



Evolution without Lamarck's Theory and its Use in the Darwinian Theories of Evolution

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Abstract

The first modern theory of evolution was put forward by Jean Baptist de Lamarck the inheritance of acquired structures/characters that transmits to the offspring. It has been recognized that the inheritance of acquired characters is not transmitted to the offspring. Hence Lamarck's theory can hardly be accepted in the light of modern molecular genetics that available in the present century. Darwin directly accepted the Lamarck's theory in 'the Origin of Species' (natural selection) under the heading 'the effect of use and disuse'. He also uses Lamarck's theory in 'the Descent of Man in Relation to Sex' (sexual selection theory). Consequently, Darwin's theory is less accepted by the most biologists. As a result they synthesize the modern synthetic theory of evolution (neo-Darwinism) as an alternate theory of natural selection and sexual selection.

1. Introduction

Of all theory of biology, theory of evolution is most important. It is so fundamental to biology that the science can not be understood without its (Krishnaswamy, 1971). Evolution suggests that all species of living organisms have evolved from simpler organisms over a long period of time. Human beings, like all other plants and animals, have evolved from simpler organisms (WBES, 1994). It is also declared that life arose by a natural process from non-living originators and achieved its present diversity (variety) including man (Buffaloe, 1963). However, Darwin defines evolution as descent with modification through natural selection from a few common ancestors (Darwin, 1859).

The first modern theory of evolution was forwarded by Jean Baptist de Lamarck (1744-1829), a French botanist who proposed the theory of inheritance of acquired structures, popularly known as Lamarckism. Lamarck began his career as a botanist but later became a zoologist. Lamarck published his theory in his book 'Philosophic Zoologique' in 1809. He used the term 'biology' in 1802 (Anonymous, 2011). Lamarck's theory of inheritance of acquired structures is based on four important postulates: (1) Living organisms and their organs tend continually to increase in size. (2) New organs result

from new needs and desires. (3) Those organs will develop due to use and degenerate due to disuse. (4) Modifications of structure produced by the above principles during the lifetime of an individual will be inherited by its offspring's after generation and produce new species (Lamarck, 1809; Cockrum and McCauley, 1965).

Darwin directly accepted the Lamarck's theory in his theory of natural selection as well as sexual selection. In the preface of 'the Origin of Species' Darwin (1872) writes that Lamarck attributed something to the direct action of the physical conditions of life, something to the crossing of already existing forms, and much to use and disuse, that is, to the effects of habit. To this latter agency he seemed to attribute all the beautiful adaptations in nature; such as the long neck of the giraffe for browsing on the branches of trees. Nevertheless, it is seen the *principles of natural selection shadowed forth principles of Lamarck*. Moreover, some modern biologists also still believe in the Lamarck's theory and they are known as neo-Lamarckian (Bhuya and Timm, 1973, Gerking, 1974). So, Lamarck's theory is important in biological science.

However, biologists opposed the Lamarck's theory. Storer et al. (1980) drew attention that there is no reliable evidence to support Lamarck's theory, and it has little support today.



Jordan and Verma (1990) pointed out that Lamarck's theory is unacceptable and largely rejected because the effects of environment or of use and disuse called acquired character which are never inherited. It is noted that once genetics established a firm footing in the scientific community, the Lamarck's theory was turned out to have no scientific basis in fact (Gerking, 1974). There is no evidence to support Lamarck's theory (Ritchie and Carola, 1983). However, it has been pointed out that inheritance of acquired characters in the original form can hardly be accepted in the light of knowledge of molecular genetics made available in the present century (Ritchie and Carola, 1983).

But these opposition and acceptance of Lamarck's theory in Darwinian Theory are scattered, not organized and lack of evidence. Therefore, the objective of this article was to give a clear and elaborate idea about Lamarck's theory, its causes of unacceptance as well as its uses by Darwin with concise information, organized data and compelling evidence. This paper aims to be helpful to biologists, anthropologists and students of biology.

2. Mechanism of Lamarck's Theory

To explain his theory, Lamarck used examples like the long neck of giraffe, blindness of cave dwelling animals and limblessness in snakes. The classical example to illustrate this theory is the evolution of giraffe, originally a deer like animal, finding the supply of grasses and herbs inadequate, which led them to feed on the leaves of trees. It needed greater height to reach the higher leaves, especially in times of drought when the leaves were scarce and in the process of reaching, its neck extended longer and larger to reach the leaves of trees. This stretched condition was transmitted to the next generation. In the course of time, the long neck became a more characteristic feature, and the modern giraffe was thus evolved (Lamarck, 1809; Pai, 1986). The cave-dwelling animals such as fish lost its eyes because it had no use for an organ of sight in total darkness (Altenburg, 1970; Gerking, 1974; Jordan and Verma, 1990). Furthermore, Lamarck suggested that water birds were originally terrestrial. But an ancient land bird going to seek food in water and it would spread its toes to strike water in moving about. The skin at bases of the toes would be continually extended while swimming, thereby stretching the skin between them. This stretched condition, he thought, can be inherited by the offspring, who will then further stretch their skin during their life time and also pass this along to their offspring. Thus according to Lamarck, water birds (ducks, pelican etc.) with webbed feet evolved over a number of generations (Lamarck, 1809; Storer et al.1980; Purves and Orians, 1987). In addition, according to Lamarck a snake crawling through thick bushes and grass has to stretch its

body repeatedly to pass through and has consequently become elongated, in passing through spaces the limbs were not used and they finally disappeared by continuous disuse, the tongue was put out to feel and became protrusible sensory organ to detect objects in front of the snake. The eyes become lateral the better to see when on the ground (Lamarck, 1809; Storer et al.1980; Jordan and Verma, 1990).

3. Arguments of Falseness of Lamarck's Principle by Different Biologists

After having published his theory in 1809, Lamarck was criticized for the following reasons by the contemporary biologists during his lifetime, afterwards and even today. 1. The first principle suggests the tendency to increase in size continually. But evolution proceeded not only without any increase in size rather through a reduction in size (Gupta, 1997). For example, persons constantly busy in reading and writing and using their eyes more than others often impaired sight. But their eyes might not become more efficient (Rastogi, 1994). 2. The second principle suggests that a new organ results from new needs and desires. This principle implies that if one needs to fly, one will have wings in course of time. Likewise, in case one needs eyes on the back, they would develop ultimately. These postulates are quite obviously false (Gupta, 1997). 3. The third principle suggests that organs will develop due to use and degenerate due to disuse. This principle is not correct because the question of use or disuse does not arise when the organ does not exist. Use and disuse of organs are quite impossible in case of plants as plants are unable to move, so use and disuse of organ is not possible (Rastogi, 1994). The fourth and final principle of Lamarck was that the inheritance of structures acquired during the lifetime of an individual transmits to the offspring. However, there is no evidence to support this ideology of Lamarck. Numerous experiments over last 200 years indicate that changes in body parts, shape, colour etc. acquired by parents are not transmitted to their offspring (Ritchie and Carola, 1983). Structures can only be inherited if any change is brought about in the germ cells. This principle has been tested by many biologists who have devised different types of experiments for this and found that Lamarck's theory is entirely wrong: (i) The noted German biologist August Weismann in 1892 had cut the tails (mutilation) of white mice for more than 20 generations to observe if this has any effect on tail length. The measuring of tail length of the offspring of 20 successive generations revealed that on an aggregate, the tails were not shorter. It means that the acquired character (i.e. the cut tail) was not inherited (Dobzansky, 1955; Verma and Agarwal, 1999). (ii) Loeb artificially fertilized the eggs of sea urchin by certain chemical stimuli. These parthenogenetically fertilized eggs produced offsprings

which possessed no parthenogenesis (iii) Pavlov trained mice to take food on hearing a bell. However, this character was not transmitted to the offspring. Instead, in order to develop this character, every mouse was needed to be trained similarly (Cockrum and McCauley, 1965; Bhamrah and Juneja, 1993). (iv) Payne kept *Drosophila* in dark for 76 generations but he did not find any blind *Drosophila* (Vidwarthi, 1981). (v) In 1909, the Danish botanist Johannsen (1857-1927), published results of experiments with pure-line inheritance on the size of beans. The beans were like the sweet peas used by Mendel, reproduced mostly by self-pollination. The beans, produced by a single self-fertilizing bean plant, were assumed to be pure line. When large beans were picked from a random sample, their descendants were average larger than pure-line descendants from small beans. Within each pure-line, however, there were always a range of variations in size resulting from variations in the environment (including nutrition, sunlight, temperature, soil and such other factors). When large and small beans were planted from a single pure line stock, the range of sizes in the beans produced was almost identical. From this finding Johannsen concluded that selection is effective only in stock that contains genetic variability and that variability produced by the environment was unimportant in evolution (Altenburg, 1970; Dobzansky, 1955).

4. Authentication of Different Customs Oppose Lamarck's Theory

- (i) Boring of ears and nostrils in women in the Indian subcontinent has been continued from centuries but their offspring do not show any trace of holes in ears and nostrils (Verma and Agarwal, 1999).
- (ii) Moreover, Muslim and Jewish boys have been circumcised for thousands of years, but this has not resulted in a tendency toward the reduction of the prepuce in them.
- (iii) Additionally, it was the custom in China to bind the feet by iron shoes of their baby girls in order to keep them small and delicate, but after centuries of this practice the reduced feet have not been inherited through many generations (Bhuya and Timm, 1973; Gupta, 1997).
- (iv) The powerful arm muscles acquired by blacksmith are not inherited by offspring (Jordan and Verma, 1990).

5. Arguments of Different Biologists about Unacceptedness of Lamarck's Theory

There is a difficulty in case of Lamarck's theory in explaining how sterile classes in social insects like worker bees became adapted in their environments. It could hardly be conceived that the queen bee is able to transmit structures acquired by the worker bees. For these and several other reasons, Lamarck's theory stands rejected to-date (Dnyansagar, 1992). Based

upon Mendel's principle, the geneticists in the 20th century in intensive experimental exploration have been forced to reject completely the doctrine of the inheritance of acquired characteristics, whether these originate due to use or disuse or they are the results of direct environmental effects (Birdsell, 1975). Lamarck's notion is discredited by the geneticists (BCE, 2006). Moreover, the study of chromosome and mutations also opposed Lamarck's theory (Altenburg, 1970). However, it is well known that Lamarck's theory is no longer acceptable (Birdsell, 1975; Wallace, 1990). Consequently it has been declared that Lamarck's theory was wrong (Cockrum and McCauley, 1965; Birdsell, 1975; Curtis, 1980; Ritchie and Carola, 1983; Wallace, 1990 and Enger and Ross, 1997).

6. Evidence of Use of Lamarck's Theory in the Theory of Darwin

Beer (1996) declared (in the introduction of 'Origin of Species') that in the revision of the 'Origin of Species' during 1860, Darwin moved back towards a more Lamarckian position. Nevertheless, not only 'Origin of Species' during 1860 but also before edition of this book Darwin exploit Lamarck's theory; even in 'The Descent of Man in Relation to Sex (in sexual selection)' he applies Lamarck's theory. Its direct evidences are placed here-

6.1. Use of Lamarck's theory in the 'Origin of Species' in 1859

Darwin directly accepted the Lamarck's theory of 'inheritance of acquired characters' in the 'Origin of Species' (in 1859) in the chapter 'Laws of variation', under the sub-heading 'the effect of use and disuse. Darwin believes that the nearly wingless condition of several birds, which now inhabit or have lately inhabited several oceanic islands, tenanted by no beast of prey, has been caused by disuse..... It may imagine that the early progenitor of the ostrich had habits like these of a bustard, and that as natural selection increased in successive generations the size and weight of its body, its legs were used more, and its wingsless, until they became incapable of flight..... In some cases it might easily put down to disuse modifications of structure, which are wholly, or mainly, due to *natural selection*. Mr. Wollaston has discovered the remarkable fact that 200 beetles, out of the 550 species inhabiting Madeira, are so far deficient in wings that they cannot fly (Origin of Species, p.111).

(ii) The eyes of moles and of some burrowing rodents are rudimentary in size, and in some cases are quite covered up by skin and fur. This state of the eyes is probably due to gradual reduction from disuse, but aided perhaps by *natural selection* (Origin of Species, p.112).

(iii) On the whole Darwin thinks it may conclude that habit, use, and disuse, have, in some cases, played a considerable

part in the modification of the constitution, and of the structure of various organs, but the effect of use and disuse have often been largely combine with, and sometimes overmastered by the *natural selection* of innate variations (Origin of Species, p.117).

(iv) Disuse sometimes aided by *natural selection*, will often tend to reduce an organ, when it has become useless by change habit or under changed condition of life. It can clearly understand on this view the meaning of rudimentary organs. But disuse and selection will generally act on each creature (Origin of Species, p.347).

(v) Variability from the indirect and direct action of the external conditions of life, and from *use and disuse*; a ratio of increase so high as to lead to struggle for life, and as consequence of *natural selection*, entailing divergence of character and extinction of less-improved forms. Thus, from the war of nature, from famine and death, the most exalted object which it may capable of conceiving, namely the production of higher animals, directly follows (Origin of Species, p.395-96).

6.2. Use of Lamarck's theory in the 'Origin of Species' in 1872

Darwin (1872) wrote in the 'Origin of Species' under the head line of 'the effect of use and disuse':

(i) It can be little doubt that use in the domestic animals strengthens and enlarges certain parts, and disuse diminishes them; and that such modifications are inherited. Under free nature, it has no standard of comparison, by which to judge of the effects of long-continued use or disuse. Though its parent-forms not known; but many animals have structures which can be explained by the effects of disuse (Origin of Species, p.65).

(ii) It may to explain the entire absence of the anterior tarsi in *Ateuchus*, and their rudimentary condition in some other genera. By the long-continued effects of disuse in their progenitors; for as the tarsi are almost always lost in many dung-feeding beetles. They must be lost early in life, and therefore cannot be much used by these insects (Origin of Species, p.66).

(iii) It is well known that several animals, belonging to the most different classes, which inhabit the caves of Styria and of Kentucky, are blind. In some of the crabs the foot-stalk for the eye remains, though the eye is gone. As it is difficult to imagine that eyes, though useless, could be in any way injurious to animals living in darkness, Darwin attributes their loss wholly to disuse (Origin of Species, p.67).

6.3. Use of Lamarck's in 'The Descent of Man in Relation to Sex' (in sexual selection)

(i) Darwin wrote (in the preface of second edition of his book on 'The Descent of Man, and Selection in Relation to Sex') his critics frequently assume that he (Darwin) attributed all changes of physical structure and psychological power entirely

to natural selection of such variation as are often a call spontaneous. Whereas, he distinctly stated that great weight must be attributed to the inheritance of the effects of use and disuse with respect both to the body and mind. Even in the first edition of the Origin of Species he also emphasizes the use of Lamarck's theory (Darwin, 1874; Case, 1979).

(ii) Darwin also pointed out (in the introduction of 'The Descent of Man, and Selection in Relation to Sex') that it contains hardly any original facts regarding man. But as the conclusions, at which he arrived, after drawing up a draft, appeared to him interesting. He thought that it might be interested to others. It has often and confidently been asserted, that man's origin can never be known. But ignorance more frequently begets confidence than does knowledge. It is those who know little, and those who know much, who so positively assert that this or that problem can never be solved by science. Man is considered with other some ancient, lower, and extinct form, is not in any degree new. *Lamarck long ago came to this conclusion* (Darwin, 1871).

6.4. Use of Lamarck's theory in pangenesis hypothesis of Darwin

Darwin is also used Lamarck's theory in his pangenesis theory. Strickberger (1996) confirmed that Darwin directly allowed the inheritance of Lamarck's theory to his pangenesis theory. According to this theory, excessive use or disuse of an organ would alter its gemmules and consequently lead to a change in inheritance in the offspring or descendants. Dobzansky (1955) also drew attention that Darwin had included inheritance of acquired characters, proposed in 1868 in his temporary hypothesis of pangenesis.

7. Evidence of Usage of Lamarck's Theory by Darwin from Different Biological Books

Arguments of different biologists about the receiving of Lamarck's theory by Darwin are given below-

Sinnott et al. (1998) stated that Darwin indirectly accepted the theory of inheritance of acquired characters (Lamarckism) as an important but an additional factor in evolution and considered natural selection to the directing agent of evolutionary process. Furthermore, it is cited that 'The development and degeneration of organs is based on the use and disuse respectively'- Darwin recognized this theory, which was originally proposed by Lamarck (Gupta, 1997). Darwin accepted Lamarck's theory by exemplified the survival of the fittest by taking example of Lamarck's Giraffe with more or less similar explanation. According to Darwin, Giraffe exhibited the great variations in the length of their neck and legs. Since, grass was scarce on the land the giraffes had to eat the leaves of tall trees. Naturally, giraffes with long necks and longer legs had an advantage over those with shorter legs and necks, because

these could get food more easily and had better chances of survival. These forms fed, reproduced and become abundant. On the contrary, Giraffe with short necks starved and gradually became extinct (Rastogi, 1994). In addition it has been cited that Darwin recognized four factors (or causes) of evolution such as- natural selection, the inheritance of acquired characteristics, the inheritance of acquired character due to direct effect of the environment and suddenly recurring variation in individuals (Birdsell, 1975). However, Lamarck's theory of evolution was an important forerunner of the work of Charles Darwin (Anonymous, 2011).

8. Opposition to Lamarck's Theory by Alfred Russel Wallace

Russel Wallace, the co-inventor of natural selection, opposed Lamarck's hypothesis. He (Wallace) declared that the hypothesis of Lamarck- that progressive changes in species have produced by the attempts of animal to increase the development of their own organs and thus modify their structures and habits has been repeatedly and easily disproved by all writers on the subject of varieties and species when this was done. The whole question has been finally settled but the view here developed turn into such an hypothesis quite unnecessary, by showing that similar result must be produced by the action of principle constantly work in nature (Wallace, 1858).

9. Effect of Use of Lamarck's Theory in Darwin's Theory

As a result of the use of Lamarck's theory in Darwin's theory, many biologists opposed Darwinian Theory of natural selection and they developed alternative theories such as the mutation theory, modern synthetic theory and sociobiology, punctuated equilibrium to describe the mechanism of evolution. They oppose natural selection in different ways For example- Parves and Orians (1987) declared that history suggests that the Darwinian paradigm will in turn be modified or even replaced by another, but the form of a new one and when it will emerge are unknown to us. Moreover, it has been pointed out that the symbol of natural selection is derived from the dominant socioeconomic ideology of the Victorian era, now rejected by nearly all humanity. Indeed, much of reason for the instant success of Darwin's theory is that it was cut off from the very fabric of Victorian era or the English society. There is no cause still to cling this metaphor. As it can serve no other purposes than to support those injustices, which gave it birth (Ho, 1988). The World Book Encyclopedia of Science stated that Darwin's theory has been never proved and Darwin is the most important and controversial scientist of the modern time (WBES, 1994). Further more, Johnson, (1991) opined that during the last 130 years of very firm research, Darwinism has done no better than to find a few suspecting supporting examples as well as a

significant negative evidence too. Darlington (1959) acknowledged that Darwin's theory is not true. As Darwin's theory is suspicious, neo-Darwinism was developed. Consequently, there continues to be a resistance to Darwinism, the most recent example being the attempt by the Tennessee State Legislature (in USA) to pass a law requiring a teacher to refer to evolution as a theory not fact (Snustad and Simons, 2000). Moreover, some states of USA also passed laws that banned the teaching of evolution in public school (WBE, 1992).

Nonetheless, based on the fossil evidences, two American paleontologists Stephen J. Gould and Nile Eldredge developed a new model called punctuated equilibrium (theory of macro-evolution). This theory resists Darwinian evolution and opined that natural selection denies creativity and reduces it to a negative force. This theory is being widely adopted by more and more evolutionists. According to this model, species remain essentially unmodified for millions of years (*statis*) and subsequently evolution takes place rapidly or suddenly during the formation of species (Eldredge and Gould, 1972; Gould and Eldredge, 1977).

10. Conclusion and Perspectives

Nothing makes meaning except in the light of evolution (Dobzhansky, 1973). Darwin's theory of evolution dominates, integrates and influences of all the branches of biology. Lamarck's theory is the first modern theory of evolution and provided a base of evolution. But it is proved by different experiment of various scientists; different customs as well as contemporary knowledge do not support this theory. Hence biologists opine that Lamarck's theory is wrong. Darwin is father of evolution but he directly applied this theory to his theories of natural selection (in Origin of Species) as well as in sexual selection (in The Descent of Man) to explain how evolution occurs (or the mechanism of evolution). So, a research article is needed with elaborate information whether Darwinian Theory of natural selection (in Origin of Species) as well as sexual selection (in The Descent of Man) theories are true or false.

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