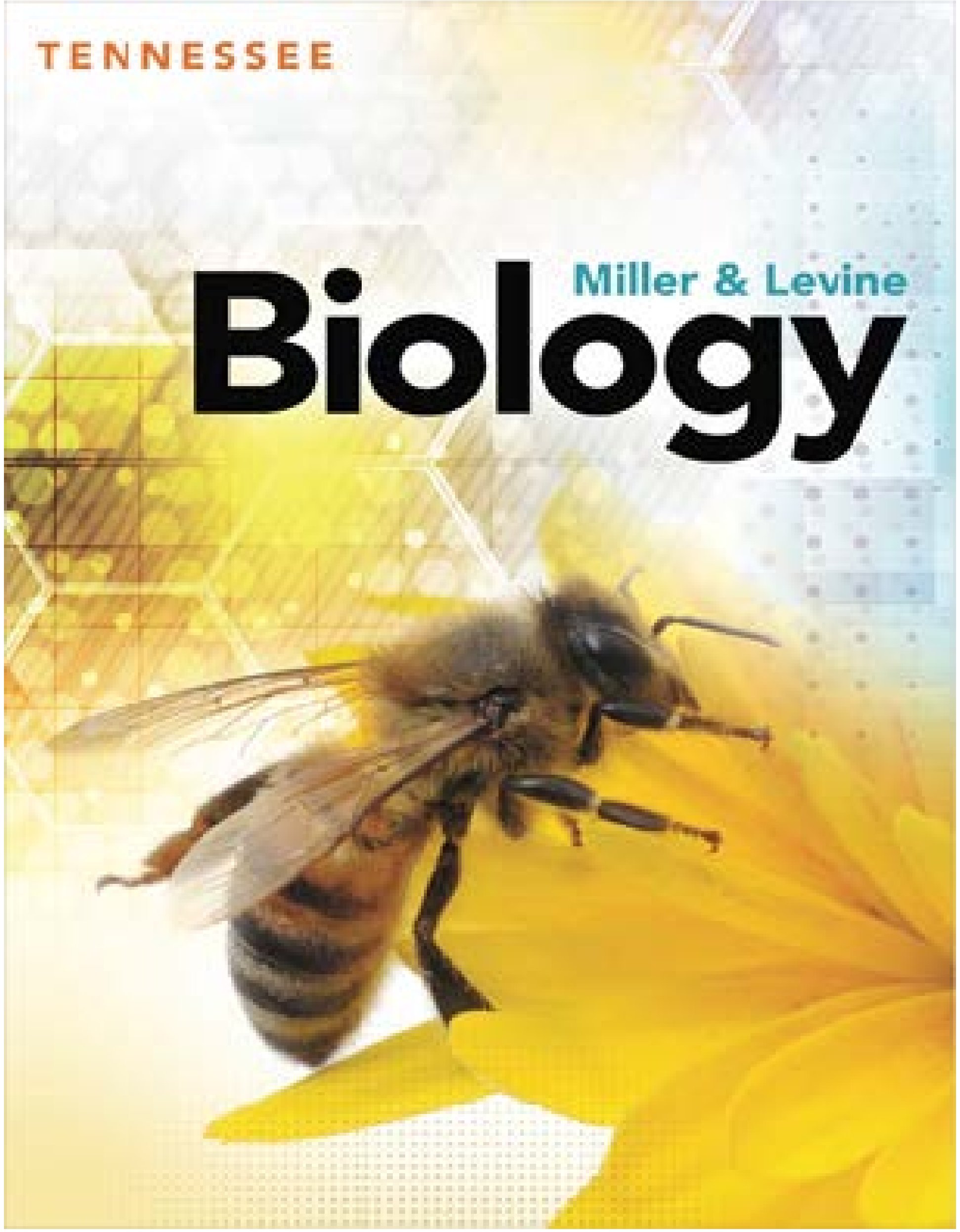


Lesson Overview

12.2 Applying Mendel's Principles

Genotype and Phenotype

phenotype - observable physical traits.

genotype - actual genetic makeup.

- each allele is represented with letters
- dominant alleles are capitalized; recessive are lowercase
- example: ***T*** represents dominant tall allele in pea plants
  t represents recessive short allele in pea plants

Organisms with two identical alleles for a gene—***TT*** or ***tt*** in this example—have **homozygous** genotype.

Organisms with two different alleles for a gene—such as ***Tt***—are **heterozygous**.


VIA 9GAG.COM
HETEROZYGOATS
MEMEFUL.COM

Genotype and Phenotype

The genotype of an organism is inherited, whereas the phenotype is formed as a result of both the environment and the genotype.

Two organisms may have the same phenotype but different genotypes.

Example: Two different genotypes – ***TT*** and ***Tt*** - both produce tall pea plants.

Probability

Because alleles segregate randomly during gamete formation, Mendel realized that the principles of probability could be used to explain the results of his genetic crosses.

Probability - likelihood that a particular event will occur.

- can be written as a fraction or as a percent
- example: 1/2 or 50%

Probabilities Predict Averages

Probabilities predict the average outcome of a large number of events.

The larger the number of offspring, the closer the results will be to the predicted values.

If an F_2 generation contains just three or four offspring, it may not match Mendel's ratios.

When an F_2 generation contains hundreds or thousands of individuals, the ratios usually come very close to matching Mendel's predictions.

Using Punnett Squares

Punnett squares allow you to predict the genotype and phenotype combinations in genetic crosses using mathematical probability.

Punnett Square for a Monohybrid Cross

(Monohybrid cross traces only a single gene.)

Write the genotypes of the two organisms that will serve as parents in a cross.

In this example we will cross a male and female osprey that are heterozygous for large beaks. They each have genotypes of *Bb.*

So B = large beak and b = small beak

Bb X Bb

Determine what alleles would be found in all of the *possible* gametes that each parent could produce.

Parent 1

Bb

B b

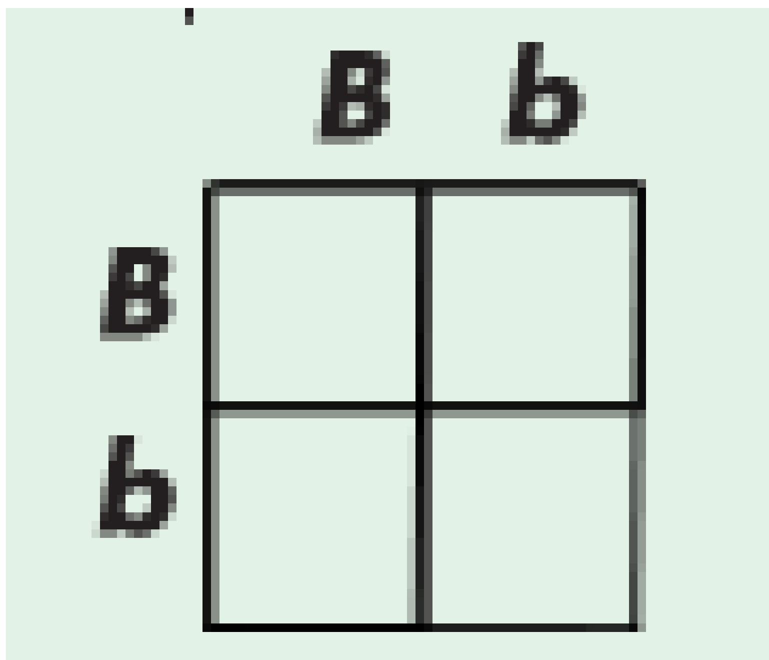
Parent 2

Bb

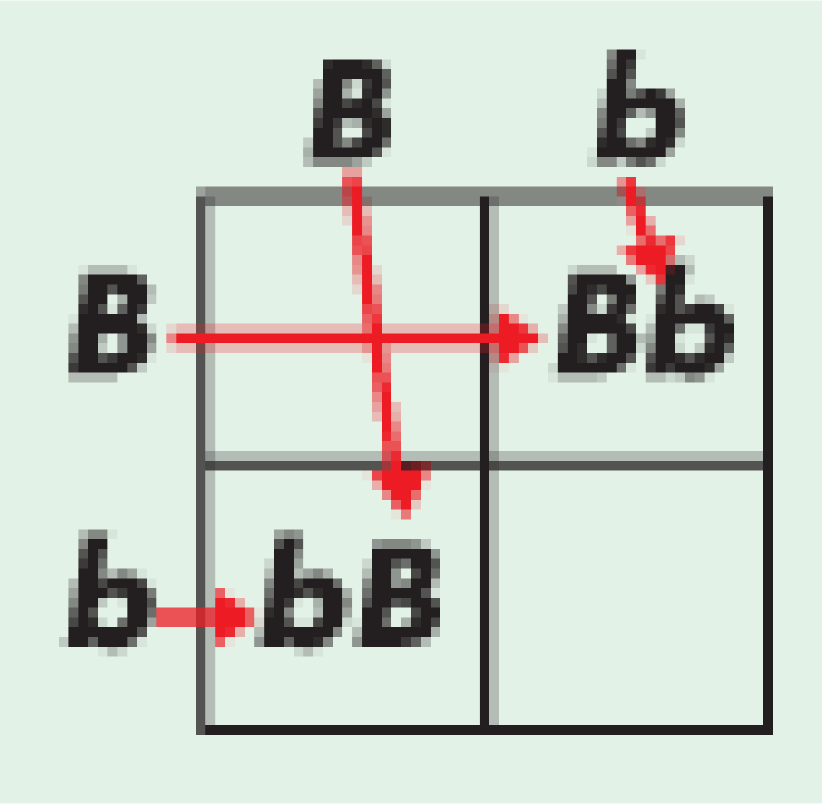
B b

Draw a table with enough spaces for each pair of gametes from each parent.

Enter the genotypes of the gametes produced by both parents on the top and left sides of the table.



Fill in the table by combining the gametes' genotypes.



	B	b
B	BB	Bb
b	Bb	bb

Determine the genotypes and phenotypes of each offspring.

Calculate the percentage of each. In this example, three fourths of the chicks will have large beaks, but only one in two will be heterozygous.

	B	b
B	BB	Bb
b	Bb	bb

Punnett Square for a Dihybrid Cross

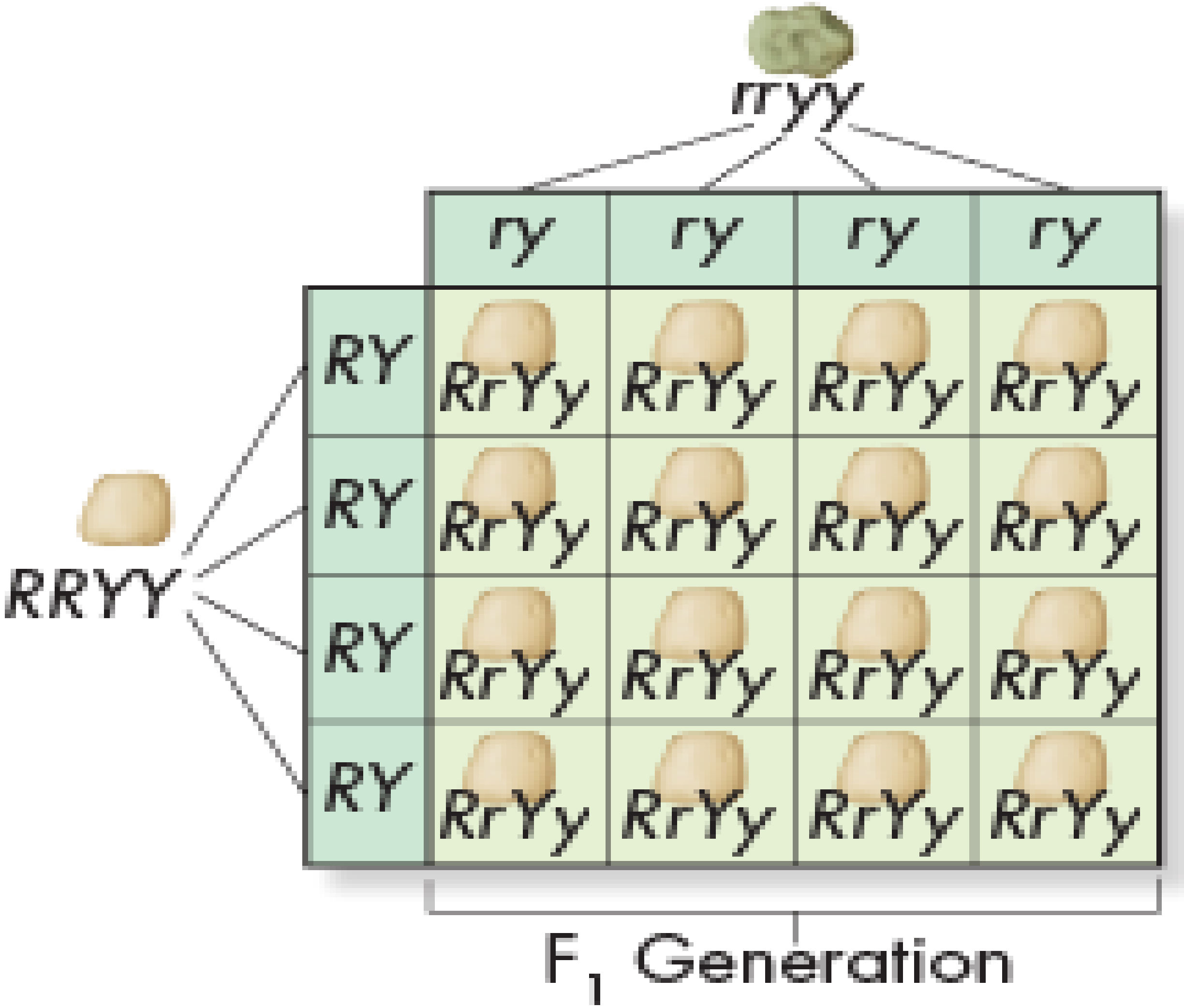
(Dihybrid cross traces 2 independently segregating genes.)

In this example we will cross true-breeding plants that produced only round yellow peas with plants that produced wrinkled green peas.

round yellow peas = *RRYY* **X** wrinkled green peas = *rryy*

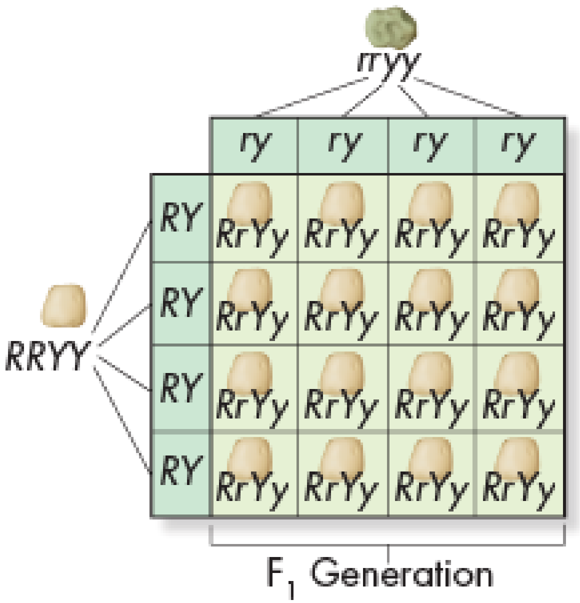
So R = round, r = wrinkled and Y = yellow, y = green

The Punnett square shows that the genotype of each F_1 offspring was *RrYy, heterozygous for both seed shape and seed color.*



The alleles for seed shape segregated independently of those for seed color.

Genes that segregate independently don't influence each other's inheritance.



Summary of Mendel's Principles

1. inheritance of biological traits is determined by genes, which are passed from parents to offspring.

2. ***Principle of Dominance -*** Where two or more forms (alleles) of the gene for a single trait exist, some alleles may be dominant and others may be recessive.

3. ***Principle of Segregation-*** In most sexually reproducing organisms, each adult has two alleles of each gene—one from each parent. These alleles segregate from each other randomly and independently when gametes are formed.

4. ***Principle of independent assortment*** states that genes for different traits can segregate independently during the formation of gametes.

Thomas Hunt Morgan and other biologists tested every one of Mendel's principles and learned that they applied not just to pea plants but to other organisms as well.

This branch of science is known as ***Mendelian Genetics***