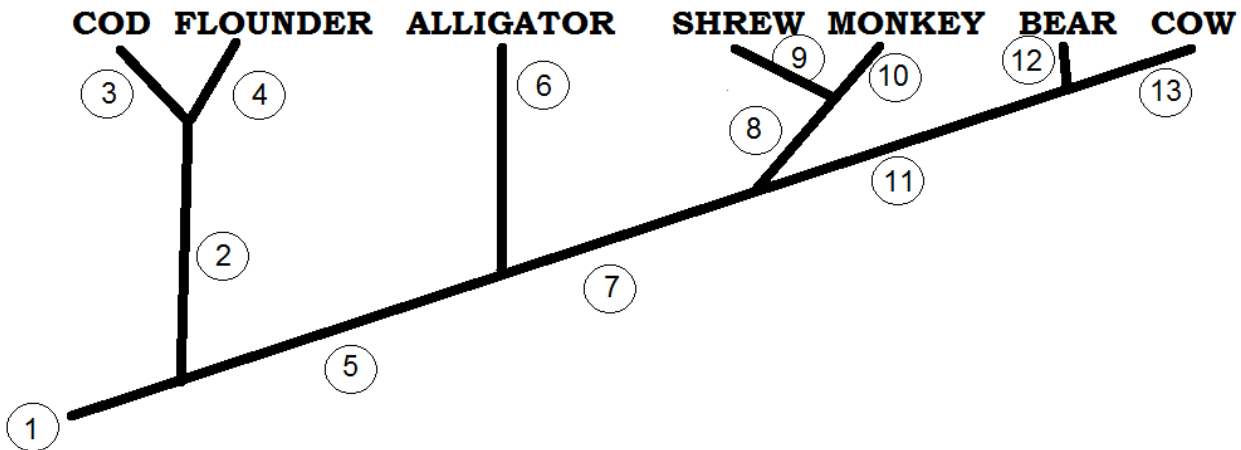


DRAWING CLADOGRAMS

1. A cladogram is a **HYPOTHESIS** about evolution; it does not **PROVE** anything.
2. Cladograms branch. They may branch equally or unequally, with many species or few (or just one) on each branch. You cannot assume any particular branching pattern until you have data.
3. Living species belong on the branch tips, not at the nodes (branching points). (A species can only be at a node if it is an ancestor to others; that usually means it is extinct.)
4. You may want to list all primitive traits (plesiomorphies) at the root of the tree.
5. It is a good idea to mark **APOMORPHIES** (derived traits) along the tree, either with words or with numbers keyed to a legend (like 7=hair). See the example below.
6. If an apomorphy is shared among two or more species, then it is a **SYNAPOMORPHY** (=homology) and represents a shared resemblance inherited from a common ancestor. On the example below, traits listed at 2, 5, 7, 8, and 11 are synapomorphies (shared resemblances reflecting shared ancestry).
7. Shared absence of an apomorphy (like "no hair") is a **SYMPLESIOMORPHY** and has no relevance in classification.
8. A trait derived more than once independently (like fins in whales and in fishes or wings in birds and butterflies) is a **HOMOPLASY**. Homoplastic traits (=analogies) evolve by convergence and are misleading in making a classification.
9. It is a good idea to write the names of species one way (suggestion: large, bold) and descriptions of traits another way (suggestion: smaller, not bold). Also, if any lines are used for labels they should be thinner than the lines used to show descent.

EXAMPLE:



- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Primitive traits:
gills, fins, symmetrical body;
no legs, lungs, hair, claws, or hoofs 2. Bony scales 3. Streamlined body; tail fin vertical 4. Flattened, asymmetrical body 5. Four legs, lungs, claws;
gills & fins lost 6. Powerful jaws, flat head | <ol style="list-style-type: none"> 7. Hair, mammary glands 8. Wide range of shoulder movement;
fingers move individually 9. Reduced size; teeth very compressed 10. Opposable thumb; climbs trees 11. Larger size; reduced shoulder flexibility 12. Meat-cutting teeth; powerful jaws 13. Claws become hoofs; grinding teeth |
|--|---|