ANTIGEN : PROPERTIES AND TYPES

ANTIGENS

Antigens **are large molecules of proteins, present on the surface of the pathogen-such as bacteria, fungi viruses, and other** foreign particles. When these harmful agents enter the body, it induces an immune response in the body for the production of antibodies.

Antigen is a substances usually protein in nature and sometimes polysaccharide, that generates a specific immune response and induces the formation of a specific antibody or specially sensitized T cells or both.

Although all antigens are recognized by specific lymphocytes or by antibodies, only some antigens are capable of activating lymphocytes. Molecules that stimulate immune responses are called I**mmunogens.**

Epitope is immunologically active regions of an immunogen (or antigen) that binds to antigen-specific membrane receptors on lymphocytes or to secreted antibodies. It is also called **antigenic determinants.**

Adjuvants are substances that are non-immunogenic alone but enhance the immunogenicity of any added immunogen.

Chemical Nature of Antigens (Immunogens)

A. Proteins

The vast majority of immunogens are proteins. These may be pure proteins or they may be glycoproteins or lipoproteins. In general, proteins are usually very good immunogens.

B. Polysaccharides

Pure polysaccharides and lipopolysaccharides are good immunogens.

C. Nucleic Acids

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

D. Lipids

In general lipids are non-immunogenic, although they may be haptens.

Types of Antigen On the basis of order of their class (Origin)

1. Exogenous antigens

These antigens enters the body or system and start circulating in the body fluids and trapped by the APCs (Antigen processing cells such as macrophages, dendritic cells, etc.)

The uptakes of these exogenous antigens by APCs are mainly mediated by the phagocytosis

Examples: bacteria, viruses, fungi etc

Some antigens start out as exogenontigens, and later become endogenous (for example, intracellular viruses)

2. Endogenous antigens

These are body's own cells or sub fragments or compounds or the antigenic products that are produced.

The endogenous antigens are processed by the macrophages which are later accepted by the cytotoxic T – cells.

Endogenous antigens include xenogenic (heterologous), autologous and idiotypic or allogenic (homologous) antigens.
Examples: Blood group antigens, HLA (Histocompatibility Leukocyte antigens), etc.

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.

Under normal conditions, these antigens should not be the target of the immune system, but due mainly to genetic and environmental factors, the normal immunological tolerance for such an antigen has been lost in these patients.
Examples: Nucleoproteins, Nucleic acids, etc.

On the basis of immune response

1. Complete Antigen or Immunogen

Posses antigenic properties denovo, i.e. ther are able to generate an immune response by themselves.

High molecular weight (more than 10,000)

May be proteins or polysaccharides

2. Incomplete Antigen or Hapten

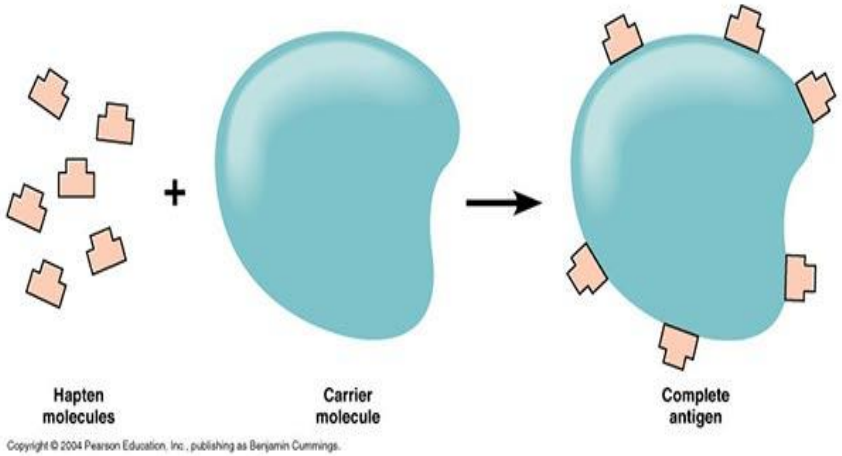
These are the foreign substance, usually non-protein substances

Unable to induce an immune response by itself, they require carrier molecule to act as a complete antigen.

The carrier molecule is a non-antigenic component and helps in provoking the immune response. Example: Serum Protein such as Albumin or Globulin.

Low Molecular Weight (Less than 10,000)

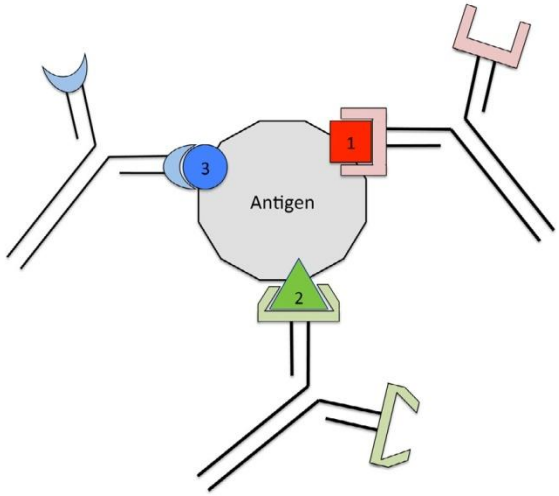
Haptens can react specifically with its corresponding antibody.
Examples: Capsular polysaccharide of pneumococcus, polysaccharide “C” of beta haemolytic streptococci, cardiolipin antigens, etc.



Determinants of Antigenicity

The whole antigen does not evoke immune response and only a small part of it induces B and T cell response.

The small area of chemical grouping on the antigen molecule that determines specific immune response and reacts specifically with antibody is called an ***antigenic determinant.***



Property of antigens/ Factors Influencing Immunogenicity

1. Foreignness

An antigen must be a foreign substances to the animal to elicit an immune response.

2. Molecular Size

The most active immunogens tend to have a molecular mass of 14,000 to 6,00,000 Da.
Examples: tetanus toxoid, egg albumin, thyroglobulin are highly antigenic.
Insulin (5700) are either non-antigenic or weakly antigenic.

3. Chemical Nature and Composition

In general, the more complex the substance is chemically the more immunogenic it will be.

Antigens are mainly proteins and some are polysaccharides.
It is presumed that presence of an aromatic radical is essential for rigidity and antigenicity of a substance.

4. Physical Form
In general particulate antigens are more immunogenic than soluble ones.
Denatured antigens are more immunogenic than the native form.

5. Antigen Specificity
Antigen Specificity depends on the specific actives sites on the antigenic molecules (Antigenic determinants).

Antigenic determinants or epitopes are the regions of antigen which specifically binds with the antibody molecule.

6. Species Specificity
Tissues of all individuals in a particular species possess, species specific antigen.
Human Blood proteins can be differentiated from animal protein by specific antigen-antibody reaction.

7. Organ Specificity

Organ specific antigens are confined to particular organ or tissue.

Certain proteins of brain, kidney, thyroglobulin and lens protein of one species share specificity with that of another species.

8. Degradability

Antigens that are easily phagocytosed are generally more immunogenic.

This is because for most antigens (T-dependant antigens) the development of an immune response requires that the antigen be phagocytosed, processed and presented to helper T cells by an antigen presenting cell (APC).