Cladistics Encyclopedia Article

Cladistics

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Cladistics

Cladistics, also known as **phylogenetic** systematics, is the study of the evolutionary history of relationships among organisms based on similarities derived from a common ancestor. The recency of a common ancestor is recognized by genealogical relationships. Through the use of **genetics**, scientists can determine the genealogical relationships among organisms in order to establish how genetically related one group of organisms is to another. In 1950, Willi Hennig established this taxonomic theory that is based on the principle of common descent.

Cladistics can be used to reconstruct the evolutionary history of organisms in a branching diagram called a cladogram. The cladogram uses shared derived traits called synapomorphies to represent evolutionary relationships of organisms. Groups of organisms called clades consist of all the **species** descended from a single point or node on the cladogram. The point at which the diagram branches represents a common ancestor that has synapomorphies inherent to all organisms above the node. Clades that are located more closely together on a cladogram share a more recent common ancestor than clades farther apart.

Just because two organisms have similar traits, however, does not necessarily mean that they descended from a common ancestor. For example, the wings of a bird and the wings of a bat both function to help the organism fly; however, the two sets of wings are built differently and evolved independently. Traits that are similar but did not evolve from a common ancestor are known as analogous traits and are the result of convergent **evolution** often because organisms live in similar environments.

Traits or structures that have evolved from a common ancestor but do not necessarily have the same function are known as homologous structures. In order to reconstruct the evolutionary history of organisms, scientists must be able to distinguish the difference between analogous and homologous structures. One way scientists can determine whether structures are analogous or homologous is through molecular biology. Molecular analysis has been used since 1970 to hypothesize the evolutionary history of organisms. Molecular structures have been used to determine the relatedness of organisms. For example, scientists theorize that all life has evolved from a single celled organism because the structure of certain **enzymes** used in **cell** metabolism is similar in all living things. Recently, scientists have started examining the order of **nucleotide bases** in **DNA** molecules to compare genetic characteristics in organisms.