

Genetics: A Crash Course

Terminology:

Allele: A specific **form** of a gene. You can have an allele for blue eyes or green eyes for example.

Genotype: the specific alleles of an organism. (AS, Aa, etc.) (I.e. the genes)

Phenotype: the observable characteristics or traits of an organism.

Dominant allele: an allele that has the same effect on the phenotype whether it is present in the homozygous or heterozygous state.

Recessive allele: an allele that only has an effect on the phenotype when present in the homozygous state.

Co-dominant alleles: pairs of alleles that both affect the phenotype when present in a heterozygote.

Homozygous: having two identical alleles of a gene. (RR or rr)

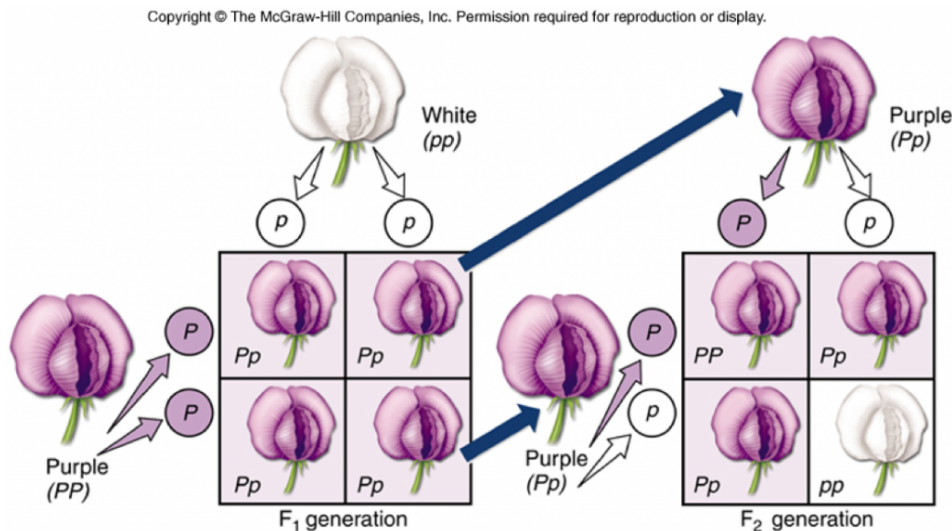
Heterozygous: having two different alleles of a gene. (Rr)

Mendel and the Basics:

- Animals and plants **inherit** one gene from each of their parents.
- This means each individual has **two copies of a gene for a single trait**. We call these copies **alleles**.
- **Gregor Mendel** (1822 -1884) was an Austrian Monk who studied pea plants. He noticed patterns in the **inheritance** of pea plants as he crossbred them.

Please answer the two questions below from the video: Gregor Mendel – Great minds.

- 1) What traits did Mendel observe in the pea plants?
- 2) What three important conclusions did Mendel come to when crossing the true breeding white and purple pea flower lines?



Pea Colour and Mendel:

Two Alleles – Y = Yellow peas, y = Green peas.

1. The genes for yellow peas are represented by a **capital Y**.

If a plant gets a Y from each parent, the genotype would be YY .

YY = Yellow Peas

2. The genes for green peas are represented by a **lower case y**.

If a plant gets a y from each parent, the genotype would be yy .

yy = Green Peas

3. What happens if a plant gets Y from one parent and a y from another parent?

Yy = Yellow Peas

This means that **Y** for yellow peas is **dominant** since it only needs one copy for that to be expressed!

Figuring out Inheritance

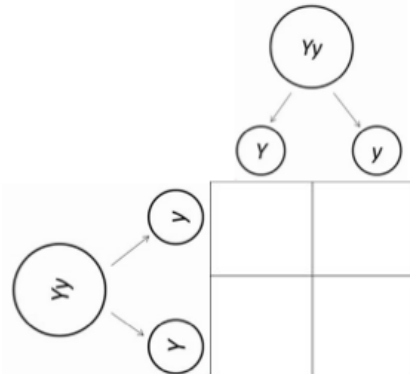
We can use a **punnet square** to figure out the potential **inheritance** from two parents!

Example:

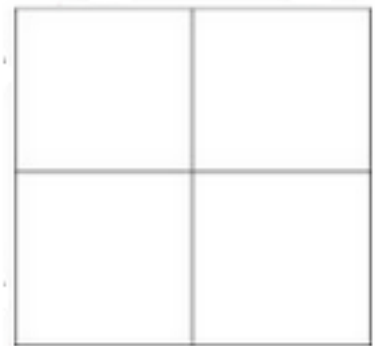
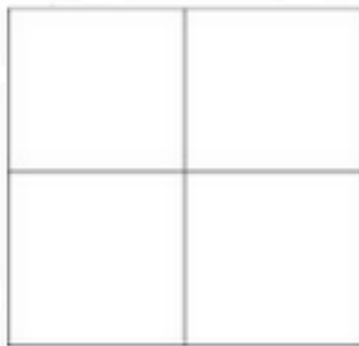
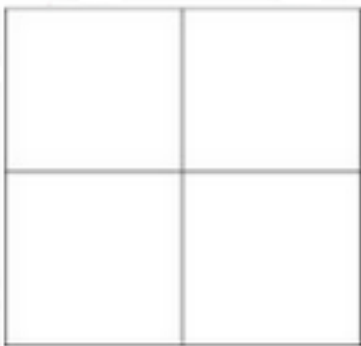
What happens if we cross two **heterozygous** yellow parents?

$Yy \times Yy$?

What are the possible outcomes for the parents?



Practice: Get a random **genotype** from Mr. Pletsch. Find **three different partners** and breed your pea plants for pea colour and complete a **punnet square**. Remember: YY = Yellow, Yy = Yellow, yy = Green since Yellow (Y) is dominant!



Genetics: Inheritance of Blood Types

- So far, we have only been considering two possibilities: dominant **A** and recessive **a**.
- **Two alleles (dom/rec) – three genotypes possible (AA, Aa, aa) and two phenotypes.**
- However, in reality there can be **three or more alleles for one gene.**

Human Blood Types have multiple alleles – A, B, O!

This makes our punnet squares a bit more difficult since there are more outcomes.

With Mendel's peas – we could have YY, Yy, yy.

With blood types – we could have AA, AO, BB, BO, AB, OO!

Another thing to consider – blood types show **co-dominance!** That both A and B are dominant and **both alleles are expressed!**

For example:

Mendel's Peas – Regular dominant/recessive

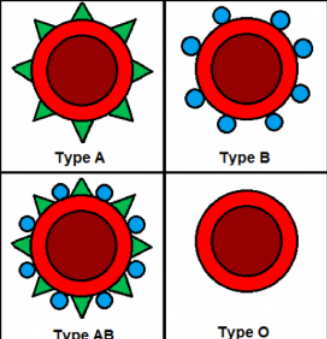
	Y	Y
y	Yy	Yy
y	Yy	Yy

100% of offspring will be Yy (Yellow Peas)

Human Blood Types - Codominance

	A	A
B	AB	AB
B	AB	AB

100% of Offspring will be AB blood type – both A and B antigens will be present!

	NOTE: A and B are <i>codominant</i> but O is <i>recessive!</i>
	<i>This leads to 4 blood types</i>
	<i>AA = Blood type A</i>
	<i>AO = Blood type A</i>
	<i>BB = Blood Type B</i>
	<i>BO = Blood Type B</i>
	<i>AB = Blood Type AB</i>
	<i>OO = Blood Type O</i>

Practice:

1. Finish the punnet squares below:

<table style="margin: auto;"><tr><td></td><td style="text-align: center;">A</td><td style="text-align: center;">O</td></tr><tr><td style="text-align: center;">B</td><td style="border: 1px solid black; width: 60px; height: 60px;"></td><td style="border: 1px solid black; width: 60px; height: 60px;"></td></tr><tr><td style="text-align: center;">B</td><td style="border: 1px solid black; width: 60px; height: 60px;"></td><td style="border: 1px solid black; width: 60px; height: 60px;"></td></tr></table> <p><i>Blood Types Possible:</i></p>		A	O	B			B			<table style="margin: auto;"><tr><td></td><td style="text-align: center;">A</td><td style="text-align: center;">O</td></tr><tr><td style="text-align: center;">B</td><td style="border: 1px solid black; width: 60px; height: 60px;"></td><td style="border: 1px solid black; width: 60px; height: 60px;"></td></tr><tr><td style="text-align: center;">O</td><td style="border: 1px solid black; width: 60px; height: 60px;"></td><td style="border: 1px solid black; width: 60px; height: 60px;"></td></tr></table> <p><i>Blood Types Possible:</i></p>		A	O	B			O			<table style="margin: auto;"><tr><td></td><td style="text-align: center;">O</td><td style="text-align: center;">O</td></tr><tr><td style="text-align: center;">A</td><td style="border: 1px solid black; width: 60px; height: 60px;"></td><td style="border: 1px solid black; width: 60px; height: 60px;"></td></tr><tr><td style="text-align: center;">B</td><td style="border: 1px solid black; width: 60px; height: 60px;"></td><td style="border: 1px solid black; width: 60px; height: 60px;"></td></tr></table> <p><i>Blood Types Possible:</i></p>		O	O	A			B		
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2. One parent has **blood type A** while the other parent has **blood type B**. They have a child with Blood type O. How is this possible? Use a punnet square to help you explain.