


# DIHYBRID CROSS



## Dihybrid Cross

There are two types of breeding processes to know the mechanism of genes and examine the inheritance of traits from parents and grandparents, one is monohybrid cross and the other is dihybrid cross. The latter occurs when the F1 generation offspring differ in two traits. It is a cross between two entities that are heterozygous for two different traits. Mendel carried out the following experiment for this cross:

- For crossing, he took a pair of contradicting characteristics or traits
  - Mendel crossed round-yellow seed and wrinkled-green seed
  - In the F1 generation, the outcome was seeds that were round and yellow
  - The F1 generation indicated that the round and yellow traits are dominant while the green colour and the wrinkled shape were recessive traits.
  - Self-pollination of F1 progeny resulted in four varying combinations of seeds in the subsequent generation, the F2 generation.
  - The outcome and the dihybrid cross-ratio were – round-yellow, wrinkled-yellow, wrinkled-green, round-green and the ratio was 9:3:3:1.
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A testcross is a cross that involves mating with a genotype that is unknown with a known genotype, a homozygous recessive genotype.


A homozygous recessive genotype is crossed because of the following:

- In the presence of dominant alleles, the effects of recessive alleles are always masked
- Thereby, the phenotype of the offspring exhibits the genotype of the unknown parent.



A dihybrid cross is a breeding experiment between two organisms which are identical hybrids for two traits. In other words, a dihybrid cross is a cross between two organisms, with both being heterozygous for two different traits.

In a dihybrid cross, the parents carry different pair of alleles for each trait. One parent carries homozygous dominant allele, while the other one carries homozygous recessive allele. The offsprings produced after the crosses in the F1 generation are all heterozygous for specific traits.



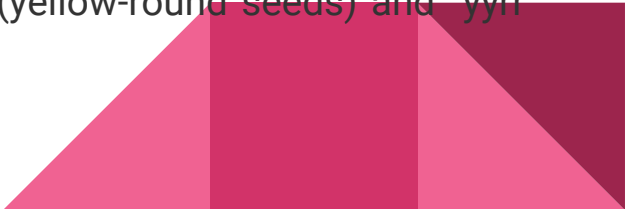
## Dihybrid Cross Examples

Mendel took a pair of contradicting traits together for crossing, for example colour and the shape of seeds at a time. He picked the wrinkled-green seed and round-yellow seed and crossed them. He obtained only round-yellow seeds in the F1 generation. This indicated that round shape and yellow colour of seeds are dominant in nature.

Meanwhile, the wrinkled shape and green colour of seeds are recessive traits. Then, F1 progeny was self-pollinated. This resulted in four different combinations of seeds in the F2 generation. They were wrinkled-yellow, round-yellow, wrinkled-green seeds and round-green in the phenotypic ratio of 9:3:3:1.

During monohybrid cross of these traits, he observed the same pattern of dominance and inheritance. The phenotypic ratio 3:1 of yellow and green colour and of round and wrinkled seed shape during monohybrid cross was retained in dihybrid cross as well.

Consider “Y” for yellow seed colour and “y” for green seed colour, “R” for round shaped seeds and “r” for wrinkled seed shape. Thus, the parental genotype will be “YYRR” (yellow-round seeds) and “yyrr” (green-wrinkled seeds).



Parents : Yellow Round x Green Wrinkled  
**YYRR** **yyrr**

Gametes :  $\text{YR}$   $\text{yR}$   
 $\text{YyRr}$

$F_1$  : Yellow Round

$F_1$  Plants are crossed: **YyRr** x **YyRr**

Gametes:  $\text{YR}$   $\text{Yr}$   $\text{yR}$   $\text{yr}$   $\text{YR}$   $\text{Yr}$   $\text{yR}$   $\text{yr}$

Gametes	$\text{YR}$	$\text{Yr}$	$\text{yR}$	$\text{yr}$
$\text{YR}$	YYRR Yellow Round	YYRr Yellow Round	YyRR Yellow Round	YyRr Yellow Round
$\text{Yr}$	YYRr Yellow Round	YYrr Yellow Wrinkled	YyRr Yellow Round	Yyrr Yellow Wrinkled
$\text{yR}$	YyRR Yellow Round	YyRr Yellow Round	yyRR Green Round	yyRr Green Round
$\text{yr}$	YyRr Yellow Round	Yyrr Yellow Wrinkled	yyRr Green Round	yyrr Green Wrinkled

$F_2$  Phenotypic ratio  
 9:3:3:1

Yellow Round : 9  
 Yellow Wrinkled : 3  
 Green Round : 3  
 Green Wrinkled : 1

Fig.2.10: Dihybrid experiment.

# Law of independent assortment

This law states that the genes for each character separate and enter the gametes independently of the genes of other characters. This law is the outcome of Mendel's dihybrid cross.

**Law of Segregation:** When gametes form, alleles are separated so that each gamete carries only one allele for each gene

**Law of Independent Assortment:** The segregation of alleles for one gene occurs independently to that of any other gene

**Principle of Dominance:** Recessive alleles will be masked by dominant alleles

