Lab: Blood Types

Today you will learn why it is so important to properly identify the various blood types before a blood transfusion takes place. In this lab you will determine individual blood type and Rh factor. We will also determine whether the class blood type data represents a cross section of the human population.

| Glossary: |
| agglutination – the clumping of red blood cells as a result of antibody/antigen interaction. |
| antibody – a protein that attacks or neutralizes foreign antigens or invading microorganisms; produced by white blood cells or leukocytes. |
| antigen – any molecule that stimulates an organism to produce antibodies. |
| blood type – the characterization of blood based upon the presence or absence of specific antigens located on a red blood cell; genetically determined. |
| donor – one who gives blood. |
| plasma – the straw-colored, fluid portion of the blood which transports red blood cells, white blood cells, dissolved nutrients, wastes and proteins such as antibodies. |
| recipient – one who receives blood. |
| red blood cell – specialized cells that transport respiratory gases; also called erythrocytes or red corpuscles. |
| universal donor – blood type O; may be donated to any other blood type in the ABO-system because of the absence of antigen A and/or antigen B on the surface of the erythrocyte (Latin for "red cell"). |
| universal recipient – blood type AB; may receive blood types A, B, AB and O because type AB lacks antibodies in the plasma against types in the ABO-system. |

**Background:**

Two factors that must be considered before a blood transfusion can take place are the blood types of both the donor and the recipient. Blood type is determined by the presence of specific carbohydrates (sugars) that are bound to fatty acid (lipid) molecules at the surface of the red blood cell membrane. These carbohydrates are called antigens. Blood group antibodies are proteins, produced in conjunction with blood group antigens, with the ability to bind to specific foreign antigens. Unlike antigens which are attached to the surface of the red blood cell (RBC), antibodies are found in the plasma. Most transfusions include only the donor's blood cells and not the plasma. Therefore, two important considerations in a transfusion are the antigens present on the donor's blood cells and the antibodies present in the recipient's plasma.

One example of an antigen/antibody blood typing system is the ABO system. The primary blood types in this system are A, B, AB and O. Type A has A antigen on the surface of the blood cell and anti-B antibodies in the plasma. Type B has B antigen on the surface of the blood cell and anti-A antibodies in the plasma. Type AB has both antigen A and antigen B on the surface of the blood cell and contains neither anti-A nor anti-B in the plasma. Type O has neither antigen A nor antigen B on the RBC but contains both anti-A and anti-B antibodies in the plasma.

Because type O blood has no antigens on the surface of the red blood cell, any blood type may receive type O blood, as the antibodies in the recipient's body will not detect a foreign antigen. Type O is known as the Universal Donor. Similarly, because type AB persons have neither anti-A nor anti-B antibodies and therefore may receive blood from persons with type A, B, AB or O, type AB has come to be known as the Universal Recipient.

Other characteristics of the donor and recipient's blood must also be considered for a transfusion to be successful. One of these, which may be readily determined using the antigen/antibody system is another type of antigen, the Rh factor. Unlike anti-A and/or anti-B antibodies which are present from birth in persons with blood types O, B or A respectively (remember: there are no antibodies present in the plasma of persons type AB), antibodies to the Rh factors are not produced until the individual is exposed to Rh factors. Rh factors are a group of antigens also found on the surface of red blood cells. These antigens derive their name from their initial discovery in rhesus monkeys. Approximately 85% of the human population has Rh antigens on their red blood cells and are said to be Rh+. Antibodies to the Rh factor are not present in persons who are Rh- until these persons are exposed, either through transfusion or the birth of an Rh+ child. If an Rh- woman is exposed to the Rh+ antigen of her child, she will subsequently produce Rh antibodies which may endanger the lives of any future Rh+ children. During a second pregnancy with an Rh+ child, antibodies induced by exposure during the first pregnancy will cross the placenta and destroy the red blood cells of the fetus. This produces a condition known as hemolytic disease of the newborn (HON) or erythroblastosis fetalis. Symptoms of the disease are anemia, jaundice, cerebral damage, mental retardation and death.
Procedure:
CAUTION: In this lab, you will be drawing and analyzing actual blood samples. It is very important that you follow all instructions. Everyone must handle their own blood and throw all used materials in the proper disposal areas. Take extra care to ensure that all sterile materials remain uncontaminated until use, and that you do not come in contact with any blood sample other than your own.

1. Take a slide out of the box and clean it with soap and water. Dry it off.
2. Using the pen provided write an A, B, and Rh on the slide.
3. Using a sterile wipe, wash one finger on your non writing hand.
4. Shake the finger down.
5. See the teacher to prick the sterilized area on your finger.
6. Apply one drop of blood to all three areas on the slide.
7. After you have one drop of blood in all three areas, wipe off your finger with the sterile wipe and discard it.
8. See teacher to add one drop of Anti-A, Anti-B, and Anti-Rh serum to the three areas on your slide.
9. Stir each drop with separate ends of clean toothpicks.
10. Examine the slide to see if clumping occurs. Clumping in any of the three samples indicate a positive test result (+).
11. Place the slide in the bucket with bleach solution.
12. Dispose of all other materials in the trash.
13. Record your results in the table and complete the questions.

DATA:
1. Draw yours or someone's blood typing results like below:

   -Which type of blood is it? How do you know?
2. Find someone who tested positive for type A, type B, type AB, and type O and draw their results.

SUMMARY QUESTIONS:
2. Distinguish between an antigen and an antibody.
3. What is agglutination?
4. Explain what happens during the blood typing of a person with type A.
5. Before any blood transfusion is given, the technician always does a "cross match." Describe what that means.
6. After checking the "cross match," which blood types can be given safely to persons with blood type B? Why?
7. After checking the "cross match," which blood types can be given safely to persons with blood type AB? Why?
8. A person with type O blood is often called a "universal donor:" Explain why.
9. A person with type AB blood is often called a "universal receiver, or recipient." Explain why.
10. What is the Rh factor?

C-E-R
Using your background knowledge about blood types and your evidence from this lab, write a CER to the following scenario:
You are a paramedic at the scene of a terrible accident. The doctor at the hospital you are in contact with orders a blood transfusion immediately due to the severity of the injuries of the patient. Unknown to you, the blood used for the transfusion was improperly labeled Type A- (the blood type of the victim) but was actually Type O-.
Is the accident victim going to die from receiving the wrong blood? How do you know?