

# Blood groups



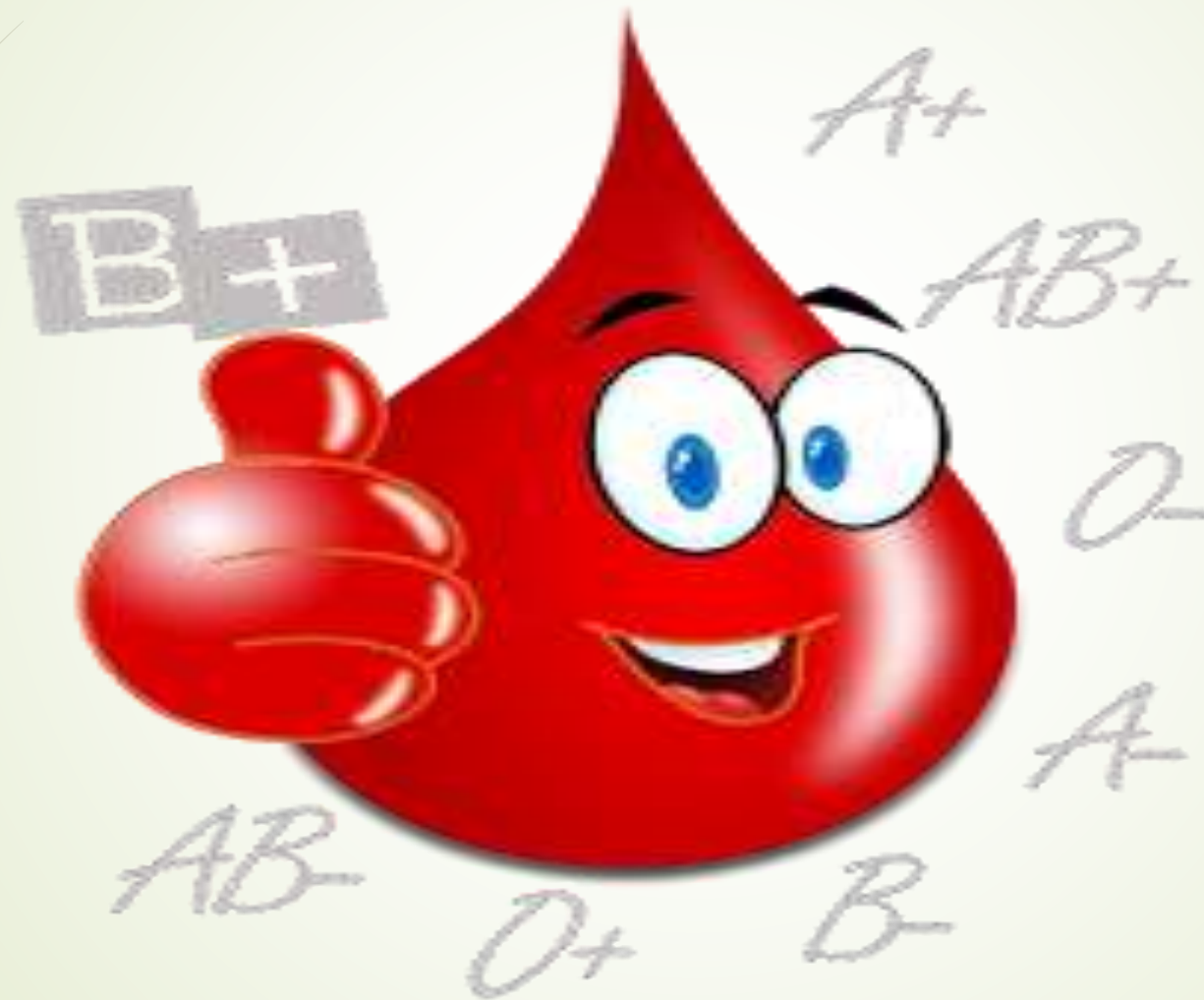
Medical physiology



## ILOs

- Identify blood types (ABO system and Rh factor)
- Mention importance of blood groups.
- Identify complication of incompatible blood transfusion.
- Mention importance of Rh factor

# BLOOD GROUPS and YOU




# BLOOD GROUPS



## ABO system:

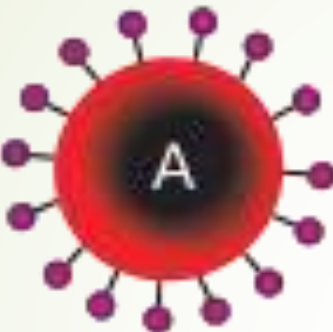

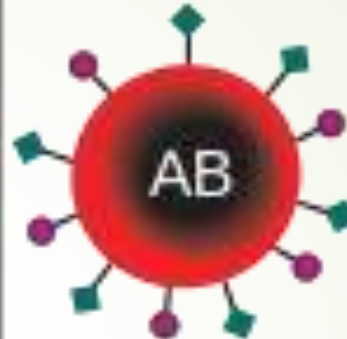

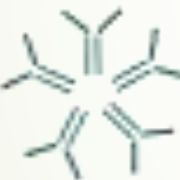

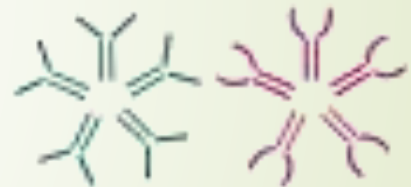



- The cell membrane of RBCs contains mucopolysaccharide substance called antigens (agglutinogen).
- Two types of antigens are known: **A** antigen and **B** antigen.
- People are classified into 4 groups according to antigen on RBC membrane (**A**, **B**, **AB**, **O**)
- The plasma contains antibodies (agglutinins) against the absent antigen.



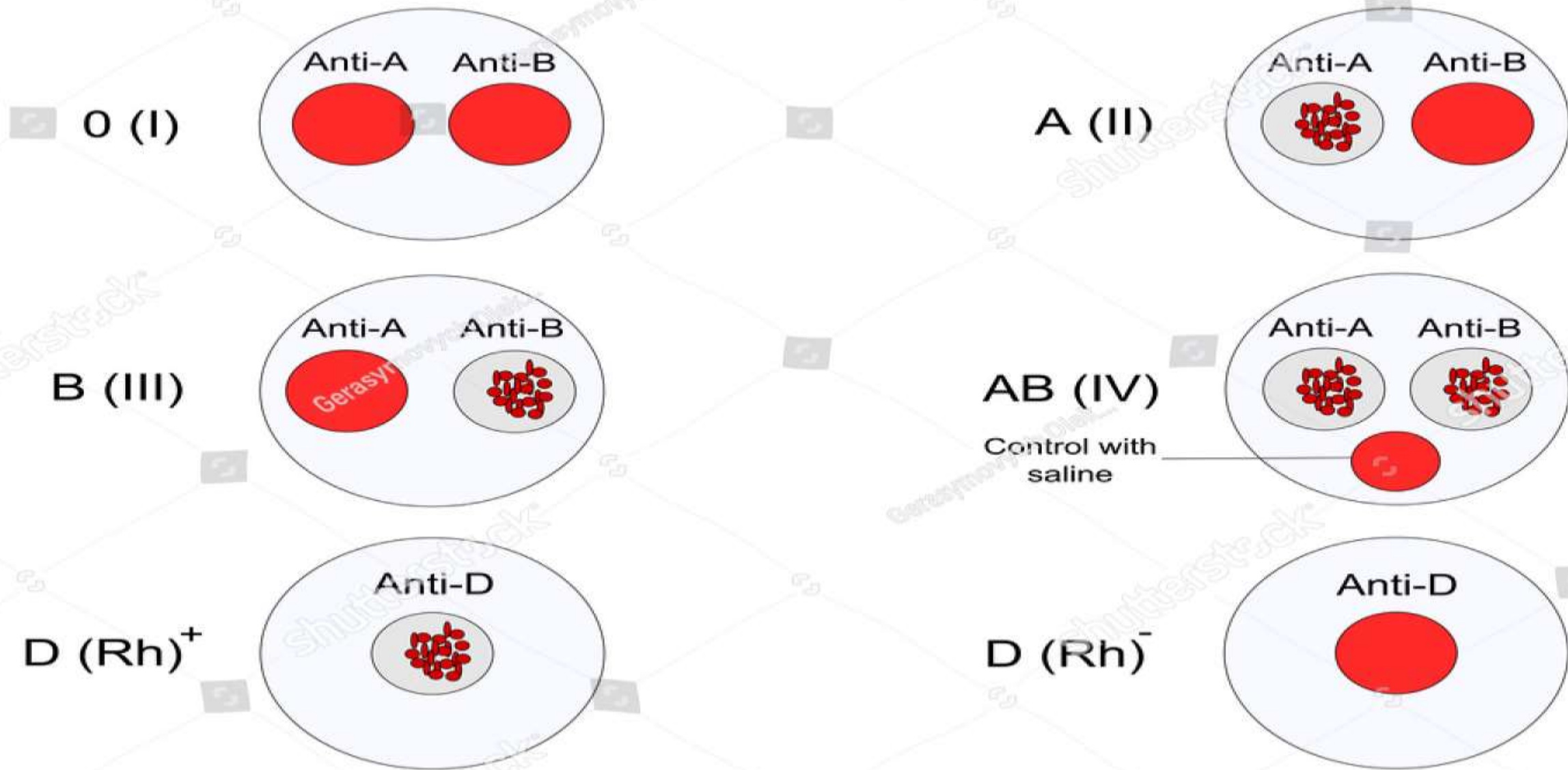
Group	<b>A</b>	<b>B</b>	<b>AB</b>	<b>O</b>
•% of people	40 %	10%	5%	45%
•Antigen	A	B	A & B	-----
•Antibody	Anti-B	Anti-A	-----	Anti-A & Anti-B

- If an antigen is present in RBCs and the plasma contains its corresponding antibodies → agglutination → hemolysis.
- The antigens are called **agglutinogen** and the antibodies are called **agglutinins**.



	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies in Plasma	 Anti-B	 Anti-A	None	 Anti-A and Anti-B
Antigens in Red Blood Cell	 A antigen	 B antigen	 A and B antigens	None

# Blood types





# Importance of blood groups:


1-Medicolegal importance

2- blood transfusion

3- Rh factor during pregnancy

## 1-Medicolegal importance (Disputed Parenthood):

- Inheritance of blood groups is by 2 antigens from both father & mother
- The A & B antigens are dominant, while the O one is recessive.
- Blood group is a good negative test in disputed parenthood.



		Father's Blood Type				Child's Blood Type
		A	B	AB	O	
Mother's Blood Type	A	A or O	A, B, AB, or O	A, B, or AB	A or O	
	B	A, B, AB, or O	B or O	A, B, or AB	B or O	
	AB	A, B, or AB	A, B, or AB	A, B, or AB	A or B	
	O	A or O	B or O	A or B	O	

## **2-Blood transfusion:**

In incompatible blood transfusion, the donor RBCs is agglutinated by recipient plasma, as the donor's plasma is diluted by the recipient blood.

- \*Group O is universal donor, because there is no agglutinogen (antigens).
- \*Group AB is universal recipient, because there is no agglutinin(antibodies)
- \***Cross matching test:** should be done before blood transfusion in  
The recipient plasma is mixed with donor's RBCs, and recipient RBCs is mixed with donor plasma, If no agglutination transfusion is done.

## **Rh factor (D factor):**

- It is a system composed mainly of **D** antigens
- It is first discovered in blood of Rhesus monkey
- D is the most antigenic component.
- 85 % of people are Rh positive i.e. have D antigen.
- 15 % of people are Rh negative i.e. have no D antigen.
- Normally Rh + Ve & Rh – Ve have no anti-D
- Negative Rh persons forms anti D if antigen D is transformed to them.
- Positive Rh never form anti D, whether receives Rh +Ve or Rh -Ve

# Rh Blood Group System



***present (+)***  
***Rh positive***



***absent (-)***  
***Rh negative***





Rh

Factor Set

# Why rh factor Blood Test Before Marriage ?



• O (I) Rh (+)

• O (I) Rh (-)

• A (II) Rh (+)

• A (II) Rh (-)

• B (III) Rh (+)

• B (III) Rh (-)

• AB (IV) Rh (+)

• AB (IV) Rh (-)

Rh

Factor Set

# Importance of Rh

**Before marriage & before blood transfusion**

## 1) Erythroblastosis Foetalis: (Rhesus hemolytic disease of newborn)

The disease occurs if:

- An **Rh negative female** is married from an **Rh positive male**
- She carries an Rh **positive fetus**

**A] The first baby will be born normal,** little fetal blood leaks into maternal circulation. & Mother will produce **anti-D** agglutinins (IgG)

**B] During next pregnancy,** maternal agglutinins (IgG) cross the placenta **causing fetal hemolysis:**

- **Anemia** of fetus
- **Jaundice**, increase bile pigments which cross the undeveloped blood BBB and deposit in basal ganglia (Kernicterus).

• **The first baby is affected in case of maternal sensitization by:**

- 1 - Previous Rh + Ve blood transfusion
- 2- Fetal maternal hemorrhage during pregnancy.

• **The disease can be prevented by:**

[1] Avoiding Rh + Ve blood transfusion to Rh – Ve females.

[2] Anti-D antibodies are given to prevent maternal sensitization.

\*If baby is born alive, he would be treated by exchange transfusion with blood group O Rh negative.

## 2) Repeated blood transfusion:

- If **Rh – Ve persons** is transfused with **Rh +Ve blood**, he will produce agglutinins against Rh factor.
- If this person is transfused (later on) with Rh +Ve blood, agglutination occurs.



MOTHER

Rh<sup>-</sup>



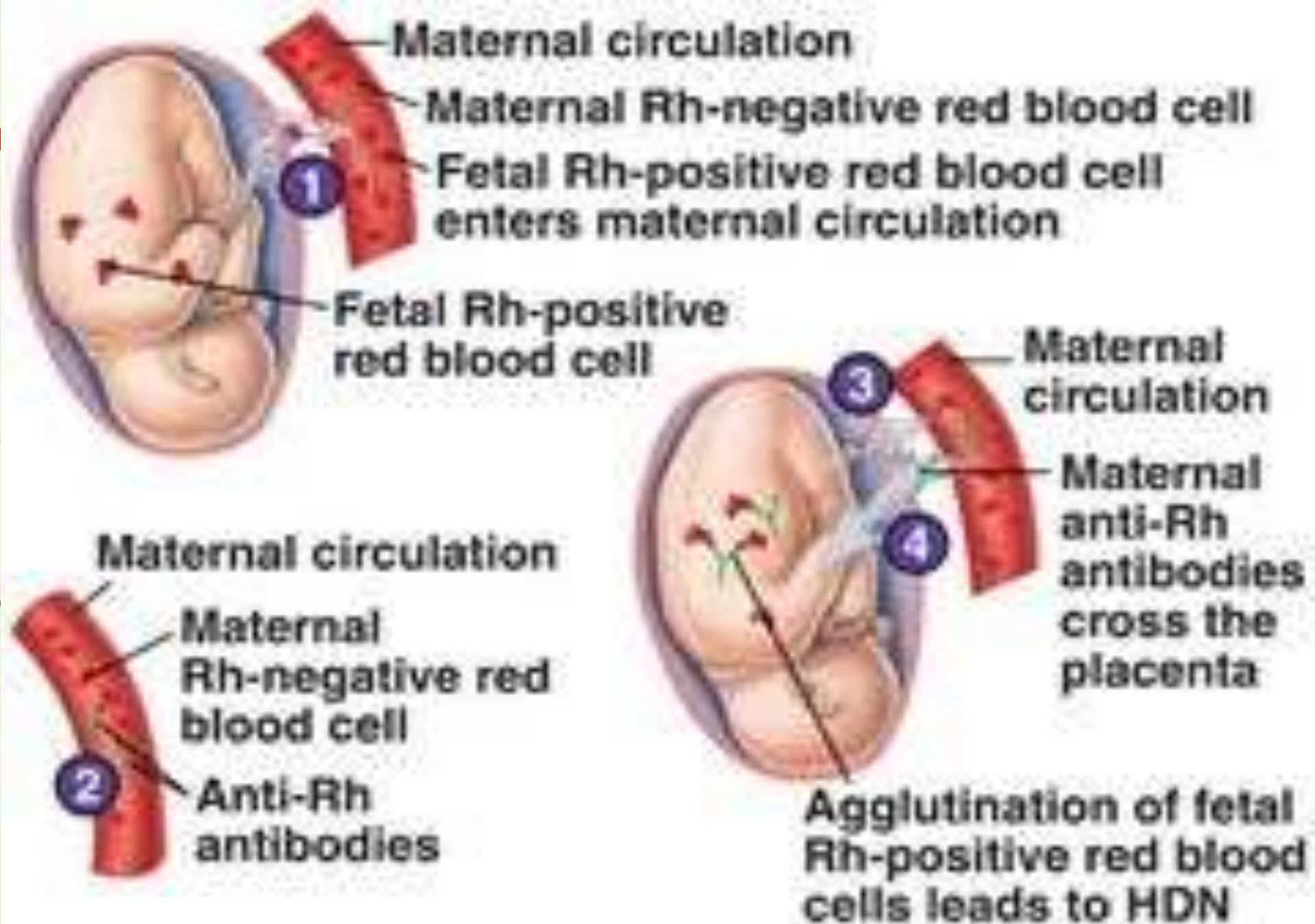
anti-Rh antibodies



FETUS

Rh<sup>+</sup>







**N.B.**

No fetal complication regarding ABO system because ABO antibodies cannot cross the placenta (IgM).



## **Indications of blood transfusion:**

- 1) To restore whole blood as in haemorrhage.
- 2) To restore one element: RBCs, WBCs & platelets.
- 3) Erythroblastosis foetalis.



## **Precautions before blood transfusion:**

- 1) Compatible blood.
- 2) High Hb content.
- 3) Free from contamination.
- 4) Free from disease.
- 5) Fresh i.e. less than 2 weeks storage.



## Storage:

Blood is stored at  $-4^{\circ}\text{C}$  not more than 2 weeks.

The following is added to it:

- citrate as an anticoagulant
- Dextrose as nutrient for cells
- Citric acid to reduce PH

Storage will lead to: → Decrease platelets

→ Decrease dextrose

→ Decrease factor 7, 8 & 9

→ Increase, potassium & lactic acid

## Complications of blood transfusion:

- 1) **Mechanical:** air or fat embolism
- 2) **Physiological:** excess transfusion → overloading → heart failure.
  - Pyrogenic reaction → fever.
- 3) **Infective:** infective hepatitis, malaria, AIDS.
- 4) **Incompatibility:** Transfusion with incompatible blood leads to clumping & hemolysis of given RBCs leading to:

## Effects of incompatibility:

### a. Blockage of blood capillaries:

This occurs by clumping RBCs leading to → backache and joint pain.

Blocking of coronary vessels leads to → angina pain

### b-Intravascular hemolysis leads to :

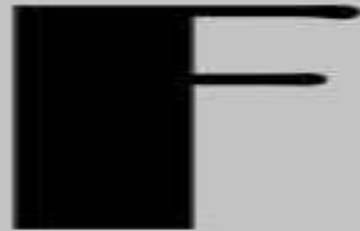
1. Shock due to release of histamine and vasodilators-→ drop of arterial blood pressure.
2. Liberation of K<sup>+</sup> (hyperkalemia)→ cardiac arrhythmia.
3. Liberation of Hemoglobin which:
  - a. is broken to bilirubin leading to yellow coloration of skin and mucous membrane (jaundice)
  - b. Leads to blockage of renal tubules as it is filtered by renal glomeruli →leading to renal failure.

# Blood Transfusion Reaction



## Allergic

MILD  
Facial Flushing  
Hives/ Rash  
SEVERE  
Increased Anxiety  
Wheezing  
Decreased BP



## Febrile

Headache  
Tachycardia  
Tachypnea  
Fever/Chills  
Anxiety



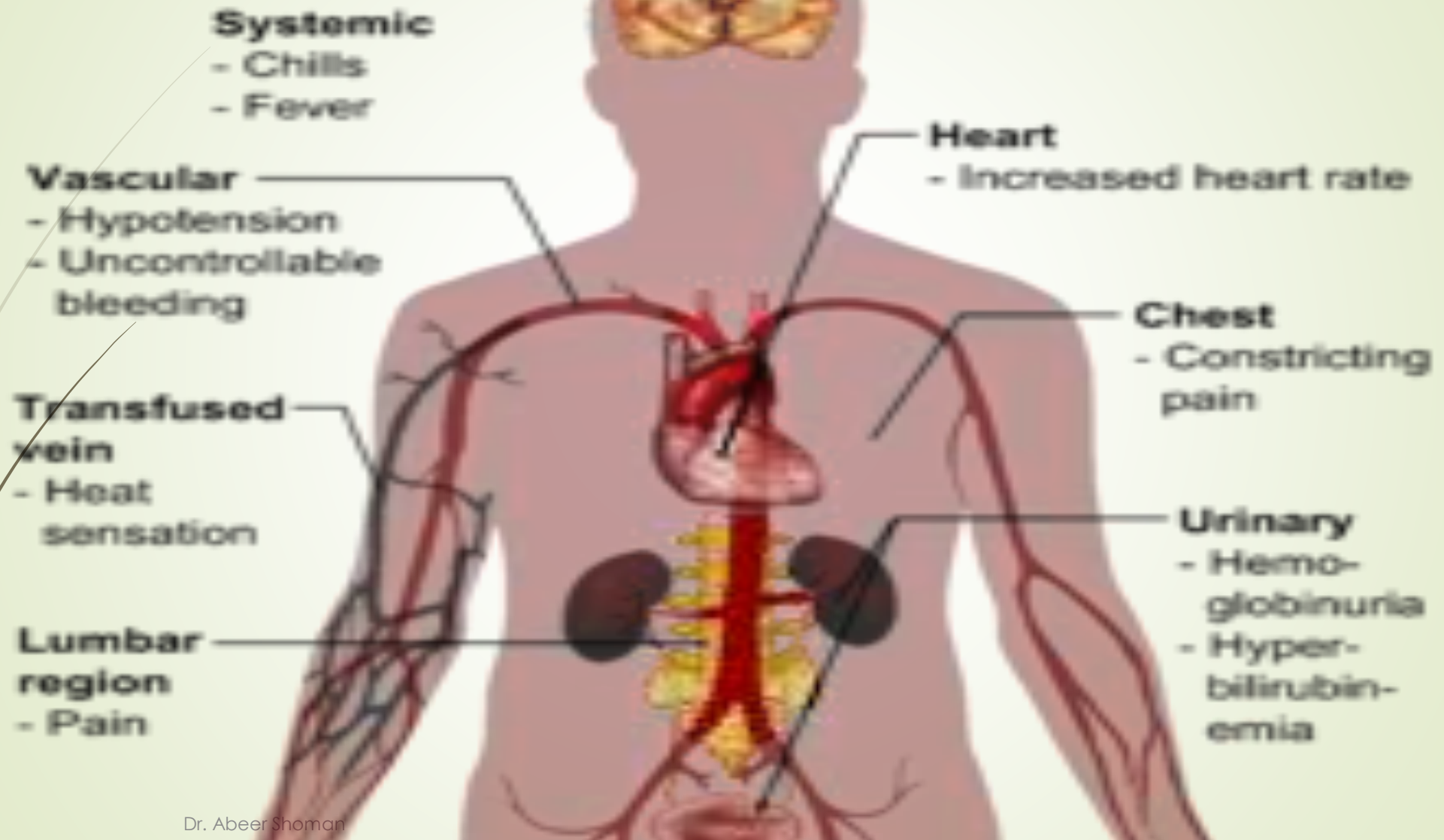
## Hemolytic

Decreased BP  
Increased RR  
Hemoglobinuria  
Chest Pain

Apprehension  
Low Back Pain  
Fever  
Tachycardia  
Chills



# Main symptoms of Acute hemolytic reaction





*Thank You*

