

A loss of more than 30% of the blood in the human circulatory system can lead to severe shock and death. Blood transfusions are given to help return the blood volume to normal levels. Blood transfusions can also be used to treat illnesses such as anemia and blood clotting disorders.

A transfusion of the wrong blood type can be fatal.

Blood differs chemically from person to person, and when two different (incompatible) blood types are mixed, **agglutination** (clumping together) of the red blood cells results. If the reaction is severe, the oxygen-carrying capabilities of the red blood cells are diminished. As well, the clumped (agglutinated) red blood cells can block capillaries in the brain, heart, and/or kidneys, leading to a stroke, heart attack, or kidney failure. All of these conditions can lead to disabilities or even the death of the individual.

### **ABO Blood Types**

The basis of the different blood types is a naturally occurring, inherited antigen located on the surface of the red blood cells. The best known of these inherited antigen systems is the ABO blood group. The ABO blood types are based on the presence or absence of two antigens: type A antigen or type B antigen. An individual who inherits the type A gene develops the A antigen on their red blood cells and will have blood type A blood. An individual who inherits the B gene develops the B antigen on their red blood cells and will have type B blood. An individual who inherits the A gene from one parent and the B gene from the other parent will have both A and B antigens develop on the red blood cells and will have type AB. Finally, an individual who inherits the gene for type O blood from both parents produces red blood cells that do not have either the A or the B antigen on their membrane.

The ABO system is unique because the red cell antigens that form are said to be “naturally occurring complementary antibodies.” “Naturally occurring” means that these antibodies form without the person being exposed to someone else’s blood. Normally, you would expect that a type A individual would develop antibodies for type B blood only if B cells were introduced into the body. In fact, type A individuals always have anti-B antibodies in their blood, even without prior exposure to type B blood. Similarly, type B individuals carry anti-A antibodies. Type AB blood has neither anti-A nor anti-B antibodies (if it did, it would destroy its own red blood cells), and type O individuals have both anti-A and anti-B antibodies.

According to the American Red Cross, “We don’t understand what stimulates the ABO antibodies to form. It may be pollen, bacteria or something else found in nature, but it is something that is ubiquitous since worldwide babies start forming the same ABO antibodies right after birth. The antibodies are usually at too low a concentration to pick up until the baby is about 3 to 6 months of age. It is these ABO antibodies that cause the most problems for transfusion and the reason we type all units for the ABO type.”

# Blood Type

## Blood Transfusions

If whole blood is transfused, the blood must be the same type as the recipient since both antigens and antibodies must be matched. If red cells are transfused where the plasma (and therefore antibodies) has been removed, the following types can be transfused:

Recipient ABO type	Recipient ABO Antibody	Compatible Red Cell ABO type
A	anti-B	type A or type O
B	anti-A	type B or type O
AB	no ABO antibody	type AB, type A, type B, type O
O	anti-A and anti-B	type O only

## What to Do

1. Complete the following chart about blood types and their related antigens and antibodies.

Blood Type	Antigen on surface of red blood cells	Antibodies found in plasma
A		
B		
AB		
O		

2. Complete the following chart about blood transfusions.

Blood Type	Possible Donors	Possible Recipients
A		
B		
AB		
O		

3. Use the information in the charts above to answer the following questions.

a) What blood type is considered to be the universal donor? Explain.

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b) What blood type is considered to be the universal recipient? Explain.

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