

EDITORIAL

Charles Darwin's Legacy - a personal view

This year celebrates the 150th anniversary of the publication of what is arguably the most important single treatise in the history of scientific endeavour - entitled "*On the Origin of Species*" by Charles Darwin (b.1809), which culminated in the hypothesis of organic evolution through a process of natural selection. Our conception of the world and our place in it underwent a profound transformation after that landmark year in 1859. Yet, humans are hardly mentioned in the Origin of Species! This came much later in other books (e.g. *The Descent of Man* in 1871).

The modern scientific zeitgeist, *weltanschauung* (world view) and philosophy of science is very much a Darwinian legacy. The new evolutionary theory provided a secular view of life on Earth, in contrast to the then prevailing ecclesiastical one. Since evolution involves large slices of time, Darwin quite logically introduced historicity into his discipline. Biology along with geology are essentially historical sciences. They both strive to explain events and processes that have already taken place. Biologists and geologists, while reading a historical narrative attempt to reconstruct a tentative scenario that led to such events and processes. In fact, the evolution of morphological characters of various fossil groups with time and their extinction is used to divide the history of the Earth into various time slices (designated Eras, Epochs, Periods, Ages etc.,).

The methodologies applied by historians and biologists and geologists (the historical method and the scientific method) have much in common and erases the arbitrary distinction between the humanities and the sciences as it is the time factor that makes events and change possible. The mechanism of natural selection explains the directional and adaptive changes observed in biological systems. Its main purpose is the elimination of inferior members in a group (loosely termed "survival of the fittest"). Why do certain individuals in a given group fail to succeed under a given set of conditions? And are those who survive the fittest? In natural selection nothing is predetermined and final causes or teleological forces leading to an end are not invoked. And most importantly, the need for selection may change from one generation to the next as environmental conditions change.

During the past 60 years, evolutionary biologists have emphasized the dual nature of biological processes – governed by the universal laws of physics and chemistry and a genetic programme resulting from natural selection. This is the new philosophy of biology. In the physical sciences, theories are based on natural laws. In biology, theories are based mostly on concepts such as competition, choice, selection, succession and dominance and cannot be reduced to the laws and theories of the physical sciences. In contrast to experimental proof in the physico-chemical sciences- observational skills, comparisons, classification and analyzing competing historical narratives are the methods of evolutionary biology.

Before 1859, the most famous practitioners of the sciences and the philosophers were Christian males, whose world was created by God. The theologians claimed that all God's creatures were harmoniously adapted to one another and to their environment as a result of the wise laws laid down by the creator. The prevailing scientific thought was in total conflict with what was propounded in the *Origin....* and *Descent....* First, Darwin rejected all supernatural phenomena and causations or the need for a creator or designer (intelligent or otherwise!). Natural selection better explained the adaptability and diversity of the world purely materialistically and that randomness and chance was universal in the process of selection. Only the first step in natural selection – the production of variation – is due to chance and the second-step, which is the actual selection, is directional. Detaching God from science demanded for purely scientific explanations of all natural phenomena (a truly logical and positivist step). This was indeed an intellectual revolution and the great legacy of Darwin.

From the ancient Greeks and up to Darwin, the diversity of the world emphasized its invariance and stability. Variety consisted of a limited number of natural types, each one forming a class, with each member thought to be identical, constant, and clearly separated from members of other classes (called the typological or essentialist view). There was the prevalent belief in the existence of a teleological force in the world that led to ever greater perfection in humans (the "final cause" of

Aristotle and Kant). Others even believed in a cosmic teleology, where a purpose and predetermined goal or end was invoked for everything in nature. The mathematician Laplace theorized that a “complete knowledge of the current world and all its processes” would enable him to predict the future right up to infinity (now called determinism).

With Darwin, all animal and human groupings (in fact all living organisms) were treated as populations made up of uniquely different individuals (rejecting the idea of the constancy of populations and final causes). The theory of common descent where humans and living apes had a common ancestry was the final straw for the theologians. Yet, humans are unique among the animal kingdom. With their superior intelligence and cognitive abilities, languages with grammar and syntax, altruism, ethical and moral concepts and the richness of their cultures they have dominated the world. The material success of a social group depends to a large extent on the harmonious coexistence of all its members based on their altruistic motives, which ensure survival and prosperity of the group and the fitness of its individuals. Hence, selection in favour of altruistic behaviour is to the advantage of the group’s continued success (exemplified by kin selection and reciprocal cooperation as seen in groups as diverse as humans, birds, bees, ants etc.). Cooperation is central to the success of societies. Darwin’s fundamental premise that all individuals in a population are unique in their diversity refutes racist stereotyping; that evolution through natural selection adequately explains the origins, maintenance and improvements in altruistic and ethical behaviour in social systems.

Darwin was also a vociferous humanist, railing against the obnoxious slave trade of the time (horrified by it during the 1830s voyages of discovery). No single scientist has matched his collective impact on both the natural and social sciences; on religions, philosophy, politics, art and human culture. Natural selection must have shaped the human species like any other. Today, geneticists study the human genome to understand human evolution. Yet, human experiences are not recorded in DNA or memorized by genes. This writer believes that our mindsets are neither fixed by evolution nor moulded by culture. Humans have vast similarities that underpin the diversity of human nature; altruism and ethical behaviour being two such characteristics. Darwin saw unity in variety/diversity. The Darwinian World is also a ruthless one – it rejects the weak and rewards the strong. If so, kindness, compassion, loyalty and gratitude (very humane qualities) should be weeded out as altruistic but weak traits. Is this so? Darwin overcame this contradiction by emphasizing the importance of group selection (gs) in populations.

In the *Descent of Man*, Darwin pointed out that many individuals in a social group (a tribe) willingly help each other and sometimes even sacrifice themselves for the common good (altruistic), to be dominant over other groups. Others dominate by producing many offspring (a very selfish trait). The hypothesis of group selection continues to be argued over even today. How can one explain the evolution of behaviour that benefits fellow organisms while lowering individual fitness? William Hamilton (probably the most respected evolutionary theorist since Darwin) in his ground breaking treatise, “*The Genetical Evolution of Social Behaviour*” proposed an alternative to (gs) called the theory of nepotistic altruism (na), which is preferentially directed towards genetic relatives (i.e. true altruism outside kinship is very rare!). The rise and maintenance of cooperation is central to our understanding of human societies. When an individual’s cooperativeness is copied by others as a choice criterion, there can be competition among individuals to be more generous than others- this is called competitive altruism (ca). The evolution of cooperation between non-relatives has a positive feedback effect by increasing levels of cooperativeness and choosiness in societies. Natural selection, therefore, should favour altruism and by extension, ethical behaviour as an advantageous trait. By the same measure, non-altruistic and unethical behaviour could lead to conflict and confrontation and instability of social groups, leading to social decline.

These concepts are the basis of modern sociobiology and evolutionary psychology. During the past 30-40 years, scientists have given a rigorous mathematical framework to explain both gs and na/ca by applying the principles of covariance and game theory. The outcome of game theory was – selfish parents would tend to leave more offspring than altruists, but a group that contained more altruists would grow faster than a group that did not. Hamilton’s thesis was that the survival of particular genes, rather than the survival of individuals who carried them, was the crucial factor.

Darwin’s great contribution was to introduce a new set of guiding principles and a rational way of thinking for humankind about the living world, devoid of the supernatural, typology, teleology and determinism. The major social implications of Darwin’s research has been the increasing acceptance of a secular view of life on Earth and explaining the evolution of cooperation and hence altruism (a most desirable trait) in humans and some animals. This editorial is a simple tribute to a genius whose monumental influence on the sciences is passing by uncommemorated in Sri Lanka.

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