen work particular work to smallpox disease. Those individuals who have been vaccinated with against the polio, immune system activates the antibody-producing cells that are capable of making smallpox antibodies [34, 35].

CONCLUSION

Many pathogens are causing the serious diseases due to increased rate of infections at extreme level. There is need to discover the drugs that can target the pathogens that showing resistance against them. There is also need to improve the synthesis of antibiotics and antiviral drugs as many of the pathogens shown resistance due to changing environments. There is also need to synthesized the drugs that can target the genetic material of bacterial and viral pathogens. It will helpful to control the rate of infections.

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