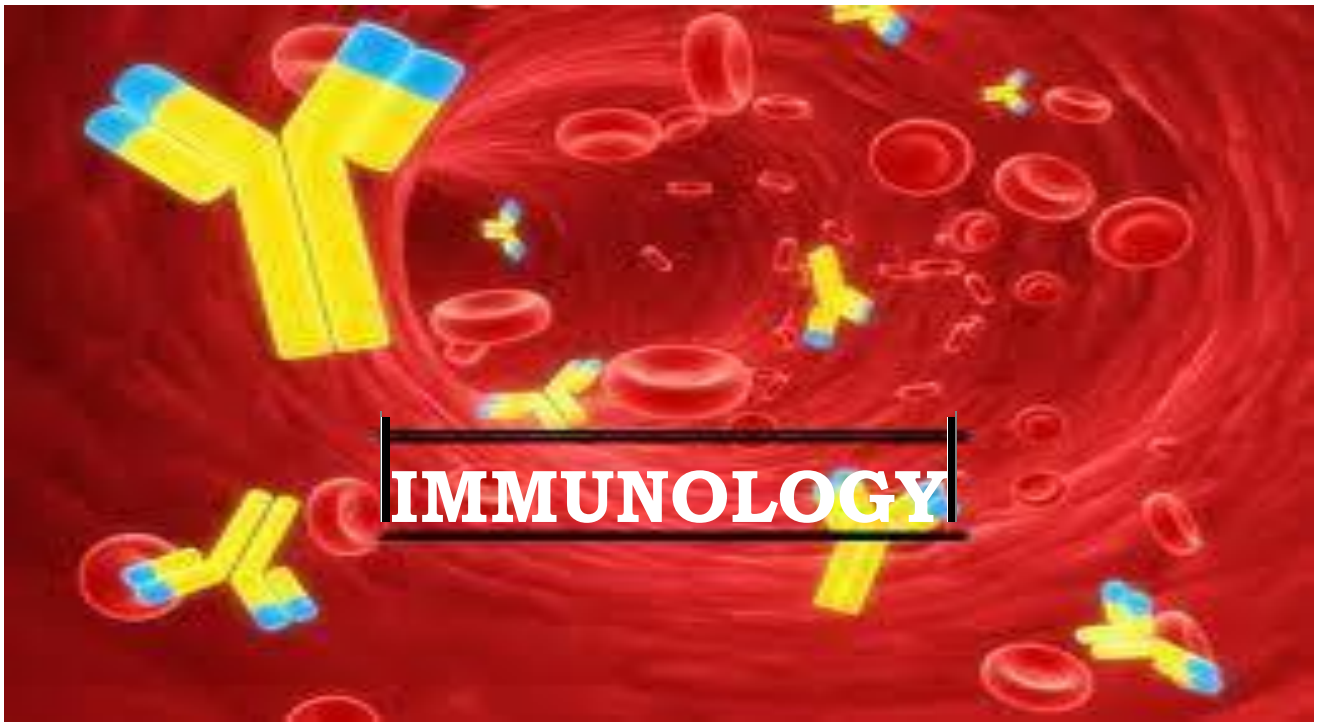
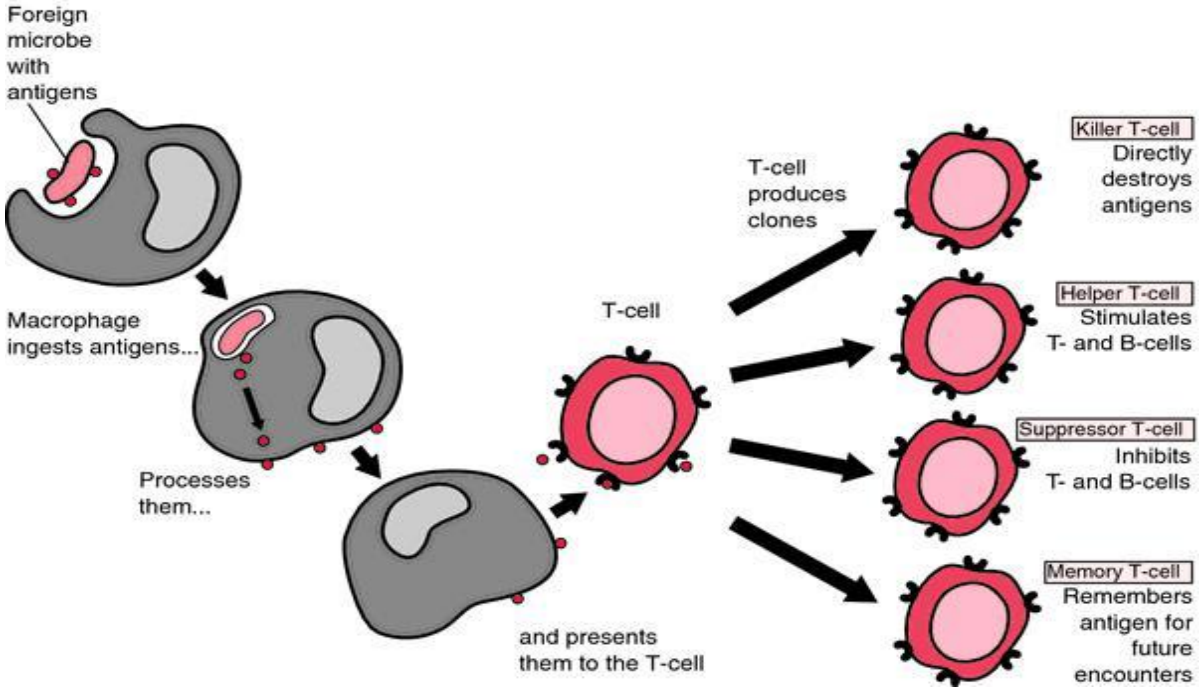


IMMUNE SYSTEM

Immune system to be a police force of our body. It is a defence system of the body that produces resistance or responce against the foreign particles or micro-organisms. Lymphocytes are the cornerstone of immune system.



IMMUNITY

It is a natural or acquired resistance of the body to a certain disease or pathogenic microorganism or foreign particles produced by immune system.

Autoimmunity

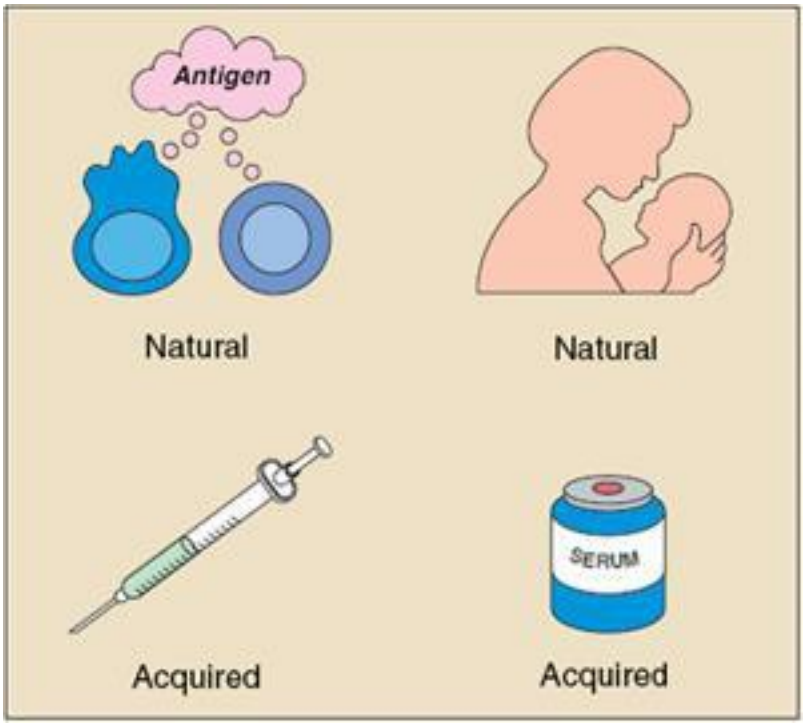
The immune system defends the body against infections and certain other diseases. It is made up of different organs, cells, and proteins known as antibodies. It identifies, attacks, and destroys germs and other foreign substances. Sometimes the immune system makes a mistake and attacks the body's own tissues or organs. This is called autoimmunity. One example of an autoimmune disease is type 1 diabetes, in which the immune system destroys the cells in the pancreas that produce insulin.

Types of Immunity

Immunity has two types;

1) Natural Immunity (Non-specific immunity)

2) Acquired Immunity (Specific immunity)



NATURAL IMMUNITY (Non specific immunity)

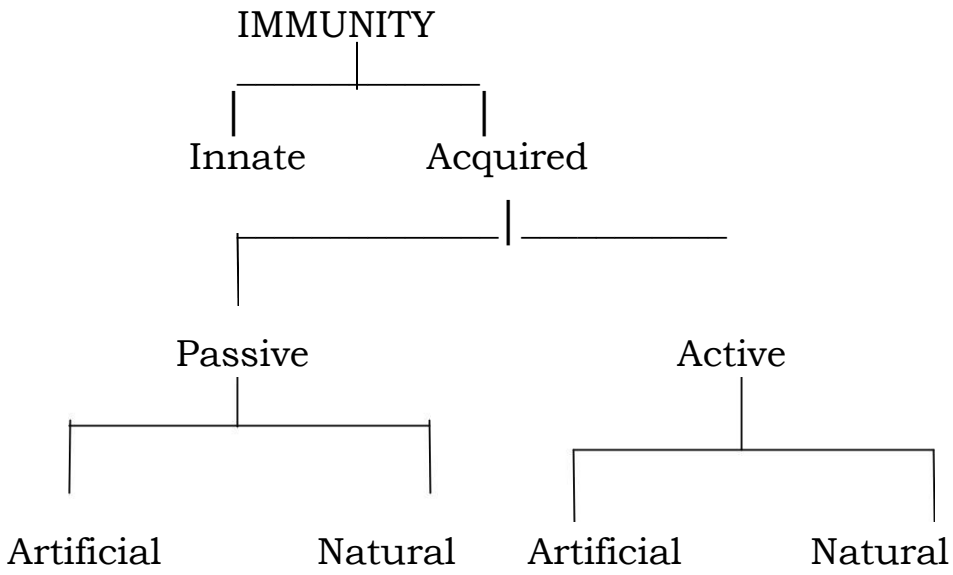
It is the natural resistance of the body against infections by a number of mechanical and chemical stimuli. It is called as nonspecific because it exists in all humans and present from the earliest time of life. Lack of such type of resistance is called as susceptibility.

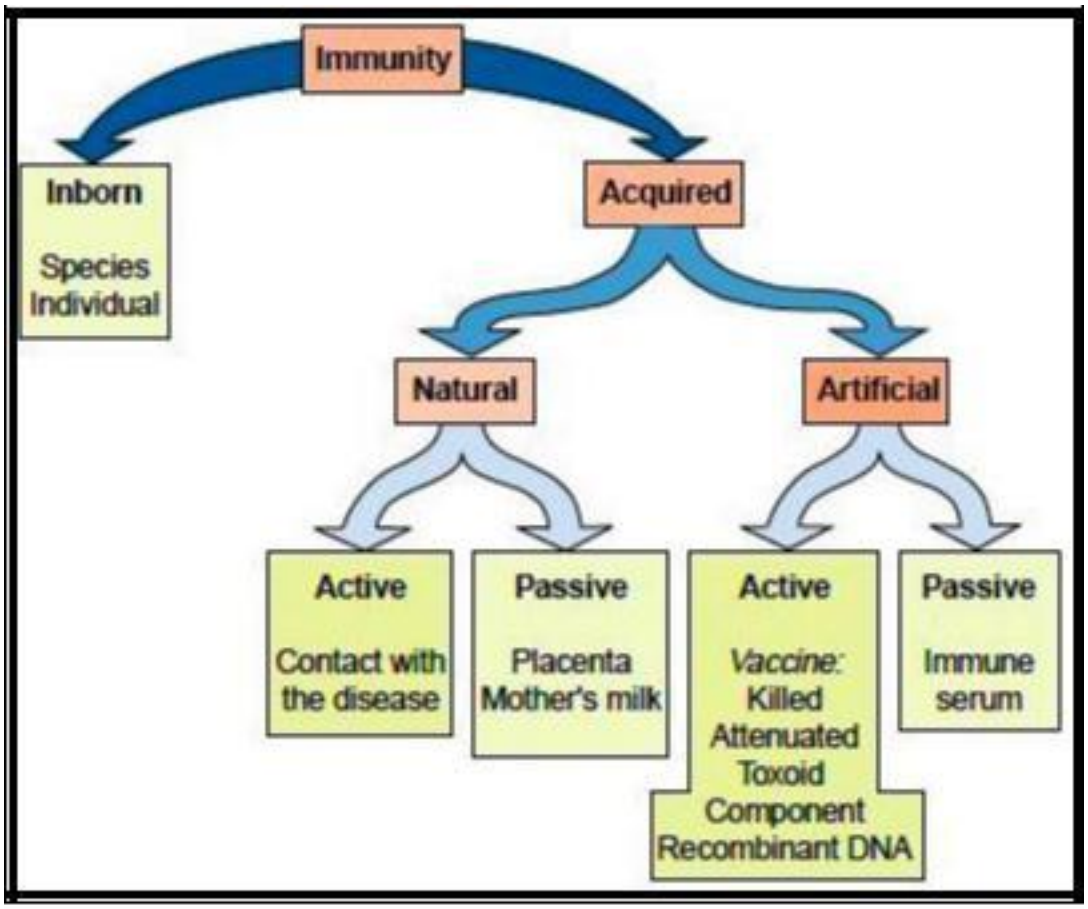
ACQUIRED IMMUNITY (Specific immunity)

It is an acquired resistance of the body against the foreign particles or micro-organisms. It involves the formation of antibodies as a result of stimulation immune system by foreign particles i.e. antigens. They are specific and provide specific resistance

TYPES OF ACQUIRED IMMUNITY (Specific immunity)

[1] Active Immunity
[2] Passive Immunity





Antigens

Definition:

Chemical substances capable of mobilizing the immune system and provoking an immune response are called Antigens. Antigens have two important properties:

Immunogenicity:

The ability to stimulate cells of the immune system.

Reactivity:

The ability to react with products of the immune system

cells or the cells themselves.

Antigen Determinants/ epitope

This is area of activity on the molecule called the antigen determinant or epitope. It contains about six to eight amino acid molecules or monosaccharide units.

TOLERANCE

Tolerance is an acquired resistance to foreign particles or drugs Which develops on its repeated administration over prolonged period.

Specific Immunologic Tolerance

Under normal circumstances one's own chemicals do not stimulate an immune response. This failure to stimulate the immune system occurs because substances are interpreted as "self". Prior to birth and during fetal stage the body's proteins and poly saccharides inactivate the immune system cells that otherwise might respond to them. The individual thereby develops a tolerance of "Self" and remains able to respond to "Nonself".

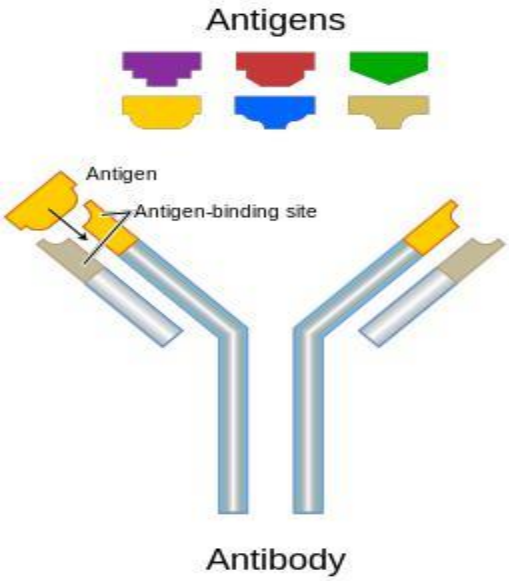
Types of Antigens

Autoantigens:

These are the person's own chemical substances that stimulate an immune response when self-tolerance breaks down. (as in lupus erythematosus)

Allo-antigens:

These are the antigens existing in certain but not all members of a species. The A, B and Rh antigens of humans are typical alloantigens.



Heterophiles:

These are the antigens found in unrelated species. For instance Erythrocytes of horses and the viruses that cause infection mononucleosis have certain identical antigens.

Antibody

A specific substance formed by the body in response to stimulation by specific foreign antigen. Terms antibody (Ab) and immunoglobulin are interchangeable. Antibodies are proteins composed of gamma globulins. These are produced by β-lymphocytes. Antibody mediated immunity s called as HUMORAL IMMUNITY.

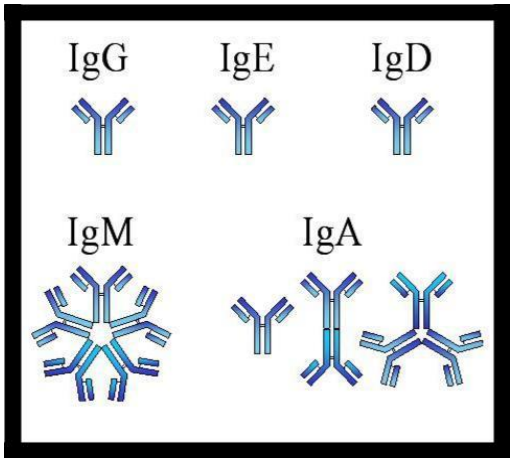
MOMOCLONAL ANTIBODIES

These are the antibodies which are produced from Hybridoma cells. In these antibodies variable regions of each immunoglobulin molecule are same (monoclone).

APPLICATIONS OF MOMOCLONAL ANTIBODIES

Diagnostic kits to detect isolated microorganisms. For specific antiserum therapy and possibly for some forms of cancer. They are used in research for specific identification of components produced in immune reaction, transplantation of organ and bone marrow.

Types of Antibodies



On the basis of differences in the heavy (H) chains in the constant region. Here the Ig stands for Immunoglobulin.

Ig M

It is the antibody of primary antibody response. It is the first antibody to appear in the circulation after stimulation of B-Lymphocytes.

Ig G:

It is the classical gamma globulin. This antibody is the major circulating antibody. IgG appears after 24 to 48 hours after the antigenic stimulation and continues the antigen-antibody reaction begun by IgM.

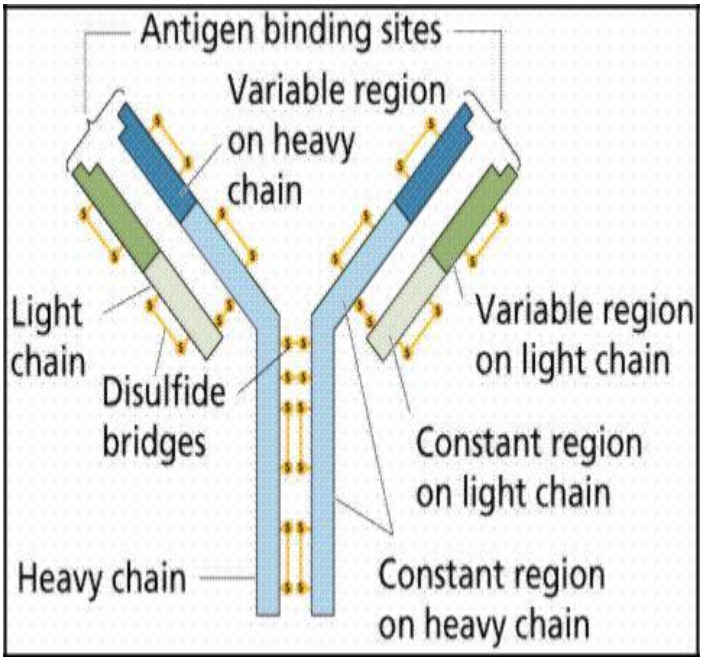
IgA:

It is of two types. Serum Ig A and Secretory IgA. **Serum IgA** is found in serum and is similar to IgG. **Secretory IgA** is found in body secretions. It comes from epithelial cells and helps to move the antibodies into the secretions. It provides resistance in the respiratory and gastrointestinal tracts.

It is also located in tears, saliva and closturm. Colostrums are the first milk secreted by a nursing mother.

IgE:

It plays a major role in allergic reactions by sensitizing cells to certain antigens.



IgD:

Both the functions and significance of the are presently unclear. However it is a cell surface receptor on the B-Lymphocytes together with IgM.

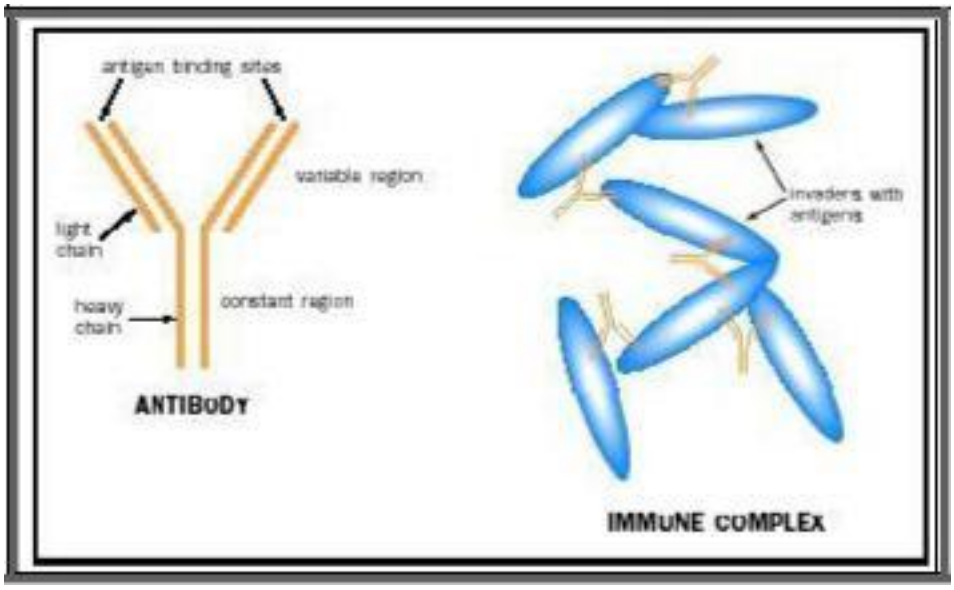
Antigen-Antibody Interactions

In order for specific resistance to develop, antibodies must interact with antigens in such a way that antigen is altered. The alteration may result in:

i) Death to the microorganism that possesses the antigen,

ii) Inactivation of the antigen,

iii) Increased susceptibility of the-antigen to other body defenses.



ANTIGEN-ANTIBODY REACTIONS

(SEROLOGICAL TESTS)

TYPES OF ANTIGEN ANTIBODY REACTIONS

There are three main serological tests used.

A) Agglutination test
B) Precipitation test
C) Complement fixation test

A) Agglutination Test

The antigen in agglutination reactions is a cell or a particle. The addition of homologous antibody will cause clumping or agglutination. Agglutination tests are of following types

1) Tube agglutination test
2) Slide agglutination tests
3) Agglutinin Adsorption test

Diagnostic Applications of Agglutination Tests:

Following Agglutination Test are used for diagnosis of different diseases.

D) Widal Test
E) Weil-Felix Test (Agglutination adsorption Test)
F) TPA Test (Treponema palladium Agglutination Test)
G) COOMB'S TEST (ANTIGLOBULIN TEST)

B) PRECIPITATION TESTS:

In these tests, a reaction takes place between a soluble antigen and a solution of its homologous antibody. The reaction is manifested by the formation of a visible precipitate at the interface of reactants.

There are two types of precipitation reactions.

(1) Ring test.

(2) Agar-diffusion method.

DIAGNOSTIC APPLICATIONS OF PRECIPITATION TESTS:

Following tests of precipitation are important from diagnostic point of view.

- KAHN TEST (VDRL TEST)
- ASCOLI TEST

C) COMPLEMENT FIXATION TEST:

It is a normal thermolabile protein constituent of blood serum that anticipate in antigen-antibody reactions,

DIAGNOSTIC APPLICATIONS OF CFT:

- WASSERMAN TEST FOR SYPHILIS
- T. PALLIDUM CFT

Allergy

According to British Immunological society. The allergy can be defined as;

"Allergy is a specific hypersensitivity of an individual to foreign particles Usually a protein to which a specific individual is exposed."

OR

"An allergy is sensitivity to a normally harmless substance, one that does not bother most people. The allergen (the foreign substance that provokes a reaction) can be a food, dust particles, a drug, insect venom, or mold spores, as well as pollen. Allergic people often have sensitivity to more than one substance."

- Swollen nasal mucous membranes, Complications in bronchi
- Migraine, GIT disturbances, Eczema, Dermatitis, Asthma,
- Runny nose/Stuffy nose Conjunctivitis, Tearing, Vomiting,
- Headache, Fever, Skin Rash.

Hypersensitivity

"It is state of increase sensitivity to an antigen arising from the previous exposure to that antigen"

"It is an exaggerated are in inappropriate reaction of immune system which are harmful to body"

or

An exaggerated response to an antigen that occurs after a prior exposure to the antigen, with consequent tissue damage,

Types of Hyper sensitivity reactions

Hyper sensitivity reaction has been classified by Gell and Coombs in to four major types

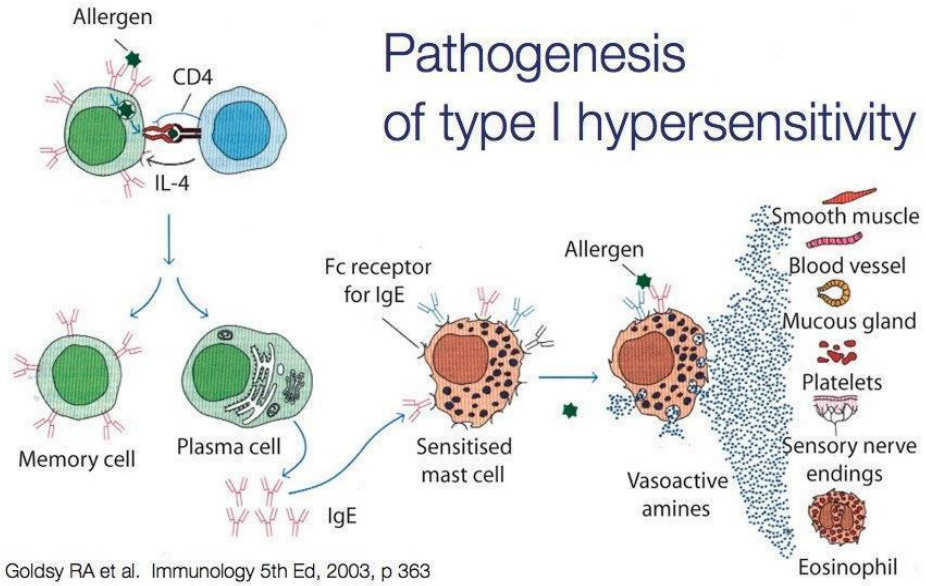
1. Anaphylactic hypersensitivity (immediate hypersensitivity)
2. Cytotoxic Hypersensitivity
3. Complex mediated Hypersensitivity
4. Cell mediated Hypersensitivity

TYPE I- ANAPHYLACTIC HYPERSENSITIVITY

This is a typical allergic response mediated by IgE type of antibodies in response to specific antigen called allergen. This reaction may be life threatening accompanied by Anaphylaxis, in which the mediators induce severe contraction of body's smooth muscles.

Common Allergens:

Plant pollens, Serum proteins, Drugs like penicillin etc.

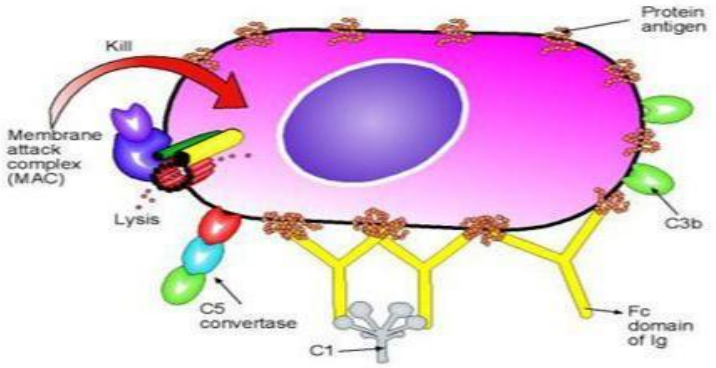


TYPE II, CYTOTOXIC HYPERSENSITIVITY

- These reactions occur when a specific antibody (Typically IgG or IgM) causes destruction of host cells.
- Cells Involved are WBCs, RBCs, and platelets.

Type 2 - antibody-dependent cytotoxicity

Figure 2a: Classical complement pathway



Antibody-dependent activation of the classical complement pathway begins with binding of IgM or IgG to antigen present on the surface of a cell. Recruitment of C1 complement protein that binds the Fc domain of Ig initiates the formation of the membrane attack complex (MAC) that promotes lysis of the cell. In addition, the Fc domain of bound antibody and surface bound complement protein C3b can promote phagocytosis by phagocytes expressing Fc and complement receptors.

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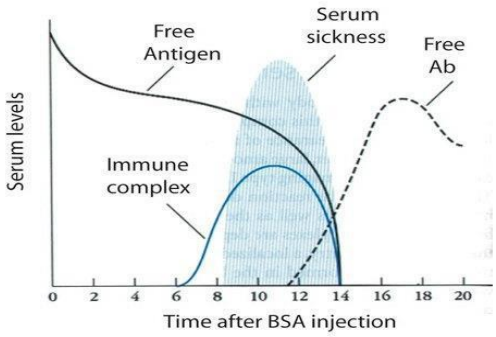
EXAMPLES

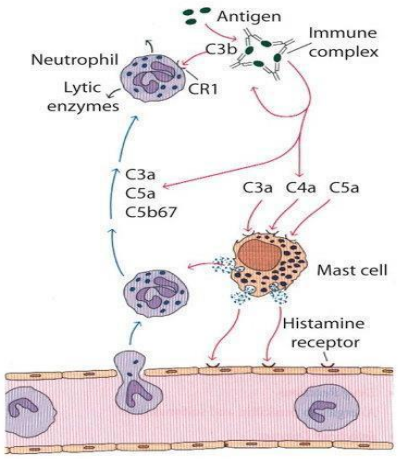
1. Blood transfusion reaction.
2. Hemolytic disease of newborn (Erythroblastosis fetalis).
3. Autoimmune disorders: These are the diseases in which body produces antibodies against its own cells.
4. Thrombocytopenia
5. Agranulocytosis
6. Myasthenia gravis

TYPE III, IMMUNE COMPLEX HYPERSENSITIVITY

"It is caused by the deposition of immune complex Antigen antibody complex) at various body locations, mainly blood vessels, kidneys, joints, lungs & skin".

Pathogenesis of type III hyper-sensitivity (right) & time course of serum sickness (below)





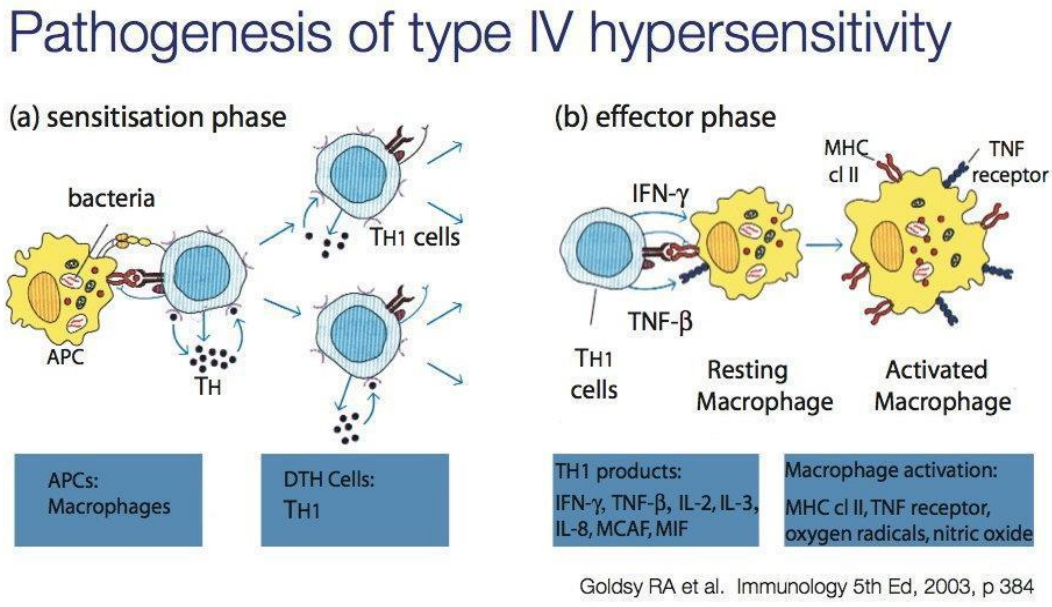
Goldsy RA et al. Immunology 5th Ed, 2003, p 381-2

- Serum sickness
- Arthus reaction
- Rheumatoid arthritis

TYPE IV, CELL MEDIATED HYPERSENSITIVITY

- "It is an exaggeration of CMI (T-lymphocytes) and develops beginning 18-24 hours following contact with antigen & peaks in 2-3 days".

- Various substances can elicit this type of response. Include metals, cosmetics, microbes & plant products.



TYPES

Two major forms of this allergy are

- Infection allergy
- Contact dermatitis