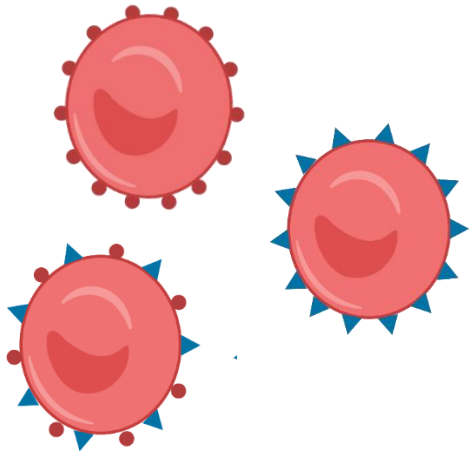
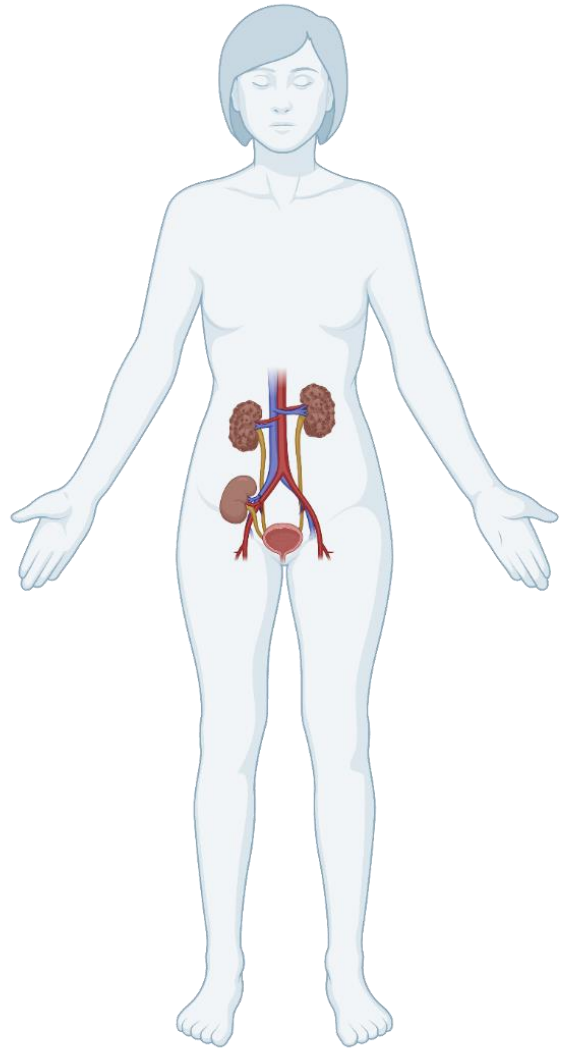
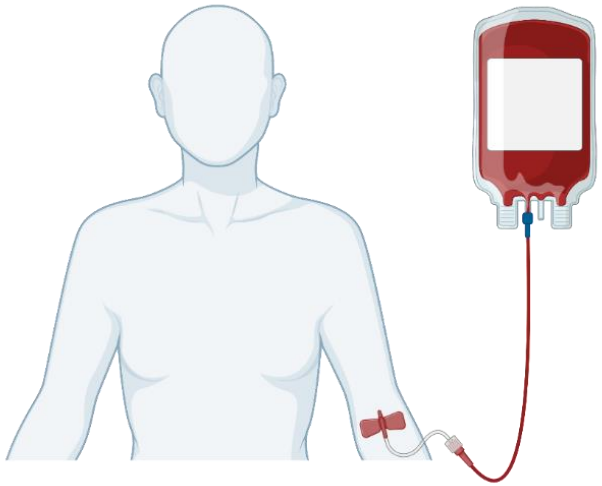
Blood Groups



Blood Groups and Transfusion Reaction





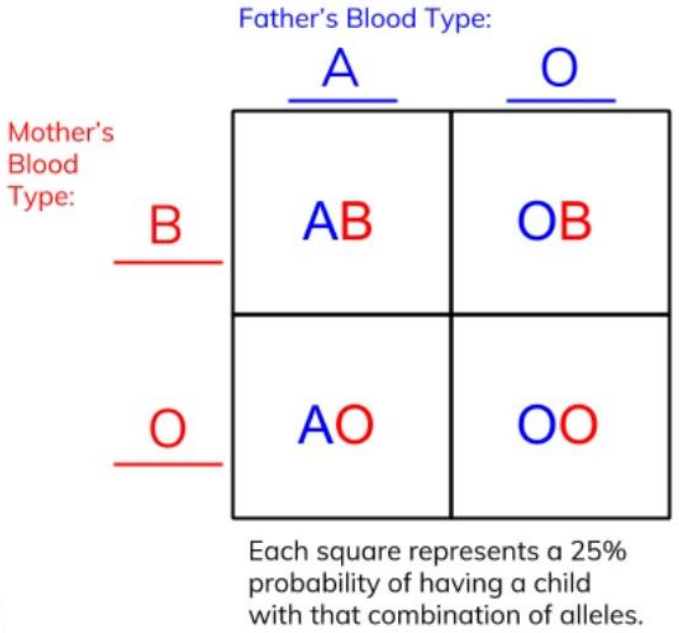
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Multiplicity of Antigens in the Blood Cells

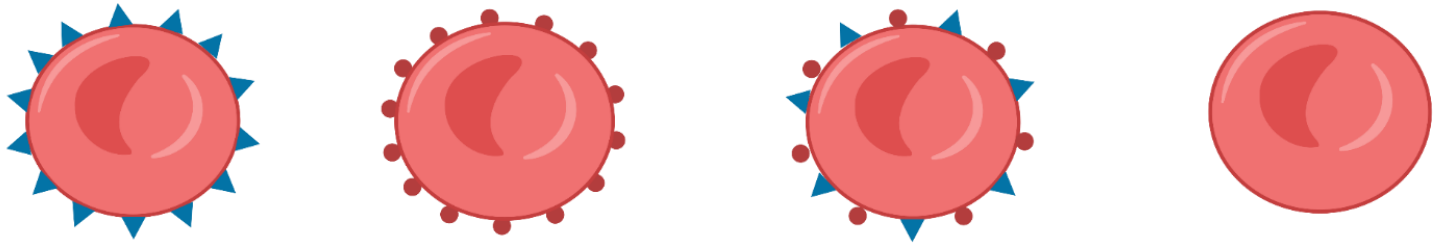
- RBCs carry many antigens belonging to different blood-group systems. ABO and RhD are especially important in transfusion practice.

Blood Groups — ABO System

- The ABO blood group is based on two **carbohydrate antigens carried on glycolipids and glycoproteins**, called A and B.
- Six possible combinations: OO, OA, OB, AA, BB, and AB.
- A and B are codominant; O is recessive.



O-A-B Blood Types



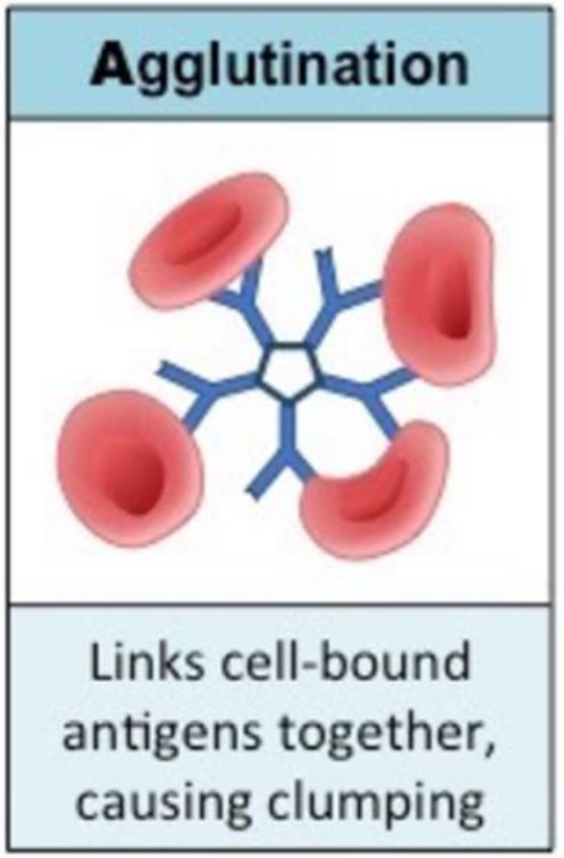
Genotype	**OA/AA**	**OB/BB**	**AB**	**OO**
Antigen	**A**	**B**	**AB**	**Neither A nor B**
Blood group	**A**	**B**	**AB**	**O**

Blood Groups — Agglutination

Agglutination: antibodies cross-link RBCs, producing clumps.

Antigen (Agglutinogen)

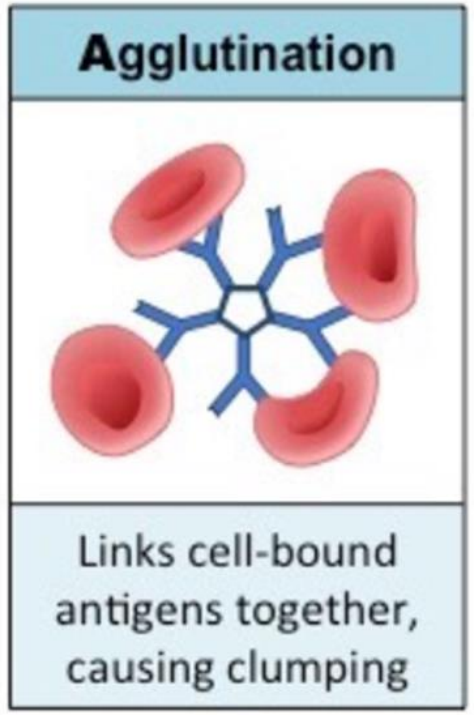
Antibody (Agglutinin)



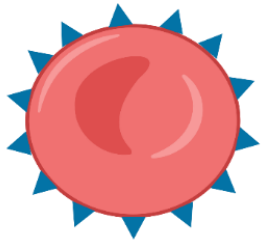
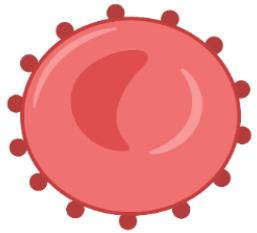
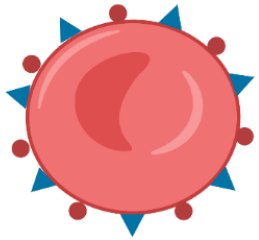
Agglutinins (antibodies)

- ABO antibodies are mainly IgM; IgG antibodies also occur, especially in group O.

- When type A agglutinogen is not present in a person's RBCs, antibodies known as anti-A agglutinins develop in the plasma.



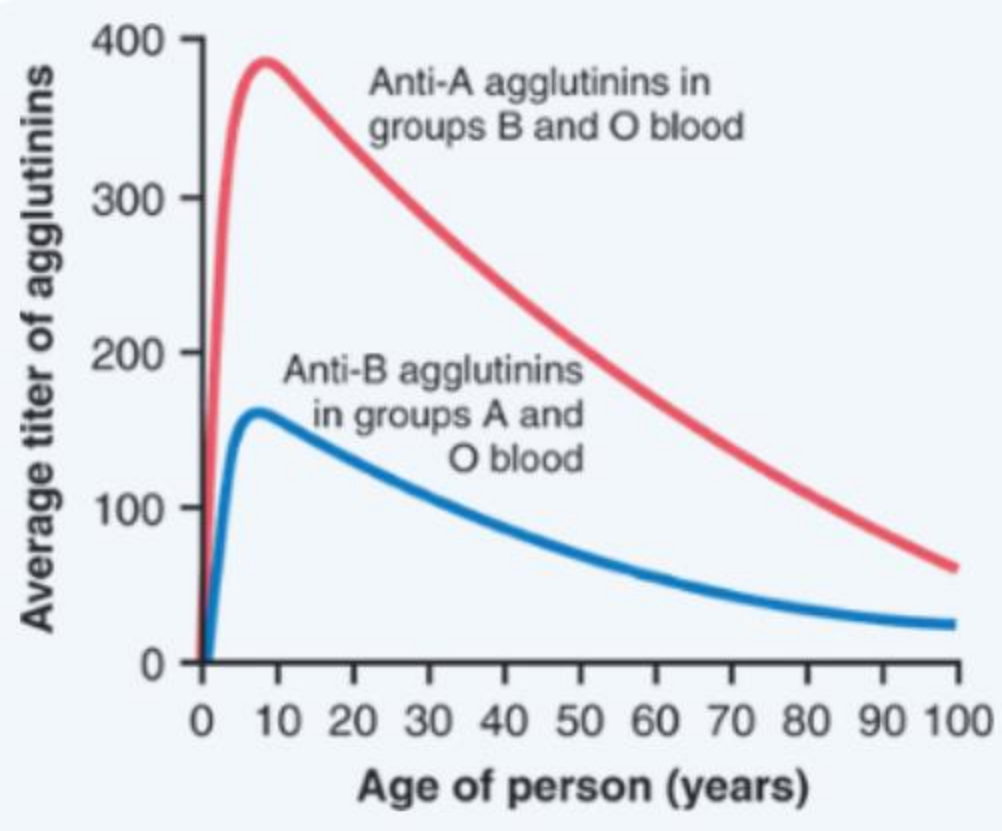
O-A-B Blood Types


Genotype	**OA/AA**	**OB/BB**	**AB**	**OO**
Antigen	**A**	**B**	**AB**	**Neither A nor B**
Blood group	**A**	**B**	**AB**	**O**
Antibody (Agglutinins)	**anti-B**	**anti-A**	**Neither Anti-A Nor anti-B**	**Anti-A & anti-B**

Agglutinins (antibodies)

- Immediately after **birth**, the quantity of agglutinins in the plasma is almost **zero.**
- **Two to 8 months** after birth, an infant **begins** to produce agglutinins.
- A **maximum** titer is usually reached at **8 to 10 years** of age, and this gradually declines throughout the remaining years of life.



Agglutinins (antibodies)

- But **why** are these **agglutinins** produced in people who do not have the **respective agglutinogens** in their RBCs?

- Exposure to environmental antigens, including microbial antigens that resemble A and B structures, stimulates antibodies against the ABO antigens the individual lacks

Blood Groups — Rh System

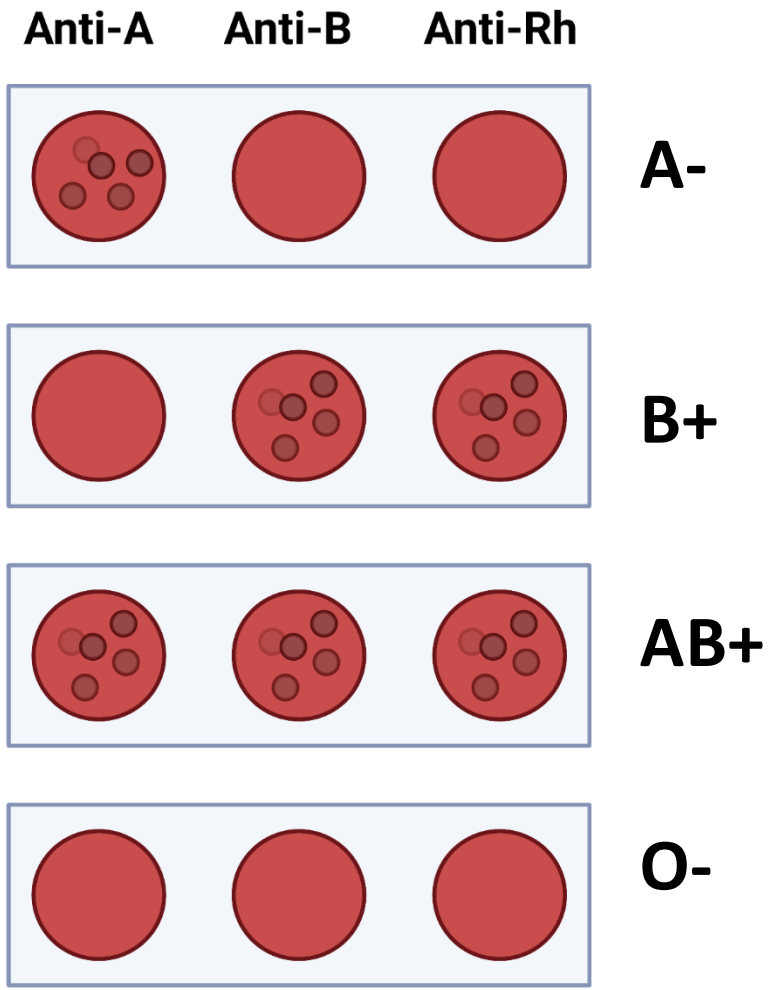
- There are **six common types of Rh antigens**, each of which is called an *Rh factor*. These types are designated C, D, E, c, d, and e.
- The type **D antigen** is widely **prevalent** in the population and considerably more antigenic than the other Rh antigens
- Anyone who has the **D antigen** is said to be Rh positive, whereas a person who does **not have type D antigen** is said to be **Rh negative**.

ABO versus RhD

Feature	ABO	RhD
Antibody development	Develop after birth following exposure to environmental A/B-like antigens	Anti-D develops after exposure to D-positive RBCs through pregnancy or transfusion
Predominant antibody	Mainly IgM IgG also occurs, especially in group O	Immune anti-D is mainly IgG
Placental transfer	IgM does not cross IgG anti-A/anti-B can cross	IgG anti-D crosses

Blood Groups

Blood Typing



Blood Groups > Blood matching

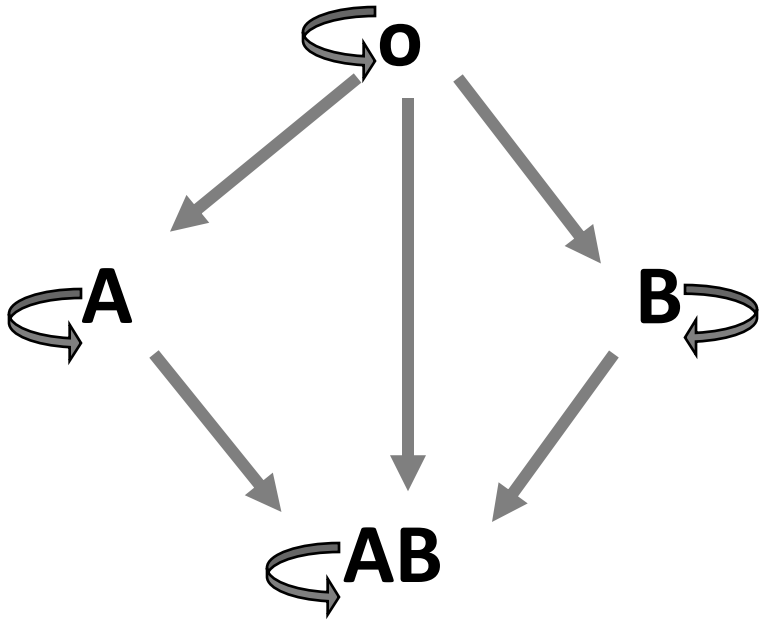
- Before giving a transfusion to a person, it is necessary to determine the **blood type** of the **recipient** and **donor** blood so that the bloods can be appropriately matched.

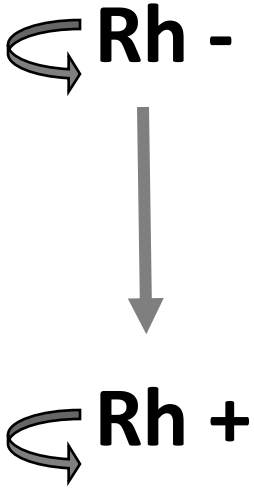
- In a cross-match, the possible **donor RBCs** are **mixed** with the **recipient's serum.** If **agglutination does not occur**, the recipient does not have antibodies that will attack the donor RBCs.

- Alternatively, the **recipient's serum** can be **screened** against a test panel of RBCs having **antigens** known to cause blood transfusion reactions to detect any antibodies that may be present.

Blood Groups

Red-cell transfusion compatibility





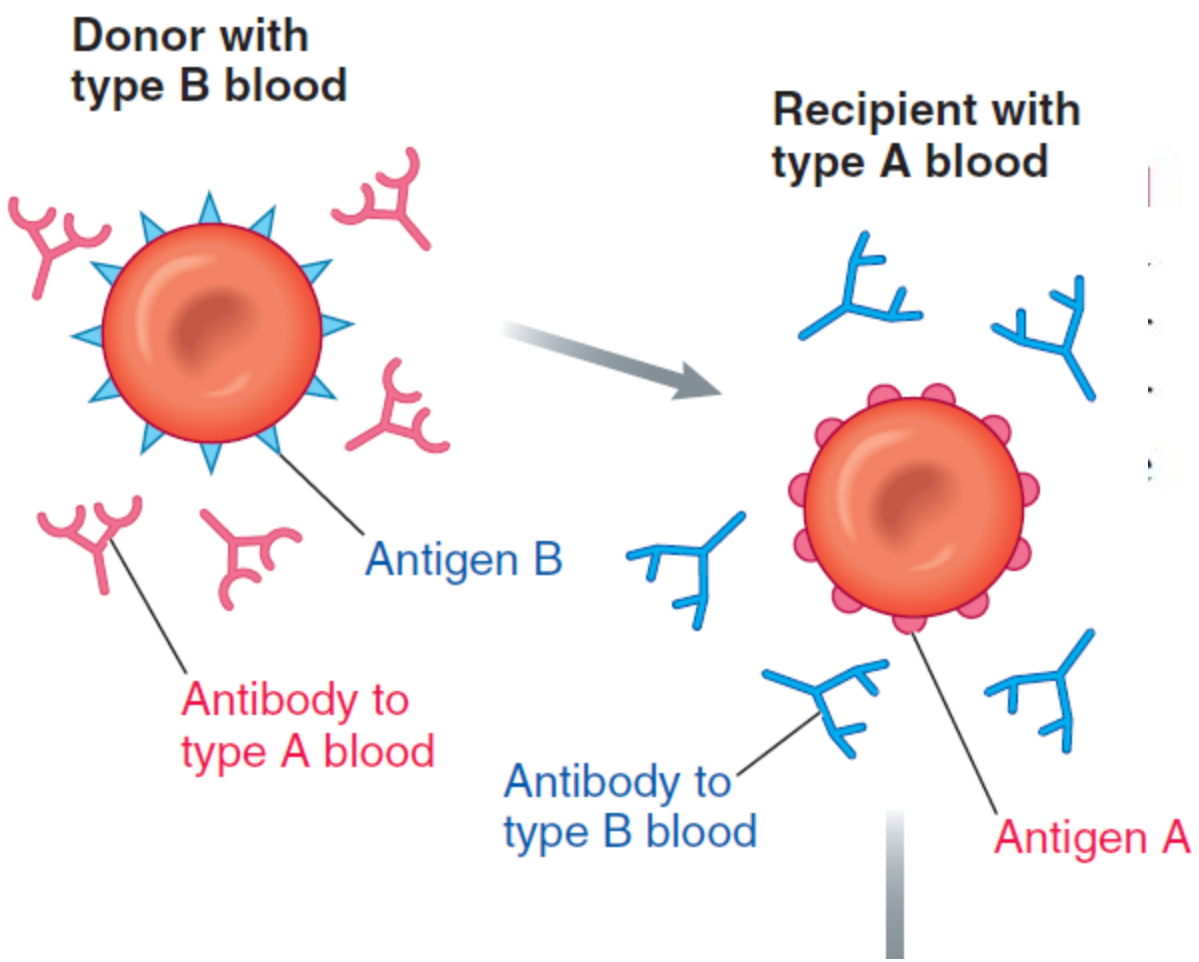
Which blood component does the patient need?

- RBCs restore oxygen-carrying capacity.
- Platelets support primary hemostasis.
- Plasma supplies coagulation factors.
- Cryoprecipitate supplies fibrinogen.

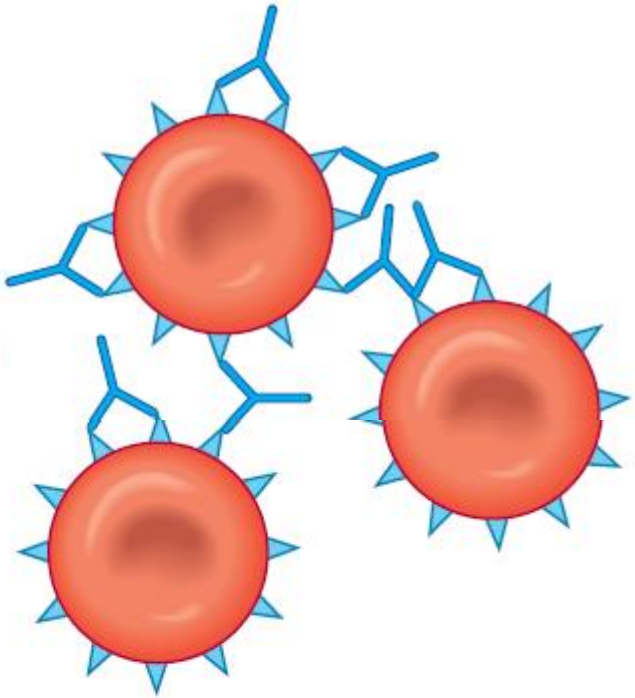
- With RBC transfusion, consider recipient antibodies against donor RBCs.
- With plasma, consider donor antibodies against recipient RBCs.

Blood Groups

Transfusion reaction

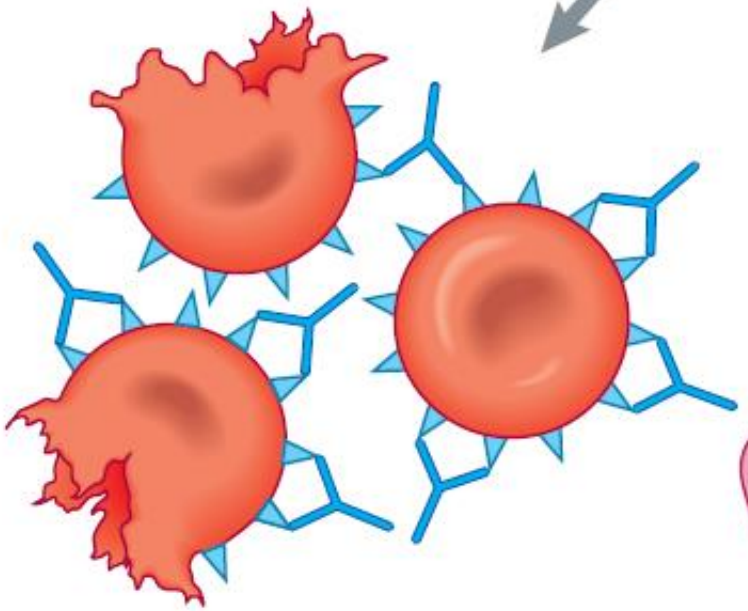


Red blood cells from donor agglutinate



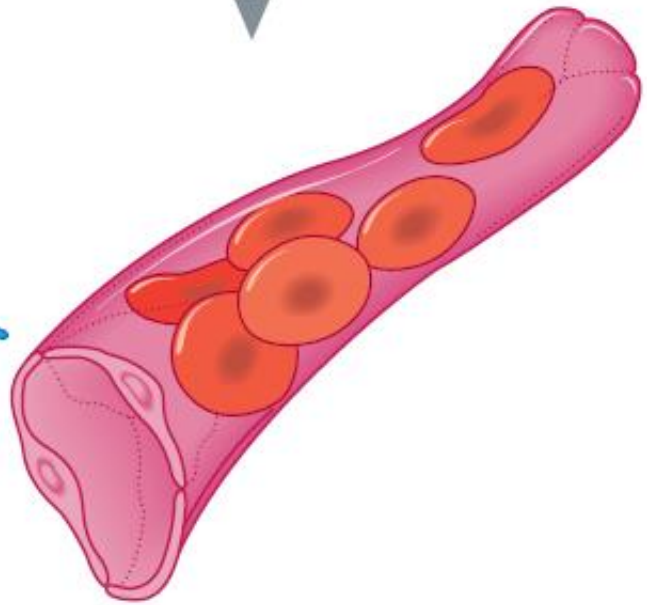
Blood Groups

Transfusion reaction



Red blood cells usually rupture

Hemoglobin precipitates in kidney, interfering with kidney function



Clumping blocks blood flow in capillaries

Oxygen and nutrient flow to cells and tissues is reduced

How antibodies destroy incompatible RBCs

Both begin when recipient antibodies bind to donor RBC antigens.

	Extravascular hemolysis	Intravascular hemolysis
Mechanism	Macrophages remove antibody-coated RBCs	Complement forms membrane pores and ruptures RBCs
Site of destruction	Mainly spleen and liver	Within blood vessels
Hemoglobin fate	Breakdown mainly inside macrophages	Release directly into plasma
Typical example	IgG anti-D-mediated RBC destruction	ABO-incompatible transfusion (often involving IgM)

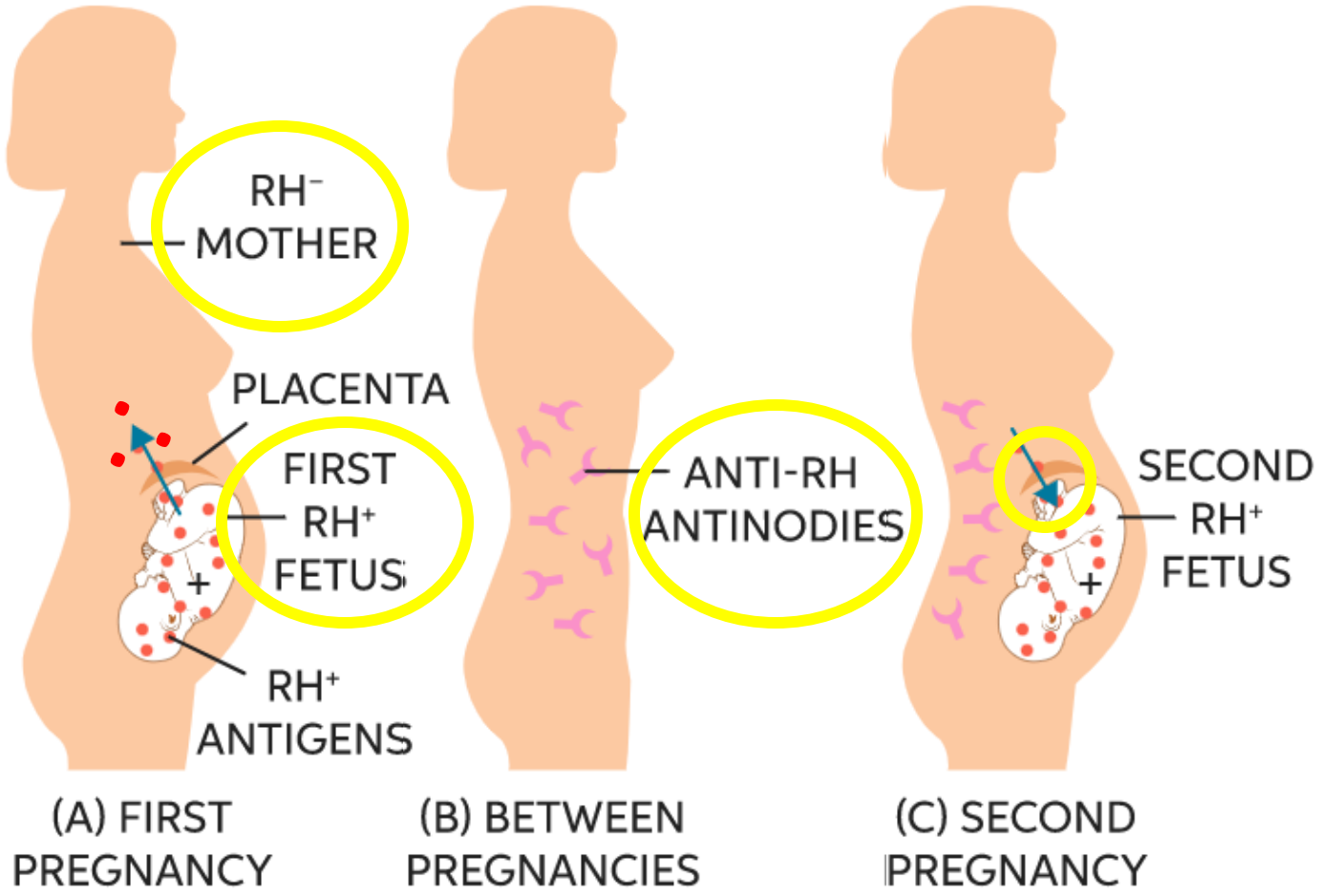
Characteristics of Rh Transfusion Reactions.

- likely cause **no immediate reaction**.
- **Anti-Rh antibodies** can develop in sufficient quantities during the next **2 to 4 weeks** to cause **agglutination** of those **transfused cells** that are still circulating in the blood.
- These cells are then hemolyzed by the tissue macrophage system. Thus, a **delayed transfusion reaction** occurs, although it is usually **mild.**

Characteristics of Rh Transfusion Reactions.

- On **subsequent transfusion** of Rh-positive blood into the same person (**sensitized)**, who is now already immunized against the Rh factor, the transfusion reaction is **greatly enhanced** and can be **immediate** and as **severe** as a transfusion reaction caused by mismatched type A or B blood.

Hemolytic Disease of the Newborn Erythroblastosis Fetalis



Chegg.com

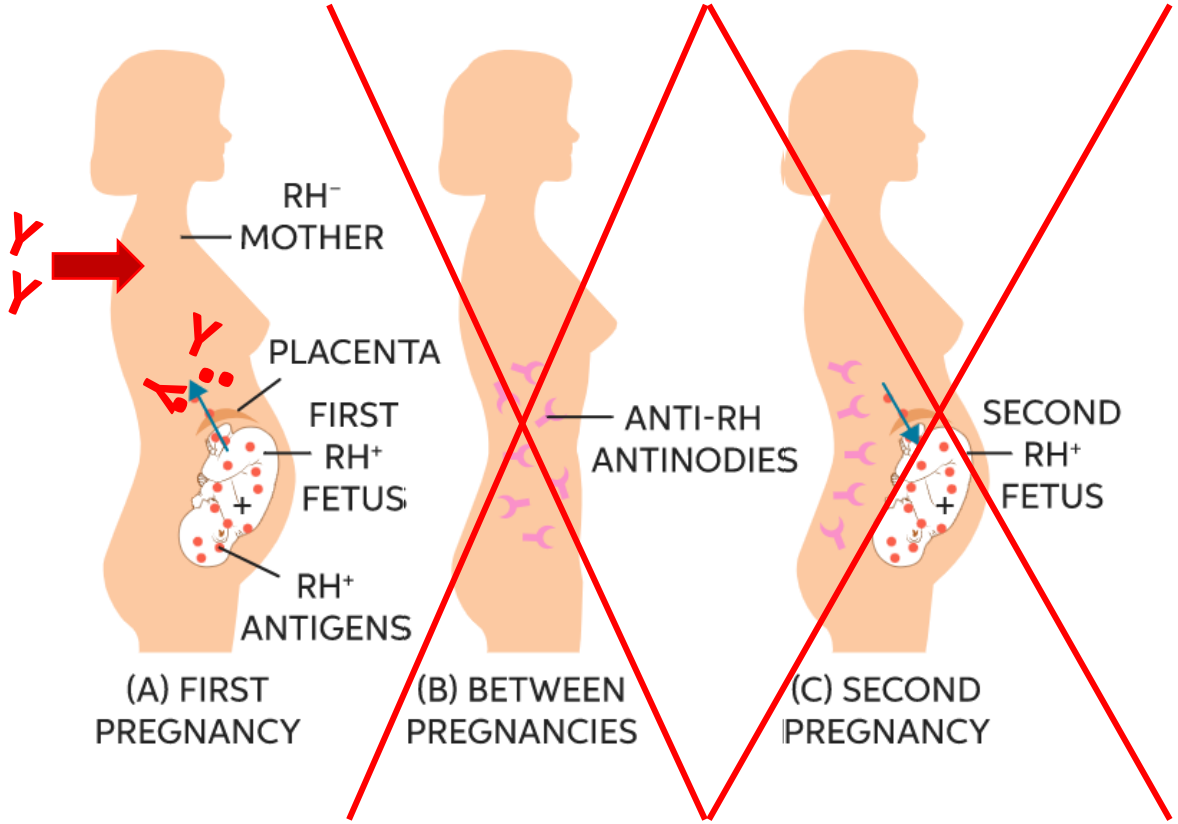
Hemolytic Disease of the Newborn Erythroblastosis Fetalis

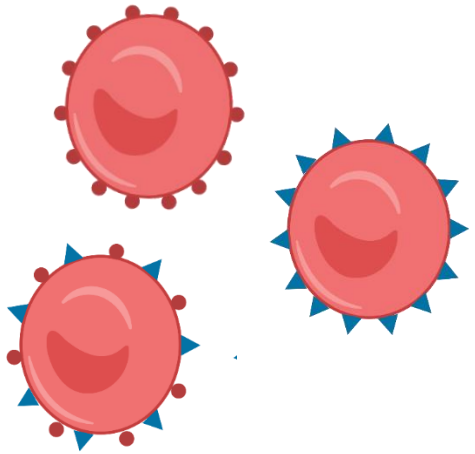
- Hemolytic anemia (fetal)
- Jaundice.
- The liver and spleen become greatly enlarged.
- Presence of nucleated blastic red blood cells.
- Permanent mental impairment or damage to motor areas of the brain.

Treatment of the Erythroblastotic Neonate

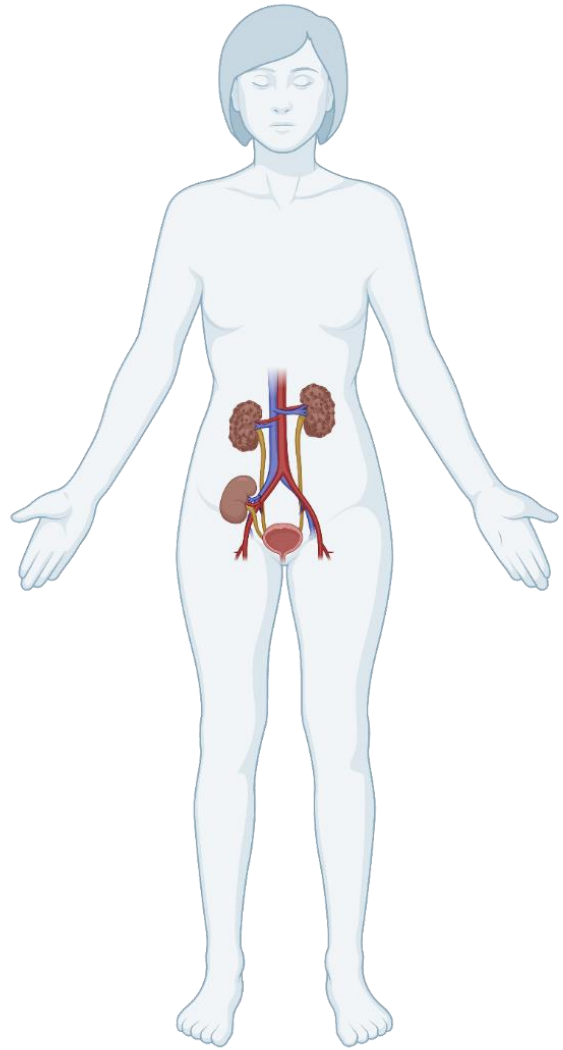
- One treatment is to **replace the neonate's blood with Rh-negative blood.**
- This procedure may be repeated several times during the first few weeks of life
- Anti-Rh agglutinins from the mother usually circulate in the infant's blood for another 1 to 2 months after birth, destroying more and more red blood cells.
- This keeps the bilirubin level low and thereby prevent complications.

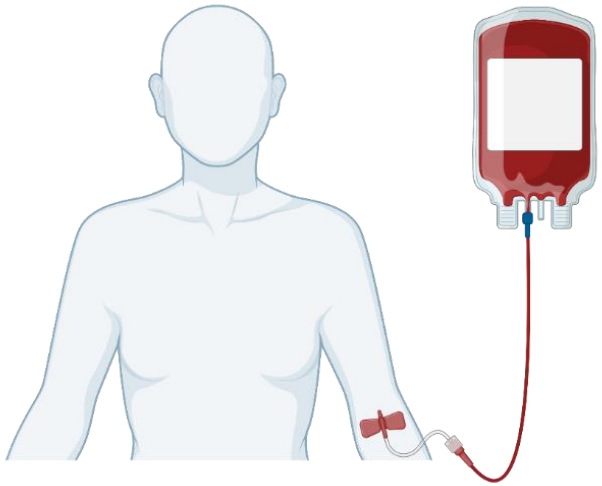
Prevention of the Erythroblastotic Neonate





Thank you!





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