



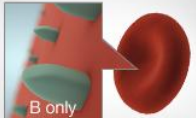





# Blood Types

Blood is a complex, living tissue that contains many cell types and proteins. A transporter, regulator, and defender, blood courses through the body carrying out many important functions. Distinct molecules called agglutinogens (a type of antigen) are attached to the surface of red blood cells. There are two different types of agglutinogens, type “A” and type “B”. Each type has different properties. The ABO blood type classification system uses the presence or absence of these molecules to categorize blood into four types: A, B, AB, and O. Another level of specificity is added to blood type by examining the presence or absence of the Rh protein. Each blood type is either positive “+” (has the Rh protein) or negative “-” (no Rh protein). For example, a person whose blood type is “A positive” (A +), has both type A and Rh proteins on the surface of their red blood cells.

The A and B antigen molecules on the surface of red blood cells are produced by two different enzymes. These two enzymes are encoded by different versions, or alleles, of the same gene: A and B. The A and B alleles code for enzymes that produce the type A and B antigens respectively. A third version of this gene, the O allele, codes for a protein that is not functional and does not produce surface molecules. Two copies of the gene are inherited, one from each parent. The possible combinations of alleles produce blood types in the following way:

Genotype	Phenotype (Blood Type)
I <sup>A</sup> I <sup>A</sup>	A
I <sup>A</sup> i	A
I <sup>B</sup> I <sup>B</sup>	B
I <sup>B</sup> i	B
I <sup>A</sup> I <sup>B</sup>	AB
ii	O

Blood is composed of red blood cells and plasma, which is the liquid the red blood cells are suspended in. The plasma is packed with proteins called antibodies. The body produces a wide variety of antibodies that will recognize and attack foreign molecules that may enter from the outside world. A person’s plasma does not contain any antibodies that will bind to molecules that are part of his or her own body, such as the red blood cells. In other words, people with type A blood cells will have antibodies for type B cells. So if a type B cell is introduced to the body, the antibodies would attach to it and kill it.

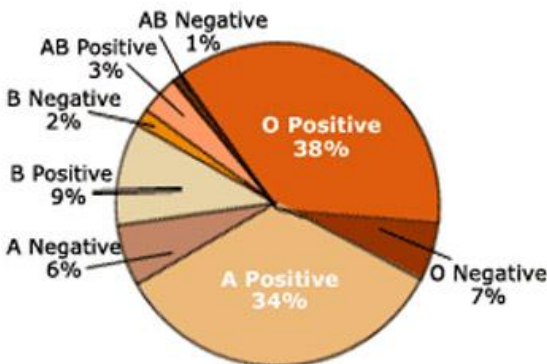
blood type	red blood cell surface molecules	plasma antibodies
type A		
type B		
type AB		
type O		

When conducting a blood transfusion, it is important to carefully match the donor and recipient blood types. If the donor blood cells have

surface molecules that are different from those of the recipient, antibodies in the recipient’s blood recognize the donor blood as foreign. This triggers an immune response resulting in blood clotting. If the donor blood cells have surface molecules that are the same as those of the recipient, the recipient’s body will not see them as foreign and will not mount an immune response.

There are two special blood types when it comes to blood transfusions. People with type O blood are universal donors because there are no molecules on the surface of the red blood cells that can trigger an immune response. People with type AB blood are universal recipients because they do not have any antibodies that will recognize type A or B surface molecules.

Blood Type Percentages



# Blood Type WKST

1. Every person has \_\_\_\_\_ alleles that determine his/her blood type.

2. Those alleles have come from \_\_\_\_\_ and \_\_\_\_\_.

3. The 3 different alleles for blood type, they are:

\_\_\_\_\_ which is dominant

\_\_\_\_\_ which is also dominant

\_\_\_\_\_ which is recessive

5. What type of blood results from the following letter combinations?

$I^B I^B$  \_\_\_\_\_

$I^A I^A$  \_\_\_\_\_

ii \_\_\_\_\_

$I^A I^B$  \_\_\_\_\_

$I^B i$  \_\_\_\_\_

$I^A i$  \_\_\_\_\_

6. You are blood type O and you marry a person with blood type AB. Complete a Punnett square for this cross.


7. Cross a parent with homozygous Type A blood with a parent with heterozygous Type B Blood in a punnett square and answer the questions below:

A. What are all the different letter combinations that might show up in their children?


B. What are all the different blood types that might show up in their children?

8. In the 1950's, a young woman sued film star/director Charlie Chaplin for parental support of her child. Charlie Chaplin's blood type was already on record as type AB. The mother of the child had type A and her son had type O blood. Complete a Punnett square for the possible cross of Charlie and the mother.


9. The judge ruled in favor of the mother and ordered Charlie Chaplin to pay child support costs of the child. Was the judge correct in his decision based on blood typing evidence? Explain why or why not.

Show your understanding of blood types by completing the table below.

Blood Group	Antigens on red blood cells	Antibodies in plasma	Can receive blood from	Can give blood to
A	A	Anti-B	A and O	A and AB
B	B			
AB	A and B			
O	None			

Which blood type would be considered a universal donor (someone who can give blood to anyone)? **And why?**

## Were the babies switched?

Two couples had babies in the same hospital at the same time. Michael and Danielle had twins, a boy, Michael, Jr., and a girl, Michelle. Denise and Earnest had a girl, Tonja. After being home for a few days, Danielle was convinced that she had the wrong girl. There must have been a mix-up at the hospital. After all, her kids were twins, and even though they were fraternal twins, you would think that they would look a lot more alike than they do—one is light-skinned and the other is dark-skinned. At Danielle's insistence, blood types were taken for her family and for Denise, Earnest and their daughter. In order to interpret the results of the blood type tests, you will need to understand the basic biology of blood types.

Here are the blood types of all the people involved:

Earnest	A	Tonja	O
Denise	B	Michelle	A
Michael	AB	Michael Jr.	B
Danielle	B		

1. Is it possible for Michael and Danielle to have a child who is type O?
2. How do you know this?
3. Was a switch made at the hospital? **Explain.**
4. Can fraternal twins be as different in appearance as Michelle and Michael, Jr., including one having light skin and the other having dark skin? **Explain.**