

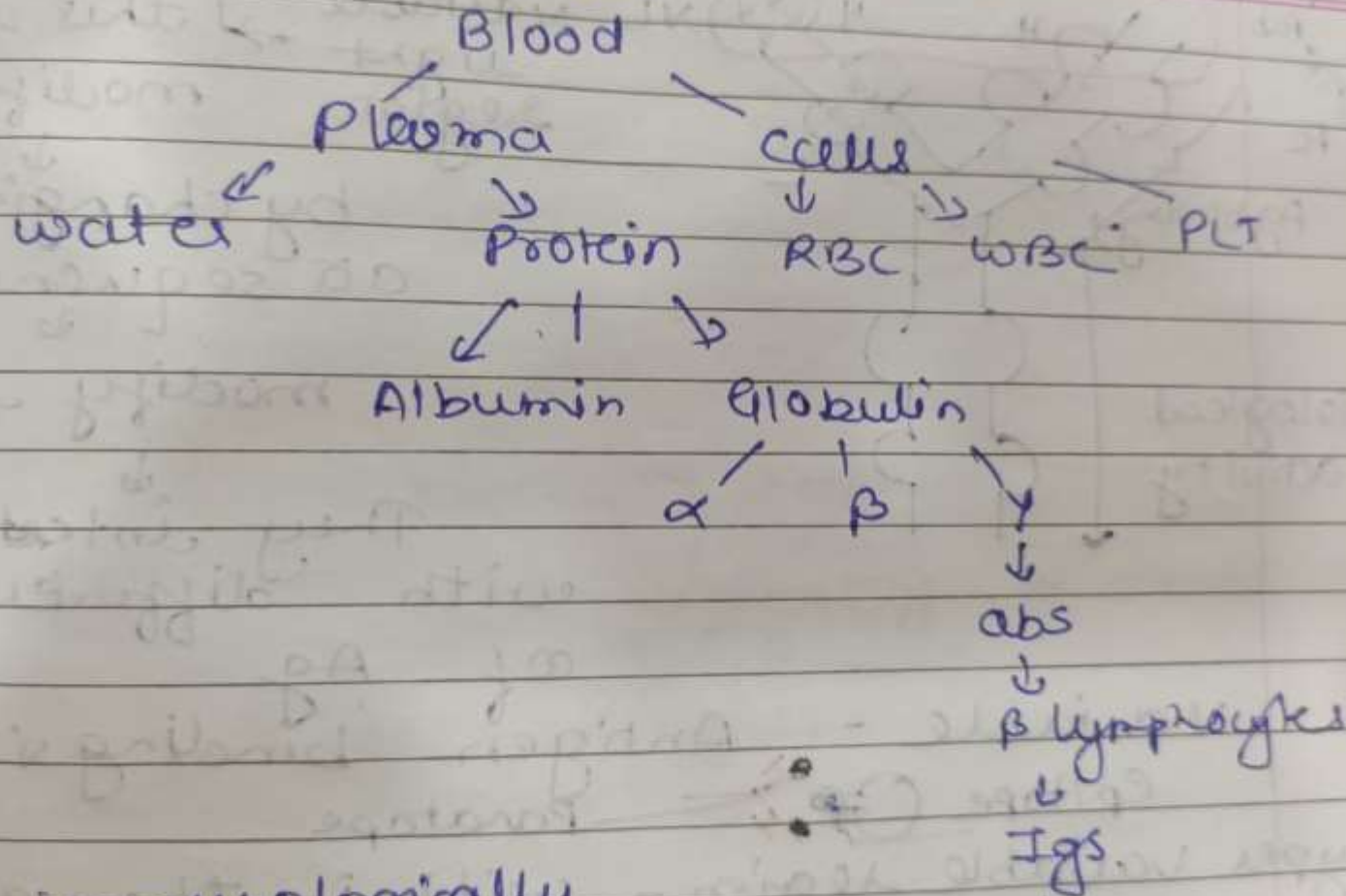
Department of Biotechnology

Antibody

By

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Antibody



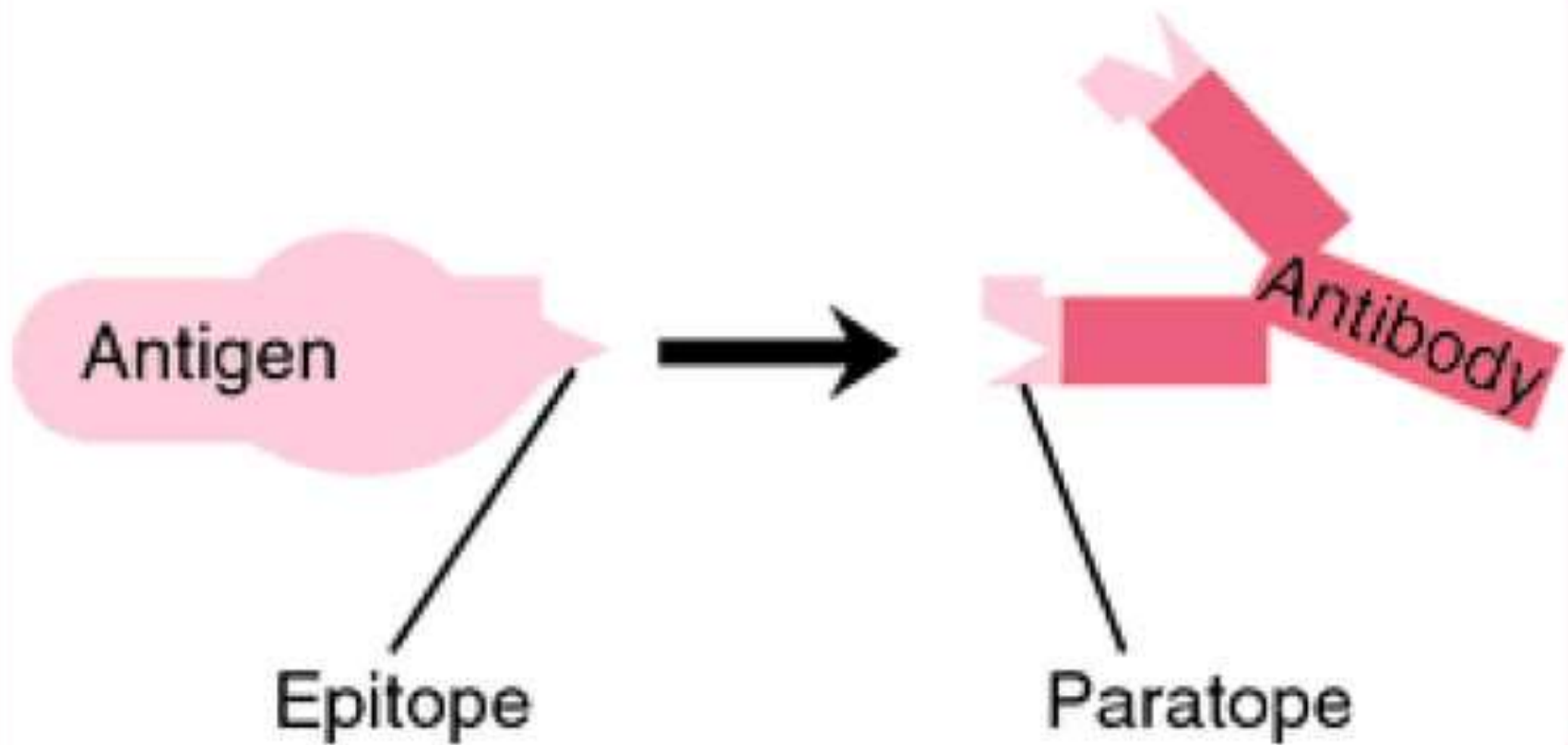
immunologically

→ They react with Ag they were given the name Ig.

Definition

- Antibody is a large protein ,constitutes γ -gloublin produced by plasma cells
- It is used by the immune system to identify and nutralize pathogens such as bacteria and viruses
- Antibodies are also called Immunogloublins
- The antibody recognizes a unique molecule of the harmful agent called ANTIGEN, via the variable region

EPITOPE (ANTIGEN) AND PARATOPE (ANTIBODY)

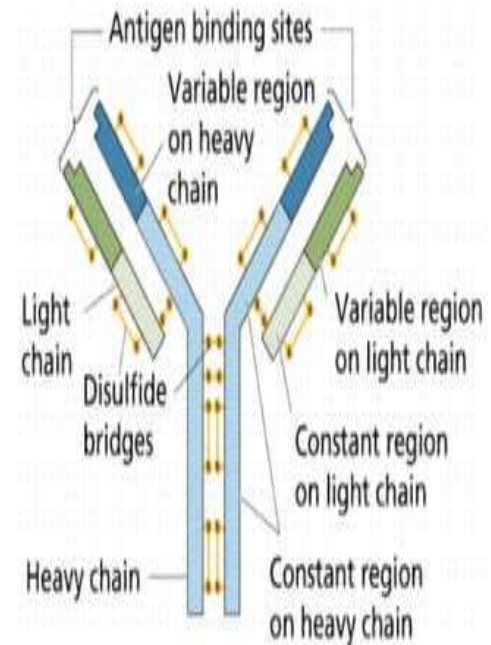


STRUCTURE

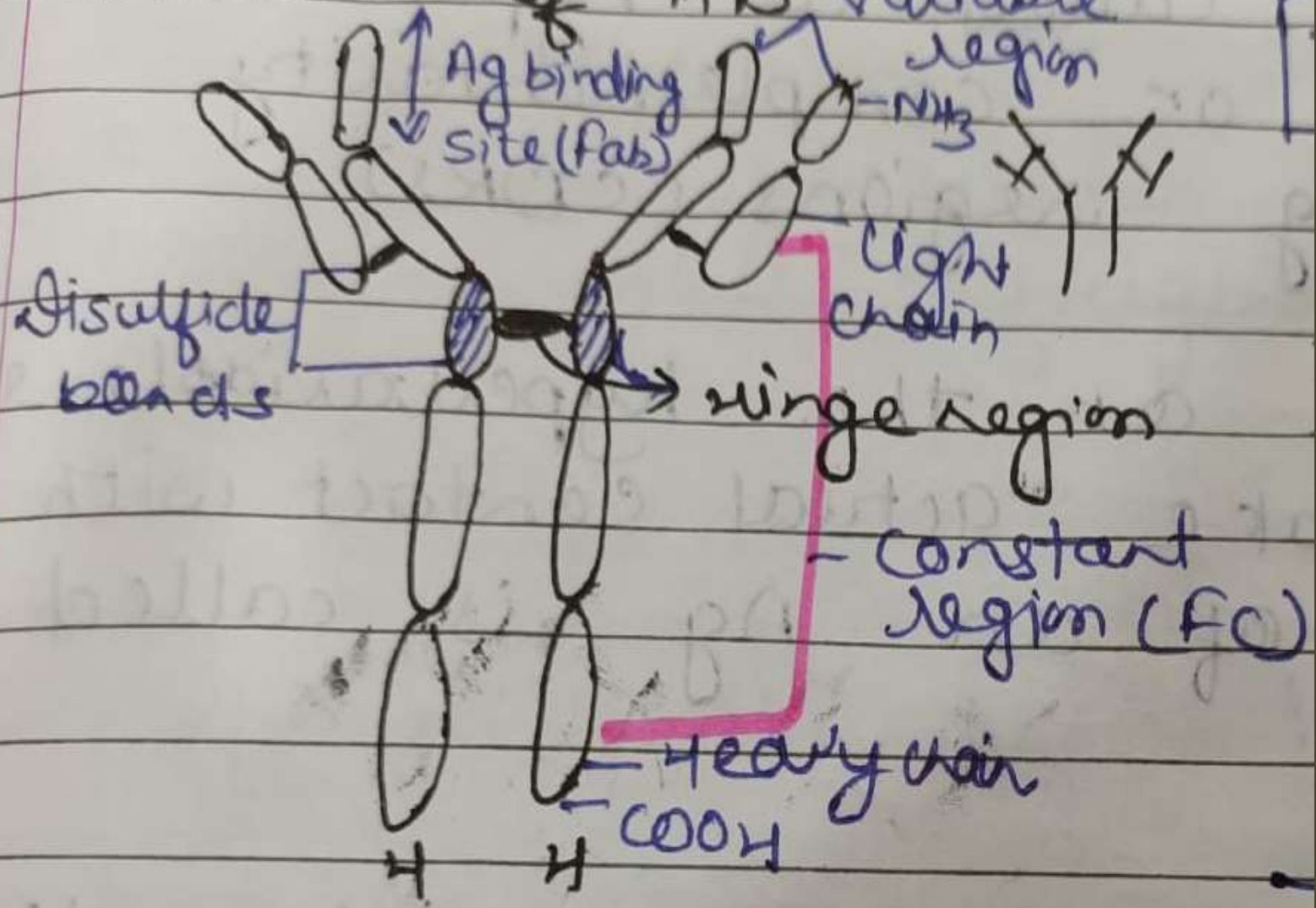
- All antibodies share a basic structure
- Antibodies are heavy globular plasma proteins[or]glycoproteins
- The attached glycans are critically important to the structure and function of the antibody
- Each antibody is heterodimer with a molecular weight of approximately 150KD

- The immunoglobulin consists of two regions, namely a **Variable region (V - Region)** and **Constant region (C - region)**.
- In the constant region, the amino acid sequence remains **constant** in most of the immunoglobulins. In the variable region, the amino acid sequence shows **variability**.
- The variable region is located at the extremity, in the **N – Terminal end**, constant region in the **C – Terminal end**.
- Based on the function aspect, two regions can be recognized in the immunoglobulin. **Fab & Fc**.

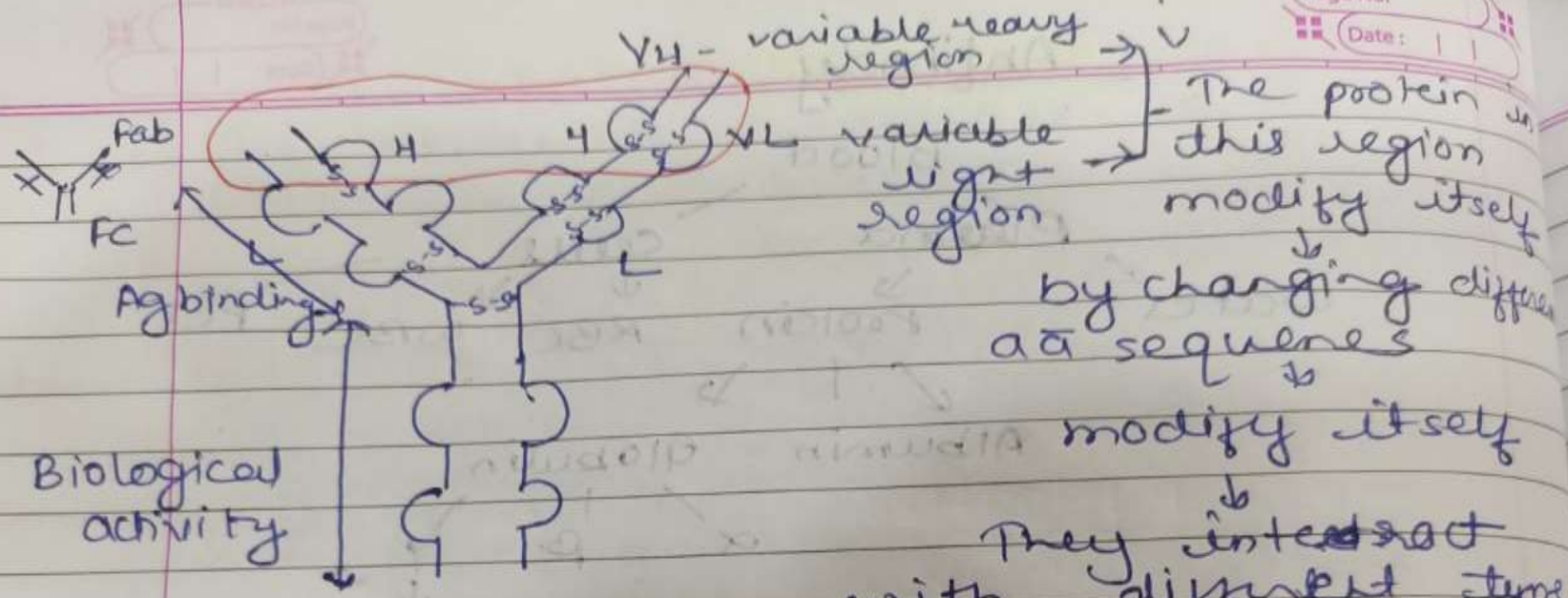
Sites of Immunoglobulin



Structure of Ab variable region



variable & constant region



variable - Antigen binding site
 Epitope Paratope

Hyper variable region - within the variable region there are some zones (hot spots) that show relatively higher variability in the amino acid sequence called as hyper variable regions or complementarity determining regions (CDRs)

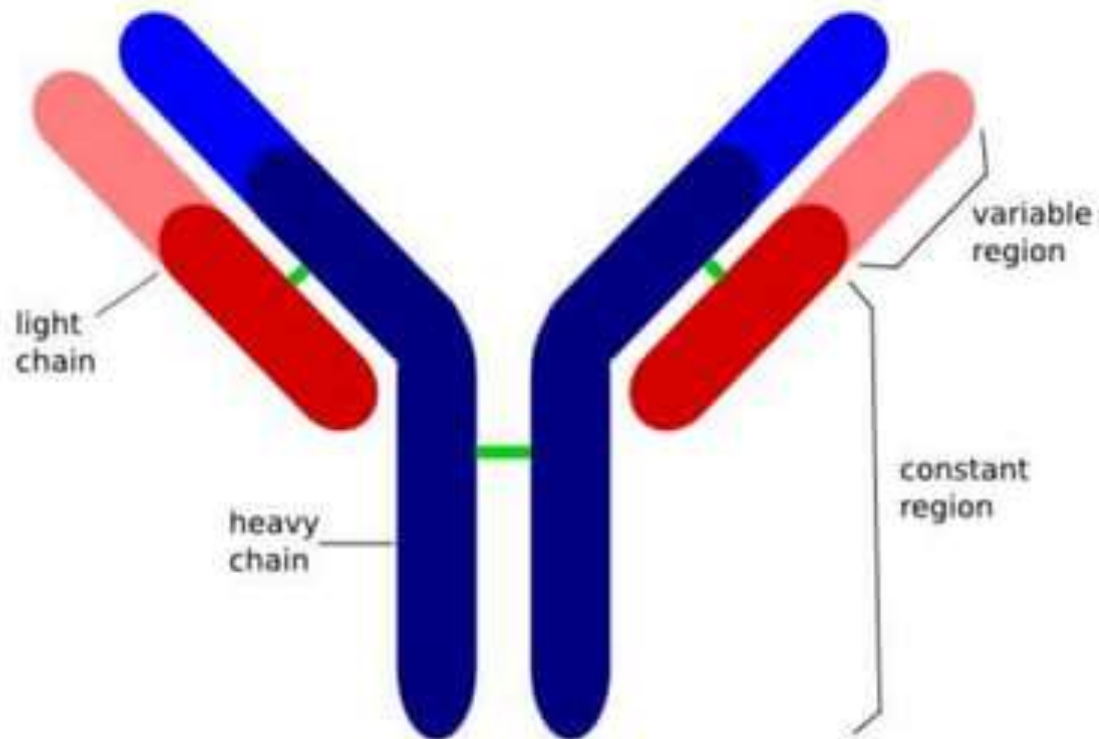
→ The site on the hypervariable regions that make actual contact with the epitope of an Ag is called paratype.

→ Hinge region → Quite flexible, allowing the Ig molecule to assume different position, thus help the Ab in reaching to wards the Ag.

→ Rich in proline & cysteine

→ Hinge region is sensitive to various enzymatic digestions.

Basic structure of Antibody



IMMUNOGLOBULIN DOMAINS

- Antibody is composed of two identical heavy polypeptide chains and two identical light chains, bonded via interchain disulphide[s-s] linkages
- Each chain is composed of structural domains called Immunoglobulin domains
- These domains contains about 70-110 aminoacids

HEAVY CHAINS

- Five types of heavy chains are present
- They are; 1)alpha(α) 2)gamma(γ) 3)delta(Δ)
- 4)epsilon 5)mu(μ)
- Each heavy chain has two regions,one constant region and one variable region
- Alpha and gamma chains contains approximately 450 aminoacids, where as mu and epsilon chains have approximately 550 aminoacids

LIGHT CHAINS

- Two types of light chains are present
- They are; 1) kappa 2) lambda
- All antibodies have one of the two kinds of light chains
- A light chain has two successive domains, one constant domain and one variable domain
- The approximate length of a light chain is 211-217 aminoacids

DIFFERENT CLASSES OF ANTIBODIES

- There are five classes of antibodies are present
- They are; 1)IgG 2)IgM 3)IgA
- 4)IgD 5)IgE
- The antibody classes are named as correspond to their heavy chain types

MAD EAg

IgE IgM IgA IgD IgE

IgM

IgA

IgD

IgE

IgG

IgE

First Ab produced
in response to
infection

found
in secretⁿ
such as

found
on the
surface
of B cells

Involved
in allergic
response

most abu
provide
protect

↓ 1^o response

tears,
saliva &
breast
milk

↓
involved in
B cell activation

↓
triggers
the release
of histamine
& other
inflammatory
molecules

↓
crosse

found in blood
& lymphatic
fluid

↓
provide
protection against
mucosal infection

↓
large (pentamer)

↓
can not cross
placenta

function

↓
complement
activation

First cry
↓
IgM IgA

then B happy
↓
IgD IgE

Respor
smc

Opso

com

Anti

IgG

most abundant Ab
provide long term
protection against virus
↓ & bacteria

crosses placenta

↓
to protect developing
fetus

↓
Responsible for 2^o response
small (monomer)

↓
Opsonization - marking tasty

↓
complement activation

↓
Anti → bacterial
→ toxin
→ viral

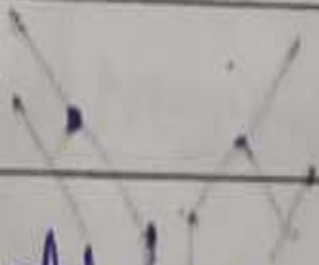
eg Rh

Trouble for the baby

'O' - opsonization -
Ab's coat the
pathogen to make them
more easily recognized
& engulfed by immune
cells.

deat cell mediated cytotoxicity -
destroy infected

Function



First

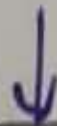
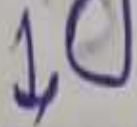
cry

then

B

happy

Always



IgM

IgA

IgD

IgE

IgG

histamin

2) IgM

- They makes up approximately 13% of the serum antibodies
- They has a half-life of about 5 days
- Most of the IgM are pentamer and has 10 - epitope binding sites.some are momomer
- It is the first immunoglobulin class produced in a primary response to antigen

functions

- Activation of classical pathway
- Defence against multivalent antigens
- Act as Opsonin

3) IgA

- They makes up approximately 6% of the serum antibodies
- They has a half-life of approximately 5 days
- IgA is a dimer and has 4-epitope binding sites
- They found mainly in body secretions such as saliva, mucous, tears, colostrum and milk

Functions

- It as a Seceratory antibody
- Effective against virus that causing Influnza
- Production to Infant gut

4) IgD

- They makes up approximately 0.2% of the serum antibodies
- IgD is a monomer and has 2-epitope binding sites
- This class antibodies are found on the surface of B-lymphocytes

Function

- B cell activation.
- Act a receptor for antigen binding

5) IgE

- It was discovered by KandT Ishizaka
- It is very low concentration in blood(17-450ng/ml)
- It contain small percentage of Lymphocytes

1) IgG

- They makes up approximately 80% of the serum antibodies
- They has a half-life of 7-23 days
- IgG is a monomer and has 2-epitope binding sites
- This is the only class of antibodies that can cross the placenta and enter the fetal circulation

Functions

- Immunity to new born
- Neutralisation of Toxins
- IgG3 binds to Fc receptor by Phagocytosis

The most important function of the Abs are to **confer protection against microbial pathogens**. Abs confer protection in the following ways:

- ✓ They **prevent the attachment** of microbes to mucosal surface of the host.
- ✓ They **reduce the virulence** of microbes by neutralizing the toxins and viruses.
- ✓ They facilitate the **phagocytosis** by **opsonization** of microbes,
- ✓ They **activate complement**, leading to complement-mediated activities against microbes

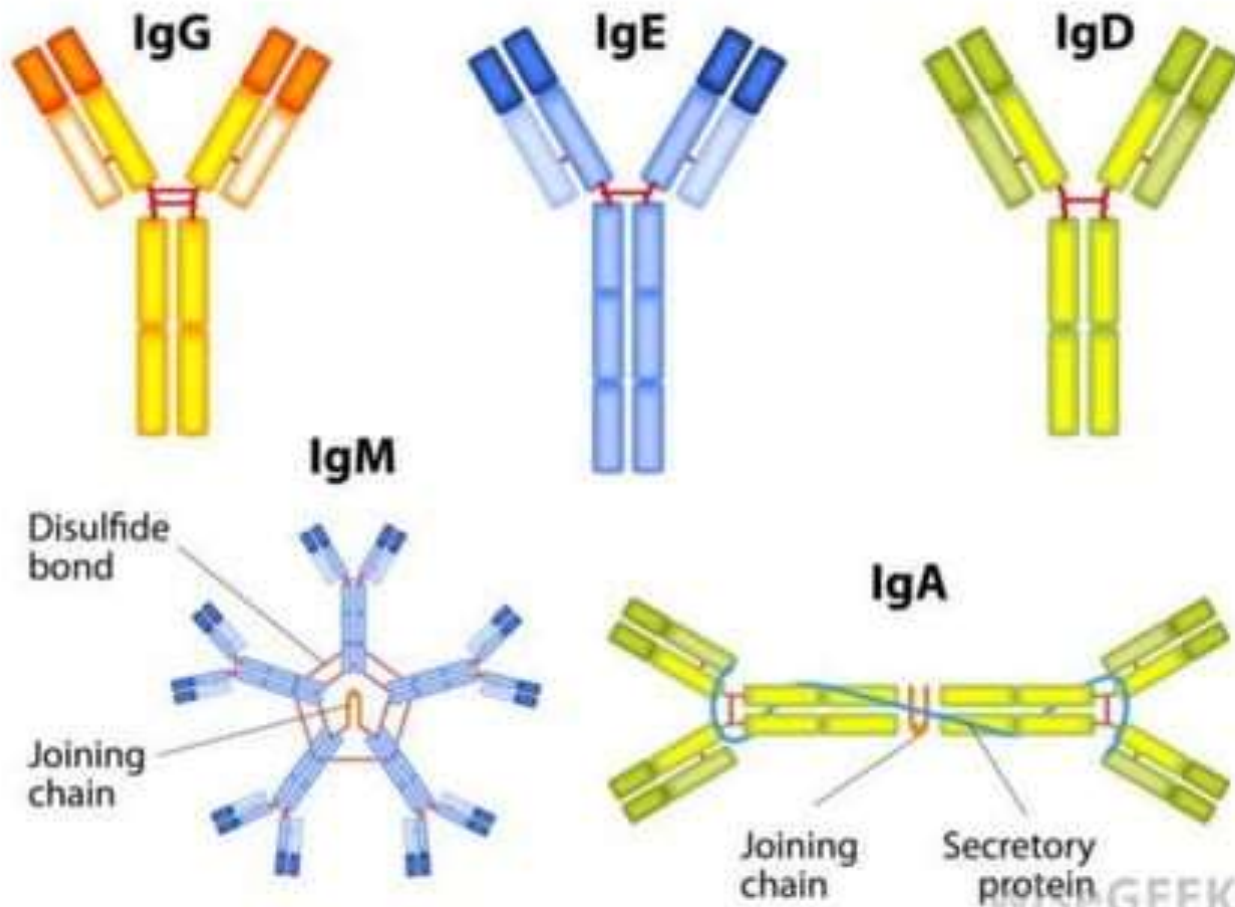


Immunoglobulin classes -

Property	IgG	IgA	IgM	IgD	IgE
Usual form	Monomer	M., dimer	monomer/pentamer	Monomer	Monomer
Valency	2	2 or 4	2 or 10	2	2
Other chains	None	J chain, secretory component	J chain	None	None
Subclasses	G ₁ , G ₂ , G ₃ , G ₄	A ₁ , A ₂	None	None	None
Half life (days)	23	6	5	3	2.5
Intravascular distribution (%)	45%	42%	80%	75%	50%
Complement activation classical pathway	++		++		
Adherence		+	+		

	IgE	IgA	IgM	IgD	IgG
placental transfer	Yes (except IgG 2)	-	-	-	-
mediate coagulation	Yes (except IgE 3)	-	-	-	-
mucosal transport	-	yes	-	-	-
mast cell degranulation	-	-	-	-	yes

Structures of Antibodies



Thank you