HOLY FAITH PRESENTATION SCHOOL

RAWALPORA SRINAGAR KASHMIR

Genetics, Heredity and evolution

(CLASS 10TH BIOLOGY)

Genetics:- It is that branch of biology which deals with the study of mechanism of inheritance (heredity) by which characters are transferred from generation to generation. Genetics also deals with the study of variations.

Heredity: - It is defined as the transmission of characters in living beings from generation to generation.

Chromosomes:- Filamentous bodies present in the nucleus, composed of chromatin materials (DNA-RNA protein complex).

Gene:- A unit of inheritance forming part of chromosomes. Genes are passed from parent to the off spring via chromosomes in the nuclei of the parent's gametes.

Gametes: Male & female sex cells.

Dominant gene: The gene which expresses itself in a heterozygous organism is called dominant gene.

Recessive Gene.:- The gene which cannot express itself in the presence of the dominant gene.

Genotype:- The genetic constitution of an organism.

Phenotype:- It refers to externally visible characters of an organism.

Homozygous:- An individual having two identical alleles of gene or factors of characters on its homologous chromosomes. e.g., TT or tt.

Heterozygous:- An individual having two different alleles of a gene on its homologous chromosomes. It is not pure and is called hybrid for that character e.g. Tt.

Alleles:- Alleles are alternate form of the same gene for example, a pea plants has one gene that determines height, but that appears in more than one form- the gene that produces a short plant is an allele of the gene that produces a tall plant.

Gene Locus:- A particular portion or region of the chromosomes representing a single gene is called gene locus.

F_1 Generation:- F_1 or first filial (Filus-son, Filia-daughter) generation is the generation of hybrids produced from a cross between the genetically different individuals called parents. For example, Tt individiuals are produced in F_1 generation from a cross between TT and tt generation.

Cross TT X tt

Gametes TT tt

F1 Generation Tt Tt Tt Tt

F2 Generation: F_2 or 2^{nd} filial generation is the generation of individuals which arises as a result of interbreeding among individuals of F_1 generation or we can say when progeny of F_1 generation cross among themselves to produce second progeny, then this progeny is called F_2 generation. An example will make it more clear. Mother and father is parental generation. Their children's are F_1 generation and the grand children's are F_2 generation.

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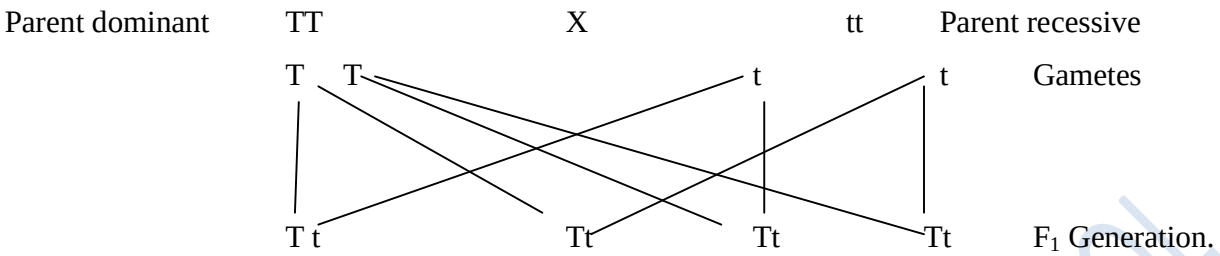
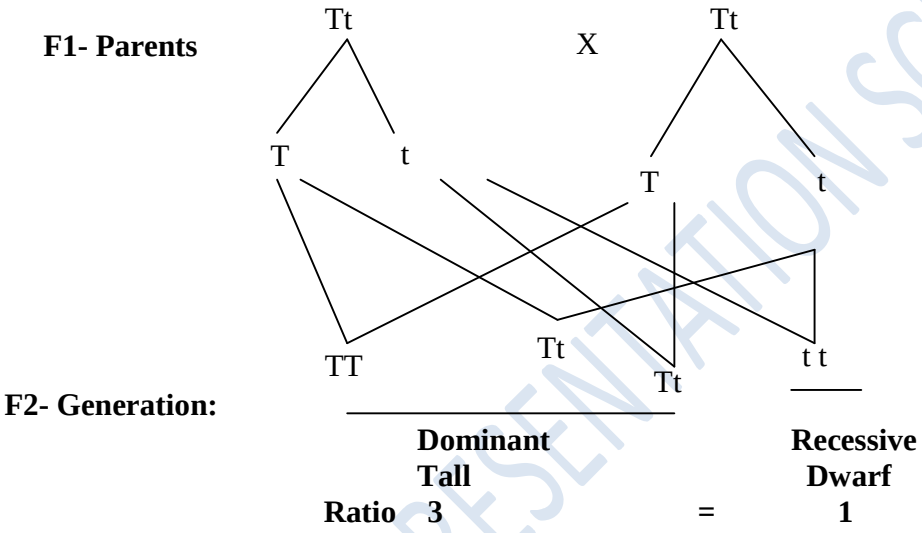




Genetic drift:- Means elimination of genes of certain traits of a species, when a section of population migrates or dies of natural calamity.

Mutation:- Which means rare, random, discontinuous, inheritable variations in the amount or the structure of genetic material. Mutation is the major source of variations.

Natural selection:- is the process of evolution of a species whereby characteristics which help individual organisms to survive & reproduce are passed on to their offspring & those characteristics which do not help are not passed on.

Q:-Discuss variations:

Ans:-Variations means the differences among the individual of the same species. These differences are morphological, physiological, cytological and behavioral. Therefore, no individuals are similar. Variations do appear even in clones.

Variations are of two types; acquired and mutational. Acquired variations are usually due to the affect of environment. They are not inherited. Differences appearing in monozygotic twins are acquired variations.

Mutational variations are inheritable variations which are produced due to change in the Genetic constitution. The rate of abnormal variations is very moderate in sexually reproducing organisms. While as asexually reproducing organisms have lesser variations.

Accumulation of variations:-

The reproduction of organisms produces variations. The variations produced in organisms during successive generations get accumulated in the organism. The significance of a variation shows up only if it continues to be inherited by the offspring for several generations e.g., a bacterium produces two bacteria by asexual reproduction. Suppose that one of the offspring bacterium has a variation due to which it can tolerate a little higher temperature than other one. Now this variation of little more heat resistance will go on accumulating in the offspring of successive generation of this bacterium.

The great advantage of a variation to a species is that it increases the chance of its survival in a changing environment.

Inherited Traits:-Parent organisms pass traits to their offspring so there are often similar characteristics seen in both parent and offspring.

Inherited human traits include:

Dimples or freckles,

Naturally curly or straight hair,

Attached or unattached earlobes, etc.

Rules for inheritance of Traits:- The rule of inheritance of traits are connected to both, the mother's and the father's contribution of the genetic material to the child. The DNA of the parent may influence the traits of the child. There will be two version for every trait of the child, i.e., that of the mother and that of the father.

Mendel's Contributions:- Gregor Johann Mendel (1822-1884) is called the "Father of genetics". His contributions to study of inheritance paved the way for our basic understanding of how traits are inherited from one generation to the next. Mendel did much of his work with easily obtained local organisms, especially garden peas. He also did genetic work with other plants and honeybees.

Q. Why did Mendel selected pea plant for hybridization.

Ans:- Mendel Selected Hybridization experiments on garden pea (pisum sativum) in 1856. Mendel's experimental use of pea plant was not accidental but the result of his careful thoughts. He selected pea plants because of certain specific characteristics which are as under:

1. Pea plants show a number of contrasting traits like purple flowers & white flowers, tall plants and dwarf plants, round seeds & wrinked seeds etc. he noted 7 pairs of such contrasting traits in pea plant.
2. Pea plants produce perfect bisexual flowers. Normally pea plant is self pollinating but cross pollination could be achieved easily by removing the stamens of flowers before the pollen grains mature.
3. Pea plants had a short life cycle so the results could be achieved within a year.
4. Pea plants produce many seeds in one generation. This helped in drawing correct conclusions
5. It could be raised, maintained & handled conveniently.
6. Pea plants pure for each of the seven characters he selected were readily available.

Q:Give the list of seven pairs of contrasting traits selected by Mendel for his experimental work?

Ans:- Mendal selected 7 pairs of contrasting traits in pea plant. These pairs of contrasting traits are under.

S.No	Character	Dominant	Recessive
1	Plant Height t	Tall (T)	Dwarf (t)
2	Flower position	Axial (A)	Terminal (a)
3	Pod colour	Green (G)	Yellow (g)
4	Pod shape	Inflated (I)	Constructed (i)
5	Seed coat/Flower	Colored (C)	White (c)
6	Seed Shape	Round (R)	Wrinkled (r)
7	Seed colour	Yellow (Y)	Green (y)

Q. Discuss Mendal's Monohybrid cross?

Ans. A breeding experiment dealing with the single character is called monohybrid cross. In order to trace the inheritance of a single pair of contrasting characteristics among the pea plants (like tall stem and short stem), Mendel crossed (Cross-breed) the pea plants differing in these traits and noted their occurrence in the progeny of succeeding generations.

1. Mendel first crossed pure tall pea plant with pure dwarf pea plant and found that only tall plants were produced in the first generations or F1 generation. No dwarf pea plant (or short pea plants) was obtained in the first generation of progeny. From this Mendel concluded that the first generation (or F1 cross) showed the traits of only one of the parent plant: tallness. The trait of other parent plant, dwarfness did not show up in the progeny of first generation.
2. Mendel then crossed the tall plant of first generation (F1 generation) and found that tall plants and dwarf plants were obtained in the second generation (or f2 generation) in the ratio of 3:1. In other words in the f2 generation three- fourth plants were tall and one- fourth were dwarf.

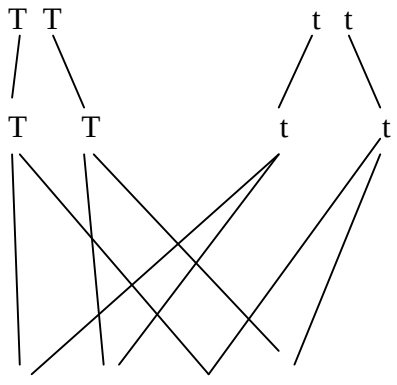
Parental cross (Monohybrid cross)

Parent's Phenotype (appearance) Tall Plant X Dwarf Plant

Factor's of inheritance T T t t

Gametes (Factor's from separation) T T t t

Crossing

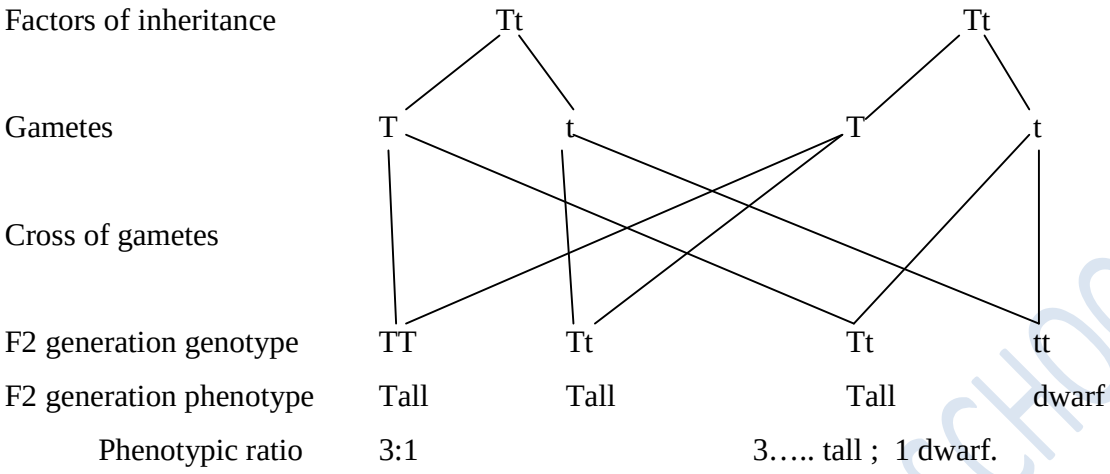


F1 generation genotype Tt Tt Tt Tt

F1 generation phenotype Tall Tall Tall Tall

F1 cross

F1 generation Phenotype Tall Plant X Tall plant



In F_2 generation, the plants produced have genotype or inheritance factors, TT, Tt, Tt and tt. Now, the plant having genotype TT, Tt and Tt all contain the factor 'T' for dominant trait 'tallness'. So all the three plant (TT, Tt and Tt) are tall. The plant having the genotype tt have both the factors t for the recessive trait and are all dwarf.

In F_2 generation we get 1 plant having genotype TT, 2 plants having genotype Tt and 1 having genotype tt so the Genotypic ratio of Monohybrid cross is TT:Tt:tt=1:2:1

Again in f2 generation, we get 3 tall plants and 1 dwarf plant, so the phenotypic ration in Monohybrid cross will be:

Tall plants: Dwarf plants= 3:1.

From the result of monohybrid cross Mendel formed following laws or principles of inheritance

1) Law of paired factors
   This law states that for "Every character there is present a pair of factors (genes) i.e., Every character is controlled by a pair of factor and an individual receives one factor for the trait from each parent. Mendel did not know the genes or chromosomes but his law of paired factors remains a basic principle in the field of genetics.
2) Law of dominance:- This principle states that one factor in a pair may express itself and prevent expression of another. The factor which expressed itself was described as dominant factor and other factor which was unable to express was described as recessive factor by Mendel e.g., in a cross between true breeding tall plant with a dwarf plant, F_1 generation produced tall plants only. However, in F_2 generation the tallness & dwarfness traits appear in the phenotype ratio of 3:1 (3 tall :1 dwarf). This explains that in F_1 generation , the factor for tallness in dominant does not allow factor for dwarfness to express itself.

Q. Discuss Mendel's di-hybrid cross??

Ans. Mendel's Di-hybrid Cross:- A breeding experiment dealing with the two characters at the same time is called di-hybrid cross.

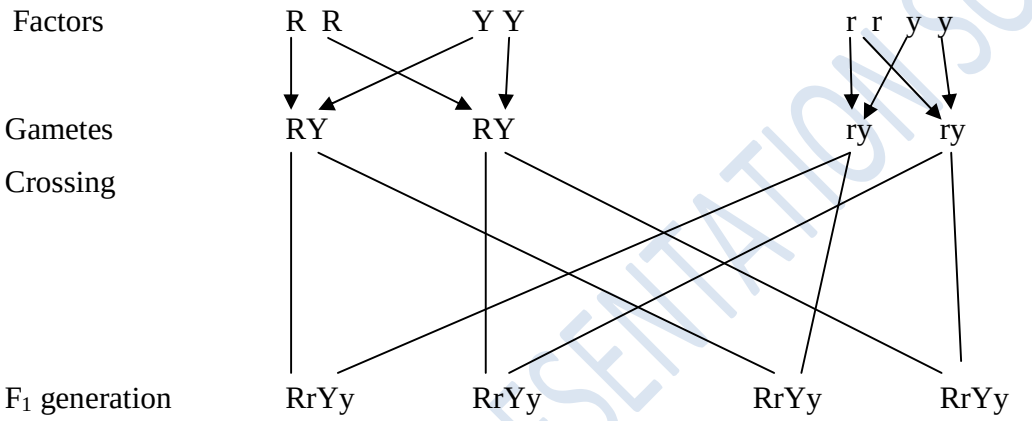
The principle of law of independent assortment can be studied by means of dihybrid cross, e.g, between pure breeding pea plant having yellow round seeds (YYRR) and pure breeding pea plants having green wrinkled seeds (y y r r). The plants of the first filial of F_1 generation have all yellow and round seeds (Y y R r) because yellow and round traits are

respectively dominate over green and wrinkled traits. On self-breeding the resultant second filial or f2 generation shows four types of plants. The data obtained by Mendel as follows:
Yellow and Round = 315/556 = 9/16
Yellow and Wrinkled = 108/556 = 3/ 16.
Green and round = 108/556 = 3/16
Green wrinkled = 32/556 = 1/16
Thus, the phenotype ratio of a dihybrid cross is 9:3:3:1

The occurrence of four types of plants in the F2 generation of dihybrid cross shows that the factors of each of the two characters assort independent of the others as if other pair of factor are not present.

Parental Cross

Parents Phenotype Plants Having yellow- Round seeds X plants having wrinkled-green seeds.



F1 Generation

Self Plants having Yellow round Seeds X Plants having Yellow round seeds

(Hybrid-I) (Hybrid-II)

♀\♂	(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

F_2 ratio = yellow – round = 9
Round- Green = 3
Wrinkled- yellow = 3
Wrinkled- Green = 1
F_2 ratio = 9:3:3:1

From the results of dihybrid cross, Mendel framed the following laws:

Law of independent assortment:- this law states that the genes of different characters located in different pairs of homologous chromosomes are independent of one another in their segregation during gamete formation (Meiosis).

Law of Segregation:-

The two factors of a character present in an individual do not change but remain distinct & segregrate from each other at the time of gamete formation(segregation during gametogensis).

So that each gamete receives only one factor for each character. In other words, the gametes carry one factor either dominant or reccessive. This is called law of segregation and is also called as law of purity of gametes because gamets are always pure for the trait. E.g., when a cross is made between two breeding tall plant with dwarf plant, each gamete from the parent will receive one unit factor (either for tallness or dwarfness). During fertilization F_1 plants will receive one unit factor for tallness & one unit factor for dwarfness. Since tallness factor is dominated over dwarf factor, So F_1 plants show only one trait i.e., tallness. When F_1 plants form gametes, they randomly receive either the tallness factor or dwarfness factor. Thus above mentioned example confirms law of segregation or purity of gametes.

Mendel's First law of inheritance:- The characteristic of an organism are determined by internal factors which occur in pairs of such only one pair of such factor can be present in a single gamete.

Mendel's 2nd law of in heritance:- In the inheritance of more than one pair of traits in a cross simultaneously, the factors responsible for each pair of traits are distributed independently to the gametes.

Sex Determination:- The process by which the sex of a person is determined is called as sex-determination. Different species use different strategies for sex determination. In some animals, such as crocodiles, turtles & sand lizard, the temperature at which fertilized eggs are kept determines whether the animals developing in the eggs will be male or female. In other animals, such as snails, individuals can change Sex, indicating that sex is not genetically determined. However, in human beings, the sex of the individual is largely genetically determined by chromosomes. The chromosomes which determine the sex of a person are called sex chromosomes.

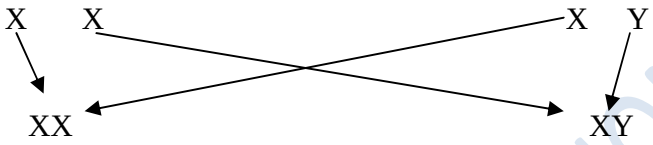
The sex chromosomes are of 2 types, one is called X-chromosomes and another is called Y-chromosomes.

A male has one X- chromosome and one Y Chromosome. This means that in male half of the chromosomes come from Sperm and half from egg. In comparison to males in females both chromosomes comes from Egg and thus have only X- chromosomes the child depends on what happens at fertilization .:

a) If the sperm carrying X- chromosomes fertilizes an egg, which carries X-chromosomes then, child will be a girl (XX).
b) If the sperm carrying Y- chromosomes fertilizes an egg, which carries X- chromosomes then the child will be a boy (XY).

Thus, it is the sperm which determines the sex of an organism.

Mother's Ova (or Egg) All- X Father's sperm (Half-X; Half Y)



Zygote (Female Child-Girl) Zygote (male Child: Boy)

Determination of sex in Human

Q. How Do Genes control the characteristics or Traits.

Ans. A gene is a section of DNA on a chromosome which codes for the formation of a protein controlling a specific characteristic (Or trait) of the organism. Suppose a plant progeny has gene for the characteristic (Or trait) called "Tallness". Now the gene for "Tallness" will give instructions to the plant cell to make a lot of growth hormones and due to these hormones the plants will grow too much and hence become tall.

Q. What are Acquired and inherited traits?

Ans. Acquired trits:- Those traits which do not pass or transmit from parent to offspring and are caused due to the affect of environment. For example, low weight of beetles because of starvation is not a trait that can be inherited by the progeny of a starving beetle.

Inherited traits:- Those traits which pass or transmit from parent to offspring and are caused due to the transmission of genetic material from parent organisms to their offspring. For example, in human beings; Dimples or freckles, Naturally curly or straight hair and attached or unattached earlobes are common example of inherited traits.

Q. What is speciation?

Ans. Speciation:-Speciation is the evolution of new species. It occurs when a population of interbreed individuals is split up into separate populations. These separate populations then continue to evolve independent of each other. Over time, they may become separate species and be unable to breed with the population from which they were initially separated. For animals that reproduce without sex, species are defined by arbitrary decisions based on how genetically distinct groups have become.

Speciation can occur if a geographic barrier prevents gene flow between two populations of the same species.

Q. Explain Evolution and its types.

Ans. **Evolution:-** The term evolution was first used by Herbert Spencer. The term "Evolution" has been derived from the Latin word "evolvere" which means to unroll or unfold. It refers to

gradual change from one form to another. Such a change in elements with the time is called inorganic evolution or chemical evolution, however, gradual change in living organisms with time since the beginning of life is termed as organic or biological evolution.

Chemical Evolution:-

It explains the formation of the complex organic compounds from simple chemical elements or compounds. This concept was put forward by Alexder.I. Oparin(1923) & J.B.S Haldance (1928) independently.

J.B.S Haldane suggested that life must have arisen on the primitive earth from a collection of chemical through a progressive series of chemical reactions in which atoms combined into inorganic molecules and inorganic molecules into simple orgainc compounds, simple organic compounds into complex organic compounds, complex organic compounds into polymers and polymers into coaservates (Aggregates of large complex organic molecules), coaservates were converted into eobionts and finally eobionts were converted into first primitive cell

Organic evolution:-

Organic evolution is concerned with the evolution of populations of living organisms. It is continuous & irreversible process of change inheritable characters.

There are number of theories which explain the mode of evolution. Some of them are discussed below:

1. **Darwinism or Darwin's theory of Natural Selection:-** The theory of natural selection was announced by English naturalist Charles Robert Darwin and an English biologist, Alferd Russel wallase. Darwin explained his theory in his book "The origin of species by means of Natural selection."

   According to this theory every living organism produces more organisms that can be supported in a particular environment & can survive. But food and space are limited. Hence because of more number of individuals that can be supported by the food and space, a severe competition starts between the members of one species as well as the members of different species. This competition is for food and space and mate and there starts a struggle for existence. So as to overcome other organisms in this struggle for existence, variations appear in each living organism. Nature selects organisms with better suited variations, by natural selection. Those variations which are selected by nature pass on to next generation. It was called inheritance of useful variations. In this way in each generation new favourable variations appear, and supplemented the favourable variations inherited from the parents . After a number of generations, the variations became so prominent that the possessor turn into new species.

   Though Darwinism got wide acceptance but it was too criticized that it could not explain how variations appear.

2. **Devries theory of mutation:-**

   Devries explains the formation of new species by sudden appearance of new characters. These sudden changes were named as mutations or saltations. He explained that evolution does not occur by gradual changes but occurs by abrupt changes (mutations). i.e., evolution is Jerky process.

3. **Modern or synthetic theory of evolution:-**

   The present concept of evolution is a modification and elobration of the Darwin's theory and often termed as neo- Darwinism. According to this theory Genetic variations appearing among the individuals bring about evolution under the influence of natural selection & isolation.

Q. Discuss various evidences of evolution

Ans. Evidences For Evolution:-

Chemical evolution produced life on primitive earth through interaction of molecules. This was followed by organic evolution, which gave rise to numerous kinds of living organisms over the ages. The following evidences not only prove the occurrence of organic evolution but also trace the evolutionary relationship amongst living organic evolution.

1. **Morphological and anatomical evidences:-** These evidences are based on the comparative forms and structures of various parts or organs of the body. These include the following:-

a) **Homologous organs:-** The organs which perform different functions in different species but have similar basic structure and similar embryonic origin are called homologous organs e.g., Forelimbs of vertebrates are adapted for different modes of locomotions. In frog they are meant to bear the shock of leap, in reptiles for creeping, in horse for running, in birds modified into wings for flight. But in all these vertebrates the forelimbs have same internal structure because they have inherited from common ancestor

b) **Analogous organs:-** The organs which have different origin and internal structure but perform same functions e.g., wings of birds & wings of insects are meant for flight but have totally different structure & origin.

c) **Vertebrate organs:-** Some vertebrate organs exhibit gradual complexity in various vertebrates e.g., Heart in fishes is two chambered, three chambered in amphibians, incompletely four chambered in birds and completely four chambered in birds and mammals. It is in conformity with gradual change in evolution.

d) **Vestigial Organs:-** Non-functional and rudimentary organs present in animals are called vestigial organs. e.g., Tail vertebrae or coccyx bone, vermiform appendix, etc., in human beings are vestigial organs. These organs were in the ancestors of human beings. But they are disappearing gradually due to change in mode of life.

2. **Embryological Evidences:-** The early embryos of all the vertebrates resemble in shape and structure. The resemblance of early embryos of fish, salamander, tortoise, chick, rabbit and man is so close that it is very difficult to distinguish them from each other, which shows that all the vertebrates have evolved from a common ancestor. Based on this fact Ernest Hackel proposed the law known as biogenetic law. This law states "Ontogeny repeats phylogency") which means, that an animal in its individual embryonic development from egg to adult, repeats in condensed form the stages through which its ancestors have passed in the course of their evolution.

Paleontological Evidence :- Paleontology is the study of fossils. Fossils are the remains or impressions of past organisms preserved in Sedimentary rocks or other media Fossils provide most reliable evidences for evolution.

i. A regular gradation from simple to complex is noted in fossils of animals. This geological succession completely agrees with concept of evolution.

ii. Extinct animals and there living allies differ greatly. This means life has been changing & this is what evolution postulates.

iii. Missing link are fossils of organisms having characteristics of two different groups. Archaeopteryx is such a link between reptiles & birds which shows some characters of reptiles like presence of teeth in jaws and some characters of birds like presence of feathers on the body. These characters have shown that birds have evolved from reptilian ancestors.

Biochemical evidence :- Organisms show similar bio-chemical reactions, similar chemical nature & similar functions of enzymes & hormones of different vertebrates. Similar composition of blood & lymph and similarities between blood proteins. These similarities clearly support common ancestory.

Q. What are fossils? How they are formed and also discuss the types of fossils?

Ans:- The remains or impressions of dead animals or plants that lived in remote past are known as fossils.

Fossilization. Fossilization of a dead organism usually begin when the dead organism is buried before extensive decay sets in. The organism sinks into bog or marsh or to the bottom of a lake, sea, or river. In some cases it is buried in sand. Even after the burial, decay occurs and the soft parts of the body are generally destroyed. The hard parts, however, survive as fossils. Water, mud or sand hardens to rock and the organic remains are safely preserved. Fossilization is a random process, only those organisms which happen to die in a spot where they can be buried before other organisms destroy them are fossilized.

Fossils are exposed by natural erosion or excavation. Fossil bearing rocks become exposed by the actions of wind, rain or rivers, or through excavations by scientists. Once exposed, they are studied in detail in terms of their antiquity and characteristics. Such study of fossils is called paleontology.

Types of fossils

There are various kinds of fossils some of the important fossils are:-

1. **Ammonite:-** These were the invertebrate animals (Molluscus) with a flat, coiled, spiral shell, which lived in the sea. The ammonite fossils are about 180 million years old.
2. **Trilobite:-** These were marine arthropods which were common between 400 to 600 million years ago.
3. **Dinosaurs:-** These are extinct carnivorous or herbivorous reptiles. They were first appeared on earth about 250 million years ago and become extinct about 65 Million years ago.

Q. What are the two methods to determine the age of fossils?

Ans. Determination of age of fossil?

Ans:- There are two methods to known the age of fossils.

1. By the relative method.
2. By carbon dating method.

Relative method:-

When we dig the earth, we find fossils at different depths. The fossils which we find closer to the surface of the earth are more recent and the fossil found in deepest layer of earth are oldest one.

By carbon-dating method:- Dating of rocks or fossils is done by working on concentration of carbon-14 atoms in fossils. This can be explained as:

All the living objects contain some carbon-14 atoms which are radioactive. When a living object dies and forms a fossil. Its carbon-14 content goes on decreasing gradually. In the carbon-14 dating method, the age of fossils is found by comparing the carbon-14 radio-activity left in fossil with carbon-14 radioactivity found in living object.

Q. What do you know about the evolution of eye and feathers?

Ans. Evolution of eye:-

The eye is a complicated organ which can not be generated by a single DNA change. The complex body organs of animals such as eye have been created in stages over many generations.

Eye has been evolved from a very simple form known as the rudimentary eye (basic eye) like that of a flatworm (planaria). The eyes of the flatworm are very simple that are actually just 'eye spots' which can detect light. These rudimentary eyes provide a survival advantage to flat worm. Starting from this basic design more and more complex eye were then evolved in various organisms. The structure of eye in octopus, insects and vertebrates is however different with their separate evolutionary origins. The evolution of eye is an example of evolution by stages.

Evolution of Feathers:-

Sometimes an evolutionary change is produced in an organism for one purpose later on becomes more useful for an entirely different functions e.g., Birds evolved feathers as means of providing insulation to their bodies in cold weather but later on these feathers became more useful for the purpose of flying. Even some dinosaurs had feathers, though they could not fly by using these feathers. Birds however adapted feathers for flying. The presence of feathers on birds tells us about that the birds are very closely related to reptiles because dinosaurs which had feathers were reptiles.

Q: What is Artificial selection or write a short note on evolution by Artificial selection?

Ans:- Artificial selection is the process by which man selects traits useful to him for improving the qualities of domesticated animals & plants.

Man selects the individuals having the desired traits and separates them from those which do not possess such characters. The selected individuals are interbreed this process is called artificial selection, when repeated for many generations, produces a new breed with desired traits.

Example:- The wild cabbage plant is good example to prove that entirely different looking organisms can evolve from same organism by the process of evolution by artificial selection. The farmers have been cultivating wild cabbage as a food plant for over two thousand years and have produced or evolved entirely different looking vegetables like cabbage, broccoli, cauliflower Kohlrabi & kale from it.

By using artificial selection for evolution some farmers wanted to have short distances between the leaves of wild cabbage and produced cabbage.

- Some farmers opted for arrested flower development & led to production of another variety called broccoli.
- Some farmers opted for the swollen parts of wild cabbage and developed Kohlrabi.
- Some farmers wanted to grow large leaves of wild cabbage & produced leaf vegetable called Kale.

Now wild cabbage is ancestor & cabbage, Broccoli, Kale etc are its varieties which have been evolved by artificial selection.

Human Evolution: Human evolution has been studied by using the various tools of tracing evolutionary relationship like excavating (digging earth), carbon-dating, studying fossils and determining DNA sequences. There is so much diversity of human body and features on the earth that for a long time people used to talk about different "races" of human beings. The races can be determined on the basis of skin-colour and named as white, black, yellow or brown.

It has been established by research that the earliest members of human species come from Africa. So , irrespective of where we have lived for the past. We have all evolved from Africa.

Q.8:- Why are human beings who look so different from each other in terms of size, colour and looks said to belong to same species?

Ans:- Human beings look different from each other in terms of size & colour but belong to same species because on the basis of time dating, study of fossils and molecular phylogeny all the human beings are evolved from the same ancestors which have been traced in Africa. The variation in

colour, size and other features among the individuals of human beings is because of migration and settlement in different geographical regions. Some of our ancestors left Africa & spread slowly across the planet while others stayed on. Over a period of time, due to variability in environmental conditions of different regions, our ancestors adopted and developed genetic variations and became different in colour and size.

Textual Questions

Q.1:-Ans. Trait B

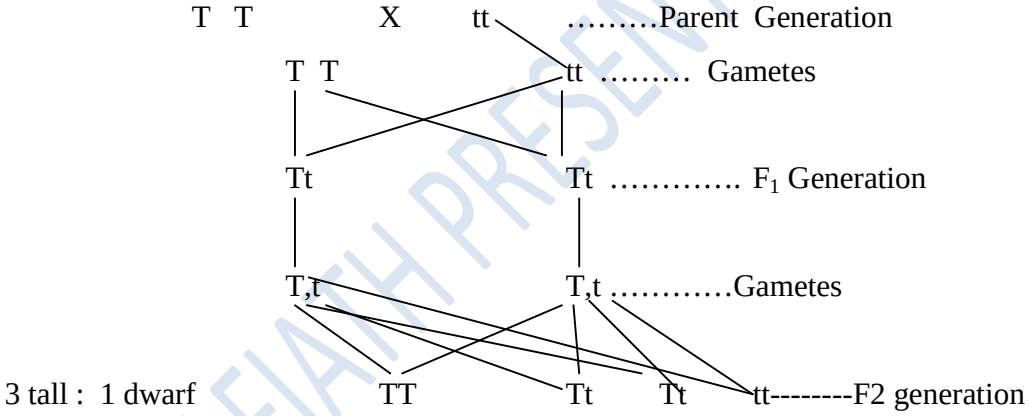
Q.2:- How does the creation of variations in a species promote survival?

Ans:- Variations in a species arise either due to errors in DNA copying or during sexual reproduction. It is the force of natural selection which selects individuals with useful variations in the prevailing environment. So as to ensure survival, the individuals with useful variations then increase in number through differential reproduction in the population.

Q. How do Mendel's Experiments show that traits may be dominated or recessive?

Ans:- Mendel Cross-Pollinated a pure tall pea plant and a pure dwarf pea plant and called them parental generation. He collected the seeds produced by this cross and grew plants from them. These plants were named as F_1 or first filial generation. In F_1 generation all the plants were found to be tall and none was dwarf or intermediated in size.

The F_1 Plants were pollinated among themselves or were allowed to undergo self-pollination and the seeds produced by F_1 plants were again collected and plants were grown from them. These plants were named as F_2 or second filial generation. The F_2 plants were found to contain both tall and dwarf individuals in the ratio of 3 tall to 1 dwarf.



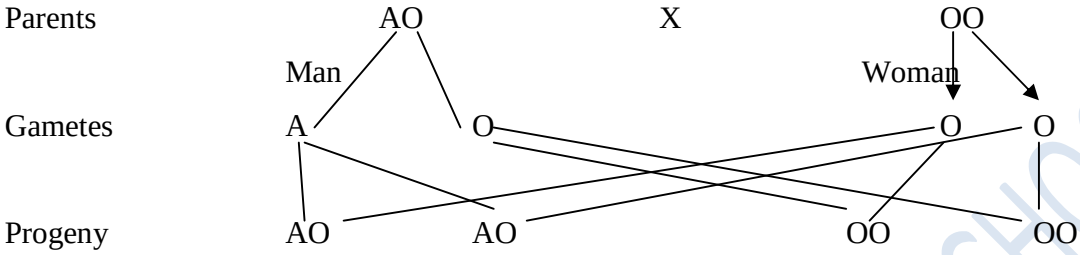
From the above experiment Mendel drew following conclusions:

1. Gametes bring from the parents "something" which makes a character in next generation. This something was called by him a factor.
2. There is pair of unit factor for each character, one inherited from each parent.
3. Certain factors do not express their characters in the individual but such factors do not change and may express in later generation.

This conclusion led by Mendel to formulate his law of heredity, the law of dominance. This law states, that one factor in a pair may express itself & prevent the expression of another. The factor that is expressed was described by Mendel as dominated & the unexpressed one as recessive.

Q.3:- A man with blood group A marries with a woman with blood group O & their daughter has blood group O. Is this important enough to tell you which of the traits blood groups A or O is dominate why or Why not?

Ans:- If a man with 'A' blood group marries with a woman with 'O' blood group then as per following flow chart.



We can't say that A is dominant over O because the daughter has blood group O as per question which means the daughter receives one gene from father i.e., 'O' and other gene from mother 'O' so we can't say A is dominated over O.

Q.4 What are the different ways in which individuals with a particular trait may increase in a population?

Ans. The different ways in which individuals with a particular trait may increase in a population are:- i. National selection ii. Genetic drift.

In Natural selection, nature selects traits favourable to the species in its environment and in genetic drift, the genes of certain traits from the small population gets eliminated when a section of the species population dies of natural calamity or migrates to other region. It alters the gene frequency of the remaining population.

Q.5:- What factors could lead to the rise of new species?

Ans.:- The factors responsible for rise of new species or speciation are:

1. Genetic variations
2. Natural Selection
3. Reproductive isolation.

Q.8:- Why are traits acquired during the life time of an individual not inherited?

Ans:- Acquired traits are those traits which are acquired by the individual during its life time e-g Experiences of individual during its life time is an acquired character.

The acquired characters are not inherited from parents to off springs because acquired characters involves changes in the non-reproductive tissues only and change in non reproductive tissue can't be passed on the DNA of germ cells. Any alteration in the DNA of germ cells, infact is the only way by which the traits of an individual are inherited from parents to off springs.

Q.10:- Why are small numbers of survival tigers a cause of worry from the point of view of genetics?

Ans:- Tigers are surviving in limited numbers i.e., their total gene Content or gene pool is small if some natural calamity kills these small populations, they will be suddenly extinct or in terms of genetics their gene pool will remain no more as per the phenomenon of genetic drift.

Q:- Will geographic isolation be a major factor in the speciation of an organism that reproduces asexually?

Ans:- Geographical isolation refers to the separation of groups of organism by Physical barriers, such as sea, mountain, desert or a river.

Geographical isolation will not be a major factor for the speciation of an organism that reproduces asexually because, asexual reproduction involves, single parents and natural barrier can occur between different organisms.

Q.13:- Give an example of characterizes being used to determine how close two species are in evolutionary terms?

Ans:- A flipper of seal used for swimming and an arm of man are homologous organs. Both these organs perform different functions but have same structure and origin. Both of these structure are modified forelimbs. During the course of evolution, these two species evolved from common ancestor having fundamental structure design that developed subsequently into flipper in seal for swimming and arm for grasping in man.

Q14:- Can the wings of butterfly and the wings of a bat be considered homologous organ? Why or why not?

Ans:- The wings of butter fly & wings of bat are not homologous organs, because they are very different in structure and embryonic origin. However they perform similar functions i.e, they are used for flying. The organs which have same functions but are quit different in fundamental structure and embryonic origin are called analogous organs. So the wings of butterfly & wings of bat are not homologous organs but analogous organs.

Q.No:-15 What are fossils? What they tell us about the process of evolution?

Ans:- Fossils are the remains, or traces of the organisms that existed in past ages died as a race.

They are direct evidences in support of organic evolution and help in determining evolutionary relationships between organisms. The study of fossils show complete evolutionary history of certain animals, such as horse, camel, elephant etc. Fossils also shows relation-ships between different organisms e.g., Archaeopteryx, lived in Jurassic period is a fossil bird. It had feathers, fused bones, beak etc, which are bird's characters. But it has also number of features which are found in reptiles e.g., teeth in Jaws, Claws on free fingers etc. Thus archaeopteryx represents a stage midway between reptiles and birds and this example also gives clue that birds have evolved from reptiles.

Q.:- In Evolutionary terms can we stay which among bacteria, spiders, fish and chimpanzee have a better body design?

Ans:- Bacteria have a better body design because bacteria inhabit the most inhospitable habitats like hot springs, deep sea thermal vents and the ice in Antarctica.

Q. How are the areas of study- evolution and classification- interlinked?

Ans. The cell is the basic unit of life in all organisms. The characteristics in the next level of classification would be shared by most, but not all organisms. A basic characteristic of a cell design that differs among different organisms is whether the cell has a nucleus or not. Bacterial cells do not have the nucleus while the cells of most other organisms have. Among organisms with nucleated cells, which ones are unicellular and which ones are multi-cellular? That property marks a very basic difference in body design, because of specialization of cell types and tissues. Among multi-cellular organisms, whether they can undertake photosynthesis or not will provide the next level of classification. Among the multi-cellular organisms that cannot do photosynthesis, whether the skeleton is inside the body or around the body will mark another fundamental design difference. We can see that, even in these few questions that we have asked, a hierarchy is developing that allows us to make classification groups.

Q: Explain the importance of fossils in deciding evolutionary relationships.

Ans: The things which explain the importance of fossils in deciding evolutionary relationships are

(i) A broad historical sequential evolution can be built up.

(ii) Habits and behaviours of extinct species can be inferred.

(iii) Fossils provide direct evidence of past life.

(iv) These provide convincing proof of organic evolution.

Q: What evidence do we have for the origin of life from inanimate matter?

Ans:- There is no natural discontinuity between life and the rest of creation. Scientific conclusions that include discontinuity in the operation of the universe are representative of theoretical error. This is true for gaps existing within mechanical theory, and it is true for the gap between mechanical theory and life. The universe includes mechanics, life and intelligence, all of which had the same origin. The universe gave birth

to life. We are formed from its substance and are a part of its nature. Our particles of matter existed for years as part of the inanimate universe before they joined together and became us. Our insignificant amount of common matter did not change its nature when it became us. It is still a part of the nature of the full universe. It will return again to the inanimate universe and be indistinguishable.

Q:-Explain how sexual reproduction gives rise to more viable variations than asexual reproduction. How does this affect the evolution of those organisms that reproduce sexually?

Ans:-In asexual reproduction, organisms raised are the exact copies of their parents and are known as clones. Due to their identical set of chromosomes, they exhibit no or very little variations. These variations may be either due to some environmental factors like, light, scarcity of food, abundance of food, temperature etc. or mutations that are sudden changes in genes. Out of these two factors, only mutations are heritable.

In sexual reproduction, two parents are involved and there is formation and fusion of gametes. Due to crossing over and exchange of gene segments, offspring show variations from their parents. They are not the carbon copies of their parents. Due to recombination of parental genes, variations occur which are heritable.

Q:- How is the equal genetic contribution of male and female parents ensured in the progeny?

Ans:-During gametogenesis meiotic division results in haploid set of chromosomes in the gametes. These gametes (egg and sperm) when fuse or fertilization process occurs, half of the chromosome of the zygote consists of paternal genes and half maternal genes.