UNIT 4

EVOLUTION

What is Evolution?

- The change in genetic composition of a population over successive generations, which may be caused by **meiosis**, **hybridization**, **natural selection** or **mutation**.
- This change leads to a sequence of events by which the population diverges from other populations of the same species and may lead to the origin of a new species.

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The Origin of Life

- Five main theories

1. Special Creationism

- linked to religion.
- some supreme being created life on Earth.
- It has many different versions.

A. Young Earth Creationism

- The earth is only a few thousand years old
- Created in six 24 – hour days

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B. Old Earth Creationism

- The Earth is very old.
- All life was created by God.

C. Day – age and gap creationism

- Much longer than six Earth days and the 'days' are just symbolic.
- A large gap between the formation of the Earth and the creation of all animals and humans.

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D. Progressive Creationism

- accepts Big Bang as the origin of the universe.
- accepts fossil record but does not accept these as part of a continuing process.
  - ➢ modern species are not seen as being genetically related to ancient ones.

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E. Theistic Evolution

- God 'invented' evolution and takes some form of an active part in the ongoing process of evolution.

F. Intelligent design

- the newest version.
- life developed due to a combination of natural forces and the intervention of a supernatural being.

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2. Spontaneous generation

- life can evolve 'spontaneously' from non – living objects.
- What about the very first cell?
- Disproved finally by Louis Pasteur

3. Eternity of life

- No beginning no end to life on Earth.
- Life is an inherent property of the universe and has always existed.

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4. Cosmozoan theory

- Life on earth originally came from elsewhere in the universe.
  - ➢ lacks evidence
  - ➢ linked to 'eternity of life'
- Panspermia – Organic compounds arrived from outer space.

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5. Biochemical Theory (Abiogenesis)

- Life on earth originated as a result of a number of biochemical reactions producing organic molecules which associate to form cells.
- This idea was put forward by two biologists: John Haldane and Aleksandr Oparin.

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i. The primitive atmosphere of the earth was reducing.

ii. There was an appropriate supply of energy.

iii. Provision of energy for the reactions that formed organic compounds.

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Oparin's idea on the origin of life

- Simple organic compounds could have undergone a series of reactions leading to more and more complex molecules.
- The molecules might have formed coacervates in aqueous environment.
- The coacervates were able to absorb and assimilate organic compounds from the environment.
  - ➢ First true cell evolved.

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Haldane's idea on the origin of life

- Primitive sea served as a vast chemical laboratory powered by solar energy.
- The sea became a 'hot dilute soup' of organic monomers and small polymers.
  - ➢ Prebiotic soup.

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Evidence

- Stanley Miller (1953) conducted spark discharge experiment.

1. He passed electric sparks repeatedly through a mixture of CH_4,NH_3,H_2O and H_2.
2. The liquid in the water trap contained a number of simple organic molecules.
3. A large variety and more complex organic molecules were formed.

- Amino acids, Pentose sugars, Hexose sugars & HCN.

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Problems of the biochemical Theory

1. Why only 'left – handed' amino acids are found in living things?
2. Purines and pyrimidines are not synthesized under the same conditions.
3. Unable to demonstrate polymerisation.

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Stages in explaining the origin of life

i. The origin of biological monomers

ii. The origin of biological polymers

iii. The evolution from molecules to cell

How did autotrophs evolve on earth?

- The first organisms were prokaryotes and had RNA.

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- They gave rise to 3 distinct lines:
  i. Archaebacteria
  ii. Eubacteria
  iii. Eukaryotes
- Shift from the reducing to oxidizing atmosphere 2.4 billion years ago.

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- Cyanobacteria had been producing O_2 by photosynthesis.
  - Use phycocyanin & are photoautotrophs.
  - Made aerobic respiration possible.
- Some of the first organisms to inhabit were chemo-autotrophs.

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