

# The Origin of Life & Evidences of Evolution

## 1 Mark Questions

**1. Why are analogous structures a result of convergent evolution? [All India 2014]**

**Ans.** When two species have structures that are similar in function but differ in origin and anatomy are called analogous structures. This is because both move from different areas to a habitat where they adapt themselves accordingly, therefore it is called convergent evolution.

**2. Name the type of evolution that, has resulted in the development of structures like wings of butterfly and bird. What are such structures called? [Delhi 2014 C]**

**Ans.** Convergent evolution has resulted in the development of structures like wings of butterfly and bird and such structures are called analogous organs.

**3. State the significance of the study of fossils in evolution. [Delhi 2012]**

**Ans.** Fossils help us to know the morphological details of the organisms in the past and relate them to the organisms in the present for understanding the process of evolution. We can also trace the time at which the organism existed.

**4. State the significance of biochemical similarities among diverse organisms in evolution. [Delhi 2012]**

**Ans.** Similarities in biochemicals such as DNA, helps in deriving the line of evolution. Organisms with more similar DNA sequences are considered close relatives or have evolved from the same ancestor,

5. Write the similarity between the wing of a butterfly and the wing of a bat. What do you infer from the above, with reference to evolution? [Delhi 2012]

or

Comment on the similarity between the wings of a cockroach and the wings of a bird. What do you infer from the above, with reference to evolution? [All India 2012]

or

Comment on the similarity between the flippers of dolphin and penguins, with reference to evolution. [Foreign 2012, 2009]

**Ans.** Similarity between the wings of both the organisms is that they perform similar functions. They are thus, analogous organs. With reference to evolution, it can be inferred that these are result of convergent evolution

6. Name the scientist who disproved spontaneous generation theory. [Delhi 2010]

**Ans.** Louis Pasteur disproved the spontaneous generation theory.

7. Why are wings of butterfly and wings of bat called analogous? [Delhi 2009]

**Ans.** They are called analogous because they perform similar functions, but are dissimilar in their development and basic structure.

8. Mention the type of evolution that has brought the similarity as seen in potato tuber and sweet potato. [Delhi 2009]

**Ans.** Convergent evolution has brought the similarity as seen in potato tuber and sweet potato.

9. Are the thorn of Bougainvillea and tendrils of Cucurbita homologous or analogous? What type of evolution has brought such a similarity in them? [HOTS; Delhi 2009]

or

Are the wing of a bird and the forelimb of a horse homologous or analogous? Name the type of evolution that explains the development of such structures. [Foreign 2009]

**Ans.** They are homologous. Divergent evolution has brought this similarity in them

10. Name any two vertebrate body parts that are homologous to human forelimbs. [All India 2008]

**Ans.** Wings of birds and forelimbs of horses are homologous to human forelimb.

11. Name the placental mammals corresponding to the Australian spotted Cuscus and Tasmanian tiger cat, which have evolved as a result of convergent evolution. [All India 2008 C]

**Ans.** Australian spotted cuscus – Lemur Tasmanian tiger cat – Bob cat.

## 2 Marks Questions

12. Identify the following pairs as homologous or analogous organs:

(i) Sweet potato and potato.



**(ii) Eye of Octopus and eye of mammals.**

**(iii) Thorns of Bougainvillea and tendrils of Cucurbits.**

**(iv) Forelimbs of bat and whale. [Delhi 2014]**

**Ans.** The given pairs are identified as

- (i) Analogous organs.
- (ii) Analogous organs.
- (iii) Homologous organs.
- (iv) Homologous organs.

**13. What was proposed by Oparin and Haldane on origin of life? How did SL Miller's experiment support their proposal? [Foreign 2014]**

**Ans.** Oparin and Haldane proposed that life originated on earth spontaneously from non-living matter, i.e. organic molecules. SL Miller conducted an experiment where he created conditions similar to primitive atmosphere, in laboratory such as high temperature, reducing atmosphere consisting of  $\text{CH}_4$ ,  $\text{NH}_3$ , etc. When he created an electric discharge in the flask containing all of these at  $800^\circ\text{C}$ . Organic molecules, e.g. amino acids were formed. This supports the above hypothesis that life could have originated from organic matter.

**14. List the two main propositions of Oparin and Haldane. [All India 2013]**

**Ans.** Two main propositions of Oparin and Haldane were

- (i) The primitive atmosphere was reducing, i.e. free oxygen was absent.
- (ii) There was high temperature, high methane, ammonia and hydrogen gas in the atmosphere.

**15. Write the Oparin and Haldane's hypothesis about the origin of life on earth. How does meteorite analysis favour this hypothesis? [All India 2013]**

**Ans.** Oparin-Haldane theory states that origin of life is the result of a long series of physicochemical changes, brought about first by chemical evolution and then by biological evolution.

Analysis of meteorites also revealed the presence of similar compounds as found in the atmosphere, indicating occurrence of similar processes elsewhere in space.

**16. Write about the ancestry and evolution of bat, horse and human on the basis of a comparative study of their forelimbs. What are these limbs categorised as? [Delhi 2013c]**

**Ans.** Bat, horse and human (all mammals) share similarities in the pattern of bones of forelimbs. Though these forelimbs perform different functions in these animals, they have similar anatomical structure, i.e. all of them have humerus, radius, ulna, carpals, metacarpals and phalanges in their forelimbs.

**17. Divergent evolution leads to homologous structures. Explain with the help of an example. [All India 2011 C]**

**Ans.** Divergent evolution is a process where the same structure develops along different directions in different organisms due to adaptations to different needs. Divergent evolution leads to homologous structures, as they all have similar anatomical structure and origin, but perform different functions.

Examples, the thorn of Bougainvillea and tendrils of Cucurbita are homologous organs as both of them are modified stem which perform different functions.

**18. Convergent evolution leads to analogous structures. Explain with the help of an example. [All India 2011 c]**

**Ans.** Convergent evolution is a process of evolution, where anatomically dissimilar structures in different organisms perform similar functions.



It leads to analogous structures, in different group of organisms as they perform similar function, but are anatomically different, Example, potato (stem modification) and sweet potato (root modification), flippers of penguins and dolphins

**19. Mention the contribution of SL Miller's experiments to origin of life. [Delhi 2010]**

**Ans.** SL Miller's experiment provided experimental evidence for chemical evolution. Result of the experiment showed that the first non-cellular forms of life were created about three million years ago. Experiment also demonstrated that non-cellular biomolecule exist in the form of DNA, RNA, polysaccharides and proteins.

**20. Why are wings of butterfly and birds said to be analogous organs? Name the type of evolution the analogous organs are a result of. [Foreign 2010]**

**Ans.** Wings of butterfly and birds are analogous structures because they are morphologically different but performs same function. i.e, flying. It occurs due to convergent evolution.

**21. What is adaptive radiation? How did Darwin explained this process of evolution? [Delhi 2008 C]**

**Ans.** Adaptive radiation is the process of evolution of different species in a given geographical area starting from a point and radiating to other habitats. Darwin went to Galapagos islands and observed that there were many varieties of finches in the same island. All the varieties evolved on the island itself. Darwin reasoned that after originating from a common ancestral seed eating stock, the finches must have radiated to different geographical areas and undergone adaptive changes in their beaks enabling some to become insectivorous.

**22. (i) Explain adaptive radiation with the help of suitable example.**

**(ii) Cite an example where more than one adaptive radiations have occurred in an isolated geographical area. Name the type of evolution your example depicts and state why it is so named? [All India 2014]**

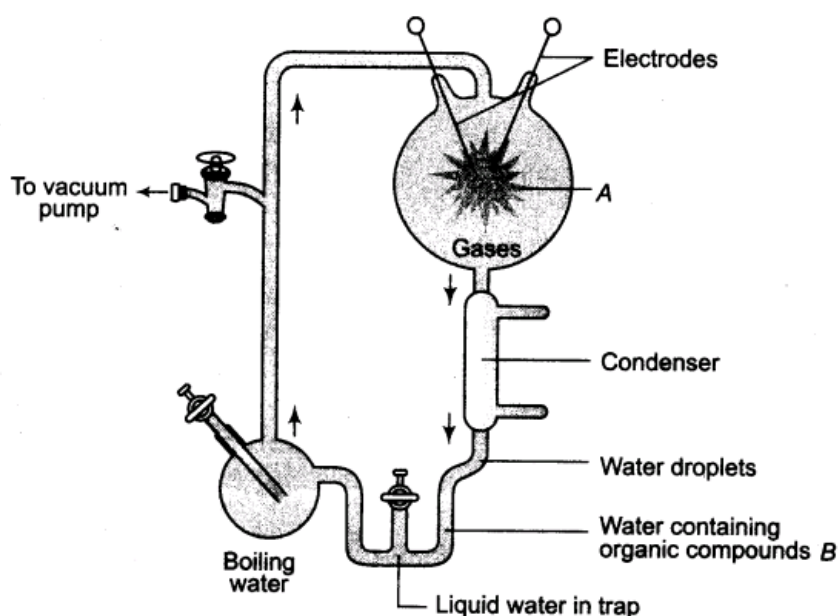
**Ans. (i)** The process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas or habitat is called adaptive radiation such as alterations in beaks of finches on Galapagos island.

**(ii)** An example where more than one adaptive radiations have occur in an isolated geographical area is Australian Marsupials, where a number of different marsupials evolved from an ancestral stock but within the isolated Australian island, but adapted to different habitats, e.g. Tasmanian wolf (marsupial) and placental wolf (placental mammals).

The above cited example depicts convergent evolution as these marsupials show development of similar adaptive functional structures in unrelated groups of organisms

### 3 Marks Questions

**23. Given below is a diagrammatic representation of the experimental set-up used by SL Miller for his experiment**



(i) Write the names of different gases contained and the conditions set for the reaction in the flask A.

(ii) State the type of organic molecule he collected in the water at B. [Delhi 2013C]

(iii) Write the conclusion he arrived at. [Foreign 2011]

**Ans.** (i) Gases are methane, ammonia, hydrogen and water vapour. In 'A' flask electric discharge is created using electrodes.

(ii) The organic molecules collected in water at 'B' are amino acids.

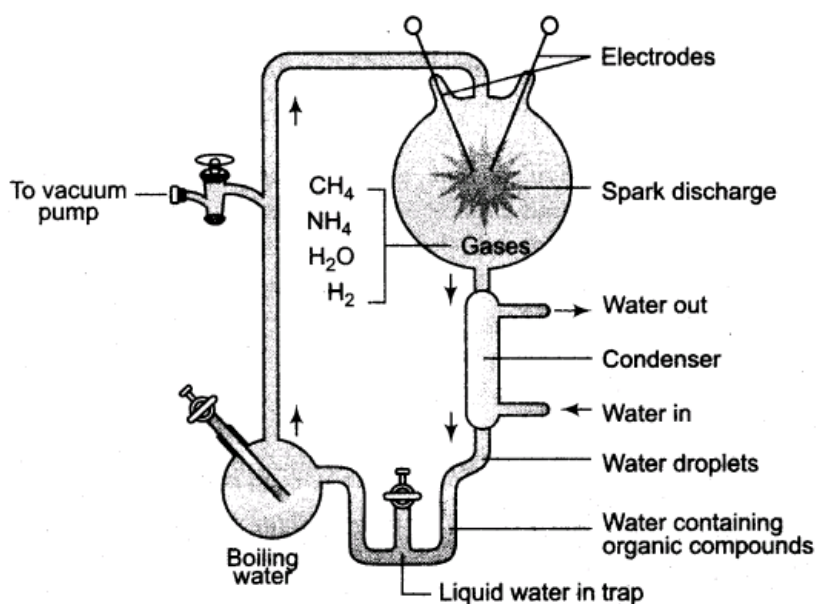
(iii) He concluded that life could have come from pre-existing non-living organic molecules and their formation was preceded by chemical evolution.

24. State the theory of biogenesis. How does Miller's experiment support this theory? [Delhi 2012]

or

State the views of Oparin and Haldane on evolution. How does SL Miller's experiment support their views? [Delhi 2011 c]

**Ans.** The theory of biogenesis was proposed by Oparin and Haldane. It states that life could have come from pre-existing non-living organic molecules (e.g. RNA, protein, etc.) and that formation of life was preceded by chemical evolution, i.e. formation of diverse organic molecules from inorganic constituents.



Diagrammatic representation of Miller-Urey experiment

In 1953, Urey and Miller conducted an experiment to prove this theory. They created the



conditions of primitive earth-high temperature, volcanic storms, reducing atmosphere containing  $\text{CH}_4$ ,  $\text{NH}_3$ , etc. at laboratory scale. They then stimulated electric discharge in a closed flask containing  $\text{CH}_4$ ,  $\text{H}_2$ ,  $\text{NH}_3$  and water vapour at  $800^\circ\text{C}$ . They observed formation of amino acids. In similar experiments, others observed formation of sugars, nitrogen bases, pigment and fats. These small organic molecules are the building blocks for proteins and other components. Hence, this experiment supported that life has come from pre-existing non-living organic molecules

**25. Convergent evolution and divergent evolution are the two concepts explaining organic evolution. Explain each one with the help of an example. [Foreign 2011; Delhi 2010]**

**Ans.** Divergent evolution is a process where the same structure develops along different directions in different organisms due to adaptations to different needs. Divergent evolution leads to homologous structures, as they all have similar anatomical structure and origin, but perform different functions.

Examples, the thorn of Bougainvillea and tendrils of Cucurbita are homologous organs as both of them are modified stem which perform different functions.

Convergent evolution is a process of evolution, where anatomically dissimilar structures in different organisms perform similar functions.

It leads to analogous structures, in different group of organisms as they perform similar function, but are anatomically different, Example, potato (stem modification) and sweet potato (root modification), flippers of penguins and dolphins

**26. Explain adaptive radiation and convergent evolution by taking example of some of Australian marsupials and Australian placental mammals. [Foreign 2010]**

or

**Australian marsupials and placental mammals are suitable examples of adaptive radiation and convergent evolution. Explain giving reasons. [All India 2010 c]**

or

**(i) What is adaptive radiation?**

**(ii) Explain with the help of a suitable example, where adaptive radiation has occurred to represent convergent evolution. [Delhi 2009 c]**

**Ans.** The process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas of geography (habitat) is called adaptive radiation.

Australian marsupials are a good example.

Many Australian marsupials, each different from the other, e.g. kangaroo, sugar glider, etc. evolved from a common ancestral stock, but all within the Australian island continent.

When more than one adaptive radiation occur in an isolated geographical area, it can be called as convergent evolution.

Australian placental mammals also show adaptive radiation in evolving into varieties of such placental mammals, each one of which appear similar to a corresponding marsupial, e.g. placental wolf and Tasmanian wolf, anteater and numbat, etc.

**27. Anthropogenic action hasten evolution. Explain with the help of suitable example. [Foreign 2010]**

**Ans.** Human activities' i.e. anthropogenic action are found to enhance evolution.

For example,

(i) Excessive use of DDT as a fertiliser in crops resulted in evolution of DDT resistant mosquitoes.

(ii) Evolution of antibiotic resistant microbes occur due to overuse of antibiotics.

- When DDT was used first time, many mosquitoes died, but few survived.
- Survived mosquitoes showed resistance to DDT and reproduced in presence of DDT.

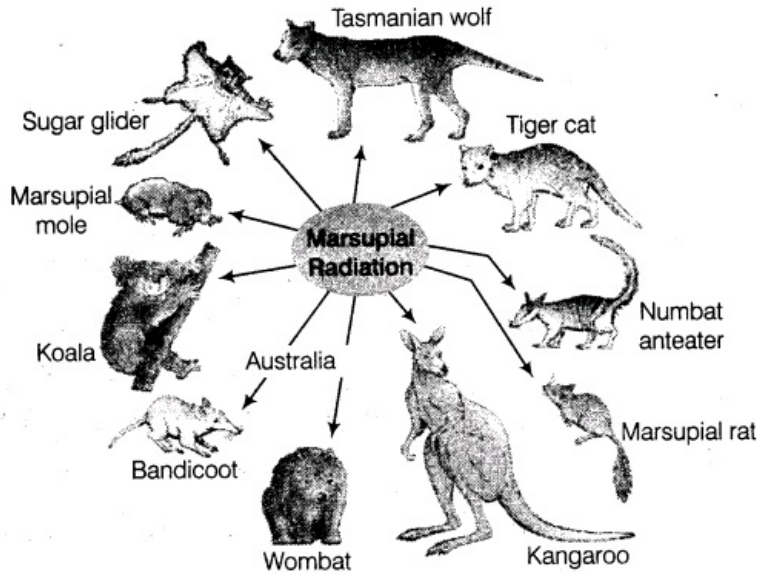


- Offspring produced by these mosquitoes were also resistant to DDT.
- Hence, DDT is not effective on mosquito population today

28.(i) Mention the specific geographical region, where these organisms are found.

(ii) Name and explain the phenomenon that has resulted in the evolution of such diverse species in the region.

(iii) Explain giving reasons the existence of placental wolf and Tasmanian wolf sharing the same habitat. [Delhi 2009]



Ans.(i) Australia

(ii) The phenomenon responsible for evolution to such diverse species in the region is the adaptive radiation. It is evolutionary phenomenon in which different species are evolved in a given geographical area starting from a point and literally radiating to other habitats in that area.

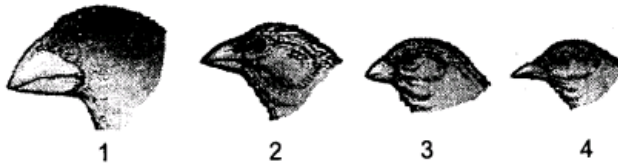
(iii) Tasmanian wolf and placental wolf share same habitat since, they exhibit adaptive radiation and evolved into varieties.

29.(i) Write your observations on the variations seen in the Darwin's finches shown below.

(ii) How did Darwin explain the existence of different varieties of finches on Galapagos islands? [All India 2009]

or

Darwin observed a variety of beaks in small black birds inhabiting Galapagos islands. Explain what conclusion did he draw and how? [All India 2009]



Ans.(i) Darwin's finches show variations in beaks due to adaptation to different food habits.

(ii) Darwin's explanation

- All the varieties must have evolved within the same island itself. The original finches were seed-eating. From them, some arose with altered beaks as insectivorous and some as vegetarian finches.
- This process of evolution of different species in a given geographical area starting from a point and radiating to other habitats is called adaptive radiation.

30. The study of

**(i) fossils of dinosaurs.**

**(ii) forelimbs of cheetah, bat, whale and human.**

**(iii) thorns of Bougainvillea and tendril of Cucurbita.**

**Shows that evolution of life forms has indeed taken place on earth. Explain. [All India 2008 C]**

**Ans.**(i) **Fossils of dinosaurs** provide palaeontological evidences for evolution. Different aged rock sediments contain fossils of different life forms who probably died during the formation of the particular sediment. Some of them appear similar to modern organisms. They represent extinct organisms (e.g. dinosaurs).

(ii) **Forelimbs of cheetah, bat, whale and human** provide evidences from comparative anatomy and morphology. These organisms share similarities in the pattern of bones of forelimbs. Though these forelimbs perform different functions in these animals, they have similar anatomical structure.

(iii) **Thorns of Bougainvillea and tendril of Cucurbita** provide evidences from comparative anatomy and morphology. The thorns of these plants represent homology. They are not anatomically similar structures, though they perform similar functions. Hence, analogous structures are a result of convergent evolution.

These evidences indicate that the evolution of life forms has indeed taken place on earth

