

Plant systematics

Body punched card:

- These cards make use of cards with holes in the body of the card
- Round holes are punched besides a family number for the families that have that character
- In this process one card is used for one character

Edge punched card:

- Here holes are punched all along the edges of the card, one for each character
- Holes are punched for each character
- It has one card for each taxon

Unit-8 Phylogeny of Angiosperms

Primitive (plesiomorphic):

- Plesiomorphy refer to an evolutionary character homologous within a particular clade but, not unique to all members of that particular clade.
- A plesiomorphic character is not similar through out the clade
- Plesiomorphy is a primitive or ancestral character.
- A plesiomorphic character cannot be used as a defining character for the clade.

Advanced (apomorphy)

- Apomorphy refers to a novel evolutionary character, unique to a particular clade and all its descendants
- An apomorphic character is similar throughout the clade
- Apomorphy is a derived or specialized character
- An apomorphic character can be used as a defining character for the clade

Homology and Analogy

These terms were first used and defined by Owen (1848)

- Homology as the occurrence of the same organ in different animals under every variety of forms and functions. In plants , the rhizome of ginger, the corn of colocasia, tuber of potato, and runner of lawn grass are all homologous, as they represent a stem
- 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.
- The tuber of potato and the tuber of sweet potato, on the other hand, are analogous as the latter represents a root.
- Two or more organisms may be homologous for a particular character if their immediate common ancestor also had this character. Such a character is called Shared homologue.
- If the character is present in the immediate common ancestor, but not in the earlier ancestor, i.e. the character is a derived one, the situation is known as synapomorphy. (fig.I. 6.2 Gurcharan Singh)

- If the character is present in the immediate common ancestor, as well as in the earlier ancestor, i.e. it is an original character, the situation is known as symplesiomorphy. (Fig. II 6.2 Gurcharan Singh)

Parallelism:

Simpson (1961) defined as the independent occurrence of similar changes in groups with a common ancestry, and because they had a common ancestry.

- Parallelism is similarity of features between two species resulting from their having taken similar evolutionary paths following their initial divergence from a common ancestor.
- In parallel evolution the similar features can develop separately in two or more genetically similar, fairly closely related lineages.
- In parallel evolution development proceeding from similar forms to new similar forms.
- Example: The similar aquatic habit and dissected leaves character can be seen in three species of *Ranunculus* subgenus *Batrachium* (*R. hederaceus*, *R. tripartitus* and *R. fluitans*)

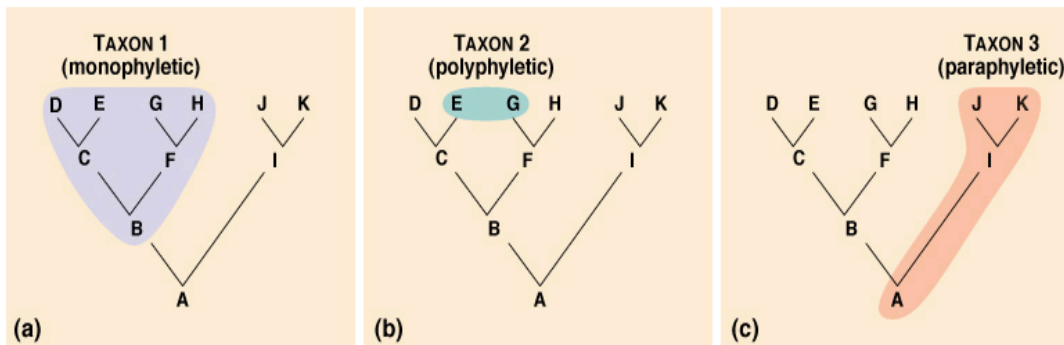
Convergence:

Convergence implies increasing similarity between two distinct phyletic lines, either with regards to individual organ or to the whole organism.

Convergence is generally brought about by similar climate and habitats, similar methods of pollination or dispersal. Once convergence has been identified between two taxa, which have been grouped together, they are separated to make the groups natural and monophyletic.

- Convergence is the evolution of similar structures or traits unrelated species in similar environments, convergent evolution
- In convergent evolution the similar features can develop separately in two or more genetically diverse and not closely related lineages and not due to common ancestry.
- In convergent evolution development proceeding from dissimilar forms to similar ones.
- Example: Distinct families Ceratophyllaceae and Najadaceae show aquatic habitat, dissimilar groups of genera *Equisetum*, *Ephedra* and *Casuarina* have jointed stem and reduced leaves.

Monophyly, Paraphyly and Polyphyly



A **taxon** (pl. **taxa**) is any group of organisms that is given a formal taxonomic name.

- **Monophyletic** taxon is one that includes a group of organisms descended from a single ancestor.
- Simpson 1961 defined monophyly as the derivation of a taxon through one or more lineages from one immediately ancestral taxon of the same or lower rank.
- If, genus B evolved from genus A through one species of the latter, since in that case the genus would be monophyletic at the same rank (genus) as well as at the lower (species) rank. On other hand, if genus B evolved from two species of genus A, it would be monophyletic at the genus level but polyphyletic at the lower rank.
- **Polyphyletic** taxon is composed of unrelated organisms descended from more than one ancestor.
- These loose definitions fail to recognize the fact that **all organisms are related**, therefore any conceivable group is logically "*monophyletic*". In modern usage, a **monophyletic** taxon is defined as one that includes the most recent common ancestor of a group of organisms, *and all of its descendants* [as in (a)].
- Such groups are sometimes called **holophyletic**. It is also possible to recognize a **paraphyletic** taxon as one that includes the most recent common ancestor, *but not all of its descendants* [as in (c)].
- A **polyphyletic** taxon is defined as one that **does not include the common ancestor** of all members of the taxon [as in (b)].
- Well-known monophyletic taxa include **Mammalia** and **Aves** (modern birds), recognizable as all furry and feathered vertebrates, respectively.
- Taxonomists tend to fall into two schools, 'Evolutionary' or 'traditional' systematics versus 'Phylogenetic' or "**cladistic**" systematics. Since the 1970s, 'phylogenetic systematics' has been replacing 'traditional systematics'.