अभय

CLASS X - SCIENCE

HEREDITY AND EVOLUTION

Recorded

PRASHANT KIRAD

अभय

PK HITS🔥

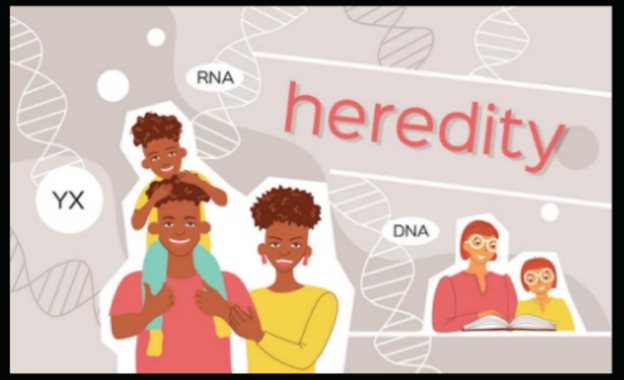
- Definition of 3 Laws of Mendel
- Monohybrid Cross (Numerical on F2 generation)
- Difference in Acquired and Inherited traits

3

अभय

HEREDITY

Heredity is the transmission of genetic traits from parents to offspring through genes. It determines physical and biological characteristics in successive generations.

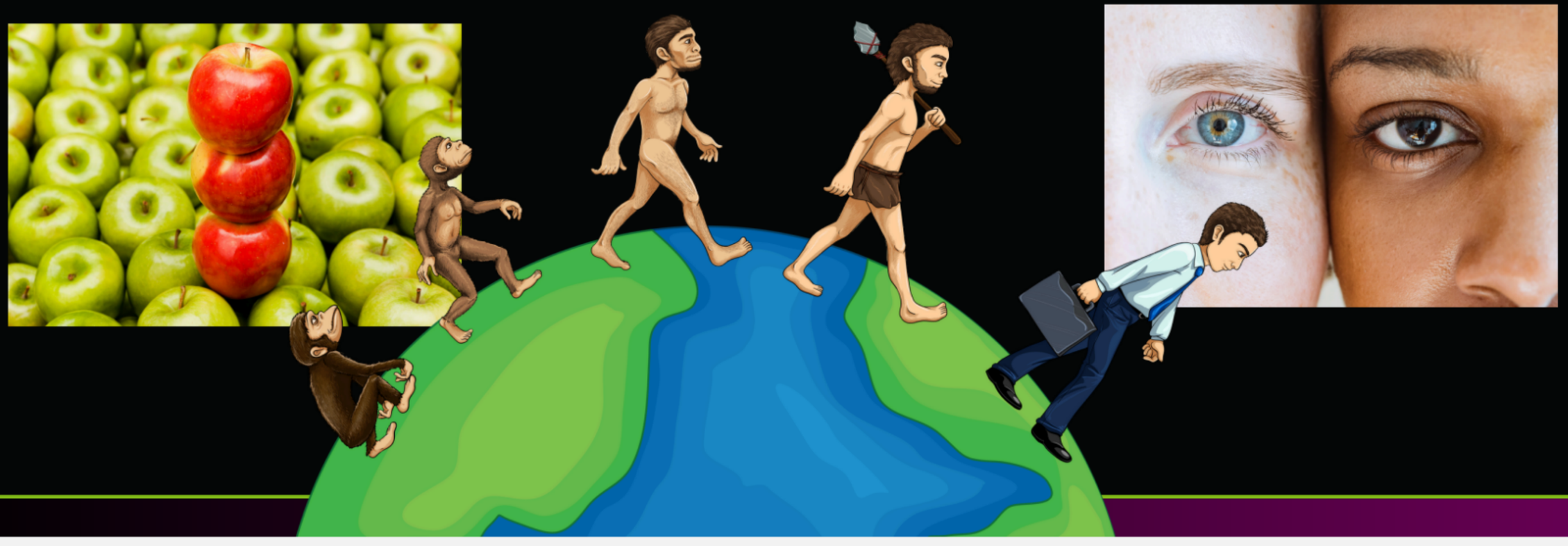


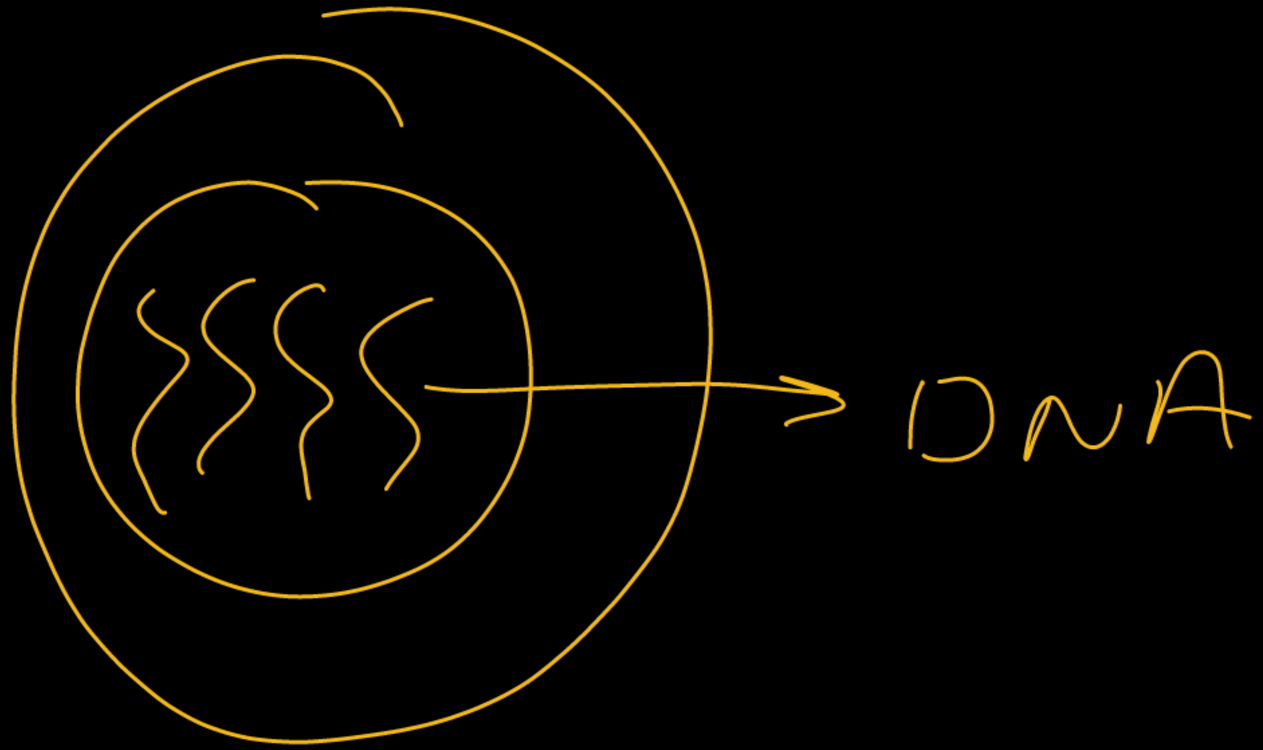
Inheritance - It is the process by which genetic information and traits are passed from parents to offspring through genes.

अभय

VARIATION

Variation refers to the differences in traits or characteristics among individuals of the same species.
It arises due to genetic differences, environmental factors, or mutations, ensuring diversity within a population.

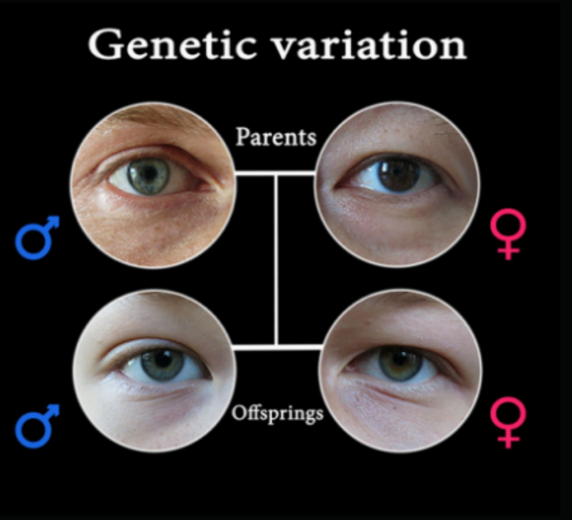



DNA

अभय

IMPORTANCE OF VARIATION

- **Helps in Survival:** Variations allow some individuals to adapt better to environmental changes, increasing their chances of survival.
- **Drives Evolution:** Over generations, beneficial variations accumulate, leading to the development of new species.
- **Provides Disease Resistance:** Variations ensure that some individuals are naturally resistant to certain diseases, helping the species survive.
- **Maintains Biodiversity:** Variations create diversity within populations, which helps ecosystems remain balanced and stable.

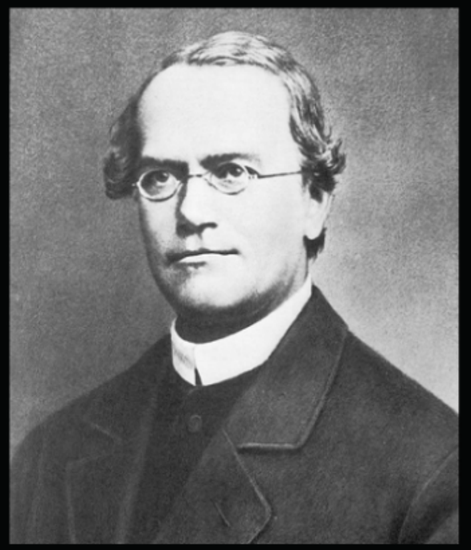


अभय

GENETICS

Genetics is the study of transmission of these characteristics from parents to their offsprings.

William Bateson
(He coined the term genetics)

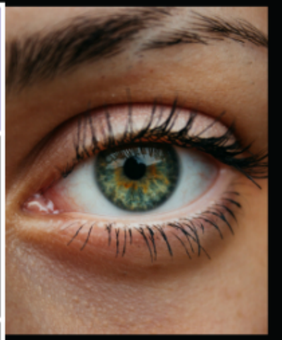


Gregor Mendel
(Father of genetics)

TRAITS

Traits are specific characteristics or features of an organism, such as height, eye color, or blood type, that are inherited from parents through genes.

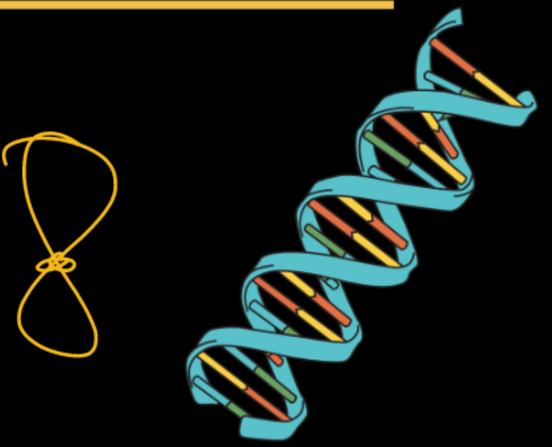
Acquired traits	Inherited traits
Traits that are developed by the individual during his lifetime.	Traits which are present in an individual since birth.
These are a result of changes in non-reproductive issues.	These are a result of changes in the DNA.
Cannot be passed on to the progeny, e.g. pierced ear, large muscle size etc.	These are transmitted in the progeny, e.g. color of eyes, skin or hair.



अभय

DNA: DEOXYRIBONUCLEIC ACID

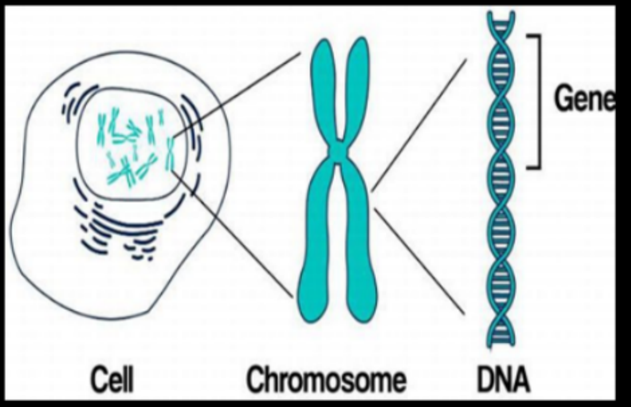
DNA is the hereditary material in living organisms that carries genetic instructions for growth, development, functioning, and reproduction.



Structure of DNA - Double-helix made of two strands.

CHROMOSOMES

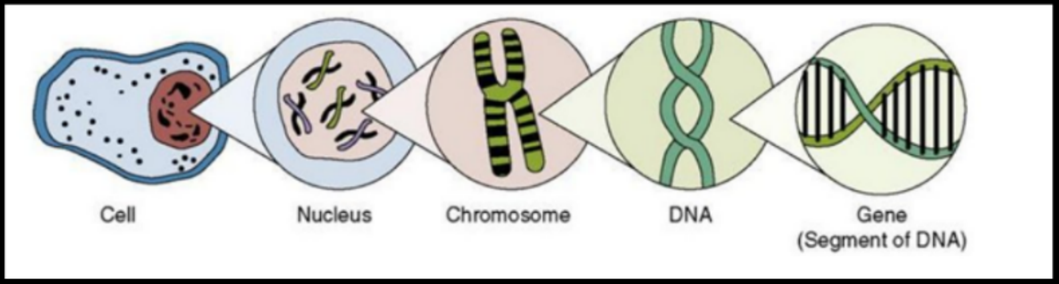
A thread-like structure in the nucleus of the cell. It appears during cell division and it carries genes.



अभय

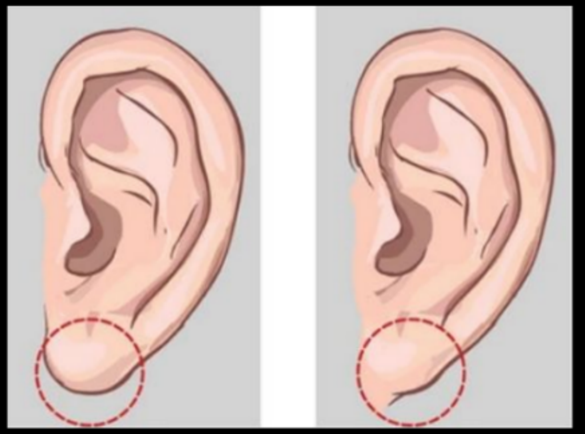
CHROMATIN

It refers to a mixture of DNA and proteins that form the chromosomes found in the cells of humans and other higher organisms.



GENES

- Genes are the functional unit of DNA that defines out characteristics.
- A segment or part of DNA that carries information for a particular character.
- Due to the differences in genetic great deal of variations. makeup, human population show a
- It has been observes that attached and free earlobes are two variations found in human population.



DIPLOID AND HAPLOID

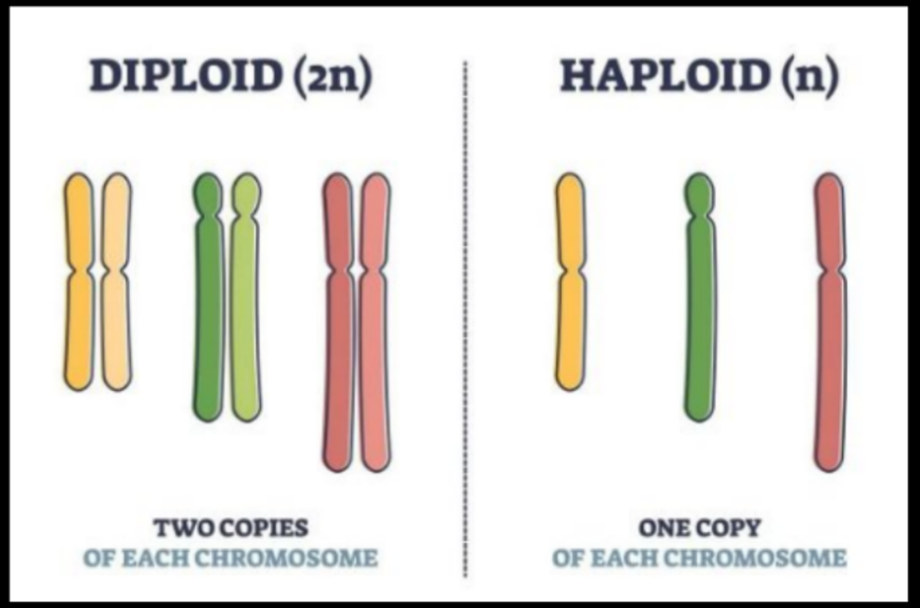
अभय

Diploid

- Cells that contain two sets of chromosomes (one from each parent).
- Found in most body cells (somatic cells).

Haploid

- Cells that contain only one set of chromosomes.
- Found in gamete cells



MENDEL'S CONTRIBUTIONS

अभय

Gregor Johann Mendel (1822–1884)

Mendel was educated in a monastery and went on to study science and mathematics at the University of Vienna. Failure in the examinations for a teaching certificate did not suppress his zeal for scientific quest. He went back to his monastery and started growing peas. Many others had studied the inheritance of traits in peas and other organisms earlier, but Mendel blended his knowledge of science and mathematics and was the first one to keep count of individuals exhibiting a particular trait in each generation. This helped him to arrive at the laws of inheritance that we have discussed in the main text.

Mendel used a number of contrasting visible characters of ***garden peas – round/wrinkled seeds, tall/short plants, white/violet flowers and so on.***

He took pea plants (Pisum sativum) with different characteristics – a tall plant and a short plant, produced progeny by crossing them, and calculated the percentages of tall or short progeny.

TRAITS STUDIED BY MENDEL

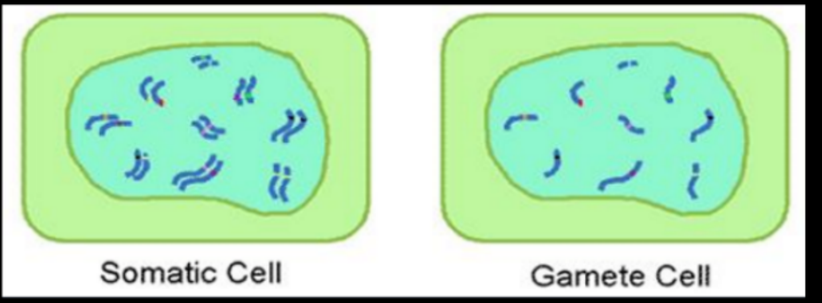
अभय

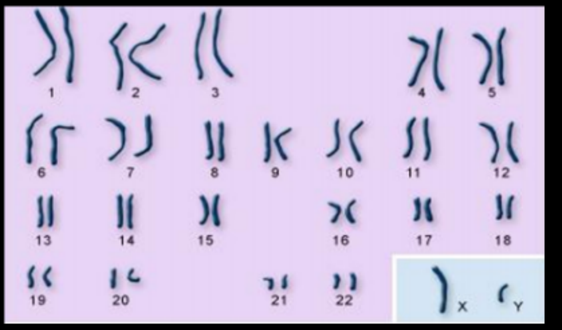
Traits	Shape of seeds	Colour of seeds	Colour of pods	Shape of pods	Plant height	Position of flowers	Flower colour
Dominant trait	Round 	Yellow 	Green 	Full 	Tall 	At leaf junction 	Purple 
Recessive trait	Wrinkled 	Green 	Yellow 	Flat, constricted 	Short 	At tips of branches 	White 

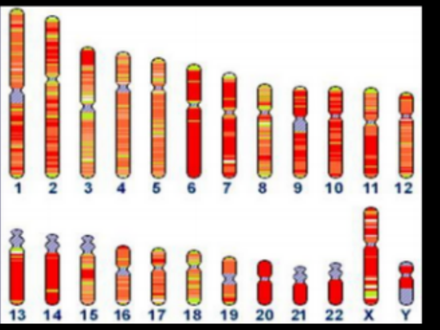
Seven pairs of contrasting traits in pea plant

ALLELE

- *An allele is a variant form of a gene that determines specific traits in an organism.*
- Each ***individual inherits two alleles for each gene, one from each parent.***
- Alleles are alternate forms of genes that occupy a specific location on a particular chromosome and control the same character.







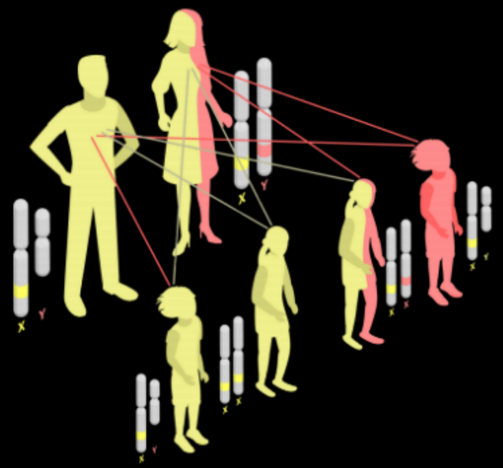
अभय

ALLELE

Dominant Allele:

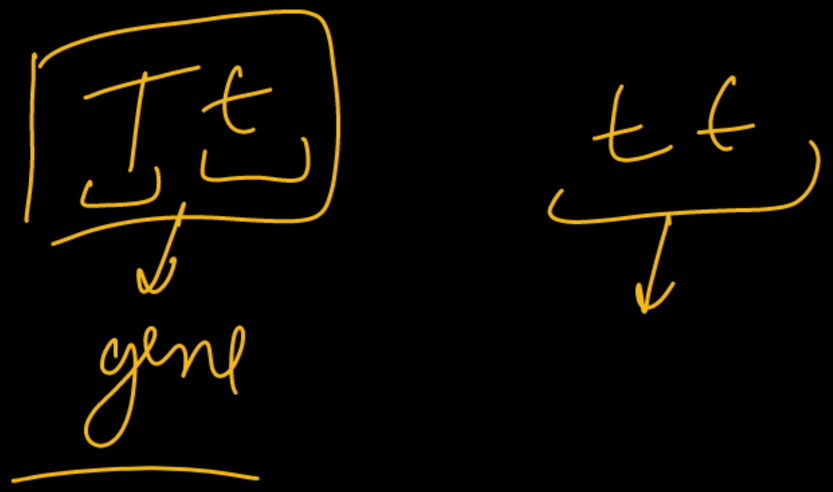
- It is the stronger one from the two alleles.
- It expresses its trait when present.
- Denoted by capital letter - T, B, R, V, W.

T, B, R



Recessive Allele:

- It is the weaker one from the two alleles.
- It expresses its trait only when paired with another recessive allele.
- Denoted by small letter - t, b, r, v ,w


T t
gen
t t

DOMINANT AND RECESSIVE TRAITS

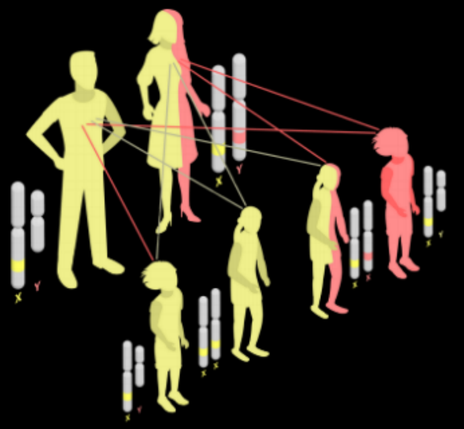
अभय

Dominant Traits:

- Traits which appears due to expression of dominant allele is called dominant trait.
- Expresses itself in both -
  -Hoozygous condition
  -Heterozygous condition

Recessive Traits:

- Traits which is suppressed due to effect of dominant allele
- Expresses itself only in-
  -Homozygous condition



अभय

Homozygous Dominant condition	Heterozygous condition	Homozygous Recessive condition
TT	Tt	tt

HOMOZYGOUS V/S HETEROZYGOUS

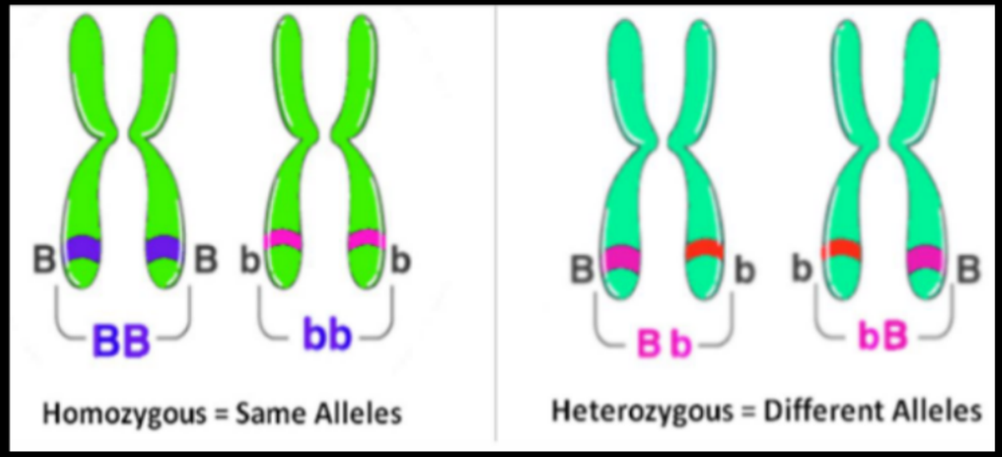
अभय

Homozygous

- An individual is homozygous for a gene if they inherited the same version (allele) of that gene from each parent
- E.g. (TT)-> homozygous tall.

Heterozygous

- An individual is heterozygous for a gene if they inherited different versions (alleles) of that gene from each parent.
- E.g. (Tt) → heterozygous



GENOTYPE V/S PHENOTYPE

GENOTYPE	PHENOTYPE	
The genotype is an organism's genetic information.	The phenotype is the set of observable physical traits.	
BB homozygous dominant	purple	
Bb heterozygous	purple	
bb homozygous recessive	white	

F1 AND F2 GENERATION

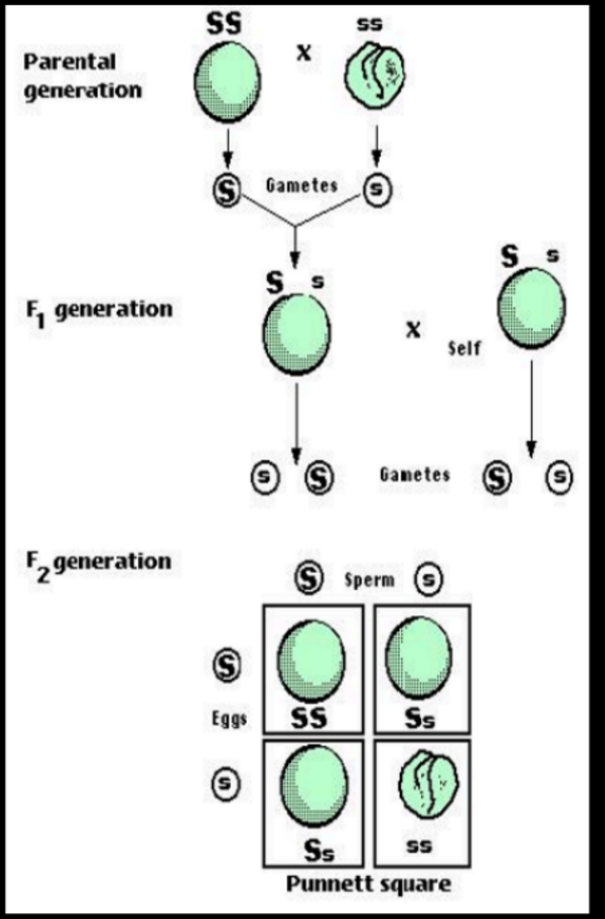
अभय

F1 Generation

The F1 generation refers to the offspring produced by crossing two genetically distinct parents.

F2 Generation

The F2 generation is the offspring produced by self-pollinating or crossing individuals from the F1 generation.



WHY DID MENDEL CHOSE PEAS?

- He chose the garden pea (Pisum sativum) for his experiments ***because it had several detectable contrasting traits.***
- The plant had a **short life span**, making it ***suitable for multiple generations of study.***
- It normally *allowed self-fertilization but could also undergo cross-fertilization.*
- The plant *produced a large number of seeds, facilitating extensive experimentation.*

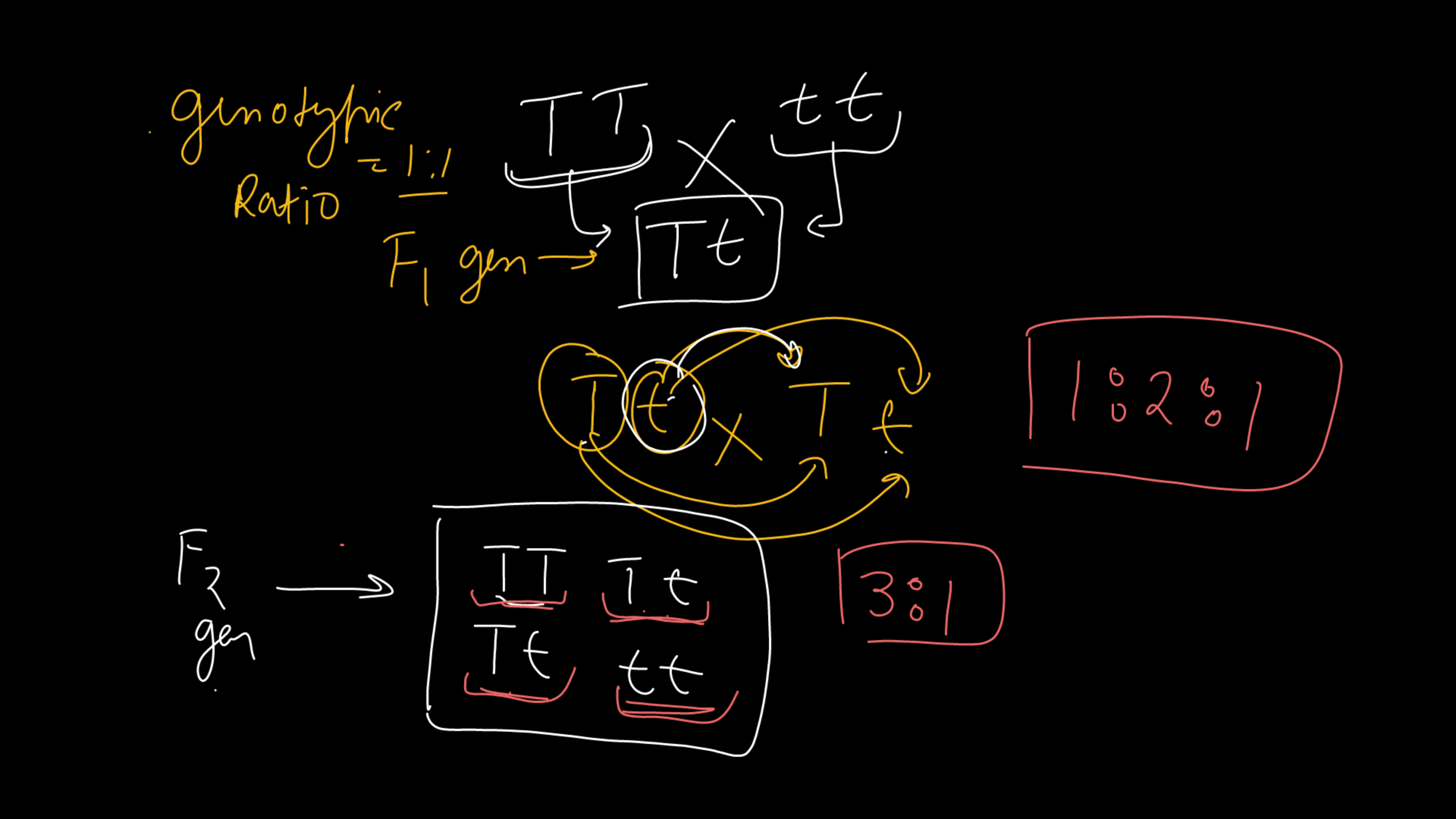
Plant growth Fast

MONOHYBRID CROSS

अभय

A cross between two types of plants of same species considering only the transmission of one character is called **monohybrid cross.**

For example - *A cross between tall pea plants and dwarf pea plant that is considering only the height of the parents is a monohybrid cross.*


genotypic Ratio = 1:1
TT
tt
Tt
F1 gen
T
t
X
T
t
1:2:1
F2 gen
TT
Tt
Tt
tt
3:1

MONOHYBRID CROSS

अभय

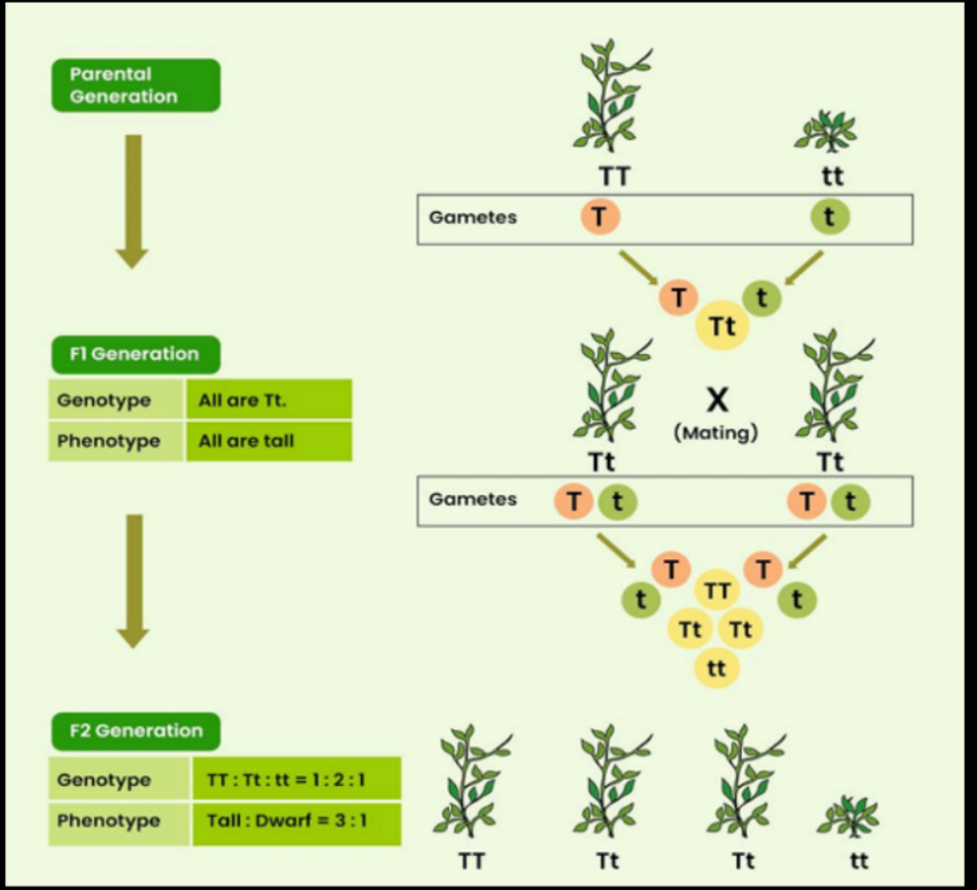
- *First-generation or F1 progeny were all tall.*
- Second-generation or F2 are progeny (descendant) of the F1 tall plants are both tall and dwarf.
- **Both the tallness and shortness traits were inherited in the F1 plants, but only the tallness trait was expressed.**

F2 gen

Phenotypic ratio: 3 : 1

Genotypic ratio: 1 : 2 : 1

F2



Total no. of Short in F_2

$= 400$, Tall plants

T : S

3 : 1

1200

3 : 1

Q → Total no. of 400 → 300, 100

R, r → F2 gen

Pure Round = 200

Pure Wrinkled = 200

TT Tt Tt tt

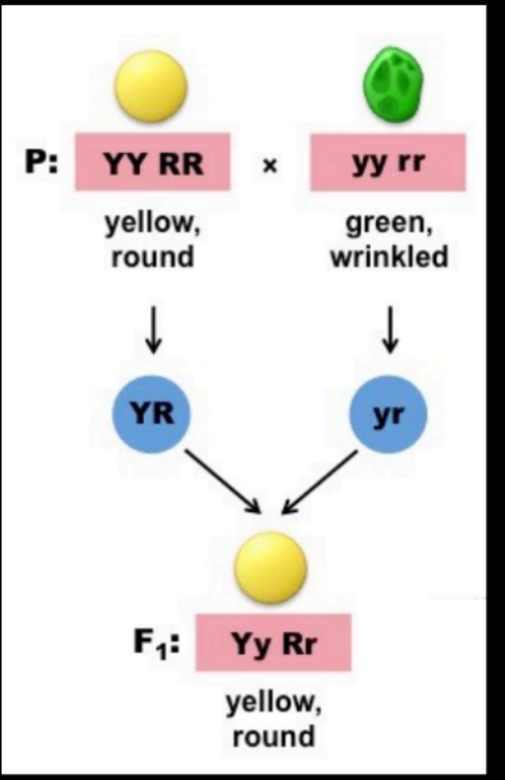
1 : 2 : 1 200×2=400

DIHYBRID CROSS

अभय

- *A dihybrid cross is a breeding experiment between two organisms which are identical hybrids for two traits.*
- Two characters are considered while crossing.
- A cross in which inheritance of two pairs of contrasting characters is simultaneously studied.

For example - *Parents ---> Round green x wrinkled yellow*



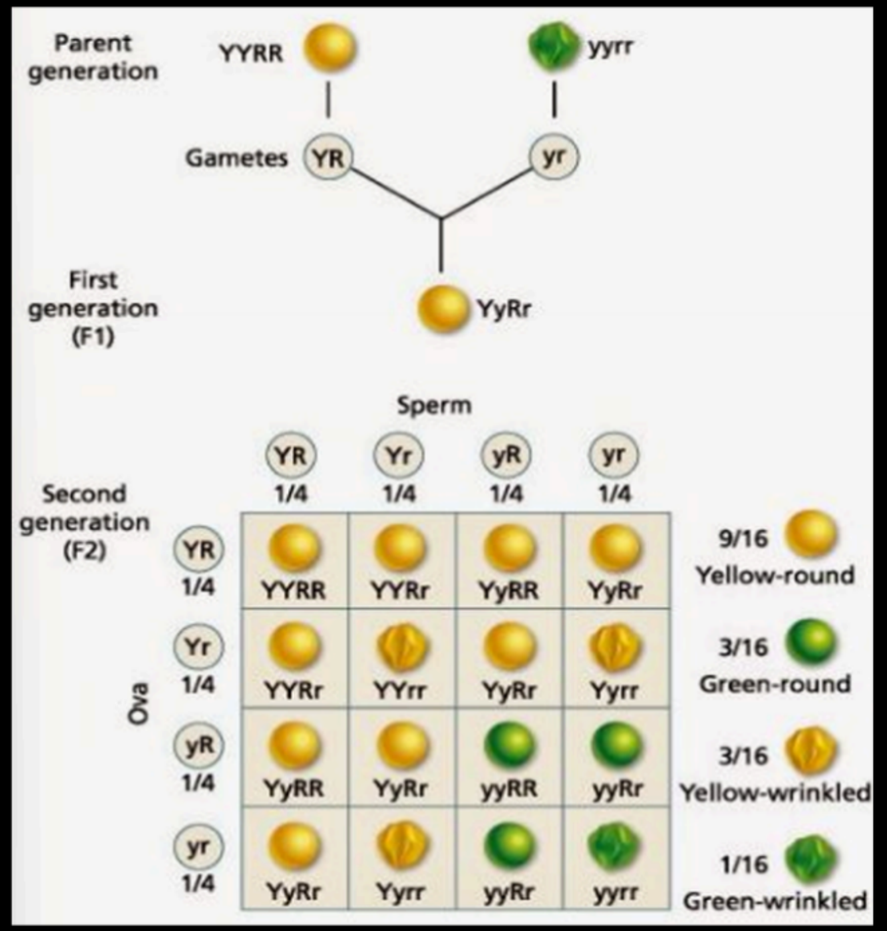
DIHYBRID CROSS

अभय

- Self-pollination of F1 plants produced parental phenotypes and recombinants in a **9:3:3:1 ratio.**
- Round and yellow seeds are dominant traits.
- *New phenotype combinations indicate independent inheritance of genes* for round and yellow seeds.

Phenotypic Ratio (F1 Generation) : 9 : 3: 3 : 1

Genotypic ratio: 1 : 2 : 2 : 4 : 1 : 2 : 1 : 2 : 1



9 = Y + R
3 = Y + W
3 = G + R
1 = G + W

YYRR × yyrr

YRyr

F1 gen YyRr × YyRr

(9 : 3 : 3 : 1)

	YR	Yr	yR	yr
YR	YYRR	YYRr	YyRR	YyRr
Yr	YYRr	YYrr	YyRr	Yyrr
yR	YyRR	YyRr	yyRR	yyRr
yr	YyRr	Yyrr	yyRr	yyrr

Abhay Premier League

अभय

Q. In an experiment to study independent inheritance of two separate traits: shape and colour of seeds, the ratio of the different combinations in F2 progeny would be (2024)

(A) 1: 3

(B) 1: 2: 1

(C) 9: 3 : 3 : 1

(D) 9 : 1 : 1 : 3

Abhay Premier League

अभय

Q.A cross between a tall pea-plant (TT) and a short pea-plant (tt) resulted in progenies that were all tall plants because(2023)

(a) tallness is the recessive trait.

(b) shortness is the dominant trait.

(c) height of pea-plant is not governed by gene T or t.

(d) tallness is the dominant trait.

Abhay Premier League

अभय

Q.In peas, a pure tall plant (TT) is crossed with a pure short plant (tt). The ratio of pure tall plants to pure short plants in F2 generation will be:

(a) 1 : 3

(b) 3 : 1

(c) 1 : 1

(d) 2 : 1

1 : 2 : 1

अभय

Abhay Premier League

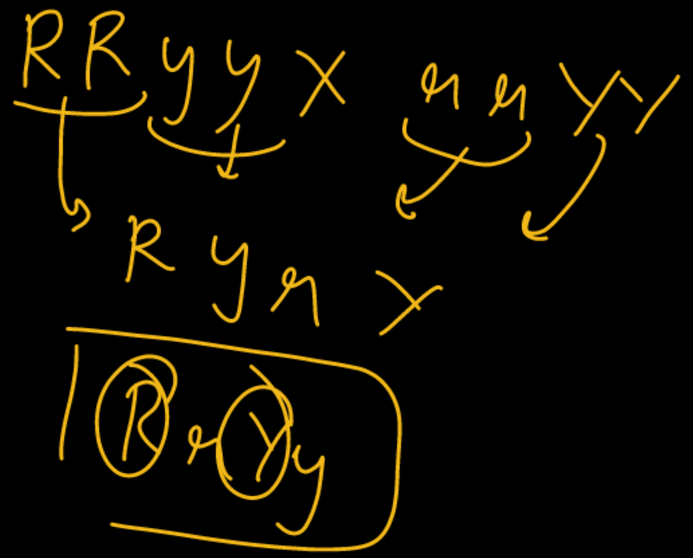
Q,If a round, green seeded pea-plant (RRyy) is crossed with a wrinkled yellow seeded pea- plant (rrYY), the seeds produced in F1 generation are

(a) round and green

(b) round and yellow

(c) wrinkled and green

(d) wrinkled and yellow



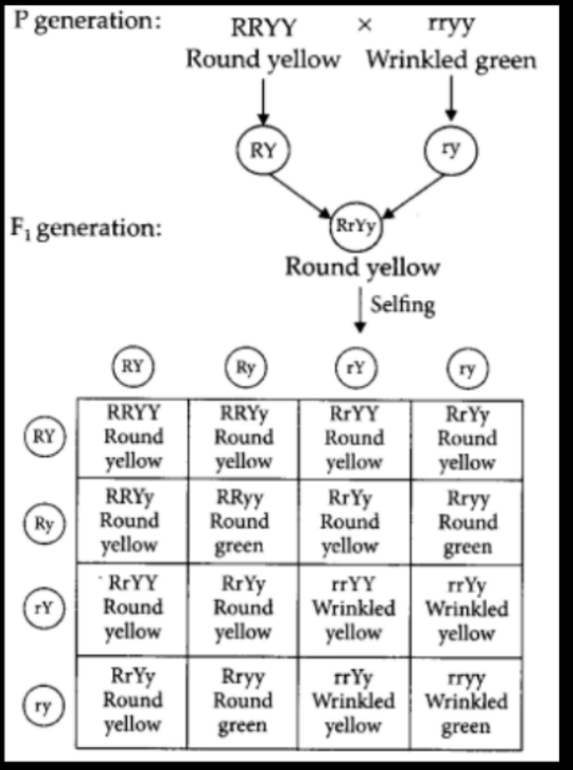
Abhay Premier League

RRYY
R R Y Y
R Y

अभय

(a) Why did Mendel carry out an experiment to study inheritance of two traits in garden pea?
(b) What were his findings with respect to inheritance of traits in F1 and F2 generation?
(c) State the ratio obtained in the F2 generation in the above mentioned experiment.(2023)

a) Mendel carried out crosses with two traits to see the interaction and basis of inheritance between them. In a dihybrid cross given by Mendel, it was observed that when two pairs of characters were considered each trait expressed independent of the other.
(b) For example, a cross between round yellow and wrinkled green parents.



	RY	Ry	rY	ry
RY	RRYY Round yellow	RRYy Round yellow	RrYY Round yellow	RrYy Round yellow
Ry	RRYy Round yellow	RRyy Round green	RrYy Round yellow	Rryy Round green
rY	RrYY Round yellow	RrYy Round yellow	rrYY Wrinkled yellow	rrYy Wrinkled yellow
ry	RrYy Round yellow	Rryy Round green	rrYy Wrinkled yellow	rryy Wrinkled green

In F1 generation, all plants are with round yellow seeds. But in F2 generation,
we find all types of plants : Round yellow, Round green, Wrinkled yellow, Wrinkled green.
F2 generation ratio : Round-yellow = 9 : Round- green = 3 : Colour of stem in F1 progeny Wrinkled- yellow = 3 : Wrinkled-green = 1

अभय

Abhay Premier League

Q.List two differences between acquired traits and inherited traits by giving an example of each.

Acquired traits	Inherited traits
Traits that are developed by the individual during his lifetime.	Traits which are present in an individual since birth.
These are a result of changes in non-reproductive issues.	These are a result of changes in the DNA.
Cannot be passed on to the progeny, e.g. pierced ear, large muscle size etc.	These are transmitted in the progeny, e.g. color of eyes, skin or hair.

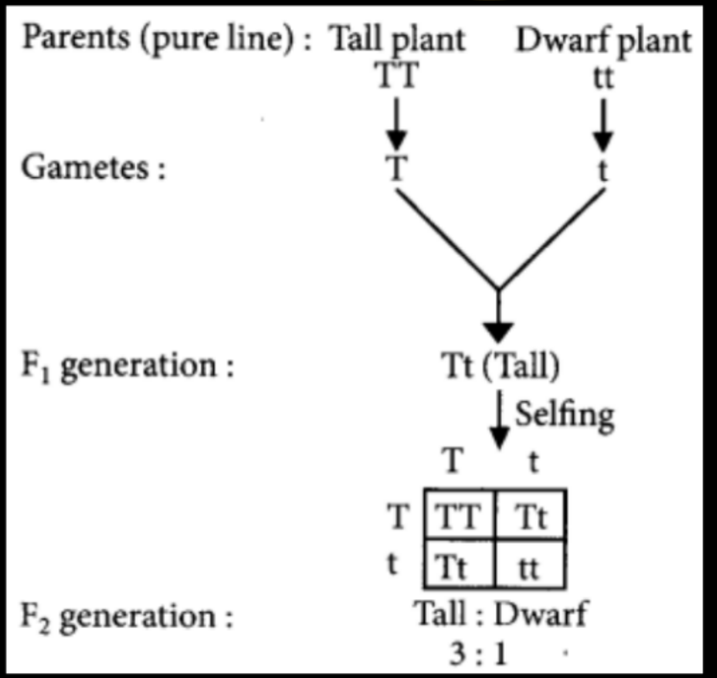
Abhay Premier League

Q.How did Mendel explain that it is possible that a trait is inherited but not expressed in an organism?

TT x tt Tt

Mendel first selected two pure line plants. He then crossed such plants having contrasting characters. In the F1 generation, he observed that only one of the two contrasting character appeared, he called it dominant and the one which does not get expressed in F1 was recessive. He later selfed the F1 plants and observed that both the traits appear but in a definite proportion. It can be explained by the following cross :

This is how Mendel explained that a trait may be inherited but not expressed in the plant.



Abhay Premier League

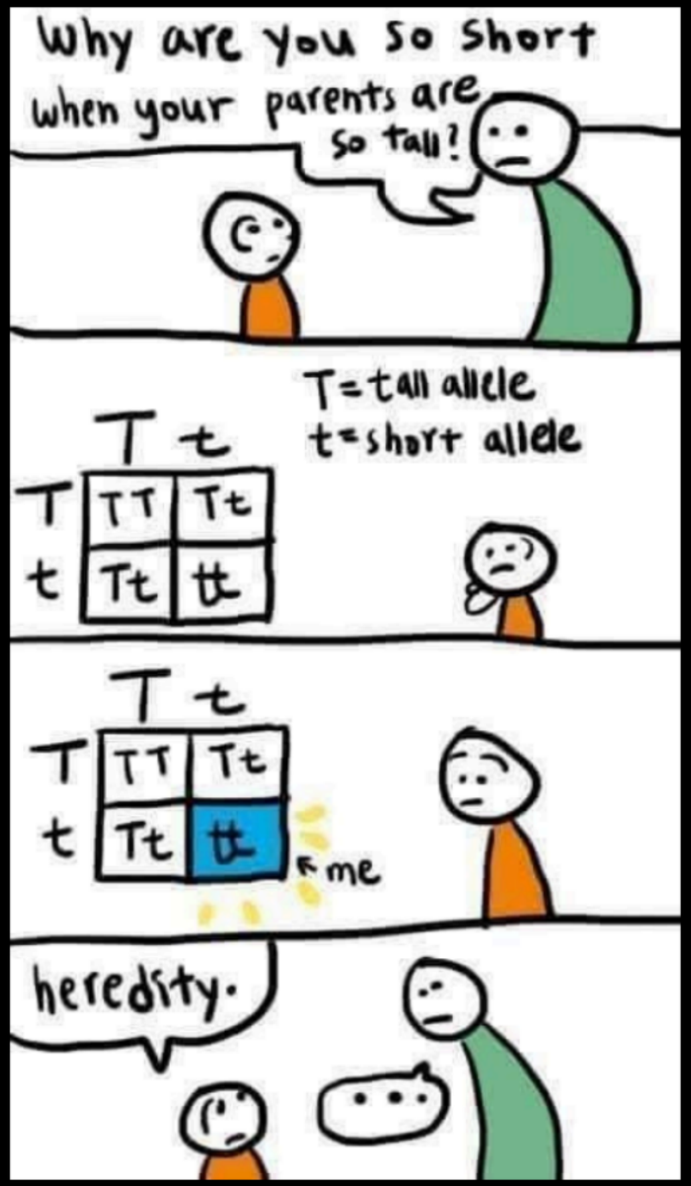
Q.Why did Mendel choose the pea plant for his experiments?(2019,(2023)

Mendel decided to conduct his experiments on the pea plant for the following reasons:

-Pea plants are simple to grow
yet only live a brief time.

-They have flowers that are larger.

-The pea plant self-pollinates.



SOCHNE KI BAAT H!

अभय

RULE FOR THE INHERITANCE OF TRAITS

- ***The inheritance of traits in humans is determined equally by genetic material from both parents.***
- Each child inherits two versions of a trait, *one from the mother and one from the father.*
- The traits expressed in the child follow Mendel's rules of inheritance, established through his experiments over a century ago.

LAW OF DOMINANCE

- When an inherited pair of two alleles is heterozygous, the allele that is called dominant while the other is called recessive.

First law of inheritance