

Ministry of Higher Education
and Scientific Research
Tishk International University
Faculty of education
Department of Biology



Antibody

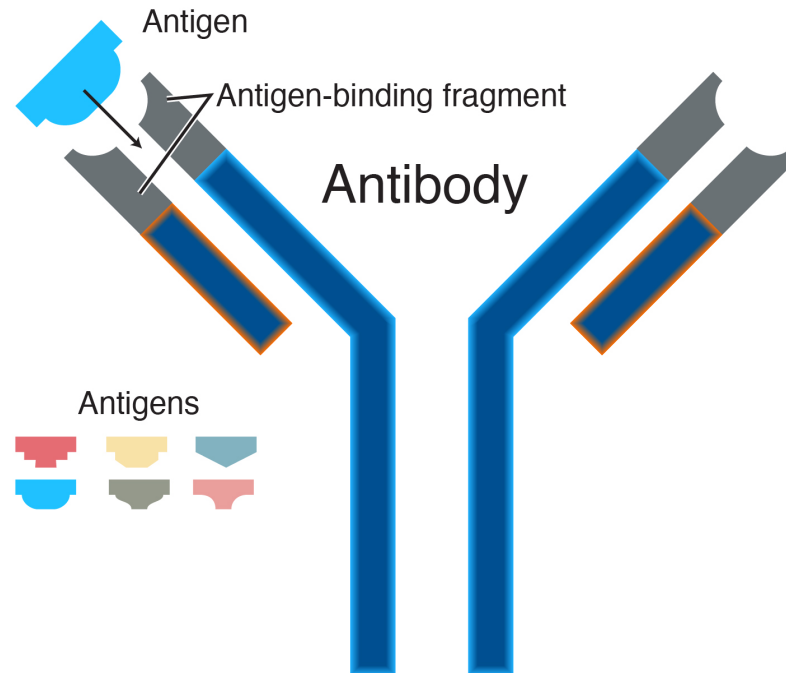
By

Lecture-7-

Harmand Ali

Antibodies

Immunoglobulins (Ig) : Specific glycoproteins produced by specialized B-lymphocytes (Plasma cells) in response to immunogen enhancement.

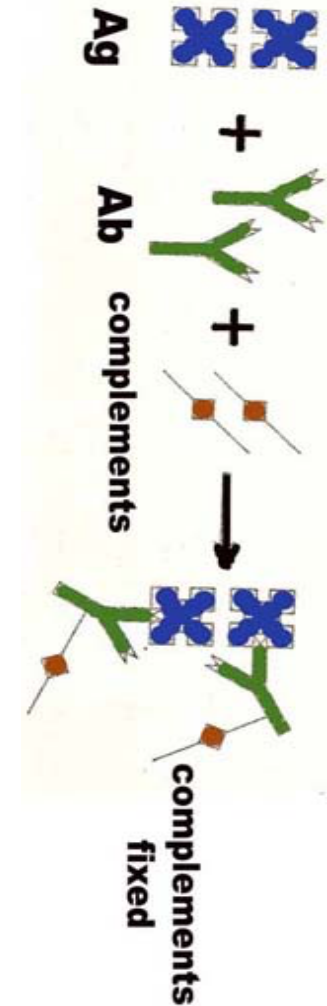
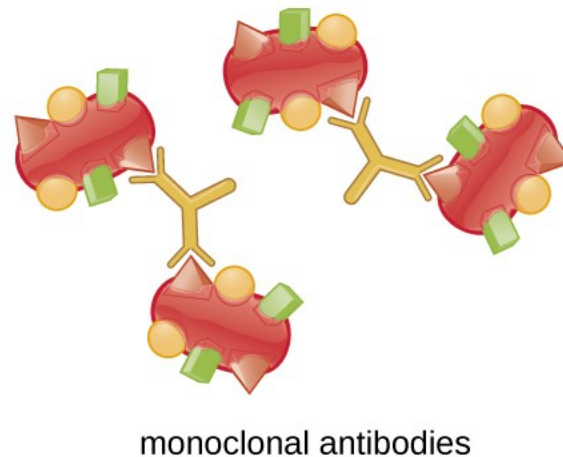
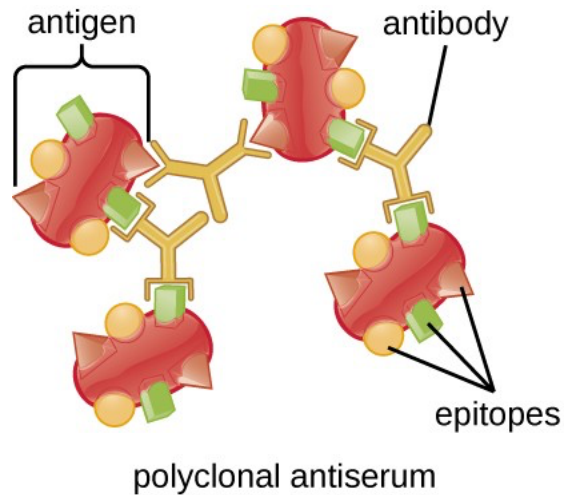


General Functions of Igs

a. Ag binding.

a. Effector Functions

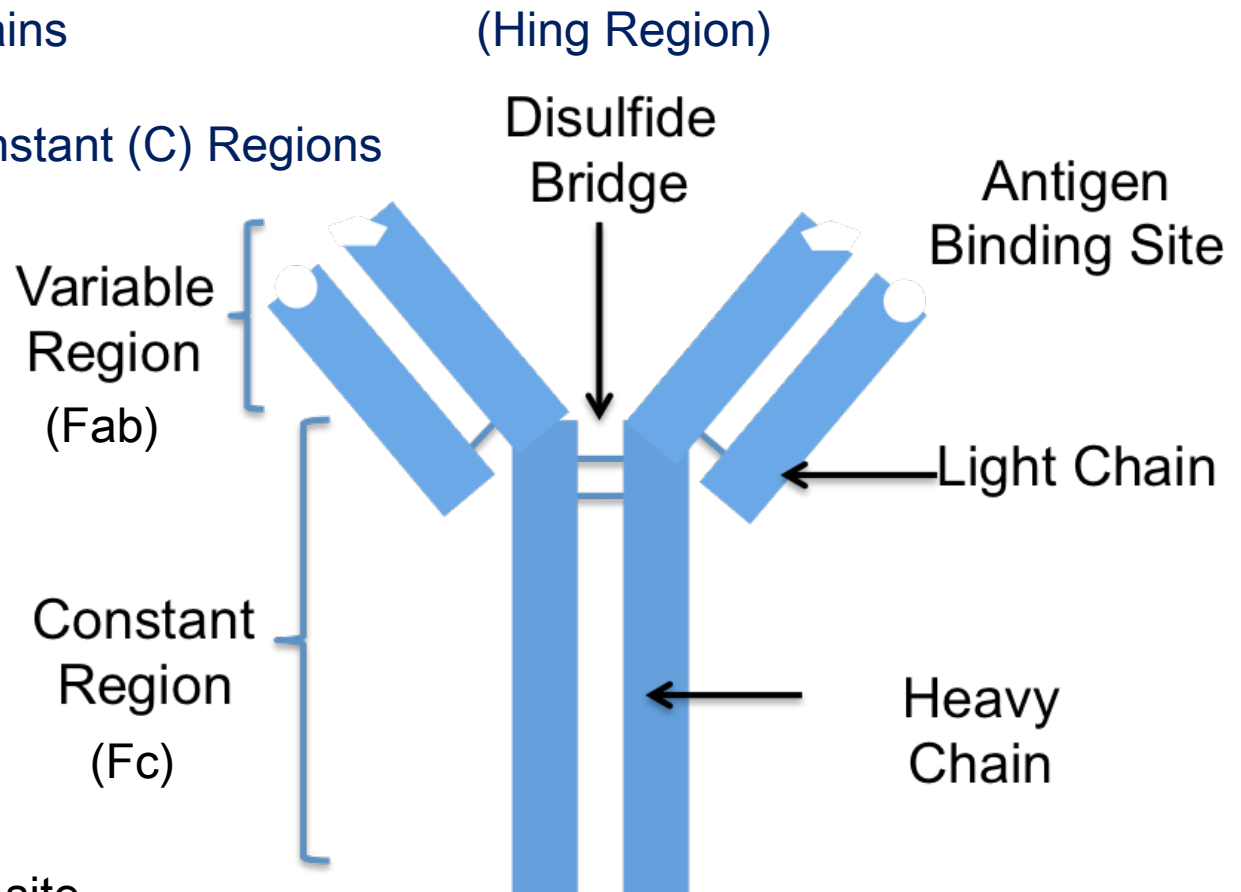
1. Fixation of complement
2. Binding to various cell



Basic structure of Igs

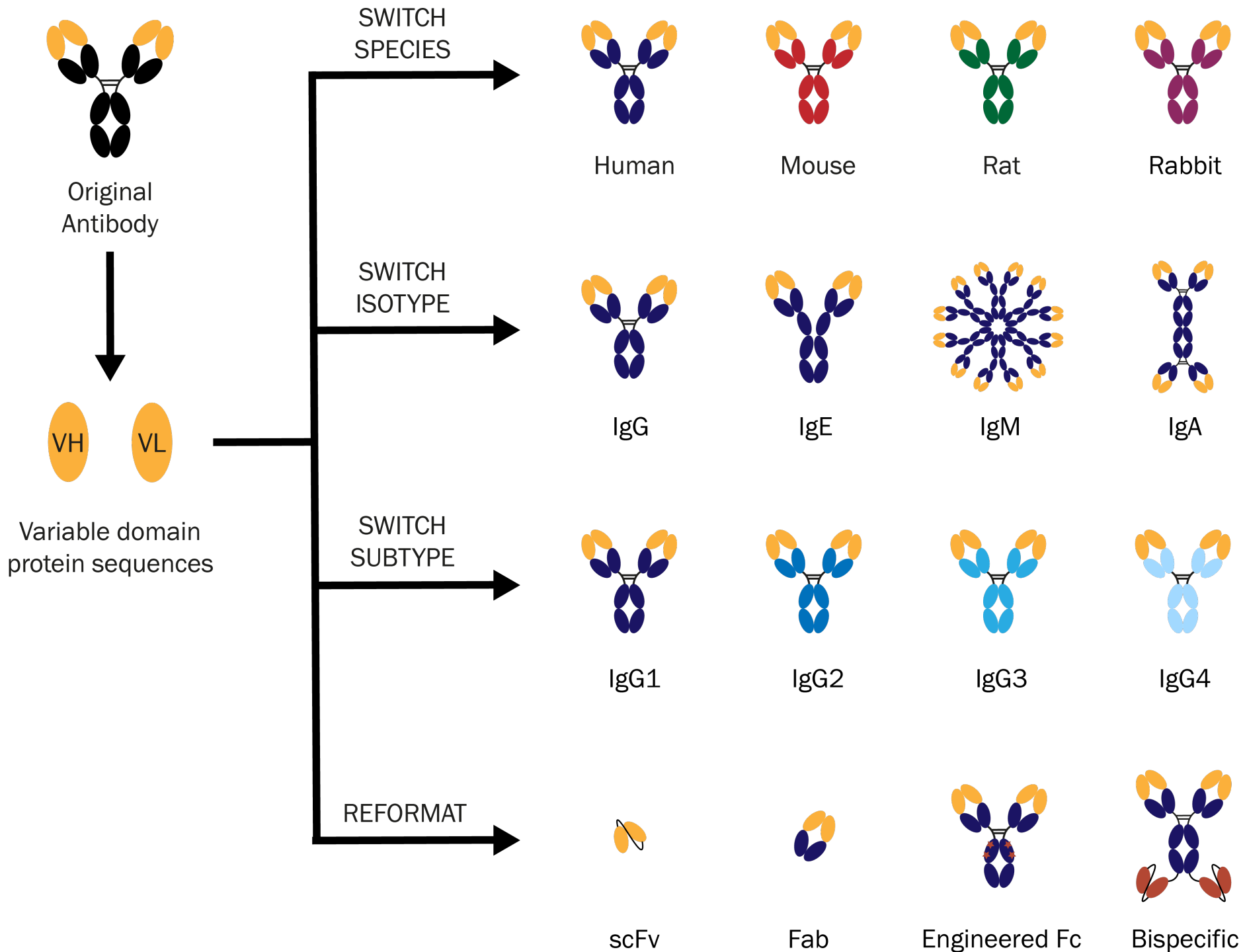
An antibody composed of the following structure:

- A. Heavy and Light Chains
- B. Disulfide bonds
- C. Variable (V) and Constant (C) Regions
- D. Hing Region
- E. Domains
- F. Oligosaccharides



Igs Fragments:

- A. Fab – Antigen binding site
- B. Fc - Biological functions



VI. Human Ig classes , sub-classes:

A. Immunoglobulin classes depending on the heavy chain:

IgG – Gamma heavy chains

IgM – Mu heavy chains

IgA - Alpha heavy chains

IgD - Delta heavy chains

IgE - Epsilon heavy chains

B. Immunoglobulin Subclasses

1. IgG Subclasses

- a) IgG1 - Gamma 1 heavy chains
- b) IgG2 - Gamma 2 heavy chains
- c) IgG3 - Gamma 3 heavy chains
- d) IgG4 - Gamma 4 heavy chains

2. IgA Subclasses

- a) IgA1 - Alpha 1 heavy chains
- b) IgA2 - Alpha 2 heavy chains

Immunoglobulin Types depending on the light chain:






1. Kappa light chains
2. Lambda light chains

Immunoglobulin Subtypes:

- a. Lambda 1
- b. Lambda 2
- c. Lambda 3
- d. Lambda 4

Major functional properties of antibodies

Antibody class	Major Functional properties
IgM	complement activation; antigen trapping; antigen receptor of naïve B cells
IgG	complement activation, phagocytosis, ADCC, transfer of adaptive immunity to offspring, regulation of antibody production
IgA	mucosal immunity, phagocytosis
IgE	activation of mast cells, basophils, eosinophils
IgD	antigen receptor on naïve B cells

Name	Properties	Structure
IgA	Found in mucous, saliva, tears, and breast milk. Protects against pathogens.	
IgD	Part of the B cell receptor. Activates basophils and mast cells.	
IgE	Protects against parasitic worms. Responsible for allergic reactions.	
IgG	Secreted by plasma cells in the blood. Able to cross the placenta into the fetus.	
IgM	May be attached to the surface of a B cell or secreted into the blood. Responsible for early stages of immunity.	

A. IgG

1. Structure

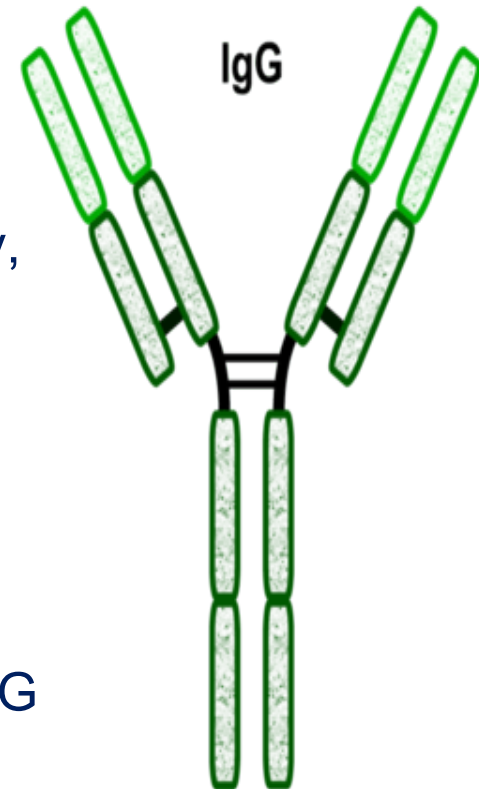
All IgG molecules are monomers (7S immunoglobulin). The subclasses differ in the number of disulfide bonds and length of the hinge region.

Functions/ Opsonization, Agglutination, placental transformation, Ab/ depended cell mediated cytotoxicity, and neutralize a toxin

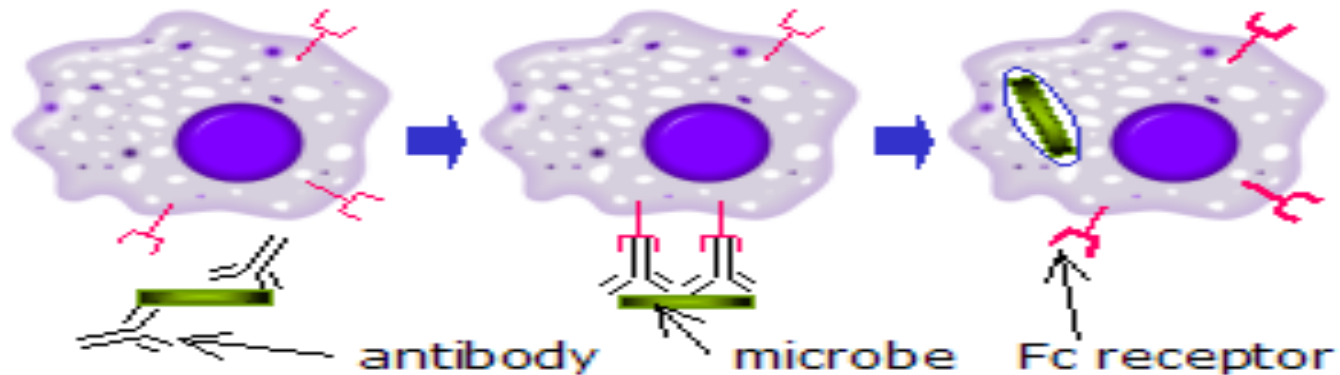
2. Properties

IgG is the most versatile immunoglobulin because it is capable of carrying out all of the functions of Ig molecules.

- a. IgG is the major Ig in serum - 75% of serum Ig is IgG and it make 15% of all serum protein
- b. IgG is the major Ig in extra vascular spaces
- c. Placental transfer - IgG is the only class of Ig that crosses the placenta (Not all subclasses cross equally well; IgG2 does not cross well).



- d. Fixes complement (Not all subclasses fix equally well; IgG4 does not fix complement).
- e. Binding to cells - Macrophages, monocytes, PMNs and some lymphocytes have Fc receptors for the Fc region of IgG (Not all subclasses bind equally well; IgG2 and IgG4 do not bind to Fc receptors).

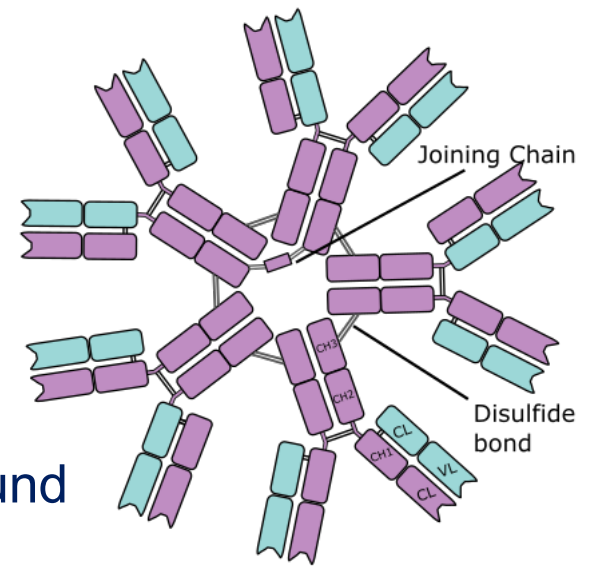


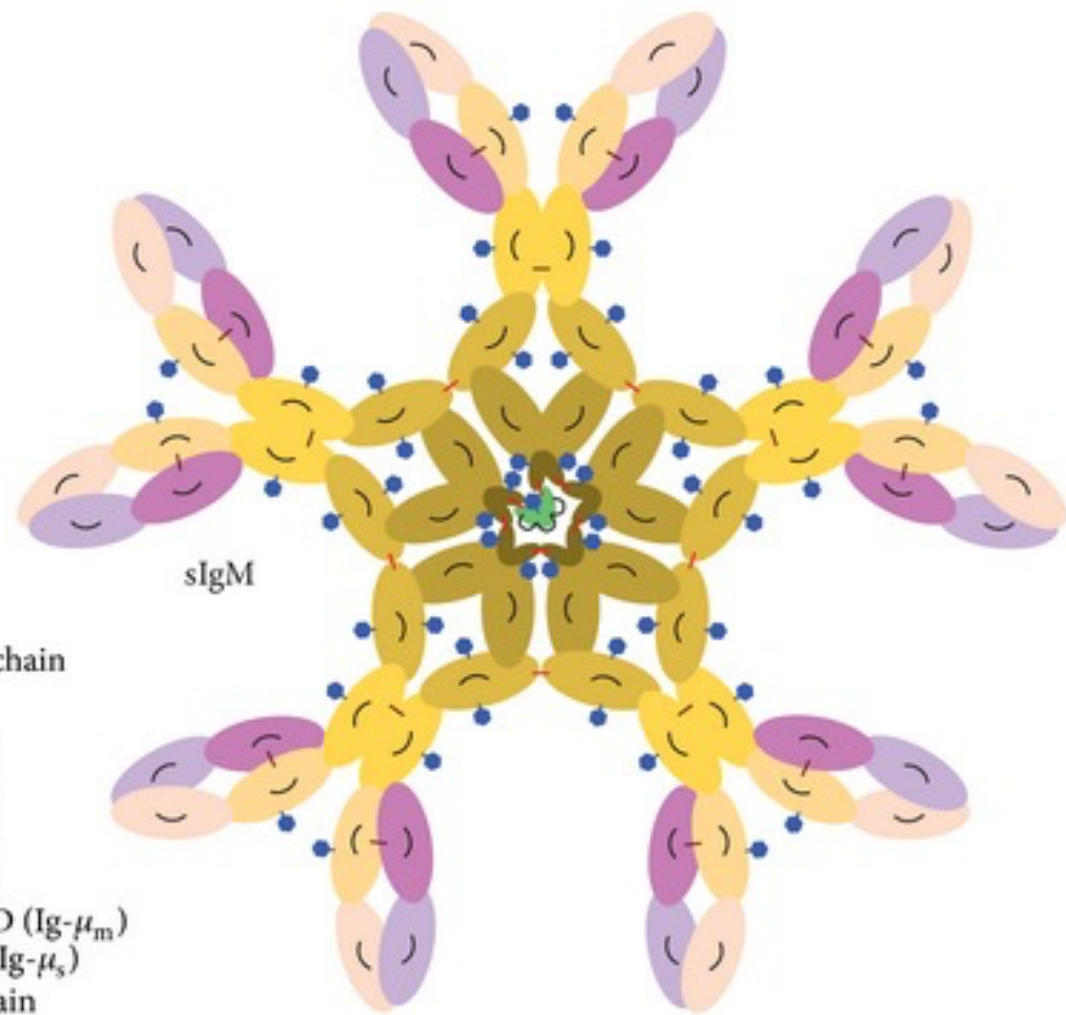
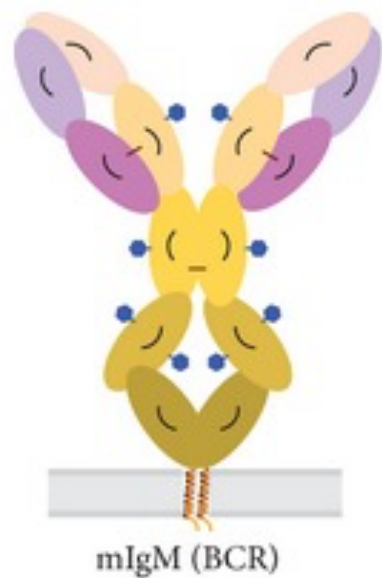
- f. IgG is a good opsonin (**opsonin** is used to describe substances that enhance phagocytosis).

B. IgM

1. Structure

- IgM normally exists as a pentamer (19S Ig) but it can also exist as a monomer.
- In the pentameric form all heavy chains and light chains are identical. Thus, the valence is theoretically 10.
- IgM has an extra domain on the mu chain (CH4) and it has another protein covalently bound via a S-S bond called the J chain, functions in polymerization of the molecule into a pentamer.





Disulfide bonds

— Intradomain

- Intersubunit

- Intersubunit (sIgM only)

• Glycans

Light chain

V_L

C_L

Heavy chain

V_H

C_{H1}

C_{H2}

C_{H3}

C_{H4}

⊥ TMD (Ig-μ_m)

⊥ TP (Ig-μ_s)

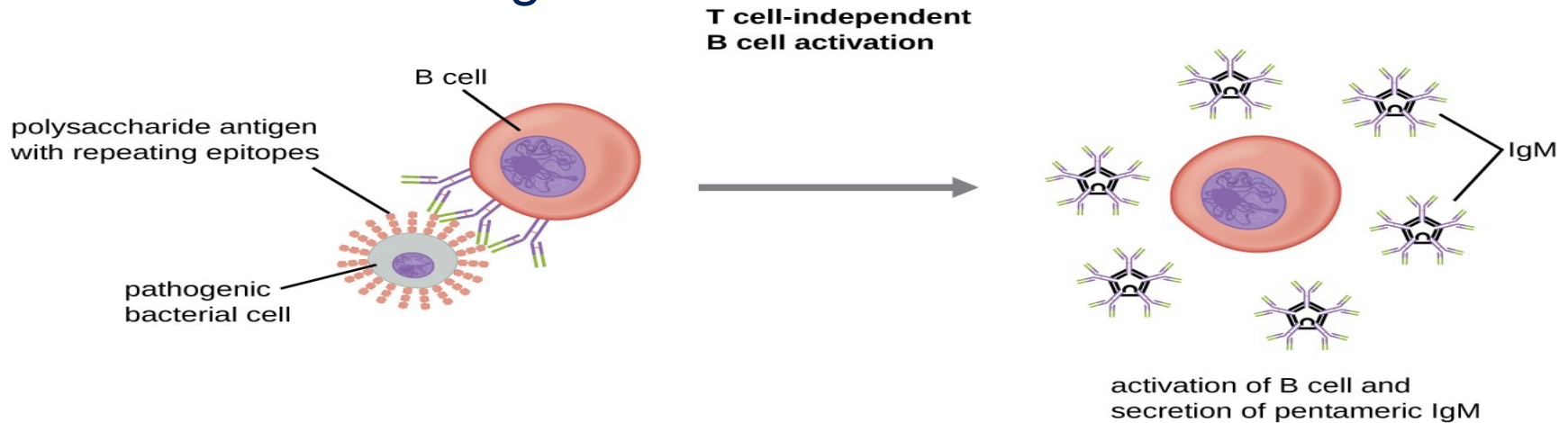
■ J-chain

2. Properties

- a. IgM is the third most common serum Ig.
- b. IgM is the first Ig to be made by the fetus and the first Ig to be made by a virgin B cells when it is stimulated by antigen.
- c. As a consequence of its pentameric structure, IgM is a good complement fixing Ig.
- d. As a consequence of its structure, IgM is also a good agglutinating Ig . Thus, IgM antibodies are very good in clumping microorganisms for eventual elimination from the body.

e. IgM binds to some cells via Fc receptors.

f. B cell surface Ig:



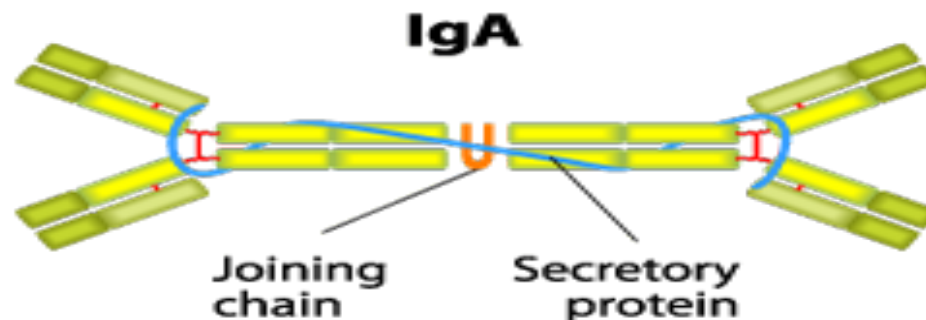
e. Surface IgM exists as a monomer and lacks J chain but it has an extra 20 amino acids at the C-terminus to anchor it into the membrane.

f. Cell surface IgM functions as a receptor for antigen on B cells.

C. IgA

1. Structure

- Serum IgA is a monomer but IgA found in secretions is a dimer (When IgA exits as a dimer, a J chain is associated with it).
- When IgA is found in secretions is also has another protein associated with it called the secretory piece or T piece; sIgA is sometimes referred to as 11S Ig.
- Unlike the remainder of the IgA which is made in the plasma cell, the secretory piece is made in epithelial cells and is added to the IgA as it passes into the secretions.
- The secretory piece helps IgA to be transported across mucosa and also protects it from degradation in the secretions.



2. Properties

- a. IgA is the 2nd most common serum Ig.
- b. IgA is the major class of Ig in secretions - tears, saliva, colostrum, mucus. Since it is found in secretions secretory IgA is important in local (mucosal) immunity.
- c. Normally IgA does not fix complement, unless aggregated.
- d. IgA can binding to some cells - PMN's and some lymphocytes.

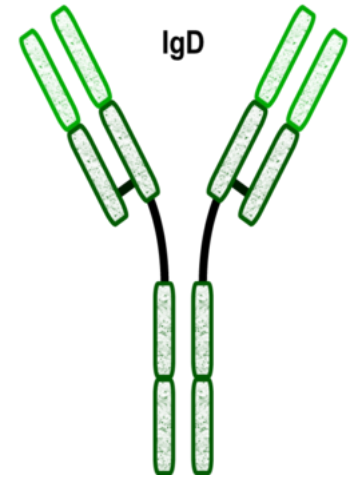
D. IgD

1. Structure

- IgD exists only as a monomer.

2. Properties

1. IgD is found in low levels in serum; its role in serum uncertain.
2. IgD is primarily found on B cell surfaces where it functions as a receptor for antigen.
3. IgD does not bind complement.



E. IgE

1. Structure

- IgE exists as a monomer and has an extra domain in the constant region.

2. Properties

1. IgE is the least common serum Ig since it binds very tightly to Fc receptors on basophils and mast cells even before interacting with antigen, and involves in allergic reactions
2. IgE also plays a role in parasitic helminth diseases, and serum IgE levels rises in parasitic diseases.
3. Eosinophils have Fc receptors for IgE and binding of eosinophils to IgE-coated helminths results in killing of the parasite.
4. IgE does not fix complement.

