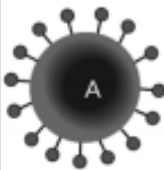
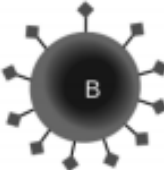
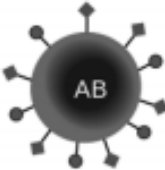
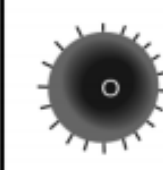


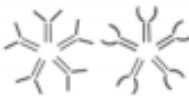





Genetics and Blood Typing: Mr. Johnson's Kids or Not?

Introduction:

Karl Landsteiner identified the ABO blood group in 1901. The ABO blood group includes four types of blood (A, B, AB, and O). The differences in blood types are due to the presence or absence of certain types of antigens and antibodies. Antigens are molecules that are located on the surface of the red blood cells (RBCs), and antibodies are molecules that are located in the blood plasma. Individuals have different types and combinations of these molecules. The figure below shows which antigens and antibodies are associated with each blood type in the ABO blood group.

Blood types and red blood cell surface antigens

	Type A	Type B	Type AB	Type O
Red blood cell type				
Antibodies in Plasma	 Anti-B	 Anti-A	None	 Anti-A and Anti-B
Antigens in Red Blood Cell	 A antigen	 B antigen	 A and B antigens	None

A single gene that consists of three different versions (or alleles) determines the four blood types in the ABO group. Allele A codes for RBCs that have the type A antigens on their surface. Allele B codes for RBCs that have the type B antigens on their surface, and allele O codes for RBCs that lack surface antigens. The A and B alleles are codominant to each other, and both the A and B alleles are dominant over the O allele. Although there are three different alleles associated with the ABO blood group gene, each individual only inherits two copies of it. One copy of the gene comes from the mother, and one copy of the gene comes from the father. The ABO blood type therefore follows the multiple allele model of inheritance.

Although blood type is an inherited trait, the U.S. judicial system does not recognize ABO blood typing as an acceptable way to determine paternity because many individuals can have the same blood type. In the United States approximately 44% of the population has type O blood, 42% has type A blood, 10% has type B blood, and 4% has type AB blood. ABO blood typing, however, can be used to exclude a man from being a child's father. Therefore, it is sometimes useful to conduct a quick and inexpensive test for ABO blood type to determine if further testing using a DNA analysis is warranted.

Your Task

Mr. and Mrs. Johnson have been married for eight years. During this time, Mrs. Johnson has had three children. Recently Mr. Johnson found out that Mrs. Johnson has been secretly dating another man, Mr. Wilson, throughout their marriage. Mr. Johnson now questions if he is the biological father of the three children. Your goal is to use what you know about the inheritance of ABO blood types to determine if Mr. Johnson can be excluded as the father of any of Mrs. Johnson's children. The guiding question of this investigation is, **Are all of Mr. Johnson's children his biological offspring?**

Materials

Blood samples from Mr. and Mrs. Johnson, Mr. Wilson
 Blood samples from the three children
 Anti-A serum

Anti-B serum
 6 blood typing slides
 toothpicks

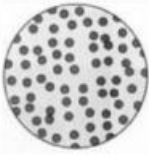
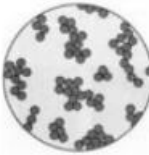
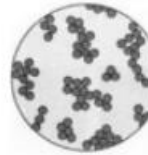

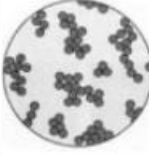
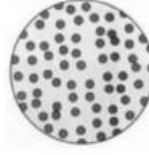
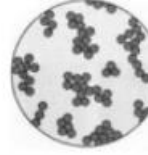
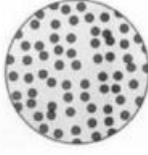
Getting Started

To test a person's blood type, you can mix a sample of blood with an antiserum that has high levels of anti-A or anti-B antibodies. The simple test is performed as follows:

1. Add two drops of a blood sample to well A and to well B of a blood-typing slide.
2. Add two drops of the appropriate antiserum to each of the samples.
3. Stir each sample for 20 seconds with a toothpick.

If the blood samples have the appropriate antigens on their surface, agglutination (clumping of the blood) will occur. For example, if anti-A serum is added to the sample and agglutination occurs, the blood contains cells with the A antigen on their surface. The figure below illustrates the reaction of each antiserum with each blood type.

Reaction of different blood types with antiserum

Antiserum	Reaction when blood is mixed with antiserum			
	Type A	Type B	Type AB	Type O
Anti-B				
Anti-A				

Argumentation Session

Once your group has finished collecting and analyzing your data, prepare a poster that you can use to share your initial argument. Your poster should include all the information shown in the figure. To share your argument with others, one member of your group will stay at your station to share your group's argument while the other members go to the other stations to listen to and critique the arguments developed by your classmates.

The goal of this session is not to convince others that your argument is the best one but rather to identify errors or instances of faulty reasoning in the arguments so these mistakes can be fixed. You will need to evaluate the content of the claim, the quality of the evidence used to support the claim, and the strength of the justification of the evidence included in each argument. In order to do this, you will need more information than what is included on the poster. You might need to ask the presenter one or more follow up questions such as

- How did you collect your data? Why did you use that method? Why did you collect those data?
- What did you do to make sure the data are reliable? What did you do to decrease measurement error?
- What did you do to analyze your data? Why did you decide to do it that way?
- Is that the only way to interpret the results? How do you know that your interpretation is appropriate?
- Why did your group decide to present your evidence in this manner?
- What other claims did your group discuss? Why did your group abandon those alternative ideas?
- How confident are you that your claim is valid? What could you do to increase your confidence?

Once the argumentation session is complete, you will meet with your group and revise your original argument. You might need to gather more data or design a way to test one or more alternative claims as part of this process. Remember, your goal at this stage is to develop the most valid or acceptable answer to the research question.

Report

Once your research is complete, you will write a report (typed, double spaced, 12 point, TNR, two pages or less) that consists of three sections answering the following questions:

- 1) What question were you trying to answer and why?
- 2) What did you do during your investigation and why did you do it?
- 3) What is your argument?

The Guiding Question:	
Our Claim:	
Our Evidence:	Our Justification of the Evidence: