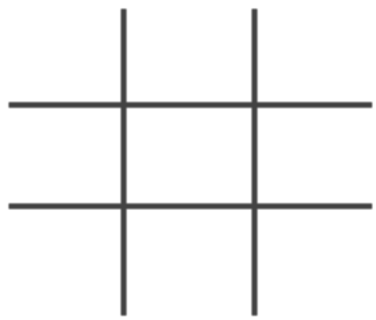
Punnett Squares

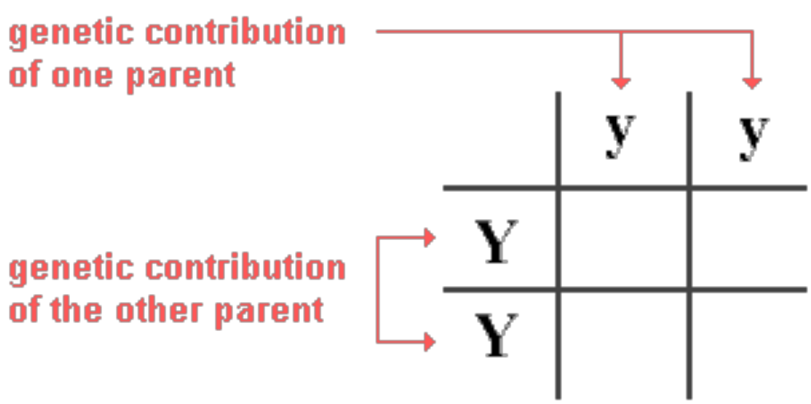
The Punnett square is a diagram that is used to predict the outcome of a particular breeding experiment, or **cross**. It is named after Reginald Punnett, who created the method.

The Punnett square shows every possible genotype that can result from the combination of one maternal allele with one paternal allele for a given gene. In addition, the Punnett square shows the probability of each genotype occurring.

Setting up a Punnett square is quite easy once you understand how it works. Begin by drawing a grid of perpendicular lines.

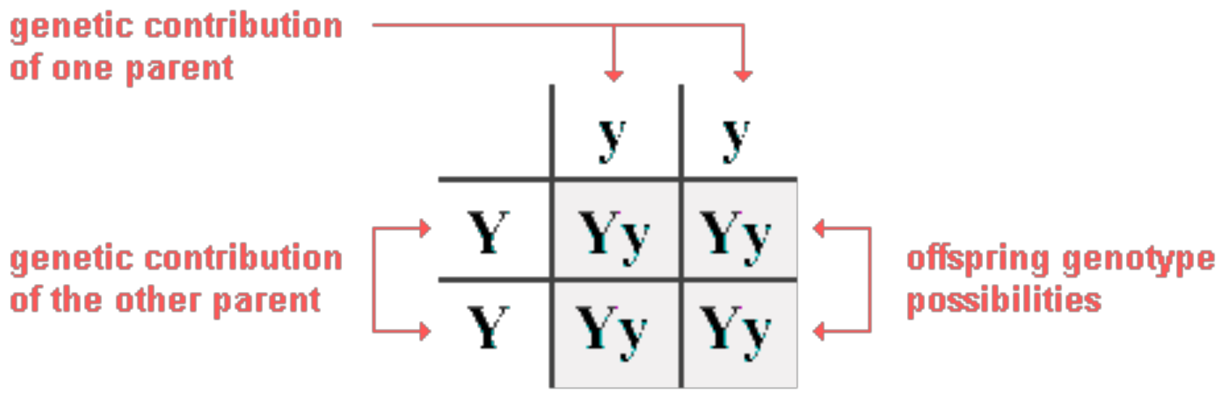


Next, put the genotype of one parent across the top and the genotype of the other parent down the left side. For example, if parent pea plant genotypes were homozygous yellow seeds (YY) and homozygous green seeds (yy), the setup would be:



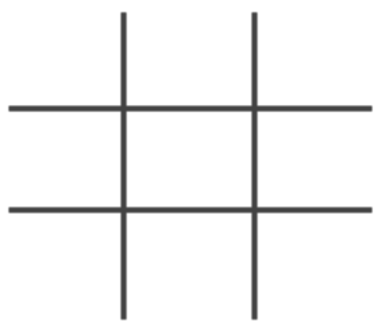
Note that only one letter goes in each box for the parents. It does not matter which parent is on the side or the top of the Punnett square.

Next, all you have to do is fill in the boxes by copying the row-head and column-head letters across or down into the empty squares. This gives us the predicted frequency of all of the potential genotypes among the offspring each time reproduction occurs.



In this example, 100% of the offspring will have the genotype Yy. In addition, since yellow (Y) is dominant over green (y), we can see that 100% of the offspring will have a yellow phenotype.

Example 1
Two parent plants are crossed. If both plants are hybrid yellow seeds (Yy), predict the possible genotypes and phenotypes of their offspring.

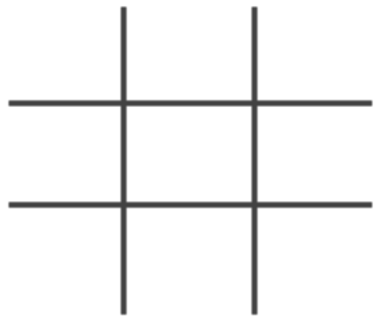


Genotypes: Phenotypes:

Example 2

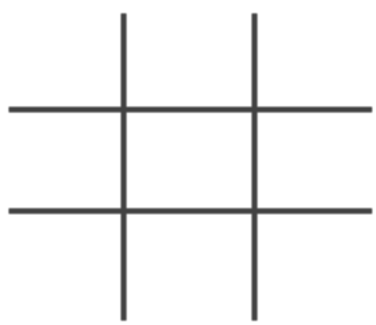
Cystic fibrosis is a genetic disorder that only affects individuals who are homozygous recessive (aa). If two parents who are both carriers mate, what is the chance that they will produce a child with cystic fibrosis?

Note: A carrier is someone who carries the gene, but does not have the disease. This occurs when the individual is heterozygous dominant (Aa).



Example 3

In humans, dwarfism (D) is dominant over normal (d). A homozygous dominant (DD) person will die before the age of one. A heterozygous (Dd) person is dwarfed. A homozygous recessive (dd) person is normal. If a heterozygous dwarf man mates with a heterozygous dwarf woman,



a) what is the probability of having a normal child?

b) what is the probability of having a child that is a dwarf?

c) what is the probability of having a child that dies before the age of one?