TOPIC SIX: Evolution

A. Modern species evolved from earlier, different species and share a **common ancestor**.

B. Charles Darwin proposed that **natural selection** is the mechanism that causes species to change. The basic steps in natural selection are:

1. Overproduction of offspring. Offspring have variation.
2. Competition for limited resources. Variations affect outcome of competition.
3. Survival and passing on genes OR death and no passing on of genes.
4. Variations that are beneficial are passed on and become more common in a population. Those that are harmful become less common because they are not passed on.

C. *Fit* organisms are better adapted to their environment and able to successfully pass on their genes.

1. Unfit organisms usually die and do not pass on their genes, so their traits are eventually removed from the gene pool.
2. **Common mistake**: *Stronger organisms are more fit than weak ones.* Evolutionary fitness is not physical fitness. Fitness is determined by who is better adapted to survive in a particular environment and who can pass on their genes. Stronger is not always better.

D. Evolution is usually driven by a change in the environment. This includes a change in the organisms living in the environment (such as a new species moving into the area).

E. Species that cannot adapt to changes in their environment become extinct.

1. Species with little or no variety have a more difficult time adapting to new environments, and are thus more likely to become extinct than those species with greater variety among individuals.
2. **Common mistake:** *The animal could not adapt and it went extinct.* Individual organisms die; they cannot go extinct. Only species can become extinct.

F. To evolve, variations must exist in a species BEFORE the environment changes (pre-adaptation).

Common mistake: *Giraffes got long necks because they <u>needed</u> them to eat leaves at the tops of trees.* Species do not evolve traits because they need them. Short necked giraffes were never given long necks – they were out-competed by longer necked giraffes. Better

answers are *Giraffes evolved long necks because the ones with longer necks were better adapted to get food than short neck giraffes;* or *Giraffes evolved long necks because more short necked giraffes died, and more long neck giraffes lived and reproduced.*

G. Variations exist primarily as the result of sexual reproduction and mutation.

H. Species with more variation are better able to survive environmental changes than species with little diversity.

I. Gradualism is the idea that says evolutionary change occurs slowly. **Punctuated equilibrium** says evolution happens in *quick* bursts.

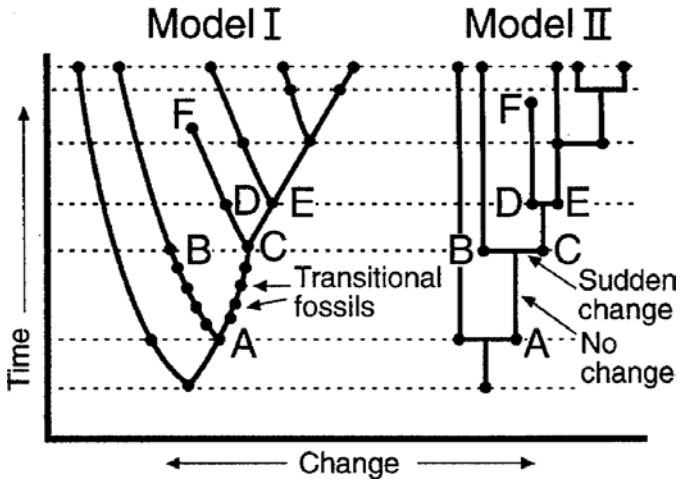
J. Creation of new species usually requires **geographic isolation** which eventually results in **reproductive isolation.**

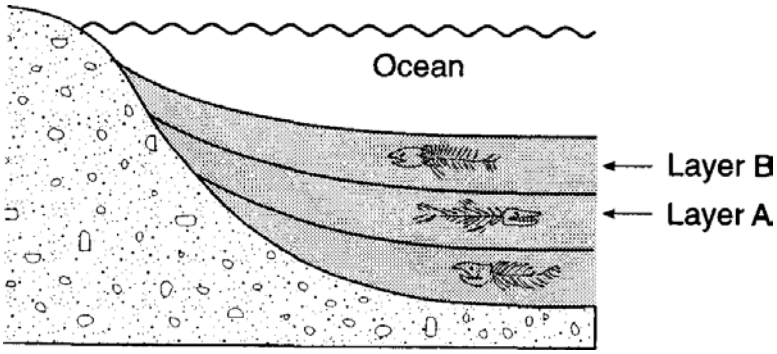
K. Evidence in support of evolution comes from the fields of geology (fossil record and radioactive dating), genetics, biochemistry, anatomy and embryology (among others).

L. Classification – Organisms are classified based on their evolutionary relationship.

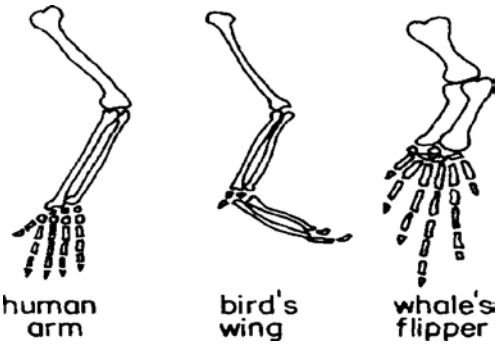
1. **<u>Kingdoms</u>** are large groups of related organisms (fungi, bacteria, protists, animals, plants).
2. A **<u>species</u>** is able to successfully reproduce amongst its members.
3. Branching tree diagrams (cladograms) are often used to show evolutionary relationships.

Gradualism (Model I) vs.
Punctuated Equilibrium (Model II)



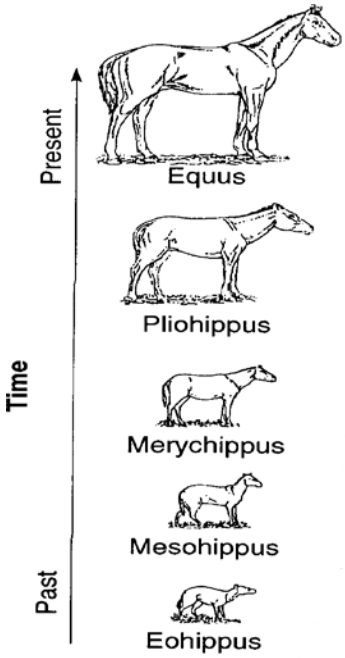


Deeper fossils are typically older than those above them.

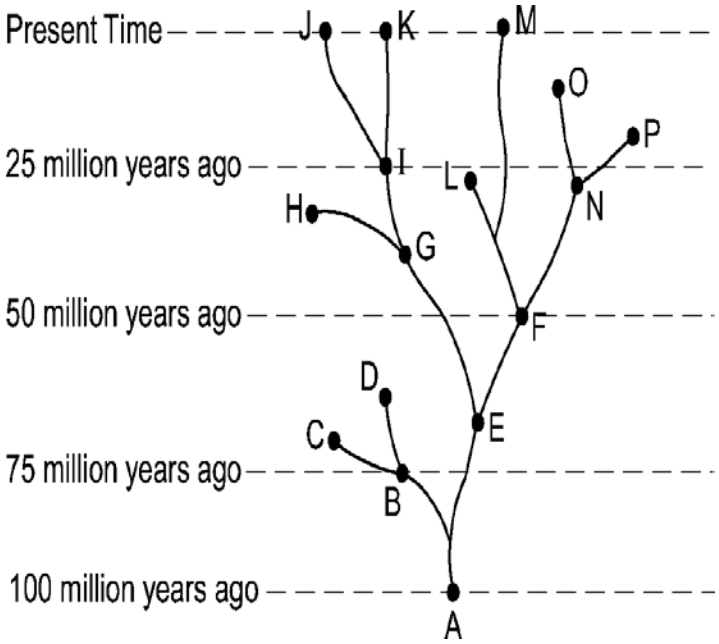


Homologous Structures reveal that the same body parts can be modified to perform different functions.

Transitional forms for many species can be found in the fossil record. This diagram shows the evolution of the modern horse from a small, many-toed ancestor.



Evolutionary trees can show the relationship between living and extinct species.



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