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.
Blood transfusions – who can receive blood from whom?

- **A antigen**
  - Red blood cell
  - Blood type A
- **B antigen**
  - Blood type B
- **Blood type AB**
  - Universal recipient
- **Blood type O**
  - Universal donor

Diagram showing the compatibility of blood transfusions:
- A can receive A or O
- B can receive B or O
- AB can receive AB or O
- O can receive O, A, B, or AB
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)