Blood Groups

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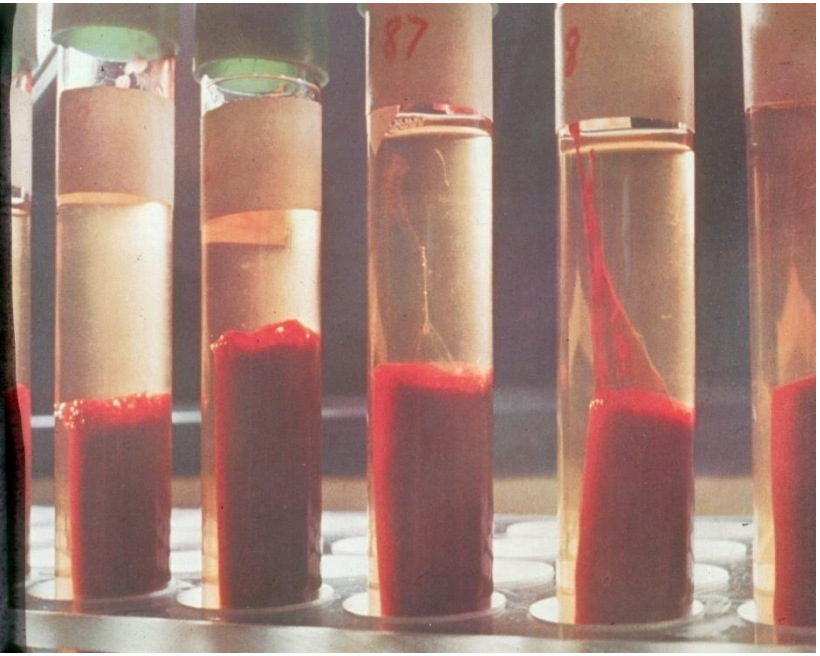
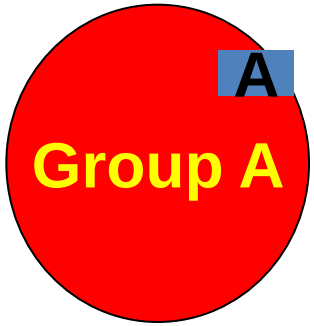
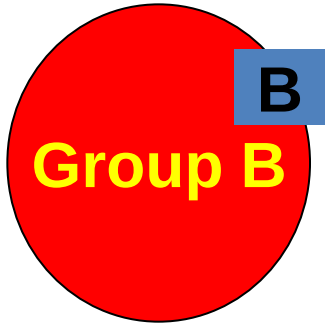
Objectives

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

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




A
Group A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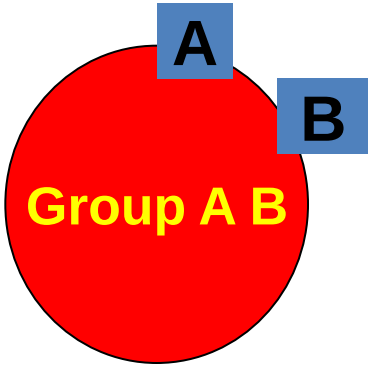
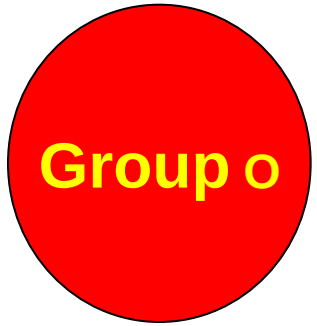
Group B


A
B
Group A B


Group O

BLOOD GROUPS

- **Determined by:**

Antigens (glycoprotein) on the surface RBC

- **The chief blood groups are:**

  Clinically most significant

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

Rhesus (Rh) Blood Group

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

The ABO system:

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

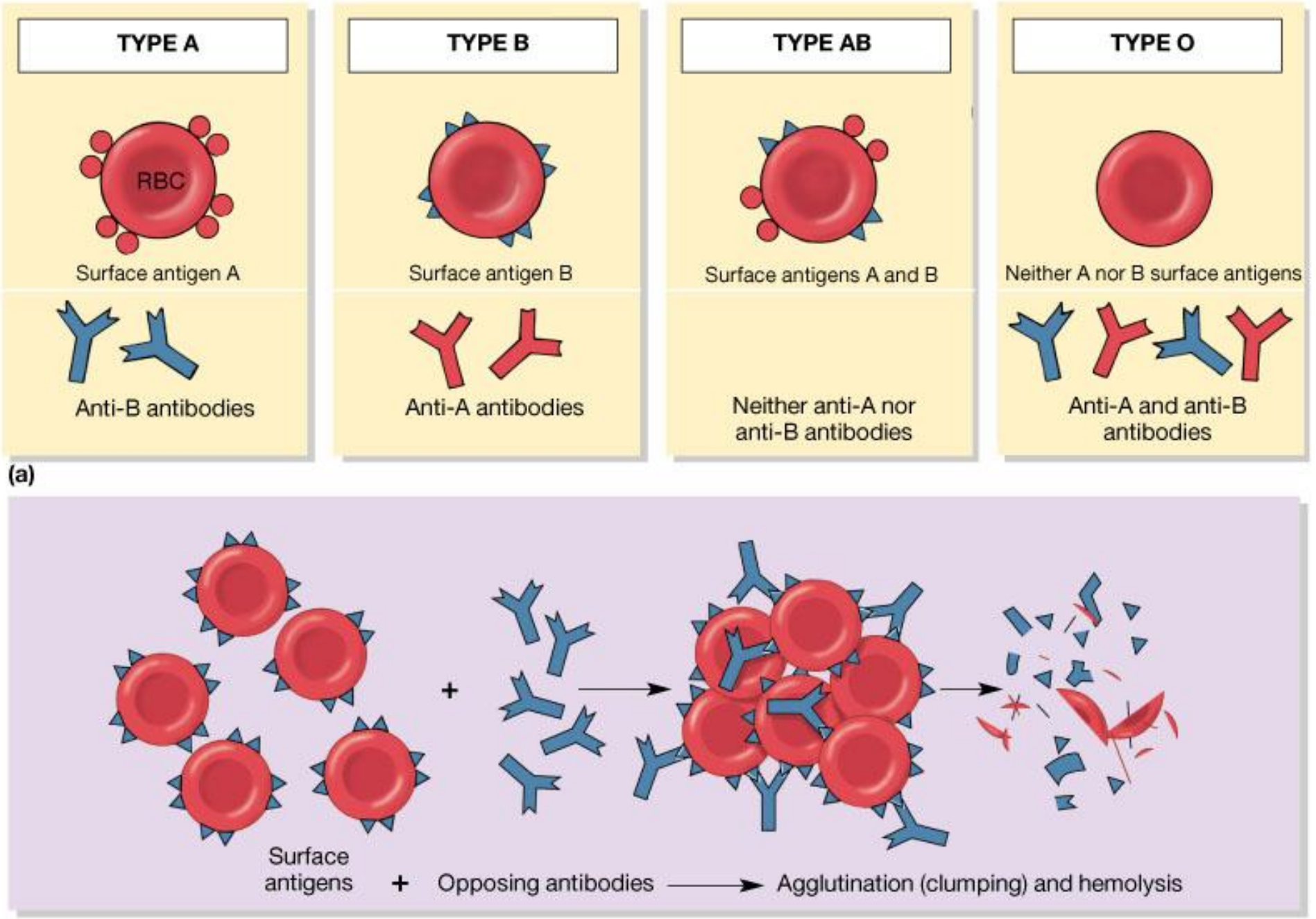
  A and B

- Four main ABO groups:

  A, B, AB, O

The ABO Blood groups

GroupBlood	Agglutinogen (Antigen)	Agglutinin (Antibody)
A	A	
B	B	
AB	A & B	
O	-	



The ABO system- cont.

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

Inheritance of blood groups

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

- Sorting disputes in paternal cases.
- Frequency of ABO has ethnic variation.

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.

Importance of blood groups

1. Blood Transfusion.

2. Rh incompatibilty between mother and fetus

Blood Transfusion

- O blood group is a universal donor.
- AB blood group is a universal recipient.

Agglutination in transfusion

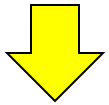
- **If a patient of blood group *A* transfused with blood of *group B***

- **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.

- If a person with blood group A transfused with blood of group B (contains anti-A in plasma)
- The anti-A in plasma of recipient blood group B will agglutinate the transfused cell (A)
- The clumped cells plug small blood vessels
- Sometimes causes immediate hemolysis



Transfusion reaction

Complications of blood transfusion

1. Immune reaction: Incompatible blood transfusion leading to immediate or delayed reaction, fever, haemolysis, allergic reaction

2. Transmission of diseases; malaria, syphilis, viral hepatitis & Aids

3. Iron overload due to multi-transfusion in case of sickle cell anemia and thalassemia.

Blood tests before transfusion

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

Blood tests before transfusion

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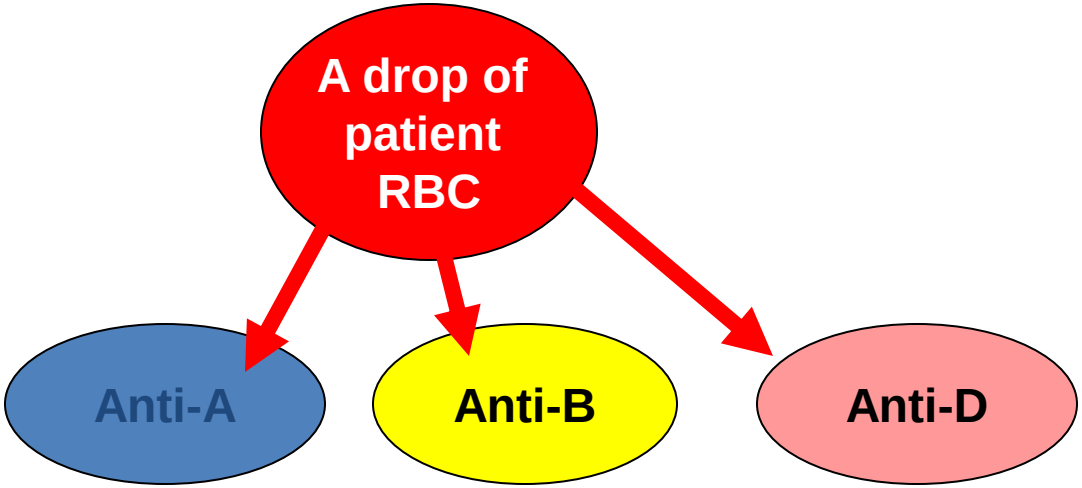
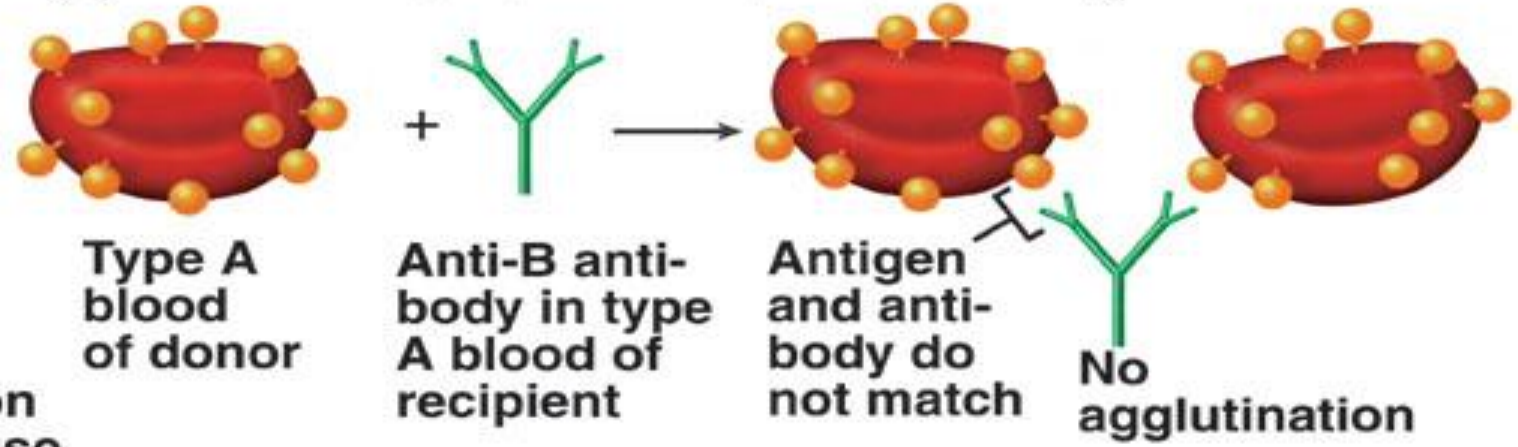
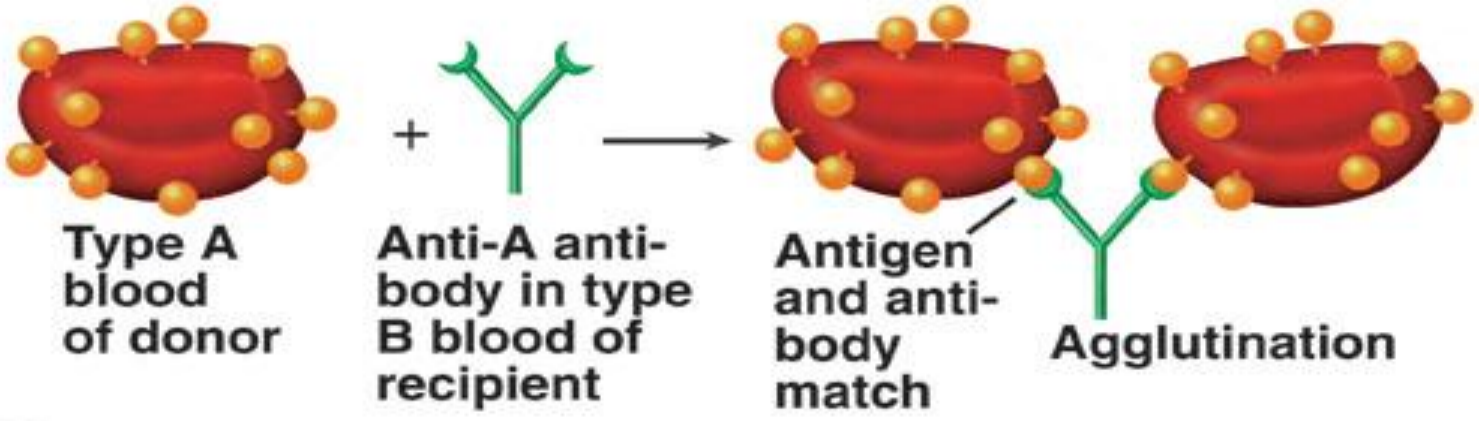
Blood tests before transfusion



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.

Blood tests before transfusion

RBC	Anti A	Anti-B
O	-	-
A	+	-
B	-	+
AB	+	+

Blood tests before transfusion

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

Blood tests before transfusion

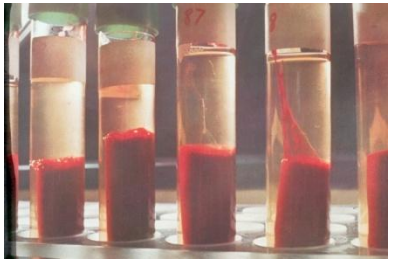
2. Cross-matching:

donor cells

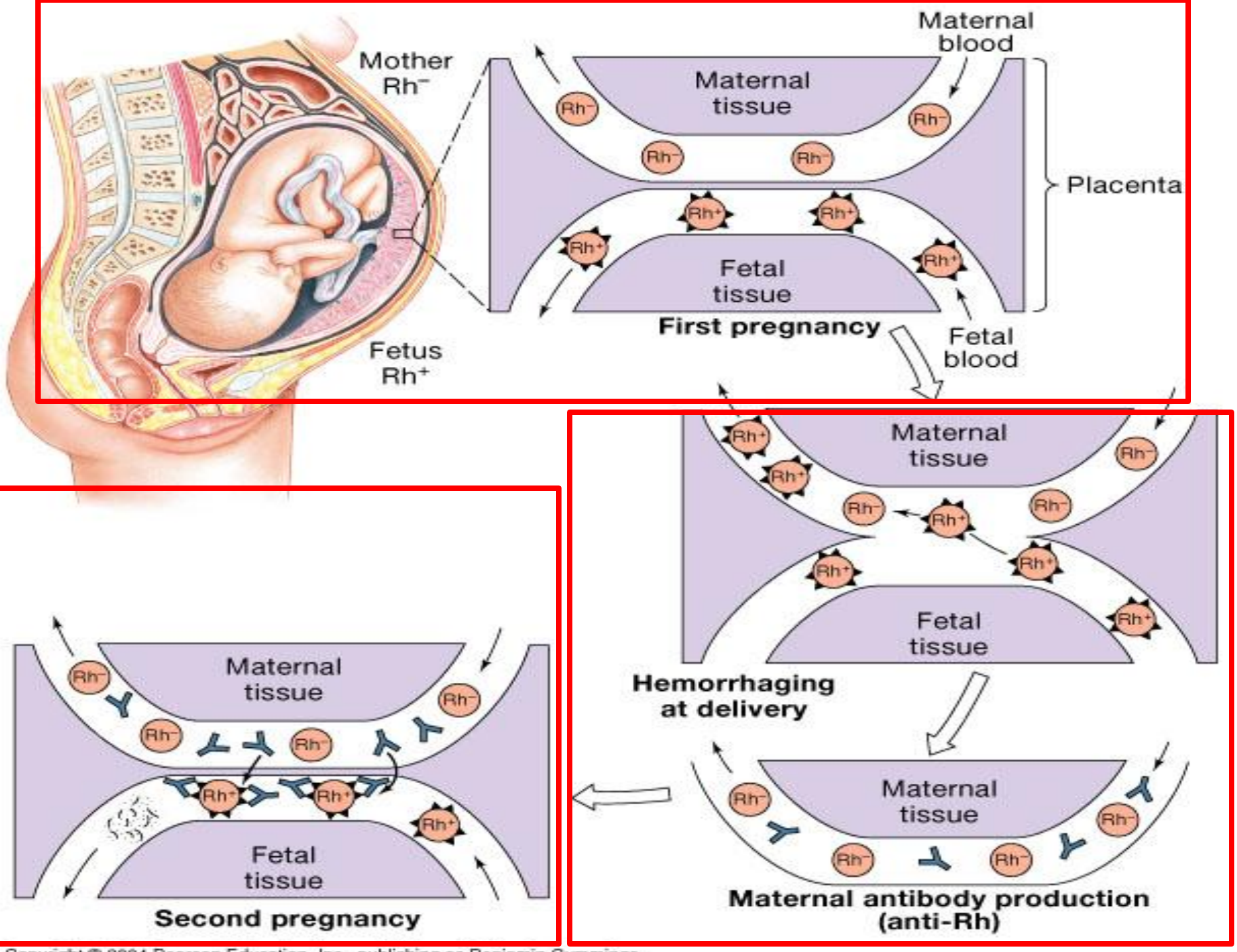
+

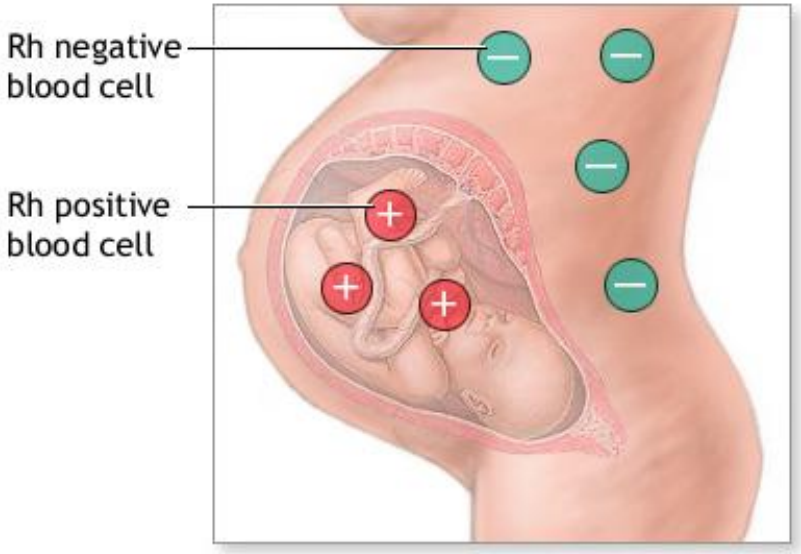
recipients (patient)

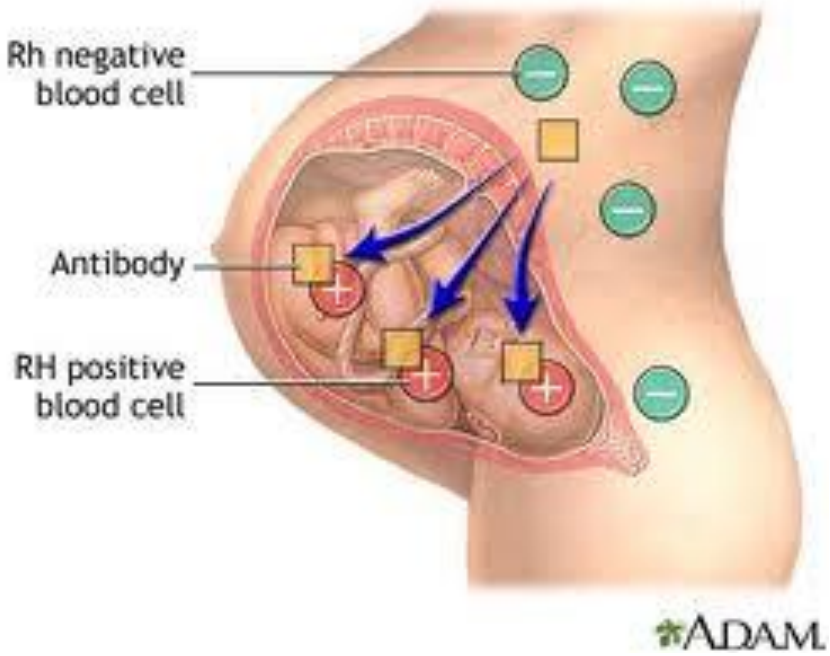
serum



Rh incompatibilty between mother and fetus




Rh negative blood cell
Rh positive blood cell


Rh negative blood cell
Antibody
RH positive blood cell
ADAM.

Rh incompatibilty between mother and fetus

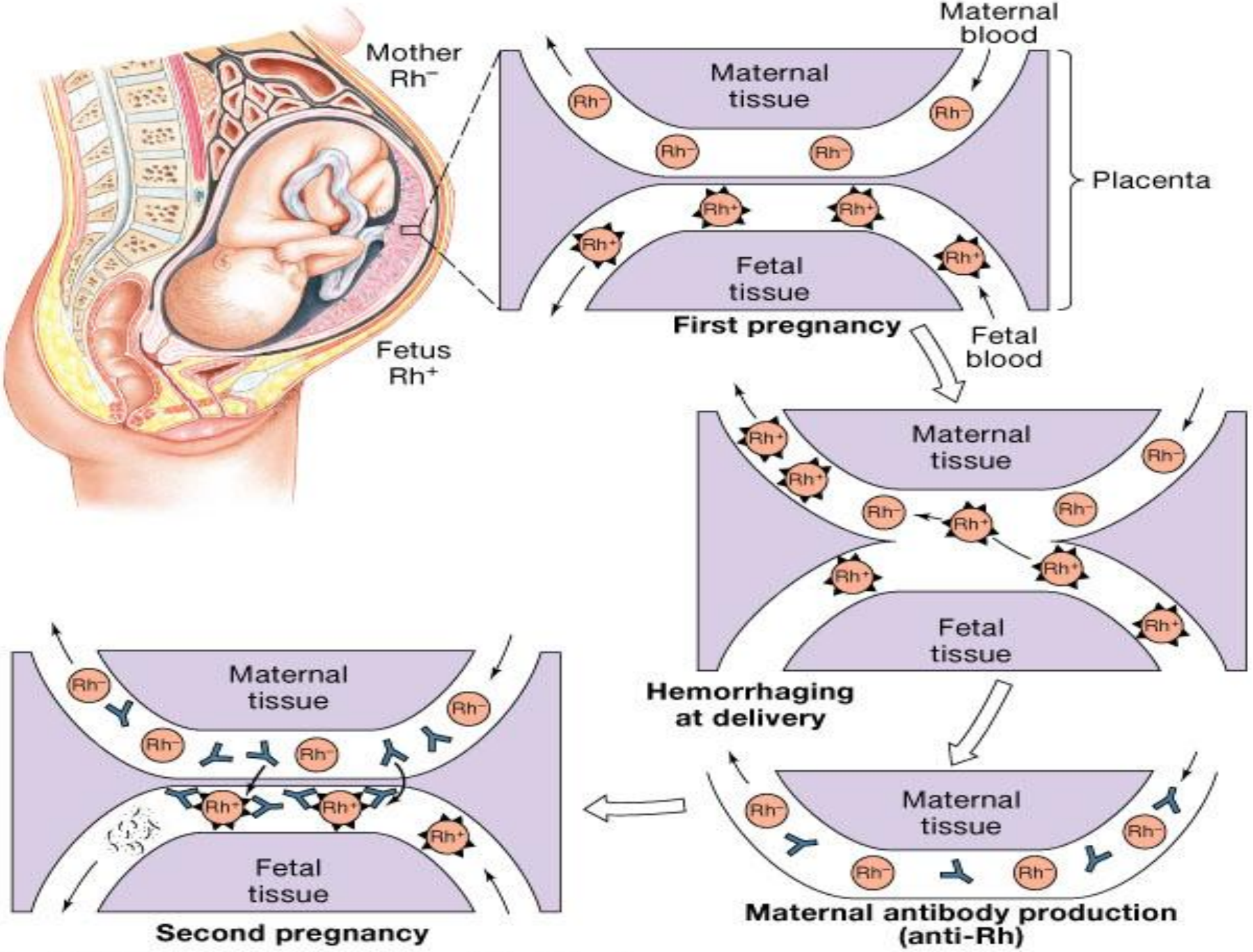
- Mother Rh-ve first Rh+ve baby:
- At delivery
  - Fetal Rh+ RBC cross to maternal blood
- The mother will develop Anti-D after delivery.
- First child escapes & is safe

(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)

Hemolytic Disease of the newborn-cont.

Prevention:

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

- Antenatal (during pregnancy) prophylaxis