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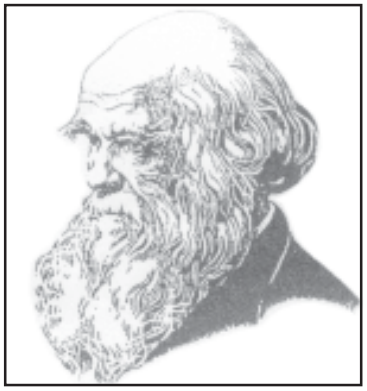
The Genius of Darwin: Two Hundred Years*

This analytical article is a humble tribute to the genius of Charles Robert Darwin (1809 – 1882) in his bicentenary birth anniversary**. Darwin's theory of evolutionary biology by natural selection (1859) is, though accepted by the majority scientific community, not accepted universally. It is an intellectual attempt to analyse the impact of Darwinism on various other aspects – socio-logical, theological, cultural, economic, etc., of the day, and active till today. Darwinism is still a riddle wrapped in mystery inside an enigma. There are still many unanswered questions. In his evolutionary theory, the "missing link" between apes and humankind or between man-apes and apes-man is till missing. The debate continues……

Introduction

There is a popular misunderstanding that "evolution" and "creation" are contradictory terms. Evolution simply means change over time. Creation is just the act of formation over time. The two terms are, therefore, complementary and not contradictory.

Evolution is a gradual directional change, now most commonly used to refer to cumulative changes in the characteristics of population of organisms from generation to generation. Evolution occurs by the fixation of changes (mutations) in the structure of genetic material, and the passing on of these changes from ancestor to descendant. It is well demonstrated over geological time by the sequence of organisms preserved in the fossil record. There are two opposing schools of thought regarding the pattern and tempo of evolution.



Charles Robert Darwin (1809-1882)

The gradualist school is based on a model of evolution in which species change gradually through time by slow directional change within a lineage, producing a long graded series of differing forms.

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The punctuated equilibria school is based on a model in which species are relatively stable and long-lived in geological time, and that new species appear during outbursts of rapid speciation, followed by the differential success of certain of the newly formed species.

Speciation is the process by which a species does not merely change its characteristics over time, but actually splits into two or more species, which are no longer capable of interbreeding with the parent stock or one another and, consequently, go their separate ways.

Peep Into The Past

Where we have come today in the trail of our evolution is not important; what is important, is how we came to, where we are today in the tree of our creation. This pertinent question has been lurking in many thinking minds since antiquity.

A Chinese philosopher – Tson Tse by name – wrote in the sixth century BC about the time of Buddha:

> "All organizations are originated from a single species. This single species had undergone many gradual and continuous changes and then gave rise to all organisms of different forms. Such organisms were not differentiated immediately but, on the contrary, acquired their differences through gradual change, generation after generation." (Quoted from Jawharlal Nehru: *Glimpses of World History* – "Darwin and the Triumph of Science" (Feb. 3, 1933), pp. 525 – 526, Oxford University Press, New Delhi, 1982).

Amazing observation by the old Chinese biologist and philosopher! But he did not arrive at a conclusion, which it took the world two and a half millennia to rediscover. However, the posterity is still pondering over the methodology, acceptability and far-reaching consequences of the concept of evolution in the back-ground of the complexity and diversity of humankind.

All traditional religions – Hinduism, Christianity, Islam and so on, propagated the supremacy of the supernatural – "God" created man in his own image. Biblical account puts creation of the world just 4004 years before the birth of Christ. Indian (Hindu) mythology, however, measures time in enormous periods, like the geological periods. But, the conclusion on the creation of man and the universe was no different in any orthodox traditional faith.

Ancient Greek philosophers, like Hippocrates (460 – 377 BC), Father of Rational Medicine, Aristotle (384 – 324 BC) were interested in the development of living organisms; Empedocles of Agrigentum (504 – 443 BC), Sicily, considered that "the creatures survived, being accidentally compounded in a suitable way; but where it did not happen, the creatures perished and are perishing still."

Darwin and Evolution

Charles Robert Darwin (1809 – 1882) was not the first to propose the theory of evolution; he was the first to propose a scientific mechanism for the process of evolution and to provide an over-whelming amount of organized evidence in support of it. He formulated the theory of evolution by means of natural selection following a five-year voyage (1831 – 1836) around the world aboard the H.M.S. Beagle. He published his theory – "On the Origin of Species by Means of Natural Selection or the Preservation of Favoured Races in the Struggle for Life" in 1859 – a book that shook the Christian world of the day. The debate still continues. He then worked on a series of supplemental treatises, including *The Descent of Man* (1871), which postulated the descent of the human race from anthropoid group. He is remembered primarily as the leader of evolutionary biology. He wrote many other works on plants and animals.

The idea of evolution was not novel. In fact, during the 1770's Darwin's own grandfather – Erasmus Darwin (1731 – 1802) – a physician, had published a book discussing the concept. But no probable method was proposed, and there was not enough factual evidence to support the theory. More importantly, acceptance of evolution required the abandonment of strict biblical teaching in Victorian England. That was out of the question at the time.

Though it is acclaimed as one of the great classics of scientific literature, Charles Darwin's *On the origin of species* was written in a way that can be understood by a wide general audience.

Darwin's theory is based on observable facts. It was the way in which he related them to each other that made it so unexpectedly different and valuable. The basis of the theory was that:

1. Species are made up of variable populations.
2. Variation in maintained by sexual reproduction.

3. Individuals produce more eggs or seeds than are needed for the species to survive.
4. Individuals that are well adapted to their environment will be more likely to survive and reproduce thereby passing on their traits to succeeding generations.

The theory of populations control of the English economist and clergyman – Thomas Robert Malthus (1766 – 1834) in his book – *Essay on the Principle of Population* (1798, Revised 1803) influenced Darwin's thinking on natural selection as the driving force of evolution. According to Malthus, population increases by geometric ratio (1, 2, 4, 8….. with increasing difference) while food supply increases by arithmetic ratio (1, 4, 7, 10…… with constant difference). Darwin was an acute observer of living things around him and a meticulous recorder of what he observed.

Darwinism is synonymous with evolution to most people, but not universally. Darwin's theory so captures the imagination that it continues in popular culture and to stretch scientific thought. From behavioural studies of our closest living relatives in the animal kingdom to genetic engineering the principles of evolution are being employed for the benefit of mankind and the environment. Mendelism – the theory of heredity, propounded by Gregor Johann Mendel (1822 -1884), adds strong support to the theory of Darwin. Darwin's influence reaches ever widening fields of research as we continue to seek the answer to that still fascinating "mystery of mysteries": the origin of living thins.

Neo-Darwinism is the modern theory of evolution built up since the 1930's by integrating Darwin's theory of evolution through natural selection with the theory of genetic inheritance founded on the work of Gregor Mendel – the Austrian monk. In fact, genetics of Mendelism provided the sinews of evolutionary biology.

Genetics now regulates everything in the biological world. A gene is a region of Deoxyribo-nucleic acid (DNA) that provides the body's instruction for building life. Genes make up only there (3) percent of DNA. The remaining 97% "junk DNA" may help move genes around. Most gene mutations (change) appear in males. If our DNA is laid end-to-end, it would reach the sun and back more than 600 times.

Between 1920 and 1935 mathematicians and experimentalists began laying the groundwork for a theory combing Darwinian evolution and Mendelian genetics.

The Russian-American geneticist and evolutionist – Theodosius Grigorevich Dobzhansky (1900 – 1975), in his book – *Genetics and the Origin of Species* (1937) proposed the first substantial synthesis of evolutionary biology and evolutionary genetics. "Nothing in biology makes sense except in the light of evolution", he wrote. In 1927 he worked with the famous geneticist – Thomas Hunt Morgan (1866 -1945), Nobel Laureate in Physiology or Medicine, 1933, in the small "Fly Room" at Columbia University , New York.

Darwinism is synonymous with evolution. In the scientific community, evolution by natural selection is a fundamental unifying theory of all the life sciences.

(Chronology and List of Publications given in the "Appendix")

Global Impact of Darwinism

Ancient Indians, unlike other ancient nations, had vast conception of space and time. Even Indian mythology deals with ages of hundreds of millions of years. To Indians, the vast periods of modern geology or the astronomical distances of stars would not have come as a surprise. Because of this background, Darwin's and other similar theories could not create in India the turmoil and inner conflict, which they produced in Europe in the middle of the 19th century. The popular mind in Europe was used to a timescale which did not go beyond a few thousand years.

The Missing Link

"Missing Link" is the hypothetical extinct creature in the evolutionary line between modern man and his anthropoid progenitors. In the latter half of the 19th century, a common misinterpretion of Darwin's work was that man has lineally descended from existing species of apes. To accept this theory and reconcile it with the hierarchial "great chain of being", some fossil ape-man or man-ape seemed necessary to complete the chain. *Piltecanthro pus erectus* (now *Homo erectus*), *Eoanthropus daswsoni* (the Piltdown man hoax) and even the modern Hottentots of Southern Africa (when newly discovered) were suggested as the missing link. Today it is recognized that man's relationship to the present anthropoid apes (e.g. chimpanzees) is through common ancestors rather than through direct descent.

However, Darwin concluded his seminal boom – *The Descent of Man* with the following words: "….Man still bears in his bodily frame the indelible stamp of his lowly origin."

The question of our origin still remains open. Time will tell. The relegation of the human by the theory of evolution by natural selection to the status of advanced apes has led to moral and ethical objections over its implied justification of selfish and even barbaric behaviour.

Social Darwinism

Darwin's theory of evolution was concerned with the origin and development of species. But this did not explain in any way human social relations.

However, social Darwinism is a 19th century theory of socio-cultural evolution, deriving its name from its relation to the biological theories to Darwin. The idea that life of man in society was a struggle for existence ruled by "survival of the fittest" – a phrase proposed by the English evolutionary philosopher scientist and sociologist, Herbert Spencer (1820 – 1903) in his *Principles of Biology*, 1864 (vol. I, p.444) and was not introduced by Darwin, but his work gave it the force of natural law.

The social Darwinists – notably Spencer, British economist and political theorist, Walter Bagehot (1826 – 1877) and others – believed that the process of natural selection acting on variations in the population would result in the survival of the best competitors and in continuing improvement in the population. Societies, like individuals, were viewed as organisms that evolve in this manner.

The theory was used to support political conservatism. Class stratification was justified on the basis of "natural" inequalities among individuals, for the control of property was said to correlate of superior and inherent moral attributes such as industriousness, temperance and frugality. An attempt to reform society, politically, socially, culturally and economically, would therefore interfere with natural processes; unrestricted competition (as in globalized market economy) and defence of the status quo were in accord with biological selection. The poor and the underprivileged were the "unfit" and should not be aided; in the struggle for existence, wealth was a sign of success. At the societal level, social Darwinism was used as a philosophical rationalization for imperialist and racist policies, sustaining belief in Anglo-Saxon or Aryan cultural and biological superiority.

Social Darwinism declined during the 20th century, as an expanded knowledge of biological and cultural phenomena undermined, rather than supported, its basic tenets. Evidence shows that natural selection does not necessarily favour

the most competitive or aggressive individual, that distinction must be made between learned and inherited characteristics, and that social evolution has not proceeded in a single straight line.

Mapping of Human Genome (Book of Life), completed on June 26, 2000, inflicted the final death nail into the corpus of Social Darwinism. There is no single genome sequence that defines everyone. There are no two humans other than identical twins, who share identical genome. Though genomes are more than 99% (99.98%) identical, each individual is unique. Genetial anthropology has ushered in a new understanding of our evolutionary history. It has established the rational basis of relatedness among humans, irrespective of race, colour, religion, culture, ethnicity and other aspects of life. It has totally demolished the very concept of superiority of one humankind over another. The concept of "Eugenics" – a term coined in 1883 by Darwin's cousin, Francis Galton (1822 -1911) as "the science which deals with all influences that improve the inborn qualities", has been consigned to the dustbin of history. Eugenics is non-scientific, illiberal and inhumane. There is 99.90% similarity between any two randomly chosen persons out of more than 6 billion people on this planet earth. It has established equality among humankind on a scientific basis for the first time. Genetical variability is more in intragroup than in inter-groups. New genetics has shattered the myth of racial superiority of Anglo-Saxons, Aryans or whoever. Social Darwinism is dead for ever.

The Epilogue

Evolution of humans from ancestral primates is complex. The African apes (gorilla and chimpanzee) are shown by anatomical, molecular, cellular and genetic comparisons to be the closest living relatives of humans. The oldest hominids (of the human group), the Australopithecines, found in Africa, date from 3.5 – 4.4 million years ago. The first to use tools came 2 million years later, and the first humanoids to use fire and move out of Africa appeared 1.7 million years ago. Neanderthals (found in Germany in 1856) were not direct ancestors of the human species. Modern humans are all believed to descend from one African female of 200,000 years ago, although there is a rival theory that humans evolved in different parts of the world simultaneously.

The theory of evolution is still a riddle wrapped in mystery inside an enigma. The final word has not yet been said. That is how science advances. This very fact needs to be stressed emphatically in the bicentenary birth anniversary of

Charles Robert Darwin – the greatest genius that the world has ever produced. The debate continues….

> "Dust in the air suspended
> Marks the place where a story ended."
> [Thomas Stearns Eliot (1888 – 1965), Nobel Literature, 1948: Four Quartets – Little Gidding, 1942.]

Appendix

Chronology and Publications of Charles Darwin

1809	Charles Darwin is born on February 10 in Shrewsbury, England.
1818	Enters Shrewsbury School.
1825-27	Studies medicine at Edinburgh University, Scotland – Never completed.
1828-31	Studies theology to become a Church minister at Cambridge University, England.
1831-36	H.M.S. Beagle voyage around the world.
1839	Marries his first cousin – Emma Wedgwood (1808 – 1896) – Had ten children (only seven of whom survived infancy).
1839	Publishes *The Journal of Researches into the Geology and Natural History of the Various Countries Visited by H.M.S. Beagle under the Command of Captain Fitzroy, R.N*. (from 1832 to 1836). The Royal Society of London elects Darwin a Fellow. Awarded Copley Medal, 1864.
1842	Moves to Down House, Kent, and writes first 35-page draft outlining theory of evolution.
1843	Writes 230-page essay outlining his ideas regarding the origin of species.
1846-54	Studies barnacles (a marine crustacean attached permanently to underwater surfaces.
1858	Receives Alfred Wallace's (1823 – 1913) essay. Papers on evolution by Wallace and Darwin, both are read to the Linnean Society. Darwin's priority is established. Never received formal recognition from the British Government.
1859	Publishes *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*. All 1,250 copies sell the first day.
1860	Huxley-Wilberforce debate takes place at Oxford University.
1871	Publishes: *The Descent of Man and Selection in Relation to Sex*.
1872	*The Expression of Emotions of Man and Animals*.

1875 *Insectivorous Plants*.

1875 *The Movements and Habits of Climbing Plants*.

1876 *Autobiography for his children*.

1882 Dies of heart attack on April 10 in Kent and is buried at Westminster Abbey, London, near Isaac Newton (1642 – 1727).

Suggested Reading

1. Sisir K. Majumdar (2003): 'Mendelism in Human Genetics – 100 years on'. *Bull. Ind. Inst. Hist. Med.* Vol. XXXIII, pp. 179 – 192 (Indian Institute of History of Medicine, Hyderabad, A.P. India)

2. Sisir K. Majumdar (2004): 'D.N.A.: fifty years'. *Indian Journal of History of Science*, vol. 39.3, pp. 365 – 372 (Indian National Science Academy, New Delhi, India.)