

## Lamarckism and Neo- Lamarckism

**Lamarckism**, a theory of evolution based on the principle that physical changes in organisms during their lifetime—such as greater development of an organ or a part through increased use—could be transmitted to their offspring.

Lamarckism was proposed by Jean-Baptiste de Monet Lamarck in the year 1809. He published *Philosophie Zoologique*, in which he described a two part mechanism by which change was gradually introduced into the species and passed down through generations. His theory is alternatively referred to as the theory of transformation or simply Lamarckism. Though today Lamarck's work is considered a major step forward, in his lifetime he did not receive much recognition. This theory was based on the principle that all the physical changes occurring in an individual during its lifetime are inherited by its offspring.

An acquired character is produced by the organism's behavior, which in the wild is usually a response to the environment. Thus, the ancestral giraffes, striving to reach the leaves of trees as an alternative source of food, were able to lengthen their necks, just as a weightlifter can acquire better-developed muscles. If such characters are inherited, the next generation of giraffes would be born with longer necks and would then stretch them further. This mechanism was once popular in biology, and corresponds quite closely to how humans transmit new ideas to their descendants. But where teaching and learning provides a natural mechanism for ideas to be transmitted, modern genetics has shown that there is no way in which acquired biological characters can be inherited. Lamarckism has been banished from biology: The giraffe got its long neck because those who by chance inherited the genes producing that character reproduced faster than those who carried the genes for shorter necks. The genetic differences are the product of mutations which are random as far as the requirements of the species are concerned.

### **The four propositions of Lamarckism are as follows:**

- a. Living organisms and their parts tend to increase in size continuously due to internal forces of life.
- b. New organs are formed in the body of organisms in response to a new need. For example, in the evolution of the horse, the plantigrade type of foot changed to unguligrade foot. The ancestor of the horse lived in soft ground for which the plantigrade foot was adequate. When the soft ground in the jungle was replaced by dry hard land, the foot changed to unguligrade type that suited running on hard ground.
- c. If an organ is used continuously and constantly, it tends to be highly developed, whereas misuse results in degeneration.
- d. Changes acquired during the lifetime of an individual are inherited by its offspring.

Some examples are:

- i. Aquatic birds develop webbed foot by stretching the skin between the toes.

ii. Limbs are absent in snakes, Proteus and some burrowing animals since they were of no use in crawling and were a hindrance in movement.

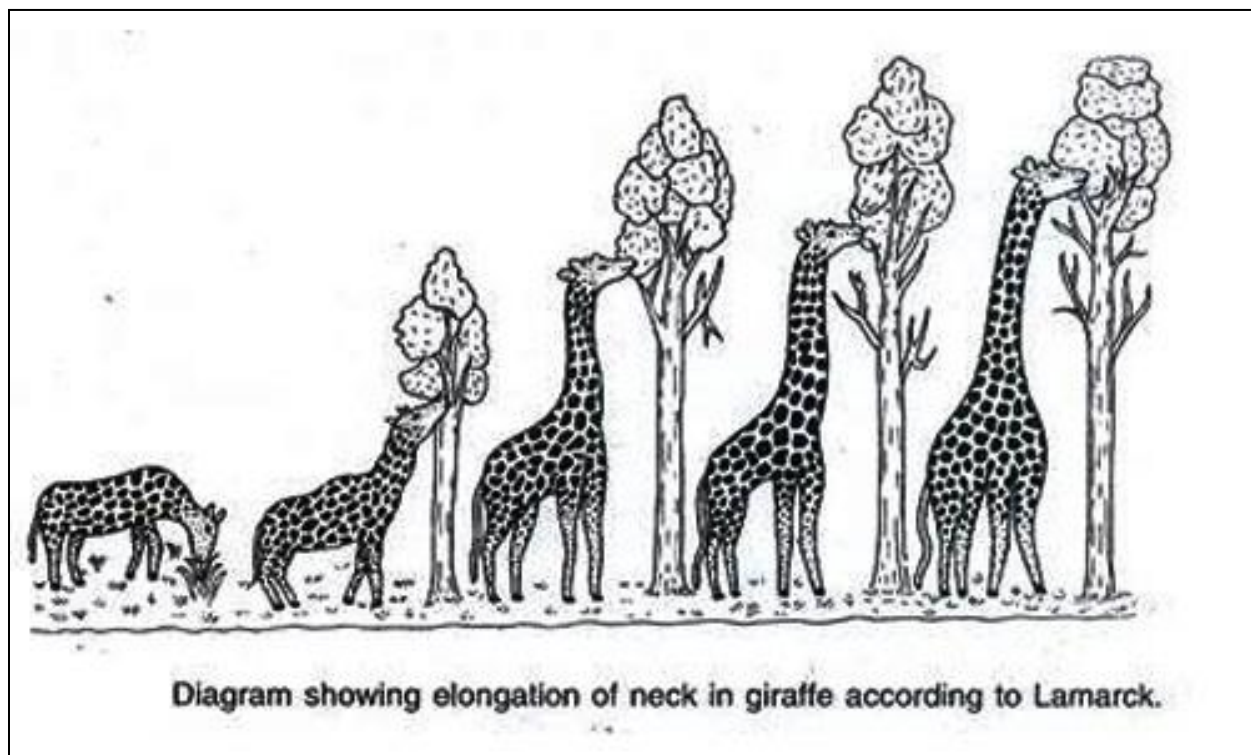
iii. The long neck of the giraffe developed due to constant stretching to reach food.

iv. The muscles of the external ear or pinna in man are reduced but functional and well developed in animals like the dog, rabbit etc. to collect sound waves.

### Use and Disuse

The classic example used to explain the concept of use and disuse is the elongated neck of the giraffe. According to Lamarck's theory, a given giraffe could, over a lifetime of straining to reach high branches, develop an elongated neck. A major downfall of his theory was that he could not explain how this might happen, though he discussed a "natural tendency toward perfection." Another example Lamarck used was the toes of water birds. He proposed that from years of straining their toes to swim through water, these birds gained elongated, webbed toes to better their swimming.

These two examples demonstrate how use could change a trait. By the same token, Lamarck believed that disuse would cause a trait to become reduced. The wings of penguins, for example, would be smaller than those of other birds because penguins do not use them to fly.



### Lamarckian Inheritance

The second part of Lamarck's mechanism for evolution involved the inheritance of acquired traits. He believed that traits changed or acquired over an individual's lifetime could be passed

down to its offspring. Giraffes that had acquired long necks would have offspring with long necks rather than the short necks their parents were born with. This type of inheritance, sometimes called Lamarckian inheritance, has since been disproved by the discovery of hereditary genetics.

An extension of Lamarck's ideas of inheritance that has stood the test of time, however, is the idea that evolutionary change takes place gradually and constantly. He studied ancient seashells and noticed that the older they were, the simpler they appeared. From this, he concluded that species started out simple and consistently moved toward complexity, or, as he termed it, closer to perfection.

### **Criticism of Lamarckism:**

During the 1890s a revival of Lamarckian ideas became a strong component of the general upsurge in biological thought. Characteristically, the conditions and expressions of the revival varied from one country to another. Lamarck's theory was subject to severe criticism. Two scientists Cuvier and Weismann were great critics of Lamarck.

### **Some objections raised against Lamarckism are as follows:**

- a. Though the tendency to increase in size has been shown in many forms, there are also instances where there is reduction in size. For example, trees that are primitive are large in size, while the shrubs, herbs and grasses that evolved later are smaller in size.
- b. If new organs were to develop in response to a new need, then man should have developed wings by now.
- c. Changes acquired during the lifetime of an organism cannot be inherited by the offspring. For example, if a man loses his arm in war, he does not produce children without an arm. According to August Weismann, somatic changes acquired during the lifetime of the organisms are non-heritable, whereas, changes in the germplasm or reproductive cells are inheritable by the offspring.

Weisman theory is known as the theory of continuity of germplasm. August Weismann in 1904 removed the tail of mice for about 22 generations. The offspring of the 22nd generation also had a tail as long as in the original parents.

- d. Mendel's law of inheritance also disproved Lamarck's theory.

### Neo Lamarckism:

1. It is a modification of the original theory of Lamarck in order to make it more suitable to modern knowledge.
2. Neo-Lamarckism does not give any importance to these factors.
3. The theory stresses on the direct effect of changed environment on the organisms.
4. Normally only those modifications are transferred to the next generation which influence germ cells or where somatic cells give rise to germ cells.

Lamarck's 'theory of inheritance' was further studied by a group of scientists. Their ideas supporting Lamarck's opinion collectively constitute neo-Lamarckism.

The neo-Lamarckians were of the opinion that 'adaptations' are universal in nature. An adaptation happens through causal relationship of structure, function and environment. Due to changes in the environment, habits and life style of organism gets altered. Thus gradually the organism acquires new structures. The newly obtained character gradually becomes an inheritable trait. This opinion and argument is a modified form of Lamarckism. These ideas stressed direct action of environment on organisms.

#### Support to neo-Lamarckian concept - Experiments

1. McDougall (1938) tried to prove that learning is an acquired character that can be inherited. He did his experiments on rats.

He devised a 'T' shaped tank. The tank had two exits. One exit was well lighted. However at the terminal region of the exit he devised an arrangement for giving electrical shock. The pathway to the other exit was kept dark. At the terminal exit point a small piece of cheese was kept as a reward. McDougall dropped several rats into the tank. Many of the rats preferred lighted pathway to escape and at the exit they received electric shock. Those rats that preferred dark pathway received the cheese. He repeated the trial several times. Gradually many rats learnt the correct route for escape. Subsequently the rats were allowed to breed and the next generation developed.

The same experiment was repeated in the second generation. According to Mc Dougall, it was claimed that the number of mistakes committed, gradually got reduced. The speed of learning increased from generation to generation. Thus he concluded that learning is an acquired character.

However later workers found some technical mistakes in the work of Mc Dougall. The same experiment while repeated in other laboratories failed to give similar results.

2. Temperature related changes in the body of mice were noted by F.B. Sumner (1910). He reared one set of white mice in warmer temperature (20 - 30<sup>0</sup>c) and another set in cold conditions. He found that in warmer conditions the mice developed larger ears and longer tails. He further claimed that these characters were inherited.

Through similar works claim for inheritance of acquired characters were made by Lindsey, Guyer and Smith and Kammerer. In all these works while repeating, critics have found technical mistakes and rejected them outright.

However, the controversy over 'inheritance' of acquired characters still continues. This theory of Lamarck while has not been disproved totally, it remains to be proved correct.