

Are YOU the son or daughter of Mommy and Daddy Warbucks?

Topic: Heredity of Blood Types

Level: 8th grade Integrated Science

Arizona Science Standards Addressed: S1C2PO4 Use appropriate scientific tools (e.g. microscopes) S1C2PO5 Keep a record of observations, notes, sketches, questions and ideas. S1C3PO1 Analysis and Conclusions - Analyze and interpret data to explain results. . S1C3PO5. Explain how evidence supports the validity of a conclusion. S1C4PO5 Communicate the results and conclusions of the investigation. S4C2PO2 Explain the basic principles of heredity using the human example of blood type.

Problem Based Learning: This lesson involves the students in a simulation to solve a mock mystery of which student in the class is the lost son or daughter of Mommy and Daddy Warbucks.

Engage: The class begins with the news that Mommy and Daddy Warbucks have learned that their long lost son or daughter has been traced to that class of students at that school. Students are informed that they will participate in a problem solving mystery to use science to learn which one of them is the lost son or daughter. The Warbucks have left an ASU shirt and letter to be given to their lost son or daughter.

Explore: The students' first task is to participate in mock medical school. They will use microscopes to observe and sketch real blood cells. The prepared slides show human blood cells and have been safely sealed in the laboratory. After seeing and sketching the slides their professor will introduce the medical students to samples of 4 mock blood types (A, B, AB, and O). Mock blood is laboratory made and is not actually harmful. Students will wear gloves to protect their hands from possible stains from the mock blood. Students do chemical tests to discover the differences among the 4 types of blood. Students will work with their collaborative groups and ASU mentor to collect, organize, and carefully record data about the results of the chemical tests. They will place 2 sets of samples of each type of blood (A, B, AB, and O) in a chemical well tray. They will apply a drop of each type of test solution (A and B) to each type of blood. **Explain:** Students also record summaries, insights, and questions in their lab notebooks at the end of medical school.

Elaborate / Apply: Students will then become geneticists and work in collaborative groups with their ASU mentors to help Daddy Warbucks determine which student is his lost son or daughter. Collaborative groups make Punnett Squares (elaboration from previous lesson) on large whiteboards to predict possible outcomes from crosses between Mommy and Daddy Warbucks. Daddy Warbuck's genotype is known, however the students must consider 3 possible genotypes for Mommy Warbucks. Students have worked with predicting possible genotypes and phenotypes in previous lessons, however they must elaborate in this situation to include codominance. Students discuss probabilities and reasoning within their groups with

their ASU mentor and record all Punnett Squares and thinking in their lab notebooks.

Problem Solve and Draw Conclusions: Students then select a small container of a mock blood sample (facilitators have prepared samples so only ONE student will get the blood type matching the missing offspring) as if it is *their sample blood*. They use the test solutions and a 2 part well tray to make an inference about their mock blood type. Cooperative groups and ASU mentors talk about how they can figure out what type of blood they have using their lab records. Discuss observations, clues, reasons, and inferences thoroughly. Students should be able to give evidence for their claims. An announcement is made about the blood type of Mommy Warbucks. Students combine the results of their mock blood test with their Punnett Square that shows possible genotypes of the offspring of Mommy and Daddy Warbucks to determine if they could be the lost offspring. They write a conclusion about whether or not they are the lost offspring of Mommy and Daddy Warbucks and explain their reasoning. The lost offspring gets an ASU Tshirt and a letter from Mommy and Daddy Warbuck praising him/her for the clever problem-solving abilities. All students get an ASU sticker from their ASU mentor.

Posted Objectives: Mock Medical School Use a compound microscope and make labeled sketches of blood cells. Do a chemical test on 4 mock blood samples: Type A, Type B, Type AB, Type O. Make a detailed data table of the reactions of the 4 samples in the control group. **Geneticist at Mock Forensics Lab** Make a Punnett Square showing the possible blood types of offspring in a cross between Daddy Warbucks and Mommy Warbucks. Test your mock blood sample and compare it to your control sample data. Draw a conclusion about your mock blood type. Analyze all your blood type data and your Punnett Square to draw a conclusion about who is the lost child of Mommy and Daddy Warbucks.

Assessment: Participation cards, lab notebook rubric

Vocabulary: Mock, Blood Type A, B, AB, O; Geneticist, Codominant, homozygous, heterozygous, draw a conclusion

Core Concepts: Instructions for development are passed from parents to offspring in thousands of discrete genes, each of which is now known to be a segment of a molecule of DNA. In sexual reproduction, a specialized cell from a female fuses with a specialized cell from a male. Each of these sex cells contains an unpredictable half of the parent's genetic information. When a particular male cell fuses with a particular female cell during fertilization, they form a cell with one complete set of paired genetic information, a combination of one half from each parent. As the fertilized cell multiplies to form an embryo, and eventually a seed or mature individual, the combined sets are replicated in each new cell.

Common preconceptions:

Students may perceive the phenotype and the genotype as being the same thing.

Students confuse the dominant variation with the most frequently occurring variation.

Students may not understand the **probabilistic** nature of the ratios generated in Punnett squares. Instead they think they are certainties.

