ASSOCIATION FOR ADVANCEMENT IN PLANT PROTECTION

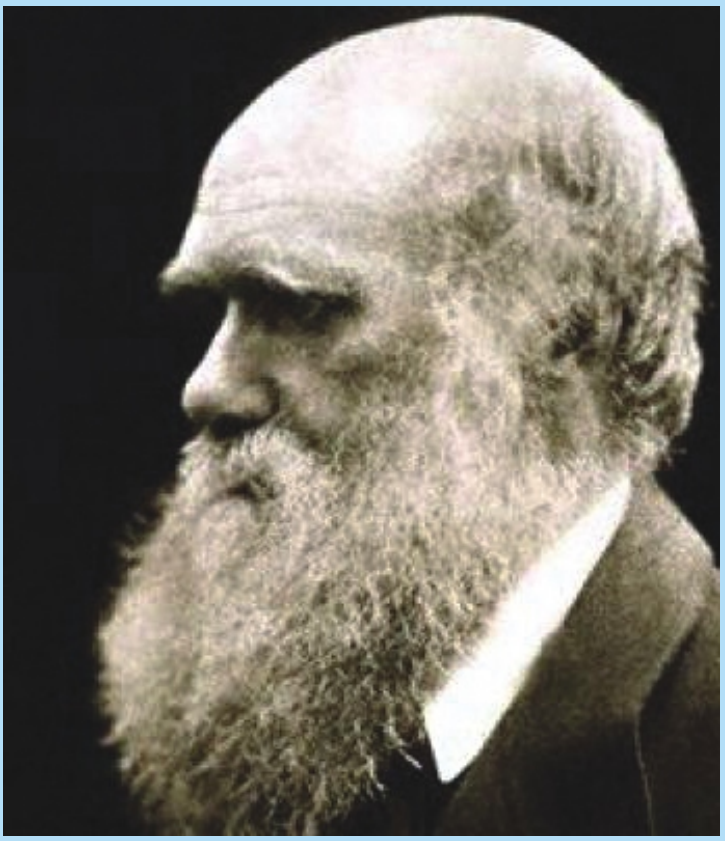
Newsletter

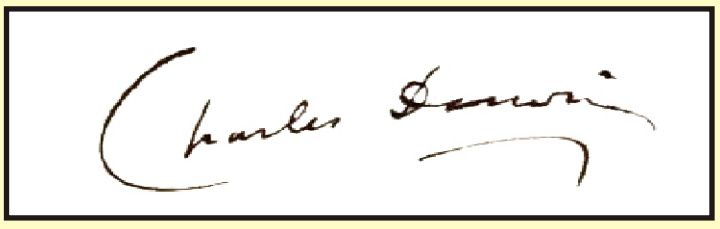
2006

Charles Darwin Special, Feb. 12, 2009

Together we will protect our crops

"I have called this principle, by which each slight variation, if useful, is preserved, by the term Natural Selection."-Charles Darwin, 1859.

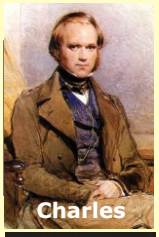


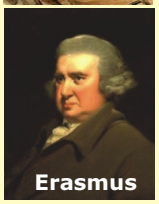


Charles Robert Darwin (1809-1882)

Big enough to undermine the idea of creation but simple enough to be stated in a sentence, the theory of natural selection is a masterpiece, writes Richard Dawkins, *The Guardian*, Feb. 9, 2008.

" The very essence of instinct is that it's followed independently of reason." – Charles Darwin on Instinct.

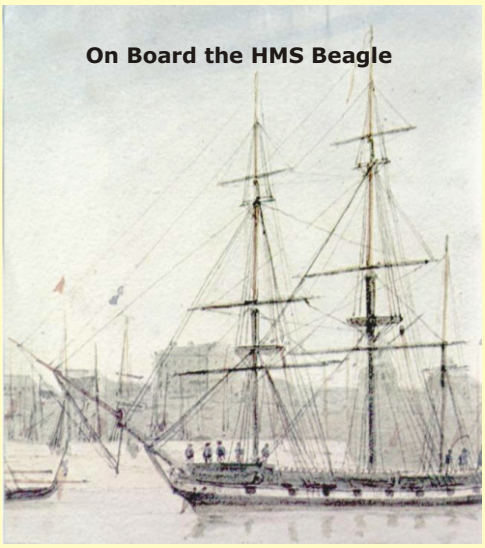

Charles


Erasmus

C R Darwin produced a prolific array of works during his lifetime. To understand his upright, reticent nature and the unabated desire for perceiving nature, Darwin's life needs to be traced from at least the time of his Grandfather, Erasmus, who was a Physician of repute (practiced at Derby) and a nature writer from whom Charles perhaps developed his interest in natural history. Erasmus had a surprising insight into the methods of nature; he threw out a multitude of pregnant hints in biology and once or twice he nearly stumbled on the idea of Natural Selection (NS). He saw the "struggle for existence"(SE) with remarkable clarity.

The Darwins and the Newtons came of old Lincolnshire families. Charles' father, Robert Waring Darwin, the third son of Erasmus, also settled down as doctor at Shrewsbury. His shrewdness, rectitude and benevolence gained him universal love and esteem.

Charles Darwin was the fifth child and second son of Robert and Susannah, born in Shrewsbury, England on February 12, 1809, sharing the same birthday with Abraham Lincoln. As desired by his father, Charles Darwin pursued an academic career at Edinburgh in medicine with total horror for blood. He instead developed an interest from his childhood in natural history in the footsteps of his grandfather Erasmus... His distaste for medicine and negligence made his father to put him instead for a carrier in clergy at Cambridge. He showed no interest in it but this gave him the opportunity to come in contact with the botany professosr the Rev. John Henslow, Dr. Whetzel and the then geology professor Sedgwick and his attention was turned to geology. On returning from a geological tour of North Wales with Sedgwick he found a letter form Henslow offering him a share of charismatic Captain Fitzroy's cabin on board the "Beagle" if he cared to go without pay as naturalist. The offer was accepted. The intended 3 year voyage stretched to 5 years and Charles had wonderful experience as he circumnavigated the world, spending over 3 of the 5 years exploring the coastline, flora and fauna of S. America. Upon his return to England he arranged his notes and read voraciously in all fields of Science. Finally in 1838 he put his ideas together in what eventually became his theory of evolutionary change and the origin of species by a process of NS. Meanwhile he married his cousin Emma Wedgewood on January 29th, 1839. His wife was singularly helpful, making his home happy and insubordinating herself to the great ends of his life. They had 10 children, 7 surviving to adulthood and lived a long and happy life together, untouched by the slightest hint of poverty or scandal. After living several years in London, they moved to a country house at Down in Kent about 16 miles from the outskirts of London. This Downe House now houses the heritage Charles Darwin Museum. His tragedies were premature death of 3 of their children and his own poor health. His life was plagued by a chronic illness and his son Francis writes "*For nearly 40 years he never new one day of health of ordinary man, and his life was one of long struggle against the weariness and pain of sickness*".


On Board the HMS Beagle


Wallace in Borneo rain forest

During this time Darwin introduced the idea of randomness and non-necessity of assuming any divine overseeing Creator as the driving force behind the variety or types in the natural world.


Darwin's study at Down House

The idea of evolution did more than contradict the *Genesis* story that disturbed the Victorian society and shook the faith of many. Lord Tennyson wrote a poem, '*In Memorium*' in 1850 where he drew from images of natural history, the debate over evolution and the heartlessness of an eat-or-be-eaten scenario of the natural World:

'Are God and nature then at strife, that nature lends such evil dreams// So careful of the type she seems, so careless of the single life.// Who trusted God was love indeed, and love creation's final law.// The nature, red in tooth and claw, with ravine shrieked against his creed'.

On May 14, 1835 he began a 'sketch' account and by July had decided to produce a full technical treatise '*On the Species*'. Darwin was immensely surprised in 1858 when he received a package from Indonesia containing an essay written by the young English naturalist, Alfred Russell Wallace containing an outline of a theory nearly identical to his own which Wallace claimed was '*devised one night over a malarial fit*'.

Finally, it was agreed that both (Darwin and Wallace) present their papers concurrently at the Linnaean Society and on July 1, 1858 the Wallace and Darwin papers titled respectively,'*On the Tendency of Species to form Varieties*' and '*On the Perpetuation of Varieties and Species by Natural Means of Selection*' were read out. In 1859 John Murray published on the *'Origin of Species By Means of Natural Selection or The Preservation of Favoured Races in the Struggle for Life'* on 24th November. Several editions followed in quick succession with some changes and in the sixth edition (19th Feb., 1972) the title was shortened to the snappier *'Origin of species'*.

During these and following trying times of a theological challenge, Darwin's main support came from Botanist Joseph Dalton Hooker and Philosopher Thomas Huxley. Altogether Darwin wrote 14 books, 4 monographs and his narrative of the voyage of the Beagle. In 1971, his book '*The Descent of Man*' was published in which he argued that humans were no different from all other forms of life and we too have an evolutionary history and are influenced by the forces of NS. Then in '*The Expression of the Emotions - Man and Animal*'(1972), he dared to claim that most of our refined human


A page from family album

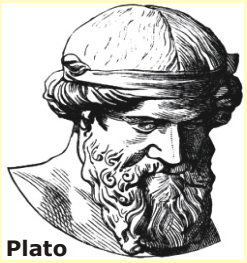
behaviour - the expression of our emotions also reflected our evolutionary past.

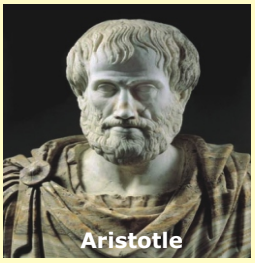
Darwin's health deteriorated sharply following the death of his older brother Res, in Aug 1881 and on April 19, 1882, at 73 years age, he died at Downe House attended by his wife, his daughter Henrietta and son Francis. The last words spoken to his wife were '*I am not the least afraid to die*'. Darwin wanted a simple burial but by the wish of the Parliament, a State burial was given to Charles Darwin on April 26, 1892, a few feet away from the grave of Sir Isaac Newton at the Westminster Abbey. His pall bearers included Alfred Wallace, Joseph Hooker and Thomas Huxley. A special funeral anthem began with the words - '*Blessed is the man who finds wisdom and who gains understanding*'! Said Huxley in his eulogy during the funeral services " *his was intense and almost passionate honesty by which all his thoughts and actions were irradiated, as if lit by a central fire*'. Emma Darwin, his loyal and devoted wife, moved to Cambridge but returned to Downe House during the summers for 14 more years until her death there in 1896.

Further Reading :

(1) Janet Browne (2007). *Darwin's Origin of Species: A Biography*. ISBN 978-08711395356. (2) G.W. Foote (1889). *Darwin on God*. Progressive publishing Co.28 Stonecutter St. E.C.(3)Michael Ruse. (2008). *Charles Darwin*. Blackwell Great Minds. U.K.

Darwinism the Platform


Plato


Aristotle

What influenced and moulded Charles Darwin's thoughts may well start with his grand father Erasmus, who in his medical text book *Zoonomia* (1794) included a brief and obscure chapter on evolution and variation that Charles read as a small boy.

From antiquity, Plato (c.428-248 BC) had established the philosophy of essentialism which he called "*Theory of Forms*". This Theory holds that objects observed in the real world are only reflections of a limited number of essences. Aristotle (384-322 BC) in his *Scala Naturae*, described in *Historia Animalum*, classified organisms in relation to a hierarchical "*Ladder of life or Chains of being*", placing them according to their complexity of structure and function, relative to organisms that showed greater vitality and ability to move described as higher organisms.

The two creation accounts in the book of *Genesis*, however, contradict themselves concerning the creation of man. The order described by first account follows: day and night, the sky, the sea and vegetation, the sun and moon, sea creatures and birds and finally land creatures and man… (Genesis 1:1-26). Darwin had exposure to *Genesis* at Cambridge through William Paley's text as *Natural Theology* based on the argument of design. As a classification system, it became the major organizing principle and foundation of emerging science of biology in the 17th and 18th centuries.

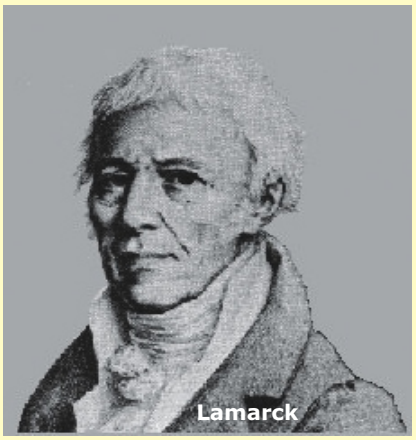
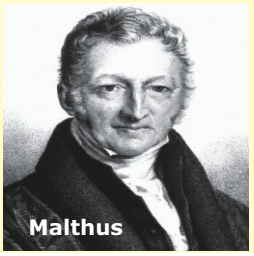
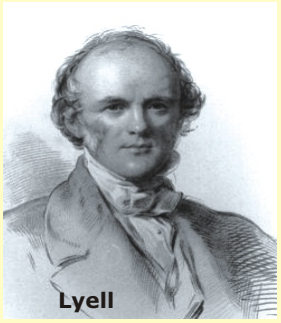

Lamarck

Diagram from "*Vestiges of Natural History of Creation*" (1844) by Robert Chambers shows a model of development: fish (F), reptiles (R) and Birds (B) represent branches from a path leading to mammals.

Jean Baptiste Pierre Antonie de Monet de Lamarck is credited with the theory of Inheritance of Acquired Characteristics (IAC) which he published in his book in 1809, *Philosophie Zoologique*. Lamarck did not believe that all living things shared a common ancestor but rather that simple form of life was created continuously by spontaneous generation. He also believed that an innate life force drove species to become more complex over time advancing up a linear ladder of complexity that was related to the great chain of being. He believed species were adapted to their environment. Organs may change through use or disuse just as muscles are affected by exercise. The changes are inherited in the next generation.

Robert Grant, the anatomist developed Lamarck's and Erasmus Darwin's thoughts of transmutation and evolutionism and investigated homology to prove common descent. Charles Darwin was involved with Grant in investigations on the life cycle of animals. The book by Chambers and Vestiges proposed an evolutionary scenario for origin of the Solar System and Life in Earth. It claimed that fossil records showed a progressive ascent of animals with current animals being branched off as main line that leads progressively to humanity. It implied that the transmutations lead to the unfolding of a preordered plan that had been woven into the laws that govern the universe.


Malthus


Lyell

George Guier attacked the idea of Lamarck agreeing with Aristotle that species were immutable. Richard Owen (1847) showed diagrammatically his conceptual archetype for all vertebrates. Charles Lyell opposed scriptural geology and in his '*Principles of Geology*' (1830-33) he criticised Lamarck's theories of development.

The above, albeit brief background, shows that not all ideas of Charles Darwin in his '*Origin of Species*' were original. Thus, the hypothesis of transmutation of species is influenced by Lamarck, E. Darwin and Lyell's antilamarckian arguments:

SE may be influenced by many including Malthus. The first author of the idea was of Heraclitus.

Common descent may have been influenced by von Baer and Owen, the first author being Maupertus.

Biogeographical speciation was largely influenced by Lamarck. First author Guelin, von Buch.

NS was independently discovered by Wallace.

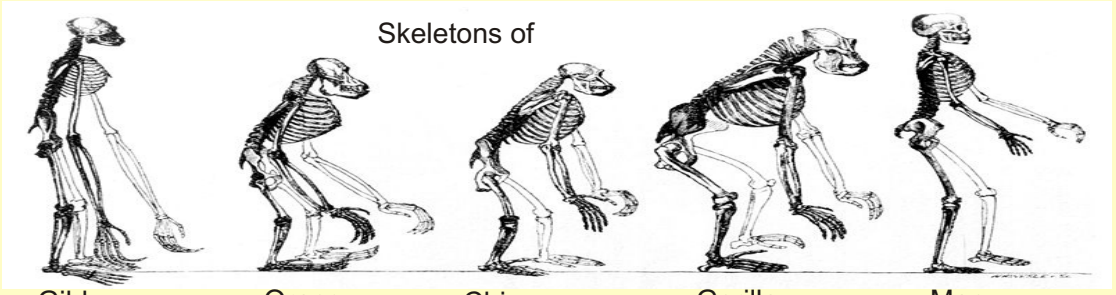
Heredity (use and disuse) was largely influenced by Lamarck

Heredity (pangenesis) and sexual selection can be considered as totally independent contributions of Charles Darwin. As Ruse (1979) pointed out he was not a solitary genius indifferent to and unaffected by the currents around him.

There are some hints that he was possibly influenced by Buddhism! (Nat. Geog. News, Feb 16, 2009).

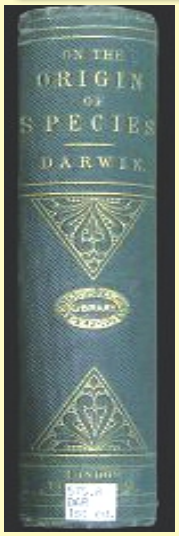
Further Reading:*(1)Harry* Cook and Hank D. Bestman *(2000) A Persistent View: Lamarckian Thought in Early Evolutionary Theories in Modern Biology***.** In *Perspectives on Science and Christian Faith* 52:86-97. Department of Biology, The King's University College , Edmonton, Alberta T6B 2H3. hcook@kingsu.ab.ca hbestman@kingsu.ab.ca. (2) Stephen J Gould (1980) *The Panda's Thumb*. New York: W.W.Norton & Company. (3) Ruth Anshen (1985) *Creation and Evolution: Myth or Reality?* New York: Praeger Publishers.(3) Zirkle, C. (1959). *Evolution, Marxian Biology and the Social Scene*. Univ. Penn. Press. P.72. (4) Gerschenowitz, H. (1984). Prof. Zirkle's vitriolic attack on Lamarck. *Indian J. Hist. Sci*. 19: 261-72.


Darwin at Shrewsbury



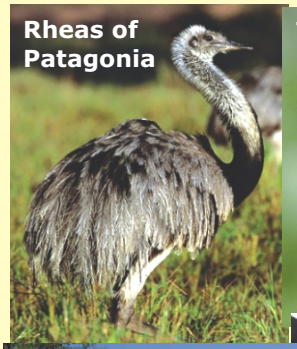
Drawn by W.Hawkins from specimens in the Museum of the Royal College of Surgeons

DARWINISM- ORIGIN OF SPECIES AS PRESENTED



The first few pages are devoted to quotations that attempts to balance between Darwinism and natural theology. Quotes are followed by an INTRODUCTION where he presents his observations while on board HMS 'Beagle' starting with the distribution of rheas, Galapagos tortoises and mocking birds inspiring doubts in species being fixed, and the close relationships he found in S. America to animals currently living in the same continent.

As many more individuals of each species are borne than can possibly survive, and as consequently, there is frequent recurring SE, it followed that any being, if it vary however slightly in any manner profitable to itself, under the complex and some times varying condition of life, will have better chance of surviving, and thus be naturally selected.

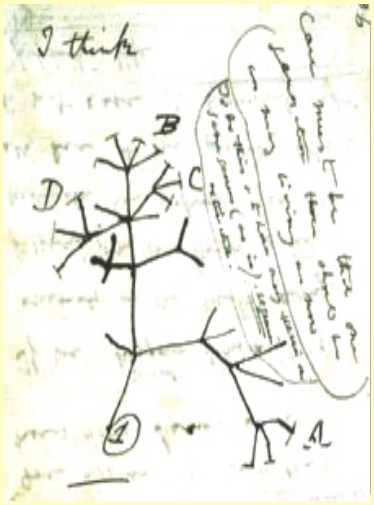

Rheas of Patagonia


The finch


Darwin creatures

In chapter-I, Darwin discussed the considerable amount of variation of plant and animals under condition of domestication, apparently occurring since the Neolithic period giving details related to rock pigeons that show astonishing range of diversity. This is adopted in breeding domestic animals for which he introduced the term artificial selection.

In chapter-II, Darwin deals with variation under nature stating that in a large genus with several species there are also usually numerous varieties that he preferred to value as incipient species.



Chapter-III deals with SE,"*I have called this principle, by which each slight variation, if useful, is preserved, by the term natural selection (NS) in order to mark its relations to man's power of selection.*" In the 5th and 6th edition he used the term survival of the fittest (SF) first coined by Herbert Spencer as being more accurate. He discussed the likelihood of prolific increase in population leading to a Malthusian struggle. He also stated that the competition is more severe among closely related forms (which fill nearly the same niche).

Chapter IV then turns to NS under infinitely complex and close fitting mutual relations of all organic beings with their environment. He sites examples of extinctions of some species at any one locale, immigration of others to new locales where they adapted themselves more readily. Having no knowledge of Mendelian genetics Darwin tried to deal with anticipated blending of inherited characteristics. He then introduces "*sexual selection*" to explain the seemingly non functional differences between sexes (plumage of tail of Bird of Paradise). He drew attention to cross breeding between varieties giving vigour and fertility to the off springs. With the aid of a tree diagram and calculations he indicates the divergence of characters from original species into multiple new species and genera - branches stopping where extinction occurred, while fresh buds form new branches.

At that time unfortunately there was no agreed upon model of heredity although Gregor Mendel (1822-84) had already shown on garden peas that whole characters are transmitted as units. Each higher organism had a pair of units (genes) for each inherited character. A particular gene may be expressed or lie dormant but it is not simply diluted out as Darwin feared.

Darwin accepted the Lamarckian version of IAC and in Chapter V discussed the effects of Use and Disuse saying that such modifications are inherited.

In Chapters VI through XIV, Darwin justified his arguments of NS and discussed the imperfection of geological records (Chapter-X, XI), the possibilities of geographical distribution (Chap-XII, XIII) and finally presented a comprehensive recapitulation justifying the conclusions. These *John Wilkins* rounded up as follows:

1) Transmutation - Species change from one to another opposed to Aristotelian view that species were natural and eternal.

2) Common descent - Similar species with similar homologies were similar because they descended from a common ancestor.

3) Struggle for existence - More organisms borne than can survive. Consequently most fertilised zygotes die and of those that are borne many will die or fail to reproduce. The competition here is against environment which includes other species that use the same food resources (*interspecific*).

4) *Natural selection* - Variants that confer advantage on the bearer organisms will reproduce more frequently than competitors (intraspecific).

5) Sexual selection - Many features being obvious hindrances and are born by one sex only. Usually relates to those that give quantitative advantage in attracting mates. Competition here is between *conspecifics* of the same gender.

6) Biogeographic distribution - Dispersal of similar but related species were due to their evolution in one place and migration into other regions.

7) Heredity - Not knowing principles of genetics it is stipulated that the use of the features of the organism would change the way those features were inherited.

The impact of Darwin's philosophy on subsequent generations were as profound as the Newtonian philosophy had and Darwin hesitantly put out his views in two volumes "*The Descent of Man, and Selection in Relation to sex* " where he sought to show that man is descended from the great apes. The main grounds on which he based his arguments were :

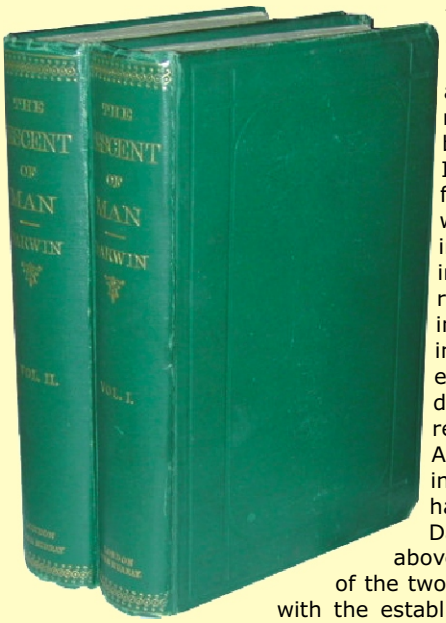
(1) there is correspondence in bodily structure between man and

other animals; the bones of his skeleton, the muscles, nerves, viscera and brain correspond; the structure of the tissues and composition of the blood are similar; men and animals have common parasites.

(2) The embryo of man closely resembles the embryo of other mammals and undergoes a corresponding order of development and maintains, up to a point, the characters of a common ancestor.

(3) Man possesses certain rudimentary organs - muscles and other parts which can only be explained by the fact of their having been possessed by some forerunner in a perfectly serviceable state.

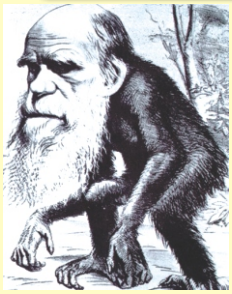
These facts concur in furnishing for supposing that man is no more by his descent than a more highly organised form or modification of pre-existent mammal. It is argued that the distribution e.g. human reason and animal instinct is not one of degree but of kind. So far the emotional parts of mental constitution go, the emotions of animals are plainly our own: terror, suspicion courage, good and bad humour, revenge, affection - all these moods and turns may be as truly predicated. If we turn to the faculties of intelligence, we find in the lower, as in the higher, memory, imitation, curiosity and rudiments of imagination (as shown in their dreams) and even the complex derivative quality of reason.



A great mass of interesting phenomenon has been collected by Darwin in proof of the above proposition. The bulk of the two volumes are occupied with the establishment of a different the ory that the difference between races is due to some measure to what he calls "*Sexual Selection*" (SS). SS is a force capable for accounting for many characters which, as not being beneficial for SE, cannot be expected by the process of NS. Modifications of this kind has been acquired through advantages which they confer on their possessors in respect of propagation, by giving them the choice of the most vigorous and fruitful partners. Finally, Darwin gave some highly ingenious explanations of the mode in which a moral sense may be presumed to have originated.

The Church vehemently objected to man being projected as evolutionary end product of apes. To this, exasperated Darwin responded "*For my part I would as soon be descended from that heroic little monkey, who braved his dreaded enemy in order to save the life of his keeper, or from that old baboon, who descending from the mountains, carried away in triumph his young comrade from a crowd of astonished dogs -- as from a savage who delights to torture his enemies, offer up bloody sacrifices, practices infanticide without remorse, treats his wives like slaves, knows no decency, and is haunted by the grossest superstitions".* ■

Darwinism vs. Theological Beliefs (Religions)*



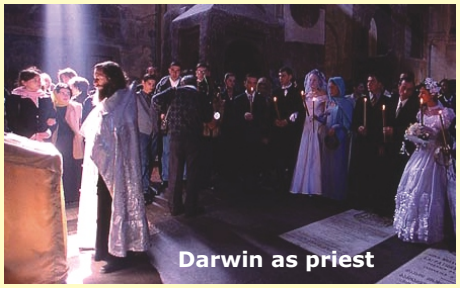
It's still monkeys writing Shakespeare, only now they have word processors with "cut and paste" functions

What was it about Darwin's scheme which challenged the theological descriptions of the time? These could be summed up as:

It refuted the notion that creatures had been individually designed by God showing no evidence of ingenuity of their design and exquisite nature of their adaptations pointing to existence of God.

It cohered with the geological proposal of Lyell that earth was very old compared with the chronology suggested by Genesis.

If implies that apes and humans have a common ancestor.


Darwin as priest

What are these theological positions? We have seen the Christian belief with two opinions in genesis supporting the thought that God created all kinds (species) and their variants (subspecies) independently from each other (Genesis 1:1-2;3) during each day of a 7-day week. Creation is by divine command: God say "*Let there be light*" and light is created. Mankind (male and female) are created after the entire world is prepared for them. The 2nd story (Genesis 2:4-25) begins with the creation of man and woman (Adam and Eve) separately in God's Garden of Eden. They live in harmony with God until they gain "*knowledge of good and evil*" and are expelled from God's presence into the fallen world. Bible says universe is only about 6000 years old.

Hinduism The more ancient Hinduism having its roots in Vedic culture says essentially that there are many universes. The universe in question is *'Brahmand'* and God *'Brahman'* has a life span having both birth and death. Thousands of such Brahmans have passed away and compared to predictions of age of universe by modern science to be 15 bill years, the Vedic culture states it to be about 1,55,522 billion years old. Vishnu the eternal God (Universe) is timeless. Only Brahman, of the local big bang universe, is time bound. Its major divergence with Darwinism is that Vedas accept *consciousness* and is aware of its existence while Darwinism does not.


Darwin at café of British Museum

Hindus like Darwin were evolutionists and recognized that various forms of life exist conceptually within God and evolve out of matter (which itself evolves from the superior consciousness) in conjunction with the desires of karmically bound souls. In fact the *Dasavatara Strotam* (10 incarnations of Vishnu) almost parallels the Puranic notions of life's evolution from aquatic life upwards: Matsya (fish)> Kurma (Amphibians) >Varaha (Terrestrial animal) > Narasingha (Both animal and man) etc. Jivas develop from gross to refined, subtle expressions through 8,400,000 forms beginning with aquatic life. There is no real contradiction with Darwin's SE in which one living being is food for another (*Jivo jivasya jivanam* = survival of the fittest).

Taoism Tao is the nameless void, the Mother of the ten thousand things. Tao is considered by Laozi to be that which eternally gives without being depleted and eternally receives without being filled. According to Taoist genesis (in Tao Te Ching), tao-nothingness or Wuji gave rise to existence of Taichi; this existence splitting into the binary yin and yang, these splitting into four realms and then eight countenance and every beings or nonbeings emerge. Taoism explicitly denies the fixity of biological species and they are speculated to have developed different attributes in response to different environments.

Buddhism: Itself generally ignores the questions regarding the origin of life.

Jainism According to Jains the universe was never created nor will it ever cease to exist. It is eternal and passes through an endless series of cycles. Each of the upward or downward cycles is divided into 6 world stages (*Yugas*). The present world age is the 5th stage of one of the downward cycles.

Sikhism: According to Guru Grantha Sahib, prior to creation all that existed were God *(Vahiguru)* and his will *(Hukum)*. After contemplating for millennia, God created all the resources enclosed in a shell like that of an egg. As the shell burst, the entire cosmos. was created (Big Bang?) and all elements of the universe started moving away from the point of bursting.

Surat Sabda Yoga This cosmology depicts the whole of creation (the macrocosm) as being emanated and arranged in a spiritually differentiated hierarchy often referred to as eggs, regions or planes. The constitution of the microcosm is an exact replica of the macrocosm. The bodies in it develop over yugas through involution (higher to lower planes) and evolution (lower to higher planes).

Islam One of the narrations in Qurán is similar to Judeo-Christian accounts of creation, the processes of creation taking 6 days (or epochs). It further states that God moulded clay, soil, water and sand into a model of man. He breathed life and power into it, and it immediately sprang to life and was called Adam. He lived in paradise. God created Hawa (Eve), the first woman out of Adam's side and she was also placed in the garden in paradise with only one stricture - not to eat from the forbidden tree. But Iblis (Satan) tempted them to disobey God and eat the fruit. For this disobedience, He cast them out of paradise.

The first Muslim biologist and philosopher was the Afro-Arab writer Al-Zahiz (9th century). He considered the effects of environment on an animal's chance for survival and described the SE.Ibn Miskawayh's al-Fawz al-Asghar and epistles of Ikhwan al Safa set forth ideas on how species develop : from matter into vapour and thence to water, thence mineral into plants and then animals leading to apes and finally humans.

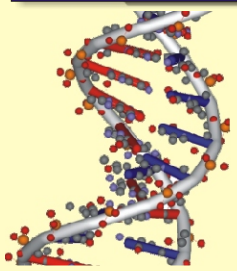
Mayas The Maya of Mesoamerica's account of evolution is recounted in the book "*Popol Vuli*". Tepan and Gucamatz came together and created the world in the order forest, birds, deer, jaguars and snakes.

Incan Then *Con Tiqui* created the sun (*Inti*), the moon, and the stars to light the world. It is from Inti's teat the *Sapa Inca*, emperor of Tuwantin Suya is descended.

Babylonian The Babylonian myth is recounted in the "Epic of Creation" known as *Enuma Elish* dating to 2nd millennium B.C. ….. *the flood is over, the animals disembark and Zirud Sira prostrates himself before Au* (Sky-God) *and Enlil* (chief of the Gods) *who give him eternal life and take him to live in Dilmuh for preserving the seed of animals and the seeds of mankind*.

Bahâi - Bahâis believe that humanity and everything therein are creations of God and formed and developed by Him. Earth came into being at particular moment and then subsequently breaks down into constituent parts. Bahais believe that humanity was created to know God and to serve his purpose.

Darwinism and Modern Evolutionary Synthesis:



Will mutations produce wings like in angels, in a human being? If you wanted to develop a race of angels, would it be possible to select for a pair of wings?
Theodosius Dobzhansky
I could try! Peter Medawar

Darwinism as modified by the findings of modern genetics is popularly called Neo-Darwinism (ND), the term first coined by George Ramaness. ND in other words is theory of evolution that represents a synthesis of Charles Darwin's theory in terms of NS and modern population genetics. Lynn Marguilis stated that ND attempts to reconcile Mendelian genetics (organisms do not change with time) with Darwinism which says they do.

The modern evolutionary synthesis resulted from the developments in population genetics during 1918-32. It showed Mendelian genetics was consistent with NS and gradual evolution. This synthesis is still the current paradigm in evolutionary biology (See Julian Huxley : *Evolution: The Modern Synthesis*, 1942).

Alternatives to NS discussed included Lamarckism, orthogenesis (progressive evolution) and saltationism (evolution by jumps). Key to the controversies was Weismann's theory of germplasm which says the germplasm forms the body but the body had no influence on germplasm (Weismann's barrier). In his book, "*The Genetical Theory of Natural selection*', R A Fisher showed how Mendelian genetics was consistent with the idea of evolution by NS. J B S Haldane applied mathematical analysis to real world examples of NS. Dobzhansky was the first to describe and define genetic polymorphism (human blood group polymorphisms). Mayr (in his *Systematics and the Origin of species*, published in 1942) introduced the concept of biological species that defined the species as of potentially interbreeding populations that were reproductively isolated from all other populations. G G Simpson showed that (see his *Tempo and Modes in Evolution,* 1944) NS was compatible with palaeontology.

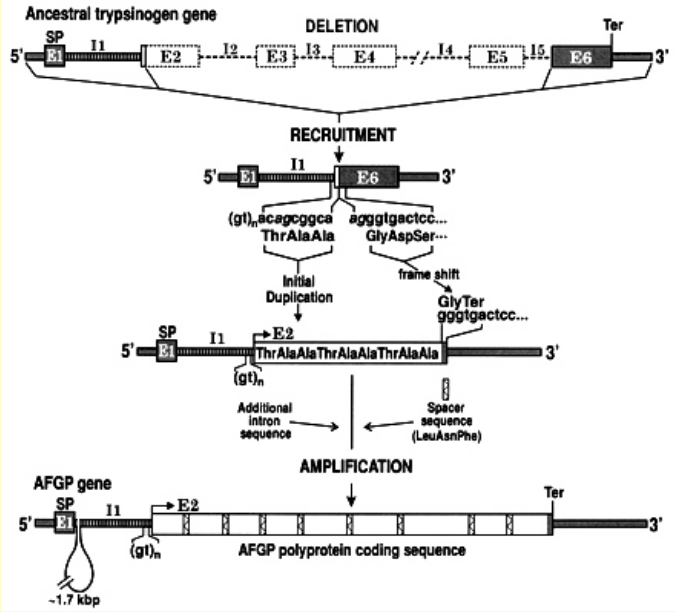
The genetically accepted view at the time was: evolution is overwhelmingly gradual; small genetic changes, recombinations (Rc) ordered by NS. Discontinuities amongst species (or other taxa) are explained as originating gradually through geographical separation and extinction (not saltation).

According to this new paradigm, evolution is driven by chance affecting one or a few nucleotides of DNA per occurrence. Bigger changes from Rc occur by which longer DNAs are swapped, transferred or doubled. These two processes - mutations and Rc create new meaning in DNA by lucky accidents.

Lucky accident hypothesis do not always gel. Take for example the ability of bacteria to become resistant (R) to antibiotics (or where R is shown to have pre-existed in the gene pool) or the case of the sleeping sickness causing trypanosomes - where antibiotics produced by animals bind to the coat protein (CP) of the parasite. But some of the parasite produces new CP and the cycle continues (Dulbecco, 1987). These studies uncovered an amazing organization in the parasite's DNA. Radioactive probes have revealed that a hundred or more genes are devoted to CP each specifying one kind of coat molecule - only one effective at a time. Among viruses, mutations can even alter a CP thereby temporarily disguising the virus.

*Further Reading: (1) Mayr E (1982) *The* Chapter IV in *Growth of Biological Thought: Diversity, Evolution & Inheritance*. Harvard, Cambs. p567 et seq. (2) E.K. Peters (1996) *No Stone Unturned: Reasoning about Rocks and Fossils*. (3) Renato Dulbecco (1987) *The Design of Life,* Yale University Press. (4) www.icgt.org/MonitorPastArticles/IslamicEvolution.htm. (5) Biruni, Al (1000 AD) *The Athar-Ul-Bakiya* (The Chronology of Ancient Nations). Translated by Dr. C. Edward Sachu. London: W.H.Allen, 1879.

The notothenoid trypsinogen (T) to AFGP (antifreeze gene proteins) conversions is the first clear cut example of how a protein gene spawned a new gene for an entirely new protein with a new function (Chen *et al.* 1997) - linking 2 genes with different functions in a common Arctic Fish, one coding for T, the other for AFGP. This divergence in gene was later shown to have occurred 5-14 million year ago coinciding with the approximate time when Antartic ocean froze. This showed that AFGP evolved from T gene by a series of steps including whole gene duplication and the deletion, insertions, duplication and amplification of smaller sequence, and a frame shift mutation.



Trypsinogen to AFGP conversion

Again Darwin postulated evolution is a gradual process with tiny steps at a time. However fossil history shows that species remain unchanged for long periods and then suddenly a burst of new forms appear in fairly rapid succession. Thus, the entire Cambrian explosion of about 570 million years took 5-9 million years where all kinds of multi-celled creatures in astonishing variety appeared as if out of nowhere. This is more the rule than exception. This was described as punctuated equilibrium (PE). This is explained by suggesting that big evolutionary steps occur gradually in small isolated populations. Perhaps PE is a clue that the genetic mechanism underlying evolutionary progression is altogether different from the one currently in favour.

Richard Dawkins (1994) says eyes could have evoluted many times because there are about 40 different kinds of eyes. It has been shown recently that the same gene co-ordinates in eye-making of wasps and mice. The coordinating genes must come first! This shows that genetic control mechanisms of development are much more universal than anticipated. Impressive similarities between homeotic gene in fruit fly and flowering plants have been demonstrated, thus indicating that coordinating genes were standardised across a broad range of multicelled animals.

Convergent evolution (CE) has been observed since the time of Darwin e.g. physical similarities between sharks (fish) and dolphins (mammals); parallel origin of the cochlea of birds and mammals. Convergences keep happening because organisms keep wanting to do similar things and there are just so many limited ways of doing them. Stephen Gould believes that slight differences in the course of evolution should lead to totally different outcomes (see Bonssau *et al.*, *The Nature,* 2008).

Two terms commonly being used today are - micro- and macro-evolution (MiE and MaE). MiE is a change in the gene pool of a population over successive generations. MaE is change in grand scale encompassing the origin of novel design etc. Gould (2003) points out that MiE occurs during stasis and MaE at punctuated points. The scenario is inconsistent with Darwinian graduation. ND adequately accounts for MiE through changes in existing allele frequencies (darkening of English moth's wings). A single nucleotide substitution that alters a virus' CP into one that host's immune system is not able to recognise – MaE. In the evolution of photosynthesis it requires wholly new genes with new instruction sequences).

To sum up:

A considerable part of Darwinism is not of the nature of an empirical theory, but is a logical truism.

Artificial selection never produces wholly new characteristics without the import of new gene(s) that differs from any known predecessor by more than say a dozen essential nucleotides.

The evolution of AFGPs in Antarctic cods presents problems for both Darwinism and Cosmic Ancestry.

Evolution does not appear to be gradual contrary to Darwin's firm prediction.

The standard theory cannot explain why the coordinating genes that control the development of embryos and major features are often similar across totally different species.

CE is a surprise not well explained by ND.

Macroevolutionary progress is not accounted for by ND.

So, in summing up, it would appear that a small step taken back in 1859 permitted the subsequent generations of geneticists and population biologists to take giant leaps forward ever-closing the gap (s) between what is said and what remains to be said on the origin of species through NS. ■

Further reading:

(1) Negus, M R, Christopher Southgate (1999) *God, Humanity and the Cosmos*. T&T Clark.

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(10) Sagan, Carl (1997) *Pale Blue Dot.* Random House, USA.

(11) See also www.ngm.com on Darwin. ■

Darwin Publications

1839. The Voyage of the Beagle. ; J.Res.at.Hist.
1842. The Structure and Distribution of Coral Reefs
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1851. A Monograph of the Sub Class Cirripedia
1854. A Monograph on Sessile Cirripeds
1854. A Monograph on Fossils Penniculated Cirripeds of GB
1859. ON THE ORIGIN OF SPECIES ……..
1862. On the Contrivances by Which British and Foreign Orchids are Fertilised by Insects
1868. The Variation of Animals and Plants under Domestication
1871. The Descent of Man and Selection in Relation to Sex
1872. The Expression of Emotions in Man and Animals
1875. Insectivorous Plants
1875. The Movements and Habits of Climbing Plants
1876. The Effects of Crops and Self Fertilization in the Vegetable Kingdom
1877. The Different Forms of Flowers on Plants of the Same Species
1880. The Power of Movement of Plants
1881. The Formation of Vegetable Molds Through the Action of Plants. ■

Things You may not Know About Charles Darwin:

Emma's Diaries Online March 12, 2007 - THE PERSONAL diaries of Emma Darwin have gone online and span about sixty years of her life. The diaries provide us with a great deal off information on the family life of Charles Darwin, his wife, Emma, and their children. The 60 pocket diaries contain appointments, illnesses, family visits, and a wealth of other information on Darwin's personal life. "*These books were found in a cardboard box in an old cupboard about 20 years ago*," said the director of Darwin Online, Dr John van Wyhe. "*People weren't really interested in the day-to-day Darwin then, just the Origin of Species*." The diaries are available online at darwin-online.org.uk. Here you will find each page of Emma's diaries scanned and presented in an easy to navigateform. NB - Darwin scholars will be most pleased to discover that Emma's handwriting is far more legible than that of her husband, Charles.

Emma Darwin

Darwin's Tortoise Died on June 23, 2006 -.When Charles Darwin visited the Galapagos Islands in 1835 he captured three tortoise and took them with him. The one which would eventually become known as Harriet, was just five years old at the time. The story (which is disputed by some) goes that Darwin took Harriet back to England with him and gave her to the Bishop of Llandaff in Wales; from here she found her way to the Botanic Gardens in Brisbane, Australia, and then spent her last years living at Steve Irwin's zoo in Beerwah, Queensland, Australia. She died at the age of 176 of a heart attack on June 23rd, weighed 150 kg, and was the oldest living animal in captivity.

Darwin's Tortoise

Darwin Collection is Purchased- June 8, 2006 -The Kohler Darwin Collection, which includes nearly everything Darwin published from 1829 onwards, has been bought by the Natural History Museum in London for about £1,000,000 British pounds. The collection consists of about 3,500 items, which include 470 editions of "On the Origin of Species" and a rare copy of *Zoology of the Voyage of HMS Beagle,* bound in original cloth, and a map of the Falkland Islands from the Beagle voyage. The science director for the Natural History Museum, Richard Lane, said: *"This acquisition makes the Museum the ultimate Darwin resource. Combining this collection with our existing holdings give us an unprecedented insight into how the theory of evolution developed, and how Darwin worked."* It will take about three years to move, catalogue, and conserve the collection, and it will become part of a major Darwin exhibition planned for 2008.

Natural History Society Bldg.

Darwin's Childhood Home to be Restored- May 23, 2006 - . The Mount, Darwin's childhood home in Shrewsbury, is currently occupied by the District Valuer and Valuation Office Agency. But plans are being drawn up to convert the house back to its original condition from when Charles Darwin lived there and open it up to the public. The Shrewsbury and Atcham Borough Council hopes to have the restoration complete by the year 2009 - Darwin's bicentennial. Negotiations have started with the Valuation Office Agency to have them vacate the premises, but if these fail the council plans to use a compulsory purchase order to force them to vacate the house.

Darwin's Birthplace at Shrewsbury

More than 120 Species Named after Darwin-- AS THE father of natural selection and evolution theory Darwin has inspired numerous naturalists and scientists. Many of these scientists have in turn honoured Darwin by naming new species after him. These species often have specific names such as darwinii or darwiniensis. Today there are more than 120 species (and 9 genera) named after Darwin.

The batfish *O. darwini*

ESA : The Darwin Mission

The Darwin Mission-- THE DARWIN mission is an ESA (European Space Agency) project named after Charles Darwin, which aims to find Earth-like planets in our galaxy. The Darwin mission will survey 1000 of the closest stars, looking for small, rocky planets which are the most likely places for life to develop at least as we know it. The idea for the mission was proposed in 1993 and since then ESA has been working on a feasible design of the Darwin flotilla.

The Last Sip

Whisky, -the Last Drink to Pass Darwin's Lips– DARWIN'S daughter Henrietta Emma Darwin described the last minutes of Darwin's life in her manuscript Recollections of Darwin. According to her "...*they gave him some of the whisky and he was able to swallow and after three teaspoonfuls recovered consciousness...* ".

Christ College Cambridge

A section of Darwin's collection of bugs

Darwin the Priest-- AT THE AGE OF 16 Darwin went to the University of Edinburgh to study medicine, but was revolted by the brutality of surgery and neglected his studies. The failure to pursue medical studies annoyed his father, who shrewdly enrolled him at Christ's College, Cambridge to qualify as a clergyman and get a good income as apriest. The young Darwin soon neglected his studies once more and spent more time out in the field collecting beetles.

Crazy for Bugs-- ***DARWIN was a devoted beetle collector in his youth. According to his autobiography few things "... gave him as much pleasure as collecting beetles...". Another passage in his autobiography give proof of his affection for beetles: "... I saw two rare beetles and seized one in each hand; then I saw a third - a new kind, which I could not bear to lose, so that I popped the one which I held in my right hand into my mouth. Alas it ejected some intensely acrid fluid, which burnt my tongue so that I was forced to spit the beetle out, which was lost, as well as the third one.*** ■

Thank you Charles Darwin, for providing us so much food for thought - AAPP Group

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