General Physiology

Blood Groups

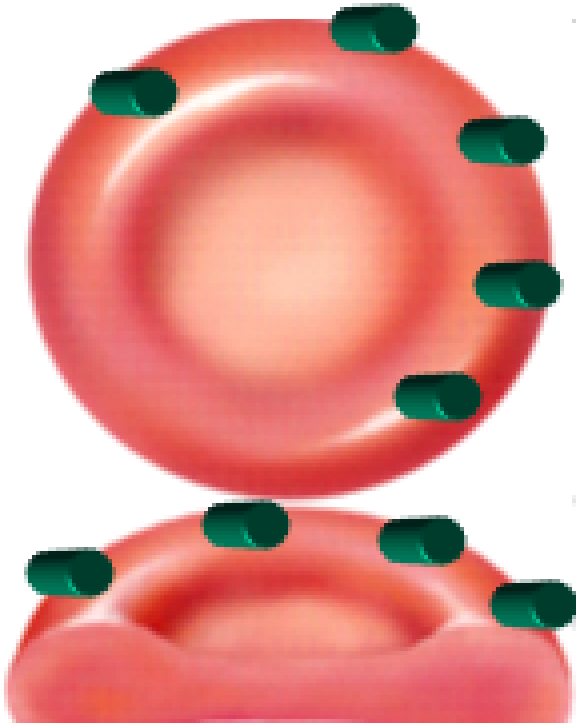
Blood groups

- The ABO blood group consists of blood types A, B, AB and O, depending on the presence or absence of two antigens type A and type B occur on the surface of the R.B.C. it is also called (agglutinogens) because they often cause blood cell (agglutination) after blood transfusion.

- Because of the way these agglutinogens are inherited, people may have neither of them on their cells, they may have one, or they may have both simultaneously.

- Type A: RBCs carry agglutinogen A.
- Type B: RBCs carry agglutinogen B.
- Type AB: RBCs carry both A and B agglutinogens.
- Type O: RBCs carry no A or B agglutinogens.

***Blood type* is determined by**



Agglutinogens

- are specific glycoproteins on red blood cell membranes.
- All RBCs in an individual carry the same specific type of agglutinogens.

- Agglutinins react against any A.B agglutinogen expect those present on a person's own R.B.C.
- The agglutinin that reacts against antigen A is called α agglutinin, or anti-A, it is present in the plasma of people with type O or type B blood, that is , any one who does not possess agglutinogen A .
- The agglutinin that reacts against antigen B is β agglutinin, or anti-B, and is present in type O and A individuals – those who don't possess agglutinogen B.
- An agglutinin can therefore attach to several R.B.C.s at once and bind them together.

Agglutination

- Is the process in which R.B.C.s adhere to each other in masses that are bound by these agglutinins.

Agglutinins

- The agglutinins are gamma globulins, as other antibodies, and they are produced by the same cells that produce antibodies to any other antigens. Most of them are IgM and IgG immunoglobulin molecules.
- But why are these agglutinins produced in people who do not have the respective agglutinogens in their R.B.C.s? however, small amount of group A and B antigens enter the body in the food, in bacteria, and in other ways and these substances initiate the development of the anti-A or anti-B agglutinins.

Blood types	***Agglutinogens***	***Agglutinins***
A	**A**	**Anti B**
B	**B**	**Anti A**
AB	**A and B**	**---------**
O	**-------**	**Anti A and Anti B**

- A person's ABO blood type can be determined(How?) ///by placing one drop of blood in a pool of anti-A serum and another drop in a pool of anti-B serum.
- Blood type AB will exhibit conspicuous agglutination in both antisera; type A or B will agglutinate only in the corresponding antiserum; and type O will not agglutinate in.

- In giving transfusion, it is imperative that the donor's blood not agglutinate as it inters the recipient's blood stream.
- For example, if type B blood were transfused into type A recipient, the recipient's anti-B agglutinins would immediately agglutinate the donor's R.B.C.s.
- A mismatched transfusion causes a *Transfusion Reaction.*
- The agglutinated R.B.C.s block small blood vessels, hemolysis occure, and will release their Hb over the next few hours to days. Free Hb can block the kidney tubules and cause death within a week or so from acute renal failure.
- For this reason, a person with type A (anti-B) blood must never be given a transfusion of type B or AB blood.

- **Type (AB) called the *Universal Recipient* while (O) *Universal Donor*.**

Transfusion Reactions resulting from mismatched Blood Types

- If donor's blood of one blood type is transfused to a recipient of another blood type, a transfusion reaction is likely in which the R.B.C.s of donor blood are agglutinated.
- It is rare that the transfused blood causes agglutination of the recipient's cells, the plasma portion of the donor's blood immediately becomes diluted by all the plasma of recipient, there by decreasing the titer of infused agglutinins to a level low to cause agglutination.
- On other hand, the infused blood does not dilute the agglutinins in the recipient's plasma to major extent. Therefore, the recipient's agglutinins can still agglutinate the donor's cells.

The Rh Group

- Along with the O-A-B blood group system, the Rh system is important in the transfusion of blood.
- There are 6 types of Rh antigens, each of which is called an Rh factor.
- These types are C,D,E,c,d and e.
- A person who has a C antigen doesn't have c, but person missing the C antigen always has the c antigen. The same for D-d and E-e antigens.

- The type D is widely prevalent in the population. Therefore, anyone who has this type is said to be Rh+ve, where as a person who does not have type D is said to be Rh-ve.
- About 85% of people are Rh+ve and 15% are Rh-ve .

Formation of Anti-Rh agglutinins:

- When R.B.C.s containing Rh factor or even protein breakdown products of such cells are injected into a person whose blood does not contain the factor (into the Rh-ve person), anti-Rh agglutinins develop slowly and maximum concentration of agglutinins occurring about 2-4 months.
- On multiple exposure to Rh factor, the Rh-ve person become strongly (*sensitized*) to Rh factor.

Erythrobastosis Fetalis (Hemolytic disease of Newborn)

- This disease of the fetus is characterized by agglutination and phagocytosis of R.B.C.s.
- In most instances of this diseases, the mother is Rh-ve and father is Rh+ve. The baby has inherited the Rh+ve antigen from father, and mother has developed anti-Rh agglutinins from exposure to the baby's Rh antigen , in turn, the mother agglutinins diffuse through the placenta into the fetus to cause R.B.C.s agglutination.

Effect of the Mother's Antibodies on the Fetus:

- After anti-Rh antibodies have formed in the mother, they diffuse slowly through the placental membrane into the fetus's blood. There, they cause agglutination of fetus's blood.
- The agglutinated R.B.C.s subsequently hemolyse, releasing Hb into the blood.
- The macrophages then convert the Hb into *Bilirubin*, which causes the skin to be yellow colored (Jaundice).

- The jaundiced neonate is usually anemic at birth, and anti-Rh agglutinins from mother usually circulate in the infant's blood for 1-2 months after birth, destroying more and more R.B.C.s.

- The usual treatment is to replace the neonate's blood with Rh-ve blood.

- Then (later), the Rh-ve cells are replaced with the baby own Rh+ cells.


Thank you