

Mendelian Inheritance and Punnett Squares

	B	B
b	Bb	Bb
b	Bb	Bb

Punnett squares like the one shown above are an excellent means to determine the potential genotype of offspring. The genotype of the parents are the top row and left most column (BB and bb, respectively) whereas the offspring are the boxes inside.

An important concept is that Punnett squares display probability; if offspring are generated there is no guarantee that they will follow the ratios displayed in the Punnett square exactly. Secondly, Punnett squares track genotype, NOT phenotype. The phenotype can only be inferred if the interactions between the alleles are known, e.g. Dominant/Recessive, Codominant, Incomplete Dominance.

Important Definitions

- **Allele** - Versions of a given gene. For instance, brown and blue eyes are alleles of the eye color gene
- **Homozygous** - Organism has the same allele for both copies of the gene (BB or bb)
- **Heterozygous** - Organism has two different alleles of the given gene (Bb)
- **Dominant** - The allele overrides the phenotype of the other allele. People who are heterozygous for eye color always have brown eyes, even though they carry the blue eye allele
- **Recessive** - This allele does not display its phenotype in the presence of a dominant allele. Blue eyes are only seen if the person carries two copies of the blue allele, or Homozygous Recessive.

Practice Problems

In Galapagos Finches, the allele for large beaks (L) is dominant over the one for short beaks (l). If a heterozygous bird is crossed with a short-beaked bird, what are the genotypes of the offspring? For each problem, draw a Punnett square and list the phenotypes.

How would the phenotypic ratio change if the alleles were codominant? What might these heterozygous birds look like?

Imagine there was an additional gene (Bb) that had a lethal recessive mutation that resulted in no beak? If our codominance rule from the previous question still applies, what would the genotypes and phenotypes of the offspring be if we crossed a heterozygous finch that carried the lethal no beak allele with a small beaked finch that also carried the lethal recessive allele?