

Phylogenetics Terminology

(modified from U Columbia, UC Berkeley, Wiley 1981 and other sources)

adaptation - Change in an organism resulting from natural selection; a structure which is the result of such selection.

anagenesis – (Micro) evolutionary change along an unbranched lineage; change without speciation.

ancestor - Any organism, population, or species from which some other organism, population, or species is descended by reproduction.

ancestral - Describes a character state that is present in the common ancestor of a clade. An ancestral character state is inferred to be the original condition of that character within the clade under consideration. For example, "presence of hair" is an ancestral character state for all mammals, whereas the "hairlessness" of whales is a derived state for one subclade within the Mammalia.

character - Heritable trait possessed by an organism and assumed homologous across taxa; e.g., "hair".

character states - alternative forms of a character across taxa: "hair present" vs. "hair absent," where "hair" is the character, and "present" and "absent" are its states.

clade - A monophyletic taxon; a group of organisms which includes the most recent common ancestor of all of its members and all of the descendants of that most recent common ancestor. From the Greek word "klados," meaning branch or twig.

cladogenesis - The development of a new clade; the splitting of a single lineage into two distinct lineages; speciation.

cladogram - A diagram, resulting from a cladistic analysis, which depicts a hypothetical branching sequence of lineages leading to the taxa under consideration. The points of branching within a cladogram are called nodes. All taxa occur at the endpoints of the cladogram.

convergence - Similarities which have arisen independently in two or more organisms that are not closely related. Homoplasy, contrast with homology.

crown group - All the taxa descended from a major cladogenesis event, recognized by possessing the clade's synapomorphy. See: stem group.

derived - Describes a character state that is present in one or more subclades, but not all, of a clade under consideration. A derived character state is inferred to be a modified version of the ancestral condition of that character, and to have arisen later in the evolution of the clade. For example, "presence of hair" is an ancestral character state for all mammals, whereas the "hairlessness" of whales is a derived state for one subclade within the Mammalia.

diversity - Term used to describe numbers of taxa or variation in morphology.

endosymbiosis - When one organism takes up permanent residence within another, such that the two become a single functional organism. Mitochondria and plastids are believed to have resulted from endosymbiosis.

evolution - Darwin's definition: descent with modification. The term has been variously used and abused since Darwin to include everything from the origin of man to the origin of life.

evolutionary tree - A diagram which depicts the hypothetical phylogeny of the taxa under consideration. The points at which lineages split represent ancestor taxa to the descendant taxa appearing at the terminal points of the cladogram.

extinction - When all the members of a clade or taxon die, the group is said to be extinct.

gradualism - A model of evolution that assumes slow, steady rates of change. Charles Darwin's original concept of evolution by natural selection assumed gradualism. Contrast with punctuated equilibrium.

homology - Two structures are considered homologous when they are inherited from a common ancestor which possessed the structure. This may be difficult to determine when the structure has been modified through descent. The term holds both for characters as well as character states.

hypothesis - A concept or idea that can be falsified by various scientific methods.

ingroup - In a cladistic analysis, the set of taxa which are hypothesized to be more closely related to each other than any are to the outgroup.

lineage - Any continuous line of descent; any series of organisms connected by reproduction by parent of offspring; an internal branch in a cladogram.

monophyletic - Term applied to a group of organisms which includes the most recent common ancestor of all of its members and all of the descendants of that most recent common ancestor. A monophyletic group is called a clade.

nomenclature - The naming of groups of organisms; a process that interacts with classification.

outgroup - In a cladistic analysis, any taxon used to help resolve the polarity of characters, and which is hypothesized to be less closely related to each of the taxa under consideration than any are to each other.

paraphyletic - Term applied to a group of organisms which includes the most recent common ancestor of all of its members, but not all of the descendants of that most recent common ancestor.

parsimony - Refers to a rule used to choose among possible cladograms, which states that the cladogram implying the least number of changes in character states is the best.

phenetic – (Classification) based on overall similarity without regard to polarity.

phyletic (evolutionary) taxonomy - Based on intuitive, subjective criteria.

phylogenetics - Genealogical relationships and representation (classification) of branching order in strict sense; evolutionary history of a group in broad sense.

phylogeny - The evolutionary relationships among organisms; the patterns of lineage branching produced by the true evolutionary history of the organisms being considered.

plesiomorphy – An ancestral character state for the taxa under consideration.

polarity of characters states - The states of characters used in a cladistic analysis, whether ancestral or derived. Ancestral characters are those acquired by an ancestor deeper in the phylogeny than the most recent common ancestor of the taxa under consideration. Derived characters are those acquired by the most recent common ancestor of the taxa under consideration.

polyphyletic - Term applied to a group of organisms which does not include the most recent common ancestor of those organisms; the ancestor does not possess the character shared by members of the group.

punctuated equilibrium - A model of evolution in which change occurs in relatively rapid bursts, followed by longer periods of stasis.

radiation - Event of rapid cladogenesis, believed to occur under conditions where a new feature permits a lineage to move into a new niche or new habitat, and is then called an adaptive radiation.

rank - In traditional taxonomy, taxa are ranked according to their level of inclusiveness. Thus a genus contains one or more species, a family includes one or more genera, etc.

relatedness - Two clades are more closely related when they share a more recent common ancestor between them than they do with any other clade.

reticulation - Joining of separate lineages on a phylogenetic tree, generally through hybridization or through lateral gene transfer. Although probably fairly common in certain land plant clades, reticulation is thought to be rare among metazoans.

selection - Process which favors one feature of organisms in a population over another feature found in the population. This occurs through differential reproduction - those with the favored feature produce more offspring than those with the alternate feature, such that they occupy a greater percentage of the population in the next generation. Evolution occurs if the feature is heritable.

sister group - The two clades resulting from the splitting of a single lineage.

stasis - A period of little or no discernible change in a lineage.

stem group - All the taxa in a clade preceding a major cladogenesis event. They are often difficult to recognize because they may not possess synapomorphies found in the crown group.

synapomorphy - A character state that is derived, and because it is shared by the taxa under consideration, is used to infer common ancestry.

systematics - Field of biology that deals with the evolution and historical genealogical relations of organisms.

taxon - Any named group of organisms with a proper name, not necessarily a clade.

taxonomy - Description and order; theory of organismal classification.

vicariance - Speciation which occurs as a result of the separation and subsequent isolation of portions of an original population.