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CONCEPTS & COMPETENCE



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VOLCANO-X Board Excellence BIOLOGY

Heredity & Evolution

NCERT IN TEXT & EXERCISE QUESTIONS

NCERT Pg 143 Box Q1: 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?

During asexual reproduction the traits which are present in the previous generation will remain the same with very minor differences. On the basis of the trait which are present in high percentage will be arising earlier i.e., trait 'B' having existence 60% is likely to have arisen earlier.

NCERT Pg 143 Box Q2: How does the creation of variations in a species ensure survival?

The creation of variation in a species ensures survival because:

- the variation existed already in the environment will affect the forthcoming generation which will ensure survival.
- it adapts an organism for the newly encountered changes in the surroundings.
- it adapts an organism for the NEW NEEDS & hence survival of species.

NCERT Pg 144 Activity 9.2. In fig 9.3 NCERT Pg 144, what experiment would we do to confirm that the F2 generation did in fact have a 1:2:1 ratio of TT, Tt & tt trait combinations?

By crossing the individuals of F1 generation with Recessive parent (TEST CROSS). The supportive material in the box.

TEST FOR PURITY OF GAMETES / RECIPROCAL CROSS.

WHAT'S THE PROBLEM ?????

We studied,

TT x tt

t t

T	Tt	Tt
T	Tt	Tt

F1 generation (Tt) This is on paper BUT practically it is to be found that this tall is PURE(TT) OR IMPURE(Tt)???

Probable Solution: In this we test the purity (homozygous nature) of the offspring of F1 generation by crossing it with its parent. And that's why it is called as RECIPROCAL CROSS because we have gone one Generation Backwards.

[1] BACK CROSS

When F1 individuals are crossed to the parent with dominant parent (i.e.- homozygous for tallness) then the cross is called as BACK -CROSS

Back Cross: Tt x **TT(Dominant Parent)**

Phenotypic Ratio: 1:1 i.e 100% tall

Genotypic Ratio: 1:1 i.e 100% tall

"WE HAD NOT FOUND"

	T	T
T	TT	TT
T	Tt	Tt

[2] TEST CROSS

When F1 individuals are crossed to the parent with RECESSIVE parent (i.e.- homozygous for DWARFNESS) then the cross is called as TEST -CROSS

Test Cross: Tt x **tt(Recessive Parent)**

Phenotypic Ratio : 50% tall; 50% dwarf

Genotypic Ratio : 1:1 i.e 100% tall (But there is some impurity)

	t	t
T	Tt	Tt
t	tt	tt

"WE HAD FOUND" Because some individuals are dwarf.

NCERT Pg 147 Box Q1: How do Mendel's experiments show that traits may be dominant or recessive?
Test cross explained on previous page.

NCERT Pg 147 Box Q2: How do Mendel's experiments show that traits are inherited independently?
Explanation of Dihybrid cross.

NCERT Pg 147 Box Q3: A man with blood group A marries a woman with blood group O and their daughter has blood group O. Is this information enough to tell you which of the traits - blood group A or O - is dominant? Why or why not?

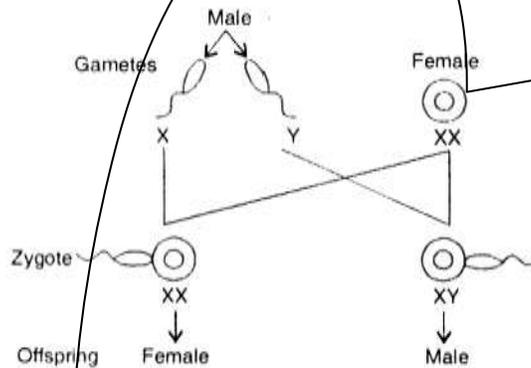
Blood group 'O' is dominant because in progeny male had blood group O. In F-1 generation blood group O is visible due to dominance. This information is sufficient to tell about the dominance and recessiveness.

NCERT Pg 147 Box Q4: How is the sex of the child determined in human beings?

- * Sex chromosomes help in the determination of sex in human beings.
- * In males, the sex chromosomes are two types X and Y (i.e., XY), while in females the sex chromosomes are of same type X and X (i.e., XX).
- * The males produce two types of sperms (in a ratio of 50 : 50) – one type of sperms carrying X-chromosome, and other type of sperms carrying Y chromosome.
- * The females produce eggs with only one of chromosome, i.e. X-chromosome. All eggs are alike (each with one X-chromosome), but sperms are either with X- or Y-chromosome (50% of each kind). Which

Sperm fertilizes the egg determines whether the child will be male or female.

- * When a sperm carrying X-chromosome fertilizes an egg, the zygote (XX) will develop into a girl.
- * When a sperm carrying Y-chromosome fertilizes an egg, the zygote (XY) will develop into a boy.



NCERT Pg 150 Box Q1: What are the different ways in which individuals with a particular trait may increase in a population?

There are following ways in which individual with particular trait may increase in a population:

1. A colour variation arises during reproduction so that the population may be increased. (In some insects change in colour protects the insect from the pest & its population gets increased.)
“Teacher can here give the example of INDUSTRIAL MELANISM ON ENGLAND.”
2. Sexual reproduction between individuals having LAR TRAIT, REPEATEDLY may increase the no. of individuals of that particular trait in population
3. Genetic Drift provides diversity without any adaptation.

“Teacher can here again define & explain about Genetic Drift ”

Genetic Drift: It is the random change in the frequency of alleles / traits in a population over successive generations due to sampling error in the gametes.

NCERT Pg 150 Box Q2: Why are traits acquired during the life-time of an individual not inherited?

The traits which are acquired during the life-time of an individual are not transferred on DNA of GERM CELLS / GAMETES. The traits acquired during lifetime only change the phenotype. So they remained in one species population which could not transfer in the next generation.

NCERT Pg 150 Box Q3: Why are the small numbers of surviving tigers a cause of worry from the point of view of genetics?

The small numbers of surviving tigers are cause of worry from the point of view of Genetics because when they are in smaller number, sets of genes will also be limited in their population and during sexual reproduction VARIATION IN CHARACTERS may also be LIMITED and it will be dangerous for their survival in changing conditions.

NCERT Pg 151 Box Q1: What factors could lead to the rise of a new species?

The factors which are responsible for rising a new species are:

- (i) Natural selection. (ii) Genetic Variations (iii) Reproductive Isolation

NCERT Pg 151 Box Q2: Will geographical isolation be a major factor in the speciation of a self-pollinating plant species? Why or why not?

"It can be a DEBATABLE TOPIC. The answer is YES as well as NO."

Yes, geographical isolation CAN be a major factor in the speciation of a self-pollinating plant species. There are TWO types or characters i.e., **Genotypic and Phenotypic** characters. Genotypic characters are due to the presence of genes on chromosomes which will remain the same but the phenotypic characters will be influenced by the geographical conditions. So, phenotypic isolating condition will be the major factor in the speciation of the self pollinating plant species.

No, geographical isolation will not be a major factor in the speciation of a self-pollinating plant species. Because, new genes do not enter in the population of self pollinating plants and no species is formed. Hence, there is a little variation possible. Speciation takes place only when genetic variation is combined with geographical isolation.

NCERT Pg 151 Box Q3: Will geographical isolation be a major factor in the speciation of an organism that reproduces asexually? Why or why not?

"It can be a DEBATABLE TOPIC. The answer is YES as well as NO."

YES, Geographical isolation will be a major factor in the speciation of a sexually reproducing organism. An organism survives in a phenotypic condition but if some of the organisms of the same species are migrated to the neighbouring geographical isolation having different phenotypic characters, & asexual reproduction takes place in the surviving condition then due to the change of phenotypic conditions SPECIATION WILL TAKE PLACE.

No, geographical isolation will not be a major factor in the speciation of an organism that reproduces asexually. It is because there is neither genetic drift nor gene flow to play any role during speciation.

NCERT Pg 156 Box Q1: Give an example of characteristics being used to determine how close two species are in evolutionary terms.

- (i) Homologous Organs. (ii) Embryonic Similarities & differences
(iii) Sharing of Reproductive Process.

NCERT Pg 156 Box Q2: Can the wing of a butterfly and the wing of a bat be considered homologous organs? Why or why not?

The wings of butterfly and wings of bat are similar in function but dissimilar to the origin. This ¹/₁ phenomenon is called analogous organs. So they are not homologous organs.

NCERT Pg 156 Box Q3: What are fossils? What do they tell us about the process of evolution?

Fossils are the remnants or the impressions of the extinct organism which were obtained from the earth after digging.

Significance of Fossils:

1. Broad historical sequence of biological evolution can be made by the study of fossils of different ages.
2. Fossils provide direct evidence of past life.
3. Habits & behavior of extinct species can be inferred by the study of fossils
4. These provide a convincing proof of organic evolution.

NCERT Pg 158 Box Q1: Why are human beings who look so different from each other in terms of size, colour and looks said to belong to the same species?

Human beings look very different from each other due to the change in phenotypic characters. In geographical conditions they become different in size, colour and look.

They belong to same species because:

1. Their genotypic characters are same so their organs are same. (DNA Studies provide the proof)
2. No. of chromosomes in all races of human species are the same.
3. All have a common ancestor. (Anthropology proves it)
4. They INTERBREED AMONG THEMSELVES to produce fertile young ones of their own kind.

NCERT Pg 158 Box Q2: In evolutionary terms, can we say which among bacteria, spiders, fish and chimpanzees have a 'better' body design? Why or why not?

In the SURVIVAL terms bacteria, spiders, fish and chimpanzee have the property to persist in the diversity of generation. So they ALL have a better body design.

In the EVOLUTIONARY Terms **Chimpanzees** have a 'better' body design among bacteria, spiders and fish because they have a well developed body structure, better adapted for locomotion, communication and thinking.

NCERT EXERCISES Pg 159

1. A Mendelian experiment consisted of breeding tall pea plants bearing violet flowers with short pea plants bearing white flowers. The progeny all bore violet flowers, but almost half of them were short. This suggests that the genetic make-up of the tall parent can be depicted as :

- (a) TTWW (b) Ttww (c) TtW4V (d) TtWw.

Ans. (a) TtWW.

2: An example of homologous organs is :

- (a) our arm and a dog's fore-leg (b) our teeth and an elephant's tusks
(c) potato and runners of grass (d) all of the above. .

Ans. (a)

3. In evolutionary terms, we have more in common with:

- (a) a Chinese school-boy (b) a chimpanzee
(c) a spider (d) a bacterium.

Ans. (a)

4. A study found that children with light-coloured eyes are likely to have parents with light-coloured eyes. On this basis, can we say anything about whether the light eye colour trait is dominant or recessive? Why or why not?

Ans
On the basis of the study the light coloured eyes trait is dominant which can pass from the existing progeny to the next coming generation. The dominant trait may transfer to the next generation with similar or recessive trait and show presence in the absence of dominant trait.

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

Ans.
Evolution and classification are interlined with each other in the following ways :

Classification is most important term to explain evolution.
Classification is based on the similarities and difference between two species or among two organisms. More closer the characteristics, the more closer is the evolution and chances to be in the same group of classification. Thus, the classification of species is a reflection of their evolutionary relationship.

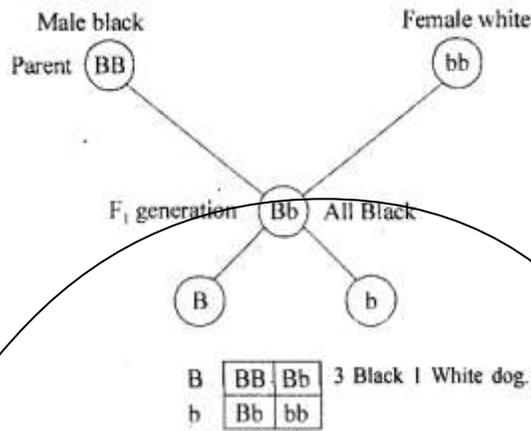
6. Explain the terms analogous and homologous organs with examples.

Ans. Homologous Organs: The organs similar in structure and origin but different in function are known as Homologous organs. Example : Forelimbs of frog, wings of bird, wings of bat; flappers of whale, forelimbs of horse and forelimb of man are similar in their origin but different in their functions.

Analogous Organs : Organs similar in function but different in structure and origin are known as Analogous organs. Example: Wings of butterfly and that of bird have similarity in their functions but their origins are different. So they are called an Analogous organs.

7. Outline a project which aims to find the dominant coat colour in dogs.

Ans. A homozygous black (BB) male dog and a homozygous white (bb) female dog is taken and given to mate and produce offspring in F₁ generation. Let coat colour B (Black) be dominant over coat colour b (white).



8. Explain the importance of fossils in deciding evolutionary relationships.

Ans. **Significance of Fossils:**

1. Broad historical sequence of biological evolution can be made by the study of fossils of different ages.
2. Fossils provide direct evidence of past life.
3. Habits & behavior of extinct species can be inferred by the study of fossils
4. These provide a convincing proof of organic evolution.

9. What evidence do we have for the origin of life from inanimate matter?

Ans. **MOLECULAR EVIDENCE:**
As we know that several organic and inorganic materials combine in a particular manner and form **genes** which is a unit of inheritance. An actual human **chromosome** has between 30,000 to 40,000 genes on it. Chemically gene is a segment of a large **DNA** which forms the most important constituent of a chromosome. DNA is the gametic material in all the organisms which forms **Proteins** & the main 'INANIMATE' part of proteins is **NITROGEN**. Thus it proves that the life originated from inanimate or non-living matter.

PRACTICAL EVIDENCE: (Not in Syllabus but given in NCERT Pg 150 Do you know BOX)
Stanley L Miller and Harold C Urey provided evidence regarding origin of life from inanimate matter. They assembled an atmosphere similar to that existed on early earth. The atmosphere had molecules like ammonia, methane and hydrogen sulphide, but no oxygen over water at a temperature just below 100°C and sparks were passed through the mixture of gases. At the end of a week, 15% carbon from methane had been converted to simple compounds of carbon like amino acids which make up protein molecules. So, life arose afresh on earth.

10. 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 sexual reproduction, the genes of the **chromosomes transfer from each other** and the gene which contains specific character transfers from the parent to the **new offspring**. This transfer is responsible for a variable variations. In asexual reproduction the fragments of the chromosomes transfer in separate parts of the organism. Each part develops and gives rise to new individual. Thus the offset in asexual reproduction has more similarities with its parents.

11. How is the equal genetic contribution of male and female parents ensured in the progeny?

Ans. During sexual reproduction, a female gamete or egg cell fuses with a male gamete or sperm cell which are haploid to form zygote. **Zygote is diploid which contains 23 chromosomes from mother and 23 from father.** In this way, an equal genetic contribution of male and female parents is ensured in the progeny.

12. Only variations that confer an advantage to an individual organism will survive in a population. Do you agree with this statement? Why or why not?

Ans. The question clearly asks about SURVIVAL OF THE FITTEST.
Yes, we agree with the statement that only variations that confer an advantage to an individual organism will survive in a population. It is because, the changes of survival depends on the nature of variations. Different individuals have different kinds of advantages. For example, a bacteria that can withstand heat will survive better in a heat wave i.e., the organisms who are fit in the competitive environment and with great variations will be able to survive and adapt. Thus, more offsprings and populations with genetic variations will survive.