

Web Activity: Global Variation in Blood Type

Blood type is an inherited characteristic. Each individual has type A, B, AB, or O blood, which is also either Rh negative (Rh⁻) or Rh positive (Rh⁺). The alleles responsible for these blood types are designated as I^A , I^B , I^O , Rh^+ , and Rh^- .

You probably know that blood type has many medical implications, such as in blood transfusions, organ donations, and even childbirth. A transfusion of incompatible blood or organ can lead to the death of the patient receiving it. When an Rh⁻ mother carries an Rh⁺ fetus, the fetus can be harmed. Before transfusions and organ implantations and during pregnancy, the individual's ABO and Rh blood types are determined. Incompatible transfusions or Rh-compromised infants now happen extremely rarely.

Your blood type was determined by the direct inheritance of one allele from each of your parents; it cannot be altered by any environmental factor. As a result, blood types are ideally suited for the study of human genetic variation and provide dramatic evidence of human genetic diversity at the population level. **Figures 1, 2, and 3** show the prevalence of three human blood alleles around the world.

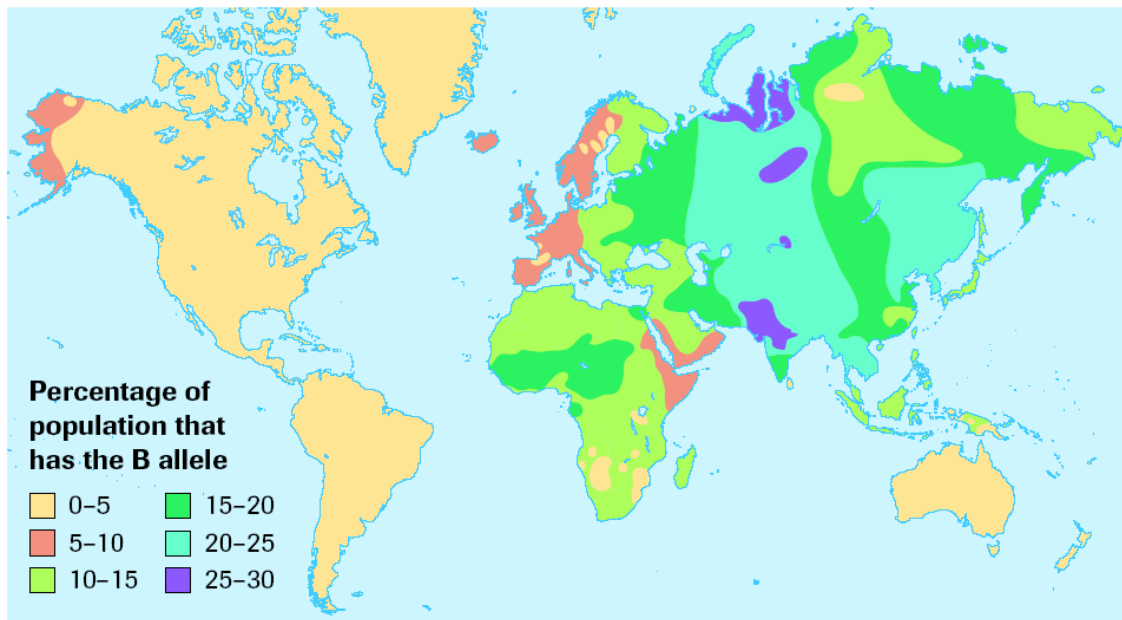


Figure 1
Global distribution of the type B (I^B) allele in native populations. The B allele is almost absent in Australia and the Americas.

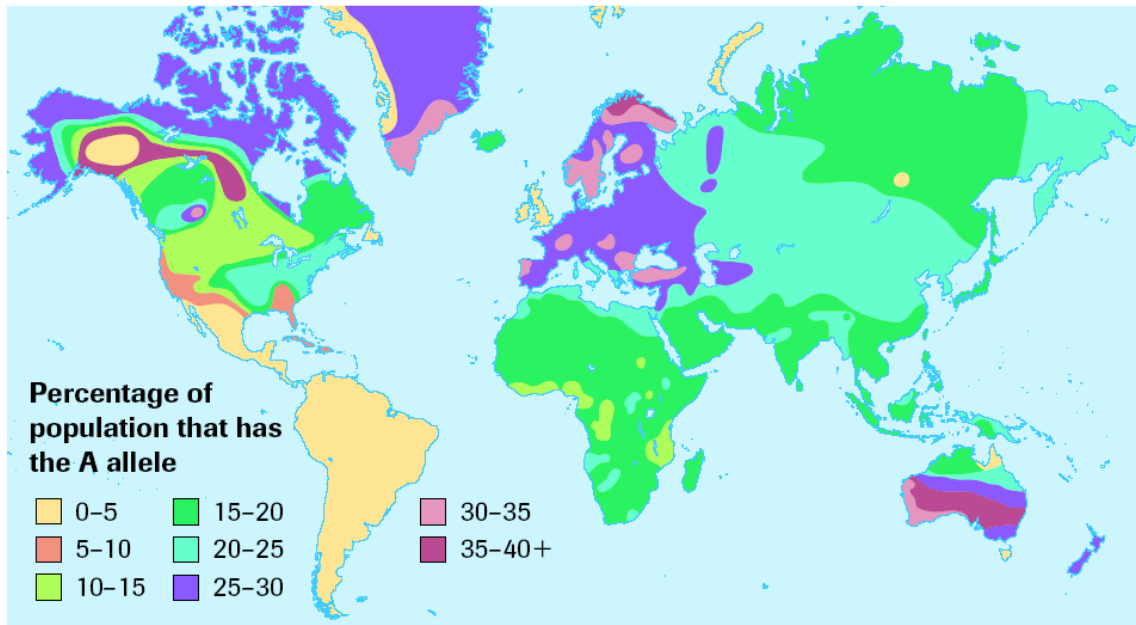


Figure 2
Global distribution of the type A (I^A) allele in native populations. This allele is almost absent in South and Central America.

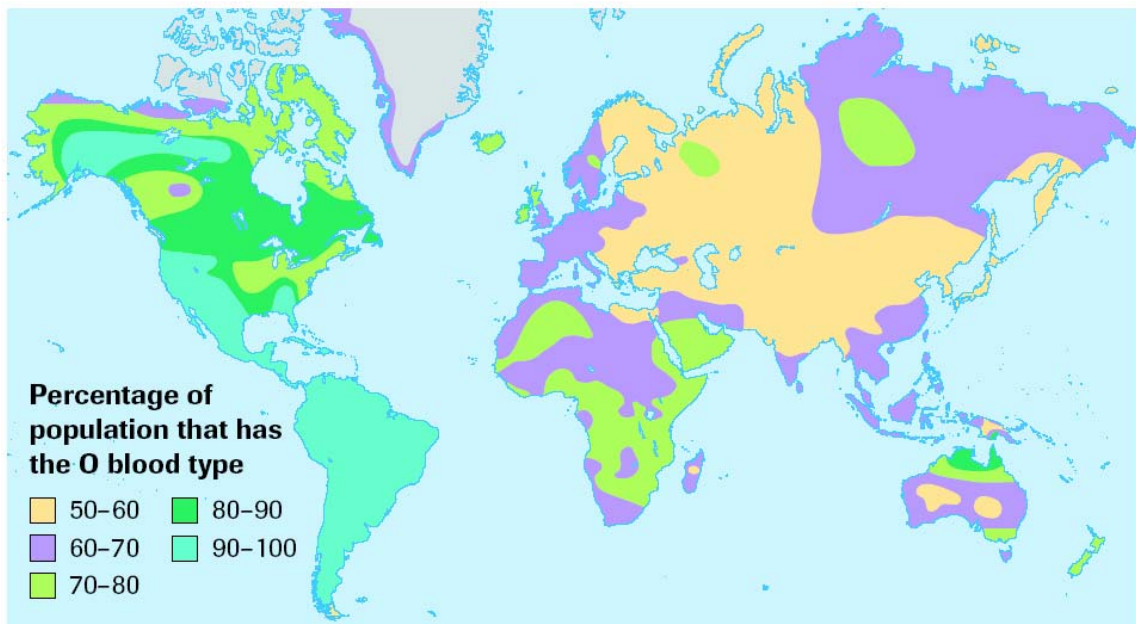


Figure 3
Global distribution of the type O (I^O) allele in native populations. The O allele is extremely common in the Americas.

Like the I^A , I^B , and I^O alleles, other blood alleles show different distributions. For example, the Rh^- (which is recessive) is found in only 15% of Canadians. However, its frequency is much higher along the border of France and Germany.

Another blood-type allele, called Diego positive, is only found in Native Americans and East Asians.

What can the dramatic differences in allele frequency in different parts of the world tell us about human genetic diversity? How can we use our understanding of genetics, evolutionary processes, and populations to account for the distribution patterns?

Case Study Questions

1. Which of the three I^A , I^B , and I^O human blood alleles is the most common, globally? Which is the least common?
2. Hypothesize possible explanations for why one allele might be more common than another.
3. Choose one of the three alleles in **Figures 3, 4, and 5** and suggest an explanation to account for the distribution pattern of that allele. What might cause one blood allele to be much more common in one part of the world than another?
4. Suggest a geographic origin of the I^B allele.
5. How might genetic mutation play a role in the variability and distribution of human blood alleles?
6. Would you expect the distribution patterns of human blood alleles to remain fixed over long periods of time? Explain your reasoning.
7. What does the distribution of the Diego positive allele suggest about the origins of Native Americans?