AJPMHS GLOBAL RESEARCH NETWORK

AMERICAN Journal of Pediatric Medicine and Health Sciences
Volume 2, Issue 1, 2024 ISSN (E): 2993-2149

PRODUCTION OF ANTIBODIES

Xasanboyeva Nafisaxon Abdullajonovna
Assistant of the department of pharmacology of Fergana Medical Institute of Public Health.

Abstract: Part of the normal production of immunoglobulin undoubtedly represents the response to antigenic stimulation that happens continually, but even animals raised in surroundings completely free from microbes and their products make substantial, though lesser, amounts of immunoglobulin. Much of the immunoglobulin therefore must represent the product of all the B cells that are, so to speak, "ticking over" even if not specifically stimulated. It is therefore not surprising that extremely sensitive methods can detect traces of antibodies that react with antigenic determinants to which an animal has never been exposed but for which cells with receptors are present.

Keywords: B cells, T-cell, the major histocompatibility complex (MHC), as HLA (human leukocyte antigens), Helper T cells, CD4, T and B lymphocytes.

All B cells have the potential to use any one of the constant-region classes to make up the immunoglobulin they secrete. As noted above, when first stimulated, most secrete IgM. Some continue to do so, but others later switch to producing IgG, IgA, or IgE. Memory B cells, which are specialized for responding to repeat infections by a given antigen, make IgG or IgA immediately. What determines the balance among the classes of antibodies is not fully understood. However, it is influenced by the nature and site of deposition of the antigen (for example, parasites tend to elicit IgE), and their production is clearly mediated by factors, called cytokines, which are released locally by T cells.

Structure of the B cells receptor. T-cell antigen receptors are found only on the cell membrane. For this reason, T-cell receptors were difficult to isolate in the laboratory and were not identified until 1983. T-cell receptors consist of two polypeptide chains. The most common type of receptor is called alpha-beta because it is composed of two different chains, one called alpha and the other beta. A less common type is the gamma-delta receptor, which contains a different set of chains, one gamma and one delta. A typical T cell may have as many as 20,000 receptor molecules on its membrane surface, all of either the alpha-beta or gamma-delta type. The T-cell receptor molecule is embedded in the membrane of the cell, and a portion of the molecule extends away from the cell surface into the area surrounding the cell. The chains each contain two folded domains, one constant and one variable, an arrangement similar to that of the chains of antibody molecules. And, as is true of antibody structure, the variable domains of the chains form an antigen-binding site. However, the T-cell receptor has only one antigen-binding site, unlike the basic antibody molecule, which has two. Many similarities exist between the structures of antibodies and those of T-cell receptors. Therefore, it is not surprising that

the organization of genes that encode the T-cell receptor chains is similar to that of immunoglobulin genes. Similarities also exist between the mechanisms B cells use to generate antibody diversity and those used by T cells to create T-cell diversity. These commonalities suggest that both systems evolved from a more primitive and simpler recognition system.

Function of the T-cell receptor. Despite the structural similarities, the receptors on T cells function differently from those on B cells. The functional difference underlies the different roles played by B and T cells in the immune system. B cells secrete antibodies to antigens in blood and other body fluids, but T cells cannot bind to free-floating antigens. Instead they bind to fragments of foreign proteins that are displayed on the surface of body cells. Thus, once a virus succeeds in infecting a cell, it is removed from the reach of circulating antibodies only to become susceptible to the defense system of the T cell. But how do fragments of a foreign substance come to be displayed on the surface of a body cell? First, the substance must enter the cell, which can happen through either phagocytosis or infection. Next, the invader is partially digested by the body cell, and one of its fragments is moved to the surface of the cell, where it becomes bound to a cell-surface protein. This cell-surface protein is the product of one of a group of molecules encoded by the genes of the major histocompatibility complex (MHC). In humans MHC proteins were first discovered on leukocytes (white blood cells) and therefore are often referred to as HLA (human leukocyte antigens). (For information on the genetic basis of the HLA, see human genetics.) There are two major types of MHC molecules: class I molecules, which are present on the surfaces of virtually all cells of the body that contain nuclei—that is, most body cells—and class II molecules, which are restricted to the surfaces of most B cells and some T cells, macrophages, and macrophage-like cells. Two main types of mature T cells—cytotoxic T cells and helper T cells—are known. Some scientists hypothesize the existence of a third type of mature T cell called regulatory T cells. Some T cells recognize class I MHC molecules on the surface of cells; others bind to class II molecules. Cytotoxic T cells destroy body cells that pose a threat to the individual—namely, cancer cells and cells containing harmful microorganisms. Helper T cells do not directly kill other cells but instead help activate other white blood cells (lymphocytes and macrophages), primarily by secreting a variety of cytokines that mediate changes in other cells. The function of regulatory T cells is poorly understood. To carry out their roles, helper T cells recognize foreign antigens in association with class II MHC molecules on the surfaces of macrophages or B cells. Cytotoxic T cells and regulatory T cells generally recognize target cells bearing antigens associated with class I molecules. Because they recognize the same class of MHC molecule, cytotoxic and regulatory T cells are often grouped together; however, populations of both types of cells associated with class II molecules have been reported. Cytotoxic T cells can bind to virtually any cell in the body that has been invaded by a pathogen. T cells have another receptor, or coreceptor, on their surface that binds to the MHC molecule and provides additional strength to the bond between the T cell and the target cell. Helper T cells display a coreceptor called CD4, which binds to class II MHC molecules, and cytotoxic T cells have on their surfaces the coreceptor CD8, which recognizes class I MHC molecules. These accessory receptors add strength to the bond between the T cell and the target cell. The T-cell receptor is associated with a group of molecules called the CD3 complex, or simply CD3, which is also necessary for T-cell activation. These molecules are agents that help transduce, or convert, the extracellular binding of the antigen and receptor into internal cellular signals; thus, they are called signal transducers. Similar signal transducing molecules are associated with B-cell receptors.

Life cycle of T and B lymphocytes

T cells. When T-cell precursors leave the bone marrow on their way to mature in the thymus, they do not yet express receptors for antigens and thus are indifferent to stimulation by them. Within the thymus the T cells multiply many times as they pass through a meshwork of thymus cells. In the

course of multiplication they acquire antigen receptors and differentiate into helper or cytotoxic T cells. As mentioned in the previous section, these cell types, similar in appearance, can be distinguished by their function and by the presence of the special surface proteins, CD4 and CD8. Most T cells that multiply in the thymus also die there. This seems wasteful until it is remembered that the random generation of different antigen receptors yields a large proportion of receptors that recognize self antigens—i.e., molecules present on the body's own constituents—and that mature lymphocytes with such receptors would attack the body's own tissues. Most such self-reactive T cells die before they leave the thymus, so that those T cells that do emerge are the ones capable of recognizing foreign antigens. These travel via the blood to the lymphoid tissues, where, if suitably stimulated, they can again multiply and take part in immune reactions. The generation of T cells in the thymus is an ongoing process in young animals. In humans large numbers of T cells are produced before birth, but production gradually slows down during adulthood and is much diminished in old age, by which time the thymus has become small and partly atrophied. Cell-mediated immunity persists throughout life, however, because some of the T cells that have emerged from the thymus continue to divide and function for a very long time.

B cells. B-cell precursors are continuously generated in the bone marrow throughout life, but, as with T-cell generation, the rate diminishes with age. Unless they are stimulated to mature, the majority of B cells also die, although those that have matured can survive for a long time in the lymphoid tissues. Consequently, there is a continuous supply of new B cells throughout life. Those with antigen receptors capable of recognizing self antigens tend to be eliminated, though less effectively than are self-reactive T cells. As a result, some self-reactive cells are always present in the B-cell population, along with the majority that recognize foreign antigens. The reason the self-reactive B cells normally do no harm is explained in the following section.

Activation of T and B lymphocytes. In its lifetime a lymphocyte may or may not come into contact with the antigen it is capable of recognizing, but if it does it can be activated to multiply into a large number of identical cells, called a clone. Each member of the clone carries the same antigen receptor and hence has the same antigen specificity as the original lymphocyte. The process, called clonal selection, is one of the fundamental concepts of immunology. Two types of cells are produced by clonal selection—effector cells and memory cells. Effector cells are the relatively short-lived activated cells that defend the body in an immune response. Effector B cells are called plasma cells and secrete antibodies, and activated T cells include cytotoxic T cells and helper T cells, which carry out cell-mediated responses. The production of effector cells in response to first-time exposure to an antigen is called the primary immune response. Memory cells are also produced at this time, but they do not become active at this point. However, if the organism is reexposed to the same antigen that stimulated their formation, the body mounts a second immune response that is led by these long-lasting memory cells, which then give rise to another population of identical effector and memory cells. This secondary mechanism is known as immunological memory, and it is responsible for the lifetime immunities to diseases such as measles that arise from childhood exposure to the causative pathogen.

Activation of T cells

Helper-T-cell activation. Helper T cells do not directly kill infected cells, as cytotoxic T cells do. Instead they help activate cytotoxic T cells and macrophages to attack infected cells, or they stimulate B cells to secrete antibodies. Helper T cells become activated by interacting with antigen-presenting cells, such as macrophages. Antigen-presenting cells ingest a microbe, partially degrade it, and export fragments of the microbe—i.e., antigens—to the cell surface, where they are presented in association with class II MHC molecules. A receptor on the surface of the helper T cell then binds to the MHC-antigen complex. But this event alone does not activate the helper T cell. Another signal is required, and it is provided in one of two ways: either through stimulation by a cytokine or through a

costimulatory reaction between the signaling protein, B7, found on the surface of the antigen-presenting cell, and the receptor protein, CD28, on the surface of the helper T cell. If the first signal and one of the second signals are received, the helper T cell becomes activated to proliferate and to stimulate the appropriate immune cell. If only the first signal is received, the T cell may be rendered anergic—that is, unable to respond to antigen. A discussion of helper-T-cell activation is complicated by the fact that helper T cells are not a uniform group of cells but rather can be divided into two general subpopulations—TH1 and TH2 cells—that have significantly different chemistry and function. These populations can be distinguished by the cytokines they secrete. TH1 cells primarily produce the cytokines gamma interferon, tumour necrosis factor-beta, and interleukin-2 (IL-2), while TH2 cells mainly synthesize the interleukins IL-4, IL-5, IL-6, IL-9, IL-10, and IL-13. The main role of the TH1 cells is to stimulate cell-mediated responses (those involving cytotoxic T cells and macrophages), while TH2 cells primarily assist in stimulating B cells to make antibodies. Once the initial steps of activation have occurred, helper T cells synthesize other proteins, such as signaling proteins and the cell-surface receptors to which the signaling proteins bind. These signaling molecules play a critical role not only in activating the particular helper T cell but also in determining the ultimate functional role and final differentiation state of that cell. For example, the helper T cell produces and displays IL-2 receptors on its surface and also secretes IL-2 molecules, which bind to these receptors and stimulate the helper T cell to grow and divide.

Results of helper-T-cell activation. The overall result of helper-T-cell activation is an increase in the number of helper T cells that recognize a specific foreign antigen, and several T-cell cytokines are produced. The cytokines have other consequences, one of which is that IL-2 allows cytotoxic or regulatory T cells that recognize the same antigen to become activated and to multiply. Cytotoxic T cells, in turn, can attack and kill other cells that express the foreign antigen in association with class I MHC molecules, which—as explained above—are present on almost all cells. So, for example, cytotoxic T cells can attack target cells that express antigens made by viruses or bacteria growing within them. Regulatory T cells may be similar to cytotoxic T cells, but they are detected by their ability to suppress the action of B cells or even of helper T cells (perhaps by killing them). Regulatory T cells thus act to damp down the immune response and can sometimes predominate so as to suppress it completely.

Activation of B cells. B cell becomes activated when its receptor recognizes an antigen and binds to it. In most cases, however, B-cell activation is dependent on a second factor mentioned above—stimulation by an activated helper T cell. Once a helper T cell has been activated by an antigen, it becomes capable of activating a B cell that has already encountered the same antigen. Activation is carried out through a cell-to-cell interaction that occurs between a protein called the CD40 ligand, which appears on the surface of the activated helper T cells, and the CD40 protein on the B-cell surface.

The helper T cell also secretes cytokines, which can interact with the B cell and provide additional stimulation. Antigens that induce a response in this manner, which is the typical method of B-cell activation, are called T-dependent antigens. Most antigens are T-dependent. Some, however, are able to stimulate B cells without the help of T cells. The T-independent antigens are usually large polymers with repeating, identical antigenic determinants.

Such polymers often make up the outer coats and long, tail-like flagella of bacteria. Immunologists think that the enormous concentration of identical T-independent antigens creates a strong enough stimulus without requiring additional stimulation from helper T cells. Interaction with antigens causes B cells to multiply into clones of immunoglobulin-secreting cells. Then the B cells are stimulated by various cytokines to develop into the antibody-producing cells called plasma cells. Each plasma cell can secrete several thousand molecules of immunoglobulin every minute and

continue to do so for several days. A large amount of that particular antibody is released into the circulation. The initial burst of antibody production gradually decreases as the stimulus is removed (e.g., by recovery from infection), but some antibody continues to be present for several months afterward. The process just described takes place among the circulating B lymphocytes.

The B cells that are called memory cells, however, encounter antigen in the germinal centres—compartments in the lymphoid tissues where few T cells are present—and are activated in a different way. Memory cells, especially those with the most effective receptors, multiply extensively, but they do not secrete antibody. Instead, they remain in the tissues and the circulation for many months or even years. If, with the help of T cells, memory B cells encounter the activating antigen again, these B cells rapidly respond by dividing to form both activated cells that manufacture and release their specific antibody and another group of memory cells. The first group of memory cells behaves as though it "remembers" the initial contact with the antigen. So, for example, if the antigen is microbial and an individual is reinfected by the microbe, the memory cells trigger a rapid rise in the level of protective antibodies and thus prevent the associated illness from taking hold.

In conclusion, originally immunologists thought that the complement system was initiated only by antigen-antibody complexes, but later evidence showed that other substances, such as the surface components of a microorganism alone, could trigger complement activation. Thus, there are two complement activation pathways: the first one to be discovered, the classical pathway, which is initiated by antigen-antibody complexes; and the alternative pathway, which is triggered by other means, including invading pathogens or tumour cells. (The term alternative is something of a misnomer because this pathway almost certainly evolved before the classical pathway. The terminology reflects the order of discovery, not the evolutionary age of the pathways.) The classical and alternative pathways are composed of different proteins in the first part of their cascades, but eventually both pathways converge to activate the same complement components, which destroy and eliminate invading pathogens.

Reference:

1. Хошимова, А. Ё. (2018). ВЛИЯНИЕ ЗАГРЯЗНЕНИЯ ОКРУЖАЮЩЕЙ СРЕДЫ НА ЗАБОЛЕВАЕМОСТЬ БРОНХИАЛЬНОЙ АСТМОЙ. Актуальные вопросы современной пульмонологии. Ма, 200.
2. Кулиева, Э. М., & Абдуганиева, А. Е. РОЛЬ ТЕОРИЙ И КОНЦЕПЦИЙ ЭПИДЕМИОЛОГИИ В ПРОФИЛАКТИКЕ ИНФЕКЦИОННЫХ БОЛЕЗНЕЙ. СБОРНИК, 97.
3. Хошимова, А. Ё., & Маматкулова, М. Т. (2016). ВЛИЯНИЕ ЗАГРЯЗНЕНИЯ ОКРУЖАЮЩЕЙ СРЕДЫ НА ЗАБОЛЕВАЕМОСТЬ ДЕТЕЙ ПНЕВМОНИЕЙ. Актуальные вопросы современной пульмонологии. Ма, 233.
4. Хасанбоева, Н. А. (2021). ЦЕЛЕБНЫЕ СВОЙСТВА ПРЕПАРАТОВ, ПОЛУЧЕННЫЕ ИЗ ПРОДУКТА ХВОИ. Интернаука, 22, 7
5. Khasanboeva, N. A. (2023). MEDICINAL PLANTS OF THE FERGANA REGION. International Journal of Medical Sciences And Clinical Research, 3(02), 1-4.
6. Khasanboeva, N. A. (2023). Fees in Folk and Modern Medicine. The Peerian Journal, 14, 14-17.
7. Abdullajonovna, H. N. INTERACTION BETWEEN DRUG SUBSTANCES AND NUTRIENT PRODUCTS. International Journal of Advanced Research in ISSN, 2278-6252.
8. Xasanboeva, N., & Raximova, X. (2023). B12 VITAMINI YETISHMOVCHILIGI VA UNI DAVOLASHDA QO 'LLANILADIGAN DORI VOSITALARI. Евразийский журнал медицинских и естественных наук, 3(5), 267-273.
9. Abdullojonovna, K. N. (2021). In the Chronopharmacology of Drugs and Medicinal Substances. Academicia Globe, 2(6), 225-228.

10. Болтабоева, Д. И. (2023). ОИВ ИНФИЦИРЛАНГАНЛАРДА ГЕРПЕТИК ИНФЕКЦИЯЛАРИНИ КЛИНИК КЕЧИШ ХУСУСИЯТЛАРИ. Scientific Impulse, 2(13), 174-177.
11. Азимов, М. Б., & Болтабоева, Д. И. (2021). ОСОБЕННОСТИ КЛИНИЧЕСКОГО ТЕЧЕНИЯ ГЕРПЕТИЧЕСКОЙ ИНФЕКЦИИ ВИЧ-ИНФИЦИРОВАНЫХ БОЛЬНЫХ. In Молодежь, наука, медицина (pp. 14-18).
12. Рапиков, И. Г. (2019). Роль народных подходов к учащимся начальной школы на основе труда, экономики и предпринимательства. доктора/кандидата наук предлагаем вступить в редакционную коллегию журнала (подробности на сайте), 90.
13. Rapikov, I. (2020). SCHOLARS'VIEWS ON THE FORMATION OF SAVINGS AND ENTREPRENEURSHIP ON THE BASIS OF LABOR EDUCATION IN PRIMARY SCHOOL STUDENTS. Scientific and Technical Journal of Namangan Institute of Engineering and Technology, 2(11), 309-313.
14. Pulatova, Z., & Ganijonov, H. (2023, June). MODERN VIEWS OF BEHAVIORAL CHANGES IN 16-17-YEAR-OLD STUDENTS. In International Conference on Education and Social Science (Vol. 1, No. 2, pp. 30-32).
15. Jalolidinovna, I. Z. Cellular Changes in Cardiomyocytes Due to Ischemia and Necrosis. JournalNX, 7(04), 1-2.
16. Tilyaxodjaeva, G. (2022). ISSUES OF PREVENTION OF ENT DISEASES WITH HIRUDO THERAPY TREATMENT. Science and Innovation, 1(8), 885-887.
17. Gulbakhor, T. (2022). ETIOPATHOGENETIC MECHANISMS OF VARICOSE VEINS. Universum: химия и биология, (5-3 (95)), 29-31.
18. Tilyaxodjaeva, G. (2022). ISSUES OF PREVENTION OF DISEASES OF ENT ORGANS WITH TREATMENT BY HIRUDOTHERAPY. Science and innovation, 1(D8), 885-887.
19. Tilyakhodzhaeva, G. B. (2022). TREATMENT OF MIGRAINE WITH HIRUDOTHERAPY. Scientific Impulse, 1(5), 892-896.
20. Tilyaxodjaeva, G. (2022). APPLICATION OF HIRUDOTHERAPY IN MEDICINE. Science and innovation, 1(D8), 1007-1010.
21. TILYAKHODJAEVA, G. (2022). BULLETIN OF SCIENCE AND PRACTICE. BULLETIN OF SCIENCE AND PRACTICE Учредители: Овечкина Елена Сергеевна, 8(6), 452-455.
22. Косимова, З. М. (2023). Информационно-Компьютерная Технология Организации Работы Отдела Переливании Крови В Ферганском Филиале Республиканского Научного Центра Экстренной Медицинской Помощи. Research Journal of Trauma and Disability Studies, 2(4), 7-13.
23. Madaminjanovna, Q. Z. (2023). Diagnosis and treatment of emphysematous pyelonephritis in diabetic patients. Eurasian Medical Research Periodical, 19, 4-8.
24. Achilov, F. K., Khashimov, A. A., Abdukadirova, N. M., Bakaev, I. K., Tulaboeva, G. M., & Sh, T. Y. (2022). SOME PATHOPHYSIOLOGICAL FEATURES OF THE COURSE OF COVID-19 IN ELDERLY PERSONS AND OLD AGE. British Medical Journal, 2(1).
25. Achilov, F. K., Khashimov, A. A., Tulaboeva, G. M., & Sh, T. Y. (2022). ASPECTS OF CARDIOVASCULAR PATHOLOGY IN ELDERLY AND SENILE AGE. Art of Medicine. International Medical Scientific Journal, 2(1).
26. Khashimov, A. A., Sh, T. Y., Tulaboeva, G. M., Abdukadirova, N. M., & Akhmadaliev, B. K. (2022). PROGNOSTICATING THE RISK OF FATAL COMPLICATIONS IN PATIENTS WHO UNDERWENT COVID-19. Art of Medicine. International Medical Scientific Journal, 2(1).