

Phylogeny and the history of life

Phylogeny

The history of life

Processes of diversification

Outline

Phylogeny

Interpreting phylogenetic trees

Constructing phylogenetic trees

Example: the evolution of whales

The history of life

The shape of the tree

The fossil record

Putting the timeline together

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Adaptive radiations

Mass extinctions

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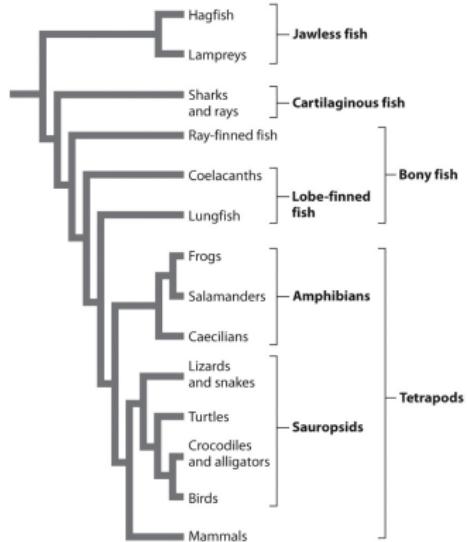


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Interpreting phylogenetic trees

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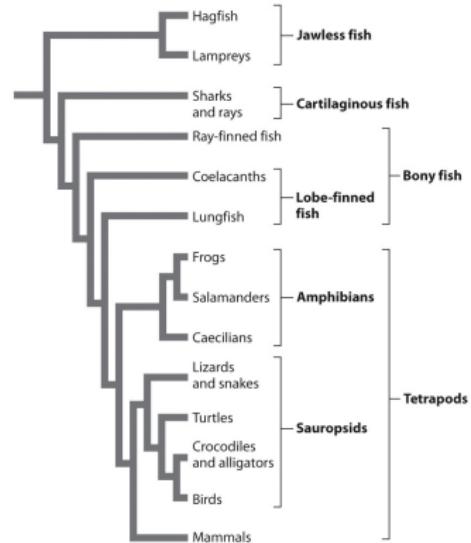


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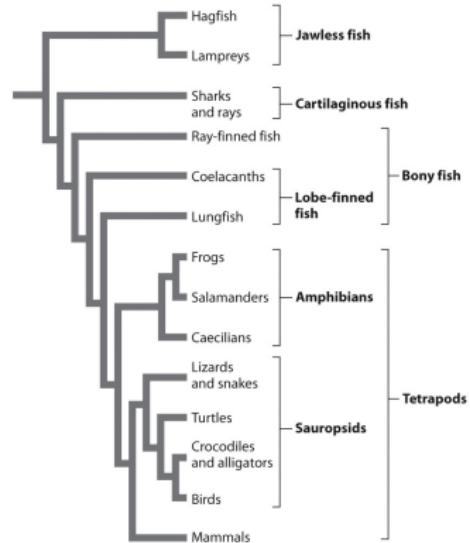


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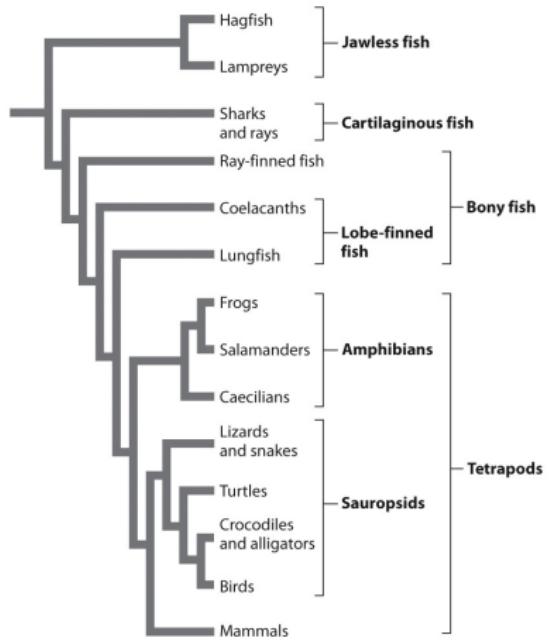


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Sister taxa

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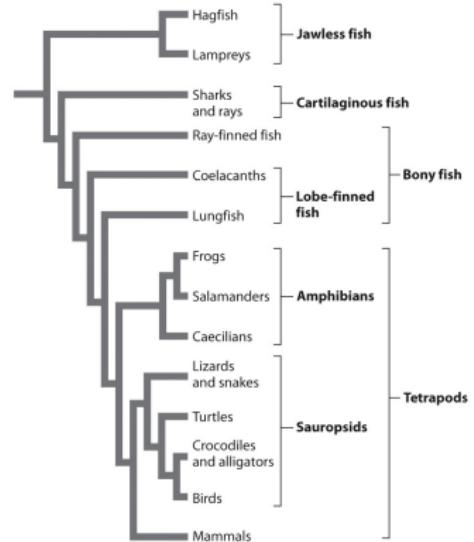


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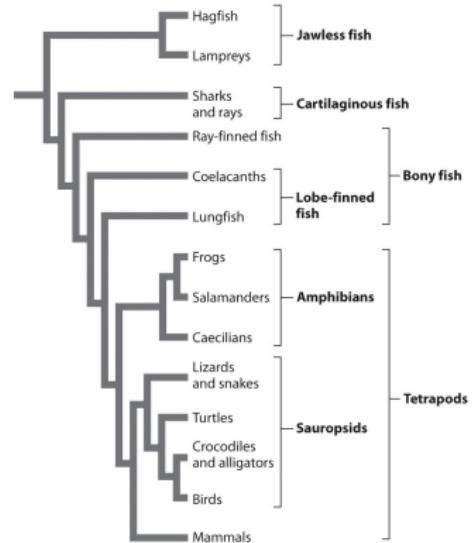


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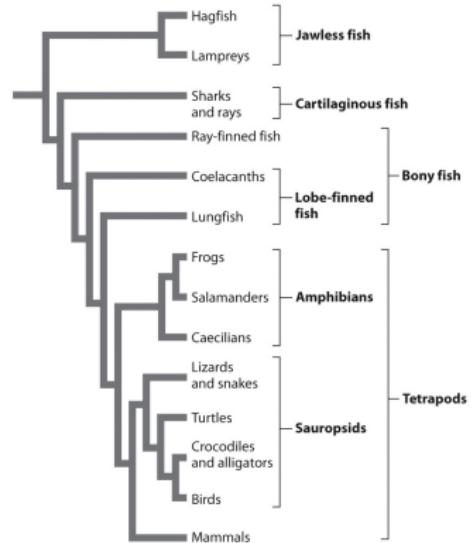


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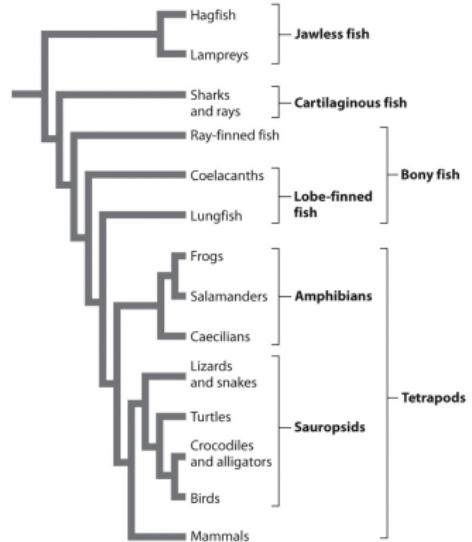


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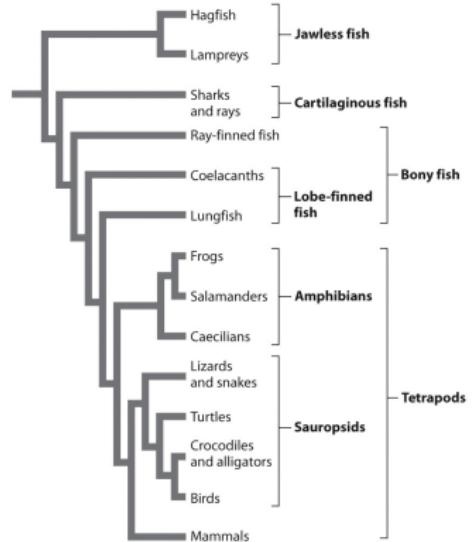


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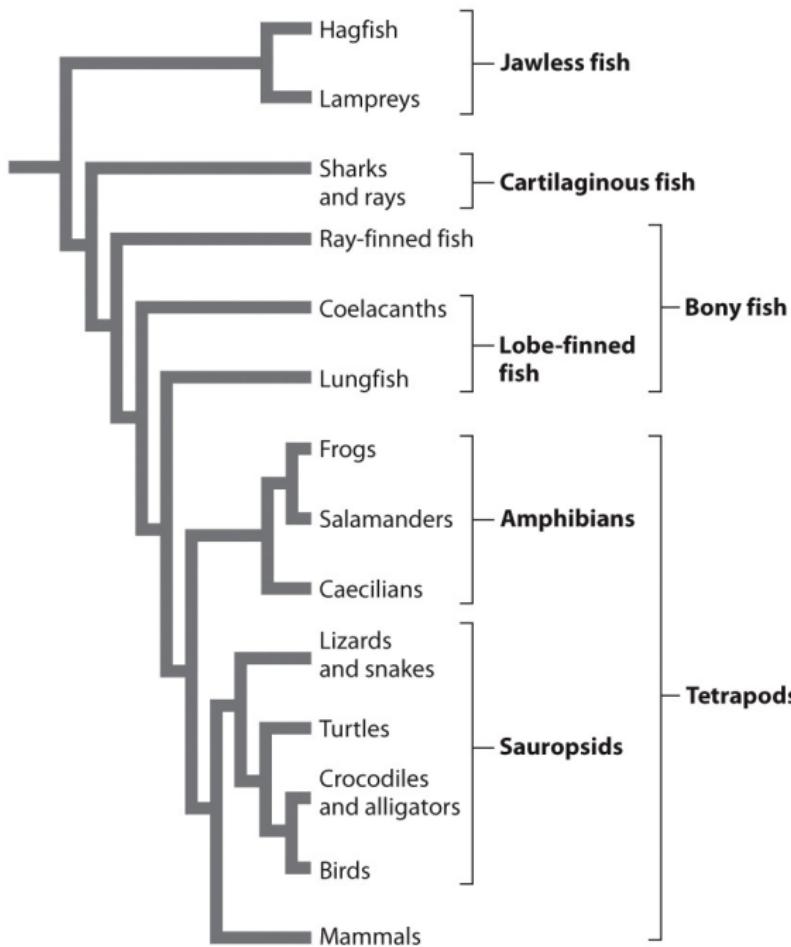


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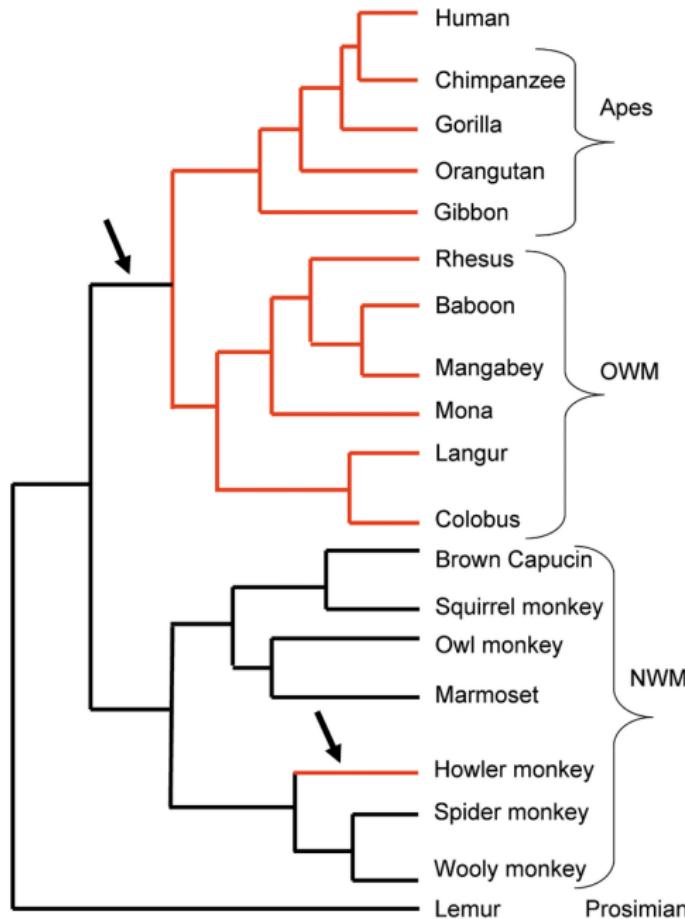
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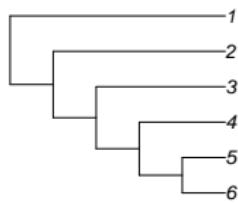
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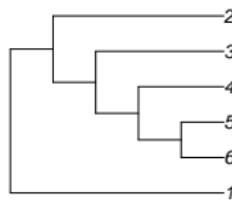
Wikimedia commons: Phylogenetic Tree of Primates

Activity: which of these things is not like the others?

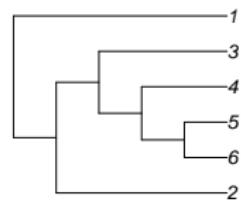
A



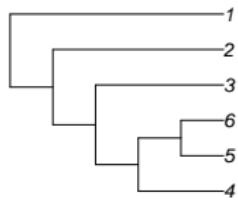
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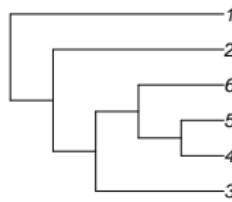
C



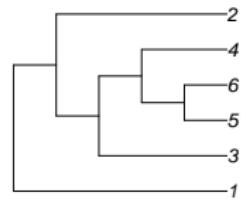
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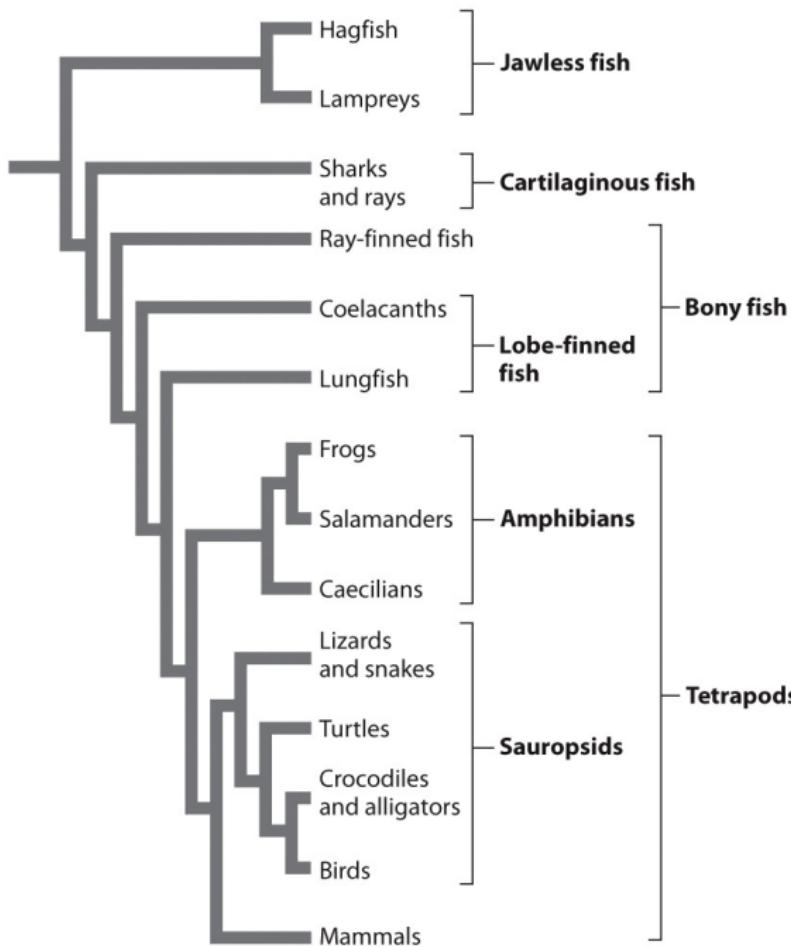
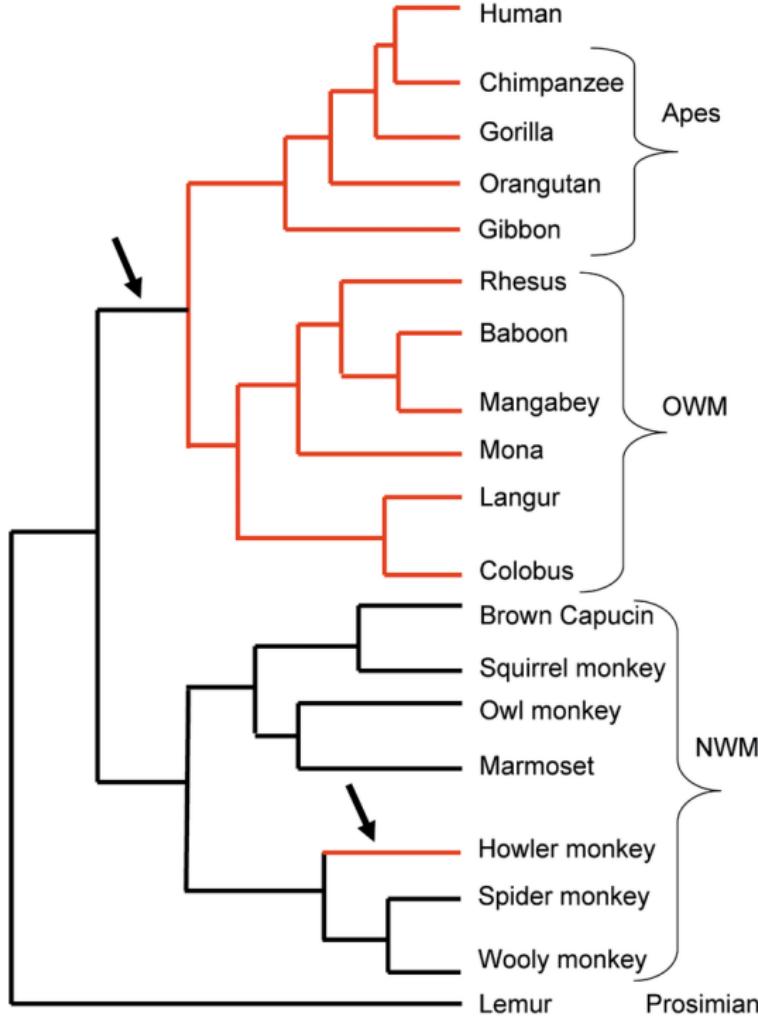


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- ▶ Classical cladistic analysis is based on **synapomorphies** – shared, **derived** characters – as evidence that two taxa are related
- ▶ Why do we focus on derived characters?
 - ▶ * These are things that evolved in the relevant context
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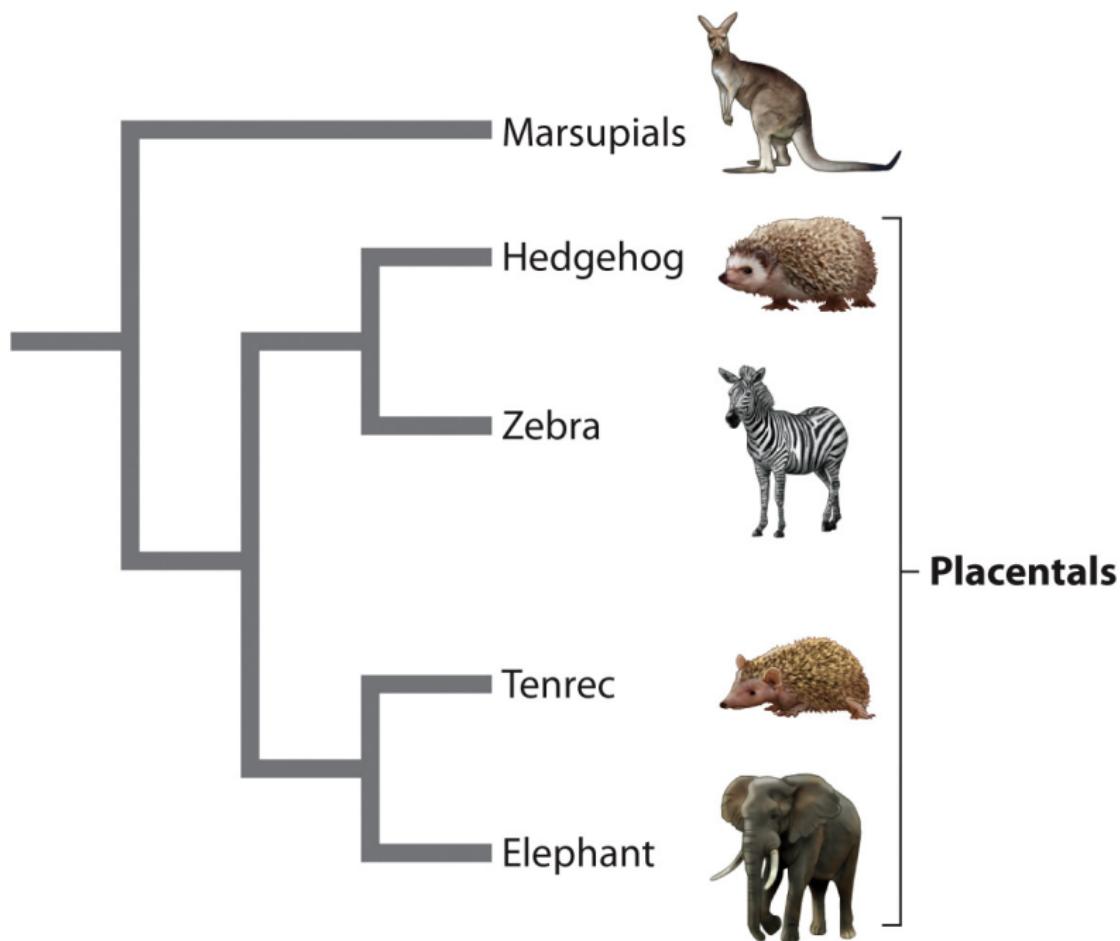


Figure 22.7
Biology: How Life Works
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Outline

Phylogeny

Interpreting phylogenetic trees

Constructing phylogenetic trees

Example: the evolution of whales

The history of life

The shape of the tree

The fossil record

Putting the timeline together

Processes of diversification

Adaptive radiations

Mass extinctions

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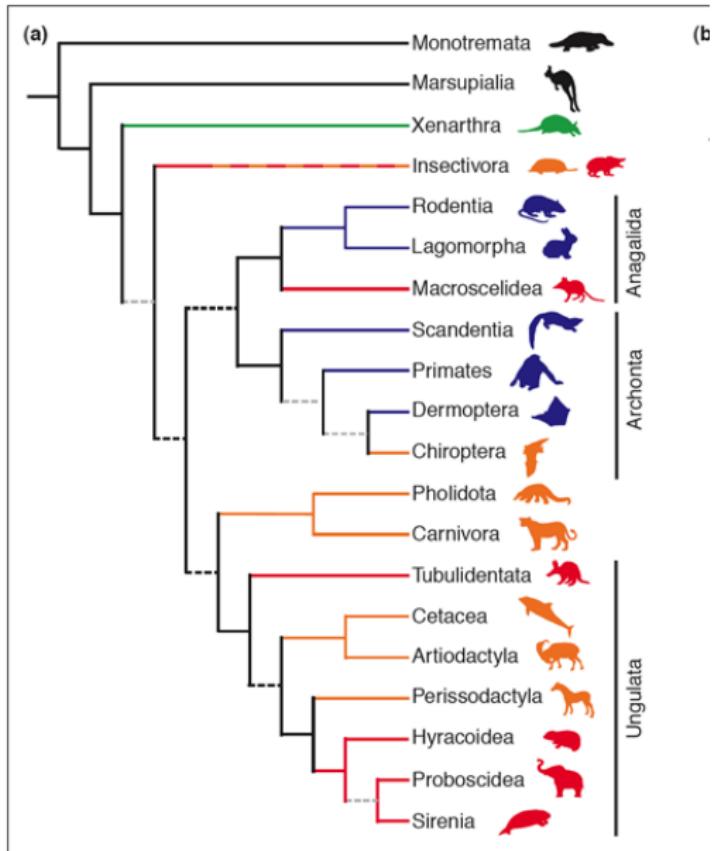
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Morphological tree



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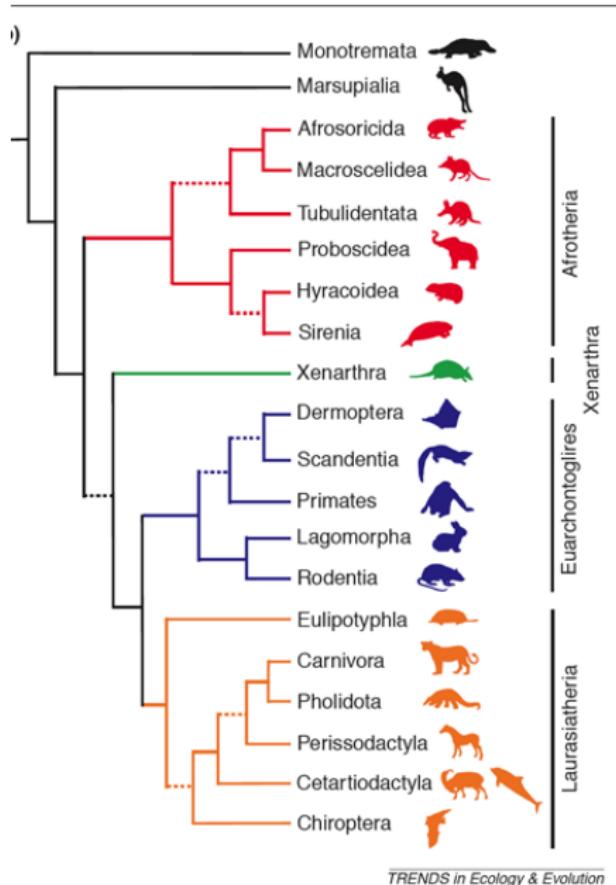
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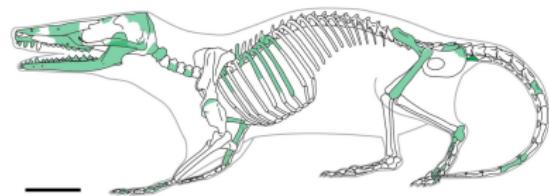
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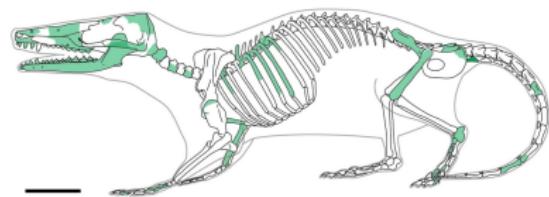


Confirmation



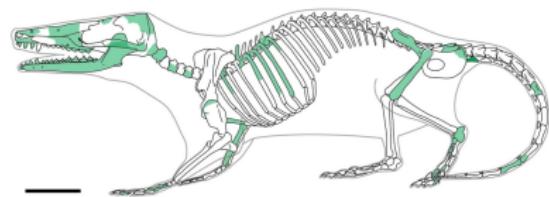
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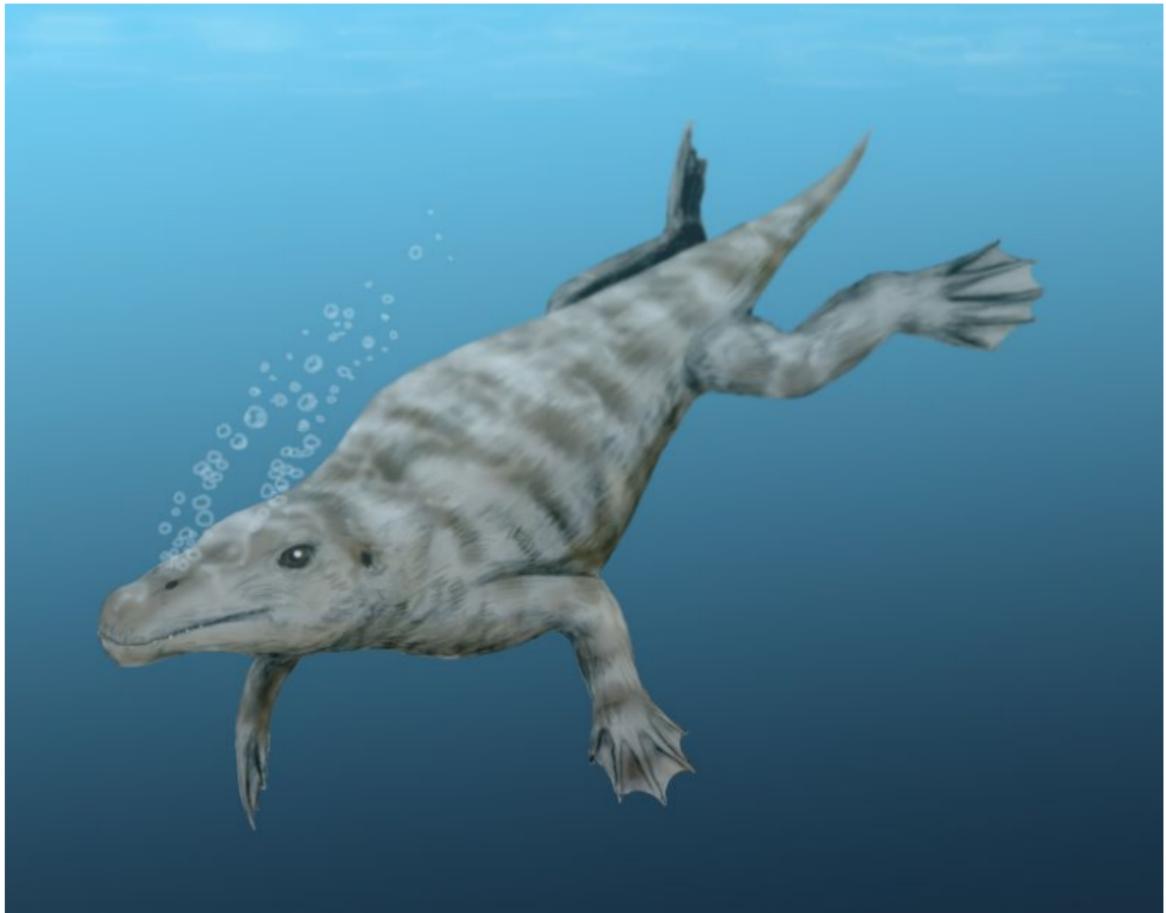


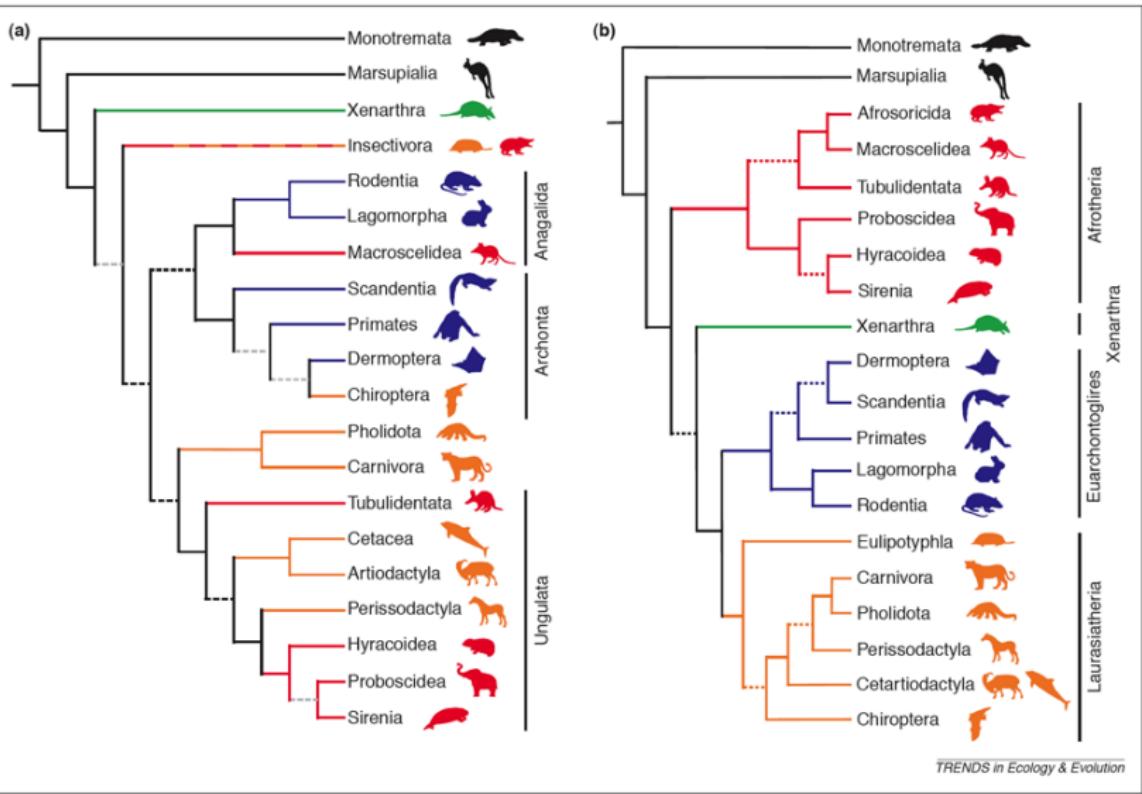
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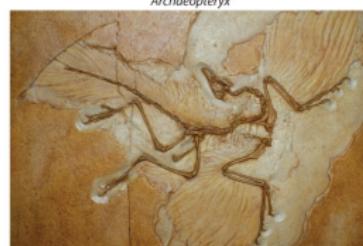
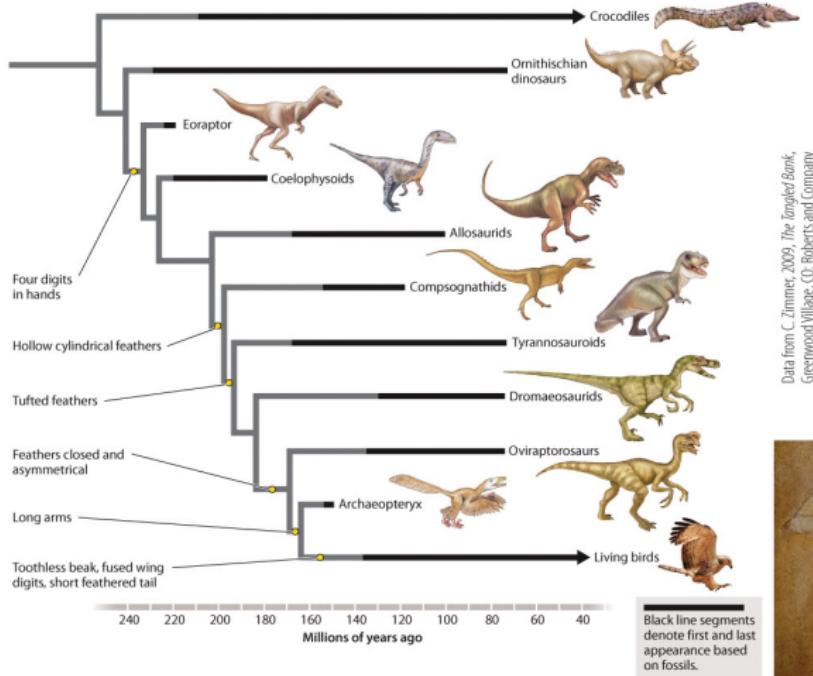


Figure 22.21
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Outline

Phylogeny

Interpreting phylogenetic trees

Constructing phylogenetic trees

Example: the evolution of whales

The history of life

The shape of the tree

The fossil record

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Processes of diversification

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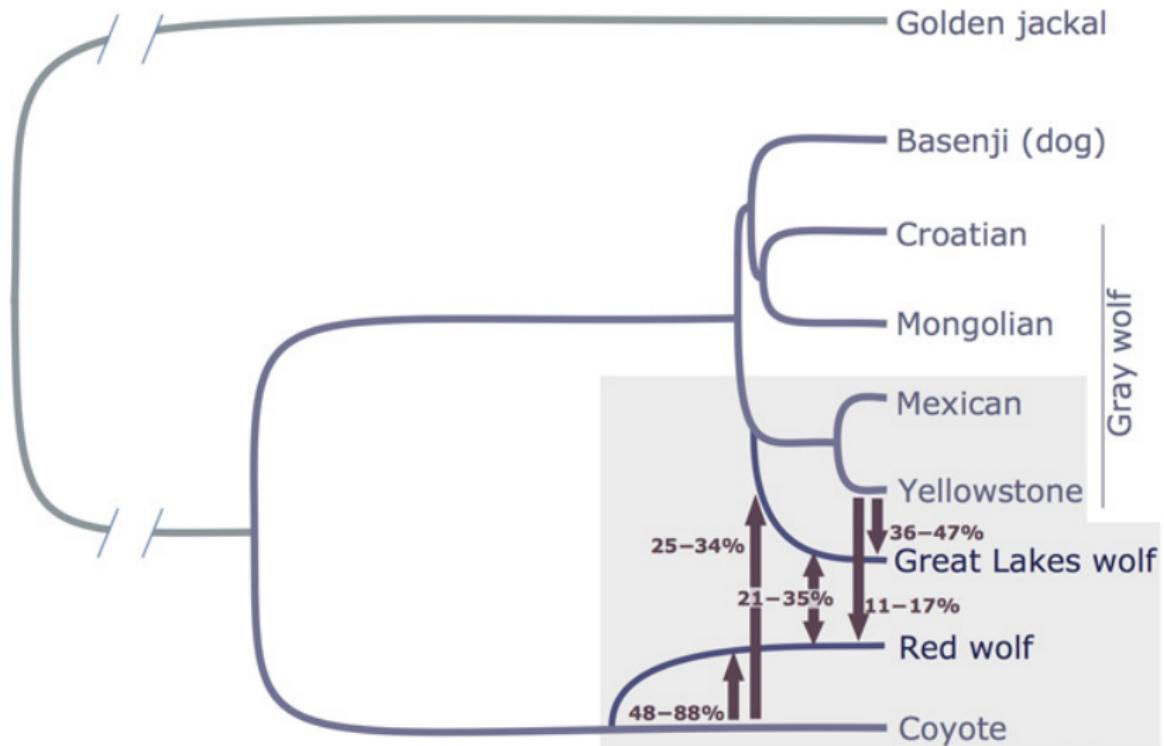
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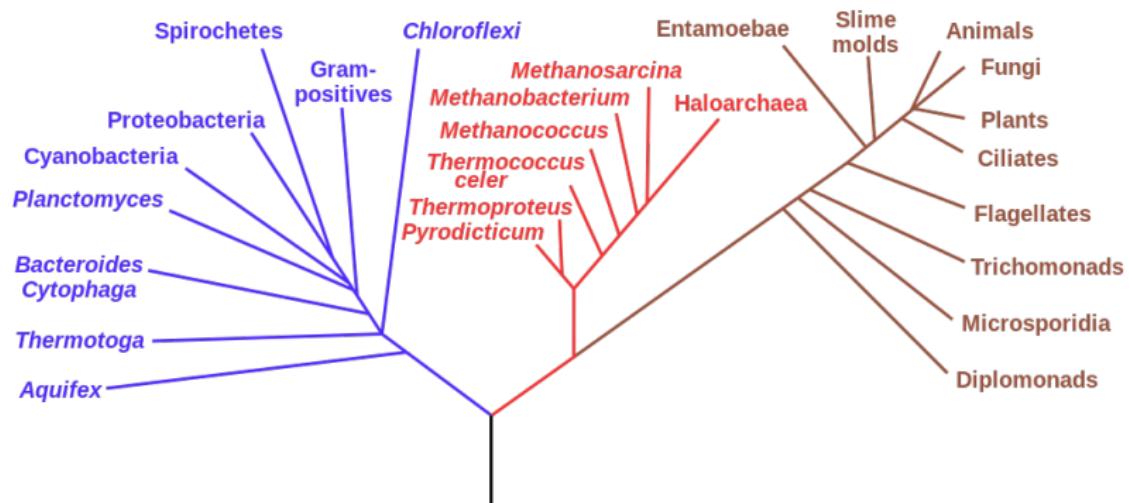
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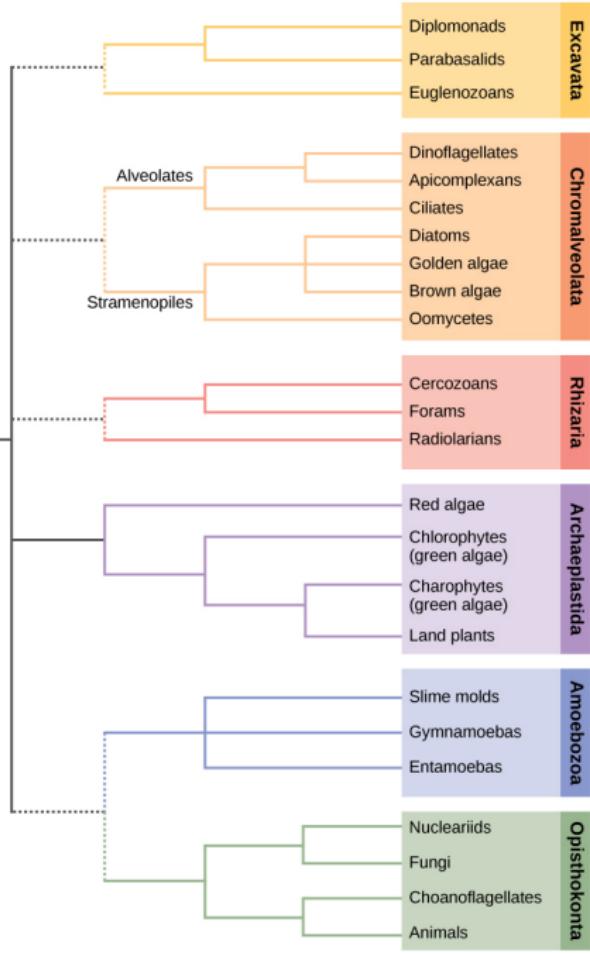
Archaea

Eukarya

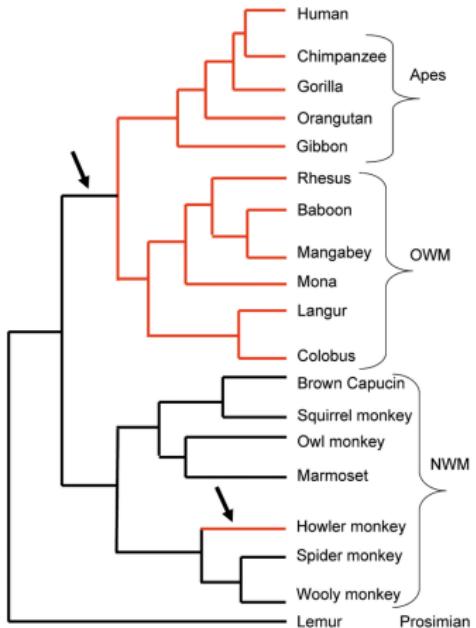


Eukaryotic Supergroups

Common eukaryotic ancestor

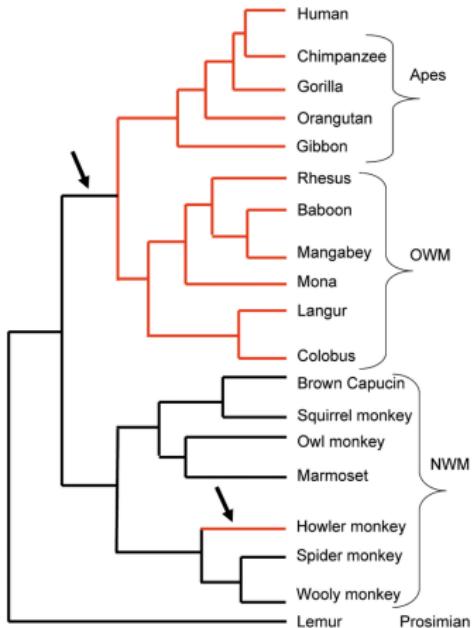


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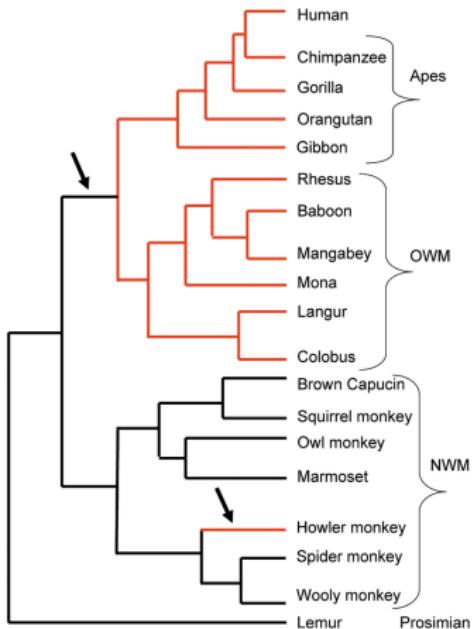
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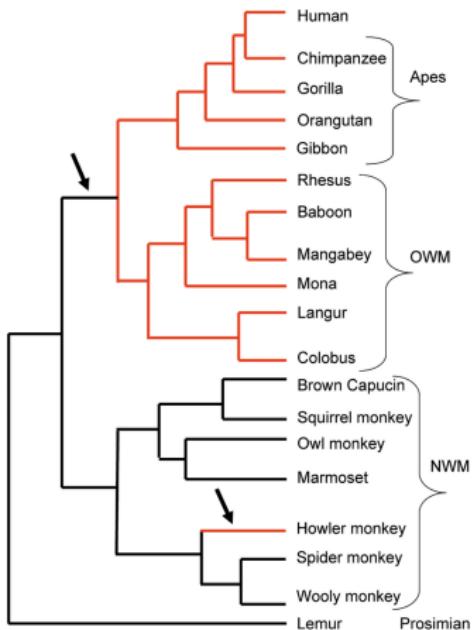
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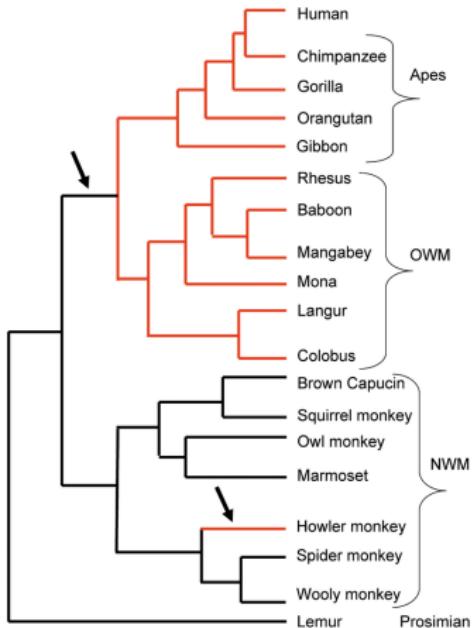
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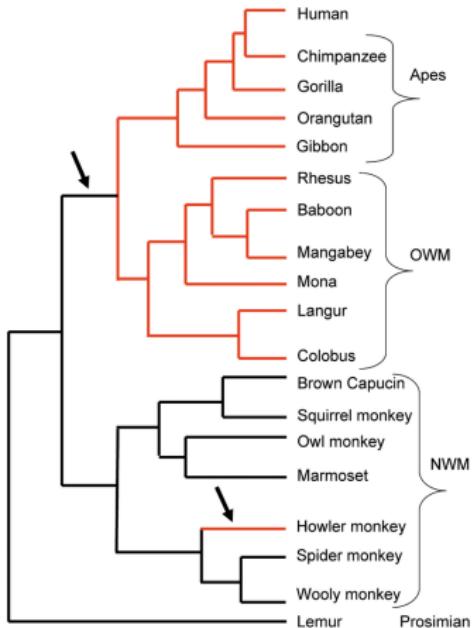
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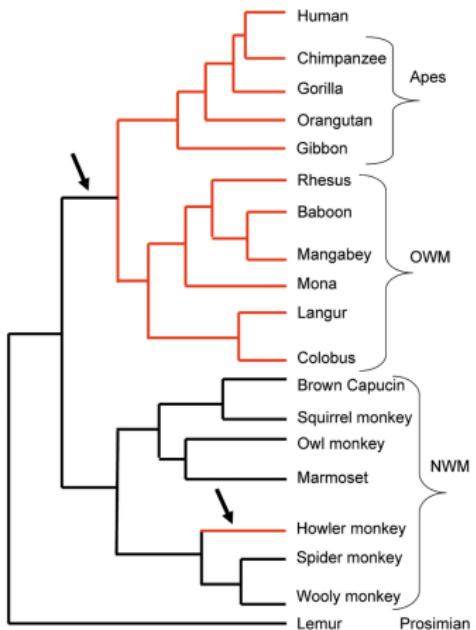
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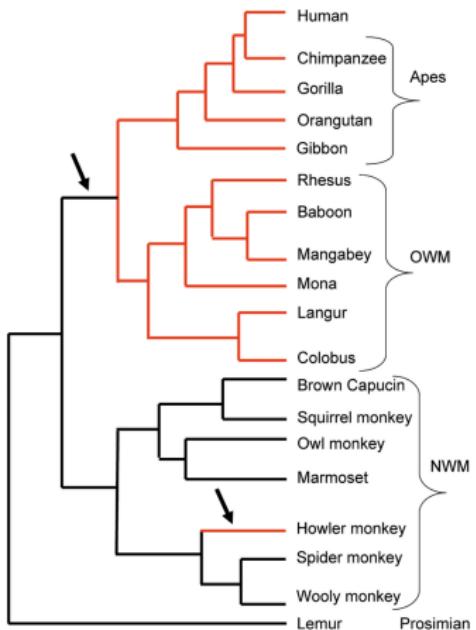
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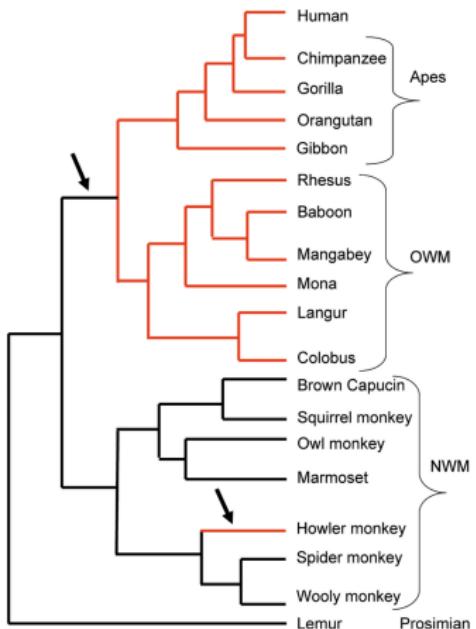
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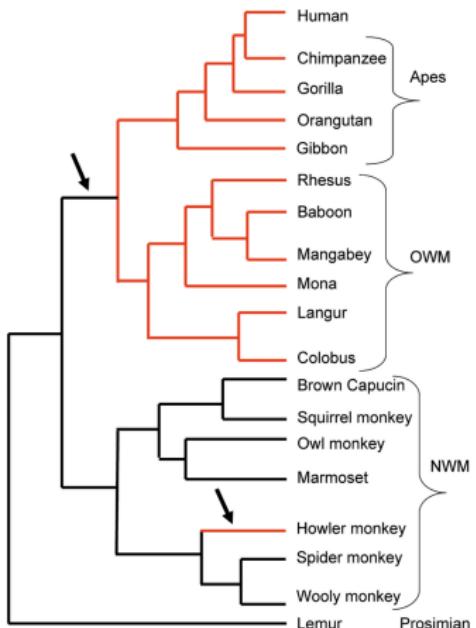
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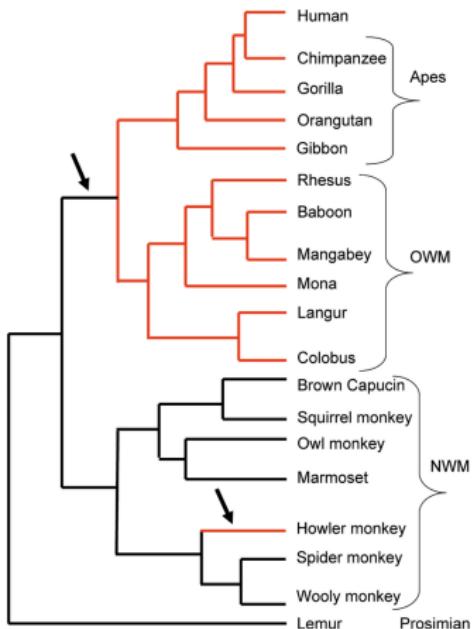
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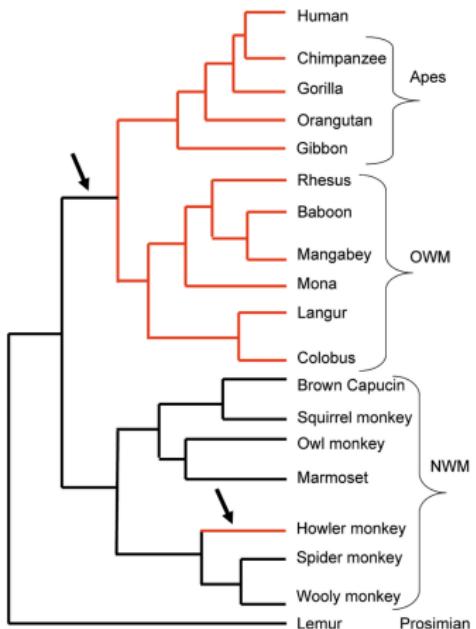
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White beds contain fossilized tracks of vertebrate animals that lived about 260 million years ago.

Limestone accumulated in the oceans about 335 million years ago, burying marine animals and preserving their skeletons.

Slopes made of mud laid down in a shallow sea about 500 million years ago contain fossils of early arthropods called trilobites.

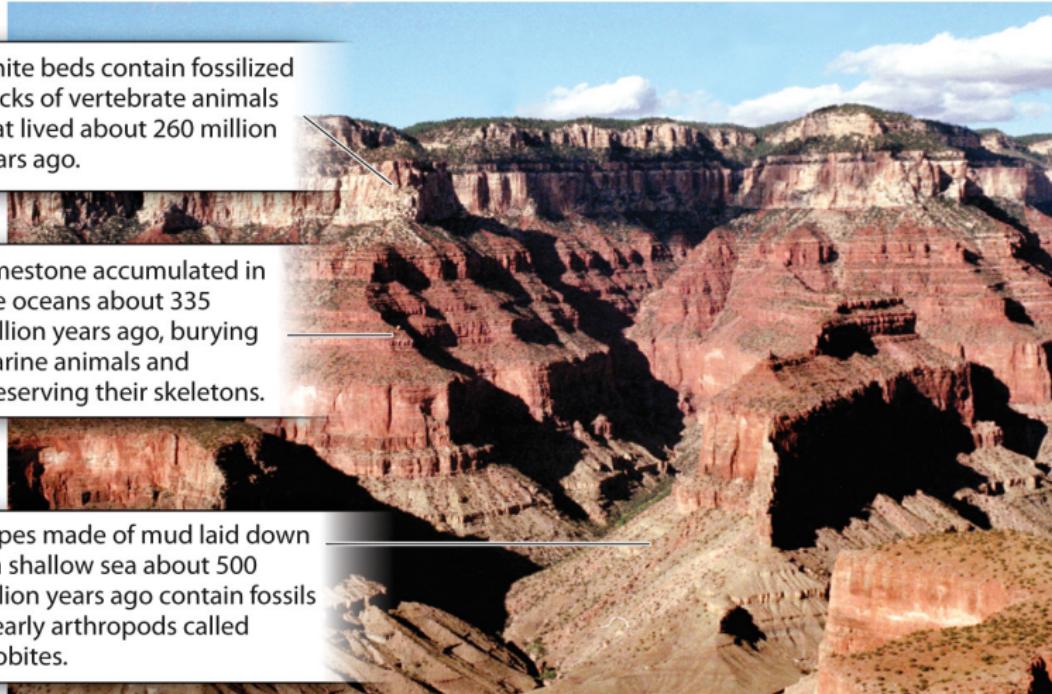


Figure 22.14

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Figure 22.15
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José Antonio Hernaiz/AGF Fotostock



Figure 22.16
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Wild Horizon/Getty Images



Figure 22.17
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Biases in the fossil record

- ▶ Scientists have learned a lot from studying fossils, but care is needed. Very few things fossilize, and some things are much more likely to fossilize than others, for example:

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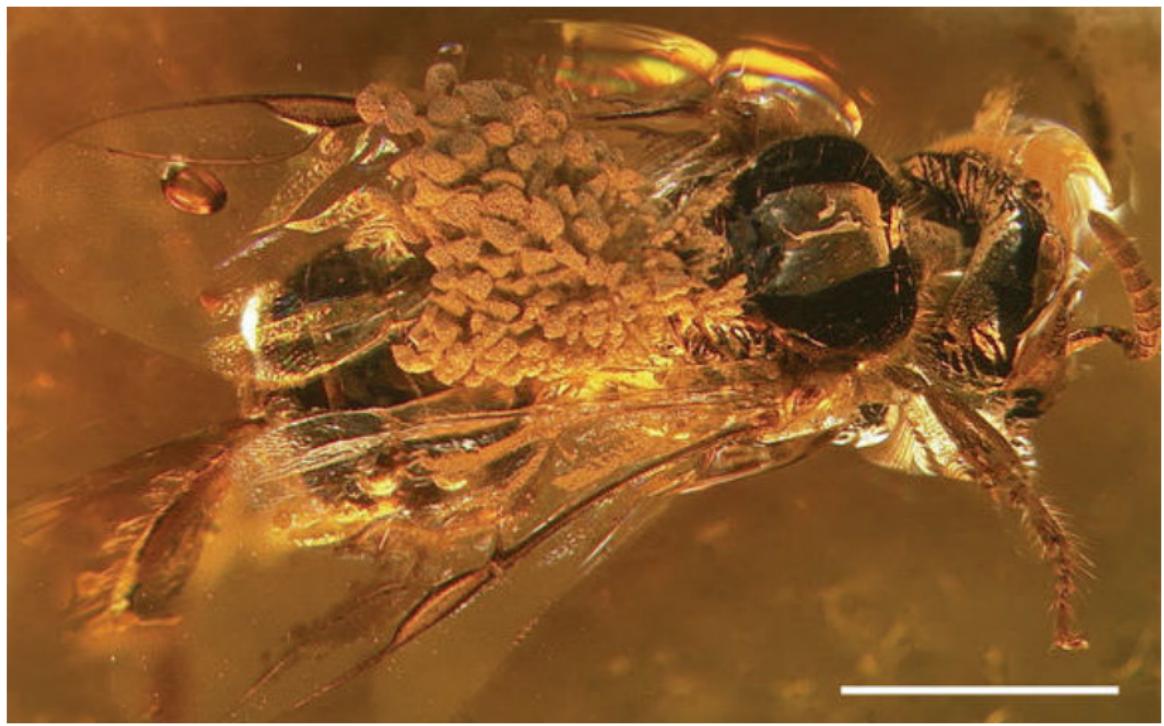
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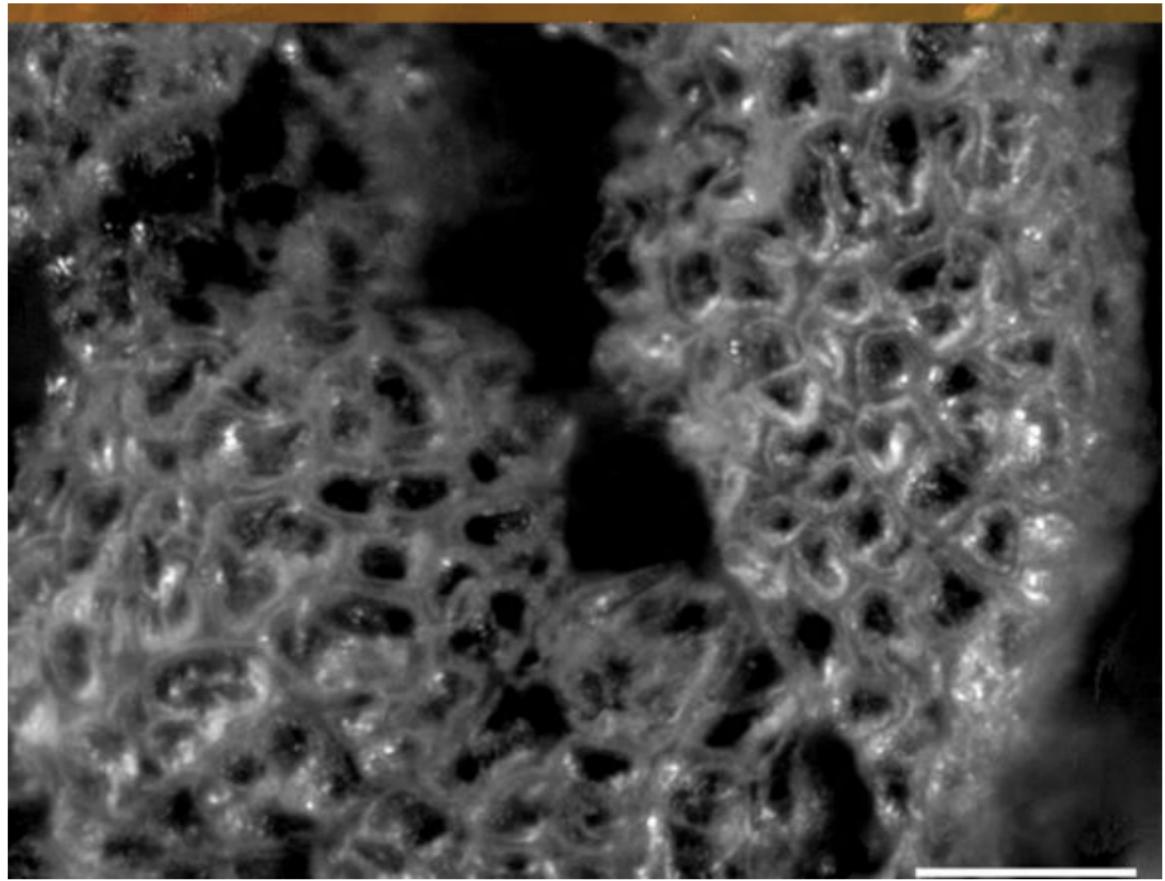
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- ▶ Life has diversified both gradually, and with dramatic episodes
 - ▶ Adaptive radiations, mass extinctions

Conclusion

- ▶ The best way to reconstruct evolution is with a *model* of how it occurred
 - ▶ Molecular information, and computer modeling has changed our view of the tree of life
 - ▶ life is not really a tree
 - ▶ genetic information can be transferred
 - ▶ sexual mixing occurs at different scales
- ▶ Scientists use many clues to figure out the history of life on earth
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