

Difference Between T Helper and T Cytotoxic Cells

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Key Difference – T Helper vs T Cytotoxic Cells

Lymphocytes are a type of white blood cells with a single round nucleus. They are important defense cells in vertebrates immune system. T cells or T lymphocytes are a subtype of lymphocytes. They are part of the adaptive immunity and are mainly involved in cell mediated immunity which does not occur through antibody production. T cells are produced by bone marrows. Then they travel to the thymus and become mature. These T cells can be distinguished from other lymphocytes due to the presence of T cell receptors on the T cell surface. There are several types of T cells which have separate roles in the immune system. They include helper T cells, memory T cells, cytotoxic T cells (killer T cells) and suppressor T cells. Helper T cells cooperate with B cells in antibody production and activation of macrophages and inflammation. Killer T cells kill antigen infected cells (mostly virus infected cells), cancer cells and foreign cells directly. The key difference between T helper cells and cytotoxic cells is that **helper T cells are involved in coordination of the immune response against the pathogen with B cells and other T cells while cytotoxic cells directly kill or destroy cancer cells and antigen infected cells.**

What are T Helper Cells?

T helper cells (also called $CD4^+$ T cells) are the main cells that coordinate immune response against an infection. T helper cells instruct other immune cells such as killer T cells, B cells, phagocytes (macrophages) and suppressor T cells by giving signals to work against the pathogen. Many helper T cells are needed for this function. Helper T cells perform all these functions by secreting small proteins called T cell cytokines (activating proteins). Helper T cells help to suppress or regulate the immune response as well. T helper cells also assist B cells and memory B cells for maturation.

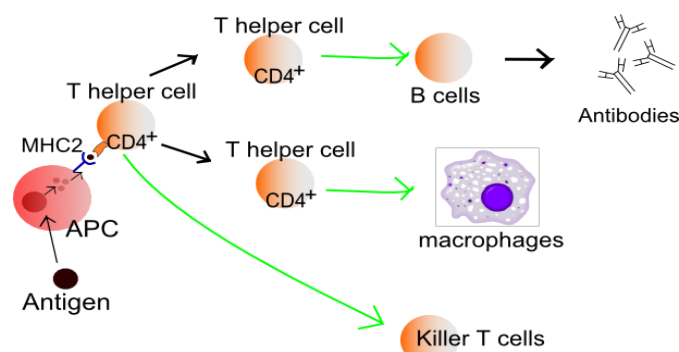


Figure 01: Role of Helper T cells

When T helper cell detects a virus infection, it activates and divides into many T helper cells. This process is known as **clonal expansion**. Some of the divided cells remain as memory cells while other cells react in different ways as follows to respond to viral infection by producing activating proteins called cytokines.

1. Activate killer T cells to kill virus infected cells directly.
2. Stimulate B cells to produce antibodies to stick with free viral particles.
3. Stimulate macrophages to become effective in cleaning dead viral particles.
4. Stimulate suppressor T cells to slow down the immune response after the viral attack is neutralized.

What are T Cytotoxic Cells?

Cytotoxic T cells, also known as CD8⁺ T cells or killer T cells, are a type of T cells which directly kill cancer cells, virus infected cells and damaged cells via creating holes in the cell walls. When cell covers are broken, cell contents leak out and destroy the cells. Killer T cells express T cell receptors on cell surfaces to recognize antigens. Antigens bind to class I MHC molecules. Hence, cytotoxic T cells realize the threat. Cytotoxic T cells release granules containing important molecules to kill the pathogen.

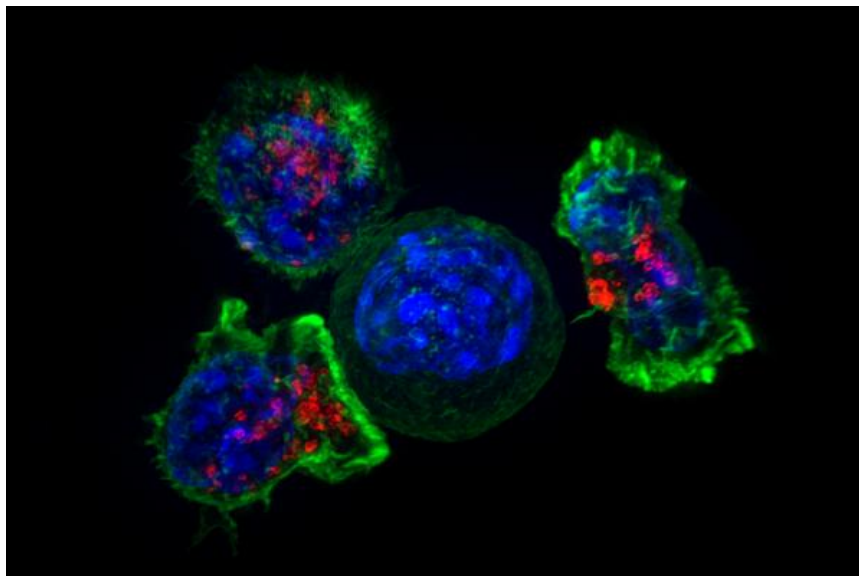


Figure 02: Killer T cells surround a cancer cell

Two types of molecules are involved in cytotoxic T cells killing action. They are perforin and granzymes. Granzymes are proteases trigger [apoptosis](#). Perforin molecules form holes or pores in the lipid bilayer.

What are the Similarities Between T Helper and T Cytotoxic Cells?

- T helper cells and cytotoxic T cells are white blood cells (leukocytes).
- T helper and T cytotoxic cells are two main types of T lymphocytes.
- Both are involved in adaptive immunity.

What is the Difference Between T Helper and T Cytotoxic Cells?

T Helper vs T Cytotoxic Cells	
T Helper cells are the T cells which instruct B cells and other immune cells to respond to the infection (to develop an immune response).	T Cytotoxic Cells are the T cells which kill cancer cells and virus infected cells directly by destroying the cell membranes.
After the Infection	
T Helper cells slow down the immune response when the infection is gone.	T Cytotoxic Cells keep on killing due to the activation.
Functions	
T Helper cells have several functions including stimulation of B cells, macrophages, suppressor T cells, activation of killer T cells, etc.	T Cytotoxic Cells has one major function which is to kill antigens directly.
Ability to Kill the Pathogen Directly	
T Helper cells cannot directly kill the infected cells.	T Cytotoxic Cells have the ability to kill infected cells directly.

Summary – Helper T Cells vs Cytotoxic T Cells

Helper T cells and Cytotoxic T cells are the two main types of T cells. Helper T cells are involved in the coordination of the complete immune response against an infection. These cells instruct and stimulate B cells, other T cells and macrophages to perform their specific roles. Cytotoxic T cells directly kill the infected cells, cancer cells and other damaged cells. This is the difference between T helper cells and cytotoxic T cells. Both types are extremely important white blood cells of the immune system.

References:

1. "The body's second line of defence." Science Learning Hub. N.p., n.d. Web. [Available here](#). 13 July 2017.
2. Janeway, Charles A., and Jr. "T cell-mediated cytotoxicity." Immunobiology: The Immune System in Health and Disease. 5th edition. U.S. National Library of Medicine, 01 Jan. 1970. Web. [Available here](#). 13 July 2017.

Image Courtesy:

1. "Lymphocyte activation simple" By Häggström, Mikael (2014). "Medical gallery of Mikael Häggström 2014". WikiJournal of Medicine 1 (2). DOI:10.15347/wjm/2014.008. ISSN 2002-4436. (Public Domain) via [Commons Wikimedia](#)
2. "[Killer T cells surround a cancer cell](#)" By The National Institutes of Health – (Public Domain) via [Commons Wikimedia](#)

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