

Board –CBSE

Class –10th

Topic – Heredity and Evolution

1. What is meant by analogous organs? Taking a suitable example, explain how they support the theory of Organic Evolution.

Ans. Analogous organs are those organs that have different basic structural designs and developmental origins but have a similar appearance and perform similar functions. Example: The wings of birds and bats look similar but have a different design in their structure. They have a common function of flying but their origins are not common. So, birds and bats are not closely related.

2. Define 'evolution'. Describe Darwin's theory of evolution.

Ans. Evolution is the sequence of gradual changes which take place in primitive organisms over millions of years and new species are produced. Since the evolution is of the living organisms, so it is called 'Organic Evolution'.

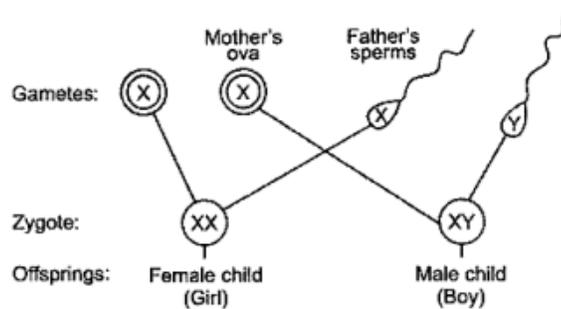
Darwin's theory of Evolution: Charles Robert Darwin gave the theory of evolution in his famous book, 'The Origin of Species'. The theory of evolution proposed by Darwin is known as 'The Theory of Natural Selection. It is also called 'Darwinism'. According to Darwin's theory of evolution:

1. There is natural variation within any population and some individuals have more favourable variations than others.
2. Population remains fairly constant even though all species produce a large number of offspring.
3. This is due to 'competition' or struggles for existence between the same and different species.
4. The struggle for survival within-population eliminates the unfit individuals and those with 'favourable variations' survive and pass on these variations to their progeny to continue. This is called natural selection.
5. The favourable variations are accumulated over a long time period leading to the origin of a new species.

3. Define variation in relation to a species. Why is variation beneficial to the species?

Ans. Variation refers to the differences in the characters or traits among the individuals of a species. Variations are beneficial to the species because:

1. They enable the organisms to adapt themselves to changing environments.
2. Variations form the basis of heredity.



3. They form the raw materials for the evolution and development of new species.
4. Describe briefly four ways in which individuals with a particular trait may increase in a population. **Ans.** The four ways in which individuals with a particular trait may increase in a population are as follows:
 1. Sexual reproduction results in variations.
 2. The individuals with special traits survive the attack of their predators and multiply while the others will perish.
 3. Genetic drift provides diversity without any adaptation.
 4. Variations in the species may lead to increased survival of the individuals.

5. What are fossils? What do they tell us about the process of evolution?

Ans. The remains of dead plants and animals which were buried under the rocks millions of years ago are called fossils.

Fossils tell us about the process of evolution. The fossils of different organisms have some features similar to one species while some features are similar to the other species.

In this way, they show the link between the two species. They tell us that one species evolves from the other

6. Explain the mechanism of sex determination in humans. Or with the help of a flow chart explain in brief how the sex of a newborn is genetically determined in human beings. Which of the two parents, the mother or the father, is responsible for the determination of sex of a child?

Ans. Mechanism of Sex Determination in Human Beings: In human beings, the sex of the individual is genetically determined.

- Sex determination is the process by which the sex of a newborn individual can be determined.
- Human beings have 1 unpaired sex chromosome. The sex chromosome of a male is XY and of a female is XX.
- The sex of a child depends on what happens at fertilization.

Thus, the father is responsible for the determination of the sex of a child.

7. Give one example of each of the characters that are inherited and the ones that are acquired in humans. Mention the difference between the inherited and the acquired characters.

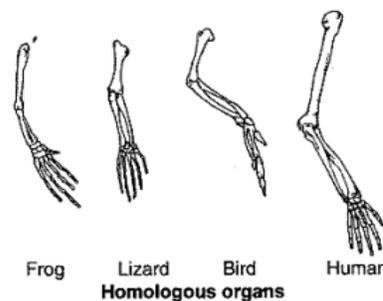
Ans. The eye colour or hair colour of a person is an example of an inherited character whereas, body weight is an example of an acquired character.

The basic difference between inherited and acquired character is that inherited character is passed on from parent to offspring and acquired characters are acquired by an individual during his lifetime depending upon his lifestyle.

8. What are homologous organs? Can the wing of a butterfly and the wing of a bat be regarded as homologous? Why?

Ans. Homologous organs are those organs which have the same basic structural design and developmental origin but have different functions and appearances.

Example: The forelimb of a frog, a lizard, a bird, and a man seem to be built from the same basic design of bones, but they perform different functions.



No, the wing of a butterfly and the wing of a bat cannot be considered homologous organs because they have a common function for flying but their origin and structure are not common. So, they are analogous organs

9. What is meant by the term speciation? List four factors that could lead to speciation.

Ans. Speciation is the evolution of reproductive isolation among once interbreeding population. Factors which can lead to speciation are:

1. Genetic drift: Over generations, genetic drift may accumulate which leads to speciation.
2. Natural selection: Natural selection may work differently in a different location which may give rise to speciation.
3. Severe DNA change.
4. A variation may occur which does not allow sexual acts between two groups.

10. 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. As species are asexually reproducing, there would be only very minor differences generated due to small inaccuracies in DNA copying, so trait B, which exists in 60% of the same population may get inherited earlier while trait A, which exists in 10% of the population may be originated late due to variations. Thus, traits B have arisen earlier since it is present in 60% of the same population.

11. How do Mendel's experiments show that traits may be dominant or recessive?

Ans. Mendel took pea plants with contrasting characteristics — tall plant and dwarf (short) plant. On cross-pollination, he got all tall plants in the F₁ generation. Then by self-pollination of F₁ tall plants, he produced second generation (F₂) consisting of tall and short plants in the ratio of 3: 1. Then he concluded that the 'T' (tall) trait is dominant while the 't' trait for shortness is recessive

12. How do Mendel's experiments show that traits are inherited independently?

Ans. In a dihybrid cross made by Mendel, it was observed that when two pairs of traits or characters were considered; each trait was expressed independently of the other. Thus, Mendel was able to propose the Law of Independent Assortment which says about the independent inheritance of traits.

13. A man with blood group A marries a woman with blood 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?

Ans. No. This information is not sufficient to determine which of the traits – blood group A or O – is dominant. This is because we do not know about the blood group of all the progeny. Blood group A can be genotypically AA or AO. Hence, the information is incomplete to draw any such conclusion.

14. How is the sex of the child determined in human beings?

Ans. The females carry two X-chromosomes. Females produce one type of gametes (eggs) with the same type of chromosomes (22 + X). Males have one X and one Y- chromosome. Among the male gametes, half of the sperms carry X-chromosome (22 X) and half carry Y-chromosome (22 + Y). Thus, female is homogametic and male is heterogametic. When a sperm carrying X- chromosome fertilizes an egg, the zygote develops into a female (XX condition). When sperm carrying Y-chromosome fertilizes an egg, the zygote develops into a male (XY condition). Thus, sex is determined at the time of fertilization.

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

Ans. Different ways are variation, natural selection, and genetic drift (isolation).

16. Why are traits acquired during the lifetime of an individual not inherited?

Ans. Because acquired characters bring changes only in non-reproductive tissues and cannot change the genes of the germ cells. Thus, acquired traits cannot be passed on to the next generation.

(i) If any natural calamity occurs and kills these small numbers of surviving tigers, they can become extinct resulting in the loss of some genes forever.

(ii) Small numbers will lead to little recombination and, therefore, lesser variations. These both are very important for giving better survival chances to the species.

(iii) Less number of species means a lesser extent of diversity and a lesser number of traits which reduces the chances of adaptability with respect to the change in the environment.

17. Why are the small numbers of surviving tigers a cause of worry from the point of view of genetics? **Ans.** Genetic variations, natural selection, and reproductive isolation could lead to the rise of a new species.

18. What factors could lead to the rise of a new species?

Ans. No, because pollination occurs on the same plant in self-pollinating plant species.

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

Ans. No, because asexual reproduction involves a single parent or organism.

20. Give an example of characteristics being used to determine how close two species are in evolutionary terms?

Ans. Homologous organs, analogous organs, and vestigial organs help to identify evolutionary relationships amongst the species

21. Can the wing of a butterfly and the wing of a bat be considered homologous organs? Why or why not?

Ans. No, the wing of a bat and the wing of a bird cannot be considered homologous organs because they have different basic structures.

22. How are fossils formed? Describe, in brief, two methods of determining the age of fossils.

Ans. When organisms die; their bodies decompose due to the action of micro-organisms. However, sometimes the body or at least some parts of the body may be in such an environment that does not let it decompose completely. All such preserved traces of living organisms are called fossils.

The age of fossils can be estimated by the following two methods:

1. If we dig into the earth and start finding fossils, it can be assumed that the fossils closer to the surface are more recent than those found in deeper layers.
2. By detecting the ratios of different isotopes of the same element in the fossil material.

23. State the meaning of inherited traits and acquired traits. Which of the two is not passed on to the next generation? Explain with the help of an example.

Ans. Inherited traits are the characteristics transmitted from parents to their offspring. Acquired traits are characteristics which are developed during the lifetime of an individual. Acquired traits are not passed on to the next generation. For example, if we breed a group of mice, all their progeny will have tails. Now, if the tails of these mice are removed by surgery and allowed to breed, the next generation mice will also have tails. If these tails are also removed and allowed to breed, the progeny of mice will again have tails. Removal of the tail by surgery is an acquired trait and does not change the genes of germ cells and hence, are not passed on to the next generation.

24.” An individual cannot pass on to its progeny the experiences of its lifetime.” Justify the statement with the help of an example and also give the reason for the same.

Ans. Experience achieved during the lifetime of an individual does not make any change in the gene of the individual. For example, if a person reads a book on birds, the knowledge he earns by reading the book does not make any change in the gene, hence, this knowledge will not get automatically transmitted to the next generation. Such a trait is called an acquired trait.

25. Explain the terms: (i) Speciation (ii) Natural selection

Ans. (i) Speciation is the evolution of reproductive isolation among once-interbreeding populations, i.e. the development of one or more species from an existing species.

(ii) Natural selection is the process, according to Darwin, which brings about the evolution of new species of animals and plants