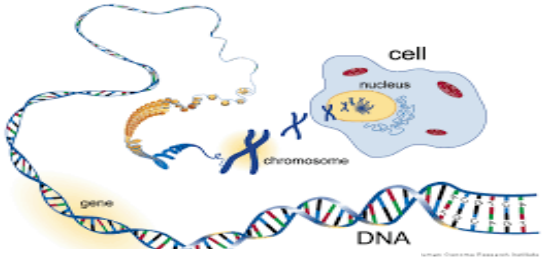
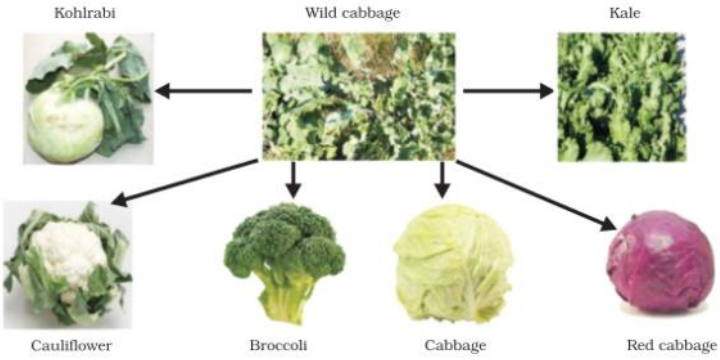
Chapter 9

Heredity and Evolution





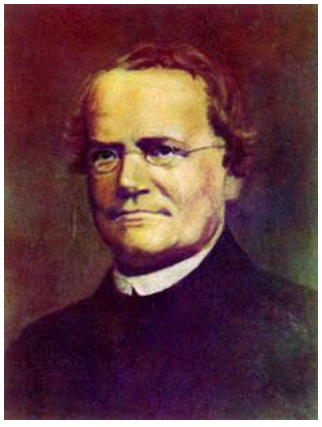
Q. Define :-

1. **Heredity -** It is the transfer of characters from parents to offsprings.

2. **Variation -** They are the differences of traits found among the individual of same species.

2019

3. **Genetics -** It is a branch of biology which deals with the study of heredity & variations.



Q. Who is known as the father of genetics ?

Ans. Gregor Johann Mendel

2019

Q. Define Genetics. Why is decrease in the number of surviving tigers is the cause of concern from the point of view of genetics ? Explain briefly.

Ans. **Genetics :-** Same as above ↑

- A small number of surviving tigers are the cause of worry from the point of view of genetics because genes in the tigers made them adapt to the particular environment during the long process of evolution.
- If they all die out and become extinct

- If they all die out and become extinct, their genes will be lost forever.

NCERT

Q. If a trait A exists in 10 % of a population of an asexually reproducing species and a trait B exists in 60 % of the same population, which trait is likely to have arisen earlier ?

Ans. Trait B because in asexual reproduction traits which are present in the previous generation are carried over to next generation with minimal variations.

Trait B have higher percentage so it is likely to have arisen earlier.

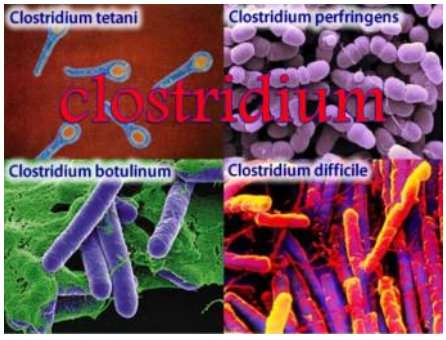
Q. Variation is useful for the survival of species over long time. But the variants have unequal chances of survival. Explain this statement.

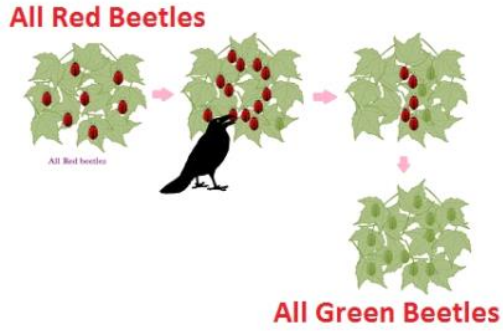
or

Q. Do all the variations in a species have equal chances of survival ? Explain.

Ans. Due to changing environment, variants have unequal chances of survival. Some variations are useful and become survival advantage.

For example :- a bacteria which can withstand heat, will have better chances of survival in heat than other bacteria.





3 marks

2019

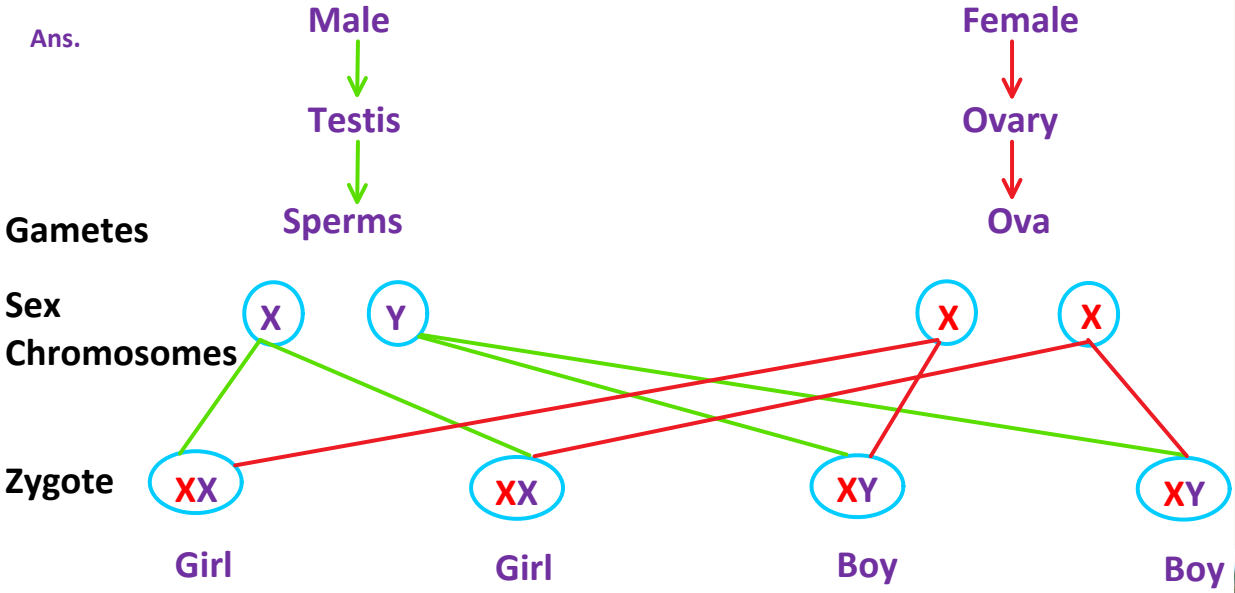
Q. How does the creation of variations in a species promote survival ? Explain with the help of an example.

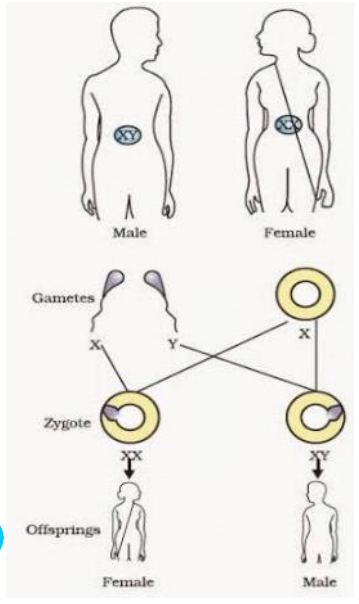
Sex Determination in Human beings

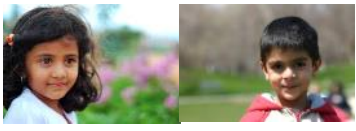
** 2013

Q. "The sex of a newborn child is a matter of chance and none of the parents may be considered for responsible for it." Justify this statement with the help of a flow chart showing determination of sex of a newborn.

Ans.







- The chromosomes which determine sex are called sex chromosomes.
- They are of 2 types X and Y.
- In males, 50% of the sperms have X chromosome and other half has Y chromosome.
- In females, egg has only X chromosome.
- When a sperm carrying X chromosome fertilises an egg then girl child will be born.

- When a sperm carrying Y chromosome fertilises an egg then boy child will be born.

So, we can say that 50 % chances of getting female child and 50 % chances of getting a male child.

2014

Q. What is the main difference between sperms and eggs of humans ? Write the importance of this difference.

2013

Q. State the importance of chromosomal difference between sperms and eggs of humans.

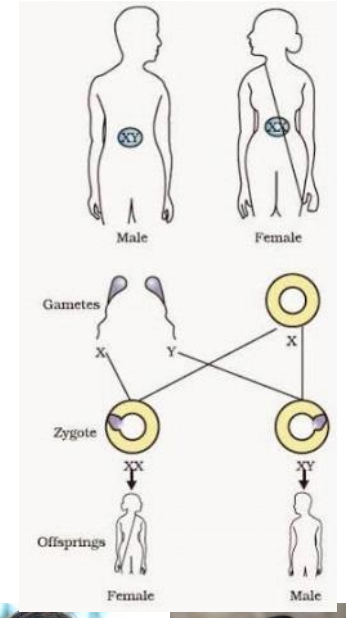
Q. A normal baby girl receives her X chromosome from whom : father, mother, both mother and father ?

Ans. From both mother and father.

X X X Y

X X

Girl

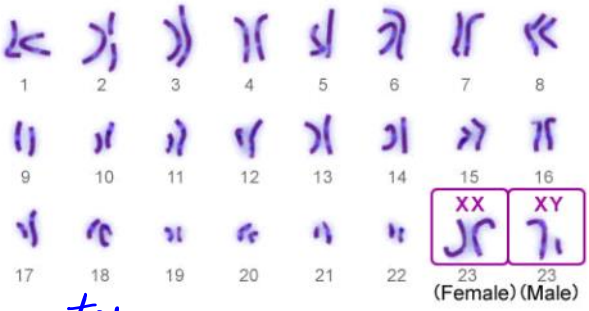


Q. The humans have a genetic basis of sex determination.

(a) Besides humans which organism have genetic basis ?

(b) Which chromosomes are similar in human males and females

(c) What is the function of these types of chromosomes ?



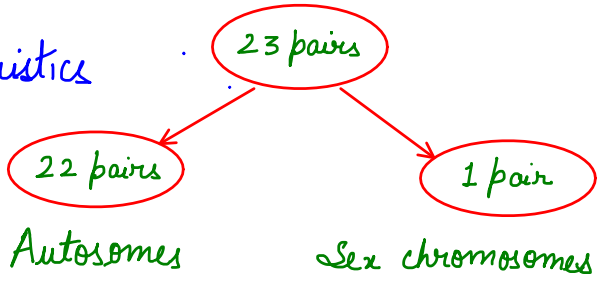
Ans.

(a) Cow, Dog, Monkey, mouse, etc.

(b) 22 pairs of chromosomes which are called autosomes are same in males and females.

(c) Autosomes determine somatic characteristics

Chromosomes in Humans



Q. How many pairs of chromosomes are present in human beings ? Out of these how many are sex chromosomes ? How many types of sex chromosomes are found in human beings ?

Equal Genetic contribution

2014

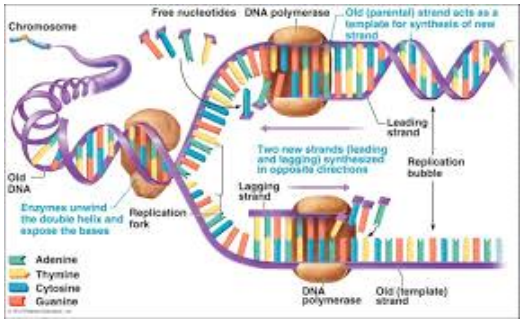
Q. How does the amount of DNA remain constant through each new generation is a combination of DNA copies of two individuals ?

2019 or

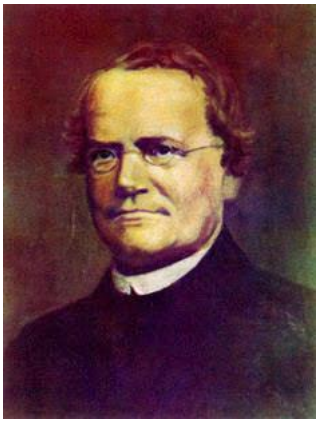
Q. How equal genetic contribution of male and female parents ensured in next progeny ? Explain.

Ans.

- In sexual reproduction, DNA from male and female gametes, combined together to form zygote but the amount of DNA does not get doubled because haploid sperm fuses with a haploid egg to produce a diploid zygote.
- Gametes are special type of cells which contain only half the amount of DNA.



Q. Who studied inheritance of traits in pea plants ? Why did he select the pea plant ?



Gregor Johann Mendel

Father of Genetics

Ans. Gregor Johann Mendel

→ He selected pea plants because it has a number of contrasting visible characters like white/violet flowers, tall/dwarf plants, round/wrinkled seeds, yellow/green seeds etc.

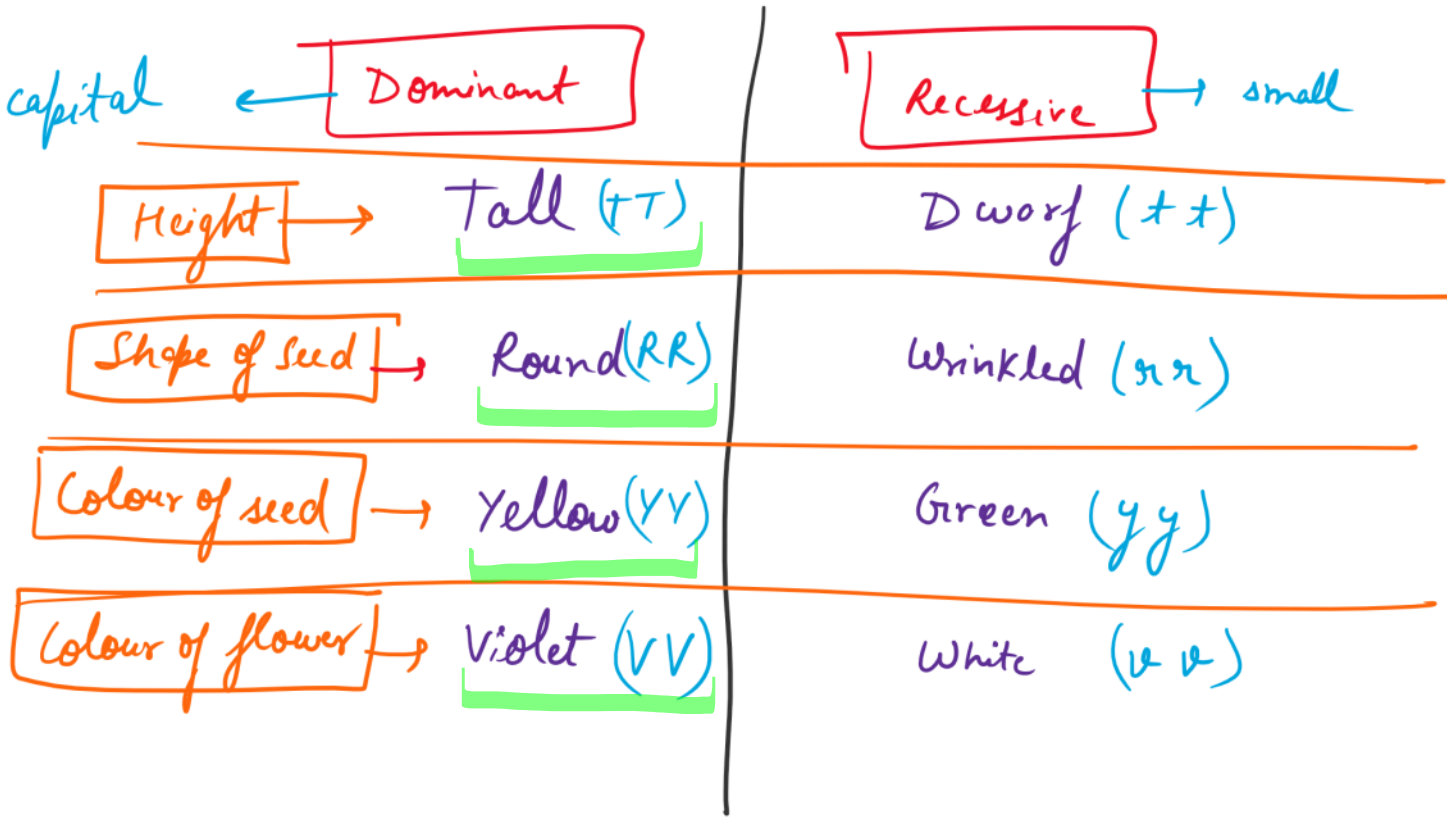
→ Pea plants are easy to grow. (culture)

(Self-pollinating)

Q. What is the scientific name of pea plant ?

Ans. Pisum Sativum

Homo Sapiens


capital
Dominant
Recessive
small
Height
Tall (TT)
Dwarf (tt)
Shape of seed
Round (RR)
Wrinkled (rr)
Colour of seed
Yellow (YY)
Green (yy)
Colour of flower
Violet (VV)
White (vv)

Monohybrid cross

2014

Q. "A trait may be inherited, but may not be expressed." Justify the statement with the help of suitable example.

NCERT 2015

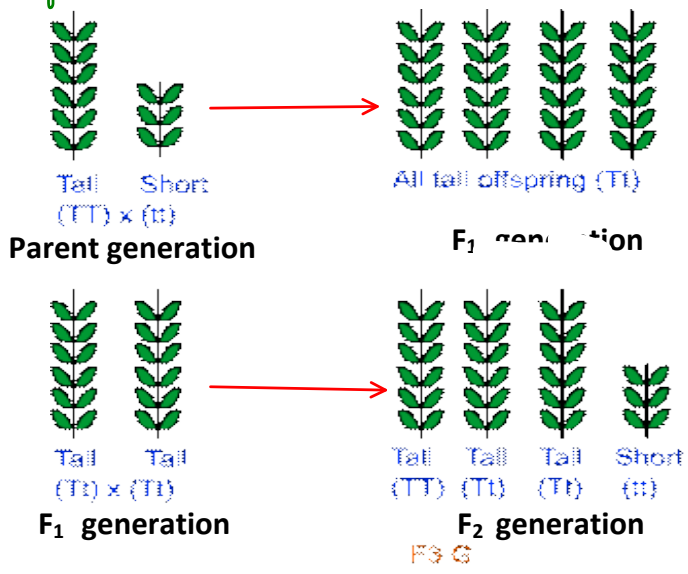
Q. How do mendel's experiment show that traits may be dominant or recessive ?

or

Q. What is monohybrid cross ? Which trait gets expressed in the first generation ? In what ratio, traits with one contrasting character gets expressed in the second generation ?

Ans. **Monohybrid cross :-** cross between one pair of contrasting trait is carried out.

- Mendel crossed pure-bred tall with pure-bred dwarf pea plants.
- In F_1 generation all the plants were tall.
  This shows that tall height is a dominant trait.
- Mendel then self pollinate pea plants of F_1 generation.
- In F_2 generation, all the plants were not tall. One-fourth were dwarf.
- This shows that dwarf height is a recessive trait.



In F_2 generation,

75% 25%

Phenotypic ratio :- Tall : Dwarf

3 : 1 ← **Monohybrid Ratio**

Genotypic ratio :-

TT	:	Tt	Tt	:	tt
1	:	2		:	1

2018

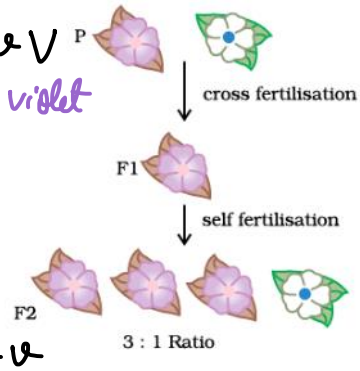
Q. A Mendelian experiment consisted of breeding pea plant bearing violet flowers with pea plants with pea plant bearing white flowers. What will be the result in F_1 progeny ?

Ans. In F_1 progeny, all the plants are of dominant trait i.e. violet

VV × vv → Vv Vv Vv Vv

(Violet) (white) (Violet Violet Violet Violet)

(Parent Generation) (F_1 generation)



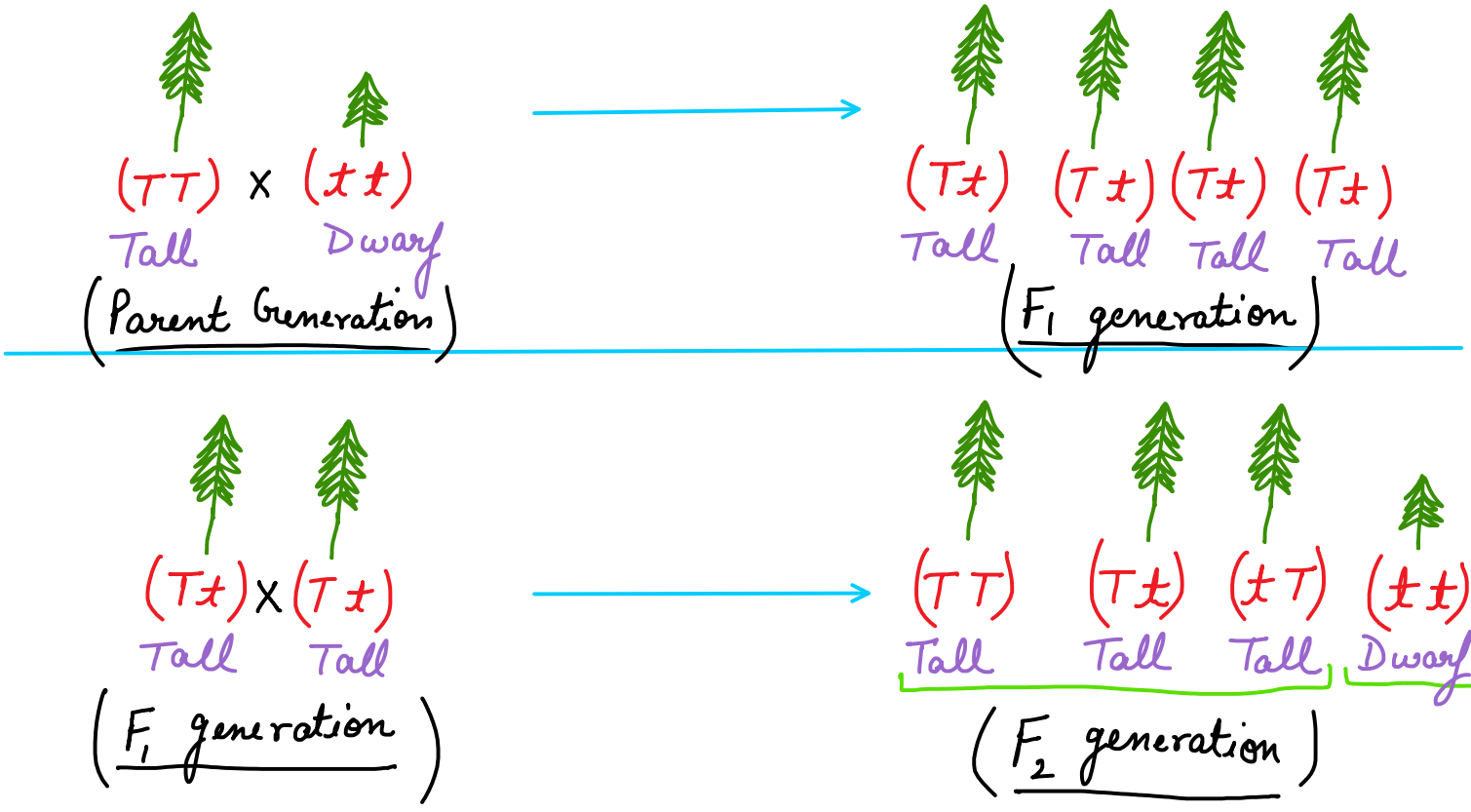
Vv × Vv → VV Vv vV vv

(Violet) (Violet) (Violet Violet violet white)

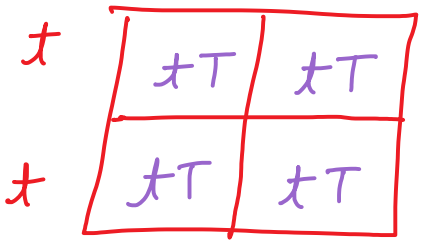
F_1 Generation

3 : 1

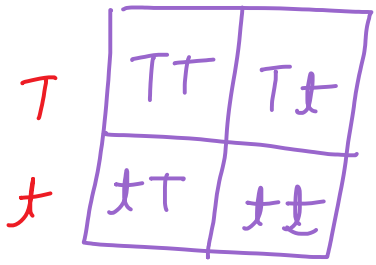
(F_2 generation)


(TT) x (tt)
Tall Dwarf
(Parent Generation)
(Tt) (Tt) (Tt) (Tt)
Tall Tall Tall Tall
(F1 generation)
(Tt) x (Tt)
Tall Tall
(F1 generation)
(TT) (Tt) (tT) (tt)
Tall Tall Tall Dwarf
(F2 generation)

T T T t

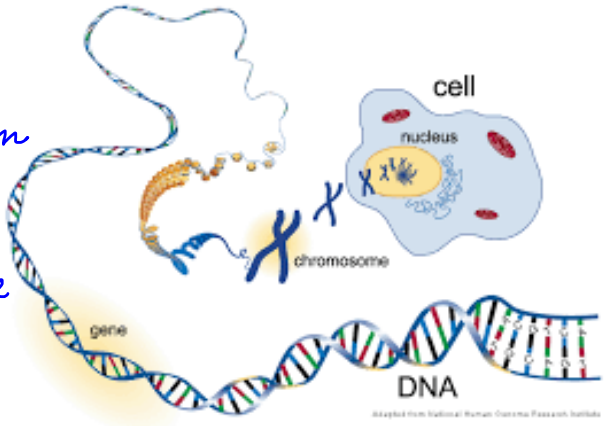


F_1 generation



F_2 generation

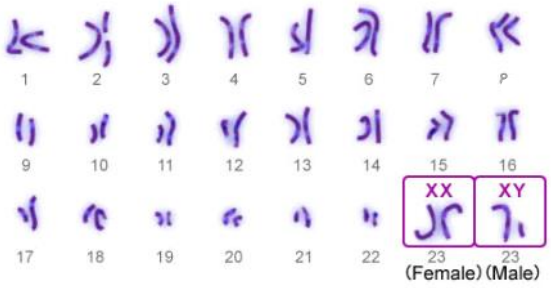
Q. (a) "Chromosomes are heredity carriers." Why do we say
(b) Which vital function is not controlled by autosomes ?



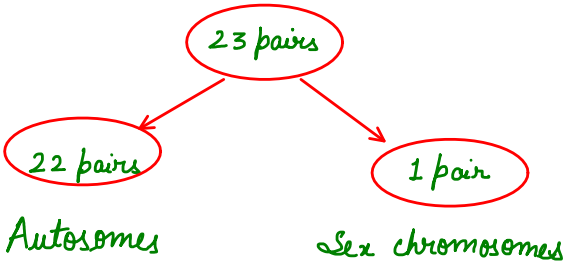
Ans(a) Genes are heredity units which transfer from parents to offspring.

→ Genes are located on the chromosomes. So, we can say chromosomes are heredity carriers.

Ans.(b) Sex of the child is not determined by autosomes.



Chromosomes in Humans



2014

Q. What is a gene ?

Ans. Genes are the heredity units which transfer characteristics from parents to offsprings during reproduction.

Q. " The sex of a newborn individual in some species is largely determined genetically. "Different species use different strategies to determine sex of a newborn individual." Explain the statement by giving examples."

Ans. In some organisms, the environmental factors play an important role in sex determination :-

1.) In a species of a turtle, if hatching temperature is more then it develops female. (28°C)

2.) In a species of lizard, if hatching temperature is more then it develops male.

3.) Snails can change their sex.

Thus, sex is not genetically determined in these cases.

Dihybrid cross

2015

Q. How do Mendel's experiments shows that traits are inherited independently? Depict with the help of a cross. NCERT

or

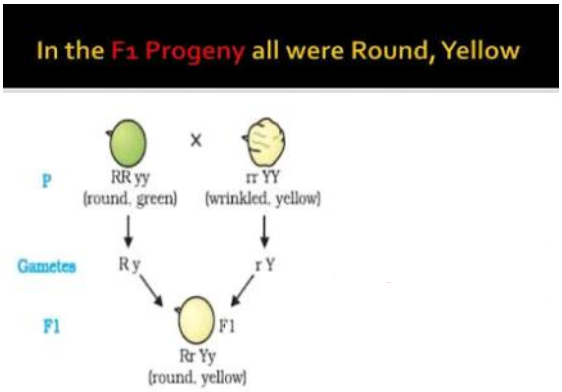
Q. Define Dihybrid cross. A round green seeded plant (RRyy) is crossed to a wrinkled yellow (rrYY) seeded plant .Find out phenotypes and genotypes in F_1 and F_2 generations with the help of a cross.

Ans. **Dihybrid cross :-** cross between two pair of contrasting traits is carried out.

Parents : RR yy (Round, green) × rr YY (wrinkled, Yellow)

Gametes: R y, r Y

F_1 progeny: Rr Yy (Round, Yellow) Genotype / Phenotype



- When a pea plant with round, green seeds was crossed with a pea plant with wrinkled, yellow seeds.
- F_1 progeny all plants were Round, Yellow seeds.
- It means that Round, Yellow are Dominant traits.
  and Wrinkled, green are Recessive traits.

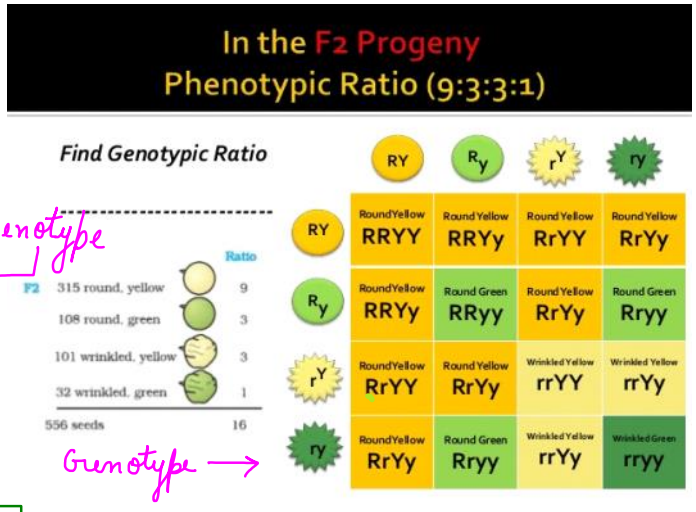
→ When F_1 plants were self pollinated, there were four types of plants obtained in F_2 generation.

obtained in F_2 generation.

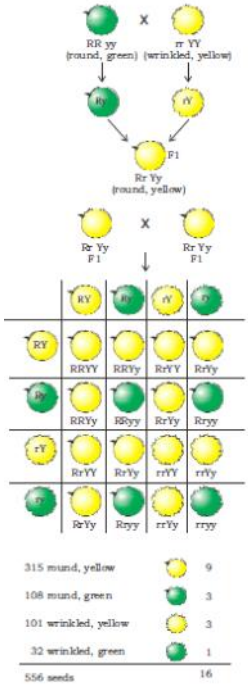
F_1 progeny : Rr Yy x Rr Yy
(Round, Yellow) (Round, Yellow)

Gametes : RY Ry rY ry

F_2 progeny :
(Round, Yellow) ---- 9
(Round, green) ---- 3
(wrinkled, Yellow) ---- 3
(wrinkled,green) ---- 1

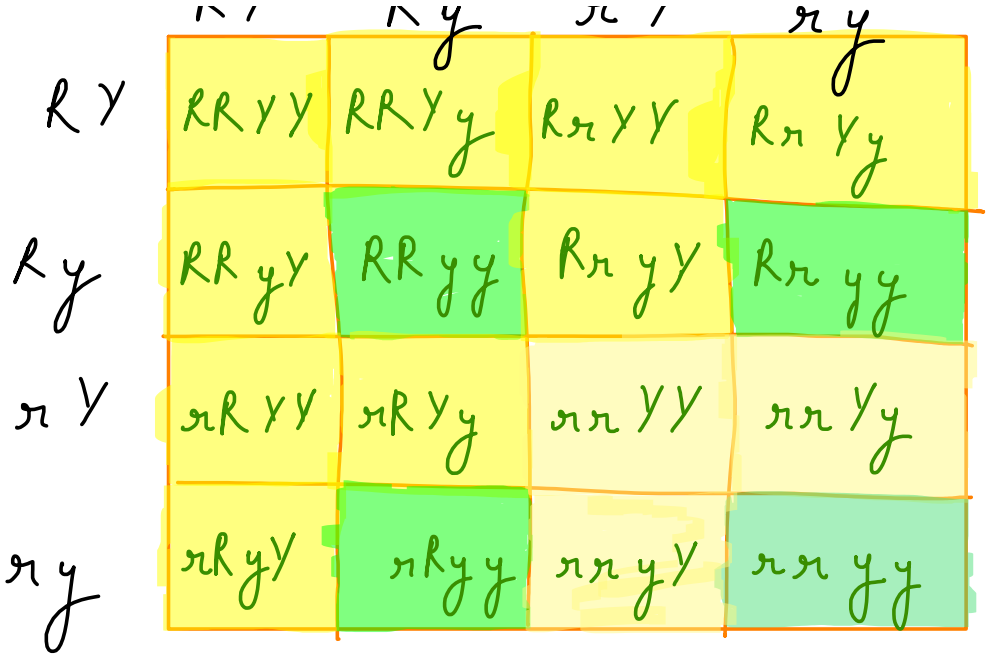


Phenotypic Ratio : 9 : 3 : 3 : 1 ← **Dihybrid ratio**



RY Ry rY ry

RY


RY
Ry
rY
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RrYY
RrYy
RRyY
RRyy
RryY
Rryy
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rrYY
rrYy
rRyY
rRyy
rryY
rryy

Acquired and Inherited Traits

2013

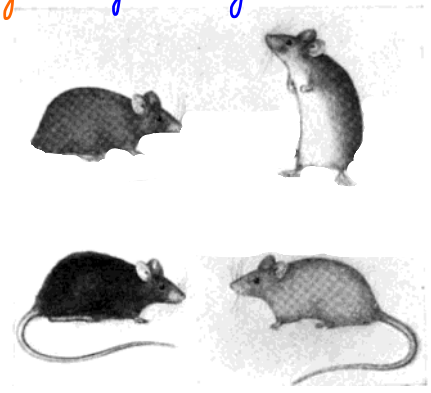
Q. Explain with the help of suitable examples why certain traits cannot be passed on to the next generation ? What are such traits called ? or

Q. Give reason why acquired traits are not inherited. Explain with the help of example of mice.

Ans. Acquired traits are not inherited because they do not cause any change in genes or (DNA)

Example :— If tails of mice are cut surgically and breed them, we will get next generation with none of them tail-less.

→ Cut tail of mice is an acquired trait which is never passed on to next generation. This is because cutting the tail of mice does not change the genes of the gamete.



Q. What are three laws of heredity proposed by Mendel ?

Ans.

1.) **Law of Dominance** :- An organism with different forms of a gene will express the gene that is dominant.

2.) **Law of Segregation** :- Each inherited trait is determined by a pair of genes. Only one pair of gene can be present in a single gamete.

3.) **Law of Independent Assortment** :- In the inheritance of more than one pair of traits, genes are distributed independently to the gametes.

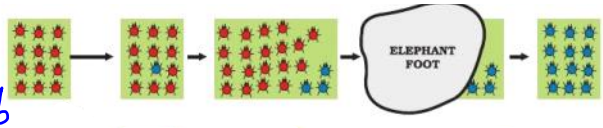
NCERT

Q. Explain the two ways by which individuals with a particular trait may increase in population.

Ans. 1.) **Survival by natural selection** :–

Due to variation there is a green beetle in a group of red beetles. Crows cannot see green beetle on green leaves and therefore cannot eat the green beetles. Green beetles survive and increase in number.

2.) **Survival by chance** :–



Due to variation there is a blue beetle in a group of red beetles. Crow can see both blue and red coloured beetles in the green leaves and therefore can eat them. An elephant comes and crush the bushes. Blue beetles survive and increase in number.

Q. Define species. What is Speciation ?

Ans. **Species** :– is a group of similar organisms which can interbreed and produce fertile offsprings

Speciation :– is a process by which new species develop from existing species.

2016

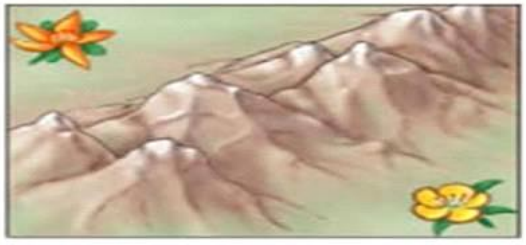
Q. What factors responsible for speciation ? or **2016**

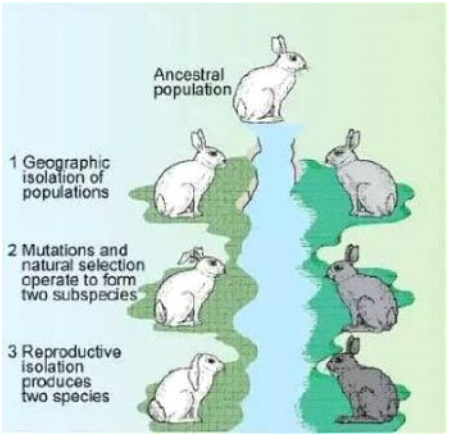
Q. What factors could lead to the rise of new species ? NCERT

Ans. 1) **Geographical Isolation** :- caused by various types of barriers (mountains, rivers) between seperated population. Geographical isolation leads to reproductive isolation due to which there is no flow of genes between them.

Table 23.1a

Geographical Isolation – Separated by geographic barrier like rivers ,mountains, or bodies of water (ex: squirrel)





2) **Genetic drift** :- caused by drastic change in gene frequency.

Albert & Kaibab Squirrels

3) **Natural selection** :- process by which nature selects particular type of species i.e. getting survival advantage from enemy or environment.

Table 23.la
Geographical Isolation — Separated by geographic barrier like rivers ,mountains, or bodies of water (ex: squirrel

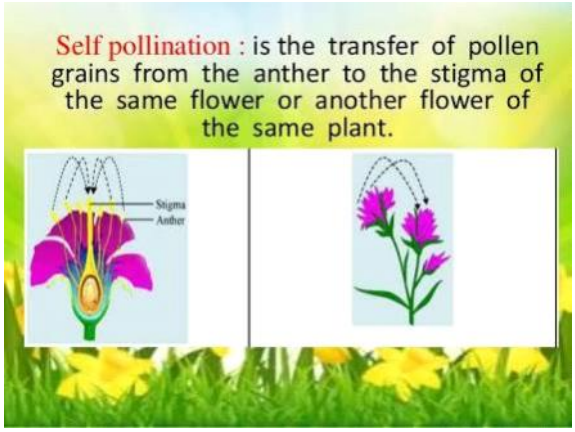
NCERT

Q. Will geographical isolation be a major factor in the speciation of self pollinating plant species ? Why or Why not ? 2016

Ans. No, because it does not depends on the other plants to carry out reproduction.

Table 23.1a

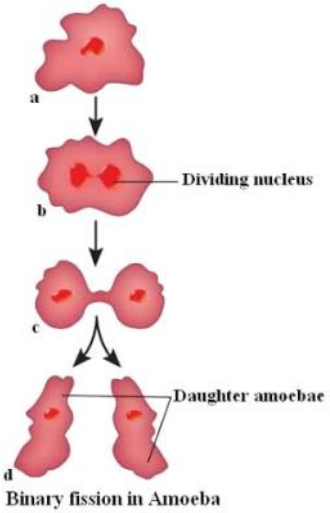
Geographical Isolation – Separated by geographic barrier like rivers ,mountains, or bodies of water (ex: squirrel)



NCERT

Q. Will geographical isolation be a major factor in the speciation of an organism that reproduces asexually ? Why or Why not ?

Ans. No, because it does not require any other organism to carry out reproduction



Binary fission in Amoeba

Q. Classification of species is a reflection of evolutionary relationship. Explain with the help of example.

NCERT

or

Q. "Two areas of study namely 'evolution' and 'classification' are interlinked." Justify this statement.

2016

Ans. → Classification is based on similarities and differences among organisms.

→ The more characteristics two species have in common, the more closely they are related, the more recently they had a common ancestor in evolutionary terms

Example :- A brother and sister are closely related. They have common ancestor in first generation i.e. parents.

A girl and her cousin are also related but less similar. This is because cousins have common ancestors i.e. grandparents.

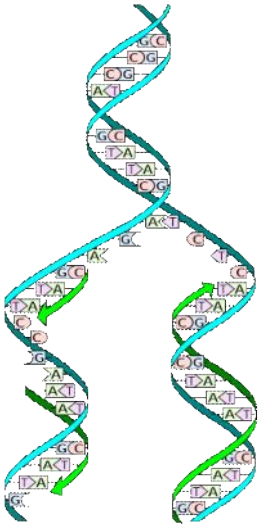
So, we can say that classification of species is a reflection of evolutionary relationship.

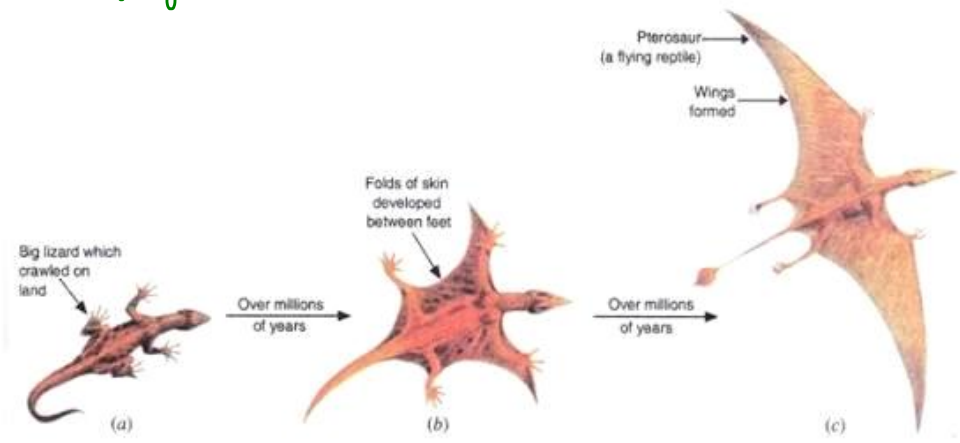
2016

Q. Define Evolution. How does it occur ?

Ans. **Evolution** :– is the sequence of gradual changes which takes place in primitive organisms over millions of years in which new species are produced.

→ It occur because there is an inbuilt tendency to variation during reproduction due to errors in DNA copying.





Q. (a) "Evolution has occurred in stages." Justify the statement.

Q. What are the evidences for evolution ?

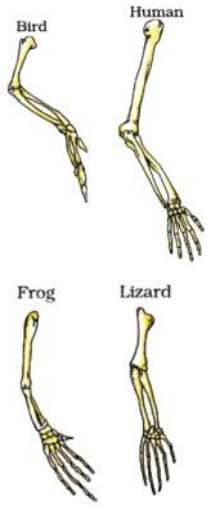
Q. Explain how evolutionary relationship can be traced.

or

Ans. Evolutionary relationship can be traced by the study of :—
1) Homologous organs
2) Analogous organs
3) Fossils

or

Evidence for evolution are :—



1) **Homologous organs** :— organs which have same basic structure but different functions.

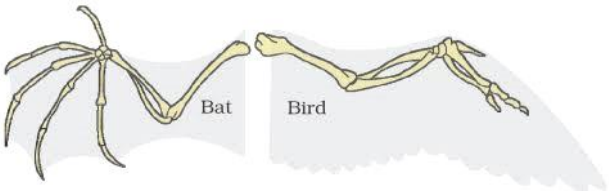
example :— forelimbs of bird, human, frog & lizard.

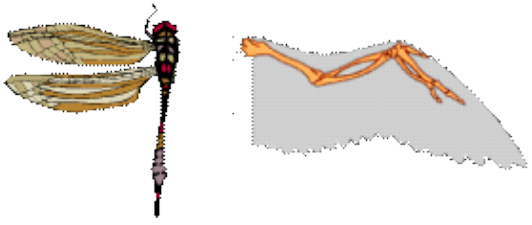
→ They all have same basic structure which provides evidence that all have evolved from common ancestor.

2) **Analogous organs** :— organs which have different basic structure but same function.

example :— (i) wings of bird and bat (ii) wings of bird and insect.

→ they have different basic structure which provide evidence they are not evolved from common ancestor.





3) **Fossils** :– remains of plants or animals that lived in remote past.

→ Fossils provide evidence for evolution.

example :– a fossil called Archaeopteryx has feathered wings like birds but teeth and tail like reptiles which suggests that birds have evolved from reptiles.

Fossil

Archaeopteryx

Fossils

Tree trunk

Ammonite

Trilobite

Fish (Knightia)

Dinosaur (Rajasaurus)

2017 , 2019

Q. How do the following provide evidences in favour of evolution in organisms ? Explain with an example for each.

(i) Homologous organs

(ii) Analogous organs

(iii) Fossils

Ans. Same as above

2016

Q. How fossils provide us evidence in support of evolution ?

2014

Q. Give the evidence that the birds have evolved from reptiles.

Ans. Same as above

Q. Differentiate between homologous organs and analogous organs.

Q. Explain two methods to determine the age of fossils. 2019

or

Q. How can we estimate the age of fossils ?

Ans. **(i) By relative depth method :-** If we dig into the earth and start finding fossils, the fossils we find closer to the earth are more recent than the fossils we find in deeper layers.

(ii) By carbon dating method :- It is the method by which the age of fossils can be determined by knowing Carbon 14 isotope left in the organism after its death.

Evolution of wild cabbage

Q. Humans have cultivated the wild cabbage over more than two thousand years. Then by artificially selecting the traits a variety of plants have been obtained. Write the characteristic feature of each variety.

Ans.

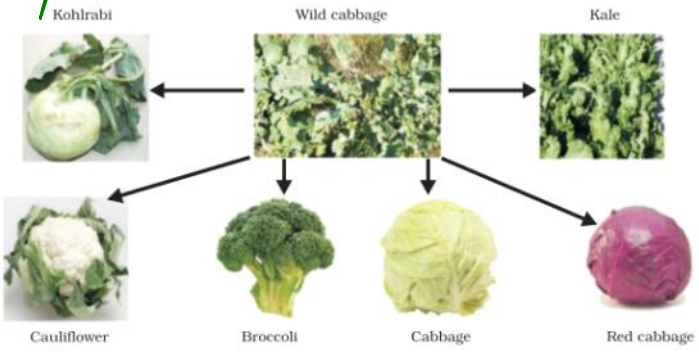
(a) Kohlrabi : for swollen parts.

(b) Cauliflower : for sterile flower.

(c) Broccoli : for arrested flower development.

(d) Cabbage : for very short distances between leaves.

(e) Kale : for larger leaves.



Charles Darwin Theory

1. There is struggle for existence.
2. Each individual is capable of reproduction.
3. There is competition among the organisms for food, shelter, etc.
4. Changes keep on accumulating from one generation to another.