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# Charles Darwin's Work, Life And His “Theory Of Evolution By Natural Selection”

## Introduction

Up until the mid 1800's, scientists, heavily influenced by the religion of the time, believed God had created the world and species did not change. In 1859, Charles Darwin challenged this, presenting his “Theory of Evolution by Natural Selection” based on enormous amount of research. Although, the following decade after Darwin's publication, his ideas were very contentious and heavily debated, they have since been accepted in their entirety by contemporary scientists. His theory has revolutionised natural history into biology, a testable science, making his theories essential to understanding biology.

## The Build

Before Charles Darwin's 1859 “Theory of Evolution by Natural Selection”, evolutionary thought was as varied as it was contentious. For centuries the “Great Chain of Being”, proposed by Aristotle (a linear chain of order used for classifying living beings), and “natural theology” (the living world was created by God and species did not change) was widely accepted by scientists due to their strong religious beliefs.

It wasn't until the 1700's that scientists began to question whether living things could change over time. George Louis Leclerc, Comte de Buffon, was one of the first scientists to theorise living things change, even suggesting humans and apes are related. While Buffon carefully hid his radical views to avoid public criticism, he sparked a new thinking around the capacity of species to change. The first evolutionist to confidently state their ideas about biological change was Jean-Baptiste Chevalier de Lamarck. He developed the “Theory of Inheritance of Acquired Characteristics” stating individuals inherited traits their parents had acquired during their life.

While Lamarck's theory has since been disproved, he essentially argued the environment directly affected individuals, pulling organisms along into a new form. The last major theory of evolution preceding Darwin's theory was one by scientist Georges Cuvier. In his 1817 book, *Le Regne Animal*, he divided the animal kingdom on the basis of anatomy, discrediting Aristotle's belief of growing perfection. Due to Cuvier's careful examination of fossils, he also officially established the extinction of some animals. His fossil evidence led him to propose that the Earth periodically went through sudden changes, each of which would wipe out certain species.

Geologist Charles Lyell proposed a theory called “uniformitarianism” in his 1830 book, *Principles of Geology*. He argued the formation of Earth's surface took place through countless small changes occurring over a huge amount of time. The idea of small changes over time was said to be instrumental in leading Charles Darwin to his understanding of biological evolution.

By the early 1800s, the current evolutionary theories had established; traits may be passed onto their offspring, living things do not grow from one another in a linear line, and there are species that no longer exist. However, no theories explained how this happened or why - until Darwin introduced his “Theory of Evolution by Natural Selection”, building on previous theories.

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## The Work

Born 12 February 1809, Charles Robert Darwin was a third-generation scientist. His father, Robert Darwin, was a successful doctor and his grandfather, Erasmus Darwin, was a physician who also published ideas on evolution and a common ancestor. In 1825, Darwin enrolled at University of Edinburgh to study medicine, but transferred to Christ's College in Cambridge two years later. His father suggested he study to become a parson instead, but Darwin preferred natural history.

When Darwin graduated in 1831, he joined a voyage on the HMS Beagle, a five-year survey voyage (1831-1836) around the world giving Darwin an opportunity to observe natural life in a great variety of settings and gathered an array of fauna, flora and fossilised specimens. Darwin was able to observe hundreds of similar-looking species close together but living in slightly different environments. The variety of unique species on the Galapagos Islands was of particular interest to Darwin who observed that the birds had adapted to the aspects of each island, specifically to the food available.

Darwin's observations during this voyage provided invaluable research of his future "Theory of Evolution by Natural Selection". When he arrived home, Darwin published his journal, filled with reports and observations called *The Voyage of the Beagle*, marking him as a first-class naturalist. By the time he was 30, Darwin had formulated his theory; small variations occur in reproduction and individuals with variations best suited for their environments live and produce offspring with the same characteristics. Over time, these variations result in new species, while those not sufficiently adapted do not live long enough to have their own offspring. Darwin theorised that all living species were related.

While Darwin shared his theories with close friends, he did not rush to publicise his ideas, wanting to wait until he had incontrovertible proof. His ideas were contradictory due to religious implications, particularly how they refuted the fixity of species and their perfect design (YourDictionary, 2018).

Over the next 20 years, Darwin amassed more data to support his theory. It wasn't until 1858 when Alfred Russel Wallace, an English naturalist, sent Darwin a letter outlining his own similar ideas that Darwin published his ideas. The following month, they jointly published a collection of Darwin's earlier notes and an essay by Wallace; *The Tendency of Species to Form Varieties; and on the Perpetuation of Varieties and Species by Natural Means of Selection*. Their theories received little attention, however Darwin's published book entitled, *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life* gained immediate widespread attention .

In his book, Darwin wrote of his two main ideas, descent with modification and natural selection, that over time would create new species. He presented three kinds of evidence in support of his theory; fossils of species changing over time, geographical distribution showing species descended from local ancestors, and unexpected similarities between the anatomy of species.

Darwin focused on what he knew from his observations of beetles, finches, tortoises, barnacles, pigeons and fossils. Darwin even acknowledged the difficulties facing his theory; lack of transitional forms in fossil records, unknown cause in variations, and unknown method for how the variations are passed to the next generation.

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Darwin was not the first to theorise about evolution, yet his vast supply of evidence carried conviction where earlier theorists had failed. Over the following years, Darwin updated his book regularly, authoring six significantly different editions. He waited until 1871 to openly speak of human evolution, in his *The Descent of Man*.

## The Debate

Charles Darwin's "Theory of Evolution by Natural Selection" turned into the greatest scientific controversy of the 19th century, some of which persist today. His theories challenged religious and long-held scientific beliefs and were refuted by religious figures and mainstream scientists.

Darwin's evolutionary theory was rejected by some as it directly contradicted religious beliefs about divine creation. Before Darwin, the prevailing scientific theories of life's origins coincided with these beliefs. Prominent clergymen, politicians and others condemned the work for its far-reaching implications. Compared to natural theology; there was no Creator involved in making species; species aren't fixed; the process takes aeons; there's no 'divine design' rather, useful traits emerge over time; and humans had no special, God-given place in nature. Darwin's theory caused outrage; German pathologist Rudolf Virchow called the idea of man descending from apes an attack on society's moral foundations.

There were also scientists that criticised Darwin's work, including renowned scholars Adam Sedgwick, John Herschel and John Stuart Mill. They claimed his conclusions were based on assumptions and his scientific method was too subjective, based on the method of hypothesis and thus prove nothing. Many scientific rivals also called to attention the gaps in Darwin's evidence, including the 'missing links' in the fossil records.

Opposingly, early supporters included renowned scientists Charles Lyell and Joseph Dalton Hooker. Allies applauded Darwin's theory as a brilliant unifying breakthrough. For many readers, Darwin's writing and the depth of his and Wallace's evidence settled the matter. When it came to critiques, Darwin largely distanced himself from the scientific and moral controversies his opponents presented. Instead, Thomas Henry Huxley, an English biologist and anthropologist, fought for Darwin's theory. Huxley became Darwin's public champion and defender, fiercely lecturing in favour of Darwin to crowds. He led what became known as the Great Debate against Samuel Wilberforce, Bishop of Oxford, who refuted Darwin's theory based on biblical creation. Huxley even argued for the separation of religion from science.

## The Prestige

By the 1870's, the idea that species evolved was accepted by mainstream scientists, however less accepted was the concept of natural selection. Darwin was unable to supply the mechanism for natural selection, the source of variation and what passed traits on, causing many scientists to reject the concept. Natural selection as the mechanism for evolution was not accepted until after Ronald Fisher's 1930 book *The Genetical Theory of Natural Selection*. Fisher united the previously incompatible heredity laws of Gregor Mendel with Darwin's theory of natural selection. Mendel's 1860's experiments established 'factors', now known as genes, were the mechanism for natural selection. Darwin's "Theory of Evolution by Natural Selection" has yet to be seriously challenged by another scientific explanation.

Evolution through natural selection is one of the most substantiated theories in science.

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Evidence from a wide variety of scientific disciplines have established and reaffirmed the theory, while also answering the difficulties Darwin outlined. Biologists have discovered the structure of the genetic code, DNA, and how it passes on traits and produces the variations Darwin's talked about, now called mutations. Genetic and fossil evidence proves humans emerged from Africa and are most closely related to chimpanzees. Paleontologists have discovered a myriad of fossils, considered as the 'missing links'. Modern geology, with the discovery of plate tectonics, have explained the existence of oddly similar terrestrial species on separate continents. Truly one of the most remarkable traits of Darwin's theory is that it has withstood heavy scientific scrutiny for 160 years yet manages to accommodate new ideas.

Charles Darwin's work heavily impacted scientific thought, sparking the separation of religion from science. Before Darwin, there was no biology, only 'natural history' based on observational knowledge. His book *On the Origin of Species* marked an evolution of natural history, focused on observation and description, into modern-day biology, focused on testing theories about living things. Darwin's theory did to biology what Newton's Law of Gravitation did to physics; it made sense to a vast number of things in the natural world. Darwin's theory united many branches of natural history into a synthetic theory, proposing clear and important questions for future research. As famously noted by evolutionary biologist, Theodosius Dobzhansky; "nothing in modern biology makes sense except in the light of evolution" .

## Conclusion

No biological concept has been more extensively tested and more thoroughly corroborated than the evolution of species through millions of years via natural selection. Backed by extensive research, Charles Darwin's "Theory of Evolution by Natural Selection" has been able to withstand heavy scrutiny from society and scientists alike. Darwin's work alone established biological evolution as a valid scientific theory and changed the way living things are examined within science. What remains true is that the work of Charles Darwin should be considered one of the greatest achievements in humankind, particularly for his search for a scientific and logical explanation in front of such a dogmatic society.