

# ORIGINS

## AN INTERDISCIPLINARY APPROACH TO DARWIN AND HIS IDEAS

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This course explores the history and the science of Charles Darwin, one of the most significant thinkers ever. His ideas on evolution, and particularly on the non-teleological development of all living systems, were at the center of the fundamental scientific, philosophical, and theological debates of the nineteenth century. Today, Darwin's ideas are no less important. He receives over forty citations a year in contemporary scientific literature, and the broad ramifications of his ideas have never been more widely pondered or acutely felt, as books like *Darwin's Dangerous Idea*, *A Natural History of Love*, *The Evolution of Desire*, and *The Bell Curve* consistently hit the best-seller list.

Such an incomparably influential figure, rooted in the nineteenth century yet active in contemporary science and society, presents an extremely elusive object of investigation. He shapes the very viewpoint from which we examine him; he defies placement in a single historical context; and he transcends the boundaries of any single discipline's investigative apparatus. Given the difficulties posed by Darwin's dual residence in past and present, this course adopts an interdisciplinary approach. We will examine Darwin and his ideas from two distinct perspectives, one provided by an historian of nineteenth century science, the other by an evolutionary biologist.

This approach is somewhat controversial, particularly in light of the recent division between scientists and those who study what science is and how it works. More than a generation ago, historians of science lost interest in revealing what a past scientist had gotten "right" or "wrong", and embraced a new project of situating science in its social and cultural context. However, the increasingly defiant adoption of this program by some scholars has provoked acrimonious discord with scientists, who often perceive that radically "relativized" accounts of science harbor a thinly veiled animus against the prestige and power of scientific claims to truth.<sup>1</sup> Misunderstandings and caricatures have further polarized the debate.

A mutually enriching dialogue across the presently all-too-deep disciplinary divide is not impossible, as the authors of this proposal have discovered over more than six years of collaboration and conversation. We will bring this interdisciplinary dialogue to the seminar setting by offering students two different ways of "reading" Darwin. In fact, we will ask students to literally read Darwin's most important works twice. In the "historical" reading, we will focus on reconstructing Darwin's intellectual and cultural context in order to see Darwin's world and ideas as he himself saw them. In the "biological" reading, we will consult modern scientific literature for help in seeing Darwin's ideas as biologists now see them. While the two "readings" that this course presents will certainly reevaluate, critique, and even, at points, undermine each other, we are confident that the interdisciplinary exchange will gradually give rise to a more vigorous and robust "hybrid"—a synthesis of the more compelling aspects of each discipline's view of Darwin and his ideas. This synthesis will offer students not only a subtler and more sophisticated understanding of Darwin, but also, perhaps, a new conception of the disciplines of history and biology themselves. Ultimately, moving from dichotomy to discourse will let us better understand why Darwin saw what he did, and why we see what we do when we look closely at the natural world—or at the figures who have cast light upon it.

<sup>1</sup> See the recent exchanges between Geison and Perutz in *The New York Review of Books*, December 1995, and the still more brutal furor over Sokal's *Social Text* hoax, *Lingua Franca*, May/June and July/August 1996.



## READING DARWIN, PART I

### Weeks 2-6

#### WEEK 2: *A Sporting Man* (DGB)

Natural history/geology context in early 19th century. Deep time and its meaning. Early evolutionary ideas, Malthus and Erasmus Darwin. Linnean taxonomy and the tradition of "gentlemanly" collecting. Ordering nature in space and time.

##### Primary:

Darwin, C. (1993) *Autobiography*, edited by Nora Barlow. HBJ, New York.

##### Secondary:

Browne, J. (1995) *Charles Darwin: Voyaging*. Princeton University Press, Princeton: Part I, "Collector".

Gould, S.J. (1987) *Time's Arrow, Time's Cycle: Myth and Metaphor in the Discovery of Deep Time*. Harvard University Press, Cambridge: Chapter 3, "James Hutton's theory of the earth: machine without a history"; Chapter 4, "Charles Lyell, Historian of Time's Cycle".



#### WEEK 3: *Overseas* (DGB)

Empire and science. The enlightenment tradition of the natural history expedition. Biogeography and geological change before Darwin. The influence of Humboldt. The special place of islands in scientific and political discourse.

##### Primary:

Darwin, C. (1933) *Journal of Researches into the Geology and Natural History of the Various Countries Visited by H.M.S. Beagle*, edited by Nora Barlow. MacMillan, New York: selected excerpts.

Humboldt, A. and Bonpland, A. (1822) *Personal Narrative of Travels to the Equinoctial Regions of the New Continent*, trans. by H.M. Williams. Longman, London: "Stay at Teneriffe".

Lyell, C. (1856) *Principles of Geology*. Appleton, New York: Book I, Chapters iv and viii; Book III, Chapter xlii.

##### Secondary:

Browne, J. (1995) *Charles Darwin: Voyaging: Part II, "Traveller"*.

Secord, J. (1991) The discovery of a vocation: Darwin's early geology. *BJHS* 24: 133-57.

Sullway, F. (1982) Darwin's conversion: the beagle voyage and its aftermath. *Journal of the History of Biology* 15: 325-349.



## WEEK 6: *Difficulties with the Theory* (DGB)

The two big problems (of different sorts) that emerged in relation to *The Origin*. One, the philosophical/theological problem of how man fit into the theory; the other, the persistence of a certain line of criticism of the power of natural selection along "aesthetic" grounds (the "beauty" of birds, flowers, etc.). These two issues were at the heart of *The Descent*....

### Primary:

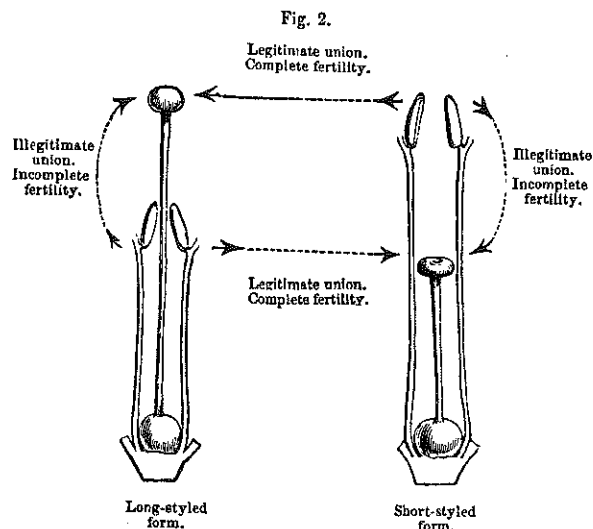
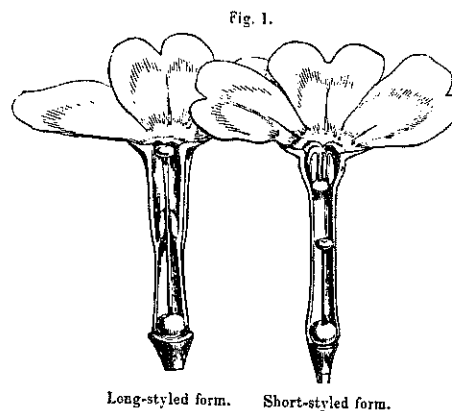
Darwin, C. (1881) *The Descent of Man and Selection in Relation to Sex*, intro. by J.T. Bonner and R.M. May. Princeton University Press, Princeton: Chapters IX-XIII and XVII-XXI.

Huxley, T.H. (1863) *Man's Place in Nature*. Murray, London: Chapter 2, "On the relation of man to the lower animals".

### Secondary:

Desmond, A. and J. Moore (1992) *Darwin: The Life of a Tormented Evolutionist*: Chapters 39-42.

Livingstone, D.N. (1987) *Darwin's Forgotten Defenders*. Scottish Academic Press, Edinburgh: selected excerpts.



## READING DARWIN, PART II

### Weeks 7-12

#### WEEK 7: *Inheritance, Variance, and Monsters* (AEH)

A close reading of Darwin's discussion of inheritance reveals why the second big theory in biology (DNA and the mechanism of inheritance) goes a long way toward corroborating the first (Evolution by Natural Selection) over its competitors (Lamarckism and Design). What was, and what is, the importance of domestic varieties and monstrosities to theories of evolution and species? What really is a species?

##### Primary:

Darwin, C., *The Origin of Species...*: Chapters I and II.

##### Secondary:

Campbell, N.A. (1992) *Biology*. Benjamin Cummings, Redwood City: "Three experiments that revealed the mechanism of inheritance".

Morey, D.F. (1994) The early evolution of the domestic dog. *American Scientist* 82: 336-347.

Simpson, G.G. (1952) How many species? *Evolution* 6: 342.

Mayr, E. (1981) Biological classification: Toward a synthesis of opposing methodologies. *Science* 214: 510-6.

#### WEEK 8: *Ecology to Evolution: Birth and Death of Species* (AEH)

Darwin's chapter on "the relation of organism to organism" augurs much of modern Ecology. How did he—and how can we—take the leap from an ecological scale to an evolutionary one? How is a species created, and once it exists, how will it be maintained? We'll see several methods for corroborating Darwin's theory of evolution, but which of these is not simultaneously corroboration for competing theories? A final question to consider in this chapter: does the theory of natural selection necessitate perpetual increases in complexity?

##### Primary:

Darwin, C., *The Origin of Species...*: Chapters III and IV.

##### Secondary:

Begon *et al.* (1994) *Ecology*. Blackwell Scientific Publications, Boston: "Interactions" pp. 193-195; "Intraspecific competition and the regulation of population size" pp. 203-209; "Competitive exclusion or coexistence?" pp. 247-253; "Coexistence through niche differentiation" pp. 269-278.

Campbell, N.A. (1992): "Evolution: The Core Theme of Biology" p. 11; "How Populations Evolve" pp. 438-453; "Genetic Mechanisms of Speciation" pp. 467-469.

Boag, P.T., and P.R. Grant (1981) Intense natural selection in a population of Darwin's finches in the Galapagos. *Science* 214: 82-85.

Grafen, A. (1994) Optimality and the comparative approach. In Krebs and Davies (eds.) *Behavioural Ecology*: Blackwell, New York.

WEEK 9: *To Defend and Extend the Theory:  
The Import of the Imperfect (AEH)*

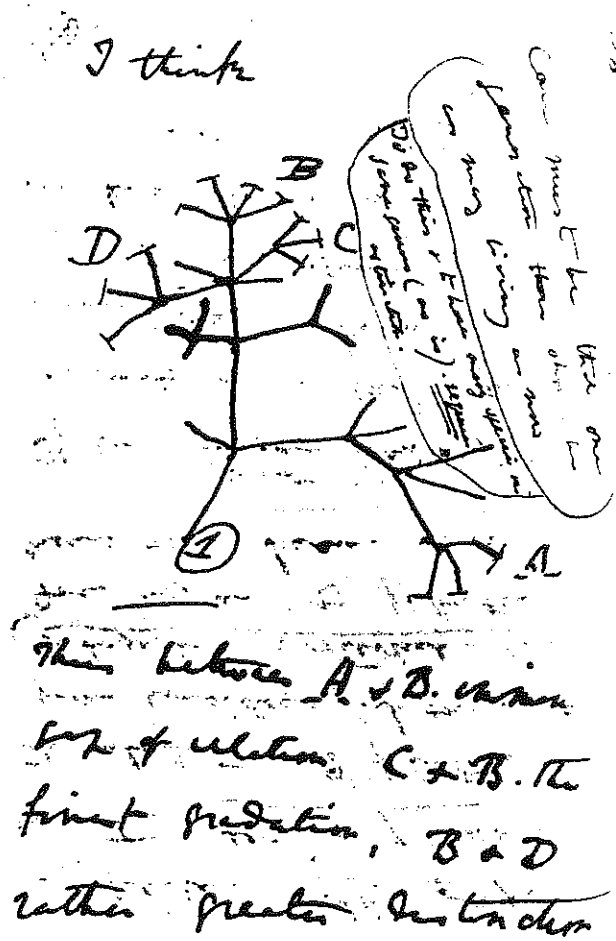
Darwin shows that features usually attributed to "use and disuse" (Lamarckism) can also be explained by his theory. He also describes patterns of variation that can't be explained by other theories, but are nicely explained by his own. While Darwin eloquently describes the evolution of such a perfect creation as the human eye, cases of imperfection, in which function and structure are out of kilter, are in fact more important to his theory. Game-theory and Darwin offer two answers to a difficult question for his theory: why would an animal ever be nice? With so many examples and explanations of cooperation and altruism, Darwin's nature might not be red in tooth and claw after all.

**Primary:**

Darwin, C., *Origin of Species...*: Chapters V-VIII

**Secondary:**

Diamond, J. (1985) Blood, genes, and malaria. *Natural History*.  
 Ewald, P. (1993) The Evolution of virulence. *Scientific American*.  
 Orgel, L.E. and F.H. Crick (1980) Selfish DNA: The ultimate parasite. *Nature* 284: 601-603.  
 Gould, S.J. (1985) *The Flamingo's Smile*. W.W. Norton, N.Y.: "The flamingo's smile" pp. 23-39.  
 Begon, M. et al. (1994): "Mutualism" pp. 434-440.  
 Maynard Smith, J. (1976) Evolution and the theory of games. *American Scientist* 64: 41-45.  
 Hamilton, W.D. (1963) The evolution of altruistic behavior. *American Naturalist*: 97.



**WEEK 10: *On Continents and Incontinence:*  
*Biogeography and the Pace of Evolution* (AEH)**

How long has the earth been around, and is this long enough for evolution by Darwinian selection to create all of life? Darwin's evolutionary gradualism: what does its repudiation mean for the rest of the theory? From paleontology we get an empirical view from above of the theory we developed from the bottom up. The distribution of species, in connection with the geological theory of continental drift, provides very strong support for Darwin's theory, but how exclusively do the two theories rely on each other? Islands remain significant in scientific and metaphoric senses alike.

**Primary:**

Darwin, C., *The Origin of Species...*: Chapters X-XIII.

**Secondary:**

Gould, S.J. (1985) *The Flamingo's Smile: "False Premise, Good Science"* pp. 126-138.

Campbell, N.A. (1992): "The Record of the Rocks" pp. 475-486.

Gingerich, P.D. (1994) The rapid evolution of whales. *Science*

Feduccia, A. (1995) The rapid evolution of birds. *Science*

MacArthur, R.H., and E.O. Wilson (1967) *Island Biogeography and the design of biological preserves*. In *The Theory of Island Biogeography*. Princeton University Press, Princeton, N.J.

**WEEK 11: *Wherefore Sex? or, The Game of Seduction:*  
*Sex for a Date, Dinner Included* (AEH)**

Things useless and beautiful—from the peacock's tail to the elk's bugle—are not explained by *The Origin of Species*. Enter Sexual Selection. But while Darwin enumerated sexual dimorphisms with his usual breadth, he did not resolve several fundamental questions: Why sex? Why two sexes? Why equal numbers of both sexes—or are there? Darwin's natural history of desirous insects can be staggering. Try to see past the strangeness of sex-changes, etc. to ask why Darwin and contemporary biology alike offer us this smut. What was, and what is, its import to the larger questions?

**Primary:**

Darwin, C., *The Descent of Man...*: Chapters VIII-XII.

**Secondary:**

Gould, J.L. and C.G. Gould (1989) *Sexual Selection*. Scientific American Library, New York: "Why Sex?" pp. 37-69.

Anderson, A. (1992) The evolution of sexes. *Science* 257: 324-6.

Andersson, M. (1986) Evolution of condition-dependent sex ornaments and mating preferences: sexual selection based on viability differences. *Evolution* 40: 804-816.

Harvey, P.H. and S.J. Arnold (1982) Female mate choice and runaway sexual selection. *Nature* 297: 533-4.

Hirsh, A.E. and J.L. Gould (in press) Sexual selection in nonsocial species.

## WEEK 12: *Our Descent?* (AEH)

The predictions of the theory of sexual selection are tested on the "higher" orders, including human beings. Women may promote sperm competition, men may lek in Florence, and graduate students may indeed optimize the amount of sperm they spend on each date, but how far should sociobiology go?

### Primary:

Darwin, C., *The Descent of Man...*, Chapters XIII-XXI

### Secondary:

Orians, G.H. (1969) On the evolution of mating systems in birds and mammals. *American Naturalist* 103: 589-603.

Borgia, G. (1986) Sexual selection in bowerbirds. *Science American* 254: 92-100.

Zuk, M. (1984) A charming resistance to parasites. *Natural History* 4: 28-34.

Alatalo, R.V., et al. (1991) Lekking in the black grouse—a test of male viability. *Nature* 352: 155-6.

Blaffer Hrdy (1990) Daughters or Sons. *Natural History*

Dunbar (1990) Monogomy on the Rocks. *Natural History*

Buss, D. (1994) The evolution of desire: strategies in human mating: selected excerpts.

Bellis, M.A. and R.R. Baker (1990) Do females promote sperm competition? Data for humans. *Animal Behaviour* 44: 301-12.

Krebs, J.R. and P.H. Harvey (1988) Lekking in Florence. *Nature* 335: 12-13.

## WEEK 13: *Debating Darwin:*

### *Negotiating the Implications of his Ideas* (DGB and AEH)

The application of the theory of sexual selection illustrated the extension of Darwinian ideas to humans. Return to some fundamental questions of the course. What does the history of a science look like? Is history only useful in explaining wrong answers? How does one corroborate Darwin's theory over its competitors? How ineluctable are the theory's implications? These queries turn out to be different facets of the same difficult issue. How profoundly, and how imperceptibly, do Darwinian ideas determine our answer?

### Readings:

Dennett, D. (1995) *Darwin's Dangerous Idea: Evolution and the Meanings of Life*: selected excerpts.

Maynard Smith, J. (1990) *Did Darwin Get it Right?*: selected excerpts.

