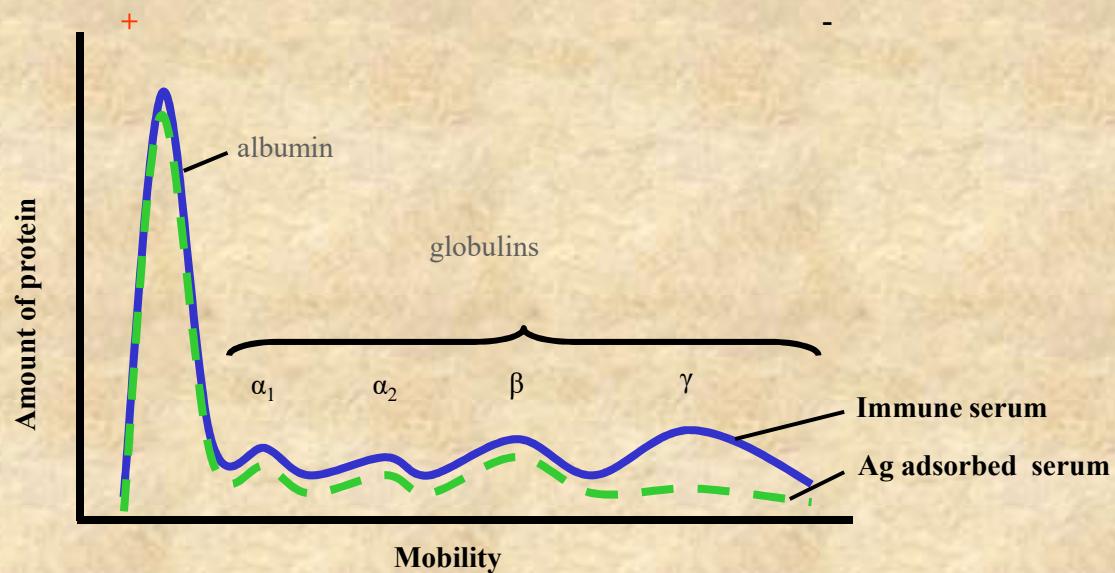


Immunoglobulins: Structure and Function

Immunoglobulin: Structure and Function

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

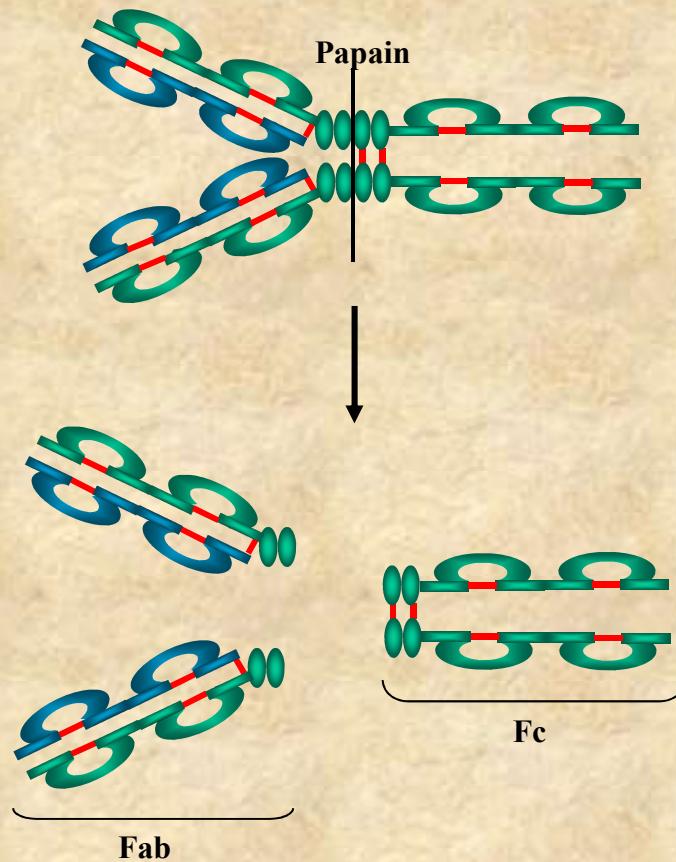


General Functions of Immunoglobulins

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

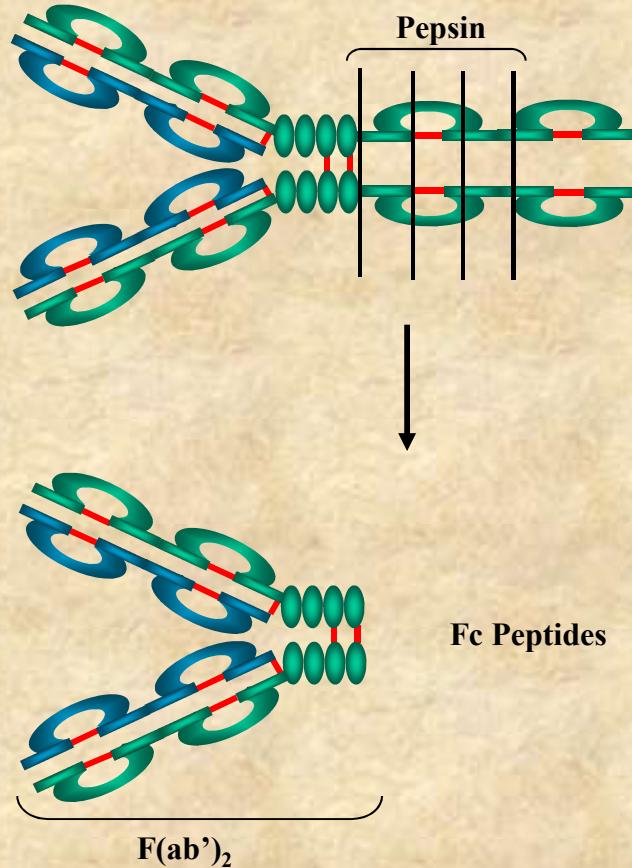
Immunoglobulin Fragments: Structure/Function Relationships

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



Immunoglobulin Fragments: Structure/Function Relationships

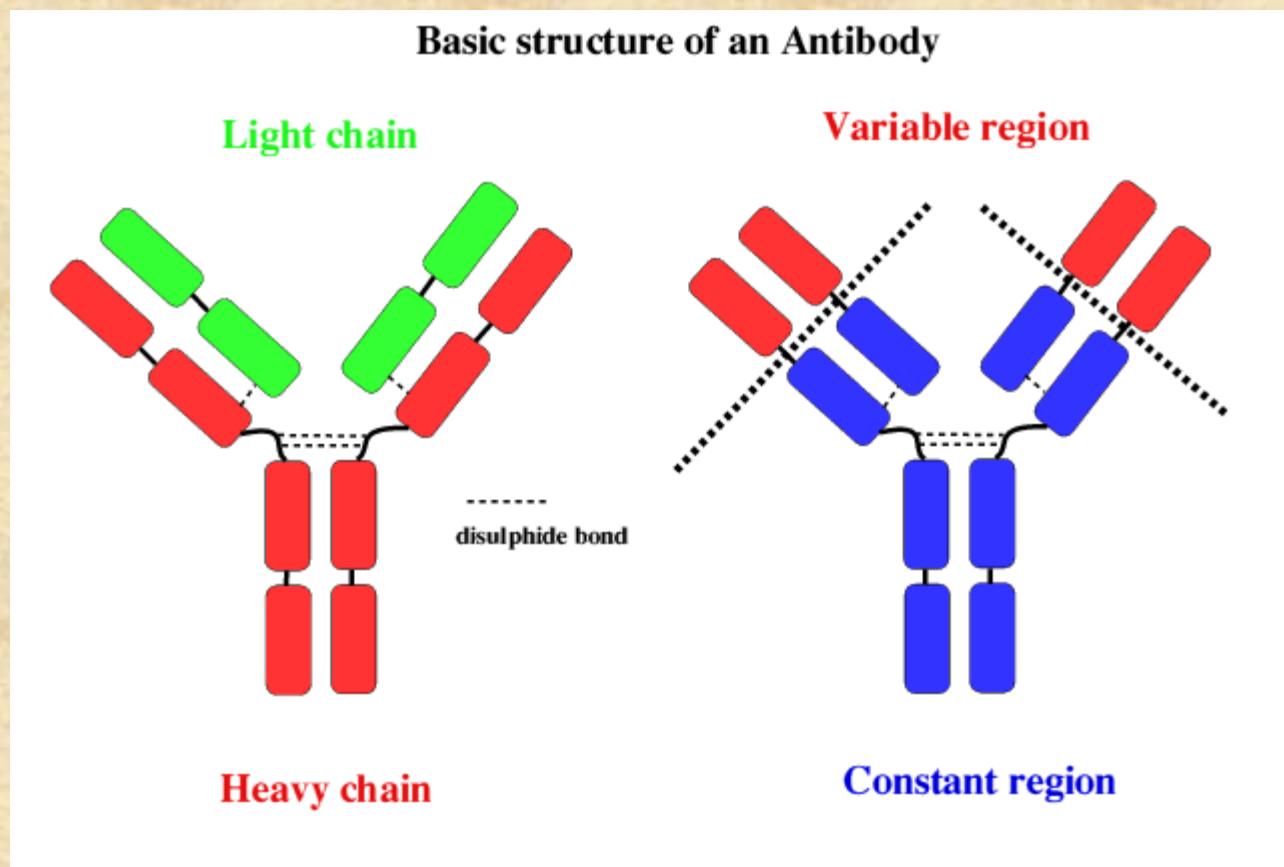
- Fab
 - Ag binding
- Fc
 - Effector functions
- $F(ab')_2$



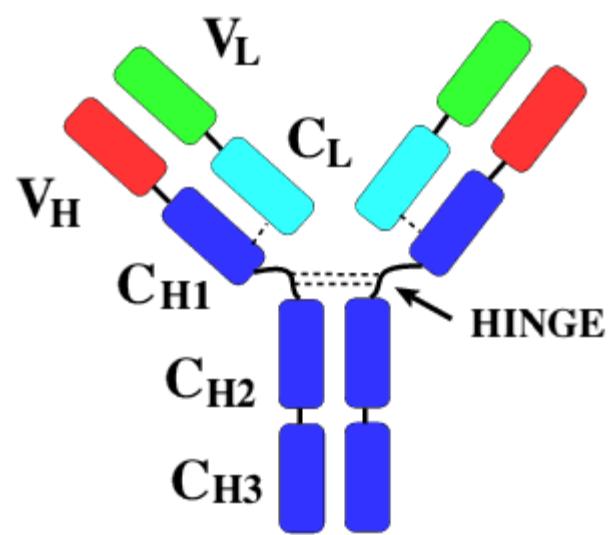
Basic Immunoglobulin Structure

- Immunoglobulins - heterogeneous
- Myeloma proteins - homogeneous immunoglobulins

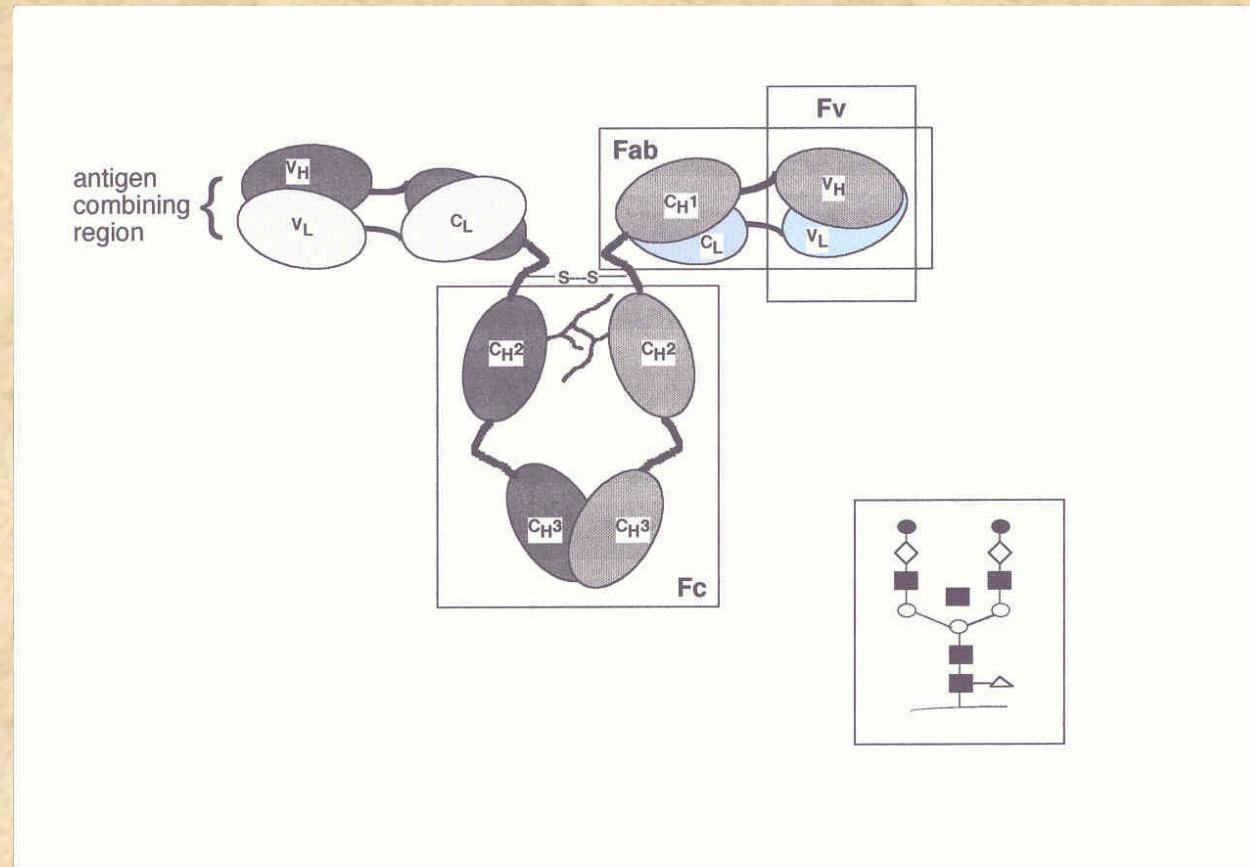
Immunoglobulin Structure



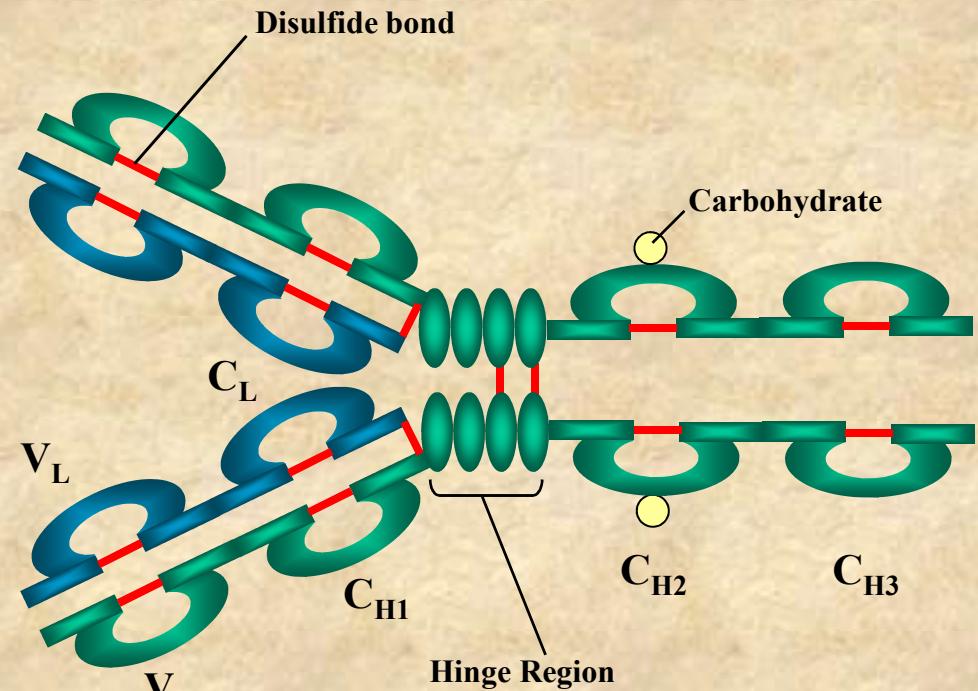
ANTIBODY DOMAIN STRUCTURE



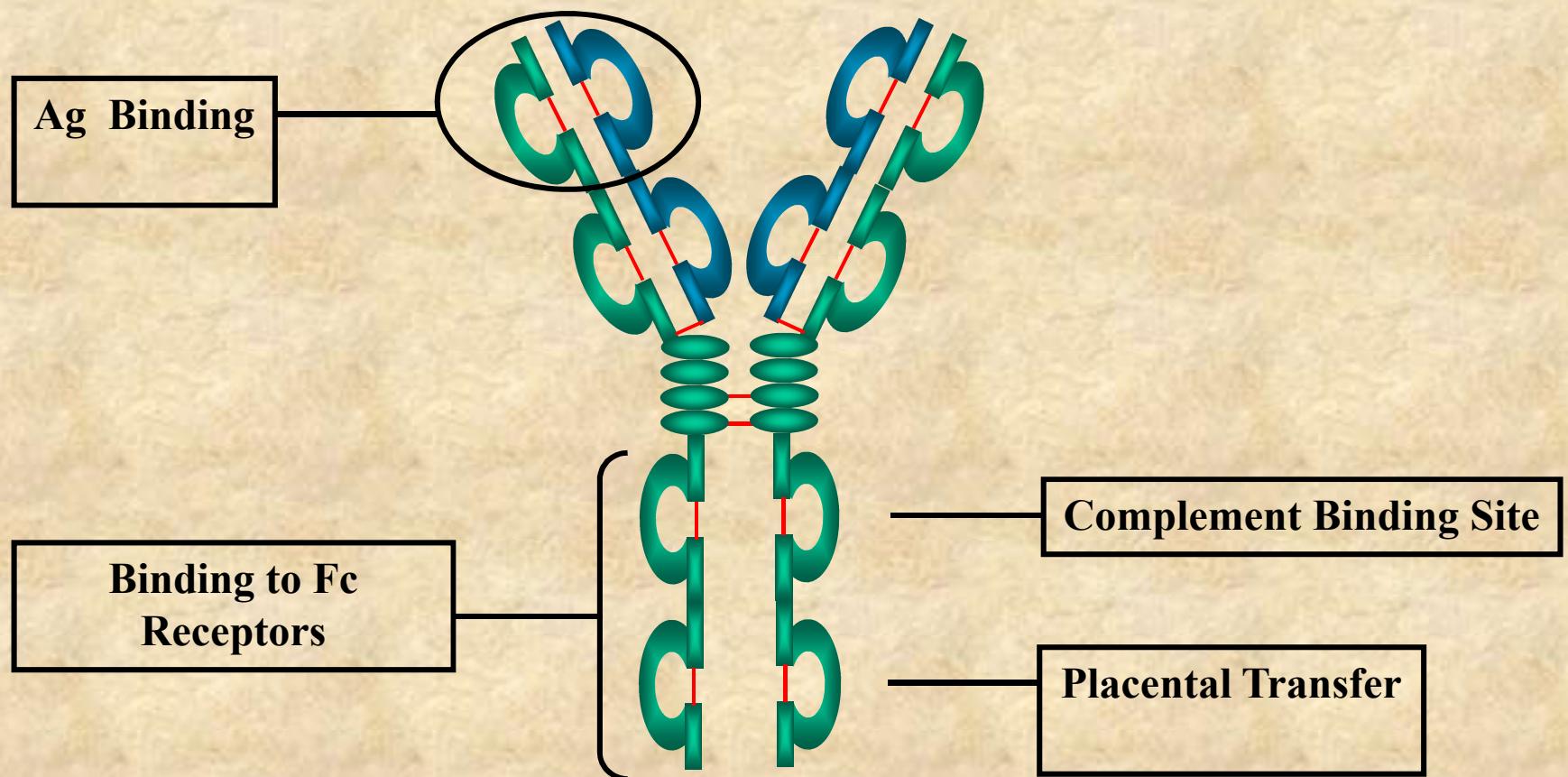
- Immunoglobulin domains
 - each chain has about 110 amino acids
 - intrachain disulfide bonds
 - Discrete compactly folded region
- 4 (or 5) in heavy chain, 2 in light chain.
- Both heavy and light chains have
 - 1 variable domain at the N-terminus
- Chains held together by
 - disulfide bonds
 - noncovalent interactions



- Heavy & Light Chains
- Disulfide bonds
 - Inter-chain
 - Intra-chain
- Variable & Constant Regions
 - V_L & C_L
 - V_H & C_H
- Hinge Region
- Domains
 - V_L & C_L
 - V_H & C_{H1} - C_{H3}
(or C_{H4})
- Oligosaccharides



Immunoglobulin Fragments: Structure/Function Relationships



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

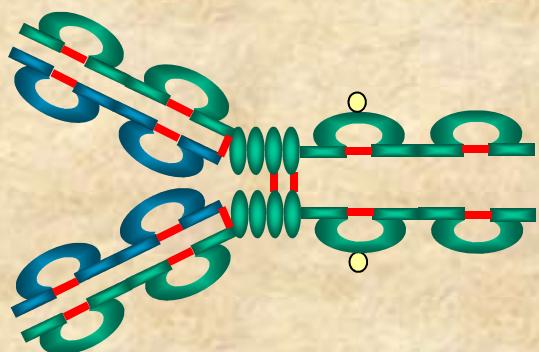
- Kappa (κ)
- Lambda (λ)

Human Immunoglobulin Light Chain Subtypes

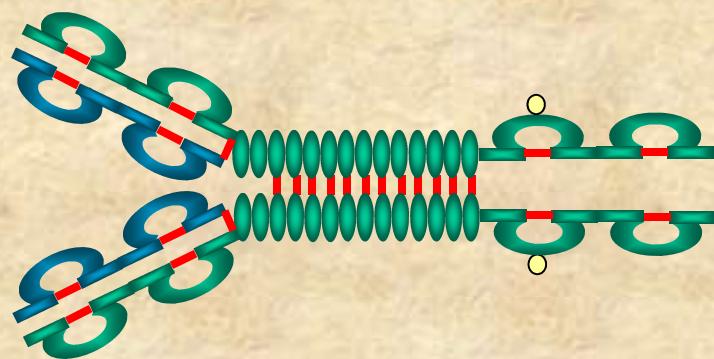
- Lambda light chains
 - Lambda 1 ($\lambda 1$)
 - Lambda 2 ($\lambda 2$)
 - Lambda 3 ($\lambda 3$)
 - Lambda 4 ($\lambda 4$)

IgG

- Structure
 - Monomer (7S)



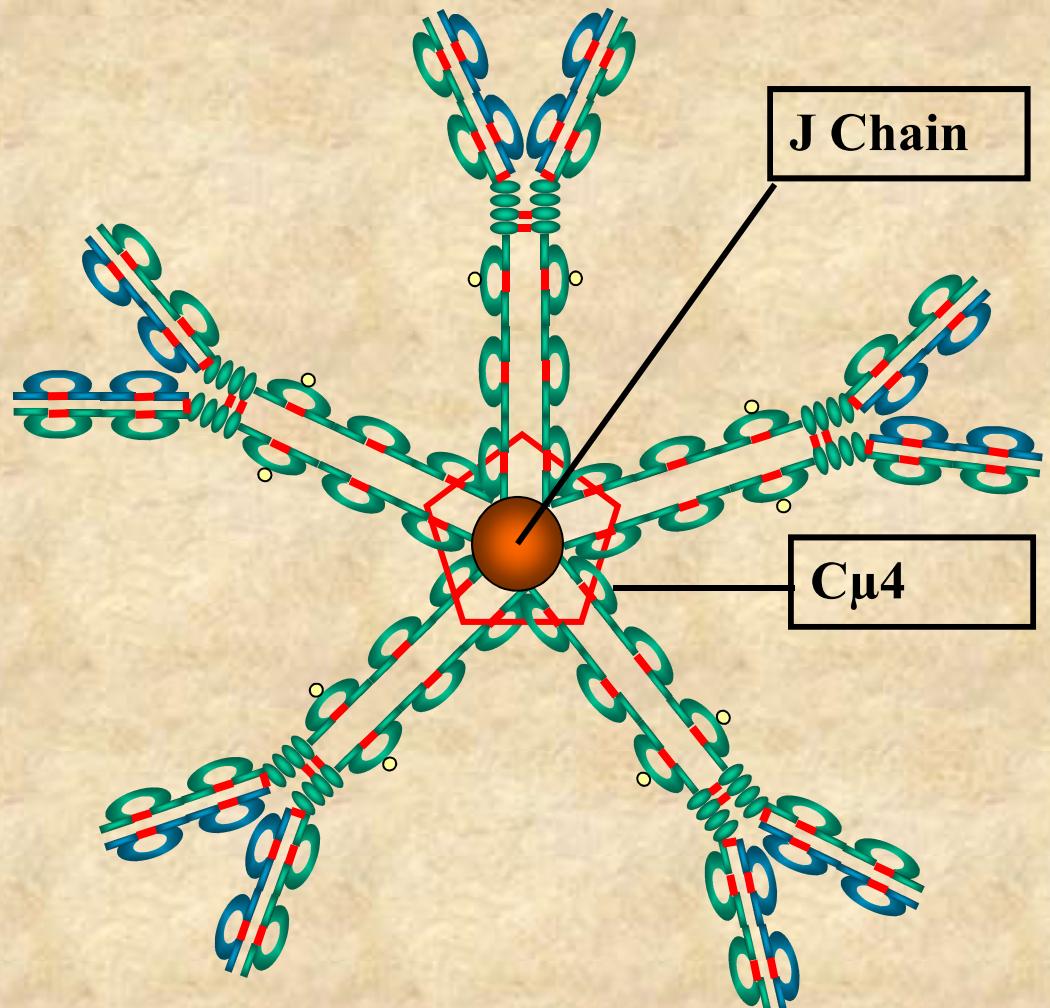
IgG1, IgG2 and IgG4



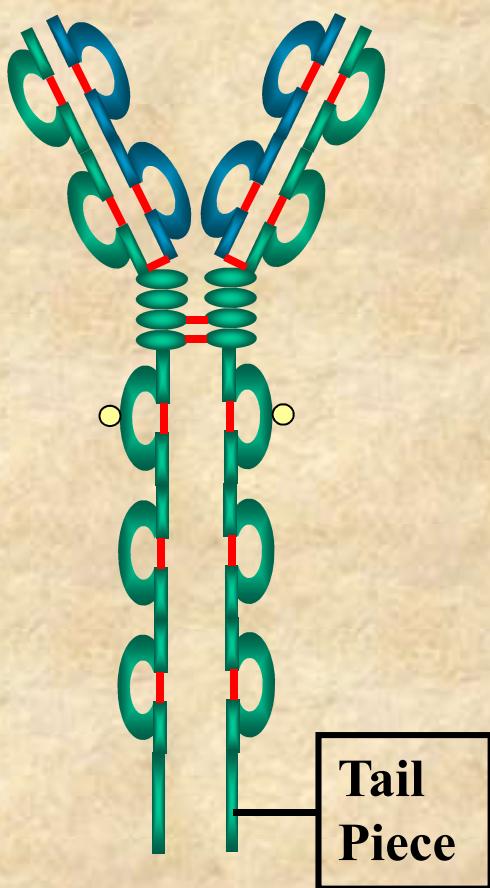
IgG3

IgM

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

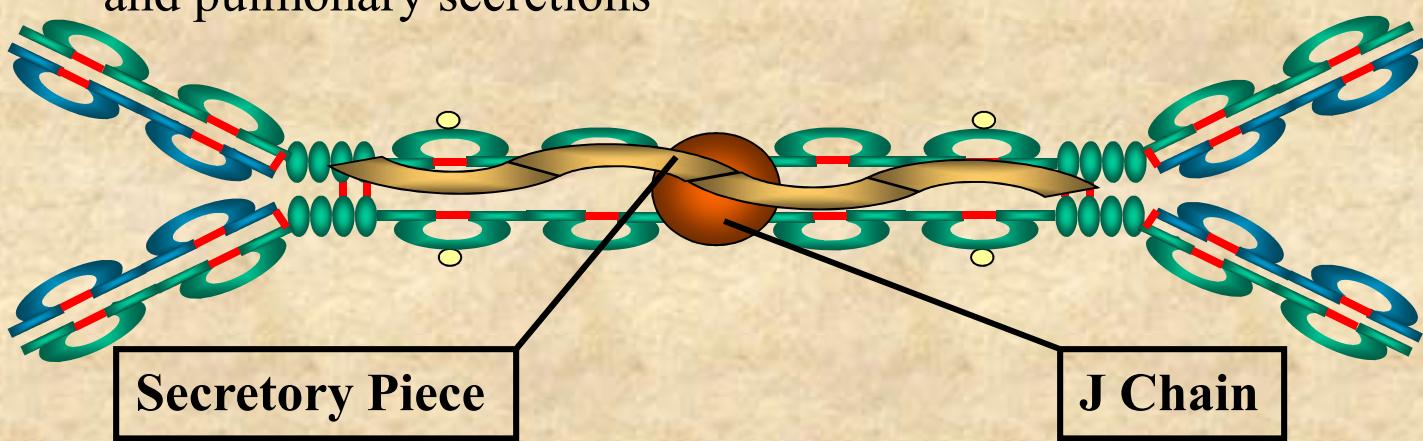


IgM



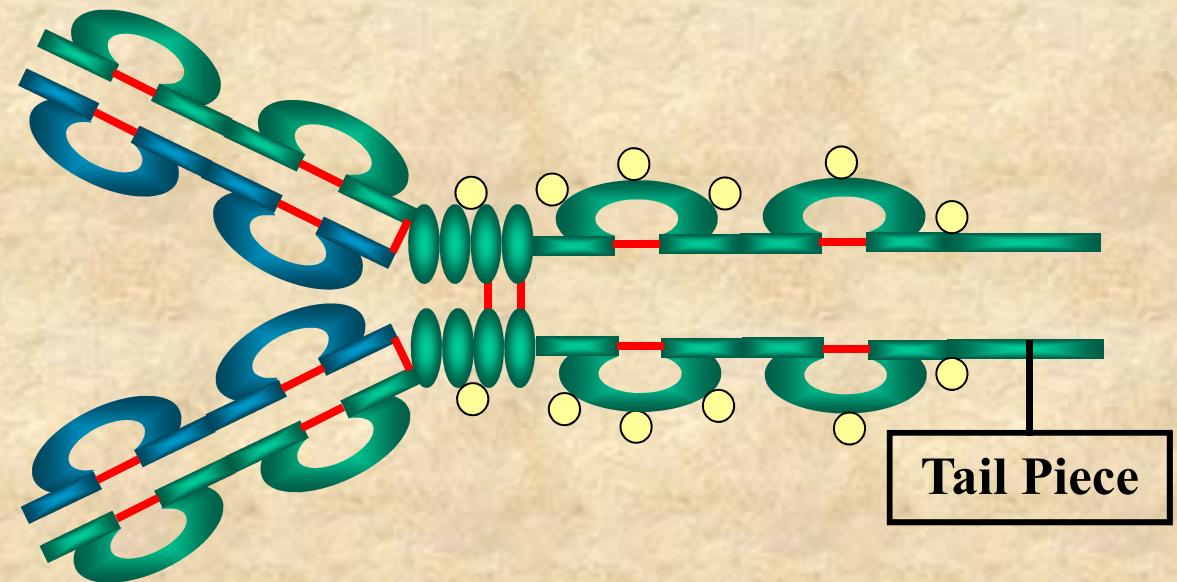
IgA

- Structure
 - Serum - monomer
 - Secretions (sIgA)
 - Dimer (11S)
 - J chain
 - Secretory component- Major secretory Ig (Mucosal or Local Immunity) Tears, saliva, gastric and pulmonary secretions



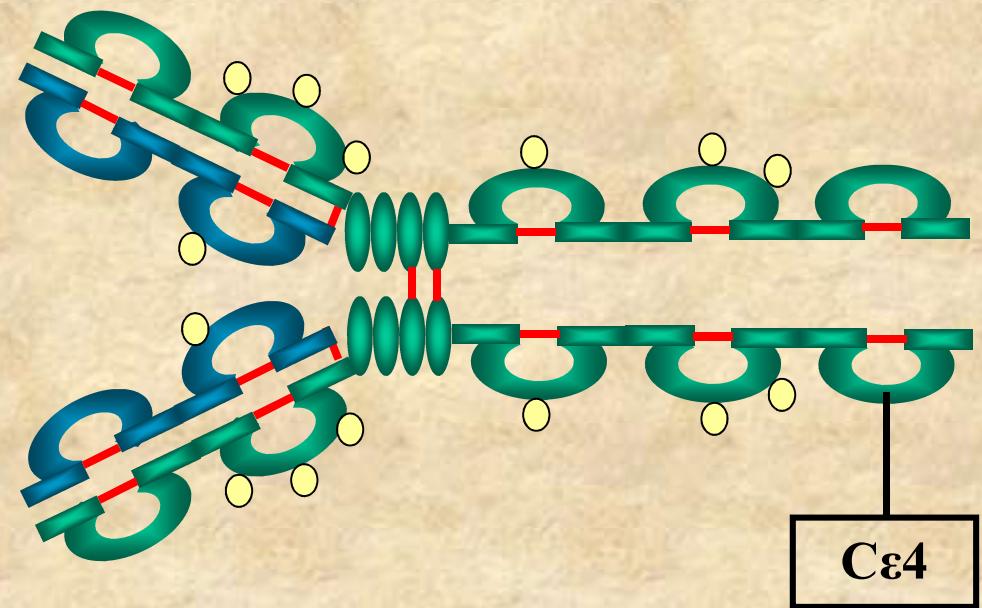
IgD

- Structure
 - Monomer
 - Tail piece



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

Immunoglobulin subclasses differ in structure and function

	IgM	IgG1	IgG2	IgG3	IgG4	IgA1,2	IgE	IgD
form	pentamer	mono	mono	mono	mono	dimer	mono	mono
serum level (mg/ml)	1.5	9	3	1	0.5	3.5	0.00005	0.03
Complement activation	+++	+++	+	+++	-	-	-	-
Placental transfer	-	+	+	+	+	-	-	-
macrophage (Fc receptor) binding	-	+	-	+	-	-	-	-
present in external secretions	mucus etc	milk	milk	milk	milk	mucus etc	-	-