

5.1 Understanding Inheritance

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Gregor Mendel (1822-1884)

- Known as the “_____ of Genetics”
- Austrian monk
- He explored patterns of inheritance by crossbreeding thousands of pea plants and carefully recording the offspring’s traits

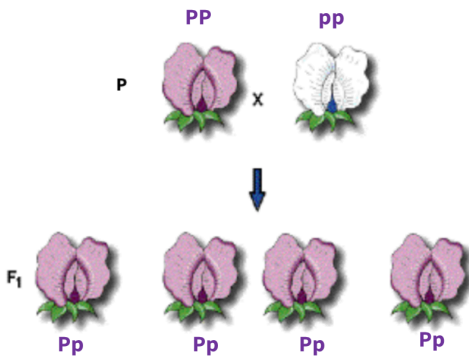
FLOWER COLOR	Purple	White
FLOWER POSITION	Axial	Terminal
SEED COLOR	Yellow	Green
SEED SHAPE	Round	Wrinkled
POD SHAPE	Inflated	Constricted
POD COLOR	Green	Yellow
STEM LENGTH	Tall	Dwarf

Mendel’s Garden Pea Plant Why did he choose to use peas?

- Pea plants are easy to grow, _____, have a short generation time, easily self-fertilized or cross fertilized*, and only have two _____ per characteristic
- Mendel performed his experiments on seven hereditary characteristics of pea plants.

The Results of Mendel’s True-Breeding Crosses

- Mendel cross fertilized true-breeding plants, which differed in only one characteristic. These were the _____, or P generation plants.
- Offspring of the P generation were called the first _____ generation (F₁ generation)

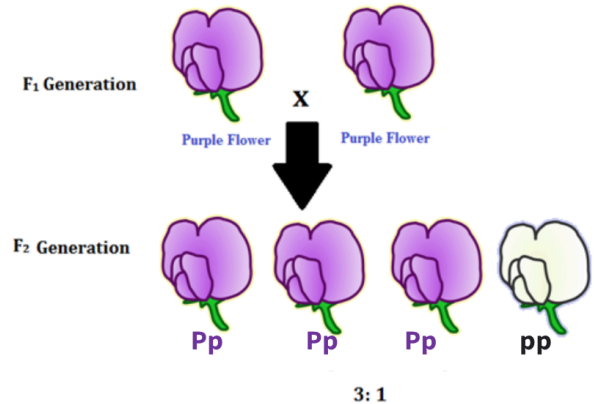


The Results of Mendel’s True-Breeding Crosses

- Only one form of the trait (purple) was expressed in all offspring produced (F₁ generation)

What would happen if the flowers in the F₁ generation self-fertilized?

- Mendel tested this out and observed something surprising!
- The white flower trait (that was hidden in the F₁ generation) _____ in the F₂ generation!
- Notice that the colours (phenotypes) of the offspring appear in a 3:1 ratio.



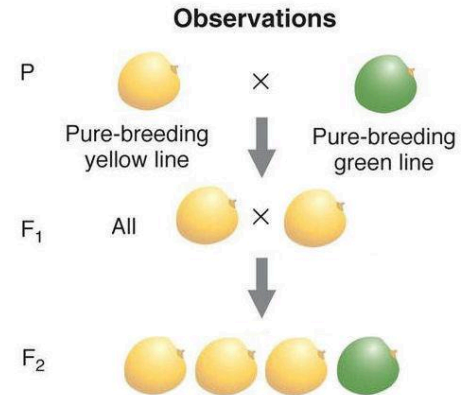
His Hypothesis - Dominance/Recessive

- Mendel hypothesized that the trait appearing in the F₁ generation was _____.
- **Dominant allele:** the allele that, if present, is _____ expressed.

- Therefore, allele for purple flower colour is dominant (P)
- Allele for _____ flower colour is **recessive** (p)
 - The recessive trait began to show up in the F₂ generation in a **3(dominant):1(recessive)** ratio

When crossing purebreds for different traits he made similar observations...

- F₁ offspring would always show the dominant form of the trait
- Ratio of phenotypes in F₂ offspring was always _____ (dominant:recessive phenotypes)
- Which form of the trait is dominant? _____
- In what ratio does it appear in the F₂ generation? _____

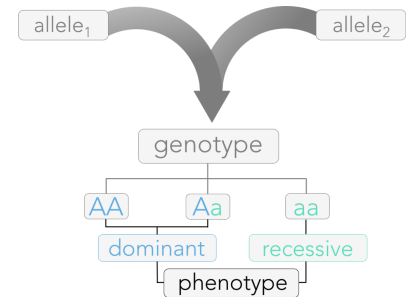


Representing Alleles

- Alleles are represented using upper-case and lower-case letters
- **Dominant allele:** upper-case letter (usually _____ with the trait)
- _____ **allele:** lower-case (letter as dominant allele)

Genotype and Phenotype

- **Genotype:** the combination of _____ for any given trait
 - E.g: PP, Pp, pp
- **Phenotype:** an individual's outward _____ with respect to a specific characteristic.
 - E.g. purple flowers, white flowers



Genotype cannot always be determined by observing phenotype...

- If you saw a purple flower you could not know for sure what its genotype is (either FF or Ff)

Example: purple flower colour is represented by 'P' and white flower colour is represented by 'p'

Three possible allele combinations:

1. PP → purple flowers
2. Pp → _____ flowers
3. pp → white flowers

How Traits are Determined

- The form of trait that is expressed depends on which allele was inherited from each _____.
- If _____ dominant allele(s) is present, the dominant form of the trait will be expressed; dominant alleles hide recessive alleles.
- For a recessive trait to be expressed, two recessive alleles must be present.

Allele Combinations

- **Homozygous:** an organism that has two of the same alleles for a gene
 - PP = _____ dominant
 - pp = homozygous recessive

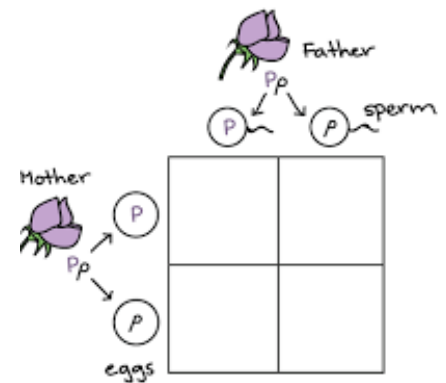
- **Heterozygous:** an organism that has two different alleles of a gene
 - Pp = _____ dominant

Practice Questions:

1. How would you represent...
 - a. the dominant allele for seed shape
 - b. The recessive allele for seed shape
2. What is the genotype of a plant that is homozygous dominant for plant height:
3. Genotype of a plant that is heterozygous for plant height:

Punnett Squares - Monohybrid Cross

- A monohybrid cross is a cross between two organisms with different variations at _____ genetic locus of interest.
- The _____ square is a square diagram that is used to predict the _____ of a particular cross or breeding experiment.



Law of Segregation

- Law of - a pair of factors (_____) are segregated, or _____, during the formation of gametes (meiosis)
- Organisms donate only one copy of each gene to their gametes because genes separate during _____ formation
- Therefore, when gametes fuse to form a zygote, the zygote gets one allele from the mother and one from the father



Practice - Monohybrid Cross

In guinea pigs, short hair is dominant over long hair. If a heterozygous short haired guinea pig is crossed with a long haired guinea pig, what are the possible genotypes and phenotypes of their offspring and the percent chance of each?

Genotype of parents: _____ X _____

Genotypes of offspring (with percents):

Phenotypes of offspring (with percents):

Probability: a measure of the chance an event will happen and can determine the outcomes without using a Punnett square.

- E.g: If one parent is homozygous dominant and the other parent is heterozygous for a trait
- a. 100% (or 1) of the first parent's gametes will receive the dominant allele.

- b. 50% ($\frac{1}{2}$) of the second parent's gametes will receive the dominant trait; 50% ($\frac{1}{2}$) will receive the recessive allele.

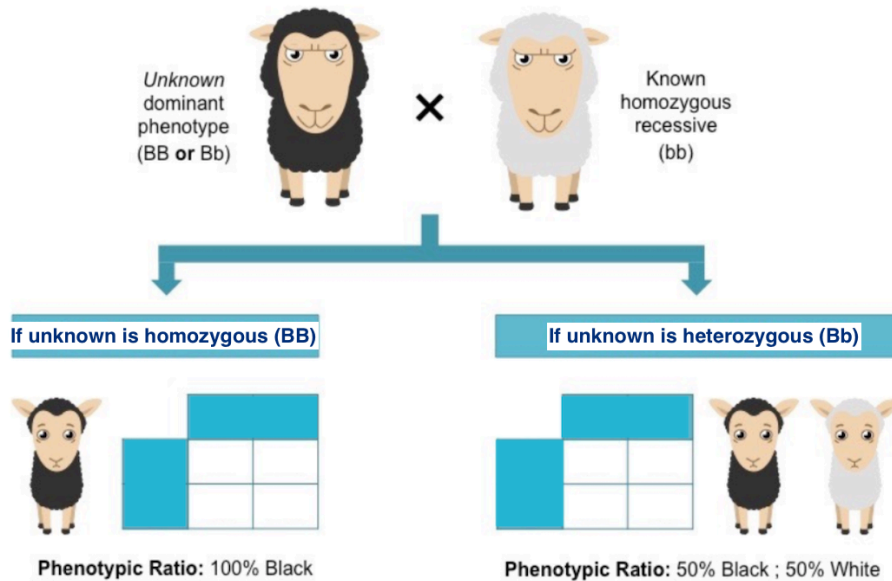
Therefore, if I want to predict how many offspring will be homozygous dominant, I can use the following:

- $1 \times \frac{1}{2} = \frac{1}{2}$ will be homozygous dominant
- $1 \times \frac{1}{2} = \frac{1}{2}$ will be heterozygous
- $0 \times \frac{1}{2} = 0$ will be homozygous recessive.

Test Cross

- A testcross is used to determine the genotype of an individual expressing a _____ trait.
- Determines if an individual is _____ dominant (e.g DD) OR _____ dominant (e.g Dd)
- Dominant individual is crossed with a homozygous _____ individual (dd).
 - If all offspring are dominant in phenotype
→ the unknown parent genotype is probably _____
 - If the offspring display both dominant and recessive phenotypes
→ the unknown parent is _____

Fill out the Punnett squares:



Practice - Test Cross

Use a testcross to find the genotype of the missing parent (DD or Dd).

The trait for dimples: having dimples (D), having no dimples (d)

Answer: The parent is _____ dominant.

	D	
d	Dd	dd
d	Dd	dd

Definitions

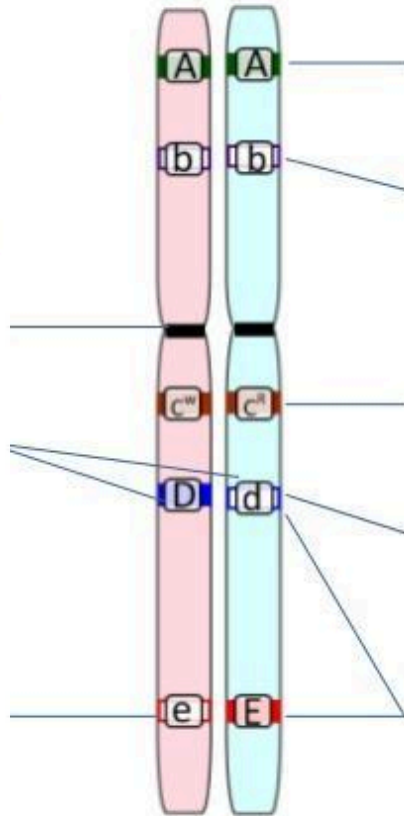
This image shows a pair of homologous chromosomes. Name and annotate the labeled features.

Genotype

The *combination of alleles* of a gene carried by an organism

Phenotype

The *expression of alleles* of a gene carried by an organism



 <http://sciencevideos.wordpress.com>

Homework: P. 193 #2, 5 (use chart), 6-10