Interaction with Innate Immunity

Adaptive immune responses closely interact with innate immune responses.

Host is considered immune compromised if any part of the innate or adaptive system is impaired.

Adaptive responses come into action when innate defenses fail.

Four Main Stages of Adaptive Immune Responses

Antigen Presentation: Involves antigen-presenting cells (APCs) showing antigens to T cells.

Lymphocyte Activation: Lymphocytes are activated by cytokines

Lymphocyte Proliferation and Differentiation: Leads to effector cells and memory cells.

Antigen Elimination and Memory: Cellular and humoral responses collaborate to eliminate the antigen.

T Cell Differentiation

T cells can be classified into T cytotoxic cells (TC cells) and T helper cells (TH cells)

T helper cells, especially CD4+ T cells, release cytokines and activate other immune cells.

T helper cells can further differentiate into subclasses like TH1, TH2, and Treg cells

MHC I and MHC II in Antigen Presentation

MHC I presents intracellular antigens on most body cells.

MHC II, exclusive to APCs, presents extracellular antigens to T cells

MHC matching is crucial for tissue transplantation (allorecognition).

Active vs. Passive Immunity

Characteristics of Adaptive Immune Responses

Take longer to mount (days to weeks) compared to innate responses.

Specific to a particular antigen and exhibit immunological memory.

Secondary exposure to the same antigen results in a rapid and effective response.

Production and Function of B and T Cells

B and T cells recognize a wide range of antigens

T cells originate in the bone marrow, mature in the thymus, and play roles in both cellular and humoral branches.

B cells coordinate the humoral response by producing antibodies

Mature B and T cells mainly reside in lymphoid tissues.

T Cytotoxic Cells

CD8+ T cytotoxic cells directly destroy infected or cancerous cells.

Roles in antigen elimination involve interferons, MHC I production enhancement, and inducing apoptosis in target cells.

Antibodies in Antigen Elimination

Plasma cells secrete antibodies (immunoglobulins) that neutralize antigens, activate complement cascades, and promote phagocytosis.

Different antibody isotypes (IgG, IgA, IgM, IgE, IgD) have specialized functions

MHC Matching in Transplantation

Critical for avoiding tissue rejection in transplantation.

Allorecognition is the process by which lymphocytes distinguish self from foreign MHCs.

Transplant waiting lists exist due to the difficulty of finding an adequate MHC match.

MHC Matching in Transplantation

Branches of Adaptive Immune System

Cellular response (T cell-mediated immunity).

Humoral response (antibody-mediated immunity).

Both aim to eliminate identified antigens and form memory for faster future responses.

Antigens and Immunogenicity

Antigens trigger immune responses and can be proteins, polysaccharides, or molecules in various organisms.

Immunogenicity depends on antigen size, molecular complexity, and chemical composition

Stages of Cellular/ Humoral Immune Responses

Both branches progress through four stages: antigen presentation, lymphocyte activation, lymphocyte proliferation and differentiation, antigen elimination, and memory.

Memory Cells in Immune Response

Effector cells die off, while memory cells provide long-lasting immunological memory.

Enable rapid reactivation of the adaptive response upon encountering the same antigen.

Secondary immune response involves quick generation of high-affinity IgG antibodies

Active immunity involves memory cell and antibody formation, obtained through infection or vaccines.

Passive immunity entails receiving antibodies without memory cell involvement, providing temporary protection.

Naturally acquired active and **artificially acquired active immunity** confer long-lasting protection, while **naturally acquired passive immunity** provides only temporary protection.

Critical for avoiding tissue rejection in transplantation.

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By **sunnyeve33**

cheatography.com/sunnyeve33/

Published 11th November, 2023.
Last updated 11th November, 2023.