(Introduction)

Good afternoon, everyone. Today we will be comparing two important parts of the immune system: T cell and B cell.

T cells are a type of lymphoid cell that plays an important role in the cellular immunity. There are many different types of T cells, among which helper T cell and cytotoxic T cell are the most significant. While helper T cells can activate other immune cells through signal molecules, cytotoxic T cell can recognize and kill infected cells by releasing a toxic chemical. Meanwhile, B cells are lymphoid cells that dominate humoral immunity. It also contains two main types: plasma cells that can release antibody to fight against antigens, and memory B cells which can transfer into plasma cells quickly when meeting the same antigen again.

Although both of the cells function to support the immune system, there are many differences between them. The two major differences are the way they get activated, and their unique functions to resist the antigen invasion. Now let us introduce them one by one.

(Difference1)

Antigens are phagocytosed by macrophages, and after being processed macrophages will contain antigen-MHC complexes, and these signals can be presented to cytotoxic T cells and helper T cells. Cytotoxic T cells encounter antigens corresponding to its receptor and are presented on the antigen-MHC complex, are stimulated to divide and differentiate to form new memory cytotoxic T cells and effector cytotoxic T cells. Meanwhile, helper T cells are activated and secrete proteins to promote the proliferation and differentiation of cytotoxic T cells.

New effector cytotoxic T cells circulate in body fluids and recognise, contact, and lyse infected somatic or cancer cells. Memory cytotoxic T cells are retained in the body, and when the same pathogen is next encountered, they can rapidly proliferate and differentiate into effector cytotoxic T cells, which produce an immune response rapidly and efficiently.

B lymphocytes are sensitized by binding to the appropriate antigen but have not begun to divide. The antigen is phagocytosed by macrophages, which extract and present the antigen-MHC complex, which activates helper T cells, which secrete interleukin-2 to induce B lymphocytes to increase in value and divide to produce new memory B cells and effector B cells. Effector B cells secrete antibodies, which circulate throughout the body with body fluids and bind to the corresponding pathogens. Thereby, they can either inhibit the proliferation of pathogens or their adhesion to human cells, or causing the antigen to gather and be devoured by macrophages. Memory B cells are stored in the body, and when the same antigen is encountered again, they immediately differentiate into effector B cells and thus an immune response occurs.

(Difference2)

There’s another difference between B cells and T cells. This difference is about their function. You may be confused, like “ Aren’t both these cells’ function about clearing the pathogens in our body?”. Surely, you are right. But what I want to state is that B cells and T cells are in case of different circumstances. In other words, they are fighting against pathogens in different infecting periods.

We can know this from the attacking methods of these cells.

The way that T cells fight against the pathogen is by using a special protein which we call perforin. Perforin can attach to the infected cells and induce apoptosis. Through this, the pathogens lose their chance to reproduce themselves so that the effect of the pathogen is controlled.

While the B cell, secrete antibodies to deal with the pathogens. The antibodies is a Y-shaped protein. It uses one arm to attach the pathogen and another arm to fix itself. In this way, the pathogen will not move around and can be easily cleared by the white cell.

By comparison, T cells deal with the pathogen inside the cell. Its function is to affect the reproduction process of the pathogens, so that the population of pathogens will be limited. However, T cells cannot directly decrease the population of pathogens, while this can be done by B cells. By releasing antibodies that bind with pathogens, B cell can cooperate with the white cell to destroy the pathogen. As a conclusion, the functions of the B cell and T cell are different and complementary. With both B cells and T cells, we form a defence system against pathogens, and both two types are indispensable.

(conclusion)

In conclusion, although both cells need the signal from helper T cells to get activated, cytotoxic T cells can only recognize the antigen-MHC complex presented by macrophages, while B cells can recognize the antigen structures directly. Also, cytotoxic T cells prevent the production of antigens by killing infected cells, while B cells prevent the antigens from infecting the cells by releasing antibodies. Hopefully our introduction can help you better understand the characteristics of these cells.