

# 9

## Heredity and Evolution

### In the Chapter

- Variations arising during the process of reproduction can be inherited.
- Such variations may lead to increased survival of the individuals.
- Sexually reproducing individuals contain two copies of genes for the same trait. If the copies are not identical, then the trait that gets expressed is known as the dominant trait and the other is known as the recessive trait.
- Traits in one individual may be inherited separately, generating new combinations of traits in the offspring of sexual reproduction.
- Sex is determined by different factors in various species. In human beings, the sex of the child depends on whether the paternal chromosome is Y (for boys) or X (for girls).
- Changes in the non-reproductive tissues caused by environmental factors are not inheritable.
- Variations in the species may confer survival advantages or merely contribute to the genetic drift.
- Speciation may occur when variation is combined with geographical isolation.
- Evolutionary relationships are used in the classification of organisms.
- Tracing common ancestors back in time leads us to the idea that at some point of time, non-living material must have given rise to life.
- Complex organs may have evolved because of the survival advantage of even the intermediate stages.
- Evolution can be worked out by the study of not just living species, but also fossils.
- Organs or features may be adapted to new functions during the course of evolution. For instance, feathers are thought to have been initially evolved for warmth and later adapted for flight.
- Evolution cannot be said to 'progress' from 'lower' forms to 'higher' forms. Rather, evolution appears to have given rise to more complex body designs even while the simpler body designs continue to flourish.
- Study of the evolution of human beings shows that all of us belong to a single species that evolved in Africa and spread across the world in stages.

**Intext Exercises****Page No. 143**

1. **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 A is likely to have arisen earlier because traits reduce from one generation to the next generation.

2. **How does the creation of variations in a species promote survival?**

**Ans.** All the variations in the species do not have equal changes of surviving in the environment. The survival of the variations depend on the nature of variations. Different individuals have different chances. Selection of variants by the environmental factors forms the bases for evolutionary process.

**Page No. 147**

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

**Ans.** Mendel took pea plants having different characteristics, like a tall plant and a short plant. He produced progeny from them and calculated the percentages of tall or short progeny. There are no halfway characteristics in the first generation. All plants were tall. This meant that only one of the parental traits was seen, not the other. Here, the trait of tallness is dominant while shortness is the recessive characteristics.

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

**Ans.** Mendel performed an experiment in which he took two different traits, like tall and short plant, and round and wrinkled seeds. In 2nd (F<sub>2</sub>) generation, some plants were tall with round seeds and some were short with wrinkled seeds. There would also be short plants having round seeds. Thus, the tall/short traits and round/wrinkled seed traits are independently inherited.

3. **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?**

**Ans.** Yes, this information is enough to tell that trait A is dominant. It is because only dominant traits are expressed from one generation to next generation.

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

**Ans.** There are 23 pairs of chromosomes in the cell of human body. Out of these, 22 pairs do not take part in sex-determination in human beings. The 23rd pair in gonadal cell called sex chromosome is not always a perfect pair. Women have a perfect pair having XX-chromosomes. But men have a pair having XY-chromosomes. This cell is divided meiotically in both men and women to form gametes. All children will inherit an X-chromosome from mother and an X- and Y- chromosomes from their father. Thus, the sex of children is determined by the chromosomes they inherit from their father. A child inheriting X-chromosome from father will be a girl and one inheriting Y-chromosome from him will be a boy.

**Page No. 150**

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

**Ans.** There are following ways in which individuals with a particular trait may increase in a population :

- (i) By natural selection,
- (ii) By inheritance.

**2. Why are traits acquired during the life-time of an individual not inherited?**

**Ans.** The germ cells of sexually reproducing populations are made in specialised reproductive tissue. The acquired traits cannot change the DNA of the germ cells. Therefore, the acquired traits cannot be inherited over generations during the lifetime of an individual.

**3. Why are the small numbers of surviving tigers a cause of worry from the point of view of genetics?**

**Ans.** Genetics is the science of heredity and variations. It explains how the traits are inherited from generation to generation. The small numbers of surviving tigers is the cause of worry from the point of view of genetics because the diversity and the traits are reduced gradually. This fact wants explanation and genetics should answers.

**Page No. 151**

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

**Ans.** Following factors could lead to the rise of a new species :

- (i) Natural selection.
- (ii) Processes of genetic drift.
- (iii) Mutation (sudden change in genetic make-up)
- (iv) Environmental factors.
- (v) Local factors.
- (vi) The differences or variations from one generation to the next.

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

**Ans.** No, geographical isolation will not be a major factor in the speciation of a self-pollinating plant species. It is due to the fact that new genes do not enter in the population, so new species is not produced or formed.

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

**Ans.** Yes, geographical isolation is a major factor in the speciation of an organism. It is due to the fact that migrant organism will reproduce with the local population. This will result in the genes of migrant organism entering a new population. This kind of gene flow is bound to happen between populations that are partly but not completely separated.

**Page No. 156**

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

**Ans.** Forelimbs of human and birds show the closeness between these species. The basic structure of the limbs is similar, though it has been modified to perform different functions.

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

**Ans.** The wing of a butterfly and the wing of a bat cannot be considered homologous because they have a common use for flying but their origins and structure are not common. Rather, they are analogous organs.

**3. 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 two species. They tell us that one species evolves from the other species.

**Page No. 158**

**1. 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?**

**Ans.** The human beings are different from each other in terms of size, colour and looks but they are said to belong to the same species. It is due to their fundamental characteristics. The fundamental characteristics of one species are more closer among these organisms than the other organisms of other species. All human have same fundamental characteristics. So they belong to the same species.

**2. In evolutionary terms, can we say which among bacteria, spiders, fish and chimpanzees have a 'better' body design? Why or why not?**

**Ans.** Chimpanzees have a better body design because they have a well-developed body system, well developed brain, and the thumb opposite to the finger to catch very small and minute things.

### Exercise

**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) TtWW                      (d) TtWw

**Ans.** (c) 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.** (d) all of the above.

**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) a Chinese school-boy.

**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.** We can say that light eye colour trait is dominant because only dominant traits are transferred from the parents to the children in the first generation.

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

**Ans.** Evolution and classification are interlinked with each other. Classification is the most important term to explain evolution. Classification is based on the similarities and differences between two species or among two organisms. More closer the characteristics



are, the more closer is the evolution and more chances are to remain in the same group of classification. We can appreciate that classification of species is in fact a reflection of their evolutionary relationship.

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

**Ans. Analogous organs :** The organs having the same functions but different in structure, origin and components are called analogous organs. For example, the wings of a bat and the wings of an insect are analogous organs.

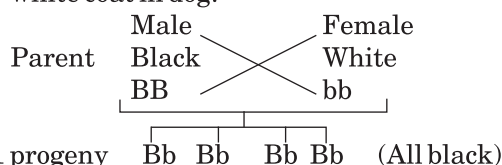
**Homologous organs:** The organs having the same structure, origin and components but different functions are called homologous organs.

For example, the forearms of a horse and the hands of a human.

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

**Ans.** Select a homozygous black (BB) male dog and a homozygous white (bb) female dog. Allow them to make and produce offspring (F1 generation).

If all of the F1 offspring are black, we can conclude that black coat colour is dominant than white coat in dog.



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

**Ans.** Fossils are the remains of dead plants or animals which died million of years ago. The study of fossils helps us to know about the evolution or the link between two species. Fossils tell us how new species are developed from the old. So fossils have an importance in deciding evolutionary relationship.

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

**Ans.** An experiment conducted by Stanley L. Miller and Harold C Urey in 1953 provided that origin of life takes place from inanimate matter. They assembled the atmosphere containing  $\text{NH}_3$ ,  $\text{CH}_4$  and  $\text{H}_2\text{S}$  but no  $\text{O}_2$  over water. This was maintained at a temperature just below  $100^\circ\text{C}$  and sparks were passed through the mixture of gases. At the end of a week 15% carbon from methane has 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.** Sexual reproduction gives rise to more viable variations than asexual. It is because the genes of the traits are transmitted from one generation to the next generation and dominant characters are expressed. While in asexual reproduction, gene cannot be separated from the parental organisms. So no more variations occur.

This cause of variation affects the evolution of those organisms that reproduce sexually. By this process, more and more variations are produced in the next generations. In this way, the genetic drift will accumulate, which causes the formation of new species.

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

**Ans.** There are 23 pairs of chromosomes. Most human chromosomes have maternal and a paternal copy. We have 22 such pairs. These pairs contain half chromosomes from mother and half from father. One pair is called sex chromosomes. At the time of sex determination, the egg cells fuse with the 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.** We agree with this statement that only variations that confer an advantage will survive in a population.

All the variations do not have an equal chance of surviving in the environment in which they find themselves. The chances of surviving depend on the nature of variations. Different individuals would have different kinds of advantages. A bacteria that can withstand heat will survive better in a heat wave. Selection of variants by environmental factors forms the basis for evolutionary processes.

### Additional Questions

**1. Do genetic combination of mothers play a significant role in determining the sex of new born child ?**

**Ans.** No. Mothers have no role in determining the sex of the new born child. Mothers are homogametic, that is, they produce only one type of ova ( $22 + X$ ). Fathers are heterogametic, that is they produce two types of germs, gymnosperm ( $22 + X$ ) and androsperms ( $22 + Y$ ). If gymnosperm ( $22 + X$ ) fertilises the ovum ( $22 + X$ ), the sex of new born child will be female ( $44 + XX$ ). If androsperm ( $22 + Y$ ) fuses with ovum ( $22 + X$ ), the new born child will be boy ( $44 + XY$ ).

**2. (i) What is 'genetic' ?**

**(ii) Give the common name of the plant on which Mendel performed his experiments.**

**(iii) What did Mendel use the term factors and what are these factors called now?**

**(iv) What are genes ? Where are the genes located ?**

**Ans.** (i) Genetics : It is the branch of biology which deals with the study of heredity and variation.

(ii) Garden pea plant.

(iii) Mendel used the term factor for the trait of a character of the pea plant.

These factors are now called genes.

(iv) Genes are the segments of DNA molecule. The genes are located on the chromosomes.

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

**Ans.** Reproductive processes in a species give rise to new individuals that are similar in basic body design but subtly different. These subtle differences are called variation.

Some of the variants may survive in changed environment thus variation helps in continuing race of a species.

**4. Mention the information source of making proteins in the cell. What is the basic event in reproduction ?**

**Ans.** DNA is the basic source of making proteins in the cells.

The basic event in reproduction is the creation of a DNA copy. Cells use chemical reactions to build copies of their DNA in a reproducing cell, and they will need to be separated from each other. DNA copying occurs accompanied by the creation of an additional cellular apparatus. The DNA copied then separate, each having its own cellular apparatus for maintaining life processes.

**5. 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 ?**

**Ans.** This information is not enough to tell us which of the trail A or O blood group is dominant. The blood group is determined by a pair of gene. In this case the child inherited gene coding for O group from mother as well as father. The father is having AO genotype and mother OO genotype.

**6. What are fossils ? What do they tell about the process of evolution ?**

**Ans.** The remains of dead plants and animals which were buried under the rocks million of years ago are called 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 two species. They tell us that one species evolves from the other species.

**7. “Only variations that confer an advantage to an individual organism will survive in a population,” Comment on the statement.**

**Ans.** Depending on the nature of variations different individuals would have different kinds of advantages. In a population of bacteria that can withstand heat will survive better in a heat wave condition while those which do not have such variation will be eliminated. Hence, it is true that “Only variations that confer an advantage to an individual organism will survive in a population.”

**8. A woman has only daughters. Analyse the situation genetically and give an explanation.**

**Ans.** A woman produces only one type of ova ( $22 + X$ ) while her husband produces two types of sperms, gymnosperms ( $22 + X$ ) and androsperms ( $22 + y$ ) in equal proportion. It is a chance that each time the woman conceived, only the gymnosperm fertilised the egg so that only daughters were born.

**9. Does the occurrence of diversity of animals on earth suggest their diverse ancestry also ? Discuss this point in the light of evolution.**

**Ans.** Diversity of animals does not mean that they have diverse ancestry. Animals can be grouped into distinct line ages (e.g., mammals, birds, reptiles, annelids). Many of the line ages further show some similarities in basic traits indicating a common ancestry e.g., vertebrates. Therefore, animals having a common ancestor in the remote past have successively developed newer and newer traits forming various groups of animals.

**10. Name two homologous structures in vertebrates. Why are they so called ? How do such organs helps in understanding an evolutionary relationship?**

**Ans.** Limbs of birds/reptiles.

Limbs of reptiles/amphibians.

The organs having similar structure to perform different functions in various vertebrates. The homologous characteristics indicate common ancestry.

**11. Write the full form of DNA. Name the part of the cell where it is located. Explain its role in the process of reproduction of the cell.**

**Ans.** DNA = Deoxyribo Nucleic Acid. It is located inside the nucleus on the chromosomes as genes. Basic event in reproduction is the creation of a DNA copy. Cells use chemical reactions to build copies of their DNA. This creates two copies of the DNA in the reproducing cell. DNA copying is accompanied by the creation of an additional cellular apparatus and then the DNA copies separate with its own cellular apparatus. This way a cell divides to give rise to two cells.

**12. Does geographical isolation of individuals of a species lead to formation of new species ? Provide a suitable explanation.**

**Ans.** Yes, geographical isolation gradually leads to genetic drift. This may impose limitations to sexual reproduction of the separated population. Slowly the separated individuals will reproduce among themselves and generate new variations. Continuous accumulations of

those variations through a few generations may ultimately lead to the formation of new species.

**13. What would happen to beetle population if the bushes on which it lives start suffering from a plant disease ?**

**Ans.** The beetle will be formly nourished if the bushes on which beetles live start suffering from a plant disease because the amount of leaf material for the beetles is reduced.

The average weight of adult beetles decreases from what it used to be when leaves were plentiful. After a few years and a few beetle generations of such scarcity, the plants disease is eliminated. There is a lot of leaf food. At this time, the weight of beetles will again increase.

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

**Ans. Fossils :** The remains (or impression) of dead animals or plants that lived in the remote past are known as 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 link between two species. They tell us about one species that evolves from the other species.

**15. Give an example of body characteristics used to determine how close two species are in terms of evolution and explain it.**

**Ans.** Analysis of the organ structure in fossils allows us to make estimates of how far evolutionary relationship go, e.g. presence of feathers in some fossil dinosaurs indicted the birds are closely related to reptiles.

Another example is by comparing DNA of different species.

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

**Ans. Homologous organs :** The organs which have the different functions and are of similar structure and origin are called homologous organs.

No, though the function of wing in both the case is same but their structural place and origin are different.

**17. Explain Mendel's view of a dominant trait. Give an example.**

**Ans.** Mendel took pea plants with contrasting characteristics—talls plant and dwarf (short) plant. On cross pollination, he got all tall plants in  $F_1$  generation. Then by self pollination of  $F_1$  tall plants, he produced second generation ( $F_2$ ) consisting of tall and short plants in the ratio of 3 : 1. The he concluded that 'T' (tall Trait) is dominant.

**18. What is meant by “acquired traits”? How do Mendel's experiments show that traits may be dominant or recessive ?**

**Ans.** A trait of an organism which is not inherited but develops in response to the environment is called an acquired trait.

Mendel took pea plants with contrasting characteristics-talls plant and dwarf plant. On cross pollination, he got all tall plants in  $F_1$  generation. Then by self pollination of  $F_1$  tall plants, he produced second generation ( $F_2$ ) consisting of tall and short plants in the ratio of 3 : 1. He then concluded that 'T' (tall Trait) is dominant while 't' trait for shortness is recessive.

**19. Give one or two words for the following :**

(a) Process of gradual change from simple to complex.

(b) Sudden inheritable change.

(c) The resemblance of colour of animal with environmental surroundings.

**Ans.** (a) Evolution (b) Mutation (c) Camouflage.

**20. What is individual's role in the evolutionary process ?**



**Ans.** To pass on its genetic variations to its offspring and thereby to contribute its specific genes to the gene pool of the population.

**21. What is the source of variation in monoparental (asexual) reproduction?**

**Ans.** The chromosomal aberrations and gene mutations are the only source of genetic variation in monoparental reproduction.

**22. Explain the statement "natural selection really means differential reproduction."**

**Ans.** Some members of a population have traits (genes) which enable them to grow up and reproduce at a higher rate and leave more surviving offspring in the next generation than others.

**23. What is genetic drift ? Define speciation.**

**Ans. Genetic drift.** Random changes in the allelic frequency by chance are called genetic drift.

**Speciation.** Formation of one or more new species from existing one.

**24. The human hand, cat paw and the horse foot, when studied in detail show the same structure of bones and point towards a common origin.**

**(i) What do you conclude from this?**

**(ii) What is the term given to such structures?**

**Ans.** (i) They have basic structure and indicate relationship.

(ii) Homologous organs.

**25. What is meant by heredity?**

**Ans.** Heredity. It is defined as the transmission of characters from parents to offspring from one generation to the successive generations of living beings.

We observe in our daily life that similarities tend to be greatest between members of a family, between the offsprings of parents. Children tend to resemble parents, even grandparents and persons of earlier generations. The similarities are not due to coincidence but rather due to inheritance or heredity.

**26. What is genetics ?**

**Ans.** Genetics. It is that branch of science which deals with study of heredity (inheritance of characters) and variations. It deals with inborn characteristics of the organisms. Genetics also deals with inborn differences between offsprings of family and related organisms.

**Genes** are carriers of characters and present on chromosomes. Mendel is considered as "Father of genetics."

**27. What is microevolution ?**

**Ans.** A change in relative abundance of a gene (controlling a trait) within a population over a succession of generations is termed microevolution.

**28. Define macroevolution.**

**Ans.** Macroevolution involves large scale changes among group of species.

**29. What do you understand by origin of life ? Explain.**

**Ans. Origin of Life**

The oldest surviving terrestrial rocks, about 4.3 billion years old, contain no definite trace of life, at least not recognisable as yet. Some rocks, about 3.9 billion years old, contain carbonates. Geologists interpret that these carbonates have resulted from life processes. Therefore, life was present on Earth about 3.9 billion years ago. However, the oldest microfossils discovered so far that of photosynthetic cyanobacteria.

**30. Write the contribution of Urey and Miller.**

**Ans.** Urey and Miller conducted experiment which supported that life originated by chemosynthesis. The chemosynthetic theory (Oparin-Haldane) states that life originated from non-living matter is based on the presence of methane and ammonia in the atmosphere. It required a high temperature, high energy radiations and electric discharges.



**31. How does taxonomy support the evolution ?**

**Ans.** The organisms which have similar characteristics are placed in a specific group. The characters taken for a definite group must be present either in the embryonic stages or in the adult stage. Fish, frog, lizard, bird and man are grouped together as vertebrates because all of them possess vertebral column.

Similarly, animal kingdom is divided into phyla, classes, orders, families, genera and species on the basis of similar character. Moreover, classifications are based on phylogeny.

**32. What are homologous organs? Give examples.**

**Ans. Homologous organs.** The organs of different classes have different forms because they have to perform different functions but their structures basically remains similar. Such organs are called homologous organs.

**Examples of homologous organs.** 1. The wings of bird and bat, flipper (fin) of whale, structure of human forearm are different in forms because these have to perform different functions. Studies of the bones forming the skeleton of these organs, would reveal similarity in construction. In fact, these are the forms of fore-arms which have originated from pentadactyl forms and due to the difference functions they are performing hence transformed into different forms.

2. In plants, the homologous organs may be a thorn of Bougainvillea or a tendril of cucurbita, both arising in axillary position.

### Multiple Choice Questions

**1. Exchange of genetic material takes place in**

- (a) vegetative reproduction
- (b) asexual reproduction
- (c) sexual reproduction
- (d) budding

**Ans.** (c) sexual reproduction

**2. Two pink coloured flowers on crossing resulted in 1 red, 2 pink and 1 white flower progeny. The nature of the cross will be**

- (a) double fertilisation
- (b) self pollination
- (c) cross fertilisation
- (d) no fertilisation

**Ans.** (b) self pollination

**3. Which of the following statement is incorrect ?**

- (a) For every hormone there is a gene.
- (b) For every protein there is gene.
- (c) For production of every enzyme there is a gene.
- (d) For every molecule of fat there is a gene.

**Ans.** (d) For every molecule of fat there is a gene.

**4. If a round, green seeded pea plant (RR yy) is crossed with wrinkled, yellow seeded pea plant, (rr YY) the seed produced in F<sub>2</sub> generation are**

- (a) round and yellow
- (b) round and green
- (c) wrinkled and green
- (d) wrinkled and yellow

**Ans.** (a) round and yellow

**5. In human males all the chromosomes are paired perfectly except one. These unpaired chromosomes is/are**

- (i) large chromosomes
- (ii) small chromosomes
- (iii) Y-chromosome
- (iv) X-chromosome
- (a) (i) and (ii)                      (b) (iii) only
- (c) (iii) and (iv)                    (d) (ii) and (iv)

**Ans.** (c) (iii) and (iv)

**6. The maleness of a child is determined by**

- (a) the X chromosome in the zygote
- (b) the Y chromosome in zygote
- (c) the cytoplasm of germ cell which determines the sex
- (d) sex is determined by chance

**Ans.** (b) the Y chromosome in zygote

**7. A zygote which has an X-chromosome inherited from the father will develop into a**

- (a) boy                                      (b) girl
- (c) X-chromosome does not determine the sex of a child
- (d) either boy or girl

**Ans.** (b) girl

**8. Select the incorrect statement.**

- (a) Frequency of certain genes in a population change over several generations resulting in evolution.
- (b) Reduction in weight of the organism due to starvation is genetically controlled.
- (c) Low weight parents can have heavy weight progeny.
- (d) Traits which are not inherited over generations do not cause evolution.

**Ans.** (b) Reduction in weight of the organism due to starvation is genetically controlled.

**9. New species may be formed if**

- (i) DNA undergoes significant changes in germ cells
- (ii) chromosome number changes in the gamete
- (iii) there is no change in the genetic material
- (iv) mating does take place
- (a) (i) and (ii)                      (b) (i) and (iii)
- (c) (ii), (iii) and (iv)            (d) (i), (ii) and (iii)

**Ans.** (c) (i) and (ii)

**10. In basket of vegetables contains carrot, potato, radish and tomato, which of them represent the correct homologous structures ?**

- (a) Carrot and potato
- (b) Carrot and tomato
- (c) Radish and carrot
- (d) Radish and potato

**Ans.** (c) Radish and carrot

**11. Select the correct statement.**

- (a) Tendril of a pea plant and phylloclade of Opuntia are homologous.
- (b) Tendril of a pea plant and phylloclade of Opuntia are analogous.
- (c) Wings of birds and limbs of lizards are analogous.
- (d) Wings of birds and wings of bats are homologous.

**Ans.** (a) Tendril of a pea plant and phylloclade of Opuntia are homologous.

**12. Which of the following statement is not true with respect to variation ?**

- (a) All variations in a species have equal chance of survival.

- (b) Change in genetic composition results in variation.
- (c) Selection of variants by environmental factors forms the basis of evolutionary processes.
- (d) Variation is minimum in asexual reproduction.

**Ans.** (a) All variations in a species have equal chance of survival

**13. A trait in an organism is influenced by**

- (a) paternal DNA only
- (b) maternal DNA only
- (c) both maternal and paternal DNA
- (d) neither by paternal nor by maternal DNA

**Ans.** (c) both maternal and paternal DNA

**14. Select the group which shares maximum number of common characters.**

- (a) two individuals of a species
- (b) two species of a genus
- (c) two genera of a family
- (d) two genera of two families

**Ans.** (a) two individuals of a species

**15. The two versions of a trait (character) which are brought in by the male and female gametes are situated on**

- (a) copies of the same chromosome
- (b) two different chromosomes
- (c) sex chromosomes
- (d) any chromosome

**Ans.** (a) copies of the same chromosome

**16. The number of pair(s) of sex chromosomes in the zygote of humans is**

- (a) one
- (b) two
- (c) three
- (d) four

**Ans.** (a) one

**17. The theory of evolution of species by natural selection was given by**

- (a) Mendel
- (b) Darwin
- (c) Morgan
- (d) Lamarck

**Ans.** Darwin

**18. Some dinosaur had feathers although they could not fly but birds have feathers that help them to fly. In the context of evolution this means that**

- (a) reptiles have evolved from birds
- (b) there is no evolutionary connection between reptiles and birds
- (c) feathers are homologous structures in both the organisms
- (d) birds have evolved from reptiles

**Ans.** (d) birds have evolved from reptiles