# ABO and Rh
# Blood Group Systems


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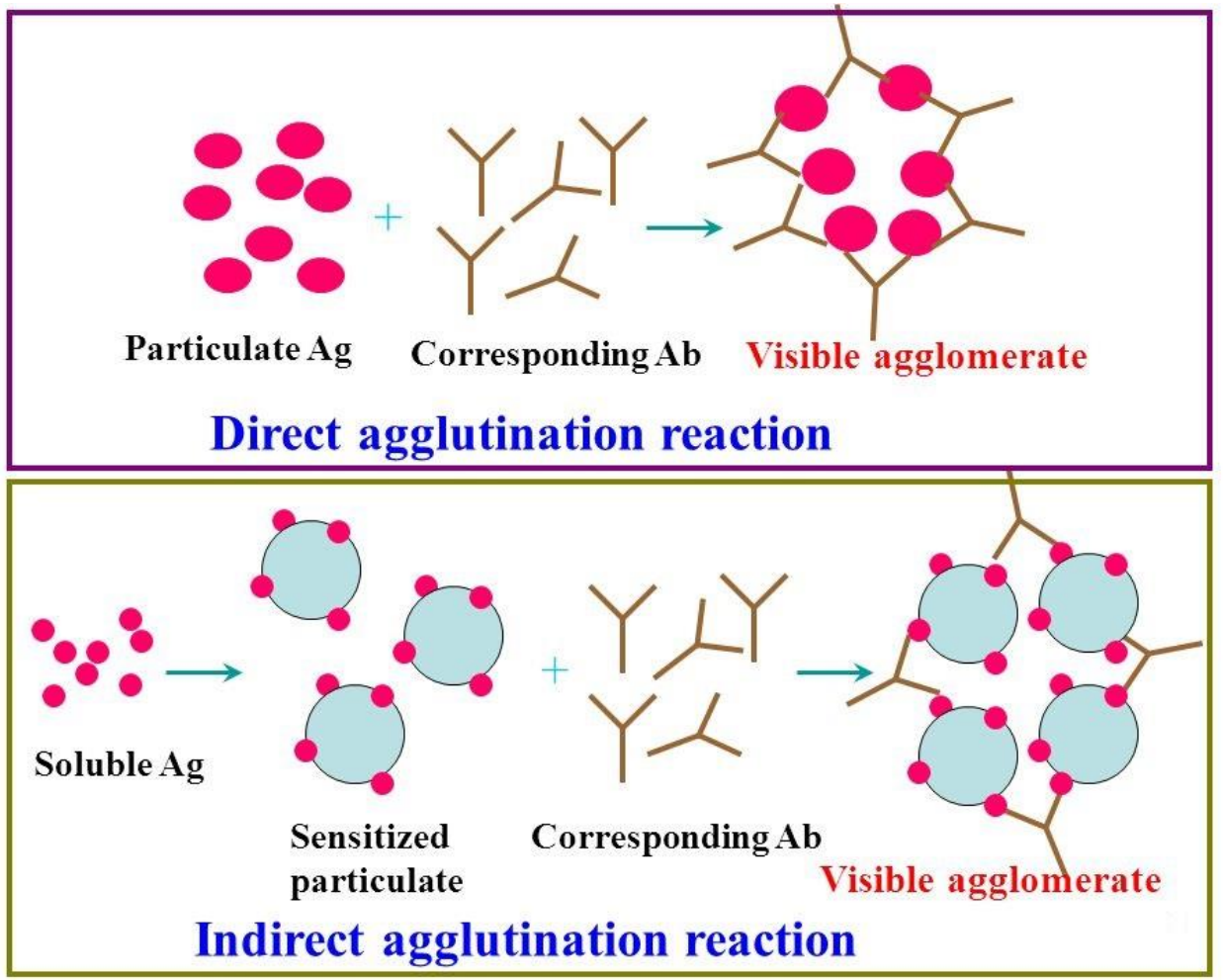
# IMMUNOLOGICAL METHODS

- Agglutination/Hemaglutination
- Immunoprecipitation
- Immunodiffusion
- Immunoelectrophoresis
- RIA/ELISA
- Immunoflorescence
  - Immunohistochemistry
  - Flow Cytometry
- Molecular Methods
  - PCR
  - Sequence Analysis
  - Immunomics
  - Gene transfection

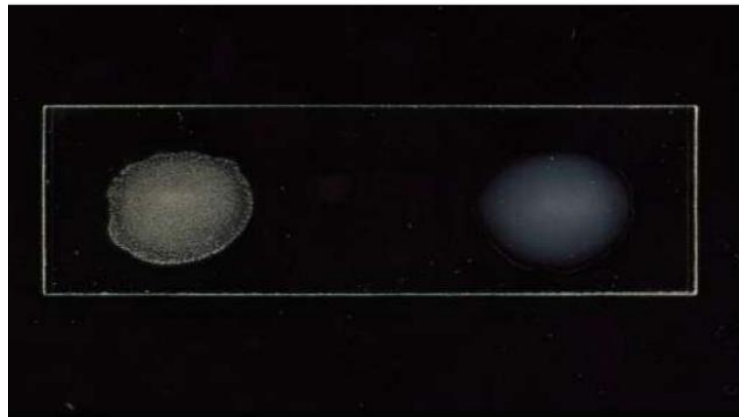
**Types of agglutination test:**

**1.Direct agglutination**: These reaction can be performed on the slide (rapid tests) or on the microtiter plates or tubes for antibody titration if required. It includes slide agglutination test, tube agglutination test, heterophile agglutination test and antiglobulin test.

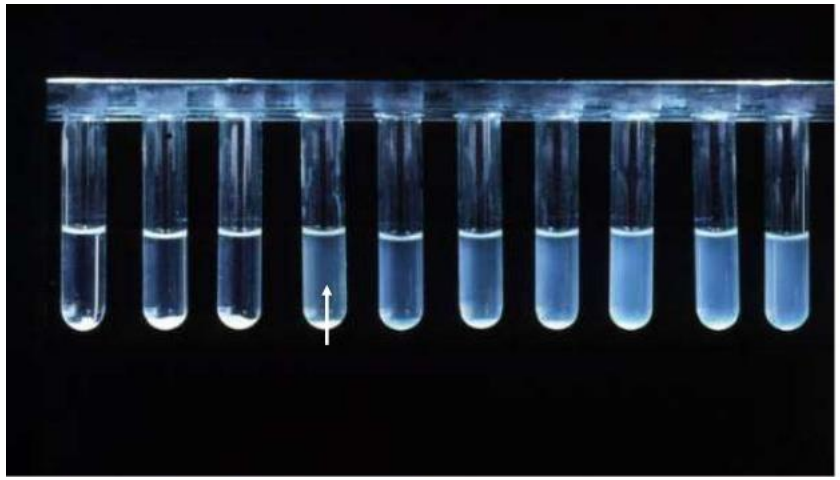
**2.Indirect/passive agglutination**: An agglutination reaction that employs particles that are coated with antigens not normally found in the cell surfaces. It includes latex agglutination test, hemagglutination test and co-agglutination test.



## Active agglutination/direct agglutination



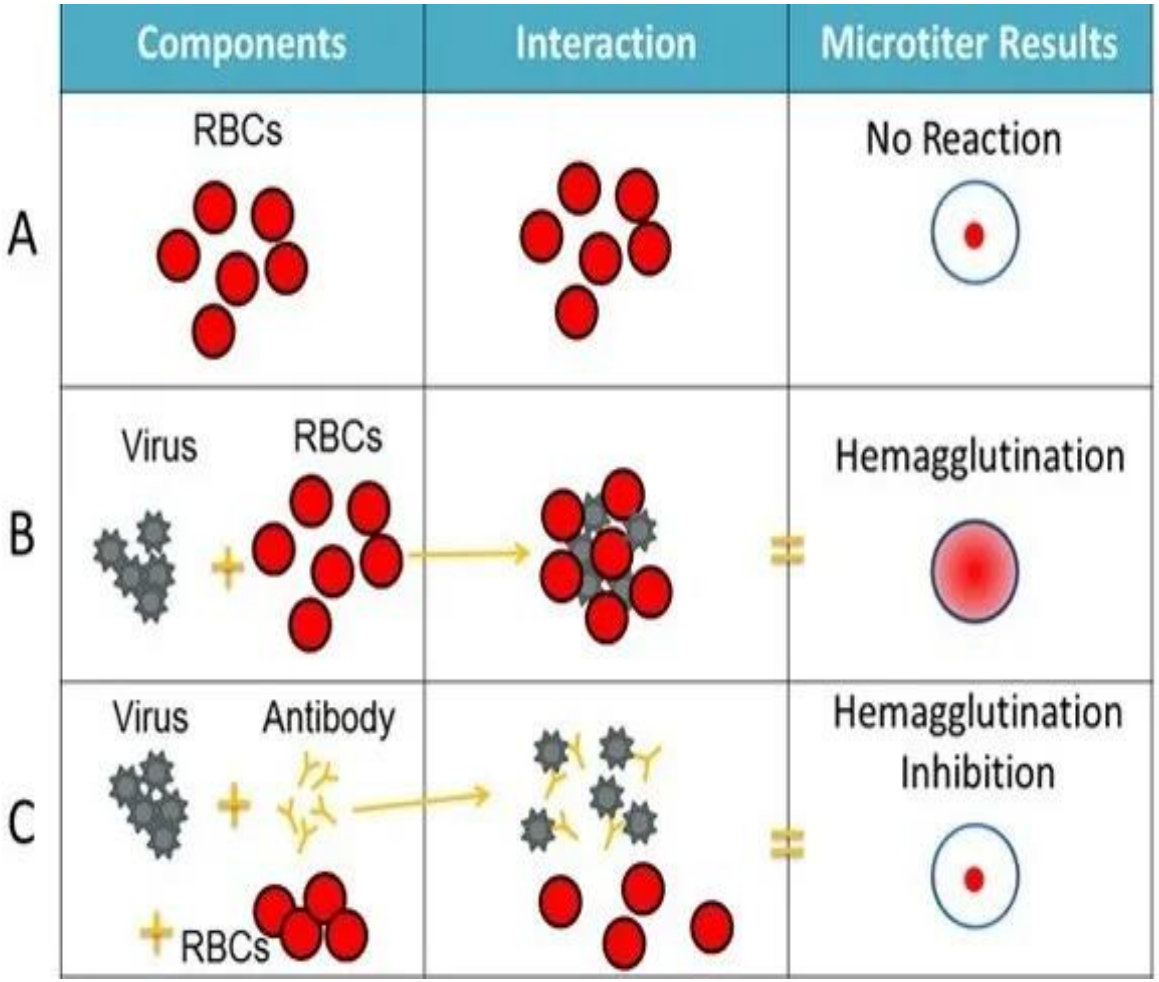
**1.Slide/agglutination:** Basic type of agglutination reaction that is performed on a slide. Identification of bacterial types represents a classic example of a slide agglutination. In this method suspension of unknown antigen is kept on slide and a drop of standardized antiserum is added or vice versa. A positive reaction is indicated by formation of visible clumps.



**2.Tube agglutination:** It is agglutination test performed in tube and standard quantitative technique for determination of antibody titer. In this method serum is diluted in a series of tubes and standard antigen suspensions (specific for the suspected disease) are added to it. After incubation, antigen-antibody reaction is indicated visible clumps of agglutination.

The nucleic acids of various viruses encode surface proteins *(e.g. hemaaglutinin (HA) of influenza virus)* that agglutinate red blood cells (RBC) of a variety of species. The reaction of viral hemagglutinins with red blood cells results in a lattice of agglutinated cells that settle irregularly in a tube or microtiter well. Unagglutinated cells settle in a compact button. This process is known as **hemagglutination**.

Hemagglutination occurs when measles viruses and red blood cells are mixed. But, if the serum of a person infected with **virus** is mixed with RBC and the virus, there won't be any agglutination of RBC. This phenomenon is known as **hemagglutination inhibition**. This arises because antibodies present in the serum of that infected person reacts with the viruses and neutralize them (positive result).



# I. Human Blood Groups

- **Red cell membranes have antigens (protein/glycoprotein) on their external surfaces.**

- **<u>These antigens are</u>:**
  - **Unique to the individual.**
  - **Recognized as foreign if transfused into another individual.**
  - **Promote agglutination of red cells if combine with antibody.**

- **Presence or absence of these antigens is used to classify blood groups (ABO & Rh).**

- **ABO blood group consist of:**
  - **Two antigens (A & B) on the surface of the RBCs.**
  - **Two antibodies in the plasma (anti-A & anti-B).**

- **When blood-cell antigens bind with their matching antibodies results in AGGLUTINATION!**

- **Agglutination = Binding of antigens with antibodies.**
  - **Causes a clumping of factors.**
  - **Looks like a thickening of blood.**

- **Type AB: (Universal Recipient)**
  - **RBC's have both A and B antigens.**
  - **Can receive from A, B, AB, and O types.**
  - **Can donate to AB type only.**

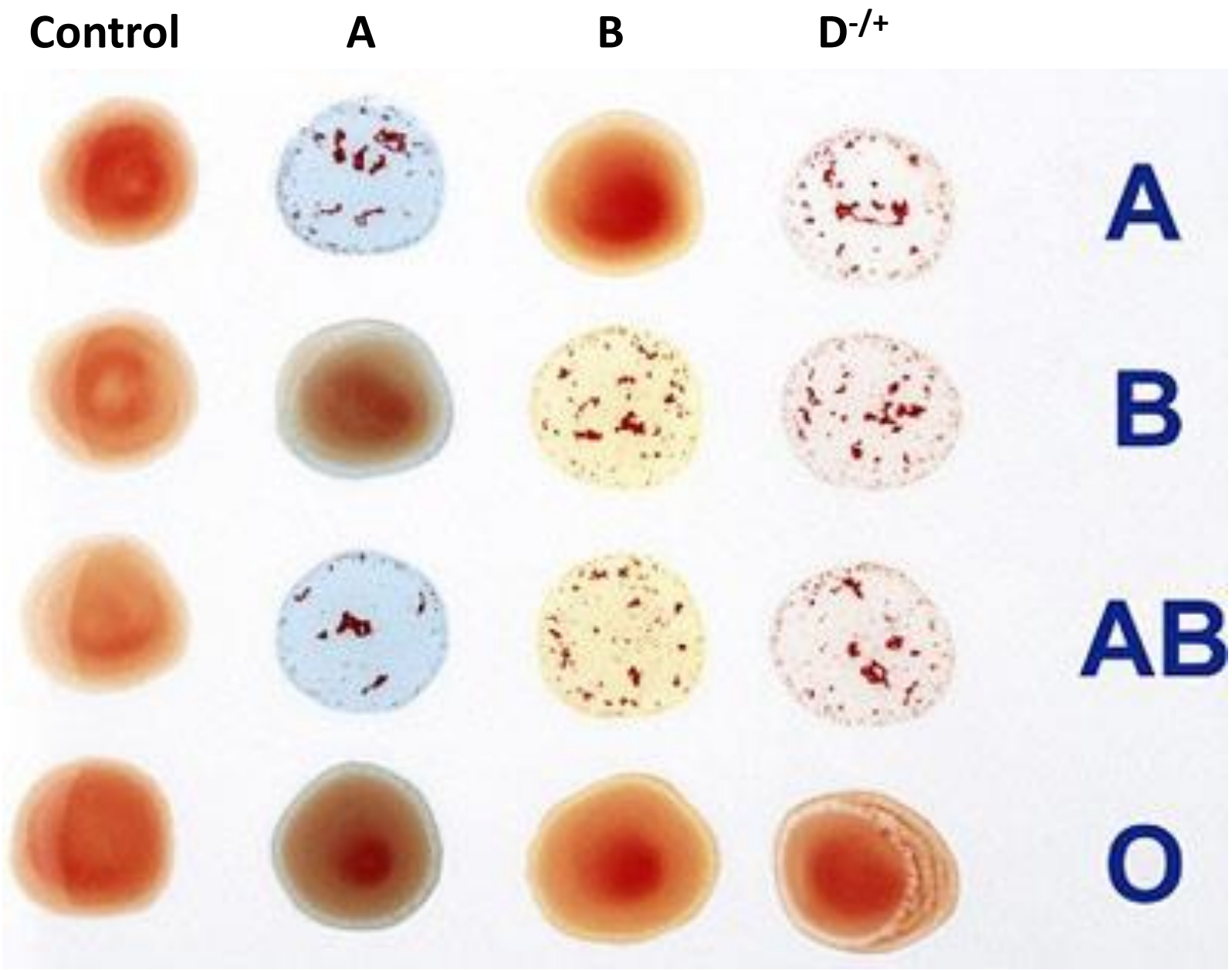
- **Type O: (Universal Donor)**
  - **RBC's have NO antigens.**
  - **Can receive from O type only.**
  - **Can donate to A, B, AB and O types.**

- **Type A:**
  - **RBC's have A antigens only.**
  - **Can receive from A and O types.**
  - **Can donate to A and AB types.**

- **Type B:**
  - **RBC's have B antigens only.**
  - **Can receive from B and O types.**
  - **Can donate to B and AB types.**

- **Purpose:**
  - **Check blood for organ/blood donations.**
  - **Test both recipient + donor.**

- **Procedure:**
  - **Mix blood with “Immune Serums”**
  - **“Immune Serum” = Liquid with Antibodies**
  - **No Agglutination = Does NOT have those antigens**
  - **Agglutination = Those antigens present**


Control
A
B
D-/+
A
B
AB
O

# Relationship between ABO antigens and antibodies

| Antigens on RBCs | Antibody in plasma / serum | Blood group |
|---|---|---|
| A | Anti-B | A |
| B | Anti-A | B |
| AB | None | AB |
| None | Anti-A, Anti-B | O |

# Inheritance of ABO Blood Groups

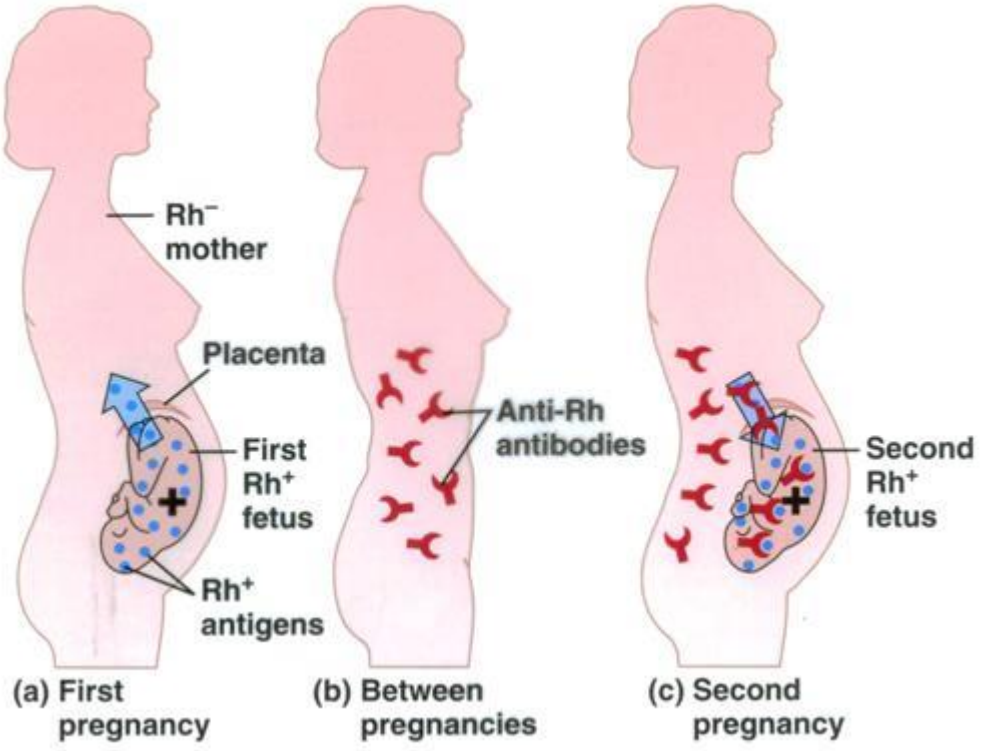
| Mother | Father | Offspring Blood Group |
|---|---|---|
| AA | BB | 100% AB |
| BO | OO | 50% each of B or O |
| OO | OO | 100% O |
| OO | AO | 50% each of A or O |

# II. Rh Blood Group System

- **Rh antigens are an integral part of the red cell membrane.**
- **Rh is a blood group system with many antigens, one of which is D.**
- **Rh refers to the presence or absence of the D antigen on the red blood cell.**
- **Unlike the ABO system, individuals who lack the D antigen do not naturally produce anti-D.**
- **The result of this typing determines the Rh status of the cells (Rh - positive or Rh - negative).**

**Rhesus Factor**

- **Production of antibody to D requires exposure to the antigen.**
- **If immunized to Rh (D) antigen the antibody can cross the placenta and destroy Rh (D) positive fetal cells resulting in death.**
- **This is why Rh negative women are given <u>anti-D</u> after birth of Rh positive baby.**



# Thanks