

### **Blood type:**

A blood type also called a (blood group) is a classification of **blood** based on the presence or absence of **inherited antigenic** substances on the surface of **red blood cells** (RBCs).each representing a particular blood group. These antigens may be **proteins** ,**carbohydrates** ,**glycoproteins** ,or **glycolipids** ,depending on the blood group system he most clinically important of these is the ABO blood group

**Antigen:** Any substance : recognized as foreign by the body which stimulates the immune system to mount a response against it.

### **Clinical importance of blood group systems:**

Derives from the development of antibodies against these antigens

- a. Autoantibodies (against self antigens)
- b. Alloantibodies (against foreign antigens)

**Antibody:** A protective protein produced by the immune response of an individual to stimulation by a foreign protein. It recognizes antigen on foreign red cells and may cause in vivo agglutination and subsequent haemolysis. These antibodies may cause several pathological processes:

- a. Destruction of native red cells (Autoimmune haemolytic anemia)
- b. Destruction of transfused red cells (Haemolytic transfusion reactions)
- c. Destruction of foetal red cells by maternal antibodies which traverse the placental barrier (Haemolytic disease of the Newborn)

### **Major blood group systems:**

**1. The ABO system:** ABO blood grouping is the most important blood-group system in human-blood transfusion. It is determined based on the presence or absence of particular sugar molecules attached to the common H antigen, found on the surface of RBCs. The addition of these sugars is coded by a gene. This gene bears 3 alleles:

- 1. O : inactive enzyme (no added sugar).

2. A : N-Acetyl galactosamine transferase enzyme.
3. B : Galactose transferase enzyme

Within the ABO system four major blood groups can be recognized:

4. Blood group A (A antigen on RBC + B antibody in plasma)
5. Blood group B (B antigen on RBC + A antibody in plasma)
6. Blood group AB (A and B antigens on rbc + **No** anti A or anti B antibodies in plasma)
7. Blood group O (**No** A nor B antigens on rbc + anti- A and B antibodies in plasma)

**Note:** ABO antibodies to antigens that are absent appear in first 3 months of life.

Blood Types:	Antigen(s) on RBC	Antibodies produced	Can donate blood to:	Can receive blood from:	Genotypes:
A	Antigen A	Anti B	A AB	A O	$I^A I^A$ $I^A i$
B	Antigen B	Anti A	B AB	B O	$I^B I^B$ $I^B i$
AB	Antigens A&B	NONE	AB	ALL	$I^A I^B$
O	Neither	Anti A&B	ALL	O	$ii$



**2.Rh (D) system:** The Rh system is the second most significant blood-group system in human-blood transfusion with currently 50 antigens. The most significant Rh antigen is the D antigen because it is the most likely to provoke an immune system response of the five main Rh antigens. About 85% of the general population is Rh positive (D positive) and the remaining 15% is Rh negative (D negative). The other important antigens: C; E; e; c. This system does not possess natural antibodies: So a « normal » person does not possess any anti Rhesus antibodies in his plasma. They appear by immunisation as a consequence of blood transfusions or by pregnancy. The Rhesus antibodies are immune antibodies, warm, of the IgG type, incomplete (non agglutinating in saline solution).

**Notes:**

1. A subject possessing the D antigen on the surface of his red blood cells is called Rhesus positive (D + or Rh +).

2. A subject who does not possess the D antigen is Rhesus negative (D - or Rh - or d).

**3. The Lewis system :** This system was focuses on a single locus with two antigens , Le a and Le b. These antigens do not form an integral part of the red cell membrane , but are soluble antigens which may be present in body fluids and secretions . They are adsorbed on to the surface of red cells if they are present in the plasma in sufficient amounts . There are only three phenotypes : Le (a-b-) ; Le (a+b-) ; and Le ( a-b+ ).

**\* Lewis antigens during pregnancy**

1. Lewis antigen strength may decline dramatically during pregnancy .
2. The transiently Le (a – b -) pregnant woman may produce Lewis antibodies during pregnancy
3. These antibodies disappear after delivery as the normal Lewis phenotype is restored .
4. Le antigens are absent or extremely weak at birth .

**\* Lewis antigens in infants**

- a. Antigens absent or extremely weak at birth
- b. Expression of Leb gradual

- Birth Le (a-b-)
- 2 months Le(a+b-)
- 12 to 18 months Le(a+b+)
- 2 to 3 years Le (a-b+)

**3. Others (Minor antigens)**

There are also a variety of other minor blood groups that can cause clinically significant transfusion reactions. Some examples of these blood antigens are: Kell, Duffy ( not usually tested routinely on donated blood).