



Al-Rasheed University College Pharmacy Department

2nd Stage / 1st Semester

2021-2022



Blood Grouping

Physiology lab #2

Done by:

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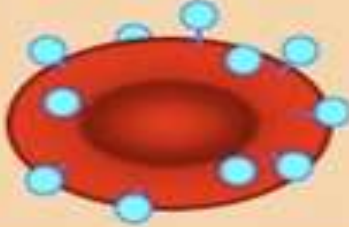



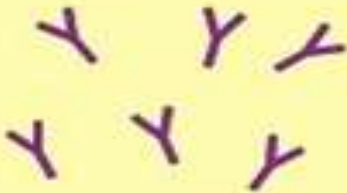


Introduction

- **Blood** grouping is mainly done by the ABO system.
- Investigation of the different types of **blood** group was based on the presence of specific molecules on surface of the erythrocytes.

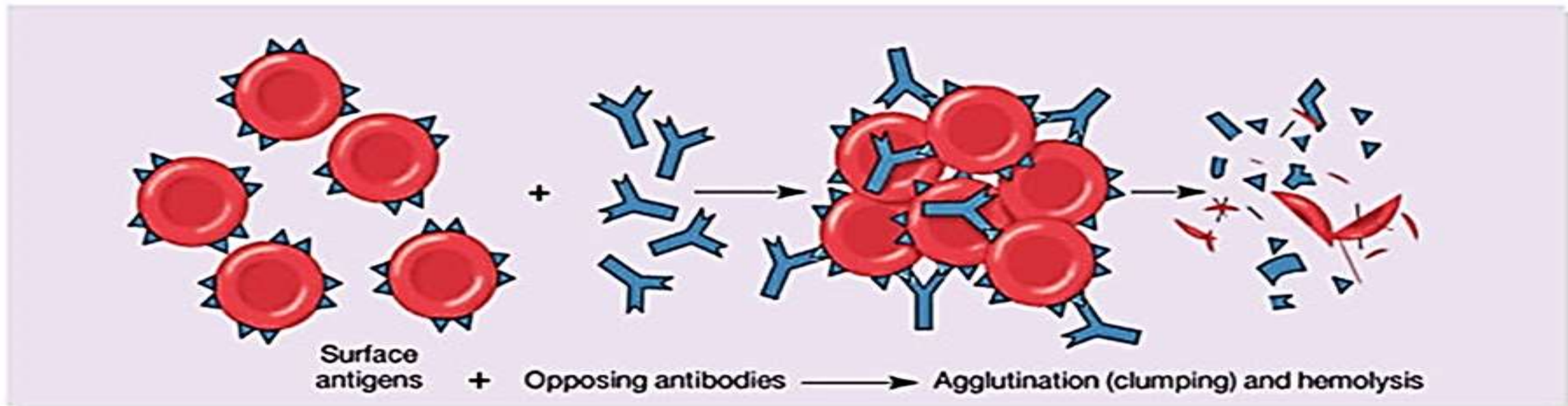
The surface of **erythrocytes** is mostly covered by antigens or agglutinogens.

HOWEVER!, **plasma** (liquid matrix) contains specific proteins >> antibodies or agglutinin

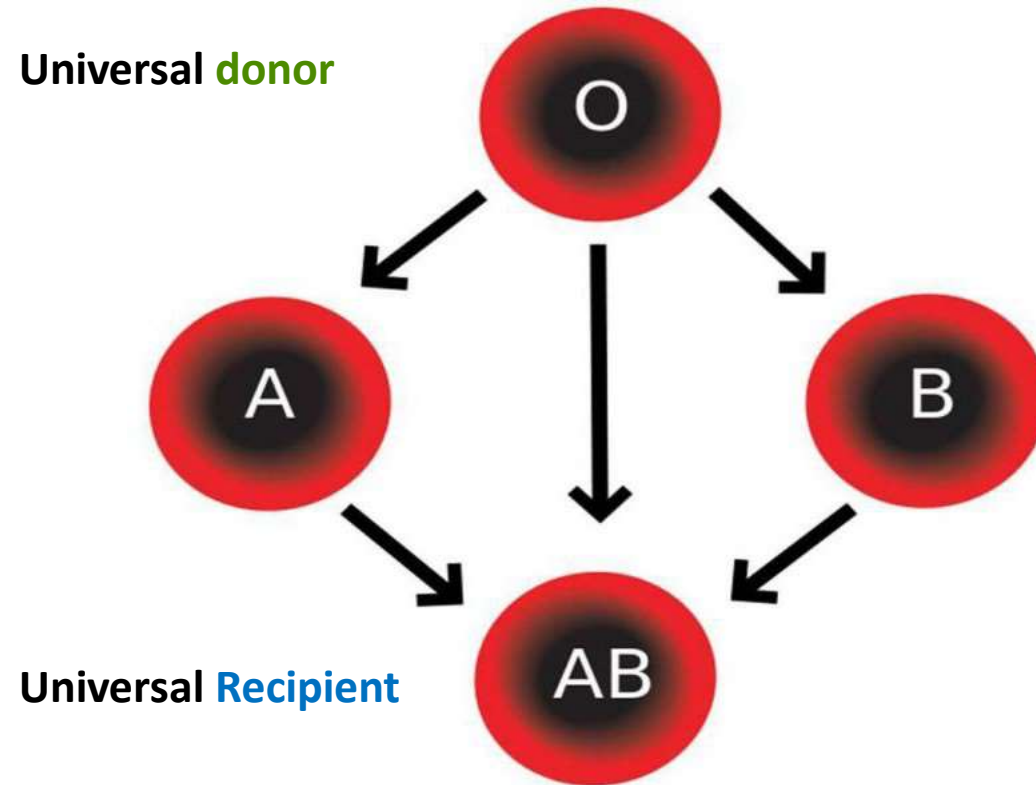
ABO blood's classification

ABO Blood Groups				
Antigen (on RBC)	Antigen A 	Antigen B 	Antigens A + B 	Neither A or B 
Antibody (in plasma)	Anti-B Antibody 	Anti-A Antibody 	Neither Antibody	Both Antibodies 
Blood Type	Type A Cannot have B or AB blood Can have A or O blood	Type B Cannot have A or AB blood Can have B or O blood	Type AB Can have any type of blood Is the universal recipient	Type O Can only have O blood Is the universal donor

- The clumping of an **antigen** with the corresponding **antibody** >> agglutination or clumping.
- The reaction between different or incompatible **antigen** and **antibody** >> transfusion reaction
- Agglutination mechanism results in:
 - A-Hemolysis or puncture of the erythrocytes
 - B-Promoting clotting cascade
 - C-Might contribute into tissue damage.



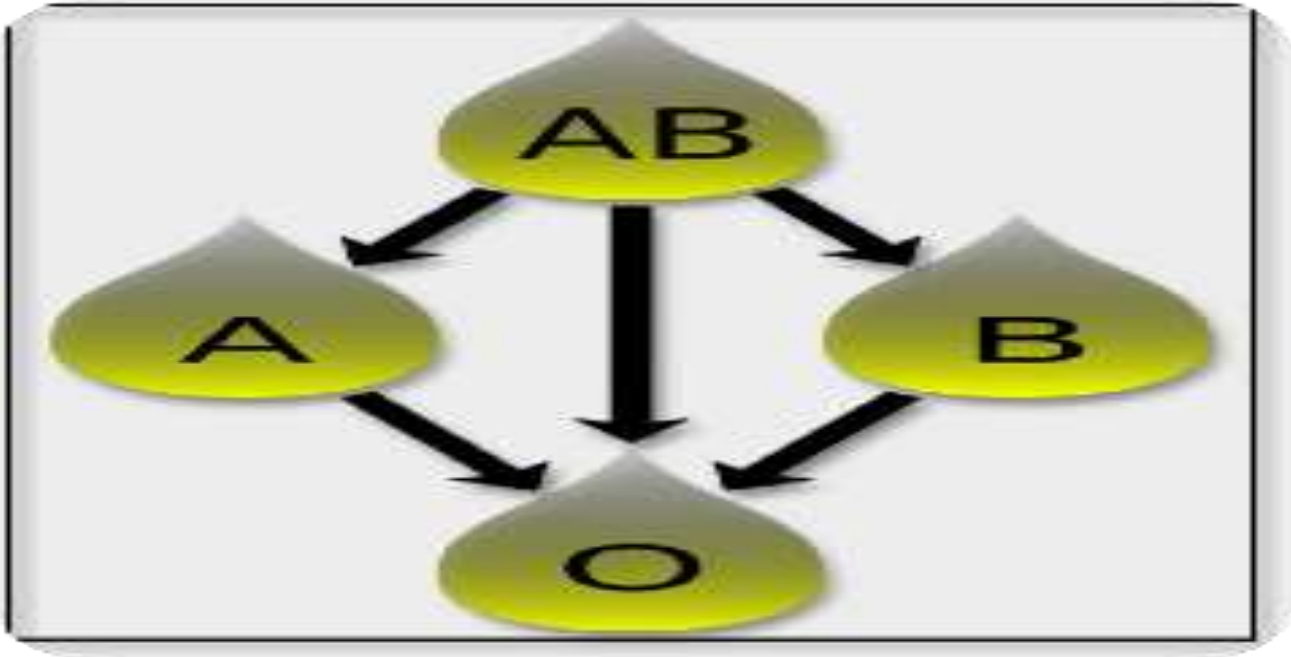
- Donor >> Individual who gives away blood.
- Recipient >> Individual who receive blood.



Utilizing the “Universal Donor” (type O) is only considered in life threatening cases

Plasma donation

Universal donor



Universal recipient

According to the donation scheme

- **Blood** donation:

Type O >> **Universal Donor**

Type AB >> **Universal Recipient**

- **Plasma** donation:

Type AB >> **Universal Donor**

Type AB >> **Universal Recipient**

The term universal donor is considered misleading and should only be considered in life threatening situations because:

1-Presence of subgroups of blood groupings

2-Antibodies present in the plasma of type O blood reacts with antigens of the other types of blood groupings



Rh blood grouping

- Rhesus antigens (**Rh** antigens) are a transmembrane proteins expressed on the surface of **erythrocytes**.
- People with **Rh+** >> they have **Rh** antigen on their **RBCs**
People with **Rh-** >> they don't have **Rh** antigen on the **RBCs**
- An individual with **Rh-** blood doesn't produce antibodies unless he/she receives a **Rh+** blood.

Question time

- What will happen if a **Rh-negative person** receives blood from a **Rh-positive** person?

First time: there will be sensitization and production of antibodies to the Rh antigen.

Second time: more antibodies will be produced, and transfusion reaction will occur

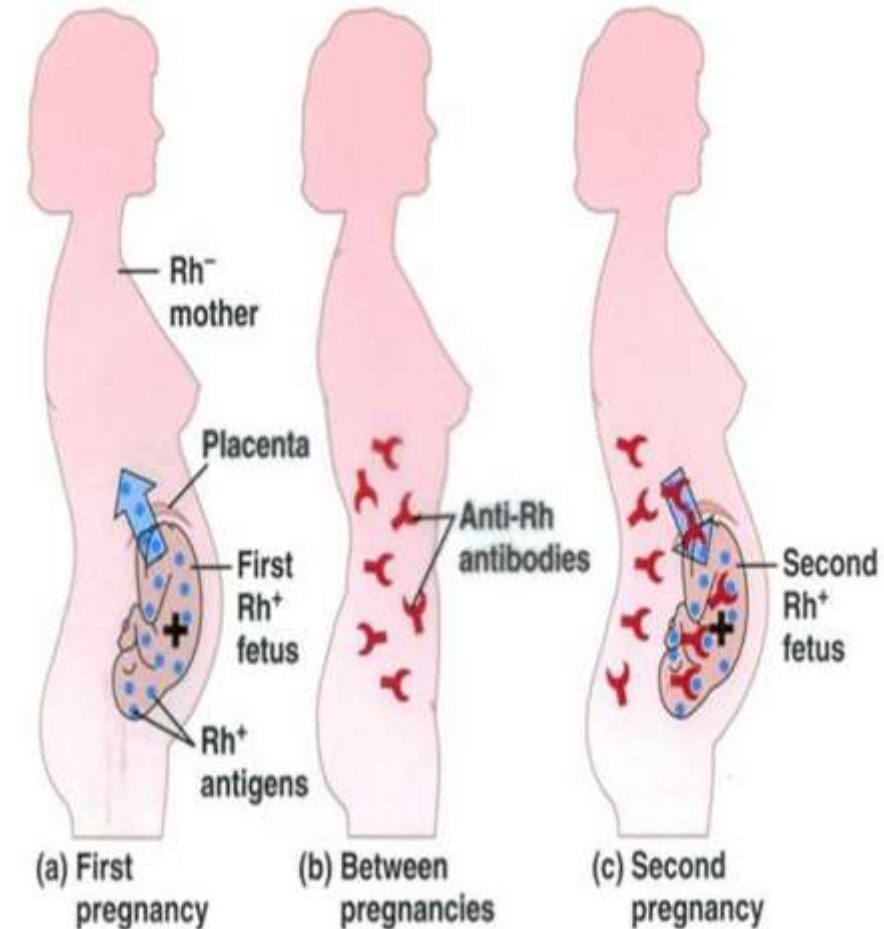
Rh blood grouping and pregnancy

Rh blood groups is considered critical in the following cases:

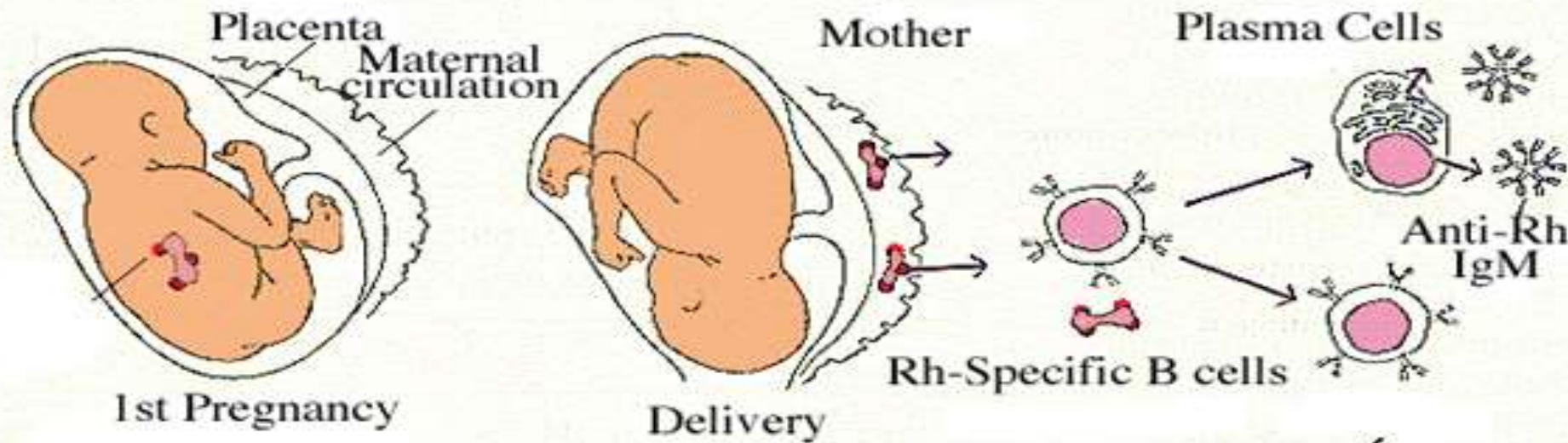
- 1- Transfusion of blood
- 2- During pregnancy because Rh groups may cause HDN!

Hemolytic disease of newborn (HDN) develops when:

- 1-Mother blood is Rh-negative, fetus is Rh-positive
- 2- There is a tear in the placenta, fetal blood leaks through and mixes with mother's blood later in pregnancy or during delivery
- 3-The mother becomes sensitized to Rh antigen and produces Antibodies
- 4-Occurs in the second pregnancy rather than the first

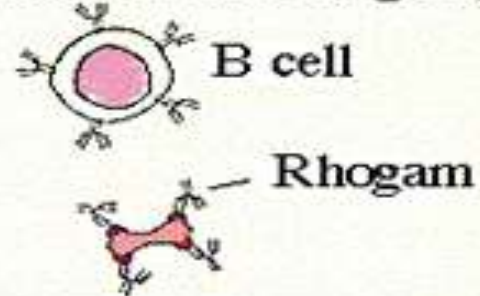


Development Of Erythroblastosis Fetalis (Without Rhogam)

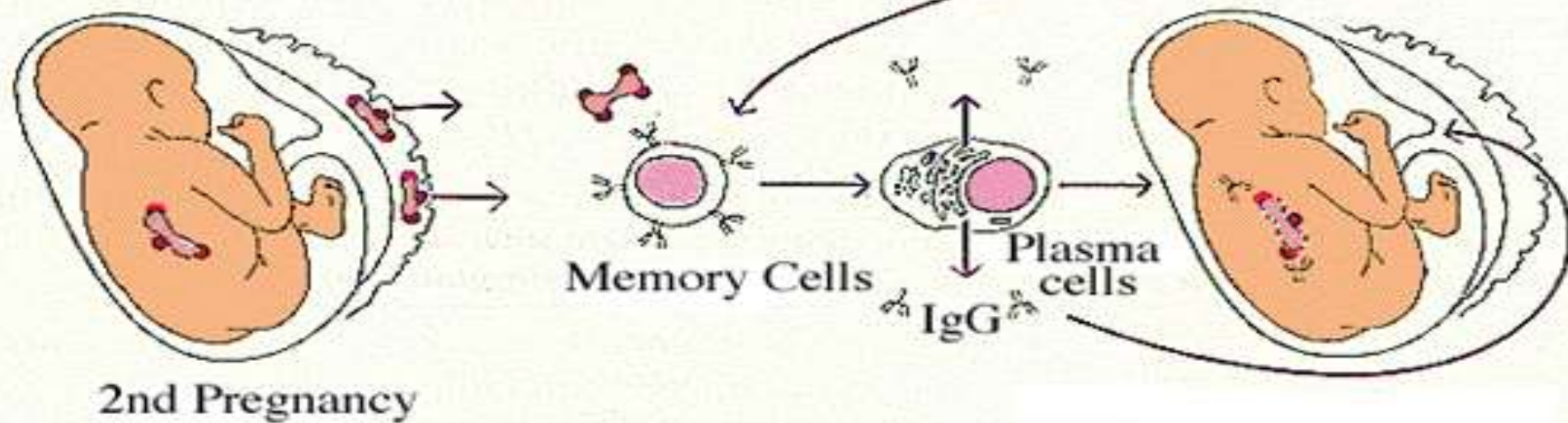


Prevention (With Rhogam)

Mother (treated with Rhogam)



Prevents B-cell activation and memory cell formation



HDN can be prevented by administering the mother with **anti-Rho (D) immunoglobulin** injection after each delivery and abortion (**within 48-72hr**)

The injection contains antibodies against Rh antigens.

The injected antibodies binds to the Rh antigens of any fetal **erythrocytes** that may have crossed the mother's blood.

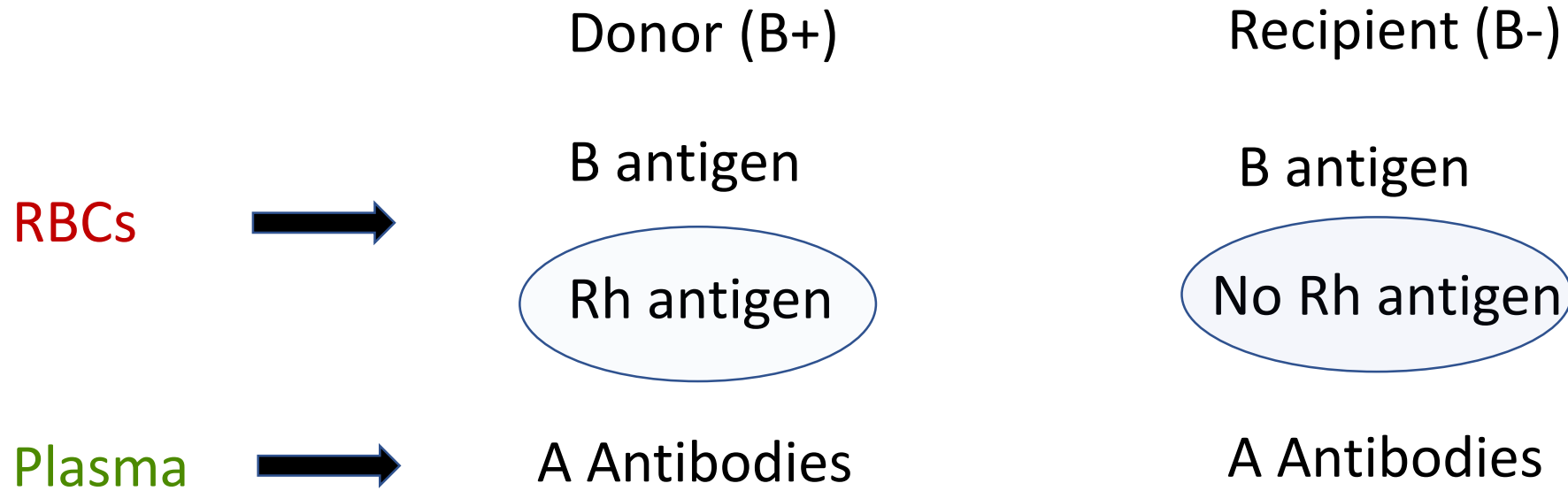
This treatment inactivates the fetal Rh antigens and prevents sensitization of the mother.



- If **HDN** develops, treatment consist of:
 1. Slowly removing the blood of the newborn and replacing it with **Rh- blood**
 2. Exposing the newborn to fluoresce light which helps breakdown the excess of **bilirubin** formed from the **hemolysis of blood**
- *If HDN was not **treated**, then excessive levels of **bilirubin** can be toxic to the brain tissues and may lead to a condition named **kernicterus***

Examples

- A person with a blood type (B+) donated blood to a person with blood type (B-). What would be the outcome?



- **First time:** No transfusion reaction but there will be sensitization to the Rh antigen and production of antibodies
- **Second time:** There would be transfusion reaction because the produced antibodies will react with Rh antigen

Examples

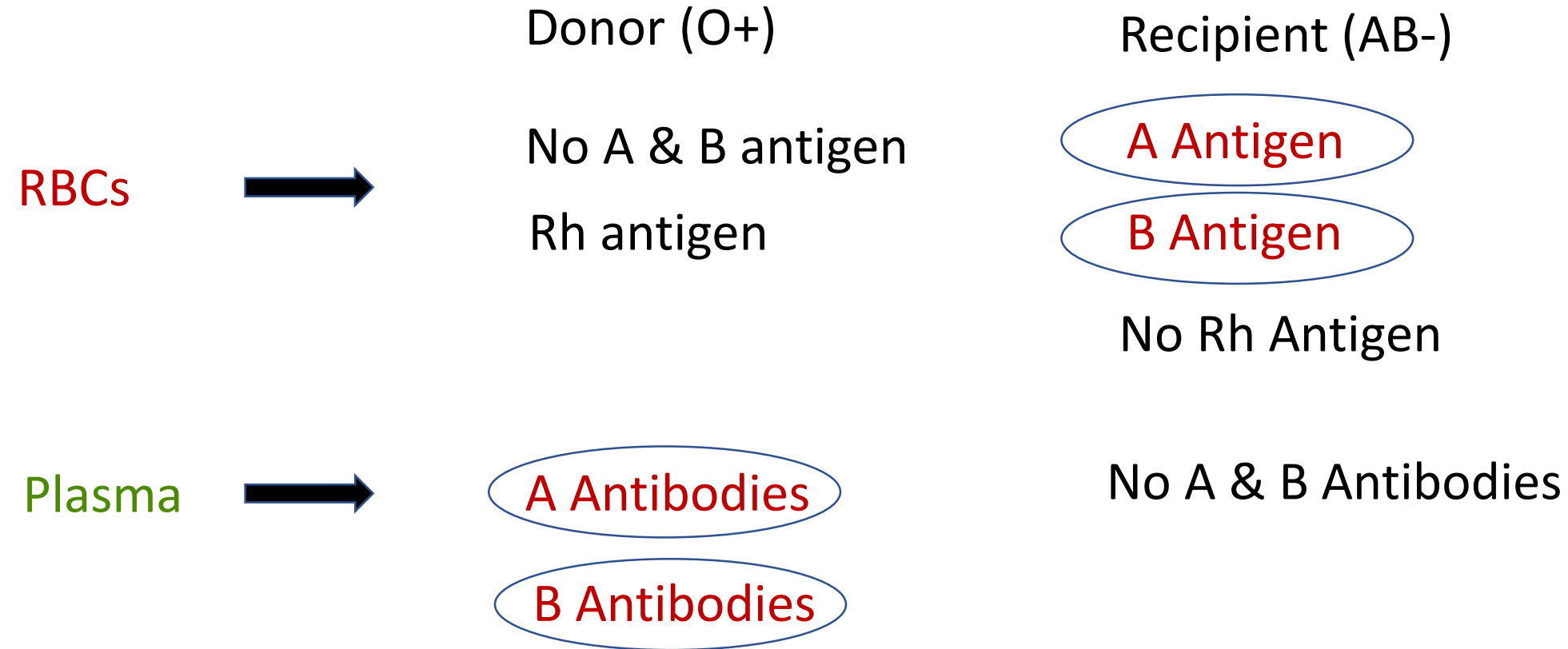
A person with a blood type (O-) donated blood to a person with blood type (B+). What would be the outcome?

	Donor (O-)	Recipient (B+)
RBCs →	No A & B antigen No Rh antigen	B antigen Rh antigen
Plasma →	A Antibodies B Antibodies	A Antibodies

- There will be a transfusion reaction, but the reaction is **mild** because blood of the donor will be diluted in blood of the recipient. Such transfusion should only be considered in life threatening cases

Examples

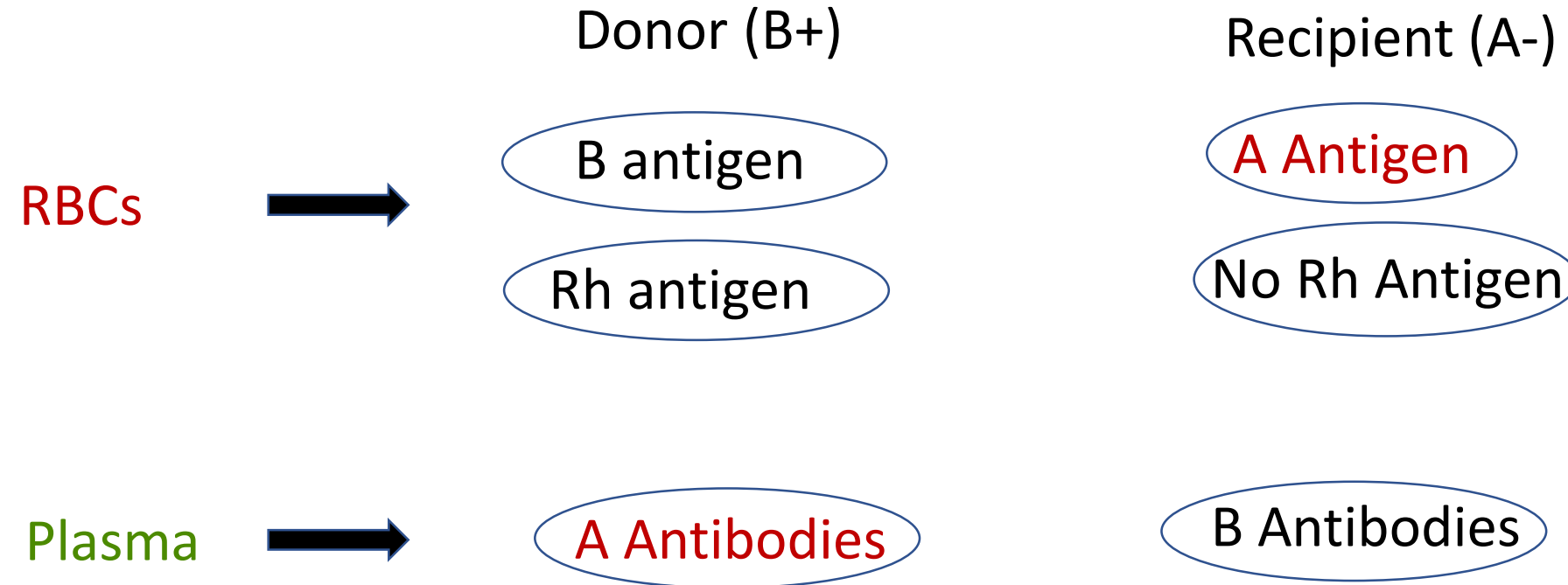
What is clinical outcome if a (O+) blood is transferred to a (AB-)?



- Such transfusion **is unacceptable**, because the antibodies in the donor blood will react with antigens in the recipient blood; and the Rh antigen in the donor blood will cause sensitization to the recipient

Examples

What is clinical outcome if a (B+) blood is transferred to a (A-)?



- Such transfusion is unacceptable and wrong >> Antibodies and antigens between the two groups will react >> **The Rh antigen** in the donor will cause sensitization of recipient. This transfusion will result in a **lethal kidney failure!!**

Acute kidney shutdown

- Transfusion reaction between **different and incompatible groups** can lead to **life threatening renal failure** and it seems to result from three causes:
 - 1-Powerful Renal vasoconstriction
 - 2-Circulatory shock
 - 3-Renal tubular blockage from excessive levels of hemoglobin released from the hemolyzed RBCs

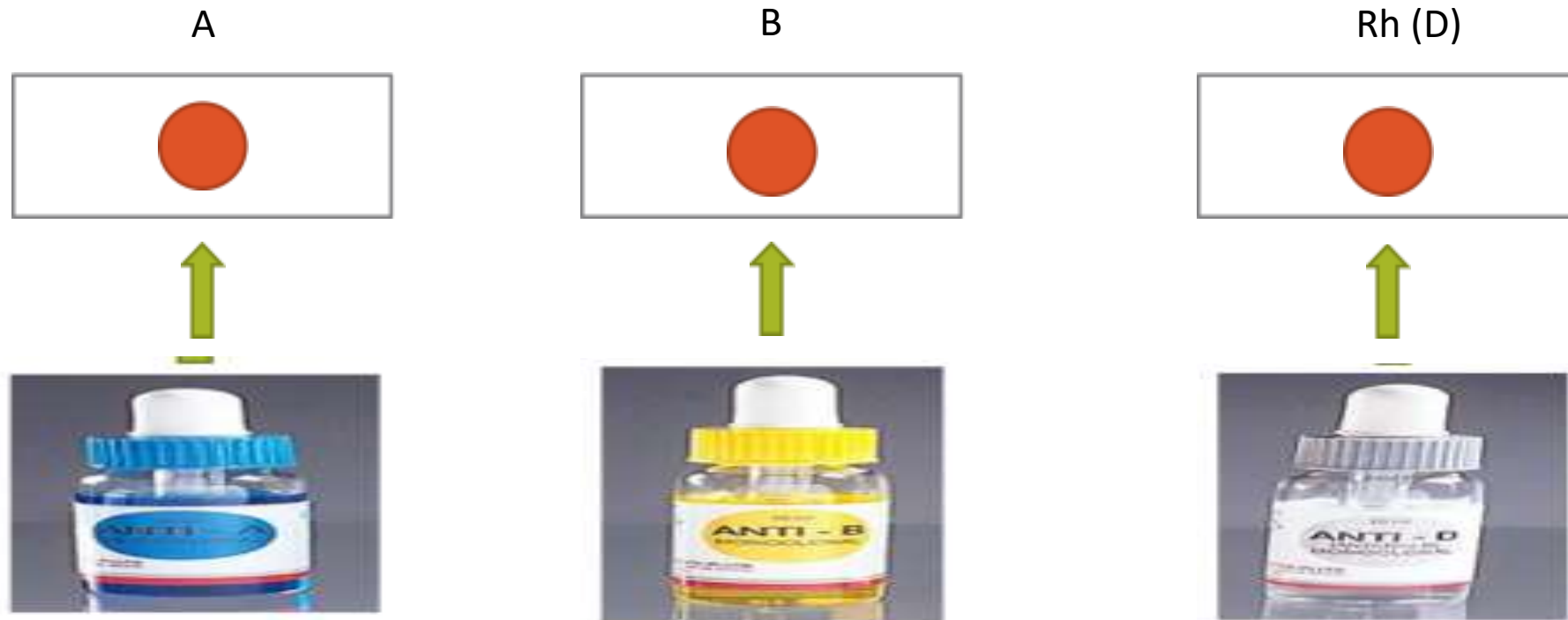
Procedure Requirements

- 70% alcohol and cotton (sterilization)
- Sterile blood lance
- Clean slides
- Wooden sticks
- ABO antibody kit

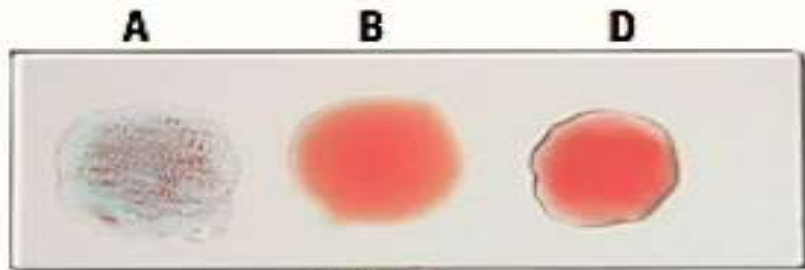


Procedure

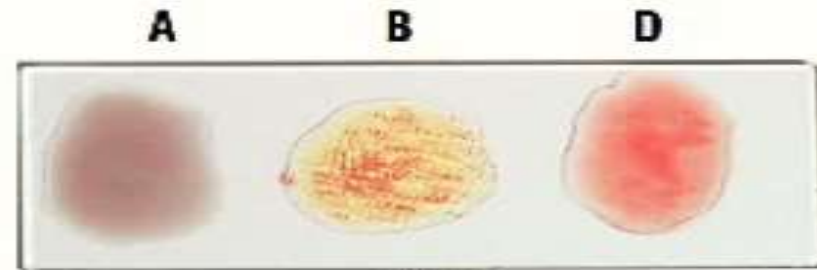
- Prepare 3 clean slides and mark each one
- Finger puncture, and add three big drops of blood to each slide



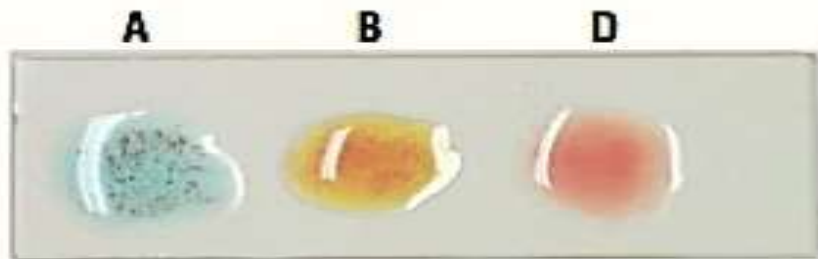
Your blood group is determined by the appearance
of agglutination in different slides!



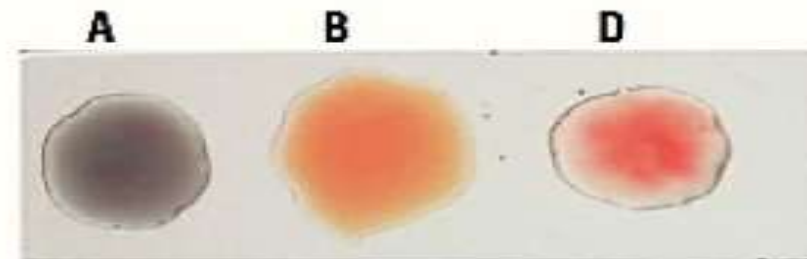
Slide 1



Slide 2



Slide 3



Slide 4

Q/During the experiment, why did you add 2 drops of anti-D sera?

The reaction between **Rh antigens** and **Rh antibodies** is very weak

The concentration of **Rh antigens** is low

END OF THE LECTURE!

