

# Thomas Henry Huxley (1825-1895)

In nineteenth century Great Britain, Thomas Henry Huxley proposed connections between the development of organisms and their evolutionary histories, critiqued previously held concepts of homology, and promoted Charles Darwin's theory of evolution. Many called him Darwin's Bulldog. Huxley helped professionalize and redefine British science. He wrote about philosophy, religion, and social issues, and researched and theorized in many biological fields. Huxley made several methodological contributions to both invertebrate and vertebrate embryology and development, and he helped shape the extra-scientific discourse for these fields.

Huxley was born to Rachel Withers and George Huxley, a senior assistant public schoolmaster, on 4 May 1825 in Ealing, England. Huxley was the second youngest of eight children in a middle-class family. Huxley's family experienced economic hardship when the school at which his father taught closed, so Huxley attended school from ages eight to ten. Despite his lack of early formal education, he studied about mechanical engineering and science, and he read books of many subjects. His self-taught study of German enabled his future proficiency in the biological research conducted in Germany, and a talent for drawing aided his later zoological studies.

In 1841 Huxley apprenticed with one of his brothers-in-law, John Godwin Scott, who practiced medicine in the north of London. During this time Huxley continued his self-education in mathematics, German, physics, and physiology. These academic studies influenced Huxley's career, but so did his exposure to the poverty, unemployment, starvation, and poor sanitary conditions of the working class that characterized post-economic recession East London.

Huxley received a scholarship to Charing Cross Hospital in 1842, and published his first scientific paper in 1845. This paper detailed Huxley's discovery of a human hair-root membrane, later named Huxley's layer. In 1845 Huxley took the first part of his Bachelor of Medicine exam, however, he did not receive a university degree because he did not complete his second Bachelor of Medicine examination. His scholarship expired with Huxley in debt from borrowing money for living expenses.

To pay his debts, Huxley joined the Royal Navy as a ship's surgeon and was assigned to the H.M.S. Rattlesnake from 1846 to 1850. On his four-year voyage, Huxley attended to his clinical duties, but he also studied natural history and focused on marine invertebrates. Huxley was not the ship's naturalist, and so undertook his natural history studies on his own time. These ship-board natural history studies fueled his life-long studies in the natural sciences, and they led Huxley away from medicine and towards a career in zoology.

While Huxley was on the Rattlesnake in 1849, the Royal Society of London published his paper "On the Anatomy and the Affinities of the Family of the Medusae." In this paper, Huxley added to the comparative embryological discoveries of Karl Ernst von Baer, professor at the University of Königsberg in Königsberg, Prussia who had asserted that vertebrates from different species appeared similar as they passed through stages of embryological development. Adult jellyfish, Huxley found, were made of two cell layers. When Huxley compared the tissue layers of these adult marine organisms to the germ layers of vertebrate embryos, he noticed that the vertebrate embryos exhibited the same double-tissued structure in the early stages of development as the adult jellyfish. By drawing parallels between the body plan of adult jellyfish and the body plan of embryonic vertebrates, Huxley inferred a connection between organismal development, called ontogeny, and historical relationships between taxa, called phylogeny. The relationship between ontogeny and phylogeny would be adopted and elaborated over the following years by Charles Darwin in London, and by Ernst Haeckel, the Professor of Comparative Anatomy at the University of Jena in Jena, Germany.

Upon returning to England, Huxley was granted leave from active duty to prepare the scientific reports of his voyage. Huxley's work gained notoriety within the British scientific community, and the Royal Society of London subsequently elected him to fellowship at the age of twenty-five in 1850. Two years later, Huxley was the youngest person to receive the Royal Society's Gold Medal. Huxley remained mired in financial difficulties. He relied upon the assistance of influential friends and colleagues including the physicist John Tyndall and Joseph Dalton Hooker, a botanical researcher at the Royal Botanical Gardens, Kew, in London. In 1853, Huxley the Royal Navy refused Huxley further leave from and discharged him from the navy when he refused to return to his ship. In this year he also published "The Cell-Theory," a paper in which he criticized the Schleiden-Schwann conception of the cell, which treated nuclei as the most significant features of cells, and which treated cells as the basic structural features of living tissues. Huxley found employment in 1854 as professor of natural history at the Royal School of Mines in London. The following year, Huxley became Curator of Fossils in the Museum of Practical Geology in London, where he initiated a lecture series for workingmen.

Huxley's newfound prosperity enabled him in 1855 to marry Henrietta Heathorn, who he had met in Australia in 1847 during his voyage aboard the Rattlesnake. Huxley and Heathorn had eight children over the next decade, and later they became grandparents to evolutionary biologist Julian Huxley and writer Aldous Huxley.

Huxley gave popular science lectures and developed his own course at the Royal School of Mines, wrote a regular science column for the Westminster Review, and helped to organize the collections at the Museum of Practical Geology. Huxley's jobs also guided his scientific focus from invertebrate zoology to vertebrate zoology. Before 1854, Huxley wrote and presented papers on the various marine invertebrates that he collected while in the Royal Navy. Following his new preoccupation with fossils and paleontology, he now began to publish papers on vertebrate physiology, morphology, and fossil descriptions.

In 1856, Huxley received a Fullerman lectureship at the Royal Institution in London. During the late 1850s, Huxley researched the embryology of vertebrates. He emphasized that the comparison of adult body structures provided insufficient evidence of homology between taxa, but that researchers should establish homologies by appealing to the embryological development of structures. Huxley highlighted that method in his 1858 Croonian lecture, "On the Theory of the Vertebrate Skull," in which he rejected a theory proposed by Johann Wolfgang von Goethe and Lorenz Oken in Germany and by Richard Owen in England that the bones of the skull and of spine in vertebrates were serial homologous.

In 1859, Charles Darwin published *On the Origin of Species*, which contained his theory of natural selection and the evidence for it. While Huxley privately discussed his initial reservations about aspects of the theory, publicly Huxley championed the theory of natural selection. He reviewed *On the Origin of Species* in the London Times a month after it was published, and he further supported Darwin's theory with a number of papers and lectures. Huxley's advocacy garnered him the epithet Darwin's Bulldog.

The 1860s saw controversy and debate surrounding Darwin's theory. Huxley debated with Bishop Samuel Wilberforce at the 1860 meeting of the British Association for the Advancement of Science at Oxford University, in Oxford, England. During this debate, Wilberforce asked Huxley whether on his father's side or on his mother's side Huxley claimed his descent from a monkey. Huxley replied that between a man that abused his intellectual capabilities and an ape, Huxley would rather claim relation to the ape. The widely publicized "Huxley-Wilberforce debate" symbolized the nineteenth century conflict between religion and science.

In 1863, three years after the debate with Wilberforce, Huxley became Hunterian Professor at the Royal College of Surgeons, and he published his first book, *Evidence as to Man's Place in Nature*. Huxley used research from embryology, paleontology, and comparative anatomy to demonstrate the evolutionary relationship between humans and apes. The book was based on Huxley's public lectures, as well as on research that had played a role in a feud between Huxley and Owen. In 1857, Owen had read a paper at the Linnean Society of London on his anatomical study of primate brains, in which he held that humans were distinct from apes based on cerebral structures, including the

hippocampus minor, a structure that Owen had claimed was unique to humans. At the 1860 British Association for the Advancement of Science meeting, Owen, who also advised Wilberforce during the meeting, said that the gorilla brain was more similar to those of the lower primates than to those of humans. Huxley, through his own dissections and comparative examinations, and citing the works of others, refuted Owen's claim, showing that the similarities in cerebral morphology between apes and humans were greater than between apes and lower primates, and he demonstrated the presence of the hippocampus minor in apes and monkeys.

In 1868, Huxley inaugurated and became head of the South London Working Men's College, which, along with its educational opportunities for working class men, held evening classes for women and kindergarten classes for the children of working class families. Huxley published textbooks in physiology and zoology, and for a little more than a year, was a member of the School Board of London, for which he advocated for the inclusion of science in school and university curricula. Huxley also worked to integrate laboratory practices into science classrooms, and he created training courses for biology teachers.

By the early 1870s, Huxley had published numerous works in paleontology. These papers further illuminated the evolutionary relationships between birds and reptiles, and between fish and amphibians. Huxley constructed a classification system of birds based on skeletal characteristics and geographic distribution, a methodology that influenced later avian taxonomic research. In 1871, Huxley became secretary of the Royal Society, a position he kept for the next decade. Over the next few years, Huxley was elected Lord Rector of the University of Aberdeen in Aberdeen, Scotland, and he was president of the British Association for the Advancement of Science.

From the 1880s onward, Huxley published less about science and more about philosophy and theology. Though the primary subject of his writings had shifted, Huxley continued his assorted institutional commitments. Throughout the late nineteenth century, Huxley served on ten different Royal Commissions, and he belonged to several societies, including the Geological Society, the Ethnological Society, and the Metaphysical Society.

Huxley was elected President of the Royal Society in 1883. By 1885, Huxley's health failed, and he resigned as President of the Royal Society. He began a series of papers collectively called *Evolution and Ethics*, delivered a Romanes lecture at Oxford University on the relationship between evolution and ethics, and he engaged in a written dispute with statesman William Gladstone about science and religion. In 1888, Huxley was elected a trustee of the British Museum, and he received the Royal Society Copley Medal. In 1892, Huxley became Privy Councillor, an advisor on affairs of state, and in 1894 the Royal Society awarded Huxley the Darwin Medal.

During the winter of 1895, Huxley contracted influenza and bronchitis that resulted in problems with his heart and lungs. Huxley had partially recovered by May, but died due to heart failure on 29 June 1895 at the age of seventy. He was buried in Marylebone Cemetery in Finchley, a northern district of London, next to his son Noel and his brother George.

## Sources

1. "Thomas Henry Huxley." *Science* 2 (1895): 85-7.
2. Blinerman, Charles S. "Thomas Henry Huxley." *The Scientific Monthly* 84 (1957): 171-82.
3. Clodd, Edward. *Thomas Henry Huxley*. London: William Blackwood and Sons, 1905. <http://dx.doi.org/10.5962/bhl.title.33076> (Accessed November 25, 2013).
4. Darwin, Charles. *On the Origins of Species*. London: John Murray, 1859. <http://darwin-online.org.uk/content/frameset?pageseq=1&itemID=F373&viewtype=text> (Accessed November 25, 2013).
5. Davis, James Richard Ainsworth. *Thomas H. Huxley*. London: J. M. Dent, 1907. <https://archive.org/details/thomashuxley00ainsuoft> (Accessed November 25, 2013).
6. Desmond, Adrian. *Huxley: The Devil's Disciple*. London: Michael Joseph, 1994.
7. Desmond, Adrian. "Huxley, Thomas Henry." *Dictionary of Scientific Biography* 21 (2008): 429-34.

8. Goudge, Thomas A. "Huxley, Thomas Henry (1825-1895)." *Encyclopedia of Philosophy* 2 (2006): 530-4.
9. Huxley, Thomas Henry. "On a Hitherto Undescribed Structure in the Human Hair Sheath." *London Medical Gazette* 1 (1845): 1340.
10. Huxley, Thomas Henry. "On the Anatomy and the Affinities of the Family of the Medusae." *Philosophical Transactions of the Royal Society of London* 139 (1849): 413-34. <http://rstl.royalsocietypublishing.org/content/139/413.full.pdf+html> (Accessed November 25, 2013).
11. Huxley, Thomas Henry. "The Cell-Theory." *British and Foreign Medico-Chirurgical Review* 12 (1853): 285-314. <https://archive.org/stream/britishandforei00goog#page/n300/mode/2up> (Accessed November 25, 2013).
12. Huxley, Thomas Henry. "The Croonian Lecture: On the Theory of the Vertebrate Skull." *Proceedings of the Royal Society of London* 9(1857-1859): 381-457. <http://rspl.royalsocietypublishing.org/content/9/381.full.pdf+html> (Accessed November 25, 2013).
13. Huxley, Thomas Henry. 1859. "Darwin on the origin of species." Review of *On the Origin of Species*, by Charles Darwin. *The Times*, December 26, 1859: 8-9. <http://darwin-online.org.uk/content/frameset?pageseq=3&itemID=A166&viewtype=side> (Accessed November 25, 2013).
14. Huxley, Thomas Henry. *Evidence as to Man's Place in Nature*. London: Williams and Norgate, 1863. <http://dx.doi.org/10.5962/bhl.title.45796> (Accessed November 25, 2013).
15. Huxley, Thomas Henry. *Science and Culture*. London: Macmillan, 1888. <http://dx.doi.org/10.5962/bhl.title.30243> (Accessed November 25, 2013).
16. Huxley, Thomas Henry. *On the Origin of Species: or, The Causes of the Phenomena of Organic Nature; A Course of Six Lectures to Working Men*. New York: Appleton, 1895. <http://dx.doi.org/10.5962/bhl.title.61267> (Accessed November 25, 2013).
17. Huxley, Thomas Henry. *Evolution and Ethics*. New York: D. Appleton, 1896. <http://dx.doi.org/10.5962/bhl.title.19179> (Accessed November 25, 2013).
18. Jensen, John Vernon. *Thomas Henry Huxley*. Newark, New Jersey: University of Delaware Press, 1991.
19. Leighton, Gerald. *Huxley: His Life and Work*. London: Dodge Publishing, 1912.
20. Owen, Richard. *On the classification and geographical distribution of the mammalia, being the lecture on Sir Robert Reade's foundation, delivered before the University of Cambridge, in the Senate-House, May 10, 1859. To which is added an appendix "on the gorilla," and "on the extinction and transmutation of species."* London: J.W. Parker and Son, 1859. <http://dx.doi.org/10.5962/bhl.title.32722> (Accessed November 25, 2013).
21. Peterson, Houston. *Huxley: Prophet of Science*. London: Longmans and Green, 1932.
22. Regal, Brian. "Thomas Henry Huxley." *Science and Its Times* 5 (2000): 162-3.
23. Richmond, Marsha L. "T. H. Huxley's Criticism of German Cell Theory: An Epigenetic and Physiological Interpretation of Cell Structure." *Journal of the History of Biology* 33 (2000): 247-89.
24. Richmond, Marsha L. "Thomas Henry Huxley's Developmental View of the Cell." *Nature Reviews: Molecular Cell Biology* 3 (2002): 61-5.
25. von Baer, Karl Ernst. *Über Entwicklungsgeschichte der Thiere. Beobachtung und Reflexion. [On the Developmental History of Animals. Observation and Reflection]*. Königsberg: Bornträger, 1828. <http://babel.hathitrust.org/cgi/pt?id=inu.32000003298751;page=root;view=1up;size=100;seq=7;orient=0> (Accessed October 3, 2012).
26. White, Paul. "Huxley, Thomas Henry." *Europe 1789-1914: Encyclopedia of the Age of Industry and Empire* 2 (2006): 1101-3.
27. Williams, Wesley C. "Huxley, Thomas Henry." *Dictionary of Scientific Biography* 6 (2008): 589-97.