BHARATHIDASAN UNIVERSITY

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Programme: M.Sc., Biotechnology (Marine)

Course Title : Immunology

Course Code : 21 CC7

Unit: III
Structure and Types of Immunoglobulin

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IMMUNOGLOBULIN

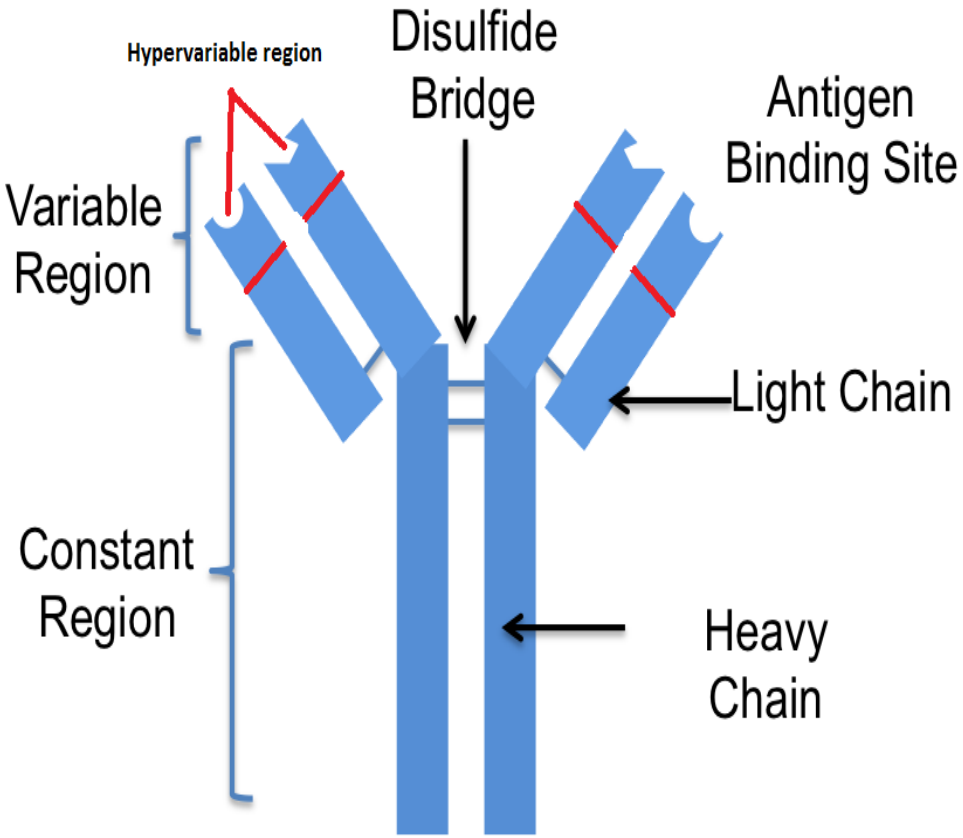
Immunoglobulins, also known as antibodies, are proteins produced by the immune system in response to the presence of foreign substances, such as bacteria, viruses, or toxins. They play a crucial role in protecting the body against infections and diseases.

Immunoglobulins can…….

- Neutralize pathogens and toxin
- Activate complement proteins to destroy pathogens
- Facilitate phagocytosis by binding to pathogens and marking them for destruction

STRUCTURE

- Immunoglobulins have a Y-shaped structure composed of four polypeptide chains:
- Two heavy chains and two light chains.
- These chains are linked by disulfide bonds, forming a structure with two antigen-binding sites at the tips of the Y, allowing for specific binding to antigens.



TYPES OF IMMUNOGLOBULIN :

There are five classes of immunoglobulins, each with distinct functions and characteristics:

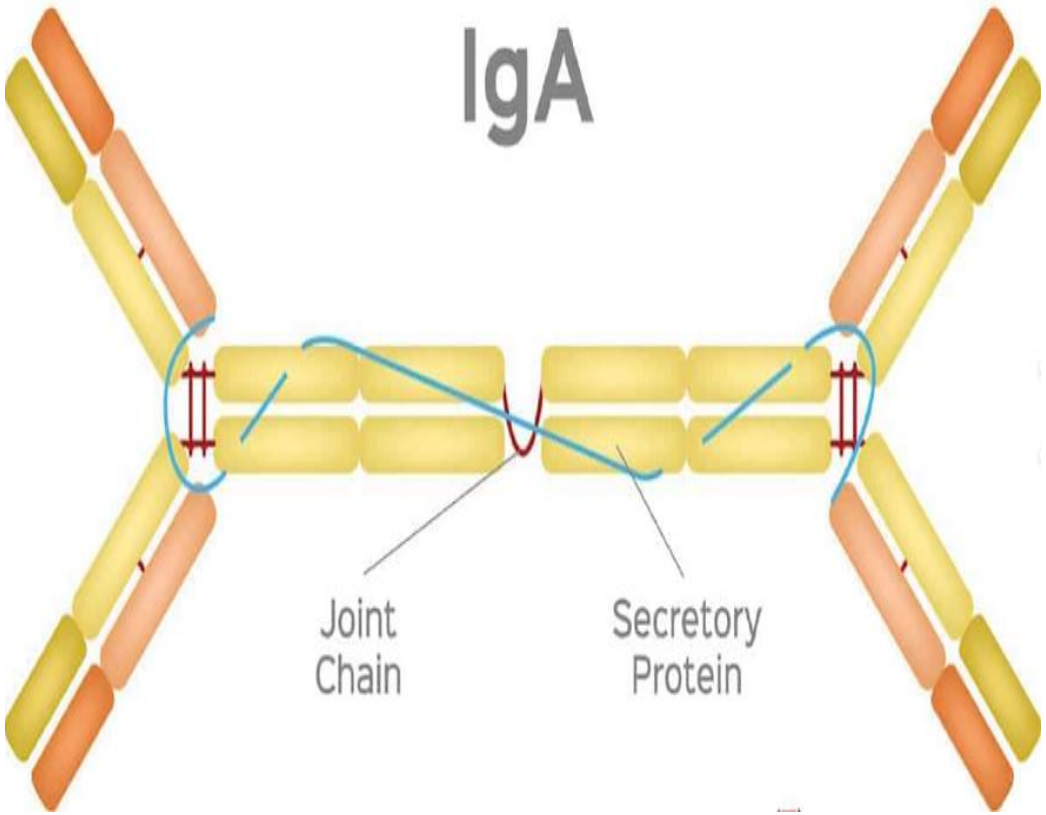
1. IgA: Found in mucosal surfaces, such as the respiratory and gastrointestinal tracts, and provides protection against pathogens that enter the body through these routes.
2. IgD: Expressed on mature B cells and plays a role in activating the immune response.
3. IgE: Involved in allergic reactions and parasitic infections.
4. IgG: The most abundant class, providing long-term immunity against infections.
5. IgM: The first antibody produced in response to an infection, providing immediate protection.

BIOLOGICAL AND CHEMICAL PROPERTIES OF IgA

- **Location**: Found predominantly in mucosal areas such as saliva, tears, and breast milk.
- **Function**: Protects mucosal surfaces by preventing pathogens from adhering and penetrating epithelial cells. Plays a crucial role in immune defense at entry points like the gastrointestinal and respiratory tracts.
- **Properties**: Exists mainly in two forms: serum IgA (monomeric) and secretory IgA (dimeric, with a secretory component).

CHEMICAL PROPERTIES

- **Glycosylation**: Contains carbohydrate chains that contribute to its stability and function.
- **Secretory Component**: In secretory IgA, the secretory component helps protect the antibody from degradation by digestive enzymes in mucosal areas.

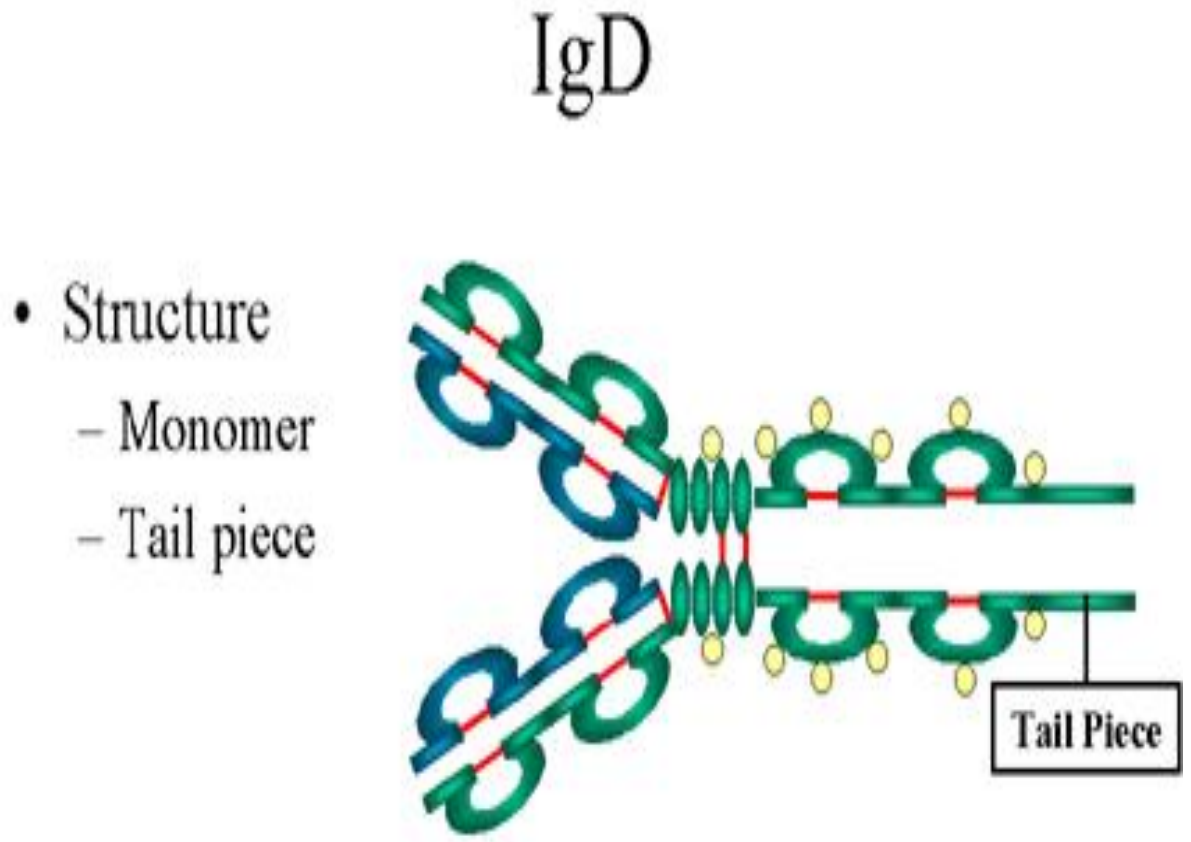


BIOLOGICAL AND CHEMICAL PROPERTIES OF IgD

- **Location**: Present on the surface of mature B cells and in the respiratory tract.
- **Function**: Involved in the initiation and regulation of immune responses by acting as a receptor for antigens on B cells.
- **Properties**: Low concentration in the blood; primarily acts in antigen recognition and B cell activation.

CHEMICAL PROPERTIES

- **Glycosylation**: Similar to other immunoglobulins, IgD is glycosylated, but its glycosylation pattern is less well-studied.
- **Heat Stability**: Generally, more sensitive to heat compared to IgG.

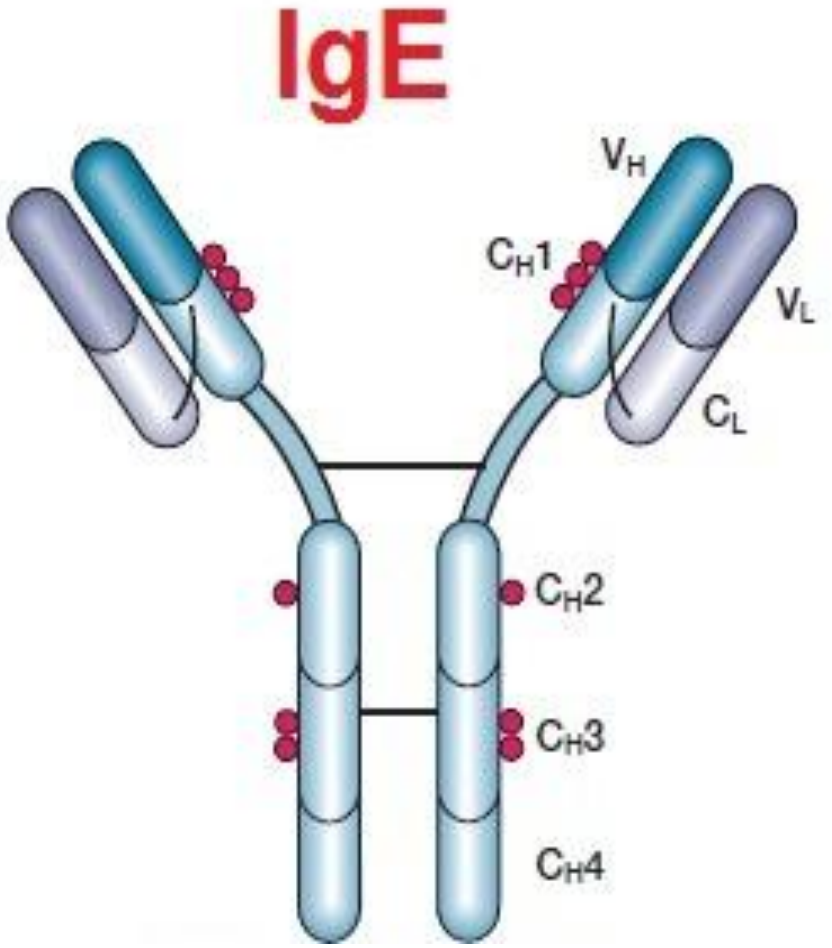


BIOLOGICAL AND CHEMICAL PROPERTIES OF IgE

- **Location**: Bound to the surface of mast cells and basophils, and present in small amounts in the blood.
- **Function**: Plays a key role in allergic reactions and defense against parasitic infections. Binds to allergens, triggering histamine release and other inflammatory responses.
- **Properties**: Elevated levels are associated with allergies and asthma. Responsible for hypersensitivity reactions.

CHEMICAL PROPERTIES

- **Glycosylation**: Highly glycosylated, which affects its ability to bind to Fc receptors on mast cells and basophils.
- **Affinity**: Has a high affinity for Fc receptors on mast cells and basophils, crucial for its role in allergic reactions.

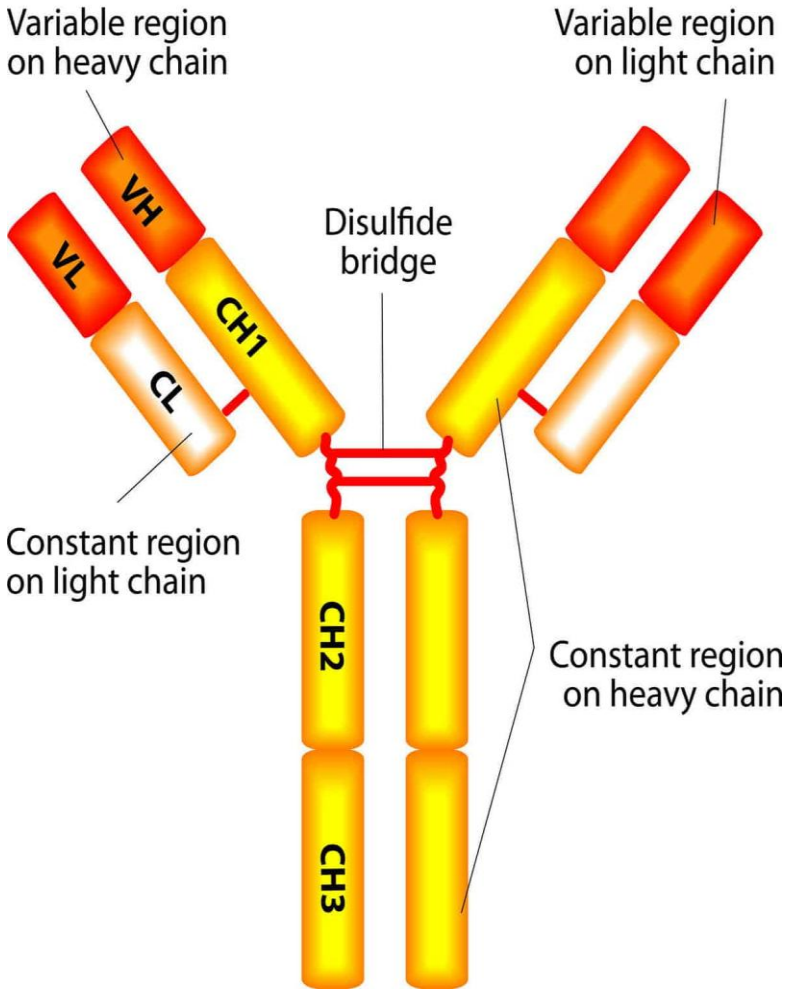


BIOLOGICAL AND CHEMICAL PROPERTIES OF IgG

- **Location**: The most abundant immunoglobulin in the blood and extracellular fluid.
- **Function**: Provides long-term immunity by neutralizing toxins, opsonizing pathogens for phagocytosis, and activating the complement system. It can cross the placenta, providing passive immunity to the fetus.
- **Properties**: Exists in four subclasses (IgG1, IgG2, IgG3, IgG4), each with distinct roles in immune defense and different complement activation abilities.

CHEMICAL PROPERTIES

- **Glycosylation**: IgG is heavily glycosylated, which affects its stability, half-life, and interactions with Fc receptors and the complement system.
- **Stability**: IgG is more stable than other immunoglobulins and has a long half-life in the bloodstream due to its ability to be recycled via the neonatal Fc receptor (FcRn).



BIOLOGICAL AND CHEMICAL PROPERTIES OF IgM

- **Location**: Found primarily in the blood and lymphatic fluid.
- **Function**: The first antibody produced in response to an infection. Effective in forming antigen-antibody complexes and initiating the complement cascade, leading to the destruction of pathogens.
- **Properties**: Exists mainly as a pentamer (five monomers linked together), making it highly effective in agglutinating antigens and activating complement pathways.

CHEMICAL PROPERTIES

- **Glycosylation**: Less glycosylated compared to IgG, with more complex glycan structures in its pentameric form.
- **Agglutination**: Its large size and pentameric structure make it highly effective in agglutinating antigens and activating the complement system.