

Chapter 12  
Mendel and Heredity



Section 1: Origins of Heredity

1. GENETICS is the science of heredity and the mechanism by which TRAITS are passed from parents to \_\_\_\_\_.

Mendel's Breeding Experiment

1. A monk named GREGOR JOHANN MENDEL lived in the 1800<sup>S</sup> in AUSTRIA.

2. What type of plant did Mendel experiment with? PEA PLANTS

3. Modern genetics is based on Mendel's explanation for the PATTERNS of heredity in garden pea plants.

4. What job did Mendel have? MENDEL WAS A PRIEST AND A TEACHER.

5. What does cross mean? TO MATE OR BREED TWO INDIVIDUALS

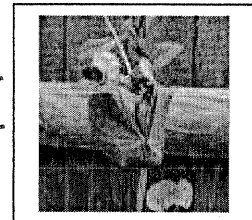
6. What two flower colors did Mendel experiment with? PURPLE AND WHITE

7. What color were the offspring flowers when Mendel crossed a purple flower and a white flower? PURPLE

8. What color were the offspring flowers when Mendel crossed two of these purple flowers?  
SOME PURPLE AND SOME WHITE

9. Review Figure 1. How did Mendel control the fertilization of flowering plants?

- MALE PARTS WERE REMOVED FROM THE FIRST FLOWER
- POLLEN IS TAKEN FROM MALE PARTS OF SECOND FLOWER
- POLLEN FROM SECOND FLOWER IS BRUSHED ONTO THE FEMALE PARTS OF THE FIRST FLOWER



Features of Pea Plants

1. Why was the garden pea plant a good subject for studying heredity? PLANTS HAVE CONTRASTING TRAITS, USUALLY SELF-POLLINATE, AND GROW EASILY.

2. What are characters? PHYSICAL FEATURE THAT IS INHERITED (EX: EYE COLOR)

3. What is a trait? ONE OF SEVERAL POSSIBLE FORMS OF A CHARACTER (EX: BLUE, BROWN)

4. What is a hybrid? THE OFFSPRING THAT RESULTS IN THE CROSS OF TWO DIFFERENT TRAITS.





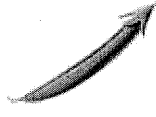





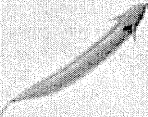
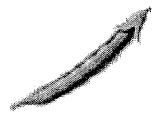
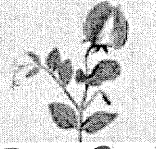

5. How can one plant fertilize itself? EACH FLOWER HAS BOTH MALE AND FEMALE PARTS

6. What type of pollination occurs between two different plants? CROSS-FERTILIZATION

7. What is the male reproductive cell of a plant called? POLLEN

8. How did Mendel assure that some plants would not self-pollinate? HE REMOVED THE MALE PARTS

9. Use Figure 2 from the book to complete the chart below.

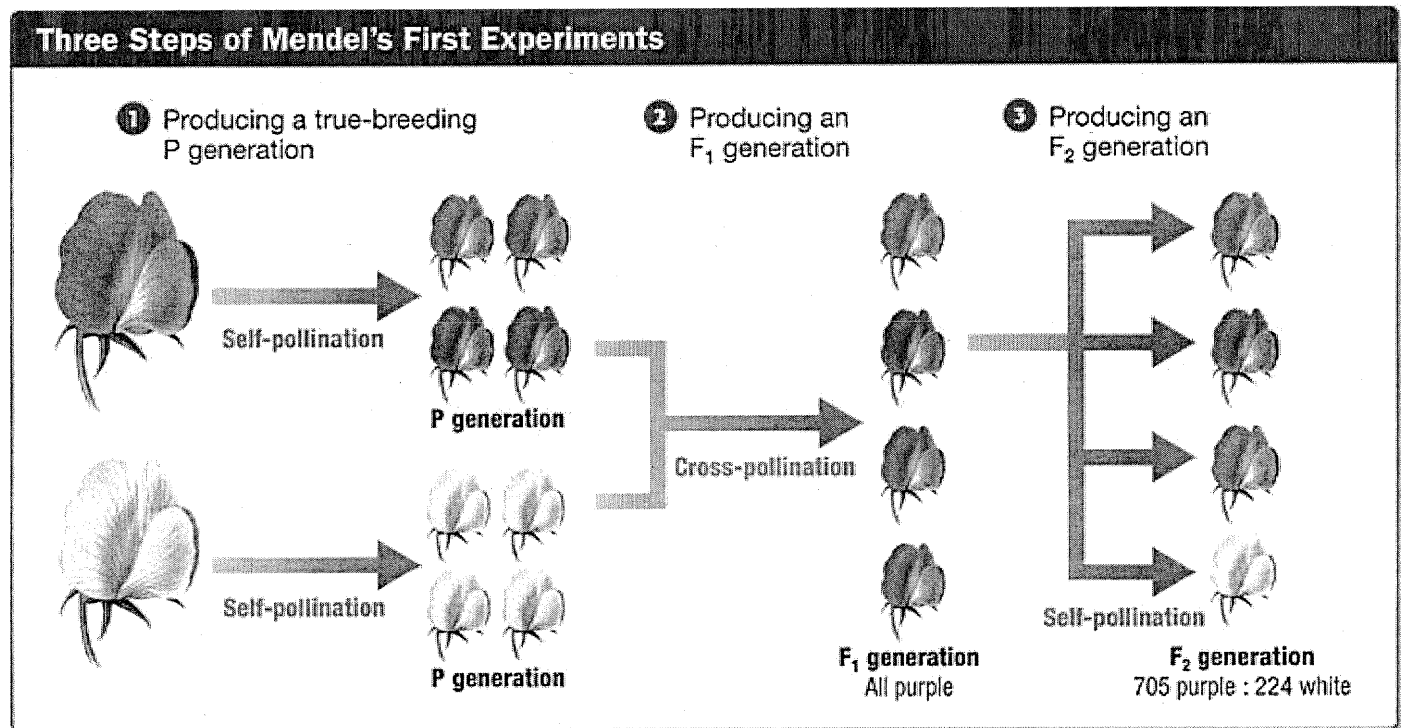
Seven Characters with Contrasting Traits Studied by Mendel						
Flower color	Seed color	Seed shape	Pod color	Pod Shape	Flower position	Plant height
 PURPLE	 YELLOW	 ROUND	 GREEN	 SMOOTH	 MID-STEM	 TALL
 WHITE	 GREEN	 WRINKLED	 YELLOW	 BUMPY	 END OF STEM	 SHORT

### Mendel's First Experiment

→ FLOWER COLOR: PURPLE VS. WHITE

1. What is being studied in a monohybrid cross? ONE PAIR OF CONTRASTING TRAITS
2. What is a generation? A GROUP OF OFFSPRING FROM A GIVEN GROUP OF PARENTS

→ Figure 3 and page 269 to answer the questions that follow the figure.



Why did Mendel allow the parent generation to self pollinate for several generations?

TO ENSURE THAT EACH PLANT ALWAYS PRODUCED OFFSPRING OF THE SAME TYPE.

4. If a true breeding purple flowered pea plant self pollinates, what color are the offspring? PURPLE
5. What did Mendel call the first generation of plants? PARENT GENERATION
- When Mendel crossed two parent plants, what did he call the first generation of offspring? F<sub>1</sub> GENERATION
7. What color were the flowers from the F<sub>1</sub> generation? All Purple
8. When Mendel allowed the F<sub>1</sub> generation to pollinate, what did he call the offspring? F<sub>2</sub> GENERATION
9. What color were the flowers from the F<sub>2</sub> generation? SOME PURPLE AND SOME WHITE
10. In the F<sub>2</sub> generation, 705 plants had purple flowers and 224 plants had white flowers.

### Ratios in Mendel's Results

1. When the number of purple and white flowering plants were counted and the ratio reduced, the reduced ratio was 3 : 1.
2.  (True or False) Mendel found a 3:1 ratio for all contrasting traits that he studied.

### Quick Lab (top of p. 270)

Use a calculator to reduce the ratios of each characteristic. Divide the big number by the little number!

Character	Traits in F <sub>2</sub> Generation		Ratio	Reduced Ratio
Flower Color	705 Purple	224 White	705:224	$705 \div 224 = 3.15$ * 3.15:1.00
Seed Color	6,022 Yellow	2,001 Green	6,022:2,001	$6,022 \div 2,001 =$ <u>3.00 : 1.00</u>
Seed Shape	5,474 Round	1,850 Wrinkled	5,474:1,850	<u>2.96 : 1.00</u>
Pod Color	428 Green	152 Yellow	428:152	<u>2.82 : 1.00</u>
Pod Shape	882 Smooth	299 Bumpy	882:299	<u>3.85 : 1.00</u>
Flower Position	651 Mid-stem	207 End of stem	651:207	<u>3.14 : 1.00</u>
Plant Height	787 Tall	277 Short	787:277	<u>2.84 : 1.00</u>

## Section 2: Mendel's Theory

### Explaining Mendel's Results

- What does Mendel's Theory of Heredity explain about patterns of inheritance? TWO OF SEVERAL VERSIONS OF A GENE COMBINE AND RESULT IN ONE OF SEVERAL POSSIBLE TRAITS.
2. Are the traits of the offspring a blend of the parent traits? No
3. What is an allele? EACH DIFFERENT VERSION OF A GENE (EX: GENE FOR EYE COLOR → BROWN EYE ALLELES ? BLUE EYE ALLELES)
4. What were the two alleles used to represent flower color in pea plants (what colors)? PURPLE ? WHITE
5. Read through Figure 4. What letter was used to represent the yellow seed color allele? Y green? y
6. How many alleles for a trait pass into a gamete (reproductive cell) when it is formed? 2
7. When two different alleles are passed to the offspring, the one that is expressed or "wins" is called the DOMINANT trait. The allele that is not expressed is called the RECESSIVE trait.
8. Use the quick lab from the previous page to predict what traits are dominant.

Character	Traits in F2 Generation		Dominant Trait	Recessive Trait
Flower Color	705 Purple	224 White	Purple	White
Seed Color	6,022 Yellow	2,001 Green	YELLOW	GREEN
Seed Shape	5,474 Round	1,850 Wrinkled	ROUND	WRINKLED
Pod Color	428 Green	152 Yellow	GREEN	YELLOW
Pod Shape	882 Smooth	299 Bumpy	SMOOTH	BUMPY
Flower Position	651 Mid-stem	207 End of stem	MID-STEM	END OF STEM
<input type="checkbox"/> Plant Height	787 Tall	277 Short	TALL	SHORT

## Random Segregation of Alleles

1. During Meiosis (formation of gametes) only one allele for each trait is passed to the offspring. Which allele goes into which gamete is completely RANDOM.

2. What is stated in the Law of Segregation? WHEN AN ORGANISM PRODUCES GAMETES, EACH PAIR OF ALLELES IS SEPERATED AND EACH GAMETE HAS AN EQUAL CHANCE OF RECEIVING EITHER ONE OF THE ALLELES.

## Mendel's Findings in Modern Terms

1. What type of letter is used to represent the dominant allele? CAPITAL

2. How is this letter determined? IT IS THE FIRST LETTER OF THE DOMINANT TRAIT

3. What letter is used to represent the dominant purple flower color in pea plants? P

4. What type of letter is used to represent the recessive allele? LOWER CASE

5. How is this letter determined? LOWER CASE VERSION OF DOMINANT LETTER

6. What letter is used to represent the recessive white flower color in pea plants? p

7. What is an organism's genotype? THE SET OF ALLELES THAT AN ORGANISM HAS FOR A CHARACTER (EX: PP, Pp, OR pp); TYPE OF GENES

8. What is an organism's phenotype? THE TRAIT THAT RESULTS FROM A SET OF ALLELES (EX: IF Pp = PURPLE); PHYSICAL APPEARANCE

9. If an organism is considered **homozygous** for a trait, they have two of the SAME alleles for that trait.

10. If an organism is considered **heterozygous** for a trait, they have two DIFFERENT alleles for that trait.

11. Use the vocabulary above to match the term with its definition.

d. genotype

a. an organism containing two different alleles for a trait

c. phenotype

b. a different form of a trait; we use letters to represent these

a. heterozygous

c. the physical appearance of a trait

e. homozygous

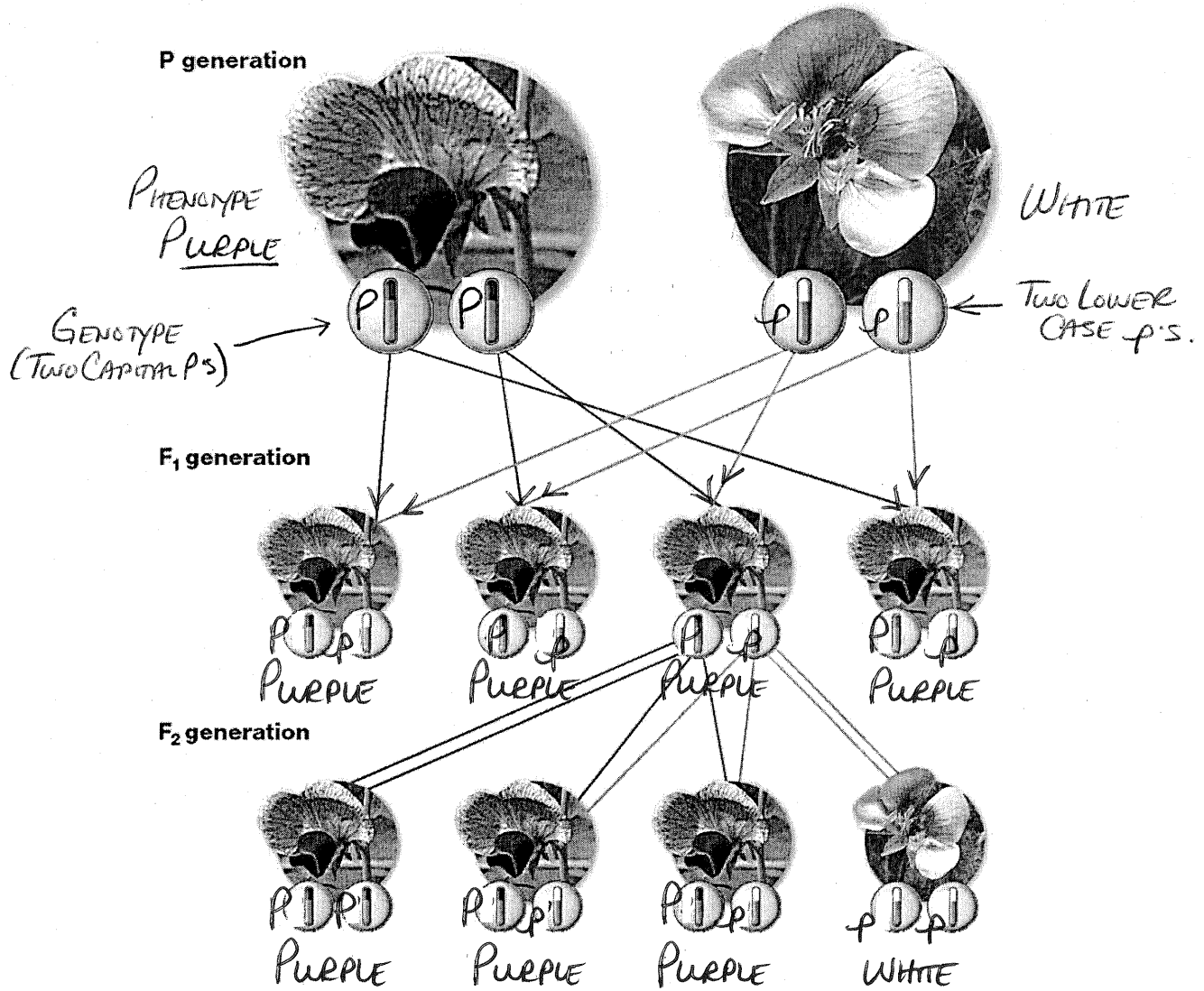
d. the type of genes an organism has; two alleles

b. allele

e. an organism containing two of the same alleles for a trait

Label Figure 5 with the following information:

- Genotype (two allele letters) for each flower.
- Determine if the flower's genotype is heterozygous or homozygous.
- Phenotype (physical appearance/color) for each flower.



### Mendel's Second Experiment

1. A dihybrid cross involves TWO characters at the same time such as seed COLOR and seed SHAPE.
2. What is stated in Mendel's Law of Independent Assortment? DURING GAMETE FORMATION, THE ALLELES FOR EACH GENE SEGREGATE INDEPENDENTLY.
3. If a pea plant has yellow seeds which is dominant, will it always have purple flowers which is also dominant? No
4. If a gene is close to another gene on a chromosome it is said to be LINKED. Linked genes are rarely separated during gamete formation.