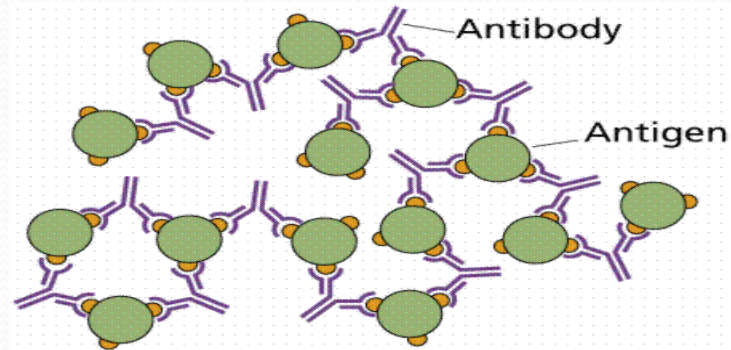


# ANTIGENS

## NATURE & TYPES

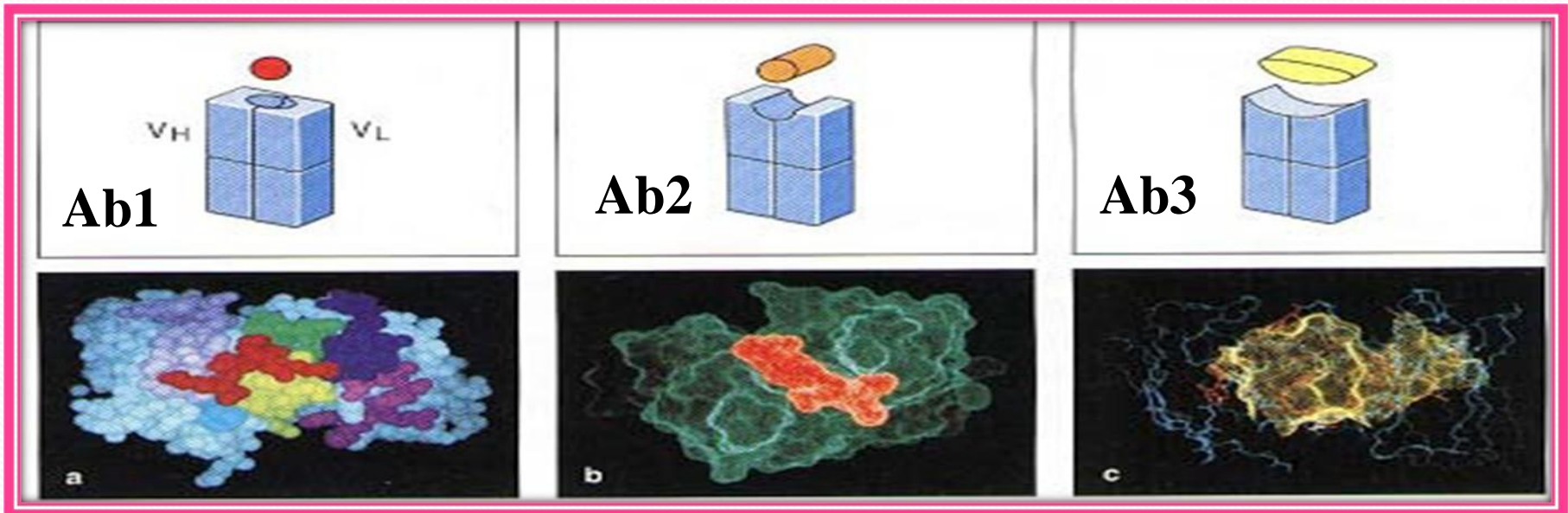
MICROBIOLOGY – V



# I. Definition of antigens

Antigens are the substance which when introduced parenterally into the body stimulates the production of an antibody with which it reacts specifically and in an observable manner.

\*Specificity is referred to that, immune responses are directed toward and able to distinguish between distinct antigen or small parts of macromolecular antigens. 

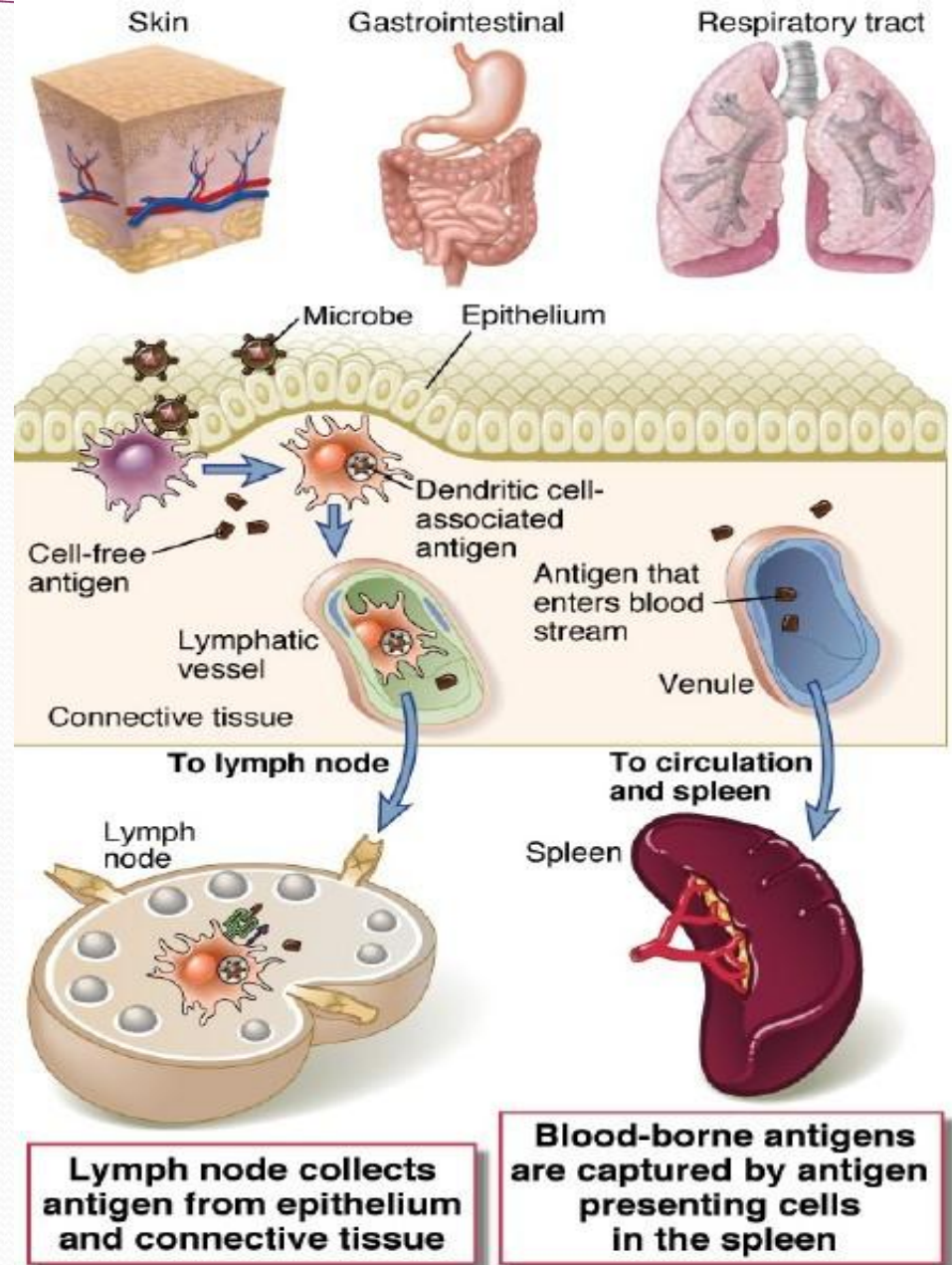


# How Antigen enters

Sites of antigen entry

Sites of initial antigen capture

Sites of antigen collection and capture

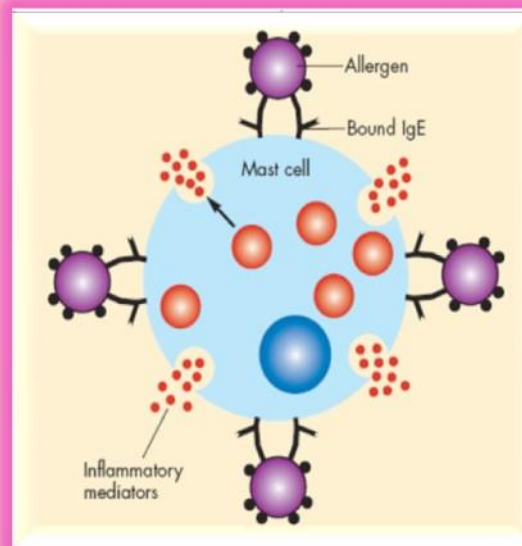


1. Immunogen: the antigen that induce specific immune response

2. Tolerogen: antigen that induce Immunologic tolerance

Immunologic tolerance is unresponsiveness to an antigen that is induced by prior exposure to that antigen.

3. Allergen: antigen that induce Anaphylaxis (severe immediate hypersensitivity reaction occurring as a result of rapid generalized mast-cell granulation)



4. Vaccine: antigens that induce a protection immune response against microbes and are used to prevent diseases



# Immunogenicity vs Antigenicity

θ Immunogenicity is the ability to induce a humoral and/or cell-mediated immune response.

B cells + antigen  $\longrightarrow$  effector B cells + memory B cells

T cells + antigen  $\longrightarrow$  effector T cells + memory T cells

θ Antigenicity is the ability to combine specifically with the final products of the **immune response** (i.e. secreted antibodies and/or surface receptors on T-cells).

θ Although all molecules that have the property of immunogenicity also have the property of antigenicity, the reverse is not true.

## Criteria for Immunogenicity:

### Nature of the immunogen

Foreignness

Molecular weight

Complexity

Degradability

### Contribution of the Biological System

Genotype of the recipient animal

Age

### Method of Administration

Dosage

Route

Adjuvants

## E) Nature of Immunogen:

- ♣ **Foreignness:** In order to elicit an immune response a molecule must be recognized as nonself by the host.

### What kinds of substances can be foreignness to immune system?

#### (1) Heterogeneous substances


Various pathogens, xenoantigenic tissues. 

#### (2) Allogeneic substance

grafted allogeneic tissues or organs.

(3) **Autoantigenic** components that never contact with lymphocytes during embryo period.

- ♣ **Molecular Size:** Usually the bigger the better. Molecules with MW of 5000-10000 are poor immunogens with the best immunogens being about 100,000 D.

❖ **Chemical complexity** : Just because a molecule is large, if its a polymer of a single amino acid or sugar it tends to lack immunogenicity. The addition of aromatic amino acids such as tyrosine and phenylalanine has a profound effect on the immunogenicity of these synthetic polymers. All 4 levels of protein organization , primary, secondary, tertiary, and quaternary- contribute to the structural complexity of a protein and hence affect its immunogenicity. 

❖ **Degradability**: Macromolecules that cannot be degraded and processed by Antigen presenting cells are poor immunogens

## II) Contribution of the Biological System: which includes

1. **Genotype of the recipient animal**: The genes that code for MHC molecules, T cell receptors, and B cell receptor all play a central role in determining the degree of immune responsiveness to an antigen.

2. **Age** : can also influence immunogenicity. Usually the very young and the very old have a diminished ability to mount and immune response in response to an immunogen.



### III) Method of Administration

**Dosage:** Too **low** a dose of Antigen will **fail to activate** enough lymphocytes for a response whereas **too high** a dose can **overwhelm** the system and cause the lymphocytes to enter a nonresponsive state.

**Route :** Generally the **subcutaneous** route is better than the intravenous or intragastric routes. The route of antigen administration can also alter the nature of the response

**Adjuvants :** Adjuvants are substances that when **mixed** with an **Antigen** **serve to enhance the immunogenicity of that Antigen.** Adjuvants are often water in oil mixtures with various bacterial components added. Aluminum potassium sulfate (alum) is the only approved adjuvant for human use.

# Classification of Antigens

Based on Immunogenicity

Based on Chemical nature

According to whether need the help of T cells when B cells produce Antibodies.

**Complete antigen**  
Which contains both immunogenicity and antigenicity

**Incomplete antigen**  
Contains only antigenicity  
e.g. Haptens



## Proteins

Majority of immunogens are proteins (pure proteins or they may be glycoproteins or lipoproteins). Proteins are usually very good immunogens.

## Polysaccharides

Pure polysaccharides and lipopolysaccharides are good immunogens.

## Nucleic Acids

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

## Lipids

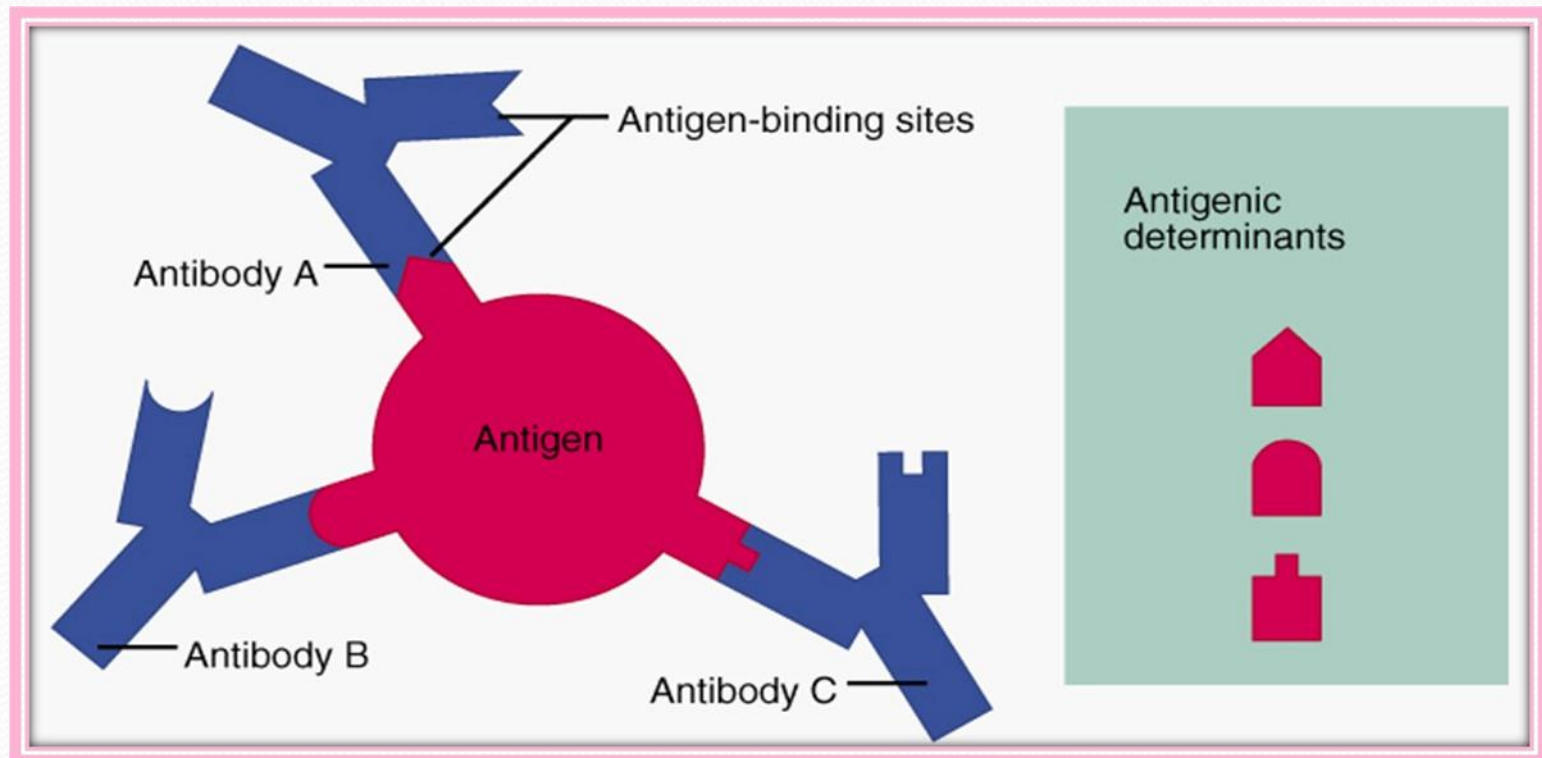
In general lipids are non-immunogenic, although they may be haptens.

**TD-Ag** (thymus dependent antigens)

**TI-Ag** (thymus independent antigens)

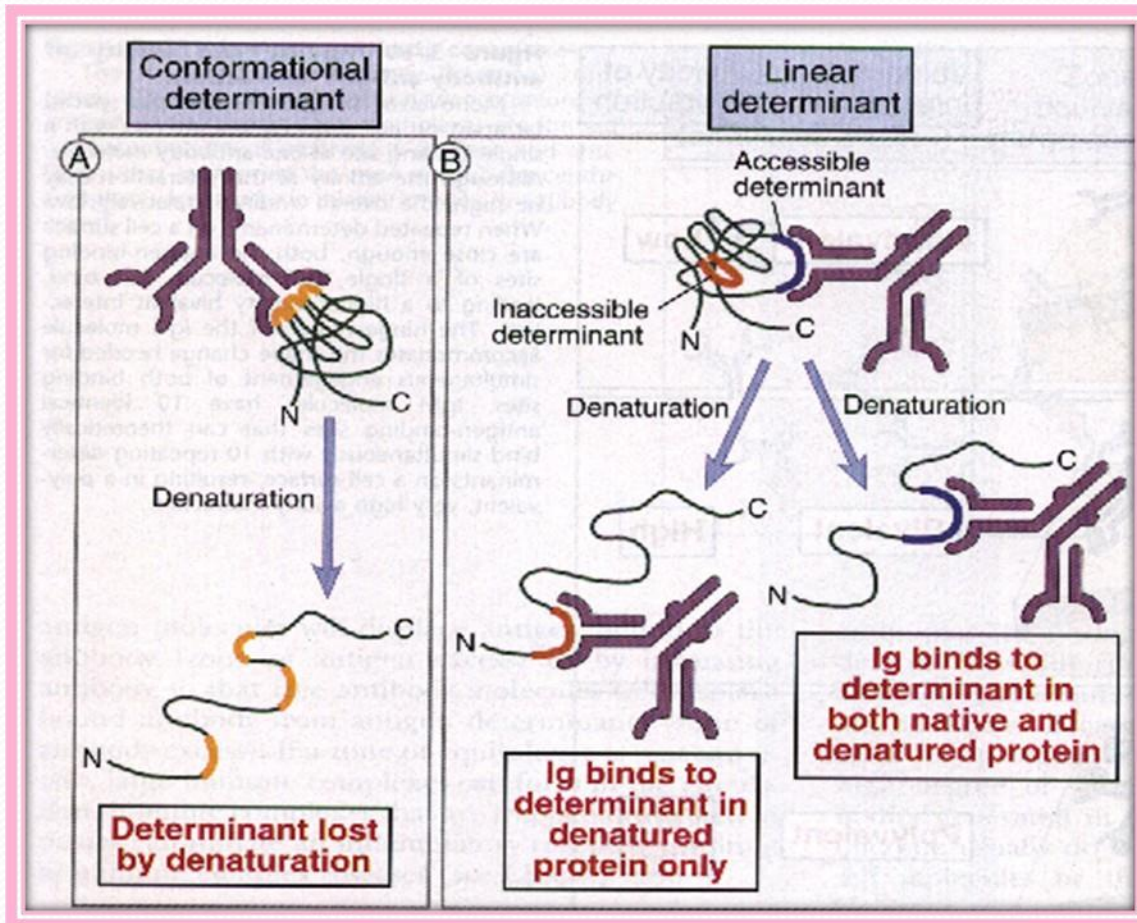
# 1. Antigen determinants (epitope)

The portion of antigen molecules which can be specifically recognized by antibody or antigenic receptor of lymphocytes.



# Classification of antigenic determinant

## 1. According to the structure of Antigen determinants



♣ Conformational determinants : are formed by amino acid residues that aren't in a sequence but become spatially juxtaposed in the folded protein

♣ Sequential (or linear) determinants

Epitopes formed by several adjacent amino acid residues are called linear determinants.

## 2. According to types of cells recognizing antigenic determinants

### T cell epitope

### B cell epitope

**Receptor**

**TCR**

**BCR**

**Nature**

**short peptide**

**proteins, polysaccharides**

**Size**

**8-17 amino acid residues**

**5-15 amino acid residues  
or 5-7 monosaccharides**

**Types**

**linear epitope**

**conformational epitope  
or linear epitope**

**Position**

**any position in antigen**

**mostly exist on the surface of  
antigen**



THANK YOU