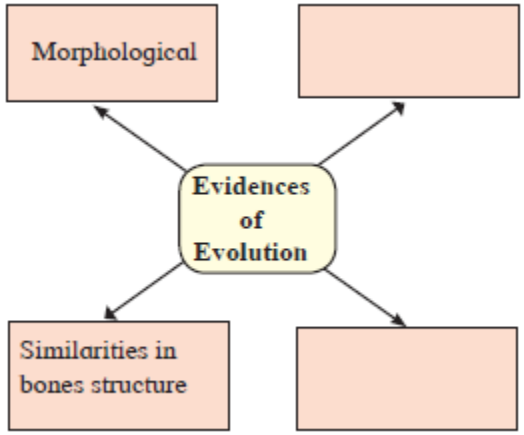
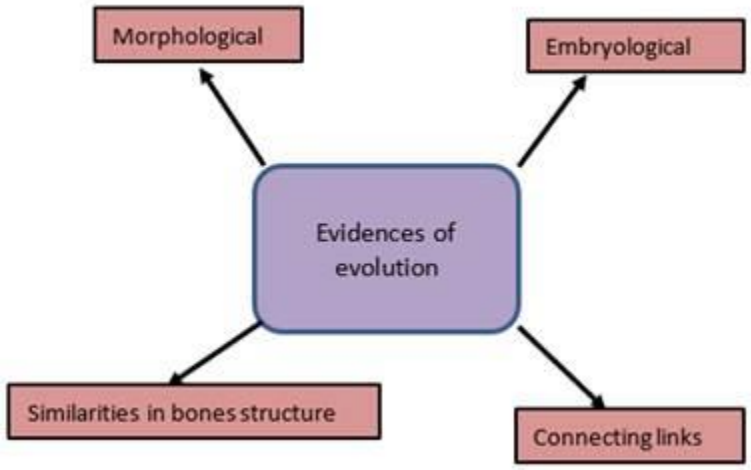
Heredity And Evolution

Exercise

Q. 1. Complete the following diagram



Answer :

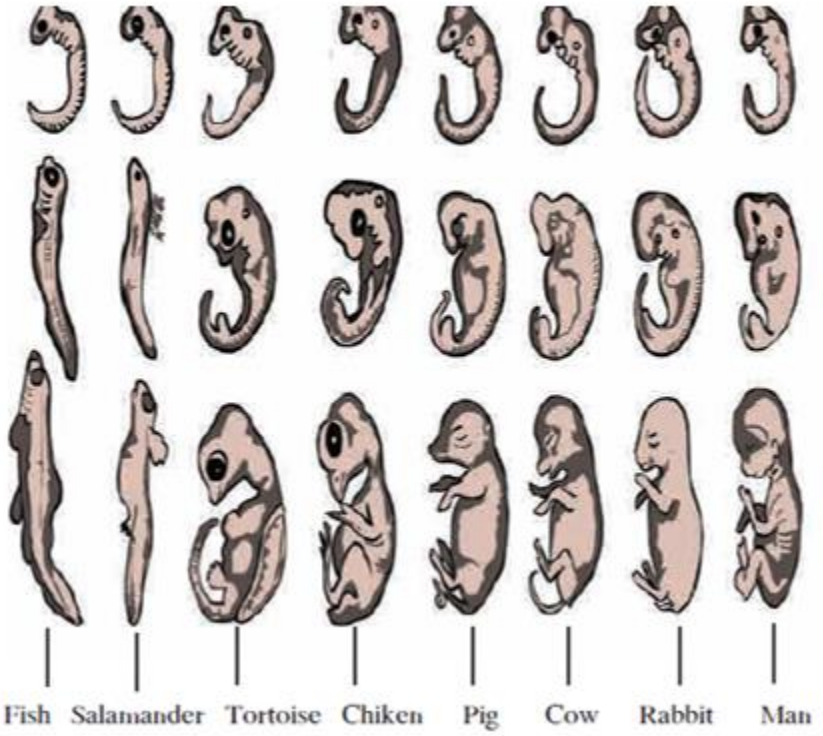


Various evidences have been put forward to support of evolution theories, such as morphological evidence, embryological evidence, and anatomical evidence (similarities in bones) connecting links.

<u>Embryological evidence</u>:

The embryos of different vertebrates (examples are fish, salamander, tortoise chicken, cow human) show similarities in early stages of development and in the later stage of

development similarities decreases. Similarities in initial stages of embryo development shows the common origin of all these animals.



Development of embryos in different vertebrates

<u>Connecting links</u>:

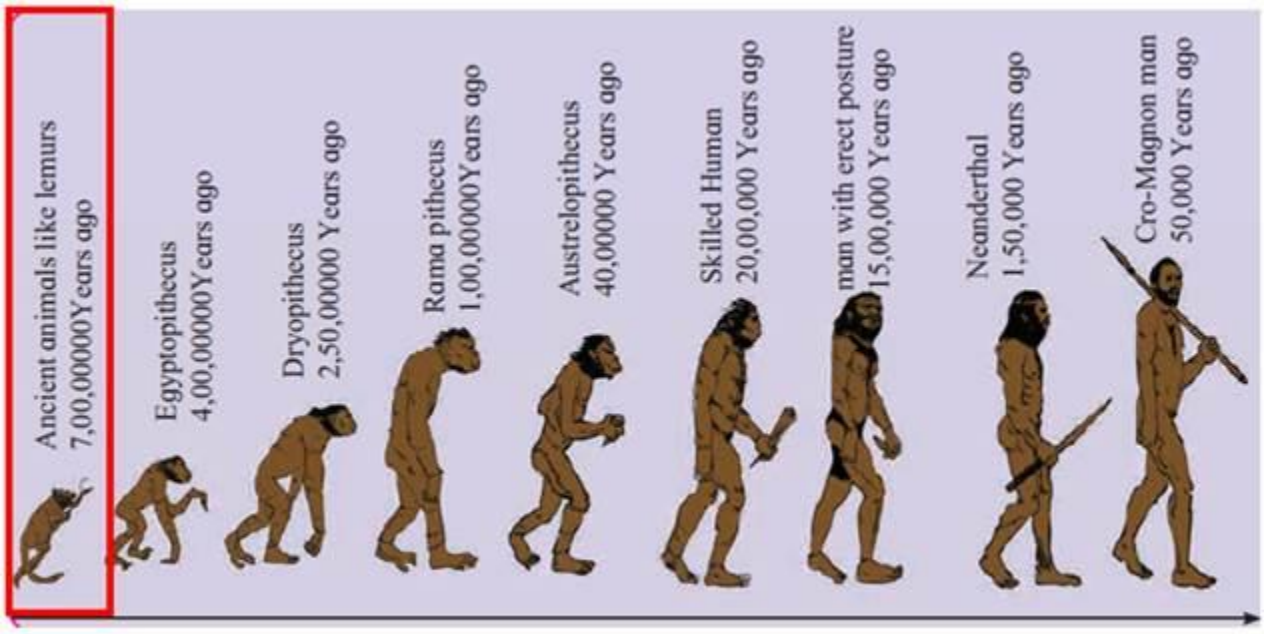
The animals or plants which possess the characteristics of two different groups of animals or plants. These plants or animals are ‘connecting links. For example, an animal duck billed platypus lays eggs like reptiles such as lizards, snakes, but share characters such as presence of mammary glands and hairs with mammals. Therefore, duck billed platypus shows link between reptiles and mammals.

Duck bill platypus

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

Human evolution began approximately 7 crore years ago.

Answer : Approximately 7 crore years ago, the dinosaurs disappeared completely. At that time, monkey-like animals appeared from more or less similar to the modern lemurs. Tail of these monkey-like animals disappeared about 4 crore years ago. Due to enlargement of brain and improvement in their hands, ape-like animals were evolved and then later they evolved into gibbon and orangutan. Therefore, it is evident from the image that human evolution began approximately 7 crore years ago.

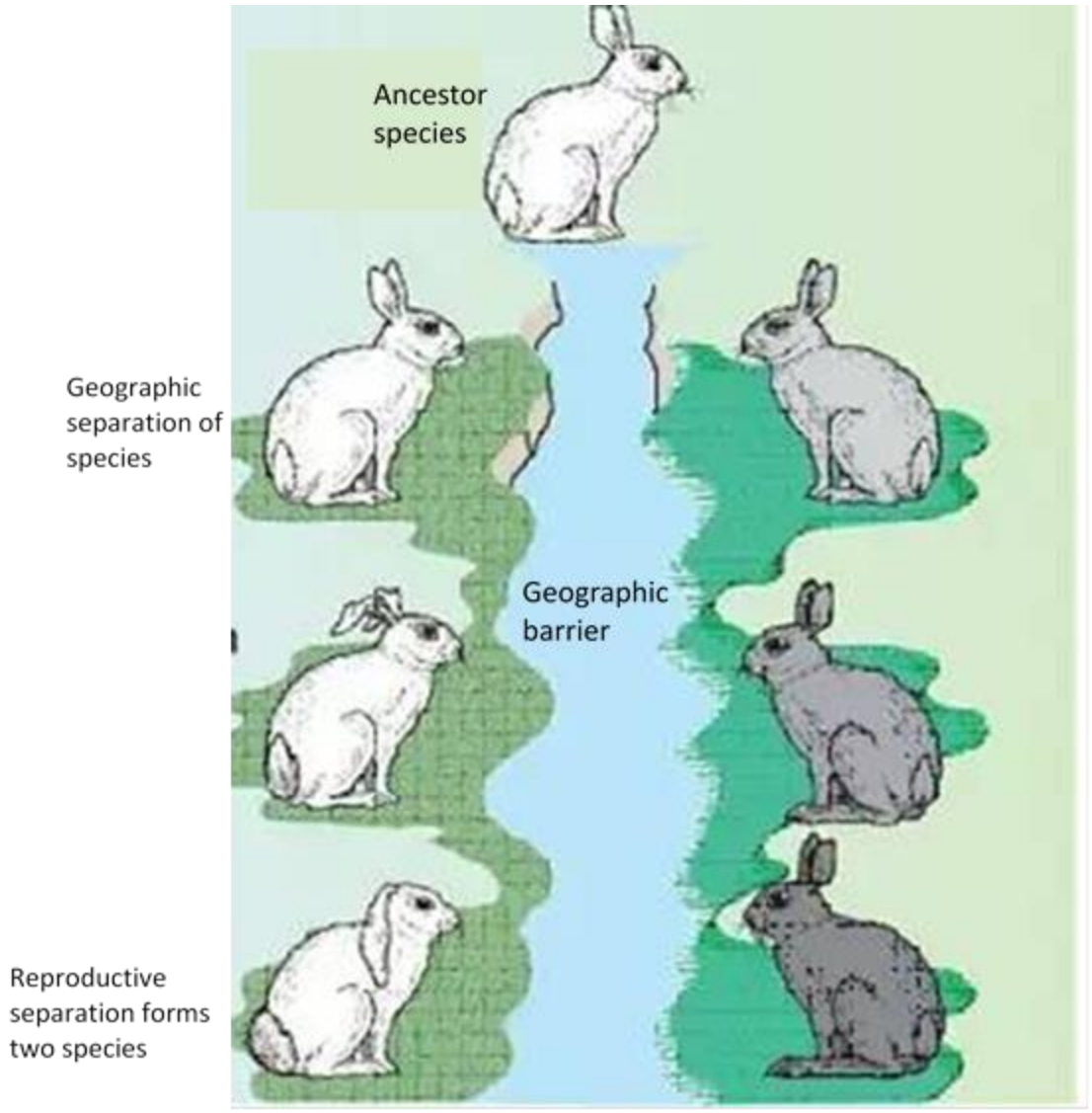


Human evolution

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

Geographical and reproductive isolation of organisms gradually leads to speciation.

Answer : Evolution leads to the formation of new species from an existing one is known as speciation. Species is the group of organisms that can reproduce among themselves and produce fertile offspring. The origin of many species is due to the separation of some individuals of one species by geographic barrier. It prevents the reproduction in separated groups. The separated groups can follow its own evolutionary course and evolved into two species.



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

Study of fossils is an important aspect of study of evolution.

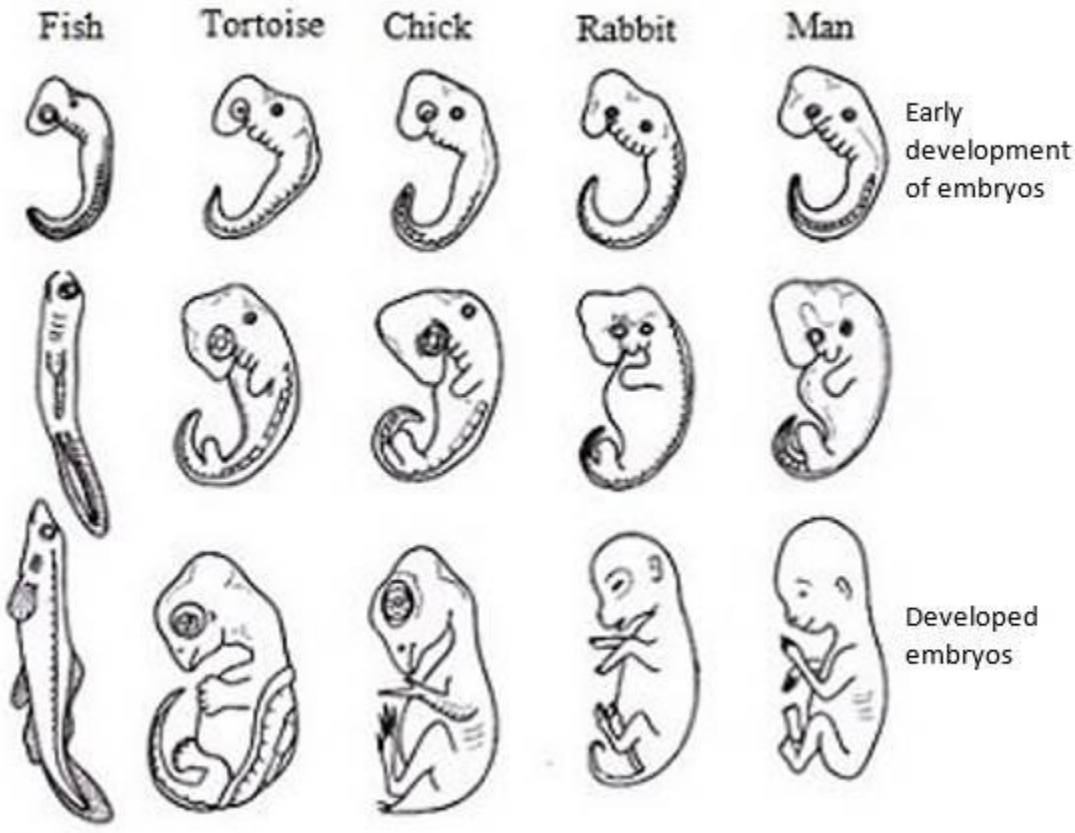
Answer : Large number of plants and animals get buried in the earth due to natural calamity such as earthquake, volcano, and flood. Remains (parts of the body) and impressions of such organisms remain preserved underground are known as **Fossils**. Examples include bones, shells, exoskeletons, stone imprints of animals, etc.

The time of death of a plant or animal can be calculated by measuring the **radioactive carbon(C-14)** in the fossil. By determining the age of the fossil, the information about other organisms can be gathered which helps in study of evolution.

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

There is evidences of fatal science among chordates.

Answer : Von Baer studies the embryo development in different vertebrates. The vertebrates include Fish, Frog, Tortoise, Pigeon, Chimpanzee and Man. The early stages of embryos development of above animals close are similarity with each other. It is difficult to separate them if the embryos were mixed. But the embryos differ in the final stages due to the formation of specialized characters. The similarity of early embryonic development indicate that the above animals have common ancestors.



Q. 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 -- -- principle of Hugo de Vries.
b. The proof for the fact that protein synthesis occurs through -- --- was given by George Beadle and Edward Tatum.
c. Transfer of information from molecule of DNA to mRNA is called as -- -- -- process.
d. Evolution means -- -- -- --.
e. Vestigial organ -- -- -- present in human body is proof of evolution.

Answer : a. The causality behind the sudden changes was understood due to Mutation principle of Hugo de Vries.

Mutation is the sudden and permanent change in the gene or DNA. It causes change in the genetic characters of the individual.

b. The proof for the fact that protein synthesis occurs through translocation was given by George Beadle and Edward Tatum.

Translocation: it is the simultaneous movement of two tRNA molecules together with the mRNA by one codon on the ribosome.

c. Transfer of information from molecule of DNA to mRNA is called as transcription process.

Transcription: it is a process in which mRNA (messenger RNA) is synthesized from a DNA. This process occurs in the nucleus of a cell.

d. Evolution means gradual development.

Evolution is the gradual change from simple to complex over a period of time. Example. Invertebrates evolve to vertebrates.

e. Vestigial organ appendix present in human body is proof of evolution.

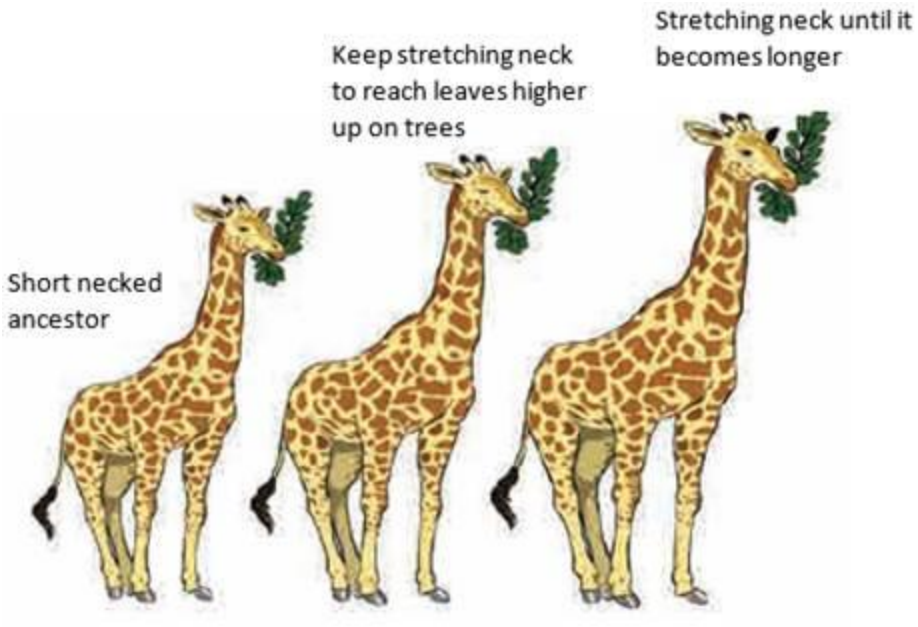
*Vestigial organs: T*hose organs which are of no use in our body but our ancestors had use them. Appendix is most known such organ in the human body.

Q. 4. A. Write short notes based upon the information known to you.

Lamarckism

Answer : Lamarckism is the first theory of evolution which was proposed by Jean Baptiste de Lamarck. It believes that change in environment brings about change in the external characters of the organisms. This happens due use of some organs more and some organ less. The characters which are acquired by the organisms, they pass on to the next generation.

Example explaining Lamarck's theory: The neck of giraffe has become too long due to feeding on leaves of tall plants by extending their neck for several generations.



Giraffe's neck

Q. 4. B. Write short notes based upon the information known to you.

Darwin's theory of natural selection.

Answer : Darwin's theory of natural selection states that all the organisms have great capacity to reproduce. As a result population of organisms increases at high rate. All the organisms compete with each other for food and space. In this competition, only those organisms survive which modified according to the environmental conditions. The nature selects only those organisms which are fit to live and the remaining disappears. The selected organisms live and perform reproduction. They give rise to the new species with their own specific characters.

Q. 4. C. Write short notes based upon the information known to you.

Embryology.

Answer : Embryology is the study of the formation and development of an embryo and fetus. All multicellular organisms start their life form one cell structure called zygote. Zygote undergoes repeated mitosis changed into morula. It changed into blastula and then to gastrula. Gastrula develops into mature fetus.

Zygote -------> Morula ------> Blastula ------> gastrula -------> fetus

Q. 4. D. Write short notes based upon the information known to you.

Evolution.

Answer : Evolution is the gradual change taking place all the in living organisms over a very long period of time. The gradual change is a very slow-going process. The changes in specific characters of living organisms for several generations form new species. The nature selects the new species. Besides, the changes occur in stars and planets in space and in biosphere on earth is also taken into the account for evolution.

Q. 4. E. Write short notes based upon the information known to you.

Connecting link.

Answer : The animals or plants which possess the characteristics of two different groups of animals or plants. These plants or animals are 'connecting links'. For example, lung fish. Lung fish resembles the fish in having paired fins, gills and scales on its body, but it respires through lungs like amphibians. Thus, lung fish acts as a connecting link between fish and amphibians.

Lung fish

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

Answer : Heredity is the transfer of genetic characters or traits from parents to their offsprings.

The traits that are transferred to the progeny are known as **inherited traits.**
Example eye colour, ear lobe structure, blood group.

Heredity includes not only physical but also physiological qualities. These qualities may be either expressed (if the trait is dominant) or they may be latent in the offspring (if the trait is recessive).

The mechanism of heredity involves:

- **Mating:** Fusion of the male germ cell spermatozoa with the female ovum (transfer of gametes and their fusion)
- **Growth:** Repeated mitotic division of the zygote (fertilised egg).
- **Chromosomes:** Both the male and female gametes contain nucleus which further contains the chromosomes. Both of them have 24 chromosomes each. (Therefore, called haploid cells)
- **Gene:** Chromosomes further contain smaller structures that are called genes. Now these genes are the structures that get passed on. Different genes are responsible for

different characters. For example, there are genes that determine eye colour, genes that determine your blood group etc. Genes get passed onto the progeny from both the mother and father. Depending on the dominance of the gene, that particular character would be expressed in the progeny.

- **Chance factor:** Even though each parent passes on 24 pairs of chromosomes to the progeny, the progeny doesn't have 48 pairs of chromosomes on fertilization. Due to reduction divison (meiosis) there are 24 pairs of chromosomes only. Which 24 pairs will be selected is a matter of chance and is not predetermined.

Q. 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.

Answer : Underdeveloped useless organs in organisms are called as vestigial organs. Such organs useless in some organisms but these organs are useful in other organisms. These organs begin to degenerate and may take thousand years to degenerate. For examples appendix. Ear pinna muscle, tail bone (coccyx).

Vestigial organs in human body	Functional in other organism
Vermiform appendix	In cows, buffalos
Ear pinna muscle	In monkeys for moving ear pinna
Tail bone (coccyx)	Useful in all tailed animals

Q. 7. A. Answer the following question.

How are the hereditary changes responsible for evolution?

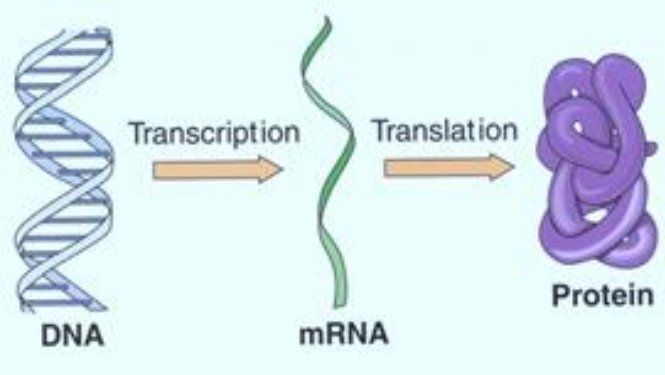
Answer : Heredity is the transfer of genes from one generation to another generation. However, sometimes sudden changes in genes occur due to a process called mutation. These are heredity changes. Evolution is the gradual change occurring in the living

organisms over a long duration. New species are formed due to changes in the specific characters of several generation and are selected by the nature to survive. Thus hereditary changes are responsible for the evolution.

Q. 7. B. Answer the following question.

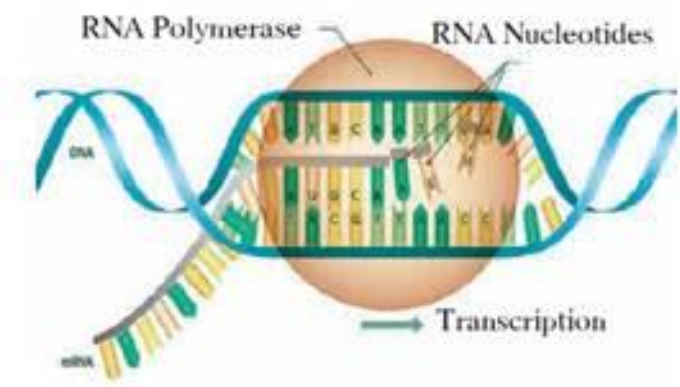
Explain the process of formation of complex proteins.

Answer : DNA forms mRNA (messenger RNA) and mRNA forms protein. This process is called 'central dogma'.



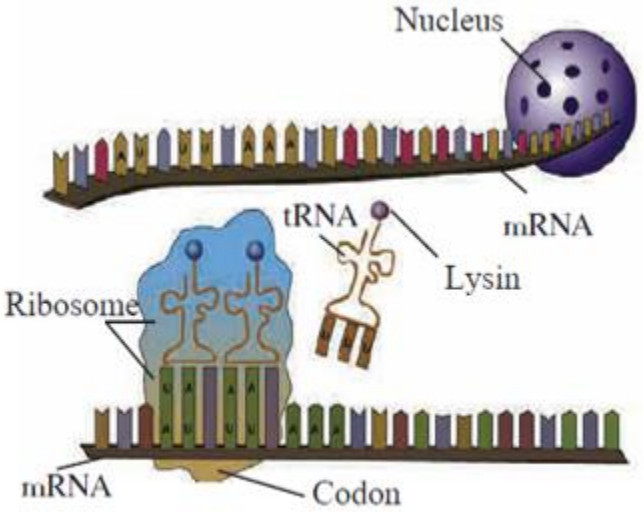
• mRNA is produced as per the sequence of nucleotides on DNA. The sequence of nucleotides in mRNA produced is always complementary to the DNA strand. RNA is synthesized by a process called transcription.

• The mRNA comes in the cytoplasm with coded message from DNA.



• The message contains codes for amino acids. The code for each amino acid consists 3 nucleotides called 'triplet codons'. Each mRNA contains thousands of triplet codons.

Amino acids are supplied by the tRNA (transfer RNA), per message on mRNA. For this, tRNA has anticodon having complementary sequence to the codon on mRNA. This is called translation.



Translation

• The amino acid brought in by tRNA is bonded together by peptide bonds with the help of rRNA (ribosomal RNA).

• During this process ribosomes keep on moving from one end to other end of mRNA by the distance of one triplet codon. Such many chains come together to form a complex protein.

Q. 7. C. Answer the following question.

Explain the theory of evolution and mention the proof supporting it.

Answer : According to this theory, protoplasm the first living material was formed in ocean. After that unicellular organisms were formed. With the gradual changes in unicellular organism, multicellular and complex organisms were formed. These changes were slow and gradual which took 300yrs and more. Progressive development of plants and animals from the ancestors having different structural and functional organization is called evolution. There are many proofs supporting the theories.

I. Morphological evidences: Similarities in morphology and physical structure prove that they have the same origin and common ancestors. For examples structure of mouth, position of nostrils, ear pinnae and thick hair on full body in animals like dog, goat and sheep.

II. Anatomical evidences: Organs of different animals are dissimilar in function but similar in structures of bones and bony joints shows that these animals may have

common ancestors. For Examples human hand, cat's foreleg, patagium of bat and flipper of whale perform different function but their bones are similar in structure.

III. Vestigial organs as evidences: Underdeveloped useless organs in organisms are called as vestigial organs. Such organs are useless in some organisms but these organs are useful in other organisms. For examples appendix useless in humans but functional in cattle. Ear pinna muscle useless in human but useful in monkeys.

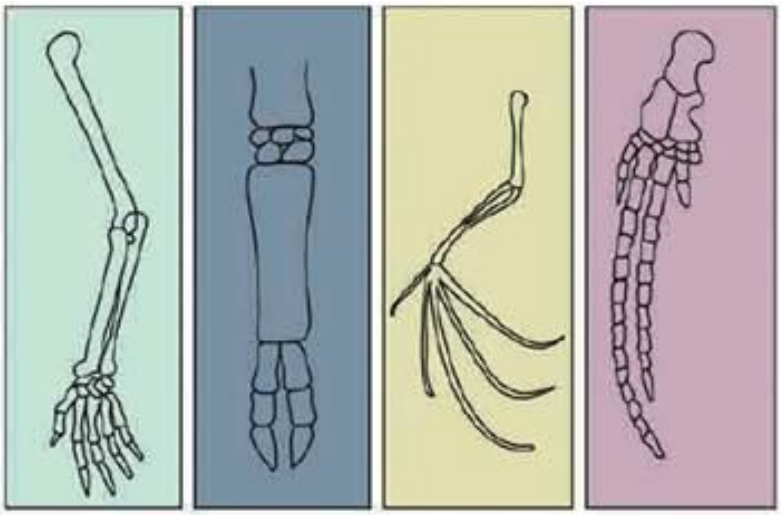
IV. Paleontological evidences: many organisms get buried under the ground due to disasters like flood, volcano, earthquake. Remnants and impression of these organisms are preserved underground and are called fossils. Study of fossils is very important for the study of evolution.

V. Connecting links: Some plants and animals have some morphological characters by which they can be related to different groups are called connecting links. Example Lung fish resembles the fish in having paired fins, gills and scales on its body, but it respires through lungs like amphibians. Thus, lung fish acts as a connecting link between fish and amphibians.

Q. 7. D. Answer the following question.

Explain with suitable examples importance of anatomical evidences in evolution.

Answer : Some organs of different animals are dissimilar in function but they are made of similar bones and bony joints. For Examples human hand, cat's foreleg, patagium of bat and flipper of whale perform different functions. Hand for holding, foreleg for walking, patagium for flying and flipper for swimming. All these organs made of similar five bones pattern



These structure shows that these animals may have common ancestors.

Q. 7. E. Answer the following question.

Define fossil. Explain importance of fossils as proof of evolution.

Answer : Any preserved remains, impression, or trace of organisms that lived in the past is called fossil. Examples include bones, shells, exoskeletons, stone imprints of animals, etc.

Fossil of fish

The time of death of a plant or animal can be calculated by measuring theradioactivity of C-14 and ratio of C-14 to C-12 (non-radioactive carbon) present in their body of the fossil organism. By determining the age fossil. This called carbon dating.

Once the age of fossil been determined, it is easy to gather the information about other past lived organisms. It can be concluded that vertebrates have been slowly originated from invertebrates.

Q. 7. F. Answer the following question.

Write evolutionary history of modern man.

Answer : The evolutionary history of modern man:

•Approximately 7 crore years ago, the dinosaurs disappeared completely.

•At that time, monkey-like animals appeared from more or less similar to the modern lemurs.

•Tail of these monkey-like animals disappeared about 4 crore years ago. Due to enlargement of brain and improvement in their hands, ape-like animals were evolved and then later they evolved into gibbon and orangutan.

•From gibbon and orangutan, gorilla and chimpanzee evolved about 2.5 crore years ago.

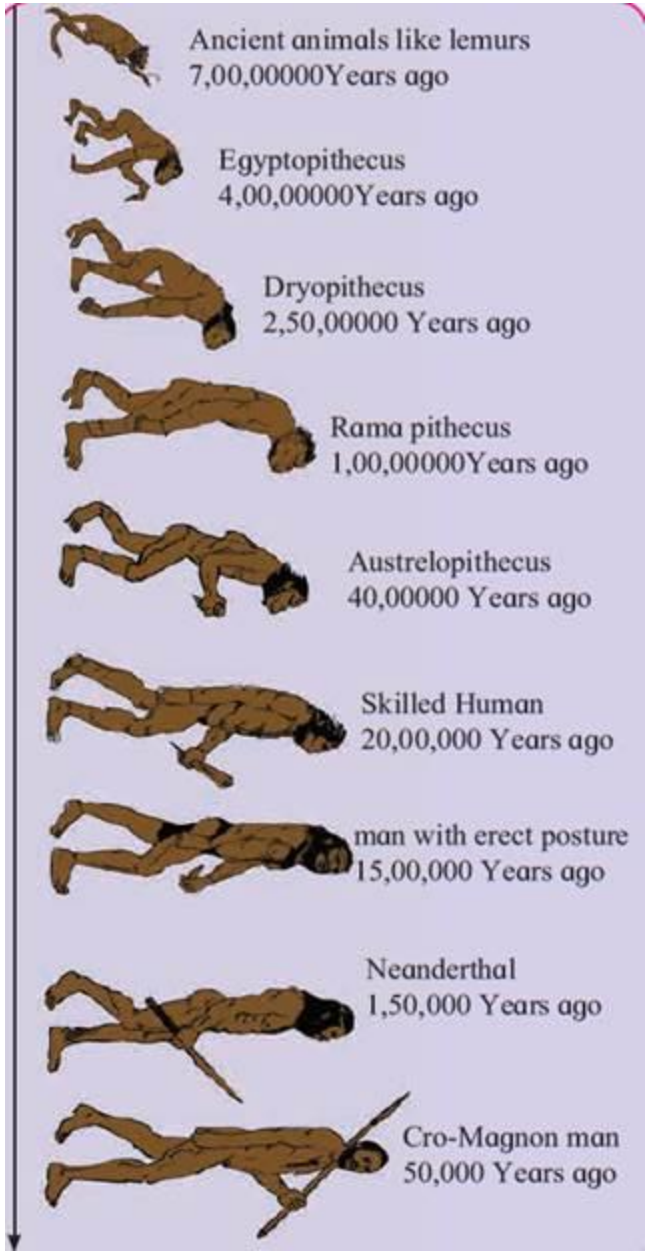
•About 2 crore years ago first human-like animals evolved who had erect posture and able to use their hands.

•Ramapithecus ape recorded as first human-like animal. Afterwards, this ape grown up in size and became more intelligent.

•About 20 lakh years ago skilled human developed and about 15 lakh years ago evolved human with erect posture and walking.

•Neanderthal man was considered as the first wise-man.

•About 50 thousand years ago the Cro-Magnon man evolved and afterwards, this evolution had been faster than the earlier.


Ancient animals like lemurs
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Egyptopithecus
4,00,00000Years ago
Dryopithecus
2,50,00000 Years ago
Rama pithecus
1,00,00000Years ago
Austrelopithecus
40,00000 Years ago
Skilled Human
20,00,000 Years ago
man with erect posture
15,00,000 Years ago
Neanderthal
1,50,000 Years ago
Cro-Magnon man
50,000 Years ago