

1. What is heredity?

Transmission of characteristics from parents to progeny is called heredity.

2. What are variations?

Variations are differences among the members of the same species.

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

Some of the variations may be helpful to the organisms in the prevailing natural conditions. Organisms with such positive variations would survive. Over the period variations keep appearing in a species. The favorable variations are chosen by natural selection to survive.

4. What is genetics? Who is the father of genetics?

The branch of science which deals with the study of heredity is called genetics.

Gregor Johann Mendel (1822-1884) is known as the father of genetics.

5. Name the plant chosen by Mendel for his experiment to study the inheritance of traits.

Garden Pea (*Pisum sativum*)

6. What term is now used for Mendel's factors?

Genes

7. Define F1 and F2 generations.

F1 or first filial generation is the generation of hybrids, derived from a cross between genetically different individuals.

F2 is the second filial generation produced as a result of the self fertilization between the individuals of the F1 generation.

8. Why did Mendel choose garden pea for his experiment?

a) Garden pea has several pairs of contrasting characteristics.

E.g. Tall-dwarf, red flower-white flower, round seed-wrinkled seed, green seed-yellow seed etc.

b) A large number of progeny can be produced in a short duration.

c) Garden peas are normally self pollinated, but they can be cross pollinated (hybridized) also.

9. Which are the two types of variants of ear lobes found in humans?

a) Free ear lobe

b) Attached ear lobe

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

The trait expressing itself in the hybrid is the dominant one.

E.g. When a tall pea plant is crossed with a short (dwarf) pea plant, all the F1 hybrids are tall. (i.e., in this case, the gene causing tallness is dominant while the gene causing dwarfness is recessive.)

(Mendel's first law of inheritance states that when a pair of contrasting factors is brought in a hybrid, one factor masks or inhibits the appearance of the other. The one which inhibits is the dominant one and which is inhibited is recessive.)

11. A man with blood group A marries 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, why not?

This information is not sufficient to tell which of the traits is dominant because

a. If A is dominant to O,

For an A group father and an O group mother, the daughter can be OO and have blood group O.

AO x OO

(b) If O is dominant over A, O group daughter can be born

Man (AA) x Woman (OO)

Man (AA) x Woman (OA)

In both cases O group daughter can be born. So this information is not enough. (Actually blood group A gene is dominant and blood group O gene is recessive.)

12. What is evolution?

Evolution can be defined as the gradual unfolding of organisms from pre-existing organisms through changes since the beginning of life.

13. What is speciation?

The process of formation of a new species as a breeding group from original species is called speciation.

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

a) Individuals with a particular variation may be selected because it provided a survival advantage and therefore was naturally selected. That particular trait may thus increase in the population.

b) It can also happen in small population due to accidents. Maybe organisms with a particular variant only accidentally survived. This gene's frequency in that population then increases though it gives no survival advantage.

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

Only changes occurring in the DNA can be inherited.

16. Why are a small number of surviving tigers, a cause of worry from the point

of view of genetics?

When a population is small, the scope and number of variations is limited, diversity and traits are reduced. This further reduces the chance of survival in the event of a disease or geographical disaster. If they all die out and become extinct, their genes will be lost forever. This is why a small number of surviving tigers is a cause of worry from the point of view of genetics.

17. What factors could lead to the rise of a new species (speciation)?

I. Geographical isolation.

II. Action of environmental factors on the isolated populations.

III. Reproductive isolation for a long time.

IV. Genetic drift and natural selection

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

No. This is because in cross pollinated species, when geographically isolated there will be more accumulation of variations. But in self pollinated species geographical isolation will not be a major factor for speciation because new genes do not enter the population.

19. Will geographical isolation be a major factor in the speciation of an organism that reproduces asexually?

No, in asexually reproducing organisms there is very little variation over generations. Asexual reproduction does not require two organisms to reproduce as variations in the DNA are not enough to raise a new species. Thus geographical isolation is not a major factor.

20. What is genetic drift?

Genetic drift is the sudden random change in the frequency of genes in a small population over successive generations.

21. What are homologous organs?

These are organs which have the same basic structural development and origin but have different functions. Eg. The forelimb of a frog, a lizard, a bird and a human hand.

22. What are analogous organs? Give examples.

These are organs which have different basic structural design and origin but have similar appearance and perform similar functions. Eg. Wings of birds and wings of butterflies

23. Give one example of characteristics being used to determine how close two species are in evolutionary terms.

Structure of forelimbs is an example of a characteristic. In frogs, birds, lizard and

the human hand, the forelimb has similar bones and similar origin but they are modified to suit the function they perform.

24. Can the wing of a butterfly and the wing of a bird be considered homologous? Why or why not?

No, they are not homologous. They perform the same function of flying but the wings of a bird have the support of skeleton, flesh and feathers whereas insects have a fold of membrane with a few associated muscles. Structurally and developmentally they are different. They are thus analogous and not homologous.

25. What are fossils?

Fossils are the preserved remains or impressions of living organisms that lived in the geological past.

26. What do fossils tell us about the process of evolution?

- a) Fossils tell us about the structure of organisms that lived long ago and the time they lived. The fossils of organisms in the upper strata are more complex compared to those in the lower strata. This indicates evolutionary process. Transitional fossils like the fossil bird are known which are intermediary between reptiles and birds. They even help us to know about evolutionary relationship.
- b) They help us to know about extinct species of organisms.
- c) They help us to study the past climatic conditions and its influence on organisms.

27. Why are human beings who look so different from each other in terms of size, color and looks said to belong to the same species?

Genetic makeup of humans may be slightly different in races of people. There is no reproductive isolation. Human beings of any color, size and look can mate and produce fertile progeny.

28. In evolutionary terms can we say which among bacteria, spiders, fish and chimpanzee have better body design? Why or why not?

No, all these organisms which exist now have body design suited to the environment. No one has especially better body design.

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

Classification is based on similarities and differences among organisms. Resemblances are because they have arisen from a common ancestor. When organisms are arranged in the order of complexity of structure it indicates the concept of evolution.

30. A study found that children with light colored eyes are likely to have parents with light colored eyes. On this basis, can we say anything about whether the

light color trait is dominant or recessive? Why or why not?

No, it cannot be concluded whether the light eye color causing gene is dominant or recessive with the above information. If parents are homozygous for light eye color, no matter whether the gene is dominant or recessive the children will be born with light eye color.

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

Genes are segments of DNA. DNA is carried on the chromosome. Chromosomes occur in homologous pairs. A pair of genes responsible for a particular trait is carried to the progeny, one on each homologue. In this way the diploid parent has pairs of genes for each trait. When this parent forms gamete, a special reproduction division (meiosis) takes place in the reproductive cells. This results in each gamete getting one member of each homologous pair of chromosomes.

In other words each gamete (haploid) has half the genetic material. When two such haploid gametes fuse, a diploid zygote with equal genetic contribution from both parents is formed. The zygote then develops into the offspring.

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

Not always. Even if there is no survival advantage, some variations remain in the population due to genetic drift.

33. Explain how sexual reproduction gives rise to more viable variations than asexual reproduction. How does this affect the organisms that reproduce sexually?

Variations are more in sexually reproducing organisms because the sources of variations here are

- I. Errors in DNA copying.
- II. Crossing over resulting in new gene recombinations.
- III. Independent inheritance of traits in the gametes.
- IV. Random fusion of gametes.

Sexual reproduction affects the process of evolution positively because of the chance for a lot of variations.

34. Outline a project which aims to find the dominant coat color in dogs.

For example for black and white color

Mate a black male with white female.

If the F1 young ones are

- I. All black (Black may be dominant).
- II. All white (White may be dominant).
- III. 50% black and 50% white

Take a black male from the above and back cross with white female.

Bb x bb

If there are black and white progeny in 1:1 ratio, black is dominant.

If the black male of the above generation is mated with a black female of the same generation and the progeny are mostly black, only about one fourth white, then black coat is dominant.

35. How is the sex determined in human beings?

Most human chromosomes have a maternal and a paternal copy, and we have 22 such pairs. But one pair, called the sex chromosomes, is odd in always not being a perfect pair. Women have a perfect pair of sex chromosomes, both called X. But men have a mismatched pair in which one is a normal-sized X while the other one is a short one called Y. So women are XX, while men are XY.

	Man	Woman
	XY	XX
Gametes	X Y	X
Zygote	XX	XY
	Girl	Boy

The figure shows, half the children will be boys and half will be girls. All children will inherit an X chromosome from their mother regardless of whether they are boys or girls. Thus, the sex of children will be determined by what they inherit from their father. A child who inherits an X chromosome from her father will be a girl, and one who inherits a Y chromosome from him will be a boy.