"DARWINISM" IN THE YEAR 2009: 150 YEARS AFTER DARWIN'S BOOK "THE ORIGIN OF SPECIES"

*Imtiaz Ahmad**

ABSTRACT

On November 24, 2009, Darwin's magnum opus (Latin for 'great work') on "The Origin of Species" would reach 150 years as Darwin, on February 12, 2009, would have turned 200 years old. In the midst of celebrations of 200 years of Darwin throughout the globe, it would probably be appropriate to look into the evolving Darwinism. No doubt, Darwin recognized how life-forms adapt and survive, but he made only a little inroad into the problem of "the evolutionary change", despite the title of his magnum opus. No doubt, he recognized that variation and heredity were the twin engines that made evolution possible but he did not know what made them possible. In this article, we take a look at some aspects of this problem, keeping in view the ideas taught in schools and colleges.

INTRODUCTION AND HISTORICAL DISCUSSION

"Darwinism", or the theory of natural selection and survival of the fittest, was fully explained and exemplified in 1859, about 150 years from now. The theory has been tested since and, in many experiments, has been proven beyond all doubts in the last 150 years. Actually, the theory was introduced for the first time in 1858 by Charles Darwin and Alfred Russell Wallace. Wallace independently found in his observations on animals in the East of Wallace's Line (Australia and Australian New Guinea) that species change through Natural Selection. Like Darwin, Wallace also based his theory on reasons derived through his observations. After he completed his manuscript explaining his theory, he sent it to Darwin for critical comments before publishing it. Darwin was so impressed by this manuscript that he was about to give his 'go ahead' signal to young Wallace but, luckily, before doing so he shared his thoughts with his friends Joseph Hooker, a botanist, and Charles Lyell, a geologist. Explaining and analyzing his observations during his mission on Beagle (a ship) to South American Galapagos Island, the two convinced Darwin to wait a little before renouncing the credit for his painstaking work. As quoted in Darwin's Finches, "The two friends of Darwin approached and convinced the young Wallace to share his theory with the Great Darwin who, by publication of Wallace's book, would have lost the entire credit for his 15 years of hard work". Finally, with the arrangements made, the Darwin-Wallace venture on "The Origin of Species by Means of Natural Selection", or "The Preservation of Favoured Races in the Struggle for Life" was presented on 1st June 1858. The next year, Darwin then hurriedly finalized his book and mailed it to his publisher, but that did not really mean that work on evolutionary biology reached its peak, just as Zimmer (2009) beautifully remarked that medicine peaked when Louis Pasteur demonstrated that germs cause diseases.

DARWIN AND MENDEL

Darwin certainly did recognize that variations and heredity were the twin engines that made evolution possible, but he did not know what made them possible. It was about a century later that scientists found the answer, i.e., the "DNA". Darwin actually did not have any clue about the mechanism of heredity. It was Gregor Mendel who presented his "Laws of Inheritance" during a seminar in 1865. When the proceedings of the seminar were published (1865), every library of Europe and USA received a copy of this publication. Darwin must have seen a copy of the "Laws of Inheritance", but surprisingly in his "Descent of Man and Domestication of Animals" (1871), six years after Mendel's publication, Darwin advocated his theory of "Pangenesis" as the mechanism of heredity. It was based on the theory of "Gemmules" secreted by each cell of the body and with the blood-circulation the cell replicates, i.e., "gemmules" reach and are concentrated in the reproductive organs, whether the testes or ovaries, in the form of sperms or ova, respectively. By the fertilization of these sperms and ova the child resembled his parents–a sheer replica of "Lamarckism". Dalton, a Darwin fan, transfused blood of a black rabbit into a white rabbit hoping that the next progeny would all be striped or drab but, to his surprise, the next progeny was all white'.

After 34 years of Mendel's publication of the "Laws of Inheritance", when the world got matured enough to understand the mechanism of inheritance, Correns in Germany, Tschermak in Austria and De-Varies in Holland independently re-described Mendel's "Laws of Inheritance". When they dug their libraries to review and analyze their results, they got hold of Mendel's 34 years old publication and all three of them unanimously came up with the same title of their work, i.e., "Rediscovery of Mendel's Laws of Inheritance". Since then, these laws have been tested many a times, in different laboratories and all the experiments

*Department of Zoology, University of Karachi, Karachi, Pakistan.

proved them right beyond all doubts.

DNA AND THE GENOME

Now the geneticists not only recognize how the traits are inherited, but they also know the four molecular letter codes of DNA, viz. the purine and two bases of pyrimidine. Today geneticists also understand how the impact of Natural Selection is imprinted on the DNA. They know how the DNA functions by instructing the cells to manufacture the proteins, some of which are structural, while the functional ones playing the role of enzymes. They also know how the DNA in the embryos form organs and organ systems. Moreover, they know that in human beings a lot of our genome is not made up of protein-coding genes; in fact 98.8% of it is not. Some of that 98.8% consists of "pseudogenes", genes that once encoded proteins but no longer can, because of "crippling mutation". Many mutations certainly produced winning effect of Natural Selection in producing traits which helped in survival of a species, but many, in fact a lot of mutations that all human genes underwent, neither helped nor harmed our ancestors. They spread just by chance, 98.9% of this junk DNA is in the form of LINES or SINES. Long DNA strands that copy themselves and then splice and reattach at various points of DNA strand are known as the "LINES" and short inter-spread strands of DNA are known as the "SINES". In humans, these segments have been insinuating themselves in the genetic code of life for billions of years. SINES contribute to this more than 10% and LINES more than 15%. They could have played a role in spawning some retroviruses, e.g., the AIDS viruses, which could have been generated from LINES. These have a unique value in mapping the twists and turns of evolution (Monarstersky, 1999; and Okada, et. al., 1999). By looking for particular examples of these copies in specific genome sites, researchers could determine when various species split off from related ones. With reference to the establishment of evolutionary relationship, even the conventional genetic analysis is not considered fool-proof. It goes awry when the same mutation occurs independently in two different species. It makes two animal sequences look similar, even though they may be only distantly related with a molecular version of convergent evolution. There could also be cases that a mutation in one spot could change again or even could correct itself, which would make the comparison of sequences much more difficult.

We are a long way from understanding the entire genome, but as we get to know a part of genome we get the understanding of how complex organs evolve. Zimmer (2009) quoted Darwin on how something as intricate as an "eye" could have evolved. But Darwin argued that new complex organs could evolve through a series of intermediate forms. Until 1980, biologists had almost no knowledge of the genes that built them. Over the past 25 years, biologists have identified many of the genomes that help build embryos. A number of genomes help layout an embryo's blue-print, by letting cells know where they are. Then cells absorb proteins floating around them and the signals trigger the cells to form other proteins which, in turn, clamp on to certain bits of DNA to switch the neighbouring genes on and off. This network of genes eventually leads a cell to give rise to an arm or a brain or a tongue (Zimmer, op.cit).

DISCUSSION

It is also surprising how Darwin chose the very title of his great book, "The Origin of Species by Means of Natural Selection", when Darwin did not have a clue of the concept of modern biological species. In his famous book, Darwin noted that when taxonomists found major morphological/taxonomical differences between two taxa, they called them different species and when they found minor differences they called them two different subspecies. Today we know well that two entirely different sympatric species, which never ever copulate with each other in nature, could be perfectly identical in their morphology. Actually, today we are familiar with thousands of cases of sibling species in different animal groups. Mayr (1963), Hackett (1937) and Bates (1940) have cited such examples among *Drosophila* and *Anopheles maculipennis* complex. Dobzhansky (1951) commented on this that Darwin was remarkably intelligent and he knew that the crux of the problem was of the origin and changes and modification in the species, and he could very well envisage that he could very easily win the battle on this front.

Although in Darwin's days very little progress was made in the field of palaeontology, but Darwin prophesied that different species share a common ancestry. Long after Darwin, the palaeontologists discovered: how the scene of evolution moved from sea to land vertebrates; how the fins evolved into hands and feet; how the fresh water bony "Crossopterygian" fish, like Eusthenopteron, evolved into first land amphibians; how the sluggish partly aquatic and partly terrestrial animals looking very similar to fish, the early amphibians, completing their life cycle in water and evolved into perfectly terrestrial

land reptiles, laying their eggs on land; how some of these early land reptiles evolved into mammal-like reptiles, i.e., therapsidans that finally evolved into reptile-like mammals. Even palaeontologists find it difficult to differentiate therapsidans and identify as reptiles or mammals (Moody, 1962). Finally, it was remarkable to see that, although the great monstrous reptilian stock, the monarchs of all they surveyed, the dinosaurs, which all perished and went into extinction, actually survive even today in the form of birds (Ahmad, 2009a). The palaeontologists have uncovered a series of fossils explaining the evolution of horses, elephants and camels. Thewissen, et. al. (2007) resolved the ever puzzling problem that some fish, like whales, dolphins and porpoises, actually evolved from even toed hoofed land mammalian group, the "Artiodactyla" (Ahmad, 2009b).

CONCLUSION

It is spectacular that almost every day paleontologists have been uncovering the ancestral stock of puzzling groups, about which those in Darwin's days the antievolutionists claimed "if evolution were true, we should have found the connecting links between every two groups evolutionists claim to have evolutionary relationship". They boasted after such remarks that these links are missing, because species were created separately and independently, and they are not evolutionarily related.

Today the strongest evidence of evolution comes from the field of paleontology. It is satisfying to note that we have marched much ahead in these 200 years of Darwinism.

IMPACT ON SCIENCE TEACHING

The present discussion may be concluded by recalling Prof. Michael Behe (2007), an American biochemist, who criticized the evolutionists, saying that many complicated organs of an animal's body could not be explained only on the basis of natural selection and probably a special designer would be needed to explain such intricate structures as the "human eye", but he also had to accept that the designer, alas!, could not be placed in an experimenter's test tube, to throw light on the personality of the designer. Today, "Evolutionary Biology" is no more a theoretical concept, but is based on hard facts of experiments, which could be repeated in different labs by different scientists who all obtain verifiable results. We are now in a position to incorporate these concepts in Biology courses in our schools.

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