Genetics Lab 3
Mendelian Genetics
Monohybrid, Dihybrid and Test crosses

Mendel made bold (and correct) statements (postulates) concerning the transmission of traits from parent to offspring. He was the first to describe "particulate unit factors" which control expression of specific traits. Mendel based his first 3 postulates on observations of the F1 and F2 generations of *many* **monohybrid crosses** of the pea plant, *Pisum sativum*. He observed 7 phenotypes in these plants, all with clear-cut alternate forms, and his quantitative data served as the cornerstone of modern genetic discoveries.

Mendel went on to cement his postulates by performing **dihybrid crosses** in which parent plants differing in 2 traits are crossed. The particulate nature of the factors was even further supported when Mendel observed new combinations of phenotypes in the F2 generations. From these crosses Mendel added a 4th postulate, describing **independent assortment** of unit factors during gamete formation. Mendel also designed the **test cross** which allows one to determine the precise genotype of an organism showing a dominant trait.

Today's exercise will allow us collect our own data from **F2 generations** of corn crosses. Our goal is to attempt to appreciate Mendel's scientific process and to determine first-hand, whether Mendel's postulates apply to other organisms. Specifically we will be looking at kernel characteristics. Kernels are the seeds (direct product of fertilization) of corn. The outer layer of the kernel is called endosperm. Endosperm can differ in a number of ways including color and texture.

We will examine F2 ears of corn from two monohybrid crosses, a dihybrid cross as well as the kernels from the offspring of a test cross.

Procedure
Materials
A. Each lab group should obtain:
1) one of the 4 types of ears of corn ears:

- F2 of monohybrid cross A
- F2 of monohybrid cross B
- F2 of dihybrid cross (A and B traits)
- Test cross offspring

2) Handful of pins

3) a recording sheet (attached)

B. Follow directions for each type of cross.

1A. Monohybrid cross A:

Examine the ear of corn from the F2 generation of the monohybrid cross involving parents showing 2 colors of endosperm: (purple or yellow) . Count the entire ear, noting the number of kernels of each color. Record below:

PURPLE YELLOW

raw data	raw data	
total purple	total yellow	total kernels

****Describe the relative numbers of purple and yellow (i.e. as a percentage of total)**

1B. Monohybrid cross B:

Examine the ear of corn from the F2 generation of the monohybrid cross involving parents showing 2 textures of endosperm: {starchy(smooth) or sweet (wrinkled)} . Count the entire ear, noting the number of kernels of each texture. Record below:

starchy sweet

raw data	raw data	
Total starchy	total sweet	total kernels

****Describe the relative numbers of starchy and sweet (i.e. as a percentage of total)**

2. Dihybrid cross:

Repeat the exercise for the ear of corn from the F2 generation following mating of plants of different endosperm color (purple or yellow) and of different texture [starchy (smooth) or sweet (wrinkled)].

kernels will be: purple/starchy
purple/sweet
yellow/starchy
yellow/sweet

purple/starchy	yellow/sweet	yellow/starchy	purple /sweet	
raw data	raw data	raw data	raw data	
total	total	total	total	total kernels

****Describe the relative numbers of the 4 phenotypes (i.e. as a percentage)**

3. Test cross:

The ears of corn from the test cross were the result of crossing a plant giving all purple kernels (dominant phenotype, but unknown genotype) with a true- breeding plant giving yellow kernels: **(This is not a standard cross—not F2 generation)**

Record the number of purple and yellow kernels on this offspring ear from the test cross.

purple	yellow	total
raw data	raw data	
total	total	total

****Describe the relative numbers of the phenotypes (i.e. as a percentage)**

Drawing information from the data.

You will need to call on your exposure to Mendel's observations and postulates to answer the following questions.

1. For parts 1 and 2 (mono and dihybrid crosses) examine your F2 data closely. Do your observations resemble those of Mendel's for the mono- and dihybrid crosses in pea plants? Briefly, explain. **Use the data and provide quantitative descriptions.**

2. Based on Mendel's observations in pea plants, reconstruct the cross for parts 1 and 2 (both monohybrid crosses and the dihybrid cross). Start with the parent (P1) corn plants, and follow the cross through the F1 and F2 generation (which you observed directly). Decide which traits are dominant and which are recessive. Choose symbols for the endosperm trait alleles you observed. Show the *expected* outcome of the F2 generation using a Punnet square, noting phenotypic ratios. **Use a separate sheet to do this exercise and label each cross you diagram.**

3. For part 3, the test cross, determine from test cross offspring, the genotype of the parent corn plant which showed the dominant phenotype. (Show with symbols).

****You will use all the data in next week's lab. No lab report for lab 3. You will combine data and analysis (next week) into a single lab report.**