

THEORIES OF ORGANIC EVOLUTION

— LAMARCKISM & NEO-LAMARCKISM

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## LAMARCKISM AND NEO-LAMARCKISM.

Lamarckism is the name given to the theory of organic evolution proposed by Jean Baptist Lamarck, a French Zoologist (1744-1829). Lamarck has explained his ideas on organic evolution in the book Philosophica Zoologique, published in 1809. Lamarck's theory is popularly known as Inheritance of <sup>acquired characters</sup>. The theory of inheritance of acquired characters (Lamarckism) states that, "modifications which the organism acquires in adaptation to the environments which it meets during its lifetime are automatically handed down to its descendants, and so become part of heredity."

### Propositions of Lamarckism :-

The theory comprises of four propositions.

1. Living organisms and their parts tend to increase in size continuously due to internal forces of life.
2. Formation of a new organ in the body of organisms is the result of a new need and new involvement which this need initiates and maintains in the body.
3. If an organ is used continuously and constantly, it will tend to become highly developed, whereas disuse results in its degeneration.
4. Modifications which are acquired during the life time of an ~~id~~ individual are inherited by its offspring. It means changes are cumulative over a period of time.

The basic propositions of Lamarckism is discussed in brief as follows :-

1. New needs as a reaction to the environment :- Lamarck believed that environment plays an important role in



influencing the form of living organisms. The influence leads to change in their habits. Lamarck demonstrated several cases where individuals of the same species, grown under different environmental conditions, exhibited marked differences. He noted smaller and weaker plants in poor soil but healthy and luxuriant plants in rich soil. Several amphibious plants exhibited heterophylly, i.e. possess two types of leaves. Lamarck from such observations, assumed that living organisms react to external conditions & become modified.

2. The effects of needs :- Lamarck thought that change of habits may initiate the formation of a new organ or may bring the modification of the existing organ or structure.

3. Use and disuse :- The constant use of an organ changes its efficiency and size and leads to its better development. On the contrary if any organ is not used for a long time it leads to the reduction in efficiency and size of the organ and ultimately leads to its degeneration.

4. Inheritance of acquired characters :- All that has been acquired by the organism during its life time due to direct or indirect environmental effects is preserved by the generation and is transmitted to the offspring. In the offspring these modifications become more and more pronounced if they are exposed to similar stress to the environment as was faced by their parents or ancestors. Such cumulative effects will ultimately result in the appearance of new species.

## Examples :-

- 1) Giraffe obtained its long neck by stretching it upwards to reach the available food in the form of leaves from tall trees.
- 2) Water birds (Duck, etc.) developed their webbed feet by constant stretching of digits of the skin between them for skimming the water surface and for swimming.
- 3) Clinging birds through constant perching on the twigs or branches of the trees have developed sharp & curved digits.
- 4) Eyes are reduced in moles because they live underground.
- 5) Muscles on pinna are reduced in man but are well developed and functional in rabbit, dog, elephant, etc. because these live in jungles & use their pinna to collect sound waves from the surroundings.
- 6) Biceps muscles in the right arm of blacksmith are more developed, because of its continuous use.
- 7) The limbs are absent in snakes and other burrowing animals because these are of no use in crawling and burrowing and rather produced a hindrance. So they became gradually reduced and finally disappeared.
- 8) The whales lost their hindlimbs as the consequence of the inherited effect of disuse.



## Criticism of Lamarckism :-

Cuvier and Weismann were the great critics of Lamarckism. Some objections which even Lamarck could not answer are as follows :-

- 1) The first principle, the tendency to increase in size, has been noted in many forms, but many times evolution shows reduction in size. Moreover, persons constantly busy in reading and writing and using their eyes more than others often develop impaired sight, (instead of more efficient eyes).
- 2) The second principle that new organs develop where the organisms feel their need is also not true. If the development of new organ or structure depends upon the desire why man who has long desired to fly like birds has not developed the wings.
- 3) Lamarck explained the improvement of a character or change, but does not explain its utility in its initial stage.
- 4) His third principle reaction to the environment, may have some weight, since organisms do react to the environment but environment causes temporary changes in their organization and these changes cannot be inherited to the offsprings. Similarly it could not be understood that how use or disuse of an organ will produce a change in its size & how this change will be inherited to the offsprings.
- 5) Experiments have discarded his law of inheritance of acquired characteristics. For eg- if any parent becomes blind or deaf before producing the offsprings, they don't produce blind or deaf offsprings. The adaptive character



of plants and animals which superficially appear to be the direct result of use or disuse or effect of environment are actually of germinal origin.

6. Chinese women use iron shoes to keep their feet short but young ones at birth have normal size. A child always learns the language which his parents taught him, but never acquires it.

7. the deadliest blow to Lamarckism came from experiments conducted by Weismann. He removed the tail of mice continuously for about 22 generations and even the offspring of 22nd generation had a tail as long as in the original parents.

Weismann differentiated between changes occurring in the soma and the changes which occur in the germplasm. He established that somatic changes acquired during the life time of the organisms are non-heritable, whereas the changes occurring in the germplasm are all inherited by the offsprings.

### NEO-LAMARCKISM

A group of scientists has further studied Lamarck's theory and has supported its modified form, which is known as Neo-Lamarckism. A few of the Neo-Lamarckians are Spencer, Cope, Richard, Uells, Lawrence (1831), Naegeli, Cradock, Dali, McDougall, etc. They suggested that if not all, some of the acquired characters are inherited to some extent.



1. Bonner carried out numerous transplantation experiments within native and unnatural environments & found that variations produced were inherited to their future generations.
2. The white mice which were reared at a high temperature ( $20-30^{\circ}\text{C}$ ) by F. B. Sumner were found to develop longer body, a long tail and longer hindlimbs. And this abnormality was found to be transmitted to the offsprings generation after generation.
3. Brown Sequard described that certain diseases are caused by injuries in the restiform body of the brain & are inherited to the offsprings.
4. McDougall trained rats to follow certain 'escape routes' from a tank of water and the training was given for about 45-50 generations. It was found that there was a decrease in number of errors made in learning the problem generation after generation.
5. Deilefson showed that rats kept for several generations in cages become adapted to rotating conditions.
6. Mutagens - Muller described the role of X-rays while C. Auerbach et. al. confirmed that chemical mutagens, cause mutations in Drosophila melanogaster, both in somatic & germinal cells.

The mutations introduced in the germ cells or gametes are expressed in the offsprings generation after generation.

At present the concept of Neo-Lamarckism is :-

- 1) Developed characters (whether acquired or not) are never transmitted by heredity and the hereditary constitution of the germ is not changed by changes in such character.
- 2) Possibly the environmental stimuli act upon germ cells at an early stage in their development. This may rarely cause changes in hereditary constitution; but ~~can~~ changes produced in somatic cells, by environment, do not cause corresponding changes in the hereditary constitution of germ cells.
- 3) Germ cells may undergo modifications which are not hereditary. Such influence may be carried over to next generation without becoming hereditary. All such cases are called induction. And many instances of supposed inheritance of acquired characters come under this category.
- 4) Environment may profoundly modify individual development but it does not generally modify heredity.

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