



# **SNS COLLEGE OF TECHNOLOGY**

## **(AN AUTONOMOUS INSTITUTION)**

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### **Department of Biomedical Engineering**

**Course Name: 19GET277 – Biology for Engineers**

**IV Year : VII Semester**

**UNIT III – GENETICS AND IMMUNE SYSTEM**

**Topic : Antigen Antibody – Immune response**



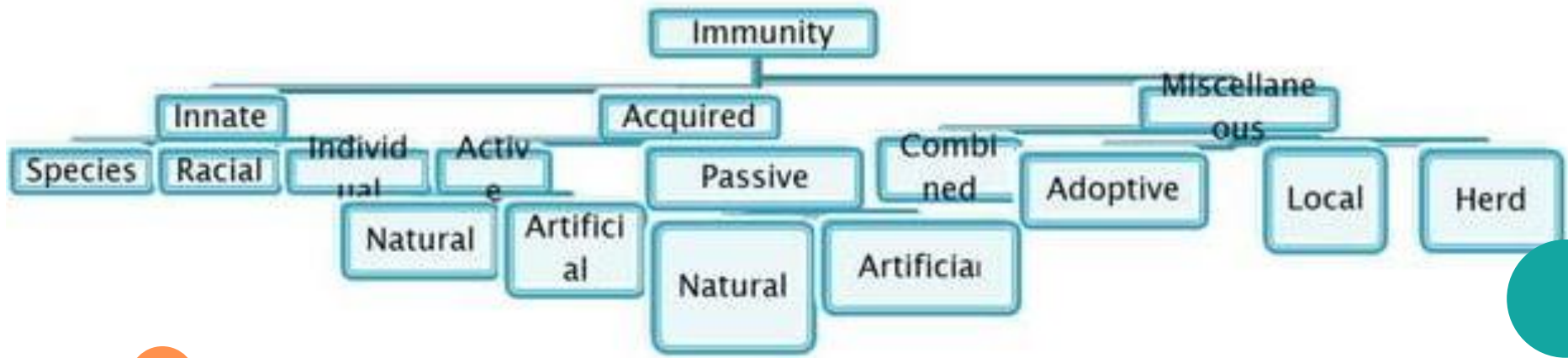
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# Introduction

- ▶ The term immunity is derived from *immunitas* (Latin for exemption from civic duties or paying taxes)
- ▶ The term 'immunity' is defined as resistance exhibited by the host against any foreign antigen including microorganisms.
- ▶ The ability of an organism to resist a particular infection or toxin by the action of specific antibodies or sensitized white blood cells is called immunity.



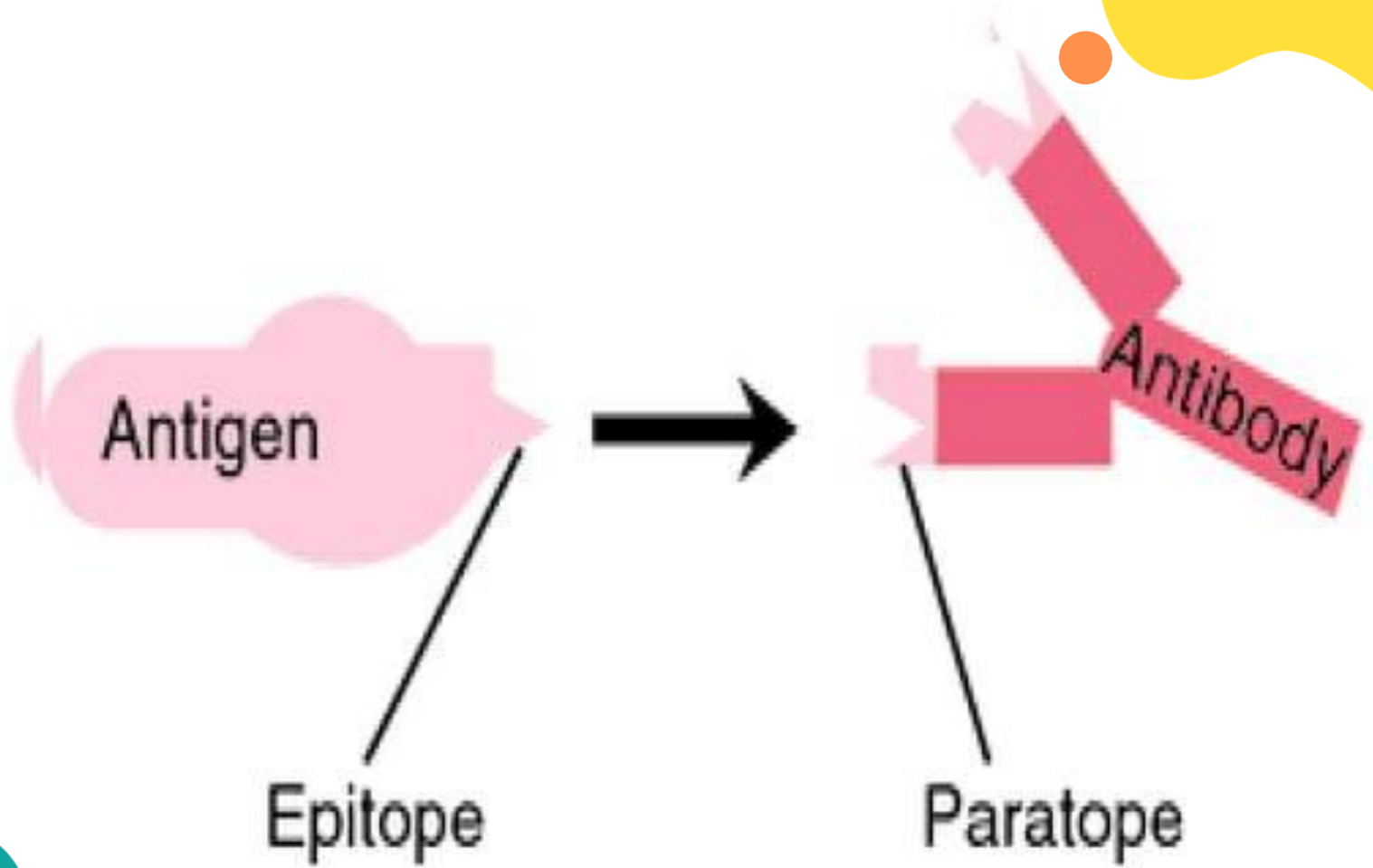


# Antigen

- ▶ An antigen is a substance which when introduced into a body evokes immune response to produce a specific antibody with which it reacts in an observable manner.
  
- ▶ It can be classified as-
  - A. Complete Antigen
  - B. Incomplete Antigen (Haptens)
  
- Complete antigens are substances which can induce antibody formation by themselves and can react specifically with these antibodies.



- ▶ Haptens are substances unable to induce antibody formation on its own but can become immunogenic (capable of inducing antibodies) when covalently linked to proteins, called carrier proteins. They can be simple or complex.
- ▶ Proantigens are low molecular weight substances which do not induce antibody formation but can cause delayed hypersensitivity reaction.
- ▶ Epitope is the smallest unit of antigenicity.
- ▶ The combining site on the antibody molecule, corresponding to the epitope is called Paratope.





# Factors of Antigenicity

- ▶ Foreignness
- ▶ Chemical nature
- ▶ Size
- ▶ Organ specificity
- ▶ Heterophile specificity
- ▶ Auto specificity
- ▶ Antigenic specificity
- ▶ Species specificity
- ▶ Susceptibility to tissue enzymes





# Superantigens

- ▶ These are molecules that can interact with antigen presenting cells and T lymphocytes in a non specific manner.
- ▶ These antigens do not involve the endocytic processing as required in typical antigen presentation.
- ▶ Viral proteins and staphylococcal enterotoxins are examples of superantigens.

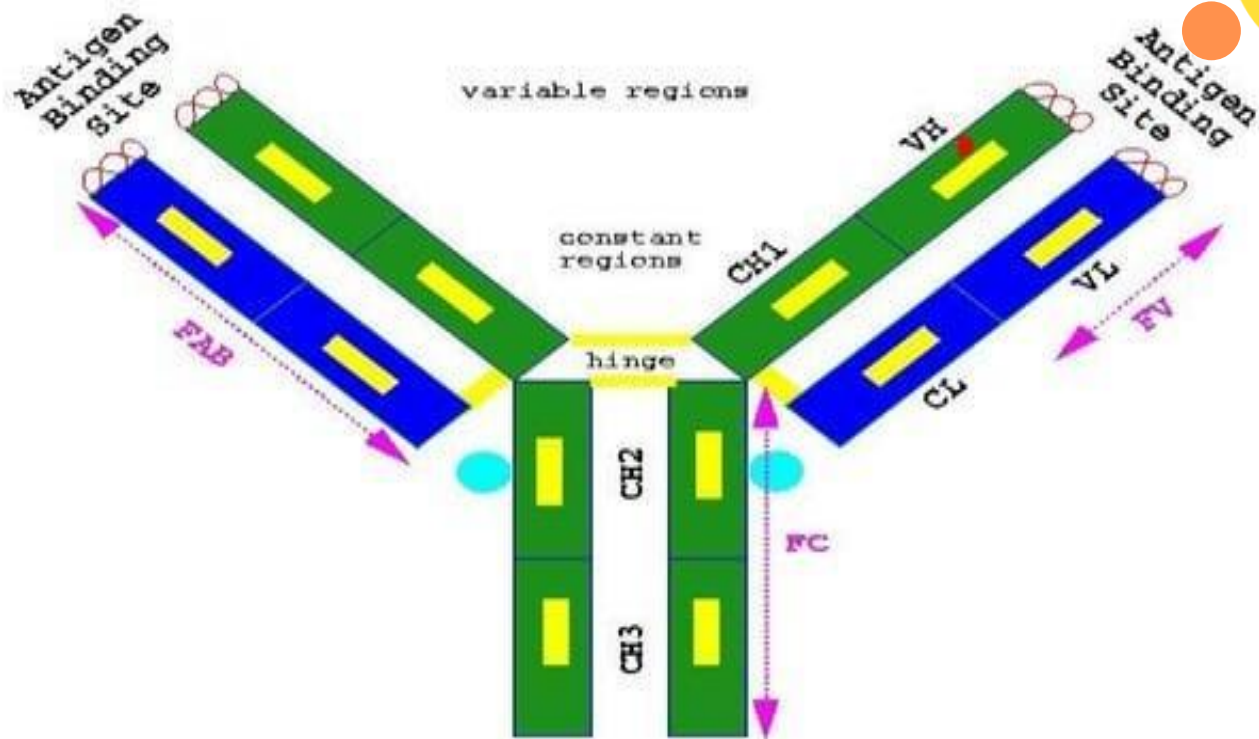


# Antibodies

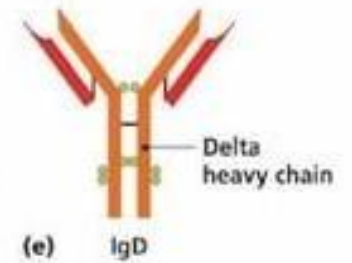
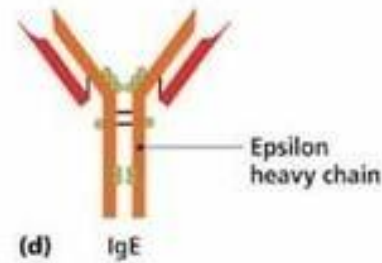
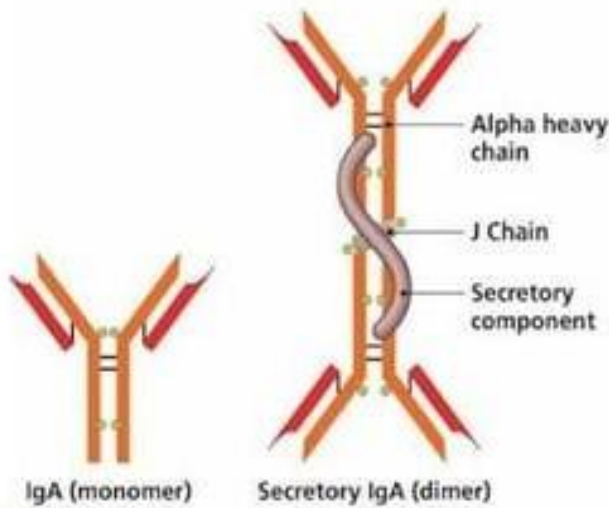
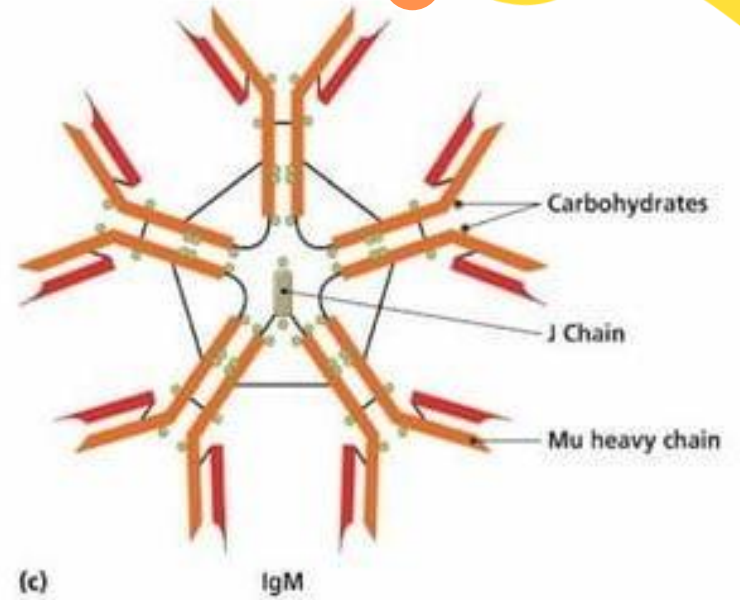
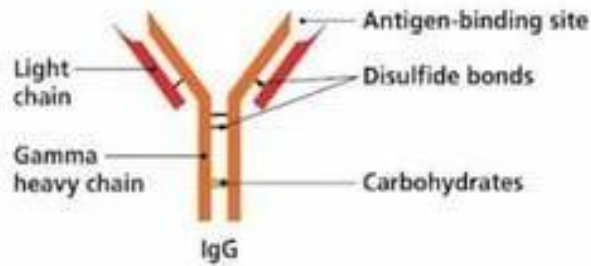
- ▶ These are substances which are formed in the serum and tissue fluids in response to an antigen and react with that antigen specifically and in some observable manner.
- ▶ Secreted by plasma cells, occur in two physical forms, a soluble form that is secreted from the cell, and a membrane-bound form that is attached to the surface of a B cell and is referred to as the B cell receptor (BCR).
- ▶ The BCR is found only on the surface of B cells and facilitates the activation of these cells and their subsequent differentiation into either antibody factories called plasma cells or memory B cells that will survive in the body and remember that same antigen so the B cells can respond faster upon future exposure



Schematic Diagram of an Immunoglobulin (IgG)



- KEY:
- Carbohydrate
  - Complementarity Determining Regions (CDRs)
  - Disulphide Bond
  - Heavy Chain
  - Light Chain





# Antigen Antibody Reaction

Its uses are

## 1. In vivo

- ▶ Forms basis of immunity against infectious diseases
- ▶ May lead to tissue injury in hypersensitivity reactions and autoimmune diseases

## 2. In vitro

- ▶ For diagnosis of infections
- ▶ Helpful in epidemiological studies
- ▶ For identification of enzymes
- ▶ Detection and quantitation of antigens or antibodies



# Characteristics

- ▶ Reaction is specific, an antigen combines only with its homologous antibody and vice versa. However cross reactions may occur due to antigenic similarity.
- ▶ Entire molecules of antigen and antibody react and not the fragments.
- ▶ Only the surface antigens participate in the antigen antibody reaction.
- ▶ The reaction is firm but reversible. The firmness of combination depends on the affinity and avidity.



# Types

- ▶ Precipitation reactions
- ▶ Agglutination
- ▶ Complement fixation test
- ▶ Neutralisation test
- ▶ Opsonisation
- ▶ Immunofluorescence
- ▶ Radioimmunoassay
- ▶ Enzyme linked immunosorbent assay
- ▶ Chemiluminescence assay
- ▶ Immunoelectronmicroscopic tests
- ▶ Immunoblotting