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ISOTYPES, ALLOTYPES, IDIOTYPES

Depending on the structural variations the antibodies are classified as Isotypes, Allotypes and Idiotypes.

Isotypes :

The name Isotypes originates from the Greek word **iso** which means equal or same. Thus Isotype antibodies refers to same group of antibodies present uniformly in different members of the same species. For example all the members of the mammalian species contain same group of antibodies. **This group contains five different types of antibodies namely IgG, IgM, IgA, IgD, IgE.** The protein type, α (alpha) forms IgA, δ (delta) forms IgD, ϵ (epsilon) forms IgE, γ (gamma) forms IgG, and μ (miu) forms IgM. This imparts them varied biochemical characteristics which help them to perform, different functions. Antibodies are formed by plasma cells by switching from producing IgM to other types. During class switching there is no alteration in L chain or in the variable portion of the H chain which form the antigen binding site. But they show class switching by acquiring different H chain in the constant regions. They are found in all members of the species. For example all

individuals of a species who are normal will exhibit all five types of antibodies in their serum. The different species do not have same type of constant region. Thus they may possess different isotypes. When these antibodies are taken from one species and are injected into the other species it will form antibody against these antibodies. They are used to measure the antibody levels and to check the immunodeficiency. They are also used to detect the B cell tumors .

Different classes of isotypes present in the mammalian system are tabulated in Table no- 1

Table 1 : Properties of different isotypes.

Properties	IgM	IgG	Secretory IgA	IgE	IgD
Exists as	Pentamer	Monomer	Dimer	Monomer	Monomer
Nature of HC	μ (mu)	γ (gamma)	α (alpha)	ϵ (epsilon)	δ (delta)
Weight (Daltons)	900,000	150,000	385,000	200,000	180,000
% of total antibody in serum	6%	60%	13%	0.02%	1%
Diffuses across Placenta	No	Yes	No	No	No
Complement Fixation	yes	Yes	No	No	No

Function	Main antibody of primary responses. It serves as B cell receptor	Main blood antibody of secondary responses, helps to kill the pathogen	It is secreted into secretions like mucus, tears, saliva and colostrum	It is secreted in response to allergens or in presence of parasitic infection	It acts as B cell receptor
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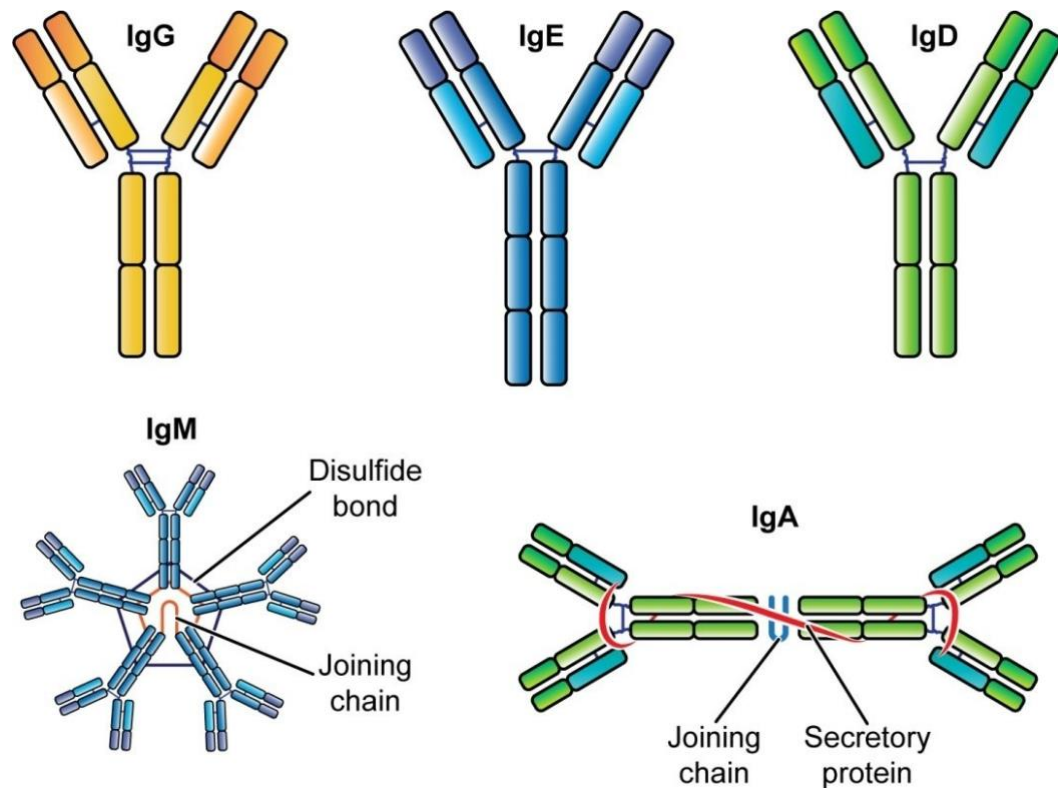


Fig. : Isotypes of antibodies, IgM, IgG, IgA, IgE and IgD, found in the mammalian blood.

Functions of different Isotypes

1. IgG can persist for many months and years following infection/ or injection , thus they give long term protection.
2. IgG helps in clearance of pathogens and toxins by initiating phagocytosis.
3. IgA is the antibody which is found in secretions like saliva, tears and mucous. Thus they can be transported out of the body easily. They also act as the first defense system in the mucosal tissues of the intestine, nose and lungs.
4. IgM acts as receptor on the B cell which enhances phagocytosis.
5. IgE is the predominant antibody which participates in allergic and antiparasitic actions.

IgD acts as B cell receptor which helps in initiating induction of antibody production.

Allotypes :

The term Allotype originates from the Greek word **Allo** which means 'different'. It has been observed that each individual member of a species inherits different alleles of the genes.. When these are injected from one member to another member of the species it will produce antibodies against allotypic determinant. Thus the antibodies formed by these alleles vary in their amino acid sequence of the constant and variable regions of the proteins present.

For example IgG (IgG1) for individual X will be slightly different from individual Y (IgG1). So, if IgG1 of individual X1 is injected into individual Y then it will produce antibodies. The most important types are identified by the markers of three types. They are **Gm** (G1m4, G1m 17) which are variants of gamma 1 heavy chain), **Am** (Alpha chain variants) and **Km** (Km1 and Km2 variants of Kappa light chain). The allotypes are used for paternity testing and monitoring bone marrow graft. They are observed during blood transfusion and pregnancy.

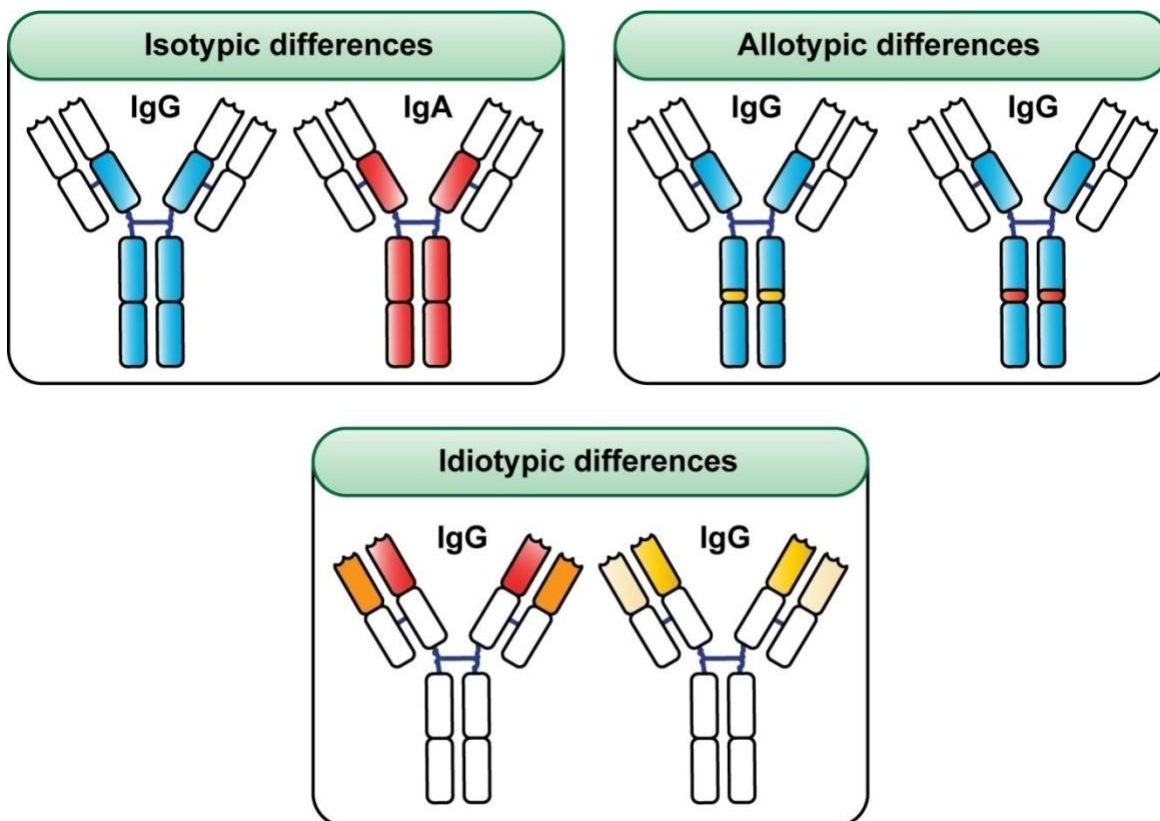


Fig. The areas in dark show the difference in various chains of Isotype, allotype and Idiotype antibodies.

Idiotypes :

The **term idio-** comes from Greek word **idios** meaning 'own, distinct', and it usually **means** personal, own, peculiar, or distinct depending on the context. It means distinct antibodies present in our body that recognize different antigens. For example, IgG1 may have entities which are specific to antigen 1, antigen 2, and antigen 3 and so on. **These antibodies of one type, present in the same body and are specific to different antigens are called the Idiotypes.** They have variability in the amino acid sequence in three to four CDRs surrounded by relatively invariant residues. These CDRs or Complementarity determinant regions are the areas which contact the epitope of the antigen and are called idiotypes. When we inject these idiotypic antibodies into genetically identical twin, idiotypic antibodies will be produced. In twins who are genetically identical, the isotype and allotype antibodies are same but idiotypes can be different. Idiotypes are used in the treatment of B cell tumors and as vaccines.
