Introduction to Anthropology

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Evolution and Genetics

More Perspective
(Hubble Deep Field)

The Cosmic Calendar:
Carl Sagan, 1979

Evolution and Genetics

What is biological evolution?

pronunciation: /ˌeveˈlo͞oSHən/
function: noun

The process [now called "natural selection"] by which different kinds of living organisms are thought to have developed and diversified from earlier forms during the history of the earth.

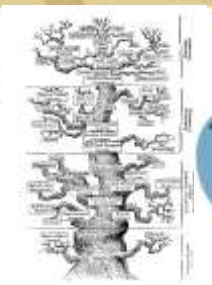
"Naturalistic" thinking is an idea that goes back at least to the 6th century BC, with the Greek philosopher Anaximander.

Evolution and Genetics

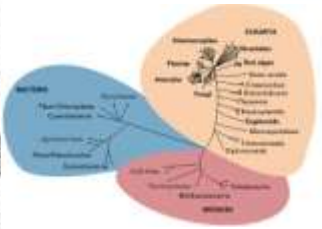
1. Notable Figures in Evolution

a. **1750: Linnaeus** – zoologic taxonomy (classification system)
b. **1800: Lamarck** – environment shapes organisms (giraffe example)
c. **1859: Darwin** – natural selection
d. **1866: Mendel** – inheritance
e. **1953: Franklin, Watson & Crick** – discover DNA

Evolution and Genetics



Linnaeus' "Tree of Life"



Contemporary Taxonomy

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2. Principles of Natural Selection
(Darwinian Evolution/ "Descent with Modification")

a. **Variation –** unique individuals;
b. **Inheritance –** traits come from ancestry/heritage;
c. **"Survival of the fittest"** *or*
"Differential Reproductive Success"
Genetic traits linked to survival are passed on.

A "gene" is a replicator of an organisms physical traits.
- Genes are copied from generation to generation.
- If a gene is positively linked to survival, the organism will reproduce and pass on that gene to its young.
- If a gene is negatively linked to survival, the organism will NOT reproduce, eliminating that trait from the "gene pool."

Evolution and Genetics

3. Why do scientists believe in evolution?
Evidence exists in many forms

a. Geology and the Geologic Record

i. **Fossils** show a **gradual increase in complexity (order)** with time;

ii. **Fossil evidence exists** *between* major groups of animals - so called **"missing links"** are well documented;

b. Radiography dating (Physics)

c. Comparative Anatomy (Biology)

d. Microevolution (Ecology)

e. Genetics (Microbiology)

Why then is evolution so controversial?

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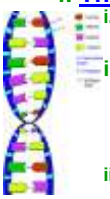
4. The Mechanism of Evolution: DNA



i. **Deoxyribonucleic acid** was discovered by Watson and Crick (w/ Franklin) in 1953;

ii. DNA is the "blueprint" for life; genes pass on our traits.

Genotype: gene "blueprint" in DNA strand
Phenotype: trait created in organism;

iii. **Dominant genes** express themselves at a **higher ratio** than **recessive genes** (**Mendels peas**)

iv. **Messenger RNA (mRNA) and ribosomes** produce the proteins that build the body.

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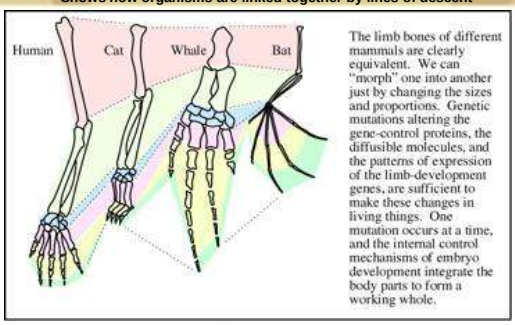
4a. Comparative Anatomy or "morphology" –

Shows how organisms are linked together by lines of descent



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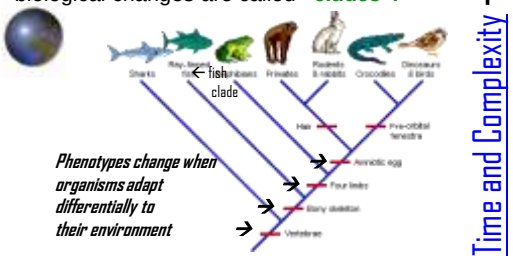
4b. Evolutionary changes take *lots of time:*

Lines of descent which describe and link biological changes are called **"clades".**



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4c. Species Differentiation (or *Speciation*)

Species Defined: A population that consists of organisms able to interbreed and produce fertile and viable offspring.

Genetic change alters the form of a species.

Sources of Genetic Change

i. **Recombination** – meiosis produces a random combination of traits from parents.
Hybridization*:* recombining DNA from 2 different species
ii. **Mutation** – alteration of DNA sequence.
iii. **Drift** – isolated populations may be missing a sequence inherent in the original population.
iv. **Flow** – decreases differentiation between populations.

Hominid Evolution

Where do HUMANS fit into this picture?