Blood Biochemistry BCH 471[Practical]

Lab (3) ABO Blood Grouping & Rh Groups

Objectives

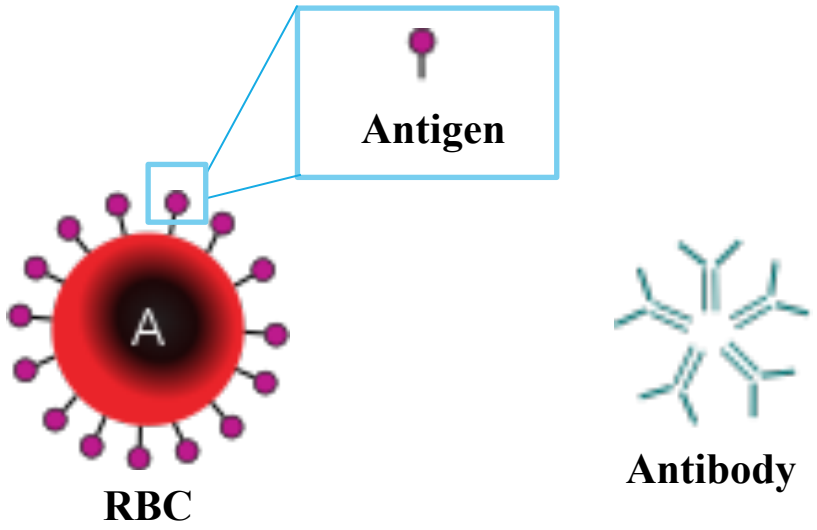
1. To determine the blood group according to the ABO system.
2. To test for the availability of the Rh factor (D antigen).

Blood Group Substances

Remember !!
Antigen X Antibody

- The differences in human blood are due to the presence or absence of certain protein molecules called **antigens** and **antibodies.**
- The **antigens** are glycoproteins located on the surface of the red blood cells.
- The **antibodies** are proteins present in the plasma to attack foreign antigens, resulting in clumping (agglutination).
- **ABO blood grouping consists of:**

1. Two antigens **(A & B)** on the surface of the RBCs
2. Two antibodies in the plasma **(anti-A & anti-B)**

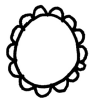
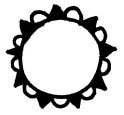


ABO Blood Type System

Remember !!
Antigen X Antibody

- 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 **glycoproteins** which are present on the surface of RBCs.

Blood Types:

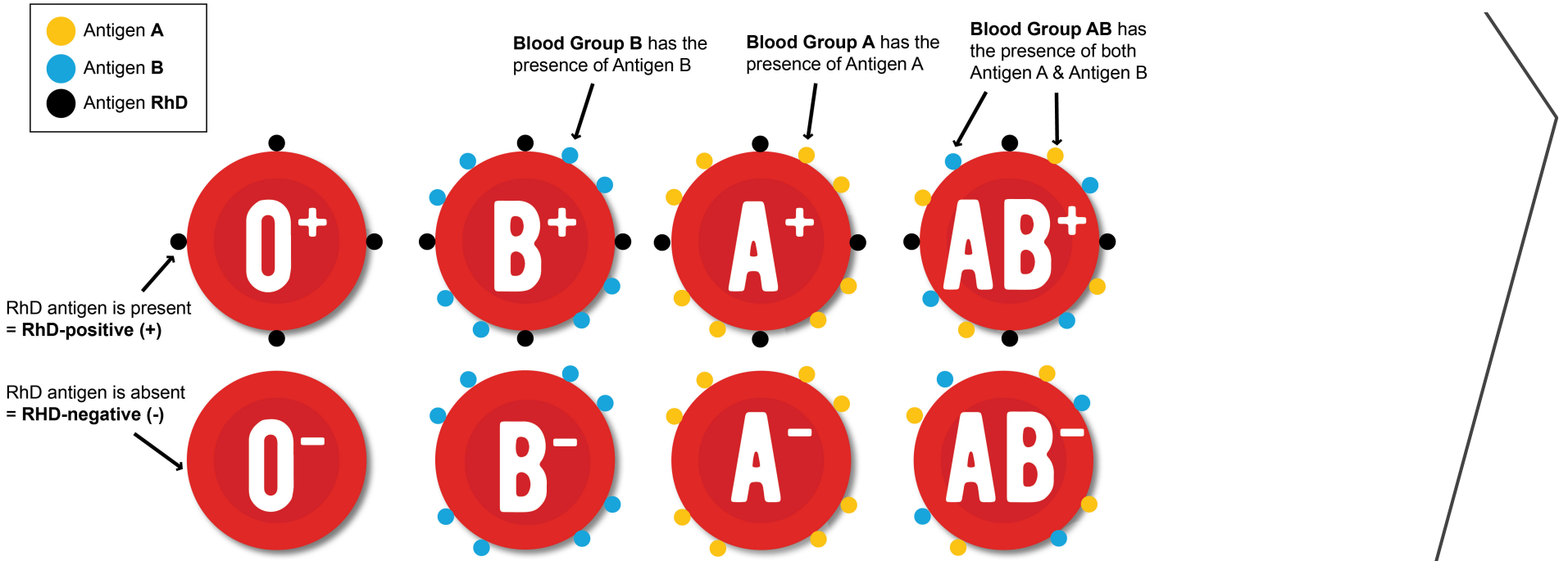
Blood Type	Surface antigens	Plasma antibodies	
Type A	A-surface antigens	Anti-B	
Type B	B-surface antigens	Anti-A	
Type AB	A and B antigens	No antibodies	
Type O	No surface antigens	Anti-A and anti–B	

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.**

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.



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.

Blood Types Compatibility

Red Blood Cells Compatibility Table

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

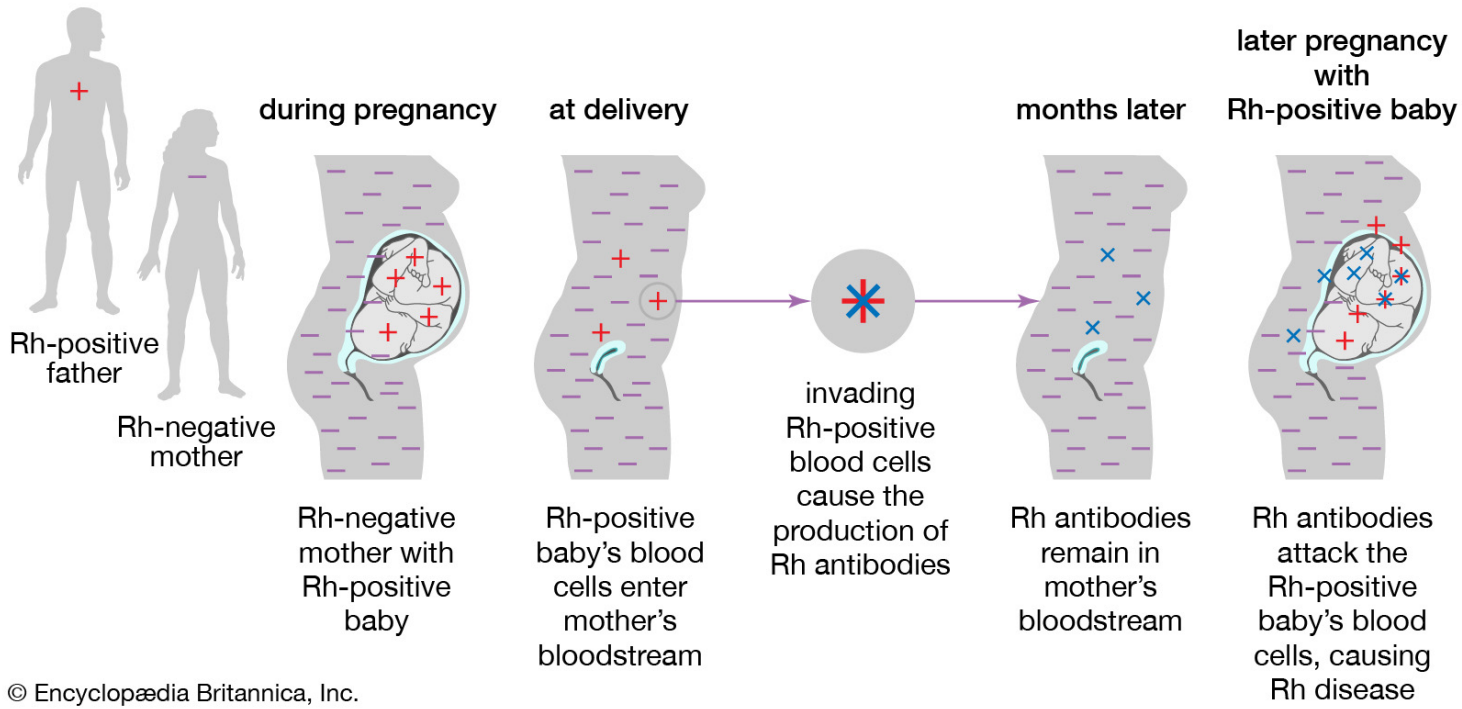
Universal Donor

Universal Recipient

Hemolytic Disease of The Newborn (HDN)

Not included !

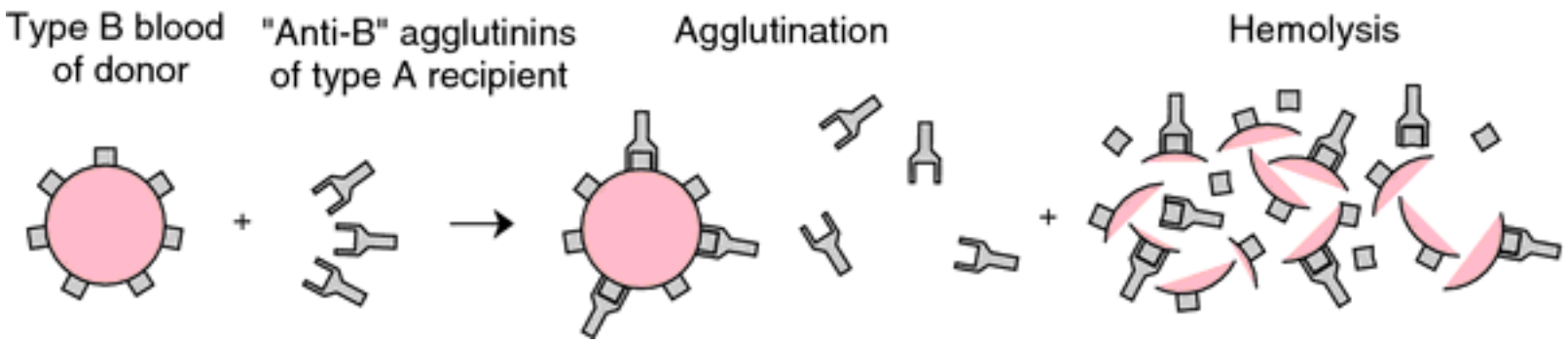
- Also called, **Erythroblastosis Fetalis** a **hemolytic anemia** in the fetus or neonate, caused by trans-placental transmission of maternal antibodies to fetal RBCs.
- Mother is Blood type Rh^-, Father and fetus are Rh^+.
- **First pregnancy** = Sensitization at delivery due to hemorrhage.
- **Second pregnancy** = Mother produce anti-Rh IgG antibodies that cross placenta to attack fetal RBCs leading to hemolysis.



Practical Part 💉

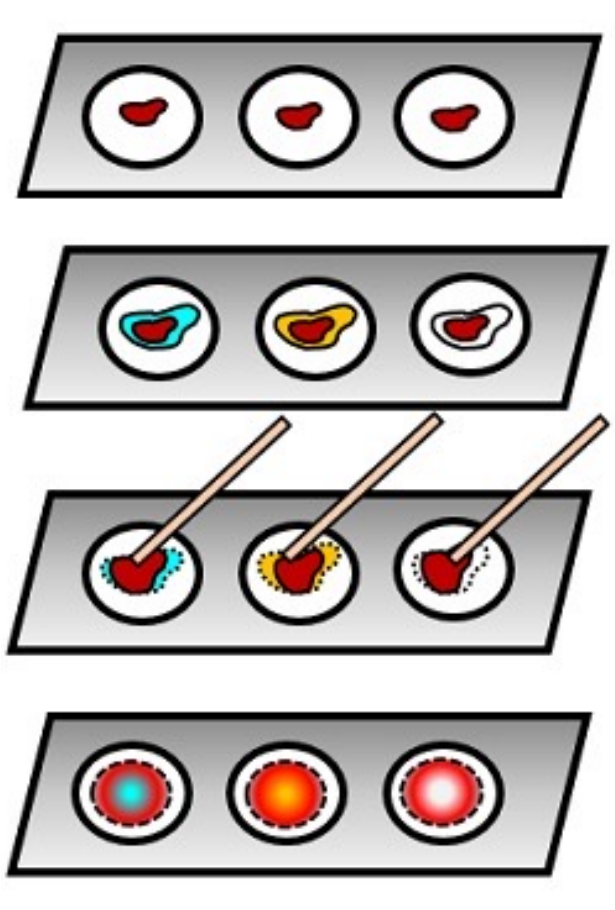
Principle of Test

- The ABO and Rh blood grouping system is based on **agglutination reaction.**
- **Agglutination** is the reaction **between antigens** present on red blood cells **and antibodies** present in serum **resulting in visible clumping.**
- Agglutination occurs if an antigen is mixed with its corresponding antibody, i.e. occurs when A antigen is mixed with anti-A or when B antigen is mixed with anti-B.



Blood grouping solutions

Procedure



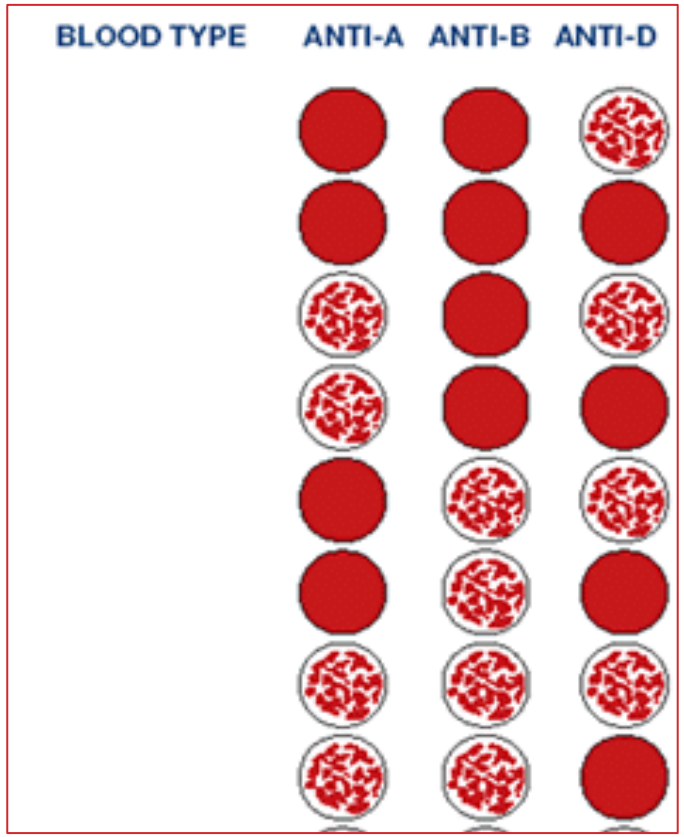
1.Add three drops of blood in a clean glass slide

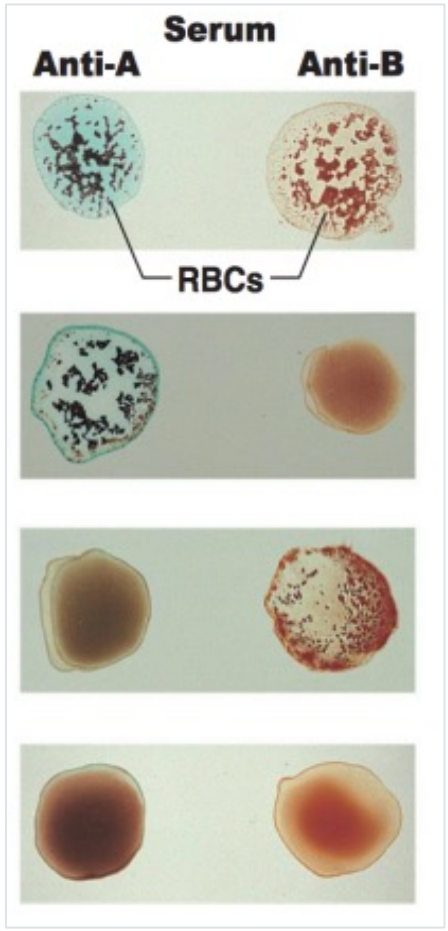
2.Add antisera A, B and D sequentially to the 1st, 2nd and 3rd drop of blood

3.Properly mix the antisera with the blood by separate toothpicks

4.Allow to stand for 2-3 minutes and note down the result on the basis of clump formation

Results





- If the agglutination occurs in the RBCs to which **both anti-A and B is added**, then the **blood group** is '**AB**'.
- If the agglutination occurs in the RBCs to which **anti-A is added**, then the **blood group** is '**A**'.
- If agglutination occurs in the RBCs to which **anti-B is added**, then the **blood group** is '**B**'.
- If there is **no agglutination occurs** in the RBCs, then the **blood group** is '**O**'.

- If the **agglutination occurs** in the RBCs to which **anti-D is added,** then the blood type is positive (+) whereas if **no agglutination** occurs in the RBCs to which anti-D is added, then the blood type is negative (-).

Homework

- Does blood type change with a **bone marrow transplant** in case of **leukemia patients**?

  If yes, why?
- How many human **blood group systems** are there? *Name two*.