

Darwin and the Origin of Species

Short Course @ YSU
April 27, 2026

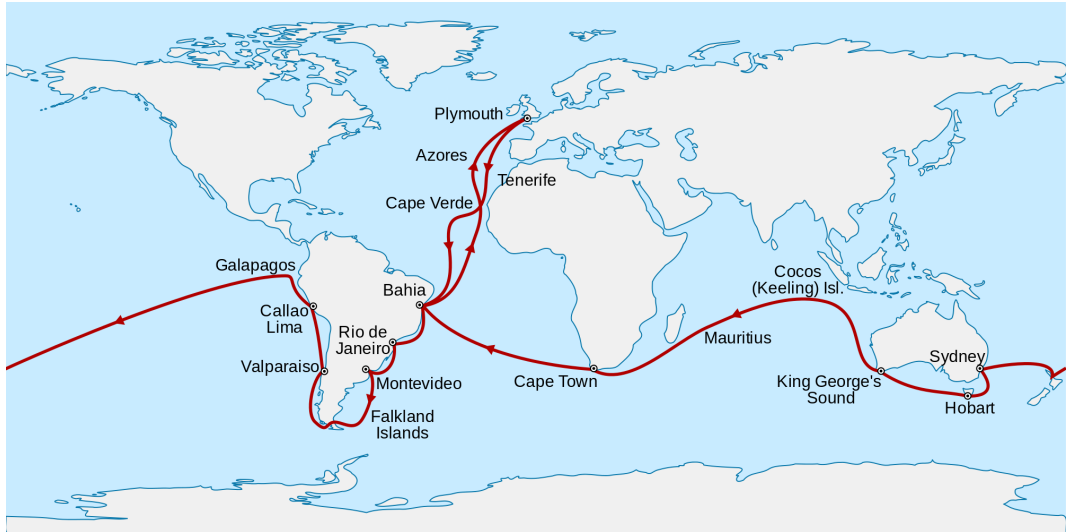
Charles Darwin (1809–1882)



HMS Beagle



The Voyage of the Beagle (1831–1836)



Mollusks in the Andes





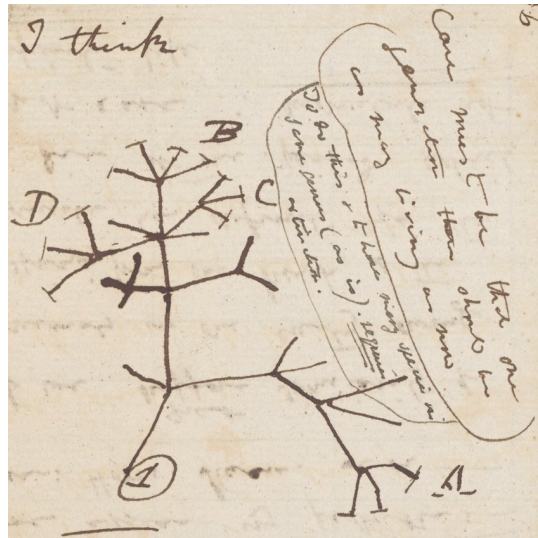
Down House



Notebook B (1838)



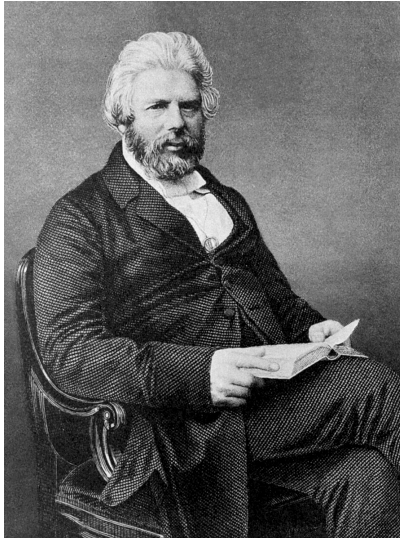
Notebook B (1838)



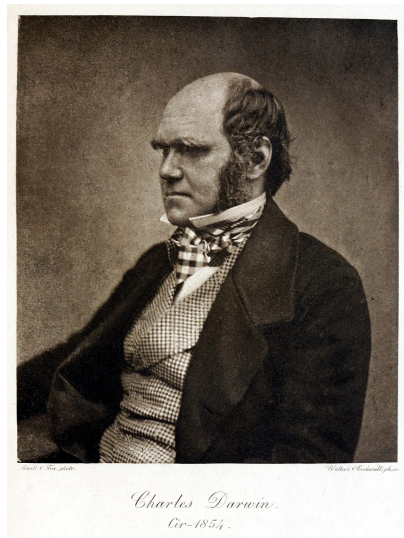
An Unusual Silence: Barnacles (1844–1859)



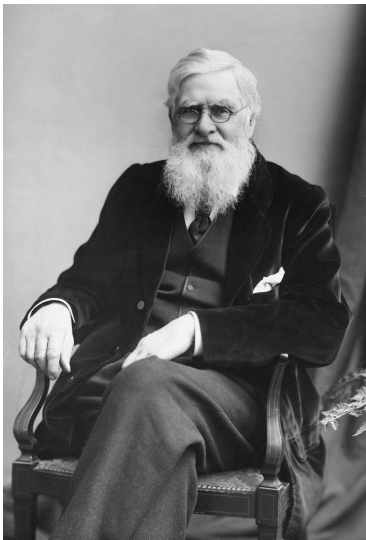
Chambers' Vestiges (1844)



Darwin in 1854



Alfred Russel Wallace (1823–1913)



Structure of the *Origin*

- Chapters 1–5: **Existence** of natural selection
- Chapters 6–9: **Adequacy** of natural selection to produce effects
- Chapters 10–14: **Responsibility** of natural selection for those and other phenomena



Variation and Artificial Selection



Charles Darwin's pigeons
Fancy breeds of pigeon owned by Charles Darwin and which provided evidence for his theory of evolution by natural selection.

Variation and Artificial Selection

From careful, conscious agricultural creation, to proto-agricultural selection, to “unconscious” selection – making space for natural selection to come



Variation and Artificial Selection

Again, we have many slight differences which may be called individual differences, such as are known frequently to appear in the offspring from the same parents, or which may be presumed to have thus arisen, from being frequently observed in the individuals of the same species inhabiting the same confined locality. No one supposes that all the individuals of the same species are cast in the very same mould. These individual differences are highly important for us, as they afford materials for natural selection to accumulate, in the same manner as man can accumulate in any given direction individual differences in his domesticated productions. (45)

Varieties, Sub-Species, and Species

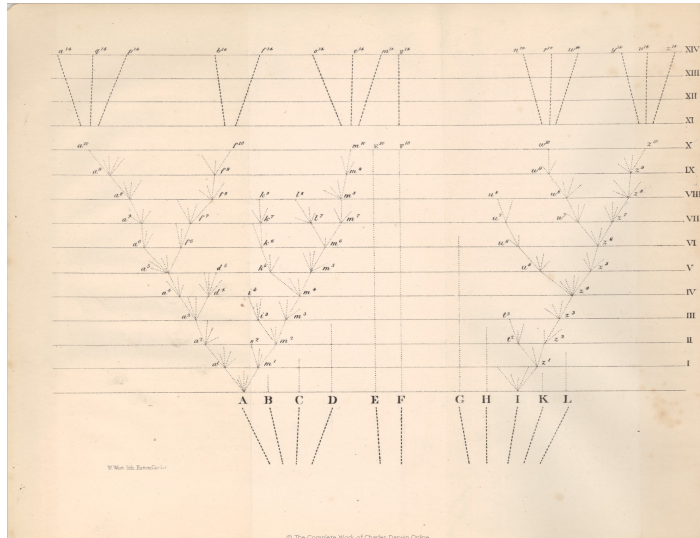


From these remarks it will be seen that I look at the term species, as one arbitrarily given for the sake of convenience to a set of individuals closely resembling each other, and that it does not essentially differ from the term variety, which is given to less distinct and more fluctuating forms. The term variety, again, in comparison with mere individual differences, is also applied arbitrarily, and for mere convenience sake. (52)



Owing to this struggle for life, any variation, however slight and from whatever cause proceeding, if it be in any degree profitable to an individual of any species, in its infinitely complex relations to other organic beings and to external nature, will tend to the preservation of that individual, and will generally be inherited by its offspring. The offspring, also, will thus have a better chance of surviving, for, of the many individuals of any species which are periodically born, but a small number can survive. I have called this principle, by which each slight variation, if useful, is preserved, by the term of Natural Selection, in order to mark its relation to man's power of selection. (61)

Relations Between Species



Relations Between Species

Of the eight descendants from (A) the three marked a^{14} , q^{14} , p^{14} , will be nearly related from having recently branched off from a^{10} ; b^{14} and f^{14} , from having diverged at an earlier period from a^5 , will be in some degree distinct from the three first-named species; and lastly, o^{14} , e^{14} , and m^{14} , will be nearly related one to the other, but from having diverged at the first commencement of the process of modification, will be widely different from the other five species, and may constitute **a sub-genus or even a distinct genus.** (123)

Relations Between Species



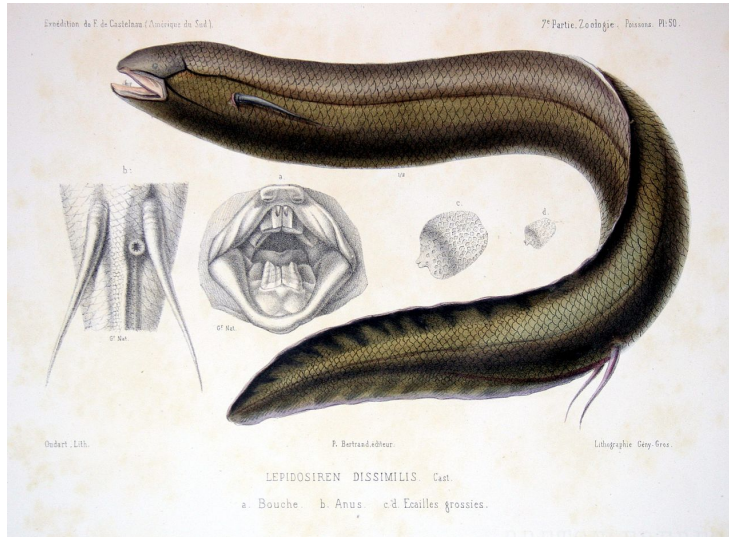
the eight descended from (A), will have to be ranked as **very distinct genera, or even as distinct sub-families.** (123)

the two little groups of genera will form **two distinct families, or even orders** (125)



Linnaean Taxonomy (1735)

[illegible]



- ① Why don't we see more *living* transitional forms between today's species?
- ② Could evolution produce strange habits? Organs of extreme perfection (eyes)? Organs that aren't very important?
- ③ Could evolution produce instincts?
- ④ Why are hybrids normally sterile? Isn't that a problem?
- ⑤ Why don't we see the entire trajectory of *fossil* forms that trace the evolution of today's species?
- ⑥ How can we explain groups that appear rapidly at our lowest known levels of fossils?



Advantages of the Theory

- ➊ Explanation for dynamics of species appearance
- ➋ Explanation for extinction
- ➌ Explanation for biogeography
- ➍ Explanation for the broad structure of taxonomy
- ➎ Explanation for homologies and analogies
- ➏ Explanation for strange developmental characteristics (e.g., gills in embryos)
- ➐ Explanation for rudimentary organs



Two Central Claims

- ❶ **Common Descent:** All living beings are linked by common descent to “a few forms or...one.” (490)
- ❷ **Natural Selection:** “I have called this principle, by which each slight variation, if useful, is preserved, by the term of Natural Selection, in order to mark its relation to man’s power of selection.” (61)



The Argument for Selection

- Organisms vary (we see this in domesticated products)
- They constantly struggle for existence
- Some variations are more useful than others in this struggle
- Organisms that have those will have the best chance to survive and reproduce
- They will have descendants that resemble them



Natural Selection (today)

- 1 Phenotypic variation
- 2 Differences in fitness
- 3 Heritability of differences in fitness



Psychology will be based on a new foundation, that of the necessary acquirement of each mental power and capacity by gradation. Light will be thrown on the origin of man and his history. (488)

It is interesting to contemplate an entangled bank, clothed with many plants of many kinds, with birds singing on the bushes, with various insects flitting about, and with worms crawling through the damp earth, and to reflect that these elaborately constructed forms, so different from each other, and dependent on each other in so complex a manner, have all been produced by laws acting around us. (489)

Thus, from the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows. There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved. (490)

The Descent of Man (1871)

THE *Descent of Man*
DESCENT OF MAN,
AND
SELECTION IN RELATION TO SEX.

By CHARLES DARWIN, M.A., F.R.S., &c.

IN TWO VOLUMES.—Vol. I.

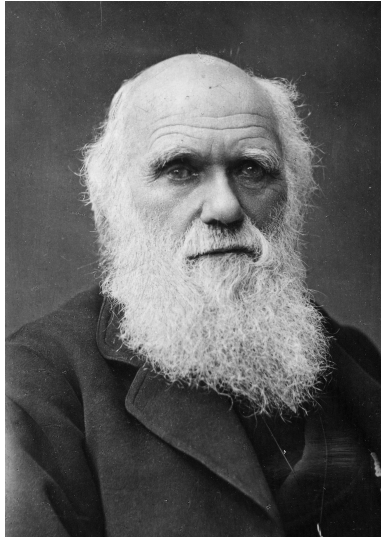
WITH ILLUSTRATIONS.



LONDON:
JOHN MURRAY, ALBEMARLE STREET.
1871.

[The right of Translation is reserved.]

Darwin (1881)



Darwin (1809–1882)



In the scientific community:

- 1 Quick acceptance of common descent
- 2 Slower acceptance of natural selection (the question of genetics)



Paley's Watchmaker (1802)

[W]hen we come to inspect the watch, we perceive...that its several parts are framed and put together for a purpose, e.g. that they are so formed and adjusted as to produce motion, and that motion so regulated as to point out the hour of the day; that if the different parts had been differently shaped from what they are, or placed after any other manner or in any other order than that in which they are placed, either no motion at all would have been carried on in the machine, or none which would have answered the use that is now served by it... [T]he inference we think is inevitable, that the watch must have had a maker – that there must have existed, at some time and at some place or other, an artificer or artificers who formed it for the purpose which we find it actually to answer, who comprehended its construction and designed its use.

Darwin Contra Paley (1887)

The old argument of design in nature, as given by Paley, which formerly seemed to me so conclusive, fails, now that the law of natural selection has been discovered. We can no longer argue that, for instance, the beautiful hinge of a bivalve shell must have been made by an intelligent being, like the hinge of a door by man. There seems to be no more design in the variability of organic beings and in the action of natural selection, than in the course which the wind blows. Everything in nature is the result of fixed laws.



What spontaneous provision is included in these words,—that which is present in the root, in the plant itself, and in the fruit, as well as that which our labour and husbandry add! God did not command the earth immediately to give forth seed and fruit, but to produce germs, to grow green, and to arrive at maturity in the seed; so that this first command teaches nature what she has to do in the course of ages. [...] Like tops, which after the first impulse, continue their revolutions, turning upon themselves when once fixed in their centre; thus nature, receiving the impulse of this first command, follows without interruption the course of ages, until the consummation of all things. (Hexæmeron, V.5, 10)

Augustine of Hippo (d. 430)

Usually, even a non-Christian knows something about the earth, the heavens, and the other elements of this world, about the motion and orbit of the stars and even their size and relative positions...and this knowledge he holds to as being certain from reason and experience. Now, **it is a disgraceful and dangerous thing for an infidel to hear a Christian, presumably giving the meaning of Holy Scripture, talking non-sense on these topics;** and we should take all means to prevent such an embarrassing situation, in which people show up vast ignorance in a Christian and laugh it to scorn. (Augustine, *De Genesi ad Litteram* I.19.39, 415 AD)



In his encyclical *Humani Generis* (1950), my predecessor Pius XII has already affirmed that **there is no conflict between evolution and the doctrine of the faith regarding man and his vocation**, provided that we do not lose sight of certain fixed points... Today, more than a half-century after the appearance of that encyclical, **some new findings lead us toward the recognition of evolution as more than an hypothesis.** (Pope John Paul II, 1996)

The proposition that God undetectably intervenes in the evolutionary process is not testable. Positivism says that this proposition is meaningless, but I do not. Neither do I say that it is false; I have no way of telling what its truth value is, and I don't find Ockham's razor an appealing argument for atheism in this instance (Sober 2009). Scientific theories don't tell you what to think about untestable propositions. That's a philosophical question that needs to be addressed as such. (Elliott Sober, *forthcoming*)

The Causal Structure of Selection

For philosophers of science and some influential nineteenth-century scientists:

What **kind** of a theory does Darwin take himself to be presenting? Clearly something that is, broadly, **Newtonian**, or at least acceptable by Newtonian standards.

But the theory itself is **very non-Newtonian!** (Namely, it's probabilistic.)

