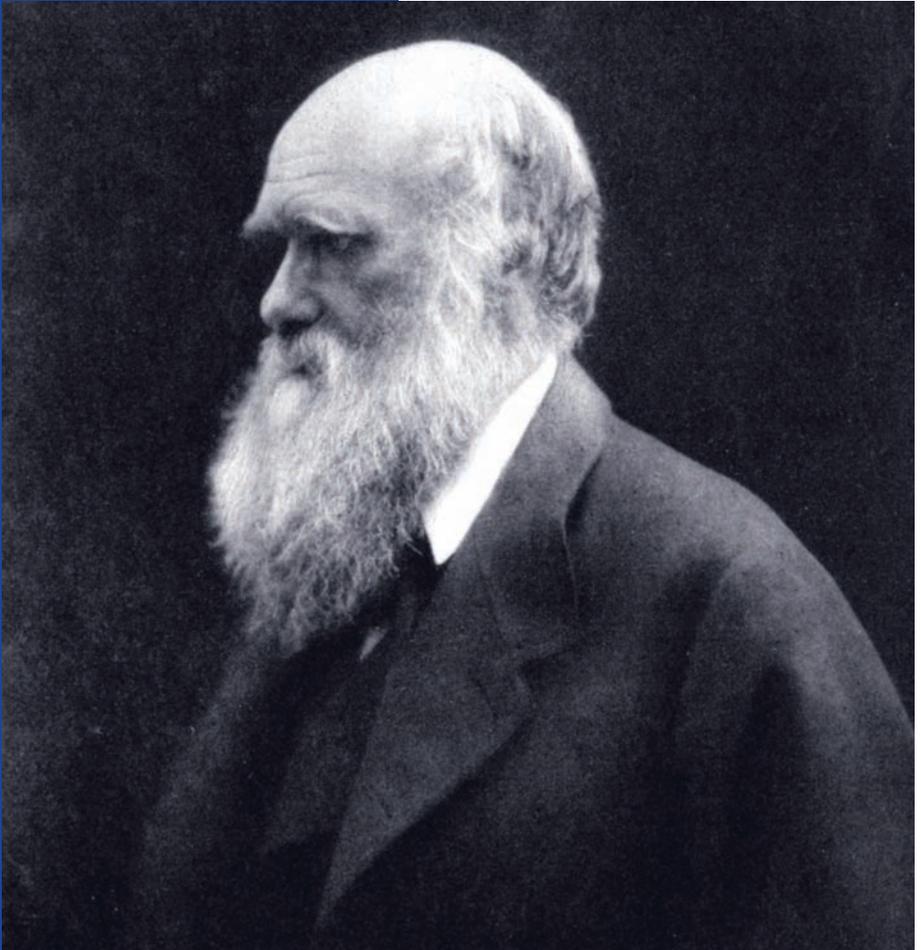


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**DARWIN,
DARWINISM, AND
THE MODERN WORLD**

COURSE GUIDE



Professor Chandak Sengupta
UNIVERSITY OF LONDON

Darwin, Darwinism, and the Modern World

Dr. Chandak Sengoopta

University of London



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Darwin, Darwinism,
and the Modern World
Professor Chandak Sengoopta



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Darwin, Darwinism, and the Modern World

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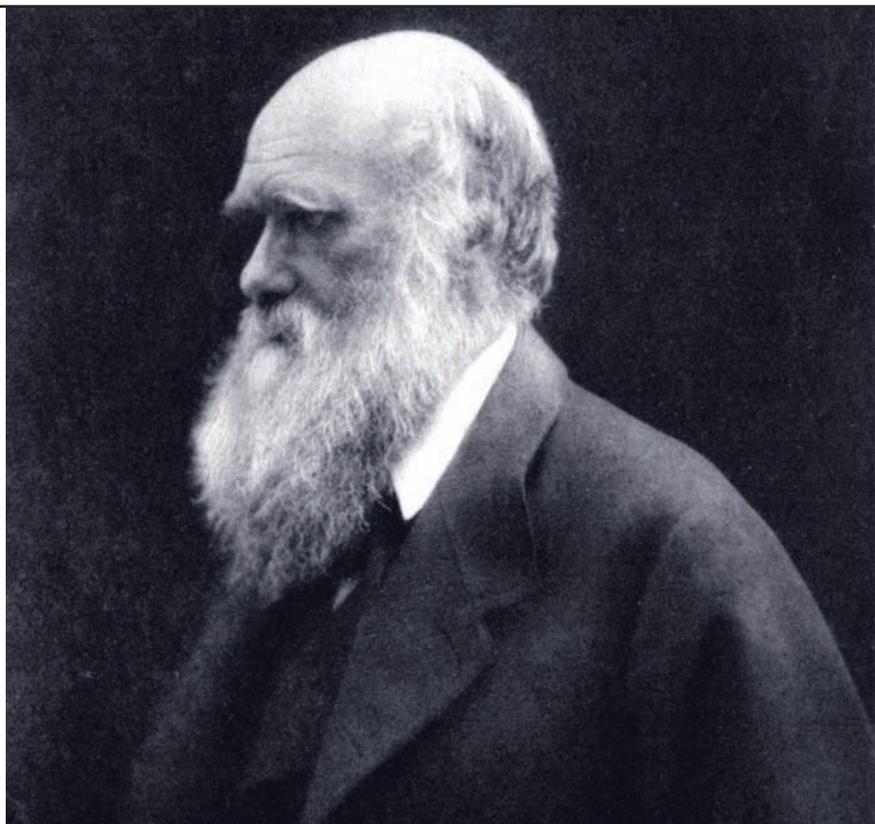
About Your Professor

Chandak Sengoopta

Dr. Sengoopta is a senior lecturer in the history of modern medicine and science at the School of History, Classics and Archaeology, Birkbeck College, University of London. He received his bachelor of medicine and surgery degree from Medical College, Calcutta; his M.D. in psychiatry from the University of Calcutta; an M.A. in history and philosophy of science and technology from Cornell; and his Ph.D. in history of science, medicine, and technology from Johns Hopkins University. Professor Sengoopta was a postdoctoral fellow at the Wellcome Institute for the History of Medicine in London as well as Medical Historian (Social History) Wellcome Institute for the History of Medicine, London. He was also a lecturer at University College, London, from 1998 to 1999, and at the Wellcome Unit for the History of Medicine, the University of Manchester, from 2000 to 2003.

Dr. Sengoopta's research interests revolve around the history of the behavioral and life sciences in Central Europe (especially turn-of-the-century Austria), with particular reference to the cultural and intellectual history of biomedical concepts of gender, insanity, and normality. He is currently teaching courses in the history of medicine and the life sciences in modern Europe, cultural history of imperialism, and the history of Victorian and Edwardian Britain.

In addition to his published articles on a wide variety of topics in the history of science and medicine, Dr. Sengoopta is the author of *Imprint of the Raj: How Fingerprinting Was Born in Colonial India* and *Otto Weininger: Sex, Science, and Self in Imperial Vienna*.



Photograph of Charles Darwin, 1868
by Julia Margaret Cameron

Introduction

The history of Western civilization can be divided neatly into pre-Darwinian and post-Darwinian periods. Darwin's 1859 treatise, *On the Origin of Species*, was not the first work to propose that organisms had descended from other, earlier organisms and the mechanism of evolution it proposed remained controversial for years. Nevertheless, no biologist after 1859 could ignore Darwin's theories and few areas of thought and culture remained immune to their influence.

Darwinism was attacked, defended, debated, modified, ridiculed, championed, interpreted, and used not only by biologists but also by philosophers, priests, sociologists, warmongers, cartoonists, robber-barons, psychologists, novelists, and politicians of various stripes.

This course will introduce the major themes of Darwin's works and explore their diverse, often contradictory impacts on science and society from 1859 to the present.

Lecture 1: Charles Darwin: The Man, His Life, and His Contexts, Part I

Before beginning this lecture you may want to . . .

Read Peter Bowler's *Charles Darwin: The Man and His Influence*.

Introduction:

Virtually everyone has heard of Charles Darwin and evolution; many of us also hold strong opinions on his theory of evolution. In the first lecture, I would like to look at the major events of his life, explore some of the ideas and themes that were of importance to the development of his views, and try to discover why and how a rather conventional English gentleman eventually became one of the most influential scientific and intellectual radicals of modern times.

Consider this . . .

1. What were the intellectual and religious assumptions Darwin had in his youth?
2. What experiences first challenged those ideas?
3. What were some of the scientific and cultural problems that Darwin had to resolve in order to develop a new view of life and nature?

I. The Youth of Charles Darwin

- A. Charles Darwin was born into a wealthy and eminent English family.
1. His grandfather, Erasmus Darwin (1731-1802), had been a religious freethinker and even proposed a theory of evolution of his own.
 2. Charles Darwin was sent to the University of Edinburgh (in Scotland) at the age of sixteen to study medicine.
 - a. He did not take to medicine and left after some years.
 - b. During those years, he developed some interest in natural history and even heard about a theory of evolution proposed long ago by the Frenchman J.B. Lamarck (see next lecture).
- B. After leaving Edinburgh, Charles decided to study for the priesthood at Cambridge University.



Erasmus Darwin
(1731-1802)

British Physician and Poet

His major works include the long poem *Botanic Garden* and *Zoonomia*.

-
1. He did a very ordinary BA degree, the curriculum of which comprised classical languages and literature, theology, and mathematics.
 2. During his studies, he was much impressed by *Natural Theology*, an influential book by the clergyman William Paley (1743-1805) arguing that the universe and all living beings in it were too intricately designed not to have a designer (i.e., God).
- C. During his years at Cambridge, Darwin's interest in natural history was encouraged by some of his academic acquaintances and mentors.
1. All of these mentors were ortho-dox Christians and trained, if not practising, priests of the Church of England.
 - a. Natural history was a traditional hobby of priests in Victorian England.
 - b. Some of them pursued their hobby to levels of high scientific excellence. (There were few full-time professional scientists in Victorian Britain—even the best were often amateurs.)
 2. It was one of those professors, the botanist John Henslow, who recommended Charles for a post on the HMS *Beagle*.
 - a. The *Beagle* set out in 1831 to survey the coastline of South America.
 - b. It was captained by the very conservative Robert FitzRoy, who was looking for a gentleman-companion and part-time naturalist.

II. The Voyage of the *Beagle*

Darwin explored the interior of South America (whilst the ship charted the coastline) and was struck by many novelties.

- A. Strange rock formations: Darwin had just encountered Charles Lyell's new geological theories and found that they explained his observations far better than earlier, more orthodox theories.
- B. Peculiarities in the distribution of plants and animals was hard to explain by divine creation.
- C. Darwin visited the Galapagos Archipelago, a chain of volcanic islands in the Pacific.
 1. He was struck by the differences of animals and plants on each island.
 2. He pondered the possible reasons for those differences.

III. Return to London and First Thoughts on Evolution (1836-1839)

- A. Doubts arose in Darwin about the traditional definition of species as absolutely distinct and separately created.
 1. New species may be formed by the gradual transformation of old ones.
 2. But what was the mechanism of transformation of one species into another?
- B. The factors of likely importance in the formation of new species:

1. Geographic isolation.
2. Evidence of animal breeders (artificial selection).
3. The population theory of Thomas Robert Malthus (1766-1834).
 - a. Population increases geometrically (2, 4, 8, 16 . . .).
 - b. Food supply can increase only arithmetically (2, 4, 6, 8 . . .).



HMS *Beagle* in the Straits of Magellan

4. Struggle for existence.
- C. Darwin's early theory of evolution (mid-1840s).
 1. Evolution is a branching process.
 2. Varieties diverge in their struggle with one another for resources.
 3. Natural selection of "favoured" varieties.

IV. The Years of Reflection and the Push to Publication (1840s-1850s)

- A. The collection of evidence.
- B. The "Big Species Book."
- C. Letter from Alfred Russel Wallace proposing a virtually identical theory.
 1. Joint presentation of Darwin-Wallace theory at the Linnaean Society, London.
 2. Darwin suspends work on the "big" book.
- D. Darwin writes the shorter and less technical work, *On the Origin of Species* (1859).

FOR GREATER UNDERSTANDING



Consider

1. What experiences induced Darwin to become an evolutionist?
2. With what kind of material and evidence did Darwin support his theory?
3. Was Darwin a lone genius working in isolation?

Suggested Reading

Bowler, Peter. *Charles Darwin: The Man and His Influence*. Cambridge: Cambridge University Press, 1996.

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Bowler, Peter. *Evolution: The History of an Idea*. Berkeley: University of California Press, 2003.

Browne, Janet. *Charles Darwin: The Power of Place*. Princeton: Princeton University Press, 2003.

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Darwin, Charles. *The Voyage of the Beagle*. New York: Penguin, 1989.

Malthus, Thomas Robert. *An Essay on the Principle of Population*. 1798, reprint edition. New York: Cambridge University Press, 1992.

Nichols, Peter. *Evolution's Captain: The Dark Fate of the Man Who Sailed Charles Darwin Around the World*. New York: HarperCollins Publishers, 2003.

Websites to Visit

1. http://pages.britishlibrary.net/charles.darwin/texts/beagle_voyage/beagle_front.html - The writings of Charles Darwin by John van Wyhe, Ph.D.
2. <http://www.ac.wvu.edu/~stephan/malthus/malthus.0.html> - Text of Malthus's *An Essay on the Principle of Population*, rendered in html format by Ed Stephan.

Lecture 2: Charles Darwin: The Man, His Life, and His Contexts, Part II

Before beginning this lecture you may want to . . .

Read Richard W. Burkhardt Jr.'s *The Spirit of System: Lamarck and Evolutionary Biology*.

Introduction:

Darwin was by no means the first evolutionary theorist, although he was, of course, to become the best known one. In this lecture, I shall survey some of the important pre-Darwinian theories. These were part of Darwin's intellectual background and some of them were later revived and used to oppose Darwin's theory. Secondly, I shall also examine some of the broader social and cultural contexts that may have influenced Darwin himself as well as the public reception of his work.

Consider this . . .

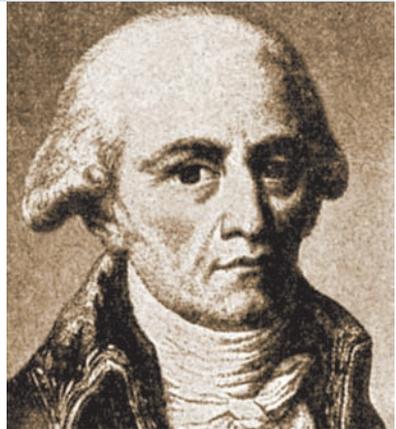
1. What were the fundamental differences between Darwin's approach to evolution and the evolutionary theories of his predecessors?
2. How extensively did Darwin draw upon the ideas of earlier theorists of evolution?
3. What were the social and cultural factors that may have influenced Darwin's theory of evolution?

I. Evolution Before Charles Darwin

A. Erasmus Darwin (1731-1802).

B. J.B. Lamarck (1744-1829).

1. Lamarck's theory was popular with antiestablishment figures in Victorian Britain.
2. According to Lamarck, life had originated spontaneously—there had never been any divine creation of life.
3. Life forms never went extinct—they transmuted into others.
4. Evolution progressed in a straight line.
5. Evolutionary change was driven by the demands of the environment.
6. All characteristics acquired in life were inherited by one's offspring.



Jean Baptiste Lamarck
(1731-1802)

French naturalist whose study and classification of invertebrates and theories of evolution preceded and influenced Darwin

C. Robert Chambers (1802-1871).

1. Chambers was an Edinburgh publisher who created a sensation with his anonymous book, *Vestiges of the Natural History of Creation* (1844).
2. Chambers claimed that life was continually being driven up toward higher intelligence by a divine law.
3. *Vestiges* familiarised the larger Victorian public with the idea of evolution.
4. Chambers tried to make the idea of evolution palatable to the middle classes by reinstating God and emphasizing progress.

II. Victorian England: A Society in Transition

A. The Maturing of the Industrial Revolution.

1. Commerce and industry flourished in the Victorian years (roughly 1840-1900).
2. There was a wide belief in the idea of *laissez-faire* (i.e., the freedom to engage in enterprise without regulations).
3. Britain became very prosperous during these years, but a great deal of poverty remained.
4. The period was also characterized by fundamental social change.



B. The Faith in Progress.

1. Victorians stressed the importance of individual innovation and individual effort.
2. Social progress was seen as virtually inevitable, even if slow.
3. There was great revulsion for (and fear of) revolutions.



Victorian Contrasts

The squalor of the poor contrasted sharply with the relative opulence of the wealthy and lent credence to the belief that social evolution was to be expected.

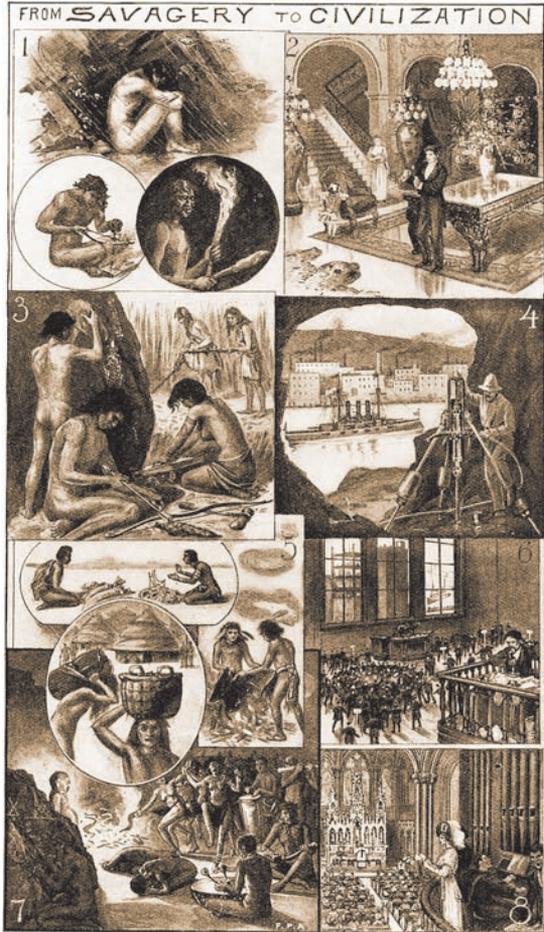
III. Secularization and Theories of Biology

- A. Simple creationism became obsolescent in the Victorian period, but there was no general turn toward evolutionism.
- B. Theological ideas remained important with regard to the origin of man. Any connection between humans and the animal world was considered to be impossible.

C. Even Chambers's idea of linear progress leading to man was criticized because it portrayed man as the highest animal.

D. Sophisticated theories compatible with creationism were introduced. These were not overtly religious. Example: Organisms might vary in their superficial attributes but at the deeper level, all members of each category were constructed on an essential, unchanging archetype.

E. Discontinuities in the fossil record made it hard to argue for evolution.



In a Victorian-era drawing, comparisons are made between "savage" man and "civilized" man without reference to an evolutionary (or creationist) process.

FOR GREATER UNDERSTANDING



Consider

1. Was Darwin's theory of evolution a theory of inevitable progress?
2. How culturally "Victorian" was the hypothesis of evolution by natural selection?
3. What was the role of the creator in Darwin's theory?

Suggested Reading

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Other Books of Interest

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Young, Robert M. *Darwin's Metaphor: Nature's Place in Victorian Culture*. Cambridge: Cambridge University Press, 1985.

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1. <http://www.lib.cam.ac.uk/Departments/Darwin> - The Darwin Correspondence Project, Cambridge University, U.K.
2. <http://guanare.regards.cnrs.fr:8080/lamarck/defaultgb.htm> - Jean-Baptiste Lamarck: Works and Heritage by Pietro Corsi (text in French)

Lecture 3: *On the Origin of Species:* The Fundamental Arguments

Before beginning this lecture you may want to . . .

Read Charles Darwin's *On the Origin of Species*.

Introduction:

Although written in a hurry, Darwin's *On the Origin of Species* (1859) remains his best-known and most influential work. A relatively nontechnical book, intended for the educated layperson, it spelled out Darwin's basic argument for evolution and offered much evidence drawn from the natural world as well as from the work of animal breeders. It also suggested a particular mechanism for evolution—natural selection. In this lecture, I shall outline the major arguments of the *Origin* and analyze how they reinforce one another.

Consider this . . .

1. What different kinds of data does Darwin use?
2. In the process of natural selection, does nature actively select certain species?
3. In the *Origin*, how much space does Darwin devote to sensitive issues such as the origin of life, the role of God, or the nature of the human mind?
4. Is Darwin's hypothesis of natural selection essential to his general case for evolution?

I. The Prevalence of Variation

- A. All species were innately variable.
- B. Wild populations showed numerous variations.
- C. Domesticated animals varied even more.

II. The Enhancement of Random Natural Variations by Breeders

- A. The "artificial" selection of favored traits by breeders was analogous to the "natural" selection of favorable variations in nature.
- B. Species were "real," but not immutable.

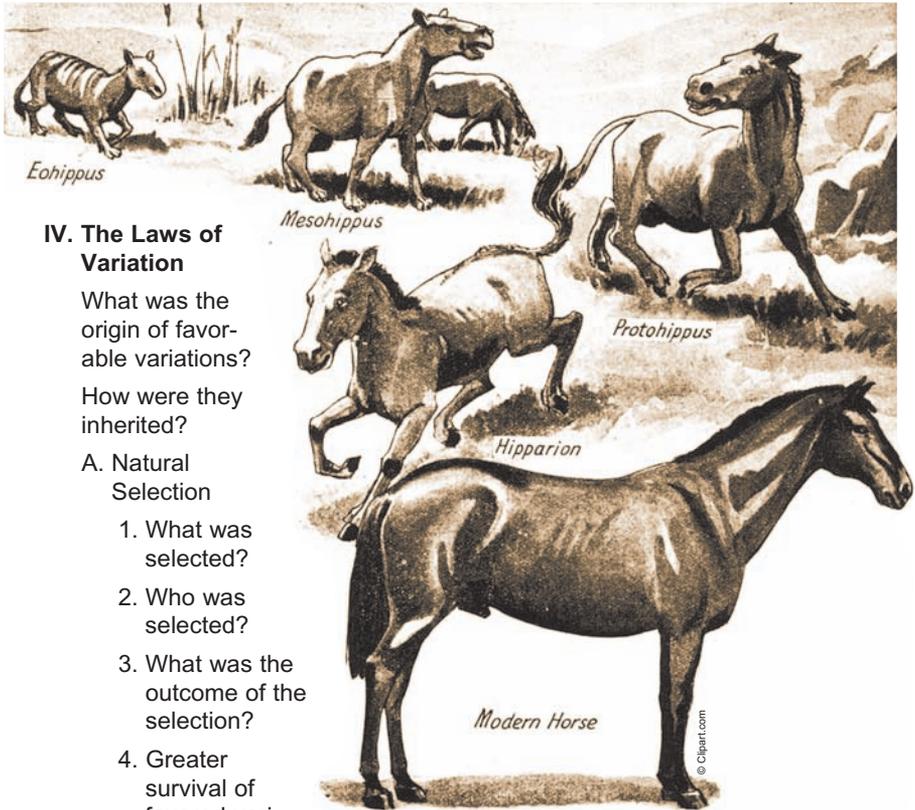
Charles Darwin

On the Origin of Species



III. The Nature and Consequences of Variability

- A. Population pressure rose inexorably because of unrestrained reproduction.
- B. This led to competition for scarce resources (i.e., to a struggle for existence).
- C. Individuals with variations that improved their performance in the struggle left more descendants with the same variations.



IV. The Laws of Variation

What was the origin of favorable variations?

How were they inherited?

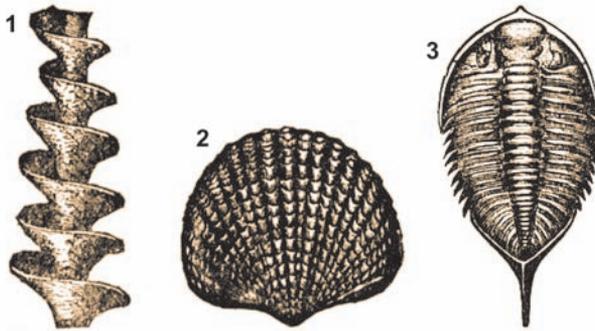
A. Natural Selection

1. What was selected?
2. Who was selected?
3. What was the outcome of the selection?
4. Greater survival of favored varieties (the "fit").
5. Death (and eventual extinction) of the "unfit."

V. The Formation of Species

- A. Species evolved by branching off from preexisting species.
 1. Random variations occurred in individuals.
 2. Those with useful variations (variations that enabled them to compete better) survived and reproduced more than those without such variations.
 3. The favorable variations were inherited by progeny and accumulated over generations.

4. Geographical isolation of strains with particular variations sped up their divergence from the parent stock.
5. These processes led to the formation of well-defined varieties (sub-species) and finally to distinct species.
6. Incessant divergence of varieties and species from one another continued.
7. There was no clear hierarchy: no species was “higher” than others.
8. Direction of branching was not progressive (i.e., not directed toward the evolution of any one species).
9. Darwin remained somewhat ambiguous on the possibility of progress in evolution.
10. Death and extinction were inseparable from the evolutionary process and constituted the dark side of Darwinian natural selection.



Three extinct marine animals: 1) “Archimedes Screw” *Wortheni bryozoe*
2) Spine-bearing Brachiopoda *Atrypa aspera*
3) Trilobite *Dalmanite limulurus*

FOR GREATER UNDERSTANDING



Consider

1. Does Nature play an active or a passive role in natural selection?
2. Does Darwinian evolution have a clear goal?
3. Do variations arise in direct response to environmental pressures?
4. What exactly does “fitness” mean in evolutionary theory?

Suggested Reading

Darwin, Charles. *On the Origin of Species*. Facsimile of 1st ed., 1859, introduced by Ernst Mayr. Cambridge, MA: Harvard University Press, 1964.

Other Books of Interest

Kottler, Malcolm J. “Charles Darwin’s Biological Species Concept and Theory of Geographic Speciation: The Transmutation Notebooks,” *Annals of Science*, 35 (1978): 275-97.

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Websites to Visit

1. http://pages.britishlibrary.net/charles.darwin/texts/origin1859/origin_fm.html - *On the Origin of Species*, 1st edition (1859)
2. http://pages.britishlibrary.net/charles.darwin/texts/foundations/foundations_fm.htm - Two essays on Darwin’s theory he wrote in 1842 and 1844 (never published in his lifetime)

Lecture 4:
On the Origin of Species:
The Unresolved Issues and the Achievements

Before beginning this lecture you may want to . . .

Read Charles Darwin's *On the Origin of Species*.

Introduction:

Darwin himself was aware of the deficiencies in his scheme and discussed them in a separate chapter of the *Origin*. In this lecture, I shall survey the weaknesses of Darwin's theory, examine what kinds of issues he avoided and finally look at some of the advantages Darwinian theory had over earlier conceptions of nature and life.

Consider this . . .

1. Does Darwin mention only those difficulties that he can explain?
2. Do the deficiencies concern the general idea of evolution or the more specific mechanism of natural selection?
3. How important are the advantages that Darwin claims for his theory?

I. The Problem of Random Variations

- A. How did variations arise and how were they inherited?
- B. Why did they not "blend away" in a few generations of mating with individuals without the variations?
- C. Why could one not find examples of "intermediate forms" between species? Darwin explained it through these points:
 1. Species branched off from a common ancestor—the latter was not an exact intermediate between the evolved species.
 2. The evolution of complex structures (e.g., the eye) was difficult to explain by a theory of gradual, piecemeal evolution.
 3. Simpler forms of complex organs could, however, be demonstrated in nature: they were intermediate in function and complexity.
- D. Darwin admitted that his whole theory would be endangered if it could be shown that a complex organ could not conceivably have had a simpler precursor.
- E. The persistence of useless organs and structures also posed a difficulty for Darwin's theory. He argued, however, that even apparently useless structures may be useful in an evolutionary context.
- F. Evolution in neuter insects (i.e., insects who could not reproduce) was another major problem for Darwin. How were variations passed on in

insects that did not even have offspring? Selection, said Darwin, could affect families as well as individuals.

- G. If species were not totally separate, then why did hybridization produce sterile offspring?
1. Crosses between different species did not always bring about sterile offspring—there was no absolute barrier between species.
 2. But Darwin agreed that the ability to produce fertile offspring did diminish gradually as species diverged away from one another.

II. Problems with the Fossil Record

- A. Why were there no intermediate organisms in the fossil record? Fossils, argued Darwin, were laid down too infrequently and unpredictably to produce a complete record of all species across time. Evolution often occurred in isolated habitats where no fossils may be laid down.
- B. Why did the fossil record show the abrupt appearance of large groups of living creatures in some periods (e.g., the Cambrian period)? Darwin explained such sudden emergences of multiple living creatures as being an artifact of the geological record—because of geological changes in the Earth's surface over time, the rock strata bearing earlier fossils may have sunk into the oceans.



A collection of fossils from the Middle Cambrian period

III. The Positive Case

- A. Although the fossil record was incomplete, there was nothing in it that directly challenged Darwin's idea of common descent. Ancestors of existing species were often identifiable as older, somewhat intermediate precursors.
- B. The geographical distribution of species could be explained successfully by Darwin's theory.

1. It explained the differences among the existing animals of the Old and New World.
 2. Major geographical barriers, according to Darwin, separated unique groups of species.
- C. Darwinian theory also led to improvements in the classification of species.
1. Grouping similar species into genera, families, etc. now became more rational.
 2. It could now be seen that similarities between organisms did not reflect some unknowable divine plan, but showed common origin.
- D. The existence of rudimentary organs was also understandable in Darwinian terms.
1. Vestigial organs were hard to explain as being created by God.
 2. Darwinian theory explained them as relics that had once been useful in the struggle for existence and persisted.

IV. Issues Left Unaddressed by Darwin's Theory

A. The origin of life on Earth.

Darwin neither acknowledged nor disputed the belief that life had first originated by divine creation. He dealt only with the subsequent history of living forms.

B. The existence and role of the creator.

Darwin did cast doubt on the creation by God of each species separately.

C. Divine control.

Darwin did not deny the possible importance of divine control of the evolutionary process. Species evolved by laws that may have been established by God.

D. The origin of humankind.

In the *Origin of Species*, Darwin avoided stating that man was simply a highly evolved member of the animal kingdom. He simply predicted at the end of the book that "light will be thrown on the origin of man and his history."



FOR GREATER UNDERSTANDING



Consider

1. How persuasive was Darwin's general case for evolution?
2. Were the deficiencies of Darwin's evidence fatal to his theory of evolution?
3. Was there room for God in a Darwinian universe?

Suggested Reading

Darwin, Charles. *On the Origin of Species*. Facsimile of 1st ed., 1859, introduced by Ernst Mayr. Cambridge, MA: Harvard University Press, 1964.

Other Books of Interest

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- Bowler, Peter. *The Mendelian Revolution: The Emergence of Hereditarian Concepts in Modern Science and Society*. London: Athlone Press, 1989.
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- Sober, Eliot, "Darwin on Natural Selection: A Philosophical Perspective," in *The Darwinian Heritage*, David Kohn, (ed.), pp. 867-899. Princeton: Princeton University Press, 1985.

Websites to Visit

1. <http://www.wku.edu/%7Esmithch/index1.htm> - The Alfred Russel Wallace page by Charles E. Smith, M.L.S., Ph.D., Western Kentucky University, Bowling Green
2. http://pages.britishlibrary.net/charles.darwin/texts/variation/variation_fm1.html - Online version of Darwin's two-volume work, *The Variation of Animals and Plants Under Domestication*, 2nd edition, 1883

Lecture 5: *The Descent of Man:* Man's Place in Nature

Before beginning this lecture you may want to . . .

Read Charles Darwin's *The Descent of Man and Selection in Relation to Sex*.

Introduction:

Some of the gravest and most persistent controversies surrounding evolution concern its implications for humanity. Are we created in the image of God or are we just a superior variety of ape? In this lecture, we shall explore the nineteenth-century debates on these issues and place them in their cultural, religious, and scientific contexts.

Consider this . . .

1. Did the Darwinian theory of human evolution deny the greatness of human qualities and achievements?
2. Which religious and cultural assumptions about human nature did Darwin challenge?
3. What kind of evidence did Darwin use to support his theory of human evolution?

I. Darwin's Early Views on Human Origins

- A. Comments in his private notebooks suggest that Darwin did not consider human beings to be separate and special.
- B. He realized early on that humans were not separate from the animal kingdom.
- C. These views were carefully omitted from the *Origin* to avoid controversy.
- D. Darwin finally published *The Descent of Man* in 1871.

II. Debates on Human Evolution Begun Long Before *The Descent of Man*

- A. Thomas Henry Huxley and "Man's Place in Nature."
 1. Huxley argued that there were deep anatomical and behavioral similarities between higher apes and humans.

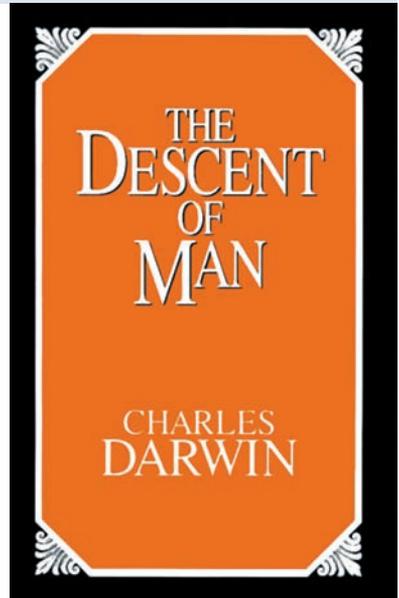


Image courtesy of HarperCollins Publishers

2. But humans, he emphasized, were from apes, not of them—the evolution of human intelligence had carried the human species much farther.

B. Huxley had a major dispute with the famous comparative anatomist Richard Owen on the supposed differences between ape and human brains.

III. Darwin's *The Descent of Man*

A. The book was not based on original research—it was a synthetic work based on the research and reports of others.

B. Darwin argued for human evolution from lower species on the following grounds:

1. The anatomical similarities between humans and apes.
2. Similarities in their senses.
3. Similarities in their process of reproduction.
4. Similarities between their embryos during the early phases of gestation.

C. Humans also displayed many mental similarities with animals—none of the following was totally unknown among the apes:

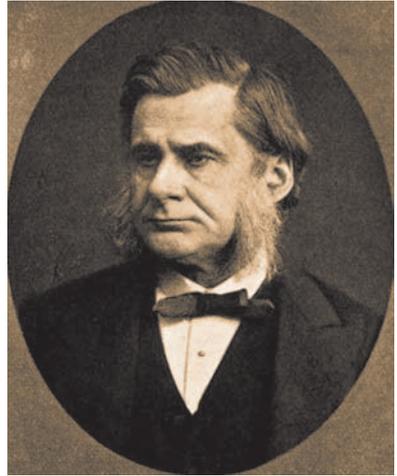
1. Instincts.
2. Human individuality.
3. Human moral sense.
4. Appreciation of beauty.
5. Language.

D. Why did humans develop high intelligence?

1. Darwin argued that the ancestors of human species had moved from arboreal existence to life on the plains.
2. They had assumed a bipedal posture in the plains; this had freed the hands for tool-making.
3. Tool-making had stimulated brain growth.
4. Higher intelligence had led to greater survival.
5. Intelligence had been subjected to natural selection.

E. Darwin proposed a secondary mechanism (sexual selection) to explain features that could not be explained by natural selection alone.

F. Sexual selection in animals was based on female choice of mate—features attractive to females were “selected,” regardless of their value in the struggle for existence.



Thomas Henry Huxley
(1825-1895)

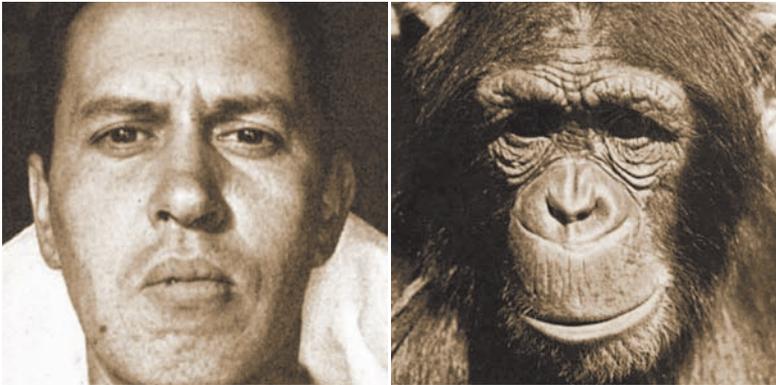
Professor Huxley was an influential publicist of the evolutionary theories of Charles Darwin.

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- G. Sexual selection explained the evolution of some male traits that natural selection could not explain.
1. Ornamentation in some birds.
 2. Singing ability.
- H. Darwin's effort to apply sexual selection to humans was convoluted—the selective power was transferred to men.

IV. Darwin's *Expression of Emotions in Man and Animals* (1872)

- A. This book was originally planned as one chapter of *The Descent of Man*. In it, Darwin studied facial and bodily expressions of humans (including infants and the insane) and the book was illustrated with many photographs.
- B. He concentrated on expressions of such emotions as rage, fear, and sorrow.
- C. He argued that the similarities between human emotional expressions and those of animals suggested common descent from a primordial ancestor.



V. Responses to Darwin's Theory of Human Evolution

- A. There was much discussion in fashionable circles.
- B. The reviews in the popular press were mixed—Darwin's moral theory was found feeble and unconvincing.
- C. Scientists were also quite critical.
1. Alfred Russel Wallace.
 2. St. George Jackson Mivart.
 3. Thomas Henry Huxley defended Darwin against his scientific critics.



Consider

1. Did Darwin portray humans as animals or did he make animals almost human?
2. How did the study of facial expressions support the idea of biological evolution?
3. How successful was Darwin in convincing his contemporaries that humans had evolved from the higher apes?

Suggested Reading

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Other Books of Interest

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Browne, Janet. "Darwin and the Expression of the Emotions." *The Darwinian Heritage*, David Kohn (ed.), pp. 307-326. Princeton: Princeton University Press, 1985.

Darwin, Charles. *The Expression of the Emotions in Man and Animals*. Paul Ekman (ed.). New York: Oxford University Press, 1998.

Durant, John R. "The Ascent of Nature in Darwin's *Descent of Man*." *The Darwinian Heritage*, David Kohn (ed.), pp. 283-306. Princeton: Princeton University Press, 1985.

Richards, Robert J. *Darwin and the Emergence of Evolutionary Theories of Mind and Behavior*, Chapters 1-5. Chicago: University of Chicago Press, 1987.

Young, Robert M. "The Historiographical and Ideological Context of the Nineteenth-Century Debate on Man's Place in Nature," in *Changing Perspectives in the History of Science: Essays in Honour of Joseph Needham*. Mikuláš Teich and Robert Young (eds.), pp. 344-438. London: Heinemann, 1973.

Websites to Visit

1. <http://pages.britishlibrary.net/charles.darwin> - The Writings of Charles Darwin on the Web.
2. <http://aleph0.clarku.edu/huxley> - Comprehensive site on the life and work of Thomas Henry Huxley, including online versions of his works. (Note: In the web address the character after "aleph" is a zero.-ed.)

Lecture 6: The Scientific Response to Darwin

Before beginning this lecture you may want to . . .

Read David L. Hull's *Darwin and His Critics: The Reception of Darwin's Theory of Evolution by the Scientific Community*.

Introduction:

Science in Victorian England was not restricted to a trained group of professionals. Many amateurs or part-time scientists contributed to scientific discussions and debates, especially on natural history. Darwin's *On the Origin of Species*, as we shall see in Lecture 10, was not written for a professional readership in any case. In order to assess the scientific response to the book, therefore, we need to examine the reactions not only of the few full-time scientists (such as Darwin's "bulldog" Thomas Henry Huxley), but also of self-taught experts (such as Herbert Spencer) and complete amateurs (such as the Bishop of Oxford, Samuel Wilberforce) who felt competent to comment on the technical dimensions of Darwin's argument.

Consider this . . .

1. Was there just one big argument in *On the Origin of Species*?
2. How was Darwin's argument nearly destroyed by a physicist?
3. Which groups found Darwin's theory most illuminating and useful?

I. The Place of Science in Victorian Britain

- A. In Victorian Britain, there was incomplete separation of "scientific" and "lay" sectors of society.
- B. Natural history and related fields were especially open to amateurs, many of whom were priests.
- C. Professional scientists began to emerge in the later years of Victoria's reign.
- D. Thomas Henry Huxley was one of the first full-time professional scientists.
- E. Huxley led a group of younger men—they wanted science and scientists to acquire unquestioned authority over scientific issues such as the evolution of species. This was one reason for Huxley's opposition to priests and the religious establishment.
- F. Darwin himself was not a trained scientist, nor was Herbert Spencer or Charles Lyell.
 1. Most of them were self-taught or amateurs and wrote for a large, educated readership.
 2. Even their most challenging works were nontechnical.

II. Differences in Responses to Different Components of Darwin's Theory

- A. Darwin's theory of evolution had at least four major elements:
 - 1. The idea of transmutation (the possibility of one species gradually changing into another).
 - 2. Naturalism (the conviction that the origin and development of living beings can be understood in the light of natural, rather than supernatural, forces).
 - 3. The concept that evolution does not proceed in a straight line but in a branching pattern.
 - 4. Natural selection (greater survival of those with favourable adaptations).
- B. By 1869, the majority of scientists in Britain had come to accept evolution. In the 1860s, the topic of evolution appeared on examination questions at the University of Cambridge.
 - 1. Usually, this acceptance of evolution meant no more than the acceptance of the idea of transmutation and naturalism; some people also accepted the idea of branching evolution, but not too many.
 - 2. Natural selection—the very heart of Darwin's system—was rarely accepted.
- C. There were many reasons for unpopularity of natural selection:
 - 1. Darwin provided no clear explanation of the origin and nature of variations (see Lectures 4 and 12).
 - 2. The randomness of natural selection offended Victorian scientific and cultural sensibilities, as did the absence of purposefulness and linear progress in Darwin's scheme.

III. The Emergence of Rival Theories of Evolution

The randomness and lack of purpose in natural selection encouraged the emergence of different, more purposeful theories.

- A. Theistic evolution.
 - 1. In theories of theistic evolution, God—either directly or through divinely created laws—governed the evolutionary process.
 - 2. The concept of direct creation of each separate species was rejected, but God remained essential.
- B. Neo-Lamarckism.
 - 1. Lamarck may have died in poverty in Paris, but his name was revived in America at the end of the nineteenth century by scientists who rejected Darwinism.
 - 2. Evolution, according to neo-Lamarckians, was driven by the inheritance of features acquired during life due to environmental needs—each generation progressed a bit farther along a certain path than the preceding generation.
 - 3. Neo-Lamarckism was naturalistic—there was no need for divine

intervention—but it was more purposeful and less random than Darwinian natural selection. It also permitted quicker evolutionary change than did Darwin's natural selection.

4. It could be easily applied to the evolution of human behavior and society. Social habits, the neo-Lamarckians and reform Darwinists claimed, could become fixed in time and be inherited as instincts.

C. Orthogenesis.

1. In this theory, evolution had no relation to adaptations or the environment.
2. Evolutionary change occurred along lines determined by forces internal to the organism. Again, it was a purposeful and linear scheme, unlike natural selection.
3. Orthogenesis had one great advantage over other theories: it could explain the development of useless or downright harmful structures (e.g., the antlers of the Irish elk, which were so big and cumbersome that the animals couldn't move and eventually became extinct).
4. It was possible to combine orthogenesis with neo-Lamarckism: a trend might begin because it was useful and then be inherited by Lamarckian use-inheritance, but after many generations, it might acquire a momentum of its own and proceed beyond the point of utility and even cause the ultimate extinction of the species.

D. Non-Darwinian theories remained popular until the early twentieth century, when the emergence of genetics revitalised Darwinism.

IV. Darwin's Impact on Scientific Research

A. There was great interest in paleontology after *Origin*.

1. There were many hunts for "missing links" (forms intermediate between known species).
2. Although one intermediate fossil—Archaeopteryx, intermediate between birds and reptiles—was found, the fossil record proved hard to complete.
3. Anti-Darwinians used the incomplete fossil record to argue for other mechanisms of evolution, notably orthogenesis.

B. Comparative anatomy and evolutionary morphology.

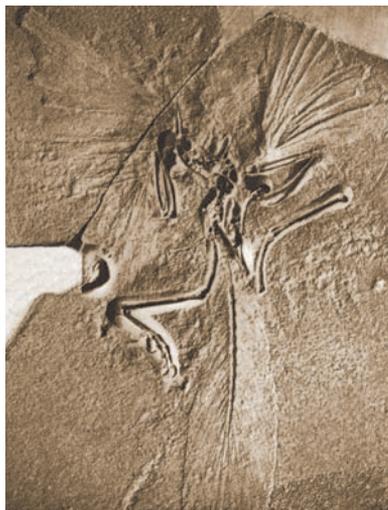
1. Some scientists were convinced that even if the fossil record did not spell out evolutionary relationships, then they could be reconstructed by the laboratory study of anatomical structures of currently existing species.
2. Studying the different forms of their internal organs would clarify their evolutionary interrelationship—this was evolutionary morphology.
3. Evolutionary morphology was especially popular in the 1870s and 1880s in Germany, where the experimental sciences were very well-developed.
4. Ernst Haeckel (1834-1919), a well-known German biologist and bestselling author of popular books on evolutionary theory, con-

structured flamboyant evolutionary trees on the basis of morphological evidence. Haeckel revered Darwin, but also incorporated other ideas into Darwinism.

- C. Immediate acceptance of Darwinism by field naturalists.
 - 1. Nothing explained the distribution patterns of animals and plants over the planet as convincingly as Darwinism.
 - 2. But even among biogeographers, the details remained controversial (e.g., was the geographical isolation of a variety essential for it to develop into a distinct species?).

V. Scientific Objections to Darwinism

- A. The age of the Earth.
 - 1. The famous physicist Lord Kelvin (William Thomson, Baron Kelvin [1824-1907]) insisted, on the basis of calculations of heat loss from the Earth's substance, that the Earth was far younger than Darwin and Lyell had assumed. So, there had not been enough time for natural selection to have worked in ways that Darwin claimed. Actually, the calculations were wrong, because Kelvin did not know of radioactivity in the earth's core, but nobody knew that at the time.
 - 2. Darwin and his followers stuck doggedly to their scheme, but they had no evidence to counter Kelvin's assertion. Darwin's opponents were delighted.
 - 3. St. George Jackson Mivart calculated that Darwinian natural selection would have needed about 2,500 million years to bring about the current state of the living world, which was 25 times as much as Kelvin was prepared to grant.



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Archaeopteryx lithographica: a “missing link”?

“He is certainly a wise man who today can tell a bird from a reptile, with only the fragments of an ancient form before him.”—O. C. Marsh, *New York Herald*, January 19, 1890.

In 1863, Sir Richard Owen, curator of the British Museum of Natural History, gave the name to the fossil he had acquired. It had been found near Pappenheim in southern Germany in 1861. Owen was no believer in evolution. While he admitted *Archaeopteryx* was neither bird nor lizard, Owen said, “How is it if all animals have proceeded by gradual modification from a common stock, that great gaps [still] exist?”

T.H. Huxley responded to this: “We, who believe in evolution, reply that these gaps were once nonexistent; that the connecting forms existed in previous epochs of the world's history, but they have died out.”

To this day, *Archaeopteryx* remains a physical manifestation of the controversy between evolutionists and creationists.

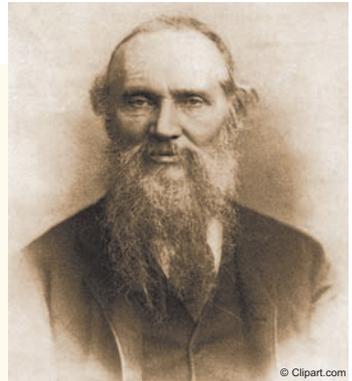
- B. Again, this kind of problem encouraged the growth of non-Darwinian theories such as the supposedly much swifter Lamarckism.
- C. No accepted theory of heredity in the nineteenth century could account for the inheritance of minute variations over as many generations as Darwin postulated. (For more on the origin, maintenance, and perpetuation of variations, see Lecture 12.)
- D. Rival schemes such as neo-Lamarckism were strengthened by Darwin's inability to explain this crucial issue and encouraged Darwin himself to make more room for the inheritance of acquired characters in his theory.

VI. Thomas Henry Huxley and the Younger Darwinians

- A. Huxley and his generation in Britain suppressed much opposition and fought fiercely for Darwin, but Huxley himself had strong reservations on natural selection.
- B. For Huxley and the younger scientists, it was Darwin's naturalism that was most attractive.
- C. Naturalism gave scientists more authority. It was useful in battling those whom they perceived as enemies of reason, especially the Church.
- D. At the end of the nineteenth century, the kind of gentlemanly, amateur science that I talked about at the beginning of this lecture was disappearing.

**William Thomson,
Baron Kelvin of Largs**
(1824-1907)

Despite his misguided statements that the Earth was too young to allow for Darwin's theory of evolution, Lord Kelvin made many contributions to science, including the "Kelvin Scale" for measuring absolute temperatures of hot and cold. After the scale was generally accepted, Kelvin said, "When you can measure what you are speaking about and express it in numbers, you know something about it."



Thomson was knighted for his development of the instruments used in and his supervision of the laying of the first transatlantic cable. In 1892, he was made a peer.

Known also for his self-confidence, Kelvin made the remarks below that were later (during his own lifetime) to prove incorrect.

In 1895:

"I have not the smallest molecule of faith in aerial navigation other than ballooning . . . heavier-than-air flying machines are impossible."

In 1900:

"There is nothing new to be discovered in physics now. All that remains is more and more precise measurement."



Consider

1. What were the main grounds of objection to Darwin's theory of evolution?
2. How did the deficiencies of Darwinism encourage the growth of rival hypotheses?
3. Why did younger scientists find Darwin's theory helpful, even when they did not entirely agree with its assertions?

Suggested Reading

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Other Books of Interest

Bowler, Peter J. *The Eclipse of Darwinism: Anti-Darwinian Evolutionary Theories in the Decades Around 1900*. Baltimore: Johns Hopkins University Press, 1983.

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Nyhart, Lynn K. *Biology Takes Form: Animal Morphology and the German Universities, 1800-1900*. Chicago: University of Chicago Press, 1995.

Russell, E.S. *Form and Function: A Contribution to the History of Animal Morphology*. London: John Murray, 1916.

Russett, Cynthia Eagle. *Darwin in America: The Intellectual Response*. San Francisco: W.H. Freeman, 1976.

Smith, Crosbie W. and Wise, M. Norton. *Energy and Empire: A Biographical Study of Lord Kelvin*. Cambridge: Cambridge University Press, 1989.

Lecture 7: Cultural and Religious Debates on Evolution in the Victorian Era

Before beginning this lecture you may want to . . .

Read Peter Vorzimmer's *Charles Darwin, the Years of Controversy: The Origin of Species and Its Critics, 1859-1882*.

Introduction:

Many people think that the emergence of evolutionary biology must have precipitated a fierce battle between science and religion. Since religion and evolution are so sharply polarised today, we tend to assume that things must have been worse in Victorian times, when religious faith was far stronger than it is now. The true story, however, is very different. Thousands of books and articles were published in response to the *Origin of Species* and much was written in Victorian times about the religious implications of evolution. Although there was a lot of religious and cultural opposition to Darwinism in the nineteenth century, there were also many attempts to reconcile the two. In this lecture, we will look at some of the ways in which religion and evolution interacted in the Victorian period.

Consider this . . .

1. Was the concept of evolution totally incompatible with Christianity?
2. Which aspects of evolutionary theory troubled Victorians the most?
3. Did people try to reconcile these differences? How?

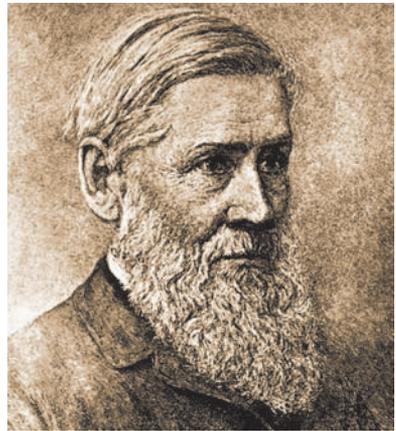
I. Darwin's Religious Evolution

- A. Darwin was conventionally religious in his youth and wanted to be a Church of England priest.
- B. At the time he wrote the *Origin*, Darwin still retained some religious faith, as shown by many references to the creator in the book.
- C. His wife Emma was quite religious and Darwin was always careful not to offend her religious feelings too deeply.
- D. Darwin did not experience any sudden loss of faith—it gradually withered away.
- E. Darwin called himself an “agnostic” (the word was coined by his associate Thomas Henry Huxley to denote a person who was neither an atheist nor a believer; the agnostic simply believed that humans can know nothing of matters beyond the world of material phenomena).

II. Protestant Responses to Darwinism in the Nineteenth Century

- A. There was no single, homogeneous response to Darwinism even within Protestant Christianity.

1. In Britain: responses varied across Christian denominations and even within single denominations (e.g., Anglicans).
 - a. Methodists and Low-Church Anglicans were strongly opposed to Darwinism.
 - b. High-Church Anglicans were more accepting and the Unitarians even more so.
 2. In America, the Christian response to Darwin was equally diverse.
 - a. Presbyterians were either very hostile or welcoming.
 - b. Methodists, Baptists, and Lutherans were opposed to evolution but not particularly interested in the debate.
- B. There were many attempts to combine Darwinism with theology, resulting in theories of theistic evolution.
1. Some theologians argued that since every part of nature was created by God, a theory of evolution need not be ungodly. Every variation and adaptation was designed by God, as were the laws by which those variations were subjected to natural selection.
 2. American botanist Asa Gray, staunch supporter of Darwin and devout Christian, declared that evolution strengthened the old argument from design.
 - a. Evolutionary theory provided a new justification for rudimentary organs and explained the apparent failures and waste of life in nature as necessary for the progress of the species. In fact, said Gray, variations might well be led along beneficial directions by God.
 - b. He held that evolution was neither a first nor a final cause—it was not concerned with origins or ultimate ends.
 - c. But even Gray took a long time to agree that humans had evolved like any other animal. The spiritual difference between humans and the highest apes was real and transcendent. That was not a matter of biology.
 3. Darwin himself did not agree that an omniscient God could permit so much waste and death in Nature but was nonetheless pleased to see that evolution could be reconciled with faith.
- C. Christian opponents of Darwin in the nineteenth century did exist, but tended to focus on Darwin's supposedly unscientific attitude.



Asa Gray
(1810-1888)

American botanist, professor at Harvard University, and author of several botany texts.

According to them, he was proposing a speculative hypothesis based on vague analogies, unproved hypotheses and arbitrary sets of facts.

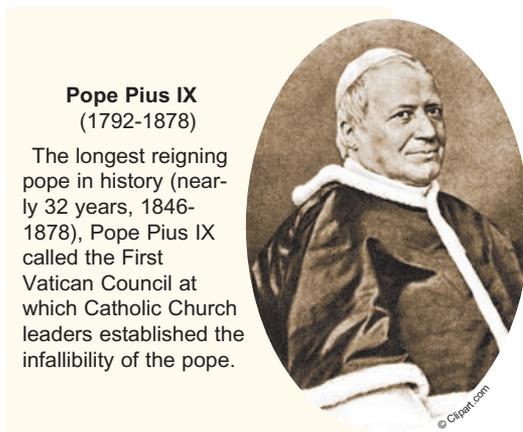
- D. The most conservative Christians were the most comfortable with Darwinism.
1. Darwinism was partly based on the teachings of the clergyman Thomas Robert Malthus—whose pessimism about social improvement was harsh, but whose outlook was thoroughly Christian. In this version of the Christian doctrine, God was not just merciful, but also ruthless when required. The ruthlessness with which natural selection weeded out failures was quite compatible with such views.
 2. Liberal Christians were drawn more to Lamarckian mechanisms, because they seemed to permit quicker and more significant improvement.

III. The Catholic Response to Darwinism

- A. In 1870, the Church declared the Pope infallible when speaking officially on matters of faith, morals, or theological doctrine.

A “syllabus of errors” drawn up earlier was now given teeth:

those who believed any of that list, which included such beliefs as “human sciences are to be so freely treated, that their assertions, although opposed to revealed doctrine, can be held as true” would be anathematized.



- B. In 1871, the Catholic anatomist St. George Jackson Mivart (1827-1900) published the book *Genesis of Species* in response to Darwin’s work.

Mivart believed in evolution, but it was evolution along lines predetermined and programmed by a higher force.

- C. In 1893, papal encyclical *Providentissimus Dei* directed Catholics to interpret the scriptures literally.

But this was a passing phase: in 1909, the Pontifical Biblical Commission issued decrees that were in favour of interpreting the Book of Genesis more as a work of history.

- D. In 1951, encyclical *Humani Generis* insisted that the genesis of the human soul could not be explained by evolution, but it left all other evolutionary questions open for discussion by “experts in science and theology.”

IV. Responses to Darwin in the Victorian Press

- A. Opinions of periodicals usually followed religious affiliations of their readership.
- B. There was a spectrum of opinion varying according to social class and educational level of the readership.
 - 1. The highbrow journals tended to accept that some kind of evolution may have occurred in plants and animals, but under the guidance of some higher force.
 - 2. With regard to man, however, even that limited approval was not forthcoming.
 - 3. With time, attitudes softened a little, especially amongst those members of the reading public who were to the left of the majority.

FOR GREATER UNDERSTANDING



Consider

1. To what extent was it possible to be Christian as well as Darwinian in the nineteenth century?
2. Did Darwin himself agree that evolutionary doctrine could be combined with a belief in an omnipotent creator?
3. Which theme of Darwin's theory of evolution was rejected most vehemently by the religious?

Suggested Reading

Vorzimmer, Peter. *Charles Darwin, the Years of Controversy: The Origin of Species and its Critics, 1859-1882*. London: University of London Press, 1972.

Other Books of Interest

- Brooke, John Hedley. "Darwin and Victorian Christianity," in *The Cambridge Companion to Darwin*. Jonathan Hodge and Gregory Radick (eds.), pp. 192-213. Cambridge: Cambridge University Press, 2003.
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- Young, Robert M. "The Impact of Darwin on Conventional Thought," in Robert M. Young, *Darwin's Metaphor: Nature's Place in Victorian Culture*, pp. 1-22. Cambridge: Cambridge University Press, 1985.

Websites to Visit

<http://human-nature.com/dm/chap1.html> - Robert M. Young's *Darwin's Metaphor: Nature's Place in Victorian Culture* (online version).

Lecture 8: “Social Darwinism” and the Natural Basis of Society

Before beginning this lecture you may want to . . .

Read Mike Hawkins’s *Social Darwinism in European and American Thought 1860-1945*.

Introduction:

As we have heard in earlier lectures, *On the Origin of Species* had virtually nothing to say on human origins or the nature of human society. And yet, right from the time of its publication, many of its readers fixed their sights on just those two issues. We have already examined some of the discussions on human origins; now let us turn to the efforts to apply evolution to society. From the nineteenth century until now, these attempts have been lumped together as “social Darwinism.” It is a popular label but also a controversial one. Nobody ever claimed to be a social Darwinist—the term was always used pejoratively by those who opposed the extension of Darwinian principles to the study of human society. This is one reason why scholars and commentators disagree profoundly about the definition of the term, its scope, how far it is applicable to particular thinkers and the functions the concept may have served in its time. In this lecture, I shall provide an outline of the issues at stake and provide some guidelines on how to approach this complicated subject.

Consider this . . .

1. What does the term “social Darwinism” mean?
2. Was Darwin himself a social Darwinist?
3. Is the debate on the definition of social Darwinism a typical pedantic dispute among academics or are there deeper questions involved?

I. Many Definitions, Much Disagreement

A. At the simplest level, a social Darwinist was one who believed that human societies should be organized so as to ensure the “survival of the fittest” (i.e., no concern should be shown to the weak and the unfit). Only in such a society, it was believed, could humanity evolve to its highest potential.

1. This was how the American historian Richard Hofstadter (1944) defined social Darwinism in his 1944 book *Social Darwinism in American Thought*.
2. According to Hofstadter, the classic example of the social Darwinist was the American robber baron, the ruthless

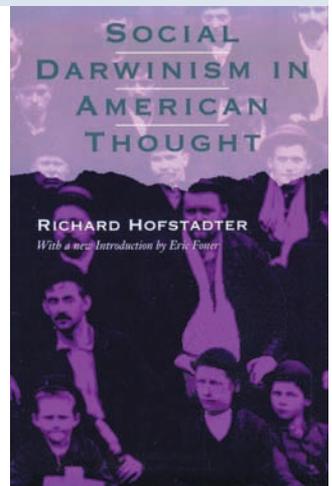


Image courtesy of HarperCollins Publishers

industrialist who made his millions by crushing the poor—survival of the fittest meant the survival of the richest.

Critics of Hofstadter point out that every nineteenth-century supporter of capitalism believed in free enterprise and free competition, but need not have believed at all in Darwinian biology.

3. Social Darwinism, according to Hofstadter, was a creed of inevitable social progress.

Many nineteenth-century thinkers believed passionately in progress but not necessarily in evolution. Conversely, many so-called social Darwinists actually believed that progress, even if possible, was not inevitable; some even thought that their society was degenerating.

4. Most later historians disagree with Hofstadter; some reject his concept almost totally.
- B. There are two broad approaches to the question of social Darwinism among historians today.
1. A restrictionist approach: social Darwinism should be used to describe only those kinds of social theory that used purely Darwinian concepts such as natural selection.

This approach leads to very few instances of any true social Darwinists: historian Robert Bannister has said that this is as it should be. Social Darwinism was a bit of a “phantom phenomenon,” a mere abusive stereotype that nineteenth-century scientists and social thinkers used to vilify their opponents.

2. A more inclusive perspective considers it unwise to restrict social Darwinism to purely Darwinian social theories.
 - a. Darwin himself was partly a Lamarckian and hence, social theories stressing inheritance of acquired characters are also social Darwinist.
 - b. Some social Darwinists paid lip service to Darwin but held biological views that were significantly different from his.
 - c. The term “social Darwinism” should denote a family of loosely related ideas linking evolutionary biology and social theory.

II. Darwin and Social Darwinism: Was Darwin Himself a Social Darwinist?

Darwin himself expressed social opinions (especially in *The Descent of Man*) that were, at first glance, quite social Darwinist in spirit.

- A. For example, he stated in *The Descent* that in highly civilised nations, the struggle for existence was weakened by welfare and charity—they interfered with the biological evolution of the human species.
- B. But Darwin did not counsel the abandonment of human sympathy—he called it the “noblest” part of human nature and thought it was a biological instinct subject to natural selection. To suppress our sympathy for the weak was to interfere with evolution.
- C. The importance of Lamarckian inheritance.

- D. The inheritance of acquired characteristics was considered to be important in the evolution of human societies and their progress.
- E. Darwin himself believed in the inheritance of acquired characteristics and did not consider natural selection to be all-sufficient.

III. Two Exemplary Social Darwinists

A. Herbert Spencer (1820-1903).

1. Spencer supported the idea of evolution even before Darwin published the *Origin*.
 - a. Spencer was not a scientist by training or profession, but wrote much on biology, psychology, and social theory.
 - b. He is forgotten today but was very influential in his time.
2. Spencer defined evolution simply as a change from a less differentiated state to one that was more complex and differentiated—applicable to every level from the cosmos to the individual human.
3. He believed that biological and social progress were inevitable—progress was a law of nature.
4. He was a strong believer in the inheritance of acquired characters but also accepted natural selection as a subsidiary mechanism of evolution.
5. Spencer was a firm opponent of welfare, relief, or any kind of state aid to the poor or the sick.

a. Such measures, he claimed, simply increased the number of “unfit” individuals and interfered with social evolution.

b. But this was not such an unusual view among Victorians. Misdirected charity was criticized for creating dependency even by staunch liberals like the philosopher John Stuart Mill.



Helping the Needy

Nineteenth century Salvation Army workers preach to needy women before supplying them with a meal.

6. Competition was all-important for evolution—it was Spencer who coined the phrase “survival of the fittest.”
 - a. Warfare was the form of competition in primitive societies, but industrial competition the form in advanced civilization.
 - b. According to Spencer, the state shrank as civilization progressed.

- c. But Spencer was also opposed to militant imperialism and the extermination of the “inferior races”—such actions merely brutalised the oppressors and did not aid evolution.

B. William Graham Sumner (1840-1910).

1. Sumner was a professor of political economy at Yale University; he had previously been an Episcopalian priest.
2. He was influenced by Spencer but repudiated Spencer’s optimism on progress.

Sumner also disagreed that competition would take different forms as society grew more civilized.

3. Sumner regarded sociology and biology as sciences dealing with different aspects of the struggle for existence.
4. According to him, the struggle for existence was of two kinds: struggle between man and nature for subsistence and struggle between individual humans for more resources.
 - a. Neither struggle should be interfered with by social welfare—that would produce “the survival of the unfittest.”
 - b. Sumner hailed the “forgotten man,” the provident, modest individual who paid the price of supporting the unfit.
 - c. Equality was incompatible with liberty.
5. Sumner was less interested in biological heredity than Spencer and other evolutionists.
 - a. Social evolution resembled biological evolution but was not directly derived from it.
 - b. The law of evolution was all-powerful, but it did not just influence the biology of organisms—it also operated through social beliefs, practices, and institutions.

IV. Social Darwinism and Political Ideology

- A. Great diversity of political beliefs among so-called social Darwinists—some were conservative but others wanted to use Darwinian principles to change society.
- B. The “New Liberals” in early-twentieth-century Britain.
 1. Darwinism was seen by younger liberal political thinkers as a way to combine individual liberty and social reform.
 2. They argued that society was an organism—evolution was leading to increased cooperation and altruism in society, making it function more and more like a well-integrated organism.
 3. The mind was a product of evolution, and the growth of human altruism, exactly as Darwin had suggested, was a biological process.
 4. Struggle and competition were to be encouraged, but nobody should have an unfair advantage because they were born rich or got a better education. Social legislation was justified because it would reduce unfair competition and level the playing field.

C. Imperialism, War, and Darwinism.

1. There was no single social Darwinist approach to imperialism.
 - a. Spencer, an archetypal social Darwinist, was opposed to imperial exploitation.
 - b. Anti-imperialists of the early twentieth century often accused Darwinism of encouraging colonial oppression. Darwinism, they claimed, was taken to justify competition between races and the subordination of inferior races by the superior. Actually, however, imperialists rarely used clearly Darwinian concepts.
 - i. One rare example of a Darwinian defender of imperialism was the British biologist and socialist Karl Pearson. But he was a very idiosyncratic figure in early-twentieth-century England and not at all typical.
 - ii. Conventional nationalism or racial pride or paternalism were actually far more frequently used to justify imperialism than Darwinism.
2. There was no uniform social Darwinist view on war either.
 - a. Spencer believed that peaceful competition replaced war in the higher stages of civilization.
 - b. Darwinism was used to argue for world peace between 1859 and 1919.
 - i. Humans as the only species who murder their own kind.
 - ii. Darwin's examples of cooperative behavior among animals.
 - c. Of course, there were exceptions. Some (e.g., Harold F. Wyatt in 1911) felt that war was "God's test" for nations.
 - d. Nations were organisms and it was natural for them to compete—war eliminated the unfit, leading to the progress of the species as a whole.
 - e. Similar views were expressed during World War II by the eminent British anatomist and anthropologist Sir Arthur Keith.
 - i. Keith claimed that periodic outbreaks of war prevented the excessive growth of individualism and the loss of group solidarity.
 - ii. War rejuvenated nations.
 - f. Darwinism, in short, was used to legitimize existing attitudes and dogmas—in itself, it did not necessarily lead to any glorification of war.

V. From Nature to Human Society—"Is" to "Ought"

A. The basic issue.

Should we follow nature as a model for human society? Should we argue, in other words, from "is" to "ought"?

B. Simple as the question is, it is one of the most difficult to answer.

1. Darwin himself thought that human beings should not blindly follow Nature.



World War I Dead

White crosses at the Meuse-Argonne cemetery in France mark the graves of French and American soldiers killed in World War I.

2. In a famous essay “Evolution and Ethics,” Thomas Henry Huxley said that humans should consciously oppose Nature in their ethics.
 3. Others, like Herbert Spencer, had no problem in following Nature, but added that what was good and natural for lower animals was not good for higher species such as humans.
 4. Some biologists thought Nature supported the idea of peace while others thought it justified war.
- C. There is no obvious, necessary link between evolution and society, although some aspects of evolutionary biology can be used to explain and justify many human activities and attitudes, including some pretty inhuman ones.



Consider

1. Was Darwinism a justification for social injustice?
2. Was Darwinism necessarily in favor of war and colonization?
3. How close and how integral were the connections between social theory and Darwinian biology in the nineteenth century?

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Lecture 9: Race, Gender, and Evolution

Before beginning this lecture you may want to . . .

Read Charles Darwin's *The Descent of Man and Selection in Relation to Sex*.

Introduction:

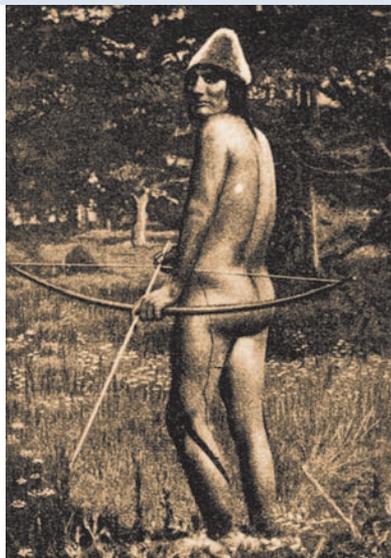
Evolutionary biology—and in particular, Darwin's theory—had much to say on nineteenth-century questions of race and femininity. Was there only one human species with many varieties or did the different races represent different species? How did women's biology shape women's social role? In this lecture, we will look at some of the ways in which evolution was used to resolve such issues and examine whether there was any simple, clear-cut relationship between evolutionary biology and nineteenth-century racism and sexism.

Consider this . . .

1. Did evolutionary theory have any “natural” link with racism or anti-racism?
2. Were convictions of woman's inferiority unique to evolutionary thinkers?
3. Did evolutionary biology support or oppose general cultural views on race and gender?

I. Darwin on Savages

- A. Darwin came from a family that had always been opposed to slavery.
- B. Darwin himself had strong humanitarian ideas.
- C. But like most Victorians, he was also convinced of the superiority of European culture.
- D. He was ambivalent on “savages.”
 1. The three “civilized” Fuegians, who were being taken back to Tierra del Fuego on the *Beagle*, impressed him greatly: he thought they must belong to the same species as all humans.
 2. Darwin was astonished, however, on seeing their uncivilized fellows, who seemed to be close to animals.



Ona Hunter

Illustration of a hunter of the Ona tribe native to Tierra del Fuego, ca. 1870.

II. Darwin on Males and Females

- A. The importance of sexual selection in evolution.
1. Sexual selection was not due to the struggle for existence but the outcome of the struggle between males for the possession of females.
 2. Strongest males left the most progeny.
 3. This led to the selection of traits unaffected by natural selection.
 - a. Examples: brilliance of feathers in male birds, length of horns in male antelopes, skin color, hair, proportions of body—characteristics that were apparently irrelevant to or downright disadvantageous in the struggle for existence.
 - b. Similar features were responsible for most racial and sexual differences in man.
 - c. These features did not confer any competitive advantage in the struggle for existence.
 - d. They persisted because they could give a reproductive advantage over other individuals.

B. Female choice of male was also an important factor in sexual selection: whatever females preferred would be selected.

C. But among humans, males had the active role in sexual selection; female choice was passive in humans.

The human male shaped the evolution of the human female, rather like the breeder selecting desirable traits in animals.

D. Males were more intelligent than females—because higher intelligence conferred advantages over the unintelligent in natural as well as sexual selection.

1. Social progress increased these intellectual differences.
2. In advanced races, woman was biologically more similar to the child than to men.



Lennie Savage, the “ideal Victorian woman”, as she appeared in *Puritan: A Journal for Gentlewomen*, ca. 1879.

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- E. Darwin's arguments about sexual selection in the animal world were often drawn from his observations of humans; his concepts of masculinity and femininity had been shaped by his understanding of the sexual code of the Victorian middle classes.
- F. Darwin's theory of sexual selection was not immediately embraced by biologists.

III. Victorian Anthropology and the Importance of Race

- A. There was a long-running debate between polygenists (who believed that the races had been created separately—each belonged to a separate species) and monogenists (who believed that all human races were varieties of one species).
- B. Eighteenth-century descriptive/historical studies of different races and cultures:
 1. There had been no interest in determining the “laws” of society.
 2. Eighteenth-century ethnologists tended to be opposed to slavery and were often allied with religious missionaries.
 3. They were generally monogenist—although ethnocentric (European culture was always the highest).
- C. The emergence of physical anthropology in the late nineteenth century.
 1. There was a new interest in identifying the “laws” of society.
 2. There was also great interest in the comparative anatomy of race.
 3. The orientation of the new anthropologists was generally polygenist.
 4. They were fiercely opposed to missionaries.
 5. There was no interest in a developmental view of man or society.

IV. Pre-Darwinian British Views of Race Often Classified Societies as Lower and Higher

In these ethnocentric views, Western European society was considered to be the highest and all other groups were measured by that criterion.

But these were fairly static views, such as the legal theorist Sir Henry Maine's classification of societies into those that were dynamic and progressive and those that were stagnant, like all Asian societies. European dominion over the latter kind of culture was a good thing, for Maine.

- A. But Maine did not show any interest in studying existing savages and had no problem about relying on the Bible for the history of the Semitic races.
- B. In his later years, he tried to give an evolutionary tone to his theories, and this was not very difficult, for the publication of *The Origin of Species* had led to a wave of anthropological evolutionism.

V. Evolution and the Study of Race in Britain after *The Origin of Species*

- A. Many tried to transcend monogenism and polygenism—Alfred Russel Wallace tried to combine the two.

-
1. All human races, Wallace claimed, had evolved from one original species—but this had happened so long ago (even before the evolution of speech) that for all practical purposes, the different races were indeed different species.
 2. The “Germanic” races had evolved most highly and such superior races would eventually drive lower, non-European races into extinction. The world would then become one harmonious society where everyone would live in perfect freedom and have total sympathy for one another.
- B. The developmental view of human societies meant that contemporary savages come to be seen as living fossils, as clues to the remote past of humanity.
- C. Higher and lower races.
1. The amateur biologist, geologist, and anthropologist John Lubbock saw present-day savages as evolutionary relics of the Stone Age—the study of savages would reveal the distant roots of the human species. Later, Lubbock emphasized that races were not necessarily stuck at their current position—all civilized races had evolved from stages that were barbaric.
 2. The lawyer and anthropological writer John F. McLellan took an evolutionary approach to social customs like marriage and adopted a comparative approach drawing on similar phenomena from all over the world. All customs developed from lower to higher stages of development. Among his arguments were some that could not have been very palatable to Victorian ears: The standard monogamous marriage, he claimed, had evolved from polyandry.
- D. The “improvement” of savages: the “White Man’s Burden” was justified by Lamarckian concepts of cultural evolution and inheritance of acquired characters.

VI. Race in America

A. Before *On the Origin of Species*.

1. Blacks were supposed to be a separate species and the “lowest grade of humanity.”
 - a. The view from Harvard: Professor Louis Agassiz, the eminent naturalist, polygenist, and upholder of creationism, thought that Blacks had been created separately from Whites.
 - b. In the 1840s, Dr. Samuel George Morton, a physician in Philadelphia, measured the skulls of all races and concluded that Blacks had the smallest skulls, hence the smallest brains, and hence belonged, to use his own words, to the “lowest grade of humanity.”
 - c. Around the same time, another physician, Josiah Clark Nott, called himself an expert on “niggerology” and wrote much on the biological inferiority of Blacks.

2. Slavery was considered to be the most appropriate treatment for Blacks.
 - a. Blacks, it was argued, could not benefit from freedom.
 - b. They became vicious if educated—illiterate Blacks were more honest and useful.
 - c. “Science” proved the futility of emancipation of slaves.
- B. Racial questions were given a Darwinian gloss after the publication of *On the Origin of Species*.
 1. Slavery had protected Blacks from the struggle for existence—emancipated slaves were bound to fail in the struggle with Whites and die out fairly soon.
 2. But during that process of racial decline, Blacks would become ever more vicious and dangerous.
 3. Any kind of philanthropy or social inclusion would only postpone extinction and make a bad situation worse.
- C. But freed Black slaves were not the only people endangering America. Undesirable races were pouring into the country from Europe.
 1. The Irish threat—lowest Caucasian variety.
 2. Italian, Spanish, and Portuguese immigrants should be restricted—they were little better than cattle.
 3. The “Aryan varieties” from Germany and Scandinavia should be welcomed.

VII. Nature vs. Nurture

- A. How much of human difference is due to biology and how much to childhood experiences, education, and cultural conditioning?
- B. Darwinism cannot really help us to decide such issues.
- C. There is no obvious, essential, or necessary connection between Darwinism and racial or sexual prejudice.

Frederick Douglass (1818-1895)

Born a slave in Maryland, Douglass was first taken from his mother as an infant and then abandoned by his grandmother at the age of six. He escaped slavery in 1838 and traveled to Massachusetts where he began his career as an abolitionist and staunch supporter of women’s rights. As publisher of his own newspaper, *The North Star*, he wrote tirelessly about the evils of slavery, injustice, and equal opportunity for African Americans and women.

During the Civil War he was a trusted advisor to President Lincoln and later was Minister-General to the Republic of Haiti.

Douglass’s life serves to show the mistaken notion that persons of African descent were the “lowest form of humanity.”



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FOR GREATER UNDERSTANDING



Consider

1. Was it Darwinism that gave birth to racism?
2. How Darwinian were the “evolutionary” ideas in Victorian anthropology?
3. Was evolutionary theory the exclusive cause of racism in America?
4. How much of Darwin’s theory of sexual selection was determined by the conventional beliefs of a typical Victorian gentleman?

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2. <http://www.wku.edu/~smithch/wallace/S093.htm> - Text of Alfred Russel Wallace’s “The Origin of Human Races and the Antiquity of Man Deduced from the Theory of ‘Natural Selection.’”

Lecture 10: Evolution, Language, and Literature

Before beginning this lecture you may want to . . .

Read Stephen G. Alter's *Darwinism and the Linguistic Image: Language, Race, and Natural Theology in the Nineteenth Century*.

Introduction:

The impact of Darwinism was not restricted to the worlds of science or religion. Evolution was a “master-concept” of the nineteenth century and Darwin’s forceful arguments had an impact on—and drew together—areas far beyond natural history or biology. In this lecture, I shall examine the literary and linguistic dimensions of Darwinism. We’ll begin with the literary shape and structure of *The Origin of Species* and then see how Darwinism and linguistic theory drew upon one another’s evidence and style of reasoning. Finally, we shall take a brief look at the influence of evolutionary thought on major writers of the nineteenth century.

Consider this . . .

1. How was Darwin’s language and literary style related to the broader impact of his works?
2. Why did Darwin find it helpful to use linguistic metaphors and analogies in his work?
3. In what ways did Victorian writers use the idea of evolution?

I. Charles Darwin as Reader and Writer

A. Darwin’s reading tastes.

1. In his old age, Darwin lost all pleasure in reading imaginative literature. All he enjoyed were pulp novels (as long as the heroine was pretty and there was a happy ending!).
2. In his younger days, however, Darwin had been an avid reader of “high” literature.
 - a. He had been fond of reading Shakespeare.
 - b. While on the *Beagle*, he was constantly reading John Milton’s poems alongside Lyell’s *Geology*.

It was, of course, Darwin who would later undermine the creationist and anthropocentric worldview of Milton’s *Paradise Lost*, but Darwin’s language would retain some of the joy in the variety and profusion of life in Milton’s work.

B. Darwin as writer.

1. Darwin’s major works, and especially *On the Origin of Species*, were not written for an exclusively scientific audience.

- a. He wrote for the educated layman.
 - b. This was usual practice at this time in Britain for all works in natural history—there was no clearly defined professional class of scientists or biologists as yet.
2. Darwin wrote a clear, but literary-flavored, English.
 3. He addressed the reader directly.
 - a. Darwin’s books were not dry research reports or simple statements of his observations.
 - b. They tried to persuade the reader with small pieces of evidence, offered in profusion, but never in simple lists: the facts were always clearly tied to arguments.
 4. He did not underplay or quickly explain away difficulties with his theories.
 5. Darwin’s *Origin of Species* did not present a cut-and-dried theory or a “discovery”—it tried to involve the reader in Darwin’s own quest, and the prose was designed to reinforce that sense of participation.
- C. Darwin’s anthropomorphism and other ambiguities.
1. Darwin often attributed human qualities to animals (e.g., maternal tenderness) instead of seeing animal behavior as instinctive.
 2. He struggled with the implications of the phrase “natural selection.”
 - a. Many of Darwin’s readers thought of natural selection as an active, conscious, and goal-directed force.

This was far from Darwin’s intention but was due in part to his language and style—e.g., he wrote about natural selection picking out favorable variations with infinite skill.
 - b. Darwin was forced to acknowledge later that in the literal sense, “natural selection” was a misnomer but the phrase was necessary as a shorthand expression.

“We shall best understand the probable course of natural selection by taking the case of a country undergoing some physical change, for instance, of climate.”

**~Charles Darwin
The Origin of Species
Chapter IV, “Natural Selection”**

II. Darwin’s Interest in the Scientific Study of Language, a Booming Field in the Nineteenth Century

- A. There was a new sense of languages as growing and developing entities.
 1. The new field of comparative philology developed in early-nineteenth-century Germany: it was the scientific study of the kinship of

- languages by minute study of structure and grammatical features.
2. The “family tree of languages” was a common metaphor in philology: all existing languages were supposed to have descended from one remote (and now lost) ancestral tongue.
 3. Some philologists even thought of the descent of languages in terms of competition.
 4. Charles Lyell used linguistic imagery in relation to geology.
 5. Cambridge mathematician and philosopher of science William Whewell combined geology, palaeontology, ethnology, archaeology, and comparative philology in one category because all of them sought to determine the nature of past conditions from the evidence of the present.
- B. Darwin’s cousin Hensleigh Wedgwood was a philological scholar and drew Darwin’s attention to German research on the “laws” of descent of languages.
1. Darwin was powerfully attracted to linguistic theory because it operated according to fundamental laws and did not require a solid and unbroken chain of material evidence—for a naturalist confronted by an incomplete fossil record, it was an attractive model.
 2. Darwin used comparative grammar to illustrate his idea of evolution in the *Origin*—species changed and evolved as languages did.
- C. Philologists responded quite positively to Darwin’s *Origin of Species*.
1. The German philologist August Schleicher hailed the convergence of biology and linguistics, each confirming the other.
 2. Schleicher pointed out, however, that the family tree of languages was based on far more concrete evidence than Darwin’s family tree of species.
 3. Philology, it was claimed, was the more precise science, and its confirmation of Darwin’s approach was therefore all the more valuable.
- D. What was the significance of the mutual reinforcement of evolutionary theory and comparative philology?
1. It was a typical instance of how fields of scientific and humanistic inquiry could fertilize one another in the Victorian period.
 2. But not every philologist was happy with the evolutionary link. Nineteenth-century lin-

**“. . . no philologist now
supposes that any
language has been
deliberately invented;
it has been slowly and
unconsciously devel-
oped by many steps.”**

**~Charles Darwin
The Descent of Man
Chapter III, “Mental Powers”**

guist Friedrich Max Müller opposed Darwin's implied blurring of boundaries in *Origin* between humans and lower species. Müller insisted that only humans could use true language.

"No process of natural selection," said Müller, "will ever distill significant words out of the notes of birds or the cries of beasts."

3. Undeterred, Darwin went on to argue in *The Descent of Man* that human speech and language had developed through natural selection and sexual selection.

III. The Literary Impact of Darwin's Theory

A. Darwin influenced some of the most important Victorian literary figures, although the evidence we have to go on is not always very explicit.

1. Charles Dickens's *Great Expectations*.

- a. Began to be serialized in 1860.
- b. There is no definite proof that Dickens was responding to Darwin (who, however, was an avid reader of Dickens).
- c. But there is a strong suggestion of Darwinian influence in the novel's preoccupations:
 - i. How useful was the investigation of origins in developing a social and moral identity?
 - ii. Did the human species obey the same laws of development as the rest of the animal world?

2. George Eliot (real name: Mary Anne Evans, 1819-1880).

- a. Her novel *Middlemarch*, published in 1871, was described by Henry James as "too often an echo of Messrs. Darwin and Huxley."
- b. *Middlemarch* was pervaded by Darwinian metaphors of webs, trees, and labyrinths; the plot moved slowly, by a Darwinian accumulation of minute changes.
- c. Darwin's conceptual influence on Eliot was quite significant. Typical example: talking of women's talents, Eliot says in *Middlemarch* that "the limits of variation are really much wider than any one would imagine from the sameness of women's coiffure."
- d. In the 1876 novel *Daniel Deronda*, Eliot was preoccupied with questions of descent, development, race, and sexual selection, all highlighted, of course, by Darwin's *Descent of Man*.
 - i. "Our daughters," Eliot wrote in *Daniel Deronda*, "must be wives. And to be wives must be what men will choose: Men's task is woman's test."
 - ii. The novel turned on the discovery of the hero's true racial identity.

3. Thomas Hardy (1840-1928).

- a. Novelist Hardy always acknowledged the influence of Darwin on his outlook.

- b. Hardy was deeply pessimistic and considered humans to have evolved too greatly to fit comfortably into their environment. “This planet,” he remarked, “does not supply the materials for happiness to higher existences.”

Hardy emphasized Darwin’s point about imperfect adaptation—no matter how favorable to life, there is never a perfect fit between individual and environment.

- c. Hardy celebrated individuality in his characters, but always put them against a backdrop of impersonal and possibly malign forces.

B. Darwin’s literary influence in the late nineteenth century: H.G. Wells (1866-1946).

1. Wells had some training in zoology.

- a. He was taught in college by Thomas Henry Huxley.
- b. Familiar with Darwinism and with late nineteenth-century speculations that evolution did not necessarily move forward: species could also degenerate into simpler, less complex forms if the environment became less challenging.

2. Evolutionary themes in Wells’s science fiction.

- a. *The Time Machine* (1895): The story portrayed the distant future, when humans have degenerated into two branches: an effete and useless upper crust and a violent, dangerous working class. It was a satire on the English class system as well as a warning that progress was not inevitable.
- b. *The War of the Worlds* (1898): In this story, Earth is taken over by hostile Martians, who have evolved far beyond humans biologically as well as technologically.



Herbert George Wells
(1866-1946)

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Consider

1. How important was the question of language to Darwin?
2. How direct was the influence of Darwin's evolutionary theory on nineteenth-century literature?
3. What does the philology-evolution connection tell us about the nature of nineteenth-century science?

Suggested Reading

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Lecture 11: Evolution and Religion

Before beginning this lecture you may want . . .

Read Ronald L. Numbers and John Stenhouse's *Disseminating Darwinism: The Role of Place, Race, Religion and Gender*.

Introduction:

We have already seen (in Lecture 7) that although there were many religious debates over the significance of evolution in Darwin's own time, they did not amount to a total, open war between science and religion. Over the twentieth century, however, and especially in America, the situation has changed. In this lecture, I shall survey the growth of modern creationism in the United States and outline the reactions of the major non-Christian faiths to evolutionary theory.

Consider this . . .

1. Is evolutionary doctrine fundamentally incompatible with a broadly Christian view of the world or only with Biblical literalism?
2. Why has the battle over evolution been fought so often in the courtroom in America?
3. How have the world's major religions tried to resolve their differences with evolutionary theory?

I. Twentieth-Century Battles Between Creationists and Evolutionists

A. Progressive America and the teaching of science in secondary schools.

1. The four decades around 1900 constituted a period of major expansion in American higher education.
2. There was great interest in teaching science and biology at high schools.
3. Evolutionary theory was given great prominence in school textbooks.

B. Many Progressives were keen to protect the young from noxious influences.

1. The theory of evolution was regarded as dangerous to the teenage mind.
2. Religious conservatives and Progressive reformers converged against the teaching of evolution.
3. Progressives had great faith in legislative interventions on cultural and moral issues.

Thirty-seven bills were introduced in twenty state legislatures between 1921 and 1929 to prohibit the teaching of evolution in public schools.

4. A bill forbidding the teaching of evolutionary theory in state-funded schools was passed in Tennessee in 1925 with much support from fundamentalists and opposition from religious modernists.
 - a. The American Civil Liberties Union (ACLU) wanted to test the case in court.
 - b. A young science teacher named John Scopes volunteered to teach evolution and be prosecuted.

C. William Jennings Bryan and the Scopes trial.

1. Bryan was a great Progressive reformer and no fundamentalist—but he cooperated with religious leaders to prevent the teaching of evolution. He considered it a “dark and dangerous doctrine” allied to eugenics.
2. Bryan went to Tennessee to represent the anti-evolution side in the Scopes trial.
3. The celebrated lawyer Clarence Darrow volunteered his services for the defense.
4. Hundreds of reporters followed them to Dayton for the trial and millions all over America and Europe followed the arguments in the trial, which was portrayed as an epic battle between science and religion.
5. Few anti-evolution witnesses could be found among scientists and, therefore, the prosecution was compelled to take a legalistic approach.
6. The defense argued that the anti-evolution law interfered with individual liberty and Darrow called Bryan himself to testify as a Biblical expert.
 - a. Clever questioning revealed the limitations of the Bible as an authority on natural history (and of Bryan’s limitations of knowledge of religion and science).
 - b. Scopes was convicted of breaking the law against teaching evolution; Bryan died a week later.



William Jennings Bryan
(1860-1925)

Three-time presidential candidate and avowed Progressive, William Jennings Bryan joined the prosecution team for the famous Scopes trial in 1925. He had been asked to join the prosecution based partly on the 1921 publication of a pamphlet he wrote entitled “The Menace of Evolution.” In that pamphlet he warned that, “Under the pretense of teaching science, instructors who draw their salaries from the public treasury are undermining the religious faith of students by substituting belief in Darwinism for belief in the Bible.”

Covering the trial as a reporter, H.L. Menken caustically observed that Bryan, “Once . . . had one leg in the White House and the nation trembled under his roars. Now he is a tinpot pope in the Coca-Cola belt and a brother to forlorn pastors who labor halfwits in galvanized iron tabernacles behind the railroad yard. . . . It is a tragedy, indeed, to begin life as a hero and to end it as a buffoon.”

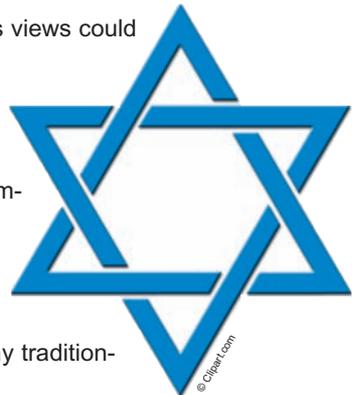
7. The case was taken to the Tennessee Supreme Court (where the verdict of the lower court was upheld) and then to the United States Supreme Court. Meanwhile, Tennessee's high court overturned Scopes's original conviction on a technicality.
 - a. The ACLU tried to continue the action but failed. The Scopes trial became an international symbol despite this downbeat ending.
 - b. The anti-evolution movement continued in the south—a new law was enacted in Arkansas in 1928 with overwhelming public support; by 1929, most Southern states had restricted the teaching of evolution in schools.

D. American creationism in the late twentieth century.

1. After the 1928 Arkansas law, legislative anti-evolution became a Southern phenomenon; there was little impetus in other parts of the nation.
 - a. New biology textbooks were published in the early 1960s; they discussed evolution prominently despite the legal barriers in some states.
 - b. Various legal skirmishes ensued in the South over the new textbooks and the anti-evolution side suffered major defeats: the 1928 Arkansas law was struck down by the United States Supreme Court in 1968.
2. What was far more important in the later years of the twentieth century was a new drive among religious activists to formulate a scientific defense of creationism, but that is a topic we shall be studying in the last lecture of this course.

II. Jewish Responses to Evolution in America

- A. Debates on Darwin were incorporated into discussions on the future of Judaism in America.
 1. There was not much interest in evolution in the 1860s—but interest rose rapidly after the publication of Darwin's *Descent of Man* (1871).
 - a. Darwin's arguments were condemned for doubting the uniqueness of the human mind and human moral sense.
 - b. A few Jewish writers felt that Darwin's views could be integrated with a belief in a divine intelligence.
 2. Darwin's theories were endorsed by the radical wing of Reform Judaism.
 - a. Evolution was seen by them to be compatible with the Reformist idea of progressive revelation.
 - b. By the 1890s, Reform Judaism was largely supportive of Darwinism.
 3. Some moderate Reform rabbis and many traditionalists criticized such arguments.



Darwinism, they argued, was a doctrine of ruthless struggle of “each against all”—therefore, it was repugnant to Jewish moral teachings.

4. Other traditionalists claimed that Darwinism was compatible with traditional Judaism.

Evolution from a primordial “speck” testified far more eloquently to the glory of God than the separate creation of each species.

- B. Evolution was also linked to other problems facing Jewish communities in America.

1. Assimilation and conversions to Christianity—Christians were seen as using evolutionary arguments to claim superiority of their religion.
2. Opposition to religion and the growth of agnosticism and materialism—these were supposed to follow from scientific endorsements of evolutionary theory.

III. Islamic Engagements with Darwinism: The Arab World

- A. Arabs encountered Darwinism at the time of general Westernization and Western-inspired reform in the 1870s.

1. Darwinism was one of a range of Western notions that invigorated an emerging Western-influenced Arab intellectual class.
2. Philosophical and social implications of Darwinism were more important to Arabs than the purely biological aspects.

- B. For secular-spirited Muslims, Darwinism was basically in tune with the fundamental tenets of Islam, though all secular Arabs rejected the use of Darwinism by Western thinkers to justify racial hierarchies or war.

- C. Arab traditionalists, on the other hand, saw the supposed materialism of Darwinism as repugnant to the religious mind.

1. Evolution in itself was not a problem, since the Koran had verses that could be interpreted as being about evolution.
2. Some religious thinkers tried to interpret Darwinian evolution as a form of development guided by God.



IV. Hindus and Evolution: Darwin in Nineteenth-Century British India

- A. India was part of the British empire until 1947.

1. There was a Western-influenced indigenous intellectual class but not many professional scientists amongst them.
2. There was deep interest in Western knowledge and technique. Many Hindus wished to reform Hinduism with Western concepts, but there was little interest in complete Westernization.

- B. The place of science in colonial India.

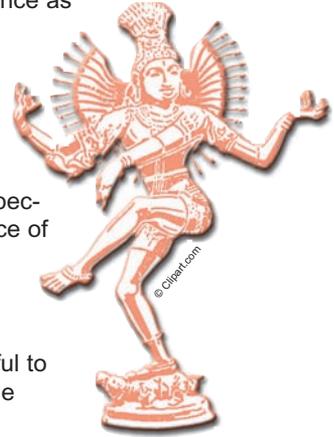
1. Christian missionaries disliked Hinduism far more than they disliked science. Some welcomed the teaching of modern science (including

evolution) in India—hoping that it would modernize the Hindu mind and eventually lead it to the true God.

2. Many liberal Hindus, too, welcomed science as an antidote to traditional Hindu customs, which they considered superstitious.

C. Hindu responses to evolution.

1. These were negligible in scientific terms.
2. Hindu thinkers made some interesting speculations on the moral and social relevance of evolution.
 - a. The evolution from animal to human occurred within the human soul.
 - b. The Malthusian struggle was distasteful to the Hindu mind—they claimed that true morality lay in self-sacrifice.
 - c. Even if the animal world was characterized by ruthless competition, the human world needed to be purged of such brutality.
3. Parallels were drawn between evolution and Hindu cosmology.
 - a. Ancient Hindu texts asserted, for instance, that the world had evolved into its current complex state from an undifferentiated substance.
 - b. Hindu cosmology also thought in terms of vast stretches of time and thought of the world as eternally changing.
 - c. There was one major difference: Darwinian evolution proceeded in one direction, but in Hindu lore, time was cyclic—the world was made, unmade, and remade over and over again.



FOR GREATER UNDERSTANDING



Consider

1. Has American creationism changed over the years? How?
2. Can a Christian be a Darwinian?
3. Is Islam more compatible with evolutionary theory than Christianity?

Suggested Reading

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Other Books of Interest

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Lecture 12: The “Modern Synthesis”: Evolution Meets Genetics

Before beginning this lecture you may want to . . .

Read Peter Bowler’s *The Mendelian Revolution: The Emergence of Hereditarian Concepts in Modern Science and Society*.

Introduction:

Today’s biology calls itself Darwinian, but Darwin himself would have found its genetic foundation quite unfamiliar. Darwin’s generation had to work without genetics. Although the monk Gregor Mendel’s experiments (on which genetics was to be based) had been performed and reported in the nineteenth century, they had no impact at the time. It was only in 1900 that Mendel’s work was rediscovered. We have now become accustomed to thinking in terms of genes or fixed units of inheritance that remain relatively unchanged across generations—but Darwin’s generation had no such concept. And that was an important deficiency—because Darwin claimed that natural selection depended on the inheritance of favorable variations over generations. Until there was a theory of heredity explaining why the variations would not change or disappear across the generations, natural selection sounded like a speculative concept—and was virtually dismissed as unworkable. When evolutionary biology was combined with genetics in the early decades of the twentieth century, Darwinism and natural selection came into their own. In this lecture, I shall discuss the nineteenth-century debates over inheritance briefly and then show how Mendelian genetics was rediscovered and combined with natural selection to produce the modern theory of evolution.

Consider this . . .

1. Why was the importance of Mendel’s work not immediately recognized?
2. Which aspects of Darwin’s evolutionary theory were most affected by the absence of a universally agreed mechanism of inheritance?
3. When Mendel’s work was rediscovered, was its relevance to Darwinism appreciated immediately?

I. Variations and Their Inheritance

- A. As we know from an earlier lecture, Darwin’s theory of evolution and his mechanism of natural selection relied on the occurrence of random variations and their regular inheritance.
- B. But there was no universally agreed mechanism of heredity that would transmit particular features undiminished over generations.
 1. The problem of blending was a severe one—isolated variations, it was feared, would blend away when the variant individual mated with a regular member of the species.

2. Darwin's answer to blending: populations have far too many variant members for blending to occur routinely. Nevertheless, this remained a problem with his theory.
 - a. Darwin came up with his own "provisional hypothesis" of inheritance by pangenesis.
 - b. This hypothesis was widely criticized and was never accepted by Darwin's contemporaries.

II. Inheritance of What?

For most nineteenth-century theories of heredity, traits acquired during life could be inherited (Lamarckian inheritance or "soft" heredity).

- A. Characters and abilities acquired by parents during life—whether physical characteristics, habits, or diseases—were passed on to their offspring.
- B. One major exception was the theory of German biologist August Weismann (1834-1914), who argued that acquired characters could never be inherited.
- C. Weismann was more Darwinian than Darwin in ruling out the inheritance of acquired characters and relied solely on natural selection as the mechanism of evolution—this was "hard" heredity.
 1. But Weismann's theory was not based on extensive experimental work—it was regarded by many as speculative and dogmatic.
 2. By ruling out Lamarckian inheritance, Weismann offended many partial supporters of Darwin's theory and in the short term, Weismann further reduced the already low popularity of natural selection.

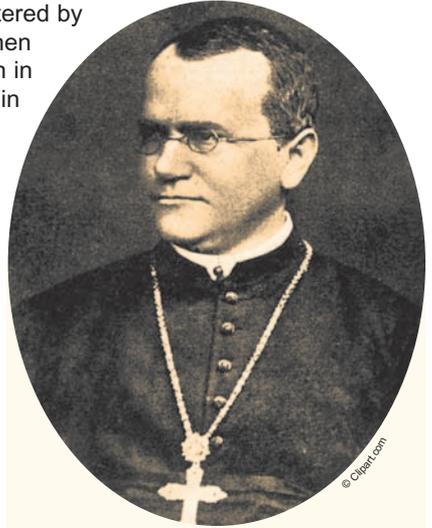
III. The Eclipse of Darwinism and the Rediscovery of Mendel

- A. Darwinism in the strict sense of evolution by natural selection became very unpopular in the last decades of the nineteenth century.
 1. Various theories of evolution emerged, based entirely on the inheritance of acquired characters or on the occurrence of major variations (evolution by saltations or big jumps, as opposed to the minute and gradual change proposed by Darwin).
 2. One saltational theorist, Dutch botanist Hugo de Vries (1848-1935), chanced upon a forgotten paper in a little-known German natural history journal by an Austrian monk, Gregor Mendel.
- B. Gregor Mendel (1822-1884), monk and amateur botanist, had hybridized pea plants, showing that cross-breeding different varieties of pea plants did not lead to the "blending" of their characters.



Hugo de Vries
(1848-1935)

1. Instead, traits were retained unaltered by subsequent generations; even when certain features seemed to vanish in one generation, they reappeared in later generations.
2. Although Mendel is hailed today as the founder of genetics, it is quite clear now that he was not really trying to establish a theory of non-blending inheritance or trying to identify the basis of heredity.
 - a. Rather, his intention may have been to show that new species could not be created by hybridization.
 - b. Publication of experiments in an obscure German journal did not help.



Gregor Mendel
(1822-1884)

IV. The Mendelians and the Biometricians

- A. When De Vries “rediscovered” his paper, Mendel’s work was seen as having anti-Darwinian significance.
 1. De Vries himself and the British biologist William Bateson (1861-1926) used Mendel’s experiments to support their theory that evolution occurred in saltations brought about by mutations of the hereditary material.
 2. Bateson was the leader of a group of British biologists who have been called the Mendelians.
 3. Their greatest opponents were the so-called Biometricians, who still subscribed to blending inheritance and the classic Darwinian natural selection of small adaptive variations.
- B. So, there was no immediate reorientation among evolutionists after the rediscovery of Mendel’s experiments: the Mendelians were not Darwinians and the Darwinians did not immediately become Mendelians.

V. The Birth of Experimental Genetics in America

- A. Thomas Hunt Morgan’s research group at Columbia University.
- B. Research on fruit flies and the refutation of inheritance of acquired characteristics.
- C. Genes did not just produce one big feature of some kind—the Morgan group showed that genes could also produce a range of very small variations. Therefore, inheritance by genes could be compatible with a gradualist mechanism of evolution such as Darwin’s natural selection.

VI. The People Who Brought Darwin and Mendel Together Were Not Experimental Biologists But Statisticians Working on the Genetic Character of Large Populations

- A. The first great work combining the two approaches was *The Genetical Theory of Natural Selection* by the British biologist Ronald A Fisher (1890-1962), published in 1930.
1. Fisher conceived of populations as complex “gene pools.”
 2. He showed by statistical analysis that the frequencies of individual genes within a population could be altered by natural selection.
 3. So, significant evolutionary change could occur gradually over long periods of time, exactly as Darwin had proposed.
 4. Natural selection would work best in large populations broken up into partly isolated local groups.
Inbreeding and variation would occur frequently and spread through the whole species.
- B. Genetics and natural selection now began to come together in the so-called “Modern Synthesis,” leading to the evolutionary biology we know today.
1. Non-Darwinian evolutionary theories such as Lamarckism or De Vries’s mutation theory went out of vogue.
 2. But not every biologist in the world accepted the synthetic theory immediately.
 - a. In Germany and the Soviet Union during the 1920s and ’30s, for instance, many biologists insisted on seeing genetic inheritance as only one kind of inheritance.
 - b. Some thought that the Mendelian particles only transmitted trivial characteristics. Significant evolutionary change could occur only by other means.
 3. As far as America and Britain were concerned, however, the synthetic theory faced little, if any, scientific opposition.
 - a. By 1940, the synthesis was complete and evolutionary biology became a distinct scientific field incorporating perspectives from different scientific disciplines.
 - b. Disagreements over details remain frequent.

FOR GREATER UNDERSTANDING



Consider

1. Why was Darwin's mechanism of natural selection so unpopular as a mechanism of evolution?
2. Was the synthesis of genetics and natural selection so natural and so inevitable that it could have happened in the nineteenth century, had Darwin known of Mendel's experiments?
3. Why did it take so long for biologists to appreciate the relevance of Mendel's experiments to Darwinism?

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Weismann, August. "The All-Sufficiency of Natural Selection," *Contemporary Review*, 64 (1893): 309-338, 596-610.

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Lecture 13: Eugenics: A Helping Hand for Evolution

Before beginning this lecture you may want to . . .

Read Daniel Kevles's *In the Name of Eugenics: Genetics and the Uses of Human Heredity*.

Introduction:

From the final decades of the nineteenth century, there was much concern in Europe and America that in compassionate, civilized human society, biologically inferior individuals were being prevented from perishing. The natural course of evolution—the survival only of the fittest—was thus being hampered. The bad situation, it was claimed, was being made worse by the better and the better-off having fewer and fewer children. The human species, in short, was not evolving any more. Darwin himself expressed such concerns in *The Descent of Man* and his cousin Francis Galton proposed the concept of “eugenics,” a practise that involved discouraging the inferior specimens of humanity from reproducing (negative eugenics) and encouraging the superior specimens to breed more prolifically (positive eugenics). The ultimate example of a eugenic society, of course, was Hitler's Germany, but we shall see in this lecture that the idea of improving human society and the human species by controlling reproduction attracted the widest possible range of thinkers and scientists from every part of the political spectrum. The interest died out only after the Second World War because of revelations about Nazi atrocities.

Consider this . . .

1. How was eugenics complementary to evolution?
2. Was eugenics a right-wing preoccupation?
3. Did the interest in eugenics die out because of scientific reasons?

I. Evolution and Human Societies

- A. Humans were subject to natural selection, but many biologists thought that in civilized societies, the improvements in medical care and charity and welfare schemes prevented the extinction of unfavorable varieties.
 1. The least fit were breeding more and the most fit were breeding less.
 2. Darwin himself agreed that evolution was being interfered with in civilized societies but could not advocate the cessation of aid to the weak.
- B. Darwin's cousin Francis Galton, a celebrated Victorian scientist, thought that it was possible to improve the human species by adopting good breeding practices.
 1. Talent and character, argued Galton, were hereditary—social factors may help a little, but generally, talent ran in families.

The basis of inheritance was still unclear, although Galton had his own theory.

2. Galton proposed his concept of eugenics in 1883: he defined it as “the science which deals with all the influences that improve the inborn qualities of a race.”

a. The aim was not to have a uniform society but “to represent each class ... by its best specimens . . .”

b. The marriage of people of inferior health or unacceptable moral qualities should be banned.

c. But it was far more important to encourage the marriage of intellectually and culturally worthy people.

3. The point of Galton’s eugenics was not to redesign society but to give a helping hand to evolution. As he put it himself, “What nature does blindly, slowly, and ruthlessly, man may do providently, quickly, and kindly.”

C. Support for eugenics rose after the Boer (South African) War of 1899 to 1902.

1. During recruitment for the war, it was found that the physical qualities of the average Englishman were dangerously poor.

2. There was much social and political concern over “degeneration” of the race.

3. Many wondered whether such deterioration could be prevented by regulating marriage and reproduction.

D. World War I was seen as a major national and racial disaster—the best youths were killed.

II. The Popularity of Eugenics in the Inter-War Decades

A. During these years, genetics matured as a scientific field.

B. Political conservatives were very keen on eugenics, but leftists (e.g., socialist biologists and geneticists) were also interested.

1. Everybody agreed that the best environment could not make up for the effects of bad genes.

2. Socially responsible eugenics could improve human species in a few decades, some leftist biologists claimed.

3. Some others advocated the artificial insemination of women with the sperm of men of intellectual and cultural eminence.

4. In 1939, twenty-three prominent geneticists issued the so-called “Geneticists’ Manifesto” demanding measures to improve the genetic quality of the human species.

5. In the United States, eugenic anxieties about the racial quality of immigrants from southern and eastern Europe led to the 1924 Immigration Restriction Act.

Quotas were instituted to reduce immigration from Russia, Poland, Italy, and the Balkans.

6. In Britain, the well-known writer and moderate socialist H.G. Wells called for the sterilization of “failures.”
7. In America during the Great Depression, the mentally “defective” were regularly sterilized.
 - a. By 1940, thirty American states had passed sterilization laws.
 - b. America was not alone: all the Scandinavian countries, Turkey, and Japan had all passed similar laws.

III. Eugenics in Germany Before Hitler

- A. There was a high level of interest in Darwinism from 1860.
 1. Darwin’s greatest champion was the zoologist Ernst Haeckel.
 2. In the early years, German leftists supported Darwinism because it seemed to support progressive change and could be used to oppose religious orthodoxy.
 3. But authoritarians supporting a strong state and national unity also tended to support Darwin.
- B. By the 1890s, German Darwinism was allied with hardline conservatives and was used to support racist, imperialist, and anti-social agendas.

The economic devastation and political turmoil after World War I stimulated a new interest in eugenics.

IV. Eugenics in Hitler’s Germany

- A. Nazi Germany had the harshest eugenic laws ever enacted.
- B. There was a massive program for the sterilization of the “unfit”—especially the mentally ill or the mentally subnormal.
- C. The marriage of Jews and Germans was prohibited—such unions were supposed to be harmful to “racial hygiene.”
- D. *Lebensborn* project: racially “pure” German women—whether married or not—were encouraged to bear the children of SS officers (ostensibly the best males available).

Hermann J. Muller (1890-1967)

American geneticist, Hermann Muller became interested in biology as a high school student in New York. He began his studies in genetics during his first year at Columbia University. As an active participant in the Thomas Hunt Morgan research group studying *Drosophila* fruit flies, Muller started on the path that was to lead to his life-long investigations into gene mutation.

Muller was largely responsible for the “Geneticists’ Manifesto” published in 1939, which stated that natural talent could not be assessed in a society such as the United States, which did not offer equal opportunities for advancement to its citizens; only under socialism could the fit be identified as such and then encouraged to multiply.

Muller was awarded the 1946 Nobel Prize in Physiology or Medicine for demonstrating the effect of radiation on chromosomes.

During the remainder of his life, Muller spoke out against the use of x-rays as a common medical practice due to the harmful effects he had witnessed in his studies of genetic mutations.

E. Much of this was supported by “Darwinian” rhetoric of selection and survival of the fittest.

But there was no straight line from the *Origin of Species* to the Holocaust.

F. In the 1930s, virtually everybody found something of what they needed in Darwinism and its eugenic version.

1. The larger social and political conditions determined who would get to enforce what in the name of Darwin.

2. Hitler’s political context enabled him to institute a eugenic program that was never seriously considered in Britain, where eugenic interest was quite high but the political situation totally different.



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V. The Collapse of Eugenics in the 1950s

A. Older champions of eugenics did not necessarily change their views after World War II.

B. But younger scientists (and the young in general), horrified by revelations about Nazi Germany, recoiled from anything related to eugenics.

C. Eugenics never went through a process of scientific testing and rejection—it was rejected because of political and moral reasons.

FOR GREATER UNDERSTANDING



Consider

1. What could be the attractions of eugenics for a leftist?
2. What were the practical differences between negative and positive eugenics?
3. Was eugenics affiliated with any particular kind of politics?

Suggested Reading

Kevles, Daniel. *In the Name of Eugenics: Genetics and the Uses of Human Heredity*. New York: Knopf, 1985.

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Lecture 14: At Century's End: Fresh Debates and Old Concerns

Before beginning this lecture you may want to . . .

Read Richard Morris's *The Evolutionists: The Struggle for Darwin's Soul*.

Introduction:

At the end of the twentieth century, Darwinism, at the purely conceptual level, was more secure than it had ever been. At all other levels, however, its travails were far from over. The immense expansion of the biological profession had given Darwinism its own constituency, but this constituency was far from uniform. Different scientists had different ideas about the nature and potential of evolutionary theory and their debates could be acrimonious. Simultaneously, there was a new resurgence of creationism in America and fresh, ever more sophisticated attempts to challenge the scientific status of evolutionary biology. As it enters the twenty-first century, evolutionary biology faces new challenges from old adversaries, some of whom come from within its own ranks.

Consider this . . .

1. What are the major controversies over evolutionary theory today?
2. How are they reminiscent of older debates?
3. Are the disputes between evolutionists narrowly technical or do they embrace broader issues?

I. Darwinism and Ultra-Darwinism

- A. The traditional focus of Darwinian selection was the individual organism.
- B. Some biologists argue today that it is in fact the gene that is the unit of selection.
 1. According to this new view, reproductive success—the transmission of one's genes to progeny—should be the sole criterion of evolutionary fitness.
 2. *The Selfish Gene*, a 1976 book by Richard Dawkins, was one of the prominent sources of this argument.
 3. Such arguments are often lumped together as “ultra-Darwinism.”
- C. Opposition to ultra-Darwinism.
 1. Harvard biologist and writer Stephen Jay Gould.
 - a. Gould emphasized that the genes might transmit characters, but the development of an organism was dependent upon complex physiological processes.
 - b. Many adult characteristics could be the results of that physiological process rather than directly caused by the genes.

- c. Every character need not serve a clear adaptive purpose—could be a simple by-product of developmental processes.
 - d. The origin of species may not be as gradualist as Darwin thought—evolution might occur by saltations.
2. Some scientists argue that the descent of one species from another cannot be established.
 - a. They say that only sister species can be identified, not ancestors.
 - b. They consider evolutionary trees of the traditional kind to be unscientific.

II. The Sociobiology Controversy of the 1970s: Return of Social Darwinism?

A. In 1975, Harvard biologist Edward O. Wilson published *Sociobiology: The New Synthesis*.

1. In this book, Wilson argued that all animal behavior (including human) was genetically determined, although the genetic influence was shaped by environmental factors.

“The genes hold culture on a leash,” wrote Wilson in 1978. “The leash is very long, but inevitably values will be constrained in accordance with their effects on the human gene pool.”

2. Wilson applied natural selection to the study of behavior.
 - a. Genes predisposing their individual carrier to adopt behavioral traits increasing chances of reproductive success would spread through natural selection.
 - b. He also proposed speculative genetic explanations for crime, murder, and ethnocentrism.

Edward O. Wilson (1929-)

World-renowned Harvard biologist and conservationist Edward O. Wilson has written 20 books, won two Pulitzer prizes, and discovered hundreds of new species. Considered to be one of the world’s greatest scientists, E.O. Wilson is often called “the father of biodiversity.”

B. Sociobiology was furiously opposed by left-wing commentators and scientists in America as a conservative attempt to revive dog-eat-dog capitalism, racism, social Darwinism, and eugenics.

1. Wilson responded that sociobiology was an analysis of behavioral selection, not a justification of social inequalities or of unacceptable conduct.
2. But some of his followers explained human aberrations in ways that seemed to justify them.

One 1987 study claimed, for instance, that human rape was a way in which low-status men could have some reproductive success and thus obtain an evolutionary advantage over other low-status men who did not rape.

III. The Revival of Creationism

A. In the late twentieth century, American creationists launched new demands for treating evolution merely as a theory and granting equal time to creationist explanations of the origin and development of life.

1. Again (see Lecture 11), Arkansas enacted a law providing for the teaching of creationism in 1981.

This law was dismissed as unconstitutional in 1982.

2. There was a Supreme Court battle in 1987 over a Louisiana equal time law—this led to the outlawing of “creation science” teaching in schools.

3. In 1999, Kansas State Board of Education decided to remove all references to evolution (including the Big Bang theory of the genesis of the universe) from the school curriculum.

This decision was later reversed.

B. Creationism moved beyond litigation and fundamentalism.

1. Demands for bans on the teaching of evolution are no longer common.

The new demand is for “creation science” to be given equal time in the school curriculum.

2. Sophisticated creationists no longer argue for a literal interpretation of the Bible.

The account of creation in the Book of Genesis is now acknowledged to be inconsistent.

3. There is a new stress on “intelligent design.”

a. William Paley’s argument from design has been resurrected with trimmings from molecular biology and other new scientific disciplines.

b. Living beings, it is argued by intelligent design theorists, are too cleverly and intricately designed to be built up piecemeal by a natural process.

c. Theories of intelligent design are sometimes combined with theories of theistic evolution that evolution proceeds according to laws instituted by God.

4. Creationists have made many gains by using skilled public orators to spread their message to the public.



5. The new creationism has been strengthened by continuing disagreements on the mechanisms of evolution among scientists.
6. The new creationist strategies have been successful in creating doubt about evolutionary biology among many educated Americans.
 - a. If science is a body of incontestable facts (as the public tends to believe), then evolution, say the creationists, is not real science—it is just a theory.
 - b. Scientists have also stepped up efforts to enhance the public understanding of science—“creation science,” they argue, is just a euphemism for fundamentalist religious dogma.

IV. The Future of Evolutionary Biology

- A. The scientific status of evolution is in no danger, but disagreements among evolutionists puzzle the public.

Public understanding of the nature of evolutionary biology is still deficient.

The public has yet to be educated that evolutionary laws refer to past events and processes, which can never be identified with the accuracy and precision one expects in physics or chemistry.

- B. Opposition to evolution is likely to remain strong among traditionalists, at least in the short and medium term.
- C. The spread of Darwinian ideas into the social sciences.

The recent upsurge in evolutionary psychology is likely to constitute a strong trend of the future.

In the present political climate, evolutionary psychology is unlikely to face the strong opposition that its direct ancestor sociobiology did in the turbulent 1970s.



FOR GREATER UNDERSTANDING



Consider

1. How many of the new debates in evolution are truly novel and how many are just updated versions of nineteenth-century concerns?
2. Do the disagreements over the mode of evolution among biologists make biology vulnerable to creationist attacks?
3. Does the new creationism amount to a genuine “creation science”?

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