Origin Life Evidence

Theories of Origin of Life

Several theories explain how life began on Earth. The **Abiogenesis** theory suggested life arose spontaneously from non-living matter, but was disproved by Louis Pasteur who demonstrated life comes from pre-existing life. The **Biogenesis** theory states life originates only from existing life forms. The **Cosmic Theory** or Panspermia proposes life came to Earth from spores in space. The **Special Creation** theory attributes life to a supernatural creator. The **Chemical Evolution** theory by Oparin and Haldane suggests life formed gradually from inorganic molecules through chemical reactions.

Urey-Miller Experiment

This experiment simulated early Earth conditions with gases like methane, ammonia, hydrogen, and water vapor, and electric sparks to mimic lightning. It produced amino acids and organic compounds, supporting chemical evolution as a plausible origin of life.

Evidence of Evolution

Evolution is supported by multiple evidences including fossils, comparative anatomy, embryology, molecular biology, and biogeography. Fossils show changes over geological time. Homologous organs indicate common ancestry, while analogous organs show convergent evolution. Embryological similarities suggest relatedness. Molecular similarities in DNA and proteins confirm evolutionary relationships. Adaptive radiation demonstrates species diversification from common ancestors.

Solved Examples

Example 1

Select two pairs from the following that exhibit divergent evolution. Give reasons for your answers.

(i) Forelimbs of cheetahs and mammals

(ii) Flippers of dolphins and penguins

(iii) Wings of butterflies and birds

(iv) Forelimbs of whales and mammals

Answer: The pairs exhibiting divergent evolution are:

(i) Forelimbs of cheetahs and mammals

(iv) Forelimbs of whales and mammals

These pairs have similar bone structures but perform different functions, indicating they evolved from a common ancestor but adapted differently to their environments.

Practice Set

- **Level 1:** Define homologous and analogous organs with examples.
- **Level 2:** Explain the significance of the Urey-Miller experiment in understanding the origin of life.
- **Level 3:** Discuss how fossil evidence supports the theory of evolution, citing specific examples.

Answer Key

Level 1: Homologous organs have similar structure but different functions (e.g., human hand and bat wing). Analogous organs have similar functions but different structures (e.g., wings of insects and birds).

Level 2: The Urey-Miller experiment demonstrated that organic molecules necessary for life could form under early Earth conditions, supporting chemical evolution as a plausible origin of life.

Level 3: Fossils provide chronological evidence of species changes over time. For example, Archaeopteryx shows traits of both reptiles and birds, indicating transitional forms in evolution.

Evolution Theories Mechanisms

Darwinism and Natural Selection

Charles Darwin proposed natural selection as the mechanism of evolution, where organisms better adapted to their environment survive and reproduce. This leads to

gradual changes in populations over generations.

Modern Synthetic Theory

This theory combines Darwinian natural selection with Mendelian genetics, explaining evolution as changes in allele frequencies within populations due to mutation, genetic recombination, genetic drift, natural selection, and isolation.

Hardy-Weinberg Principle

This principle states that allele frequencies in a large, randomly mating population remain constant if no evolutionary forces act. Deviations indicate evolution.

Solved Examples

Example 2

Write two differences between Homo erectus and Homo habilis.

Answer:

- Homo erectus had a larger brain capacity (900 cc) compared to Homo habilis (650-800 cc).
- Homo erectus walked upright with good posture, while Homo habilis had a stooped gait.

Practice Set

- **Level 1:** What is natural selection and how does it affect populations?

- **Level 2:** List the five factors that can disturb Hardy-Weinberg equilibrium.
- **Level 3:** Explain the difference between stabilizing, directional, and disruptive selection with examples.

Answer Key

Level 1: Natural selection is the process where individuals with favorable traits survive and reproduce more, changing population traits over time.

Level 2: The five factors are gene migration, genetic drift, mutation, genetic recombination, and natural selection.

Level 3: Stabilizing selection favors average traits, reducing variation; directional selection favors one extreme trait, shifting the population; disruptive selection favors both extremes, creating two distinct groups.

Quick Reference Table

Common Mistakes and Misconceptions

Glossary