BLOOD GROUPS AND BLOOD TRANSFUSION

ABO BLOOD GROUP SYSTEM

Blood groups are controlled by multiple alleles i.e. allele A, B and O. Each individual possess two of these alleles which may be the same or different as shown in the table below:-

Genotype	**Blood group**
AA	Blood group A
BB	Blood group B
OO	Blood group O
AO	Blood group A
BO	Blood group B
AB	Blood group AB

Note

Blood groups are transmitted in the mendellain fashion (transmission obeys the law of segregation).

BLOOD TRANSFUSION

This is the transfer of blood from one individual to another but of the same species. The recipient must always have low quantities of blood in order to receive blood. If the blood of two individuals is not compatible when mixed, the red blood cells of the donors blood clump together in the recipient's blood vessels due to the formation of blood clots hindering blood flow. This is also known as agglutination. Agglutination occurs because donors' blood cells contain antigens which are complementary to the recipient's antibodies. Human population exists in four blood groups i.e. A, B, AB and O. they have these blood groups because their red blood cells contain antigens.

Blood group	Antigen in RBC
A	A
B	B

AB	A and B
O	None

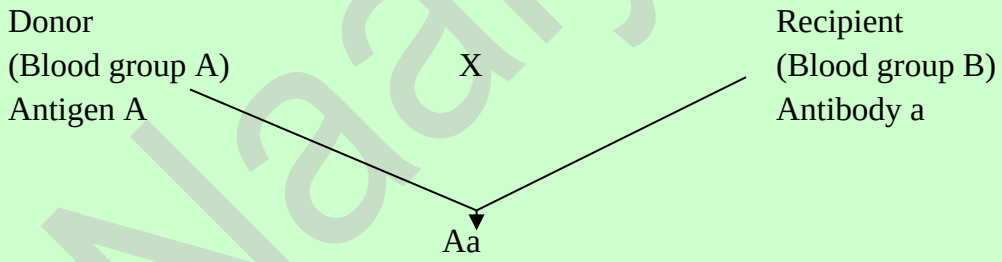
The corresponding antibodies to the above antigens are found in blood plasma and they include the following:

Antibody a, b, a and b, none. If an individual has a particular antigen in the red blood cell. This individual cannot have the corresponding antibody. And if this occurs, agglutination takes place. Therefore any individual's blood should contain antigens and antibodies of the types below.

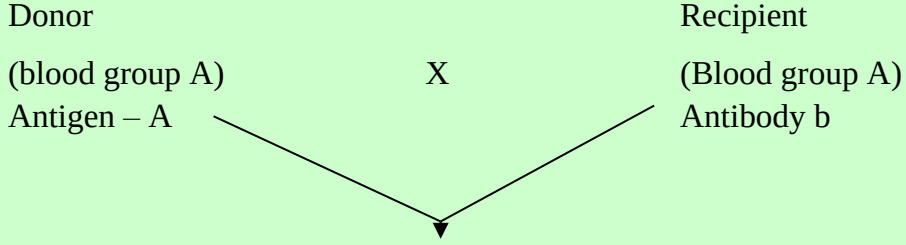
Antigen	**Antibody**
A	b
B	a
AB	…. None
O	a, b

Therefore during blood transfusion this must be considered "transfusion can only occur if the recipients' blood does not contain antibodies correspiding to the donor's antigens"

Example



Blood agglutinates and this may lead to death due to interrupted blood flow.



Ab

Blood does not agglutinate hence successful blood transfusion

In practice, blood transfusion is normally carried out using blood which belongs to the same group as that of the recipient. A group to which a sample of blood belongs is obtained by a simple compatibility test shown in the table below.

X	**RECIEPIENT**				
	⟍	A(b)	B(a)	AB(none)	O(a,b)
DONOR	A (A)	√	X	√	X
	B(B)	X	√	√	X
	AB(AB)	X	X	√	X
	O(None)	√	√	√	√ ← Universal donor

↓ Universal recipient

Individuals of blood group O can donate blood successfully to individuals of all blood groups. This individual is known as a universal donor. Individuals of blood group AB can receive blood successfully from individuals of any blood groups therefore they are universal recipients. Individuals of blood group O are antibody rich containing a variety of antibodies secreted without any limitation and they can destroy different types of antigens during polyclonal activation, therefore such individuals have a sufficient body immune system. Individuals of blood group AB are antibody deficient and they have a poor immune system. This is due to low rate of antibody secretion and they may not secrete certain types of antibodies.

THE RHESUS BLOOD GROUP SYSTEM

This is called so because it was first tested in the rhesus monkeys. Rhesus factors are more common in white people than black people. Rhesus factors are contained in red blood cells

and are known as rhesus antigens. If one's blood contains rhesus factors, then this individual is considered to be rhesus positive. (Rh+) but if one's blood lacks the rhesus factor, the individual is considerd to be rhesus negative (Rh-). Presence of rhesus antigens in one's blood results into production of rhesus antibodies, therefore a rhesus negative individual lacks rhesus antibodies. When a rhesus positive blood sample is mixed with a rhesus –ve blood of the recipient. The latter blood responds by producing corresponding antibodies without any harmful effect. But if rhesus negative recipient subsequently receives another dose of rhesus positive blood, blood of the rhesus –ve individual produces more rhesus antibodies at a very high rate which causes rapid agglutination in the recipient's blood. This condition leads to bursting of the red blood cells.

During pregnancy, when a rhesus negative mother carries a rhesus positive child in her uterus, in the last weeks of the pregnancy fragements of red blood cells containing the rhesus antigens enter the mother's blood across the placenta.
The mother's blood responds by producing rhesus antibodies which then enter foetal circulation destroying the child's blood cells immediately or after birth but since rhesus antibodies are slowly secreted and in very small amounts, there is no significant effect on the first born.

If the subsequent children are also rhesus positive they suffer from massive red blood cell destruction a condition known as haemolytic disease also known as erythroblastosis. This condition results into subsequent children dying because due to the presence of memory cells from the previous encounter, there is rapid secretion of large amounts of rhesus antibodies. These accumulate in the babies causing massive destruction of their red blood cells leading to death unless the child's blood is transfused from birth.

TYPES OF IMMUNITY

Immunity may be described as active or passive. Both types may be acquired naturally or artificially providing immunity artificially is called immunization.

NATURAL ACTIVE IMMUNITY

This is the immunity obtained as a result of an infection. The body manufactures its own antibodies when exposed to an infectious agent that accesses the body naturally. Secretion of these antibodies is facilitated by the existing memory cells. This is the most effective type of immunity and generally persists for a long time.

ARTIFICIAL ACTIVE IMMUNITY

Artificial active immunity is achieved by injecting or orally administering small amounts of antigen commonly known as vaccine into the body of an individual. The process of doing this is called vaccination. These antigens may be dead or just attenuated. These antigens stimulate the body to manufacture its own antibodies against the antigen hence providing protection to the body.

Natural passive immunity

Passive immunity may be gained naturally e.g. antibodies from a mother cross the placenta and enter the foetus since the foetus can not produce its own antibodies because the foetal immune system is not yet fully functioned. Passive immunity may be provided by colostrums, the secretion of the mammary glands, from this the baby gains antibodies. The antigens enter the foetus naturally without being introduced.