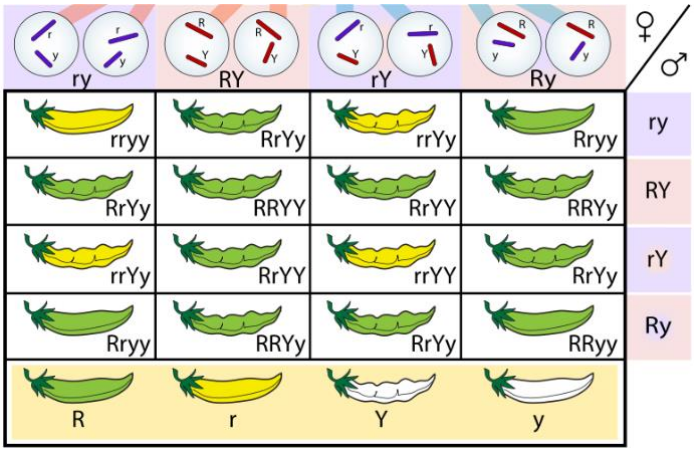
# MENDELIAN GENETICS

## Introduction

The **laws of genetic inheritance** were discovered by Gregor Mendel during his experiments with pea plants. Mendel observed that the physical traits in offspring are not a blend of genes from their parents. He also discovered that some traits are found in offspring that are not present in either parent.

The physical, observable trait of an organism is known as the **phenotype** while the specific set of genes an organism carries is known as the **genotype**. Mendel's **Law of Segregation** states that when two pairs of alleles are different, one is **dominant** and one is **recessive**. This means that the phenotype expressed is either always observable (dominant) or only observable if there is no dominant gene (recessive). The dominant gene is written in upper case and the recessive gene is written in lower case.

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https://bit.ly/2tslGtE

Phenotypes in diploids (organisms with two sets of chromosomes per cell) can be expressed in two ways: **homozygous** or **heterozygous**. Homozygous phenotypes can be *homozygous dominant* where both genes are dominant (RRYY) or *homozygous recessive* where both genes are recessive (rryy). On the other hand, *heterozygous* phenotypes contain one gene of each (RrYy).

This experiment focuses on the inheritance patterns found in corn focusing on kernel colour (purple, yellow) and kernel texture (smooth, wrinkled). However, determining which genotypes are dominant or recessive is not possible by simple observation of the phenotype. A **monohybrid cross** is when offspring differ in one trait, whereas a **dihybrid cross** is when offspring differ in two traits. This experiment will be to determine the pattern of inheritance in the cobs.

## Purpose

The purpose of this experiment is for students to determine which alleles are dominant and recessive as well as to discover the type of cross that occur to create the F2 cobs.

## Hypothesis

What is your hypothesis concerning the dominant and recessive genotype of the corn and phenotypic ratio you expect of your cobs?

_____

_____

## Materials

- 2 ears of corn that are yellow/purple

## Procedure

**Part 1**

1. Obtain two ears of corn.

2. For each ear, count the number of purple and yellow kernels. Record observations.

3. For each ear, count the number of smooth and wrinkled kernels. Record observations.

**Part 2**

1. For each ear, count the number of purple/smooth and purple/wrinkled kernels. Record observations.

2. For each ear, count the number of yellow/smooth and yellow/wrinkled kernels. Record observations.

## Data

**Part 1**

**Cob #1**

| | Numbers | | | Numbers | |
|---|---|---|---|---|---|
| Colour | Kernels | Percentage | Texture | Kernels | Percentage |
| Yellow | | | Smooth | | |
| Purple | | | Wrinkled | | |

Total number of kernels: _____

Dominant colour: _____ Dominant texture: _____

**Cob #2**

| | Numbers | | | Numbers | |
|---|---|---|---|---|---|
| Colour | Kernels | Percentage | Texture | Kernels | Percentage |
| Yellow | | | Smooth | | |
| Purple | | | Wrinkled | | |

Total number of kernels: _____

Dominant colour: _____ Dominant texture: _____

**Part 2**

**Cob #1**

| | Numbers | | | Numbers | |
|---|---|---|---|---|---|
| Phenotypes | Kernels | Percentage | Phenotypes | Kernels | Percentage |
| Purple/Smooth | | | Yellow/Smooth | | |
| Purple/Wrinkled | | | Yellow/Wrinkled | | |

Total number of kernels: _____

**Cob #2:**

| | Numbers | | | Numbers | |
|---|---|---|---|---|---|
| Phenotypes | Kernels | Percentage | Phenotypes | Kernels | Percentage |
| Purple/Smooth | | | Yellow/Smooth | | |
| Purple/Wrinkled | | | Yellow/Wrinkled | | |

Total number of kernels: _____

**Experimental Ratio between cobs**:

Purple/Smooth: _____

Purple/Wrinkled: _____

Yellow/Smooth: _____

Yellow/Wrinkled: _____

Total kernels/Total kernels: _____

## Results

**Part 1**

1. According to your results, what are the genotypes of the parental cob #1 for:

colour: _____

texture: _____

2. According to your results, what are the genotypes of the parental cob #2 for:

colour: _____

texture: _____

3. What is the expected ratio of dominant-recessive genes in a monohybrid cross: _____

3. Did your results match the expected ratio? Explain.

_____

_____

**Part 2**

1. Create the Punnett Square using the genotypes from part 1 to determine the expected ratio of genotypes for your specific cobs:

**Cob #1**

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Ratio: _____

**Cob 2**

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Ratio: _____

2. Is the ratio between expected and experimental genotypes the same for both your cobs? _____

3. What type of cross created cob 1: _____

4. What type of cross created cob 2: _____

**<u>Notes for teachers</u>**

Possible changes:

- Students can perform a Chi-Square analysis if the course is that far ahead
- Students can use photographs of corn if cobs aren't available; white-yellow cobs can also be used but can be much harder to distinguish especially if any of the students are colour-blind
- If the experiment is to be used as is, make sure the cobs used by the students are from a dihybrid cross so that they can look at colour and texture. If not, the experiment can be changed to the students looking at a cob produced from a monohybrid cross (just colour) and then use a different cob that is from a dihybrid cross to allow them to make comparisons.