

CHAPTER 7

EVOLUTION

POINTS TO REMEMBER

Artificial Selection : It is the process carried out by man to select better breeds of plants and animals.

Bio-geography : The study of patterns of distribution of plants and animals in different parts of earth.

Founders Effect : A genetic drift in human population where a population in a new settlement have different gene frequency from that of the parent population. The original drifted population said to be founder.

Gene Pool : Sum total of all the genes in a population.

Genetic Drift : Chance elimination of genes of certain traits from a population due to migration or death.

Panspermia : Units of life in the form of so called spores, which were transferred to earth from outer space (as believed by some scientists).

Saltation : Single step large mutations.

Speciation : It is the formation of new species from the pre-existing ones.

Organic (Biological) Evolution : Changes in the characteristics/features of organisms or groups of such populations over a number of generations.

Homologous organs : These have same basic structure and embryonic origin but perform different functions in different species.

Analogous organs : These organs are different in their basic structure and embryonic origin but perform similar functions.

Human Evolution : *Ramapithecus* → *Australopithecus* → *Homo habilis* → *Homo erectus* → *Homo sapiens* → *Homo sapiens sapiens*.

The Theories of Origin of Life

1. **Theory of Special Creation** : According to this theory God has created life within 6 days.

2. **Theory of Spontaneous Generation** : According to this theory life originated from decaying and rotting matter like straw and mud.
3. **Panspermatic Theory** : According to this theory life come from space in the form of spores called 'Panspermia'.
4. **Modern Theory or Oparin-Haldane Theory** : According to this theory life originated upon earth spontaneously from non-living matter. First inorganic compounds then organic compounds were formed in accordance with ever changing environmental conditions. This is called chemical evolution. The conditions on earth were – high temperature, volcanic storms, reducing atmosphere (without free oxygen) containing methane and ammonia.

Experimental Evidence for Abiogenesis (Miller's Experiment) :

Stanley Miller in 1953 demonstrated in a laboratory that electric discharges can produce complex organic compounds from a mixture of methane, ammonia, water vapours and hydrogen. In his experiment he found that simple organic compounds including some amino acids are formed. In similar experiments others observed the formation of sugar, nitrogen bases, fats and pigments.

Divergent evolution : It shows relationship of structures having same origin but perform different functions. It is called homology. Examples : (i) Wings of a bird, forelimbs of horse, flippers of whale. (ii) Thorns of Bougainvillea and tendrils of cucurbita.

Convergent evolution : This shows the relationship of structures having functional similarities but different origin. It is called analogy. Examples : (i) Wings of insects and wings of bird. (ii) Sweet potato and potato.

Industrial melanism : It is an adaptation where moths living in the industrial area developed melanin pigments to match their body colour to the tree-trunk. Before Industrialisation in England, it was observed that there were more white-winged moths on trees than dark-winged moths (melanised moths). After industrialisation (in 1920), there were more dark-winged moths in some areas. After industrialisation, trees got covered by smoke. So white-winged moth were picked up by the birds but dark-winged moths escaped and survived. Thus, industrial melanism supports the evolution by natural selection.

Adaptive radiation : The process of evolution of different species in a geographical area starting from a point and literally radiating to other habitats is called adaptive radiation. Examples : (i) Darwin's finches found in Galapagos island. (ii) Marsupials of Australia.

Evolution of Plants : Unicellular → Multicellular → Algae → Rhynia type plants → Cycads → Gnetales → Dicot → Monocot.

Hardy-Weinberg Principle : The allele frequencies in a population are stable and is constant from generation to generation. Sum total of all the allele frequencies is 1.

Factors Affecting Hardy-Weinberg Equilibrium : Gene migration, Genetic drift, Mutations, Recombination, Natural Selection.

Some Facts :

- The Universe is about twenty billions years old.
- Earth was formed about 4.5 billion years ago.
- Life started appearing about 4 billion years earlier.

QUESTIONS

VSA (1 MARK)

1. Name one fish like reptile that evolved from land reptile about 200 million years ago?
2. For a long time, it was believed that life originated from decaying matter. What is this theory known as? Name the scientist who experimentally disproved this theory.
3. If abiotic origin of life is in progress on a planet other than earth, what should be the conditions there?
4. Name the person who proposed that population tends to increase geometrically while food production increases arithmetically.
5. Name the scientist who had also come to similar conclusion as that of Darwin about natural selection as a mechanism of evolution. Which place did he visit to come to conclusions?

SA-II (2 MARKS)

6. Explain Oparin-Haldane theory of chemical evolution of life.
7. Distinguish between convergent and divergent evolution giving one example of each.
8. What is adaptive radiation? Explain with an example.
9. How did Louis Pasteur disprove spontaneous generation theory?

SA-1 (3 MARKS)

10. (i) State the Hardy-Weinberg principle.
 (ii) When there is a disturbance in the Hardy-Weinberg equilibrium, what would it result in?
 (iii) According to this principle, what is the sum total of all allelic frequencies?
11. Classify the following as examples of homology and analogy–
 (i) Hearts of fish and crocodile
 (ii) Wings of butterfly and birds
 (iii) Eyes of Octopus and Mammals
 (iv) Tubers of potato and Sweet potato
 (v) Thorns of *Bougainvillea* and spines of *Opuntia*
 (vi) Thorn of *Bougainvillea* and tendrils of cucurbits.
12. Stanley Miller and Harold Urey performed an experiment by recreating in the laboratory the probable conditions of the atmosphere of the primitive earth.
 (i) What was the aim of the experiment?
 (ii) In what forms was the energy supplied for chemical reactions to occur?
 (iii) For how long was the experiment run continuously? Name two products formed.
13. 'Industrial Melanism' in peppered moth is an excellent example of 'Natural selection'. Justify the statement.
14. Fill up the blanks left in the table showing Era, period and organism.

Era	Period	Organisms
Cenozoic	a	Modern man, Mammals, Birds, rise of monocot
	b	Tertiary
Mesozoic	c	Rise of first Primate, angiosperm
	d	Gingko, Gnetales
Paleozoic	e	Jurassic
	f	Conifers, cycads, Reptiles
		Early reptiles (extinct)
		Silurian
		Psilophyton

15. (i) In which part of the world, Neanderthal man lived?
 (ii) What was his brain's capacity?
 (iii) Mention the advancement which Neanderthal man showed over *Homo erectus*.

16. Figures given below are of Darwin's finches?



Variety of beaks of Darwin's finches.

- Mention the specific geographical area where these were found.
 - Name and explain the phenomenon that has resulted in the evolution of such diverse species in the region.
 - How did Darwin visit the particular geographical area?
17. Give examples to show evolution by anthropogenic action.

LA (5 MARKS)

- Is evolution a 'process' or the end result of a 'process'? Discuss. Describe various factors that effect Hardy-Weinberg equilibrium.
- How do Darwin and Hugo de Vries after regarding Mechanism of Evolution?
- With the help of suitable diagram, represent the operation of natural selection on different traits.

ANSWERS

VSA (1 MARK)

- Ichthyosaurs.**
- Theory of Spontaneous generation; Louis Pasteur.
- Very high temperature, volcanic storms, Reducing atmosphere containing CH_4 , NH_3 , H_2 and water vapours.
- Thomas Malthus.
- Alfred Wallace, Malay Archipelago
- The first life form could have come from the pre-existing, non-living organic molecules (like RNA, Proteins, etc.) and the formation of life was preceded by chemical evolution.
- Refer page 130, 131, NCERT Text book, Biology - XII
- Refer page 133, NCERT book, Biology - XII

9. Louis Pasteur showed that in pre-sterilized flasks, life did not come from killed yeast while in another flask open to air, new organisms arose from 'killed yeast.

SA-I (3 MARKS)

10. (i) The allele frequency in a population are stable and constant from generation to generation.
(ii) Evolution.
(iii) One.
11. (i) Homology (ii) Analogy (iii) Analogy (iv) Analogy
(v) Analogy (vi) Homology
12. (i) To prove Oparin's theory of origin of life.
(ii) Electric discharge using electrodes.
(iii) One week; Amino acids and Sugar.
13. Refer Page 131, NCERT Text book of class XII.
14. (a) Quaternary (b) Coenozoic (c) Cretaceous
(d) Mesozoic (e) Carboniferous (f) Paleozoic
15. (i) Near Eastern and Central Asia
(ii) 1400 c.c.
(iii) More brain capacity, use of hides to cover body and burial of dead.
16. (a) Galapagos Island.
(b) Adaptive radiation – Refer page 133, NCERT book.
(c) Through sea voyage in a sail ship called H.M.S. Beagle.
17. Excess use of herbicides pesticides etc. has resulted in selection of resistant varieties in a much lesser time scale. Same is true for antibiotic or drug resistant microbes.

LA (5 MARKS)

18. Refer page 135, NCERT Text book, Biology - XII
19. Darwin : Darwinian variations are gradual, small and directional
Hugo deVries : put forth idea of mutations, mutations are sudden random and directional
20. Refer page No. 136, NCERT Text book of class XII.