

Interaction between Antigens and Immune System and its Types

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DESCRIPTION

Antigens are fundamental components of the immune system, serving as the key role in the body's defense against invading pathogens and foreign substances. These molecular entities are crucial for immune recognition and activation, playing a pivotal role in triggering the immune response.

Understanding the nature and function of antigens is essential to comprehend how our immune system combats diseases and develops immunity. This article discusses about antigens, their characteristics, types, and significance in safeguarding our health.

An antigen is any molecule that can be specifically recognized by the immune system and elicit an immune response. These molecules are typically foreign to the body, such as those found in bacteria, viruses, fungi, and other pathogens. However, antigens can also be present on the surface of our body's cells, acting as a "self" identifier that allows the immune system to distinguish between "self" and "non-self" entities.

Characteristics of antigens

Antigens can vary greatly in size, structure, and complexity. They can be proteins, polysaccharides, lipids, or even nucleic acids. The part of the antigen that directly interacts with immune cells, triggering the response, is called the "epitope" or "antigenic determinant." Epitopes are specific regions of antigens that are recognized by receptors on immune cells, such as antibodies or T-cell receptors.

Types of antigens

Exogenous antigens: These antigens originate from outside the body and are taken up by Antigen-Presenting Cells (APCs), such as macrophages and dendritic cells. APCs process the exogenous antigens and present their epitopes on their cell surface in association with Major Histocompatibility Complex (MHC) molecules. This presentation is essential for activating T cells, which play a central role in cell-mediated immunity.

Endogenous antigens: Endogenous antigens are derived from within the body, originating from infected or abnormal host cells. These antigens are presented on the surface of infected

cells or cancerous cells in association with MHC molecules. Cytotoxic T cells, also known as CD8+ T cells, recognize and eliminate cells displaying endogenous antigens.

Autoantigens: Autoantigens are the body's own antigens, and they are normally tolerated by the immune system to prevent autoimmune reactions. However, in autoimmune diseases, the immune system mistakenly identifies self-antigens as foreign and mounts an attack against healthy tissues, leading to inflammation and tissue damage.

Significance of antigens in immunity

The interaction between antigens and the immune system is a complex and dynamic process that orchestrates the body's immune response. When a foreign antigen is encountered, the immune system launches a multi-faceted defense mechanism involving various cell types and immune molecules:

B cells and antibodies: B cells are a type of white blood cell that produces antibodies, also known as immunoglobulins. These Y-shaped proteins can bind to specific epitopes on antigens, effectively neutralizing or marking them for destruction by other immune cells.

T cells: T cells, including helper T cells and cytotoxic T cells, are critical in recognizing and eliminating infected or abnormal cells. Helper T cells facilitate B cell activation, enabling antibody production, while cytotoxic T cells directly target and destroy infected or cancerous cells.

Memory cells: After an immune response, memory cells are generated. These long-lived cells "remember" the encountered antigen, leading to a faster and more robust immune response upon future exposures. This process forms the basis of immunological memory, which underlies vaccination and long-term protection against certain diseases.

Antigens play an indispensable role in shaping our immune system's response to various threats. Their diversity and specificity enable the immune system to differentiate between self and non-self, keeping us protected from harmful invaders while maintaining tolerance to our body's own cells. Understanding the intricacies of antigen recognition and immune response is vital

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Received: 22-May-2023, Manuscript No. CSSB-23-25920; **Editor assigned:** 24-May-2023, Pre QC No: CSSB-23-25920 (PQ); **Reviewed:** 09-Jun-2023, QC No. CSSB-23-25920; **Revised:** 16-Jun-2023, Manuscript No: CSSB-23-25920 (R); **Published:** 23-Jun-2023; DOI: 10.35248/2332-0737.23.11.044

Citation: Niaze R (2023) Interaction between Antigens and Immune System and its Types. J Curr Synth Syst Bio.11.044.

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for vaccine development, disease treatment, and advancing our knowledge of immunology. The ability of the antigens and our

immune system to work in harmony showcases the complexity and brilliance of the human body's defense mechanisms.