In immunology, an **antigen** (Ag), or **antibody generator**, is any substance which provokes an adaptive immune response. That is to say, an antigen is a molecule that also induces an immune response in the body.

An antigen is often foreign or toxic to the body (for example, a bacterium) which, once in the body, attracts and is bound to a respective and specific antibody

The antigen may originate from within the body ("self") or

from the external environment ("non-self").

FACTORS INFLUENCING IMMUNOGENICITY

***1-Foreignness** The immune system normally discriminates between self and non-self such that only foreign molecules are immunogenic

***2-Chemical composition :-** In general

,- proteins are usually very good immunogens.

-Pure polysaccharides and lipopolysaccharides are good immunogens.

-Nucleic acids are usually poorly immunogenic. However, they may become immunogenic when single stranded or when complexed with proteins.

-In general lipids are non-immunogenic.

***3-Molecular size** :There is not absolute size above which a substance will be immunogenic. However, in general, the larger the molecule the more immunogenic it is likely to be.

***4-Chemical complexity:** In general, the more complex the substance is chemically the more immunogenic it will be..

***5-Genetic constitution :**, Some substances are immunogenic in one species but not in another. Similarly, some substances are immunogenic in one individual but not in others (*i.e.* responders and non-responders). The species or individuals may lack or have altered genes that code for the receptors for antigen on B cells and T cells or they may not have the appropriate genes needed for the APC to present antigen to the helper T cells.

6- Dosage The dose of administration of an immunogen can influence its immunogenicity. There is a dose of antigen above or below which the immune response will not be optimal.

Origin of antigens

Antigens can be classified in order of their class.

1-Exogenous antige nsare antigens that have entered the body from the outside, for example by inhalation, ingestion, or injection.

2-Endogenous antigens

Endogenous antigens are antigens that have been generated within previously normal cells as a result of normal cell metabolism, or because of viral or intracellular bacterial infection.

3- Autoantigens

An autoantigen is usually a normal protein or complex of proteins (and sometimes DNA or RNA) that is recognized by the immune system of patients suffering from a specific autoimmune disease.

ADJUVANT

Substance, which when mixed with an antigen, enhances the magnitude and duration of the immune response

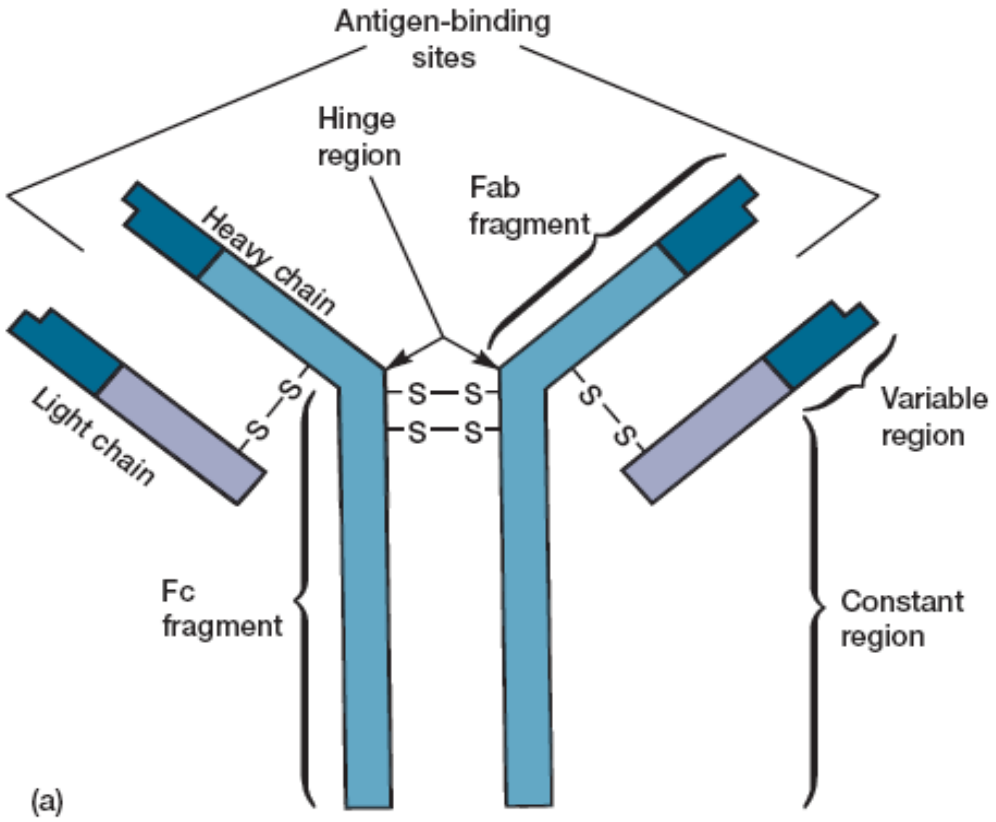
Functions: •

*Prolong retention of immunogen

*Increase the effective size of the immunogen

*Stimulate local influx of macrophages or immune cells to the injection site

Antibody-mediated Immunity



Antibodies are proteins produced by lymphocytes that can specifically bind a wide variety of protein and polysaccharide antigens and elicit a response that is significant in antimicrobial defense.

In conjunction with the complement system, antibodies are the mediators of humoral (circulating) immunity, and their presence on mucosal surfaces provides resistance to many infectious agents. Antibodies are essential for the prevention and/or cure of many types of bacterial and viral infections.

, it was discovered at the turn of the century that antibodies were contained within the serum fraction of blood. It was demonstrated in 1939 that antibodies were specifically located in the gamma fraction of electrophoresed serum, thus the term **gammaglobulin** was

coined for serum containing antibodies. Antibodies themselves, were called **immunoglobulins**.

BASIC STRUCTURES

Antibodies have more than one antigen combining site

All Ig have a basic structure composed of 4 polypeptide chains connected to each other by disulphide bonds.

Each light chain consist of 220 aa and has a mass of approx. 25kDa.

Each heavy chain consists of about 440 aa and has a mass of 50-70kDa

Both light and heavy chains contain 2 different regions

constant and variable region

The four chains are arranged in the form of a flexible "Y" with the hinge region and is termed as crystallizable fragment (Fc) and contains the site at which Ab binds.

Top of the "Y" consist of two Ag binding fragments (Fab) that bind with antigenic determinant sites.

The Classes of Antibodies

There are a number of types of antibodies or immunoglobulins that react specifically with an antigen that induced their formation.

Each of these classes of immunoglobulins **(Ig)** is produced by a specific clone **of plasma cells. Five immunoglobulin** classes are defined on the basis of their heavy chain composition, named **IgG, IgM, IgA, IgE, and IgD. IgG and IgA** are further divided into subclasses.

IgG. Immunoglobulin G is the predominant Ig in the serum; it makes up about 80% of the total antibody found in an animal at any given time, being 75% of the total serum antibody.

.- Its concentration in tissue fluids is increased during inflammation.

- It is particularly effective at the neutralization of bacterial extracellular toxins and viruses.

- It also has opsonizing ability and complement-fixing ability.

- It is IgG that crosses the placental barrier, and thereby provides passive immunity to the fetus and infant for the first six months of life.

. It is probably due to its relatively small size and its persistence in the serum of a mother, that IgG is shared with the fetus in utero, and the infant is born with the full complement of mother's IgG antibodies.

IgM

is the first immunoglobulin to be synthesized by infants and the first to appear in the blood stream during the course of an infection. Mainly, it is confined to the bloodstream giving the host protection against blood-borne pathogens.

IgM makes up about 10% serum immunoglobulins. IgM is arranged to resemble a pentamer of five immunoglobulin molecules (mw = 900kd) tethered together at by their Fc domains.

. Probably, the most important role of IgM is

1- its ability to function early in the immune responses against blood-borne pathogens

2--IgM is very efficient at agglutinating particulate antigens. Also,

3- IgM binds complement strongly

4- IgM antibodies bound to a microbial surface act as opsonins, rendering the microbe more susceptible to phagocytosis.

-In the presence of complement and IgM whole microbial cells may be killed and lysed.,