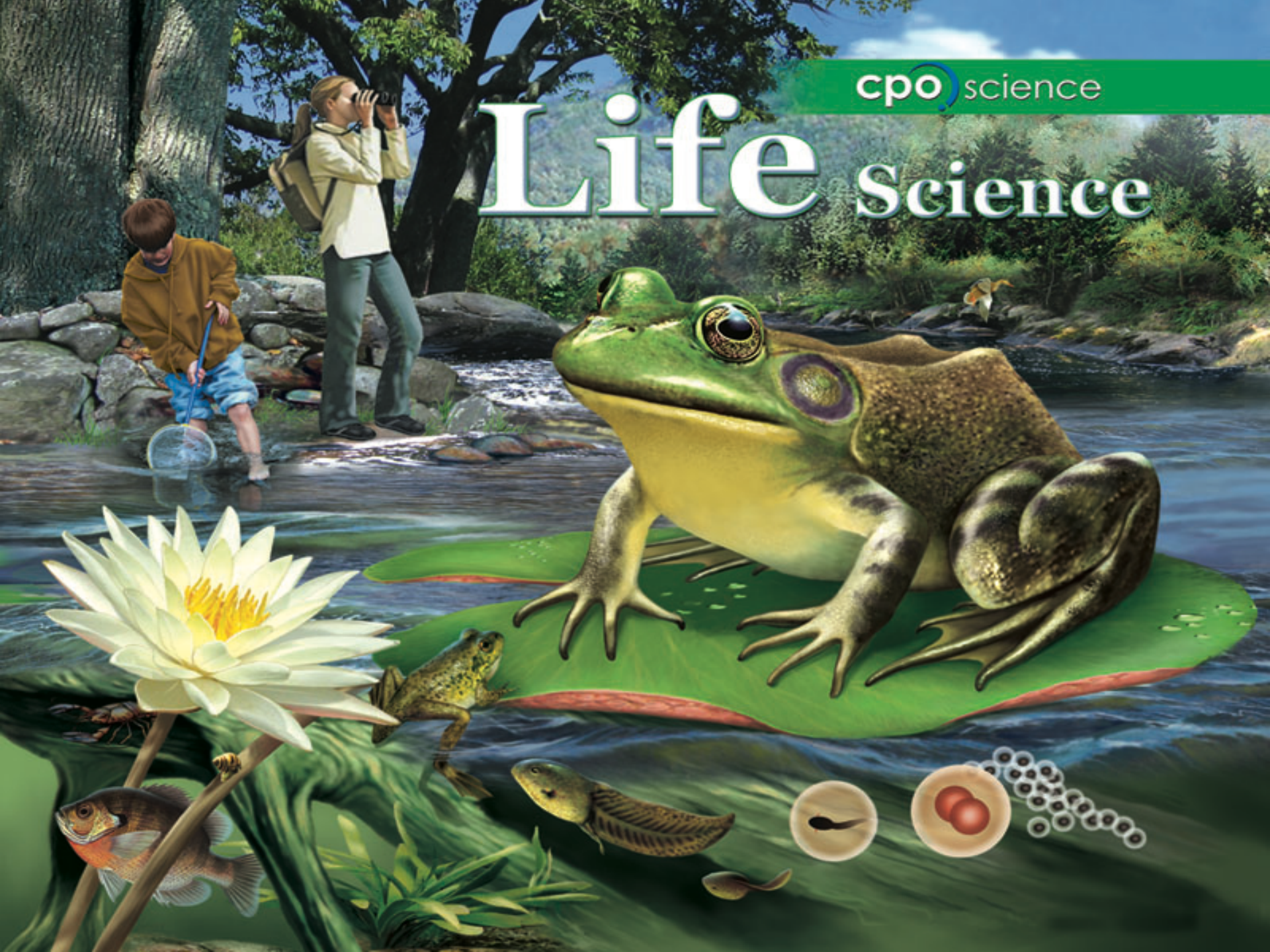


cpo science

Life Science





Traits,
Genes
&
Chromosomes

My
Family

UNIT
4

Genetics

A blue-tinted background image of a science laboratory. It shows various pieces of equipment including a microscope, a computer monitor, a keyboard, a globe, and several papers or charts on a desk.

Chapter Eleven: Heredity

- **11.1 Traits**
- **11.2 Predicting Heredity**
- **11.3 Other Patterns of Inheritance**

Investigation 11A

Observing Human Traits

- *How much do traits vary in your classroom?*

Thumb



Straight

Hitchhiker's

11.1 Traits

- A **trait** is a characteristic that an organism can pass on to its offspring.



What type of earlobe did you inherit from your parents?

11.1 Traits

- Dog breeders select certain traits to produce dogs for different purposes.



11.1 Heredity

- Ancient dog breeders thought that the **traits** inherited by a dog were a blend of those from the mother and father.
- An organism's **heredity** is the set of traits it receives from its parents.
- Today we know that heredity is not so simple.



11.1 Genetics







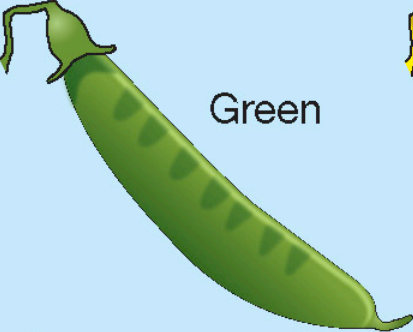
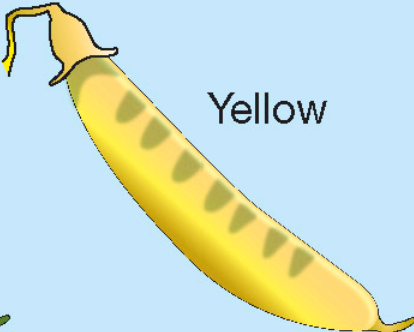
- **Genetics** is the study of heredity.
- A monk named Gregor Mendel was one of the first to experiment with heredity.
- He is often called the “Father of Genetics.”



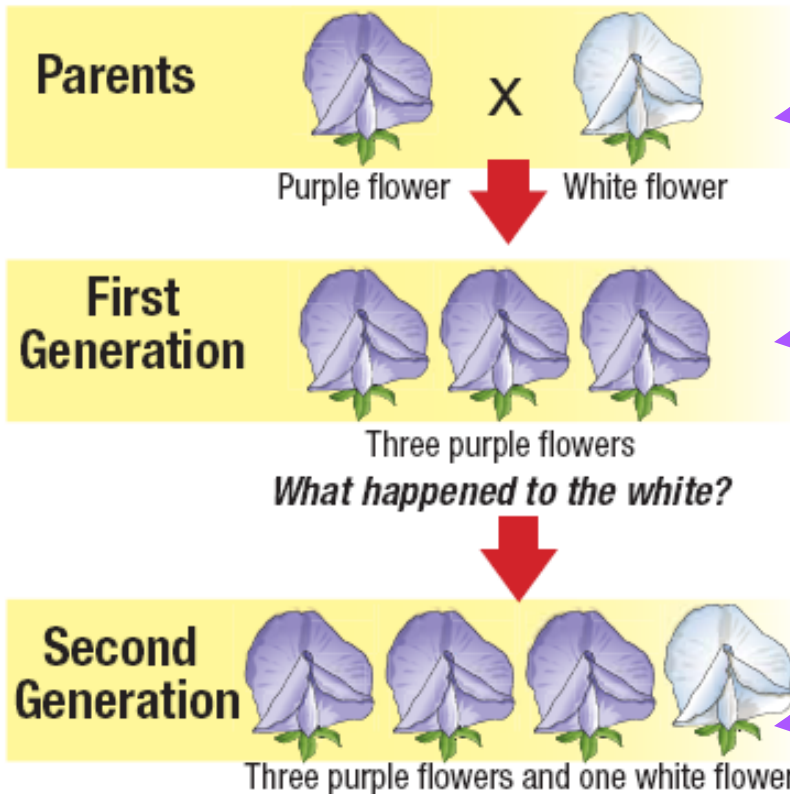
11.1 The priest and the pea

- Mendel carefully studied pea plants in the monastery garden.
- He noticed peas had 2 forms of a trait.
 - Flower color was **purple** or **white**
 - Seed shape was **smooth** or **wrinkled**
 - Seed color was **yellow** or **green**
 - Pod color was **green** or **yellow**

Four Traits in Pea Plants

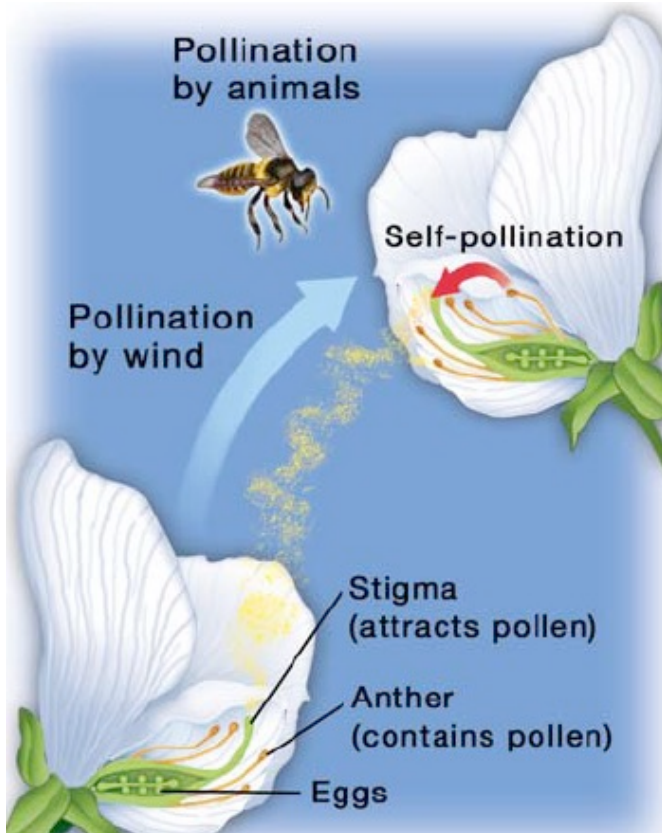
TRAIT	FORM 1	FORM 2
Flower color	 Purple	 White
Seed shape	 Smooth	 Wrinkled
Seed color	 Yellow	 Green
Pod color	 Green	 Yellow

11.1 The priest and the pea



- Mendel noticed that a trait from the parent pea plant did not always show up in the **offspring** (1st generation).
- Mendel wanted to find out why traits disappeared and then appeared again.

11.1 Pollination



- Flowering plants reproduce by **pollination**.
- During pollination, **pollen** from the male part of the plant is carried to the female part of the plant called the **ovule**.
- What are 3 ways pollen can be transferred?

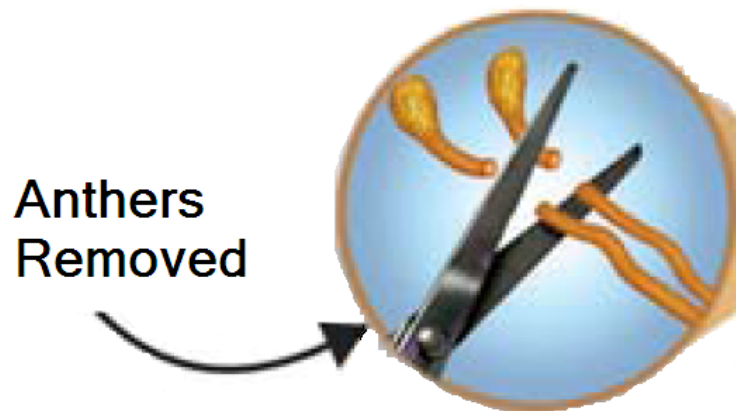
11.1 True Breeding Plants

- For his experiments, Mendel was careful to start out with true breeding parent plants.
- A true-breeding plant with **purple** flowers will only produce plants with **purple** flowers.



11.1 Cross-Pollination

- To better control his experiments, Mendel used a method called **cross-pollination**.
- The parts of the flower that contain pollen (the anthers) were removed so the flower could not **self-pollinate**.



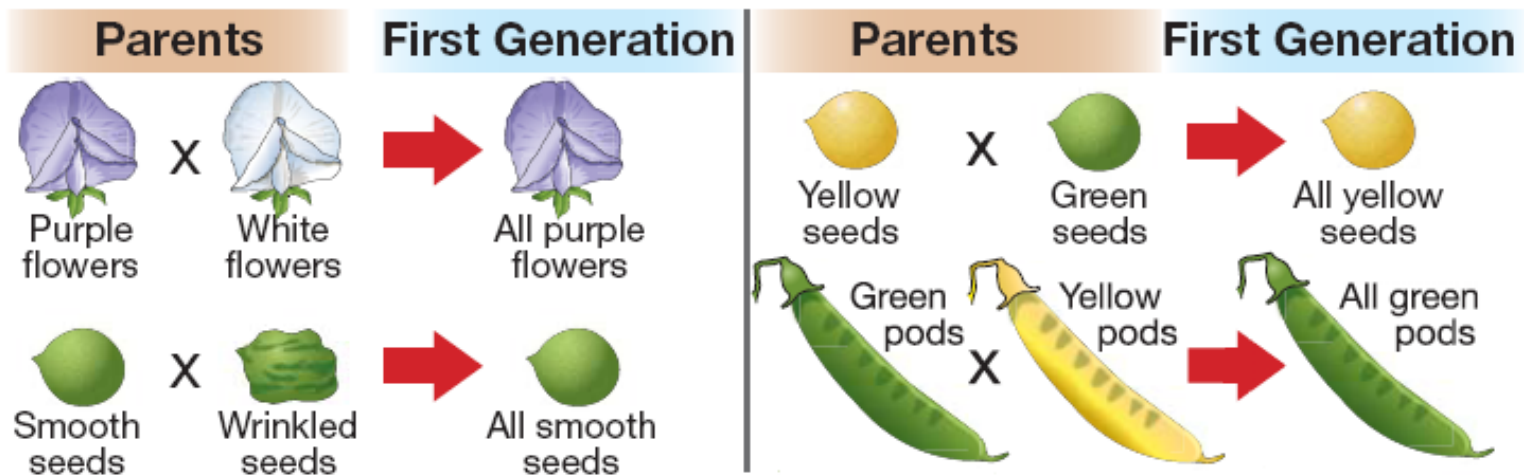
11.1 Cross-Pollination

- Then Mendel used pollen from true breeding plants with different traits to produce new combinations of offspring.



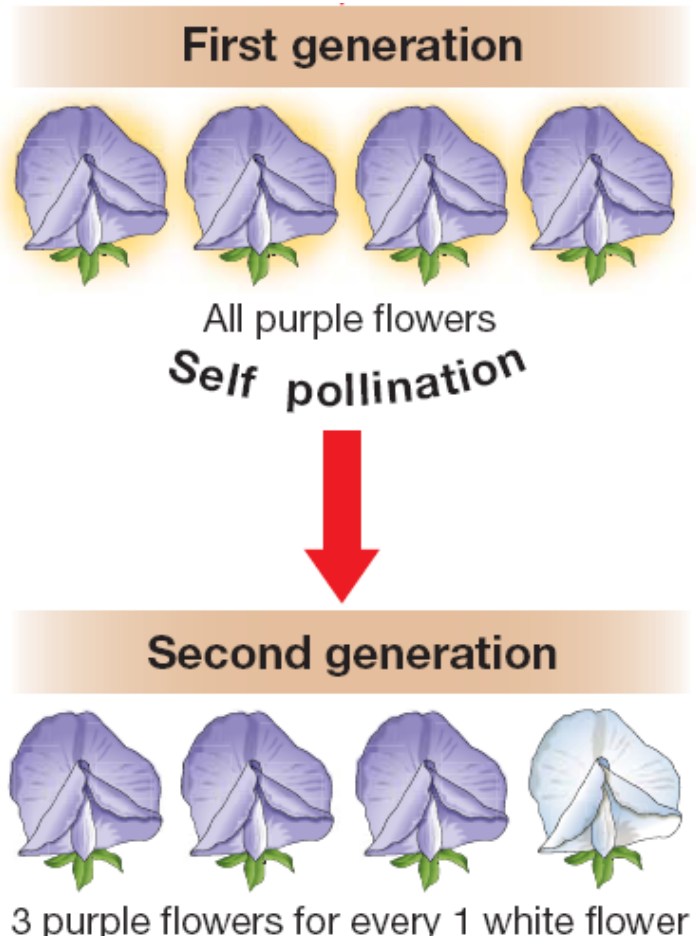
11.1 First Generation

- When Mendel crossed true-breeding, purple-flowered plants with true-breeding, white-flowered plants, the first generation produced **all** purple-flowered plants!
- Mendel got similar results for the other traits.



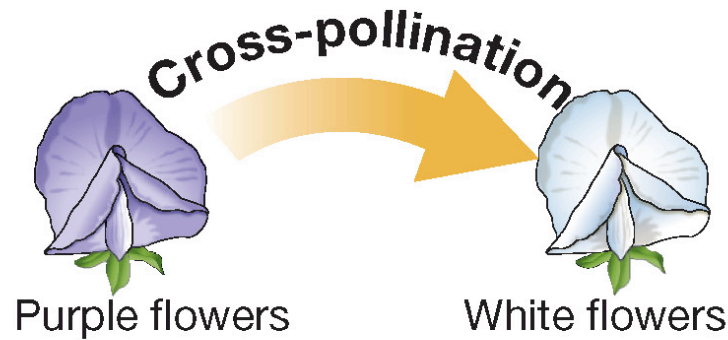
11.1 Second Generation

- When the purple-flowered plants of the offspring self-pollinated, white flowers reappeared in the second generation.
- Mendel was careful.
- How could this happen?

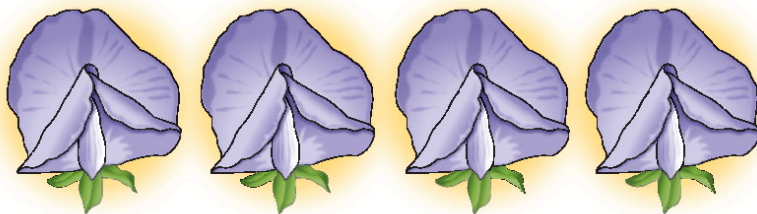


Pea Flower Crosses

Parent generation



First generation



All purple flowers

Self-pollination



Second generation



3 purple flowers for every 1 white flower
(3:1 ratio)

11.1 Ratios

- Mendel compared the number of purple to white flowers by counting them.
- A **ratio** is a way to compare two numbers.
- Here's how Mendel calculated the ratio of purple flowers to white flowers:

ratio symbol

$$705 \text{ purple} : 224 \text{ white} = \frac{705}{224} = \frac{(705 \div 224)}{(224 \div 224)} = \frac{3.15}{1} = 3:1$$

1. Write as a fraction

2. Divide top and bottom by the smallest number

3. Write as a ratio, rounded to the nearest whole number

11.1 Mendel's Conclusions

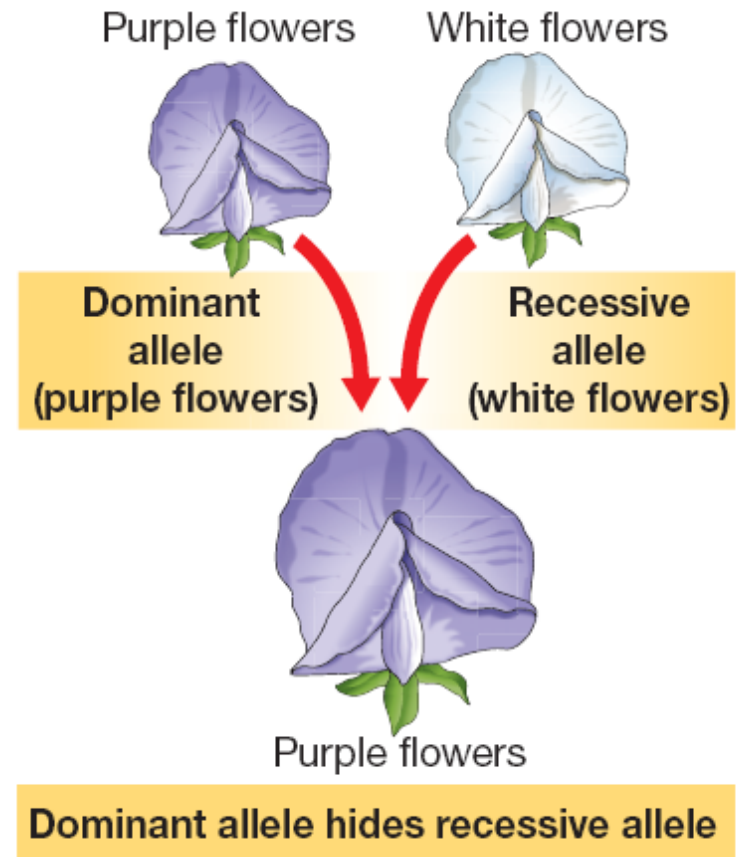
- From his results, Mendel proved that all traits do not blend in a 50/50 ratio.
- Pea plants preferred one trait over another in a ratio of about 3 to 1.
- Mendel concluded that pea traits like flower color were determined by **separate** units.
- Today, we call those units **genes**.

11.1 Dominant and Recessive Alleles

- We call the different forms of the same trait **alleles**.
- Mendel showed us that the **dominant allele** (purple flower) appears in peas more often and seems to “hide” the other form (white flower).
- A **recessive allele** is the form of a gene that gets hidden if the dominant allele is present.

11.1 Dominant and Recessive Alleles



- If **both** alleles for flower color get passed to the offspring, then the **dominant allele** that causes purple flowers hides the **recessive allele**.
- **No** white flowers show up in the next generation.





11.1 Genotype

- Mendel used letters to show how the different forms of a gene were passed to the next generation.
- Mendel discovered that a pea plant with purple flowers could have a genotype of either **PP** or **Pp**.
- A pea plant with white flowers could only have a genotype of **pp**.
- An organism's **genotype** shows the alleles of a gene it contains.



Flower color

	Genotype	Phenotype
 Purple (P)	PP	Purple
	Pp	Purple
 White (p)	pp	White



Seed shape

	Genotype	Phenotype
 Round (R)	RR	Round
	Rr	Round
 Wrinkled (r)	rr	Wrinkled

Seed color

	Genotype	Phenotype
 Yellow (Y)	YY	Yellow
	Yy	Yellow
 Green (y)	yy	Green

Pod color

	Genotype	Phenotype
 Green (G)	GG	Green
	Gg	Green
 Yellow (g)	gg	Yellow

11.1 Phenotype

- An organism's **phenotype** is the form of a trait that is visible.
- For flower color, a pea plant can show a phenotype of purple or white flowers.

purple phenotype



white phenotype

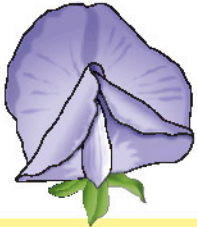


Flower Genotype/Phenotype

Parent generation



First generation



X



Genotype: **PP**

Genotype: **pp**

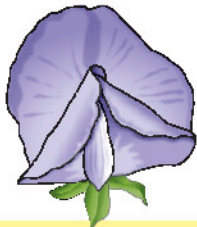
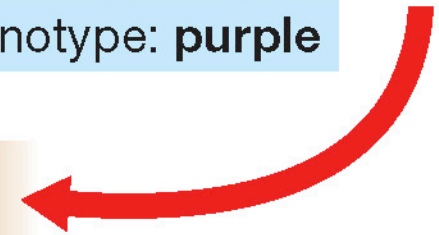
Genotype: **Pp**

Phenotype: **purple**

Phenotype: **white**

Phenotype: **purple**

Second generation



Genotype: **PP**

Genotype: **Pp**

Genotype: **pp**

Phenotype: **purple**

Phenotype: **purple**

Phenotype: **white**