**Name:_____** **Blood typing lab**

**Prelab assignment:**

1. Define the following terms:
   a. antigen:

   b. antibody:

   c. Kastle-Meyer color test:

   d. precipitin test:

2. What does luminol do and why is it advantageous as a test for blood?

3. What are the chances of a suspect matching a blood sample of type B, N, PMG 2-1, AK 2-1, and ADA-2, given the following data:

| Alelle | Percent abundance | Alelle | Percent abundance |
|---|---|---|---|
| Type A | 42 | PGM-1 | 58 |
| Type B | 12 | PGM-2 | 6 |
| Type O | 43 | PMG 2-1 | 36 |
| Type AB | 3 | | |
| | | AK1 | 93 |
| MN | 48 | AK 2-1 | 7 |
| M | 30 | | |
| N | 22 | ADA1 | 89.9 |
| | | ADA 2-1 | 9.9 |
| | | ADA 2 | 0.2 |

4. Below is a table with the results of a blood typing test. Identify the blood types based on the reaction with the antisera.

| Sample | Result with anti-A | Result with anti-B | Blood Type |
|---|---|---|---|
| 1 | agglutination | no reaction | |
| 2 | no reaction | no reaction | |
| 3 | no reaction | agglutination | |
| 4 | agglutination | agglutination | |

Introduction

A blood transfusion with blood of a mismatched blood type usually has serious consequences for the recipient of the blood. Today, complete blood analysis is done with sophisticated, costly equipment before transfusions are done. The basic principles of blood typing will be illustrated in this activity using simulated ABO blood typing sera and simulated bloods.

Early attempts to transfer blood from one person to another produced varied results. Sometimes it seemed to help the recipient and other times it produced very serious consequences. Eventually, it was discovered that each individual has a unique combination of substances in his or her blood. Some of these substances may be compatible with another person's blood and some may not be compatible. These findings led to the discovery and development of procedures to type an individual's' blood. It is now known that safe transfusions of blood depend upon properly matching the blood types to the donors and the recipients.

ABO blood type is determined by the presence or absence of specific proteins on an individual's red blood cells. A basic genetic principle is that an individual's inherited genes determines which proteins are produced in the individual's body. In the ABO blood typing system (just one of many blood factors) the blood proteins (antigens) are called the A dn B proteins. The presence or absence of the A and B proteins on the red blood cells determines the individual's blood type in the ABO typing system. Individuals whose red blood cells contain protein A and Lack protein B have type A blood. Those with protein B and lack protein A are called Type B. Individuals with both protein A dn protein B are called type AB and individuals with neither of the proteins is called type O.

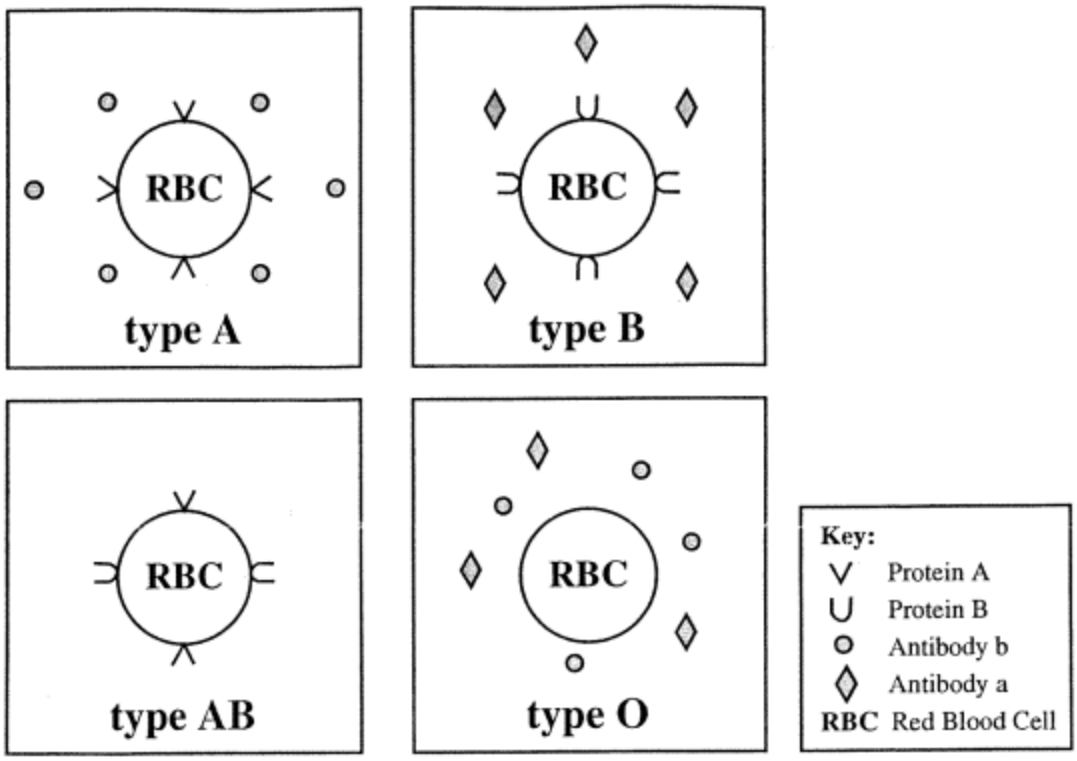
ABO blood type is a genetic example of multiple alleles. There are three alleles in the gene pool for ABO blood type, i.e $I^A$, $I^B$ and i. $I^A$ codes for protein A, $I^B$ codes for protein B and i codes for neither A nor B. within this multiple allele pool the gene interactions illustrate both simple dominance as well as codominance. When $I^Ai$ allel combination occurs, the individual is blood type A. When $I^AI^B$ combinations occur, the alleles are codominant and the individuals are type AB. The chart below illustrates the allele combinations, resulting blood type, proteins on the red blood cells, and antibodies in the blood.

| **Phenotype** | **Genotype** | **Protein on RBC** | **Antibodies in plasma** |
|---|---|---|---|
| Type A | $I^AI^A$ or $I^Ai$ | A | B |
| Type B | $I^BI^B$ or $I^Bi$ | B | A |
| Type AB | $I^A I^B$ | A and B | --- |
| Type O | ii | --- | A and B |

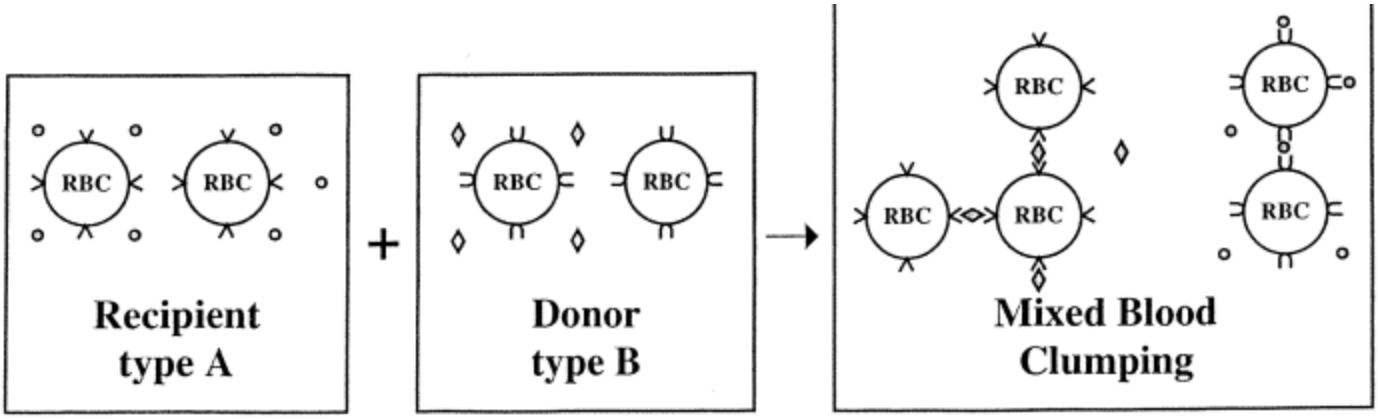
Blood transfusions

Blood groups are critically important with respect to transfusions. If someone with type A is given a transfusion of type B blood the two bloods will interact, clump and clog arteries which will have serious consequences to the individual. The climping reaction is caused by the interaction of the proteins on the red blood cells and the antibodies present in the blood plasma antibodies are produced by the body in reaction to foreign proteins and are important in protecting the body against diseases. Antibodies cannot distinguish a disease protein from protein on red blood cells. Individuals do not produce antibodies for proteins of their own red blood cells, but do

produce antibodies for foreign proteins. Thus, a person with type A blood does not produce A antibodies but will produce Antibodies for B protein. If a person with blood type A is given B type blood for a transfusion, their antibodies will attack the type B blood and cause them to clump. The illustrations below, in a very oversimplified way, illustrate the makeup of each of hte four blood types.




Using the same illustration scheme, a transfusion of type B blood into an individual with type A blood might be illustrated as follows:




Because type AB blood lacks both a and b antibodies, it would appear that an AB person could receive a transfusion of blood from an other type. For this reason, type AB persons are sometimes called universal recipients. It should be noted however, that type A, type B and type O still contain antibodies that could cause clumping of type AB cells. Consequently, even for AB individuals, it is always best to use donor blood of the exact same type as the recipient blood. If the matching type is not available and type A,B, or O is used, it should be transfused very slowly so that the donor blood is well diluted by the recipients larger blood volume.

Similarly, because type O blood lacks antigens A and B, it would seem that this blood type could be transfused into persons with any other type of blood. For this reason persons with type O blood are often referred to as

universal donors. Type O blood, however, does contain both anti-a and anti-b antibodies, and this, if it is transfused into a person of a different blood type it should be down slowly to minimize clumping reaction.

Bottom line for transfusions is that blood types should be matched for transfusions.

Blood typing

ABO blood typing is based upon the clumping phenomenon of bloods of mixed types. Blood sera antibodies can be isolated from other components of the blood and then used as blood typing sera. Anti-A sera (from a person with type B blood) will cause clumping in the presence of the A protein. Anti-B sera will cause clumping in the presence of type B protein. Clumping will occur in both serum with type AB blood and no clumping will occur in type O blood.

There are many other blood typing systems in addition to the ABO classification system. One commonly used system is the Rh factor. The Rh blood group has several antigen factors on the surface of the red blood cells. If any of the antigens are present on the RBC surface, clumping can occur and the individual is said to be Rh positive ($Rh^{+}$). Conversely if the red cells lack Rh antigens, the blood is said to be Rh negative ($Rh^{-}$)

If an Rh-negative person receives a transfusion of Rh-positive blood, the recipients antibody producing cells are simulated by the presence of the foreign Rh antigen and will begin producing anti-Rh antibodies. Generally, no serious consequences result from this initial transfusion. But if the Rh-negative person who is now sensitized to Rh-positive blood (has antibodies) received another transfusion of Rh-positive blood at a later time, the donor's red cells are likely to clump.

Procedure

1. Get three microscope slides and place them on a piece of white paper. Label the paper W, X, and Y so you know which slides are for each sample
2. Place 2 drops together of Person W blood on each end of the slide marked W. You should have two different spots with blood on that slide. Do the same for slides X and Y.
3. Add 2 drops of Anti-A sera to the blood on the left side of each slide. Do the same thing with Anti-B sera on the right side of each slide
4. Stir the mixture in all six locations, using a different clean toothpick for each location in order to avoid cross contamination.
5. Observe each spot against the white background and record the results in the Observations data table
6. Study the results and answer the questions in the lab.
7. Dispose of all of the materials as described by your instructor and clean up.

Observations

| Blood sample | clumps for anti-a | clumps for anti-b | Type |
|---|---|---|---|
| W | | | |
| X | | | |
| Y | | | |

**Post Lab Questions**

1. What antigens are present on person X's blood?

2. What antibodies are present in person Y's blood?

3. Could a man with type AB blood be the father of a child with type O blood? Explain

4. Could a child with type B blood with a mother of Type A have a father with type A blood?

5. Conclude: which if any, blood samples tested can the patient with B+ receive. explain

6. Analyze: explain how you were able to use your knowledge of how different types of blood react with anti-a and anti-b antibodies in order to determine the blood types of the samples

7. Infer: if a person has type A blood, he or she would have antibodies for what blood type?

8. Infer: why is type-o negative blood known as the universal donor?

9. apply: if a person has type O blood, what types of blood would she not be able to receive?

10. evaluate: is knowing the ABO blood type of a potential blood donor enough to determine a suitable match? explain your answer

11. identify effect: what might happen if someone with type A received a transfusion of type b blood?