

Charles Darwin



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Charles Robert Darwin



At the age of 51, Charles Darwin had just published
On the Origin of Species.

Born	February 12, 1809 Mount House, Shrewsbury, Shropshire, England
Died	April 19, 1882 (aged 73) Down House, Kent, England
Residence	England
Nationality	British
Field	Naturalist

Institutions	Royal Geographical Society
Alma mater	University of Edinburgh University of Cambridge
Known for	The Origin of Species Natural selection
Notable prizes	Royal Medal (1853) Wollaston Medal (1859) Copley Medal (1864)
Religion	Church of England, though Unitarian fan background, Agnostic after 1851.

Charles Robert Darwin (12 February 1809 – 19 April 1882) was already eminent as an English naturalist^[1] when he proposed and provided scientific evidence to show that all species of life have evolved over time from one or a few common ancestors through the process of natural selection. ^[1] The fact that evolution occurs became accepted by the scientific community and the general public in his lifetime, while his theory of natural selection came to be widely seen as the primary explanation of the process of evolution in the 1930s,^[1] and now forms the basis of modern evolutionary theory. In modified form, Darwin's scientific discovery remains the foundation of biology, as it provides a unifying logical explanation for the diversity of life.^[2]

Darwin developed his interest in natural history

while studying first medicine at Edinburgh University, then theology at Cambridge.^[3] His five-year voyage on the *Beagle* established him as a geologist whose observations and theories supported Charles Lyell's uniformitarian ideas, and publication of his journal of the voyage made him famous as a popular author. Puzzled by the geographical distribution of wildlife and fossils he collected on the voyage, Darwin investigated the transmutation of species and conceived his theory of natural selection in 1838. Having seen others attacked as heretics for such ideas, he confided only in his closest friends and continued his extensive research to meet anticipated objections. [4] In 1858, Alfred Russel Wallace sent him an essay describing a similar theory, causing the two to publish their theories early in a joint publication. [5]

His 1859 book *On the Origin of Species* established evolution by common descent as the dominant scientific explanation of diversification in nature. He examined human evolution and sexual selection in *The Descent of Man, and Selection in Relation to Sex*, followed by *The Expression of the Emotions in Man and Animals*. His research on plants was published in a series of books, and in his final book, he examined

earthworms and their effect on soil.^[6]

In recognition of Darwin's pre-eminence, he was buried in Westminster Abbey, close to John Herschel and Isaac Newton.^[7]

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Biography

Early life

For more details on this topic, see Charles Darwin's education.

Charles Darwin was born in Shrewsbury, Shropshire, England on 12 February 1809 at his family home, the Mount.^[8] He was the fifth of six children of wealthy society doctor and financier Robert Darwin, and Susannah Darwin (*née* Wedgwood). He was the grandson of Erasmus Darwin on his father's side, and of Josiah Wedgwood on his mother's side. Both families were largely Unitarian, though the Wedgwoods were adopting Anglicanism. Robert Darwin, himself quietly a freethinker, made a nod toward convention by having baby Charles baptised in the Anglican Church. Nonetheless, Charles and his



The seven-year-old Charles Darwin in 1816, one year before his mother's death.

siblings attended the Unitarian chapel with their mother, and in 1817, Charles joined the day school, run by its preacher. In July of that year, when Charles was eight years old, his mother died. From September 1818, he attended the nearby

Anglican Shrewsbury School as a boarder.^[9]

Darwin spent the summer of 1825 helping his father treat the poor of Shropshire as an apprentice doctor. In the autumn, he went to the University of Edinburgh, Scotland, to study medicine, but he was revolted by the brutality of surgery and neglected his medical studies. He learned taxidermy from

John Edmonstone, a freed black slave who told him exciting tales of the South American rainforest. Later, in *The Descent of Man*, he used this experience as evidence that "Negroes and Europeans" were closely related despite superficial differences in appearance.^[10]

In Darwin's second year, he joined the Plinian Society, a student group interested in natural history.^[11] He became a keen pupil of Robert Edmund Grant, a proponent of Jean-Baptiste Lamarck's theory of evolution by acquired characteristics, which Charles's grandfather Erasmus had also advocated. On the shores of the Firth of Forth, Darwin joined in Grant's investigations of the life cycle of marine animals. These studies found evidence for *homology*, the radical theory that all animals have similar organs which differ only in complexity, thus showing common descent.^[12] In March 1827, Darwin made a presentation to the Plinian of his own discovery that the black spores often found in oyster shells were the eggs of a skate leech.^[13] He also sat in on Robert Jameson's natural history course, learning about stratigraphic geology, receiving training in classifying plants, and assisting with work on the extensive collections of the University Museum, one of the largest museums in Europe at the time.

[14]

In 1827, his father, unhappy at his younger son's lack of progress, shrewdly enrolled him in a Bachelor of Arts course at Christ's College, Cambridge to qualify as a clergyman, expecting him to get a good income as an Anglican parson.

[15] However, Darwin preferred riding and shooting to studying.^[16] Along with his cousin William Darwin Fox, he became engrossed in the craze at the time for the competitive collecting of beetles.^[17] Fox introduced him to the Reverend John Stevens Henslow, professor of botany, for expert advice on beetles. Darwin subsequently joined Henslow's natural history course and became his favourite pupil, known to the dons as "the man who walks with Henslow".^{[18][19]} When exams drew near, Darwin focused on his studies and received private instruction from Henslow. Darwin was particularly enthusiastic about the writings of William Paley, including the argument for divine design in nature.^[20] It has been argued that Darwin's enthusiasm for Paley's religious adaptationism paradoxically played a role even later, when Darwin formulated his theory of natural selection.^[21] In his finals in January 1831, he performed well in theology and, having scraped through in classics, mathematics and physics, came

tenth out of a pass list of 178.^[22]

Residential requirements kept Darwin at Cambridge until June. Following Henslow's example and advice, he was in no rush to take Holy Orders. Inspired by Alexander von Humboldt's *Personal Narrative*, he planned to visit the Madeira Islands with some classmates after graduation to study natural history in the tropics. To prepare himself, Darwin joined the geology course of the Reverend Adam Sedgwick and, in the summer, went with him to assist in mapping strata in Wales.^[23] After a fortnight with student friends at Barmouth, he returned home to find a letter from Henslow recommending Darwin as a suitable (if unfinished) naturalist for the unpaid position of gentleman's companion to Robert FitzRoy, the captain of HMS *Beagle*, which was to leave in four weeks on an expedition to chart the coastline of South America. His father objected to the planned two-year voyage, regarding it as a waste of time, but was persuaded by his brother-in-law, Josiah Wedgwood, to agree to his son's participation.^[24]

Journey of the *Beagle*

For more details on this topic, see Second voyage of HMS Beagle.

The *Beagle* survey took five years, two-thirds of which Darwin spent on land. He carefully noted a rich variety of geological features, fossils and living organisms, and methodically collected an enormous number of specimens, many of them new to science.^[1] At intervals during the voyage he sent specimens to Cambridge together with letters about his findings, and these established his reputation as a naturalist. His extensive detailed notes showed his gift for theorising and formed the basis for his later work. The journal he originally wrote for his family, published as *The Voyage of the Beagle*, summarises his findings and provides social, political and anthropological insights into the wide range of people he met, both native and colonial.^[25]

While on board the ship, Darwin suffered badly from seasickness.^[26] In October 1833 he caught a fever in Argentina, and in July 1834, while returning from the Andes down to Valparaíso, he fell ill and spent a month in bed.^[27]

Before they set out, FitzRoy gave Darwin the first volume of Charles Lyell's *Principles of Geology*, which explained landforms as the outcome of gradual processes over huge periods of time.^[III] On

their first stop ashore at St Jago, Darwin found that a white band high in the volcanic rock cliffs consisted of baked coral fragments and shells. This matched Lyell's concept of land slowly rising or falling, giving Darwin a new insight into the geological history of the island which inspired him to think of writing a book on geology.^[28] He went on to make many more discoveries, some of them particularly dramatic.^[1] He saw stepped plains of shingle and seashells in Patagonia as raised beaches, and after experiencing an earthquake in Chile saw mussel-beds stranded above high tide showing that the land had just been raised. High in the Andes he saw several fossil trees that had grown on a sand beach, with seashells nearby. He theorised that coral atolls form on sinking volcanic mountains, and confirmed this when the *Beagle* surveyed the Cocos (Keeling) Islands.^[29]

In South America, Darwin found and excavated rare fossils of gigantic extinct mammals in strata with modern seashells, indicating recent extinction and no change in climate or signs of catastrophe. Though he correctly identified one as a *Megatherium* and fragments of armour reminded him of the local armadillo, he assumed his finds were related to African or European species and it was a revelation to him after the voyage when

Richard Owen showed that they were closely related to living creatures exclusively found in the Americas.^[30]



As HMS *Beagle* surveyed the coasts of South America, Darwin began to theorise about the wonders of nature around him.

Lyell's
second

volume, which argued against evolutionism and explained species distribution by "centres of creation", was sent out to Darwin. He puzzled over all he saw, and his ideas went beyond Lyell.^[31] In Argentina, he found that two types of rhea had separate but overlapping territories. On the Galápagos Islands, he collected mockingbirds and noted that they were different depending on which island they came from. He also heard that local Spaniards could tell from their appearance on

which island tortoises originated, but thought the creatures had been imported by buccaneers.^[32] In Australia, the marsupial rat-kangaroo and the platypus seemed so unusual that Darwin thought it was almost as though two distinct Creators had been at work.^[33]

In Cape Town he and FitzRoy met John Herschel, who had recently written to Lyell about that "mystery of mysteries", the origin of species. When organising his notes on the return journey, Darwin wrote that if his growing suspicions about the mockingbirds and tortoises were correct, "such facts undermine the stability of Species", then cautiously added "would" before "undermine".^[34] He later wrote that such facts "seemed to me to throw some light on the origin of species".^[35]

Three natives who had been taken from Tierra del Fuego on the *Beagle's* previous voyage were taken back there to become missionaries. They had become "civilised" in England over the previous two years, yet their relatives appeared to Darwin to be "miserable, degraded savages".^[36] A year on, the mission had been abandoned and only Jemmy Button spoke with them to say he preferred his harsh previous way of life and did not want to return to England. Because of this experience,

Darwin came to think that humans were not as far removed from animals as his friends then believed, and saw differences as relating to cultural advances towards civilisation rather than being racial. He detested the slavery he saw elsewhere in South America, and was saddened by the effects of European settlement on Aborigines in Australia and Maori in New Zealand.^[37]

Captain FitzRoy was committed to writing the official *Narrative* of the *Beagle* voyages, and near the end of the voyage, he read Darwin's diary and asked him to rewrite this *Journal* to provide the third volume, on natural history.^[38]

Inception of Darwin's evolutionary theory

For more details on this topic, see Inception of Darwin's theory.

While Darwin was still on the voyage, Henslow fostered his former pupil's reputation by giving selected naturalists access to the fossil specimens and a pamphlet of Darwin's geological letters.^[39] When the *Beagle* returned on 2 October 1836, Darwin was a celebrity in scientific circles. After visiting his home in



While still a young man, Charles Darwin joined the scientific élite.

Shrewsbury and seeing relatives, Darwin hurried to Cambridge to see Henslow, who advised on finding naturalists available to describe and catalogue the collections, and agreed to take on the botanical specimens. Darwin's father organised investments, enabling his son to be a self-

funded gentleman scientist, and an excited Darwin went round the London institutions being fêted and seeking experts to describe the collections. Zoologists had a huge backlog of work, and there was a danger of specimens just being left in storage.^[40]

An eager Charles Lyell met Darwin for the first

time on 29 October and soon introduced him to the up-and-coming anatomist Richard Owen, who had the facilities of the Royal College of Surgeons at his disposal to work on the fossil bones collected by Darwin. Owen's surprising results included gigantic sloths, a hippopotamus-like skull from the extinct rodent *Toxodon*, and armour fragments from a huge extinct armadillo (*Glyptodon*), as Darwin had initially surmised.^[41] The fossil creatures were unrelated to African animals, but closely related to living species in South America.
[42]

In mid-December, Darwin moved to Cambridge to organise work on his collections and rewrite his *Journal*.^[43] He wrote his first paper, showing that the South American landmass was slowly rising, and with Lyell's enthusiastic backing read it to the Geological Society of London on 4 January 1837. On the same day, he presented his mammal and bird specimens to the Zoological Society. The ornithologist John Gould soon revealed that the Galapagos birds that Darwin had thought a mixture of blackbirds, "gross-beaks" and finches, were, in fact, twelve separate species of finches. On 17 February 1837, Darwin was elected to the Council of the Geographical Society, and in his presidential address, Lyell presented Owen's findings on

Darwin's fossils, stressing geographical continuity of species as supporting his uniformitarian ideas. [44]

On 6

March

1837, Darwin moved to London to be close to this work, and joined the social whirl around scientists and savants such as Charles Babbage, who thought that God preordained life by natural laws rather than ad hoc miraculous creations. Darwin lived near his freethinking brother Erasmus, who was part of this Whig circle and whose close friend the writer Harriet Martineau promoted the ideas of Thomas Malthus underlying the Whig "Poor Law reforms" aimed at discouraging the poor from breeding beyond available food supplies. John Herschel's question on the origin of species was widely discussed. Medical men including Dr. Gully even joined Grant in endorsing transmutation of species, but to Darwin's scientist friends such radical heresy attacked the divine basis of the social order already under threat from recession and riots.^[45]

Gould now revealed that the Galapagos mockingbirds from different islands were separate species, not just varieties, and the "wrens" were yet

finches. Darwin had not kept track of which islands the finch specimens were from, but found information from the notes of others on the *Beagle*, including FitzRoy, who had more carefully recorded their own collections. The zoologist Thomas Bell showed that the Galápagos tortoises were native to the islands. By mid-March, Darwin was convinced that creatures arriving in the islands had become altered in some way to form new species on the different islands, and investigated transmutation while noting his speculations in his "Red Notebook" which he had begun on the *Beagle*. In mid-July, he began his secret "B" notebook on transmutation, and on page 36 wrote "I think" above his first sketch of an evolutionary tree.^[46]

Overwork, illness, and marriage

As well as launching into this intensive study of transmutation, Darwin became mired in more work. While still rewriting his *Journal*, he took on editing and publishing the expert reports on his collections, and with Henslow's help obtained a Treasury grant of £1,000 to sponsor this multi-volume *Zoology of the Voyage of H.M.S. Beagle*. He agreed to unrealistic dates for this and for a

book on *South American Geology* supporting Lyell's ideas. Darwin finished writing his *Journal* around 20 June 1837 just as Queen Victoria came to the throne, but then had its proofs to correct.^[47]

Darwin's health suffered from the pressure. On 20 September 1837, he had "palpitations of the heart". On doctor's advice that a month of recuperation was needed, he went to Shrewsbury then on to visit his Wedgwood relatives at Maer Hall, but found them too eager for tales of his travels to give him much rest. His charming, intelligent, and cultured cousin Emma Wedgwood, nine months older than Darwin, was nursing his invalid aunt. His uncle Jos pointed out an area of ground where cinders had disappeared under loam and suggested that this might have been the work of earthworms. This inspired a talk which Darwin gave to the Geological Society on 1 November, the first demonstration of the role of earthworms in soil formation.^[48]

William Whewell pushed Darwin to take on the duties of Secretary of the Geological Society. After first declining this extra work, he accepted the post in March 1838.^[49] Despite the grind of writing and editing, remarkable progress was made on transmutation. While keeping his developing ideas

secret, Darwin took every opportunity to question expert naturalists and, unconventionally, people with practical experience such as farmers and pigeon fanciers.^{[1][50]} Over time his research drew on information from his relatives and children, the family butler, neighbours, colonists and former shipmates.^[51] He included mankind in his speculations from the outset, and on seeing an ape in the zoo on 28 March 1838 noted its child-like behaviour.^[52]

The strain told, and by June he was being laid up for days on end with stomach problems, headaches and heart symptoms.^[53] For the rest of his life, he was repeatedly incapacitated with episodes of stomach pains, vomiting, severe boils, palpitations, trembling and other symptoms, particularly during times of stress, such as when attending meetings or dealing with controversy over his theory. The cause of Darwin's illness was unknown during his lifetime, and attempts at treatment had little success. Recent attempts at diagnosis have suggested Chagas disease caught from insect bites in South America, Ménière's disease, or various psychological illnesses as possible causes, without any conclusive results.^[54]

On 23 June 1838, he took a break from the

pressure of work and went "geologising" in Scotland. He visited Glen Roy in glorious weather to see the parallel "roads", horizontal ledges cut into the hillsides. He thought that these were raised beaches: they were later shown to have been shorelines of a glacial lake.^[55]



Fully recuperated, he returned to Shrewsbury in July. Used to jotting down daily notes on animal breeding, he scrawled rambling thoughts about career and prospects on two scraps of paper, one with columns headed "Marry" and

"Not Marry". Advantages included "constant companion and a friend in old age ... better than a dog anyhow", against points such as "less money for books" and "terrible loss of time."^[56] Having

decided in favour, he discussed it with his father, then went to visit Emma on 29 July 1838. He did not get around to proposing, but against his father's advice he mentioned his ideas on transmutation.
[57]

Continuing his research in London, Darwin's wide reading now included "for amusement" the 6th edition of Malthus's *An Essay on the Principle of Population* which calculates from the birth rate that human population could double every 25 years, but in practice growth is kept in check by death, disease, wars and famine.^{[1][58]} Darwin was well prepared to see at once that this also applied to de Candolle's "warring of the species" of plants and the struggle for existence among wildlife, explaining how numbers of a species kept roughly stable. As species always breed beyond available resources, favourable variations would make organisms better at surviving and passing the variations on to their offspring, while unfavourable variations would be lost. This would result in the formation of new species.^[59] On 28 September 1838 he noted this insight, describing it as a kind of wedging, forcing adapted structures into gaps in the economy of nature as weaker structures were thrust out.^[1] He now had a theory by which to work, and over the following months compared

farmers picking the best breeding stock to a Malthusian Nature selecting from variants thrown up by "chance" so that "every part of [every] newly acquired structure is fully practised and perfected", and thought this analogy "the most beautiful part of my theory".^[60]

On 11 November, he returned to Maer and proposed to Emma, once more telling her his ideas. She accepted, then in exchanges of loving letters she showed how she valued his openness, but her upbringing as a very devout Anglican led her to express fears that his lapses of faith could endanger her hopes to meet in the afterlife.^[61] While he was house-hunting in London, bouts of illness continued and Emma wrote urging him to get some rest, almost prophetically remarking "So don't be ill any more my dear Charley till I can be with you to nurse you." He found what they called "Macaw Cottage" (because of its gaudy interiors) in Gower Street, then moved his "museum" in over Christmas. The marriage was arranged for 24 January 1839, but the Wedgwoods set the date back. On the 24th, Darwin was honoured by being elected as Fellow of the Royal Society.^[62]

On 29 January 1839, Darwin and Emma Wedgwood were married at Maer in an Anglican

ceremony arranged to suit the Unitarians, then immediately caught the train to London and their new home.^[63]

Preparing the theory of natural selection for publication

*For more details on this topic, see
Development of Darwin's theory.*

Darwin had found the basis of his theory of natural selection, but was aware of how much work remained to make it credible to his fiercely critical scientific colleagues. As Secretary of the Geological Society at its meeting on 19 December 1838, he saw Owen and Buckland display their hatred of evolution when destroying the reputation of his old Lamarckian teacher Grant.^[64] Work on his *Beagle* findings continued, and as well as consulting animal husbanders he carried out extensive experiments with plants, trying to find evidence answering all the arguments he anticipated when his theory was made public.^[65] When FitzRoy's *Narrative* was published in May 1839, Darwin's *Journal and Remarks (The Voyage of the Beagle)* as the third volume was such a success that later that year it was published on its

own.^[66]

Early in 1842, Darwin sent a letter about his ideas to Lyell, who was dismayed that his ally now denied "seeing a beginning to each crop of species". In May, Darwin's book on coral reefs was published after more than three years of work, and he then wrote a "pencil sketch" of his theory.^[67] To escape the pressures of London, the family moved to rural Down House in November.^[68] On 11 January 1844 Darwin wrote to his botanist friend Joseph Dalton Hooker about his theory, saying it was like confessing "a murder", but to his relief Hooker thought that "there might have been a gradual change of species" and expressed interest in Darwin's explanation. By July, Darwin had expanded his "sketch" into a 230-page "Essay".^[69] His fears that his ideas would be dismissed as Lamarckian Radicalism were reawakened by controversy over the anonymous publication in October of *Vestiges of the Natural History of Creation*, which was severely attacked by establishment scientists. However, the book was a best-seller and widened middle-class interest in transmutation, paving the way for Darwin as well as reminding him of the need to answer all difficulties before making his theory public. Darwin completed his third geological book in

1846, and embarked on a huge study of barnacles with the assistance of Hooker. In 1847, Hooker read the "Essay" and sent notes that provided Darwin with the calm critical feedback that he needed, but would not commit himself and questioned Darwin's opposition to continuing acts of Creation.^[70]

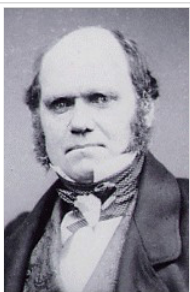
In an attempt to improve his chronic ill health, Darwin went to a spa in Malvern in 1849. To his surprise, he found that two months of water treatment helped.^[71] Then his treasured daughter Annie fell ill, reawakening his fears that his illness might be hereditary. After a long series of crises, she died and Darwin lost all faith in a beneficent God.^[72]

Darwin's eight years of work on barnacles (*Cirripedia*) found "homologies" that supported his theory by showing that slightly changed body parts could serve different functions to meet new conditions.^[73] In 1853 it earned him the Royal Society's Royal Medal, and it made his reputation as a biologist.^[74] In 1854 he resumed work on his theory of species, and in November realised that divergence in the character of descendants could be explained by them becoming adapted to "diversified places in the economy of nature".^[75]

Publication of the theory of natural selection

*For more details on this topic, see
Publication of Darwin's theory.*

By the start of 1856, Darwin was investigating whether eggs and seeds could survive travel across seawater to spread species across oceans. Hooker increasingly doubted the traditional view that species were fixed, but their young friend Thomas Henry Huxley was firmly against evolution. Lyell was intrigued by Darwin's speculations without realising their extent. When he read a paper by Alfred



Darwin was forced into early publication of his theory of natural selection.

Russel Wallace on the *Introduction* of species, he saw similarities with Darwin's thoughts and urged

him to publish to establish precedence. Though Darwin saw no threat, he began work on a short paper. Finding answers to difficult questions held him up repeatedly, and he expanded his plans to a "big book on species" titled *Natural Selection*. He continued his researches, obtaining information and specimens from naturalists worldwide including Wallace who was working in Borneo. In December 1857, Darwin received a letter from Wallace asking if the book would examine human origins. He responded that he would avoid that subject, "so surrounded with prejudices", while encouraging Wallace's theorising and adding that "I go much further than you."^[76]

Darwin's book was half way when, on 18 June 1858, he received a paper from Wallace describing natural selection. Though shocked that he had been "forestalled", Darwin sent it on to Lyell, as requested, and, though Wallace had not asked for publication, offered to send it to any journal that Wallace chose. His family was in crisis with children in the village dying of scarlet fever, and he put matters in the hands of Lyell and Hooker. They agreed on a joint presentation at the Linnean Society on 1 July of *On the Tendency of Species to form Varieties; and on the Perpetuation of Varieties and Species by Natural Means of*

Selection; however, Darwin's baby son died of the scarlet fever and he was too distraught to attend.
[77]

There was little immediate attention to this announcement of the theory; the president of the Linnean remarked in May 1859 that the year had not been marked by any revolutionary discoveries.
[78] Later, Darwin could only recall one review; Professor Haughton of Dublin claimed that "all that was new in them was false, and what was true was old."^[79] Darwin struggled for thirteen months to produce an abstract of his "big book", suffering from ill health but getting constant encouragement from his scientific friends. Lyell arranged to have it published by John Murray.^[80]

On the Origin of Species by Means of Natural Selection, or The Preservation of Favoured Races in the Struggle for Life (usually abbreviated to *The Origin of Species*) proved unexpectedly popular, with the entire stock of 1,250 copies oversubscribed when it went on sale to booksellers on 22 November 1859.^[81] In the book, Darwin set out "one long argument" of detailed observations, inferences and consideration of anticipated objections.^[82] His only allusion to human evolution was the understatement that "light will

be thrown on the origin of man and his history".
[83] He avoided the then controversial term "evolution", but at the end of the book concluded that "endless forms most beautiful and most wonderful have been, and are being, evolved."^[84] His theory is simply stated in the introduction:

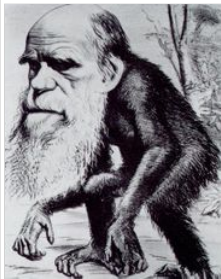
As many more individuals of each species are born than can possibly survive; and as, consequently, there is a frequently recurring struggle for existence, it follows that any being, if it vary however slightly in any manner profitable to itself, under the complex and sometimes varying conditions of life, will have a better chance of surviving, and thus be *naturally selected*. From the strong principle of inheritance, any selected variety will tend to propagate its new and modified form.^[85]

Reaction to the publication

For more details on this topic, see Reaction to Darwin's theory.

There was wide public interest in Charles Darwin's book and a controversy which he monitored closely, keeping press cuttings of reviews, articles,

satires, parodies
and caricatures.
[86] Critical
reviewers were
quick to pick out
the unstated
implications of
"men from
monkeys", while
amongst
favourable
responses
Huxley's reviews
included swipes
at Richard Owen,
leader of the
scientific
establishment
Huxley was
trying to overthrow. Owen's verdict was unknown
until his April review condemned the book.^[87]



A typical satire was the later caricature in *Hornet* magazine portraying Darwin with an ape body and the bushy beard he grew in 1866.

The Church of England scientific establishment, including Darwin's old Cambridge tutors Sedgwick and Henslow, reacted against the book, though it was well received by a younger generation of professional naturalists. In 1860, the publication of *Essays and Reviews* by seven liberal Anglican

theologians diverted clerical attention away from Darwin. An explanation of higher criticism and other heresies, it included the argument that miracles broke God's laws, so belief in them was atheistic—and praise for "Mr Darwin's masterly volume [supporting] the grand principle of the self-evolving powers of nature".^[88]

The most famous confrontation took place at a meeting of the British Association for the Advancement of Science in Oxford. Professor John William Draper delivered a long lecture about Darwin and social progress, then Samuel Wilberforce, the Bishop of Oxford, argued against Darwin. In the ensuing debate Joseph Hooker argued strongly for Darwin and Thomas Huxley established himself as "Darwin's bulldog" – the fiercest defender of evolutionary theory on the Victorian stage. Both sides came away feeling victorious, but Huxley went on to make much of his claim that on being asked by Wilberforce whether he was descended from monkeys on his grandfather's side or his grandmother's side, Huxley muttered: "The Lord has delivered him into my hands" and replied that he "would rather be descended from an ape than from a cultivated man who used his gifts of culture and eloquence in the service of prejudice and falsehood".^[89]

Darwin's illness kept him away from the public debates, though he read eagerly about them and mustered support through correspondence. Asa Gray persuaded a publisher in the United States to pay royalties, and Darwin imported and distributed Gray's pamphlet *Natural Selection is not inconsistent with Natural Theology*.^[90] In Britain, friends including Hooker^[91] and Lyell^[92] took part in the scientific debates which Huxley pugnaciously led to overturn the dominance of clergymen and aristocratic amateurs under Owen in favour of a new generation of professional scientists. Owen made the mistake of (wrongly) claiming certain anatomical differences between ape and human brains, and accusing Huxley of advocating "Ape Origin of Man". Huxley gladly did just that, and his campaign over two years was devastatingly successful in ousting Owen and the "old guard".^[93] Darwin's friends formed *The X Club* and helped to gain him the honour of the Royal Society's Copley Medal in 1864.^[92]

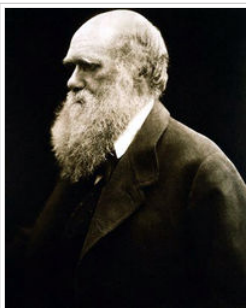
Broader public interest had already been stimulated by *Vestiges*, and the *Origin of Species* was translated into many languages and went through numerous reprints, becoming a staple scientific text accessible both to a newly curious middle

class and to "working men" who flocked to Huxley's lectures.^[94] Darwin's theory also resonated with various movements at the time^[III] and became a key fixture of popular culture.^[IV]

***Descent of Man*, sexual selection, and botany**

More detailed articles cover Darwin's life from Orchids to Variation, from Descent of Man to Emotions and from Insectivorous plants to Worms

Despite repeated bouts of illness during the last twenty-two years of his life, Darwin pressed on with his work. He had published an abstract of his theory, but more controversial



aspects of his
"big book"
were still

Julia Margaret Cameron's portrait
of Darwin

incomplete,
including explicit evidence of humankind's descent
from earlier animals, and exploration of possible
causes underlying the development of society and
of human mental abilities. He had yet to explain
features with no obvious utility other than
decorative beauty. His experiments, research and
writing continued.

When Darwin's daughter fell ill, he set aside his
experiments with seedlings and domestic animals
to accompany her to a seaside resort where he
became interested in wild orchids. This developed
into an innovative study of how their beautiful
flowers served to control insect pollination and
ensure cross fertilisation. As with the barnacles,
homologous parts served different functions in
different species. Back at home, he lay on his
sickbed in a room filled with experiments on
climbing plants. A reverent Ernst Haeckel who had
spread the gospel of Darwinismus in Germany
visited him.^[95] Wallace remained supportive,
though he increasingly turned to spiritualism.^[96]

Variation of Plants and Animals Under

Domestication, the first part of Darwin's planned "big book" (expanding on his "abstract" published as *The Origin of Species*), grew to two huge volumes, forcing him to leave out human evolution and sexual selection, and sold briskly despite its size.^[97] A further book of evidences, dealing with natural selection in the same style, was largely written, but remained unpublished until transcribed in 1975.^[98]



Punch's almanac for 1882, published shortly before Darwin's death, depicts him amidst evolution from chaos to Victorian gentleman with the title *Man Is But A Worm*.

The question of human evolution had been taken up by his supporters (and detractors) shortly after the publication of *The Origin of Species*,^[99] but Darwin's own contribution to the subject came more than ten years later with the two-volume *The Descent of Man*, and

Selection in Relation to Sex published in 1871. In the second volume, Darwin introduced in full his concept of sexual selection to explain the evolution of human culture, the differences between the human sexes, and the differentiation of human races, as well as the beautiful (and seemingly non-adaptive) plumage of birds.^[100] A year later Darwin published his last major work, *The Expression of the Emotions in Man and Animals*, which focused on the evolution of human psychology and its continuity with the behaviour of animals. He developed his ideas that the human mind and cultures were developed by natural and sexual selection,^[101] an approach which has been revived in the last three decades with the emergence of evolutionary psychology.^[102] As he concluded in *Descent of Man*, Darwin felt that, despite all of humankind's "noble qualities" and "exalted powers": "Man still bears in his bodily frame the indelible stamp of his lowly origin."^[103]

His evolution-related experiments and investigations culminated in books on the movement of climbing plants, insectivorous plants, the effects of cross and self fertilisation of plants, different forms of flowers on plants of the same species, and *The Power of Movement in Plants*. In his last book, he returned to the effect earthworms

have on soil formation.

He died in Downe, Kent, England, on 19 April 1882. He had expected to be buried in St Mary's churchyard at Downe, but at the request of Darwin's colleagues, William Spottiswoode (President of the Royal Society) arranged for Darwin to be given a state funeral and buried in Westminster Abbey, close to John Herschel and Isaac Newton.^[104]

Darwin's children





Darwin and his eldest son William Erasmus Darwin

Darwin's Children

William Erasmus Darwin	(27 December 1839–
Anne Elizabeth Darwin	(2 March 1841–22 April 1849)
Mary Eleanor Darwin	(23 September 1842–
Henrietta Emma "Etty" Darwin	(25 September 1843–
George Howard Darwin	(9 July 1845–7 December 1845)
Elizabeth "Bessy" Darwin	(8 July 1847–1926)
Francis Darwin	(16 August 1848–19
Leonard Darwin	(15 January 1850–26
Horace Darwin	(13 May 1851–29 September 1851)

The Darwins had ten children: two died in infancy, and Annie's death at the age of ten had a devastating effect on her parents. Charles was a devoted father and uncommonly attentive to his children.^[3] Whenever they fell ill he feared that they might have inherited weaknesses from inbreeding due to the close family ties he shared with his wife and cousin, Emma Wedgwood. He examined this topic in his writings, contrasting it with the advantages of crossing amongst many organisms.^[105] Despite his fears, most of the surviving children went on to have distinguished careers as notable members of the prominent Darwin-Wedgwood family.^[106]

Of his surviving children, George, Francis and Horace became Fellows of the Royal Society, distinguished as astronomer,^[107] botanist and civil engineer, respectively.^[108] His son Leonard, on the other hand, went on to be a soldier, politician, economist, eugenicist and mentor of the statistician and evolutionary biologist Ronald Fisher.^[109]

Religious views

For more details on this topic, see Charles

Darwin's views on religion.

Though Charles Darwin's family background was Nonconformist, and his father, grandfather and brother were Freethinkers,^[110] at first he did not doubt the literal truth of the Bible.^[111] He attended a Church of England school, then at Cambridge studied Anglican theology to become a clergyman.^[112] He was convinced by William Paley's teleological argument that design in nature proved the existence of God,^[113] but during the *Beagle* voyage he questioned, for example, why beautiful deep-ocean creatures had been created where no one could see them, or how the ichneumon wasp paralysing caterpillars as live food for its eggs could be reconciled with Paley's vision of beneficent design.^[114] He was still quite orthodox and would quote the Bible as an authority on morality, but did not trust the history in the Old Testament.^[115]

When investigating transmutation of species he knew that his naturalist friends thought this a bestial heresy undermining miraculous justifications for the social order, the kind of radical argument then being used by Dissenters and atheists to attack the Church of



The 1851 death of Darwin's daughter, Annie, was the final step in pushing an already doubting Darwin away from the idea of a beneficent God.

England's privileged position as the established church.^[116] Though Darwin wrote of religion as a tribal survival strategy, he still believed that God was the ultimate lawgiver.^[117] His belief dwindled, and

with the death of his daughter Annie in 1851, Darwin finally lost all faith in Christianity. He continued to help the local church with parish work, but on Sundays would go for a walk while his family attended church.^[118] He now thought it better to look at pain and suffering as the result of general laws rather than direct intervention by

God.^[119] When asked about his religious views, he wrote that he had never been an atheist in the sense of denying the existence of a God, and that generally "an Agnostic would be the more correct description of my state of mind."^[120]

The "Lady Hope Story", published in 1915, claimed that Darwin had reverted back to Christianity on his sickbed. The claims were refuted by Darwin's children and have been dismissed as false by historians.^[121] His daughter, Henrietta, who was at his deathbed, said that he did not convert to Christianity.^[122] His last words were, in fact, directed at Emma: *"Remember what a good wife you have been."*^[123]

Political interpretations

_____ Darwin's theories and writings, combined with Gregor Mendel's genetics (the "modern synthesis"), form the basis of all modern biology.^[124] However, Darwin's fame and popularity led to his name being associated with ideas and movements which at times had only an indirect relation to his writings, and sometimes went directly against his express comments.



Caricature from 1871 "Vanity Fair"

Eugenics

For more details on this topic, see Eugenics.

Following Darwin's publication of the *Origin*, his cousin, Francis Galton, applied the concepts to human society, starting in 1865 with ideas to promote "hereditary improvement" which he elaborated at

length in 1869.^[125] In *The Descent of Man* Darwin agreed that Galton had demonstrated the probability that "talent" and "genius" in humans was inherited, but dismissed the social changes Galton proposed as too utopian.^[126] Neither Galton nor Darwin supported government

intervention and thought that, at most, heredity should be taken into consideration by people seeking potential mates.^[127] In 1883, after Darwin's death, Galton began calling his social philosophy *Eugenics*.^[128] In the 20th century, eugenics movements gained popularity in a number of countries and became associated with reproduction control programmes such as compulsory sterilisation laws,^[129] then were stigmatised after their usage in the rhetoric of Nazi Germany in its goals of genetic "purity".^[V]

Social Darwinism

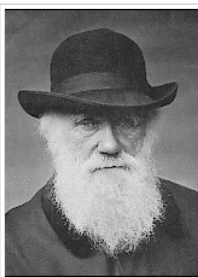
For more details on this topic, see Social Darwinism.

The ideas of Thomas Malthus and Herbert Spencer which applied ideas of evolution and "survival of the fittest" to societies, nations and businesses became popular in the late 19th and early 20th century, and were used to defend various, sometimes contradictory, ideological perspectives including laissez-faire economics,^[130] colonialism,^[131] racism and imperialism.^[131] The term "Social Darwinism" originated around the 1890s, but became popular as a derogatory term in the 1940s

with Richard Hofstadter's critique of laissez-faire conservatism.^[132] The concepts predate Darwin's publication of the *Origin* in 1859.^{[131][133]} Malthus died in 1834^[134] and Spencer published his books on economics in 1851 and on evolution in 1855.^[135] Darwin himself insisted that social policy should not simply be guided by concepts of struggle and selection in nature,^[136] and that sympathy should be extended to all races and nations.^{[137][VI]}

Commemoration

During Darwin's lifetime, many species and geographical features were given his name. An expanse of water adjoining the Beagle Channel was named *Darwin Sound* by Robert FitzRoy after Darwin's prompt action saved them from being marooned on a



Darwin in 1880, still

nearby shore when a collapsing glacier caused a large wave that would have swept away their boats,^[138] and the nearby Mount Darwin in the Andes

working on his contributions to evolutionary thought which had an enormous effect on many fields of science.

was named in celebration of Darwin's 25th birthday.^[139] When the *Beagle* was surveying Australia in 1839, Darwin's friend John Lort Stokes sighted a natural harbour which the ship's captain Wickham named *Port Darwin*.^[140] The settlement of Palmerston founded there in 1869 was officially renamed Darwin in 1911. It became the capital city of Australia's Northern Territory,^[140] which also boasts Charles Darwin University^[141] and Charles Darwin National Park.^[142]

The 14 species of finches he collected in the Galápagos Islands are affectionately named "Darwin's Finches" in honour of his legacy.^[143] Darwin College, Cambridge, founded in 1964, was named in honour of the Darwin family, partially because they owned some of the land it was on.^[144] In 1992, Darwin was ranked #16 on Michael H. Hart's list of the most influential figures in history.^[145] Darwin came fourth in the *100*

Greatest Britons poll sponsored by the BBC and voted for by the public.^[146] In 2000 Darwin's image appeared on the Bank of England ten pound note, replacing Charles Dickens. His impressive, luxuriant beard (which was reportedly difficult to forge) was said to be a contributory factor to the bank's choice.^[147]

As a humorous celebration of evolution, the annual Darwin Award is bestowed on individuals who "improve our gene pool by removing themselves from it."^[148]

Darwin has been the subject of many exhibitions, including the "Darwin" exhibition organised by the American Museum of Natural History in New York City in 2006 and shown in various cities in the US.^[149] Numerous biographies of Darwin have appeared, and the 1980 biographical novel *The Origin* by Irving Stone gives a closely researched fictional account of Darwin's life from the age of 22 onwards.

Works

For more details on this topic, see List of works by Charles Darwin.

Darwin was a prolific author, and even without publication of his works on evolution would have had a considerable reputation as the author of *The Voyage of the Beagle*, as a geologist who had published extensively on South America and had solved the puzzle of the formation of coral atolls, and as a biologist who had published the definitive work on barnacles. While *The Origin of Species* dominates perceptions of his work, *The Descent of Man, and Selection in Relation to Sex* and *The Expression of Emotions in Man and Animals* had considerable impact, and his books on plants including *The Power of Movement in Plants* were innovative studies of great importance, as was his final work on *The Formation of Vegetable Mould Through the Action of Worms*.^[150]

His writings are currently available at The Complete Work of Charles Darwin Online – the Table of Contents provides links to all of his publications, including alternative editions, contributions to books & periodicals, correspondence, life and letters, autobiography, as well as a complete bibliography and catalogue of his manuscripts. The works are free to read, but not public domain, and include publications still under copyright. For unencumbered versions of his major

works, see Works by Charles Darwin at Project Gutenberg.

See also

- Darwin's Frog – a species of frog named after Charles Darwin.
- Descent with modification
- Harriet – a Galápagos tortoise, possibly collected by Darwin; died 23 June 2006 at an estimated age of 175.
- Patrick Matthew – an amateur evolutionary theorist and contemporary of Darwin.
- Randal Keynes – the great-great grandson of Charles Darwin who wrote a book about him, his daughter, and human evolution
- The Tree of Life – an excerpt from the Origin of Species

Notes

I. ^ Darwin was eminent as a naturalist, geologist, biologist, and author; after working as a physician's assistant and two years as a medical student was educated as a clergyman; and was trained in taxidermy.

II. ^ Robert FitzRoy was to become known after the voyage for biblical literalism, but at this time he had

considerable interest in Lyell's ideas, and they met before the voyage when Lyell asked for observations to be made in South America. FitzRoy's diary during the ascent of the River Santa Cruz in Patagonia recorded his opinion that the plains were raised beaches, but on return, newly married to a very religious lady, he recanted these ideas.^[151]

III. ^ See, for example, WILLA volume 4, *Charlotte Perkins Gilman and the Feminization of Education* by Deborah M. De Simone: "Gilman shared many basic educational ideas with the generation of thinkers who matured during the period of "intellectual chaos" caused by Darwin's *Origin of the Species*. Marked by the belief that individuals can direct human and social evolution, many progressives came to view education as the panacea for advancing social progress and for solving such problems as urbanisation, poverty, or immigration."

IV. ^ See, for example, the song "A lady fair of lineage high" from Gilbert and Sullivan's *Princess Ida*, which describes the descent of man (but not woman!) from apes.

V. ^ The Nazi eugenics policies are discussed in a number of sources. A few of the more definitive ones are Robert Proctor, *Racial hygiene: Medicine under the Nazis* (Cambridge, MA: Harvard University Press, 1988) and Dieter Kuntz, ed., *Deadly medicine: creating the master race* (Washington, D.C.: United States Holocaust Memorial Museum, 2004) (online exhibit). On the

development of the racial hygiene movement before National Socialism, see Paul Weindling, *Health, race and German politics between national unification and Nazism, 1870–1945* (New York: Cambridge University Press, 1989).

VI. ^ See Darwin 1887, p. 23:

Early in the voyage at Bahia, in Brazil, FitzRoy defended and praised slavery, which I abominated, and told me that he had just visited a great slave-owner, who had called up many of his slaves and asked them whether they were happy, and whether they wished to be free, and all answered "No." I then asked him, perhaps with a sneer, whether he thought that the answer of slaves in the presence of their master was worth anything? This made him excessively angry, and he said that as I doubted his word we could not live any longer together.

See also Darwin 1845, pp. 207–208 on the Fuegians:

It seems yet wonderful to me, when I think over all his many good qualities, that he should have been of the same race, and doubtless partaken of the same character, with the miserable, degraded savages whom we first met here.

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- The Complete Work of Charles Darwin Online
- The Friends of Charles Darwin
- Darwin's work on orchids
- Darwin Correspondence Project

- The Darwin Digital Library of Evolution
- Institut Charles Darwin International
- Darwin's portrait on £10 note
- Twelve different portraits of Charles Darwin, National Portrait Gallery, U.K.
- BBC: "Darwin family repeat flower count"
- Mis-portrayal of Darwin as a Racist
- Listing of the significant places in Shrewsbury relevant to Darwin's early life.
- Digitized titles by Charles Darwin in *Botanicus.org*
- 1871 Caricature of Charles Darwin by Thomas Nast, Harper's Weekly
- Charles Darwin at the Open Directory Project
- Free LibriVox Audiobook: On the Origin of Species by Means of Natural Selection

Charles Darwin

Darwin's life

Education | Voyage on HMS *Beagle* |
 Inception of theory | Development of theory |
 Publication of theory | Reaction to theory
Orchids to *Variation* | *Descent of Man* to
Emotions | *Insectivorous plants* to *Worms*

Darwin's family, beliefs and health

Darwin — Wedgwood family | Views on

religion | Illness

Darwin's writings

The Voyage of the Beagle
Zoology of the Voyage of H.M.S. Beagle
*On the Tendency of Species to form Varieties;
and on the Perpetuation of Varieties and
Species by Natural Means of Selection*
The Origin of Species | *The Descent of Man,
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*The Expression of the Emotions in Man and
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Autobiography | *Correspondence*

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Processes of evolution: adaptation - macroevolution -
microevolution - speciation

Population genetic mechanisms: natural selection -
genetic drift - gene flow - mutation

Evolutionary developmental biology (Evo-devo)
concepts: phenotypic plasticity - canalisation -
modularity

Modes of evolution: anagenesis - catagenesis -
cladogenesis

History: History of evolutionary thought -
Charles Darwin - *The Origin of Species* -
modern evolutionary synthesis - Evolutionary history

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Other subfields: ecological genetics - human evolution
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List of evolutionary biology topics - Timeline of
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