Adaptive Cellular Immunity

Here is the problem.

You are infected with a bacteria and the bacteria is now either "hiding" inside your cells (i.e. host cell) or in the fluids of your body (i.e. humoral). If you don't eliminate the bacteria then the bacteria will likely kill you (i.e. the host).

Fortunately, you have an immune system that is able to eliminate the bacteria. Your immune system has two divisions: one division eliminates bacteria when bacteria are inside your cells (i.e. cellular adaptive immunity) and the other division eliminates bacteria when the bacteria are outside of your cells (ie. humoral adaptive immunity). In this presentation, will will assume the bacteria are inside the host cells.

Bacteria inside cells

Eliminate with cellular adaptive immunity (cytotoxic T cells)

Bacteria in body fluids

Eliminate with humoral adaptive immunity (B cells)

These three WBC (Cytotoix-T-cells, Helper-T-cells, and B-cells) are the key cells used by your immune system to eliminate bacteria that infect the sterile regions of your body. Other WBC will also assist these three cells to eliminate the bacteria. However, before these three cells are deployed they must receive receptors that are able to recognize similar foreign antigen.

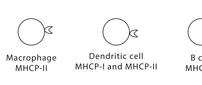
All three cells have receptors matched to the same bacterial antigen. It is estimated that bacteria have over a billion possible antigens. Your immune system has the capacity to build a billion matched receptors to match the bacterial antigens. Therefore, a single foreign antigen stimulates your immune sytem to make three different cells and each cell will have a receptor "matched" to the foreign antigen.

After the birth, education, and deployment pathway, the c-T-c, h-T-c, and B-cell are deployed as naive immunocompetent cells. These immunocompetent cell must be "turned on or activated" before they can recognize then react to (i.e. eliminate) the bacteria. This activation step will require another set of WBC called antigen presenting cells and helper-T-cells.

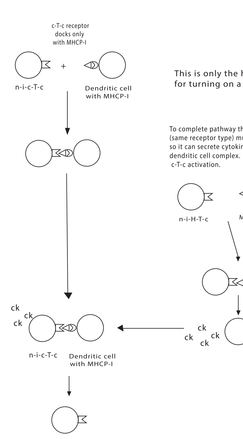
Bacteria antigen must be properly presented to the naive immune cells to turn them on so they may eliminate the bacteria. Special "antigen presenting cells" will be used to activate (turn on) the immune cells. Antigen presenting cells are dendritic cells, macrophage, and B-cells. These cells use phagocytosis to move bacteria into their cytoplasm. Here the APC will digest the bacteria to isolate the bacteria's antigen (i.e. epitope). APC save only a small portion of the antigen called the epitope. This is the "signature molecule" used to identify similar bacteria.

Antigen presenting cells must place the bacteria's epitope into their plasma membranes so the epitope is displayed on the outer surface of the APC's plasma membrane. These cells will use major histocompatability proteins (shaped like hot dog buns) to hold the epitope (the hot dog in the bun).

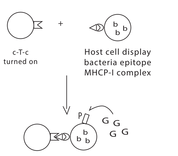
There are two types of MHCP (i.e. hot dog bun): type I and type II. Macrophage have type-II, B-cells have type-II, but dendritic cells have both type-I and type-II. (Note: host cells also use MHCP-I to display both normal protein and bacteria epitope in the host cell's plasma membrane)

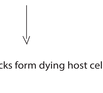


Now we need to go back to the n-i-c-T-c and consider the pathway that will be used to turn the naive immunocopetent cytotoxic T cell into a cell able to recognize host cells infected with bacteria. The c-T-c must be activated, the host cell must display an epitope, and then the c-T-c may recognize the infected host cell and give it the kiss of death.



After h-T-c secrete cytokines the n-i-c-T-c is fully activated. The c-T-c is now able to kill any host cells that displays a bacterial epitope- MHCP-I complex.





c-T-c undocks form dying host cell