قسم الكيمياء الحيوية
Biochemistry Department
College of Science - King Saud University

BCH 471

Experiment (3)

ABO Blood Grouping & Rh Groups

OBJECTIVES

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

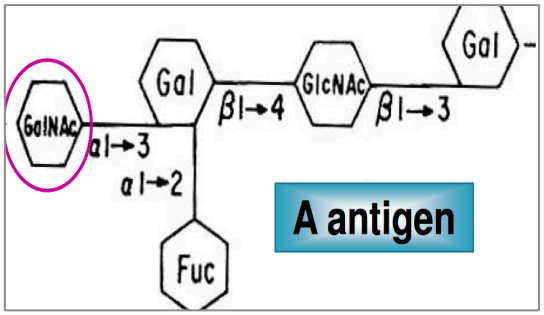
- To test for the availability of the Rh factor (D antigen) on the surface of erythrocytes.

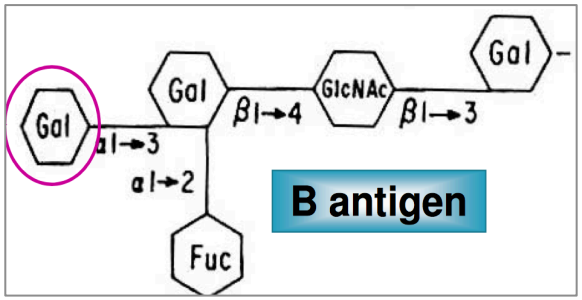
BLOOD GROUP SUBSTANCES

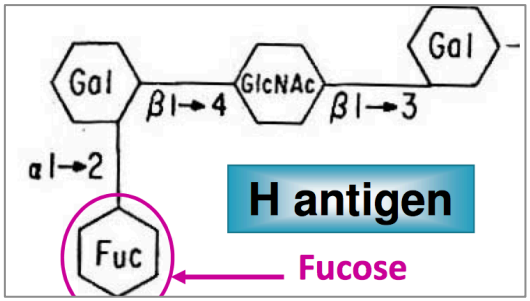
- There are more than 30 genetically determined blood group systems known today, but the ABO and Rh systems are the most important ones.
- The differences in human blood are due to the presence or absence of certain protein molecules called antigens and antibodies.
- The antigens are located on the surface of the red blood cells and the antibodies are in the blood plasma to attack foreign antigens, resulting in clumping (agglutination)
- 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.

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







IMPORTANCE OF THE ABO SYSTEM

- Blood group antigens must be determined to secure a safe practice of blood transfusion.
- They are also useful in determining familial relationships in forensic medicine.

GENETICS OF BLOOD TYPES

- Your blood type is established before you are born, by specific GENES inherited from your parents.
  - You inherit one gene from your MOTHER and one from your FATHER.
  - All are inherited according to mendelian laws of genetics.
- These genes determine your blood type by causing proteins called AGGLUTINOGENS (antigens) to exist on the surface of all of your red blood cells.

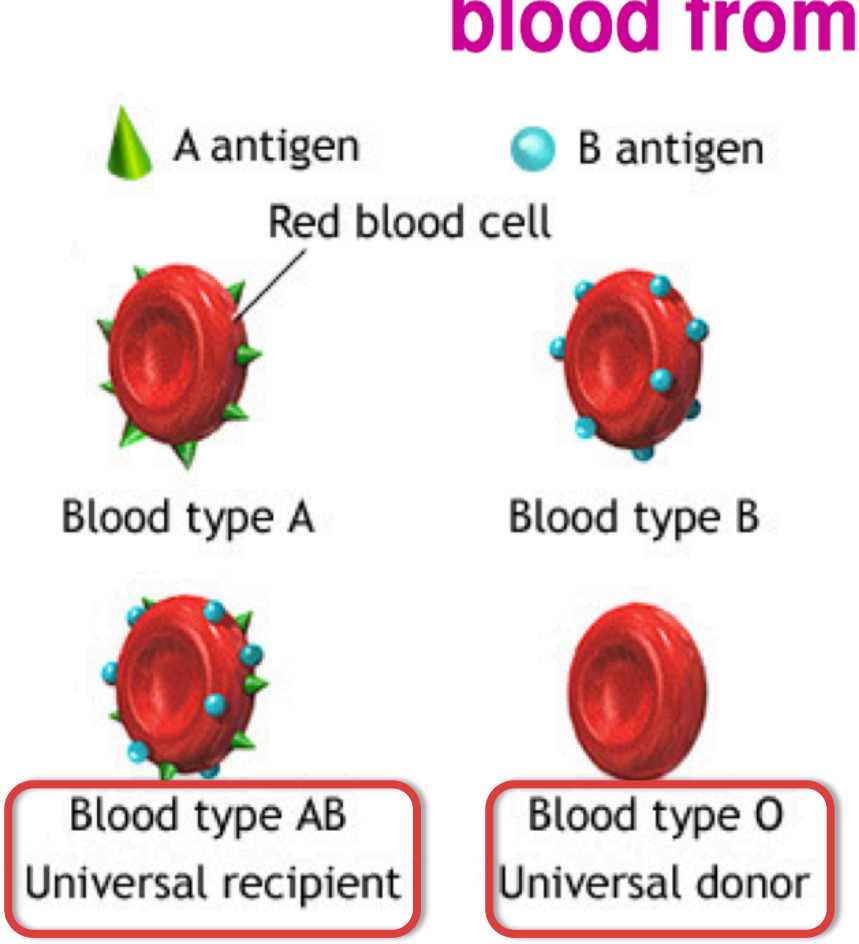
BLOOD TYPES

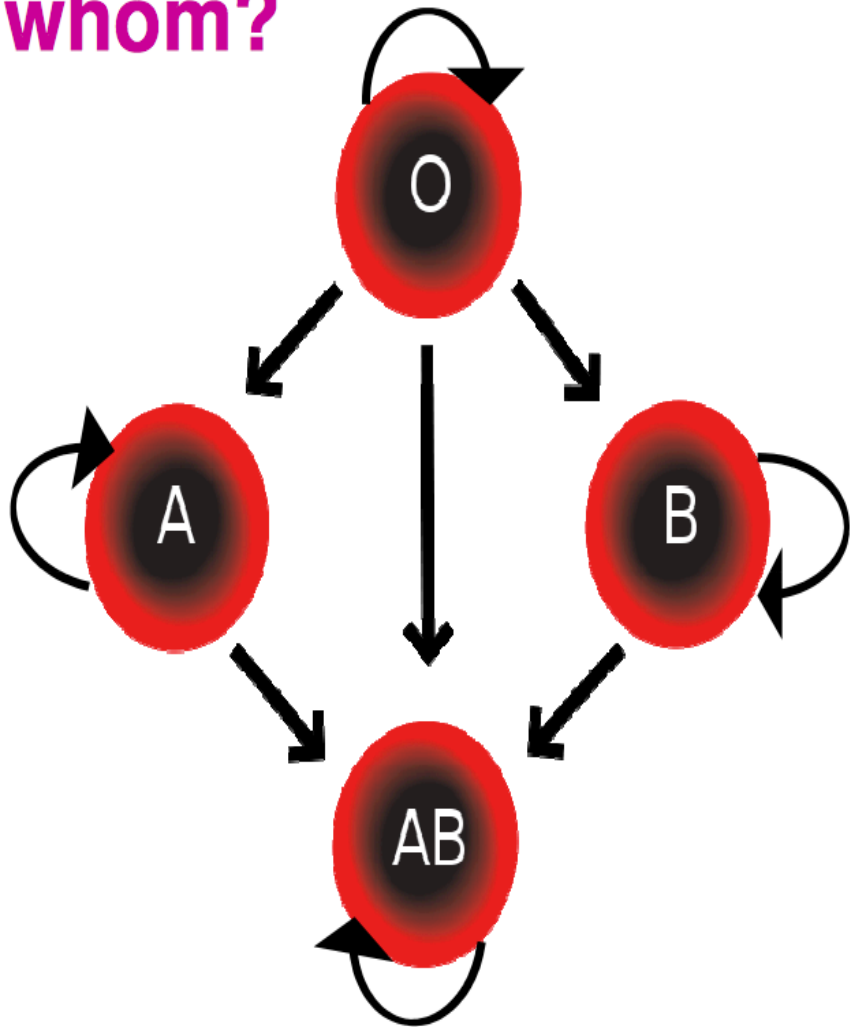
- There are 3 alleles or genes for blood type: A, B, & O.
- Since we have 2 genes, there are 6 possible combinations.

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?



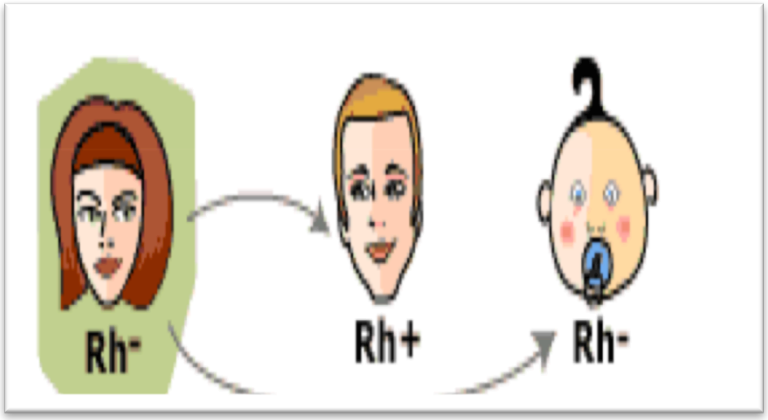


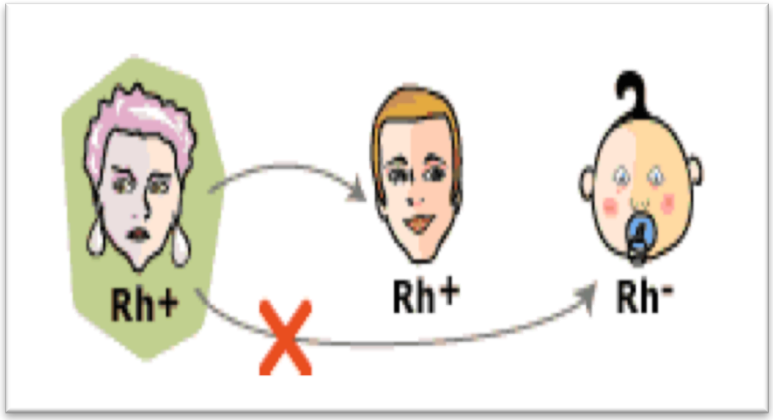
RHESUS BLOOD GROUP

- 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

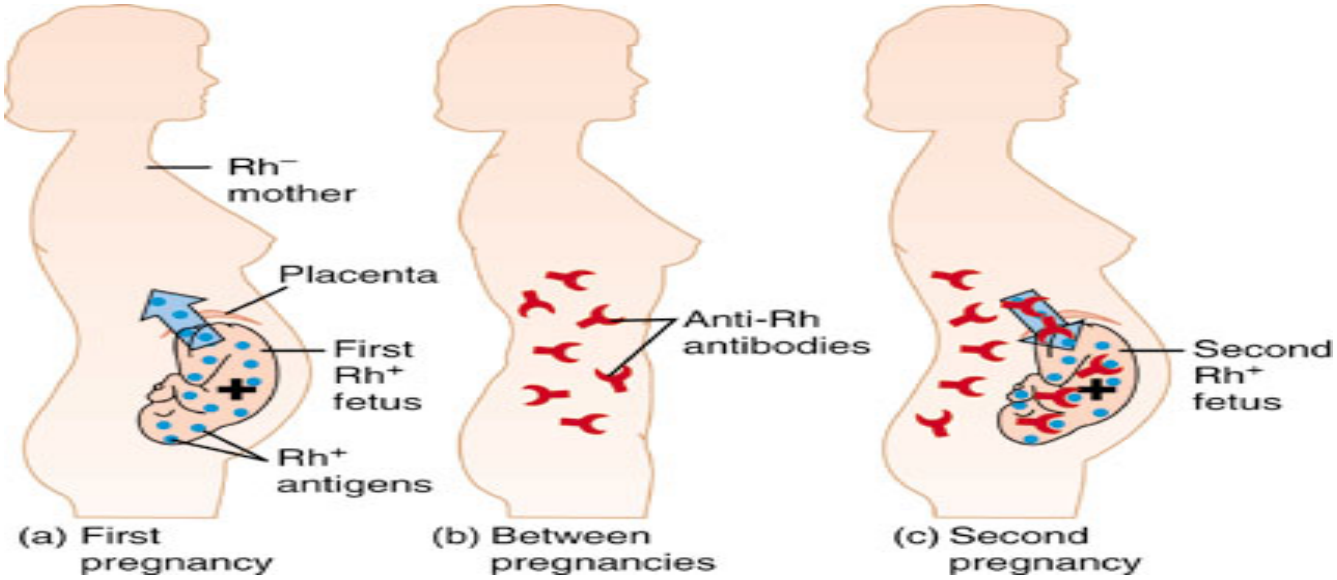
- A person with Rh+ blood can receive blood from a person with Rh- blood without any problems
- A person with Rh- blood can develop Rh antibodies in the blood plasma if he or she receives blood from a person with Rh+ blood, whose Rh antigens can trigger the production of Rh antibodies





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



Blood being tested

Type AB (contains agglutinogens A and B; agglutinates with both sera)

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)