Introduction

THE ANTIGENS

Antigens

Antigens: any substance that when introduced into the body may stimulate the immune system to form antibodies that react specifically with that antigen, or forming an active lymphocytes that eliminate the antigen from the body.

These antigens are:

proteins, glycoproteins, lipoproteins and large polysaccharides

These Ags are in the form of:

1-Microbes and/or their components, like bacteria, viruses, protozoans, algae, fungi, flagella, toxins, cell wall, capsules and others.

2-Non microbial agents: pollen, eggwhite, blood cells, serum proteins and others

Antigenicity and Immunogenicity

Antigenicity: The ability of a molecule to be recognized by an antibody or lymphocyte.

Immunogenicity: The ability of a molecule to elicite an immune response.

Factors AffectingImmunogenicity

Various physical and biochemical factors affect a substance's immunogenicity:

1- MW and Size

100KDa and more are potent immunogens

Less than 10 Kda may not stimulate an immune response.

Factors Affecting Immunogenicity

2-Foreigness

Immune system differntiate between self and non self Ags

From rabbits to rabbits

From goat to goat

From dog to rabbit

Factors Affecting Immunogenicity

3-Chemical complexity

More complex substances are more immunogenic

Example: Viruses and bacteria

Glycogen is of 2600 Da but it is immunogenic because of its complexity.

Lipid, amino acids are not immunogenic also RNA and DNA

Factors Affecting Immunogenicity

4-Flexibility: high flexible substances like gelatin are less or poor immunogens (Flagella)

5-Degradibility: stainless steel, pins, plastic heart valves commonly implanted in humans without triggering an immune response. They cannot be processed

Foreign molecules that are unstable and destroyed very rapidly may not persist for a sufficient time to stimulate an immune response.

Factors Affecting Immunogenicity

6- Route of administration

For example: an organism that normally causes infection when introduced in the lungs may be desroyed by acids in the gut if swalowed.

7-Genetics

Examples NDV can infect poultry but not ovine or caprine.

IBR can infect cattle but not man

Factors Affecting Immunogenicity

8-Cellular Reaction

Some Ags can stimulate T-lymphocytes easily like proteins but carbohydrate are weak to do so.

A-Thymic dependent antigens

These Ags can react with B lymphocytes in the presence of T-helper lymphocytes.

B- Thymic independent antigens

These Ags stimulate B cells without the need to T-helper cells like lipopolysaccharides.

Factors Affecting Immunogenicity

9-Antigenic determinants (epitopes)

A specific region on the surface of an antigen against which antibodies are formed.

Sometimes two different proteins may share some antigenic determinants. This will lead to what known as cross-reaction: for example

Antiserum against *Proteus vulgaris*

can react with antigenic determinants of

Rickettsia typhi

There are at least one antigenic determinant for each 5000 Dalton of Ags and each antigenic determinant is composed of at least 4-6 aminoacids.

Haptens

- A small molecules that cannot initiate an immune response unless first bound to an immunogenic carrier molecule.
- Examples: drugs, hormones with less than 1000 Da are too small to induce immune response
- Many drugs allergies result from drugs binding to normal proteins and so acting as haptens(Penicillin).

Approaches used to increase immunogenicity

Adjuvants: any substance that when given with an antigen, enhance the immune response to that antigen.

It is thought that adjuvants may help in:

1-increasing the effective size of immunogen

2-enhancing the persistence of the immunogen

3-activating cells such as macrophages and lymphocytes.

Example:

Aluminum salts, Water jn oil (incomplete Freund's adjuvant), BCG (Bacille Calmette Guerin), Freund's complet adjuvant, lipopolysaccharide, Saponin

MHC (Major Histocompatibility Complex)

- MHC can be considered to be an organized cluster of genes that control antigen processing and presentation.
- In order to trigger an immune response, antigen processing requires not only the fragmentation of antigen molecules inside cells, but also the binding of these fragments to an appropriate antigen presenting molecule. These antigen presenting molecule are called histocompatibility molecules.

Fate of Ags within the body

A-Given intravenously

1-Particulate Ags—Macrophages processing then elimination

2-Soluble antigen- If aggregates formed processed as above.

If non aggregates catabolized and eliminated

Fate of Ags within the body

B-Given by other routes

1-Parentral im, subcut

A-insoluble, aggregated-retained in tissue, causes local damage, infiltration of neutrophil and macrophages processed and stimulate immune system.

B-soluble—carried in tissue fluid to lymphatics or circulation processed as in A2

Fate of Ags within the body

2- Gastrointestinal:oral, rectal

If not catabolized, cross epithelium, move to mesentric lymphnode then treated by immune response

3-Respiratory tract

A-insoluble, trapped by the mucous of upper respiratory tract and removed by ciliary escalator of trachea. If reached the alveoli, engulfed by macrophages.

B-soluble, may reach body fluids or circulation and treated by immune response.