

LAB-THE MYSTERY OF THE BLOODY STAIN

BACKGROUND

Blood and blood stains left behind in a crime scene are important evidence and provide crucial information in a criminal investigation. Blood evidence is usually used to exclude someone as a suspect, narrowing the list of possible suspects. Forensic scientists look at specific proteins (**A, B and Rh**) on the red blood cells and determine the type of an unknown blood sample based upon their presence. Blood is a tissue comprised of four components: red blood cells, white blood cells, platelets and the liquid portion of the blood called plasma.



DETERMINING THE ABO-RH BLOOD TYPE OF SIMULATED BLOOD SAMPLES

There are surface proteins on the red blood cells that determine an individual's blood type. These surface proteins are called antigens.

Since the **antigens** present on the **surface of a red blood cell** determine the blood type, an individual with A antigens has A blood type. One with B antigens has B blood type, and one with both A and B, has AB blood type. A person with no antigens has O blood type.

Plasma has circulating proteins called **Antibodies**. For example, if a person has A antigens, they have B antibodies; those with B antigens have A antibodies, and those with A and B antigens have no antibodies. People with no antigens have both A and B antibodies

Data Table 1: ABO Blood types Summary

Blood Type	Antigen on Red Blood Cell	Antibodies in Plasma	Can Receive Blood From	Can Donate Blood to
A	A	B	O,A	A,AB
B	B	A	O,B	B,AB
AB	AB	none	O,AB,A,B	AB
O	none	A and B	O	O,A,B,AB

Data Table 2: Agglutination Reactions in ABO System

ABO Agglutination Reaction		
Anti-A Serum	Anti-B Serum	Blood Type
Agglutination (clumping)	No Agglutination (clumping)	A
No Agglutination (clumping)	Agglutination (clumping)	B
Agglutination (clumping)	Agglutination (clumping)	AB
No Agglutination (clumping)	No Agglutination (clumping)	O

Another Important antigen on the surface on the red blood cell is the **Rh protein**, named for the **Rhesus monkey** in which it was first studied. People who have this protein are Rh- positive and those who lack it are Rh-negative.

Data Table 3: Rh Agglutination Reactions

Rh Agglutination Reaction	Rh Factor
Agglutination	+
No Agglutination	-

CRIME SCENE SCENARIO

Last night someone broke into a jewelry store. A team of crime scene investigators were called to the scene of the burglary. Upon arrival the CSI^s noticed that several glass display cases were smashed, scattering glass throughout the store. A closer examination of the glass fragments revealed small pieces of what appeared to be blood stain clothing were left behind. The clothing pieces were carefully collected and sent to the forensics lab for analysis. Based on the evidence, the CSI^s apprehended three suspects. Since select red colored stains may look like blood, forensic scientists must first determine if the red stain is actually blood. A test is performed to determine the presence of blood components such as hemoglobin was done on the blood. *Due to the positive results and the presence of white blood cells, it was determined to be human blood.* The blood will now need to be blood typed. Your jobs as a forensic scientist is to provide crime investigators with additional proof in order to determine which of the suspects may have committed the burglary. You will type the blood samples found at the crime scene to match the samples drawn from the three suspects.



ACTIVITY ONE: ABO AND RH BLOOD TYPING

Once it is verified that a stain is indeed blood, a sample is carefully collected and taken to a forensics lab. The next test on the blood sample, collected at the crime scene is to compare it to blood types of the three apprehended suspects.

Materials:

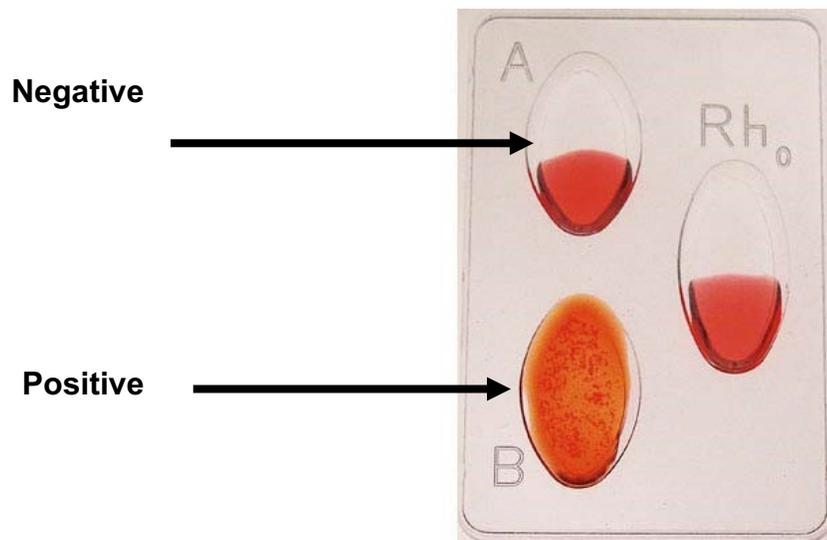
- Anti-A Serum 4 Blood Samples
- Anti B Serum Crime Scene
- Anti-Rh Serum Suspect 1
- 4 Blood Typing Trays Suspect 2
- 12 toothpicks Suspect 3
- Paper towels

Procedures:

1. Place **2 drops of the simulated blood** sample in each well of the blood typing tray. *A. You will have separate trays for each blood sample*
2. Place **2 drops of Anti-A Serum** in well A.
3. Place **2 drops of Anti-B Serum** in well B.
4. Place **2 drops of Anti-Rh Serum** in well Rh.
5. Use a **separate stick to mix** the samples and each serum for 10 seconds each.
6. Carefully examine each well to determine if there is any change.
 - A. If it is a positive reaction, the blood will agglutinate (**CLUMP**)
 - B. A change in overall color is also considered a positive reaction

Understanding your Results (Analysis)

Clumping indicates that the blood sample contains antigens that reacted against antibodies in the typing serum that you mixed it with. In the example below this individual is blood type B-



Part II:

2. FILL IN THE FLOWING TABLE WITH YOUR RESULTS

Simulated Blood Sample	Agglutination in Well A (+/-)	Agglutination in Well B (+/-)	Agglutination in Well Rh (+/-)	Blood Type	Observations
Crime Scene					
Suspect 1					
Suspect 2					
Suspect 3					

- What is an antigen?
 - Where are they found?
- What is an antibody?
 - Where are they found?
- What is agglutination?
- What does agglutination tell us?
- Based on your results, which suspect's blood type matches the crime scene blood?
- Based on your results, do you think there is enough evidence to prove the suspect committed the burglary?