

CIVILIZATION SEQUENCE PROGRAM (CVSP 204)
DARWIN, DARWINISM AND EVOLUTION

I. CHARLES DARWIN (1809-1882)

1831-1836: Voyage on HMS *The Beagle*

1858: Two manuscripts by Darwin and Wallace proposing the same concept of ‘natural selection’ presented at the meeting of the Linnaean Society of London.

1859: Publication of the first edition of “*On The Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*’.

Four principal postulates of Darwin’s theory were:

1. **Non-constancy of species**; “descent with modification”; world is not static but evolving; living things, as reflected in the fossil record, change over time.
 - Concept dates back to ancient Greek philosopher Anaxiamander (611-547 B.C.) and the Roman philosopher Lucretius (99-55 B.C.), who had suggested that all living things were related and they had changed over time.
 - Supported by palaeontology: fossils (i.e. extinction and changes in organisms), despite gaps in the fossil record (“missing links”).
 - fossils regarded as *lusus naturae* or “jokes of nature”.);
2. **Gradualism**: Process of evolution is gradual and continuous.
 - Discordant with **catastrophism**: Buffon, 1799 and Cuvier, early 1800’s: species went extinct as a result of repeated catastrophes.
 - Concordant with **uniformitarian** concept in geology: the same processes are responsible for both past and present events:
 - Proposed by Hutton, 1788 (Earth is very old, “No vestige of a beginning, no prospect of an end”).
 - Supported by Charles Lyell, 1830-33- *Principles of Geology*
3. The notion of **branching**: Similar organisms, where related, are descendants from common ancestors; all living organisms might be traced to a single origin of life. rejects Aristotle’s linear *Scala naturae*
4. **Natural selection** is the mechanism of evolution: a two step process:
 - First step: production of variation.
 - Second step: Selection through survival in the struggle for existence.
 - Agreed with Lamarckian evolution (1744-1829) in terms of adaptation and gradual change,
 - Refuted Lamarckian evolution as a goal-oriented process, the principle of use and disuse and inheritance of acquired characteristics.
 - Influenced by Thomas Malthus 1798: *An Essay on the Principle of Populatin*, (as populations increase, their resources become scarcer and that leads to shortages of food, famine, diseases, war etc)

Early 1900’s: Mendelian Genetics, The science which plugs a hole in Darwin’s theory.

1930’s and 40’s: Dobzhansky, Huxley, Rensch, Simpson, Mayr and Stebbins): Neo-Darwinism, the “new synthesis” or Synthetic Theory of evolution.

EVIDENCE FOR EVOLUTION:

- Systematics (classification) and biogeography (geographical distribution of organisms).
- Comparative anatomy: homologous organs, vestigial organs
- Embryology (= development),
- Palaeontology (= study of fossils),
- Genetics, ecology and behavior,
- Artificial selection
- Molecular & biochemical processes: Common to all types of organisms:

- Nucleotides, proteins, lipids & carbohydrates, DNA & RNA have same constituents in all organisms.
- Genetic engineering: A protein from one organisms could be synthesized in another if its DNA portion is incorporated into the host's DNA.
- Observed evolutionary changes: evolution of antibiotic resistance in bacteria, resistance to pesticides, tolerance to pollutants etc.

THE IMPACT OF EVOLUTIONARY THEORY:

- 1) Evolutionary biology: New branch in Biology:
 - “There are no living sciences, human attitudes or institutional powers that remain unaffected by the ideas that were catalytically released by Darwin’s work” (Collins 1959).
 - “no biologist has been responsible for more drastic modifications of the average person’s worldview than Charles Darwin” (Mayr 2000).
 - Evolution: the organizing principle of biology. “Nothing in Biology makes sense except in the light of evolution.” (Dobzhansky 1973)
- 2) Philosophy of Biology: a new branch in the philosophy of science.
- 3) Rejecting all supernatural phenomena and causation.
 - Conflicts with prevailing beliefs and faith: uneasy relationship with religious establishments; attacks from “creationist science” and theories of ‘intelligent design’ etc.
- 4) Refuting typology with its emphasis on invariance and stability.
 - Introducing the new “population thinking” emphasizing variability and changeability.
- 5) Refuting teleology with its assertion of a “teleological force” driving towards ever greater perfection. (Aristotle’s teleology or “final cause”)
- 6) Refuting determinism; accepting the universality of randomness and chance.
- 7) A new view of humanity.
 - Anthropocentrism not reduced but enhanced (Man is indeed unique)
 - Human Evolution: biological and cultural.
- 8) Providing a scientific (biological) foundation for ethics.

Human cooperative and altruistic behaviors favored by natural selection, enhancing group survival; Selfishness implied in “social Darwinism” is not favored by natural selection.

 - Cooperation and altruism shown not only in many animals but also other organisms.

References/Suggested Readings

- Collins, J, 1959 - Darwin’s impact on philosophy. *Thought*. **34**:186-248.
- Dawkins, R., 2009 – *The Greatest Show on Earth, The Evidence for Evolution*. Transworld Publishers, London.
- Desmond, A. and J. Moore, 1992 – *Darwin*. Penguin Books, London.
- Dobzhansky, 1973 -Nothing in biology makes sense except in the light of evolution. *American Biology Teacher* **35**:125-129.
- Mayr, E. 2000 – Darwin’s Influence on Modern thought. *Scientific American* 283:79-83.
- Mayr, E. 2002- *What Evolution Is*. Basic Books,
- Renni, J. 2002- 15 Answers to creationist nonsense. *Scientific American, July 2002*: 78-85.
- Stix, G. 2009 - Darwin's Living Legacy. *Scientific American*. January 2009:38-43.
- Vuletic M.I. (Editor) – *The Talk-Origins Archive: Exploring the evolution/creation controversy*. http://www.talkorigins.org/origins/faqs-index.html#index_d
- University of Cambridge, 2002-2007-, *The Complete Works of Charles Darwin Online*. <http://darwin-online.org.uk>.