

Blood Groups (types) Inquiry Reading

Objective:

After reading and completing this work set, you should be able to:

- Identify the 4 different blood types
- Understand the reasoning behind the different blood types
- Identify the antigens and antibodies present in each blood type
- Know how to correctly identify a blood typing test

History

It was not until the year 1900, when Karl Landsteiner at the University of Vienna, discovered why some blood transfusions were successful while others could be deadly. Landsteiner discovered the ABO blood group system by mixing the red cells and serum of each of his staff. He demonstrated that the serum of some people agglutinated the red cells of other. From these early experiments, he identified three types, called A, B and C (C was later to be re-named O for the German “Ohne”, meaning “without”, or “Zero”, “null” in English). The fourth less frequent blood group AB, was discovered a year later. In 1930, Landsteiner received the Nobel Prize in physiology and medicine for his work.

The gene that determines human ABO blood type is located on chromosome 9 (9q34.1) and is called ABO glycosyltransferase. The ABO locus has three main allelic forms: A, B, and O, as mentioned above and each of them is responsible for the production of its glycoprotein. It is therefore the combination of alleles that are inherited from parents that determines which glycoproteins (antigens) are found on persons' blood cells and thereby their ABO blood type.

After discovery of the first human blood groups (ABO) by Karl Landsteiner in 1901, gradually from 1927, other blood groups were also discovered and reported. It is important to mention that Landsteiner together with his American colleague Alexander Wiener discovered the Rh blood group and reported it in 1940, 1941.

Blood groups

When Landsteiner mixed various vials of blood, he noticed that some combinations of blood did not “bond” well with each other. The vials would show a thick precipitate or clumping/agglutination that formed when the vials were mixed. He realized that the agglutination was due to an immune response, which is the body's own natural defense mechanism, the antibodies, bonded with the **foreign** chemicals called *antigens*. After a series of testing of various blood types, he discovered the four basic blood types, A, B, AB, and O.

What the four different blood types refer to is the presence of the antigens that are present on the red blood cell. If a blood type is believed to be an A-type blood, the red blood cell is said to have the “A-Antigen”, while a B type blood would have the “B-antigen”. The AB-type blood *does not* have an AB- antigen, but rather, have *both* the A-antigen, and the B-antigen. The O-type blood would mean that the red blood cells *do not* have any antigens at all.

So what is causing the clumping?

In addition to the antigens that are found on the red blood cells, each blood type also contain different types of antibodies present in its plasma. These antibodies are *not* found on the surface of the red blood cells, but are found in the plasma to protect the organism. It only makes sense that the antibodies found in each blood type would not react with its own antigen. For example, Type A blood would have the A-antigen, but Anti-B antibodies. The anti-B antibodies will only bond to any “B-antigen” that is in the blood stream. While the B-

type blood would have anti-A antibodies that would only agglutinate with any A-antigens found in the blood stream.

What about blood types AB and O?

Since Type AB blood would have both the A-antigen and B-antigen, it cannot have any antibodies present in its plasma. It is also the reason why type AB blood is the universal recipient of blood because of that fact! It doesn't have any antibodies present, so it can actually just take in any blood.

As for the type-O blood, it does not have any antigens present in its red blood cells, but it does have both antibodies present in its plasma. That is also the reason why type-O blood cannot receive any blood from any other blood types except its own kind of blood.

Questions:

1. Who is Karl Landsteiner? What and how did he discover?
2. What are antigens and what are antibodies?
3. What are some words that you have not heard of before in this short article?
4. Complete the following table:

Blood types:				
	A	B	AB	O
Antigens Present				
Antibodies present				

Testing for blood groups

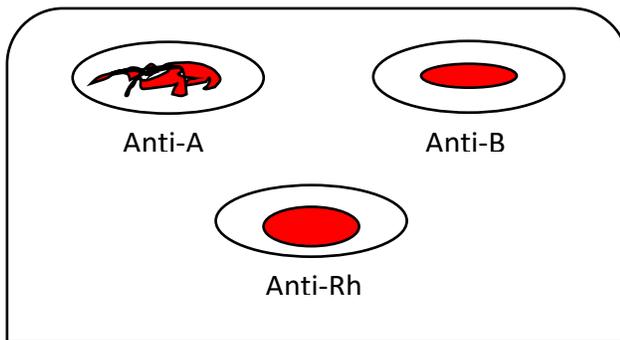
When you go to the blood clinic, they will test your blood by dropping a droplet of blood into 3 different wells and look for agglutination.

Found inside each of these wells are the antibodies that are present such as anti-A and anti-B antibody.

What is the 3rd well used for?

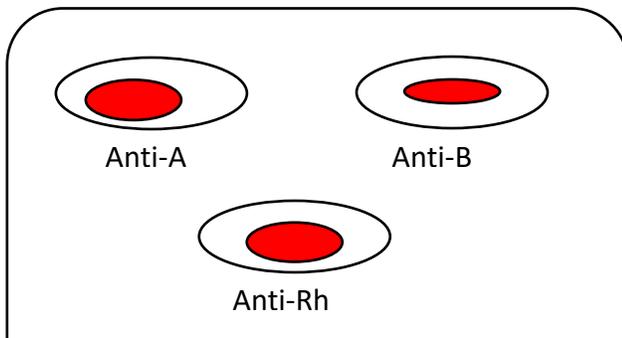
The 3rd well is used for the Rh factor or the factor that makes your blood + or -, which we will talk about later.

If your blood droplet shows agglutination (a precipitate cloudy reaction) in the anti-A well, that means that there has been a reaction between the anti-A antibody and the A-antigen. This indicates that your blood type is Type-A.



Agglutination in the Anti-A well, that means the blood type is Type A

What about the following?



There is no agglutination in any wells. What blood type would this be?

Type O
blood

Rh Factor

In addition to the A and B antigens found on the red blood cells, the Rh protein factor is also found. The Rh (Rhesus) is inherited from both parents and are independent from the A and B blood types. In other words, you will not have a ARh antigen, but rather an A-antigen, and a Rh-antigen. If there is a present of the Rh factor, then your blood is known as + blood, while a - blood means the absence of the Rh factor.

What about the antibodies?

Yes, having a Rh positive (+) blood would mean that your red blood cells would have the Rh factor on the red blood cells meaning that there won't be any Rh antibodies found in the plasma. However, if you are Rh negative (-) then you will have anti-Rh antibodies found in the plasma.

Putting it all together

To summarize, there are 4 main blood groups that are found in our blood, A, B, AB and O. The reason behind the different blood types is due to the antigen (protein) factor that are found on the surface of the red blood cells. In addition to each of these 4 blood types, each of the 4 blood cells can also contain the Rh factor which could make them Rh positive + or Rh negative (-). Therefore, there are 8 total blood types in general with their respective antibodies found in the plasma.

Blood types:								
	A-	A+	B-	B+	AB-	AB+	O-	O+
Antigens Present								
Antibodies present								

Complete the following questions:

1. What causes clumping to occur in blood transfusion?
2. What antibody(ies) is found on blood type O?
3. What is your blood type if there is clumping in the anti-A, and anti-B serum?
4. What is your blood type if there is no clumping in both your anti-A and anti-B serum?
5. How can you cause someone's blood to clump if you knew his blood type.
6. There is clumping in anti-A but not anti-B serum, what blood type do you have?
7. What antibodies are found on type AB blood?

Self-assessment: How well do you understand the science behind the blood types? How do you know?