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Perspective

Development of cell-mediated immunity and its function

Watty Min*

Department of Immunology, Harvard University, Cambridge, USA.

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DESCRIPTION

Cell-Mediated Immunity (CMI) is an immune response that doesn't use antibodies but instead involves the activation of macrophages and natural killer cells, the generation of cytotoxic T lymphocytes that are specific for an antigen, and the release of different cytokines in response to an antigen. The body is protected by cellular immunity in three ways: 1. activating antigen-specific Cytotoxic T-Lymphocytes (CTLs) that can kill body cells that have epitopes of a foreign antigen on their surface, such as virus-infected cells, cells with intracellular bacteria, and cancer cells displaying tumour antigens; 2. Activating macrophages and natural killer cells so they can kill intracellular pathogens; and 3. Inducing the release of a range of cytokines from cells, which affect how other cells engaged in both innate and adaptive immune responses operate. Microbes that survive in phagocytes and microorganisms that infect non-phagocytic cells are the main targets of cell-mediated immunity. It works best to eliminate intracellular bacteria, tumours, and virus-infected cells. It also contributes significantly to postponed transplant rejection.

Development

All type 1 cells emerge from the common lymphoid progenitor (CLp), which undergoes lymphopoiesis to differentiate into the common innate lymphoid progenitor (CILp) and the t-cell progenitor (Tp).The natural killer progenitor (NKp) or a common helper-like innate lymphoid progenitor can then be separated from common innate lymphoid progenitors (CHILp). Then, IL-15 may drive NKp cells to develop into natural killer cells. CHILp cells may be stimulated by IL-15, IL-7, or IL-3 to develop into ILC1 cells, ILC2 cells, or ILC3 cells. T-cell progenitors can develop into either naive CD8+ or CD4+ cells. After being exposed to IL-12, naive CD8+ cells may continue to develop into TC1 cells, [IL-4] can cause TC2 cells to form, and IL-1 or IL-23 can cause TC17 cells to form. When exposed to IL-12, IL-4, or TH1, naive CD4+ cells may develop into TH1 cells, TH2 cells, or TH17 cells, respectively.

- CD4+ TH1 cells
- CD8+ cytotoxic T cells (Tc1)
- T-Bet+ group 1 ILCs that produce interferon gamma (ILC1 and Natural killer cells)

Function

Cell-mediated immunity, which includes T-cell reactions, is crucial in controlling viral infections. T cells achieve this through developing effector activities, like the production of chemokines and cytokines, which can have both direct and indirect antiviral effects and also help to control the immune response as a whole. Some effector T cells have the ability to kill virus-infected cells through cell-to-cell contact, and in doing so, they offer a vital method of eliminating the host cells that act as the locations where progeny virus is produced. In addition to being beneficial during the acute phase of viral infections, cell-mediated immune responses can create long-lasting immunological memory. These memory T cells serve to guard against subsequent exposures to the initial viral disease because they quickly activate if they come into contact with virally infected cells. Although the host is able to recover from many viral infections, other viruses can survive an infection for a very long time. In these situations, T-cell responses frequently result in some early containment of the infection and work over time to regulate it at a steady-state level. Cell-mediated immune reactions to viral infections are not always advantageous because they might harm host tissues and result in immunopathology.

***Corresponding author:** Watty Min, Email: watty.min@gl.com