

Lab# 3

BCH 471 practical

ABO Blood & Rh Grouping system

Objectives:

- To determine the blood group according to the ABO system.
- To test for the availability of the Rh factor (D-antigen).

-The term “**blood group**”, refers to the entire blood group system comprising red blood cell (RBC) antigens.

-“**Blood type**”, refers to a specific pattern of reaction to testing antisera within a given system.

Table 1

Blood group systems

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

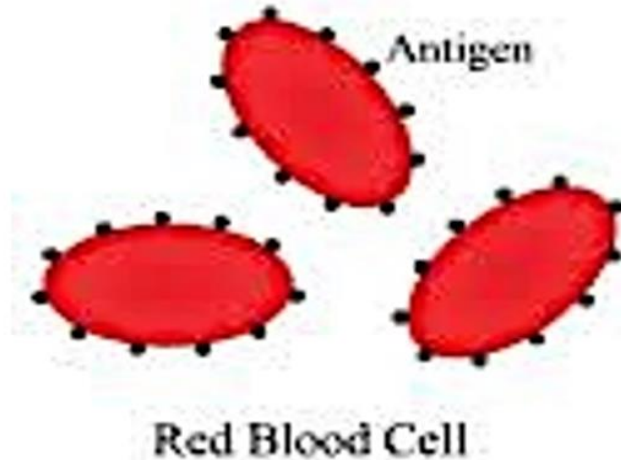
International Society of Blood Transfusion has recently recognized **33 blood group systems**. Apart from ABO and Rhesus system, many other types of antigens have been noticed on the red cell membranes.

To read the article follow this link:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4260296/>

Red blood cell antigens determine your blood group:

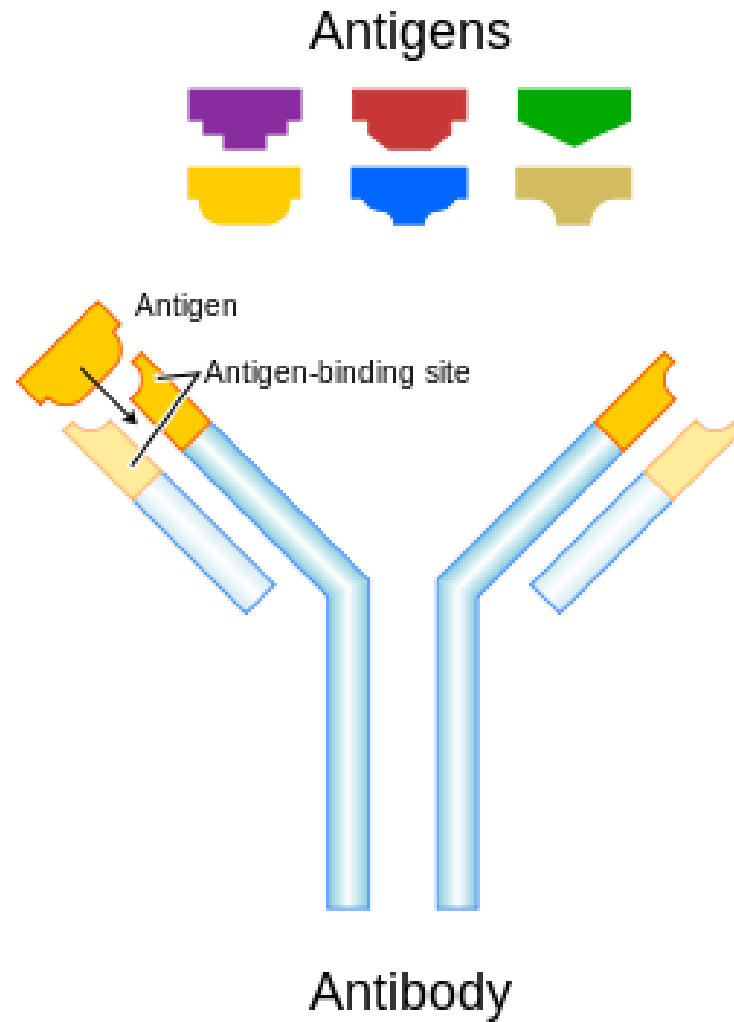
The antigens expressed on the red blood cell determine an individual's blood group. The main two blood groups are called ABO (with blood types A, B, AB, and O) and Rh (with Rh D-positive or Rh D-negative blood types). Which will be used in this lab.



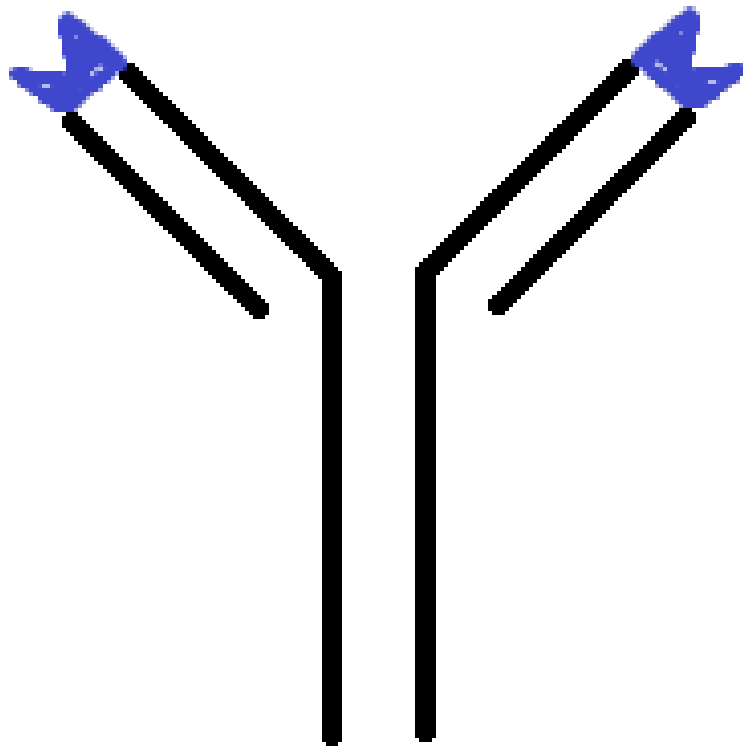
The black dots are, the antigens which located on the surface of the red blood cells.

- The differences in human blood types, are due to the presence or absence of certain molecules called antigens which are present on the surface of the RBCs.
- The antigens are located on the surface of the red blood cells.
- The antibodies present in the blood plasma have the capability to recognize and bind to foreign antigens, leading to the formation of antigen-antibody complexes and subsequent agglutination.
- Antigens are also found in a wide variety of tissues and biological fluids such as saliva, milk , seminal fluid, urine , and gastric juice.

Generally

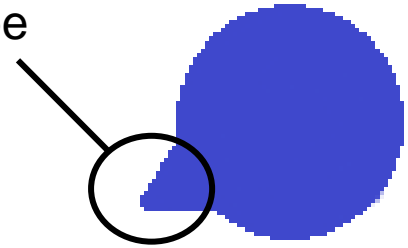


Generally



antibody

epitope


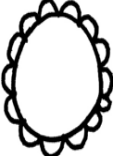
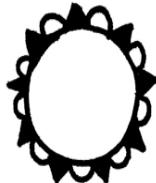



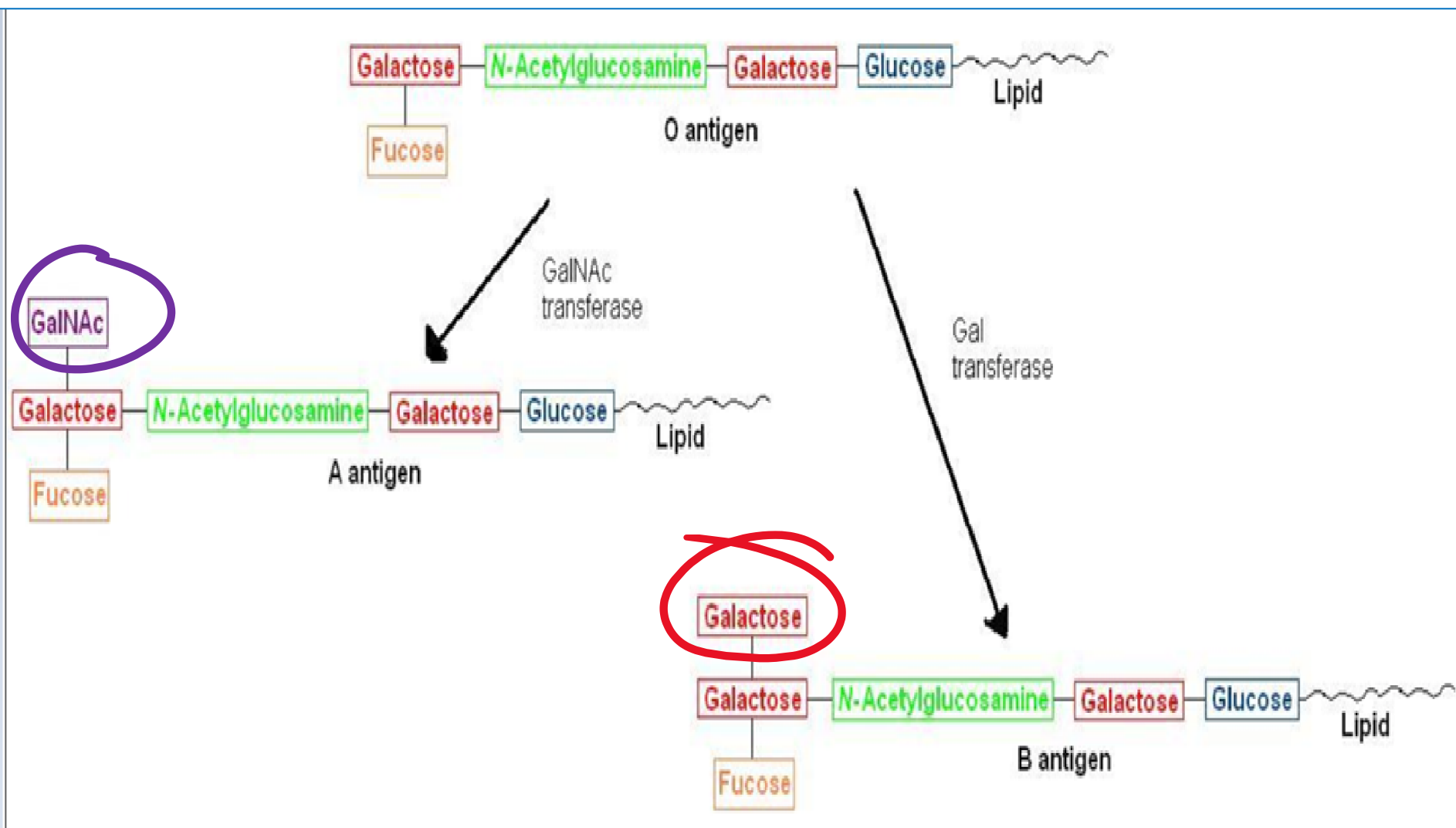
antigen

First: ABO Blood Type system

- The ABO blood type system is the major blood type classification system.
- The four blood types in the ABO system (A, B, AB, and O) refer to different versions of **oligosaccharides (the antigens mentioned before)**, which are present on the surface of RBCs.

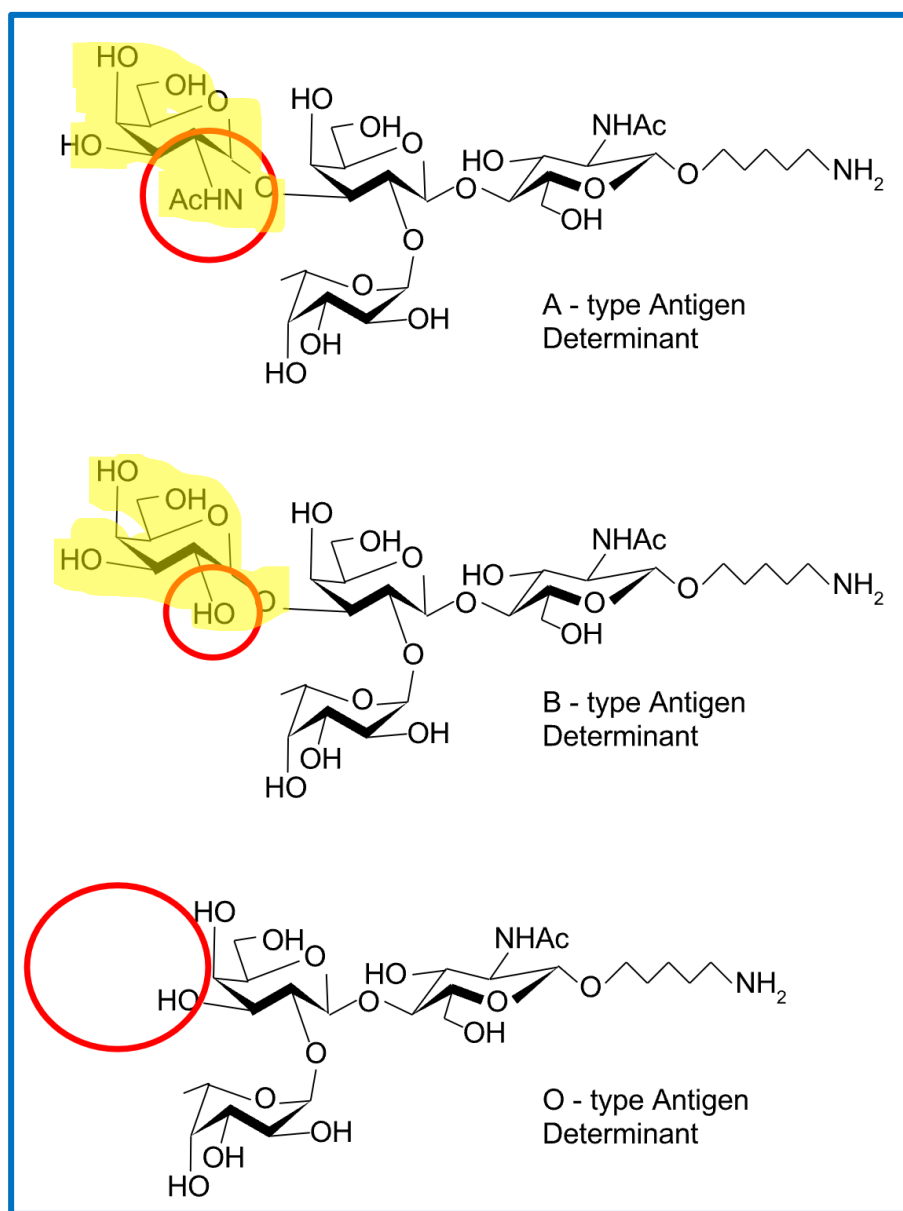
ABO Blood Type System

People with:	Have:	
Type A blood	Type A carbohydrate molecules on their red blood cells	
Type B blood	Type B carbohydrate molecules on their red blood cells	
Type AB blood	<u>Both</u> type A and type B carbohydrate molecules on their red blood cells	
Type O blood	<u>Neither</u> type A nor type B carbohydrate molecules on their red blood cells	



Scheme for A,B, and O antigens.

Note: GalNAc: N-acetylgalactosamine



Scheme for A,B, and O antigens.

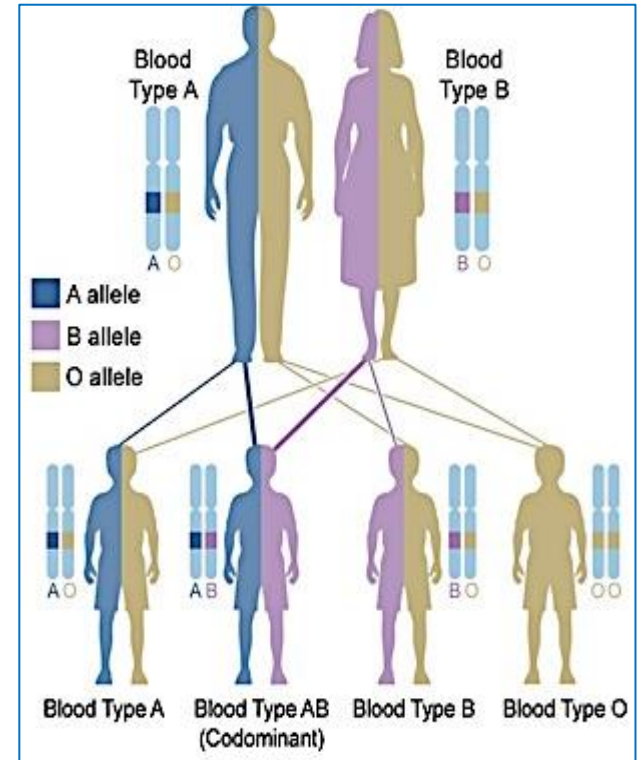
Importance of The ABO System

- safe practice of blood transfusion.
- forensic investigations.
- Organ transplantation.



Genetics of Blood Types

father	mother			Genotype = Phenotype
	A	B	O	
A	AA	AB	AO	$A+A = A$ $A+O = A$ $A+B = AB$
B	BA	BB	BO	$B+B = B$ $B+O = B$
O	OA	OB	OO	$O+O = O$



Codominance

is a condition in which the alleles of a gene pair in a heterozygote are fully expressed thereby resulting in offspring with a phenotype that is neither dominant nor recessive

Blood transfusions – who can receive blood from whom?

 A antigen  B antigen

Red blood cell



Blood type A



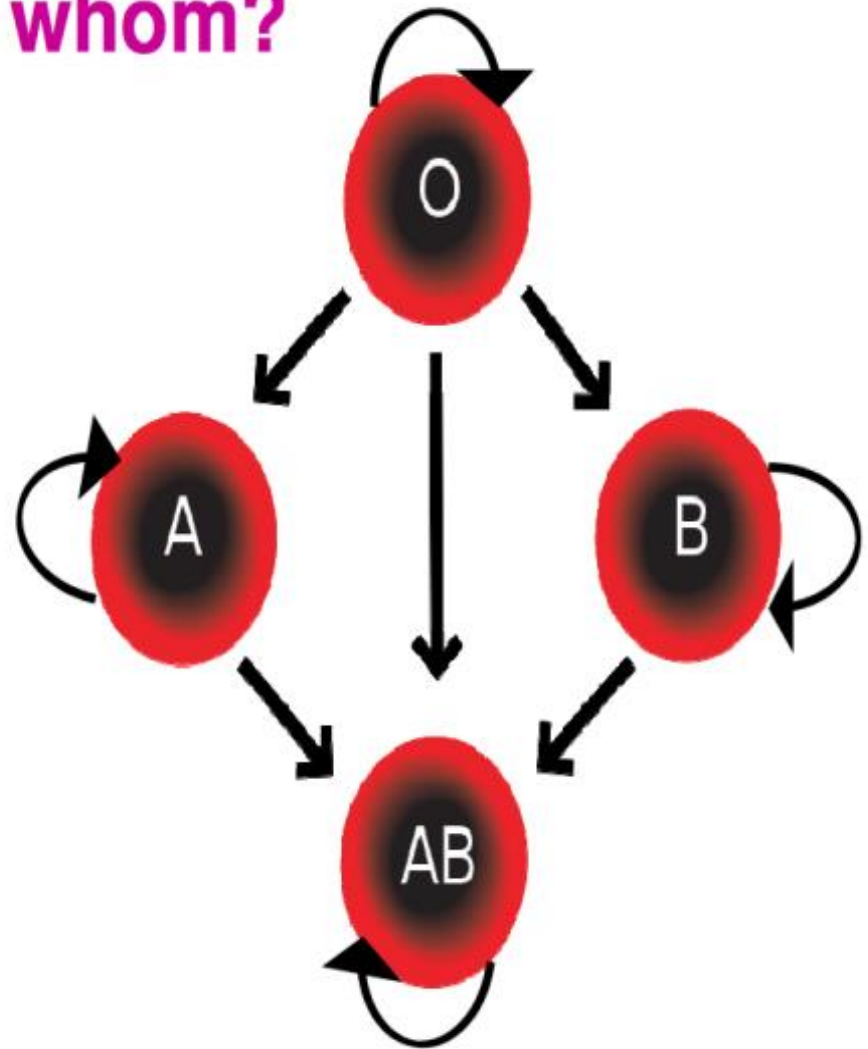
Blood type B



Blood type AB
Universal recipient



Blood type O
Universal donor

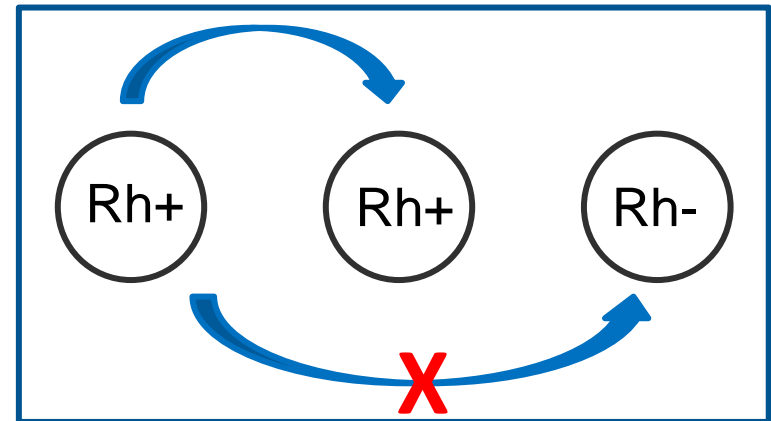
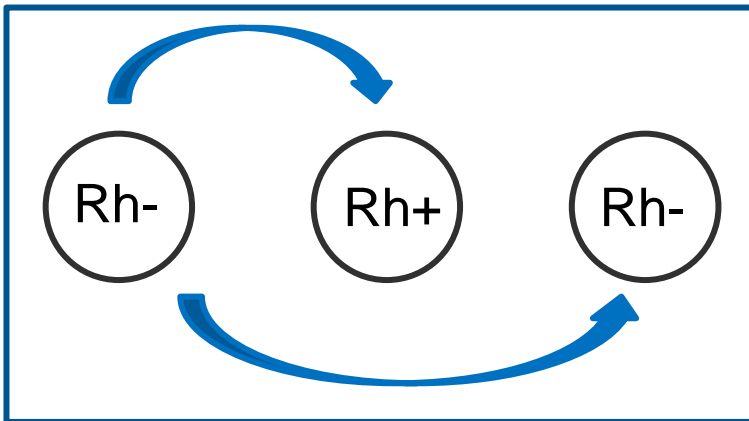


Rhesus Blood Group

- Is the second most significant blood group system in human transfusion.
- The D antigen (RhD), is the most important.
- Rh(D) status of an individual, is normally described with a positive or negative suffix after the ABO type. If it is present or absence on RBCs' surface, respectively.
- 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 Transfusion

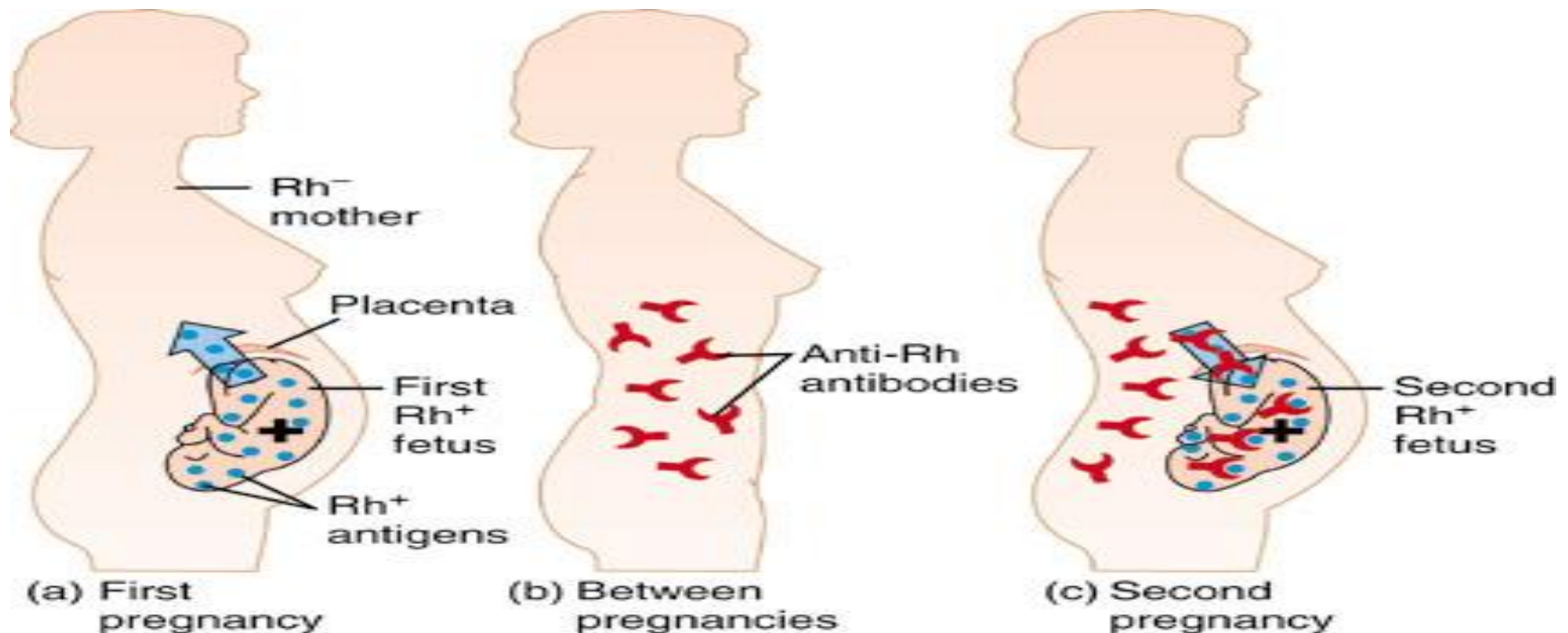
- A person with Rh+ blood can receive blood from a person with Rh- blood without any problems
- A person with Rh- blood can develop Rh antibodies in the blood plasma if he or she receives blood from a person with Rh+ blood, whose Rh antigens can trigger the production of Rh antibodies



Note: that the blood group ABO, should be considered along with Rh group.

Hemolytic Disease of The Newborn (HDN)

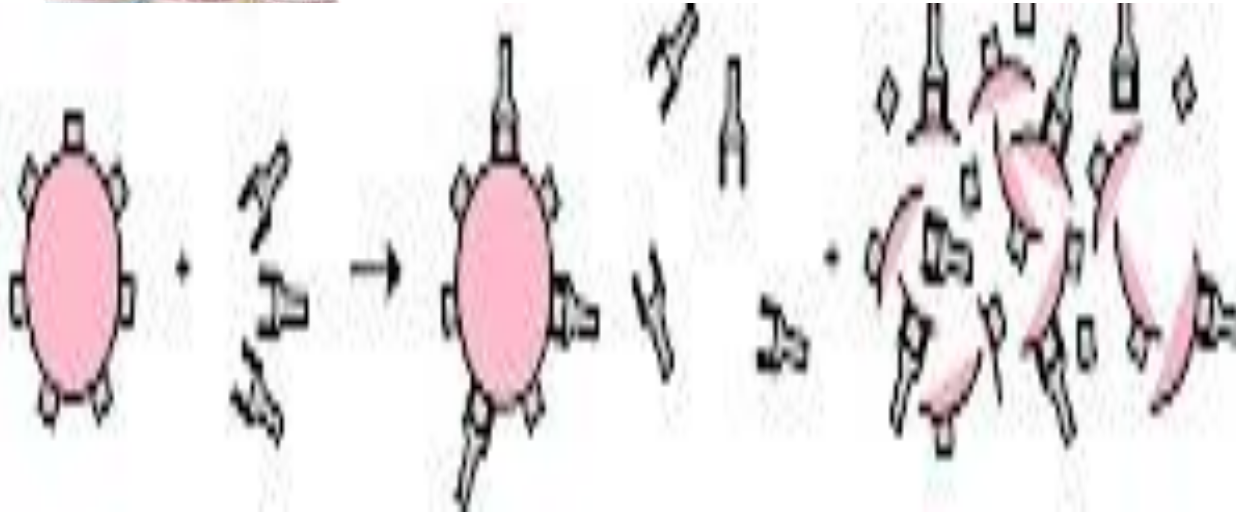
- Also called, Erythroblastosis Fetalis
- Mother is Blood type **Rh-**, Father and fetus are **Rh+**
- First pregnancy = sensitization at delivery due to hemorrhage
- Second pregnancy = Mother produce anti-Rh IgG antibodies that cross placenta to attack fetal RBCs leading to hemolysis



The principle of the ABO test:

- Method that determines an individual's blood type based on the presence or absence of certain antigens on the surface of red blood cells. [The test is based on the principle of antigen-antibody reactions.](#)
- The ABO blood group system classifies blood into four main types: A, B, AB, and O.
- [The principle of the ABO test,](#) involves mixing a small sample of the individual's blood with reagents called anti-A and anti-B antibodies. If the blood sample contains antigen A, it will agglutinate (clump) when mixed with the anti-A antibody. Similarly, if the blood sample contains antigen B, it will agglutinate when mixed with the anti-B antibody.

Principle Of Test



Type B
blood gp

Anti B
antibodies

Agglutination





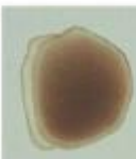



Hemolysis

Seen as the
picture



RESULTS

Blood being tested

	Anti-A	Serum	Anti-B
Type AB (contains agglutinogens A and B; agglutinates with both sera)			
	RBCs		
Type A (contains agglutinin A; agglutinates with anti-A)			
Type B (contains agglutinin 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				