SECTION

17.2 Classification Based on Evolutionary Relationships

KEY CONCEPT Modern classification is based on evolutionary relationships.

Cladistics is classification based on common ancestry.

Today, scientists agree that organisms should be classified based on evolutionary relationships and not just physical similarities. Sometimes, physical similarities can give evidence for evolutionary relationships. Other times, physical similarities do not mean that organisms are related. For example, both birds and bats have wings, but they are not closely related.

Phylogeny

The evolutionary history for a group of species is called a **phylogeny** (fy-LAHJ-uh-nee). A phylogeny is made using more than just physical similarities. It is made using evidence from living species, the fossil record, and molecular data, such as DNA and protein sequences. Phylogenies can be shown as branching tree diagrams. Each branch represents a species or another taxon. An evolutionary tree shows how different groups of species are related to each other.

Cladistics

The most common method used to make evolutionary trees is called cladistics. **Cladistics** (kluh-DIHS-tihks) is classification based on evolutionary relationships, or common ancestry. A **cladogram** is an evolutionary tree that suggests how species may be related.

Over evolutionary time, certain traits in a group of species, or a clade, stay the same. Each species also has traits that have changed over time. **Derived characters** are traits that are shared by some species but not by others. These traits can be used to figure out evolutionary relationships. The more closely related species are, the more derived characters they will share.

VOCABULARY

At the root of the words *cladistics* and *cladogram* is the word *clade*. A clade is a group of species that shares a common ancestor.

What does a cladogram show? _____

_____

Interpreting a Cladogram

The main features of a cladogram are shown in the cladogram for tetrapods below. Tetrapods are vertebrates that share a common ancestor with four limbs. Some tetrapods, such as snakes, no longer have the four limbs that their known ancestors have.

Derived characters Derived characters are shown as hash marks. All species above a hash mark share the derived character it represents. There are six derived characters labeled on the tetrapod cladogram.

Nodes Each place where a branch splits is called a node. Nodes repesent the most recent common ancestor shared by a clade. There are five nodes on the tetrapod cladogram.

Identifying clades You can identify a clade by using the "snip rule." Whenever you "snip" a branch under a node, a clade falls off. There are five clades in the tetrapod cladogram.

CLADOGRAM FOR TETRAPODS

A cladogram shows the likely evolutionary relationships among a group of species based on common ancestry and derived characters.