

"Hey, What's Your Type?"

Activity 3A

Activity Objectives:

Working in collaborative groups, students will be able to:

- ◆ Examine the ABO blood group and antigens present on the surface of red blood cells
- ◆ Identify the antigens that make each blood type unique
- ◆ Construct a model of antigens involved in ABO blood group
- ◆ Present their models to the class
- ◆ Follow written directions and complete a given task

Activity Description:

Students will create a "Hey, What's Your Type" Wheel to explore the ABO blood groups. Using the wheel and an antigen template page students will construct the antigens responsible for the ABO blood group.

Activity Background:

Even though blood has been studied for thousands of years, the discovery of the ABO blood types was not made until the 20th century. In 1901, Dr. Karl Landsteiner identified the ABO blood group. Landsteiner found that there are four possible blood types within the ABO blood group and these blood types are determined by two different *antigens*, A antigen and B antigen. An *antigen* is a molecule that can be recognized by the immune system and is capable of triggering the production of antibodies. Antigens are present on red blood cell membranes and other cells in our body. The ABO antigens are large *carbohydrate* molecules composed of smaller sugar molecules linked together.

The blood types are controlled by genes inherited randomly from our parents. *Surprisingly, the antigens themselves are not the products of these genes.* Instead, the antigens are formed by altering antigen precursor molecules on the surface of the red blood cells. The alteration of antigen precursor molecules is directed by enzymes (proteins) produced by the genes. There are two genes directly involved with the A and B antigens.

- ▼ The first gene is located on chromosome 19 and is called the *H* gene.
 - ◆ *H* gene produces an enzyme that can add *fructose* (a sugar molecule not to be confused with fructose) to antigen precursor molecules on the red blood cells.
 - ◆ Once fructose has been added, enzymes from another gene on chromosome 9 can further modify the new H antigen.
- ▼ The second gene, located on chromosome 9, and has three



Activity Overview

CAST YOUR NET: ADVENTURES WITH BLOOD



LESSON 3
ACTIVITY 3A

variations; A, B, or O.

- ◆ The A gene produces an enzyme that adds a sugar called *GalNA* to the H antigen to form A antigens and thus type A blood.
- ◆ The B gene produces an enzyme that adds a sugar called *galactose* to the H antigen to form B antigen and thus type B blood.
- ◆ The O gene does not produce any enzyme and does not alter the H antigen on the surface of the red blood cells. This means that neither A antigen nor B antigen is present, forming type O blood.

▼ The four blood types in the ABO blood group are:

A – People with type A blood have A antigens on their red blood cells.



B – People with type B blood have B antigens on their red blood cells.



AB – People with type AB blood have both A and B antigens on their red blood cells.



O – People with type O blood have neither the A nor the B antigen on their red blood cells, only H antigens.

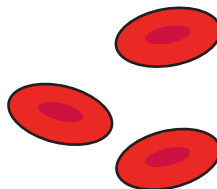


You may have heard people say their blood type is B positive or B negative. The “positive” and “negative” refers to a different antigen on the surface of their red blood cells (RBCs). This antigen is the Rhesus factor or Rh factor. If the Rh factor is present on the RBCs, a person *is* positive for the Rh factor. If the Rh factor *is not* present on the RBCs, a person is negative for the Rh factor. Discovered in 1940 in the Rhesus monkey, Rh can cause complications during incompatible transfusions as well as in a pregnancy between an incompatible mother and child. Although 45 different blood antigens have been identified to date, the Rh antigen is still the focus of research today.



Activity Materials: (per group)

- 1 copy of *Student Information Page*
- 1 copy of the *Molecule Template Page* copied onto colored paper if possible *per student*
- 1 copy of the *Student Data Pages per student*
- 1 pair scissors *per student*
- Glue
- 3 (6-inch) craft sticks per student
- 1 ruler per student
- 1 brad per student



Activity Management Suggestions:



Activity Overview Continued

CAST YOUR NET: ADVENTURES WITH BLOOD



MODIFICATIONS:

For students needing more assistance: Group these students with peers who can assist them during the activity. Check often for understanding.

For highly able students: Allow these students to do research on the carbohydrate structures that make up the ABO and Rh antigens. Students may also be grouped with other students to provide peer assistance.

EXTENSIONS:

Students can research Rh antigens and create a lesson or template showing how these factors provide different markers for the red blood cells.

Activity References Used:

Books:

Daniels, G. (2002). Human Blood Groups. Malden, MA: Blackwell Science.

Daily, JF. (1998). Blood. Arlington: Medical Consulting Group.

Quinley, E. (1998). Immunohematology: Principles and practice. New York: Lippencott.

Reid, M. & Lomas-Francis, C. (1997). The blood group antigen facts book. California: Academic Press.

Roitt, I.; Brostoff, J.; & Male, D. (1998). Immunology: Fifth edition. Philadelphia: Mosby.

Stites, D.; Terr, A. & Parslow, T. (1997). Medical immunology. Stamford, Connecticut: Appleton & Lange.

Suggested websites for additional information:

Molecular Biology Website:

<http://www.web-books.com/MoBio/Free/Ch1B5.htm>

Wayne's World Blood typing website:

<http://waynesword.palomar.edu/aniblood.htm>

Genetic Science Learning Center:

<http://gslc.genetics.utah.edu/units/basics/blood/>

American Cancer Society website:

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

Genetic Science Learning Center, University of Utah:

<http://gslc.genetics.utah.edu/units/basics/blood/types.cfm>

Nobel Prize website:

<http://nobelprize.org/medicine/educational/landsteiner/readmore.html>

Blood Groups website:

http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/B/BloodGroups.html#The_ABO

Hey, What's Your Type?



Activity Overview Continued

CAST YOUR NET: ADVENTURES WITH BLOOD



LESSON 3
ACTIVITY 3A