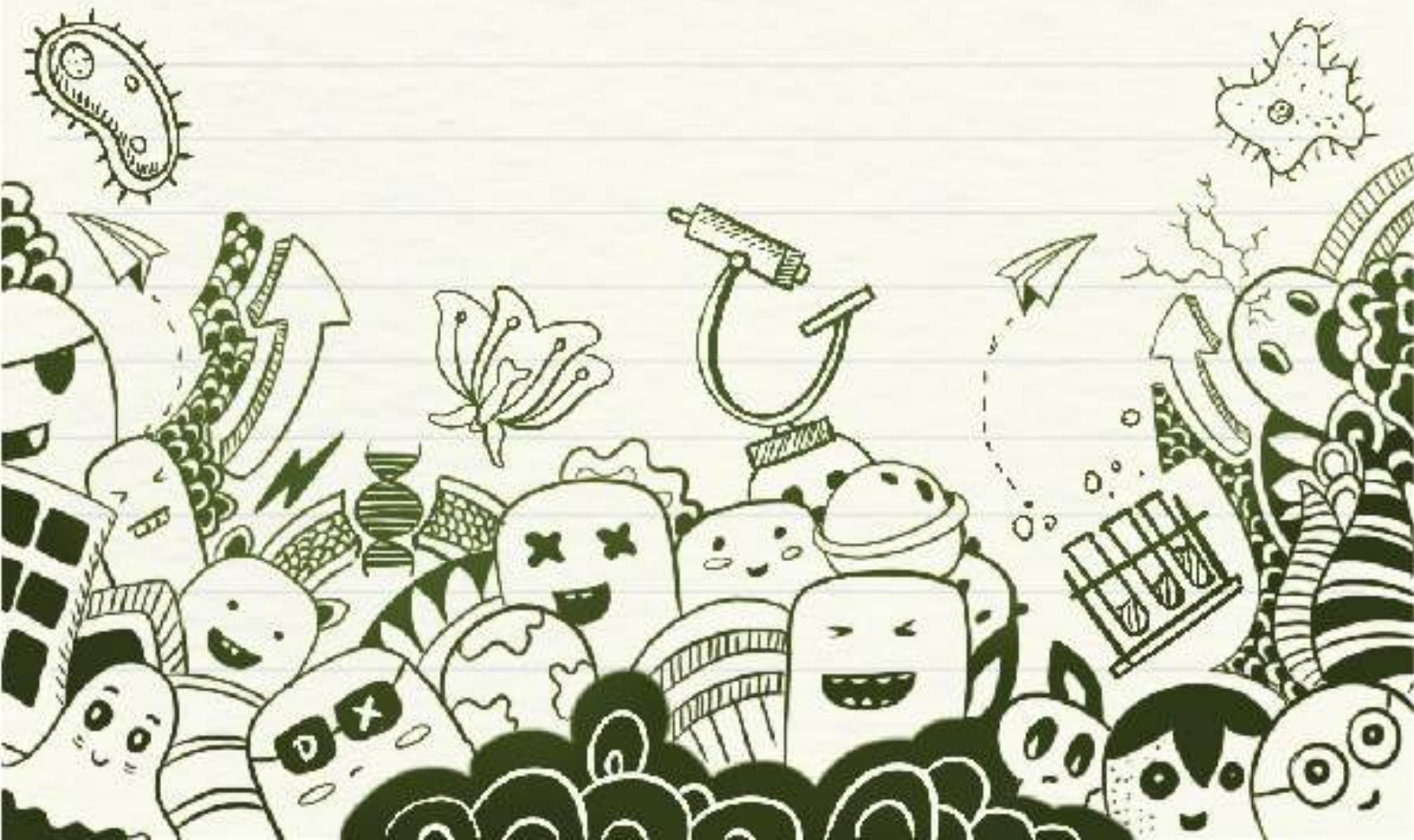


B I O L O G Y

BYJU'S
POST CLASS NOTES

Heredity & Evolution



Topics



1. Basics of Heredity

2. Mendel's Experiments

3. Sex determination





Important terms

★ Heredity

Transmission of characters from one generation to the next.

★ Chromosomes

Rod like structure visible at the time of cell division. It contain genetic information in the form of DNA which is transferred from one generation to the next.

★ Gene

Functional segment of DNA that contain necessary information for synthesizing proteins.

★ Alleles

Alternative forms of genes that occupy the same position on the chromosomes .

★ Homozygous

The two alleles controlling one character are same (TT or tt)

★ Heterozygous

The two alleles controlling one character are different.

★ Dominant allele

In heterozygous condition, the allele which express itself physically.



Important terms

★ Recessive allele:

In heterozygous condition, the allele which remains unexpressed physically.

★ Phenotype

Expressed visible character (Tall, Dwarf)

★ F1 Generation

Generation of hybrids produced from a cross between the genetically different individuals.

★ F2 Generation

Generation of individuals which arises as a result of cross amongst individuals of F1 generation.

★ Sex Chromosomes

Chromosome that determine whether the individual is male or female.

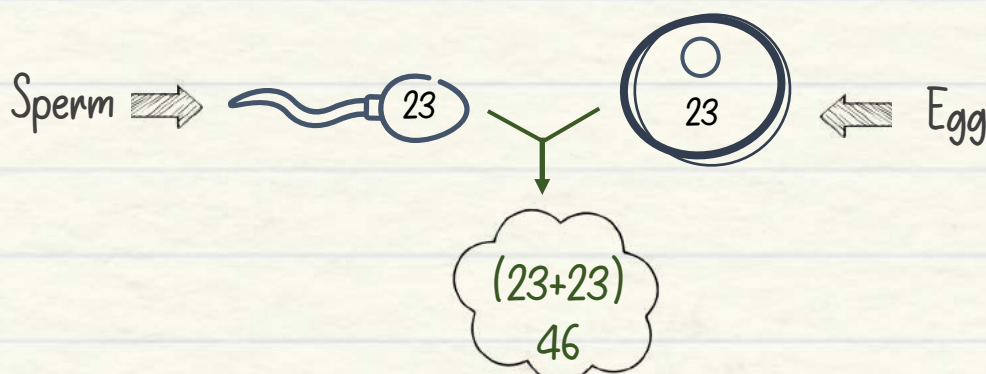
★ Autosomes

Chromosome other than that of Sex chromosome.

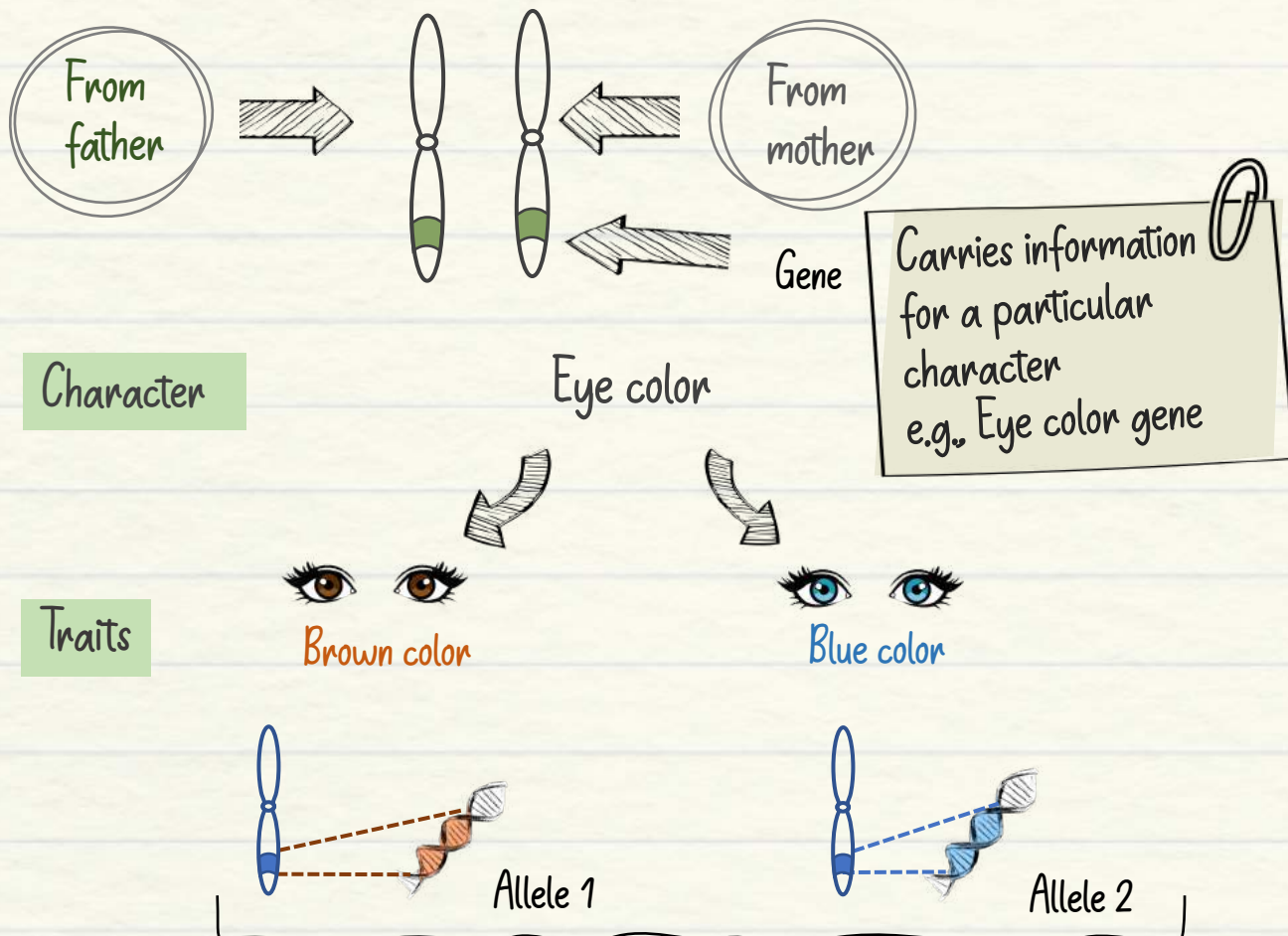
1. Basics of Heredity

- ★ Chromosomes in the nucleus carry genetic information
- ★ Humans have 46 chromosomes

In sexual reproduction



- ★ Chromosomes exist in pairs, one coming from each parent



Alleles: Alternative forms / variants of a gene

2. Mendel's Experiments















Gregor Johan Mendel

- ★ Father of genetics
- ★ Studied inheritance in pea plants
- ★ Put forth 3 laws of Inheritance

Why Pea plants?

- ★ Smaller life cycle
- ★ Many contrasting characters
- ★ Bisexual flowers

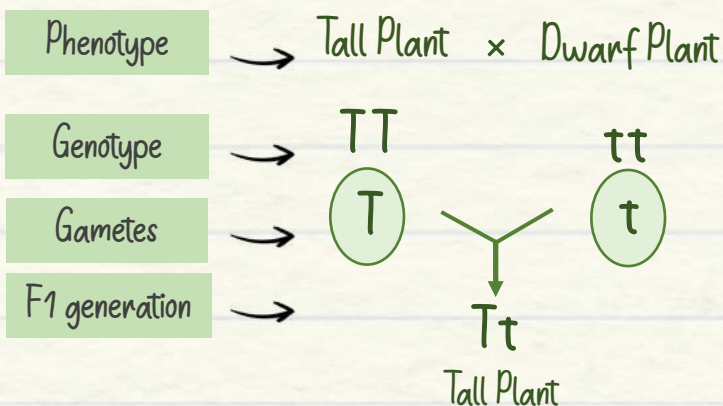
7 contrasting characters of pea plant

	Height	Seed shape	Seed colour	Flower colour	Pod shape	Pod colour	Flower position
Dominant	 Tall	 Round	 Yellow	 Purple	 Inflated	 Green	 Axial
Recessive	 Short	 Wrinkled	 Green	 White	 Constricted	 Yellow	 Terminal

2.1 Monohybrid Cross

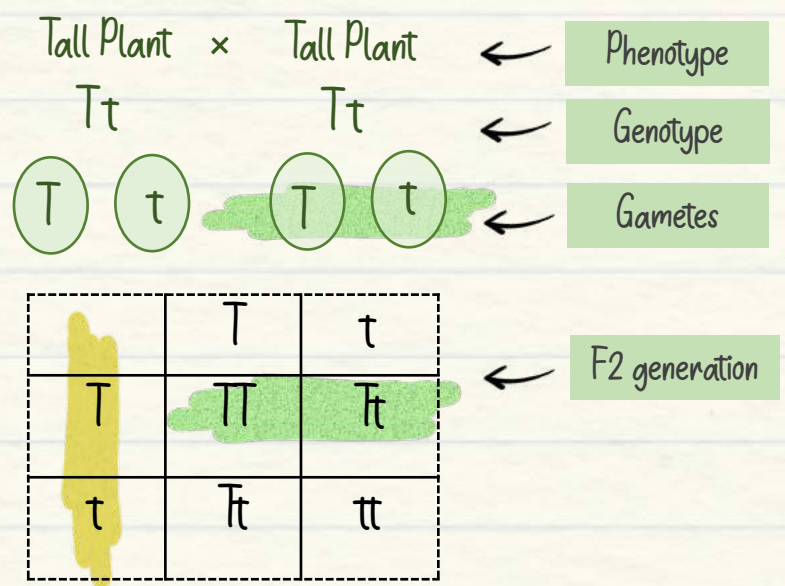
Definition :

When only one character is considered while crossing two organisms, such cross is called monohybrid cross.



Law of Dominance
In heterozygous condition, the factor or gene which express itself physically is called dominant and the other which remain unexpressed is called recessive.

Law of Segregation
The two alleles for a character will segregate from each other during gamete formation



Phenotypic ratio in F₂ generation : Tall : dwarf
3 : 1

Genotypic ratio in F₂ generation : TT : Tt : tt
1 : 2 : 1

2.2 Dihybrid Cross

Definition :

When **two characters are considered** while crossing two organisms, such cross is called **dihybrid cross**.

Phenotype → Yellow, round seed × Green, Wrinkled seed

Genotype → YYRR yyrr

Gametes → (YR) (yr)

F1 generation → YyRr
Yellow, round seed

Yellow, round seed × Yellow, round seed

YyRr × YyRr

(YR) (Yr) (yR) (yr) × (YR) (Yr) (yR) (yr)

Law of independent assortment

It states that the **alleles of two different characters/traits** segregate independently.

	YR	Yr	yR	yr
YR	YYRR ●	YYrR ●	yYRR ●	yYrR ●
Yr	YYRr ●	YYrr ●	yYRr ●	yYrr ●
yR	YyRR ●	YyrR ●	yyRR ●	yyrR ●
yr	YyRr ●	Yyrr ●	yyRr ●	yyrr ●

← F2 generation

Phenotypic ratio in F₂ generation:

9 : 3 : 3 : 1

● : ● : ● : ●

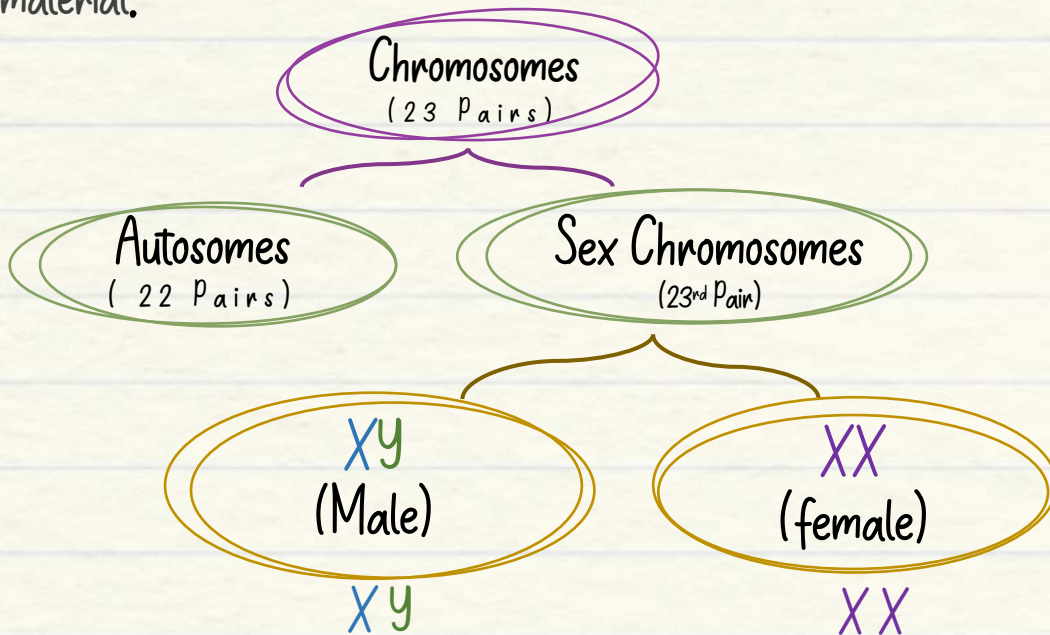
3. Sex Determination

Definition :

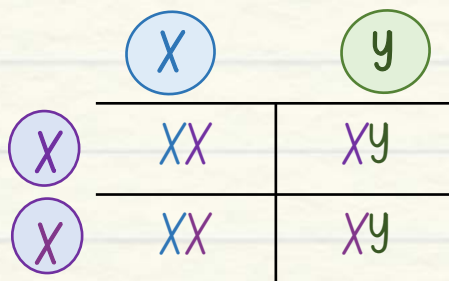
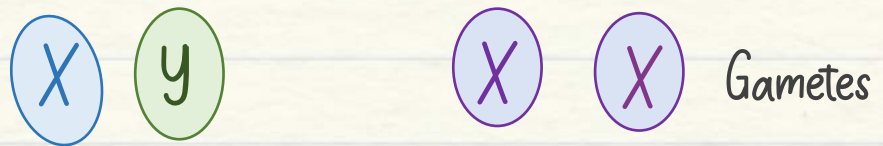
The process of determining the sex of an individual, based on the composition of the genetic material.

Chromosomes :

The process of determining the sex of an individual, based on the composition of the genetic material.



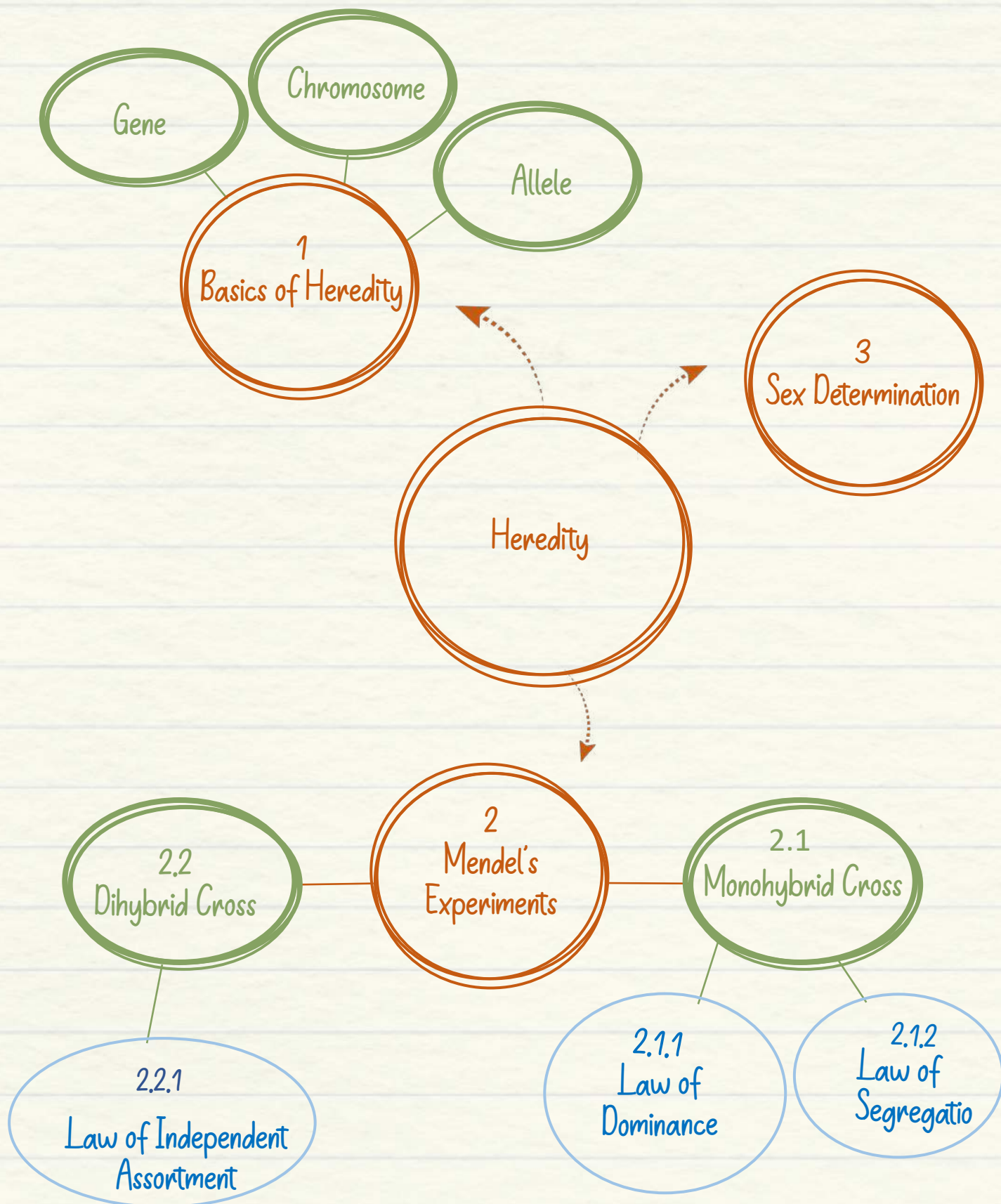
Segregation by meiosis



Conclusion

Therefore there is a 50% chance of the offspring being male or female.

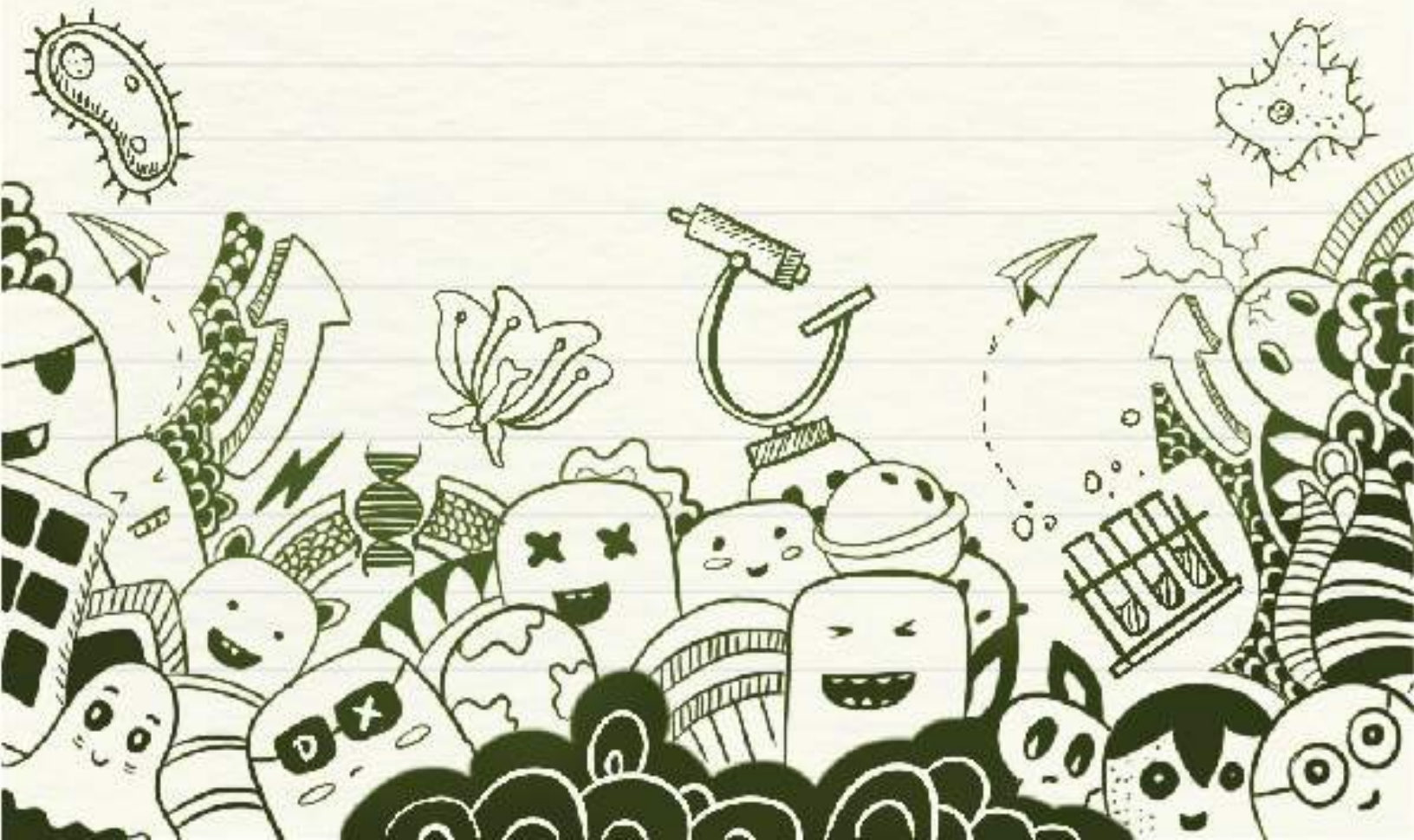
 **Mind Map**



B I O L O G Y

BYJU'S
POST CLASS NOTES

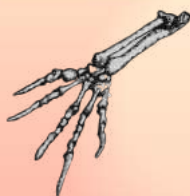
Evolution



Topics



- Evolution
- Speciation
- Evidence of Evolution
- Artificial Selection



Evolution

1.1 Variation

Difference in characteristics within a species is called Variation. For example, change in color of eyes and color of hair.

Factors affecting Variation

Environmental factors

Natural selection

Genetic drift

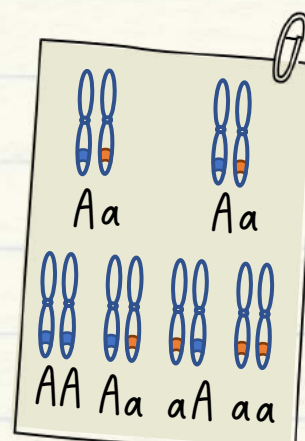
Genetic Factors

In sexual reproduction

- Higher chances of variation.
- It occurs due to **random mixing** of alleles.

In asexual reproduction

- Lower chances of variation.
- It occurs due to error in DNA copying.



Evolution

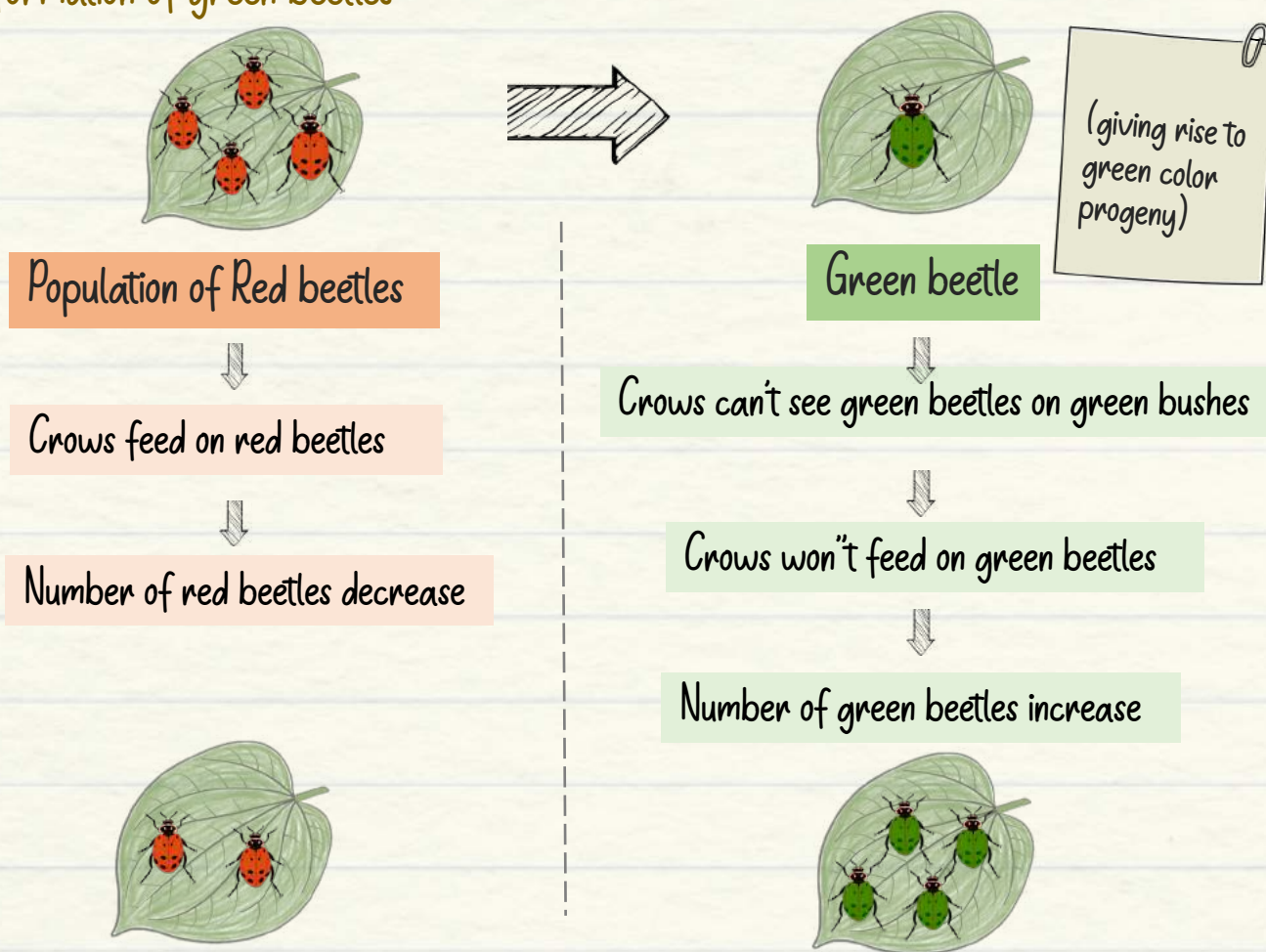
Sequence of gradual changes which takes place in the organisms over millions of years, in which new species are produced.

Natural Selection (Scenario I)

1.1 a) Natural selection

Natural selection Is a process in which organisms better adapted to their environment tend to survive and produce more offspring.

In a population of red beetles on green bushes, color variation results in formation of green beetles



Conclusion

Green color variation became more common as it got survival advantage or it was naturally selected.



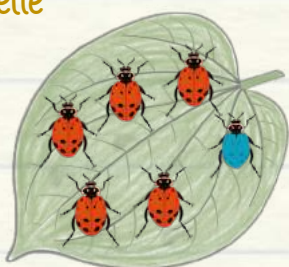
Darwin's theory of natural selection suggest that the best adapted organisms are selected by nature to pass on their characteristics to the next generation.

Genetic drift (Scenario II)

1.1 b) Genetic drift

Variation in the gene frequency leads to large changes in populations over a short period of time

In a population of red beetles on green bushes, color variation results in formation of blue beetle



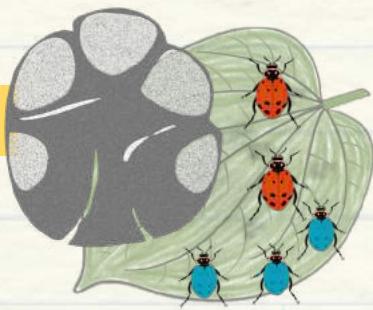
Number of red beetles are **more** than number of blue beetles



Both reproduce and give rise to offspring of their respective colors



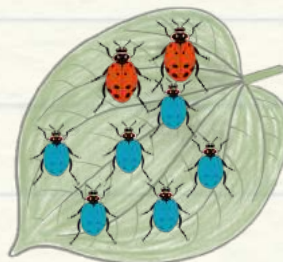
Elephant foot



Elephant steps on the bushes **where red beetle** population is more resulting in decrease in number of red beetle population



Number of blue beetle population is **more** as compared to red beetle population

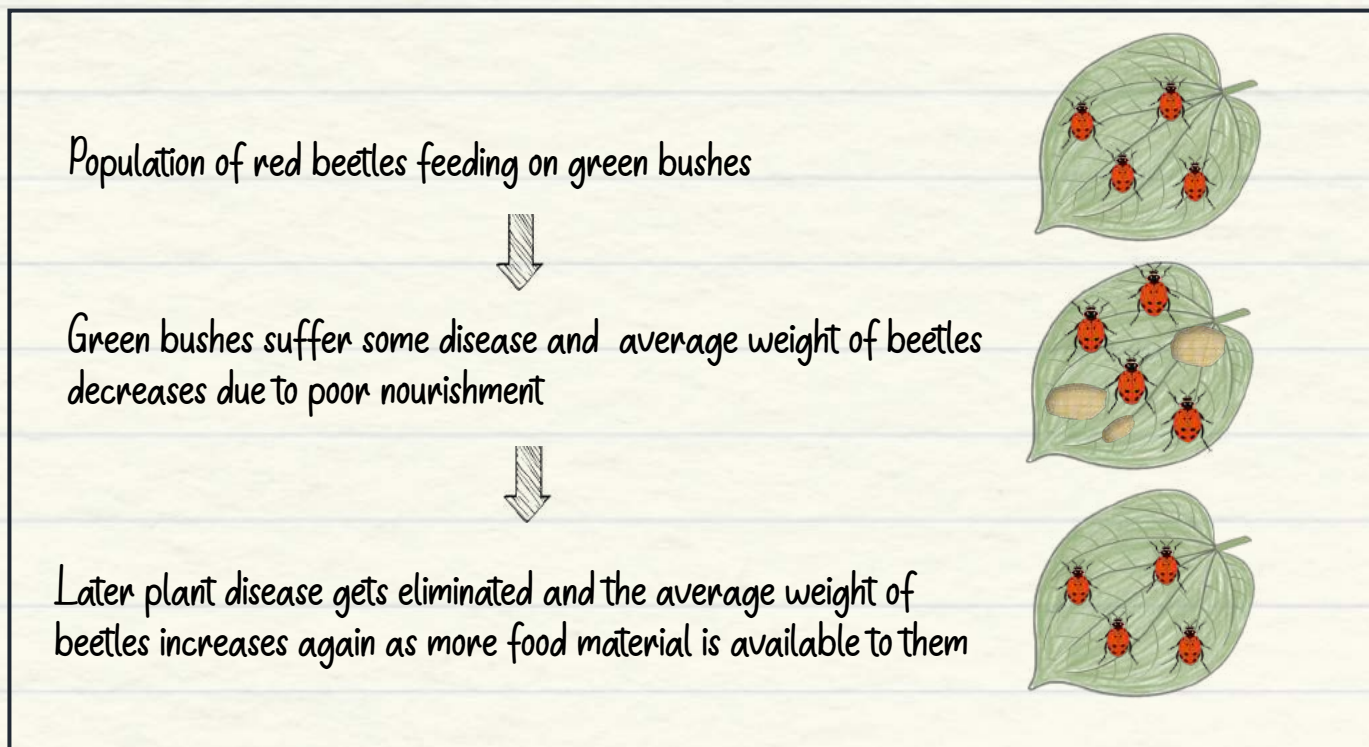


Conclusion

Blue color variation did not get survival advantage but still the number of blue beetles increased.

1.2 Acquired/Inherited Traits

(Scenario III)



Conclusion

No genetic change has occurred in the population of beetle.

Acquired Traits

- ★ The traits which are developed in an individual due to environmental conditions.
- ★ They cannot be transferred to the progeny as changes occur in somatic cells.
- ★ They cannot direct evolution. Example : Low weight of starving beetles.



Low weight of starving beetles.

Inherited Traits

- ★ The traits which are developed due to changes in DNA
- ★ They get transferred to the progeny as changes occur in germ cells.
- ★ They are helpful in evolution. Example: Colour of eyes and hair.



Colour of eyes

Speciation

Speciation

Speciation is a process of formation of new species from the pre-existing species.

Species - A group of organisms that can interbreed to produce a fertile offspring

Factor affecting speciation

1. Geographical Isolation

- ★ Isolation of two population of organisms because of geographical barriers.
- ★ Geographical barrier includes river or mountain ranges
- ★ Level of gene flow between two populations decreases

E.g., Subpopulation of green and red betel separated by a river



2. Natural Selection

Organisms adapting better to the environment tend to survive and produce more offspring.

- ★ Strong natural selection for any subpopulation generates new species.
- ★ E.g., Green beetles gets naturally selected over red beetles by crows.

3. Genetic drift

- ★ Accidents can change the frequency of some genes even if they do not get survival advantage.

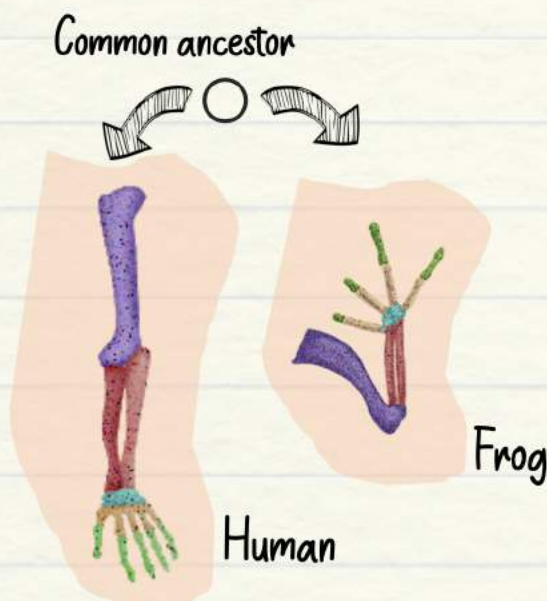
Evidence of Evolution

Higher the no. of common characteristics between two species. ⇒ The two species are closely related.

Lower the no. of common characteristics between two species ⇒ The two species are distantly related.

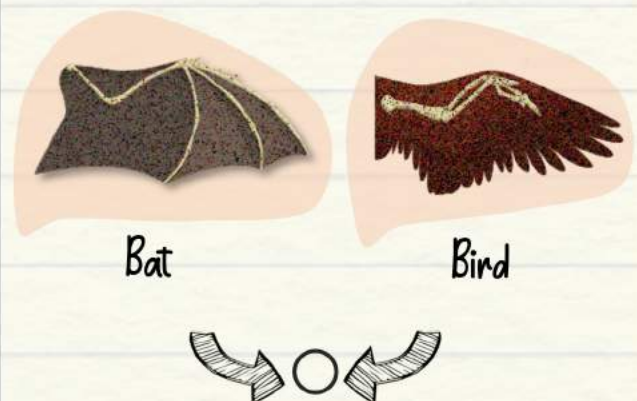
3.1 Homologous Organs

- ★ Same origin and similar structure but performs different functions.
- ★ Helps to identify common ancestry between apparently different species..
- ★ Limbs of human, birds, reptile and amphibians.
Structure: similar.
Function: different.



3.2 Analogous Organs

- ★ Different origin and different structure but performs similar functions.
- ★ Does not help in identifying common ancestry between different species.
- ★ Wings of bat and bird.
Structure: different
Function: similar



3.3 Fossils

Fossil

Preserved traces of living organisms are called as fossils.

Dead organisms \longrightarrow Undecomposed part \longrightarrow Fossil

Fossil Formation

Digging

Fossil found closer to surface
recent



Fossils found deeper - old

Carbon dating

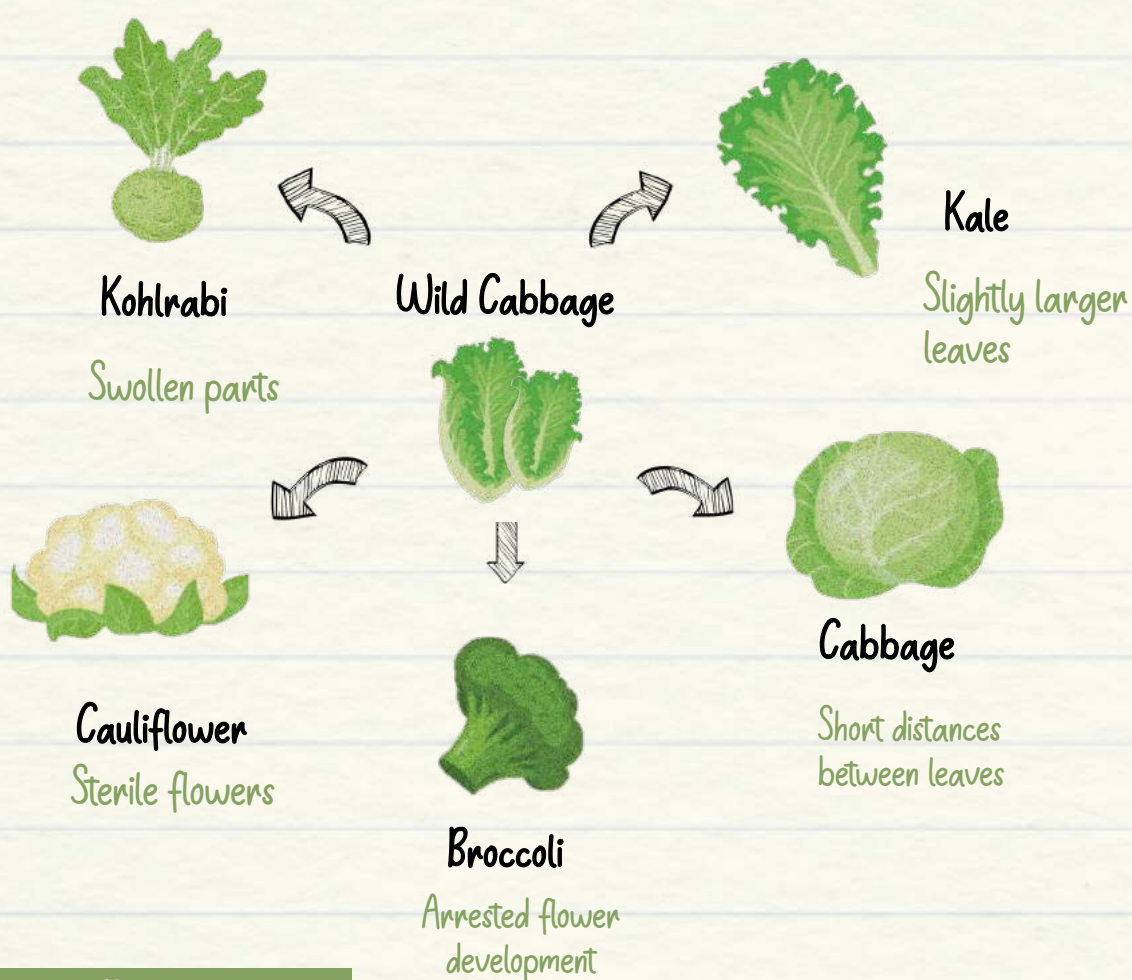
Isotopes of same elements like carbon in different ratios are used to determine the age of the fossils.

Artificial Selection

Artificial Selection

Identification of desirable traits in plant and animals by humans for the reproduction of those traits in future generation.

For more than 2000 years humans have cultivated wild cabbage as food plant and generated different vegetables from it by artificial selection



Molecular Phylogeny:

Approach to trace evolutionary relationship between species by studying the differences in their DNA.

Conclusion

Distantly related organisms



Accumulate greater no. of differences in their DNA.

 **Mind Map**

