**REPORT ON HOW B CELLS RECOGNIZE AND RESPOND TO ANTIGENS**

**Introduction**

The immune system is the body's defense system.B cells are involved in adaptive immunity.Specificity and memory are characteristics of adaptive immunity but not innate immunity. Specificity is the ability of adaptive immunity to recognize a particular substance. For example, innate immunity can act against bacteria in general, whereas adaptive immunity can distinguish among various kinds of bacteria. Memory is the ability of adaptive immunity to “remember”previous encounters with a particular substance. As a result, the response is faster and stronger and lasts longer.

**Keywords**

Innate immunity,stem cells,memory cells, lymphoblast, Antigens,clonal proliferation.

**Discussion**

**A**daptive immunity can recognize, respond to, and remember a

particular substance. Substances that stimulate adaptive immunity

are called antigens (an′ti-jenz). Antigens are divided into two

groups: foreign antigens and self-antigens. Foreign antigens are

not produced by the body but are introduced from outside it.

Components of bacteria, viruses, and other microorganisms are

examples of foreign antigens that cause disease. Pollen, animal

dander (scaly, dried skin), feces of house dust mites, foods, and

drugs are also foreign antigens and can trigger an overreaction of

the immune system in some people, called an allergic reaction.

Transplanted tissues and organs that contain foreign antigens

result in the rejection of the transplant.

Self-antigens are molecules produced by the body that

stimulate an adaptive immune system response. The response to

self- antigens can be beneficial or harmful. For example, the

recognition of tumor antigens can result in tumor destruction,

Whereas autoimmune disease can result when self-antigens stimulate unwanted tissue destruction.

B cells

About 5 to 15% of lymphocytes in the blood are B cells; they are also present in the bone marrow, spleen, lymph nodes, and mucosa-associated lymphoid tissues.

B cells can present antigen to T cells and release cytokines, but their primary function is to develop into plasma cells, which manufacture and secrete antibodies.

Patients with B-cell immunodeficiencies (eg, X-linked agammaglobulinemia) are especially susceptible to recurrent bacterial infections.

After random rearrangement of the genes that encode immunoglobulin (Ig), B cells collectively have the potential to recognize an almost limitless number of unique antigens. Gene rearrangement occurs in programmed steps in the bone marrow during B-cell development. The process starts with a committed stem cell, continues through pro‒B and pre‒B cell stages, and results in an immature B cell. At this point, any cells that interact with self antigen (autoimmune cells) are removed from the immature B cell population via inactivation (anergy) or apoptosis. Elimination of these cells ensures that the immune system is less likely to recognize these antigens as foreign (immune tolerance). Cells that are not removed (ie, those that recognize nonself antigen) continue to develop into mature naive B cells, leave the marrow, and enter peripheral lymphoid organs, where they may encounter antigens.

Their response to antigen has 2 stages:

Primary immune response: When mature naive B cells first encounter antigen, they become lymphoblasts, undergo clonal proliferation, and differentiate into memory cells, which can respond to the same antigen in the future, or into mature antibody-secreting plasma cells. After first exposure, there is a latent period of days before antibody is produced. Then, only IgM is produced. After that, with the help of T cells, B cells can further rearrange their Ig genes and switch to production of IgG, IgA, or IgE. Thus, after first exposure, the response is slow and initially provides limited protective immunity. Proliferation of B Cells Before a B : cell can be activated by a helper T cell, the B cell must phagocytize and process the same antigen that activated the helper T cell. The antigen binds to a B-cell receptor, and both the receptor and antigen are taken into the cell by endocytosis.2. The B cell uses an MHC class II molecule to present the processed antigen to the helper T cell.. There is costimulation by interleukins (cytokines) released from the helper T cell. There is costimulation of the B cell by CD4 and other surface molecules.

. The T-cell receptor binds to the MHC class II/antigen complex.. The B cell divides, and the resulting daughter cells divide, and so on, eventually producing many cells, that recognize the same antigen.. Many of the daughter cells differentiate to become plasma cells, which produce antibodies. Antibodies are part of the immune response that eliminates the antigen.

Secondary (anamnestic or booster) immune response: When memory B and Th cells are reexposed to the antigen, the memory B cells rapidly proliferate, differentiate into mature plasma cells, and promptly produce large amounts of antibody (chiefly IgG because of a T cell–induced isotype switch). The antibody is released into the blood and other tissues, where it can react with antigen. Thus, after reexposure, the immune response is faster and more effective.

**CRITICAL THINKING**

The knowledge of b cells aids in understanding of how autoimmune conditions occurs and how the body , lymphatic system and immune system functions.Here are a few examples of mnemonics related to B cell recognition and response to antigens:

1. "B-CELLS": B-Cells Engage Antigens, Lymphocytes Launch Specificity

2. "ABC": Antigen Binding, Clonal Expansion, Antibody Production

3. "FAB": Fabulous Antibodies Bind

4. "VJ": Variable Joining, VJ Recombination

5. "CDR": Complementarity Determining Region

**Conclusion**

In conclusion, B cells play a crucial role in recognizing and responding to antigens. Through their B cell receptors, they can specifically bind to antigens and initiate an immune response. Mnemonics can aid in remembering the steps involved, and understanding the relevance of B cell responses can contribute to advancements in medicine and disease prevention.

**REFERENCE**

1. Saladin, K .(2020) Anatomy and Physiology:The unity of form and function ,9th edition . McGraw Hill publishers.