1. Heredity And Evolution

1. Complete the following diagram.
Ans:
Evidence of Evalution
1) Morphological
2) Similarities in bones structure
3) Palaeontological
4) Embryological

2. Read the following statements and justify same in your own words with the help of suitable examples.

a. Human evolution began approximately 7 crore years ago.
Ans: (1) Approximately around 7 crore years back the ice age began on the earth. In such conditions, dinosaurs became extinct. The evolution and diversity of mammals started during this time. Due to change in climate the forest cover also declined rapidly.
(2) Ancestors of monkey-like animals were Lemur like animals which evolved during this time period.
(3) The tails of these monkey-like creatures started vanishing very gradually around 4 crore years ago.
(4) The body and brain both increased in volume forming first ape like animals. The monkey like ancestors gave rise to two evolutionary links to apes and human like animals.
(5) Later, the human evolution took place by changes in the brain volume, the ability to walk upright, excessive use of hand for manipulation.
(6) This journey of human evolution began 7 crore years ago. But the true wise and intelligent man arose around 50,000 years ago.

b. Geographical and reproductive isolation of organisms gradually leads to speciation.
Ans: (1) Every species survives in specific geographical conditions. The requirements of food and habitat is specific for each species. Their reproductive ability and period is also different.
(2) Therefore, the individuals from one species cannot reproduce with individuals from other species.
(3) When they are separated by a distance or geographical barriers they are said to be isolated geographically.
(4) When they cannot reproduce with each other, they are said to be isolated reproductively.
(5) The ancestor species of both these subspecies may be the same but due to isolation over a very
long-time duration, there is genetic variation between the two. Therefore, the isolation leads to speciation.

c. Study of fossils is an important aspect of study of evolution.
Ans : (1) Fossils offer palaeontological evidence for the evolutionary process.
(2) Due to some natural calamities the organisms get buried during ancient times.
(3) The impressions and remnants of such organisms remain preserved underground. The hot

lava also traps some organisms or their impressions.
All such formations form fossils.
(4) Study of fossils help the researcher to understand the characteristics of the organisms that existed in the past.
(5) Carbon dating method also helps in finding out exact age of the fossil. According to the structure of earth's crust the fossils are obtained at specific depths.
(6) The oldest ones are obtained at the depth while the relatively recent ones occupy the upper surface. Thus fossils of invertebrates were seen in very old Palaeozoic era. Later were seen fossils of Pisces, Amphibia and Reptilia. The Mesozoic era was
dominated by reptiles while Coenozoic era showed presence of mammals.
(7) In this way, study of fossils unfold the evolutionary secrets.

d. There is evidences of fatal science among chordates.
Ans: (1) Very young embryos of fish, amphibians, reptiles, birds and mammals show quite similar structure in the early stages.
(2) As the further growth takes place, they acquire different patterns.
(3) The initial similarity between the vertebrate
embryos is an evidence that during evolution, there was a common ancestor for all the vertebrate classes.
(4) This is called embryological evidence for vertebrate evolution.

3. Complete the statements by choosing correct options from bracket.
(Gene, Mutation, Translocation, Transcription, Gradual development, Appendix)
(a) The causality behind the sudden changes was understood due to mutation principle of Hugo de Vries.
(b) The proof for the fact that protein synthesis occurs through gene was given by George Beadle and Edward Tatum.
(c) Transfer of information from molecule of DNA to mRNA is called transcription process.
(d) Evolution means gradual development.
(e) Vestigial organ appendix present in human body is proof of evolution.

4. Write short notes based upon the information known to you.
a. Lamarckism
Ans. (1) Lamarckism consists of two theories which were proposed by Jean Baptiste Lamarck.
These are as follows:
(a) Use and disuse of the organs
(b) Inheritance of acquired characters.
(2) In theory of use and disuse of organs, Lamarck says**:** The characters of organs develop because specific activities that the organisms perform. If such organ is not used it gets degenerated. Thus the morphological changes take place due to activities or inactivity of a particular organism.
(3) To emphasise this theory, he quoted following examples. Due to constant extension of neck to eat foliage from the top of the trees, giraffe's neck became long. Similarly blacksmith has strong arms due to constant work. Flightless ostrich and emu did not fly and hence their wings became useless. Aquatic birds like swan and duck made their feet suitable for

swimming by living in water. Snake lost limbs as it tried burrowing mode.
(4) Such acquired characters are passed from one parental generation to the offspring. This is called inheritance of acquired characters.
(5) The theory of inheritance of acquired characters is not accepted as such transmission of acquired character does not take place. Only genetic characters are transmitted.

b. Darwin's theory of natural selection.
Ans. (1) Charles Darwin proposed the theory of natural selection after making many observations on different specimens. He published a concept 'Survival of the fittest'.
(2) Darwin explains this concept as follows: All the organisms reproduce prolifically. Therefore, there is always a competition for food, mate, etc. Only those organisms survive which show the adaptation for sustaining this struggle.
(3) Natural selection plays important role by selecting only those organisms which are fit to live.
Those that do not have better adaptations, perish. Selected sustaining organisms then perform reproduction and form new species in a very long period of time.
(4) Darwin published his views in the book titled Origin of Species'.

c. Embryology.
Ans. (1) Embryology is the study of developing embryos.
(2) These embryos in their initial stages are very similar to each other.
(3) These similarities decrease later in the development.
(4) This similarity in initial stages indicate that these vertebrates have originated from a common ancestor.
(5) In evolutionary science, comparative study of embryos of various vertebrates provide evidence for evolution.

d. Evolution.
Ans. (1) The sequential changes in the groups of Living organisms that take place very gradually is called evolution.
(2) Evolution is also described as the formation of new species due to natural selection.
(3) The process of evolution takes millions of years for development and speciation of different organisms.
(4) Changes in stars and planets in space and the changes in biosphere occurring on the Earth are all included under study of evolution.
(5) Due to evolution organisms become fit, biodiversity is increased, and new species are created.
(6) Different scientists have put forth theories to explain the process of evolution. Among these Charles Darwin's theory of natural selection and speciation is accepted worldwide.

e. Connecting link.
Ans. Some living organisms possess some characters in them which are the distinctive features of different groups or phyla. Such individuals connect these two groups by sharing the characters of both and hence they are known as connective links.
Examples :
(1) Peripatus : Peripatus is the connecting link between Annelida and Arthropoda. It shows

characters of both animal phyla. Like annelid worm, it shows segmented body, thin cuticle and parapodia. Like an arthropod, it shows open circulatory system and tracheal system for respiration

(2) Duck Billed platypus : This is a connecting link between reptiles and mammals. Like reptiles it lays eggs but like mammals it has mammary glands and hairy skin.

(3) Lung fish : Lung fish is a connecting link between fishes and amphibians. Though a fish, it shows lungs for respiration as in amphibian animals.

(4) Connecting links indicate the direction and hierarchy of evolution.

5. Define heredity. Explain the mechanism of hereditary changes.

Ans. (1) Heredity : Heredity is the process by which the biological characters from parental generation are transmitted to the next generation through genes.

(2) The mechanism of hereditary changes :

(i) Mutation : Sudden change in the parental DNA can cause mutations. This results into changes in the hereditary characters.

(ii) At the time of meiosis, the crossing over takes place. This creates new recombination of the genetic information. Therefore, the haploid gametes produced carry changed hereditary characters.

6. Define vestigial organs. Write names of some vestigial organs in human body and write the names of those animals in whom same organs are functional.

Ans.(1) Vestigial organs are degenerated or underdeveloped organs of organisms which do not perform any function.

(2) According to the principle of natural selection, such organs are on the verge of disappearance. But it takes many millions of years for its complete vanishing.

(3) The vestigial organs in one animal may be of use but to other kind of the animal as they still perform regular functions.

(4) Appendix is vestigial for humans, it does not perform any function but in ruminant animals it is concerned with digestion.

(5) Ear muscles are vestigial for us but in monkeys and cattle they are functional.

7. Answer the following questions.

a. How are the hereditary changes responsible for evolution?

Ans. Hereditary characters are transmitted from parental generation to the offspring. These characters are maintained through inheritance. But the genes which are beneficial for the organisms in helping them to adapt to the environment are transmitted to the next generations in a greater proportion. This happens due to natural selection,

The process of evolution happens at a very slow pace.

The favourable genes are preserved in the species as they bring about better survival of the individuals.

Such individual reproduces more efficiently and evolve. The individuals with unfavourable genes are not selected by nature and are thus removed from the population through natural death. The fuel for evolution is thus truly supplied by the hereditary changes.

b. Explain the process of formation of complex proteins.

Ans. The proteins are synthesised, in following steps, viz. transcription, translation and

translocation. Protein synthesis takes place according to the sequence of nucleotides present on the DNA molecule with the help of RNA molecules.
This is known as central dogma of protein synthesis.
(1) Transcription : In The process of transcription, mRNA is produced as per the nucleotide sequence on the DNA. For this the two strands DNA are separated.
Only one strand participates in the formation of mRNA. The sequence of nucleotides which is complementary to that of present on DNA is copied on mRNA. Instead of thymine present in DNA, uracil is added on the mRNA. Transcription takes place in nucleus but the mRNA leaves nucleus, carries the genetic code and enters the cytoplasm. This genetic code is always in triplet form and hence is known as triplet codon. The code for each amino acid always consists of three nucleotides.
(2) Translation : Each mRNA may carry thousands of codons. But each codon is specific for only one amino acid. The tRNA molecule brings the required amino acid as per the code present on mRNA. There is anticodon on each tRNA which is complementary to the codon on mRNA. This process is known as translation.
(3) Translocation : In translation, the ribosome keeps on moving from one end of mRNA molecule to other end by distance of oe triplet codon. While this process is taking place, rRNA, helps in joining the amino acids together by peptide bonds. The peptide chains later come together to form complex protein molecules.

c. Explain the theory of evolution and mention the proof supporting it.
Ans : (1) According to the theory of evolution, first living material was in the form of protoplasm which was formed in ocean.
(2) Gradually, it gave rise to unicellular organisms. Changes took place in these unicellular organisms which made them evolve into larger and more complex organisms.
(3) All evolutionary changes were very slow and gradual taking about 300 crore years to happen.
(4) Different types of organisms were developed as the changes and development that occurred in living organisms was all round and multi-dimensional.
(5) Hence, this overall process of evolution is called organizational and progressive.
(6) Variety of plants and animals developed from the ancestors having different structural and functional organization during the process of evolution.
Proof here means evidences of evolution.
These evidence are as follows :
(i) Morphological evidences
(ii) Anatomical evidences
(iii) Vestigial organs
(iv) Palaeontological evidences
(v) Connecting links
(vi) Embryological evidences.

d. Explain with suitable examples importance of anatomical evidences in evolution.
Ans. (1) There are similarities in the structure and anatomy of different animal groups. E.g. human hand, forelimb of bull, patagium of bat and flipper of whale are all similar in their internal anatomy.
There is similarity in the bones and joints of all these specimens.

(2) External morphology does not show any similarity. Use of each of the organ is also different in different animals. Structurally, they may not be related.
(3) However, the similarities in the anatomy is an evidence that they may have a common ancestor.
(4) In this way, the anatomical evidence throws light on the process of evolution.

e. Define fossil. Explain importance of fossils as proof of evolution.
Ans. (1) Fossils offer palaeontological evidence for the evolutionary process.
(2) Due to some natural calamities the organisms get buried during ancient times.
(3) The impressions and remnants of such organisms remain preserved underground. The hot lava also traps some organisms or their impressions.
All such formations form fossils.
(4) Study of fossils help the researcher to understand the characteristics of the organisms that existed in the past.
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(7) In this way, study of fossils unfold the evolutionary secrets.

f. Write evolutionary history of modern man.
Ans. (1) Ancestors of humans developed from animals which resembled lemur like animals.
(2) Around seven crore years ago, monkey like animals evolved from some of these lemur like animals.
(3) Then after about 4 crore years ago, in Africa the tails of these monkey like creatures very gradually disappeared.
(4) Simultaneously, there was enlargement in their body and brain volume too. The hands also improved and were provided with opposable thumb.
In this way, ape-like animals were evolved.
(5) These ape-like animals independently gave rise to two lines of evolution, one giving rise to apes like gibbon and orangutan in the South and North-East Asia and gorilla and chimpanzee which stayed in Africa around 2.5 crores of years ago.
(6) The other line of evolution gave rise to human like animals around 2 crore years ago.
(7) The climate became dry and this resulted into reduction of forest cover. This made arboreal apes to descend on the land and start terrestrial mode.
(8) Due to this, there were changes in the lumbar bones and vertebral column. The hands were also freed from locomotion and thus they became more manipulative,
(9) Later, journey of hominoid species started from around 2 crores years ago. The first record of human like animal is 'Ramapithecus ape from East Africa.
(10) Ramapithecus from Africa → Australopithecus → Neanderthal man Cro-Magnon are the important steps in human evolution.
(11) Neanderthal man was said to be the first wise man. The increasing growth of brain made man more and more intelligent and thinking animal.

(12) Later, more than biological evolution, it was cultural evolution, when man started agriculture, animal rearing. There was development of civilization, arts and science etc. About 200 years ago there were industrial inventions and thus man now rules the earth.