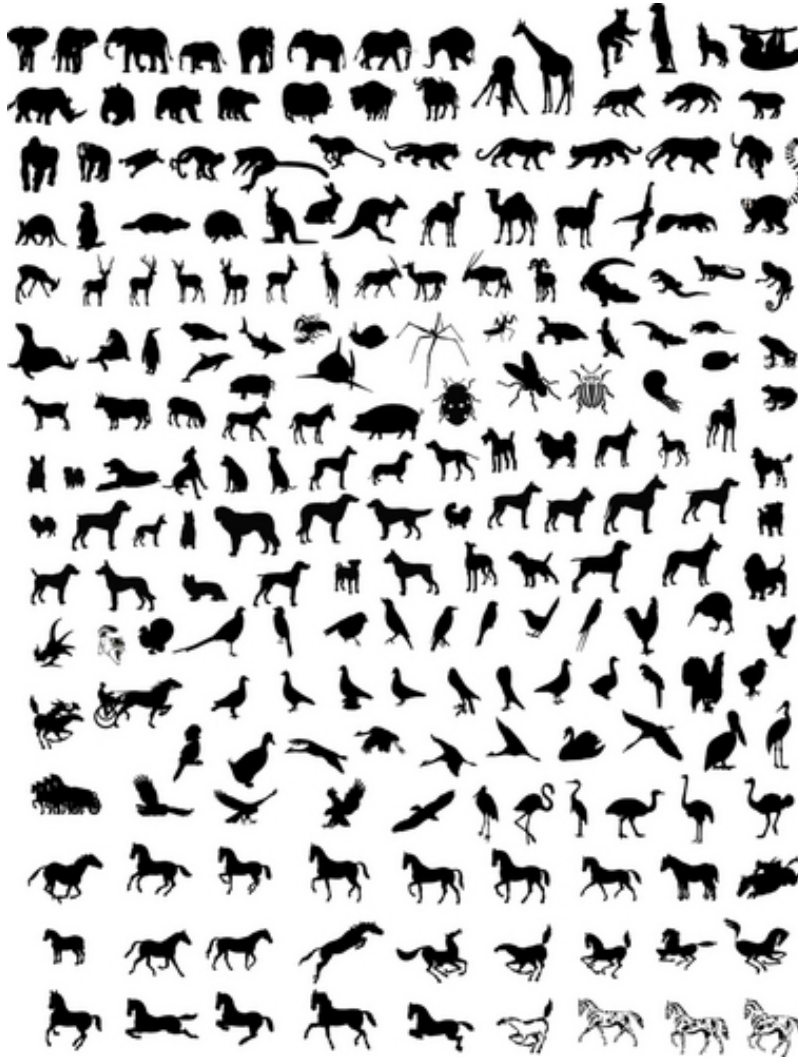


CONCEPT 1 Phylogenetic Classification

- Describe phylogenetic classification, and explain how it differs from Linnaean classification.



Can two different species be related?

Of course they can. For example, there are many different species of mammals, or of one type of mammal, such as mice. And they are all related. In other words, how close or how far apart did they separate from a common ancestor during evolution? Determining how different species are evolutionarily related can be a tremendous task.

Phylogenetic Classification

Linnaeus classified organisms based on obvious physical traits. Basically, organisms were grouped together if they looked alike. After Darwin published his theory of evolution in the 1800s, scientists looked for a way to classify organisms that showed phylogeny. **Phylogeny** is the evolutionary history of a group of related organisms. It is represented by a **phylogenetic tree**, like the one in **Figure 1.1**.

One way of classifying organisms that shows phylogeny is by using the clade. A **clade** is a group of organisms that includes an ancestor and all of its descendants. Clades are based on **cladistics**. This is a method of comparing traits

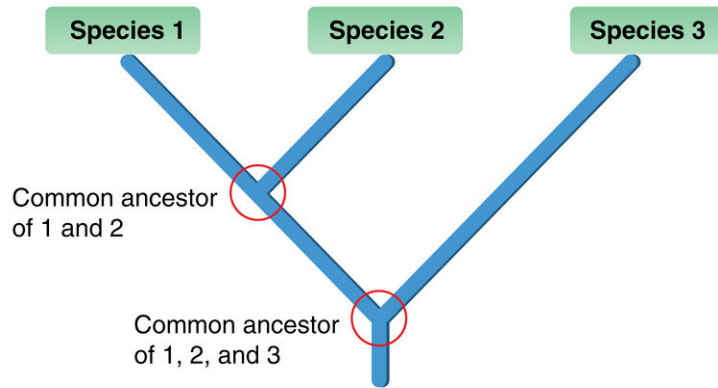


FIGURE 1.1

This phylogenetic tree shows how three hypothetical species are related to each other through common ancestors. Do you see why Species 1 and 2 are more closely related to each other than either is to Species 3?

in related species to determine ancestor-descendant relationships. Clades are represented by **cladograms**, like the one in **Figure 1.2**. This cladogram represents the mammal and reptile clades. The reptile clade includes birds. It shows that birds evolved from reptiles. Linnaeus classified mammals, reptiles, and birds in separate classes. This masks their evolutionary relationships.

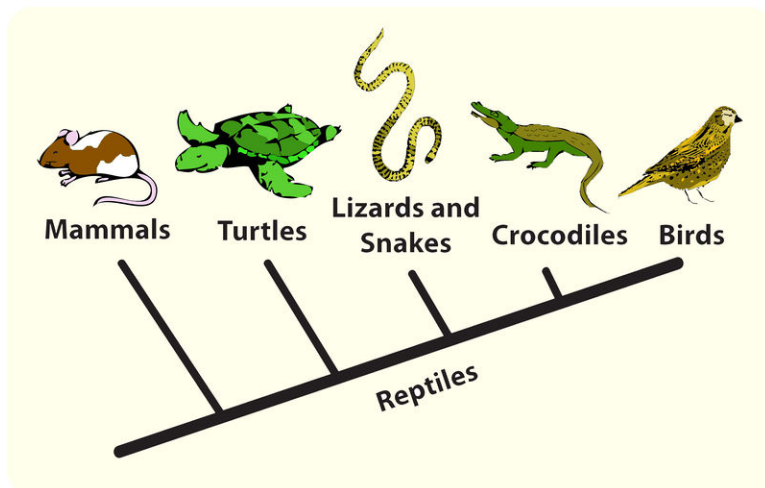


FIGURE 1.2

This cladogram classifies mammals, reptiles, and birds in clades based on their evolutionary relationships.

Summary

- Phylogeny is the evolutionary history of group of related organisms. It is represented by a phylogenetic tree that shows how species are related to each other through common ancestors.
- A clade is a group of organisms that includes an ancestor and all of its descendants. It is a phylogenetic classification, based on evolutionary relationships.

Practice

Use this resource to answer the questions that follow.

- <http://www.hippocampus.org/Biology> → Biology for AP* → Search: **Constructing Phylogenetic Trees**

1. Describe how convergence can confuse taxonomists.
2. What are the purposes of a phylogenetic tree and a cladogram? What is the difference between them?
3. What is the relationship between a clade and a taxon?
4. What is an ancestral trait? How is such a trait used to build a cladogram?
5. Distinguish between homologous and analogous structures.
6. Humans are most closely related to which of the following: goldfish, lizard, or dog?

Review

1. What is cladistics, and what is it used for?
2. Dogs and wolves are more closely related to each other than either is to cats. Draw a phylogenetic tree to show these relationships.
3. Explain why reptiles and birds are placed in the same clade.