

12 The Evolution of Gene Families

12.1 Phylogenetic Relationships

Monophyletic group Group of organisms that includes the last common ancestor of all those organisms and all the descendants of that common ancestor (e.g. insects, vertebrates, mammals, angiosperms).

Paraphyletic group Group of organisms that includes the last common ancestor of all those organisms and some, but not all, the descendants of that common ancestor (e.g. reptiles, dinosaurs, invertebrates)

Polyphyletic group Group of organisms that does not include the last common ancestor of all those organisms (e.g. winged animals).

12.2 Similarity

Homology Character shared between species that was also present in their last common ancestor (e.g. the limbs of tetrapods). There are two types of homology:

Derived homology (synapomorphy) Homology that is unique to a group of species and their ancestor. Shared derived homologies provide evidence for the monophyly of a group (e.g. feathers of birds).

Ancestral homology (plesiomorphy) Homology that is not unique to a group of species and their ancestor. Shared ancestral characters do not provide evidence for the monophyly of a group (e.g. vertebrae of birds).

Homoplasy Character shared between species but not present in their last common ancestor (e.g. wings of bats and birds). Homoplasies result from convergent evolution.

12.3 Sequence Homology

Orthologs Genes in different genomes that have been created by the splitting of evolutionary lineages.

Paralogs Genes in the same genome that have been created by gene duplication events.