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Perspective

Cytotoxic T Cell: Development and Activation

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DESCRIPTION

A cytotoxic T cell also known as TC, cytotoxic T lymphocyte, CTL, T-killer cell, cytolytic T cell, CD8+ T-cell, or killer T cell is a type of T lymphocyte that destroys cancer cells, infected or damaged cells. T-cell receptors, which can recognize a specific antigen, are found on the majority of cytotoxic T cells. Antigens are molecules that stimulate the immune system and are frequently produced by cancer cells or viruses. Antigens inside a cell bind to class I MHC molecules, which transport them to the cell's surface, where T cells may recognize them. If the TCR is specific for that antigen, it attaches to the antigen-class I MHC molecule complex, causing the T cell to kill it.

The TCR must be accompanied by a glycoprotein called CD8, which binds to the constant part of the class I MHC molecule in order for it to bind to the latter. As a result, these T cells are referred to as CD8+ T cells. During antigen-specific activation, the interaction between CD8 and the MHC molecule maintains the TC cell and the target cell close together. When CD8+ T cells become activated, they are designated as TC cells and are characterized as having a pre-defined cytotoxic role within the immune system. CD8+ T cells, on the other hand, can produce certain cytokines.

Development

Millions of potential antigens must be recognized by the immune system. Because the human body has less than 30,000 genes, it is impossible to have one gene for each antigen. Instead, the DNA of millions of white blood cells in the bone marrow is scrambled, resulting in cells with distinct receptors that may connect to diverse antigens. Because some receptors attach to tissues in the human body, those self-reactive white blood cells are eliminated during subsequent growth in the thymus, which requires iodine for development and activity.

The cells then rearrange their alpha-chain TCR DNA to generate a functioning alpha-beta TCR complex if the rearrangement is effective. This very diverse genetic rearrangement product in the TCR genes allows the body's immune system respond to nearly any protein of an intruder by generating millions of different T cells with varied TCRs. T cells are expressed by the vast majority of T cells, although certain T cells in epithelial organs express gamma-delta TCRs which identify non-protein antigens.

Activation

All host cells, with the exception of select cell types such as non-nucleated cells express Class I MHC. When these cells are infected with a virus or an intracellular disease, antigen processing is used to destroy foreign proteins. These produce peptide fragments, some of which are delivered to the T cell antigen receptor (TCR) on CD8+ T cells through MHC Class I. Several simultaneous interactions between molecules expressed on the surface of the T cell and molecules on the surface of the antigen-presenting cell are required for the activation of cytotoxic T cells.

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