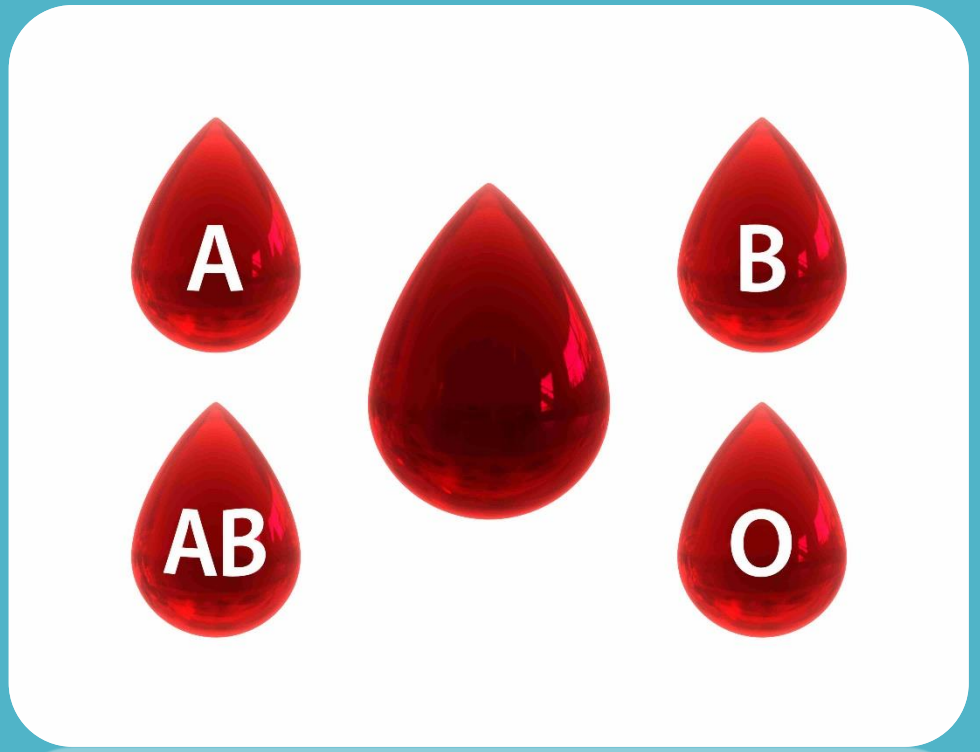
ABO Blood Grouping & Rh Groups

Experment-3



Objectives

- To determine the blood group and therefore the type of antigen carried on the surface of erythrocytes in the ABO system.

- To test for the availability of the Rh factor (D antigen) on the surface of erythrocytes.

Blood Group

- The differences in human blood are due to the presence or absence of certain protein molecules called antigens and antibodies.
- The antigens are located on the surface of the red blood cells
- Antigens are also found in a wide variety of tissues and biological fluids such as saliva, milk , seminal fluid, urine , and gastric juice.
- The antibodies are in the blood plasma to attack foreign antigens, resulting in clumping (agglutination)

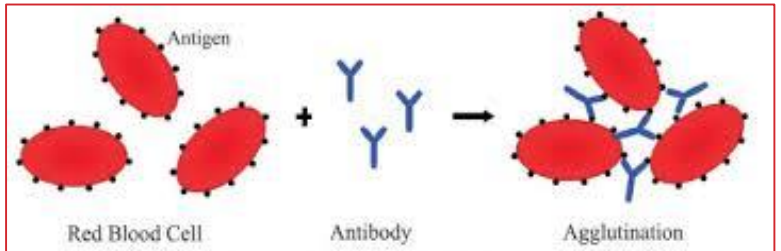
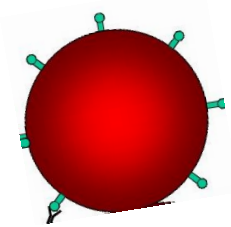


Figure 1 – Representation of the hemagglutination reaction. Blood group antigens and antibodies form a clumping of erythrocytes (modified from Parslow et al., 2004)[5]

Blood group systems

- **The term "blood group"** refers to the entire blood group system comprising red blood cell (RBC) antigens



- Understanding blood group system, their clinical significance, typing and cross-matching tests, and current perspective are of paramount importance is important

- to prevent transfusion-related complications. Nonetheless, the knowledge on blood group system is necessary to approach blood group-linked diseases which are still at the stage of research.

Blood group systems

- 33 **blood group systems** have been recognize

Name	Symbol	Number of antigens	Gene name	Chromosome
ABO	ABO	4	ABO	9
MNS	MNS	43	GYPA, GYPB, GYPE	4
P	P1	1	P1	22
Rhesus	Rh	49	RhD, RhCE	1
Lutheran	LU	20	LU	19
Kell	KEL	25	KEL	7
Lewis	LE	6	FUT3	19
Duffy	FY	6	FY	1
Kidd	Jk	3	SLC14A1	18

- Blood group antigens are not found only as part of erythrocyte membrane but also found in a wide variety of tissues and biological fluids such as saliva, milk , seminal fluid, urine , and gastric juice.
- All are inherited according to mendelian laws of genetics.
- Among the 33 systems, ABO remains the most important in transfusion and transplantation
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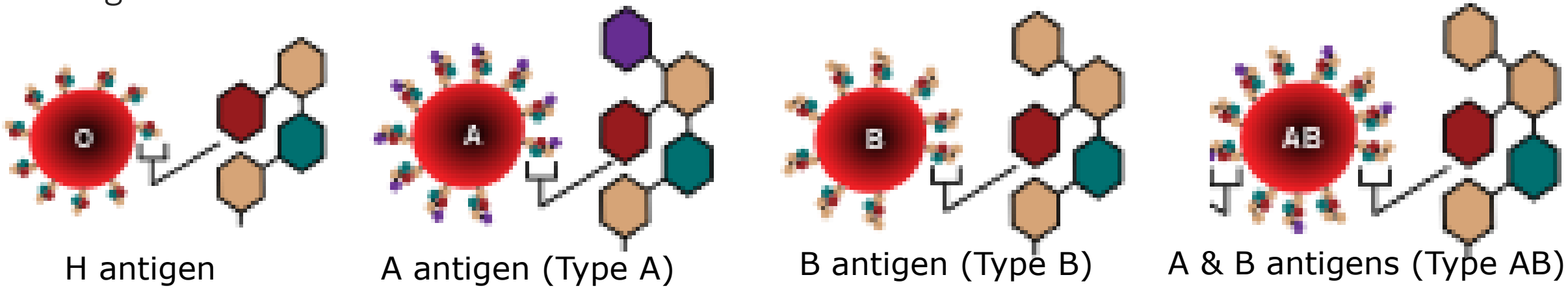
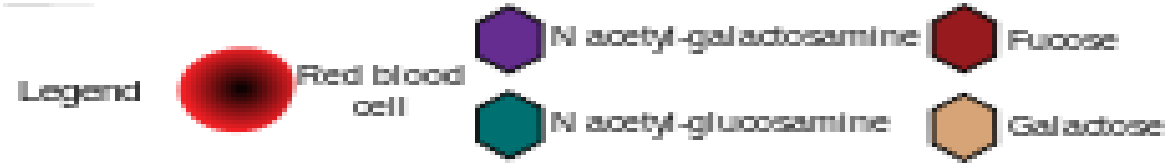
The ABO system

- The ABO system is associated with **three blood group substances** (**antigens**) on erythrocytes designated as the **A,B and H antigens.**
- H antigen is the precursor of both A substance (A antigen)and B substance (B antigen)
- These antigens have the following antigenic determinants at the non-reducing termini of oligosaccharides

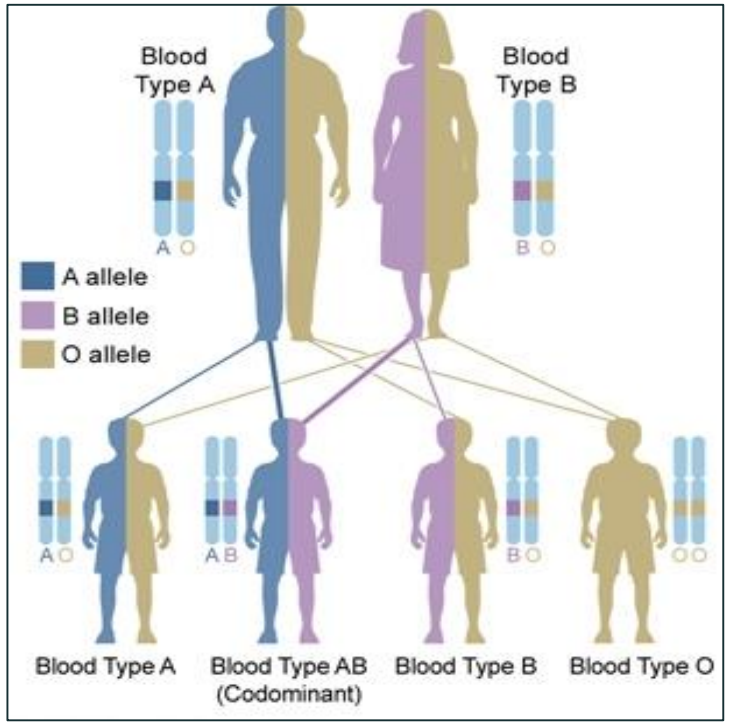


H antigen A antigen (Type A) B antigen (Type B) A & B antigens (Type AB)



What determine your blood group?

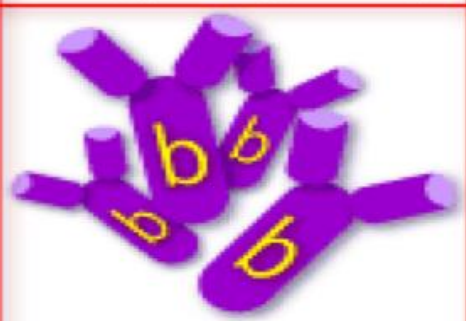
- Your blood type is established before you are born, by specific GENES inherited from your parents.
- There are 3 alleles or genes for blood type: A, B, & O.
- Since we have 2 genes, there are 6 possible combinations.



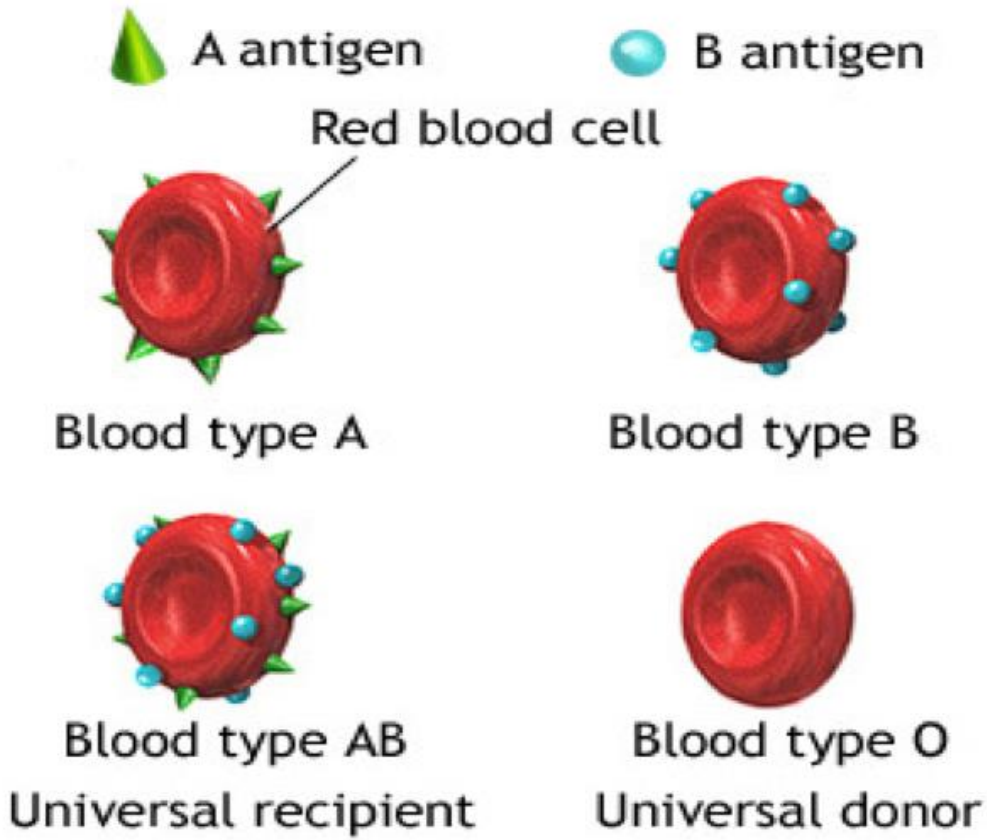
father \ mother	A	B	O
A	AA	AB	AO
B	BA	BB	BO
O	OA	OB	OO

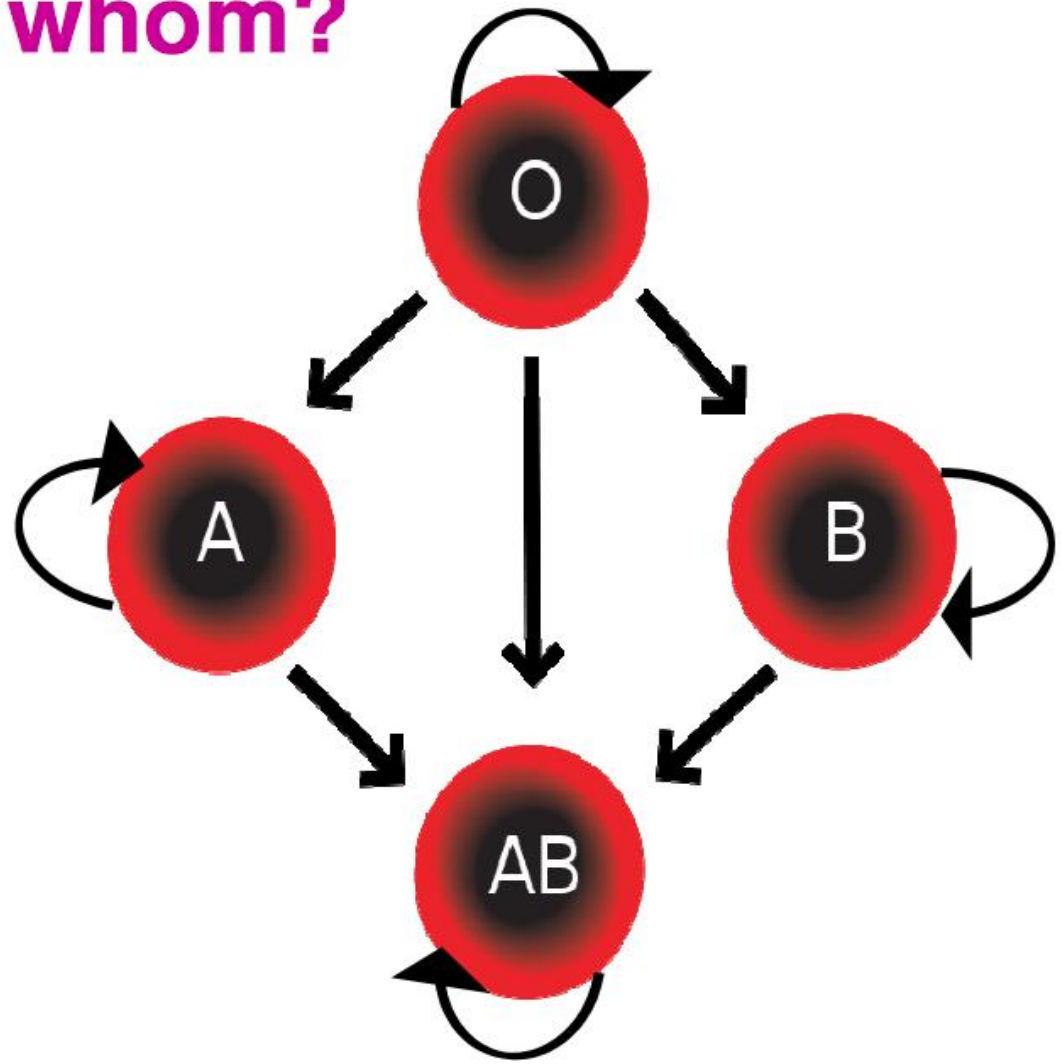
alleles	blood type
A+A	= A
A+O	= A
A+B	= AB
B+B	= B
B+O	= B
O+O	= O

The ABO Blood System

Blood Type (genotype)	Type A (AA, AO)	Type B (BB, BO)	Type AB (AB)	Type O (OO)
Red Blood Cell Surface Proteins (phenotype)	 A agglutinogens only	 B agglutinogens only	 A and B agglutinogens	 No agglutinogens
Plasma Antibodies (phenotype)	 b agglutinin only	 a agglutinin only	 No agglutinin	 a and b agglutinin

Blood transfusions – who can receive blood from whom?



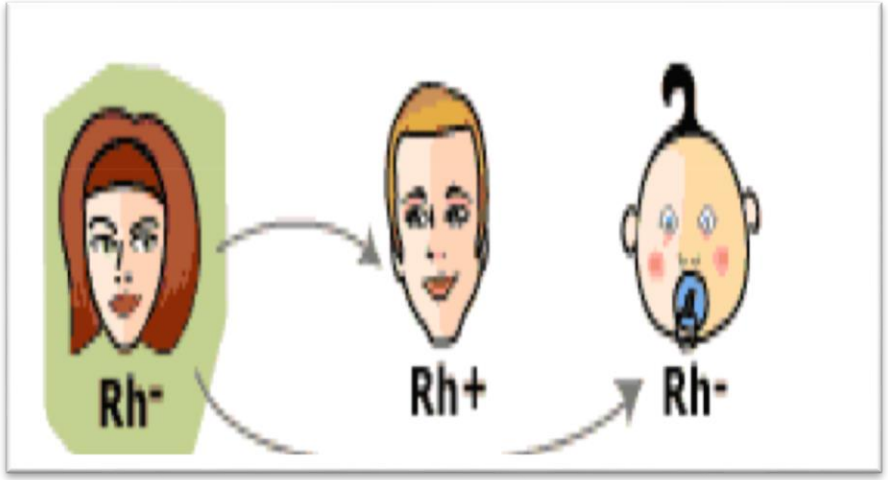


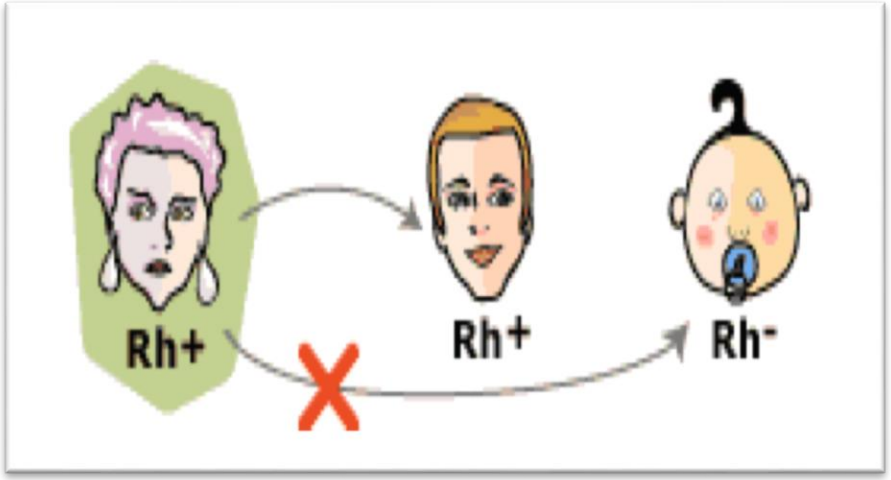
Rhesus Blood Group

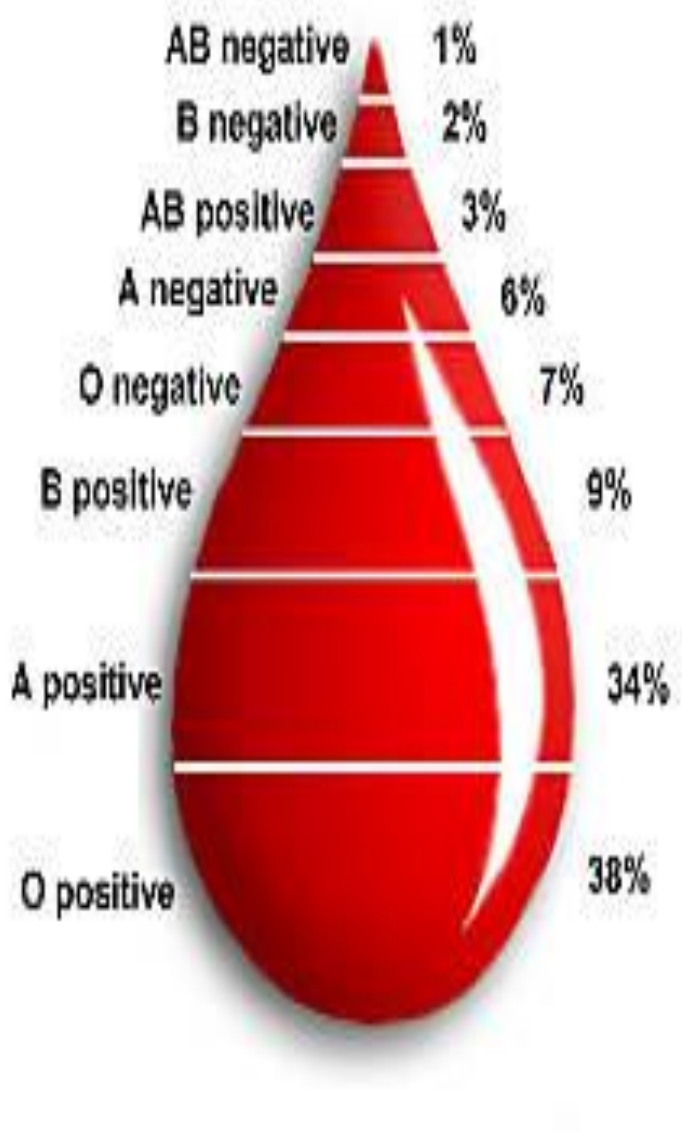
- First studied in rhesus monkeys.
- Is the second most significant blood group system in human transfusion.
- The D antigen (RhD) is the most important.
- If it is present on RBCs' surface, the blood is RhD positive (~80% of the population), if not it's RhD negative.
- So, for example, some people in group A will have it, and will therefore be classed as A+ (or A positive), while the ones that don't, are A- (or A negative) and so it goes for groups B, AB and O.

Rh blood Group

- A person with Rh+ blood can receive blood from a person with Rh- blood without any problems
- A person with Rh- blood can develop Rh antibodies in the blood plasma if he or she receives blood from a person with Rh+ blood, whose Rh antigens can trigger the production of Rh antibodies





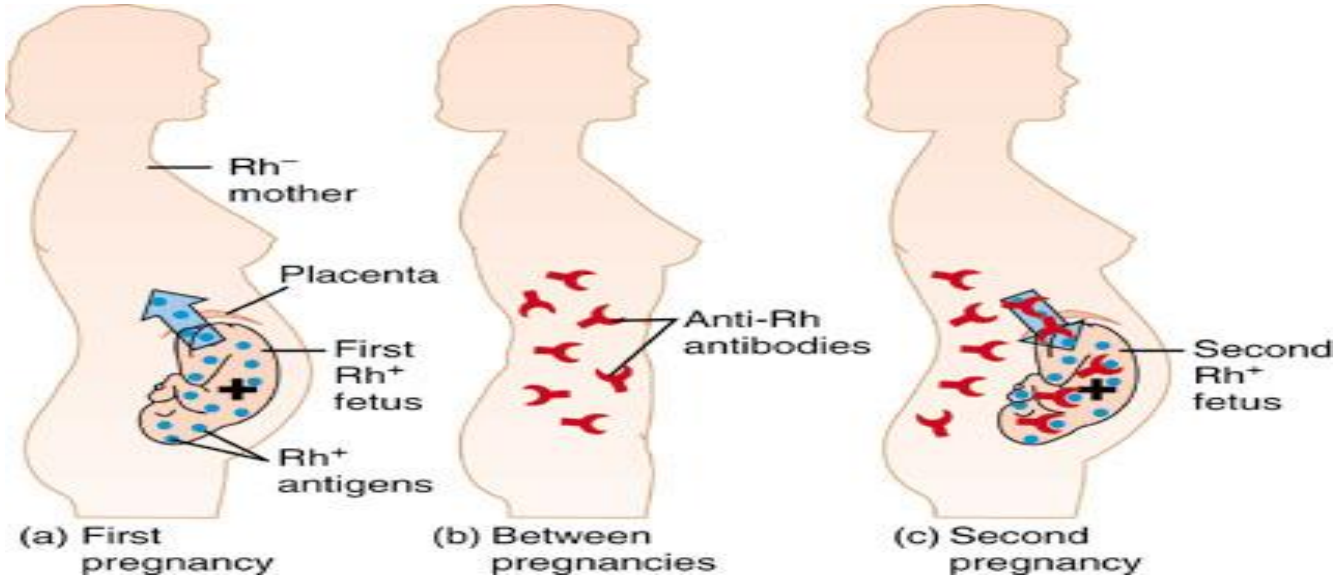


RED BLOOD CELL COMPATIBILITY TABLE

Recipient	Donor							
	O-	O+	A-	A+	B-	B+	AB-	AB+
O-	✓	✗	✗	✗	✗	✗	✗	✗
O+	✓	✓	✗	✗	✗	✗	✗	✗
A-	✓	✗	✓	✗	✗	✗	✗	✗
A+	✓	✓	✓	✓	✗	✗	✗	✗
B-	✓	✗	✗	✗	✓	✗	✗	✗
B+	✓	✓	✗	✗	✓	✓	✗	✗
AB-	✓	✗	✓	✗	✓	✗	✓	✗
AB+	✓	✓	✓	✓	✓	✓	✓	✓

Hemolytic disease of the newborn (HDN)

- Also called, Erythroblastosis Fetalis
- Mother is Blood type Rh-, Father and fetus are Rh+
- First pregnancy = sensitization at delivery due to hemorrhage
- Second pregnancy = Mother produce anti-Rh IgG antibodies that cross placenta to attack fetal RBCs leading to hemolysis

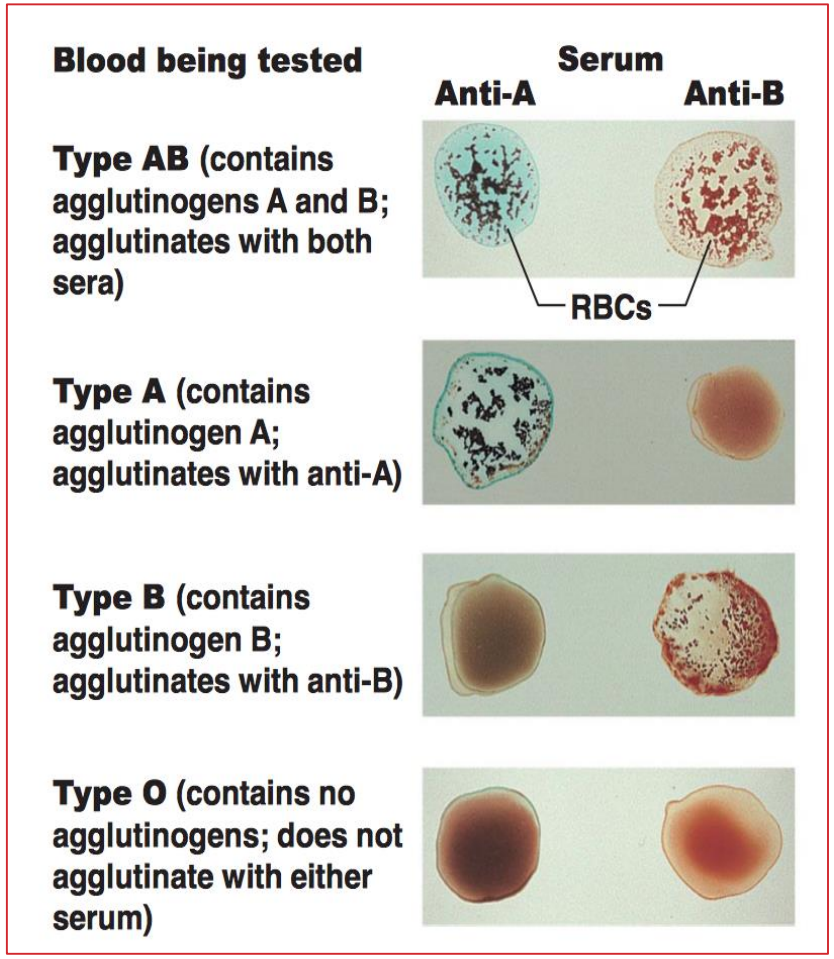


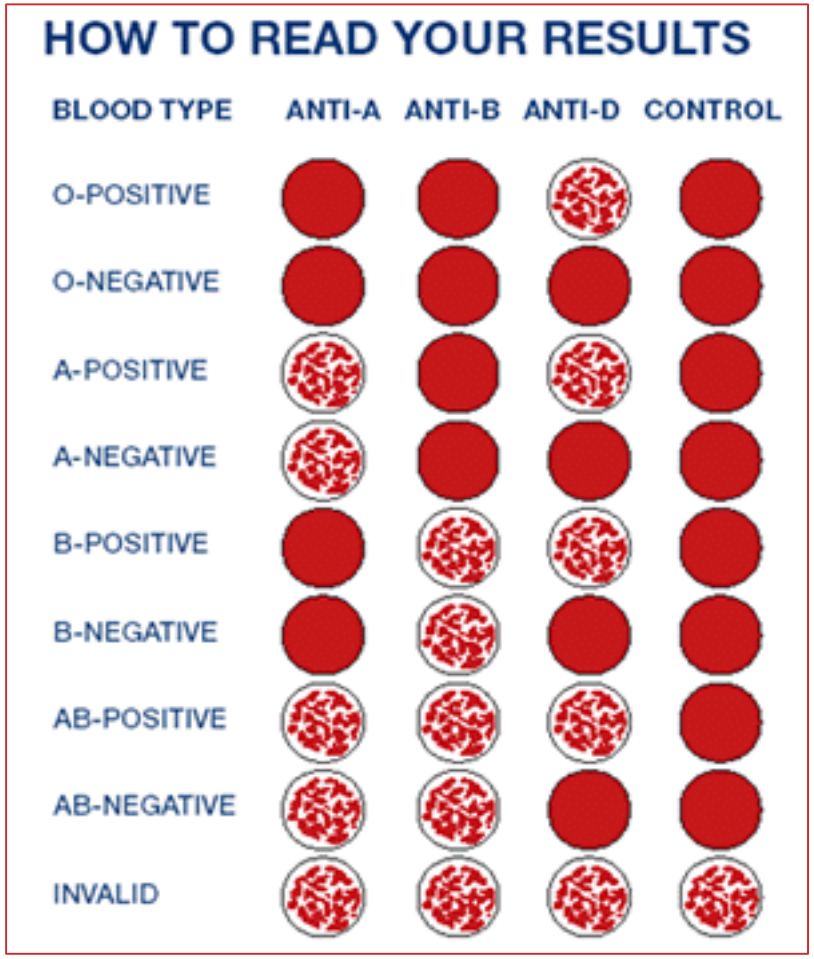
Principle of test

- Your blood sample is mixed with antibodies once against type A and then against B blood, and the sample is checked to see whether or not the blood cells stick together (agglutinate). If blood cells stick together, it means the blood reacted with one of the antibodies.

- Blood typing is also done to tell whether or not you have a substance called Rh factor on the surface of your red blood cells by adding Anti-D

Results


Blood being tested
Serum
Anti-A
Anti-B
Type AB (contains agglutinogens A and B; agglutinates with both sera)
RBCs
Type A (contains agglutinogen A; agglutinates with anti-A)
Type B (contains agglutinogen B; agglutinates with anti-B)
Type O (contains no agglutinogens; does not agglutinate with either serum)


HOW TO READ YOUR RESULTS
BLOOD TYPE
ANTI-A
ANTI-B
ANTI-D
CONTROL
O-POSITIVE
O-NEGATIVE
A-POSITIVE
A-NEGATIVE
B-POSITIVE
B-NEGATIVE
AB-POSITIVE
AB-NEGATIVE
INVALID