

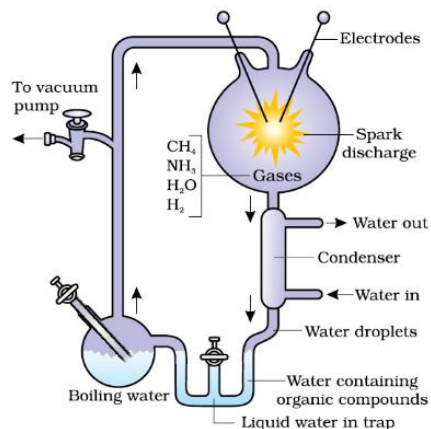
7. EVOLUTION

ORIGIN OF LIFE

Urey-Miller experiment

- **Harold Urey & Stanley Miller** experimentally proved theory of chemical evolution. They created a condition like that of primitive earth (i.e. high temperature, volcanic storms, reducing atmosphere with CH₄, NH₃, H₂O, H₂ etc).
- They made electric discharge in a closed flask containing CH₄, NH₃, H₂ and water vapour at 800°C. As a result, some amino acids are formed.

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EVIDENCES FOR EVOLUTION

a. Homologous organs

- **Homologous organs** are the organs having fundamentally similar structure and origin but different functions. This phenomenon is called **Homology**.
- E.g. Human hand, Whale's flippers, Bat's wing & Cheetah's foot. These forelimbs have different functions but similar anatomical structures such as bones (e.g. humerus, radius, ulna, carpals, metacarpals & phalanges).
- Homology is also seen in heart, brain etc.
- **Homology in plants:** E.g. Thorns of *Bougainvillea* and tendrils of *Cucurbita*.
- The origin of homologous organs is due to **Divergent evolution**. It is the evolution by which **related species** become **less similar** to survive and adapt in different environmental condition.
- Homology indicates common ancestry.

b. Analogous organs

- These are the organs having similar function but different structure & origin. This phenomenon is called **Analogy**. E.g.
- **Wings of insects** (formed of a thin flap of chitin) and **wings of birds** (modified forelimbs).

- **Eyes of Octopus** (retina from skin) and **mammals** (retina from embryonic brain).
- **Flipper of Penguins and Dolphins**.
- **Sweet potato** (modified root) & **Potato** (modified stem).

Origin of analogous organs is due to **Convergent evolution**. It is the evolution by which **unrelated species** become more **similar** to survive and adapt in similar environmental condition.

Evidences for evolution by natural selection

Industrial melanism: In England, before industrialization, there were more white-winged moths on trees than dark winged (melanised) moths. After industrialization, more dark-winged moths and less white winged moths were developed.

Reason:

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Before industrialization: There was white lichens covered the trees. In that background, white winged moths survived but dark winged moths were picked out by predators.

After industrialization: The tree trunks became dark due to industrial smoke and soot. No growth of lichens. So white winged moths did not survive because the predators identified them easily. Dark winged moth survived because of suitable dark background.

HARDY-WEINBERG PRINCIPLE

- It states that *allele frequencies in a population are stable and is constant from generation to generation.*
- E.g. Consider, in a diploid, **p** & **q** are the frequencies of alleles **A** & **a** respectively.

$$\text{Frequency of AA} = p^2$$

$$\text{Frequency of aa} = q^2$$

$$\text{Frequency of Aa} = 2pq$$

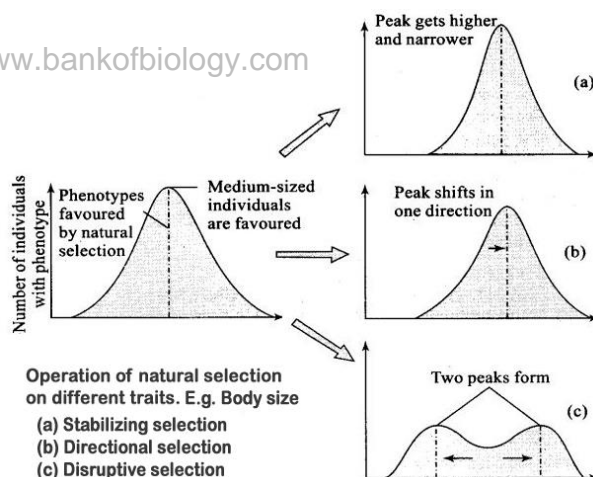
$$\text{Hence } p^2 + 2pq + q^2 = 1$$

Factors affecting Hardy-Weinberg equilibrium

- Gene migration:** Gene flow from one population to another.
- Genetic drift:** Gene flow by chance causing change in frequency.
- Mutation:** It results in formation of new phenotypes.
- Genetic recombination:** Reshuffling of gene combinations during crossing over resulting in genetic variation.
- Natural selection:** It is 3 types.
 - **Stabilizing selection:** Here, more individuals acquire mean character value and variation is reduced.

- **Directional selection:** Individuals of one extreme (value other than mean character value) are more favoured.
- **Disruptive selection:** Individuals of both extremes are more favoured.

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ORIGIN AND EVOLUTION OF MAN

Dryopithecus → *Ramapithecus* → *Australopithecines* → *Homo habilis* → *H. erectus* → *H. neanderthalensis* → *H. sapiens*

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