

26. Darwin's *On the Origin of Species*

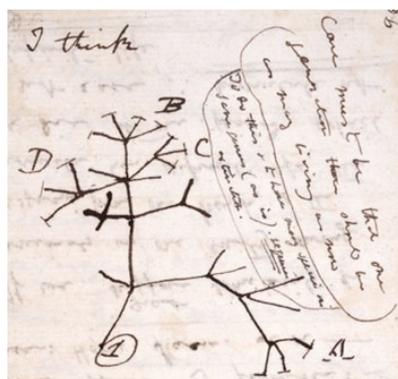
CHARLES Darwin (1809-82) is central in the development of Humanism because he represents that point in time when the human race first became aware of its place in the evolutionary process. The implication of Darwinism, as Richard Dawkins puts it, is that “slow, gradual, cumulative, natural selection is the ultimate explanation of existence”.

The idea that life on earth evolved from a common source was not new. Ancient Greek philosophers like Thales and Anaximander suggested that life originally developed in the sea and only later moved on to land. But their ideas were effectively buried for two thousand years. Aristotle argued for an unchanging hierarchical ladder of nature in which there is a progression from simple, undeveloped types of inanimate matter to the highest, which are humans with rational souls. When Christianity became the official religion of the Roman Empire, Aristotle's notion was given a Christian slant in the concept of a great chain of being, vertically extended, in which matter in the form of the earth is at the bottom of the chain and man, who is both matter and spirit, is a higher link. God, the ultimate spirit at the top, was assumed to have created this rigid hierarchy as described in Genesis.

For hundreds of years no further scientific thought was devoted to the origin of life and it was generally accepted that the earth was fairly young in modern terms. In Shakespeare's *As You Like It*, Rosalind says, “The poor world is almost six thousand years old”. Even as late as 1650, James Ussher, Archbishop of Armagh, published his *Annals of the Old Testament*, giving a chronology which dated creation from the night preceding 23rd October, 4004 BC.

Yet religious orthodoxy was already under scrutiny. The Copernican revolution had cast the earth and man out of the centre of the universe. Newtonian physics demonstrated that nature obeyed objective laws and that a God was no longer needed to maintain plane-

tary motion. The next stage on the voyage of discovery was to displace humans as the epicentre of the natural world. In the 18th century Kant speculated that organisms may have come from a single ancestral source. The French mathematician Pierre-Louis Maupertuis, the French naturalist Jean-Baptiste Lamarck and Erasmus Darwin, Charles Darwin's grandfather, also had inklings of the truth. It was, however, Darwin who conducted the necessary research and collected the empirical data to demonstrate that evolution occurred and then made the idea acceptable for scientists and the general public.



He had formulated much of his theory as early as the 1830s after returning from a voyage around the world aboard HMS *Beagle*, a 90-foot Royal Navy survey barque. Darwin, a naturalist, had been invited as a gentleman-companion of the captain, a natural history enthusiast, on the ship's second expedition to chart the coast of South America. It was planned to last two years; it took nearly five, from 1831 to 1836. While the ship and her crew surveyed and charted coasts, Darwin spent much of the time on land investigating geology and making collections, keeping careful notes of his observations and at intervals sending specimens home. He made some of his most crucial observations on the Galápagos islands where the ship was anchored for a month.

Yet he largely sat on the idea of evolution for two decades, although the second edition of his account of

The Voyage of the Beagle in 1845 contained allusions to the theory without naming it. The reasons for his hesitation included concerns about the public reaction and about upsetting his wife Emma, who was a conventional Christian. Also, he thought his theory would be more acceptable if he had a reputation as a biologist as well as a naturalist.

By 1854, and established as a biologist of the first rank, he began arranging his notes and was writing up his theory in 1858 when Alfred Russel Wallace sent him an essay outlining a similar idea. He and Darwin agreed to introduce the theory in joint papers in July 1858. There was little reaction, but when Darwin's masterwork went on sale in November 1859 the initial supply of 1250 copies sold out.

He argued that, instead of a ladder or a chain, all life is descended with modification from common ancestors through the paradigm of an irregularly branching tree of life with the same roots and the human species being just the tip of one branch. He drew a diagram in the margin of his notebook to illustrate his meaning (left). Each new species establishes itself as new roots springing off from the parent tree.

He also provided a mechanism for the process. It is in the title of the book: *On the Origin of Species by means of natural selection*. This is the process that drives the branches of the tree apart. Darwin himself described natural selection as “the preservation of favourable variations and the rejection of injurious variations”. In nature there is a ‘severe struggle for life’, and organisms show variations in character that influence their success in this struggle. Natural selection is the process by which the most advantageous heritable traits become more common in successive generations, and disadvantageous heritable traits become less common.

Darwin begins the *Origin*, not with natural selection, but with a chapter called ‘Variation under Domestication’ in which he discusses plant and animal breeding – in

other words, *artificial* selection. If readers could accept artificial selection, which has caused big changes in a very short period of time, then the leap to accepting natural selection over thousands of generations would not be so difficult.

Take the domestic dog, of which there are now possibly hundreds of breeds, from chihuahuas to great danes. It was domesticated about 10,000 years ago and, although Darwin thought it was probably descended from several wild species, advances in molecular biology have led to a consensus that all dogs are descended from a single species, probably the Eurasian gray wolf. Clearly, artificial selection can produce great diversity from a common ancestor in a relatively short time. Although natural selection is gradual and takes much longer, we now know that life on earth began about 3.5 billion years ago and the diversity that could have been created over this vast expanse of time is astounding.

In chapter 2 Darwin discusses individual, slight differences in a species which afford materials for natural selection to accumulate, later creating more permanent varieties, then leading to sub-species and eventually, when they become so different that they can no longer breed together, to different species. All these results, as he says in chapter 3, follow inevitably from the struggle for life.

Any random variation, however slight, if it is profitable to an individual, will tend to the preservation of that individual and will generally be inherited by its offspring. They in turn will have a better chance of surviving. So nature preserves favourable variations and rejects injurious variations. This is what Darwin calls natural selection, defined by Richard Dawkins as “the non-random survival of random variants”. Compared to artificial selection, it is, Darwin says, a force which is “as immeasurably superior to man’s feeble efforts, as the works of Nature are to those of Art”.

The main concern of chapter 3 is the struggle for existence. This inevitably follows from the high rate at which all organic beings tend to increase. More individuals are produced than can possibly survive. Here Darwin applies the ideas of Thomas Malthus, whose *Essay on the Principle of Population* first ap-

peared in 1798. Malthus argued that populations have the power to grow geometrically (exponentially an annual growth rate of 2% would double in 35 years), while the means of subsistence grew only arithmetically or linearly, so that the growth of population outstripped the means of subsistence. Darwin applies this doctrine ‘with manifold force’ to the whole animal and vegetable kingdoms; “for in this case there can be no artificial increase in food, and no prudential restraint from marriage”.

GIVEN limited resources, all lifeforms compete for food, sex and territory. The struggle means that there is cruelty and suffering everywhere. As Darwin wrote in a letter to Asa Gray, a Harvard botanist and devout Presbyterian in 1860, “I cannot see... evidence of benevolence and design on all sides of us. There seems to me too much misery in the world. I cannot persuade myself that a beneficent and omnipotent God would have designedly created the *Ichneumonidæ* [parasitic wasps] with the express intention of their feeding within the living bodies of caterpillars, or that a cat should play with mice”.

Another American, Robert Ingersoll, the 19th century lawyer and agnostic who suggested that “this century will be called Darwin’s century”, put it graphically: “Would an infinitely wise, good and powerful God, intending to produce man, commence with the lowest possible forms of life; with the simplest organism that can be imagined, and during immeasurable periods of time, slowly and almost imperceptibly improve upon the rude beginning, until man was evolved? Would countless ages thus be wasted in the production of awkward forms, afterwards abandoned? Can the intel-

ligence of man discover the least wisdom in covering the earth with crawling, creeping horrors, that live only upon the agonies and pangs of others? Can we see the propriety of so constructing the earth, that only an insignificant portion of its surface is capable of producing an intelligent man? Who can appreciate the mercy of so making the world that all animals devour animals; so that every mouth is a slaughter house, and every stomach a tomb? Is it possible to discover infinite intelligence and love in universal and eternal carnage?”

Evolution by natural selection has been dubbed by Daniel Dennett as ‘the single best idea that anyone has ever had’, and also as ‘Darwin’s dangerous idea’. It was dangerous, first of all, because in arguing for a mindless, blind, mechanical process, it removed the need for a designer. Human beings are not specially created by a God but are a part of the natural world and subject to its laws and processes. And if we are physical creatures like the rest of life, then we do not possess a soul and have no afterlife.

Of course, today there are many who still do not accept Darwinism. Some creationists, for example, argue that Darwin only established that there were changes within species, not that there were developments of new species. The former they often call microevolution, where the natural selection is horizontal, which they accept, while the latter is designated as macroevolution, where natural selection is vertical in producing entirely new species, which they reject. Darwin, they say, seemed to assume that the former type eventually leads to the latter. Thus the new organisms would be unable to mate with their ancestors, if we were able to bring them together.

Most biologists, however, do not use these terms because for them there is no relevant difference between microevolution and macroevolution, since both happen in the same way and for the same reasons. Creationists have a point in saying that Darwin did not explain the *mechanics* by which a new species evolves when one species splits in two, separated by reproductive barriers. It has actually been suggested that *The Origin of Species* is misnamed because it does not explain the origin of species. Even Jerry Coyne (*Why Evolution is True*) thinks a better title would have been *The Origin of Adaptations*.



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Yet Darwin describes the main factors influencing what is now called speciation without using that modern term (he never uses the word 'evolution' either, though the last word in the book is 'evolved'). He refers to isolation which, by checking immigration and consequently competition, will give time for any new variety to be slowly improved; and the size of a species' geographical range – if a species covers a large range it is likely to encounter a number of different habitats or environments, in which case natural selection will favour local adaptation and hence promote speciation.

In singling out isolation and local adaptation Darwin laid the foundations upon which later biologists have built. We now recognise the main mechanisms based upon these two factors. The first is allopatric speciation, or geographical isolation, such as the island barrier Darwin proposed. The 13 species of Galápagos finches deriving from a single species reaching the islands from Central or South America over a few million years are a classic example. The other main type is sympatric speciation, which occurs when a species splits into two groups that diversify and become genetically isolated while remaining in the same place. The individuals from each group may have a unique mutation that prevents them from breeding with the others or they may breed at different times.

OPPPOSITION to Darwin arose not only because he seemed to remove the need for a God but also because of what he seemed to put in the place of a deity. Herbert Spencer coined the term 'survival of the fittest' to describe the theory, and the concept of social Darwinism soon developed, in which the ideas of struggle and selection shifted from the world of biology to human society. Racism, cruelty, eugenics have all been seen as the end product.

On the one hand, the 'selfish gene' seemed to provide a biological basis for a laissez-faire social morality, in which competition, struggle, success and failure are regarded as not only inevitable but also desirable. In America especially, it provided an underpinning for capitalism and the ideology of extreme libertarianism. John D. Rockefeller claimed that his fortune from Standard Oil

was "merely the survival of the fittest... the working out of a law of nature and a law of God".

On the other hand, it also seemed possible to use natural selection to glorify group superiority, which is exactly how it was employed in Nazi Germany. Darwinism was seen as providing Hitler and the Nazis with a scientific justification for their policies in which the Aryan race and the German nation were treated as superior and other races were regarded as grossly inferior.

Both views were mistaken. In terms of evolution by natural selection, 'fittest' is the kind of fitness of a key to a lock, not necessarily sporting prowess, and can mean most loving and selfless rather than the most aggressive and selfish. It can also mean the best camouflaged, the most fecund, the most clever or most co-operative. In other words, forget Rambo; think Einstein or Gandhi.

The racism charge is particularly inappropriate, though it was unfortunate that Darwin's publisher John Murray added the subtitle, "*Or the Preservation of Favoured Races in the Struggle for Life*". Since the work demonstrates that, far from being separate and different, all human beings belong to one biological race, evolution actually refutes racism. In America in the 19th century it was the biblical creationists who generally supported slavery. Darwin's whole family were abolitionist and it was his grandfather Josiah Wedgwood who produced the famous cameo depicting a kneeling slave begging: *Am I not a man and a brother?* – a motto Darwin himself used in his notes.

In nature, it is not every animal for itself. Co-operation and altruism are as essential as competition. All social animals are dependent for survival on group life. Blackbirds and thrushes give warning calls when hawks fly overhead, even though it puts them in danger. Wolves and wild dogs often hunt together and bring meat back to other members of the pack. In many human societies, free health care and a welfare state have greatly weakened differences and the process of mechanical natural selection.

In his *Descent of Man* Darwin argued that we evolved from a long line of animals that care for the weak and build co-operation with reciprocal transactions. He argued for a strong continuity between human

and animal behaviour and that human morality would be impossible without certain emotional building blocks that are clearly at work in chimp and monkey societies.

In fact, far from individualism, nihilism or racism being the ethical implications of Darwinism, the relevant philosophical inference for humanity is existentialism. We have no proven purpose or fixed essence but instead we make up our own meanings and purposes. Evolution implies that we are part of nature and that we change. Like other creatures, we are not essentially good or bad but have the potential to be either. We are not static creatures but have the ability to evolve.

It is true that ethical progress has not been entirely upward. Europe's dark period in the 20th century is a moral blight on humanity. But if we had followed Darwin's true message instead of being enslaved to distortions of it, then we would have taken a far better path. His legacy is not therefore merely confined to the fields of science or medicine. It is thanks in no small part to Charles Darwin that we have the insight and the power needed to rework the human paradigm and evolve our better natures.
