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**TITLE: BASIC IMMUNOLOGY**

**ROLE OF THE IMMUNE SYSTEM**

The role of the immune system is to protect our body from any foreign matters that might cause any damage to the body or homeostatic imbalance. The success of the immune system depends on its ability to discriminate between foreign and host cells. When an organism is threatened by microorganisms, viruses, or cancer cells, the immune system acts to provide protection. Normally immune system does not mount a response against self. The lack of immune system is called Tolerance.

When a foreign matter enters the human body, our defense system recognizes this as foreign through immune system. How the human body recognize foreign against itself employs a complex “I.D”system. Each cell in the human body carries on its surface a mixture of proteins and sugars that serve to identify the cell to the immune system. Foreign objects lack the identifiers that all of the body’s cells have, but each one has unique features or antigens where the immune system attaches identifiers called antibodies. This is the basis for the specific defense mechanisms.

Once you have built the antibodies for specific antigen, the immune system will respond faster than when it had no previous exposure to the antigen. The non-specific part of the immune systems is mostly composed of phagocytes (eating-cells) which engulf and digest foreign substances like bacteria and viruses, which do not bear the body’s specific identifiers.

**TYPES OF IMMUNITY**

There are two major types of immunity and they are:

1. NATURAL IMMUNITY: This is also called nonspecific immunity that is present at birth. It provides abroad spectrum of defense against and resistance to infection. It is considered the first line of host defense following antigen exposure, because it protects the host without remembering prior contact with an infectious agent. Response to a foreign invader is very similar from one encounter to the next, regardless of the number of times the invader is encountered.

Natural (innate) immunity co-coordinates the initial response to pathogens through the production of cytokines and other effector molecules, which either activates cells for control of the pathogen (by elimination) or promotes the development of the acquired immune response. The cells involved in this response are Monocytes, Macrophages, Dendritic cells, Basophils, Eosinophils, Granulocytes and natural killer cells. Natural immune mechanisms can be divided into two stages: Immediate (generally occurring within minutes) and Delayed (occurring within several days after exposure).

Natural immunity can either be active or passive. Active immunity is resistance developed in response to stimulus by an antigen (infecting agent or vaccine) and is characterize by the production of antibodies by the host. This is immunity that is conferred by an antibody produced in another host. It may be acquired naturally or artificially (through an antibody-containing preparation).

Example of natural active immunity includes producing antibodies in response to exposure to a pathogenic infection.

Example of Natural passive immunity includes receiving antibodies from another organism (e.g. to the fetus via the colostrum or a newborn via breast milk).

2. ACQUIRED IMMUNITY: Acquired or adaptive immunity usually develops as a result of prior exposure to an antigen through immunization (vaccination) or by contracting a disease, both of which generate a protective immune response. Weeks or months exposure to the disease or vaccine, the body produces an immune response that is sufficient to defend against the disease on re-exposure. In contrast to the rapid but nonspecific natural immunity response, this form of immunity relies on the recognition of specific foreign antigens. The acquired immunity response is broadly divided into two mechanisms:

a. The cell mediator response, involving T-cell activation

b. Effector mechanisms, involving B-cell maturation and production of antibodies.

The two types of acquired immunity are known as active and passive and are interrelated.

* ACTIVE ACQUIRED IMMUNITY: this refers to immunologic defense developed by the person’s own body. This immunity typically lasts many years or even a lifetime. Example includes producing antibodies in response to the controlled exposure to an attenuated pathogen (i.e. vaccination).
* PASSIVE ACQUIRED IMMUNITY: This is temporary immunity transmitted from a source outside the body that has developed immunity through previous disease or immunization. Examples include immunity resulting from the transfer of antibodies from the mother to an infant in-utero or through breast-feeding or receiving injections of immune globulin.

Active and passive acquired immunity involve humoral and cellular (cell mediated) immunologic responses.

**TYPES OF ANTIBODIES AND THEIR ROLES**

Human antibodies are classified into five (5) isotypes which are IgM, IgD, IgG, IgA, IgE, according to their H chains which provide each isotypes with distinct characteristics and roles.

IgG

. Structure: Monomer

. Percentage serum antibodies: 80%

. Location: Blood, lymph, intestine.

. Half-life in serum: 23days.

. Complement fixation: Yes.

. Placental transfer: Yes.

. Known functions: Enhances phagocytosis, neutralizes toxins and viruses, and protects fetus and newborn.

This is the most abundant antibody isotype in the blood (plasma), accounting for 70-75% of human immunoglobulin (antibodies). IgG detoxifies harmful substances and is important in the recognition of antigen-antibody complexes by leukocytes and macrophages. IgG is transferred to the fetus through the placenta and protects the infant until its own immune system is functional.

IgM

. Structure: Pentamer

. Percentage serum antibodies: 5-10%.

. Location: Blood, lymph, B cell surface (monomer).

. Half-life in serum: 5days.

. Complement fixation: Yes.

. Placental transfer: No

. Known functions: This is the first antibodies produced during an infection. It is effective against microbes and agglutinating antigens.

IgM usually circulates in the blood, accounting for about 10% of human immunoglobulins. IgM has a pentameric structure in which five basic Y-shaped molecules are linked together. B cells produce IgM first in response to microbial infection/antigen invasion.

Although IgM has a lower affinity for antigens than IgG, it has higher avidity for antigens because of its pentameric/hexameric structure. IgM, by binding to the cell surface receptor, also activates cell signaling pathways.

This is the most abundant antibody isotype in the blood (plasma), accounting for 70-75% of human immunoglobulins (antibodies). IgG detoxifies harmful substances and is important in the recognition of antigen-antibody complexes by leukocytes and macrophages. IgG is transferred to the fetus through the placenta and protects the infant until its own immune system is functional.

IgA

. Structure: Dimer (i.e., two IgA monomers joined together).

. Percentage serum antibodies: 10-15%.

. Location: Secretions (tears, saliva, intestine, milk), blood and lymph.

. Half-life in serum: 6days.

. Complement fixation: No.

. Placental transfer: No.

. Known functions: Localized protection of mucosal surfaces. It provides immunity to infant digestive tract.

IgA is abundant in serum, nasal mucus, saliva, breast milk, and intestinal fluid, accounting for 10-15% of human immunoglobulins. IgA in breast milk protects the gastrointestinal tract of neonates from pathogens.

IgD

. Structure: Monomer.

. Percentage serum antibodies: 0.2%.

. Placental transfer: No.

. Location: B-cell surface, blood and lymph.

. Half life in serum: 3days.

. Complement fixation: No own function: In serum function is unknown. On B cell surface, initiate immune response.

IgD accounts for less than 1% of human Immunoglobulins. IgD may be involved in the induction of antibody production in B cells, but its exact function remains unknown.

IgE

. Structure: Monomer.

. Percentage serum antibodies: 0.002%,

. Location: Bound to mast cells and basophils throughout body, blood.

. Half-life in serum: 2days.

. Complement Fixation: No.

. Placental transfer: No.

. Known functions: Allergic reactions. It is also responsible for lysis of worms.

IgE is present in minute amounts, accounting for no more than 0.001% f human immunoglobulins. Its original role is to protect against parasites. In regions where parasitic infection is rare, IgE is primarily involved in allergy.