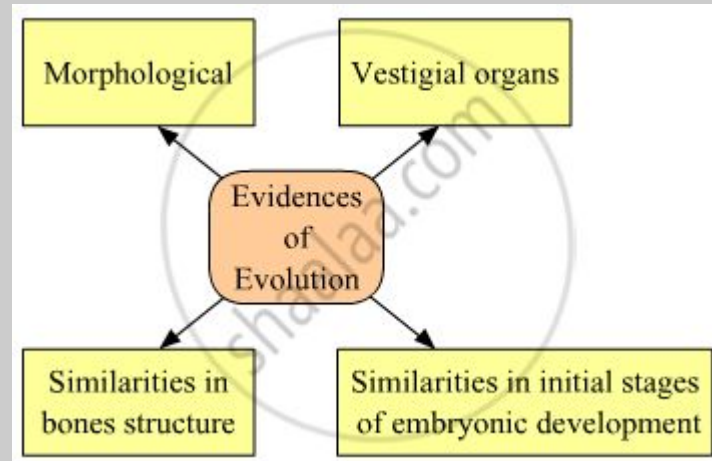

HERIDITY & EVOLUTION

SCIENCE 2 , MAHA SSC

Exercise

1. Complete the following diagram.



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2.a) Human evolution began approximately 7 crore years ago:

Dinosaurs have become extinct around 7 crore years back ,after which the humans have probably evolved. At that time monkey like animals are said to have evolved from some ancestors who have similarity with lemurs . These monkey like animals further evolved into ape like animals. Some of these animals evolved into gibbon & orangutan while others evolved into Gorilla & Chimpanzees.

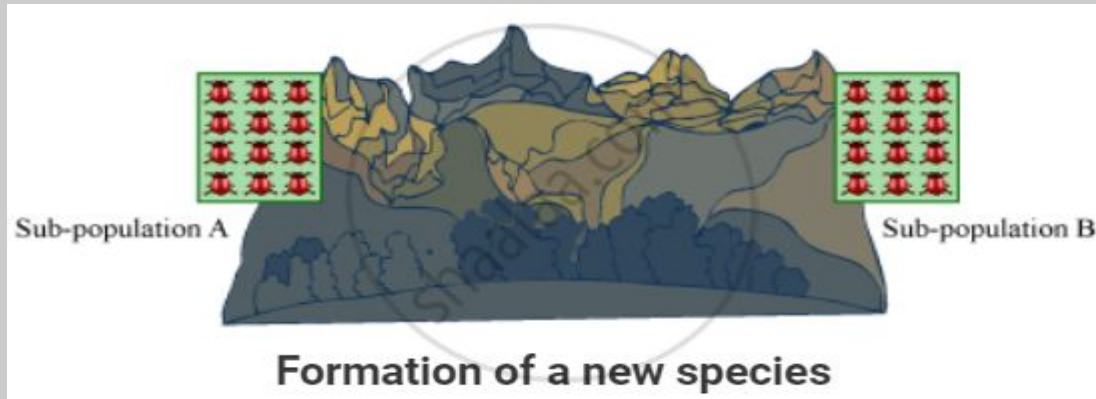
First record of human like animal is with us in the form of Ramapithecus ape from East Africa.Afterwards ,this ape grown up in size and became more intelligent and gradually progressed.

YEAR	EVOLUTION
15 MILLION YEARS AGO	DRYOPITHECUS(APE LIKE) RAMAPITHECUS (MAN LIKE)
3 TO 4 MILLION YEARS AGO	MAN LIKE PRIMATES
2 MILLION YEARS AGO	AUSTRELOPITHECUS (<u>Homo habilis</u>)
<u>1.5</u> MILLION YEARS AGO	<u>Homo erectus</u>
1 ,50,000 YEARS AGO	NEANDERTHAL
75,000-10,000 YEARS AGO	<u>Homo sapiens</u>

2 b) Geographical & reproductive isolation of organisms gradually leads to speciation :

Speciation refers to the formation of new species of plants and animals from the already existing species.

Let us understand it by a simple example :



The diagram shows beetles. Beetles are small insects which cannot travel to far off places .They gather food from nearby places .As a result ,

Subpopulations of beetles are confined to that area only.

These subpopulations can lead to entirely new species.



Geographical Isolation : Since the population of beetles are

spread over a large area , reproduction cannot occur between the individual populations.Reproduction within sub population may lead to new species formation which we call as Speciation. But ,if a river starts flowing between the two species, it will reduce the chance of gene flow and hence the chance of speciation .

Genetic Drift & Natural Selection :

Genetic drift and Natural selection give rise to new species in the sub populations .

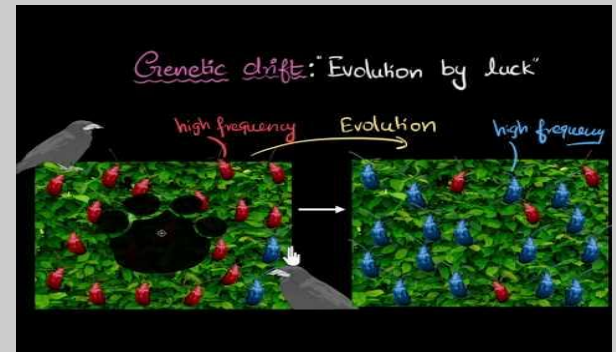
For example ,a particular subpopulation of blue & green beetles evolve due to genetic drift and natural selection.This new species continues to increase its number.Thus the two populations of beetles become completely different from each other.

These subpopulations will gradually become incapable

Of reproducing with each other and prefer their race

due to survival advantage. Hence ,a new species will

Evolve which will be reproductively isolated



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Important questions

2 c) Study of fossils is an important aspect of the study of evolution :

A **fossil** is any preserved remains, impression, or trace of any once-living thing from a past **geological age**. Examples include bones, shells, **exoskeletons**, stone imprints of animals or **microbes**, objects preserved in **amber**, hair, **petrified wood**, oil, coal, and **DNA** remnants.



Importance of fossils:

1. They inform us about the type of organisms that existed in the past.
2. They inform us about the extent to which the organisms have changed over time.
3. They inform us when a particular living organism existed on the earth.

2 d) There is evidences of fetal science among chordates :

Fetal science or embryology is used as an evidence of evolution. Comparative studies of the vertebrates and the chordates show that there is a large amount of similarity among them in the beginning while this similarity decreases with the progress of time. This similarity in the development represent their common origin.

3. Complete the sentences:

- a) The causality behind the sudden changes was understood due to mutation principle of Hugo de Vries.
- b) b. The proof for the fact that protein synthesis occurs through gene was given by George Beadle and Edward Tatum.
- c) c. Transfer of information from molecule of DNA to mRNA is called as transcription process.
- d) d. Evolution means gradual development.
- e) e. Vestigial organ appendix present in human body is proof of evolution.

Short Notes :

a. Lamarckism: Lamarck gave the principle of 'use or disuse of organs'. He proposed that the reason behind evolution was the changes in the morphological activities of the organism. For example: giraffe has a long neck because it used to browse on leaves of tall plants by extending their neck for several generations, shoulders of iron smith are strong due to repetitive hammering movements, wings of ostrich and emu are weak because they are not used for flying, legs of birds and swan are used for swimming because they live in water. These characters are termed as acquired characters which are transferred from one generation to another.

b)b. Darwin's theory of natural selection: Darwin is famous for the theory which he published in the book titled 'Origin of Species'. In this book he explained the theory of natural selection which talks about the survival of the fittest. He stated that there is a continuous competition between organisms for survival and the strongest of all survives. The chances of survival are higher for organisms which show modifications which will help them to survive. He also said that, nature also plays an important role in the selection of the fittest. Nature selects only those organisms which are capable of adapting to the changing situations while the rest which are incapable to do so perish away. The organisms which are selected by the nature then reproduce and give rise to new species which have their own characteristics

c. Embryology: Embryology is the study of the formation and development of embryo and foetus. Embryology is used as one of the evidences of evolution. Comparative study of embryos in vertebrates shows that there is lot of similarity in them at the initial stages whereas this similarity decreases gradually. This similarity in the development of embryos represents common origin of organisms.

d. Evolution: Evolution refers to the gradual change which occurs in an organism over a long duration of time. It is a slow going process which results in the development of the organism. Life originated on earth about 3.5 billion years ago. It is believed that there might have been presence of simple elements on earth which may have given rise to simple organic and inorganic molecules. From these simple molecules, complex molecules like proteins, DNA etc. may have been formed. Other evolutionary changes may have resulted in the formation of simple cells and the result of the continuous evolution on earth is the several species of plants and animals which exist on earth. Today, the diversity on earth varies from unicellular *Amoeba* to a human being and from a unicellular algae like *Chlorella* to huge Banyan tree.

Connecting link : Connecting link refers to the plants and other organisms which show characteristics of two different organisms.

Eg : Peripatus is considered to be the connecting link between the annelids and the arthropods.

It has characteristics like segmented body, thin cuticle and parapodia like organs which are similar to the annelids. While it shows open circulatory system and tracheal respiration like the arthropods.

Duck billed platypus is an example of the connecting link between the reptiles as it lays eggs and the mammals as it has mammary glands like the mammals.

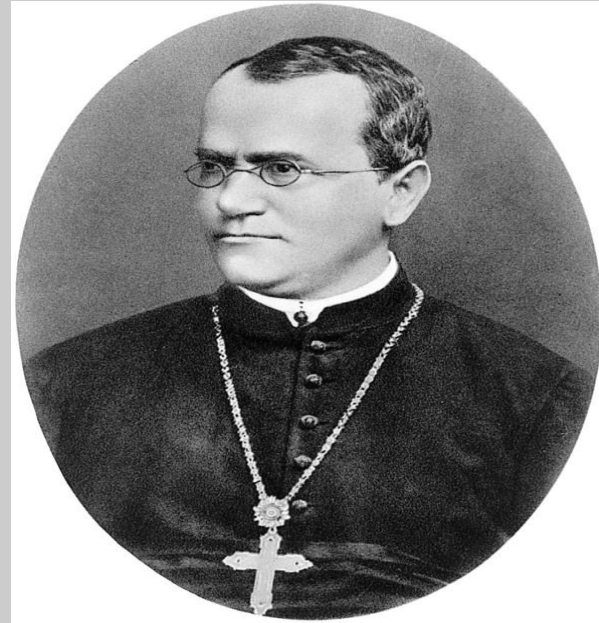
Important questions

Q 5 Define Heredity : Heredity refers to the passing of the traits from the parents to the offsprings either through sexual or asexual reproduction .Gregor Mendel was the first to explain us the concept and introduce the idea of factors through his famous experiments of Pisum sativum (green peas).

Explain the mechanism of Hereditary changes:

The characters also called as **traits** are passed on in the form of genetic information and is stored in the DNA (genes).

While a zygote is formed from the male and the female gamete(reproductive cell) it inherits 50% of the characters from the Paternal while 50% from the maternal DNA.Hence, an offspring has the characteristics of both the father & the mother.



Q6. Define : Vestigial organs Write the names of some of the vestigial organs in human body & write the names of those animals in whom some organs are functional.

Vestigial organs are the organs that have no apparent function and are considered to be the residual parts from the past ancestors. Vestigial organs are organs, tissues or cells in a body which are no more functional the way they were in their ancestral form of the trait. It is proof of evolution and hence, were helpful in explaining adaptation.

Examples of Vestigial Organs

Appendix

It is one of the most commonly known vestigial organs. This finger-like tube closed at one end arises from the vermiform process. In prime ancestors, the appendix is believed to have brought about the digestion of cellulose. Today, scientists predict that the appendix may play a role in digestion by bacteria. **Wisdom Tooth**

Forms the third set of molars in our buccal cavity. They may have been significant in the past(chewing rough and raw food) but in modern times, as they are inaccessible and remote, it causes pain and infection.

External Ear

The Helix(outer rim of the ear) is known to be a vestigial structure. Underdeveloped muscles in the ear make us incapable to bring about the movement of ears. Darwin's tubercle is a vestigial feature present on the juncture of the upper part of the ear.

Coccyx :It forms the last part of the vertebral column, the residue of the lost tail and is often termed as the tailbone. It is observed during human embryogenesis.

Wisdom Tooth : Forms the third set of molars in our buccal cavity. They may have been significant in the past(chewing rough and raw food) but in modern times, as they are inaccessible and remote, it causes pain and infection.

Nictitating Membrane : Nictitating membrane is the third eyelid found in a few animals that protect and keep the eyes moist and also helps in vision.

Tonsils

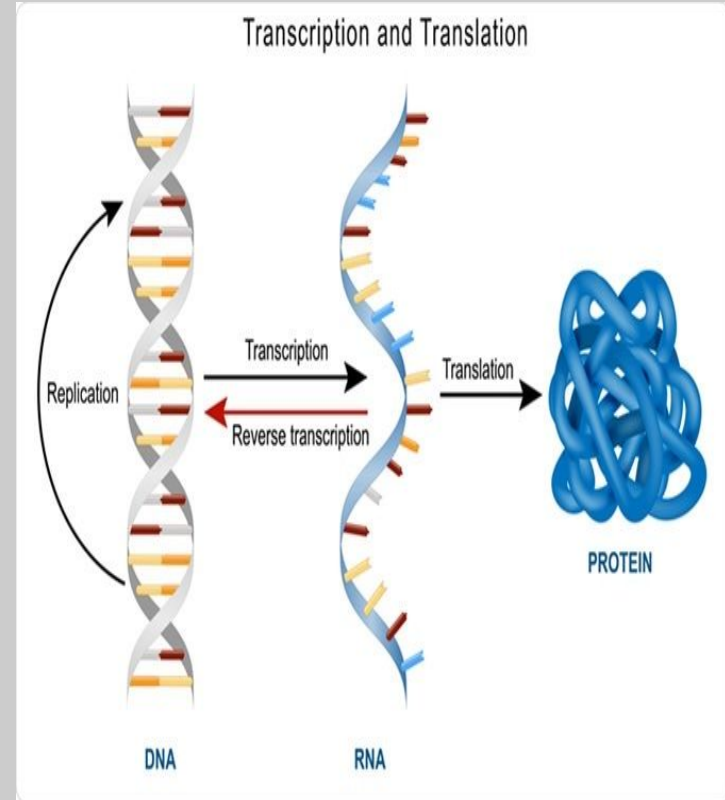
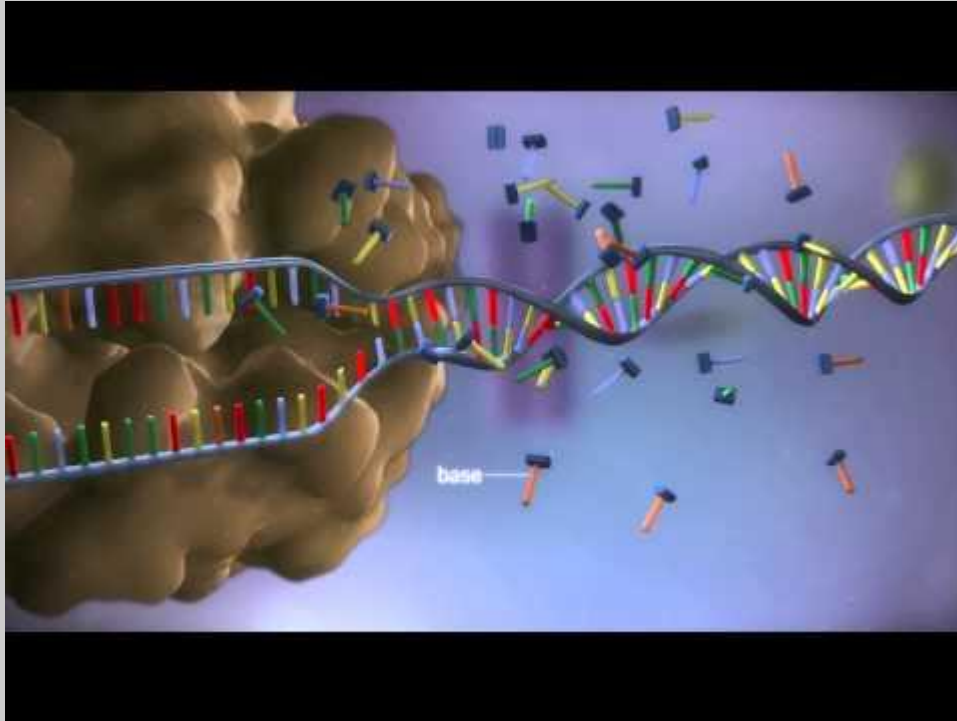
The tonsils remain as vestigial organs in the human body. They act as the first line of defence and protect the body from harmful microorganisms that are either inhaled or ingested by the body.

7 a) How are hereditary changes responsible for evolution ?

Heredity is the passing of traits from the parental generation to their offsprings. These traits which are passed from one generation to the next generation are called the inherited traits.

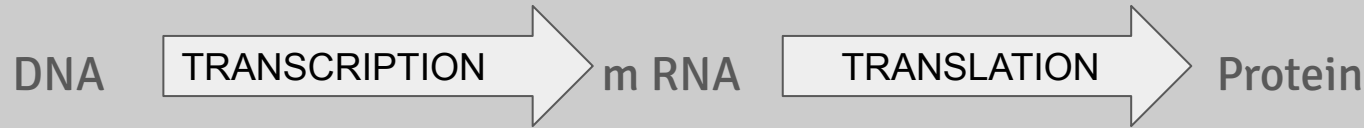
Evolution refers to the changes that occur in the inherited traits over a long period of time. These changes traits gradually become the heritable traits in the future generations. These changes occur due to the adaptation that take place in the generations with the passage of time. Hence, these hereditary changes definitely brings evolution of the fittest organisms.

7b) Explain the formation of complex proteins:



Transcription

The transfer of genetic information flows from the **DNA to RNA** and finally to the **PROTEINS**. The DNA contains all the information that is needed for the formation of the protein. The RNA is the messenger that takes the information from the DNA to the ribosome which leads to the production of the protein. This is called the **Central Dogma**.



Transcription is the process by which the information in a strand of DNA is copied into a new molecule of messenger RNA (mRNA). DNA safely and stably stores genetic material in the nuclei of cells as a reference, or template. Meanwhile, mRNA is comparable to a copy from a reference book because it carries the same information as DNA but is not used for long-term storage and can freely exit the nucleus. Although the mRNA contains the same information, it is not an identical copy of the DNA segment, because its sequence is complementary to the DNA template.

Transcription

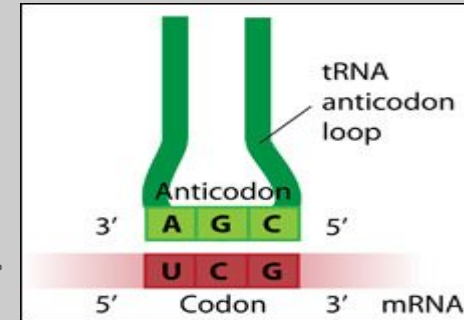


Transcription is carried out by an enzyme called RNA polymerase and a number of accessory proteins called transcription factors. Transcription factors can bind to specific DNA sequences called enhancer and promoter sequences in order to place RNA polymerase to an appropriate transcription site. Together, the transcription factors and RNA polymerase form a complex called the **transcription initiation complex**. This complex initiates transcription, and the RNA polymerase begins mRNA synthesis by matching complementary bases to the original DNA strand. The mRNA molecule is elongated and, once the strand is completely synthesized, transcription is terminated. The newly formed mRNA copies of the gene then serve as blueprints for protein synthesis during the process of translation.

Translation : The newly synthesized mRNA contains the information in the form of codons. A codon is a sequence of three DNA or RNA nucleotides that correspond with a specific amino acid. Since they are present in the group of three, they are also referred to as **Triplet Codon** .

Steps of translation :

- 1) mRNA is released into the cytoplasm . It reaches the ribosome .
- 2) Two other types of RNA (t RNA , rRNA) participate in the process of translation.
- 3) Each t RNA has an anticodon which has a sequence complementary to the codon on mRNA. These tRNA s provide the anticodons required for the codons on mRNA.



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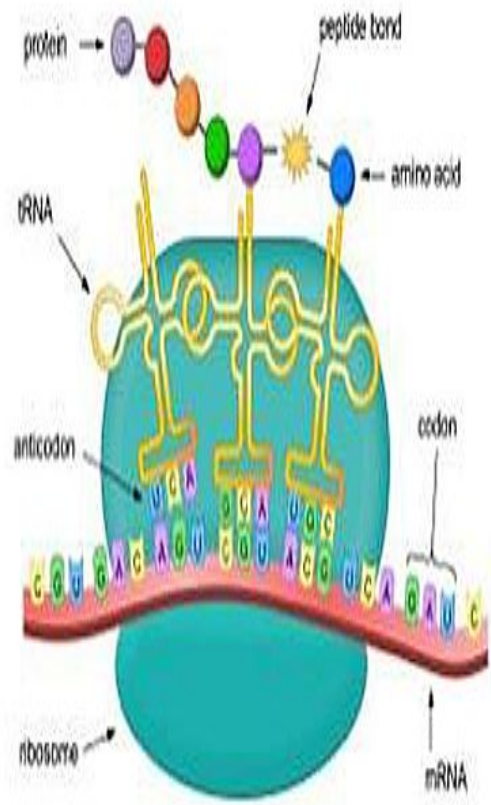
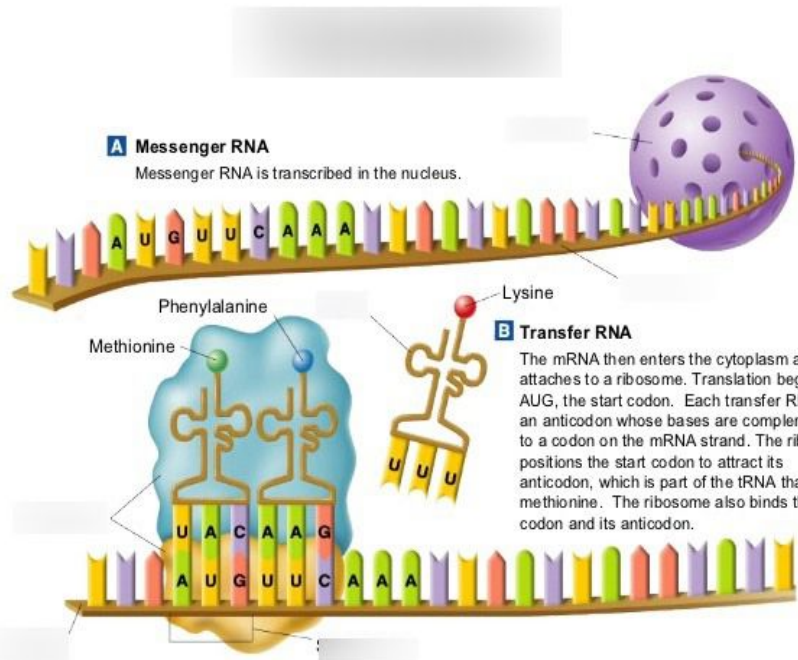


Steps of translation Contd.....

4) The amino acids which are brought about the t RNA are joined by the peptide bonds. r RNA helps in this process.

5) During this process the ribosomes move from one end of the mRNA to the other end. This process is called **Translocation**.

After this process, the protein undergoes further modifications to become complex proteins.



Explain the theory of evolution & mention the proof for supporting it :

Among many theories of evolution the **Gradual Development** of Living organisms is the most acceptable. According to this theory :

First living material **Protoplasm** was formed in the **ocean**.

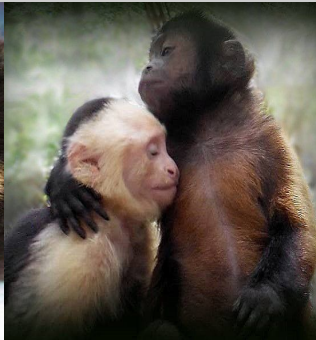
Unicellular organisms were formed.

Unicellular organisms developed changes as per **adaptive needs complex and larger organisms were formed**. This change took around 300 crore years to take place and brought about evolution of new species.

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Proof supporting this Evidence :

Morphological Evidence : Various similarities in the mouth, position of the eyes, structure of nostrils, ear pinna and thickly distributed hair on the body are the common features observed in the animals, whereas the similarities in the characteristics like leaf shape, leaf venation, leaf petiole etc...in the plants. These similarities suggest their common ancestry.

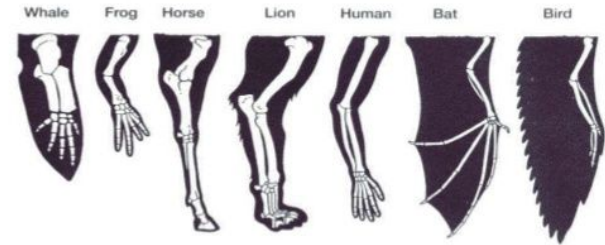


Anatomical Evidences : The structures shown here do not seem to have any superficial similarity but the structures of the bones & joints definitely prove their common ancestry.

Comparative Anatomy

i) Homologous Structures:

- Body parts of different species with similar structures but different functions.
- Evidence of close evolutionary relationship (recent common ancestor).



Connecting links: Connecting link refers to the plants and other organisms which show characteristics of two different organisms.

Eg ::



Link between annelida & Arthropods.

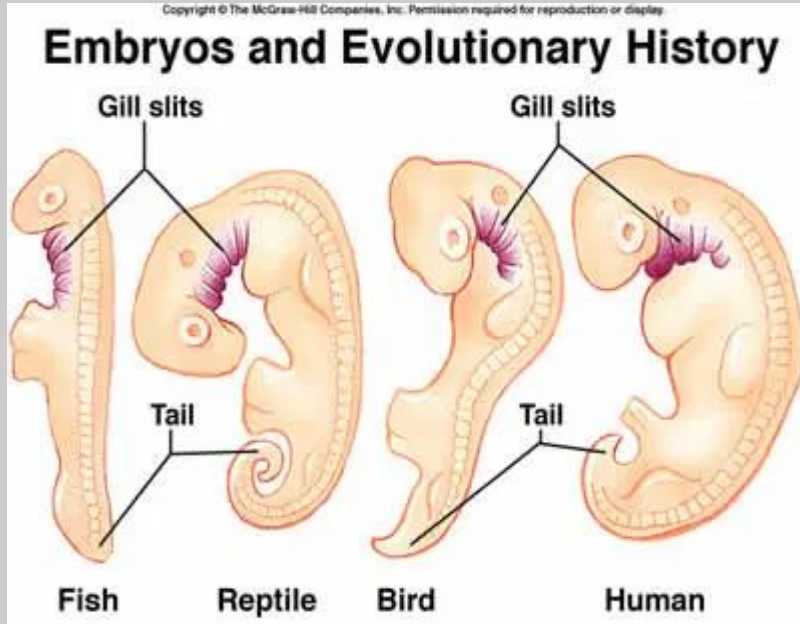


Duck billed platypus is the link between the reptiles & mammals.



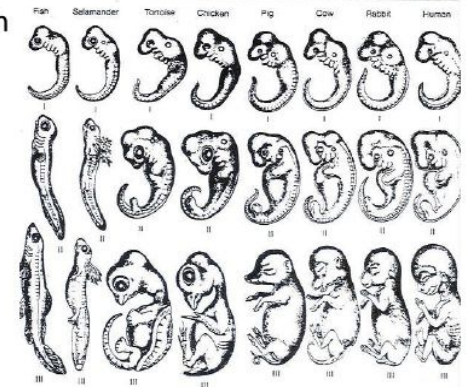
Similarities between the pieces & mammals.

Embryological evidence : Comparative study of embryological developmental stages of various vertebrates ,where it shows the similarities among various organisms.



Comparative Embryology

- Incredible similarities in embryos of different species provides evidence of common ancestor
 - Patterns of embryo development are also important.



7 e) Define fossil: Explain importance of fossils as proof of evidence :

A **fossil** is any preserved remains, impression, or trace of any once-living thing from a past **geological age**. Examples include bones, shells, **exoskeletons**, stone imprints of animals or **microbes**, objects preserved in **amber**, hair, **petrified wood**, oil, coal, and **DNA** remnants.

Importance of fossils:

1. They inform us about the type of organisms that existed in the past.
2. They inform us about the extent to which the organisms have changed over time.
3. They inform us when a particular living organism existed on the earth.

Important questions

7f) Write evolutionary history of modern man :

YEAR	EVOLUTION
15 MILLION YEARS AGO	DRYOPITHECUS(APE LIKE) RAMAPITHECUS (MAN LIKE)
3 TO 4 MILLION YEARS AGO	MAN LIKE PRIMATES
2 MILLION YEARS AGO	AUSTRALOPITHECUS (<u>Homo habilis</u>)
<u>1.5</u> MILLION YEARS AGO	<u>Homo erectus</u>
1 ,50,000 YEARS AGO	NEANDERTHAL
75,000-10,000 YEARS AGO	<u>Homo sapiens</u>

Questions :

2020

Q.1. (A) Choose the correct option and write its number for the following questions[1]

i. Transfer of information from molecule of DNA to mRNA is called _____ process.

(A) Transcription (B) Translation (C) Translocation (D) Mutation

Q 1 (B) I am connecting link between Reptilia and mammals. What is my name? (1)

Q.3. Solve the following questions : [3]

i. Explain the importance of Anatomical evidences with examples.

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2018

1. (A) (a) Rewrite the following statements with suitable words in the blanks: (1)

i. There are _____ pairs of chromosomes in human being.

2019

(B) Choose the correct alternative and rewrite the statements:

v. _____ is a connecting link between annelida and arthropoda. (1)

(A) Duck-billed platypus (B) Peripatus (C) Lungfish (D) Whale

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2016

2. Answer the following questions (2)

ii. What is the peculiarity of the 'DNA' structure?

3. Answer the following questions (any five): [3 x 2]

i. What do you mean by vestigial structures? Name four vestigial organs found in man.

ii. State Darwin's theory of evolution.

2015

6. Solve any five of the following:

iii. State the connecting links between Peripatus with Annelida and Arthropoda(2)

7. Answer any five of the following: (2)

iv. What are vestigial organs? Give two examples each in human beings and plants.

2013

8. Write the answer of any one question given below: [5]

1. Write names of different parts of human digestive system and explain functions of any three parts.

2. Answer the following: i. Draw a diagram of DNA showing genes. ii. What are peculiarities of its structure?

THANK YOU
