

Teacher Preparation Notes for Using Blood Tests to Identify Babies and Criminals

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Teaching Points

- There are four blood types in the ABO system: A, B, AB, and O. These blood types refer to the presence or absence of two different versions of a carbohydrate molecule (A and B) on the surface of red blood cells.
- Both A and B are antigens which stimulate the formation of antibodies. Anti-A antibodies react specifically with A antigens on the surface of red blood cells, and anti-B antibodies react specifically with B antigens.
- Antibodies are special proteins that travel in the blood, react with antigens, and help our bodies to destroy viruses or bacteria that may have infected our bodies.
- Normally, your body does not make antibodies against antigens which are part of your own body. If you have Type A blood, you have A antigens on the surface of your red blood cells and anti-B antibodies, but not anti-A antibodies, in your blood plasma. Etc.
- A blood transfusion can harm a person if the donated red blood cells have antigens that react with antibodies in the person's blood. Only specific matching blood types can be safely used for a blood transfusion.
- There are three alleles of the blood type gene: I^A results in the production of the A antigen, I^B results in the production of the B antigen, and i does not result in the production of either antigen. The I^A and I^B alleles are dominant relative to the recessive i allele. The I^A and I^B alleles are codominant. As a result, a person who has the $I^A I^A$ or $I^A i$ genotype will have Type A blood, a person who has the $I^A I^B$ genotype will have Type AB blood, etc..

Equipment and Supplies:

Synthetic blood of all four blood types (A, B, AB, and O)

Synthetic A and B anti-serum

Drop-controlled bottles or small bottles with droppers or pipets (8 per class)

Microscope slides or plates for mixing blood and antibodies (6 per group)

Toothpicks for mixing blood and anti-serum on plates (6 per group)

Containers such as 20 oz. soda or water bottle to use as a trash so the students can throw away their disposables immediately after use to avoid contamination (1 per group)

All of the simulated blood kits listed below contain one drop bottle of all four types of blood, at least two types of anti-sera (A and B), mixing plates (usually enough for 5-6 groups to work at once), and toothpicks. We have used the Carolina and NeoSci kits. The Carolina B reaction is easier to see than the NeoSci B reaction but you get about 5mL of each blood and anti-sera with the Carolina kit and 30mL of each with the NeoSci kit.

Website	Catalog Number	Description	Price
www.carolina.com	70-0101	ABO-Rh Blood Typing with Synthetic Blood Kit	\$26.00
	70-0102	Refill	\$11.50
www.neosci.com	E2-20-2953	The Frequency of Blood Types Using Neo/BLOOD	\$36.95
	E2-20-2955	Refill	\$18.95
www.wardsci.com	36 V 0022	Simulated ABO Blood Typing Lab Activity	\$29.95
	36 V 0035	Refill	\$16.95

¹ These teacher preparation notes, the related student handout, and multiple additional activities are available at

http://serendip.brynmawr.edu/sci_edu/waldron, with additional activities available at <http://serendip.brynmawr.edu/exchange/bioactivities>.

Preparation for Crime Investigation

As each kit above only comes with 6 drop controlled bottles (2 for anti-sera and 4 for blood) if you only purchased one kit you need to come up with 2 more drop bottles or containers with pipets so you can have a labeled bottle for each suspect (an easy way to do this is to just buy a full kit and refill).

Before class you should label a bottle for each of the blood samples the students must analyze. The following chart illustrates one possible assignment of blood types to put in the drop controlled bottles labeled with each name. If you teach multiple lab sections, you can vary the blood type in the sample from the shower door and/or from the individuals involved, in order to maintain some suspense and variety. To minimize the ambiguity of interpretation, the blood type on the shower door should match the blood type of only one of the potential culprits and should not match the victim's blood type. One possibility is as follows.

Suspects	Blood type (A, B, AB, O)
Shamari Davis – Victim	B
Daleesha Jones—Co-worker	A
Harvey Willis—Janitor	B
Mike Reed—Client	O
Steve O’Hare—Boss	AB
Blood on shower door	AB

During class you can either 1) pass around a box containing each of the 8 bottles to each group’s table as they reach the hands-on portion of the activity or 2) set up a station somewhere in your classroom where the students can come test their blood. After the initial dropping of blood and anti-sera onto plates it takes students a while to mix and read the reactions, so option 1 may be better if you have a large class.

Background for Discussion of Blood Types

The determination of blood type is more complex than the ABO blood types discussed in this activity. For additional information on blood types and transfusions see:

http://www.cancer.org/docroot/ETO/content/ETO_1_4X_Blood_Transfusion.asp?sitearea=ETO

<http://www.peacehealth.org/kbase/topic/medtest/hw3681/descrip.htm>

http://anthro.palomar.edu/blood/ABO_system.htm

Of course, modern methods for identifying an individual are much more sophisticated than simply testing blood type, often including analysis of DNA.

Possible Alternative and Extension

The same twin scenario is included as a worksheet/discussion activity entitled "Were the babies switched?" in "Soap Opera Genetics -- Genetics to Resolve Family Dilemmas and Arguments ", available at <http://serendip.brynmawr.edu/exchange/bioactivities/SoapOperaGenetics>. This worksheet/discussion activity includes explanations and questions concerning both the inheritance of blood types (including the concept of codominance) and skin color (including the concept of incomplete dominance). The section on skin color and incomplete dominance can be substituted for question 2 on page 5 of the student handout for this hands-on activity.