

# BIO 111 Mendelian Genetics Lab Background

In this lab students will be asked to collect (or be provided with) data in a group of three people, from 3 different types of ears of corn. On each ear of corn, the distribution of the kernels are expected to be the results of following type of mating:

**Type I. Monohybrid Cross:** This is a test of Mendel's Law of Segregation. Here, gene variants (called "alleles") separate during the formation of reproductive cells in the process of meiosis. If this is a random process the yellow and purple kernels should exhibit a "3:1" ratio. The result of a **monohybrid cross** (two heterozygous parents) exhibits a ratio of 3 dominant phenotypes to 1 recessive phenotype.

**Type II. Test Cross:** We use this test to identify the genotype of an individual that demonstrates a dominant phenotype by crossing it with one that is known to be homozygous recessive (because it displays the recessive phenotype). It answers the question as to whether the unknown individual is homozygous dominant or heterozygous. If the unknown individual is homozygous dominant, then all of the offspring from this cross will inherit a dominant allele and show the dominant phenotype. However, if the unknown parent is heterozygous, then half of the offspring should inherit the dominant allele from this heterozygous parent, while the other half should inherit the recessive allele. This cross (between a heterozygous parent and a homozygous recessive parent) will produce a crop of offspring that have a ratio of 1 dominant phenotype to 1 recessive phenotype. In this case the offspring will exhibit the classic "1:1" ratio of yellow to purple kernels.

**Type III. Dihybrid Cross:** This is a test of Mendel's Law of Independent Assortment. Specifically, do genes from different locations (loci) on the chromosome sort separately from one another during the formation of the gametes through meiosis? If this is true, the kernels will exhibit a combined "9:3:3:1" ratio of color/texture (purple or yellow AND rough or smooth). The result of a **dihybrid cross** (two heterozygous parents for two separate traits) typically exhibit a ratio of 9 dominant/dominant: 3 dominant/recessive: 3 recessive/dominant: 1 recessive/recessive.

Your job here is to compare the experimental data obtained to perfect theoretical populations using a statistical test called "chi-square", abbreviated mathematically as  $\chi^2$  (this symbol which looks like an "x" is the Greek letter "chi"). Obviously there will be some random variation and it is highly unlikely that an experimental test will yield 'perfect' results. A chi-square analysis will examine the variability and determine the likelihood of whether it exists due to randomness, or whether it is a true statistical difference.