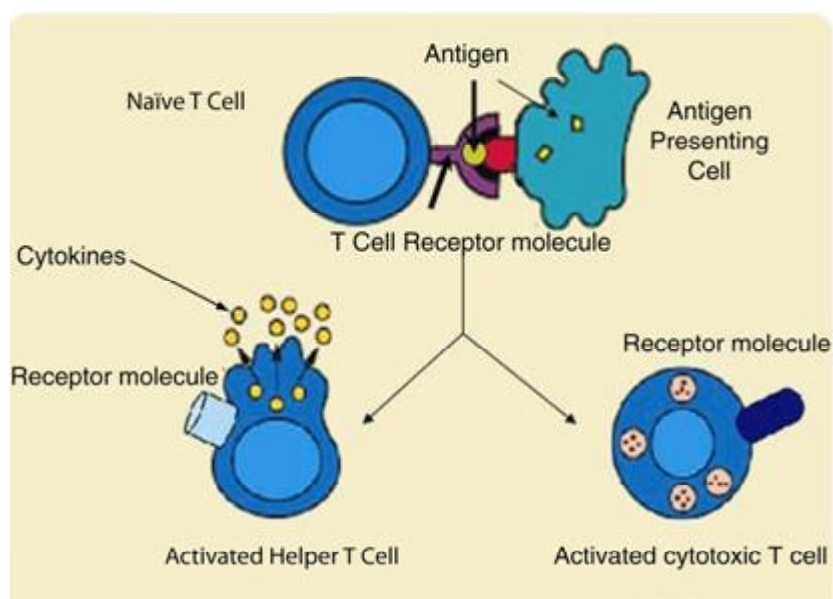


Cell-Mediated Immune Response

There are several different types of T cells including helper, cytotoxic, memory, and regulatory T cells. T cells are responsible for cell-mediated immunity. Cell-mediated immunity involves the destruction of body cells that are infected with pathogens or have become damaged or cancerous.

T Cell Activation

The different types of naïve T cells are activated in the same general way. The mechanism is shown in Figure below. It involves B cells or leukocytes such as macrophages. These other cells engulf pathogens in phagocytosis and display parts of the pathogens' antigens on their surfaces. The cells are then called antigen-presenting cells. When a naïve T cell encounters one of these cells with an antigen matching its own, it begins the activation process. After T cells are activated, the various types of T cells play different roles in the immune response.



A naïve T cell is activated when it encounters a B cell or macrophage that has engulfed a pathogen and presents the pathogen's antigen on its surface.

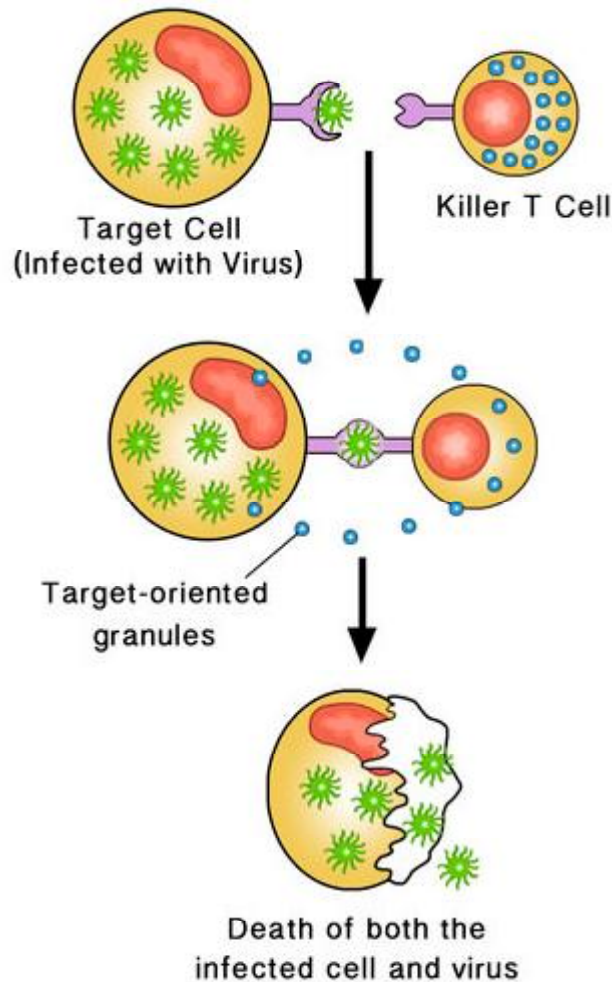
Helper T Cells

Activated helper T cells do not kill pathogens or destroy infected cells, but they are still necessary for the immune response. In fact, they are considered to be the “managers” of the immune response. After activation, helper T cells divide rapidly and secrete cytokines. These chemical signals control the activity of other lymphocytes. Cytokines from helper T cells activate B cells. They also activate other T cells.

Most activated helper T cells die out once a pathogen has been cleared from the body. However, some helper T cells remain in the lymph as memory cells. These memory cells are ready to produce large numbers of antigen-specific helper T cells if they are exposed to the same antigen again in the future.

Cytotoxic T Cells

Helper T cells are needed to activate cytotoxic T cells. Activated cytotoxic T cells destroy tumor cells, damaged cells, and cells infected with viruses. They are also involved in the rejection of transplanted organs. Once activated, a cytotoxic T cell divides rapidly and produces an “army” of cells identical to itself. These cells travel throughout the body “searching” for more cells carrying their specific antigen. Whenever they encounter such cells, they destroy them. Illustrated in Figure below is how a cytotoxic T cell destroys a body cell infected with viruses. The cytotoxic T cell releases toxins, such as the protein perforin, that form pores, or holes, in the infected cell’s membrane. T cell enzymes are then able to enter the infected cell and promote apoptosis, or programmed cell death. The infected cell bursts, destroying both the cell and the viruses inside it.



A cytotoxic T cell releases toxins that destroy an infected body cell and the viruses it contains. After cytotoxic T cells bring a viral infection under control, most of the cytotoxic T cells die off. However, some of them remain as memory cells. If the same pathogen tries to infect the body again, the memory cells mount an effective immune response by producing a new army of antigen specific cytotoxic T cells.

Regulatory T Cells

Regulatory T cells shut down cell-mediated immunity toward the end of an immune response. They also try to suppress any T cells that react against self antigens as though they were foreign. This occurs in autoimmune diseases. There is ongoing research regarding the role of regulatory T cells in treating cancer, allergies, and facilitating organ transplants.