



# Soybean Genetics



OSU EXTENSION  
4-H YOUTH DEVELOPMENT

Image: Image by [Charles Echer](#) from [Pixabay](#)

Look at the images below...

Parent 1



Parent 2



Offspring



Why does the offspring look like its parents?

Labrador Image: Image by [Doris Metternich](#) from [Pixabay](#)

Labrador Puppy: Image by [pascal OHLMANN](#) from [Pixabay](#)

Labrador In Grass: Image by [Armin Jung-Ertz](#) from [Pixabay](#)

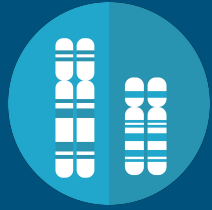
# Inheritance

Transmission of traits or information from one generation of individuals or cells to the next

Offspring inherit their “genes” from their biological parents.



Gene Icon: Image by [mcmurryjulie](#) from [Pixabay](#)

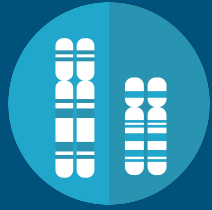


## Genes...

**Genes:** segments of DNA that code for a characteristic (trait).

- In sexually reproducing organisms, offspring inherit two sets of genetic information (one from a female gamete and one from a male gamete).

Genes Icon: Image by [mcmurryjulie](#) from [Pixabay](#)



## Genotype and Phenotype...

**Genotype:** the genetic makeup of an organism (the combination of genes/ alleles an individual possesses)

**Phenotype:** the physical, or expressed, traits of an organism

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**Note:** The expression of some traits are determined by the interactions of many genes together.  
Environmental factors can also affect the expression of traits.

Genes Icon: Image by [mcmurryjulie](#) from [Pixabay](#)



## Alleles...

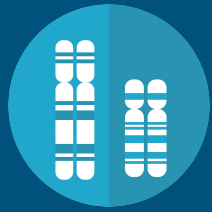
**Alleles** are variants of a gene. Alleles code for the same trait (ex. coat color) but may express different versions of it (ex: black coat, chocolate coat, red coat).



→ An individual inherits one allele from each biological parent.

Genes Icon: Image by [mcmurryjulie](#) from [Pixabay](#)

Dog Picture: Image by [Katrinbechtel](#) from [Pixabay](#)



## Alleles...

Alleles are either...

**Dominant**

**OR**

**Recessive**

**Dominant:** allele that is phenotypically (physically) expressed over another allele

**Recessive:** allele that is only expressed in the absence of a dominant allele

Genes Icon: Image by [mcmurryjulie](#) from [Pixabay](#)



## Alleles...

We label genes and alleles with letters of the alphabet.

- If the allele is dominant, use a capital letter.
- If the allele is recessive, use a lowercase letter.



Dominant: "C"

Black Lab



Recessive: "c"

Chocolate Lab

### Example:

Labrador Dog Coat Color could be labeled with a "C".

The allele for black coat is dominant: "C"

The allele for a chocolate coat is recessive: "c".

Genes Icon: Image by [mcmurryjulie](#) from [Pixabay](#)  
Chocolate Lab: Image by [Yinan Chen](#) from [Pixabay](#)  
Black Lab: Image by [Joshua Choate](#) from [Pixabay](#)



## Organisms are either homozygous or heterozygous...

- **Homozygous:** (same) inheriting two identical alleles for a gene.
- **Heterozygous:** (different) inheriting two different alleles for a gene.

### Example:

Labrador Dog Coat Color:

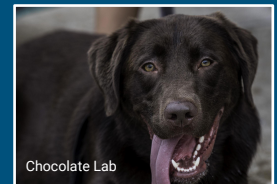
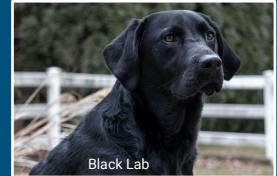
Black is dominant: "C" and Chocolate is recessive: "c".  
Each dog has two alleles for coat color (one from each parent).  
The inherited possibilities are as follows...

**Homozygous Dominant:** "CC"

**Homozygous Recessive:** "cc"

**Heterozygous:** "Cc"

★ **Remember:** a dominant allele is expressed over a recessive.



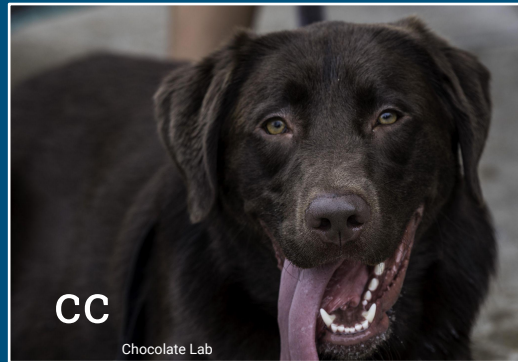
Genes Icon: Image by [mcmurryjulie](#) from [Pixabay](#)  
Chocolate Lab: Image by [Yinan Chen](#) from [Pixabay](#)  
Black Lab: Image by [Joshua Choate](#) from [Pixabay](#)

What are the possible genotypes of each dog below?

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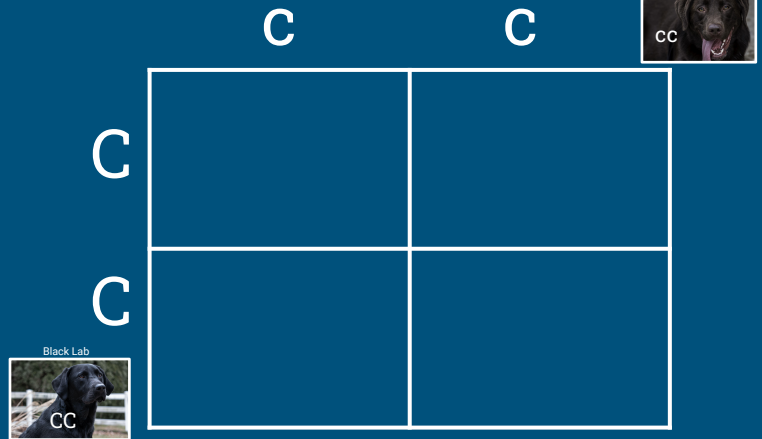
What are the possible genotypes of each dog below?



An organism's genotype determines their phenotype (outward expression of a trait).  
If a dominant allele is present, it will mask a recessive trait. Recessive traits only appear if both inherited alleles are recessive.

# Punnett Squares: a diagram to predict genotypes and phenotypes

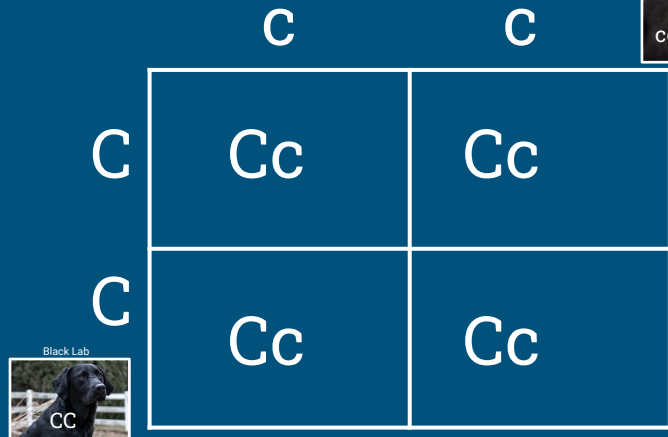
To set up a Punnett square, place the genotype of one parent along the side of the diagram, and the other along the top:



# Punnett Squares: a diagram to predict genotypes and phenotypes

To set up a Punnett square, place the genotype of one parent along the side of the diagram, and the other along the top:

Then fill in the possible combinations...



# Punnett Squares... a way to look at probabilities

What is the genotype ratio?

What is the phenotype ratio?

	C	C
C	Cc	Cc
C	Cc	Cc

Black Lab CC

Chocolate Lab CC

# Punnett Squares... a way to look at probabilities

What is the genotype ratio?

4/4 or 100% "Cc"

What is the phenotype ratio?

4/4 or 100% black coat

"C" is dominant



	C	C
C	Cc	Cc
C	Cc	Cc

# Incomplete Dominance:

In some instances, a dominant allele may not completely mask a recessive allele.

## Example:

Let's look at our labs again, but in this case we breed a lab to a poodle and are looking at the type of coat. Labs have a straight coat and poodles have a curly coat. However, when bred together the offspring can have either a straight coat, a curly coat, OR a wavy coat.



Labradoodle Puppy: Image by [Ariel White](#) from [Pixabay](#)  
Poodle: Image by [chili71](#) from [Pixabay](#)



Soybeans...

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What traits of the soybean plant do you think are inherited?

# Soybeans...



Soybeans, like dogs and humans, inherit two sets of genes. One from a female gamete and one from a male. They have many inherited traits, including:

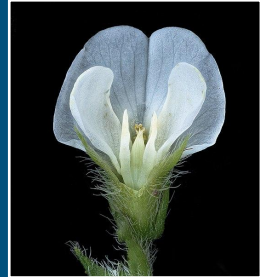
- Flower Color: color of the flower on a soybean plant
- Pod Color: color of the pod where seeds develop/mature
- Hilum Color: color of the spot where bean was attached to the pod
- Pubescence: hair color on the pod
- Abscission Layer: possible extra attachment on the hilum

We will focus on flower and pod color!



## Flower Color...

Flower color in soybeans varies from purple to white. Purple is dominant over white. Incomplete dominance can occur.  
**Purple= "W" and White= "w"**



White Flower:

[https://commons.wikimedia.org/wiki/File:Edamame,\\_side\\_shot,\\_plot\\_2\\_2020-07-28-15.12.35\\_ZS\\_copy\\_\(51494596963\).jpg](https://commons.wikimedia.org/wiki/File:Edamame,_side_shot,_plot_2_2020-07-28-15.12.35_ZS_copy_(51494596963).jpg)

Purple Flower: Image by [Julio César García](#) from [Pixabay](#)

Lavender Flower:

[https://commons.wikimedia.org/wiki/File:Soybean\\_full\\_flower\\_2021-07-16-14.08.54\\_ZS\\_PMax\\_UDR\\_\(51495083274\).jpg](https://commons.wikimedia.org/wiki/File:Soybean_full_flower_2021-07-16-14.08.54_ZS_PMax_UDR_(51495083274).jpg)



## Pod Color...

**Pod color in soybeans varies from black to tan**  
Black is dominant over tan. Incomplete dominance can occur.  
**Black= "L" and Tan= "l"**



Dark Soybean: Image by [Alex Norris](#) from [Pixabay](#)

Light Soybean: United Soybean Board:

[https://commons.wikimedia.org/wiki/File:Close-up\\_of\\_High\\_Oleic\\_Soybean\\_Pods\\_\(10872256815\).jpg](https://commons.wikimedia.org/wiki/File:Close-up_of_High_Oleic_Soybean_Pods_(10872256815).jpg) <https://creativecommons.org/licenses/by/2.0/deed.en>

Image by [Joao Batista Moraes de Oliveira JB](#) from [Pixabay](#)



## Knowledge Check:

Using your building bricks, create a soybean plant with the genotype:

**WW for flower color and LI for pod color.**

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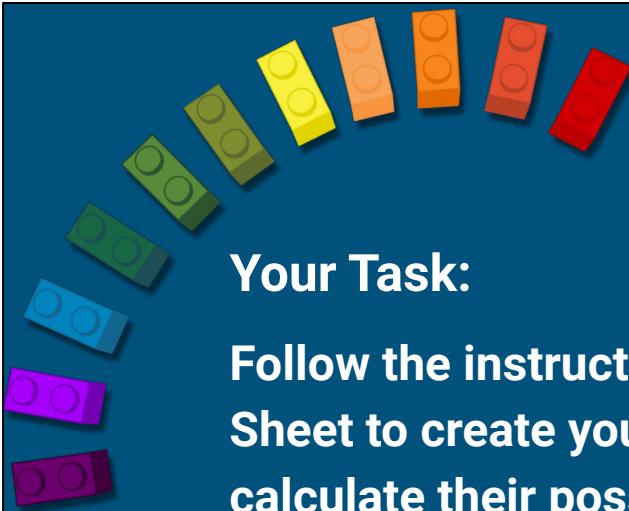
### Remember:

Flower Color: W = dominant (purple) and w = recessive (white)

Pod Color: L = dominant (black) and l = recessive (tan)

Incomplete dominance can occur with both traits.

Building Bricks: Image by [Emmie\\_Norfolk](#) from [Pixabay](#)



**Your Task:**

**Follow the instructions on your Brick Genetics Sheet to create your soybean plants and calculate their possible genotypes and phenotypes!**

Building Bricks: Image by [Emmie\\_Norfolk](#) from [Pixabay](#)