2.4: Evolutionary Theory (Part 2)

Charles Darwin

One of the most profound impacts Darwin had was to change how we ordered life, from a ladder (like the Great Chain of Being) to a tree.

Exercise 

Read Dennis O'Neil's Darwin and Natural Selection
Darwin's main Eureka! moment with evolutionary theory was that species (1) evolves into species A, B, C, and D, and everything in-between goes extinct:

“I think ... Case must be that one generation then should be as many living as now. To do this and to have many species in same genus (as is) requires extinction. Thus between A & B immense gap of relation. C & B the finest gradation, B & D rather greater distinction. Thus genera would be formed.—bearing relation.”

This is barely legible, confusing, and poorly written, so please don't use this as an example of anything you want to turn in for my class. Darwin's genius comes from translating this sketch into a 500 page bestseller by 1859, *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*, which thoroughly explained Natural Selection and supported it with voluminous evidence. We remember Charles Darwin's not for the Aha!

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*Figure (Page10) - The page from Darwin's 1837 private notebook ("Notebook B on the transmutation of species," 1837–1838)*
moment in 1837, but for the two decades of work he did afterwards to finish On the Origin of Species by 1859. The media tends to sensationalize scientific discovery (e.g. Isaac Newton gets hit by an apple and suddenly understands the mathematical equation that describes gravity), but for most scientists, it's more about hard work.

Figure \(\PageIndex{11}\) - On the Origin of Species 1859. Photo by Wellcome Collection (CC-BY-4.0)

Exercise \(\PageIndex{2}\)

Open Charles Darwin's 1859 ON THE ORIGIN OF SPECIES BY MEANS OF NATURAL SELECTION, OR THE PRESERVATION OF FAVOURED RACES IN THE STRUGGLE FOR LIFE.; Read the description of the chapters carefully (page V to page X), then skim the rest for a few minutes

* A more readable version of On the Origin of Species, and more of Darwin's writings,

Darwin had an unremarkable personal life. He wasn't a great student, he didn't have strong philosophical, political, or religious views.

* Good summary of Darwin's personal life

Darwin did not use evolution to promote atheism, or to maintain that no concept of God could ever be squared with the structure of nature. Rather, he argued that nature's factuality, as read within the magisterium of science, cannot resolve, or even specify, the existence or character of God, the ultimate meaning of life the proper foundations of morality, or any other question with the different magisterium of religion. [Gould 1999]

He wasn't oblivious to the social consequences of his findings, and was reluctant to publish.

Exercise \(\PageIndex{3}\)

Watch Creation: a pretty good Hollywood movie about Darwin's personal and ethical problems; the story of how the movie was censored in the US says a lot about how this is still an important political issue.
Understanding Natural Selection

A classic example of natural selection is the industrial melanism of the peppered moth. The same species of moth has black moths and white moths which can interbreed. When they land on white tree bark, the black moths tend to be eaten, and they become rare. Because of industrial pollution, the bark turned black, and now the white moths became rare. They cleaned up the pollution, the bark became lighter, the white moths survived more than the black moths. There are a few problems with the research but it is still a great example of how evolution works.

Note

- A video game that simulates Kettlewell's research
- Scientists may have found the gene that determines the color change of the moths.

Unfortunately, very few of us have grown up on a farm, so it's hard for us to understand where Darwin got the phrase
“natural selection” from. We don't ever use the phrase "unnatural selection" but that's what human selection is. After every harvest the farmer notices the tastiest, biggest, or most fruitful plants and keeps their seeds until next season to plant, and animal breeders mate their best stock together. The farmers and breeders are selecting desirable characteristics and increasing the chance that they will be passed on to the next generation. From this process of selection we get all the food we eat today and an amazing range of domesticated pets.

![Figure 13: "Big and Little Dog" By Ellen Levy Finch CC-BY-SA-3.0](http://teosinte.wisc.edu/index.html photos by Hugh Iltis (left) and John Doebley (right), © The Doebley Lab, Department of Genetics, University of Wisconsin-Madison)

We see in the archaeological record of Mesoamerica how teosinte was selected over thousands of years and became corn.

![Domestication of Corn](http://teosinte.wisc.edu/index.html)

Part of Darwin's genius was to recognize that the process farmers and animal breeders use to change a species, was
also a natural phenomenon, that competition in an environment of limited resources would select those individuals who were more fit for that environment, and he coined the phrase "natural selection".

When we use the word "fit", don't think of 24-Hour Fitness, think of square peg fits into square hole, round peg fits into round hole. Some individuals fit into an ecosystem or an environment better than others.

Note

- Research on the origins of corn
- Article on genes and dog size

**Sexual Selection**

Darwin didn't stop with natural selection, he continued to expand evolutionary theory throughout his lifetime. Darwin avoided a few difficult ideas in *The Origin of Species* and left them for his 1871 work:* THE DESCENT OF MAN, AND SELECTION IN RELATION TO SEX*. *This book tackled both a difficult scientific question – sexual selection, and a difficult social question – the origins of humans*. And within the book, Darwin left his most controversial chapters at the very end:* Part II Sexual selection of man (316-84) and General summary and conclusion (385-405).

Peacocks gave Darwin a headache. Natural selection says you are more likely to survive and reproduce if you are camouflaged, if you stay hidden and avoid predators. But, what gave Darwin, and the male chauvinist scientists of his time, the most trouble was the idea that the female was responsible for choosing the mate and driving evolution.

![Female peahen and chick](https://socialsci.libretexts.org/Bookshelves/Anthropology/Physical_Anthropology/Book%3A_Physical_Anthropology_(Schoenb...)

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*Figure [PageIndex{18}] - Female peahen and chick (CC BY-NC 4.0)*
Wallace was almost famous, but Darwin published before him.

Exercise \(\PageIndex{4}\)

Read Dennis O'Neil's Darwin and Natural Selection

Watch the 'Animated Life of A.R. Wallace'

Skim Wallace's early, 1855, article on evolutionary theory: *On the Law Which Has Regulated the Introduction of New Species*, skip to the end and read the comments by Bernard Michaux who argued that Wallace probably believed in something close to natural selection because his article contains all the important themes of Darwinism: "gradualism, utility, adaptation to different environments, allopatric speciation, imperfection of the fossil record" (Michaux 2000).

Imagination Question

1) Natural Selection

In the novel *Cryptonomicon*, Neal Stephenson presents the origin of his protagonist as a series of survivors:

Like every other creature on the face of the earth, [he] was, by birthright, a stupendous badass, albeit in the somewhat narrow technical sense that he could trace his ancestry back up a long line of slightly less highly evolved stupendous badasses to that first self-replicating gizmo—which, given the number and variety of its descendants, might justifiably be described as the most stupendous badass of all time. Everyone and everything that wasn't a stupendous badass was dead.

In the movie *Beast of the Southern Wild*, the teacher describes a mythical predator depicted in the Lascaux cave paintings as
a fierce, mean creature that walked the face of the earth back when we all lived in caves. They would gobble the cave-babies down right in front of their cave-parents. And the cavemen couldn't do nothing about it, because they were too poor, too stupid, too small.

Who up in here think the caveman was sitting around crying like a bunch of pussies? Y'all gotta think about that.

Any day now, the fabric of the universe is coming unraveled. Ice caps gonna melt, water's gonna rise, and everything south of the levee is going under. Y'all better learn how to survive now.

Do you think of yourself as a badass? Do you give your ancestors credit for making you what you are? Do the hardships your ancestors overcame, inspire you to overcome the problems of the future?

2) Money talks

A) If Wallace's family had more money, evolutionary theory might have gone down a different path. Wallace was more spiritual than Darwin. Jonathan Marks defines "Atheistic Darwinism" as the use of Darwin to support atheism (2011:57-9). Maybe the backlash against evolutionary theory would have been less with Wallace at the helm?

B) The fictional protagonist of Elizabeth Gilbert's novel The Signature of All Things comes up with a "theory of competitive alteration" almost identical to Darwin and Wallace, through the same methods of empirical research and world travel, but she never publishes it, mostly because of her gender. How does power influence science?

3) Great Chain of Being

Below is a tongue-and-cheek reference to the Great Chain of Being from Margaret Atwood's novel Life Before Man:

Auntie Muriel is unambiguous about most things. Her few moments of hesitation have to do with the members of her own family. She isn't sure where they fit into the Great Chain of Being. She's quite certain of her own place, however. First comes God. Then comes Auntie Muriel and the Queen, with Auntie Muriel having a slight edge. Then come about five members of the Timothy Eaton Memorial Church, which Auntie Muriel attends. After this there is a large gap. Then white, non-Jewish Canadians, Englishmen, and white, non-Jewish Americans, in that order. Then there's another large gap, followed by all other human beings on a descending scale, graded according to skin color and religion. Then cockroaches, clothes moths, silverfish and germs, which are about the only forms of animal life with which Auntie Muriel has ever had any contact. Then all sexual organs, except those of flowers. [Atwood 1979]

There has always been implicit racism in the Great Chain of Being; social inequalities were created by God. But there are broader questions. Why do humans feel the need to rank things? Why do we make top ten lists? Facebook started as a facial ranking network, Hot or Not. The grade you get in this class is basically part of a ranking system for employers and other schools. The difference in salaries between full-time and part-time faculty separates professors into two socioeconomic classes.

In the primate behavior section coming up, we'll see other primates similarly obsessed with dominance hierarchies.
Perhaps ranking is human nature?