Heterozygote Superiority Encyclopedia Article

Heterozygote Superiority

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Heterozygote Superiority

A heterozygote is a diploid (nucleus that contains two sets of chromosomes) organism with two different alleles (alternate form of a gene) at the corresponding loci. Sometimes the heterozygote is not phenotypically distinguishable because of the phenomenon of dominance and recessiveness. At other times, there is incomplete dominance and a blending of the two alleles occurs, or both alleles continue to manufacture their proteins. In certain circumstances, the heterozygous form can confer an advantage onto the organism containing it. The classic example of this is seen with humans and a blood disorder called sickle cell anemia. In sickle cell anemia, the individual is recessive homozygous and the hemoglobin in the blood is not as capable of carrying oxygen around the body as normal hemoglobin. The red blood cells are characteristically sickle shaped. The heterozygous form produces both normal and sickle blood cells. This is known as sickle trait. Sickle cell anemics are poorly adapted to their environment and many die very young. It might be thought that such a deleterious mutation would quickly be lost from the population. This would be the case were it not for the advantage that the heterozygote confers. In countries with a prevalence of malaria, sickle cell trait provides a slight immunity, thus ensuring the survival of the appropriate allele. This means that in malaria-infected areas the heterozygous form is more advantageous than either of the two homozygous forms. The heterozygous form, in this environment, has a selective advantage. This is heterozygote superiority.

Heterozygote superiority is only conferred in a particular environment, beyond that environment the heterozygote may be disadvantaged. This is the case with sickle cell anemia. In areas without malaria there is no advantage in the heterozygote. Indeed, there is a disadvantage due to the reduced capacity to carry oxygen.