

## ■ Background

**Monohybrid crosses** are crosses in which only one characteristic/trait is considered. For example, attached earlobes versus unattached earlobes in humans. **Sex-Linked crosses** are crosses in which the characteristics being considered are related to genes on either the X or Y chromosome. Of all the chromosomes a given species may have, the X chromosome carries the genes for female sex determination and female characteristics, while the Y chromosome carries the genes for male sex determination and male characteristics. Additionally, the X chromosome carries a number of other genes from near-sightedness and distichiasis (double eyelashes) in humans, to eye color in fruit flies. **Dihybrid crosses** involve tracking two traits simultaneously. For example, we can predict the outcome for offspring as the traits for both height and color are concerned.

Original parents in any given set of crosses are called the **parent generation or parentals**, while the two subsequent generations are denoted with the symbols **F1** and **F2** (a cross of two F1 individuals). **Punnett Squares** are one method for visually demonstrating genotypic crosses, the resulting **genotypes** of the offspring, and subsequent **phenotypes** as well. See the example below. Note the calculation and reporting of probabilities for the offspring.

## ■ Example 1: (Monohybrid Cross)

For humans, brown eyes are dominant (B) over blue eyes (b). A heterozygous brown-eyed man marries a blue-eyed female. What are the possible genotypes and phenotypes of the offspring? Give your answers in probabilities.

Parents: Male = Bb; Female = bb

	B	b
b		
b		

The separation of the parental genotype from Bb and bb on either side of the Punnett Square represents meiosis. Each single letter represents a possible haploid condition in either an egg or a sperm – whereas the double letters represent a diploid condition.

### Conventions

1. Male alleles on top of Punnett Square - female alleles on the left
2. Dominant allele (upper case) written before recessive allele (lower case)

## Probabilities For F1 Offspring

Genotypes: Bb = 2/4 = 50%  
bb = 2/4 = 50%

Phenotypes: Brown-eyed (Bb) = 2/4 = 50%  
Blue-eyed (bb) = 2/4 = 50%

*\*Every time you complete a Punnett Square you must list and calculate the probabilities that the cross predicts for both genotypes and phenotypes. Remember, Punnett Squares predict the probability that a particular genotype or phenotype will be produced. These values may not always match a given set of offspring.*