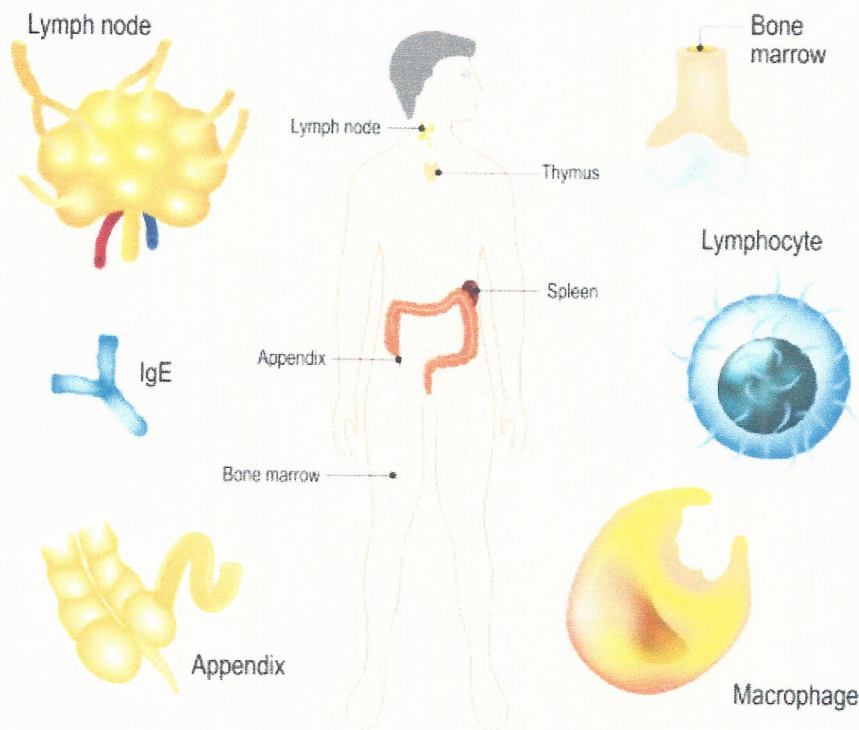


Basics of the Immune System

These are the important basic facts that one should know to understand immunosuppressants and organ rejection. The immune system, a natural defense system, serves to protect the body from disease-producing microorganisms and foreign particles (antigens). When thinking about defenses, think about the body as a castle having 3 layers of protection. The first layer is the moat that acts as a physical barrier and a chemical barrier to pathogens. The physical barrier consists of skin and mucous membranes and the chemical barrier consists of lysozymes in secretions (e.g., tears, saliva,) and hydrochloric acids (in the stomach). The second layer, the watchers, includes the white blood cells that play a role in inflammation. If a pathogen gets through the first layer, the body can activate the second line of defense and send in the phagocytes which will surround and engulf the foreign particle. They release a chemical which causes the particle to disintegrate and create conditions for healing. The third layer, if the other two layers of defense were unsuccessful, includes the soldiers or knights (if we are keeping with the idea of castles). They start the major attack using a variety of cells and chemicals with the aim to protect the body. They recognize self from non-self. Now, we are talking about immunity which begins at birth, and functions throughout life.

IMMUNE SYSTEM



Organization of the Immune System

If you are feeling dizzy with these explanations, you are very much like most people of the world. This is a complex system and you will need several readings to really understand this to your satisfaction. Let's start at the beginning. All blood cells and immune system cells come from the bone marrow at birth. They start out as immature stem cells and some remain in the bone marrow to mature. Other stem cells move to the thymus to mature into specialized T-cells. Those cells that matured on the bone marrow (as conditions in the body require) are neutrophils, basophils, eosinophils, monocytes/macrophages, megakaryocytes, plasma cells and red blood cells. Plasma cells that matured in the bone marrow (B-cells) moved to places where they can be readily activated and they produce antibodies. They are found in the spleen, lymph nodes, blood, lymph fluid, intestinal tract, and connective tissue.

Immunity is an adaptive internal protection that results in long-term resistance to microorganisms. The body learns to generate specific immune responses when it is exposed to an invasion of a pathogen or foreign particle. There are 2 types of immunity: antibody-mediated immunity (or humoral immunity) and cell mediated immunity (or cellular immunity).

This is what happens when the body is exposed to a new pathogen. 1. It needs to be in sufficient quantities to stimulate a response. 2. There is an interaction of a macrophage (a white blood cell) and a helper T-cell which "presents" the pathogen to the B-cell. 3. The B-cell is now sensitized to the new antigen on the pathogen. 4. The B-cell starts to produce antibodies. These are directed specifically against the original antigen. Antibodies are released into the blood stream and some other body fluids. 5. The antibody binds to the antigen and form an immune complex. 6. This causes more cellular events and attracts more white blood cells (leukocytes) to this complex. This results in neutralization, destruction, or elimination of the antigen. 7). If the same antigen reappears, the sensitized lymphocytes produces large quantities of the antibody specific to the antibody, More antibody production continues. (Workman, 2016).

Antibody production

Antibodies (or immunoglobulins) are secreted by the B-lymphocytes. They are found in various concentration is different sites of the body. When the body is first exposed to an antigen, the B-cell produced IgM to fight the antigen. Antibody production is slow initially. If the body is exposed to the same antigen again, the B-lymphocytes produce large amounts of IgG quickly and in large amounts. There are several classes with specific jobs. Here are a few descriptions.

- IgA: found in body fluids (tears, saliva, secretions of the respiratory and gastrointestinal tracts).
- IgE: responsible in allergy symptoms
- IgG: appears on the second and subsequent exposure to the antigen, provides sustained immunity.
- IgM: first antibody formed by a newly sensitized B-cell, kills bacteria, and is the largest of the immunoglobulins

T-Lymphocytes

When the antigen enters the body the T-lymphocytes undergo changes based on the marker proteins (antigens) on the cell's surface. Helper T-cells recognize self- versus- non-self. When they recognize a non-self antigen, they secrete cytokines that call the other white blood cells to the area to attack. They also help to activate the B-lymphocytes. Suppressor T-cells prevent overreactions and can inhibit an attack when it is not needed. Cytotoxic T-cells kill antigens directly, especially viruses and cancer cells. Suppressor T-cells can help stifle the functions of the Helper T-cells and the Cytotoxic T-cells. Finally, there are Memory T-cells which keep the blueprint to be activated if the body is re-exposed to the same antigen. These memory cells are like the citizen militia who return to their homes and their routine life once the attack is over but they can quickly move into action if an attack by the same pathogen (or antigen) occurs again.

Just remember these 3 parts are needed for full immunity (or immunocompetence): 1) inflammation, 2) antibody-mediated immunity (B-cells) and 3) cell-mediated immunity (T-cells). However, individuals who had an organ transplant do not want full immunity. It should be noted that older adults have fewer B-lymphocytes and T-lymphocytes with a loss of immune function effectiveness as part of the normal aging process.

Definitions

Acquired immunity: immunity protection that is gained after birth. It can be passive (mother to fetus or transfusion of an immunoglobulin. It also can be active where it develops after the body is exposed to a foreign antigen. The body produces antibodies (as with vaccines) or sensitized T-lymphocytes.

Antigen: a substance that causes an immune response

Cell-mediated immunity: immune response caused by T-cells

Cytokines: chemicals released by white blood cells that act as messengers between cells

Humoral Immunity: antibody-mediated immune response

Innate immunity: natural or native immunity that one has at birth, involved with non-specific responses.

Pathogen: disease causing agent (e.g., virus, bacteria, protozoa)

If you want more information, go to: <https://www.youtube.com/watch?v=PzunOgYHeyg>