

Killer Cells, Memory Cells: A Brief Introduction to the Adaptive Immune System

Imagine the siege of a castle. All of a sudden, the besiegers break through the castle's defenses. During the invasion, the invader breaches the castle's first line of defense. The defenders meet it with more powerful weapons and specialized troops.

The same scenario is true of invading pathogens. If a pathogen overcomes the protection of the innate (or non-specific) immune system, the adaptive (or specific) immune system leaps into action. The adaptive immune system is a more specialized approach to defending our bodies from infection. Its defense mechanisms directly target the specific pathogen. The defenses match small parts of the pathogen, called antigens, like a key fits into a lock. Antigens are parts of pathogens that cause an immune response.

T cells and B cells are the two main cell types of the adaptive immune system.

T cells are activated when they recognize antigens on antigen-presenting cells, or APCs. The APCs gather and present antigens to T cells (and B cells). Killer T cells travel to the site of the infection and kill infected cells. Helper T cells work in nearby lymph nodes as well as at the site of the infection. These cells help B cells to make antibodies and they help killer T cells eliminate virus-infected cells. A third type of T cell is the memory T cell. This long-lived cell monitors the body for future invasions by the same pathogen.

B cells have important roles as well. Some B cells act as APCs. A second type, the plasma B cell, is activated and produces large quantities of antibodies. Antibodies directly stop the invader by attaching to the surface of pathogens. Antibodies work in two ways. First, the pathogen is disabled because it cannot infect other cells with the antibody attached to it. Second, the antibody serves as a flag for other cells of the immune system looking to kill the pathogen. As with T cells, long-lived B cells, called memory B cells, refine their pathogen recognition tools as they monitor and protect the body from future infections by the same pathogen.

The cells of the adaptive immune system must endure over time and expand the response needed to overcome the pathogen. Otherwise, as in war, the battle will be lost.