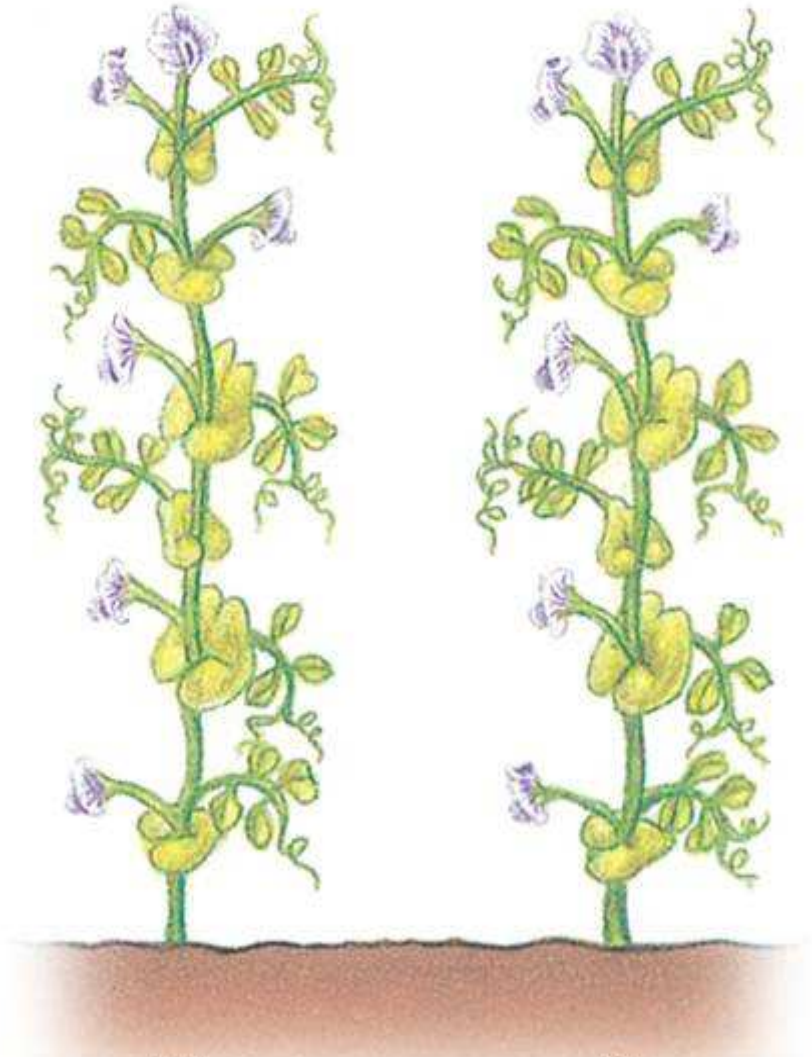
11–3 Exploring Mendelian Genetics



What is the principle of independent assortment?

The principle of independent assortment states that genes for different traits can segregate independently during the formation of gametes.

Independent assortment helps account for the many genetic variations observed in plants, animals, and other organisms.

Independent Assortment

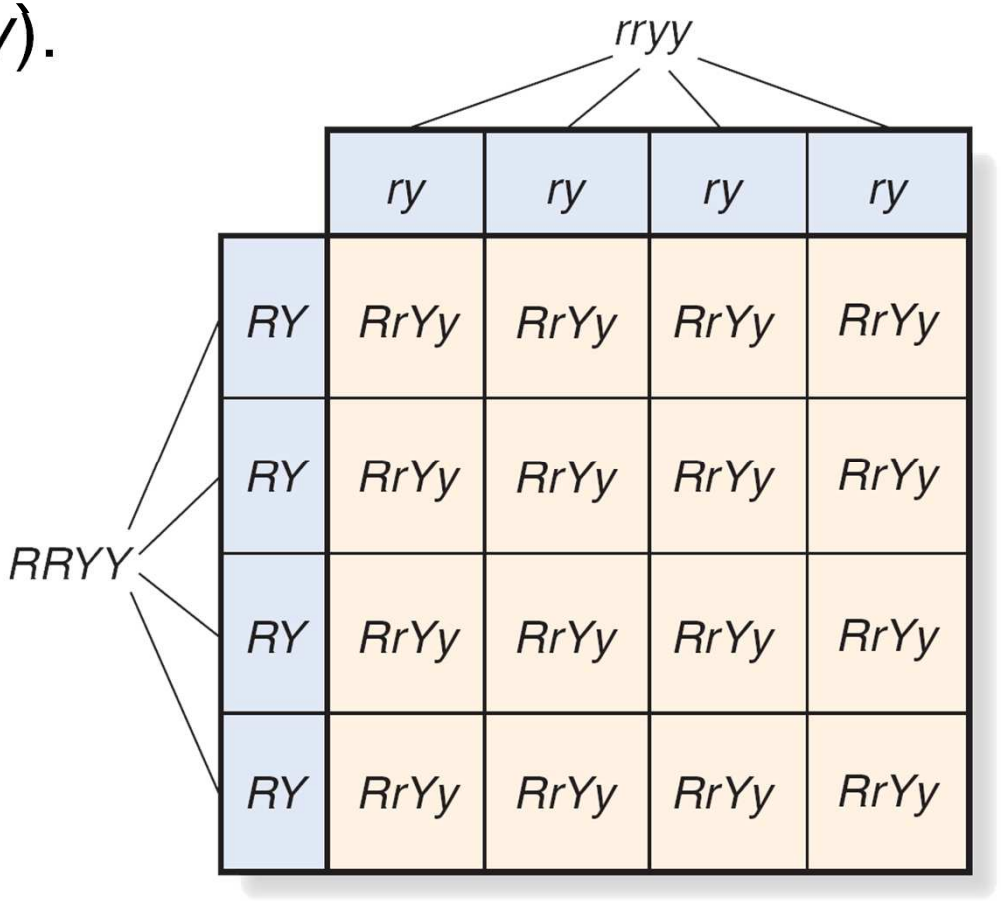
To determine if the segregation of one pair of alleles affects the segregation of another pair of alleles, Mendel performed a two-factor cross.

The Two-Factor Cross: F_1

Mendel crossed true-breeding plants that produced round yellow peas (genotype *RRYY*) with true-breeding plants that produced wrinkled green peas (genotype *rryy*).

All of the F_1 offspring produced round yellow peas (*RrYy*).

The alleles for round (*R*) and yellow (*Y*) are dominant over the alleles for wrinkled (*r*) and green (*y*).



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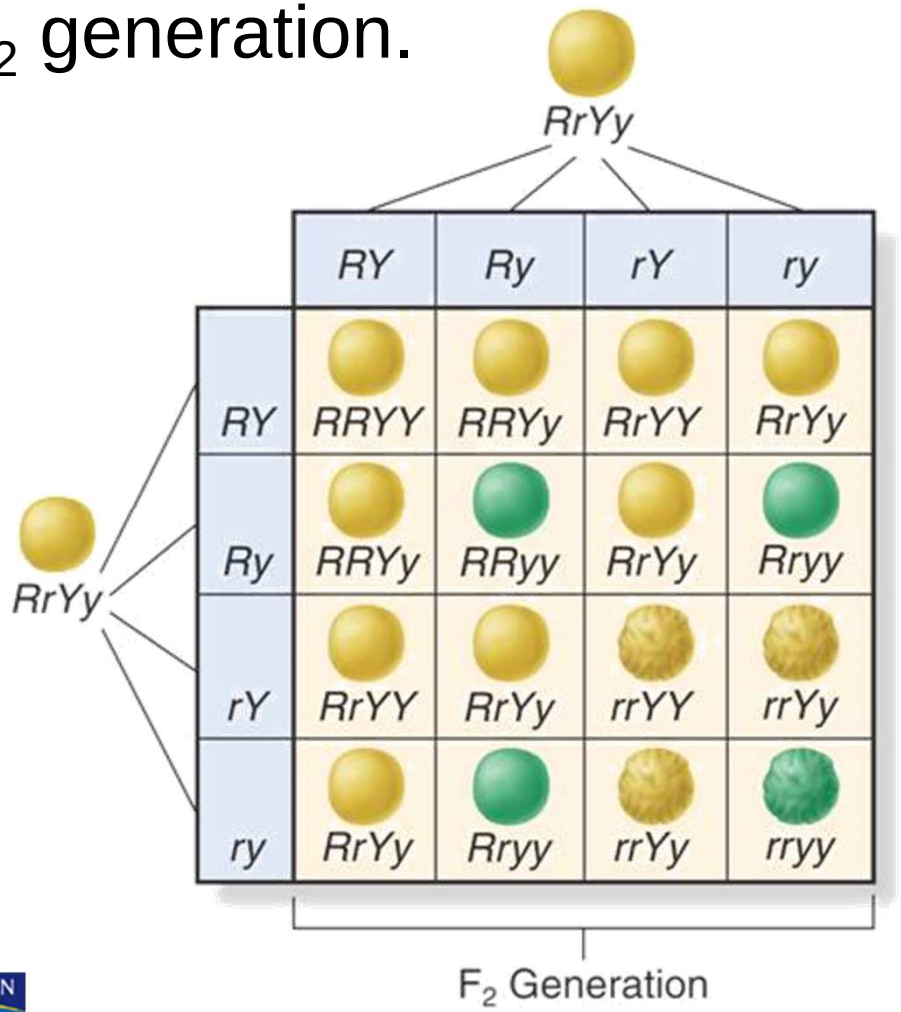
Must be in your notes for credit.

The Two-Factor Cross: F_2

Mendel crossed the heterozygous F_1 plants (*RrYy*) with each other to determine if the alleles would segregate from each other in the F_2 generation.

RrYy × *RrYy*

The Punnett square predicts a 9 : 3 : 3 :1 ratio in the F_2 generation.



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Round Yellow 9
Round green 3
wrinkled Yellow 3
wrinkled green 1

The alleles for seed shape segregated independently of those for seed color. This principle is known as **independent assortment**.

The point? **Genes that segregate independently do not influence each other's inheritance.**

(In the previous example, it means that the genes for seed color did not affect the genes for seed shape.)

A Summary of Mendel's Principles

- Genes are passed from parents to their offspring.
- If two or more forms (alleles) of the gene for a single trait exist, some forms of the gene may be dominant and others may be recessive.

- In most sexually reproducing organisms, each adult has two copies of each gene. These genes are segregated from each other when gametes are formed.
- The alleles for different genes usually segregate independently of one another.

Beyond Dominant and Recessive Alleles

What inheritance patterns exist aside from simple dominance?

- **Incomplete dominance**
- **Codominance**
- **Multiple Alleles**
- **Polygenic inheritance**

Incomplete Dominance

When one allele is not completely dominant over another it is called **incomplete dominance**.

In incomplete dominance, the heterozygous phenotype is between the two homozygous phenotypes. (A blending of traits)

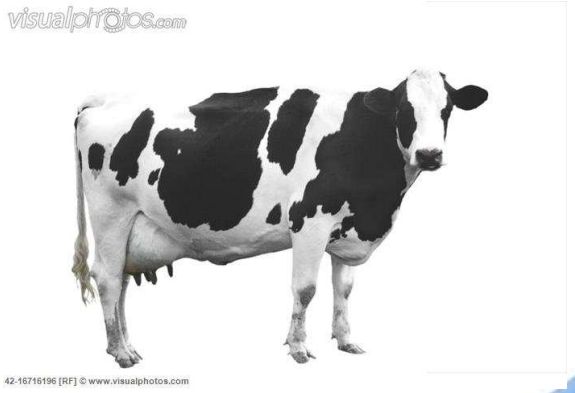
ex: red flowers + white flowers = pink flowers

Codominance

In **codominance**, both alleles contribute to the phenotype. (both are expressed, not blended)

Ex: In certain varieties of chicken, the allele for black feathers is codominant with the allele for white feathers.

So, you get chickens with both white and black feathers.



Multiple Alleles

Genes that are controlled by more than two alleles are said to have **multiple alleles**.

An individual can't have more than two alleles. However, more than two possible alleles can exist in a population.

A rabbit's coat color is determined by a single gene that has at least four different alleles.

Different combinations of alleles result in the colors shown here.

Albino: cc

KEY

C = full color; dominant to all other alleles

c^{ch} = chinchilla; partial defect in pigmentation; dominant to c^h and c alleles

c^h = Himalayan; color in certain parts of the body; dominant to c allele

c = albino; no color; recessive to all other alleles

Polygenic Traits

Traits controlled by two or more genes are said to be **polygenic traits.**

Skin color in humans is a polygenic trait controlled by more than four different genes.