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Opinion Article

Significance of B Lymphocytes and T Lymphocytes

Guobin Selin*

Department of Immunology, Bowen University, Osun, Nigeria

DESCRIPTION

B Lymphocytes

The B lymphocyte (B-cell) derives its letter designation from the site of maturation, in the Bursa Fabricius in birds; the name proved apt, as the bone marrow is its main site of maturation in humans, mice, and many other mammals. Mature B cells are definitively distinguished from other lymphocytes and all other cells by their synthesis and display of the B Cell Receptor (BCR), a membrane-bound immunoglobulin (antibody) molecule that binds to an antigen. B cells can also improve their ability to bind antigen through a process known as somatic hyper mutation, and they can make antibodies of several different functional classes through a process known as class switching.

Finally, activated B cells differentiate into effector cells known as plasma cells. Plasma cells lose surface immunoglobulin expression and become highly specialized for antibody secretion. A single cell is capable of secreting several hundred to more than a thousand antibody molecules per second. Plasma cells do not divide, and although some long-lived populations of plasma cells are found in the bone marrow, many die within 1 or 2 weeks.

T lymphocytes

T lymphocytes (T cells) derive their letter designation from the site of maturation in the thymus. Like the B cell, the T cell expresses a unique antigen-binding receptor called the T cell receptor. However, unlike membrane-bound antibodies on B cells, which can recognize soluble or particulate antigen, T cell receptors only recognize processed portions of the antigen (typically peptides) bound to cell membrane proteins called Major Histocompatibility Complex (MHC) molecules. MHC molecules are genetically diverse glycoproteins found on cell membranes. The ability of MHC molecules to form complexes with antigen allows cells to decorate their surfaces with internal (foreign and self) proteins and thus expose them to passing T cells. MHC comes in two versions: MHC class I molecules, which are expressed by almost all nucleated cells of vertebrate species, and MHC II molecules that are expressed by professional antigen-presenting cells and several other cell types during inflammation.

T lymphocytes are divided into two main cell types – T Helper (TH) cells and T Cytotoxic (TC) cells, which can be distinguished from each other by the presence of either CD4 or CD8 membrane glycoproteins on their surface.

T cells expressing CD4 generally function as TH cells and recognize antigen in complex with MHC class II, while those expressing CD8 generally function as TC cells and recognize antigen in complex with MHC class I. The ratio of $CD4^+$ to $CD8^+$ T cells is approximately 2:1 in normal mouse and human peripheral blood. A change in this ratio is often an indicator of immunodeficiency diseases (e.g. HIV), autoimmune diseases and other disorders.

Naïve $CD8^+$ T cells traverse the surfaces of antigen-presenting cells using their T cell receptors. If and when they bind to the MHC-peptide complex, they become activated, proliferate and differentiate into an effector cell called a Cytotoxic T Lymphocyte (CTL). CTL has a critical function in monitoring the body's cells and eliminating any cells that display foreign antigen in complex with MHC class I, such as virus-infected cells, tumor cells, and foreign tissue graft cells. For optimal proliferation and differentiation, naive $CD8^+$ T cells also need help from mature $CD4^+$ T cells.

Correspondence to: Dr. Guobin Selin, Department of Immunology, Bowen University, Osun, Nigeria, E-mail: seliguo12@gmail.com

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