

Heredity and Evolution



ANSWERS

Topic 1

- (c) : All progeny bore violet flowers, so they all must have gene for violet flower. As violet colour appears in hybrids thus it must be the dominant character. So, white flowered plant should have ww genes to show recessive white character. It indicates that all progenies got allele W (violet colour) from violet flowered plant, thus its all gametes should have W allele. To serve the purpose, plant must have WW genes. But, tallness was found in 50% progenies thus half of its gametes contained T gene and other half contained t gene. Inclusive, the tall parent plant had $TtWW$ genotype.
- No, from the given statement, we cannot say with certainty whether light eye colour is dominant or recessive. However, since both children and their parents have light eye colour, the possibility is that light eye colour is a recessive trait. Had the light eye colour been a dominant trait, the homozygous light eyed parents would have only light eyed children but heterozygous light eyed parents might had some recessive dark eyed children (3 : 1 ratio).
- Select two varieties of dogs, one with white coat colour and the other with black coat colour.
 - Crossbreed them taking male dog from one variety and bitch (female dog) from the other variety.
 - Observe the colour of offsprings of F_1 generation.
 - Now, bring about breeding among the organisms of F_1 generation.
 - Observe the coat colour of organisms (pups) of F_2 generation and note the variations in coat colour.
 - Draw conclusions on the basis of your study. One of the probable inheritance pattern may be as given below. Phenotypic ratio = 3 : 1, Black coat colour (3) : White coat colour (1) .

- A zygote is formed by the fusion of sperm and ovum. During the formation of gametes as a result of reductional division (meiosis), sperms and eggs receive only half of the genetic material of parent cell and thus become haploid. When fertilisation occurs, zygote is formed, which is diploid ($2n$). In this way, both male and female parents contribute exactly equal amount of genetic material to the offspring.
- It is not always true. The variations that confer an advantage to an individual organism are definitely of more survival value because natural selection prefers these variations. But there are several other variations which though do not provide advantage to the organism in the present condition, survive and are inherited to the next generations. Such non-advantageous variations may become advantageous in future when the environmental conditions change.

Topic 2

- Experimental evidence provided by Miller and Urey in 1953 proves the origin of life from inanimate matter. They designed a glass apparatus. In the apparatus, they circulated a mixture of methane, ammonia, hydrogen in the ratio of 2 : 2 : 1 and water vapour. These gases were believed to be present in the ancient atmosphere. Energy was provided by electric spark in the gas flask. The mixture was maintained at a temperature just below 100°C . The experiment was kept working continuously for one week and then the condensed material was chemically analysed. A large number of organic substances including amino acids (glycine, alanine and aspartic acid), urea, lactic acid, simple sugar, purine, pyrimidine, etc. were found in the condensed mixture which proved the abiotic

synthesis of organic molecules during the process of origin of life.

2. During sexual reproduction, at the time of gamete formation, meiotic division takes place. During meiosis, crossing over between fragments of homologous chromosomes occurs which brings about new gene combinations to be transferred to new generation. Crossing over is the fundamental cause of origin of variations in sexually reproducing organisms. Asexual reproduction does not involve meiosis and crossing over because of one parent lineage. Hence, only minute variations may occur in them due to mutation. The variations caused by crossing over in sexually reproducing organisms are subjected to selection process. Natural selection selects those variations which have more adaptive value and guide them towards evolution of new species. In this way, sexual reproduction gives rise to more viable variations for evolution.

Topic 3

1. **(d)** : Homologous organs have same origin and same basic structure but different functions like each of the above pair of organs.
 2. Modern classification system is based on the phylogenetic resemblances and evolutionary relationships between the species. Systematics deals with the classification of living beings on the basis of evolution. Thus, evolution of organisms gives a hint about their position in classification system and vice-versa. Hence, we can say that evolution and classification are two interlinked areas of study.
 3. Organs with common origin and similar basic structure but different functions are called homologous organs, *e.g.*, fins of whale and legs of horse are structurally similar but perform different functions. On the contrary, organs with similar functions but different origin and base structure are called analogous organs, *e.g.*, wings of birds (made of feathers) and wings of insects (made up of chitin).
 4. Fossils play an important role in deciding evolutionary relationships as follows:
 - (i) The fossils present in the lower strata are simple while the most recent fossils found in the upper strata are highly complex. This geographical succession completely agrees with the concept of evolution.
 - (ii) Some fossils provide a direct connecting link between two groups, *e.g.*, study of fossil bird Archaeopteryx indicates that birds have evolved from reptile-like ancestors.
 - (iii) Fossil records of certain mammals (horse, elephant, camel, man, etc.) if arranged according to geological time scale would present a complete series indicating about their evolution.
 - (iv) Fossils of the dinosaur bodies with feathers which were not used for flying but they were meant for giving warmth to the body, have been found in the rocks. These must have evolved into wings later meant for flying as seen in birds. This shows a close relationship between birds and reptiles.
 5. **(a)** : Chinese school boy is a member of same species that we are of, *i.e.*, *Homo sapiens*.
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