
BLOOD TYPES

A blood group or blood type is based on the presence or absence of two proteins (A, B) on the surface of red blood cells. Because two proteins are involved, there are four possible combinations or blood types (ABO groups):

- Type A - Only the A protein is present.
- Type B - Only the B protein is present.
- Type AB - Both proteins are present.
- Type O - Neither protein is present.

In addition to the A and B proteins, there is another protein involved called the Rh factor (Rh for Rhesus monkey, where it was first identified). The Rh factor is either present (+) or absent (-). Therefore, blood types are described as the type and Rh factor (such as O+, A+, AB-).

There are three forms of the gene (alleles) that control the ABO blood group, which are designated as iA, iB, and i. You have two alleles (one from your mother and one from your father), which are referred to as your genotype. The inheritance of the alleles is co-dominant, meaning that if the allele is present, it gets expressed. (See How Gene Pools Work for more information.) The following genotypes will yield these blood types:

- iAiA or iAi - Both genotypes produce the A protein (type A).
- iBiB or iBi - Both genotypes produce the B protein (type B).
- iAiB - This genotype produces the A and B protein (type AB).
- ii - This genotype produces no protein (type O).

So, your blood type does not necessarily tell you exactly which alleles you have. For example, a person with blood type A could have either two iA alleles or one iA allele and one i allele. It is possible for two parents with the same blood type (A or B) to have a child with type O blood. Both parents would have to have a mixed genotype, such as one i allele together with either one iA or one iB allele.

Blood types are determined by placing three drops of blood on a glass microscope slide. To one drop of blood, a drop of antibody solution to protein A (anti-A) is added. To the second drop, a drop of antibody solution to protein B is added. To the third drop, a drop of antibody solution to Rh factor (anti-Rh) is added. The blood drops and antibody drops are mixed and examined for clumps of red blood cells, and the blood type is determined. Clumps mean that the particular protein (A, B, Rh) is present. For example, clumps in anti-A and anti-Rh, but not anti-B, would indicate a person with type A+ blood.

Blood types are important for giving blood from one person to another (transfusion). The blood types must be matched. If not matched properly, the recipient will form clumps (clots) in response to the donor's blood. The clots will lead to heart attacks, embolisms and strokes (transfusion reactions). Two blood types are special:

Type O- is called the UNIVERSAL DONOR because it can be given to anybody; it has no protein to cause clumps.

Type AB+ is the UNIVERSAL RECEIVER because the recipient has all of the proteins and so will not form clumps.

Finally, the Rh factor is important for pregnant women. If an Rh+ man and an Rh- woman have a child, the child can be Rh+ or Rh-, depending upon the genotype of the father. If the baby is Rh+, this can cause problems. While in the womb, some blood cells from the baby will cross the placenta into the mother's blood stream. The mother will make antibodies to the Rh+ cells. If the woman becomes pregnant again and if the baby is Rh+, the mother's anti-Rh antibodies will cross into the baby's blood and destroy its red blood cells, which can kill the baby. If diagnosed early, it is possible to save a baby under these circumstances by replacing the baby's blood with transfusions that are free of the Rh antibodies. Also, if this situation is known, it is possible to treat a Rh- woman with anti-Rh antibodies (RhoGam) immediately after childbirth to inactivate the baby's Rh+ cells and prevent the mother from forming anti-Rh antibodies (desensitize her).

U.S. Blood-type Distribution

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| O+ | = 38 percent of population |
| A+ | = 34 percent of population |
| B+ | = 9 percent of population |
| O- | = 7 percent of population |
| A- | = 6 percent of population |
| AB+ | = 3 percent of population |
| B- | = 2 percent of population |
| AB- | = 1 percent of population |