

"Where in the World is Your Blood Type?"

Student Information Page 3€



Introduction:

Possibly your parents or doctor have told you what your blood type is, ever wonder who else has the same blood type? In this activity, you will find out which blood types are most rare and most common around the world.

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.

(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



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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.

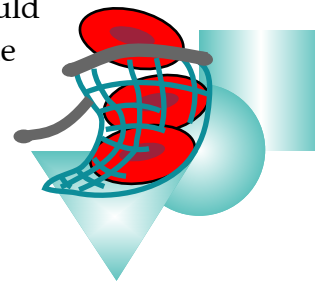


Table 1 ABO Blood Genotypes

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%
O	negative	7%	
A	positive	34%	40%
A	negative	6%	
B	positive	9%	11%
B	negative	2%	
AB	positive	3%	4%
AB	negative	1%	

(Source: American Association of Blood Banks)

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 Instructions:

1. Gather your materials.
2. The world maps outline the highest percentages of the population that have each ABO blood type allele.
3. On each map that follows, *color the highest percentage in red, the second highest percentage in orange and the third highest percentage in yellow.*
4. On the last map use the 1/4 Inch Grid Transparency to estimate the areas of the highest percentage of the **A** and **B** alleles and for the **O** blood type. (**Note:** These are the areas on each map that you colored in red.) Draw them on the last map and label clearly.
5. Use the boxes at the bottom of your map to make a key for your map.

