

Reciprocal Cross Encyclopedia Article

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Contents

Reciprocal Cross Encyclopedia Article.....	1
Contents.....	2
Reciprocal Cross.....	3



Reciprocal Cross

A reciprocal cross is one of a pair of matings in which two opposite sexes are coupled with each of two different genotypes and mated in opposite combinations. For example, a female of a certain genotype A is first crossed with a male of genotype B. Then, in the reciprocal cross, a female of genotype B is crossed with a male of genotype A. Reciprocal crosses are used to determine whether maternal or paternal factors influence the **inheritance** of the characteristic. They are used to detect sex-linkage, **maternal inheritance**, or **cytoplasmic inheritance**.

If all crosses give the same results when made reciprocally, the observed phenotypes and proportions will be the same for sons and daughters. This occurs when genes for the trait are carried on **autosomes**, not on the sex chromosomes. However, in the case of sex-linkage, differences arise in reciprocal crosses.

Eye color in *Drosophila melanogaster*, commonly known as the fruit fly, provides a classic example of a trait identified as sex-linked on the basis of reciprocal crosses. **Wild type** eye color in fruit flies is dull red and is denoted by w^+ . A recessive mutant allele of w^+ that causes white-eye color is denoted by w . Using pure lines, crossing a female with red eyes by a white-eyed male produces all red-eyed sons and daughters. This is the expected result based on simple Mendelian **genetics**, since w^+ is dominant over w . However, the reciprocal cross, that of a white-eyed female with a red-eyed male, produces only white-eyed sons and red-eyed daughters. From this result, it can be concluded that w^+ and its alleles are not carried on autosomes and are therefore sex-linked.

Genetically, the results described above can be explained by the fact that the alleles specifying eye color are carried on the **X chromosome**. Individual flies with two X chromosomes are females, while flies with one X and one **Y chromosome** are males. The Y **chromosome** lacks an allele of the eye color **gene**. Therefore, each son will express phenotypically whatever allele is on the single X chromosome he has received from his mother. The daughters, on the other hand, received two alleles specifying eye color, one on each X chromosome. They therefore present the phenotype of the dominant w^+ allele.