



## The Genetics of Blood Type ©2006

Blood type is an example of a trait determined by a single gene. Each of us has two copies of the gene for blood type on chromosome pair number 9. One copy is inherited from our mother, the other from our father. There are three versions (called “alleles”) of this gene: A, B, and O. A person’s blood type is determined by which allele he/she inherits from each parent.

The genetic constitution of an organism is called the “genotype”. The “phenotype” refers to the visible properties of an organism that are produced by the interaction of the genotype and the environment. In this case, the A, B, O allele combination a person has is their genotype, while their blood type is their phenotype. This table shows the different possibilities:

Allele Inherited From One Parent	Allele Inherited From the Other Parent	Child’s Genotype	Child’s Blood Type (Phenotype)
A	A	AA	A
B	B	BB	B
B	A	AB	AB
A	B	AB	AB
A	O	AO	A
B	O	BO	B
O	O	OO	O

You can see that the A and B genes are “co-dominant”. In other words, if both an A and B allele are inherited, both are expressed. O is a recessive allele. If an A or B gene is inherited along with the O gene, the A or B gene determines the person’s blood type. A person is type O only if he/she inherits two O genes.

Depending upon parental blood types, a variety of blood type combinations are possible in their children (that do not necessarily match their own). This table shows the possible combinations:

Parent’s Blood Type & Possible Alleles	Other Parent’s Blood Type & Possible Alleles	Possible Blood Types of Children
<b>Type A:</b> alleles are AA or AO	<b>Type A:</b> alleles are AA or AO	Type A or Type O
<b>Type A:</b> alleles are AA or AO	<b>Type B:</b> alleles are BB or BO	Type AB, Type A, Type B, or Type O
<b>Type A:</b> alleles are AA or AO	<b>Type AB:</b> alleles are AB	Type AB, Type A, or Type B
<b>Type A:</b> alleles are AA or AO	<b>Type O:</b> alleles are OO	Type A or Type O
<b>Type B:</b> alleles are BB or BO	<b>Type B:</b> alleles are BB or BO	Type B or Type O
<b>Type B:</b> alleles are BB or BO	<b>Type AB:</b> alleles are AB	Type AB, Type A, Type B
<b>Type B:</b> alleles are BB or BO	<b>Type O:</b> alleles are OO	Type B or Type O
<b>Type AB:</b> alleles are AB	<b>Type AB:</b> alleles are AB	Type AB, Type A, or Type B
<b>Type AB:</b> alleles are AB	<b>Type O:</b> alleles are OO	Type A or Type B
<b>Type O:</b> alleles are OO	<b>Type O:</b> alleles are OO	Type O

The “positive” or “negative” part of a person’s blood type is determined by a separate gene, called the Rh factor. Each of us has two copies of the gene for the Rh factor, on chromosome pair number 1. There are two versions (alleles) of the Rh factor gene: positive and negative. A person’s Rh status is determined by which allele he/she inherits from each parent. This table shows the different possibilities:

<b>Allele Inherited From One Parent</b>	<b>Allele Inherited From the Other Parent</b>	<b>Child’s Rh Type</b>
+	+	+
-	-	-
+	-	+

You can see that the Rh-positive gene is dominant over the Rh-negative gene. A person’s Rh type is negative only if they inherit two Rh-negative genes.