Charles Darwin and The Origin of Species

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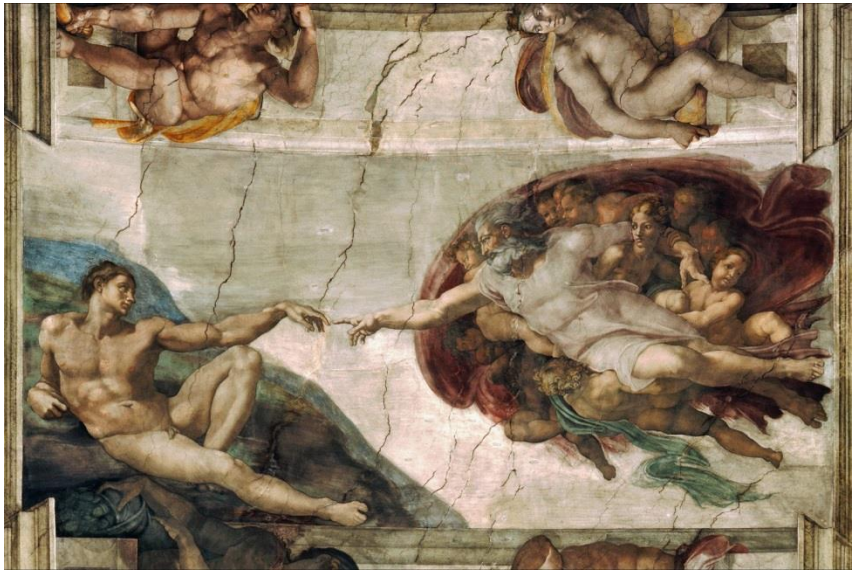
Pre-Darwinian view of Life:

- Creationism
- Perfect and constant forms
- Purposeful and Designed



Swedish Botanist, Carolus Linnaeus

- 1735, *Systema Naturae, classified all plants and animals according to physical appearance and method of reproduction*
- Binomial naming system (genus, species); eg., Homo Sapiens
- Each genus could have many different related species
- Man was classed with the primates, which was controversial
- http://anthro.palomar.edu/evolve/evolve_1.htm

Comte de Buffon, late 18th century

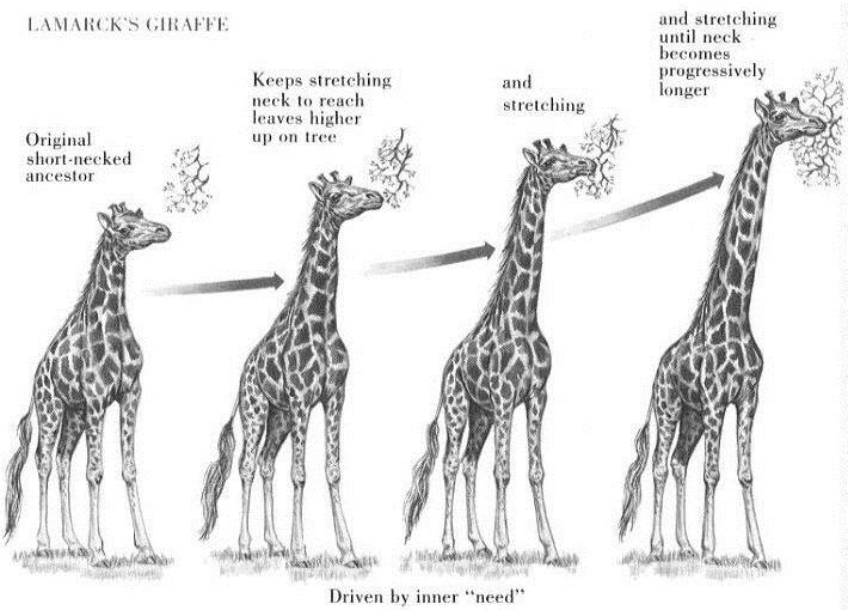
- French mathematician and naturalist
- Said that living things do change over time
- Influence of environment or chance
- Each must be older than 6000 years (75, 000)
- Advocated that species could change over time, but rejected idea that one species could change into another

Erasmus Darwin

- Charles' grandfather
- Evolution occurred in living things, including humans
- Did not understand the mechanism of change

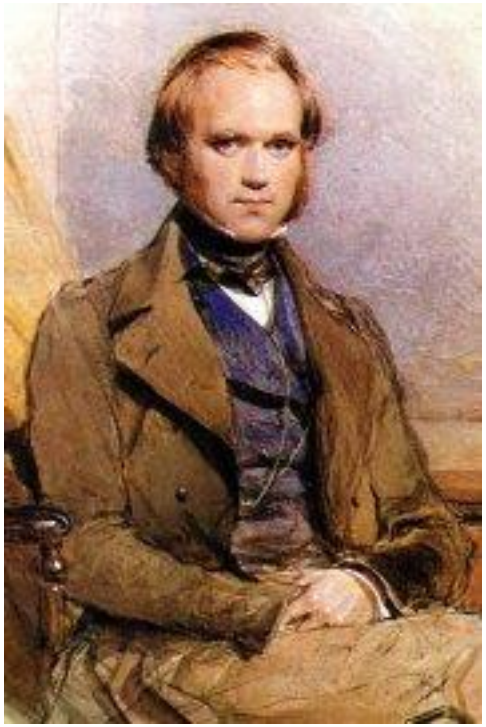
Jean-Baptiste Chevalier de Lamarck

- First to publicly assert ideas about biological change
- His theory of the process was wrong, however
- Spontaneous generation of microscopic life; constant evolution toward more complex forms, culminating in Man
- Inheritance of acquired characteristics
- Form changes by environmental Need; then this new form is inheritable by subsequent generations
- Giraffe and Long Neck



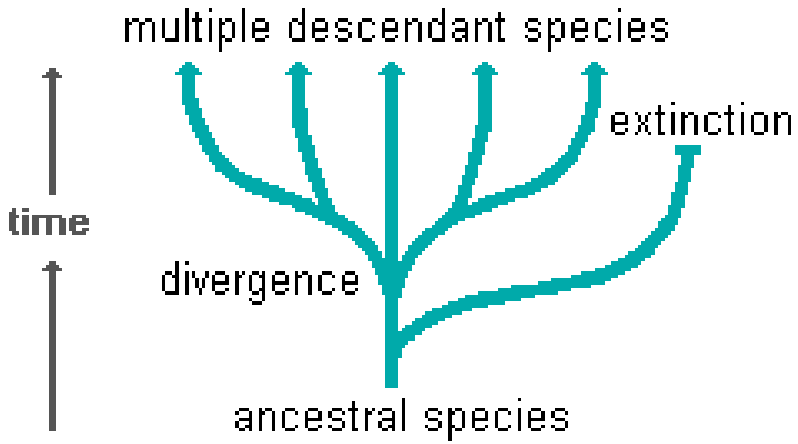
Charles Darwin

- Father was a doctor and mother was from Wedgwood family ($)
- Went to Edinburgh university to become a doctor but dropped out
- Went to Cambridge to become a minister; exposed to biology
- At 22 years of age, sailed on the Beagle as unpaid Naturalist
- Galapagos Islands: 13 species of Finches



Adaptive Radiation

- One species from mainland evolved into many descendent species
- Different environmental conditions on each island
- Different beak size and shape adapted to different food types



Descent with Modification

- Darwin noticed that individuals possessed different traits
- These traits could be passed on to subsequent generations
- Those individuals successful at surviving and reproducing would pass on their traits in greater numbers
- Over time, the species would change to reflect this modification

Natural Selection

- The process that explained the mechanism driving change
- One finch has a beak that is adapted to getting nectar from cactuses
- Another finch has a beak better suited to getting nectar from a flower
- In a given environment, one beak type will predominate as those birds get more food and are more attractive partners, reproducing more
- Unlike Lamarck, the environment didn't produce the change; the variation was already there in the population and the environment created the pressure that allowed one physical characteristic to prosper while another became extinct
- http://media.hhmi.org/fittest/natural_selection.html

Darwin understand Natural Selection but not Genetic Inheritance

- “The laws governing inheritance are quite unknown; no one can say why the same peculiarity in different individuals of the same species, and in individuals of different species, is sometimes inherited and sometimes not so; why the child often reverts in certain characters to its grandfather or grandmother or other much more remote ancestor;…” (76)
- The genetic process of inheritance would not be explained until Gregor Mendel

Variation in Domestic Species

- Darwin observed how species could change through selective breeding techniques
- “One of the most remarkable features in our domestic races is that we see in them adaptation, not indeed to the animal’s or plant’s own good, but to man’s use or fancy.” (89)

“Struggle for Existence”

- “I use the term Struggle for Existence in a large and metaphorical sense, including dependence of one being on another, and including (which is more important) not only the life of the individual, but success in leaving progeny.” (116)
- Over population spurs struggle for existence

Natural Selection Summarized (169)

- “If during the long course of ages and under varying conditions of life, organic beings vary at all in the several parts of their organization, and I think this cannot be disputed; if there be, owing to the high geometrical powers of increase….a severe struggle for life…then, considering the infinite complexity of the relations of all organic beings to each other and to their conditions of existence, causing an infinite diversity in structure, constitution, and habits, to be advantageous to them, I think it would be a most extraordinary fact if no variation ever had occurred useful to each being’s own welfare, in the same way as so many variations have occurred useful to man. But if variations useful to any organic being do occur, assuredly individuals thus characterized will have the best chance of being preserved in the struggle for life; and from the strong principle of inheritance they will tend to produce offspring similarly characterized. This principle of preservation, I have called, for the sake of brevity, Natural Selection.”
- Sexual selection magnifies the effects of natural selection by promoting the reproduction of those who are most successful in the struggle for life.

How Do We Know That Evolution Has Occurred?

- The evidence for evolution has primarily come from four sources:

1. the fossil record of change in earlier species

2. the chemical and anatomical similarities of related life forms

3. the geographic distribution of related species

4. the recorded genetic changes in living organisms over many generations

http://anthro.palomar.edu/evolve/evolve_3.htm

Challenge of Evolution

- a. Change challenges our desire for stability
- b. Man is not the focal point of Creation
- c. Man is an animal
- d. God is not essential to Physical World

Societal Response

- Religious condemnation as atheism
- Scientific support largely
- June 30, 1860: debate at British Association for the Advancement of Science; Bishop Samuel
- Wilberforce and T.H. Huxley, biologist
- Bishop asked Huxley whether he was descended from a monkey on his grandmother's side or his grandfather's.
- He responded he would rather have an ape for a grandfather than disrupt a scientific debate with personal attacks

Social Darwinism

- Problematic
- Survival of the fittest never used by Darwin; cannot be used to justify moral or ethical
- behavior or rules
- Darwin's vision: survival of those best adapted
- Eugenics: problem is that you can't predict future challenges or define what human is most fit
- Evolution is not about change from lesser to greater or worse to better; it is simply change in response to conditions
- Evolution is properly used to describe species and not individuals

Modern Darwinian Implications

- Modern Biology is dependent upon the Theory of Evolution
- Fly vaccine must be redesigned each year due to evolution of flu
- Pesticide resistant pests
- Aids virus mutates and drugs stop working
- Medicine become obsolete as bacteria and viruses evolve: use the whole prescription of antibiotics because you want to kill as many bacteria as possible and not allow some to survive and gain resistance
- Bacterial resistance to penicillin
- Malaria and mosquitoes—as mosquitoes evolve we find it harder to eradicate them and malaria spreads