Textbook
Chapter No.

05 Origin and Evolution of Life

Subtopics

HMS Beagle in the straits of Magellan

It was Darwin's experience as a naturalist on the voyage of the Beagle, a five-year surveying expedition around the world, that led up to his life-work on evolution.

Quick Review

ORIGIN OF LIFE

Big Bang Theory

According to this theory, the universe came into existence with a single titanic explosion about 15 billion years ago.

Theory of Special Creation

All living beings on the earth were created by supernatural power.

Cosmozoic Theory

- Also known as Panspermia Theory.
- Life on the earth came from a distant planet in the form of spores or micro-organisms.

Theory of Abiogenesis

- Also called the 'Theory of Spontaneous generation'.
- Life originated from non-living material spontaneously, without any interruption.

Microsphere Theory

- In 1959, Dr. Sidney Fox performed experiments by stimulating prebiotic environmental conditions in the laboratory.
- The heated amino acids polymerized into protein-like droplets called **proteinoids.**
- These aggregated into spherical colloidal droplets → **Microspheres**

Theory of Biogenesis

- Living organisms are always produced from pre-existing living forms.
- This theory could not explain origin of first life.

Theory of Chemical Origin of Life

- Proposed by Oparin and Haldane.
- According to this theory, life originated from non-living matter, initially by chemical evolution followed by biological evolution.

Steps involved:

- Origin of Earth and its primitive atmosphere.
- Formation of ammonia, water and methane.
- Synthesis of simple organic compounds.
- Formation of complex organic compounds.
- Formation of nucleic acid.
- Formation of Protobiont or precells.
- Formation of First Cell.
- Biological evolution.

ORGANIC EVOLUTION

Gradual and continuous development of present day complex forms of life on earth from their simple pre-existing form in the past.

Theories

Biological Evidences

Theory of Origin of Species

- Also known as Darwin's Theory of Natural Selection.
- Proposed by Charles Darwin.

It is based on the following points:

- Over-production
- Struggle for existence
- Organic Variations
- Survival of the fittest (Natural Selection)
- Origin of new species

Mutation Theory

- Proposed by Hugo de Vries.
- Evolution is a jerky and discontinuous process.
- Raw material for evolution → New varieties of species formed by mutations or discontinuous variations.

Modern Synthetic Theory

- Julian Huxley proposed the term 'Modern Synthesis'.
- Main contributors of this theory → Huxley, Simpson, Fisher, Haldane, Dobzhansky, Stebbins, Sewall Wright.
- This theory explains evolution in terms of genetic changes in population leading to origin of new species.

Three main concepts:

- **Genetic variations** → Gene mutations, Gene flow, Genetic drift, Genetic recombinations and Chromosomal aberrations.
- **Natural selection**
- **Isolation** → Geographical, Reproductive.

Palaeontological

- **Palaeontology** → Study of fossils.

Types of fossils:

- **Actual remains** → Most common. Generally embedded in permafrost of arctic or alpine snow.
- **Moulds** → The hardened encasements formed in the outer parts of organic remains which later decayed leaving cavities.
- **Casts** → Hard, mineral filled cavities of moulds.
- **Compressions** → Internal structure is absent but thin carbon film indicates the outline of external features.

Anatomical Evidences

- **Anatomy** → Study of internal structure of an organism.
- **Analogous organs** → Have different origin but perform same function; lead to convergent evolution.
  e.g. Wings of bird and wings of insects.
- **Homologous organs** → Have similar basic structural plan of development but differ in functions; lead to divergent evolution.
  e.g. Wings of birds and forelimbs of humans.
- **Vestigial organs** → Non-functional to the possessor but functional in the ancestors.
  e.g. Vermiform appendix, Coccyx, Nictitating membrane (in humans).

Connecting Links

- Organisms sharing common characters of two groups.
- e.g. *Archaeopteryx* → Aves and Reptiles
  Seymouria → Amphibians and Reptiles

Embryological Evidences

A comparative study of the development in different sexually reproducing organisms indicates common developmental pattern in the early embryonic stages of all vertebrates.

Molecular Evidences

- Cell forms the basic structural and functional unit of life in all living organisms.
- Various cell organelles like Mitochondria, Golgi bodies, Endoplasmic Reticulum are present in all organisms.
- ATP is the energy currency in all living organisms.

HUMAN EVOLUTION