








Biology Lab Investigation: Blood Types

Introduction: A single gene that consists of three different versions (or alleles) determines the human blood types (A, B, AB and O). Allele A codes for the synthesis of red blood cell that have the type A antigens (or agglutinogens) on their surface. Allele B codes for the synthesis of red blood cells that have the type B antigens on their surface, and allele O codes for red blood cells that lack surface antigens.

The ABO Blood System

Blood Type (genotype)	Type A (AA, AO)	Type B (BB, BO)	Type AB (AB)	Type O (OO)
Red Blood Cell Surface Proteins (phenotype)	 A agglutinogens only	 B agglutinogens only	 A and B agglutinogens	 No agglutinogens
Plasma Antibodies (phenotype)	 b agglutinin only	 a agglutinin only	NONE No agglutinin	 a and b agglutinin

The Problem: Mr. and Mrs. Jones have been married for 8 years. During this time, Mrs. Jones has had 3 children. Recently Mr. Jones found out that Mrs. Jones has been secretly dating another man, Mr. Smith, throughout their marriage. Mr. Jones now questions if he is truly the father of the three children.

The guiding question of this investigation is: ***Are any of the three children Mr. Smith's and not Mr. Jones?***

Materials available for use: You may use any of the following materials. *You may not ask Mr. Sampson for any help.*

- 6 blood typing slides
- Toothpicks
- Type A blood sample
- Type B blood sample
- Type AB blood sample
- Type O blood sample
- Blood sample from Mr. Smith, Mr. Jones, Mrs. Jones, Child #1, #2, and #3
- Anti-A serum
- Anti-B serum

Safety Precautions: There are no specific safety issues related to the materials that you will be using during this activity.

Getting Started: In order to test a person's blood type, anti-serum that has high levels of Anti-A or Anti-B antibodies are used. The simple test is performed as follows: Two drops of a blood sample is added to well "A" and to well "B" of a blood typing slide. Then two drops of the appropriate anti-serum is then added to each of the samples. If the blood cells have the appropriate antigens on their surface, agglutination (clumping of the blood) will occur. For example, if anti-A serum is added to a sample of blood and agglutination occurs that means the blood contains cells that have the type A antigens (or agglutinogens) on their surface.

Interactive Poster Session: Once your group has completed your work, prepare a whiteboard that you can use to share and justify your ideas. Your whiteboard should include all the information shown Figure 1.

To share your work with others, we will be using a **Round-Robin** format. This means that one member of the group will stay at your work station to share your groups' ideas while the other group members will go to the other group one at a time in order to listen to and critique the explanations developed by your classmates.

Goal of your Investigation What were you trying to do?	Group Member's Names
Your Explanation How do you explain the phenomenon under investigation?	Your Evidence and Reasoning How can you be sure?

Figure 1: Information needed on a Whiteboard

Remember, as you critique the work of others, you have to decide if their conclusions are valid or acceptable based quality of their explanation and how well they are able to support their ideas. In other words, you need to determine if their argument is **persuasive and convincing**. To do this, ask yourself the following questions:

- Is their explanation **sufficient** (it explains everything it needs to) and **coherent** (it is free from contradictions)?
- Did they use **genuine evidence** (they organized their data in a way that shows a trend over time, a relationship between variables, or a difference between groups and did they use **enough evidence** to support their ideas (they used more than one piece of evidence and all their ideas are supported by evidence)?
- Is their evidence of **high quality**? In other words, is their evidence valid (they used appropriate methods to gather the data) and reliable (they attempted to reduce error in their measurements or observations)?
- Is there any **counterevidence** that does not support their explanation?
- How well does their explanation **fit with other theories and laws** that are used in science to explain or describe how the world works?
- Is their reasoning **adequate** (they explain why the evidence was used and why it supports the explanation) and **appropriate** (rational and sound)?

Once the Round-Robin poster-session is complete, the **President** of the session (which might be your teacher or one of your classmates) will lead a discussion in an effort to synthesize all the various perspectives into one "class" explanation that is the most valid or acceptable way to scientifically explain *the genetic relationship between Mr. Jones and the three children*.

Report: Once you have completed your research, you will need to prepare an **investigation report** that consists of three sections. Each section should provide an answer for the following questions:

Section 1: What were you trying to explain (or figure out) and why?

Section 2: How did you go about your work and why did you conduct your investigation in this way?

Section 3: What is your argument?

Your report should answer these questions in 2 pages or less. This report must be typed and any diagrams, figures, or tables should be embedded into the document. Be sure to write in a persuasive style; you are trying to convince others that your explanation is acceptable or valid!

Peer Review

Paper By: _____ Reviewed By: _____

Criteria	No	Poor	Good	Excellent
Section 1: Goals				
Did the author introduce the phenomenon under investigation and the problem to be solved?	_____	_____	_____	_____
Did the author make the research question and/or goals of the investigation explicit?	_____	_____	_____	_____
Did the author explain why the work was done and why this work is useful or needed?	_____	_____	_____	_____
Explain why your group gave any "Poor" or "No" marks in the space below...				

Section 2: The Investigation

Did the author describe how they went about his or her work?	_____	_____	_____	_____
Did the author explain why the work was done in this way?	_____	_____	_____	_____
Did the author use appropriate terms to describe the nature of the investigation (e.g., experiment, systematic observation, interpretation of an existing data set)?	_____	_____	_____	_____
Explain why your group gave any "Poor" or "No" marks in the space below...				

Criteria	No	Poor	Good	Excellent
Section 3: The Argument				
Did the author include a well-articulated explanation that provides a sufficient answer to the research question? (It explains everything that it should)	_____	_____	_____	_____
Is the author's explanation coherent and free from contradictions ?	_____	_____	_____	_____
Did the author use genuine evidence (trends over time, differences between groups or objects, relationships between variables) to support the explanation?	_____	_____	_____	_____
Did the author present the evidence in an appropriate manner? (The author should have used correctly formatted diagrams, graphs or tables.)	_____	_____	_____	_____
Does the author have enough evidence to support the explanation? (The author supported all of his/her ideas and used more than one piece of evidence)	_____	_____	_____	_____
Is the author's evidence valid (appropriate methods were used to gather the data) and reliable (the author attempted to reduce error in the measurements)?	_____	_____	_____	_____
Does the author's explanation fit with all the available evidence?	_____	_____	_____	_____
Is the author's reasoning sufficient (it explains why the evidence was used and why it supports the explanation) and appropriate (rational and sound)?	_____	_____	_____	_____
Is the author's explanation consistent with what the other groups found and what was discussed in class?	_____	_____	_____	_____
Did the author leave out inappropriate phrases (e.g., it proves it, it's right, it's correct, my proof is) and use key terms correctly (e.g., hypothesis, prediction)?	_____	_____	_____	_____
Explain why your group gave any "Poor" or "No" marks in the space below...				

The Writing

Content: Did the author express their ideas clearly and provide the reader with valuable insight?

Organization: Does the writing have a sense of purpose and structure?

Voice: Does the reader get a sense that someone real is there on the page?

Word Choice: Did the author choose just the right words to make the writing sound natural and precise? Did the author use scientific vocabulary correctly?

Sentence Fluency: Did the author create a sense of rhythm with the sentences and a flow that is enjoyable for the reader?

Conventions: Did the author use appropriate grammar, spelling, punctuation, paragraphing and capitalization?

Final Decision: _____ Accept _____ Revise and Resubmit