Blood Groups and Blood Transfusion

TEXTBOOK OF MEDICAL PHYSIOLOGY

GUYTON & HALL 11TH EDITION

UNIT VI CHAPTERS 35

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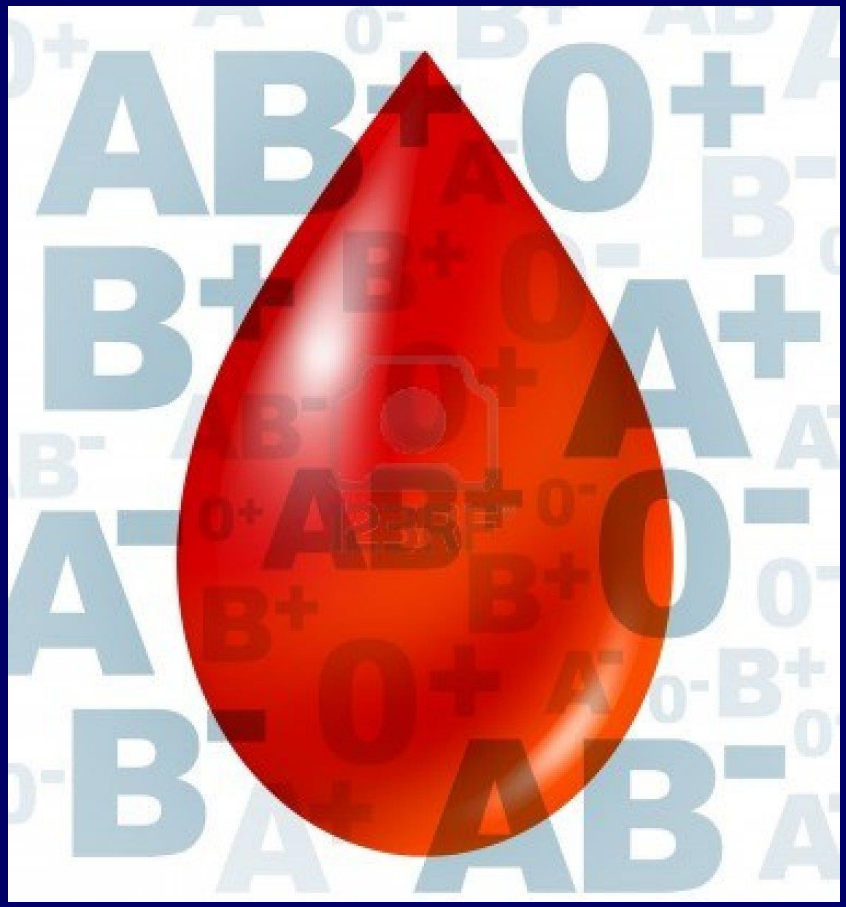


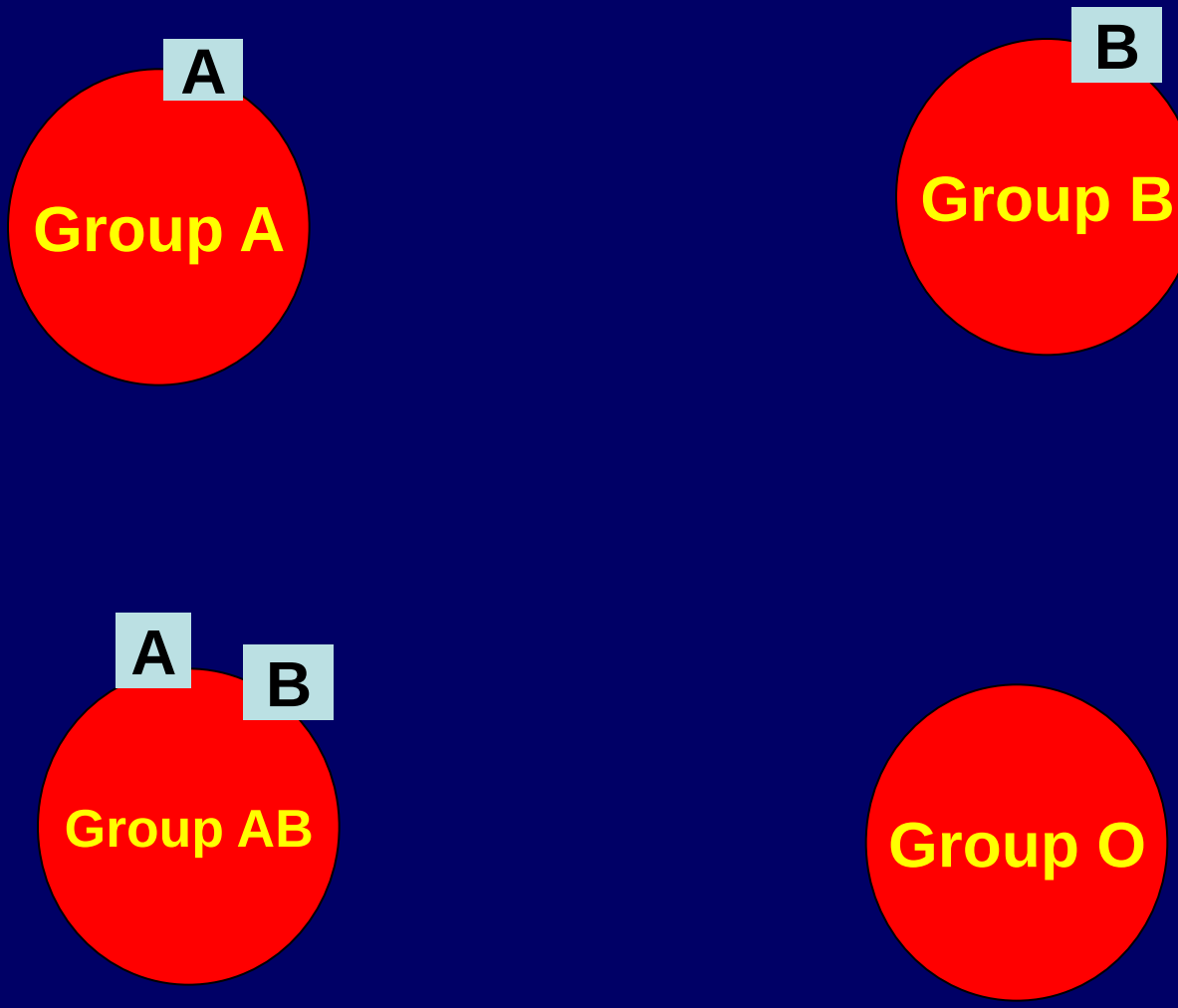
Objectives

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

1. Describe ABO blood group types
2. Recognize Agglutinins in plasma
3. Recognize transfusion (cross) reactions
4. Describe Rhesus blood groups.
5. Describe causes of hemolytic disease of the newborn.


ABO
Rh
EXPIRES
F6026
DATE COLLECTED
UNIT NO.
A RH. POS.
O RH. POS.
DATE OF COLLECTION
DO NOT USE AFTER
TRIPLE BLOOD BAG

Agglutinogens (Antigens)



BLOOD GROUPS

Determined by:

Antigens (glycoprotein) on the surface RBC

The chief blood groups are:

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

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 (individual is Rh–ve)

- Types of Rhesus antigens (Rh factors):
  D,d, C,c, E, e
  Clinically most important is D

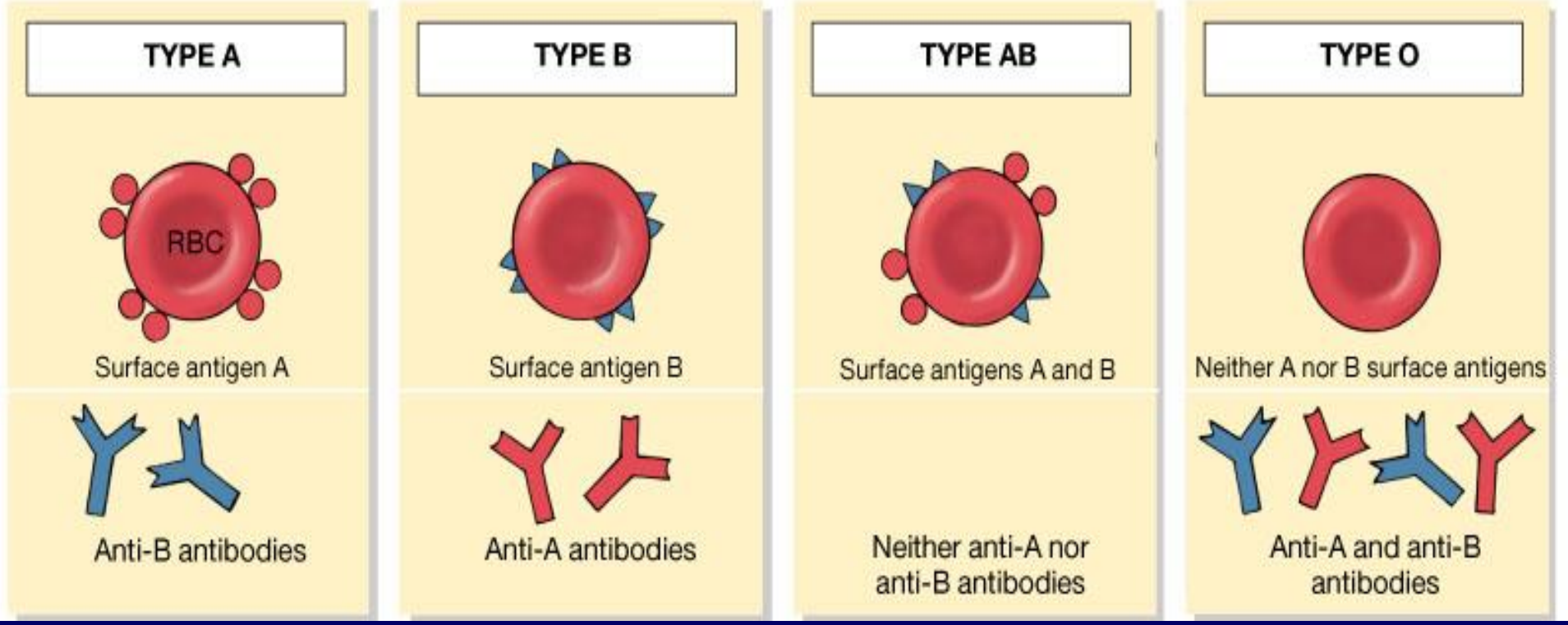
The ABO system:

- Depends on whether the red cells contain one, both or neither of the two blood antigens A and B.
- Four main ABO groups:

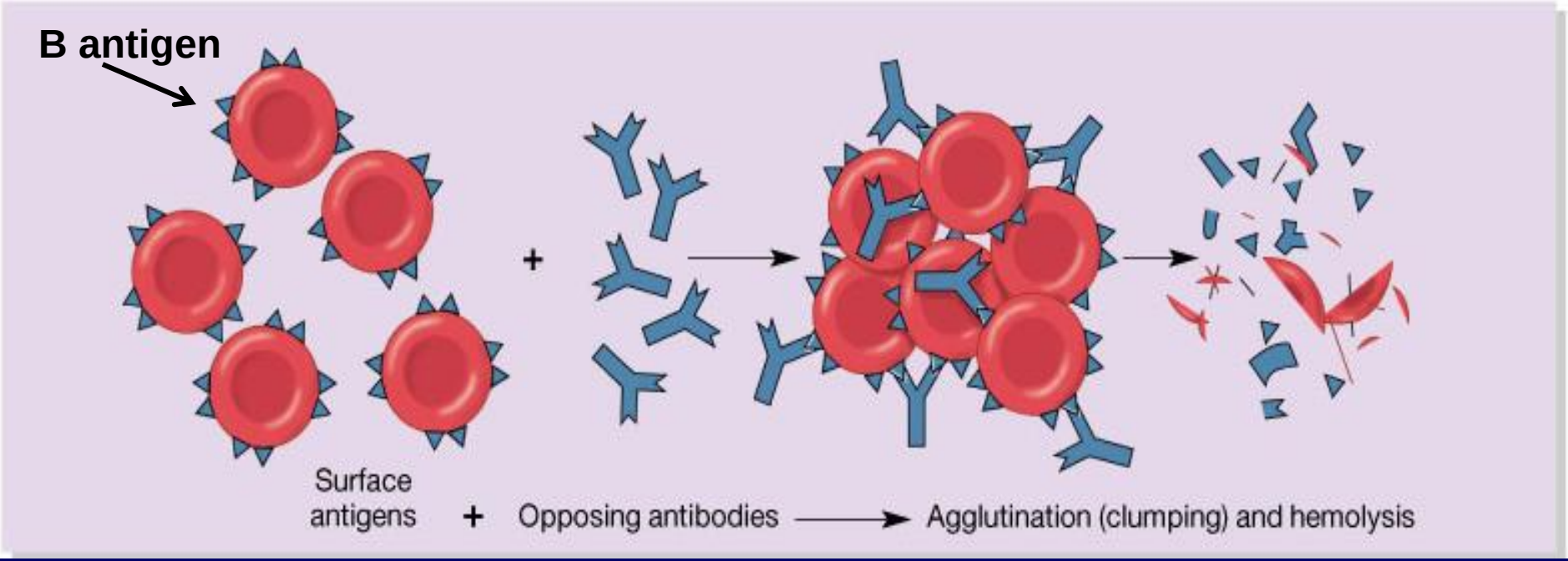
  A, B, AB, O

The ABO Blood groups

Blood Group	Agglutinogen (Antigen)	Agglutinin (Antibody)
A	A	Anti-B
B	B	Anti-A
AB	A & B	-
O	-	Anti A+B


TYPE A
RBC
Surface antigen A
Anti-B antibodies
TYPE B
Surface antigen B
Anti-A antibodies
TYPE AB
Surface antigens A and B
Neither anti-A nor anti-B antibodies
TYPE O
Neither A nor B surface antigens
Anti-A and anti-B antibodies

Type B Anti B


B antigen
Surface antigens
+
Opposing antibodies
Agglutination (clumping) and hemolysis

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

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 fetus

Inheritance of blood groups

Blood group	Genotypes
A	AA, OA
B	BB, OB
O	OO
AB	AB

Relative frequencies of the different blood types:

O	47%
A	41%
B	9%
AB	3%

Importance of blood groups

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

Agglutination in transfusion reaction

- If a patient of blood group A transfused with blood 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

Transfusion reactions

(Incompatible Blood transfusion)

- If a person with blood group B transfused with blood of group A
- 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

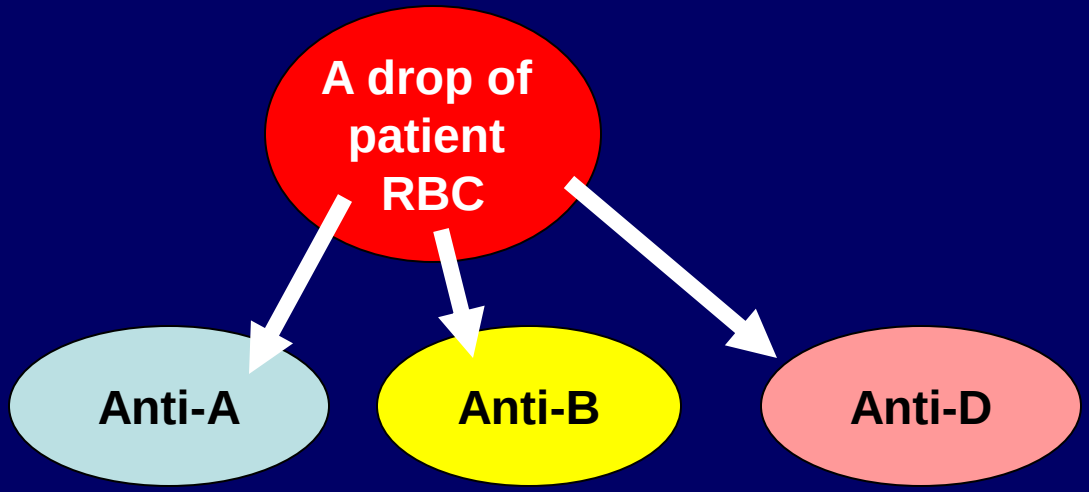
1. Immune reaction: Incompatible blood transfusion leading to immediate or delayed reaction, fever, hemolysis, allergic reaction
2. Transmission of infection; malaria, syphilis, viral hepatitis & Aids
3. Iron overload

Blood tests before transfusion

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

Blood tests before transfusion

1. Blood group type of patient (recipient)

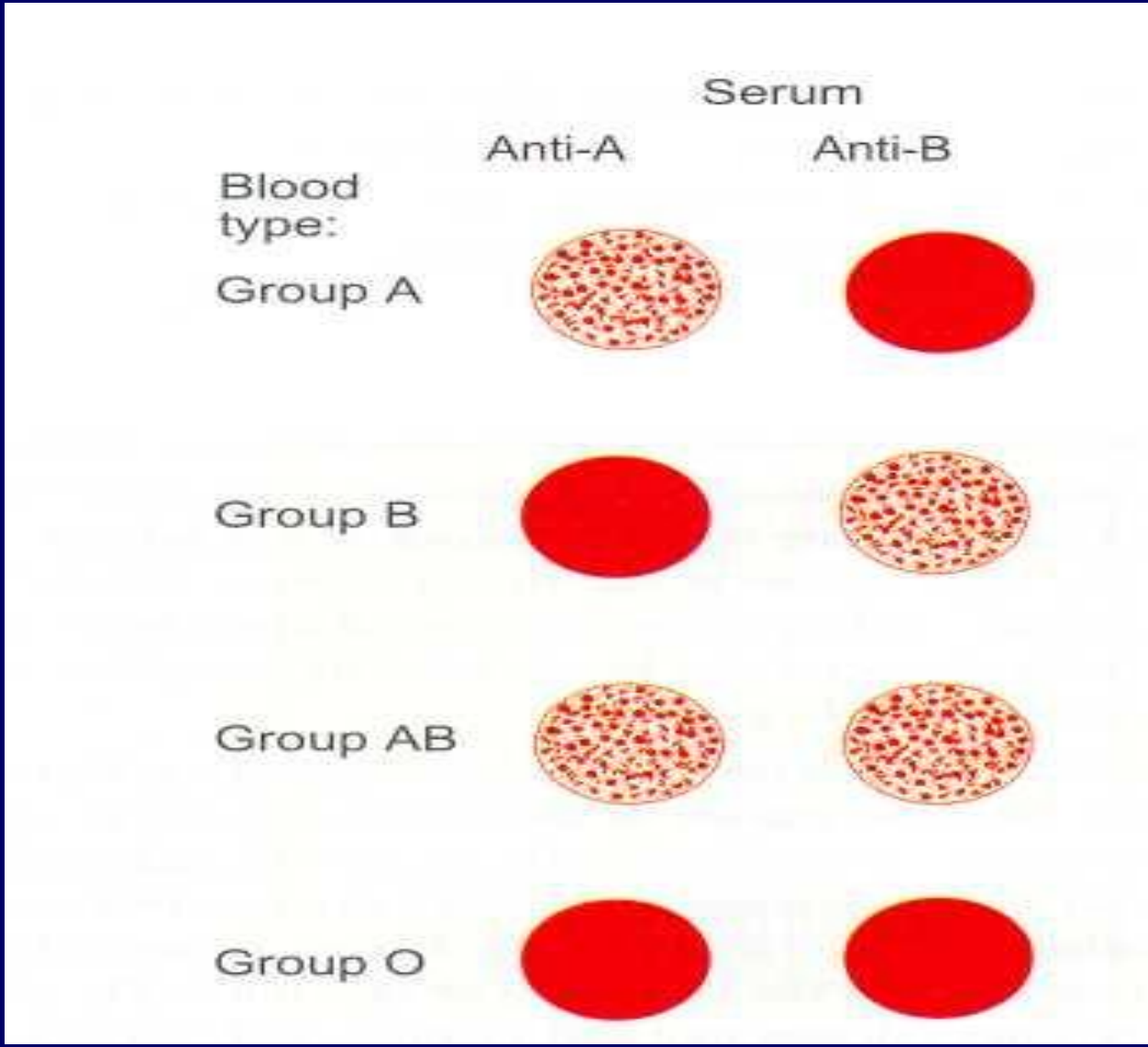


- Look for agglutination

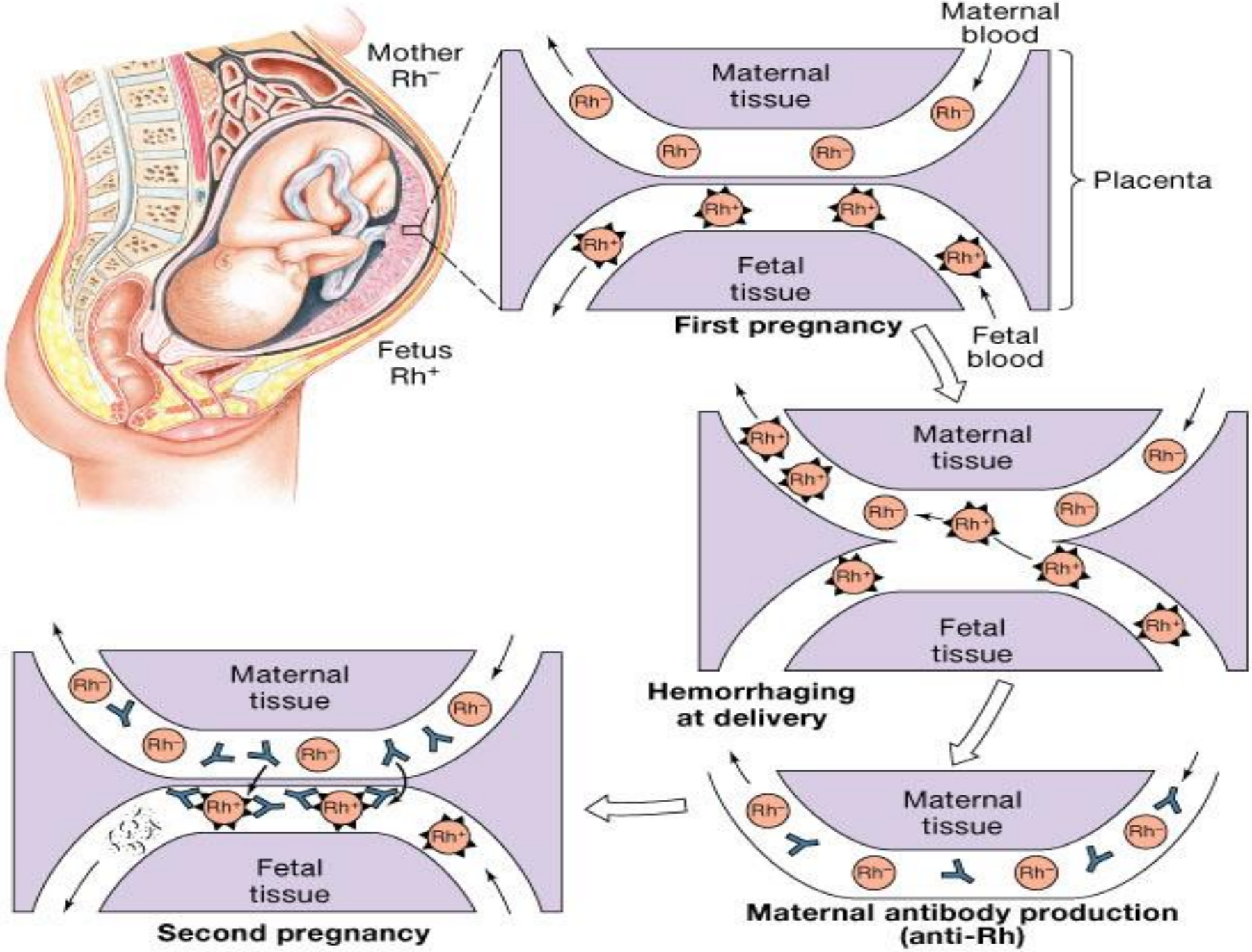
Blood tests before transfusion

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

Agglutination Reaction



Rh incompatibilty between mother and fetus



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 desease in newborn (erythroblastosis fetalis):
   - If severe:

     treated with exchange transfusion:

     Replace baby blood with Rh-ve RBC (several times)

2. Hydrops fetalis (death in uterus)

Hemolytic Disease of the newborn- cont.

Prevention:

- Injecting the mother with anti-D antibody immediately after 1st childbirth to prevent sensitization of the mother to the D antigen.