

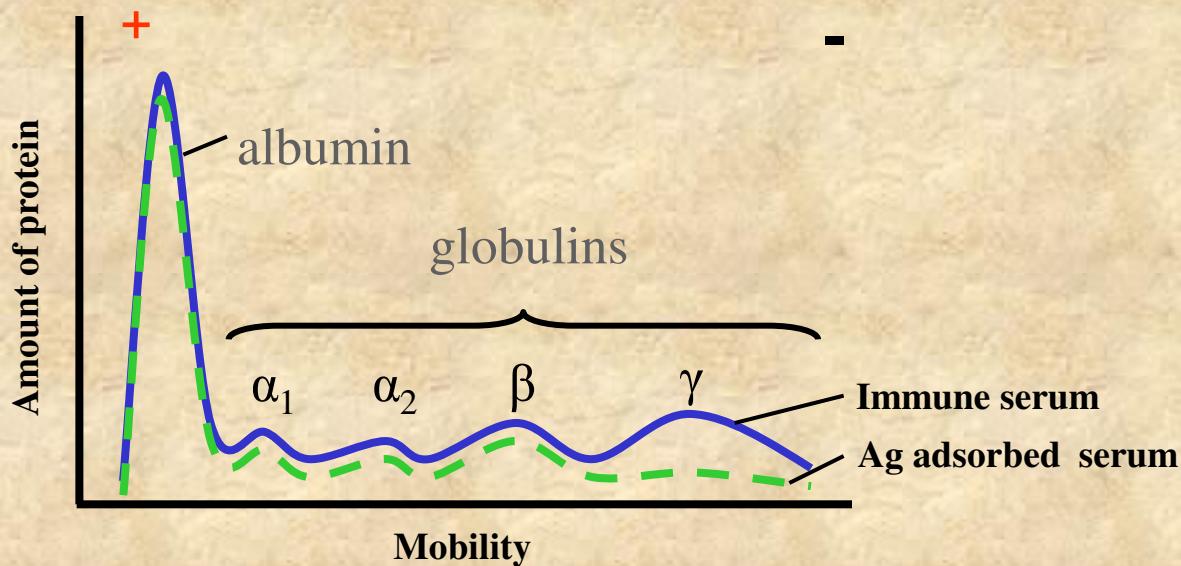
Immunoglobulins

Structure and Function

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Immunoglobulins: Structure and Function

- Definition: Glycoprotein molecules that are produced by plasma cells in response to an immunogen and which function as antibodies



General Functions of Immunoglobulins

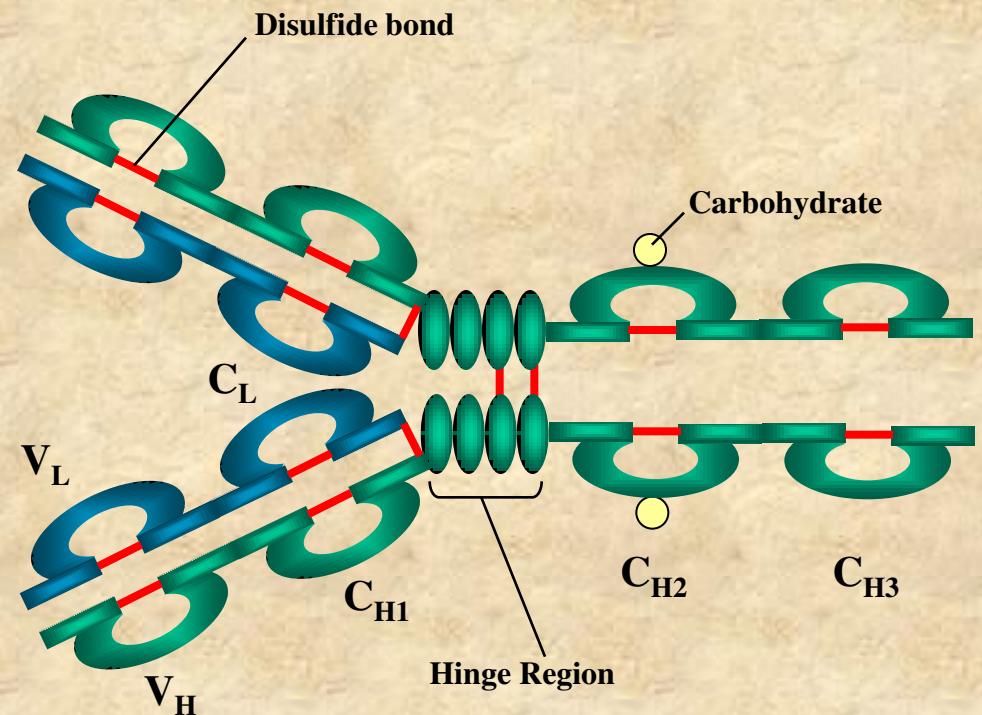
- Ag binding
 - Can result in protection
 - Valence
- Effector functions (Usually require Ag binding)
 - Fixation of complement
 - Binding to various cells

Basic Immunoglobulin Structure

- Immunoglobulins - heterogeneous
- Myeloma proteins - homogeneous immunoglobulins

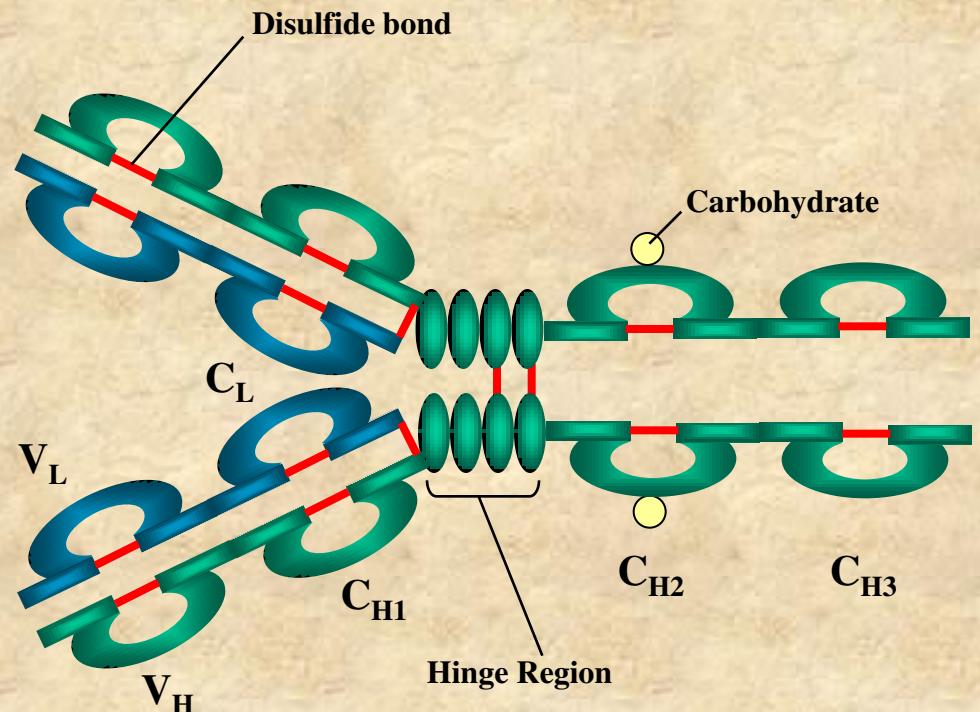
Immunoglobulin Structure

- Heavy & Light Chains
- Disulfide bonds
 - Inter-chain
 - Intra-chain



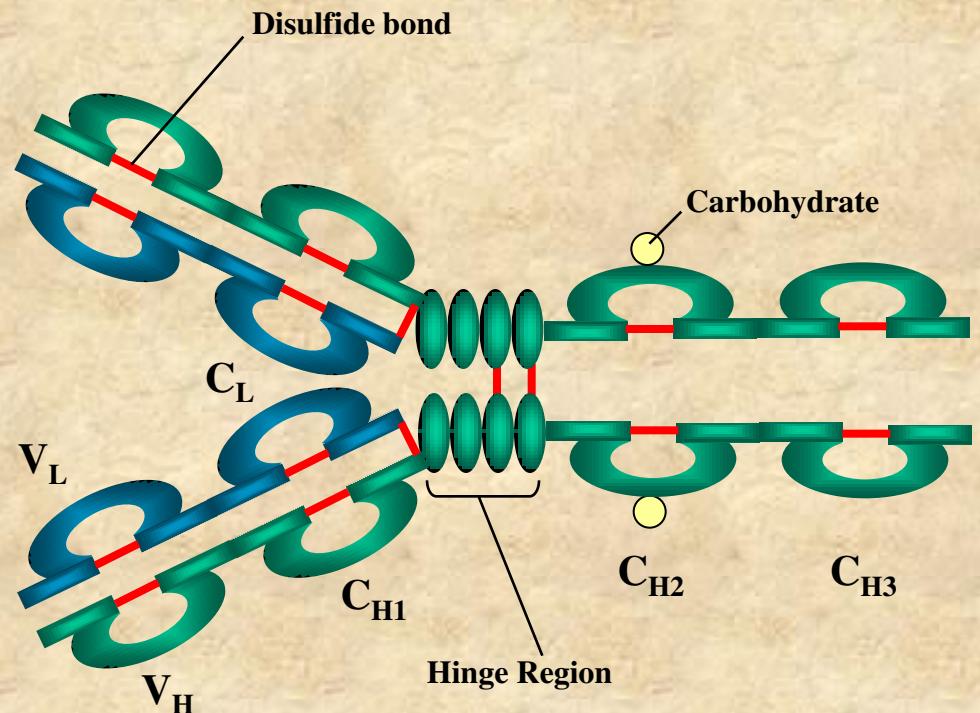
Immunoglobulin Structure

- Variable & Constant Regions
 - V_L & C_L
 - V_H & C_H
- Hinge Region

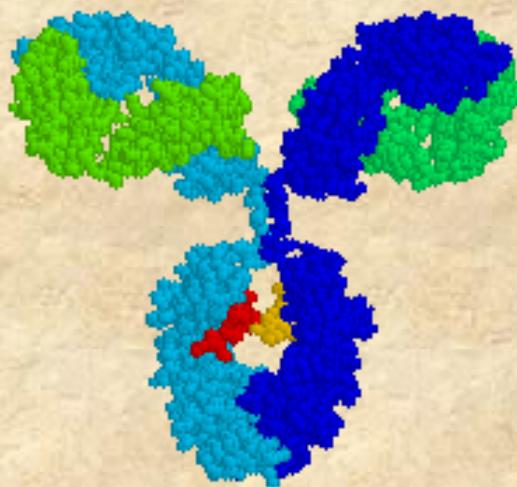


Immunoglobulin Structure

- Domains
 - V_L & C_L
 - V_H & C_{H1} - C_{H3}
(or C_{H4})
- Oligosaccharides



IgG molecule

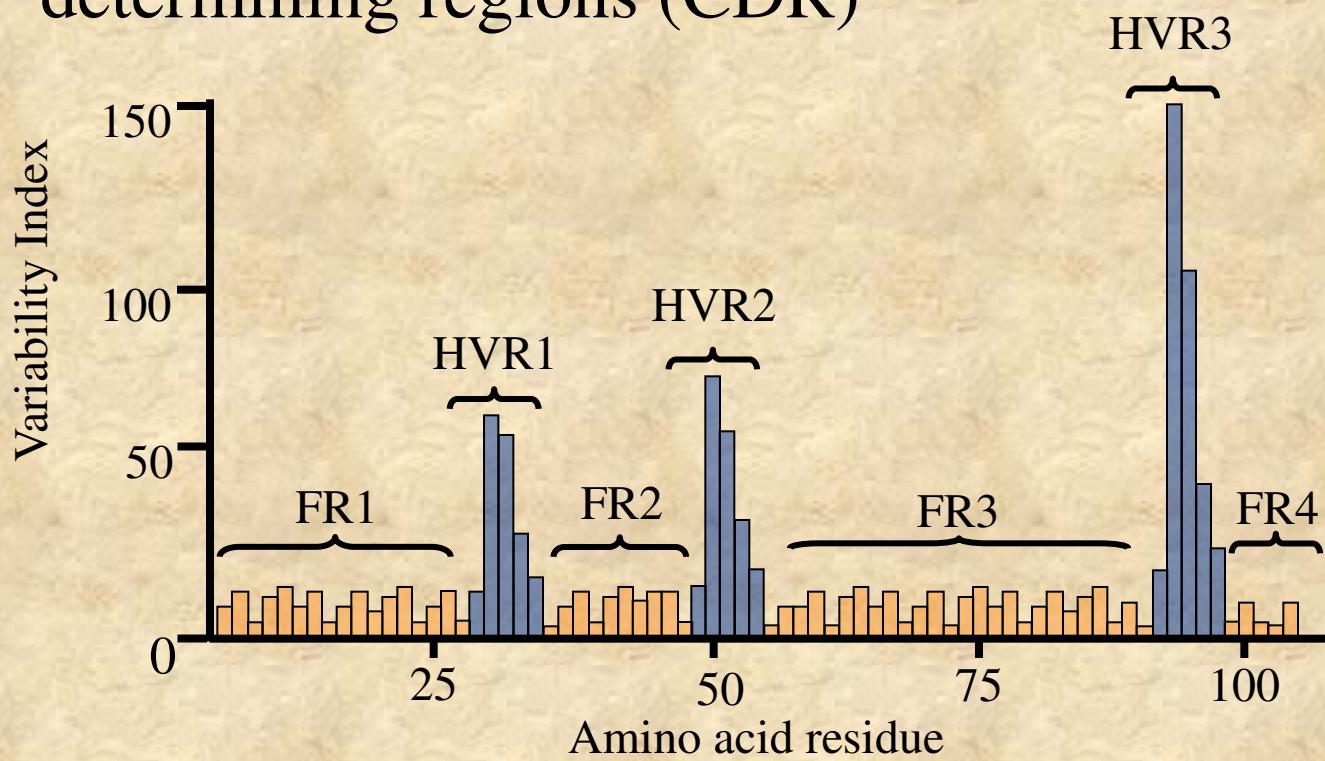


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Structure of the Variable Region

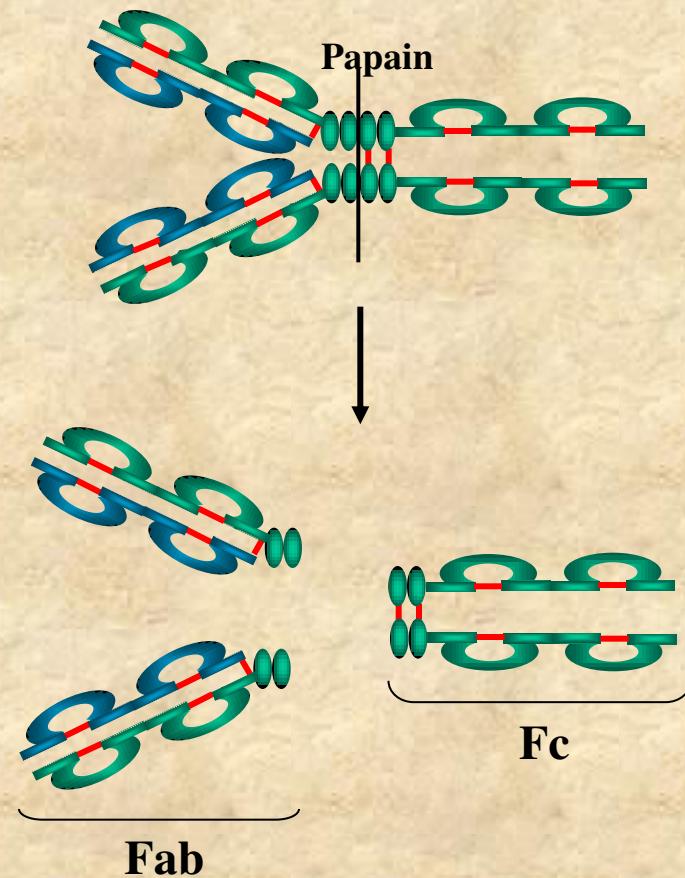
- Hypervariable (HVR) or complementarity determining regions (CDR)



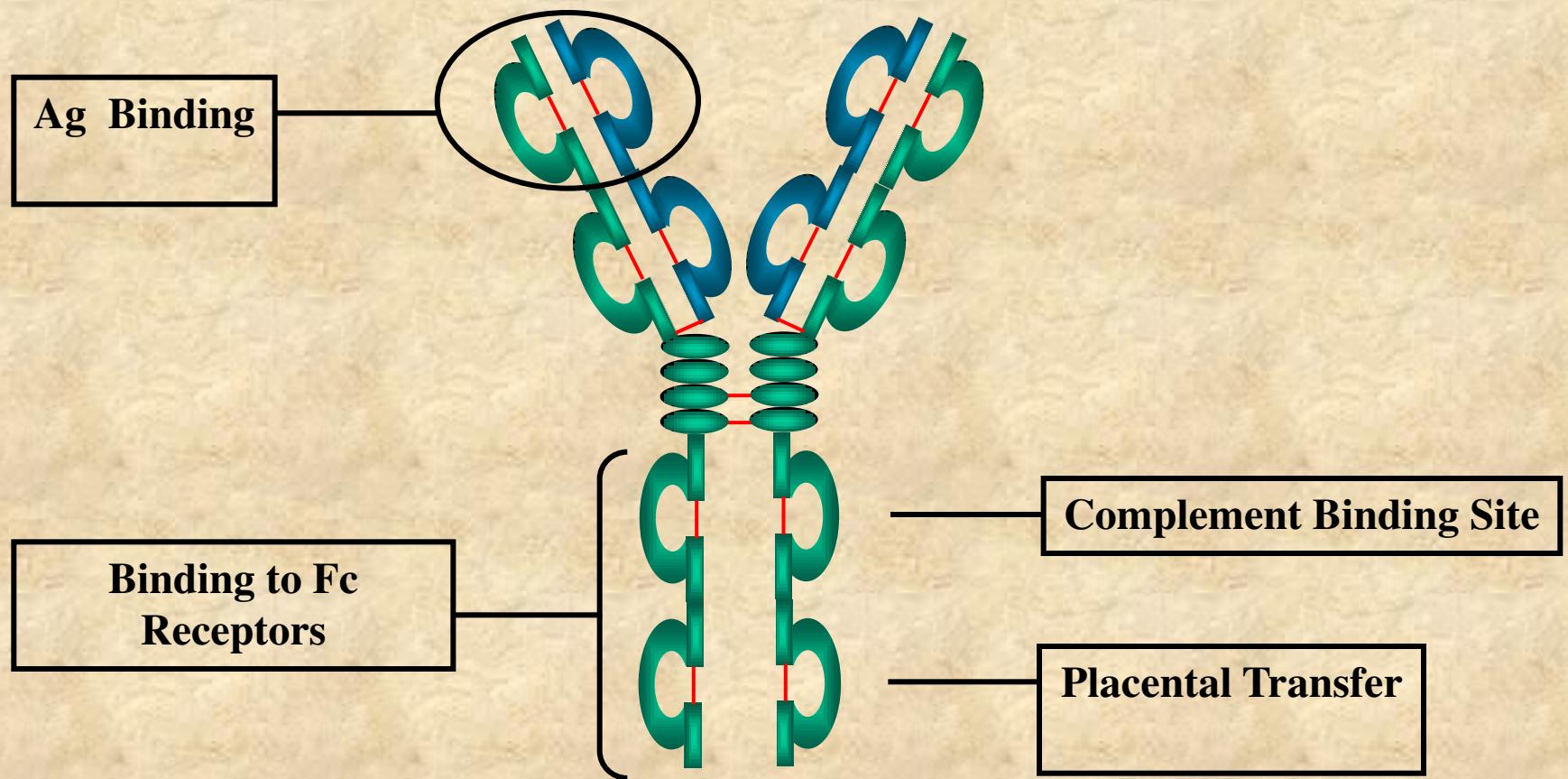
- Framework regions

Immunoglobulin Fragments: Structure/Function Relationships

- Fab
 - Ag binding
 - Valence = 1
 - Specificity determined by V_H and V_L
- Fc
 - Effector functions

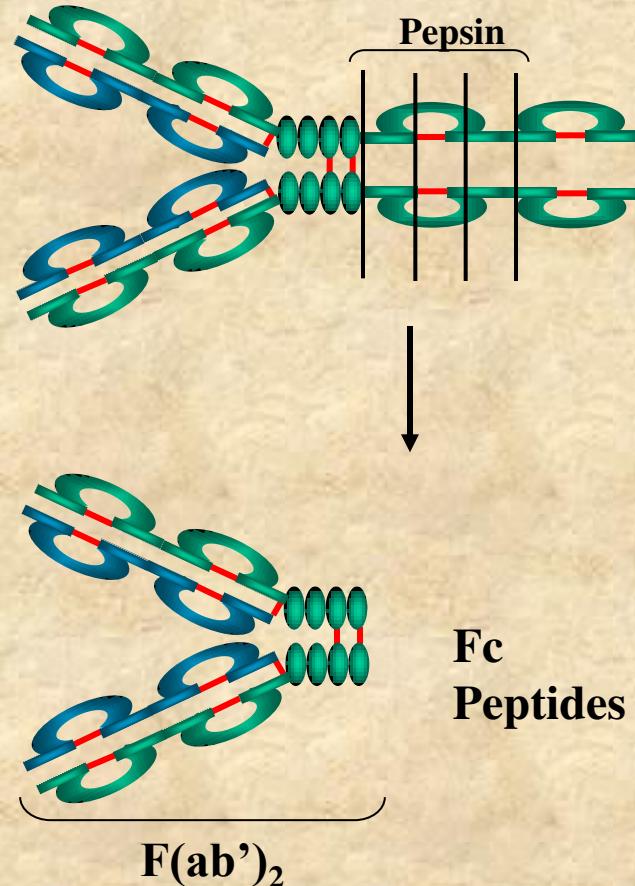


Immunoglobulin Fragments: Structure/Function Relationships



Immunoglobulin Fragments: Structure/Function Relationships

- Fab
 - Ag binding
- Fc
 - Effector functions
- $F(ab')_2$



Human Immunoglobulin Classes

- IgG - Gamma (γ) heavy chains
- IgM - Mu (μ) heavy chains
- IgA - Alpha (α) heavy chains
- IgD - Delta (δ) heavy chains
- IgE - Epsilon (ε) heavy chains

Human Immunoglobulin Subclasses

- IgG Subclasses
 - IgG1 - Gamma 1 ($\gamma 1$) heavy chains
 - IgG2 - Gamma 2 ($\gamma 2$) heavy chains
 - IgG3 - Gamma 3 ($\gamma 3$) heavy chains
 - IgG4 - Gamma 4 ($\gamma 4$) heavy chains
- IgA subclasses
 - IgA1 - Alpha 1 ($\alpha 1$) heavy chains
 - IgA2 - Alpha 2 ($\alpha 2$) heavy chains

Human Immunoglobulin Light Chain Types

- Kappa (κ)
- Lambda (λ)

Human Immunoglobulin Light Chain Subtypes

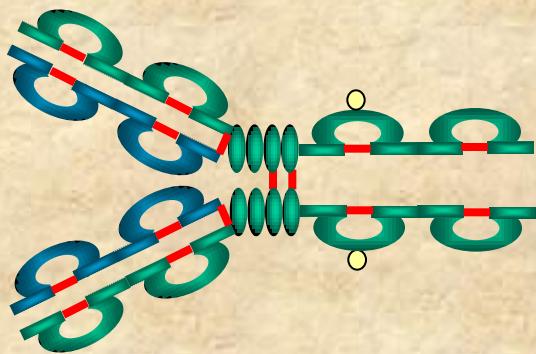
- Lambda light chains
 - Lambda 1 ($\lambda 1$)
 - Lambda 2 ($\lambda 2$)
 - Lambda 3 ($\lambda 3$)
 - Lambda 4 ($\lambda 4$)

Immunoglobulins

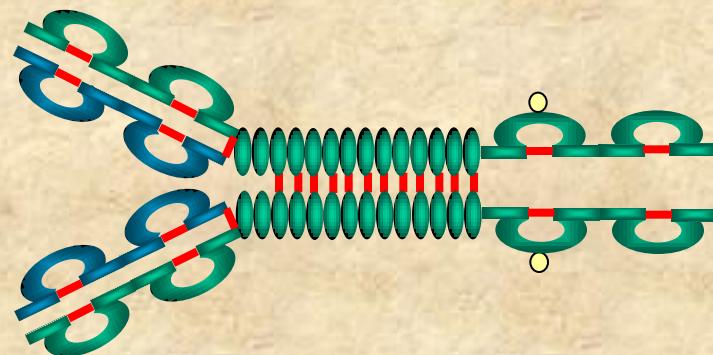
- Nomenclature
 - IgM (kappa)
 - IgA1(lambda 2)
 - IgG
- Heterogeneity

IgG

- Structure
 - Monomer (7S)



IgG1, IgG2 and IgG4



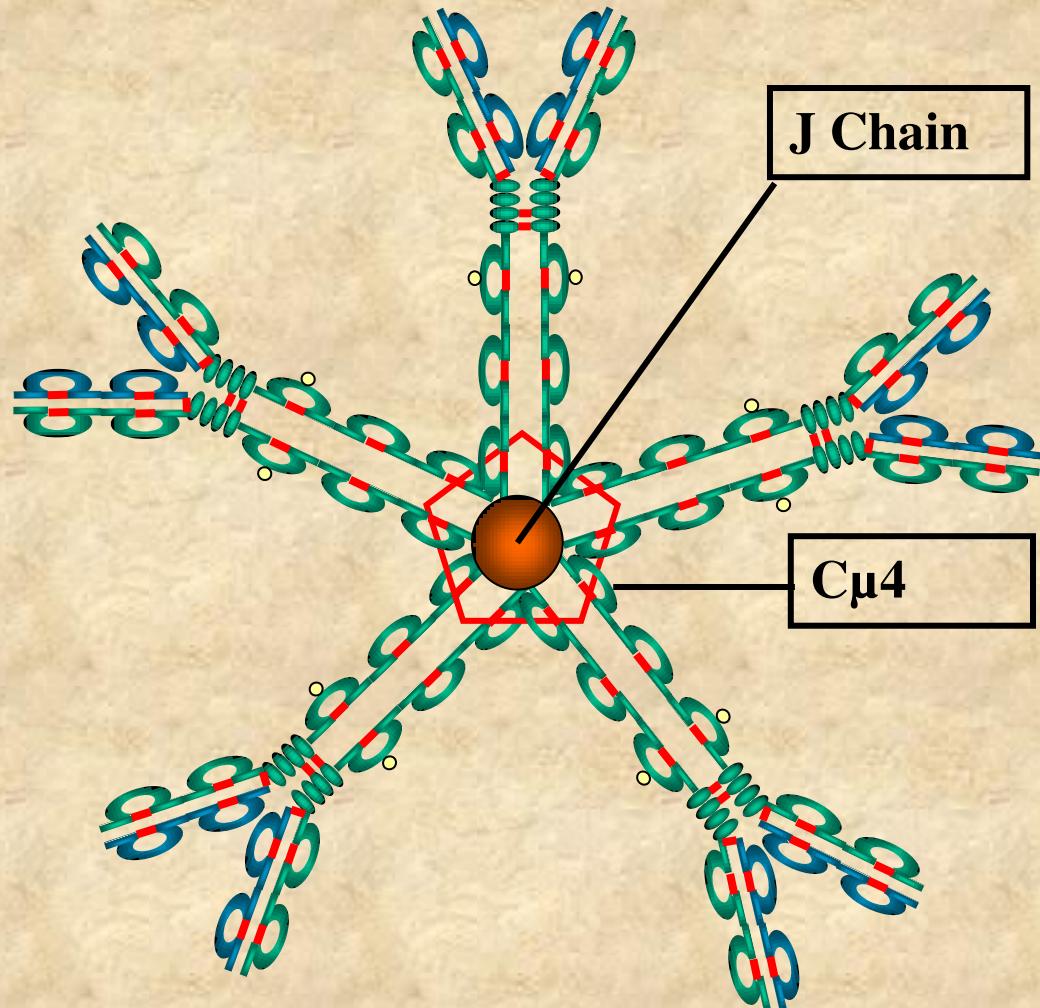
IgG3

IgG

- Structure
- Properties
 - Major serum Ig (systemic immunity)
 - Major Ig in extravascular spaces
 - Placental transfer – Does not require Ag binding (\pm IgG2)
 - Fixes complement (\pm IgG4)
 - Binds to Fc receptors (\pm IgG2, IgG4)
 - Phagocytes - opsonization
 - K cells - ADCC

IgM

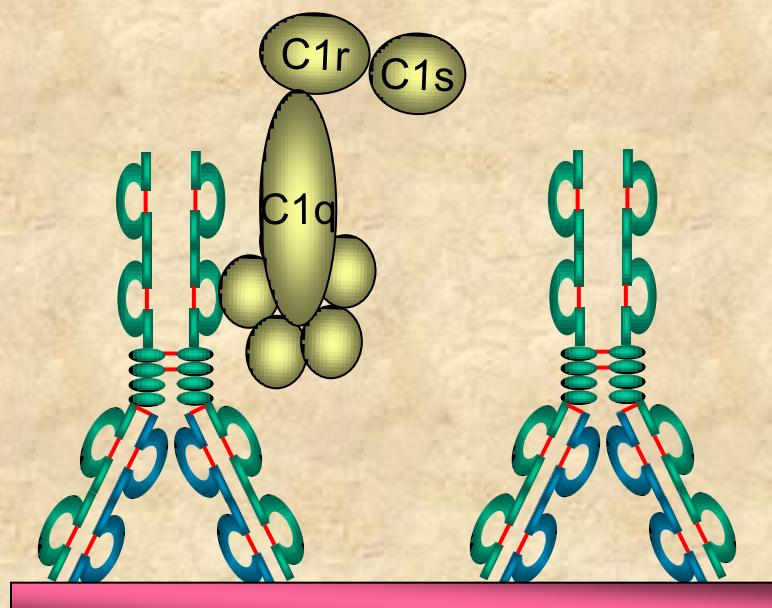
- Structure
 - Pentamer (19S)
 - Extra domain (C_{H4})
 - J chain



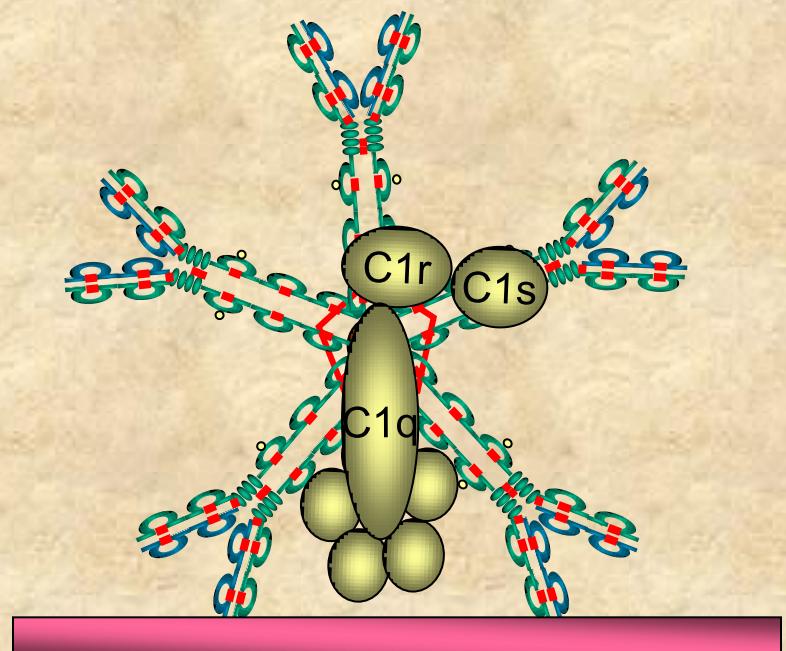
IgM

- Structure
- Properties
 - 3rd highest serum Ig
 - First Ig made by fetus and B cells
 - Fixes complement

Fixation of C1 by IgG and IgM Abs



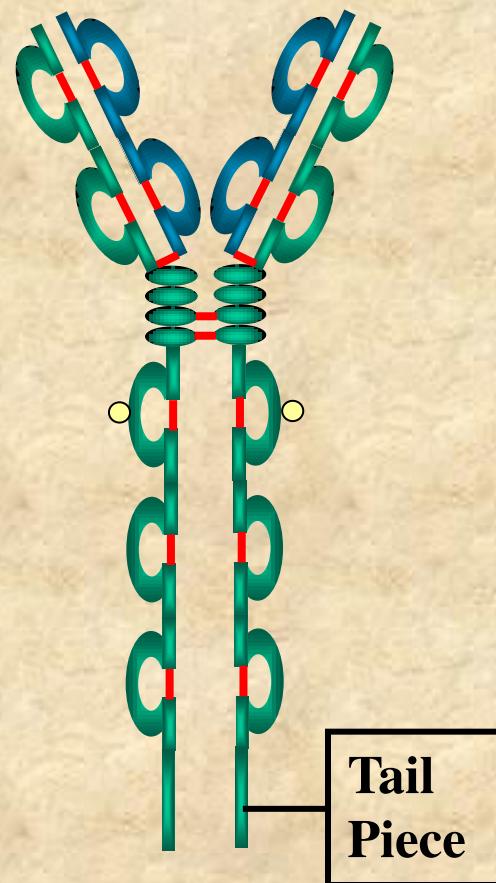
No activation



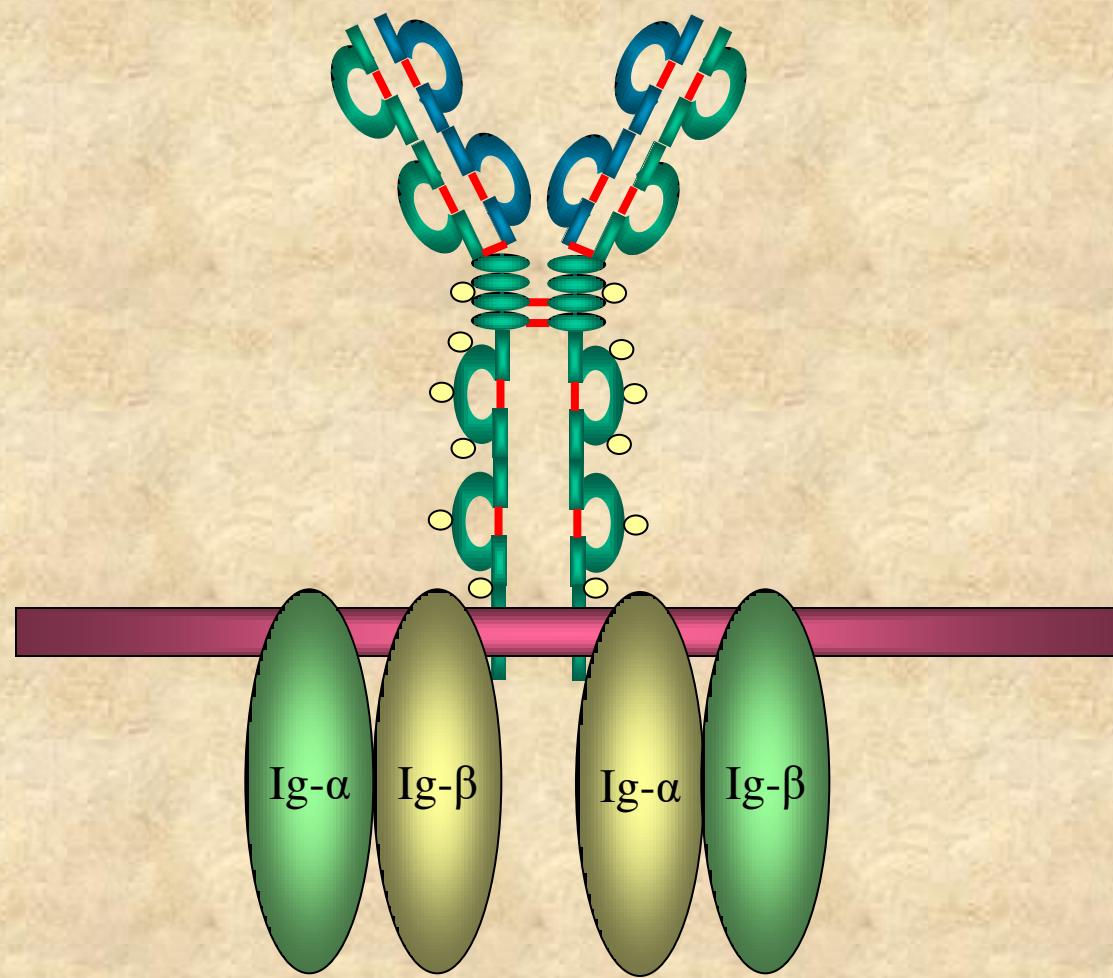
Activation

IgM

- Structure
- Properties
 - 3rd highest serum Ig
 - First Ig made by fetus and B cells
 - Fixes complement
 - Agglutinating Ig
 - Binds to Fc receptors
 - B cell surface Ig

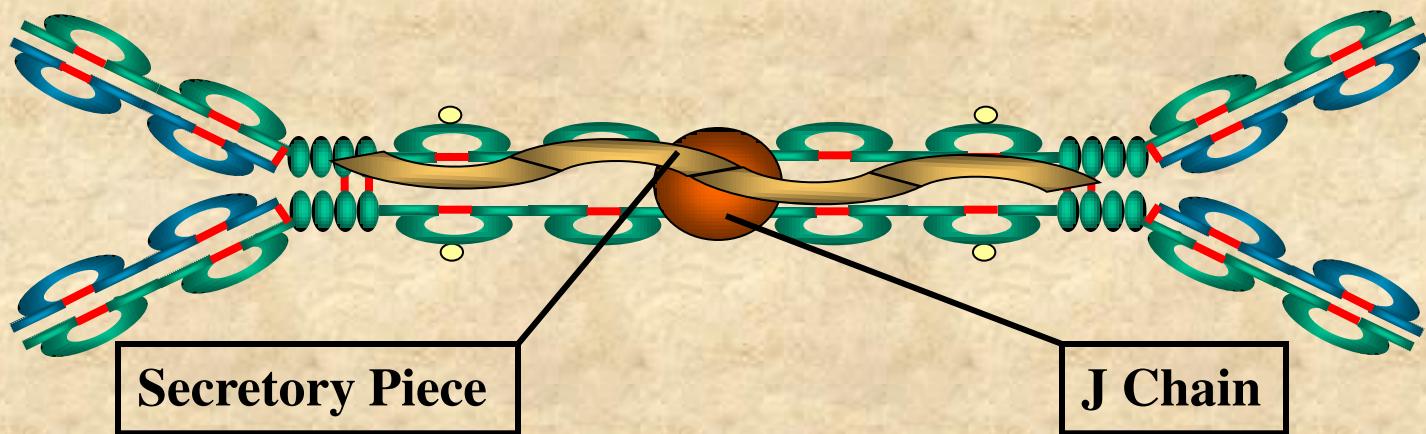


B Cell Antigen Receptor (BcR)

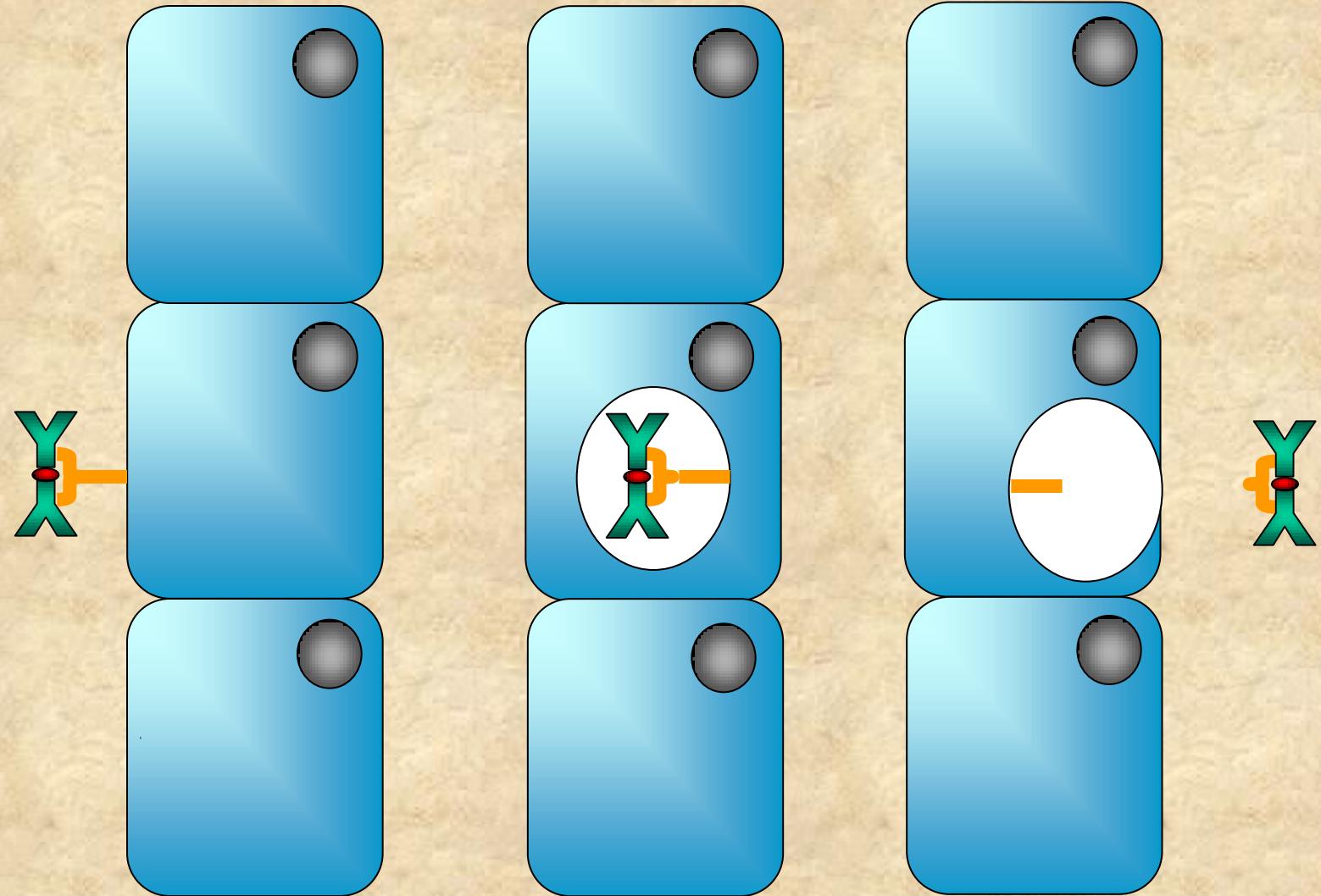


IgA

- Structure
 - Serum - monomer
 - Secretions (sIgA)
 - Dimer (11S)
 - J chain
 - Secretory component



Origin of Secretory Component of sIgA

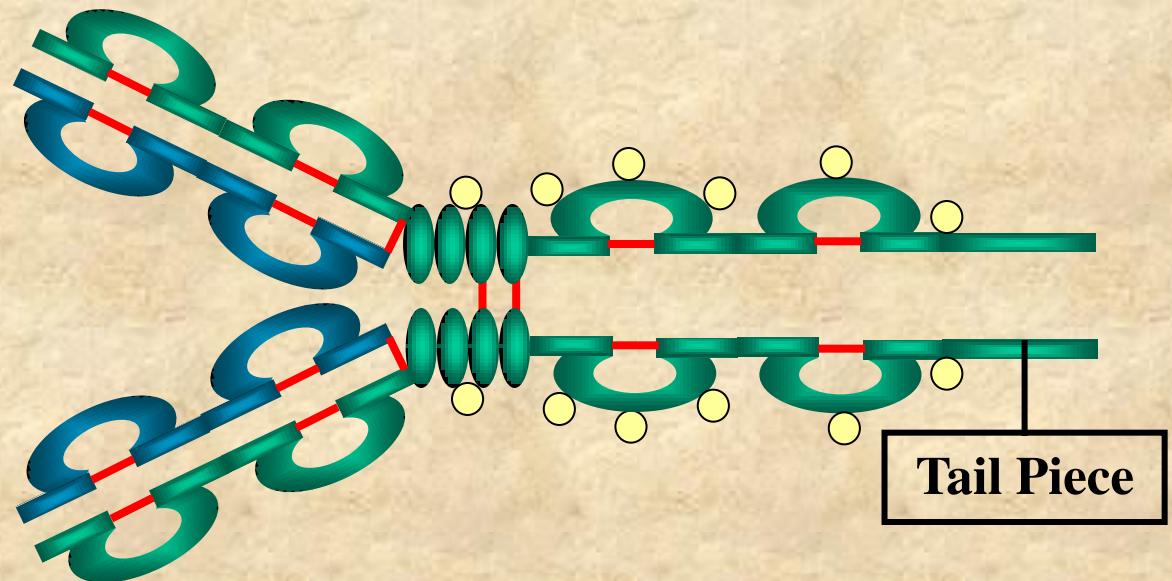


IgA

- Structure
- Properties
 - 2nd highest serum Ig
 - Major secretory Ig (Mucosal or Local Immunity)
 - Tears, saliva, gastric and pulmonary secretions
 - Does not fix complement (unless aggregated)
 - Binds to Fc receptors on some cells

IgD

- Structure
 - Monomer
 - Tail piece

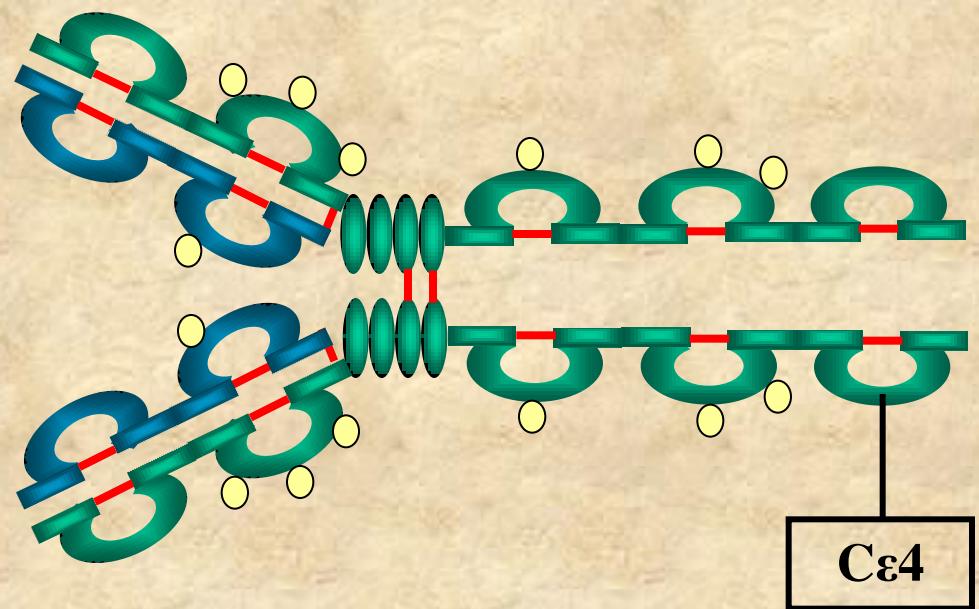


IgD

- Structure
- Properties
 - 4th highest serum Ig
 - B cell surface Ig
 - Does not bind complement

IgE

- Structure
 - Monomer
 - Extra domain (C_{H4})



IgE

- Structure
- Properties
 - Least common serum Ig
 - Binds to basophils and mast cells (Does not require Ag binding)
 - Allergic reactions
 - Parasitic infections (Helminths)
 - Binds to Fc receptor on eosinophils
 - Does not fix complement