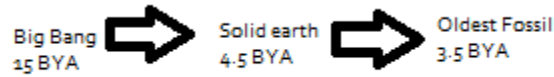


Evolution

Origin of Life



Evidence suggests organic macromolecules formed on early earth through natural atmospheric processes. RNA can form many shapes, store information, and act like an enzyme making it the first molecule of life allowing for biological evolution. The first true life was similar to bacteria. Eukaryotes formed through endosymbiosis.

Evolution A change in the allele frequencies of a population of organisms from generation to generation potentially causing new species to develop from preexisting species.

Endosymbiosis A theorized process in which early eukaryotic cells were formed from simpler prokaryotes

Mechanism for Evolution

Charles Darwin and Alfred Wallace concluded that biological evolution occurs as a result of natural selection- process in nature in which organisms possessing certain inherited traits are better able to survive and reproduce.

- **Individuals produce more offspring than can survive.** (Over reproduce)
- **Individuals are different.** (variation)
- **Offspring will compete for resources.** (some die)
- **Organisms with the best characteristics for their environment will survive and reproduce.** (make more babies)

If these four conditions are met, then the new generation of individuals will be different from the original generation in the frequency and distribution of traits.



Hardy-Weinberg Principle

The population will not change if the five factors below are true.

1. Random mating
2. No Selection
3. No Mutation
4. No Gene flow
5. Large population size

$$p+q=1$$
$$p^2+2pq+q^2=1$$

The equations above monitor allele frequency. Any change in allele frequency illustrates change in the population.

Allele Frequency The measure of the relative frequency of an allele at a genetic locus in a population; expressed as a proportion or percentage.

Other factors affect the genetic variability of a species

Founder Effect A decrease in genetic variation caused by the formation of a new population by a small number of individuals from a larger population.

Genetic Drift A change in the allele frequency of a population as a result of chance events rather than natural selection.

Isolating Mechanisms Features of behaviors, morphology, or genetics which serve to prevent mating or breeding between two different species.

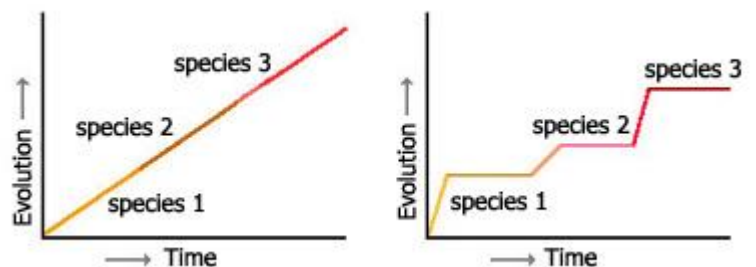
If sufficient time passes and there is significant change in genetic profile then speciation could occur.

Speciation A process typically caused by the genetic isolation from a main population resulting in a new genetically distinct species.

Rate of Evolution

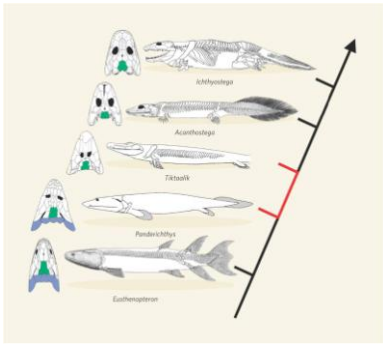
Gradualism A proposed explanation in evolutionary biology stating that new species arise from the result of slight modifications (mutations and resulting phenotypic changes) over many generations.

Punctuated Equilibrium A proposed explanation in evolutionary biology stating that species are generally stable over long periods of time. Occasionally there are rapid changes that affect some species which can quickly result in a new species.



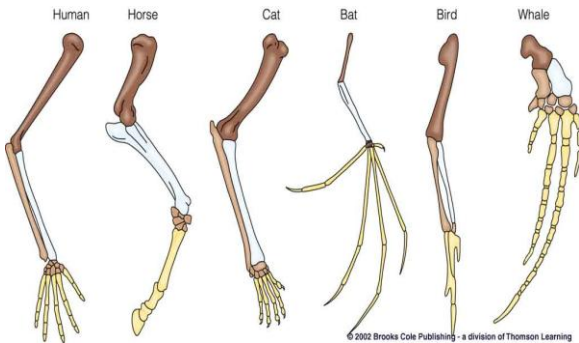
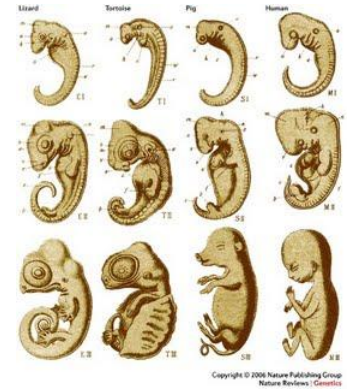
Evidence for Evolution

Evidence for evolution is based on **anatomy** (structures), **physiology** (functions) and **biochemistry** (DNA, RNA, or protein sequences) of organisms. In general, the more similarities two organisms share, the more recently they diverged from a common ancestor.



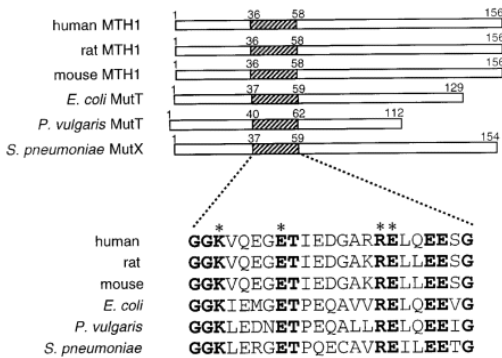
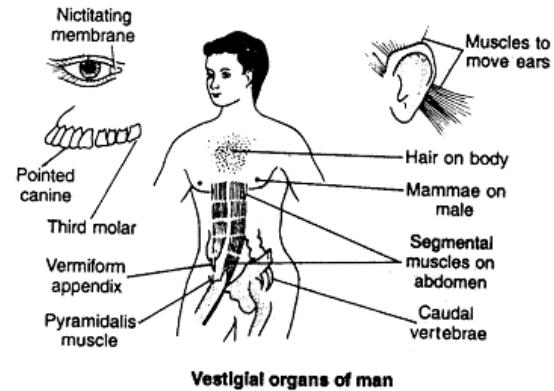
Fossils- remains of organism from the past can be linked to present day organisms.

Embryology- compares the development of embryos of different species to identify common patterns.



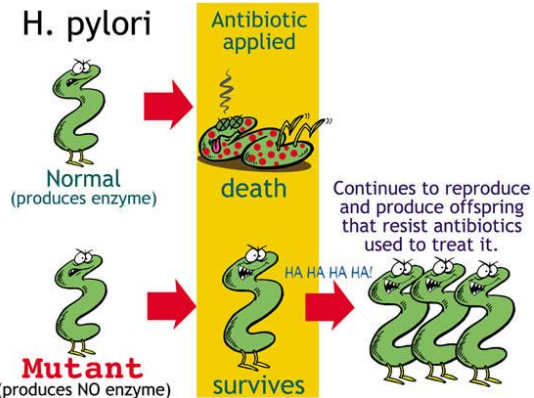
Homologous Structure-characteristic in different organisms that is similar because it was inherited from a common ancestor.

Vestigial Structure-characteristic in organisms that has lost its original function as a species has changed over time.



Biochemistry- compares the differences in either DNA or proteins. The more similar the more related.

Experimentation- intentional or accidental changes in bacteria or other organisms that result in significant changes.



Analogous Structure (similar in function but different in form and inheritance) are not evidence of speciation.

Outcomes of Evolution

Evolutionary changes result in unique organisms that continue to survive or go extinct. These organisms can be categorized and sub-categorized in the process known as taxonomy.

The taxa are: domain → kingdom → phylum → class → order → family → genus → species
To prevent confusion a unique scientific name (*Genus species*) is given to organisms.

Extinction- a species that no longer has any known living individuals.