Evolution

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Class: XII Biology

1. **Explain antibiotic resistance observed in bacteria in light of Darwinian selection theory.**
   Darwinian Natural Selection theory states that individuals with favourable variations are better adapted than individuals with less favourable variations.

   It means that nature selects the individuals with useful variation as these individuals are better evolved to survive in the existing environment.

   An example of such selection is antibiotic resistance in bacteria.

   When bacterial population was grown on an agar plate containing antibiotic penicillin, the colonies that were sensitive to penicillin died, whereas one or few bacterial colonies that were resistant to penicillin survived.

   This is because these bacteria had undergone chance mutation, which resulted in the evolution of a gene that made them resistant to penicillin drug.

   Hence, the resistant bacteria multiplied quickly as compared to non- resistant (sensitive) bacteria, thereby increasing their number.

   Hence, the advantage of an individual over other helps in the struggle for existence.

2. **Find out from newspapers and popular science articles any new fossil discoveries or controversies about evolution.**
   Fossils of dinosaurs have revealed the evolution of reptiles in Jurassic period.

   As a result of this, evolution of other animals such as birds and mammals has also been discovered.

   However, two unusual fossils recently unearthed in China have ignited a controversy over the evolution of birds.

   Confuciusornis is one such genus of primitive birds that were crow sized and lived during the Cretaceous period in China.

3. **Attempt giving a clear definition of the term species**
   Species can be defined as a group of organisms, which are capable of interbreeding among themselves to produce fertile offspring.

4. **Try to trace the various components of human evolution (hint: brain size and function, skeletal structure, dietary preference, etc.)**

   The various components of human evolution are as follows.

(i) Brain capacity
(ii) Posture
(iii.) Food / dietary preference and other important features

i. About 15 million years ago, primates called *Dryopithecus* and *Ramapithecus* existed. They were hairy and walked like gorillas and chimpanzees. *Ramapithecus* was more man-like, while *Dryopithecus* was more ape-like. So, these were the forerunners of hominids.

ii. Progress was made further when a skull was discovered about 5 million years ago.

It had a brain size of about 500 cm3within the range of an ape's brain, but its jaw and teeth were human like.

It was probably not taller than 4 feet but walked upright. It was named as *Australopithecus africanus* and lived in the East Africa grasslands.

Evidence showed that this species hunted with stone weapons but essentially ate fruits.

iii From *Australopithecus* evolved *Homo habilis* who was characterised by having a larger brain than *Australopithecus* (650-800 cc), used tools and were bipedal.

They probably did not eat meat.

iv.*Homo erectus* appeared about 1.5 million years ago.

Their brain capacity increased to about 800-1,200 cc, and they migrated to Asia and Europe. Fossils of 'Java man' and 'Peking man' belong to *Homo erectus*.

They probably ate meat.

v.*Homo erectus* was later replaced by *Homo sapiens*.

There were several sub-species of *Homo sapiens*, a widespread one of which was *Homo sapiens neanderthalensis*, a large brained game hunter.

They have a brain size of 1,400 cc and lived in the Near East and Central Asia between 100,000 and 40,000 years ago.

They used hides to protect their body and buried their dead ones.

vi.The oldest remains of *Homo sapiens sapiens* appeared about 35,000 years ago, probably having evolved from Neanderthal man.

They were as large brained (1,500 cc) as they were today and existed as hunter gatherers in co-operative bands.

They were stout, short and used hides for clothing. They built huts and buried their dead ones.

vii. Prehistoric cave art developed about 1,800 years ago. Agriculture came about

10,000 years ago, and human settlements started.

5. **Find out through internet and popular science articles whether animals other than man have self-consciousness.**

There are many animals other than humans, which have self-consciousness.

An example of an animal being self-conscious is dolphins.

They are highly intelligent. They have a sense of self and they also recognize others among themselves and others.

They communicate with each other by whistles, tail-slapping, and other body movements.

Not only dolphins, there are certain other animals such as crow, parrot, chimpanzee, gorilla, orangutan, etc., which exhibit self-consciousness.

6. **List 10 modern-day animals and using the internet resources link it to a corresponding ancient fossil. Name both.**

The modern-day animals and their ancient fossils are listed in the following table.

Modern Day	Ancient Fossil
Modern horse (*Equus*)	*Eohippus*(=*Hydracotherium*) – Dawn horse – The first fossil found in the evolution of horse.
Camel (*Camelus*)	*Protylopus*– The first ancestor of modern camel.
Modern Elephant (*Elephas*)	*Moeritherium*– The ancestor of modern elephant.
Man (*Homo sapiens*)	*Ramapithecus*– The oldest of man's ancestors.
Vertebrates	*Seymouria*– The missing link between amphibians and reptiles.
Reptiles	*Cyanognathus*– The missing link between reptiles and mammals.
Birds	*Archaeopteryx*– The missing link between reptiles and birds.
Mammals	*Cyanognathus*– The missing link between reptiles and mammals.
Apes and Mammals	*Dryopithecus*– The common ancestor of apes and mammals.

7. Practise drawing various animals and plants.

Ask your teachers and parents to suggest the names of plants and animals and practice drawing them. You can also take help from your book to find the names of plants and animals.

8. Describe one example of adaptive radiation.

Adaptive radiation is an evolutionary process that produces new species from a single, rapidly diversifying lineage.

This process occurs due to natural selection.

An example of adaptive radiation is Darwin finches, found in Galapagos Island. A large variety of finches is present in Galapagos Island that arose from a single species, which reached this land accidentally.

As a result, many new species have evolved, diverged, and adapted to occupy new habitats.

These finches have developed different eating habits and different types of beaks to suit their feeding habits.

The insectivorous, blood sucking, and other species of finches with varied dietary habits have evolved from a single seed eating finch ancestor.

9. Can we call human evolution as adaptive radiation?

No, human evolution cannot be called adaptive radiation.

This is because adaptive radiation is an evolutionary process that produces new species from a single, rapidly diversifying lineage, which is not the case with human evolution.

Human evolution is a gradual process that took place slowly in time.

It represents an example of anagenesis.

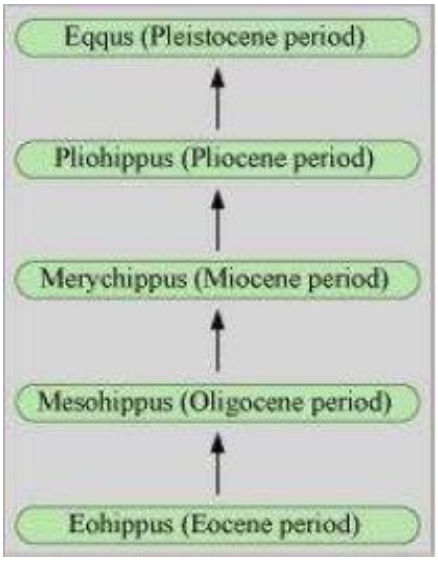
10. Using various resources such as your school library or the internet and discussions with your teacher, trace the evolutionary stages of any one animal say horse.

The evolution of horse started with Eohippus during Eocene period. It involved the following evolutionary stages.

(i) Gradual increase in body size
(ii) Elongation of head and neck region
(iii) Increase in the length of limbs and feet
(iv) Gradual reduction of lateral digits
(v) Enlargement of third functional toe
(vi) Strengthening of the back

(vii) Development of brain and sensory organs
(viii) Increase in the complexity of teeth for feeding on grass

The evolution of horse is represented as



(i) Eohippus

It had a short head and neck. It had four functional toes and a splint of 1 and 5 on each hind limb and a splint of 1 and 3 in each forelimb. The molars were short crowned that were adapted for grinding the plant diet.

(ii) Mesohippus

It was slightly taller than Eohippus. It had three toes in each foot.

(iii) Merychippus

It had the size of approximately 100 cm. Although it still had three toes in each foot, but it could run on one toe. The side toe did not touch the ground.

The molars were adapted for chewing the grass.

(iv) Pliohippus

It resembled the modern horse and was around 108 cm tall. It had a single functional toe with splint of 2nd and 4th in each limb.

(v) Equus

Pliohippus gave rise to Equus or the modern horse with one toe in each foot.

They have incisors for cutting grass and molars for grinding food.

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