

Numerical Taxonomy Example:

Taxon	Character					
	1	2	3	4	5	6
A	0	0	0	0	0	0
B	0	1	1	1	0	1
C	0	1	0	1	1	1
D	0	1	0	1	1	1
E	0	1	1	1	0	1

0= character absent
1= character present

This would lead to the following similarity matrix:

	A	B	C	D	E
A		2	2	2	2
B			4	4	6
C				6	4
D					4

(count up how many characters are shared)

Or, equivalently, the following distance matrix:

	A	B	C	D	E
A		4	4	4	4
B			2	2	0
C				0	2
D					2

This leads to the following relationships ((B,E), (C,D), A)

Compare Cladistic vs. Numerical Taxonomy:

	backbone	legs	warm blooded	deterministic growth	larvae
insect	0	0	0	0	1
starfish	0	0	0	0	1
fish	1	0	0	0	1
lizard	1	1	0	0	0
bird	1	1	1	1	0
mammal	1	1	1	1	0

Distance matrix:

	Insect	fish	lizard	bird	mammal	starfish
insect		1	3	5	5	0
fish			2	4	4	1
lizard				2	2	3
bird					0	5
mammal						5

Shared Derived Characters:

	insect	fish	lizard	bird	mammal
starfish		0	0	0	0
fish			1	1	1
lizard				3	3
bird					5

Evolution and Development

Ontogeny: The course of an *individual's development* from a fertilized egg to death.

Phylogeny: The *pattern and history of evolution* within a group of related organisms. Often depicted as a “tree”.

Isometry: Parts grow at same rate.

Allometry: Different parts grow at different rates.

Heterochrony: Evolutionary shape changes resulting from changes in developmental rate and/or timing.

Paedomorphosis: retention of embryonic or larval characteristics by adults.

Peramorphosis: evolution of shape changes by extending development beyond typical adult form.

Cladospeak

Classification: Identifying and naming taxa, arrangement into hierarchic groups (e.g., species, genera, families).

Phylogeny: The evolutionary relationships among taxa.

Systematics: The process by which phylogeny is inferred.

Character – a recognizable attribute of an organism

Binary character – a character that is present or absent (0 or 1)

Transformation series – a character that has a graded series of states (eg., 0,1,2,3,...,N)

Apomorphy – a derived or specialized character.

Plesiomorphy – a primitive or ancestral or unspecialized character.

Prefixes: **Syn- / Sym-** shared with another group

Aut- contained only by that group

Monophyletic—a group of organisms that includes the ancestor and all the descendants.

Paraphyletic—a group of organisms that includes the ancestor and only a few of the descendants

Polyphyletic – a group of organisms that does not include the most recent common ancestor.

Homology—similarity in structure resulting from common ancestry.

Homoplasy—similarity in structure due to anything but common ancestry.

Convergence—the independent acquisition of similar structures within different groups.

Parallelism—acquisition of similar structures in closely related groups due to similarity in developmental machinery.

Parsimony—The principle that all things being equal, the simplest explanation is the best. In phylogenetics, the principle that the number of evolutionary changes should be minimized.

Polarity—the direction of evolutionary change.

Outgroup—a taxon falling outside of the group of interest (**ingroup**).

Outgroup Comparison—method of determining polarity; the character states displayed by outgroup are assumed to be primitive for the group being analyzed.

Cladogram—a diagram showing taxa arranged into monophyletic groups on the basis of synapomorphies,

or the distribution of synapomorphies among taxa. Cladograms do not include a timescale.

Node: a point on a tree where two branches diverge.

Internode—the segment of a tree between two nodes.

Unresolved node—a node in which three or more branches diverge

Sister taxa—two taxa that are more closely related to each other than to any other taxon.

Crown group—a monophyletic group including the most recent common ancestor of two distinated living taxa and all its descendants, thereby excluding extinct sister taxa in the same clade.