

# "Where in the World is Your Blood Type?"

## Activity 3E

### Activity Objectives:

Using a world map, students will be able to:

- examine the worldwide distribution of the ABO blood types
- observe patterns among the locations where these blood types are prevalent
- locate geographic locations on a world map
- devise a color key to mark the location of the ABO blood types

### Activity Description:

By performing the lab, students will determine the geographic distribution of the ABO blood types. They will use a world map to color code the locations of the blood types and to determine patterns of distribution.

### Activity Background:

Even though blood has been studied for thousands of years, the discovery of the different blood types was not made until the 20th century. In 1901, Dr. Karl Landsteiner identified the *ABO blood group*, consisting of blood types A, B, and O. Landsteiner found that each blood type is based on two different *antigens*, which are molecules located on the surface of the red blood cells and capable of producing an immune response by triggering the production of *antibodies*.

*Antibodies* are proteins produced by white blood cells to circulate in the body and attach themselves to any foreign particles (antigens) found in order to help destroy the foreign particle.

Antigens are composed of *glycoproteins* which are protein and carbohydrate based molecules and *glycolipids* which are fat and carbohydrate molecules. Two types of antigens determine the blood types found in the ABO blood group.

**ABO Blood types are determined as follows:**



**A:** People with *type A blood* have *A antigens on their red blood cells and produce antibodies against B antigens.*



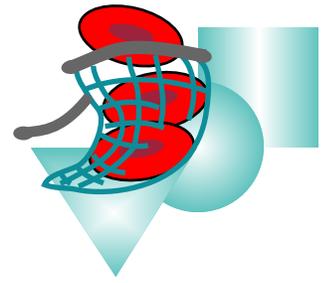
**B:** People with *type B blood* possess *B antigens on their red blood cells and produce A antibodies.*



**AB:** People with *type AB blood* have *both the A and B antigens and do not produce antibodies for either antigen.*



**O:** People with *type O blood* do not make the A nor B antigen so these antigens are not found on their red blood cells, but produce antibodies for both antigen types.



# Activity Overview

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(For more information on the specific blood groups, see activity 3A “Hey, What’s Your Type?”)

Blood type is an inherited trait. An individual receives two genes for each trait he/she inherits; one from mother and one from father. In the case of ABO blood types, there are three variations of the ABO gene. The ABO gene controls the manufacture of the ABO antigens in our cells. Different forms of one gene are called *alleles*. The alleles involved in the inheritance of ABO blood types are the *A allele*, *B allele*, and an allele that causes neither A nor B antigen to form; for simplicity, we will call this the *O allele*. For example, if an individual receives an A allele from each parent, he or she would be blood type A. If he/she inherited an A and a B allele he or she would be blood type AB. If a person receives an O allele from both parents then he/she would be blood type O. When an individual inherits an O allele and an A allele, the person will have type A blood. Likewise if a person inherits an O allele and a B allele, he or she will have type B blood. The gene combination that controls a trait, such as blood type, is referred to as a person’s *genotype*. See *Table 1 ABO Blood Genotypes* for the allele combinations that produce each ABO blood type.

*Table 1 ABO Blood Genotypes*

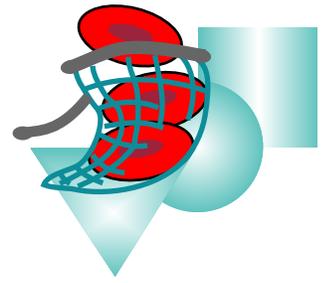
Blood Type	Genotypes
A	$I^A I^A$ & $I^A i$
B	$I^B I^B$ & $I^B i$
O	ii
AB	$I^A I^B$

Our blood types are inherited, but environmental effects can determine which blood types in a population are passed on more frequently to the next generation. Two environmental influences on the distribution of blood types might be genetic drift and natural selection. See *Table 2* for blood type frequency in the United States and *Table 3* for blood type frequency in some world populations.

*Table 2 ABO Blood Type Frequency in the United States*

ABO Type	Rh Type	How Many Have It	
O	positive	38%	45%
	negative	7%	
A	positive	34%	40%
	negative	6%	
B	positive	9%	11%
	negative	2%	
AB	positive	3%	4%
	negative	1%	

(Source: American Association of Blood Banks)



# Activity Overview Continued

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Table 3 Distribution of ABO Blood Types among Various Populations

Population	O	A	B	AB
Native South Americans	100%	—	—	—
British	46%	42%	9%	3%
Irish	52%	35%	10%	3%
French	43%	45%	9%	3%
Hong Kong	40%	26%	27%	7%
Vietnamese	45.0%	21.4%	29.1%	4.5%
Australian aboriginals	44.4%	55.6%	—	—
Germans	42.8%	41.9%	11.0%	4.2%
Bengalis	22.0%	24.0%	38.2%	15.7%
Saami	18.2%	54.6%	4.8%	12.4%
Finns	31%	44%	17%	8%

(Source Palomar College website <http://anthro.palomar.edu/blood/default.htm>)

### Activity Materials: (per student)

- ◆ Map pencils
- ◆ Copy of *Student Information Page*
- ◆ Copy of *Student Data Page*



### Activity Management Suggestions:

Make transparencies of the 1/4 Inch Grid, which is provided at the end of the teacher pages. Students can use this grid to estimate areas on their maps.



# Activity Overview Continued

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## 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 distribution of blood types and the ABO antigens. Students may also be grouped with other students to provide peer assistance.

## Extensions:

Students can research the Rh blood group and create a map showing how the ABO and Rh blood types are grouped world-wide.

Students can research additional information about genetic drift and natural selection and how these environmental influences affect the distribution of blood types around the world.

## Activity References Used:

Palomar College, San Marcos, California

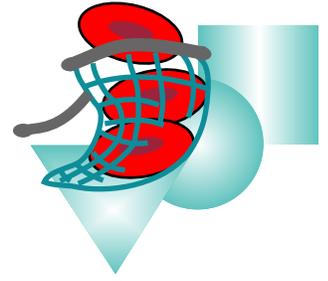
<http://anthro.palomar.edu/blood/default.htm>

Nobel Prize Website

[http://nobelprize.org/educational\\_games/medicine/landsteiner/index.html](http://nobelprize.org/educational_games/medicine/landsteiner/index.html)

American Association of Blood Banks

<http://www.aabb.org/content>



# Activity Overview Continued

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