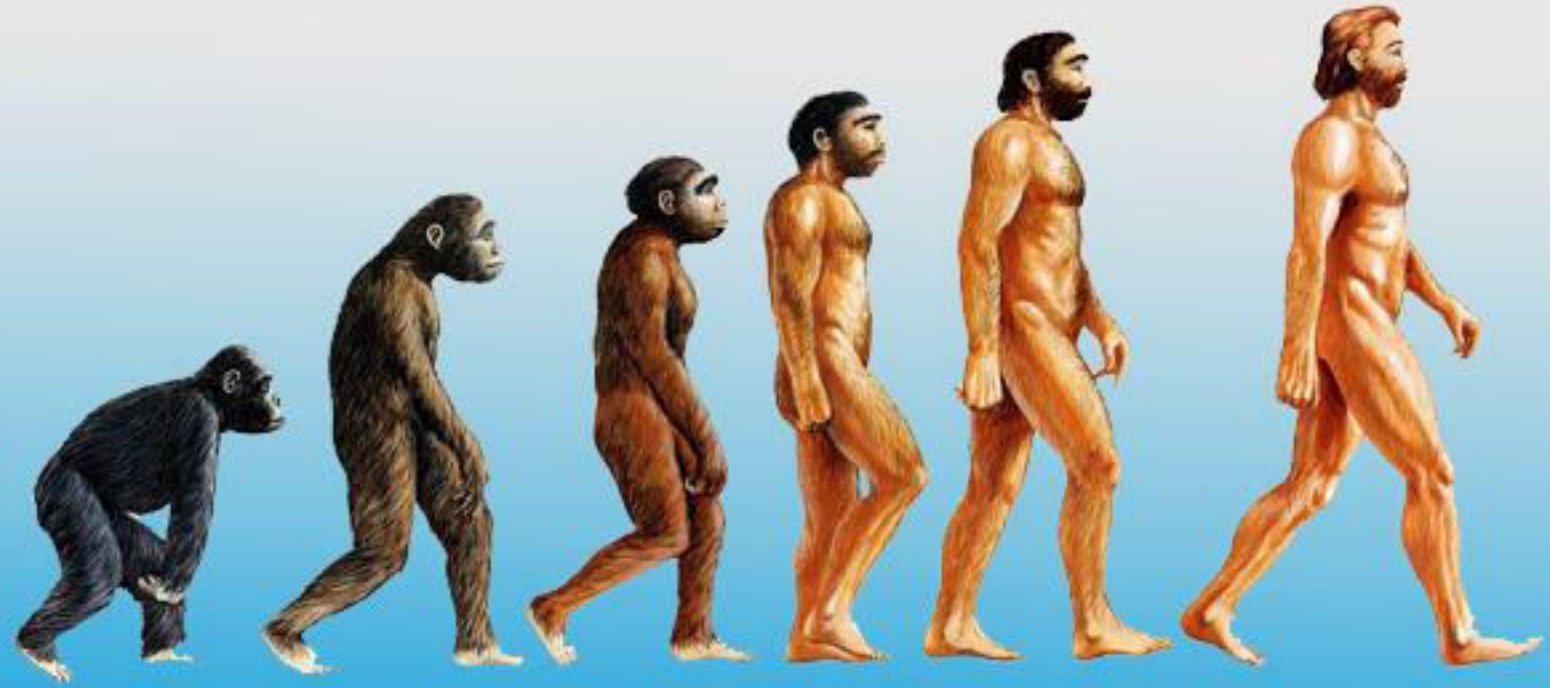
Heredity and Evolution

- **Reproduction (sexual and asexual)**



Heredity and Evolution

The Basic unit of life is

Cell

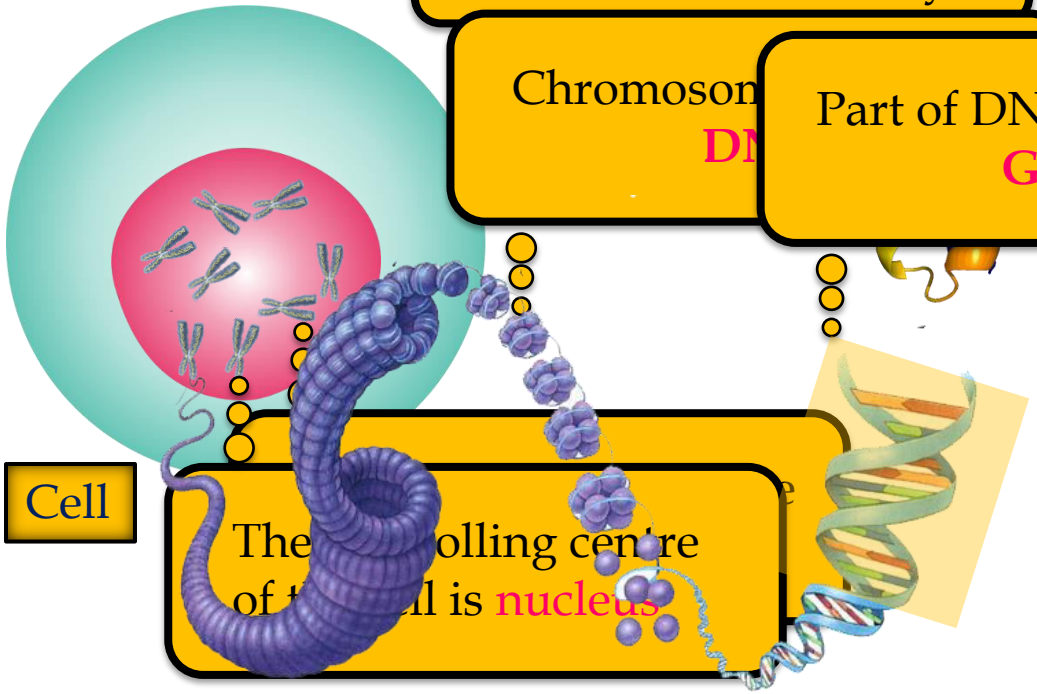
Protein decides the character of the body

Chromoson
DN

Part of DNA is called as GENE

Genes are responsible for formation of protein

The olling centre of t l is nucleus



The Basic unit of life is

These characters are transferred from parent to offspring through

reproduction

The Basic unit of life is

What is reproduction???

The Basic unit of life is

Reproduction

It is a process which give
New individuals that are
their parents
With subtle differences / variations

Reproduction are of two types

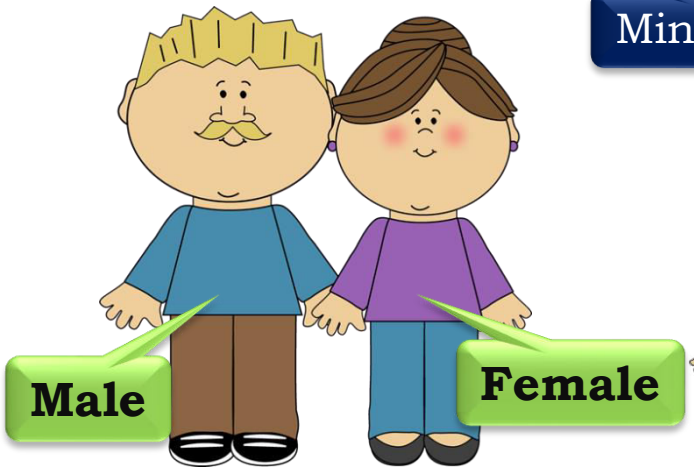
Sexual

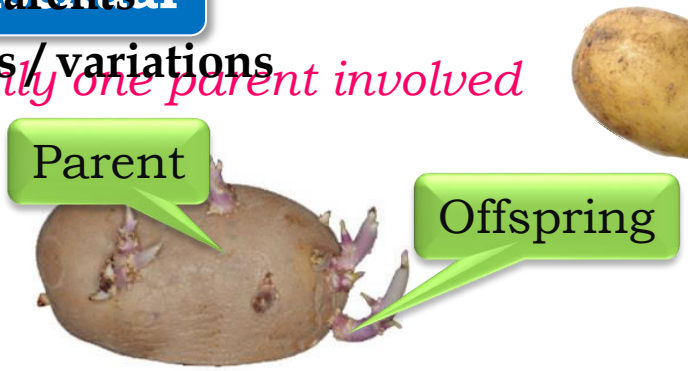
Asexual

Two parents are involved

Only one parent involved

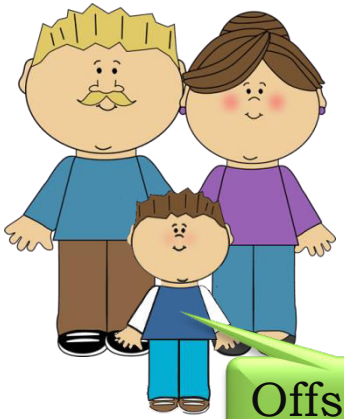
Minimum





Basic unit of life

Reproduction



Sexual

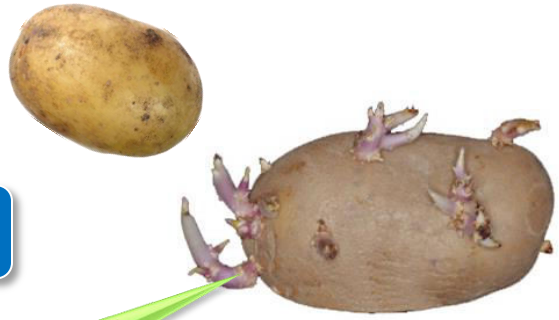
Offspring

Visible differences can be seen

Variations

Differences/Variations are maximized during sexual reproduction

Asexual



Offspring

No visible differences can be seen

Very little variations are during asexual reproduction

Thank You

Heredity and Evolution

- Variation
- Heredity

What is the mechanism by which variation are created and passed from one generation to another ???

Lets understand variations with an illustration

Inheritance from the previous generation provides both

Variations are crea

a comm

generat

changes

otle

Child gets the skin

colo from his mother

Father

Child

Mother

Transfer of characters from one generation to another is called as ***heredity***

Father

Child

Mother

When this new generation reproduces.

The second generation will have differences that they inherit from the first generation, as well as newly created differences.

Father

Child

Mother

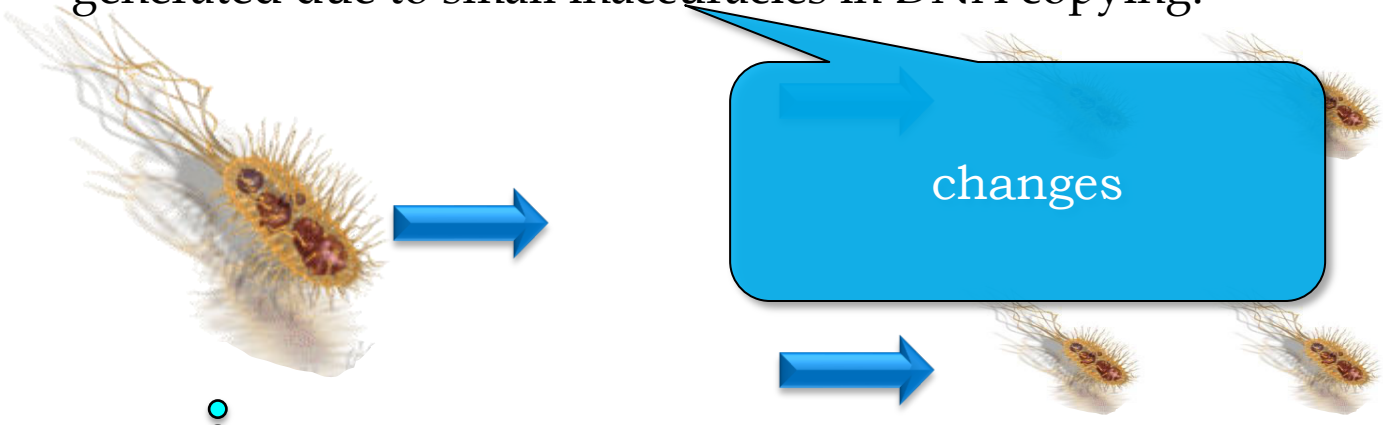
Thank You

Heredity and Evolution

- Asexual reproduction
- Inheritance

What happens when a single individual reproduces as in asexual reproduction

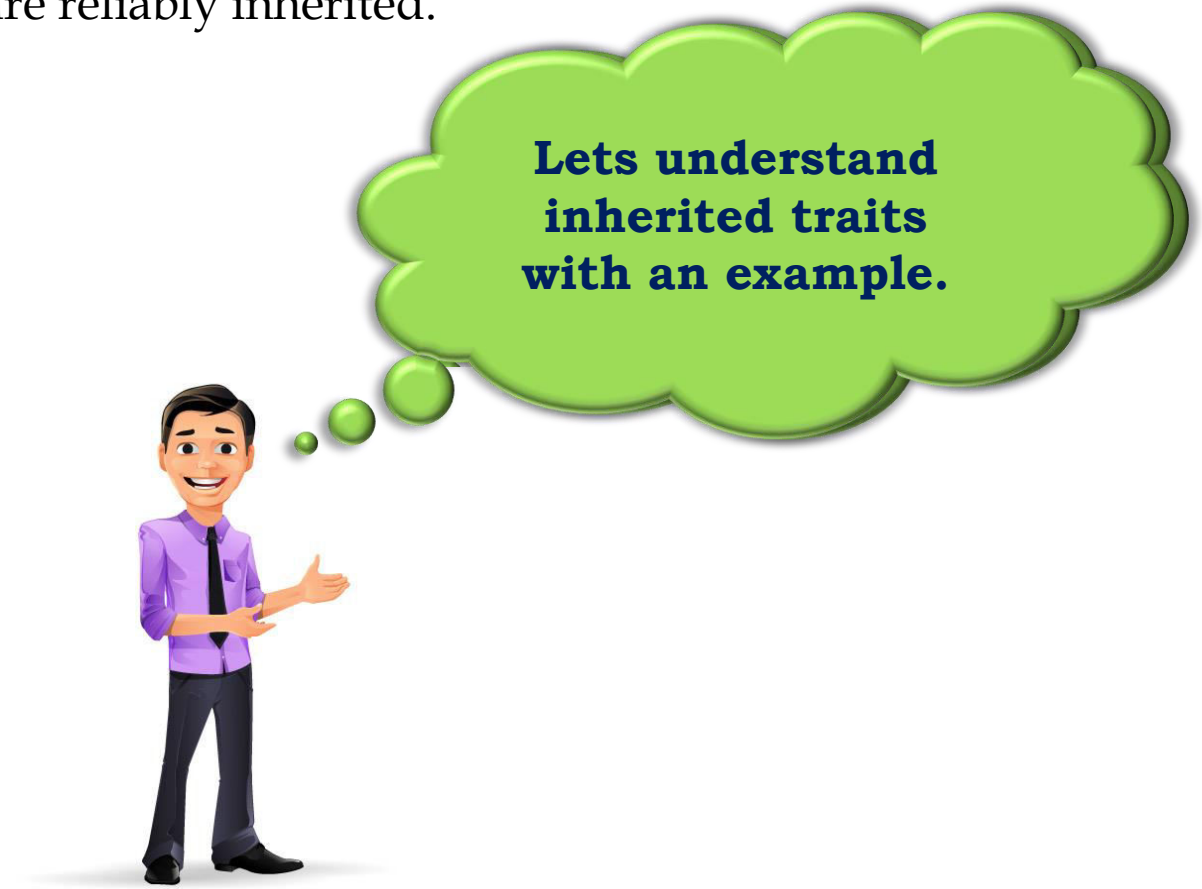
There would be only very minor differences between them, generated due to small inaccuracies in DNA copying.



If one bacterium divides, and then the resultant two bacteria divide again, the four individual bacteria generated would be very similar.

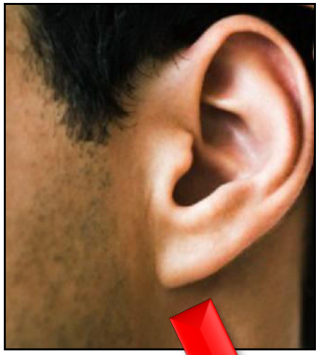
The most obvious outcome of the reproductive process still remains the generation of individuals of similar design.

Heredity determine the process by which traits and characteristics are reliably inherited.



Suppose a male with attached ear lobe marries a female with free ear lobe

Attached Ear lobe

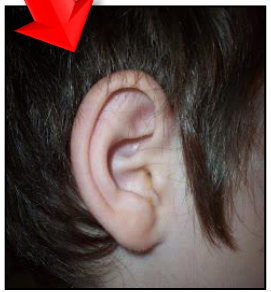


Free Ear lobe

So we can say child has inherited the trait of attached ear lobe from his father

It is observed the child has attached ear lobe

Attached



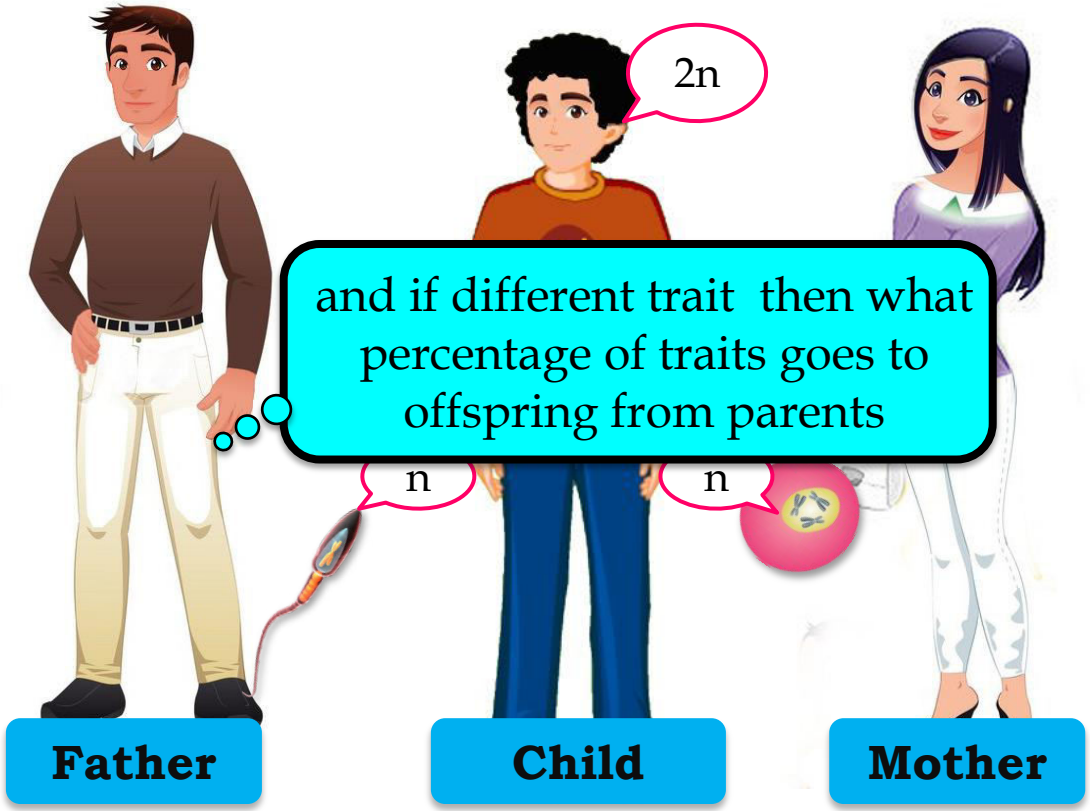

But, why the free ear lobe trait from mother has not been inherited???

Thank You

Heredity and Evolution

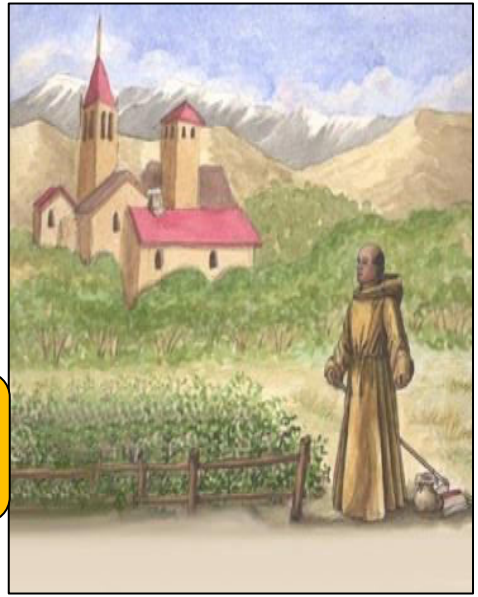
- **Life of Mendel**

Mother and father contribute equal quantity of genes,
When contribution is equal then why different trait of the child



To answer all these unanswered questions.....

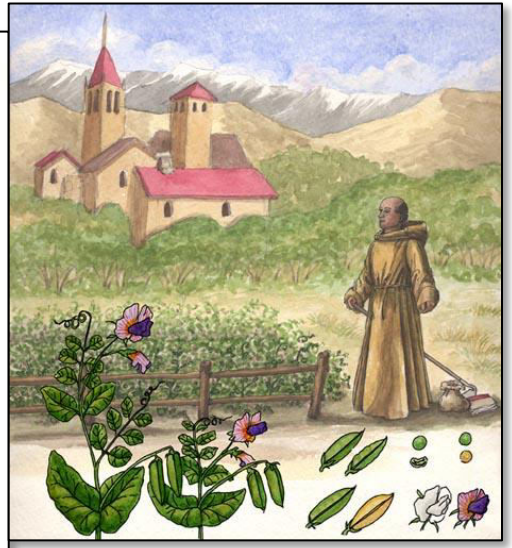
He went in a monastery for education

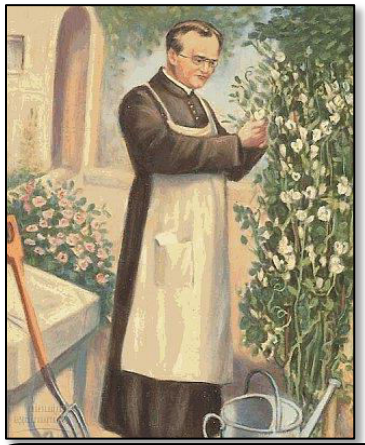


A child is born on 20 july 1822

Then he went on to study science and mathematics at the **University of Vienna.**

He went back to his monastery and started growing peas.





This helped him to arrive at the laws of inheritance

Mendel blended his k
and mathematics and
keep count of indivi
particular trait in

Thank You

Heredity and Evolution

- **Mendel's experiment**

Let’s study Mendel’s Experiments With pea plant in detail

MENDEL'S EXPERIMENT

Mendel used Visible 7 con *cters of Pisum Sativum*

Seed shape

Round/Wrinkled

Height of plant

Tall/dwarf

7 contrasting characters are

Colour of flower

Purple/White

Seed colour

Yellow/Green

MENDEL'S EXPERIMENT

Pod colour

Green/Yellow

7 contrasting characters are

Pod shape

Full/Constricted

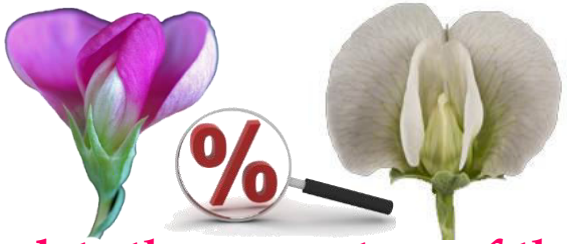
Position of flower

Axial/Terminal

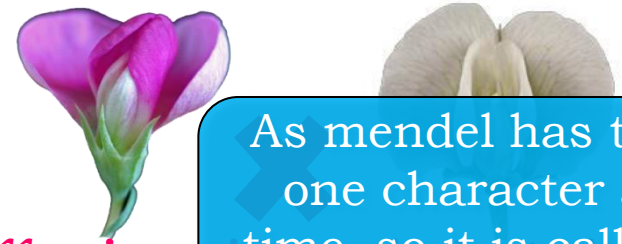
MENDEL'S EXPERIMENT

What he was thinking to do with these traits?

Producing offspring



by crossing these traits



Calculate the percentage of the offspring w

As mendel has taken one character at a time, so it is called as mono hybrid cross

Mendel made several crosses of pea plant involving only one pair of character(traits)

For eg. Tall plant ✖ Dwarf plant =

only one pair at a time

First parents for crossing

P1 GENERATION

Mono means one

Hybrid means two different characters

Thank You

Heredity and Evolution

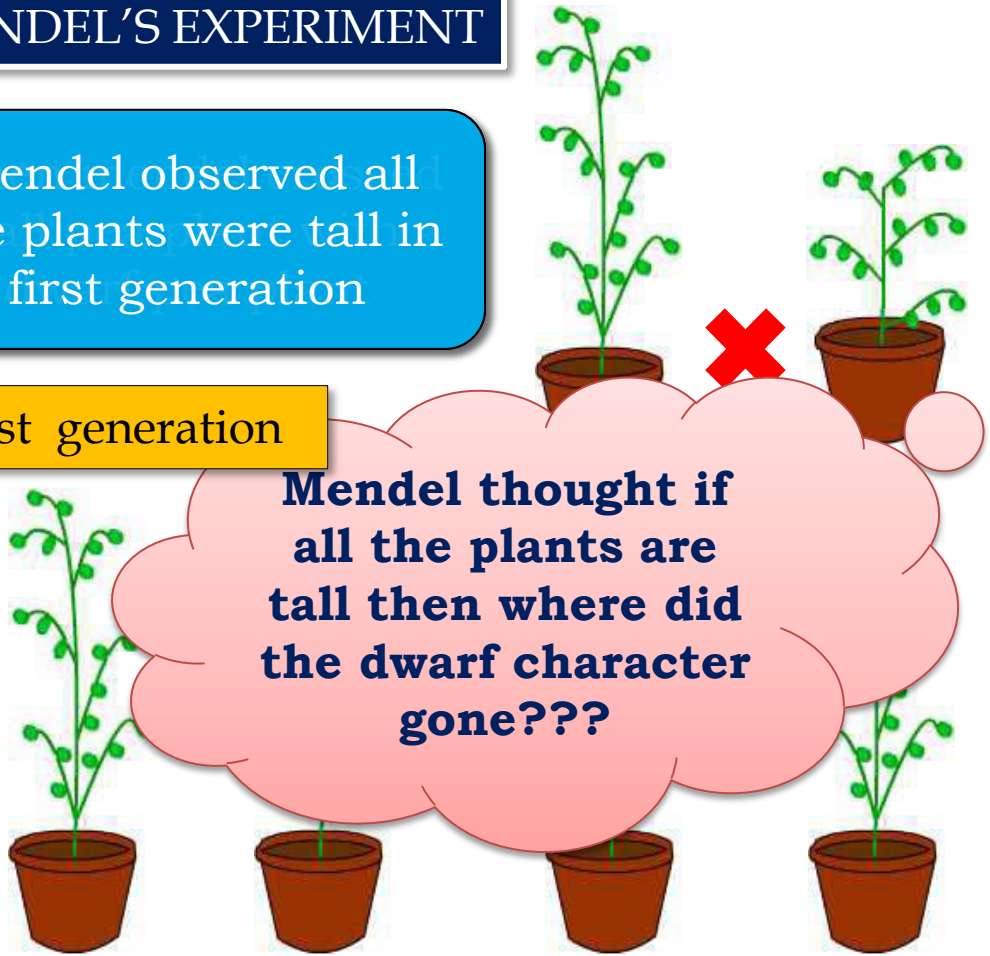
- **Results of monohybrid cross**

Lets see, what results Mendel got after his first monohybrid cross

MENDEL'S EXPERIMENT

Mendel observed all the plants were tall in first generation

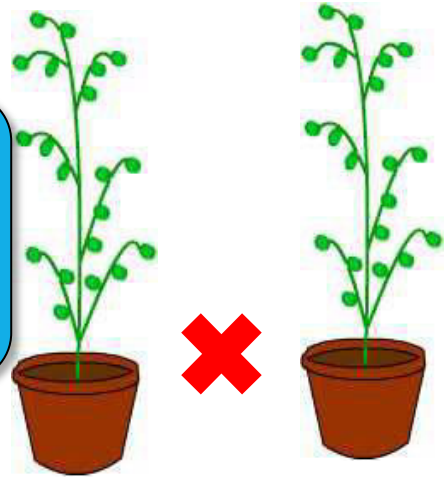
First generation



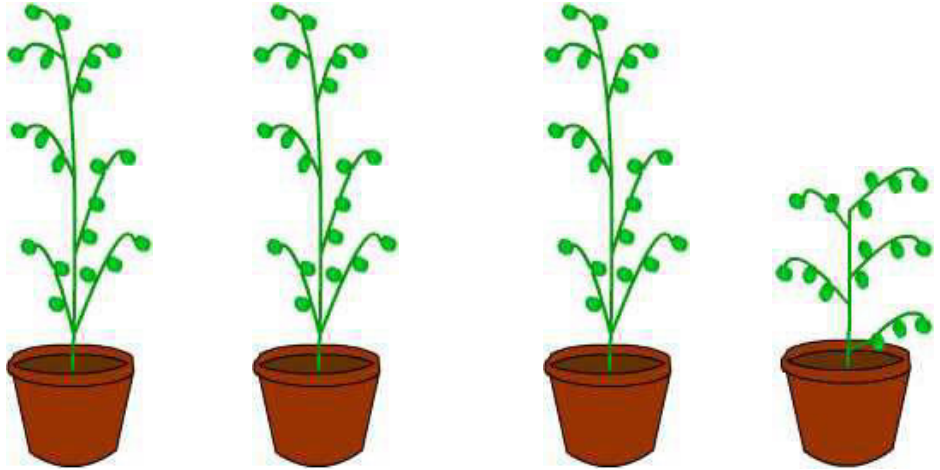
Mendel thought if all the plants are tall then where did the dwarf character gone???

MENDEL'S EXPERIMENT

Mendel observed there are three tall pea plants and one dwarf plant in the second generation



Second generation



Thank You

Heredity and Evolution

- **Mendel's terminologies**

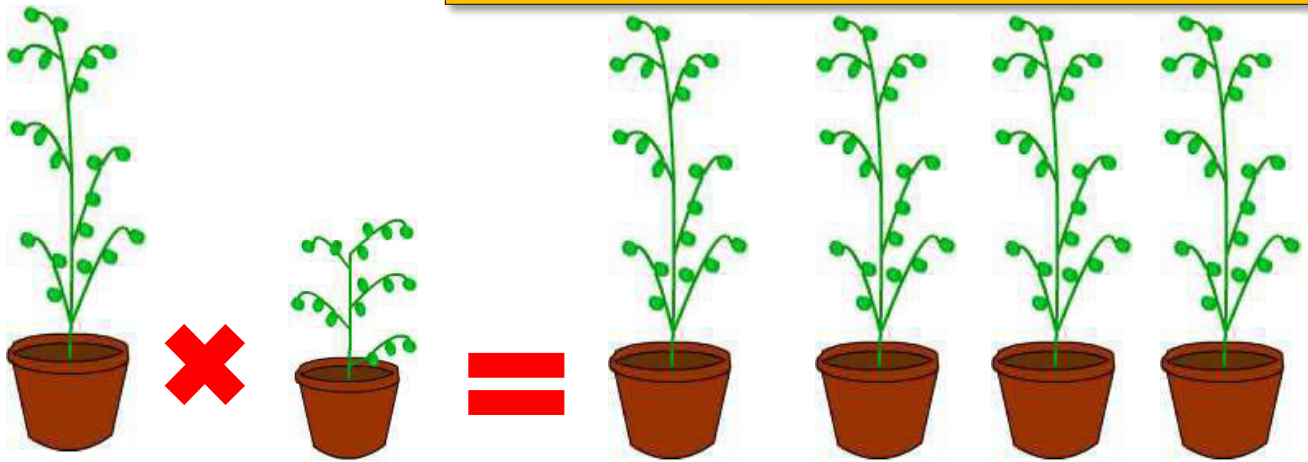
Mendel showed his experiment and results using some specific terminologies.

MENDEL'S TERMINOLOGIES

Character which masks or hides its partner is called as dominant character and the character which gets masked is called as recessive.

For eg **When tall plant is crossed with dwarf plant**

In the next generation all plant were tall



Hence, Mendel concluded that tall plant genes dominates the recessive plant genes.

MENDEL'S TERMINOLOGIES

Similarly, Mendel conducted experiments with all the other six characters and he found the following result.

Seed shape

In the next generation all seeds were Round

Round **Wrinkled** **Round**

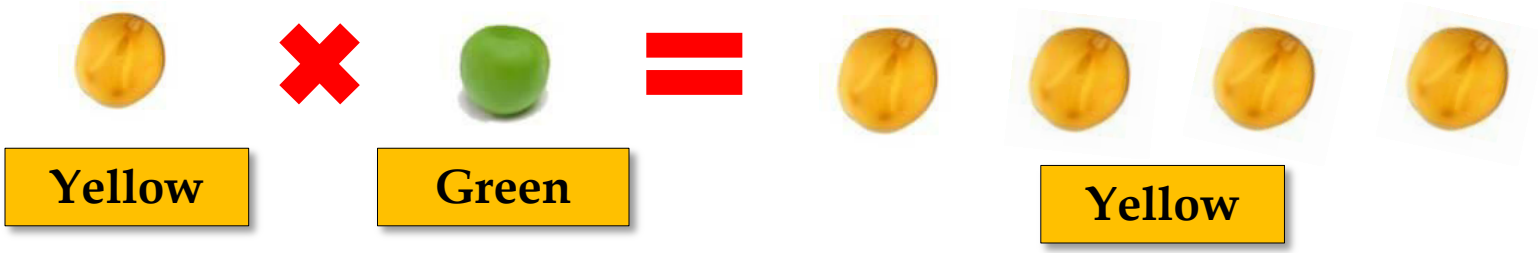
Hence, Mendel concluded that round seeds dominates over recessive wrinkled seeds.

MENDEL'S TERMINOLOGIES

Similarly, Mendel conducted experiments with all the other six characters and he found the following result.

Seed colour

In the next generation all colour of seed were yellow.



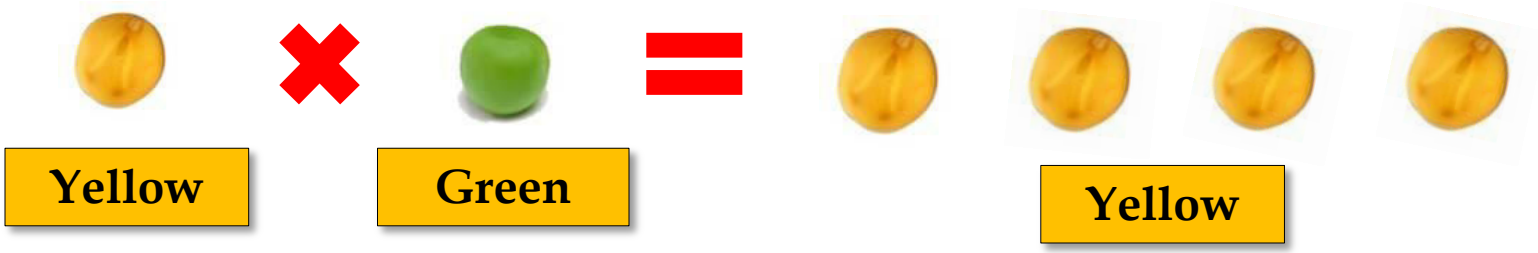
Hence, Mendel concluded that yellow seed is dominant over green seed.

MENDEL'S TERMINOLOGIES

Similarly, Mendel conducted experiments with all the other six characters and he found the following result.

Seed colour

In the next generation all colour of seed were yellow.



Hence, Mendel concluded that yellow seed is dominant over green seed.

MENDEL'S TERMINOLOGIES

Similarly, Mendel conducted experiments with all the other six characters and he found the following result.

Pod shape

Full

Constricted

In the next generation all Pod shape were full

Full

Hence, Mendel concluded that full is dominant over constricted pod shape.

MENDEL'S TERMINOLOGIES

Similarly, Mendel conducted experiments with all the other six characters and he found the following result.

Pod colour

Green

Yellow

In the next generation all Pod shape were full

Green

Hence, Mendel concluded that full is dominant over constricted pod shape.

MENDEL'S TERMINOLOGIES

Similarly, Mendel conducted experiments with all the other six characters and he found the following result.

Colour of flower → **In the next generation all colour of flower were red**

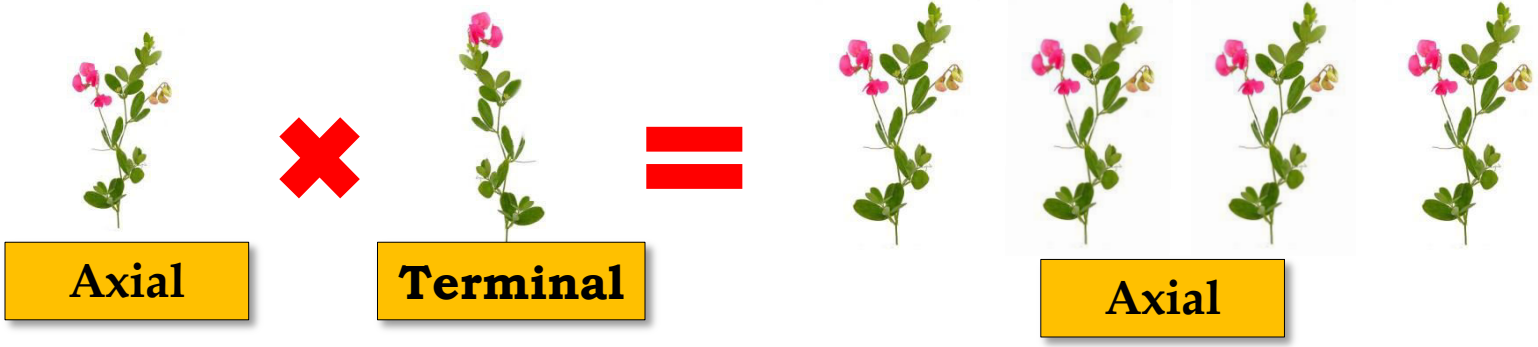
Hence, Mendel concluded that red flower is dominant over white flower.

MENDEL'S TERMINOLOGIES

Similarly, Mendel conducted experiments with all the other six characters and he found the following result.

In the next generation position of all flower were axial

Position of flower



Hence, Mendel concluded that axial flowers are dominant over terminal flower.

Thank You

Heredity and Evolution

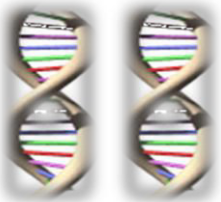
- **Mendel's symbols**

MENDEL THOUGHT

What is responsible for these traits or characters?

MENDEL STATED **Some factors**

Which were always present in pairs

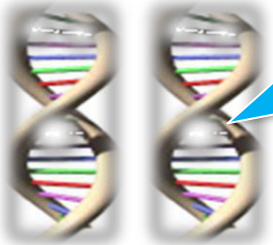


Red flower (RR) | Yellow seed (YY)

But, today we know these factors are nothing but **GENES**.

MENDEL'S SYMBOLS

Mendel showed Dominant genes with **CAPITAL LETTERS** and Recessive genes with **SMALL LETTERS**



But, Genes are present always in pairs

For eg	*Dominant*	*Recessive*
Height of plant	Tall	Dwarf
	TT	tt
Colour of flower	Red	White
	RR	rr
Pod colour	Green	Yellow
	GG	gg

MENDEL used two terms to explain his observations

Appearance of any detectable characteristics of an individual **Phenotype**

Genetic composition of an individual **Genotype**

Appearance/ Phenotype

RED

Genetic composition / Genotype

RR

Thank You

Heredity and Evolution

- **Mendel's Monohybrid cross**

Mendel's Monohybrid cross

He symbolise tall pea plant as TT and dwarf pea plant as tt

Parents (P1)

T T × t t

Tall pea plant

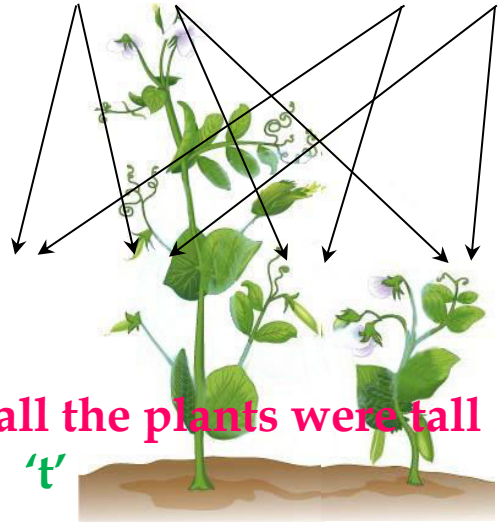
Dwarf pea plant

Gametes

T T t t

F1 generation

First filial generation



Mendel observed that all the plants were tall as 'T' is dominant over 't'

Mendel's Monohybrid cross

Mendel self crossed the two tall plants of F1 generation

Parents (P2)

T t × T t

Gametes

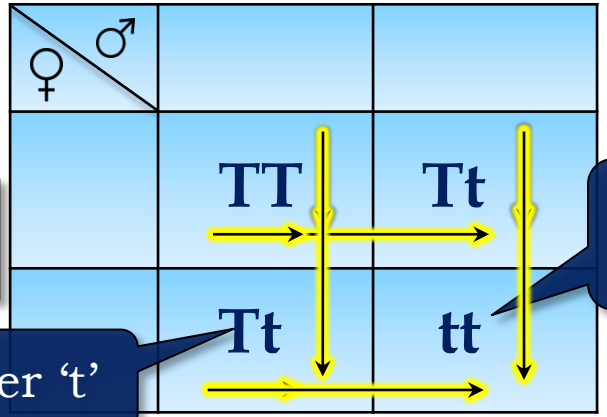
T t T t

Mendel observed there are three tall plants

and one dwarf plant

F2 generation

Second filial generation

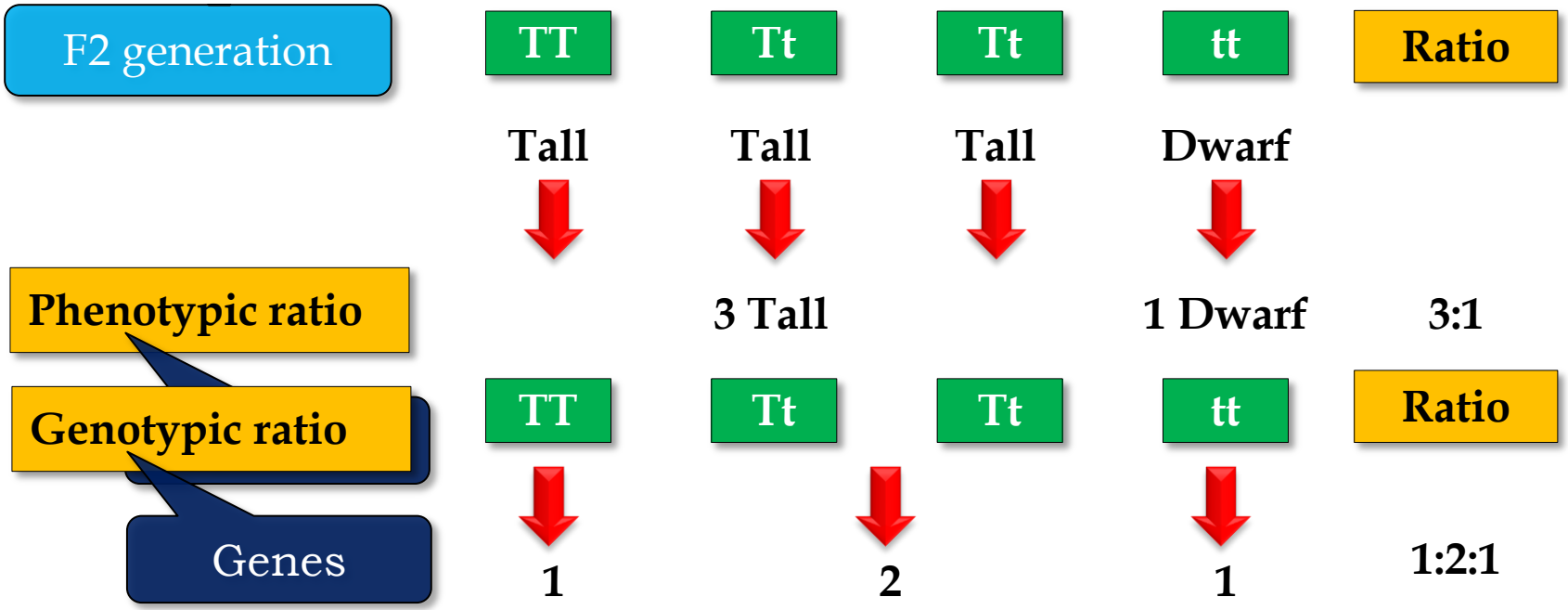


As 'T' is dominant over 't'

As 't' and 't' both are recessive

Mendel's Monohybrid cross

Mendel concluded his results of monohybrid cross as



Thank You

Heredity and Evolution

- **Mendel's Dihybrid cross**

Mendel's Dihybrid cross

Parents (P1)

TTAA × ttaa

He symbolise tall pea plant with axial flower as TTAA

Tall pea plant with axial flower

Dwarf pea plant with terminal flower

Gametes

TA TA ta ta

F1 generation

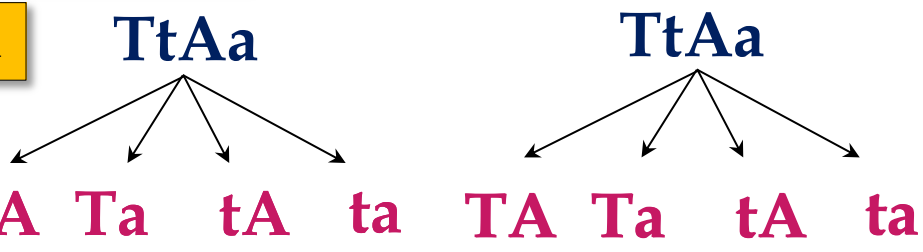
First filial generation

TtAa TtAa TtAa TtAa

Mendel observed that all the plants were tall bearing axial flowers as 'T' is dominant over 't' and as 'A' is dominant over 'a'

Mendel's Monohybrid cross

On self-pollination



Gametes

Second filial generation

♀ \ ♂				
	TTAA	TTAa	TtAA	TtAa
	TTAa	TTaa	TtAA	Ttaa
	TtAA	TtAa	ttAA	ttAa
	TtAA	Ttaa	ttAa	ttaa

Heredity and Evolution

- **Mendel's Dihybrid cross (self cross)**
- **Genotypic and Phenotypic ratio**

Mendel's Dihybrid cross

On self-pollination

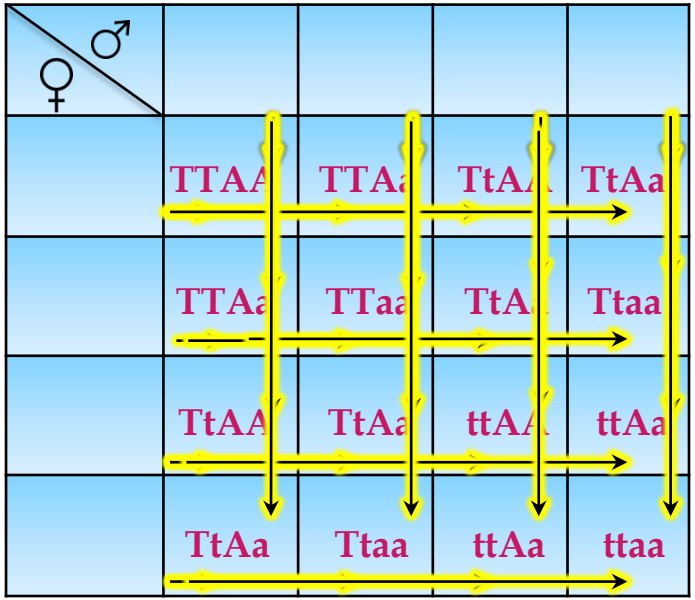
TtAa × TtAa

Gametes

TtAa → TA Ta tA ta

TtAa → TA Ta tA ta

Second filial generation



♀ \ ♂	TA	Ta	tA	ta
TA	TTAA	TTAa	TtAA	TtAa
Ta	TTAa	TTaa	TtAa	Ttaa
tA	TtAA	TtAa	ttAA	ttAa
ta	TtAa	Ttaa	ttAa	ttaa

Mendel's Dihybrid cross

♀ \ ♂	TA	Ta	tA	ta
TA	TTAA	TTAa	TtAA	TtAa
Ta	TTAa	TTaa	TtAa	Ttaa
tA	TtAA	TtAa	ttAA	ttAa
ta	TtAa	Ttaa	ttAa	ttaa

Phenotypic ratio

Appearance

Tall & axial = 9

Tall & terminal = 3

Dwarf & axial = 3

Dwarf & terminal = 1

All the genetic combination which has 't' and 'a'

9 : 3 : 3 : 1

Mendel's Dihybrid cross

♀ \ ♂	TA	Ta	tA	ta
TA	TTAA	TTAa	TtAA	TtAa
Ta	TTAa	TTaa	TtAa	Ttaa
tA	TtAA	TtAa	ttAA	ttAa
ta	TtAa	Ttaa	ttAa	ttaa

Genotypic ratio

Genes

TTAA = 1

TTAa = 2

TtAA = 2

TtAA = 4

Ttaa = 2

ttAa = 2

ttaa = 1

ttAA = 1

TTaa = 1

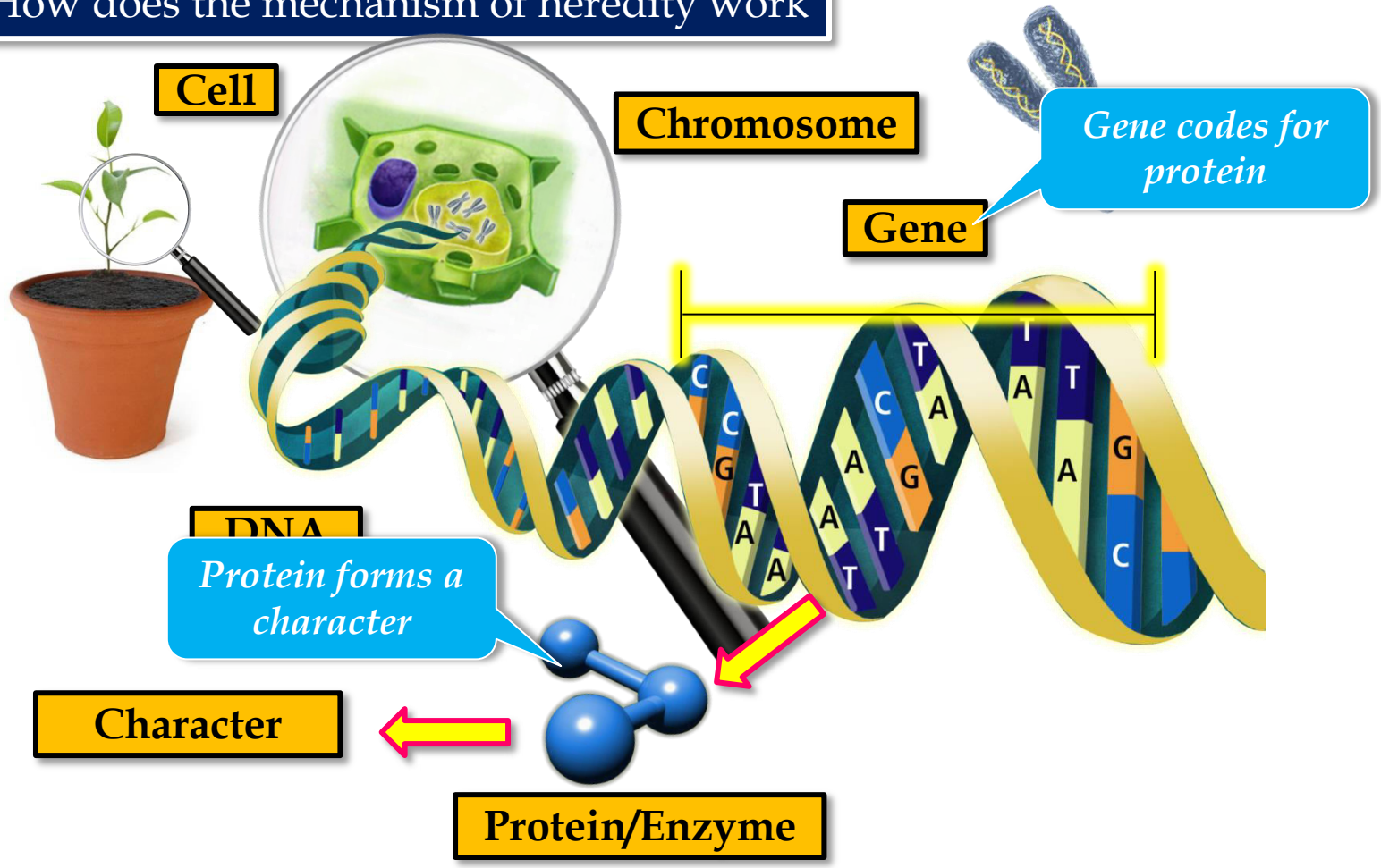
1 : 2 : 2 : 4 : 2 : 2 : 1 : 1 : 1

Thank You

Heredity and Evolution

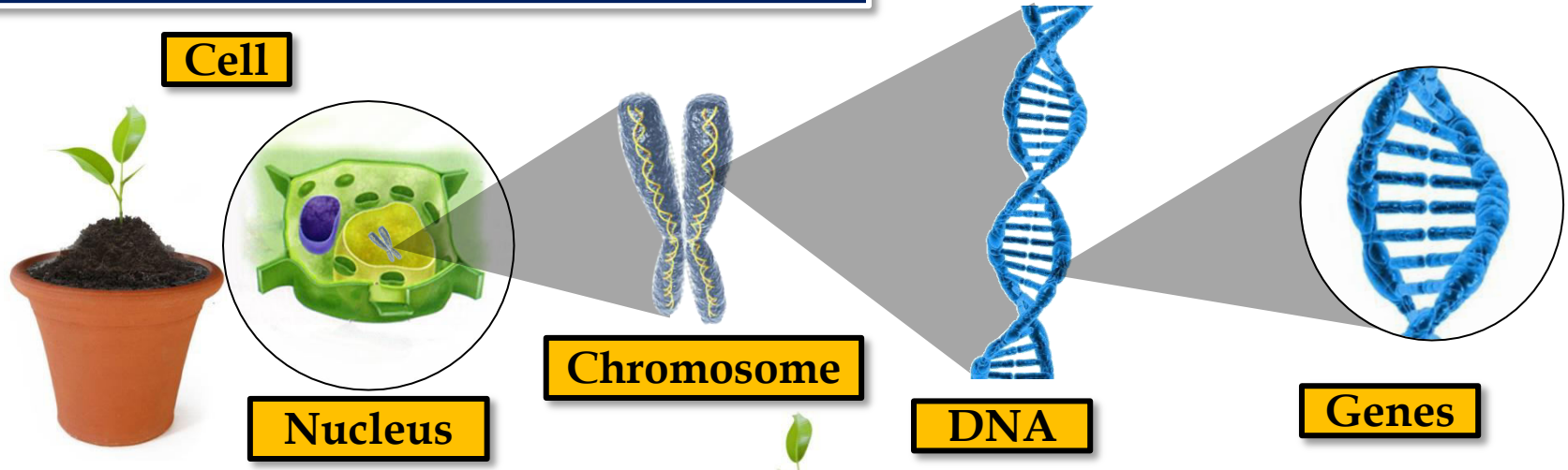
- **Mechanism of heredity**

How does the mechanism of heredity work



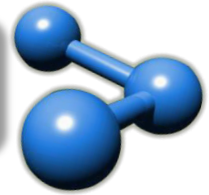
Lets understand the mechanism of heredity with an example

How does the mechanism of heredity work



Gene codes for an enzyme which is responsible for tallness in plant

This enzyme produces a hormone which triggers plant growth and results in tallness in plant

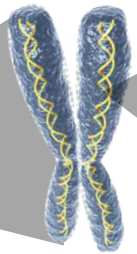


Protein/Enzyme

How does the mechanism of heredity work

Cell

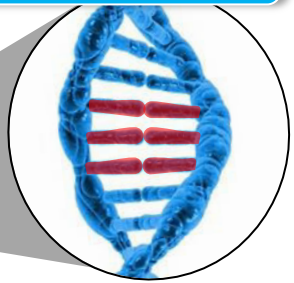
Nucleus



Chromosome

DNA

If the gene has an alteration



Genes

I
a

ne less efficient
less hormones

Protein/Enzyme

So the plant will be short

Thank You

Heredity and Evolution

- **Mechanism of inheritance**

How do offspring inherit single set of genes from mother and father when the genes are always present in pairs in a single DNA???


Lets
understand
inheritance
with an
illustration

Round Yellow

Wrinkle Green

Parents

R R Y Y

R R Y Y

Lets suppose the genes
dominant yellow colou
is shown with dark blue

The F1 progeny shows the presence of both dominant and recessive genes from the parent

wn with light blue

RY RY

Let suppose the gene
dominant round shape
is shown with dark re

Lets suppose the genes of recessive wrinkle shape RR is shown with light red

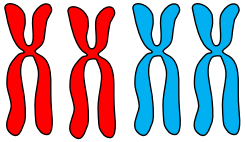
Gametes

Round Yellow

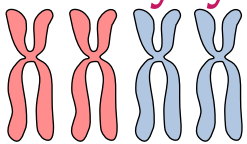
Wrinkle Green

Parents

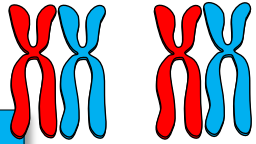
R R Y Y



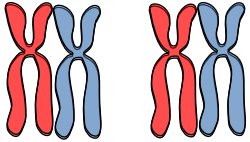
r r y y



RY RY



ry ry



Gametes

F1 Generation

RrYy

RrYy

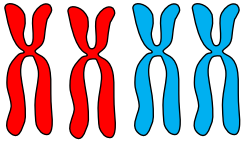
The F1 progeny shows the presence of both dominant and recessive genes from the parent

Round Yellow

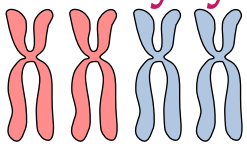
Wrinkle Green

Parents

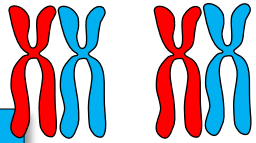
R R Y Y



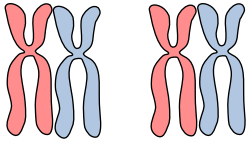
r r y y



RY RY



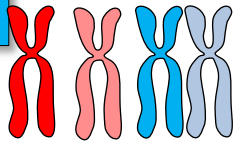
ry ry



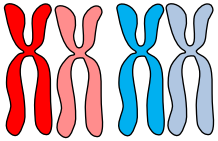
Gametes

F1 Generation

RrYy



RrYy



The F1 progeny shows the presence of both dominant and recessive genes from the parent

Round Yellow

Wrinkle Green

Parents

R R Y Y

r r y y

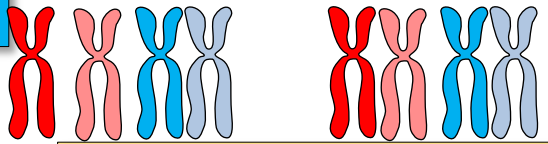
RY RY

ry ry

Gametes

F1 Generation

RrYy RrYy RrYy RrYy



Round Yellow

The F1 progeny shows the presence of both dominant and recessive genes from the parent but the phenotype of all the F1 offspring is round and yellow

Round Yellow

Wrinkle Green

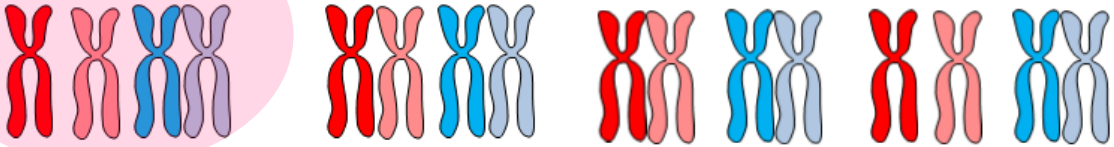
Parents

RY RY

ry ry

IF progeny plants inherited a single genes from each parent then the two characteristic seed shape and seed colour would be linked to each other and the hybrid gametes cannot be formed, but this is not the case in the experiment

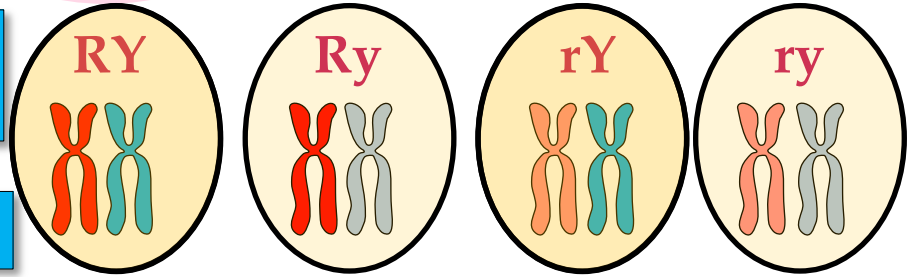
RrYy RrYy RrYy RrYy



F1 Generation

Gametes

RY Ry rY ry

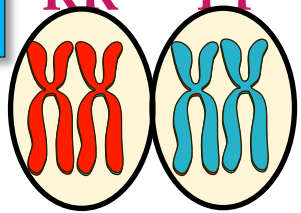


Round Yellow

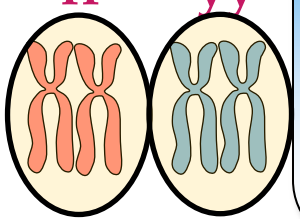
Wrinkle Green

Parents

RR YY



rr yy

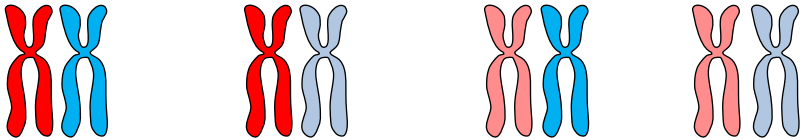


In the experiment we can see both parent and hybrid gametes, so it is explained that each gene set (seed shape and seed colour) is present not as single long thread of DNA

but as a separate independent pieces each called as chromosome

F1 Generation

RY Ry rY ry



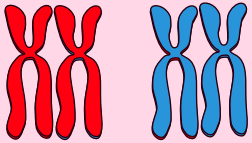
Gametes

Round Yellow

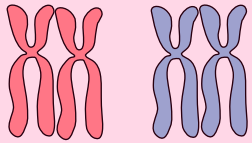
Wrinkle Green

Parents

RR YY



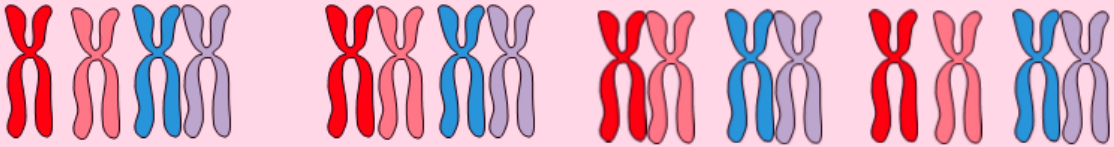
rr yy



Such mechanism of inheritance explain the results of ***MENDEL'S EXPERIMENT***

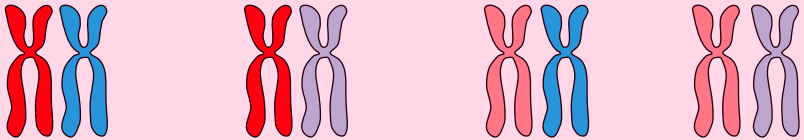
the species

RrYy RrYy RrYy RrYy



F1 Generation

RY Ry rY ry



Gametes

Thank You