

ORGANIC EVOLUTION

Very Short Answer Questions

1. What is Panspermia?

Ans. According to Cosmozoic theory, life was existed all over the universe (cosmos) in the form of resistant spores known as Cosmozoa or Panspermia. They reached the earth accidentally.

2. Define Prebiotic soup? Who coined the term?

Ans. According to chemical evolution, light elements of primitive atmosphere/reducing atmosphere combined and form compounds like ammonia, methane etc., which are accumulated in sea water and finally transformed into nucleosides and nucleotides in ocean water. Ocean water was described as the hot dilute soup or Prebiotic soup by J.B.Haldane.

In Prebiotic soup, simple organic molecules are transformed into complex polymers like polysaccharides, proteins fats and nucleic acids.

Four Billion Years Ago...

UV radiation ($\lambda < 150\text{nm}$):
 $1.6 \times 10^{-9} \text{ einsteins} \cdot \text{cm}^{-2} \cdot \text{sec}^{-1}$



Early Atmosphere:
 CO_2 : 1 to 10 atm
 N_2 , CO ,
 H_2S : 10^{-4} atm
 CH_4 : 10^{-4} atm
 O_2 : No

How did life begin?

Early Ocean:
 Na^+ , Mg^{2+} , Cl^- , SiO_3^{2-} , HCO_3^- ,
 $\text{pH} = 5.5$, $T > 50^\circ \text{C}$

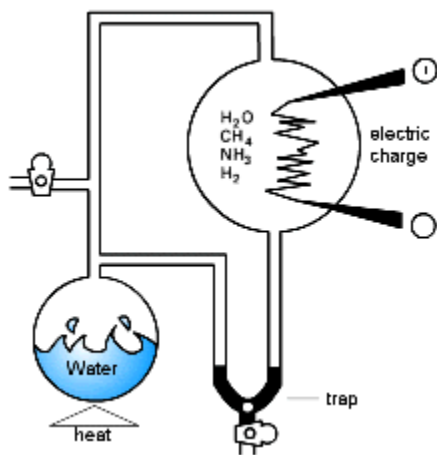
3. How did Eukaryotes evolved?

Ans. Eukaryotes were evolved by two processes..

- Prokaryotes lived in ancestral eukaryotes symbiotically evolved into organelles like mitochondria and plastids.
- Endomembrane system of eukaryotes has evolved by the infolding of plasma membrane of ancestral prokaryotes.

4. What are components of the mixture used by Urey & Miller in their experiments to simulate the primitive atmosphere?

Ans. Urey and Miller sealed a mixture of water vapour, methane, ammonia and hydrogen in a spark chamber that simulates the primordial atmosphere.



5. Mention the names of any four connecting links that you have studied?

Ans. Connecting links are the organisms which possess the characters of two different groups between which they are transitional.

E.g., i) *Eusthenopteron* – between fishes and amphibians



Eusthenopteron

ii) *Peripatus* – between annelida and arthropoda



Peripatus

iii) *Prototherians* – between reptilian and mammalian



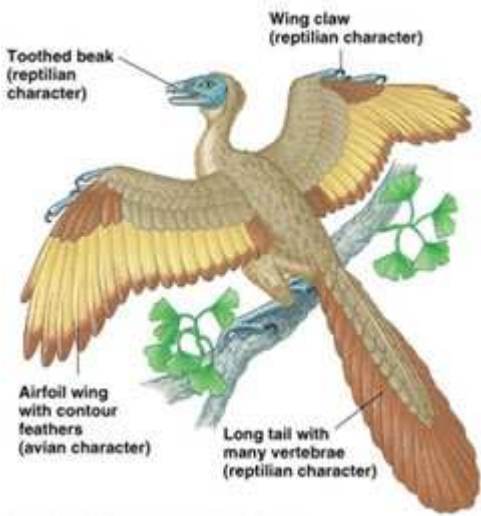
Ornithorhynchus (duck billed platypus)

iv) *Seymouria* -- between amphibians and reptiles



Seymouria

v) *Archaeopteryx* – between reptiles and birds



vi) *Cynognathus* – reptiles and mammals



Cynognathus

6. Define Biogenetic law. Give an example?

Ans. Biogenetic law or Theory of Recapitulation was proposed by Ernst Haeckel.

It states that ontogeny repeats phylogeny which means the developmental history of an organism repeats the evolutionary history of its ancestor.

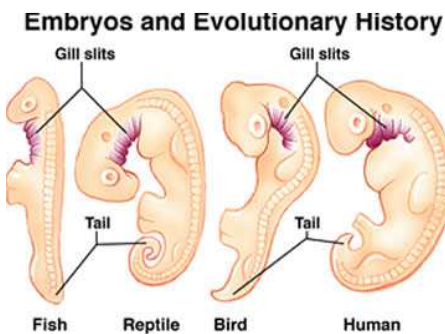
E.g: Tadpole larva of frog resembles fish both externally and internally by having a tail, gills and two chambered heart.

- Caterpillar larva of butterfly recapitulates its closest ancestor, the annelid in body form.

7. Define atavism with example?

Ans. Atavism is the condition where sudden appearance of some vestigial organs in a better developed condition.

E.g.: Appearance of tail in human baby.



8. Cite two examples to disprove Lamarck's inheritance of acquired characters?

Ans. Two examples to disprove Lamarck's inheritance of acquired characters are

- a) Well developed muscles of athletes are not inherited to their children.
- b) Making perforations to pinna for wearing ornaments has been practice in India. But no girl child is born with ready-made perforations in their pinna.

9. Who influenced Darwin much in formulating the idea of Natural Selection?

Ans. Charles Darwin was much influenced by three scientists and their publications in the following manner.

- i) Thomas Malthus - An Essay on the Principles of Populations.
- ii) Sir Charles Lyell - Principles of Geology.
- iii) A.R. Wallace - On the tendency of varieties to depart from original types.

10. What is common between Darwinism and Lamarckism?

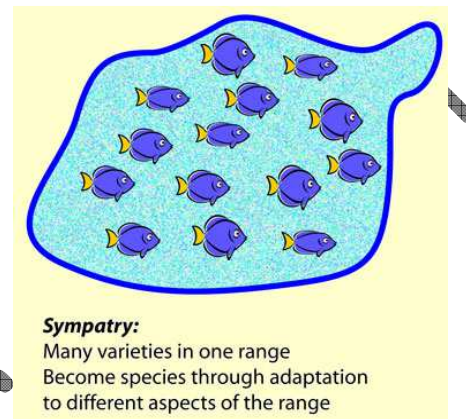
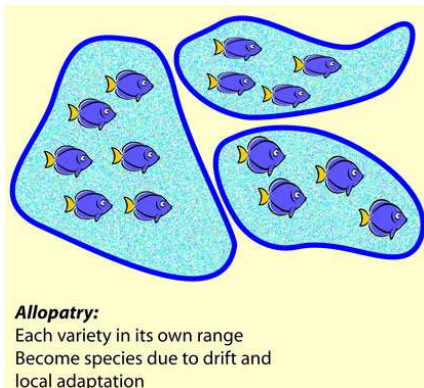
Ans. The common thing between Darwinism and Lamarckism is evolution of new species occurs by the result of accumulation of variations for over many generations.

11. What is meant by Genetic load? Give an example?

Ans. Existence of deleterious genes with the populations is known as Genetic drift.

E.g. Gene for sickle cell anaemia. Homozygous persons for sickle cell gene ($Hb^S Hb^S$) die early due to anaemia. But the persons heterozygous ($Hb^A Hb^S$) can live reasonably health and exhibit resistance to malaria.

12. Distinguish between Allopatric and Sympatric speciations?



Allopatric speciation occurs due to geographical isolation.

Sympatric speciation occurs in the organisms which live in the same habitat, capable of interbreeding but do not interbreed due to some isolation mechanisms.

13. Mention the scientific names of ape like and man like earlier primates. Which man like primate first used hides to cover the bodies?

Ans. a) *Dryopithecus* was more ape-like.

b) *Ramapithecus* was more man-like.

c) *Homo neanderthalensis* first used hides to protect their body and buried their dead.

Short Answer Type Questions

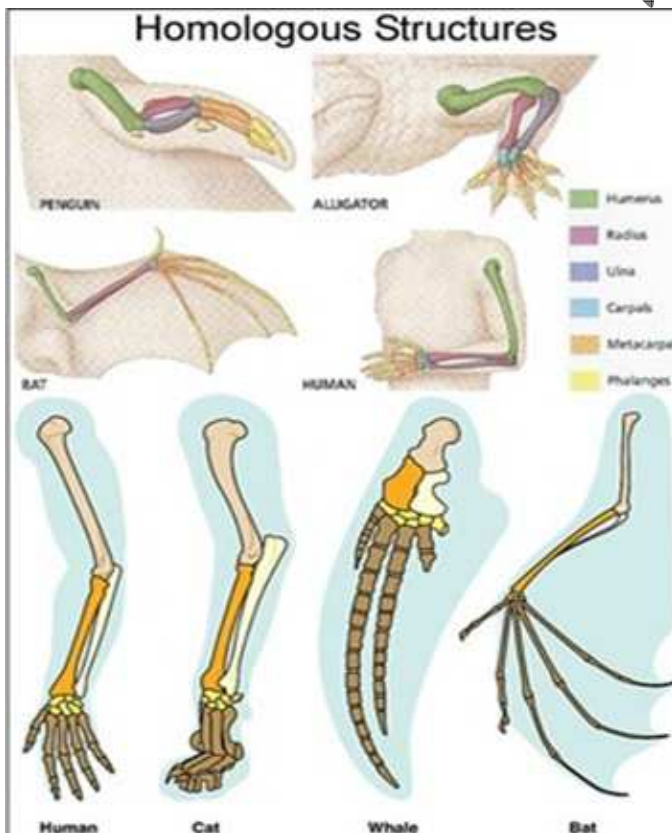
1. Distinguish between homologous and analogous organs?

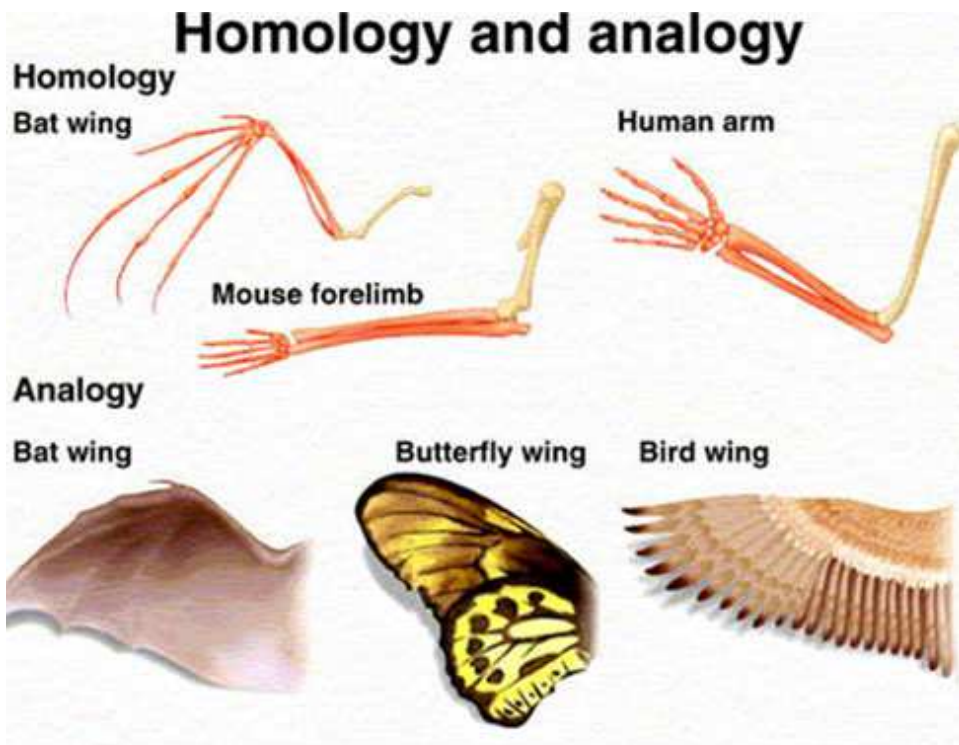
a) **Homologous Organs:** The organs which have similar structure and origin but with different functions are considered as homologous organs. This evolutionary pattern that describes the occurrence of similarity in origin and internal structure is known as homology. They show adaptive radiation and divergent evolution. They explain common ancestry.

E.g. a) Appendages of vertebrates like flippers of whale, wings of bat, forelimbs of horse, paw of cat and hand of man. All these organs show common pattern in the arrangement of bones but show differences in their external form and functions to suit their mode of life. It explains that all the vertebrates might have had a common ancestor.

b) **Analogous Organs:** The organs which have dissimilar structure and origin but perform the same function are considered as analogous organs. They suggest convergent evolution.

E.g., Wings of a butterfly and wings of a bird.
Eyes of Octopus and mammals.





2. Write a short note on the theory of mutations?

Ans. Mutations are sudden, random inheritable changes that occur in organisms.

- Mutation theory was proposed by Hugo de Vries. He found 4 different forms in *Oenothera lamarckiana*.
- Darwin called mutations as sports of nature or saltations.
- Bateson called them as discontinuous variations.
- Mutations occur from time to time in naturally breeding populations.
- Mutations are discontinuous and are not accumulated over generations.
- Mutations are full fledged and so there are no intermediate forms.
- Mutations are subjected to natural selection.

3. Explain Darwin's theory of Natural Selection with industrial melanism as an experimental proof?

- According to Darwin's Natural selection theory, the individuals with beneficial variation would increase the ability to reproduce and leave more fertile off springs. They are fittest organisms and they only can survive.
- An important practical example for the operation of Natural selection is Industrial melanism exhibited by peppered moth – *Biston betularia*. They appear in two colors – Grey and black.
- Grey moths were abundant before industrial revolution in England.
- But after industrial revolution, black forms were more.

- It is due to the fact that more soot was released due to burning of coals during industrial revolution and darkened the barks of trees. Grey moths are easily identified and predated by birds. So the number of grey moths decreased and that of the black moths increased in the populations. It means the Nature offered positive selection pressure to the black or melanic forms.
- British ecologist, Bernard Kettlewell tested this hypothesis experimentally.

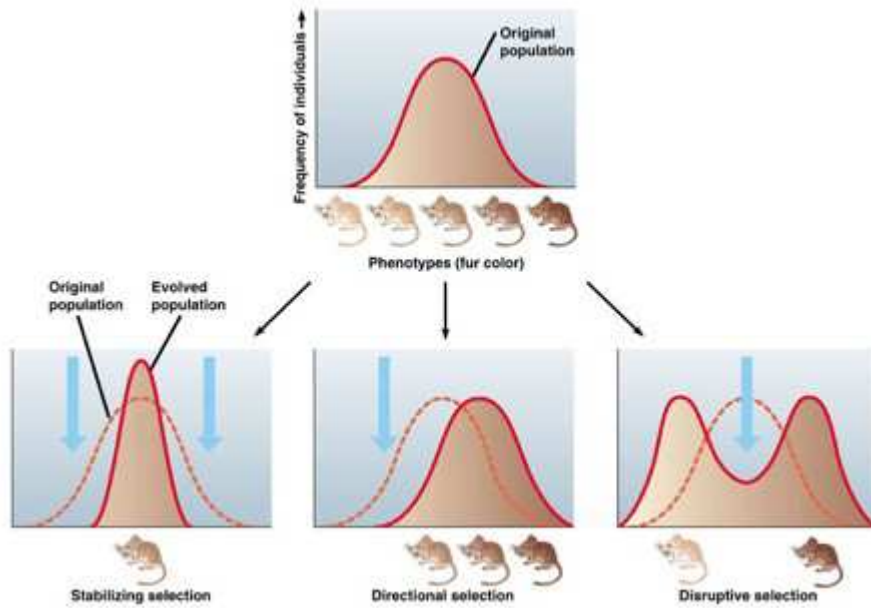


4. Discuss the role of different patterns of selections in evolution?

Natural selection is one of the evolutionary forces that bring changes in the gene pool of populations. It is of three types like stabilizing, directional and disruptive selections

A) Stabilizing Selection Or Centripetal Selection:

It operates in a stable environment. The organisms with average phenotype are preserved whereas the extreme individuals from both the ends are eliminated. It does not promote any evolutionary change that leads to speciation but maintains the phenotypic stability within the population over generations.



B) **Directional Selection:** It operates in an environment which gradually undergoes changes. It works by constantly removing the members from one end and constantly shifting the average value of fitness towards the other end of the phenotypic distribution.

E.g. The average value of length of neck in giraffes shifted towards the long-neck. It is overtake by stabilizing selection once the average value of the phenotype coincides with new optimum environmental conditions. The development of resistance to DDT by mosquitoes is another example for directional selection.

C) **Disruptive Selection (Centrifugal Selection):**

It operates when homogenous environment changes into a heterogenous type. In this process, the organisms of both the extreme phenotypes are selected while the individuals with average phenotype are eliminated. It can split the population into two or more subpopulations or species populations. It is a rare form of selection. But it can lead to the formation of two or more different species. It is known as adaptive radiation.

E.g., Dark and light coloured species in Biston betularia, Darwin's finches with different shaped of beaks, sunflower populations in California which split into two subpopulations of which one was adapted to dry area and the other was adapted to wet area. If the two sub populations do not inter breed they develop into new species.

5. Write a short note on Neo-Darwinism?

Ans. Fisher, Sewall Wright, Mayr explained Natural Selection in the light of Post-Darwinian discoveries as Synthetic theory or Genetical theory or Neo-Darwinism. Five basic factors are involved in the process of organic evolution according to this theory. They are.

a) **Gene Mutations:** The changes occur in the structure of a gene (DNA) are known as gene mutations or point mutations. They change the phenotypic characters of individuals and produce variations in the off springs

b) Chromosomal Mutations: Changes in the structure of chromosomes due to deletion, addition, duplication, inversion or translocation are known as chromosomal mutations. They also bring variations in the phenotype of organisms and lead to the occurrence of variations in off springs.

c) Genetic Recombination's: They occur due to crossing over during meiosis. They also cause genetic variability among the individuals of same species.

d) Natural selection: It does not produce any genetic changes but it favours some genetic changes and rejecting others. So it is considered as the driving force of evolution.

d) Reproductive isolation: It is the absence of gene exchange between populations. It plays a great role in the creation of new species and preserves the species diversity.

6. In a population of 100 rabbits which is in Hardy-Weinberg equilibrium, 24 are homozygous long-eared. Short ears are recessive to long ears. There are only two alleles for this gene. Find out the frequency of recessive allele in the population.

Number of rabbits in the population with Hardy – Weinberg equilibrium = 100

Number of dominant homozygous long eared rabbit = 24

Frequency of homozygous dominant long eared rabbits (P^2) $\frac{1}{100} \times 24 = 0.24$

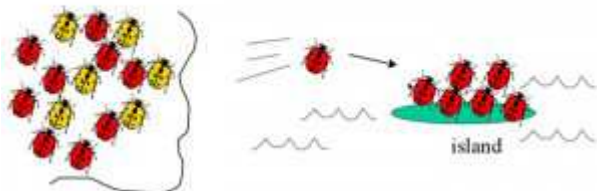
Frequency of dominant allele (P) = 0.49

Frequency of recessive allele = q = 1 – 0.49 = 0.51

∴ 0.51 is the frequency of recessive allele in the population.

7. What is meant by genetic drift? Explain genetic drift citing the example of Founder effect?

- founder effect: a few individuals from a population start a new population with a different allele frequency than the original population



Ans. The change in the frequency of a gene that occurs merely by Chance rather than selection in small populations is known as genetic drift or Sewall Wright effect.

Founder Effect: If a small group of members from a population start a new colony in an isolated region, those members are known as founders of the new population.

The allelic frequencies of their descendants are similar to those of the founders rather than to their ancestral parent population.

E.g. Appearance of O^{+ve} blood group in nearly 100% among Red-Indians. It means the forefathers of the Red Indian tribe were predominantly O^{+ve} and they isolated themselves reproductively from other populations.

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