TERMS AND CONCEPTS

PRIMITIVE AND ADVANCED CHARATERS

Sporne (1948) used the term "**primitive character**" to mean one which is possessed by a present-day taxon and was also possessed by its ancestors.

An "**advanced character**," on the other hand, is one possessed by a present-day taxon and not possessed by its ancestor, that is, it replaced an ancestral character during evolution.

Hutchinson classified the plants on the basis of primitive and advanced characters.

Some primitive Characters of Angiosperm

- Dicot plant
- Leaf arrangement: simple, alternate, stipulate
- Bisexual flowers
- Inflorescence: Solitary, terminal

Some advanced Characters of Angiosperm

- Monocot plant
- Leaf arrangement: Opposite
- Unisexual flowers
- Inflorescence: Umbel, Capitulum

HOMOLOGY AND ANALOGY

These terms were first used and defined by **Owen (1848).** He defined **Homology** as the occurrence of the same organ in different animals under every variety of forms and functions. He defined **Analogy** as the occurrence of a part or an organ in one animal which has the same function as another part or organ in a different animal. If applied to plants, the rhizome of ginger, the corm of colocasia, tuber of potato, and runner of lawn grass are allhomologous, as they all represent a stem.The tuber of potato and the tuber of sweet potato, on the other hand, are analogous as the latter represents a root.

PARALLELISM AND CONVERGENCE

Simpson (1961) defined **parallelism** as the independent occurrence of similar changes in groups with a common ancestry, and because they had a common ancestry. The two species *Ranunculus tripartitus* and *R. hederacea* have a similar aquatic habit and dissected leaves and have acquired these characters by parallel evolution. The development of vessels in Gnetales and dicotyledons also represents a case of parallelism.

Convergence implies increasing similarity between two distinct phyletic lines, either with regard to individual organ or to the whole organism. The similar features in convergence arise separately in two or more genetically diverse and not closely related taxa or lineages. The similarities have arisen in spite of lack of affinity and have probably been derived from different systems of genes. Examples may be found in the occurrence of pollinia in Asclepiadaceae and Orchidaceae, and the 'switch habit' (circular sheath at nodes) in *Equisetum, Ephe*dra and *Polygonum*. Convergence is generally brought about by similar climates and habitats, similar methods of pollination or dispersal.

MONOPHYLY OR MONOPHYLETIC GROUPS

Hennig (1966) defined a monophyletic group as a group of species descended from a single ('stem') species, and which includes all the descendants from this species. Briefly, a monophyletic group comprises all the descendants that at one time belonged to a single species.

PARAPHYLY OR PARAPHYLETIC GROUPS

Paraphyletic groups or Paraphyly, consist of common ancestor but not all descendants. The descendants of a common ancestor that are left out are united to form monophyletic groups.

POLYPHYLETIC GROUPS OR POLYPHYLY

Polyphyletic groups, with more than one common ancestor. Common ancestor of components of group is not a member of the group. Polyphyletic groups are split to form monophyletic groups.

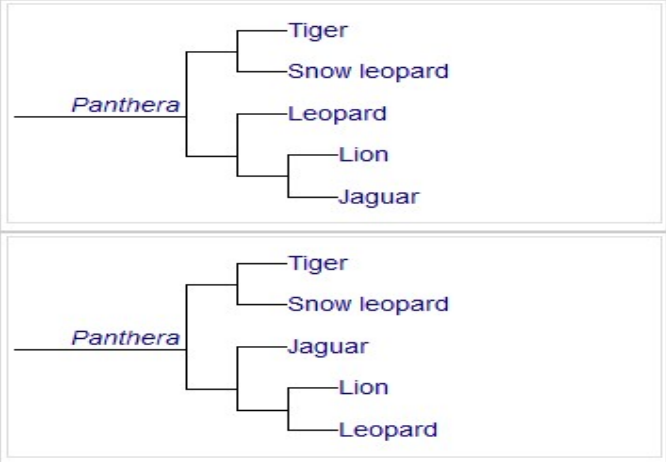
CLADES

- Evolutionary trees depict clades.
- A clade is like a branch on the tree of life.
- A clade is a group of organisms that includes an ancestor and all descendants of that ancestor.
- It is the only acceptable unit in cladistics.
- It is always monophyletic i.e. it has only one ancestor.
- The ancestor could be actual or even hypothetical.
- The term "clade" comes from the Greek "*klados*," for "branch." It's useful to think of a clade as being one "branch" on the tree of life, where the common ancestor is the place that the branch split from the main trunk.

METHODS OF ILLUSTRATING EVOLUTIONARY RELATIONSHIP

Biologists use **cladograms** and phylogenetic trees to illustrate relationships among organisms and evolutionary relationships for organisms with a shared common ancestor. Both cladograms and phylogenetic trees show relationships among organisms, how alike, or similar, they might be.

I) CLADOGRAM: A cladogram is a diagrammatic representation which shows the relationship of the closely related organisms. But it only shows the relationships between clades with the common ancestor. As an example, a cladogram shows human are more loosely related with chimpanzees than gorilla, but it does not show the evolutionary time and the exact distance from the common ancestor.



Comparing two cladograms for *Panthera*

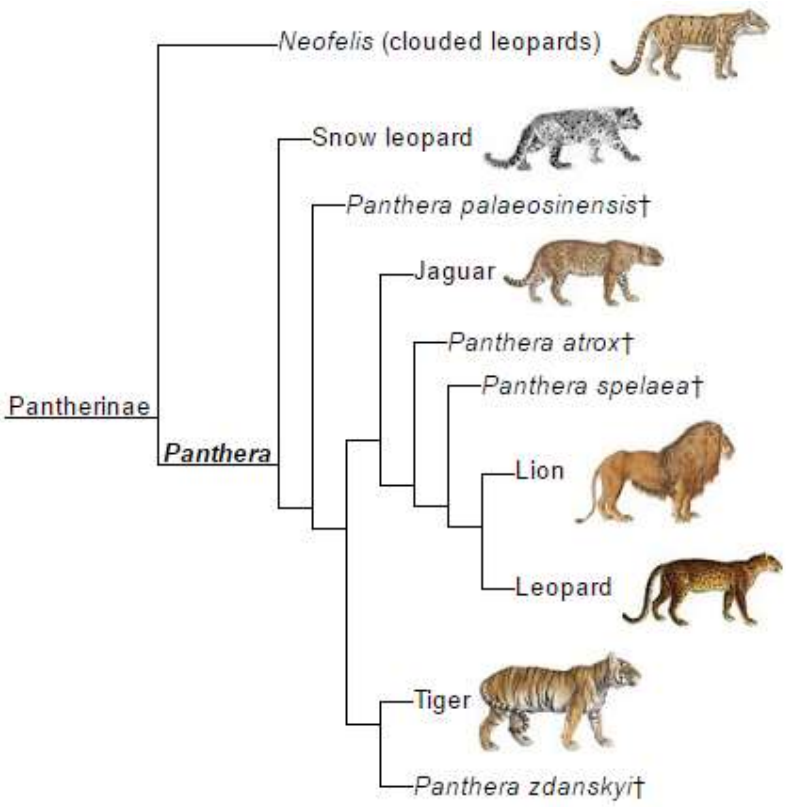
Here two different groups of scientists have created a simple cladogram for Panthera. They are similar, but not the same. If this were based on genetics, there would be more agreement on how to arrange these.

Great Auk and Little Auk

The Great Auk is a black and white flightless bird that would likely be located close to a penguin on a cladogram. However, they are not closely related genetically and would not be located near each other on a phylogenetic tree.

II) PHYLOGENETIC TREE-

A **phylogenetic tree** is similar to a cladogram, but instead of being based on characteristics it is based on genetic relationships. They are built using knowledge from DNA, protein sequences, behaviours, biochemical pathways, anatomy, and morphology. The branching pattern shows how closely related organisms are in an evolutionary sense. It should be noted that these relationships, while based on more information, are still considered hypotheses because they cannot be proven.



Simple phylogenetic tree for Panthers

Cladogram vs. Phylogenetic Tree

Many people confuse cladograms and phylogenetic trees. They are both sorting, organizing, or categorizing organisms. They are both viewed as evolutionary trees representing relationships between species. However, they have many important differences. Phylogenetic trees include more considerations including DNA, genetics, and protein sequencing.

A cladogram is a hypothesis about evolution, and a phylogenetic tree is a much more supported and tested hypothesis.