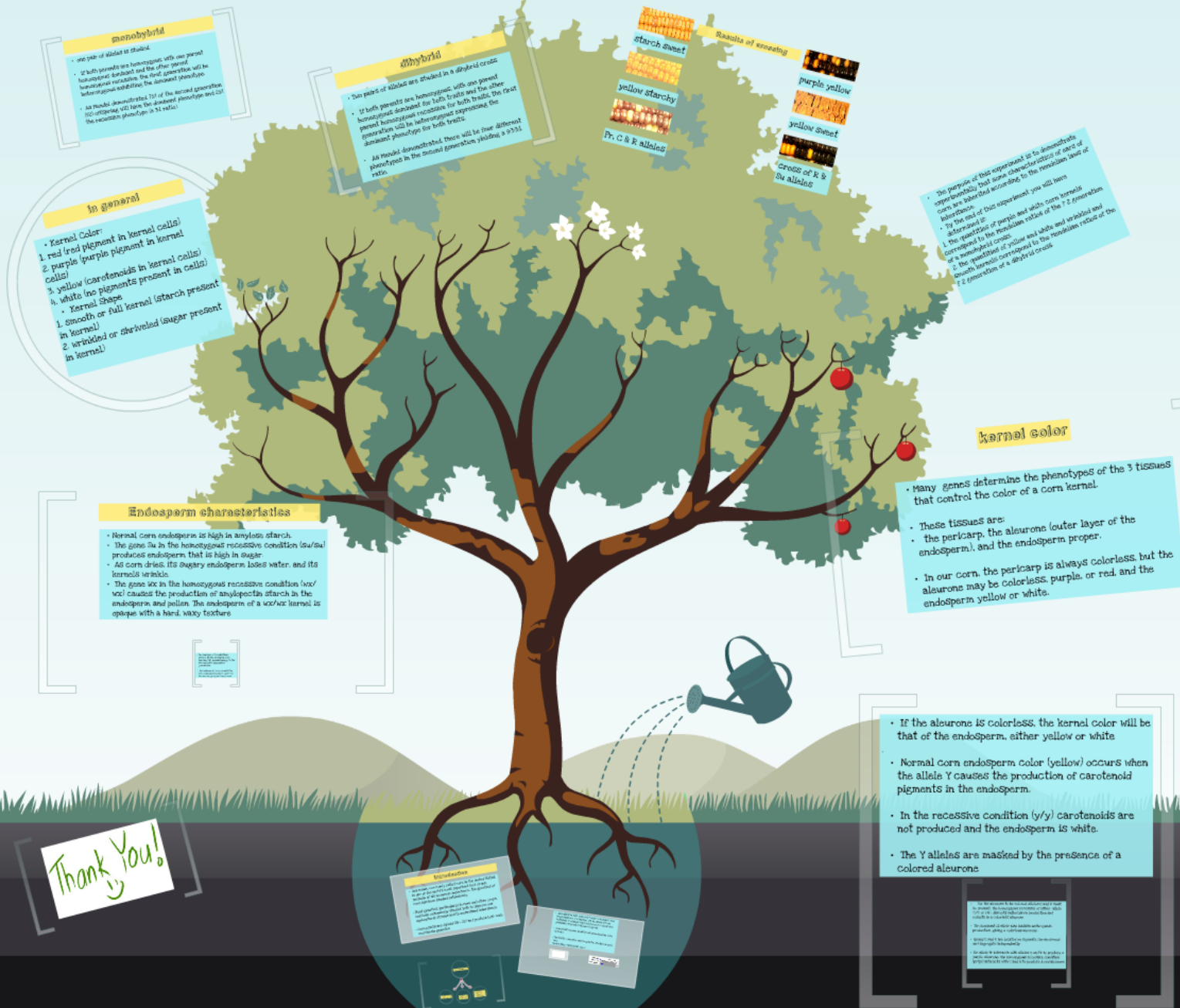


# mendelian genetics in corn



# mendelian genetics in corn

**monohybrid**

- one pair of alleles is studied
- if both parents are homozygous, with one parent homozygous dominant and the other parent homozygous recessive, the F<sub>2</sub> generation will be heterozygous exhibiting the dominant phenotype
- As Mendel demonstrated, 75% of the second generation (F<sub>2</sub>) offspring will have the dominant phenotype and 25% the recessive phenotype is 3:1 ratio

**diybrid**

- Two pairs of alleles are studied in a dihybrid cross
- If both parents are homozygous, with one parent homozygous dominant for both traits and the other parent homozygous recessive for both traits, the first generation will be heterozygous expressing the dominant phenotype for both traits
- As Mendel demonstrated, there will be four different phenotypes in the second generation yielding a 16:3:3:1 ratio

**Results of crossing**

starch sweet  
yellow starchy  
Pr. C & R alleles

purple yellow  
yellow sweet  
cross of R & r alleles

The purpose of this experiment is to demonstrate experimentally that some characteristics of corn are inherited according to the Mendelian laws of inheritance

- try the corn
- document it
- the quantities of purple and white corn kernels correspond to the Mendelian ratio of the F<sub>2</sub> generation of a monohybrid cross
- the quantities of yellow and white and wrinkled and smooth kernels correspond to the Mendelian ratio of the F<sub>2</sub> generation of a dihybrid cross

**in general**

- Kernel Color:**
  - red (red pigment in kernel cells)
  - purple (purple pigment in kernel cells)
  - yellow (carotenoids in kernel cells)
  - white (no pigments present in cells)
- Kernel Shape:**
  - smooth or full kernel (starch present in kernel)
  - wrinkled or shriveled (sugar present in kernel)

**Endosperm characteristics**

- Kernel corn endosperm is high in amylose starch
- The gene *su* in the homozygous recessive condition (*su/su*) produces endosperm that is high in sugar
- As corn dries, its sugary endosperm loses water, and its kernels shrivel
- The gene *wx* in the homozygous recessive condition (*wx/wx*) causes the production of amylopectin starch in the endosperm and pollen. The endosperm of a *wx/wx* kernel is opaque with a hard, waxy texture

**kernel color**

- Many genes determine the phenotypes of the 3 tissues that control the color of a corn kernel
- These tissues are:
  - the pericarp, the aleurone (outer layer of the endosperm), and the endosperm proper.
- In our corn, the pericarp is always colorless, but the aleurone may be colorless, purple, or red, and the endosperm yellow or white.

- If the aleurone is colorless, the kernel color will be that of the endosperm, either yellow or white
- Normal corn endosperm color (yellow) occurs when the allele *Y* causes the production of carotenoid pigments in the endosperm
- In the recessive condition (*y/y*) carotenoids are not produced and the endosperm is white
- The *Y* alleles are masked by the presence of a colored aleurone

Thank You!

**Introduction**

Genetics is the study of how traits are passed from parents to offspring. In this experiment, we will study the inheritance of traits in corn. Corn is a good model organism for studying genetics because it has many traits that are controlled by single genes. We will study the inheritance of two traits: kernel color and kernel shape. We will perform a monohybrid cross and a dihybrid cross, and we will analyze the results to see if they follow Mendel's laws of inheritance.

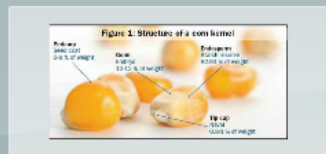
**Conclusion**

The purpose of this experiment was to demonstrate experimentally that some characteristics of corn are inherited according to the Mendelian laws of inheritance. We performed a monohybrid cross and a dihybrid cross, and we analyzed the results. The results of the monohybrid cross showed that the inheritance of kernel color followed Mendel's law of segregation. The results of the dihybrid cross showed that the inheritance of kernel color and kernel shape followed Mendel's law of independent assortment. This experiment confirmed that corn is a good model organism for studying genetics.

# Introduction

- Zea maize, commonly called corn in the United States, is one of the world's most important food crops. Because of its economic importance, the genetics of corn has been studied extensively.
- Plant genetics, particularly in corn and other crops, has been extensively studied, both to improve our agricultural strains and to understand inheritance.
- Corn plants are diploid ( $2N = 20$ ) and produce both male and female gametes.

- Each plant is both male and female ( Bisexual ), and large numbers of offspring can be obtained from individual crossings (each kernel on a corn cob is a potential offspring if allowed to grow).
- Some traits appear as different phenotypes in corn kernels.
- Two traits commonly used in genetic studies of corn are:  
kernel shape and kernel color.



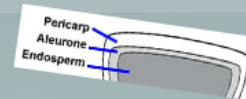
## Introduction

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- Some traits appear as different phenotypes in corn kernels.

- Two traits commonly used in genetic studies of corn are:  
kernel shape and kernel color.





**Figure 1: Structure of a corn kernel**

**Pericarp**  
Seed coat  
5-6 % of weight

**Germ**  
Embryo  
10-12 % of weight

**Endosperm**  
Starch reserve  
82-84 % of weight

**Tip cap**  
Navel  
0.8-1 % of weight





## characters of corn

```
graph TD; A((characters of corn)) --> B((color)); A --> C((shape)); A --> D((Height)); B --> B1[• Dominant trait: purple]; B --> B2[• Recessive trait: yellow]; C --> C1[• Dominant trait: smooth]; C --> C2[• Recessive trait: wrinkled]; D --> D1[• Dominant trait: tall]; D --> D2[• Recessive trait: drawf];
```

### color

- Dominant trait: purple
- Recessive trait: yellow

### shape

- Dominant trait: smooth
- Recessive trait: wrinkled

### Height

- Dominant trait: tall
- Recessive trait: drawf





## kernel color

- Many genes determine the phenotypes of the 3 tissues that control the color of a corn kernel.
- These tissues are:
  - the pericarp, the aleurone (outer layer of the endosperm), and the endosperm proper.
- In our corn, the pericarp is always colorless, but the aleurone may be colorless, purple, or red, and the endosperm yellow or white.

- If the aleurone is colorless, the kernel color will be that of the endosperm, either yellow or white.
- Normal corn endosperm color (yellow) occurs when the allele Y causes the production of carotenoid pigments in the endosperm.
- In the recessive condition (y/y) carotenoids are not produced and the endosperm is white.
- The Y alleles are masked by the presence of a colored aleurone

- For the aleurone to be colored, alleles C and R must be present. The homozygous recessive of either allele (c/c or r/r) disrupts anthocyanin production and results in a colorless aleurone.
- The dominant C1 allele also inhibits anthocyanin production, giving a colorless aleurone.
- Genes C and R are located on separate chromosomes and segregate independently.
- The allele Pr interacts with alleles C and R to produce a purple aleurone. The homozygous recessive condition (pr/pr) interacts with C and R to produce a red aleurone.

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- Genes C and R are located on separate chromosomes and segregate independently.
- The allele Pr interacts with alleles C and R to produce a purple aleurone. The homozygous recessive condition (pr/pr) interacts with C and R to produce a red aleurone

## Endosperm characteristics

- Normal corn endosperm is high in amylose starch.
- The gene *Su* in the homozygous recessive condition (*su/su*) produces endosperm that is high in sugar.
- As corn dries, its sugary endosperm loses water, and its kernels wrinkle.
- The gene *wx* in the homozygous recessive condition (*wx/wx*) causes the production of amylopectin starch in the endosperm and pollen. The endosperm of a *wx/wx* kernel is opaque with a hard, waxy texture

- The endosperm is a nutritional reserve for the developing corn seedling that provides energy to the seedling after immediately germination.
- This reserve is drawn on until the developing plant begins to generate its own energy by photosynthesis

- The endoSperm is a nutritional reServe for the developing corn Seedling that provides energy to the Seedling after immediately germination.
- This reServe is drawn on until the developing plant begins to generate its own energy by photoSynthesis

## in general

- Kernel Color:

1. red (red pigment in kernel cells)
2. purple (purple pigment in kernel cells)
3. yellow (carotenoids in kernel cells)
4. white (no pigments present in cells)

- Kernel Shape

1. smooth or full kernel (starch present in kernel)
2. wrinkled or shriveled (sugar present in kernel)



# monohybrid

- one pair of alleles is studied.
- If both parents are homozygous, with one parent homozygous dominant and the other parent homozygous recessive, the first generation will be heterozygous exhibiting the dominant phenotype.
- As Mendel demonstrated, 75% of the second generation (F<sub>2</sub>) offspring will have the dominant phenotype and 25% the recessive phenotype (a 3:1 ratio).

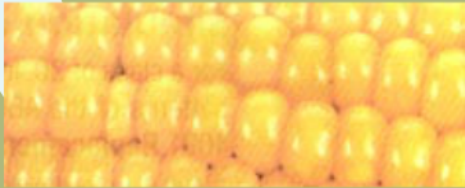
# dihybrid

- Two pairs of alleles are studied in a dihybrid cross.
- If both parents are homozygous, with one parent homozygous dominant for both traits and the other parent homozygous recessive for both traits, the first generation will be heterozygous expressing the dominant phenotype for both traits.
- As Mendel demonstrated, there will be four different phenotypes in the second generation yielding a 9:3:3:1 ratio.

## Results of crossing



starch sweet



yellow starchy



Pr, C & R alleles



purple yellow



yellow sweet



Cross of R & Su alleles

- The purpose of this experiment is to demonstrate experimentally that some characteristics of ears of corn are inherited according to the Mendelian laws of inheritance.
- By the end of this experiment you will have determined if:
  1. the quantities of purple and white corn kernels correspond to the Mendelian ratios of the F<sub>2</sub> generation of a monohybrid cross.
  2. the quantities of yellow and white and wrinkled and smooth kernels correspond to the Mendelian ratios of the F<sub>2</sub> generation of a dihybrid cross.



Thank You!  
😊

## characters of corn

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```

### color

- Dominant trait: purple
- Recessive trait: yellow

### shape

- Dominant trait: smooth
- Recessive trait: wrinkled

### Heigth

- Dominant trait: tall
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# characters of corn

# color

- Dominant trait: purple
- Recessive trait: yellow

# shape

- Dominant trait:  
smooth
- Recessive trait:  
wrinkled

# Height

- Dominant  
trait: tall
- Recessive  
trait: dwarf