



Antigens, Immunoglobulins and states of Immunity

Individuals who successfully recover from an infectious disease generally acquire some degree of resistance toward the disease agent this resistance result from the ability of the body's immune system to recognize disease agents or their products as foreign .

Molecules that the body immune system recognize as foreign are called Antigens .
One defense response of the body to antigens is the production of Antibodies or Immunoglobulin's

Antigens and Immunogens

Antigens are molecules that react with antibodies but not necessarily cause their production. Immunogens are substances that stimulate the formation of antibodies and can combine with them. Immunogenic substances play important roles in the prevention of disease and the preparation of vaccines .

Properties of Immunogens

1- immunogenic substances include :

- a- Most free protein .
- b- Combination of proteins and other organic substances .
- c- Certain polysaccharides .

2-cellular components of bacteria and certain synthetic substances can also stimulate an immune response .

3-certain drugs and molecules which by themselves cannot stimulate antibody production can become immunogenic by chemically bonding to larger molecules (carriers) .

4-In general, the greater the incompatibility between the foreign substance the recipients tissues the greater immune response .

Factors That Determine Immunogenicity and Immune Responses.

1- Immunogens generally have molecular weights greater than 5000 and large molecular surfaces to accommodate many specific groups of atoms called antigenic determinant sites .

2- The number of antigenic determinant sites on the surface of immunogen is known as the valence.

3- Other factors affect the immune response, including :

a- The species of animal involved .

b- The animals degree of immunological maturity .

c- The route of inoculation .

d- The use of substances called adjuvant which prolong and intensify the antibody provoking stimulus .

Classes of Antigens

1-**Haptens** are single antigenic determinants that do not stimulate antibody production but that can combine with antibodies that have already been formed .

2-**Generally**, antibodies are not produced in the body against its own substances or cells the body's materials are recognized as "self" in contrast to foreign matter or "not self."

3- **In exceptional cases**. Abs (auto Abs) are produced against body components to auto Ags this type of condition is known as **autoimmunization** or **autoallergy** .

4- **Isoantigens** are red-blood-cell immunogens that differ among individuals of the same species. the clumping reaction (agglutination) which can be associated with these Ags serves the basis of blood typing .

5-**Heterophile Ags** are substances present in the cells and tissues of some species that stimulate the production of Abs effective against material from unrelated species .

Antibodies (Abs):

Abs belong to a group of proteins known as globulins .

Immunoelectrophoresis (IEP) ;

IEP is used to identify Abs or Ags in a variety of body fluids and other substances.

The technique combine the elements of electrophoresis and double gel diffusion .

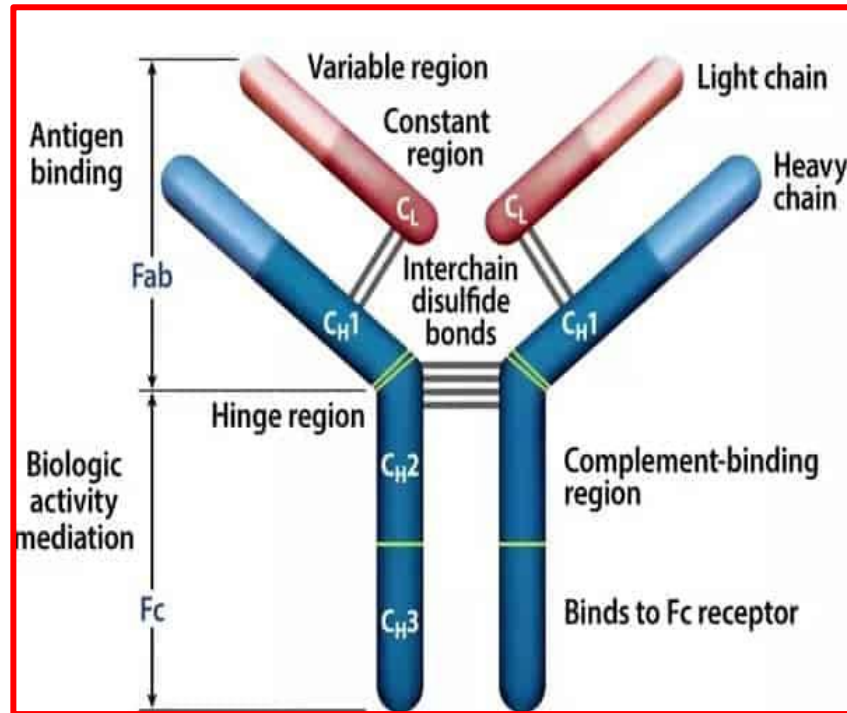
Immunoglobulin's :

1-Igs are grouped into 5 classes. **IgA**, **IgM**, **IgG**, **IgD**. and **IgE**, based on differences in their immunogenicity to other animal and their physicochemical properties .

2-The most plentiful of these protein substances in humans is **IgG**, **IgM**, is next in the order of abundance .

3- All normal Igs share the same basic molecular arrangement, which consists of two identical **H** (**heavy chains**) and two identical **L**(**light chains**) covalently linked to one another by disulfide bonds .

4-Subregion of Ig include the **Fab (Fragment antigen-binding)** domains, which contain the **Ag-binding sites**, and the **Fc (Fragment crystallizable)**, domain, which contains the chemically constant portion of the **H** chain .



Structure of Immunoglobulin

Antibody production :

The Ab production is affected by several factors including :

- 1-The nature of the immunizing material .
- 2- The dosage received .
- 3- The number and frequency of exposure .
- 4-The particular animal species.
- 5-The individual involved.

*The reaction to the first injection of immunogen is called the **primary response**. with in time. the Ab level, or titer, reaches a plateau which remains for several months or longer and then slowly declines as ab breakdown exceeds production.

* A Second injection of some immunogens will produce a secondary response which produces higher, longer, lasting Ab levels than those associated with the primary reaction.

The occurrence of normal Igs:

1-Generally, after exposure to immunogen a temporary increase in IgM occurs followed by a more permanent and greater IgG response Secondary response to the same immunogen usually produces IgG,

2-IgA is the main Ig in colostrum, gastrointestinal fluids, saliva, tears.and substances associated with the respiratory tract.

3-IgD and IgE are found in low concentration in **serum**. IgE is associated with skin sensitizing effects caused by Ags that produce allergies.

4- Most of IgG molecules in a newborn are of maternal origin. IgA and IgM do not appear in a newborns serum because they are too large to pass through the human placenta.

5- By approximately the fourth month after birth there is a sharp decrease in concentration of IgG, and the child s own IgG and IgM - producing machinery begins to function.

6- IgA levels increase between the ages of 4 and 10 years,

The Development Of Immunogenic System:

Thymus gland and its role:

1- The thymus gland, located in the chest region, is the most fully developed of the peripheral lymphoid tissue at birth, with the exception of the bone marrow.

- 2- After puberty, the gland begins to atrophy until at middle age it is relatively insignificant tissue both physiologically and structurally.
- 3- The thymus has an important role in Ab production and is believed to be the central location for the multiplication of lymphocytes (thymocytes) during embryonic development.

The immune response of the developing individual:

- 1- The maturation of the human immune system begins in utero, sometime during the second to third month of pregnancy, with the differentiation of stem cells located within the embryonic blood-forming tissue.
- 2- Depending on environmental conditions, differentiation cells may develop into either lymphopoietic or hematopoietic tissue.
- 3- Lymphopoietic tissue forms either T-lymphocytes, associated with cell-mediated immunity or B-lymphocytes, associated with Ab formation.
- 4- T-cells are derived from the thymus, B-cells are generated in sites other than the thymus (Bone Marrow).
- 5- T-cells are differentiated from B-cells in two ways:
 - a- T-cells possess the theta surface antigen and B-cells do not.
 - b- T-cells from non-immune animals form characteristic rosettes when incubated with sheep red blood cells and B-cells do not.
- 6- T-cells, B-cells, and macrophages may act together in Ab-production.

7- The 3 basic stages of the immune response are **recognition**. (the cellular binding of immunogen), **activation**, (the stimulation of a resting cell into active cell). **differentiation**, (the production of the many different cell types that required for immune response).

Immunosuppression and Immune Agents

Ig production can be suppressed in several ways through drugs, through physical agents, or through biological inhibition of the immune response. Suppression of the immune response is important to the success of foreign tissue grafts. Immunosuppressive agents such as x-rays or drugs can be used for this purpose.

States OF Immunity

Two major states of resistance are recognized

1-Innate, or Native immunity.

- a-Species immunity (resistance to disease agent with respect to species).
- b-Racial immunity (resistance on the basis of race).
- c-Individual immunity (resistance in individual of same species or race).

2-Acquired immunity may be either;

- a-Natural, **OR**
- b- Artificial,

depending upon the process involved in producing the immune state.

Also can be subdivided into:

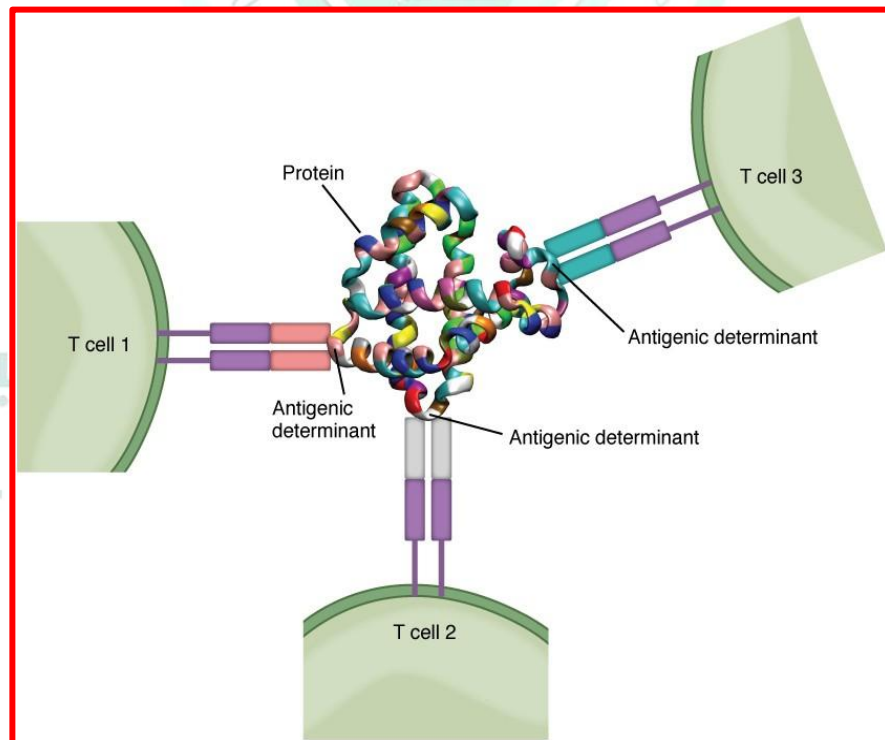
- a- **Active**, the individual produces Abs in response to immunogenic stimulus.
- b- **Passive**. Abs are introduced into the individual from outside source.

aa- Naturally acquired active immunity is the result of successful recovery from infection or series of infections.

ab- Naturally acquired passive immunity is obtained through the natural transfer of Abs from immunized donor to a non immune recipient.e-g: Igs transferred from mother to her fetus through the placenta.

ba - Artificially acquired active immunity is produced through immunizations'.e-g: killed organisms, inactivated toxins, attenuated organisms, and living organisms mixed with homologous antiserum.

bb- Artificially acquired passive immunity s produced by the injection of appropriate of antibodies generated by a different person or animal, or artificially in the laboratory



Virus particle with different type of antigenic determinant



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