ميحرلا نمحرلا اللهمسب

Blood Groups

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Objectives

At the end of this lecture student should be able to:

1. Describe ABO blood groups types
2. Recognize Agglutinin in plasma
3. Recognize transfusion reactions
4. Describe Rhesus blood groups.
5. Describe causes of hemolytic disease of the newborn.

BLOOD GROUPS

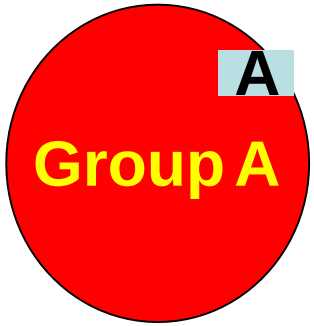
- **Determined by:**

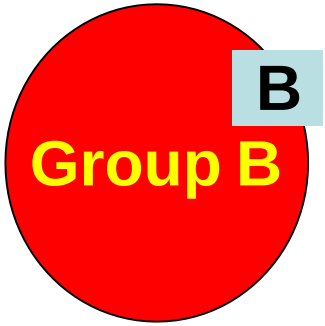
Antigens (glycoprotein) on the surface RBC

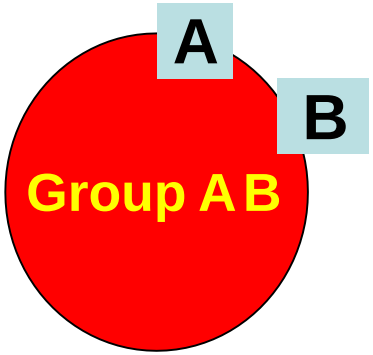
- **The chief blood groups are:**

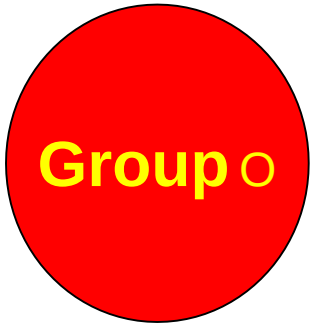
  Clinically most significant

  1. A-B-O System
  2. Rh (Rhesus) System


A
Group A


B
Group B


A
B
Group A B


Group O

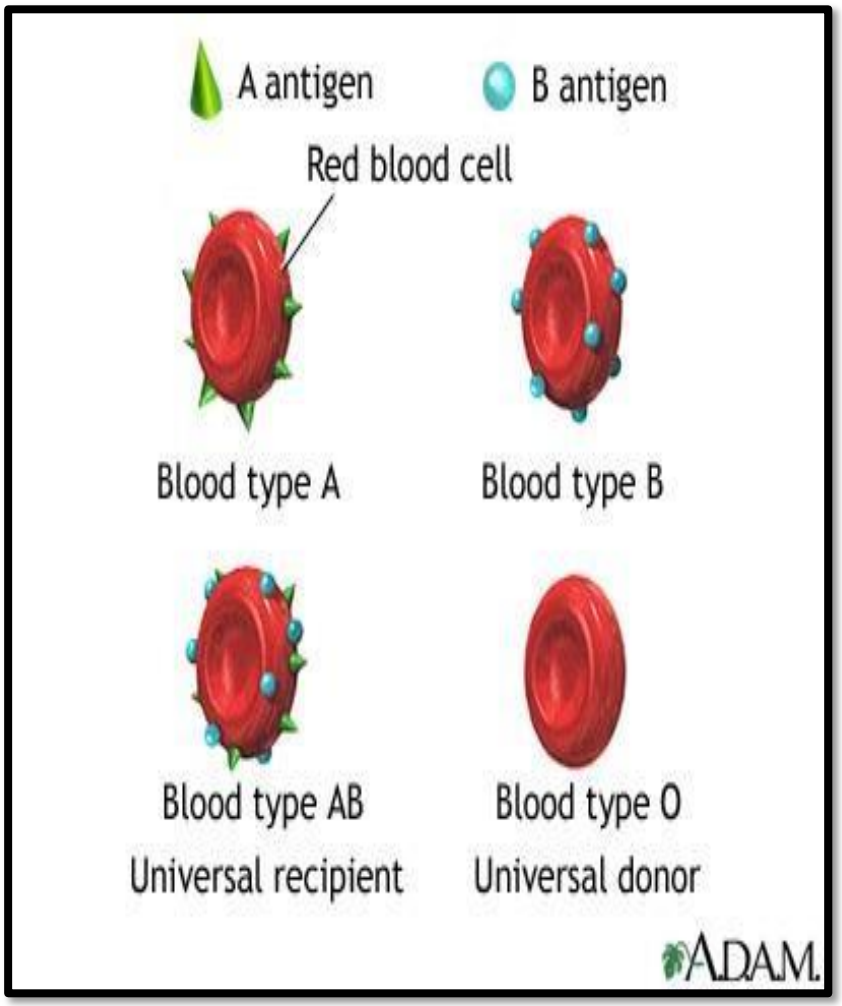
1.The ABO system:

- Depends on whether the red cells contain one, both or neither of the two blood antigens:

  A and B.

- Four main ABO groups:

  A, B, AB, O



The ABO Blood groups

GroupBlood	Agglutinogen	Agglutinin
A	A	Anti-B
B	B	Anti-A
AB	A & B	-
O	-	Anti A+B

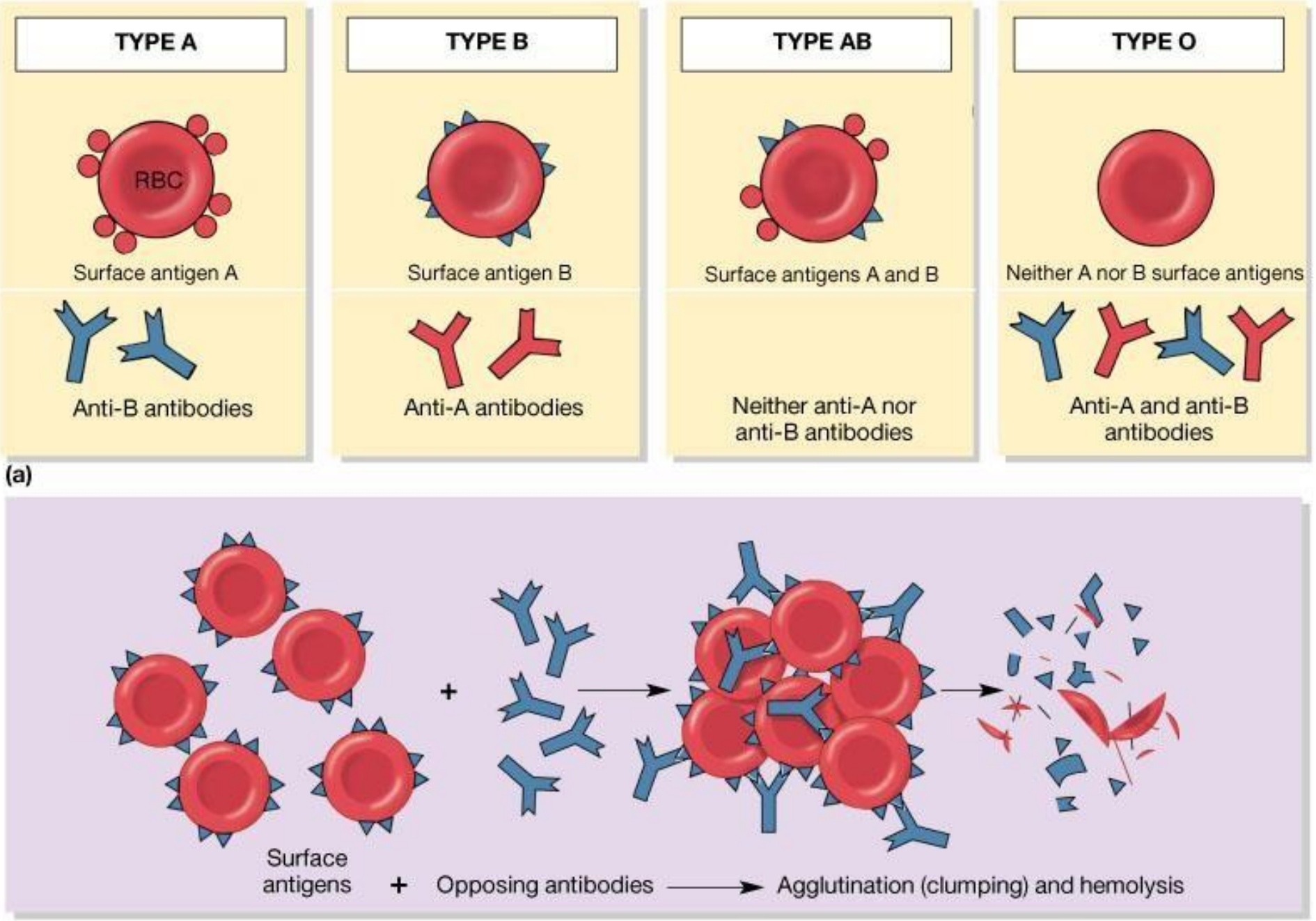
The ABO system- cont.

- Anti-A & Anti-B:

- They are naturally occurring antibodies.
- Not present at birth, appear 2-8/12
- Triggered by A & B antigens in food and bacteria

Definitions

- Agglutinogens: Blood group antigens on RBC membrane (A and B)
- Agglutinin: The respective antibody to the antigen
- Agglutination: Reaction between agglutinogen on RBC and the respective Ab.



Inheritance of blood groups

Blood group	Genotypes
A	AA, AO
B	BB, BO
O	OO
AB	AB

Uses of genotypes:

- Sorting disputes in paternal dispute
- Frequency of ABO has ethnic variation

The Question of paternity?

- Blood types cant be used to prove paternity
- Blood types can disprove paternity

2. The Question of paternity?

Nora blood (type A) and Ahmad blood (type B) Have a baby (blood type O) Can Ahmad be the father?

Phenotype	Possible genotype
Nora:A	AA or AO
Ahmad:B	BB or BO
Baby: O	OO

Possible Blood group Genotypes

Parent Allele	A	B	O
A	AA	AB	AO
B	AB	BB	BO
O	AO	BO	OO

The ABO blood groups

• The table shows the four ABO phenotypes ("blood groups“) and the genotypes that give rise to them.

Blood Group	Antigens on RBCs	Antibodies in Serum	Genotypes
A	**A**	Anti-B	*AA* or *AO*
B	**B**	Anti-A	*BB* or *BO*
AB	**A** and **B**	Neither	*AB*
O	Neither	Anti-A and anti-B	*OO*

2. Rhesus (Rh) Blood Group

Determined by:

- Presence or absence of the Rhesus antigen (D) on the surface of RBC:
  - Presence of D (individual is Rh+ve)
  - Absence of D(' ' Rh-ve)
- Rhesus antigens:
  Dd, Cc, Ee
  Clinically most important is D

Rhesus (Rh) Blood Group

Anti-D antibody (agglutinin):

-Is not naturally-occurring

-Can be acquired by:

i. Transfusion of Rh-ve individual with Rh+ve blood

ii. Rh-ve pregnancy with Rh+ve faetus.

Do you know which blood group you belong to?

According to above blood grouping systems, you can belong to either of following 8 blood groups:

A Rh+	B Rh+	AB Rh+	O Rh+
A Rh-	B Rh-	AB Rh-	O Rh-

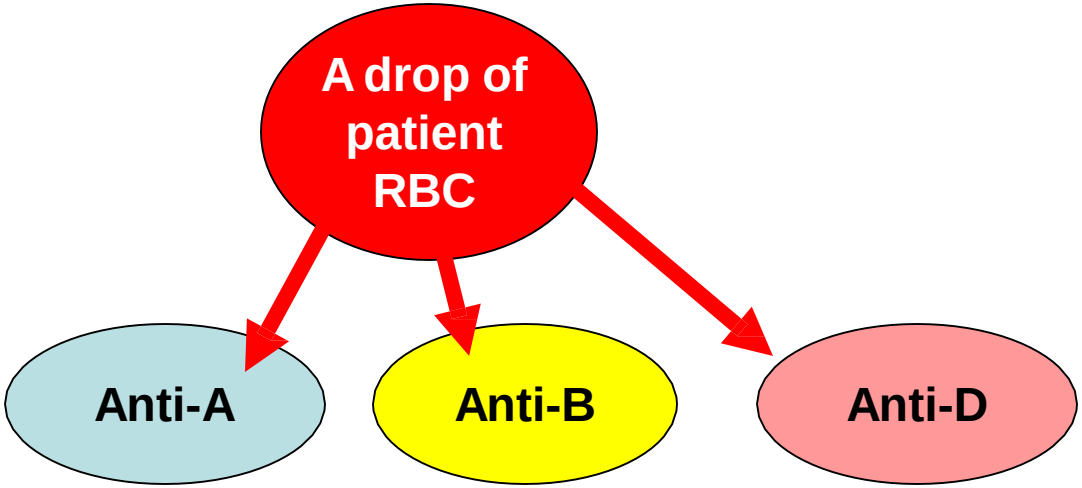
Importance of blood groups

1. Blood Transfusion.
2. Rh incompatibilty between mother and fetus

Blood tests before transfusion

1. Blood group type of patient (recipient)
2. Cross-matching

Blood tests before transfusion



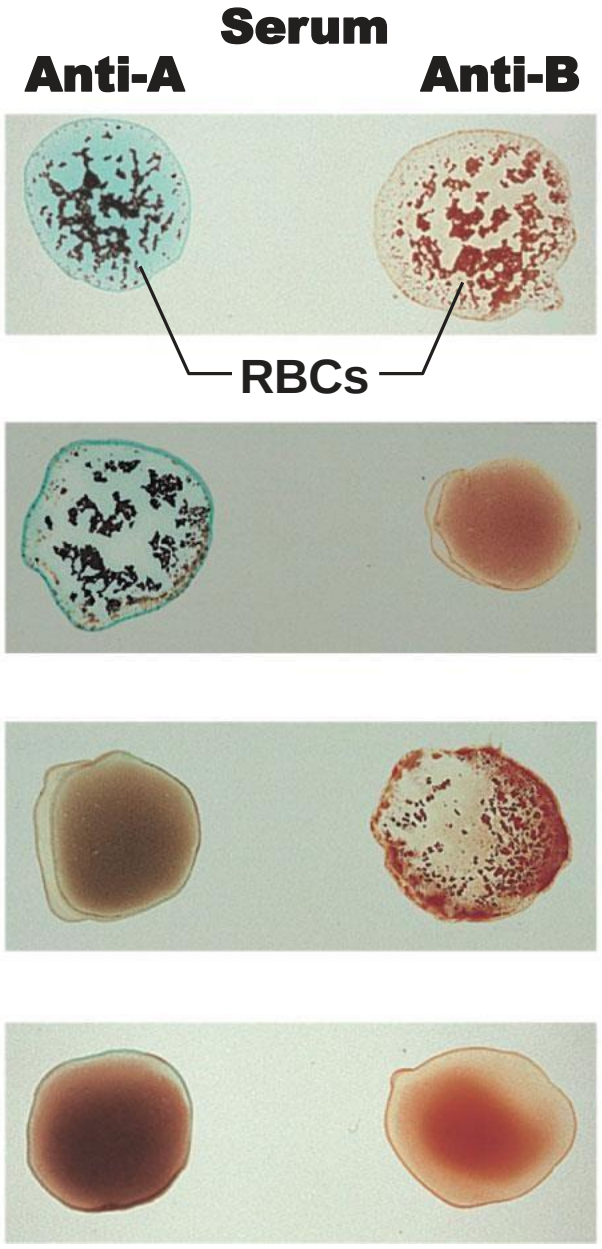
Blood being tested

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)



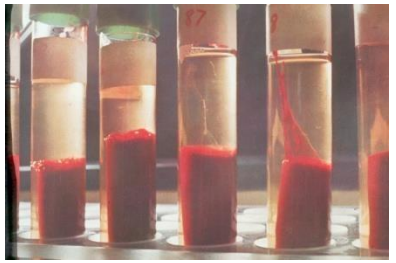
Blood tests before transfusion

2. Cross-matching:

donor cells

+

recipients (patient) serum

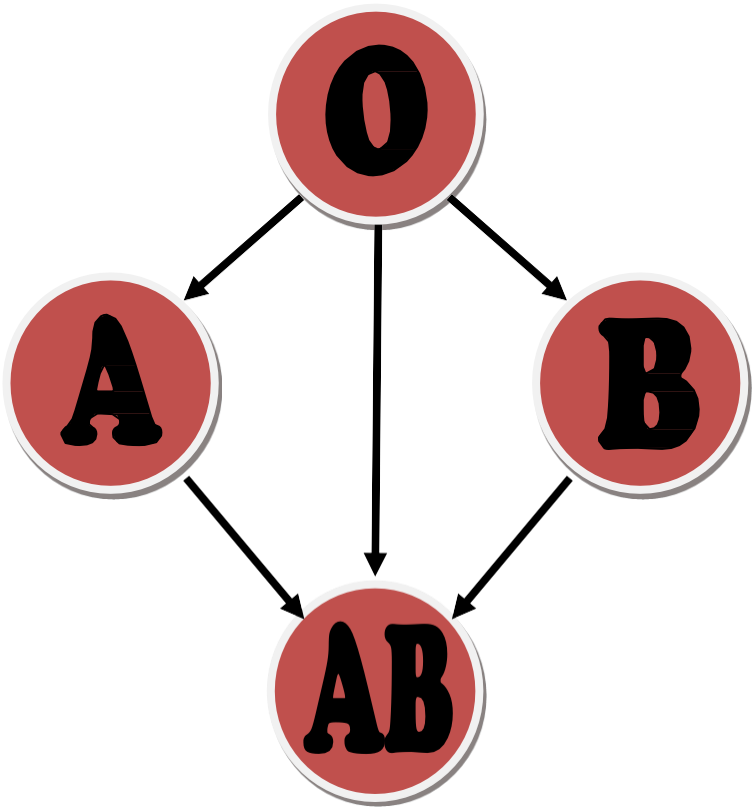


Who can give you blood?

People with **TYPE O** blood are called **Universal Donors,** because they can give blood to any blood type.

People with TYPE **AB** blood are called **Universal Recipients,** because they can receive any blood type.

Rh + → Can receive + or -
Rh - → Can only receive -

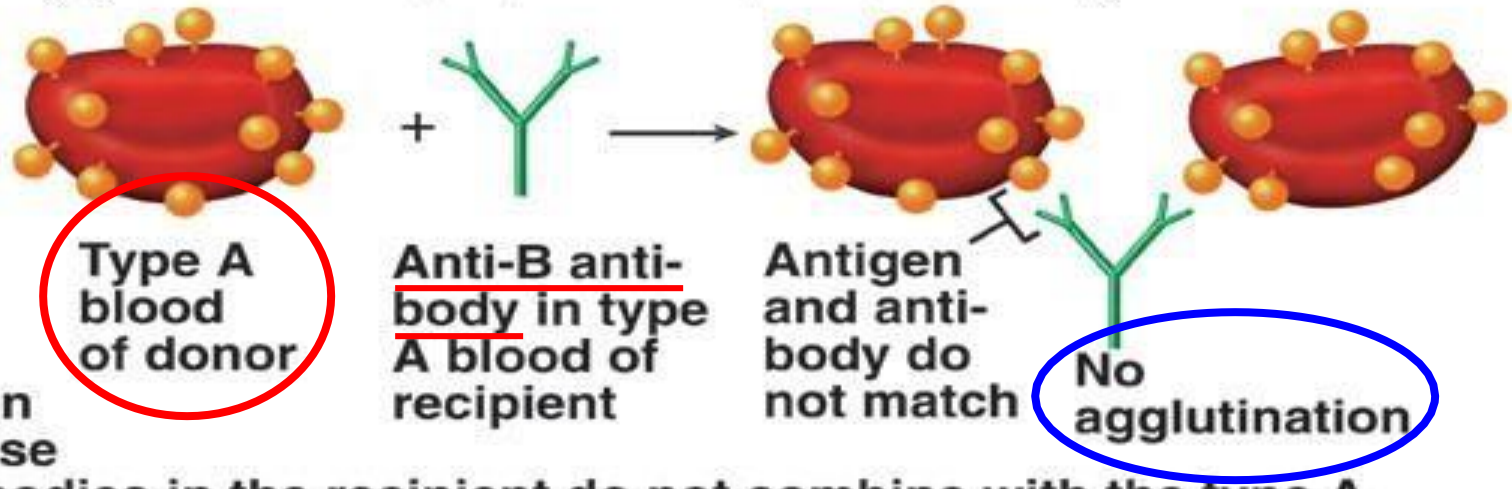


Blood Group	Antigens	Antibodies	Can give blood to	Can receive blood from
AB	A and B	None	AB	AB, A, B, O
A	A	B	A and AB	A and O
B	B	A	B and AB	B and O
O	None	A and B	AB, A, B, O	O

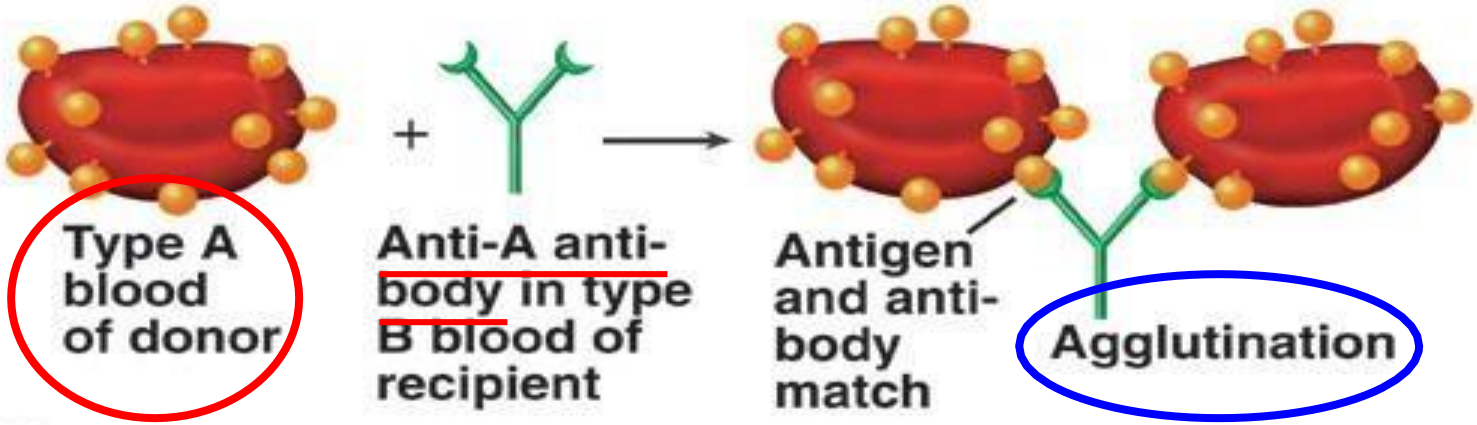
Complications of blood transfusion

1. Immune reaction: Incompatible blood transfusion leading to immediate or delayed reaction, fever, haemolysis, allergic reaction
2. Transmission of diseases (e.g.mlaria, syphilis, viral hepatitis, AIDS virus)
3. Acute kidney failure (reaction to mismatched transfusions)
4. Iron overload due to multi-transfusion in case of sickle cell anemia and thalassemia

Agglutination Reaction



(a) No agglutination reaction. Type A blood donated to a type A recipient does not cause an agglutination reaction because the anti-B antibodies in the recipient do not combine with the type A antigens on the red blood cells in the donated blood.



(b) Agglutination reaction. Type A blood donated to a type B recipient causes an agglutination reaction because the anti-A antibodies in the recipient combine with the type A antigens on the red blood cells in the donated blood.

Agglutination in transfusion reaction

- **If a patient of blood group *A* transfused with blood of group B**

- **The anti-B in plasma will agglutinate the transfused group B cells:**

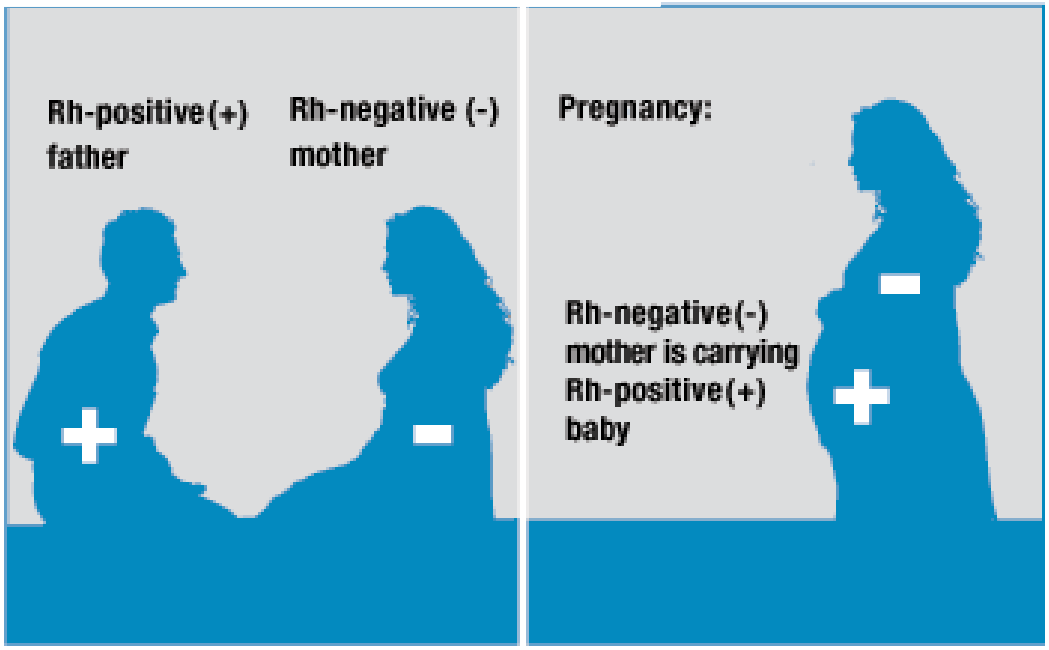
Outcome:

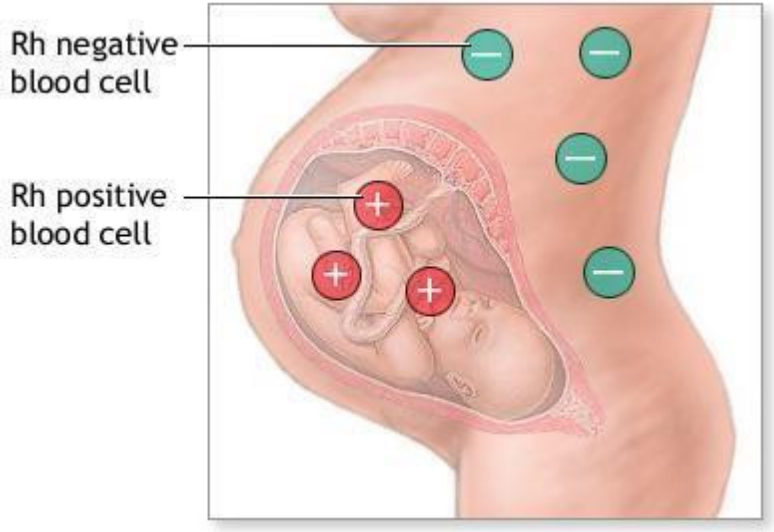
  - The clumped cells plug small blood vessels (kidney shut down)
  - Sometimes immediate hemolysis

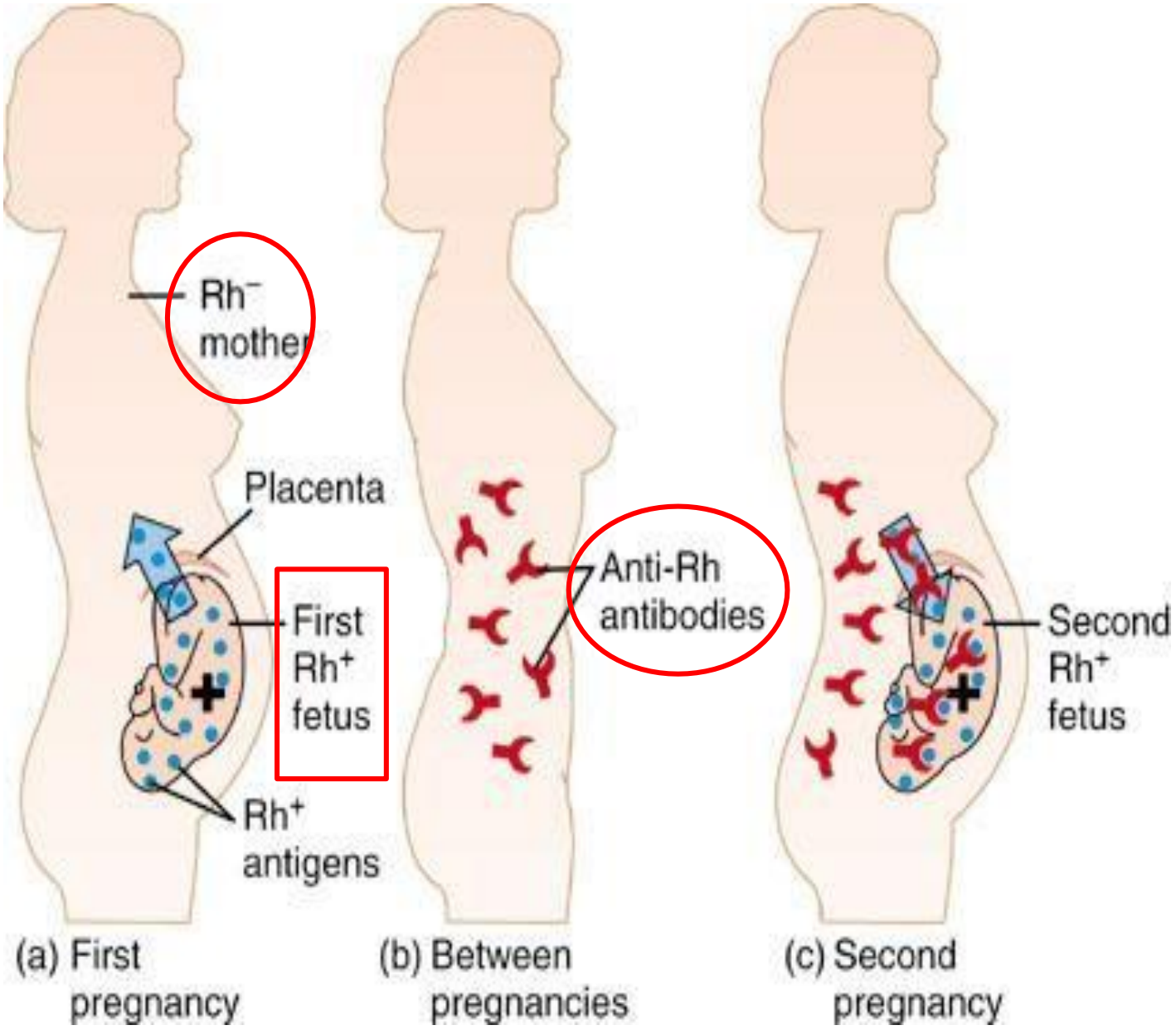
Importance of blood groups

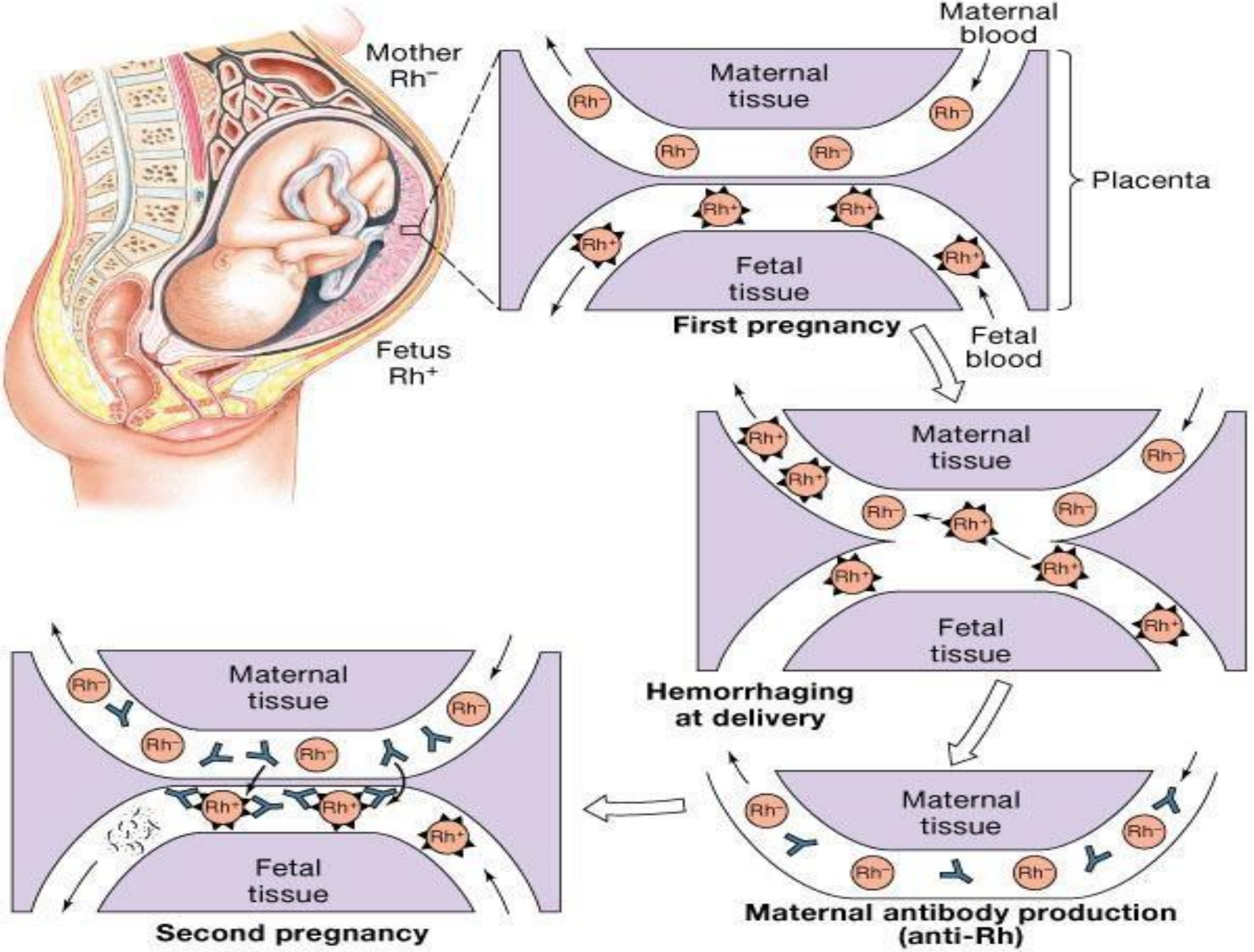
1. Blood Transfusion.
2. Rh incompatibilty between mother and fetus

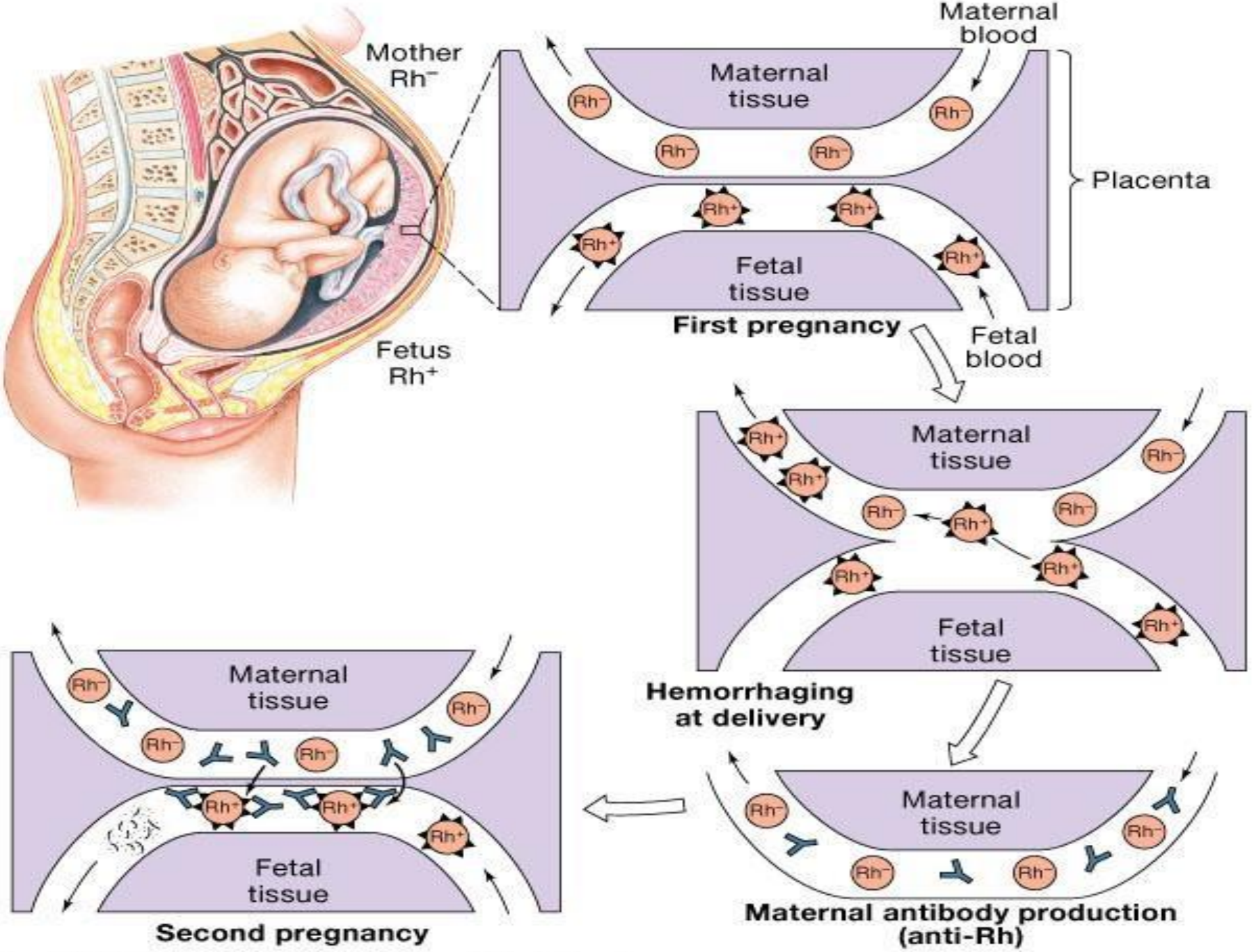
Rh incompatibilty between mother and fetus


Rh-positive (+) father
Rh-negative (-) mother
Pregnancy:
Rh-negative (-) mother is carrying Rh-positive (+) baby


Rh negative blood cell
Rh positive blood cell


Rh⁻ mother
Placenta
First Rh⁺ fetus
Rh⁺ antigens
Anti-Rh antibodies
Second Rh⁺ fetus
(a) First pregnancy
(b) Between pregnancies
(c) Second pregnancy





Rh incompatibilty between mother and fetus

- Mother Rh-ve first Rh+ve baby:
- At delivery
  - Fetal Rh+ RBC cross to maternal blood
- The mother will develop Anti-D after delivery.
- First child escapes & is safe

(If the mother is transfused with Rh+ve blood before, first child will be affected)

Rh incompatibilty between mother and fetus-cont.

- Second fetus
  - If Rh+ve
  - Anti-D crosses placenta and destroys fetal Rh+ RBC
  - Outcome?

Hemolytic Disease of the newborn

Hemolytic Disease of the newborn

1. Hemolytic anemia:
   - If severe:
     treated with exchange transfusion:
     Replace baby blood with Rh-ve RBC (several times)

2. Hydrobs fetalis (death in utero)

Hydrops fetalis

Hemolytic Disease of the newborn- cont.

Prevention:

- Injecting the mother with anti-D immediately after 1st childbirth

- Antenatal (during pregnancY) prophylaxis

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