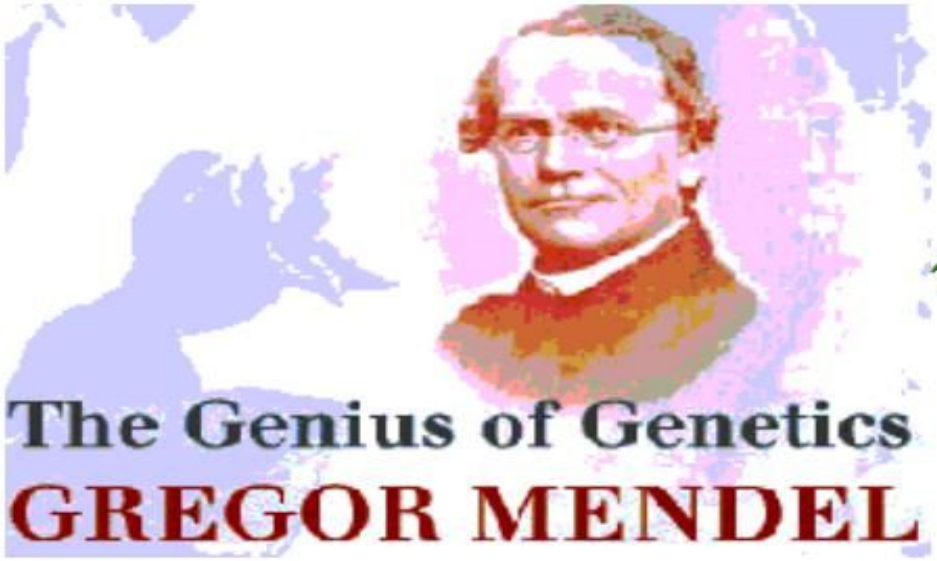
Mendelian Principles of heredity

Topic:
Mendelian Principles of heredity

Mendelian Genetics



- **Father of genetics : Gregor Mendal (1822-1884)**
- **William Bateson** Coins the Term **"Genetics**“in 1906.
- The word '**gene** coined by Danish botanist ***Willhelm Johannsen*** in 190 to describe fundamental physical and functional units of heredity


William Bateson


Johanson

Gregor Mendel

- He was born in 1822 in Austria.
- In 1854, Mendel began his classic experiments with the garden pea plant (*Pisum sativum)*.
- He discovered the law of heredity in plants and animals.
- He died in 1884 by a kidney disorder.


Site of Gregor Mendel's experimental garden in the Czech Republic

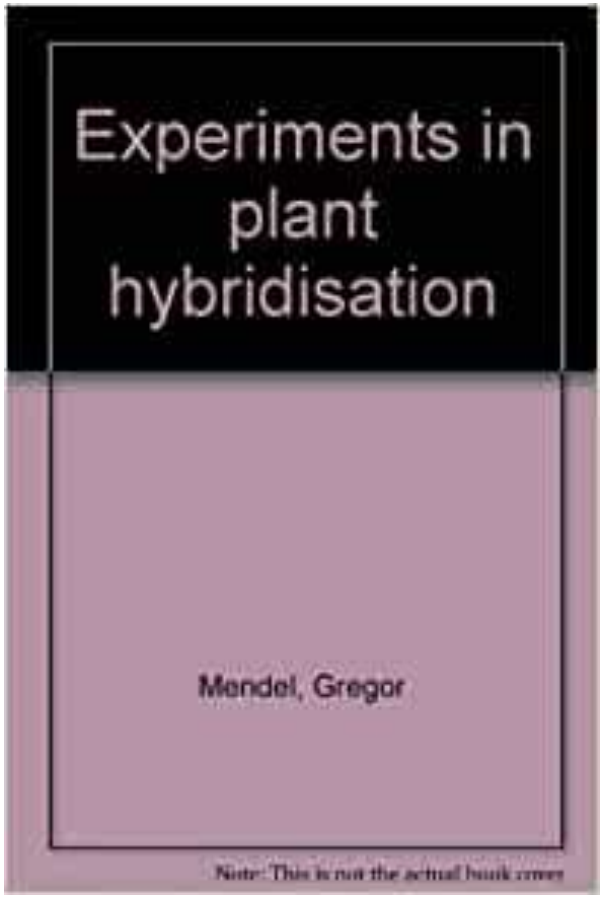
Why pea plants?

- **Easy to grow** in the garden.
- The flowers of pea plants are **hermaphrodite**, i.e flowers have bisexual characteristics.
- Easy to **obtain pure breed** plant through self-fertilization
- Have **7 pair of contrasting characters** (traits)
- Both tyes of pollination can be done- **Self and cross**
- Pea plant **generates large number of seed** for each generation
- They have excellent disease resistance and have an optimal rate of survival.

Mendel found seven contrasting traits in the peas/pea plants

	Height	Seed Shape	Seed Color	Seed Coat Color	Pod Shape	Pod Color	Flower Position
Dominant	 T	 R	 Y	 C	 I	 G	 A
	Tall	Round	Yellow	Green	Inflated (full)	Green	Axial
Recessive Trait	 t	 r	 y	 c	 i	 g	 a
	Short	Wrinkled	Green	White	Constricted (flat)	Yellow	Terminal

Mendel conducted hybridization experiments on garden pea (Pisum sativum) for eight years (1856-1863).



Experiments on Plant Hybridization " written in 1865 and published in 1866 **by Gregor Mendel**,
Considered to be **the founder of modern genetics.**

Mendel experiments

Mendel conducted 2 main experiments to determine the laws of inheritance. These experiments were:

- **Monohybrid Cross Experiment**
- **Dihybrid Cross Experiment**

While experimenting, Mendel found that **certain factors were always being transferred down to the offspring** in a stable way. Those factors are now called genes i.e. **genes** can be called the **units of inheritance**.

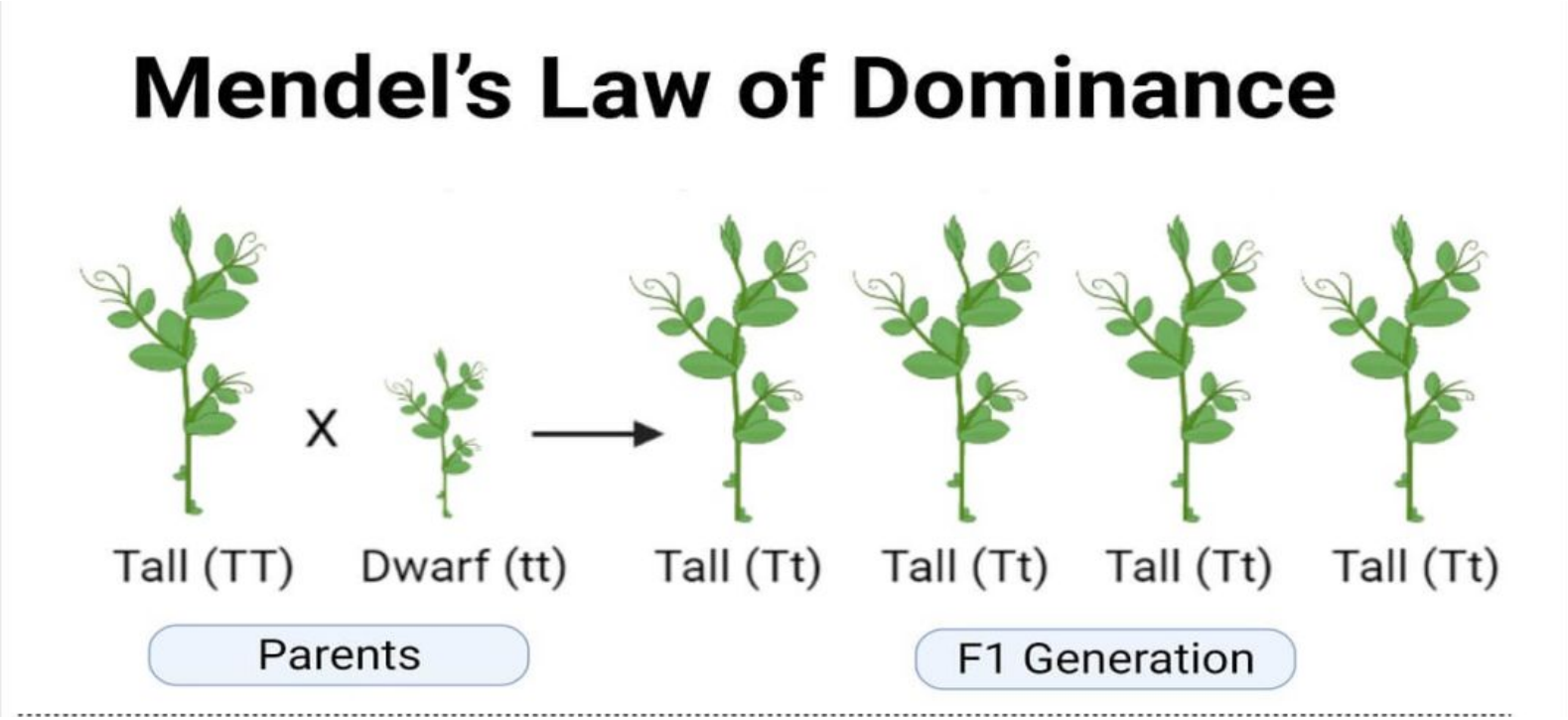
The two experiments lead to the formulation of Mendel's laws known as laws of inheritance which are:

- **Law of Dominance**
- **Law of Segregation**
- **Law of Independent Assortment**

1. Law of Dominance

When two alleles of an inherited pair is heterozygous, then, the allele that is expressed is dominant whereas the allele that is not expressed is recessive.

Dominant alleles suppress the effect of the recessive alleles



Law of Segregation

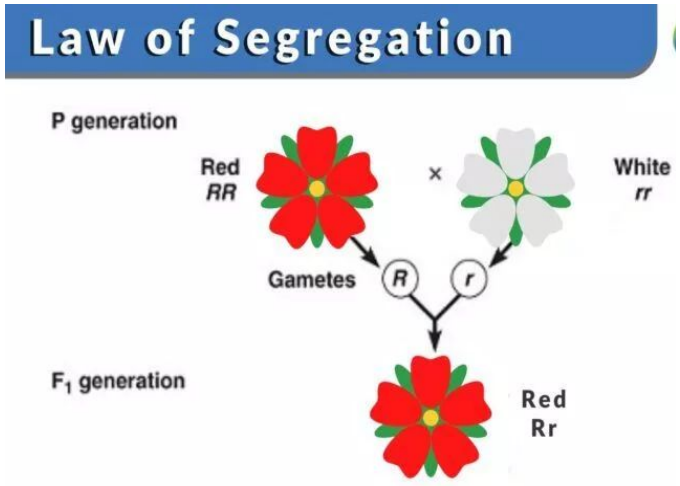
Mendel's law of segregation states that:

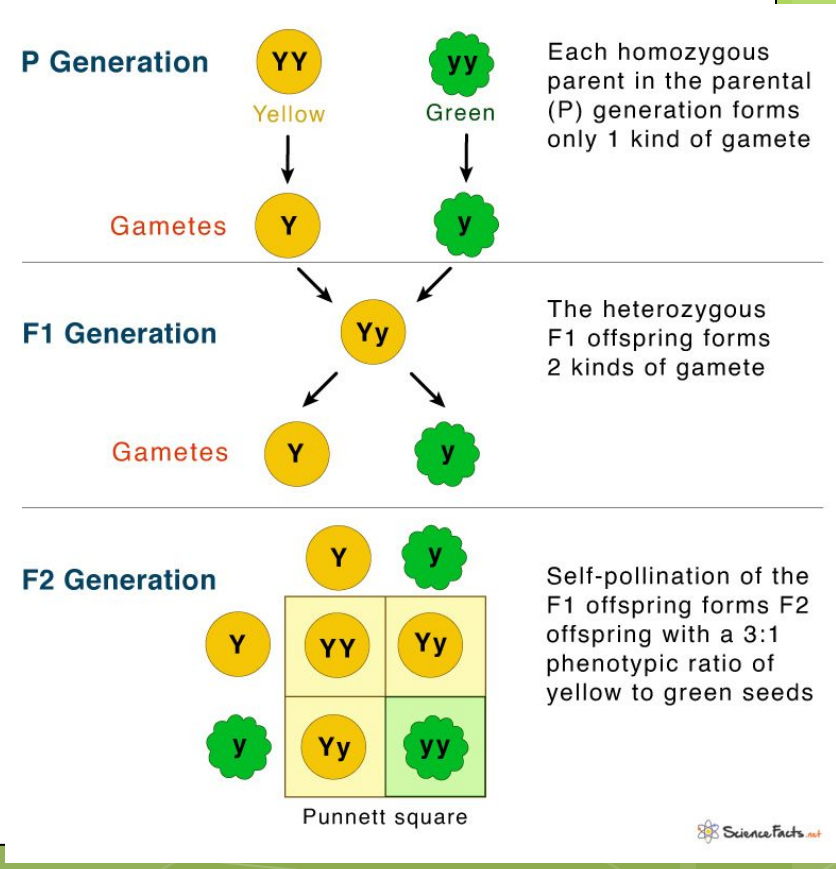
"*During the formation of gamete, each gene separates from each other so that each gamete carries only one allele for each gene*.

- **As the Gametes is pure for an allele,**

this law is also called Law of Purity of Gametes

In other words, allele (alternative form of the gene) pairs segregate during the formation of gamete and re-unite randomly during fertilization.



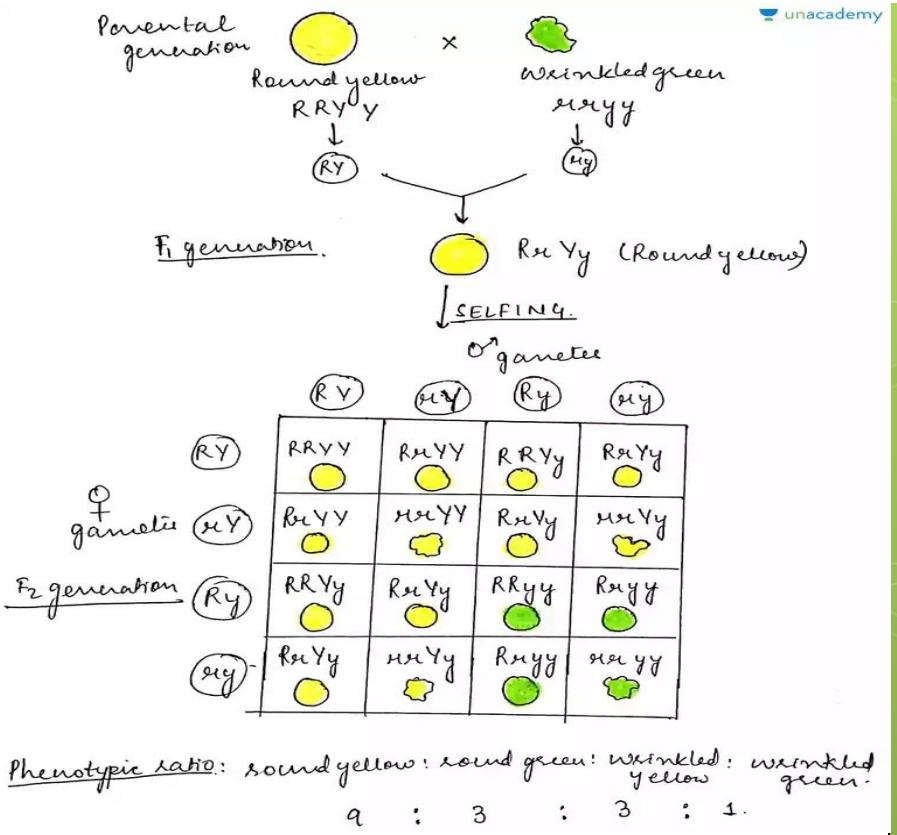


Law of Independent Assortment

Mendel's law of segregation states that:

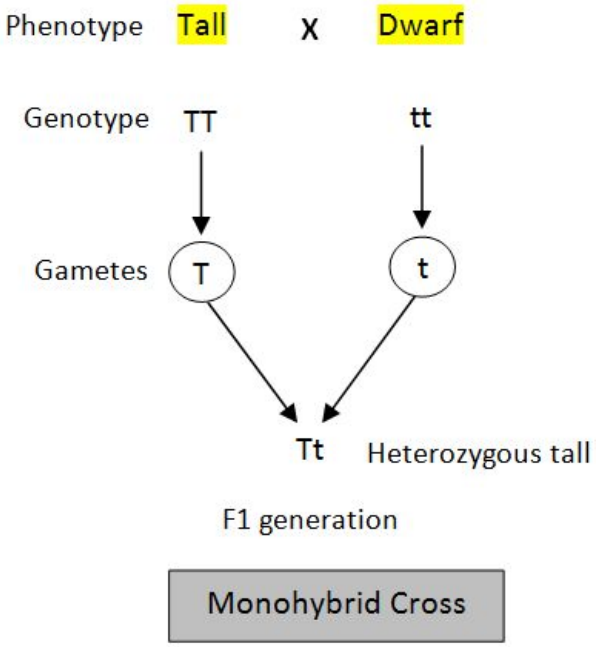
"***the alleles of two (or more) different genes get sorted into gametes independently of one another.***

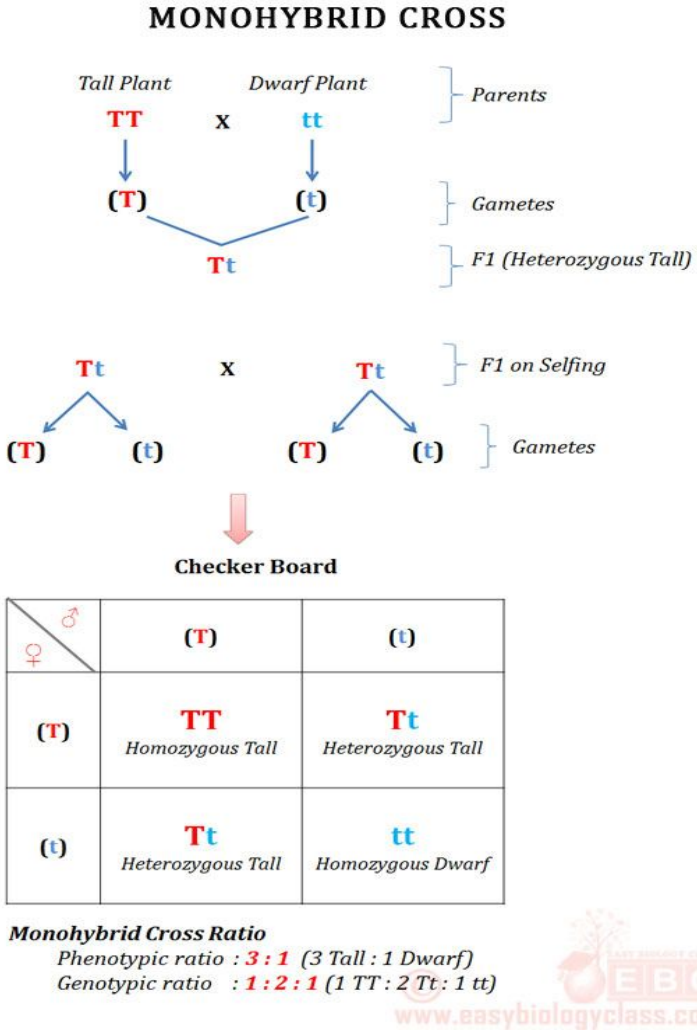
In other words,
the allele a gamete receives for one gene does not influence the allele received for another gene



Monohybrid Cross:

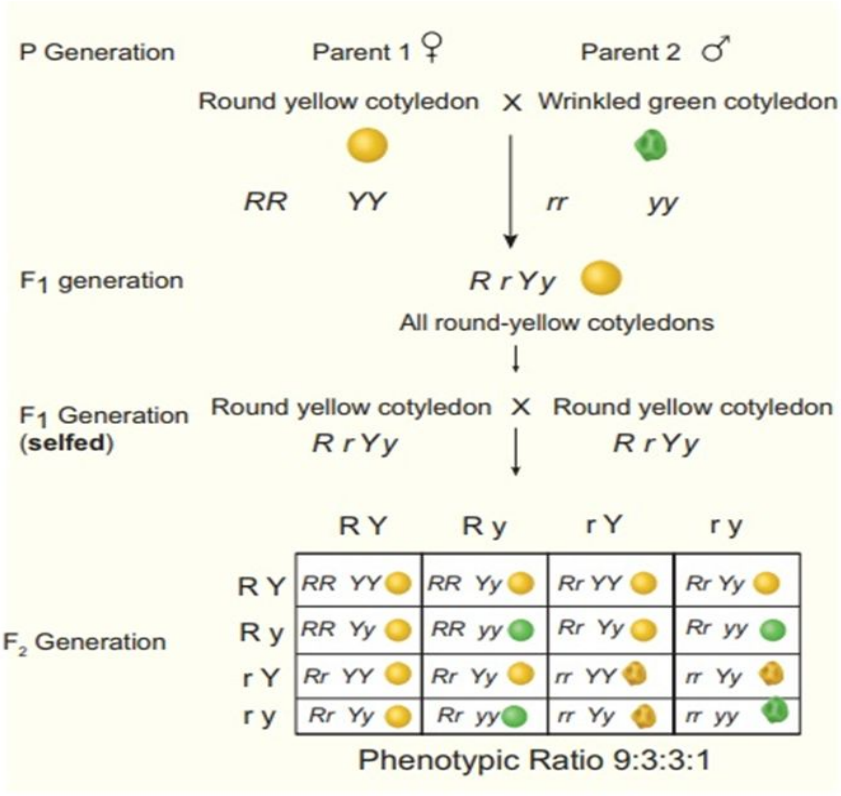
- **Cross between one trait**
- **E.g: Tall plant cross with Dwarf plant**





Dihybrid Cross:

- **Cross between Two trait**
- e.g:
  - Round yellow cotyledons plant cross with wrinkled green cotyledon plant



Dihybrid cross

Phenotypic ratio:

Yellow round		Yellow wrinkled		Green round		Green wrinkled
9	:	3	:	3	:	1

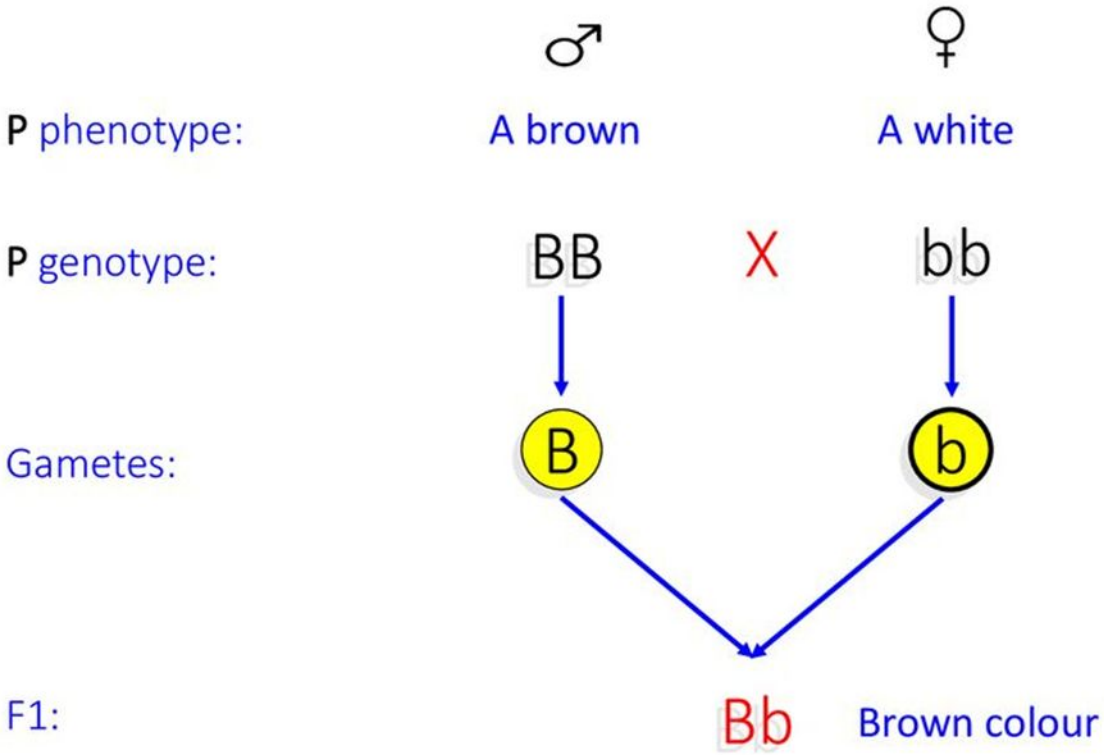
Genotypic ratio:

YYRR	YYRr	YyRR	YyRr	YYrr	Yyrr	yyRR	yyRr	yyrr
1	2	2	4	1	2	1	2	1

Monohybrid example

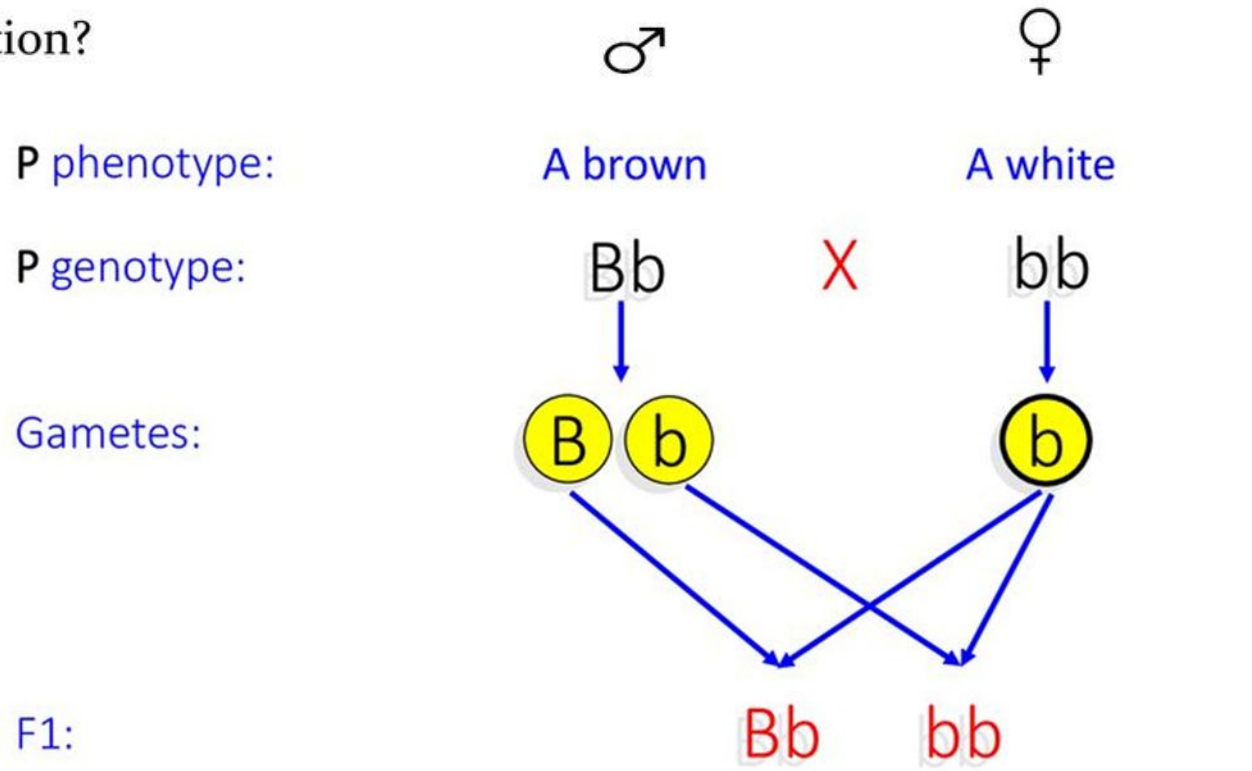
Question 1:

A rancher wants to cross a homozygous brown horse with a white mare (female). brown is dominant color. What are the F1 generation genotypes and phenotypes?



Question 2:

A rancher wants to cross a heterozygous brown horse with a white mare (female).. What are the genotypic and phenotypic ratios for the F1 generation?



Phenotypic ratio= 1 brown : 1 white (50% brown : 50% white)

Genotypic ratio= 1 Bb : 1 bb (50% Bb : 50% bb)

Question 3:

If an allele for tall plants (T) is dominant to short plants (t). What offspring would you expect from a Tt x TT cross?

P phenotype: Heterozygous tall Homozygous tall

P genotype: Tt X TT

Gametes: T t T

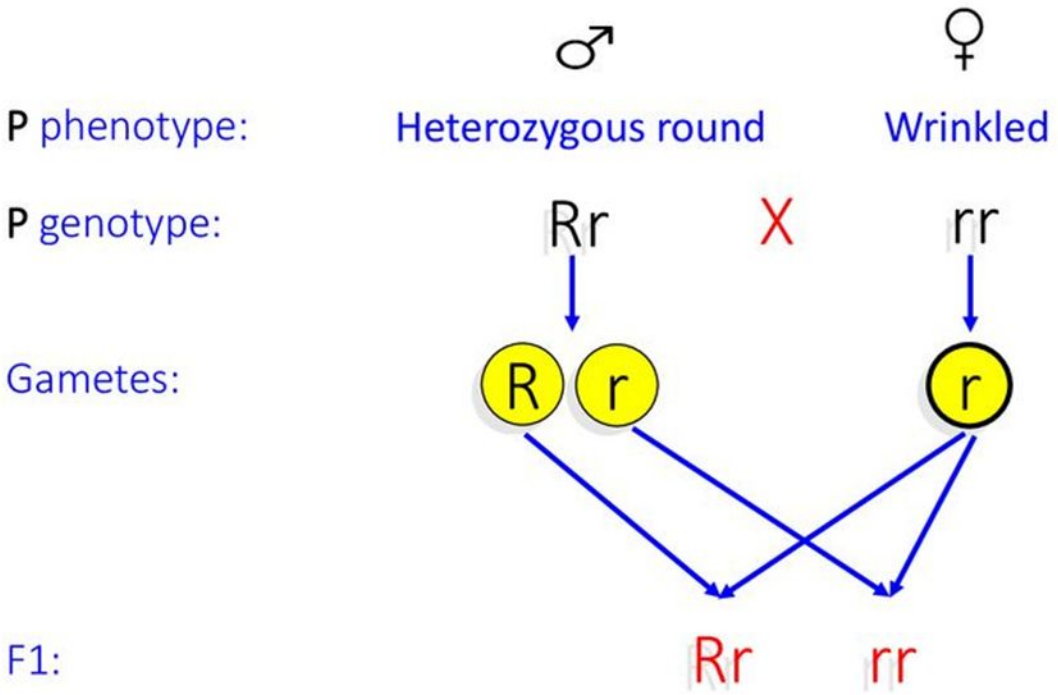
F1: TT Tt

Phenotypic ratio= 100% tall

Genotypic ratio= 1 TT : 1 Tt

Question 4:

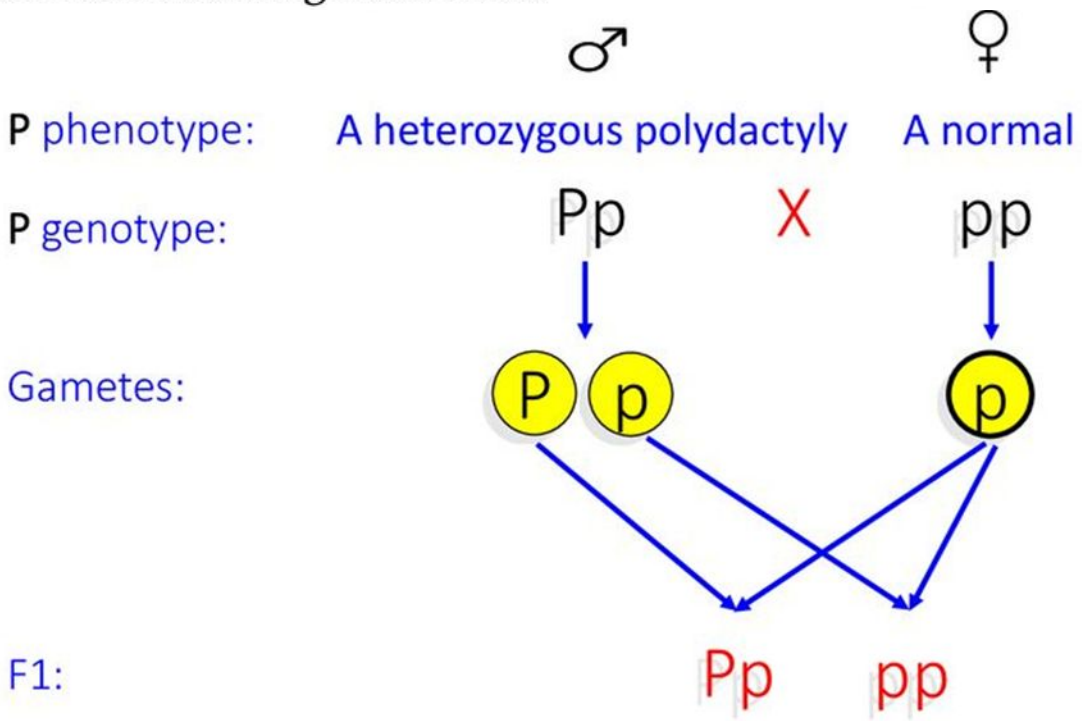
Cross a heterozygous round seeds of pea plant with a wrinkled seeds and determine the probability of producing wrinkled seeds.



The probability of producing wrinkled seeds = 50%

Question 5:

A man heterozygous for polydactyly (extra fingers and toes), a dominant trait, is married to a normal woman. What is the probability of producing an offspring that has extra fingers or toes?



The probability of producing an offspring that has extra fingers or toes? = 50%


Thank you