Blood Typing

Prelab:

1. What are the four different kinds of human blood?

2. The blood type is determined by antigens (A or B) that are present or absent on the surface of red blood cells. Humans normally produce antibodies against those antigens that are NOT on their red blood cells. REMEMBER that blood type is based on antigens, not the antibodies, that a person possesses.

   a. If someone has A antigens, what blood type are they? _____ What antibody will they have? _____
   b. If someone has B antigens, what blood type are they? _____ What antibody will they have? _____
   c. If someone has neither A nor B antigens, what blood type are they? _____ What antibody will they have? _____
   d. If someone has both A and B antigens, what blood type are they? _____ What antibody will they have? _____

There's actually another group of antigens on the surface of red blood cells that makes a person a Rh- ›or Rh+ blood type

Blood Type	Antigens (Agglutinogens)	Antibodies in Plasma (Agglutinins)	Can Give Blood To	Can Receive Blood From
A	A	Antibody B	A, AB	O, A
B	B	Antibody A	B, AB	O, B
AB	A and B	Neither Anti-A or Anti-B	AB	O, A, B, AB
O	Neither A nor B	Both Anti-A and Anti-B	O, A, B, AB	O

We are going to use a simple test to determine blood type, performed with a serum that will be added to separate samples of blood.

3. If agglutination (CLUMPING) occurs only in the drops to which the anti-A serum was added, what blood typeis it? _____
4. If agglutination (CLUMPING) occurs only in the drops to which the anti-B serum was added, what blood type is it? _____
5. If agglutination (CLUMPING) in both samples, what blood type is it? _____
6. The absence of agglutination (CLUMPING) indicates that the blood type is _____

Reaction to Antibody A Serum	Reaction to Antibody B Serum	Blood Type
Agglutination	No agglutination	A
No agglutination	Agglutination	B
Agglutination	Agglutination	AB
No agglutination	No gglutination	O

7. In the table below, fill in the appropriate genotypes for each blood type. Then complete the following Punnett square problems.

Phenotype	Genotype(s)
A	
B	
AB	
O	

8. **A man** who has the type B blood (genotype BB) is married to a woman with type O blood. What blood type will their children have?

9. A woman with type A blood is claiming that a man with type AB blood is the father of her chile, who is also type AB. Could this man be the father? Show the possible crosses.

10. A man with type AB clood is married to a woman with type O blood. They have two natural children, and one adopted child the children's blood types are A, B, and O. Which child was adopted?

Scenario

Crime investigators were called to the scene of a robbery. Mr. Smith had come home, only to find someone robbing his apartment. As the criminal rushed to leave the apartment, he ran into a glass door, cutting his arm and tearing his shirt. The crime investigators were able to remove small drops of blood from glass bits. The blood samples from the crime scene, along with the victim's blood, were sent to the forensic lab to be analyzed. The crime investigators reviewed the available evidence and apprehended 3 suspects. The last remaining piece of evidence needed to solve the crime is to match the blood type found at the scene of the crime to one of the suspects. You, along with your classmates, have been chosen to provide this last piece of evidence and determine which of the suspects is the burglar.

Materials

- 5 Blood typing trays
- Toothpicks
- Paper towel to clean the toothpicks between stirs
- Vials of: Victim's blood
  - O Crime scene blood
  - o Suspect 1's blood
  - o Suspect 2's blood
  - o Suspect 3's blood
  - o Anti-A serum
  - o Anti-B serum
  - o Anti-Rh serum

Procedure

1. Label the 5 blood typing trays by placing each tray on a piece of paper that each reads as one of the following: Crime scene, Victim, Suspect #1, Suspect #2, and Suspect #3.
2. To determine the type of blood found at the crime scene, put 3 drops of the blood found at the crime scene in each of the A, B, and Rh wells of the blood typing tray labeled "Crime Scene."
3. Place 3 drops of the simulated anti-A serum on the blood in the A well of the tray.
4. Place 3 drops of the simulated anti-B serum on the blood in the B well of the tray.
5. Place 3 drops of the simulated anti-Rh serum on the blood in the Rh tray.
6. With a toothpick, stir each sample of the anti-serum and blood. MAKE SURE THAT YOU CLEAN OFF THE TOOTHPICK BETWEEN STIRRING THE SAMPLES so that contamination doesn't occur and so you don't send the wrong suspect to jail!
7. Observe the slide and record your observations in Table 2 of the Analysis section. To confirm agglutination (CLUMPING), try reading text through a mixed sample. If you cannot read the text, assume you have a positive agglutination reaction.

8. For the Anti-Rh Serum, agglutination (CLUMPING) signifies Rh+, no agglutination (CLUMPING) means Rh-.

Once you have determined the type of blood found at the scene of the crime, you will the type the blood of the victim and the three suspects.

1. Place 3 drops of the victim's blood in each of the A B, Rh wells of the victim, and repeat for suspect #1, #2, and #3.
2. Place 3 drops of the simulated anti-A serum in each of the A wells on the four trays.
3. Place 3 drops of the simulated anti-B serum in each of the B wells on the four trays.
4. Place 3 drops of the simulated Rh serum in each of the Rh wells on the four trays.
5. Stir each sample with a clean toothpick (Remember, you clean it between stirs!)
6. Observe the slide and record your observations in the table below. To confirm agglutination, try reading text through the mixed sample. If you cannot read the text, assume you have a positive agglutination reaction.

Blood Source	Anti-A Serum	Anti-B Serum	Anti-Rh Serum	Blood Type
Crime Scene				
Victim				
Suspect 1				
Suspect 2				
Suspect 3				

Post Lab Questions

1. As a forensics technician, the courts have asked you to summarize your findings to the jury. Explain what you would say in the space below. (Remember it is your job to report the facts, not decide who is guilty.)

2. Why is it necessary to type the victims blood?

3. Look at Suspect #3, using the information in the first table and your blood type analysis
   a. What ABO antigens are present on the suspect's red blood cells. _____
   b. What ABO antibodies are found in the suspect's blood plasma? _____
   c. What is the suspect's blood type? _____
   d. If the suspect needed a blood transfusion, what types could he/she receive? _____
   e. What blood types could safely receive this suspect's blood? _____

4. You are a defense attorney representing the accuse. Your client has been shown to have the same blood type as that found at the scene of the crime. Explain to the jury why this information alone is not enough to convict your client.

5. As the client's attorney, your have also been provided with the police videotape of the crime scene analysis. In the video, you notice that one of the investigating officers has a bandage on his hand. How could you use this evidence to your advantage?

Teacher Notes

You will need:

- 1/2 cup water
- 1 tablespoon cocoa powder
- 3 or 4 tablespoon corn syrup
- 1/2 to 1 teaspoon red food coloring
- 2 drops yellow or green food coloring (optional)
- container for mixing
- mixing implement (spoon, stick etc)
- tissues

Method:

- Mix the cocoa powder thoroughly into the water before adding the other ingredients - it may help to use warm water.
- After adding the rest, blend the concoction well, and then wait for it to settle a bit.
- Either skim the bubbles & chocolate scum off the top with the edge of a tissue, or pour the mixture into another container. The longer it sits, the more the cocoa tends to settle to the bottom, which oddly mimics the effect of real blood separating.
- If you splatter this mixture onto cloth, it makes neat two-part marks that dry into pretty convincing bloodstains.
- If you let it run from a victim's mouth and then let it dry, the blood darkens and cakes to the skin in much the same way real blood does.

For blood typing experiments

Recipe No.1

Blood group A = 0.5M sodium chloride (2.9 g/100mL water) + red food dye
Blood group B = 0.M barium nitrate 92.6g/100mL water) + red food dye
Blood group AB = mix equal amounts of the above 2 reagents + red food dye
Blood group O = water + red food dye
Antisera A = 0.1M silver nitrate (1.7g/00mL water) Antisera B = 5% sodium silicate (5.0g/100mL water)
Use only enough food dye to obtain desired colour.
Keep all samples in sealed airtight containers after preparation and before use.
A "+" test results if solids form when "antisera" is mixed with "blood"
A "-" test results when no solids are formed by the mixture.

Recipe No.2

Blood Group A = HCl
Blood Group B = H2S04
Blood Group AB = HCl + H2S04 Blood Group O = water
All solutions are coloured with red food dye.

Antisera

A = AgNO3 solution B = BaCl2 solution
Concentrations of solutions are not critical (all <1M)