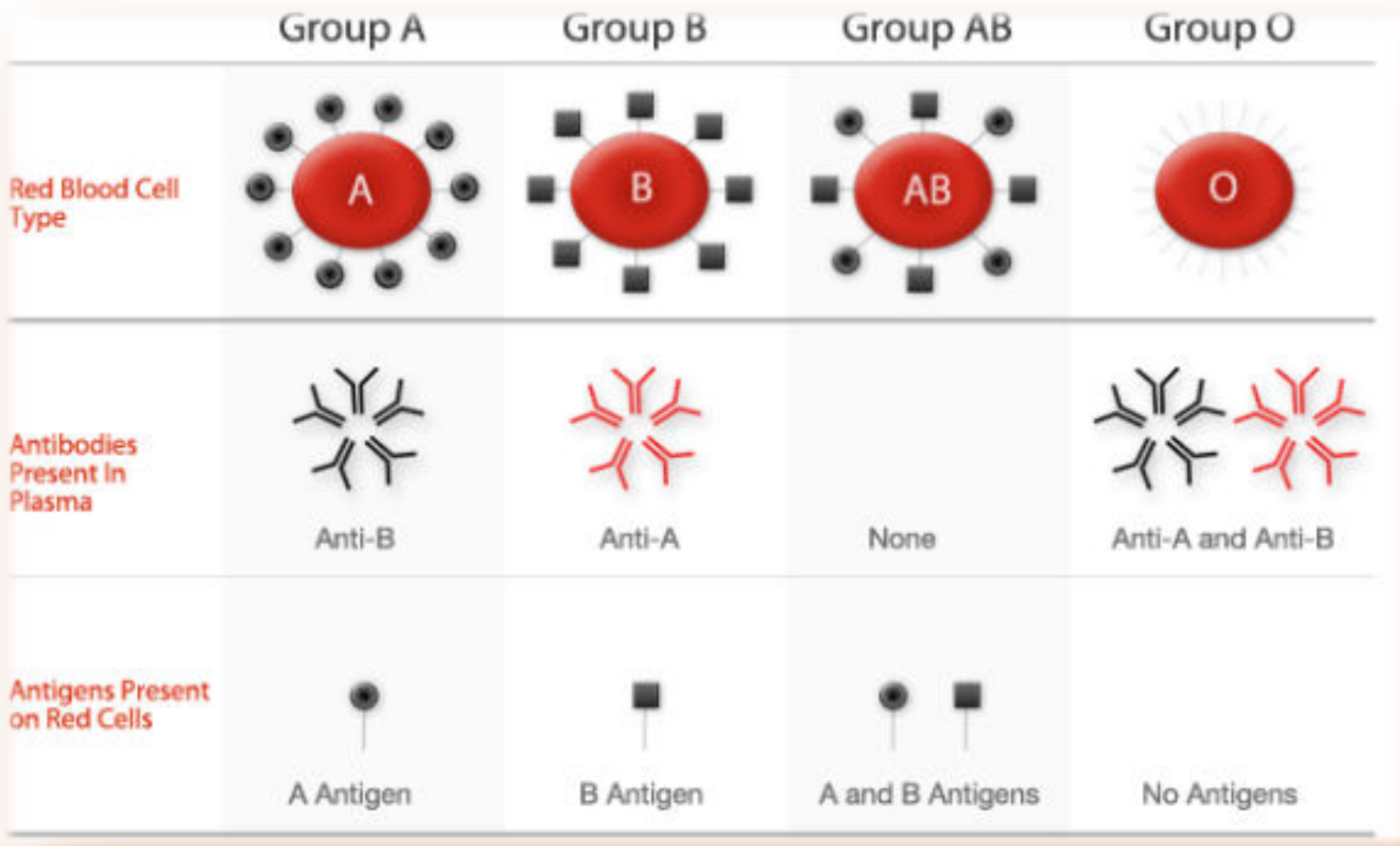
Blood Groups and Blood transfusion Physiology



Learning Objectives

- ABO and Rh systems and their clinical significance.
- Incompatibilities in Rh systems
- Blood transfusions - basis of blood typing, Cross matching
- Complications of Blood transfusions (transfusion reactions)

ABO blood group system

▫First ever blood transfusion was made dog to dog by British physician Richard Lower in 1665.

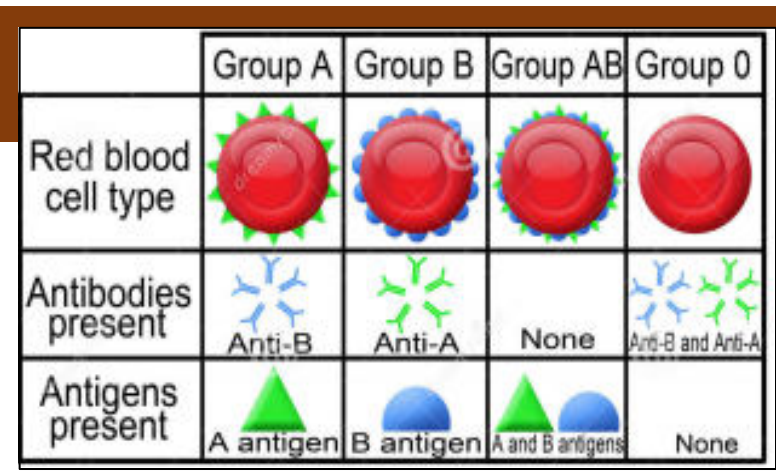
▫Austrian immunologist **Karl Landsteiner** discovered the **ABO blood group** System in 1901. In 1910 he won Nobel prize for medicine for this discovery.

In 1940- Karl Landsteiner and Alexander S Wiener reported another **Rh blood group.**

Importance of knowing about blood group system

1. Safe blood transfusion that may be life saving.
2. To prevent hemolytic disease of new born (Rh compatibility in newborn)
3. To solve the legal disputes related to parenting claimant.
4. To study the Mendelian laws of genetics.

ABO blood group system



The ABO blood group antigens are **complex** oligosaccharide chains that differ in their terminal sugar and project above the RBC surface.

following types of abs may develop-

type A: anti-B abs, type B: anti-A abs, type O : both & type AB: neither.

Landsteiner's Law

1. If a certain agglutinogen is present on the surface of RBCs, the corresponding agglutinin must be absent in the plasma.

2. If a certain agglutinogen is absent on the surface of RBCs, then corresponding agglutinin must be present in the plasma.

ABO blood group system- Relative frequency

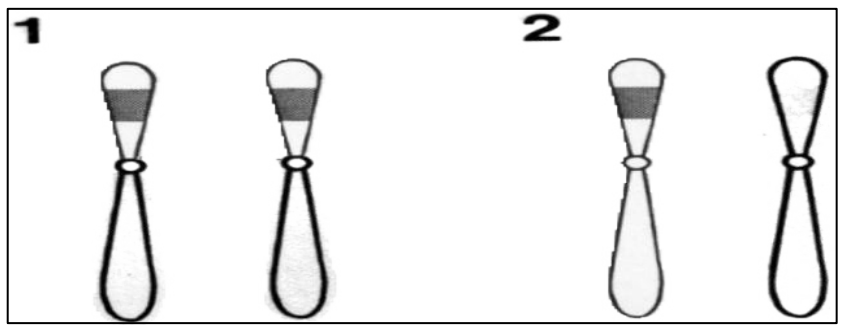
ABO blood types Relative frequency of different blood types:

- **O 47%** | A 41% | B 09% | AB 3% (World)

Inheritance of ABO blood group system

- The ABO locus has three main allele forms: A, B, & O.

The A and B genes found on **chromosome 9** and are inherited one gene (allele) from father and one from mother.



1.Homozygous A	2. Heterozygous A
Genotype A/A	Genotype A/0
Phenotype A	Phenotype A

Inheritance of ABO blood group system

Basic Precursor Substance

L-Fucosyl Transferase ↓ Presence of **H H / Hh gene**

H substance/Ag

A gene	B gene	None of A & B genes
N-acetyl-galactosaminyl Transferase	*D-galactosyl Transferase*	
A & H – Ag **Blood Group A**	**B & H – Ag** **Blood Group B**	**H – Ag** **Blood Group O**

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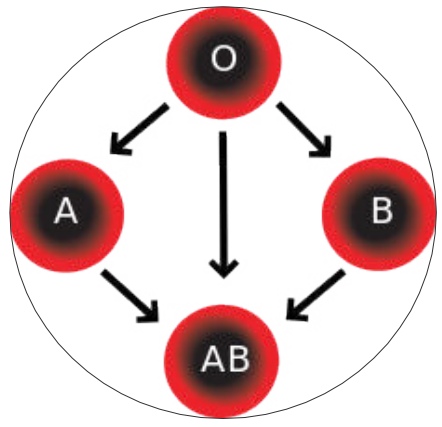
Universal Donor and Recipient / ABO blood group



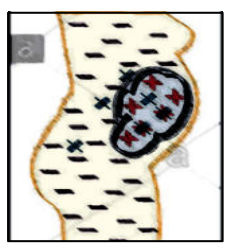
Universal Donor : **O^{-ve}** and
Universal Recipient **AB^{+ve}**

Rh blood group system

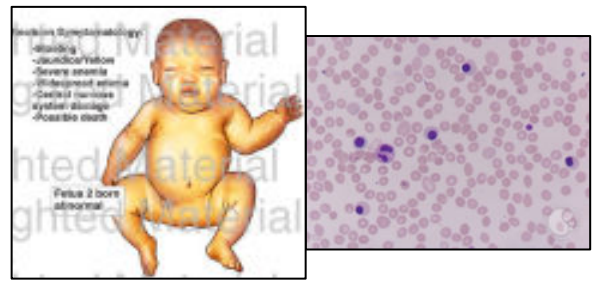
- The **Rh factor**, named for the **rhesus monkey** because it was first studied using the blood of this animal.
- 85% of whites are D-positive & 15% are D-negative; over **99% of Asians** are D-positive.
- Unlike the ABO antigens, the system has **not** been detected in tissues other than red cells.

Hemolytic disease of the newborn (Erythroblastosis Fetalis)

1. **Hydrops fetalis**-baby may die in utero.



2. **Erythroblastosis fetalis**

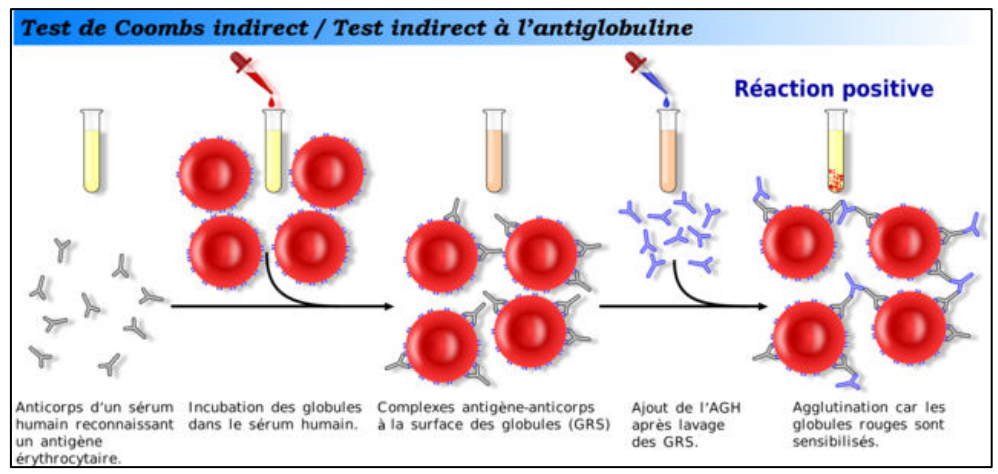


3. If mother has received **anti D abs** injection at time of Ist delivery, this causes neutralization of baby's Rh+ve RBCs, and immune system does not activate to produce abs.

Hemolytic disease of the newborn –Indirect Coomb's Test

Interpretation of the anti-human globulin test (Coombs test)

Direct	Indirect
antibodies (IgG or C3d) attached to erythrocytes.	antibodies (IgG or C3d) present in the patient's serum.



Self Assessment

Austrian immunologist Karl Landsteiner discovered the ..... System in 1901.
In 1940- Karl Landsteiner and Alexander S Wiener reported ……..

The ABO blood group antigens are attached to ……. chains that differ in their terminal sugar

If a certain agglutinogen is …… on the surface of RBCs, then corresponding agglutinin must be … in plasma.

The …… and its allele h are inherited independently of the allels A, B and O genes.

If mother has received anti D abs injection at time of Ist delivery, this causes neutralization of baby's ……. and immune system does not activate to produce abs.

Thank you