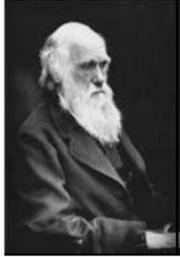


Darwinian Evolution

History of Evolutionary Thought



Comte de Buffon

- He thought that the environment acted directly on organisms through what he called "organic particles".
- Openly suggested that the planet was much older than the 6,000 years proclaimed by the church
- Discussed concepts very similar to Charles Lyell's "uniformitarianism" which were formulated 40 years later.

Carolus Linnaeus

- Father of Taxonomy
- Taxonomy—system of naming/classifying organisms
- Established binomial nomenclature (2-part name for organisms)
- Creationist
- Believed in "fixity of species"

Lamarck

- Invertebrate zoologist
- "Acquired Characteristics"—more complex organisms descended from less complex ones; adaptations are passed on to offspring
 - Ex. Giraffe's long neck
- "Use/Disuse"—structures that are used become larger/better and those that aren't used become smaller; also inheritable

Thomas Malthus

- **Observed that in nature plants and animals produce far more offspring than can survive**
- **Poverty and famine were natural outcomes of population growth and food supply**; such natural outcomes were God's way of preventing man from being lazy.
- Later, Darwin realized that producing more offspring than can survive establishes a competitive environment among siblings, and that the variation among siblings would produce some individuals with a slightly greater chance of survival.

Lyell & Hutton

- Geologists
- Earth is dynamic—not static
- **Gradualism (Hutton)**—Changes occur over time, slow but continuous/cumulative
- "Uniformitarianism Theory"(Lyell)—Geologic processes have always been the same; therefore, Earth is much older than 6,000 years old.



George Cuvier



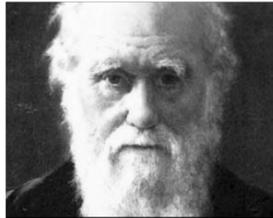
- Vertebrate zoologist; developed paleontology
- Used comparative anatomy to classify animals
- Fossils b/t strata were unlike those above & below
- **Catastrophism**—mass extinctions occurred after major catastrophes and the emergence of new populations made it appear that species change over time

Alfred Wallace

- **best known for his theory of natural selection**
- While exploring the Amazon River, he noticed differences between animals in Australia and animals in Asia
- **Instead of sending his findings directly to the publishers, he sent it to Darwin first, which led Darwin to go ahead and publish his findings (which were very similar—birds on Galapagos Islands)**
- **Greatest accomplishment? Getting Darwin to publish his work**

Charles Darwin

- **Natural Selection** explains how adaptations can lead to a change in a population over time.
- Evolution is measured as a change in allele frequency w/in a large population
- Changes would result in differential survival rates of the members of the population that are better suited for their environment.



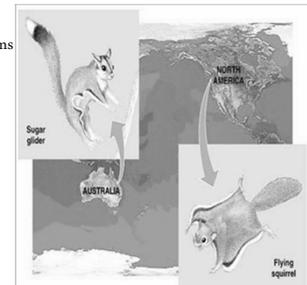
Natural Selection

- In most species, the survival rates of individuals is relatively small. Most populations are stable
- Variations among individuals in populations exist. Most variations are inheritable and increase reproduction rates.
- “Struggle for existence”—limited resources & growing population
- Inherited favorable characteristics become more common between generations. (Descent w/ modification)

Evidences to Support Darwinian Evolution

Biogeography

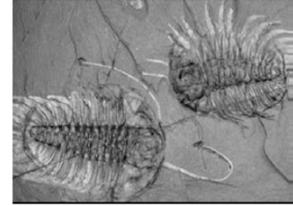
- Study of distribution of organisms
- Related organisms are found living close to one another.



The Fossil Record

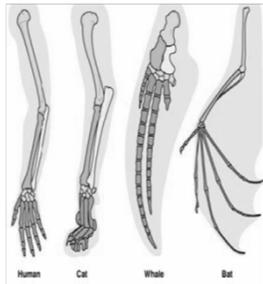
- Provides evidence that the variety of species that has inhabited the Earth has changed over time.
- Fossil—
- Found in sedimentary rock
- Strata—
- Each layer has its own type of fossils
- Fossils at lowest level=oldest

- Transitions between layers...probably mass extinctions...form basis for dividing time.
- Relative Dating
- Absolute Dating



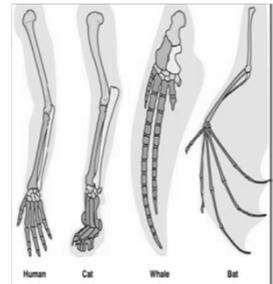
Comparative Anatomy

- Comparing structures leads to evolutionary r'ships
- Similar structures=common ancestor
- Changes in structure occur due to selective environmental pressures.



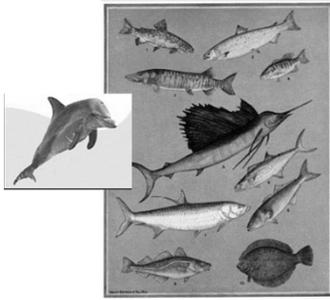
Comparative Anatomy

- Homologous—evolved from a common structure; same structure/different function
- Ex. Forelimb of human, bird, whale, dolphin, bat



Comparative Anatomy

- Analogous—different structure/similar function
- NO evolutionary r'ship
- Different origin
- Convergent Evolution
- Ex. Dolphins/fish

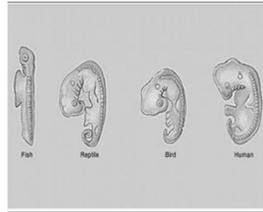


Comparative Anatomy

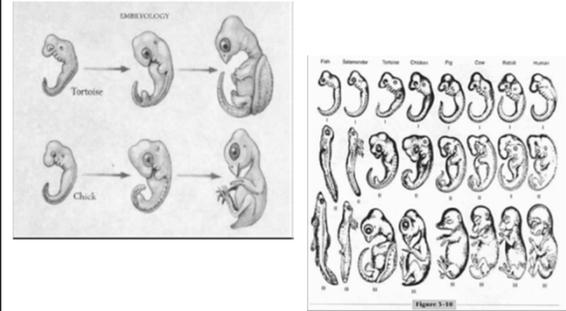
- Vestigial Structures—once served a function in ancestors, but have been reduced (s & f) in the descendent.
- Ex. Appendix, hind legs of whales/snakes

Comparative Embryology

- Comparing the stages of development
- Comparing the general appearance of embryos at various stages of development



Comparative Embryology



Molecular Biology

- Comparing DNA and amino acid sequences in proteins of various species
- Closely related species have more similar DNA/protein sequences

Table 22.1 Molecular Data and the Evolutionary Relationships of Vertebrates

Species	Number of Amino Acids That Differ from a Human Hemoglobin Polypeptide (Total Chain Length = 166 Amino Acids)
Human	0
Rhesus monkey	8
Moose	27
Chicken	45
Frog	67
Lamprey	125

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Evolutionary relationships among species are documented in their DNA & proteins