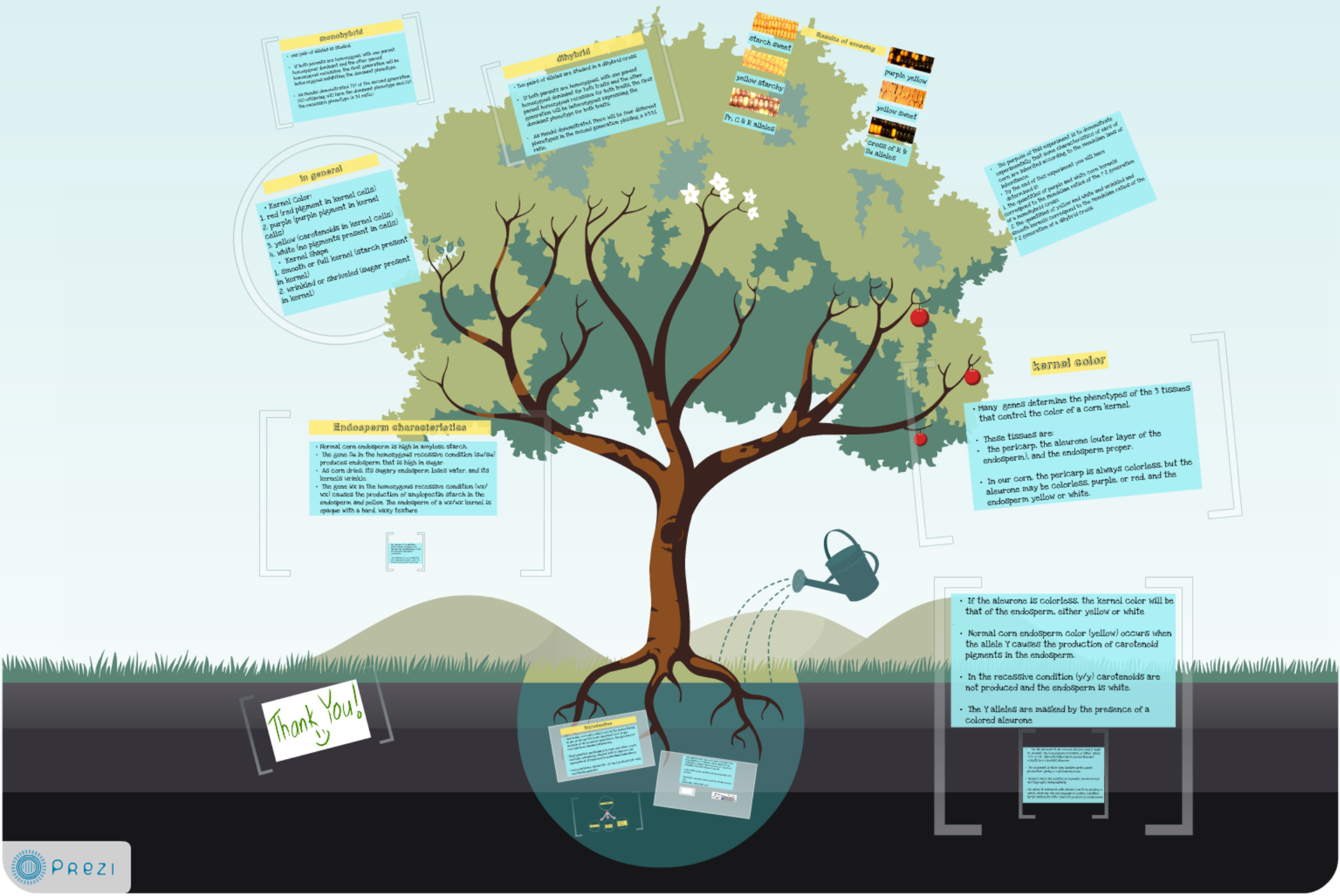
mendelian genetics in corn



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 first generation will be heterozygous exhibiting the dominant phenotype.
- As mendel demonstrated, 25% of the second generation (F2) 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

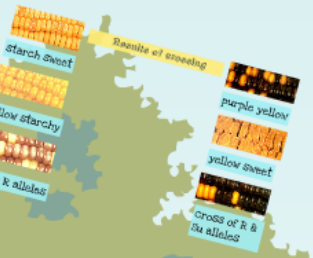
in general

- 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)



- The purpose of this experiment is to demonstrate experimentally that some characteristics of corn are inherited according to the Mendelian laws of inheritance.
- In 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 2 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 2 generation of a dihybrid cross

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

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

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.

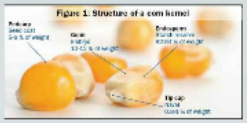
- Corn plants are diploid (2N = 20) and produce both male and female gametes.

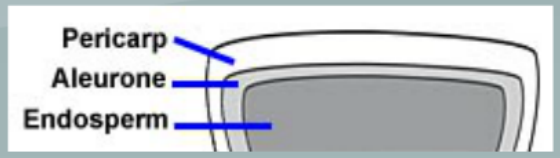
- Each plant is both male and female (Bisexual), and large numbers of offspring can be obtained from individual crossings (each kernel on a corncob is a potential offspring if allowed to grow).

- Some traits appear as different phenotypes in corn kernels.

- Two traits commonly used in genetic studies of corn are:

kernel shape and kernel color.





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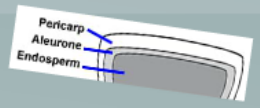


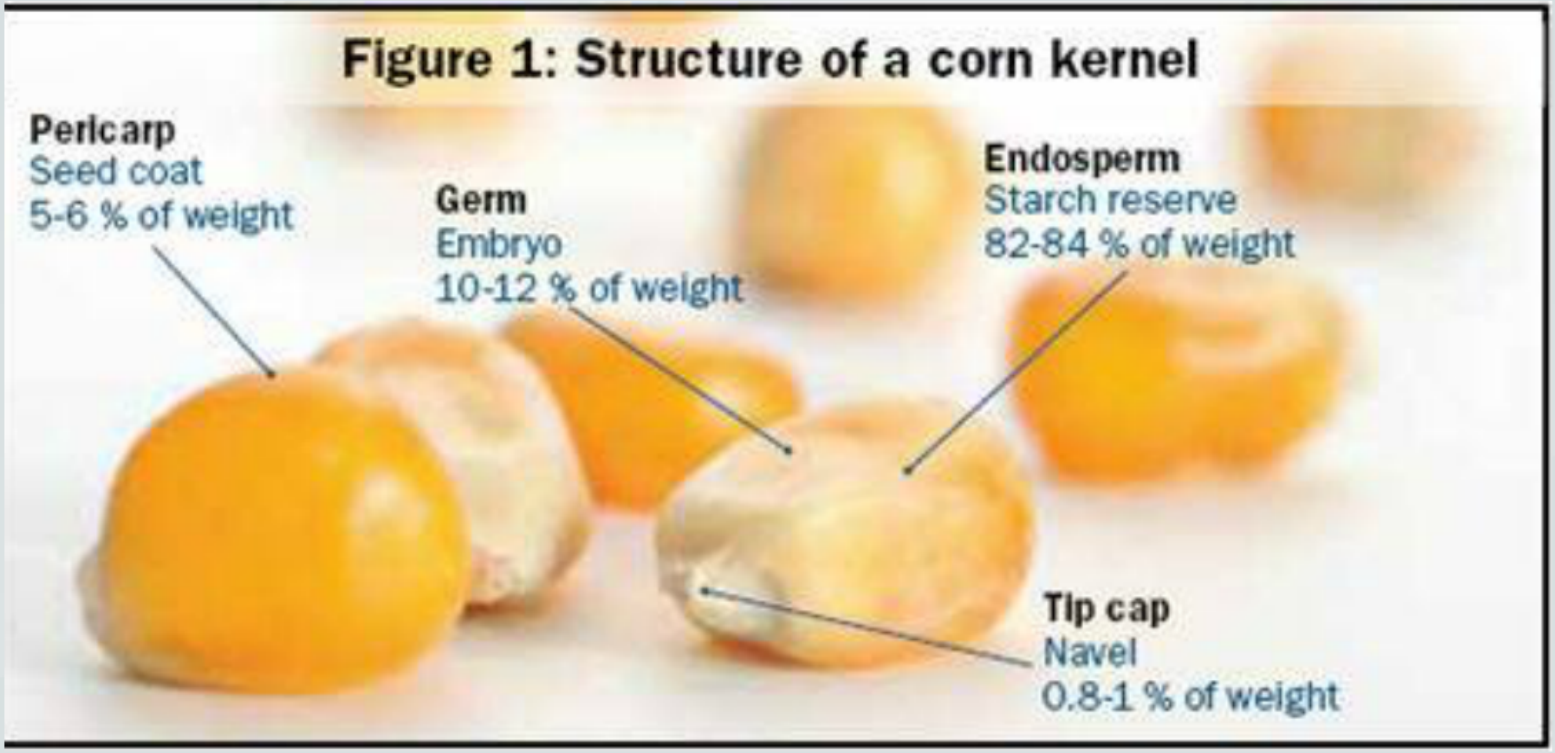
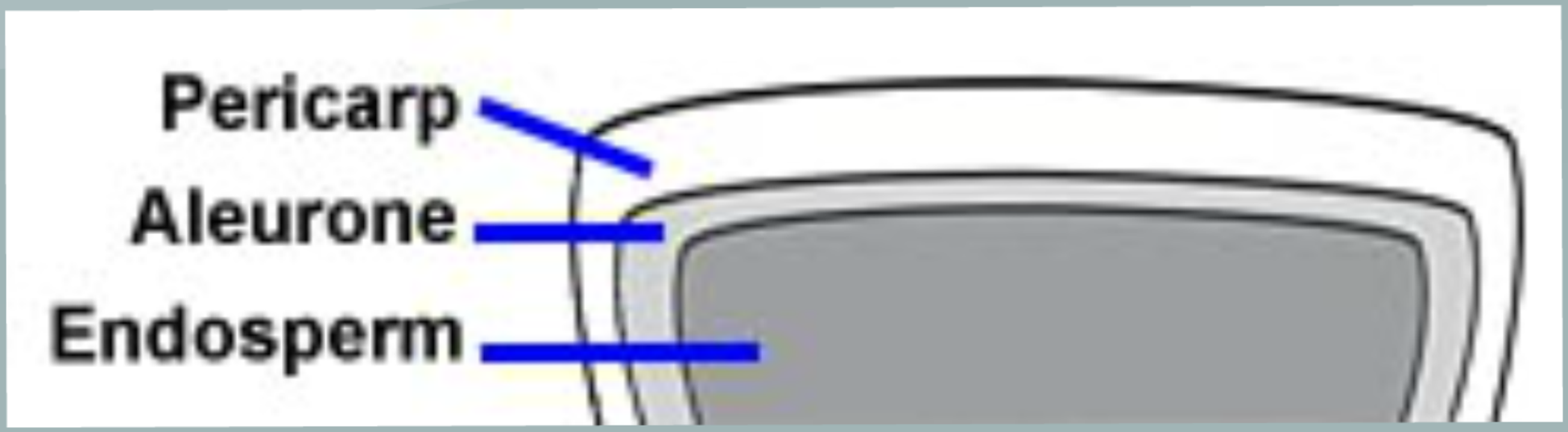
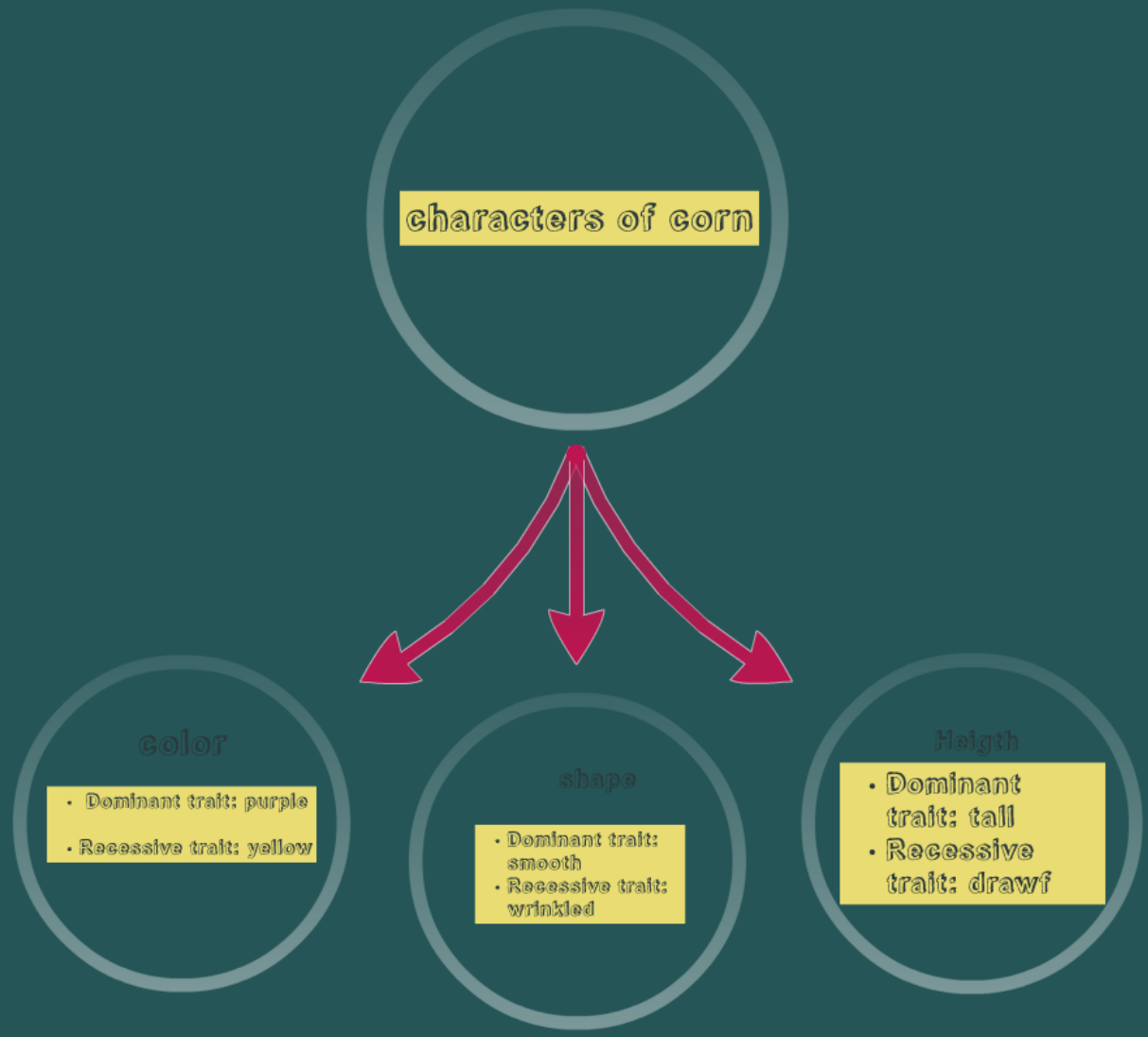


Figure 1: Structure of a corn kernel
Pericarp
Seed coat
5-6 % of weight
Germ
Embryo
10-12 % of weight
Endosperm
Starch reserve
82-84 % of weight
Tip cap
Navel
0.8-1 % of weight




characters of corn
color
• Dominant trait: purple
• Recessive trait: yellow
shape
• Dominant trait: smooth
• Recessive trait: wrinkled
Heigth
• 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.

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- 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 CI 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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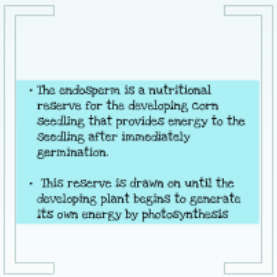

- The endosperm is a nutritional reserve for the developing corn seedling that provides energy to the seedling after immediately germination.

- This reserve is drawn on until the developing plant begins to generate its own energy by photosynthesis

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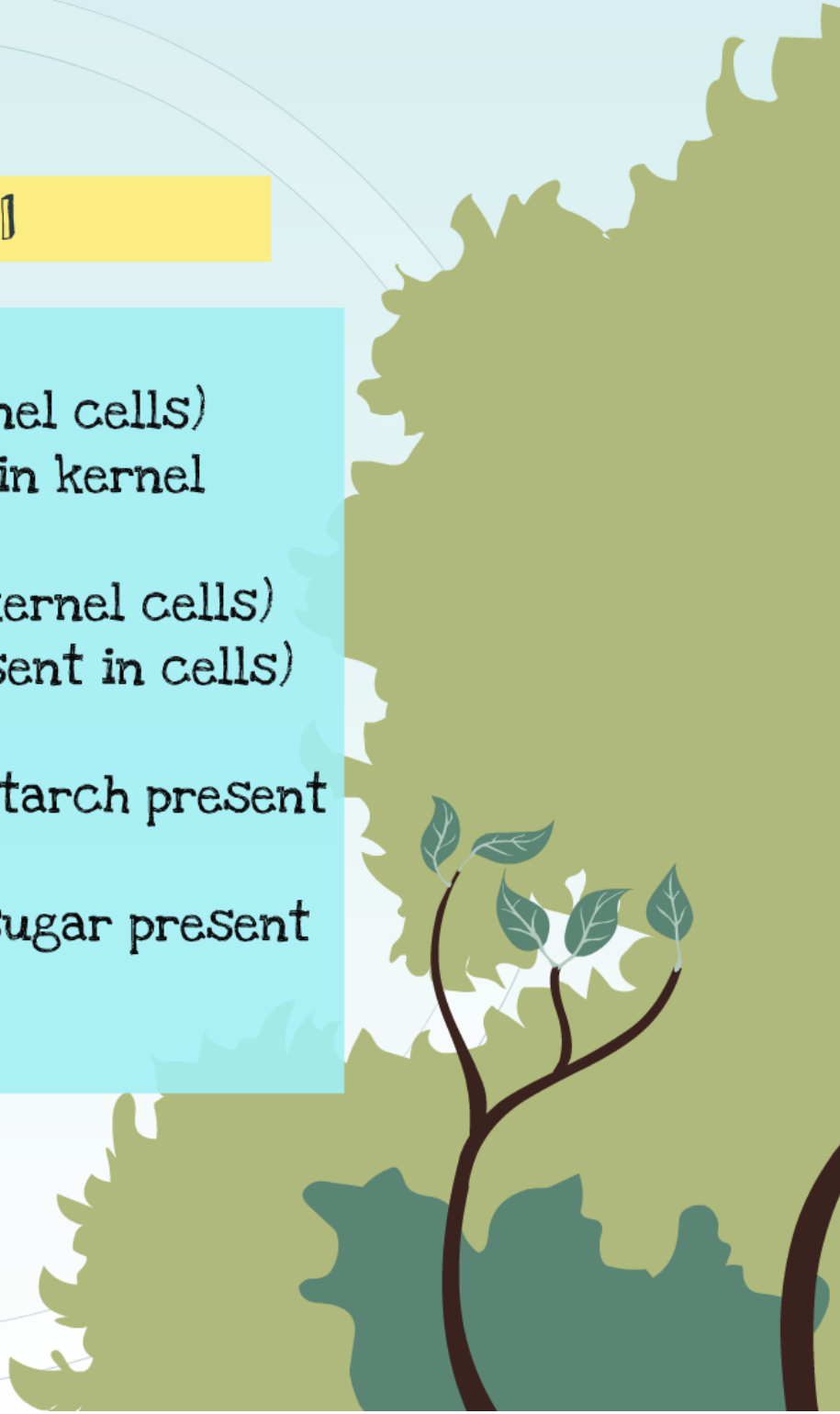

monohybrid

- 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 (F2) 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.
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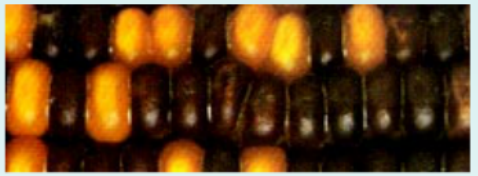
Results of crossing

starch sweet

yellow starchy

Pr, C & R alleles



purple yellow

yellow sweet

cross of R & Su alleles

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- By the end of this experiment you will have determined if:

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Thank You!

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