Why this course is worth taking:

1. Get an appreciation of remarkable diversity of life
2. Identify fundamental mechanisms and traits that unify all organisms
3. Realize that all living forms are related to one another

II. Early explanations of diversity

a. The scale of Nature (~500 BC)

-Plato believed in two worlds: ideal and eternal (real world) and a illusory world of imperfection

-Aristotle believed that all living forms could be arrange on a ladder of increasing complexity; again species are permanent, perfect

b. Natural Theology (1700's)

-Viewed diversity as the result of the Creator's design; saw adaptations of organisms as evidence for a particular purpose

- Main objective classify organisms to discover Creator's plans

Linnaeus sought to discover order in diversity of life

In summary, early ideas about diversity:

-Species were unchanged through time

-They were independent of one another

1795

James Hutton

Uniformitarianism posits that physical processes, such as mountain building and erosion, have operated continually throughout the history of the earth causing geologic change. Given the gradual nature of these processes, the earth must be much older than just a few thousand years.

How to explain fossils?

Early 1800's

Fossil observation + gradualism of geologic processes generated interest in evolutionary thought; Lamarck ideas among the most comprehensive:

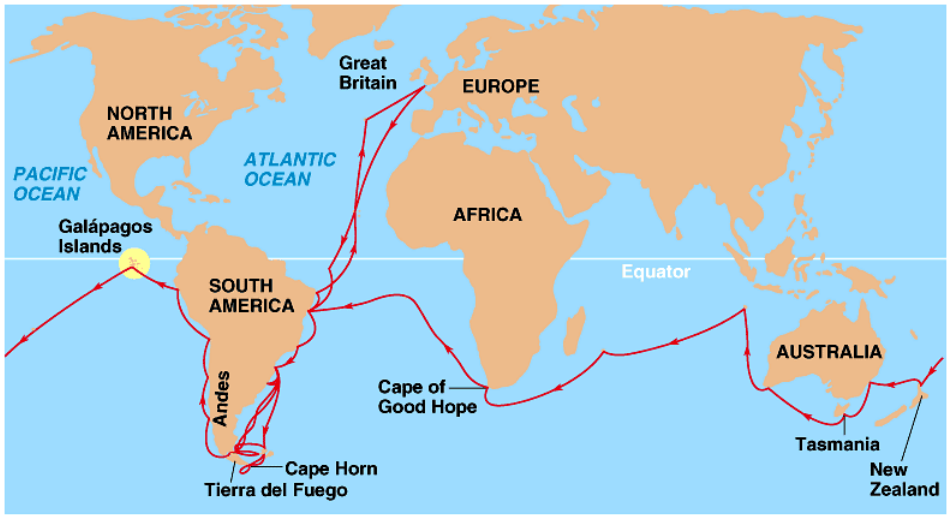
-evolution best explanation of fossil record and current diversity

-recognize great age of Earth

-emphasize adaptation to environment by inheritance of acquired characteristics

Cuvier strongly opposed evolution claiming fossils are result of catastrophes

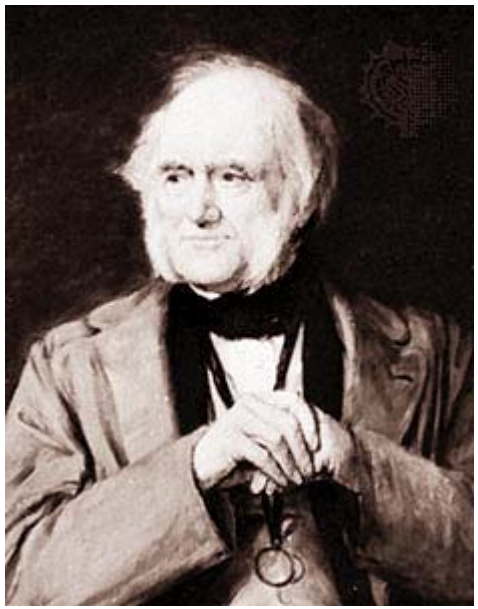
The voyage of the Beagle (1831-1836)



-Had a major influence on Darwin's thinking as it exposed him to the observation that species living in the same geographic area are quite similar even if they inhabit different environments (e.g. temperate and tropical biota in South America)

-During trip Darwin made geologic studies and collected flora and fauna

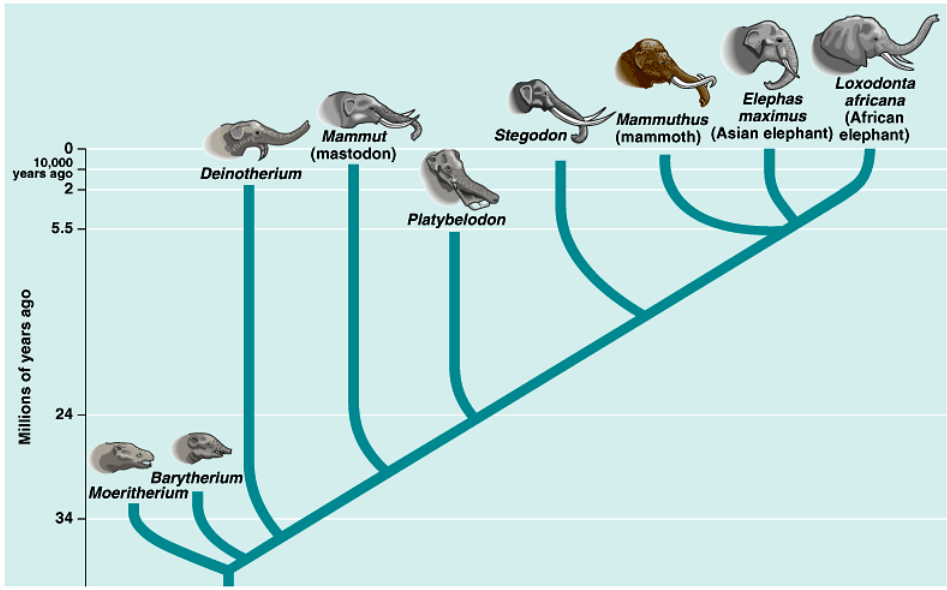
-He read Lyell's Principles of Geology book which influenced his thinking on evolution



Charles Lyell

Lyell wrote the book Principles of Geology where he amplifies the ideas of Hutton, discusses the geological dynamics and antiquity of earth, the geography of plants and animals and further emphasizes the importance of slow geologic changes Over long periods of time

Darwin's theory of evolution (1859)

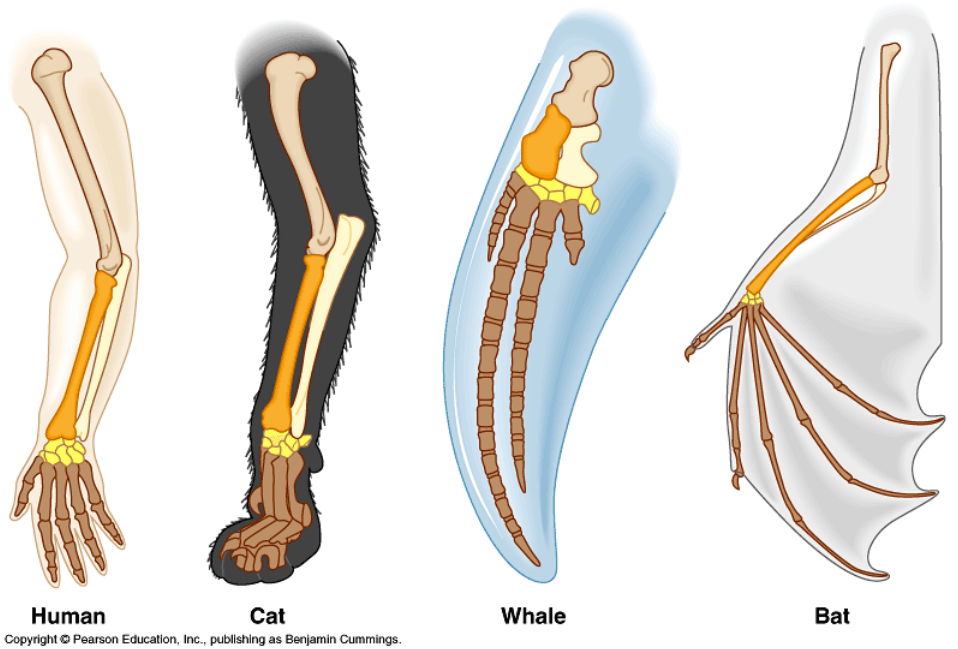


The two main points of Darwin's theory:

a. Modern biological species descend from ancestral species. Evolution explains life's unity and diversity

b. The mechanism for evolution: natural selection leading to adaptation of species to their environment; through gradual accumulations of adaptations new species arise from an ancestral one

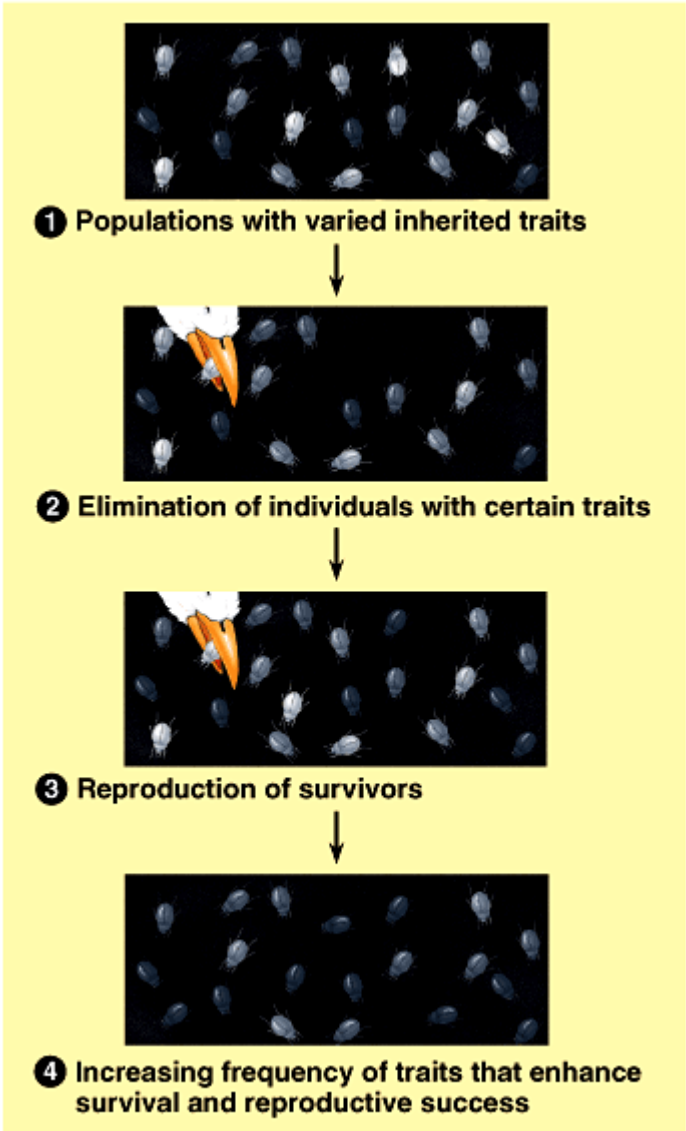
Structural homologies



Darwin amassed large amounts of evidence for evolution:

a. Similar species are distributed in the same geographic area
b. Structural and embryological homologies across species
c. Fossil record detailing succession of characters and species extinction

Natural selection leads to adaptation of organisms to environment



Four postulates of natural selection:

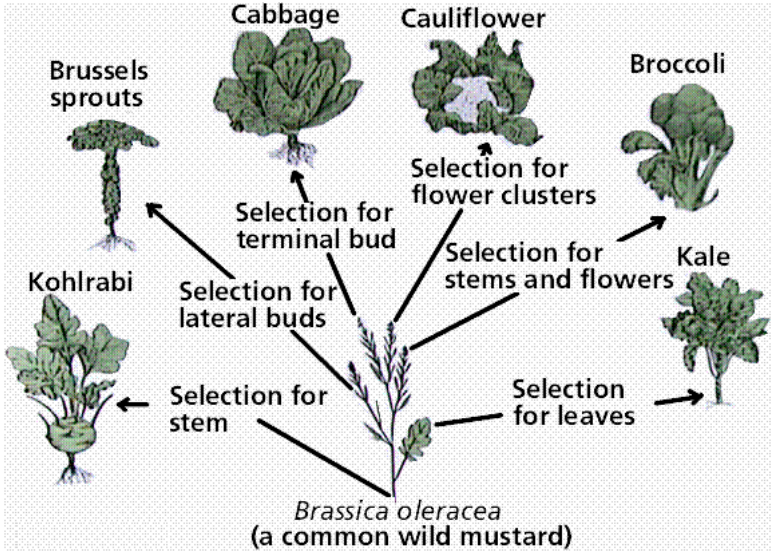
1. Individuals within a population are variable

2. Trait variation is heritable

3. In each generation, more offspring are produced than can survive. Only a subset of them survive and reproduce

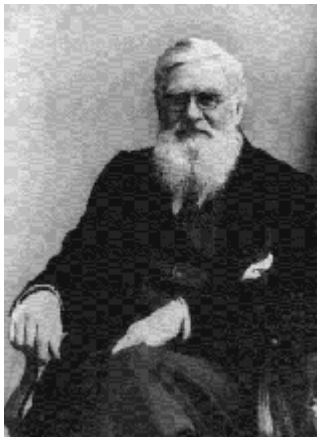
4. Subset of survived offspring not random. Individuals with certain traits are more likely to survive and reproduce or produce the greatest number of offspring

Artificial selection

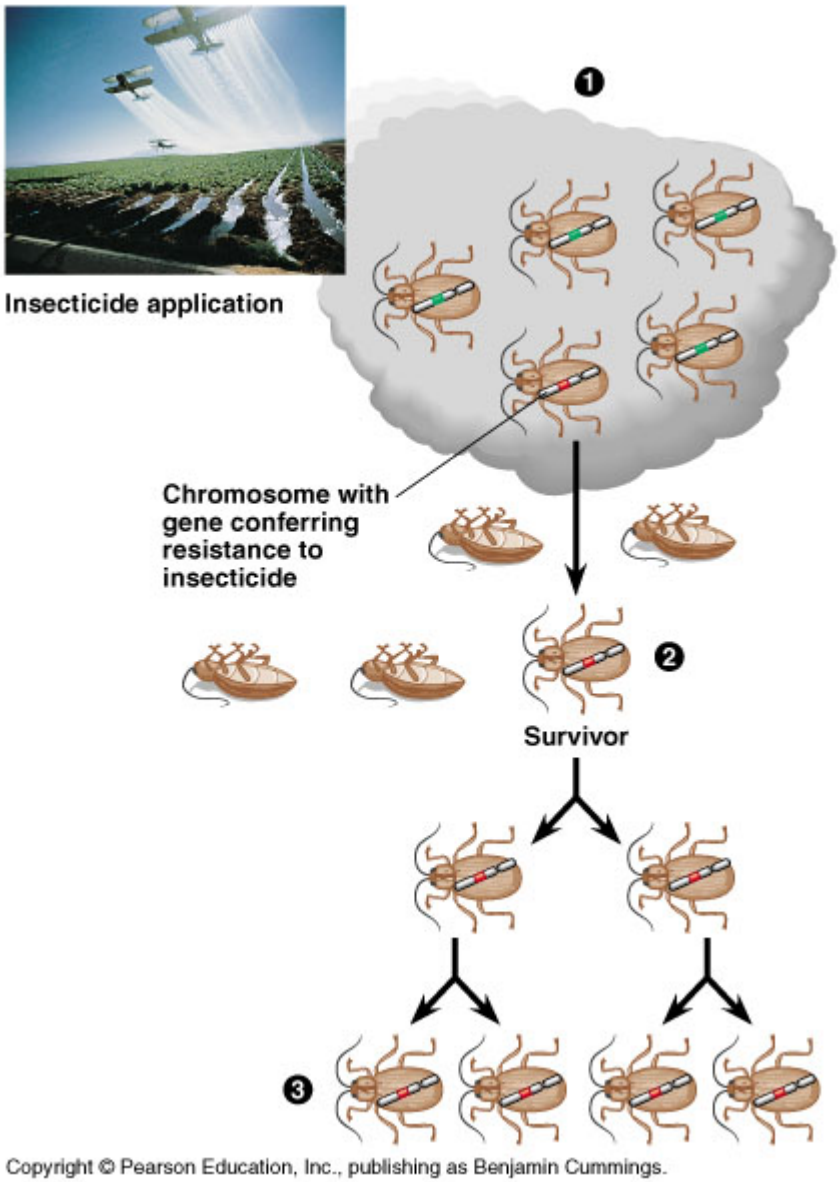


Evidence for natural selection:

-Observations of trait differentiation in populations
-Essay of Thomas Malthus on the consequences of the potential for human population to increase faster than food supplies
-Non random survival and reproduction of individuals was deemed possible by natural means through observations of artificial selection
-Darwin could not provide evidence of Inheritance agent; this came later through population genetics and the modern synthesis
-Darwin assumed that the gradualism implied by the principle of uniformitarianism could be extended to living organisms as their history depends on the history of the place they live



Alfred Russell Wallace, co-developer of the theory of evolution.
He published paper on evolution by natural selection in 1858! One year before the Origin of species. However, Darwin is given higher credit for the theory as he conceived it 15 years before Wallace.. Darwin was in poor health and feared of the reaction to his theory and thus did not send it for publication until he saw Wallace's paper!



Exercise: Fill in the four postulates of Natural selection

Natural selection in action