

CHAPTER 26 PHYLOGENY AND THE TREE OF LIFE

Learning objectives

Phylogenies Show Evolutionary Relationships

1. Distinguish between phylogeny and systematics.
2. Explain the following characteristics of the Linnaean system of classification:
 - a. Binomial nomenclature
 - b. Hierarchical classification.
3. Explain the justification for the proposal to replace Linnaean classification with phylocode designations for monophyletic taxa.
4. Explain the statement: “A phylogenetic tree represents a hypothesis about evolutionary relationships.”
5. Explain why it is crucial to distinguish between homology and analogy before selecting characters to use in the reconstruction of phylogeny. Describe how homology and analogy can be distinguished from each other.
6. Explain why bird and bat wings are homologous as vertebrate forelimbs but analogous as wings.
7. Define molecular systematics. Explain some of the problems that systematists may face in carrying out molecular comparisons of nucleic acids.

The Construction of Phylogenetic Trees

8. Define a clade. Distinguish between a monophyletic clade and paraphyletic and polyphyletic groupings of species.
9. Distinguish between shared ancestral characters and shared derived characters.
10. Explain why shared derived characters are useful in establishing a phylogeny, while shared ancestral characters are not.
11. Distinguish an ingroup from an outgroup.
12. Explain how outgroup comparison can be used to differentiate shared ancestral characters from shared derived characters.
13. Discuss how systematists use the principles of maximum parsimony and maximum likelihood in reconstructing phylogenies.