



Phylogenetic definitions of taxonomic groups

Terminology

Clade – a group composed of an ancestor and all of its descendants.

Monophyletic group – a group composed of an ancestor and all of its descendants (=clade). [Example:](#) Reptilia is a monophyletic group if (and only if) it includes birds.

Paraphyletic group – a group composed of an ancestor and only some of its descendants, where the missing ones have been placed in another group. [Example:](#) “Reptilia” is a paraphyletic group if birds are excluded from it. The names of paraphyletic groups are often placed in quotation marks by convention.

Taxon – a named group and its constituent members. Normally a taxon will be a named clade.

Phylogenetic definition (of a group) – a definition for a group that is based on common ancestry. [Example 1:](#) Tetrapoda is the group composed of the last common ancestor of living amphibians and amniotes and all taxa more closely related to that clade than to lungfish.

Character-based definition (apomorphy-based definition) – a definition for a group where membership is defined by possession of a derived trait. [Example 2:](#) Tetrapoda is the group containing living amphibians and amniotes that have evolved digits on the fore and hind limbs.

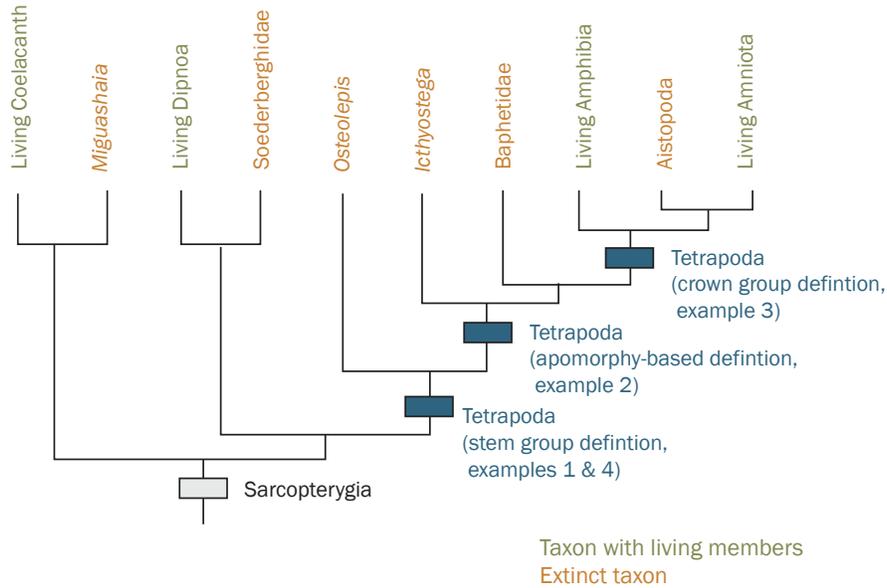
Diagnosis – the characters that can be used to recognize members of a group, regardless of how the group is defined.

Crown group definition – a phylogenetically defined group that is composed of all the descendants of the last common ancestor of the living members of the group. [Example 3:](#) Tetrapoda is the group consisting of the last common ancestor of living amphibians and amniotes and all the descendants of that ancestor.

Stem group definition – a phylogenetically defined group that is composed of all the taxa that are more closely related to the living members of the group than to the living members of other groups. [Example 4:](#) Tetrapoda is the group of taxa more closely related to living amphibians and amniotes than to lungfish or coelacanths.

Competing Definitions are Different

The different definitions of Tetrapoda given as examples above are competing definitions that refer to slightly different groups. If one was only concerned with living animals the definitions would be the same; where they differ is in which fossils are technically inside the group and which are outside.



Note that the following diagram has exactly the same meaning as the one above, but the groups are shown as brackets encompassing the group members instead of as bars located at the base of the group. If the difference is confusing, you might benefit from reading Gregory, T.R. (2008), "Understanding evolutionary trees", *Evolution Education Outreach*, 1: 121-137 (posted on OnCourse).

