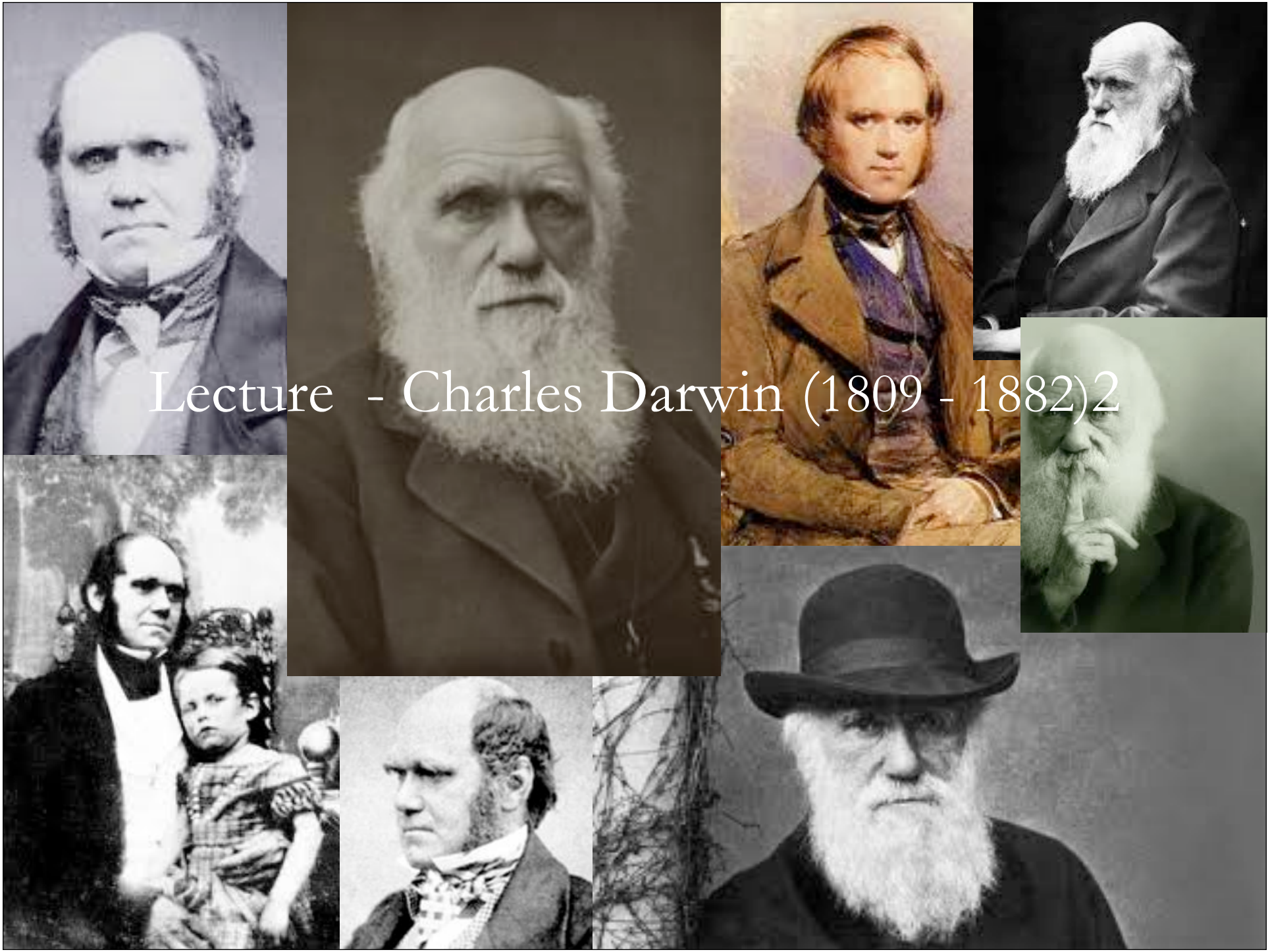
EVOLUTION & ADAPTATION
(EEB214S) 2012

Lecture 2

Jennifer Carpenter


Lecture - Charles Darwin (1809 - 1882)2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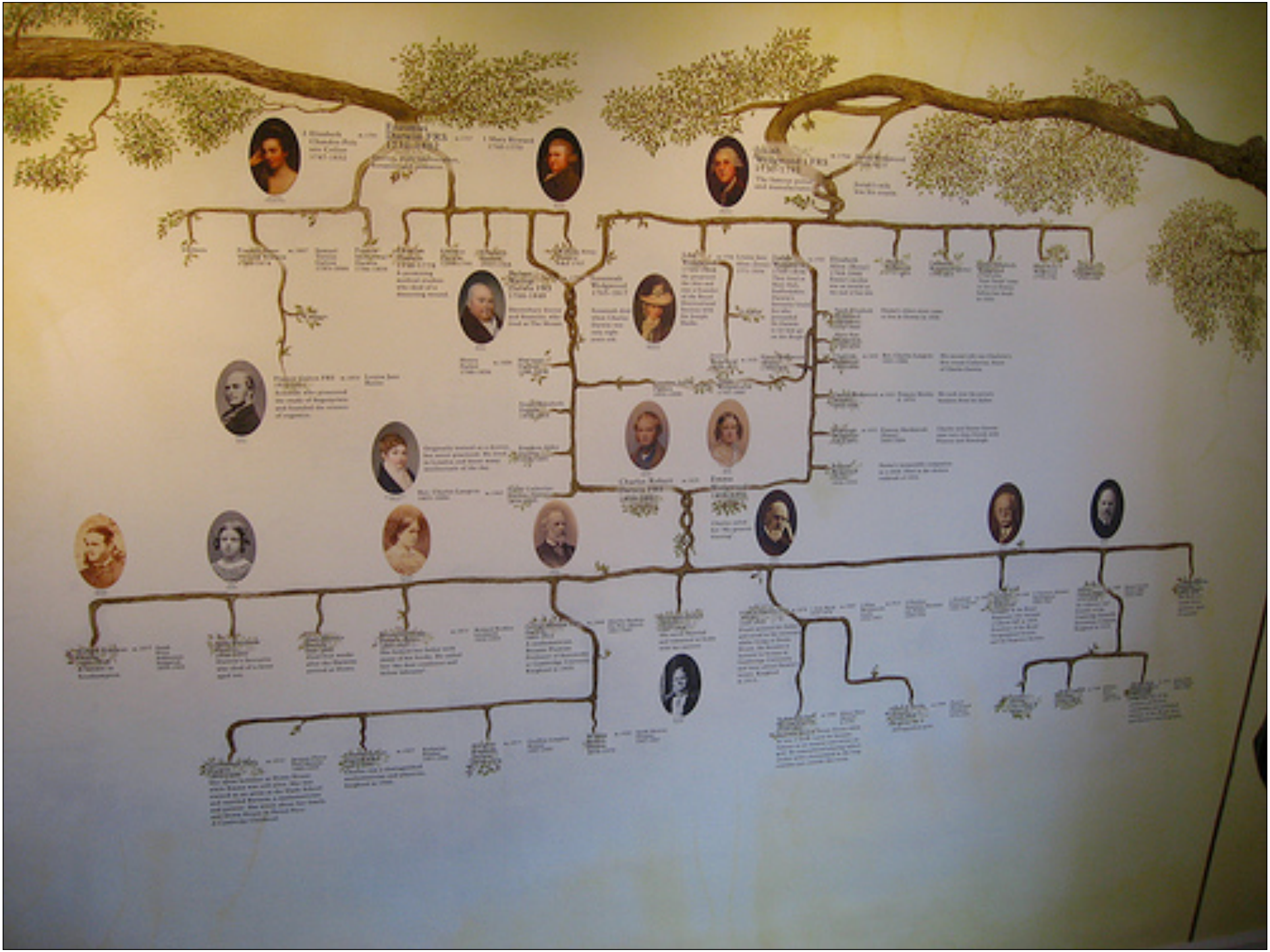
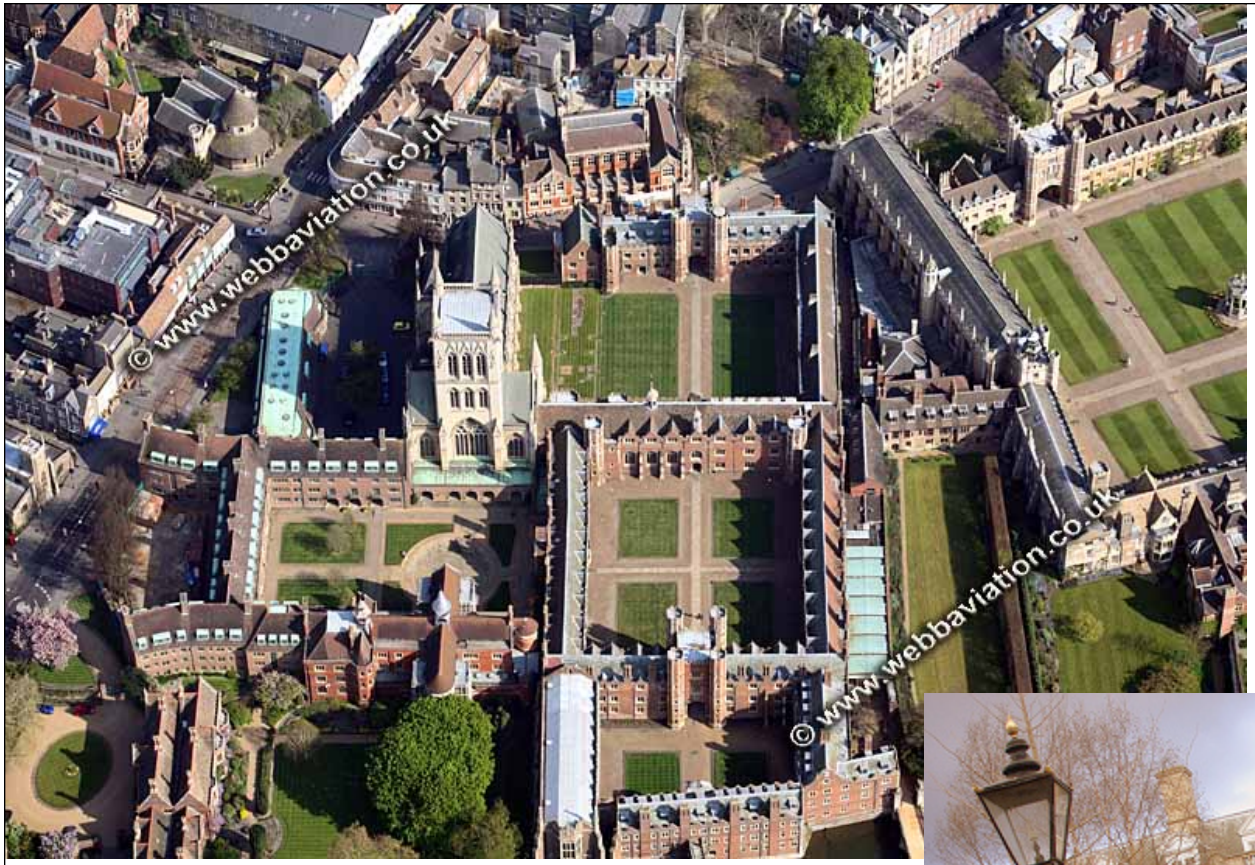


John Edmonston, a freed slave from the West Indies, tutored Darwin on how to prepare bird sins

And so after a series of serious family discussions,
Charles Darwin was redirected toward the church…



St Mary's, Cambridge

Christ's Church, Cambridge

Cambridge,
described by Jim Moore


CHARLES DARWIN
1809 - 1882
KEPT IN LODGINGS ON THIS
SITE IN 1828 WHILE AN
UNDERGRADUATE
OF CHRISTS COLLEGE

Darwin saw variation among beetles, and this must have led him to question what drove that variation…it is but a short step in logic to start thinking about evolutionary change.

Darwin's Dangerous Idea

William Paley

- The English philosopher most famously explained the world around him with a comparison to a watch lying on the ground.

"But suppose I had found a watch upon the ground, and it should be inquired how the watch happened to be in that place; I should hardly think of the answer I had before given, that for anything I knew, the watch might have always been there. (...) There must have existed, at some time, and at some place or other, an artificer or artificers, who formed [the watch] for the purpose which we find it actually to answer; who comprehended its construction, and designed its use. (...) Every indication of contrivance, every manifestation of design, which existed in the watch, exists in the works of nature; with the difference, on the side of nature, of being greater or more, and that in a degree which exceeds all computation."

-- William Paley, Natural Theology (1802)

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- Ergo, well-adapted organisms and their intricate features surely implied a conscious, celestial designer - God.

- He was one of a group of 'natural theologians' who sought to know God by studying, cataloguing and describing God's creation - all plants and animals.

Adam Sedgwick, professor of geology

John Henslow, professor of botany

William Whewell ('Hule'), professor of mineralogy

THE

PHILOSOPHY

OF THE

INDUCTIVE SCIENCES,

FOUNDED UPON THEIR HISTORY.

BY WILLIAM WHEWELL, D.D.,

MASTER OF TRINITY COLLEGE, CAMBRIDGE.

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VOLUME THE SECOND.

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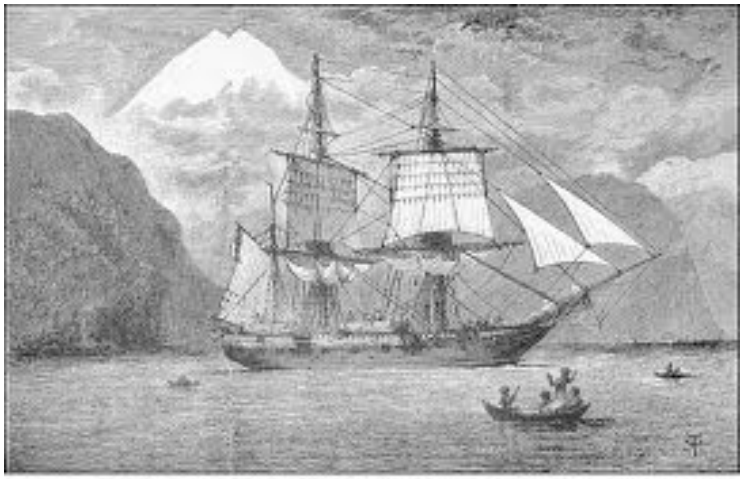
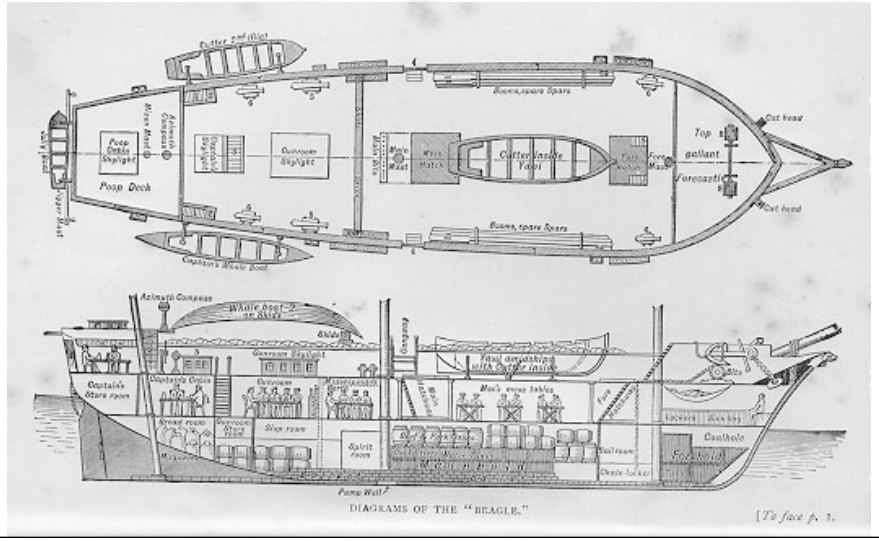
The Beagle Voyage (1831 - 1836)



H.M.S. *Beagle* in Straits of Magellan. Mt. Sarmiento in the distance.



PRINCIPLES

OF

GEOLOGY,

BEING

AN ATTEMPT TO EXPLAIN THE FORMER CHANGES
OF THE EARTH'S SURFACE,

BY REFERENCE TO CAUSES NOW IN OPERATION.

BY

CHARLES LYELL, Esq., F.R.S.

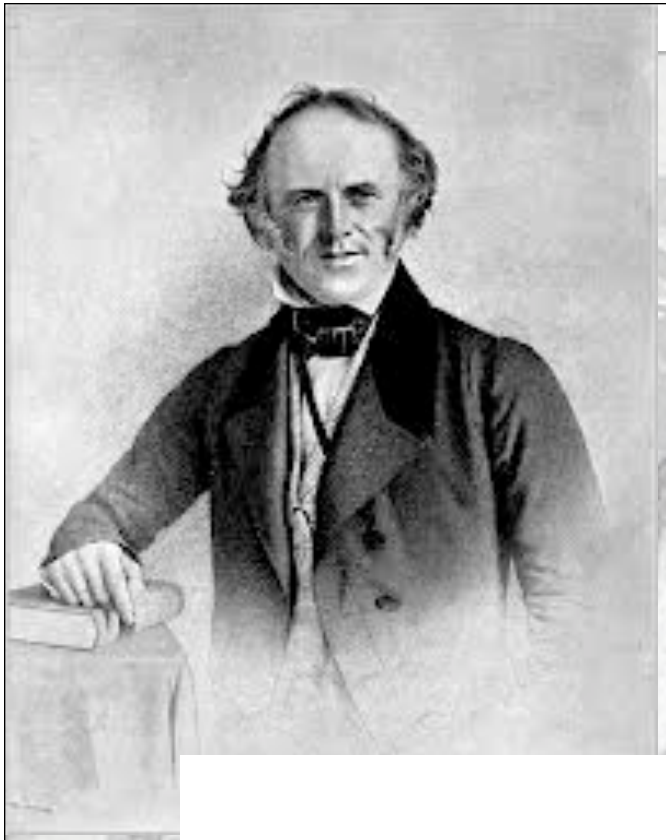
FOR. SEC. TO THE GEOL. SOC., &c.

IN TWO VOLUMES.

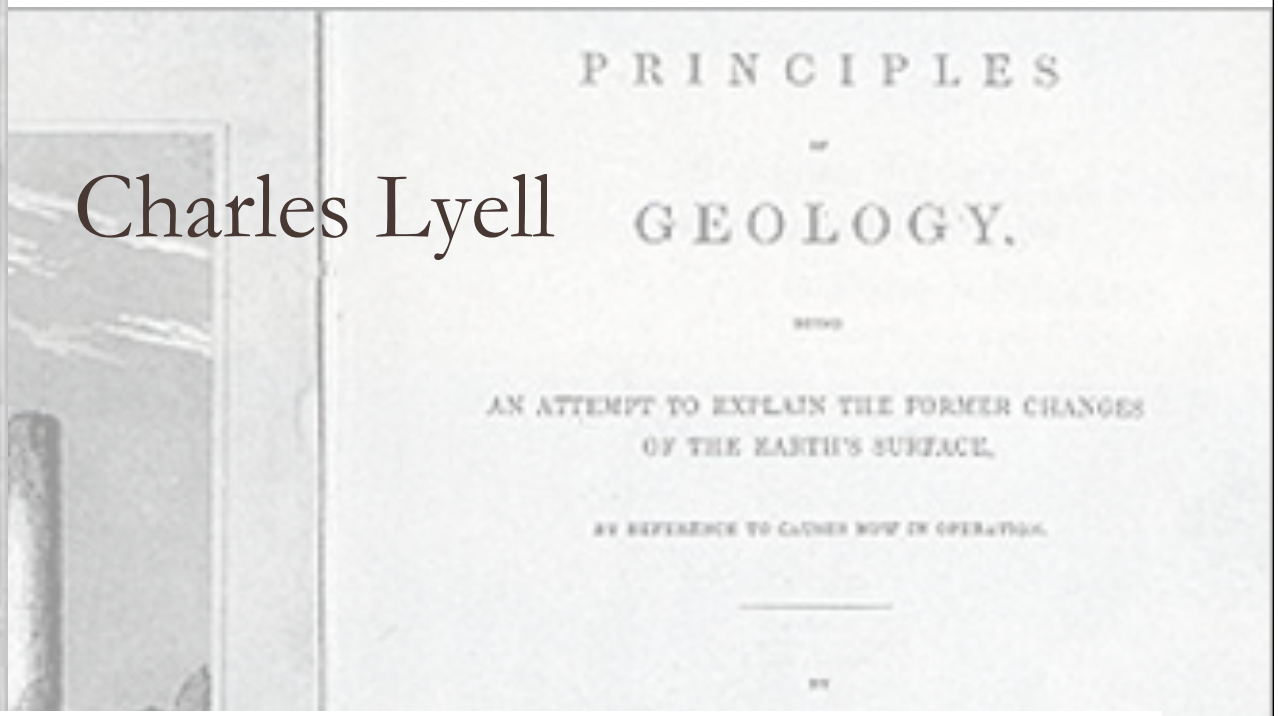
Vol. I.

LONDON:

JOHN MURRAY, ALBEMARLE-STREET.



Charles Lyell



Lyell's ideas (which Whewell called "uniformitarianism" were that the forces that we see around us today -- wind, rain, deposition , erosion, earthquakes -- caused the geological features of the earth

It can be considered a steady state view of the Earth's history

And that the Earth's surface slips around, so land becomes water and water becomes land. Therefore explaining the existence of tropical looking fossil palms in Paris.

Darwin, never the great mariner

"There has been a little swell on the sea to day, & I have been very uncomfortable: this has tried & quite overcome the small stock of patience that the early parts of the voyage left me. — Here I have spent three days in painful indolence, whilst animals are staring me in the face, without labels & scientific epitaphs. — This has been the first day that the heat has annoyed us."

-- Charles Darwin writing in his diary aboard HMS Beagle on his 23rd birthday

Video

Darwin began to believe in the idea of evolution (transmutation)

But what was the mechanism?

William Whewell ('Hule'), professor of mineralogy

William Whewell ('Hule'), professor of mineralogy

Hypothetico-deductive system - holds that one starts with a number of premises and then deduces everything from them. So for Newton you start with the laws of motion and of gravitational attraction, and then you deduce Kepler's laws.

Whewell was a rationalist - he constructed the idea of the 'Consilience of Inductions' - the reconsilation of inductions, which are logical arguments based on observations.

Herschel an empiricist - and liked to see for himself

e.g. think of a murder

Darwin took a very Hershelian approach to find his cause for the change in animals and plants through time by looking to artificial selection in domestic animals.

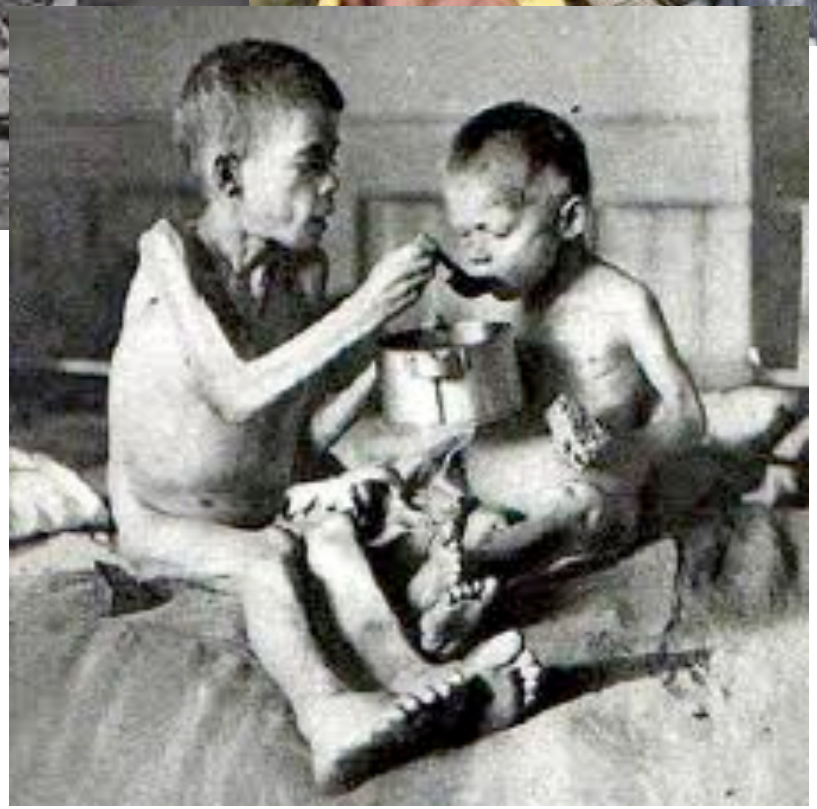
Artificial selection

Darwin took a very Hershelian approach to find his cause for the change in animals and plants through time by looking to artificial selection in domestic animals.

AND a Whewellian approach in incorporating the ideas of Thomas Robert Malthus's Essay on *the Principle of Population*

Thomas Robert Malthus's Essay on *the Principle of Population*

Malthus observes that human populations can increase in size faster than does their ability to produce food, causing a struggle for existence.



by 1838 **Darwin combined artificial selection with the idea of the struggle for existence to find his cause for the changes over time in animals and plants.**

But a small leap in logic to go from assuming some form of natural selection happening in the wild, where struggle for existence means only some survive.

Natural selection was the mechanism that causes evolution

Artificial selection + struggle for existence = cause of change in natural world

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Next lecture…evolution by means of natural selection

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John Stevens Henslow

Evolution by means of natural selection

Life on Earth evolved gradually beginning with one primitive species that lived billions of years ago; this life branched our over time, splitting and throwing off many new and diverse species; the mechanism for most of evolutionary change is natural selection.

Evolution by Natural Selection

- Evolution
- Natural Selection
- Common Ancestry
- Gradualism
- Speciation

Evolution by Natural Selection

- Evolution - simply means that a species undergoes heritable change over time.

'Living fossils' Horseshoe crabs, *Limulus_polyphemus*

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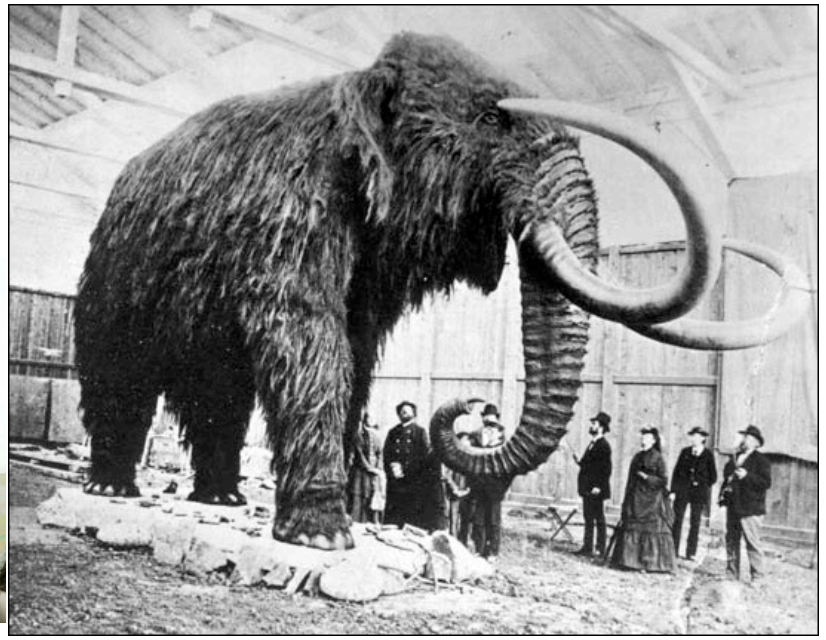

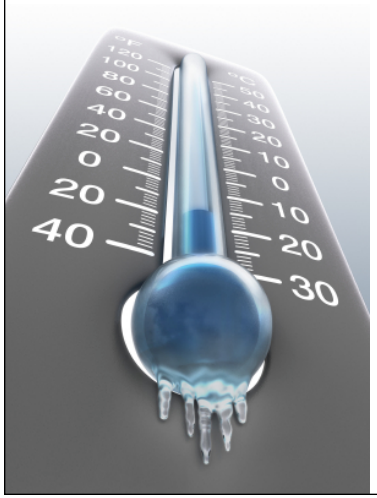
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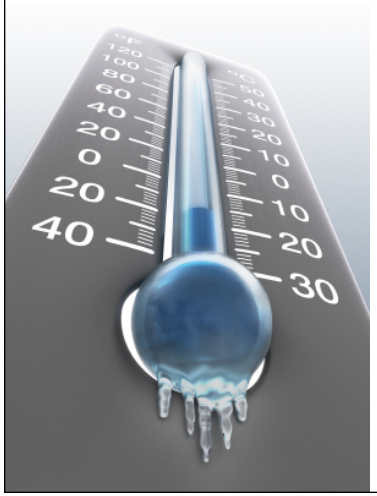
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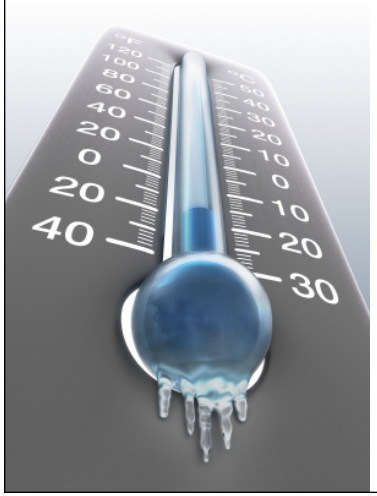
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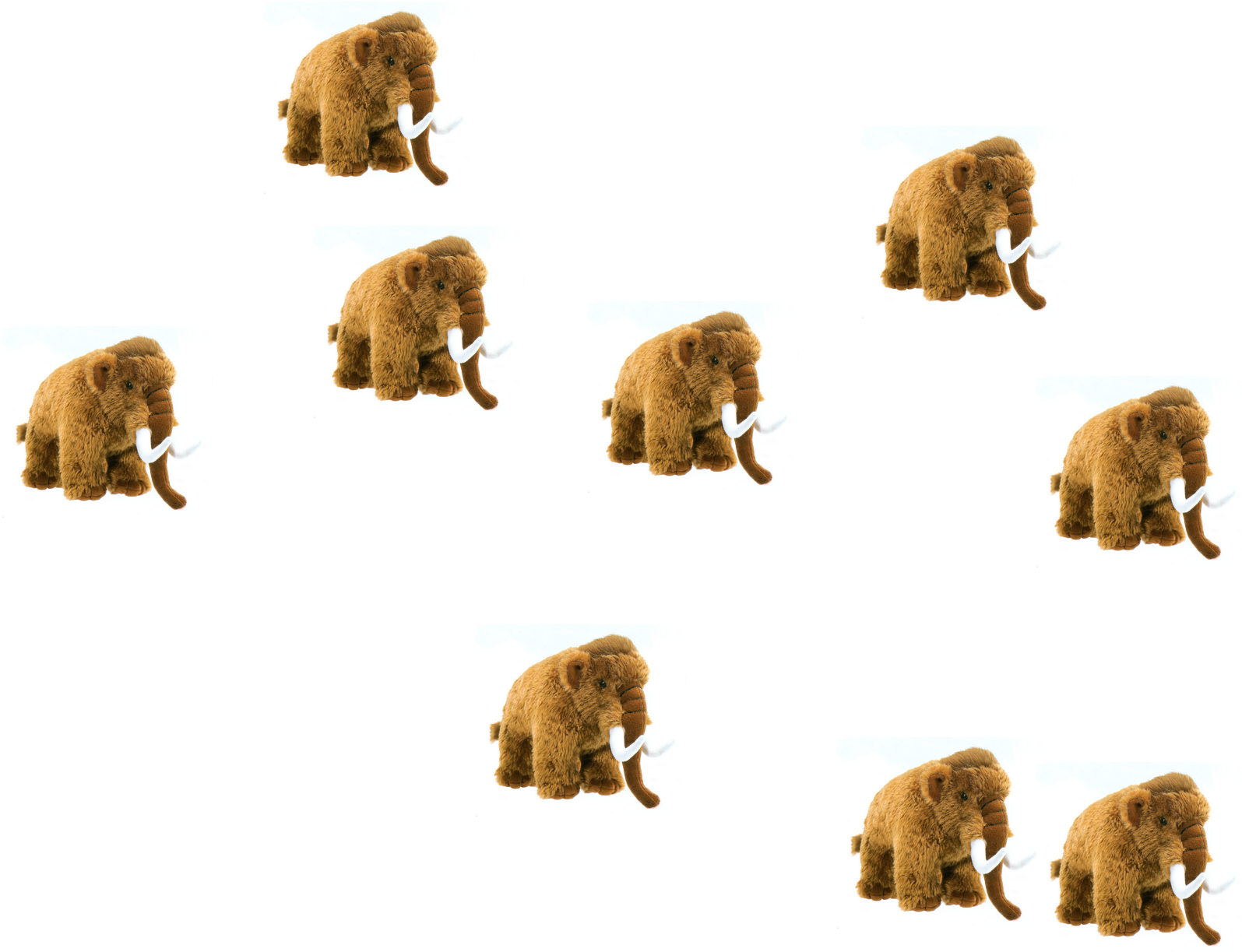

And since natural selection most likely acts on many traits -- not just hairiness -- it can , over time, sculpt animals and plants into something that looks perfectly designed to its environment.

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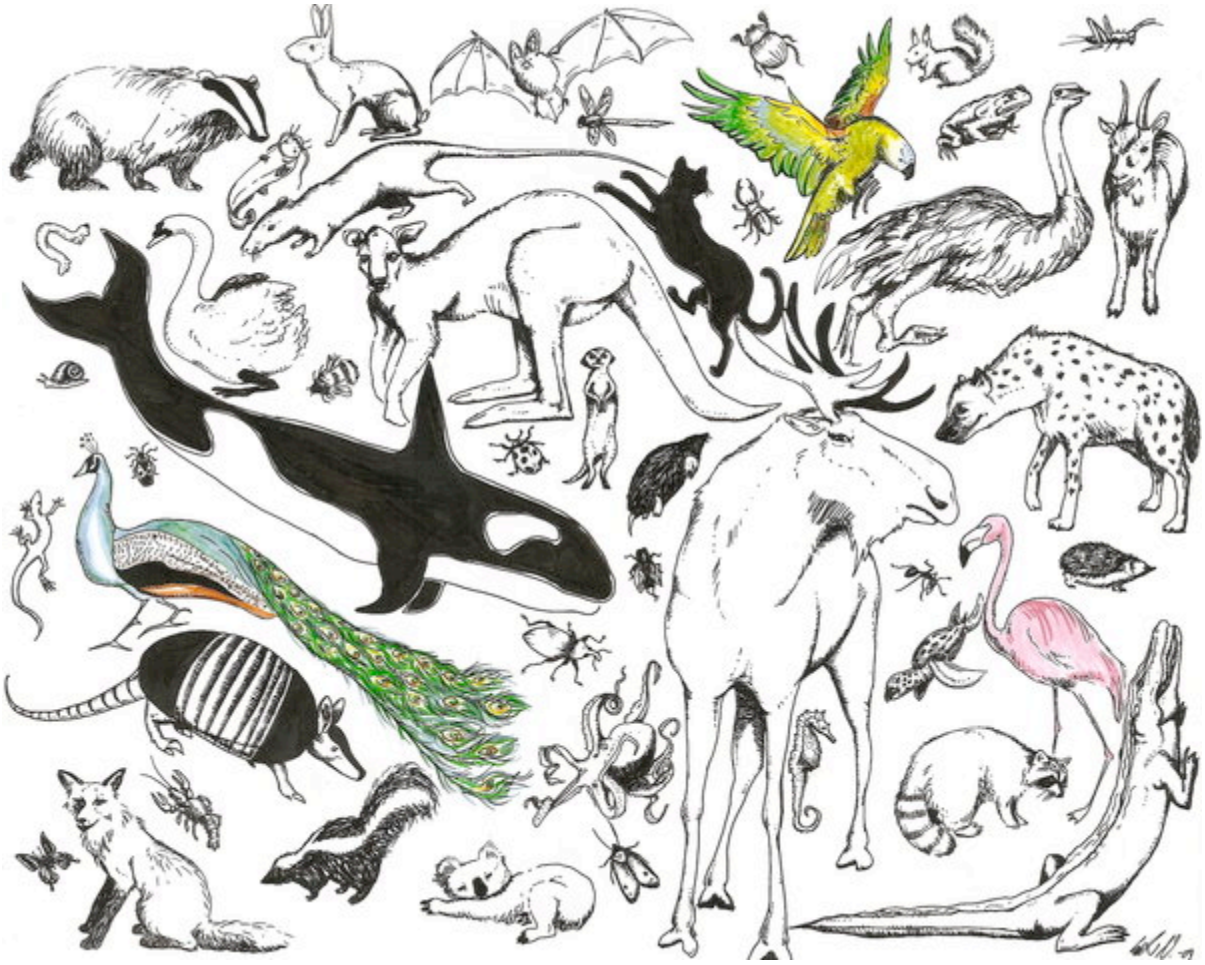
- Common Ancestry - if we look back in time we (say using the fossil record) we will find that the animals and plants at the tips -- the descendants lineage -- fuse at their ancestors

Evolutionary trees show the relationships between the different elements on the tree

10 million extent species



And there's another quarter million that we know about from the fossil record

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- Speciation - a splitting process in which a new species is formed from an initial one.

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