UCLouvain

FIAL
Un éventail de formations, une multitude d'horizons

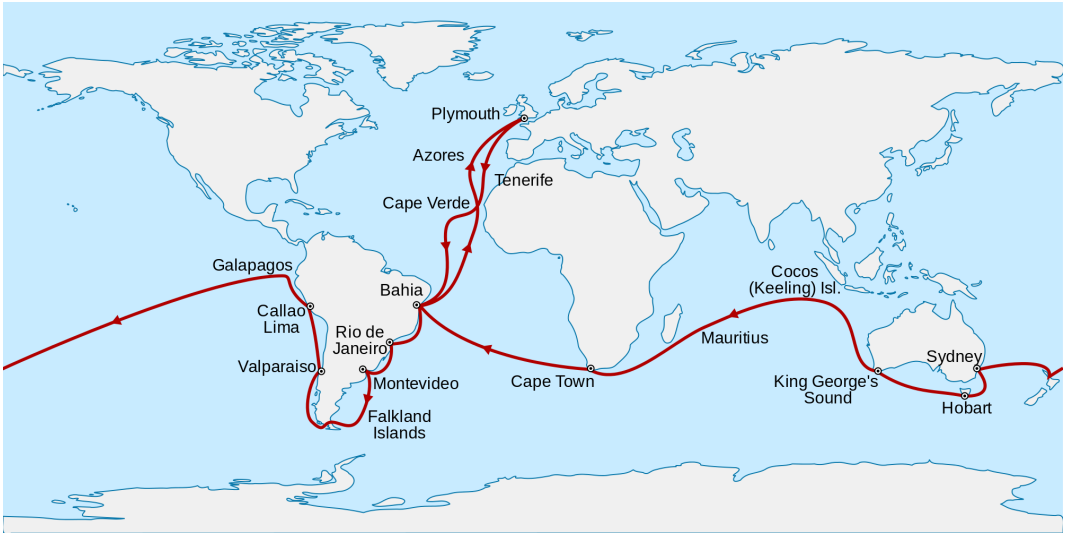
Darwin and the Origin of Species

Short Course @ YSU
April 27, 2026

Charles Darwin (1809–1882)

HMS Beagle

The Voyage of the Beagle (1831–1836)



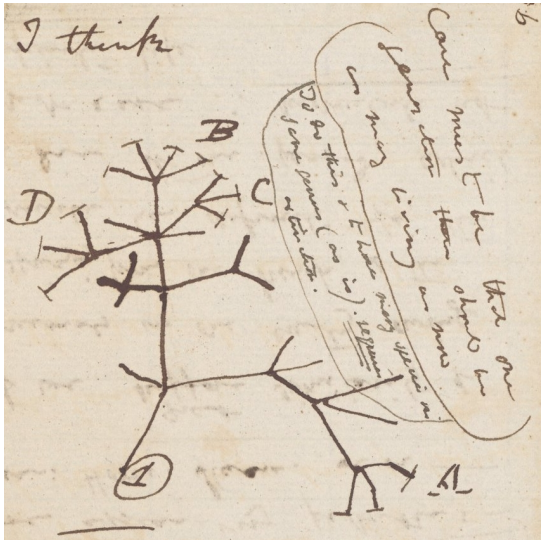
Mollusks in the Andes

Biogeography

Down House

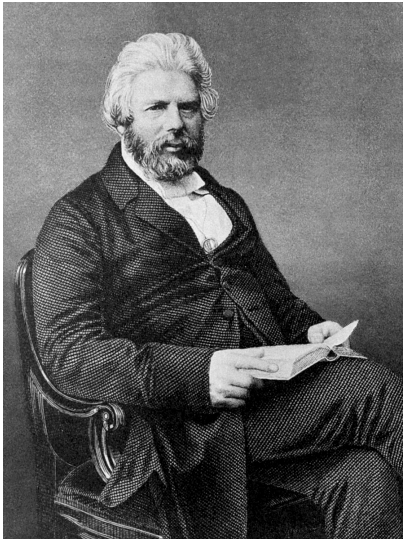
Notebook B (1838)

Notebook B (1838)

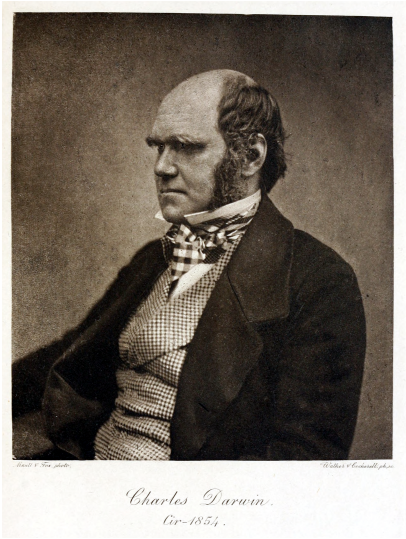


An Unusual Silence: Barnacles (1844–1859)

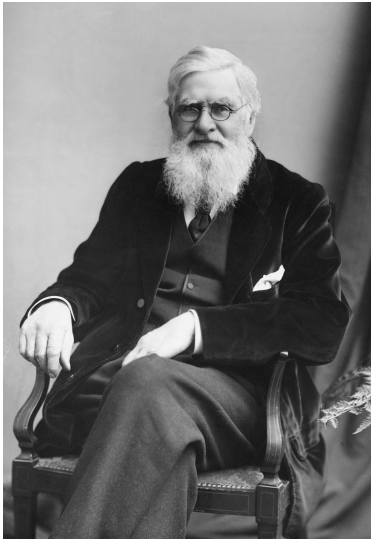
Chambers' Vestiges (1844)



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)

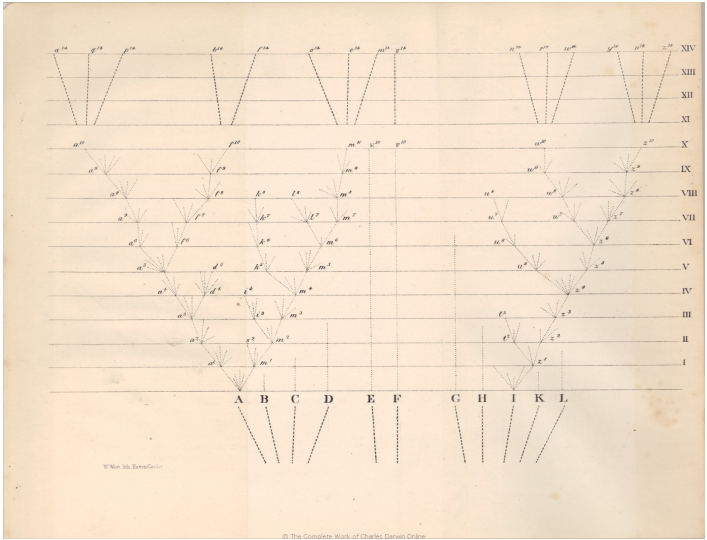
Varieties, Sub-Species, and Species

> 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)

Natural Selection

> 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

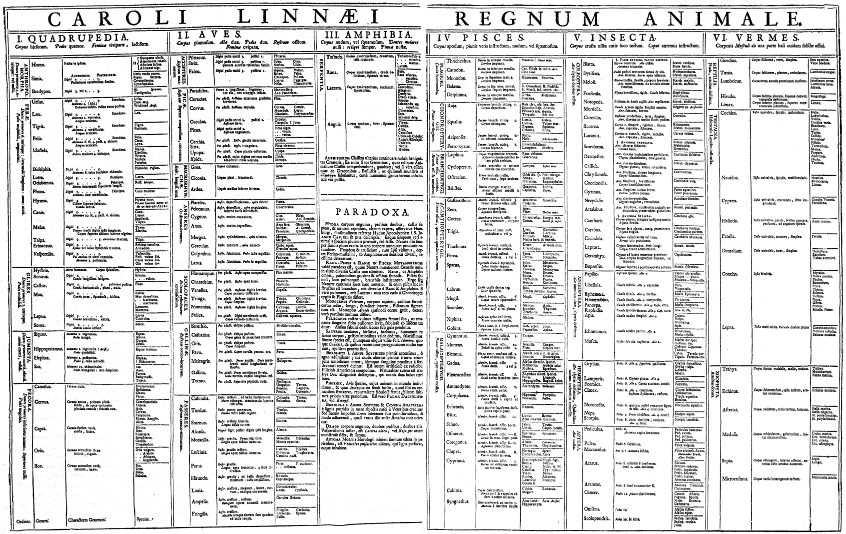
Of the eight descendants from (A) the three marked a^{14}, q^{14}, p^{14}, will be nearly related from having recently branched off from a^{10}; b^{14} and f^{14}, from having diverged at an earlier period from a^{5}, will be in some degree distinct from the three first-named species; and lastly, o^{14}, 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

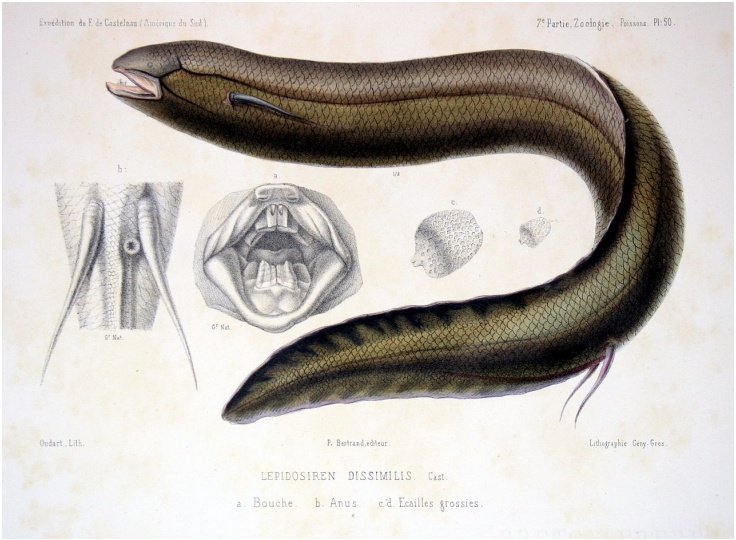
the eight descended from (A), will have to be ranked as **very distinct genera, or even as distinct sub-families.** (123)

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

Linnaean Taxonomy (1735)



Living Fossils



Worries

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 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

1. Explanation for dynamics of species appearance
2. Explanation for extinction
3. Explanation for biogeography
4. Explanation for the broad structure of taxonomy
5. Explanation for homologies and analogies
6. Explanation for strange developmental characteristics (e.g., gills in embryos)
7. Explanation for rudimentary organs

Two Central Claims

1. **Common Descent:** All living beings are linked by common descent to "a few forms or…one." (490)
2. **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

And Humans?

> 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)

The Conclusion

> 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)

The Conclusion

> 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,

AND

SELECTION IN RELATION TO SEX.

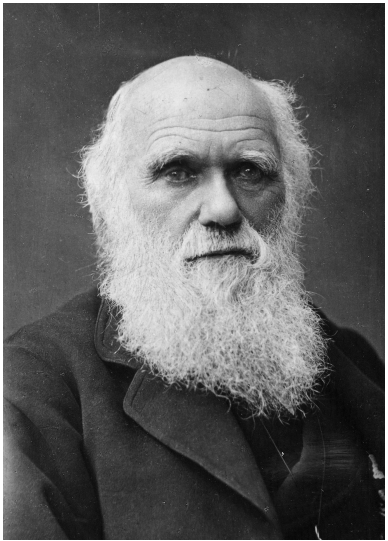
By CHARLES DARWIN, M.A., F.R.S., &c.

IN TWO VOLUMES.—Vol. I.

WITH ILLUSTRATIONS.

LONDON:
JOHN MURRAY, ALBEMARLE STREET.
1871.

Darwin (1881)



Darwin (1809–1882)

The Causal Structure of Selection

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.)