

# Fossil Record Family Tree

Name \_\_\_\_\_

## Objectives:

- analyze characteristics of fossils
- compare placement of fossils and determine relationships
- develop a “family tree” based on the features and ages of fossils

## Background

Fossils are traces of organisms that lived in the past. When fossils are found, they are analyzed to determine the age of the fossil. The absolute age of the fossil can be determined through radiometric dating and determining the layer of rock in which the fossil was found. Older layers are found deeper within the earth than newer layers.

The age and morphologies (appearances) of fossils can be used to place fossils in sequences that often show patterns of changes that have occurred over time. This relationship can be depicted in a sort of “family tree”, also known as a phylogenetic tree.

There are two major hypotheses on how species can change into new species: **gradualism** and **punctuated equilibrium**. **Gradualism** suggests that organisms go through a process of slow and constant changes that accumulate. For instance, an organism that shows a fossil record of gradually increased size in small steps, or an organism that shows a gradual loss of a structure. **Punctuated equilibrium** suggests that species change very rapidly and then stay the same for a large period of time. This rapid change is attributed to a mutation in a few essential genes. The sudden appearance of new structures could be explained by punctuated equilibrium.



Gradualism: creature became larger, segments fused



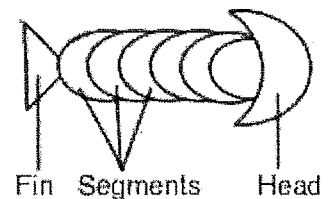
Punctuated equilibrium: head changed shape, loss of segment

## Procedure:

1. The group of "fossils" you will work with are fictitious animals. Each fossil on your sheet is marked with a time period (named for a period of glacial activity, not a state). Cut out each fossil and make sure you include the time period marked below it.

2. Arrange the fossils by age. On your data chart, place each fossil next to the period from which the fossil came from. The term "upper" means more recent and should be placed higher in the row. The term "lower" means an earlier time period, fossils from a "lower" time period should be placed toward the older time periods. In each fossil column, you may have 3 specimens, one from the main time period, one from the upper and one from the lower. Not all fossils are represented, illustrating the incompleteness of any fossil record.

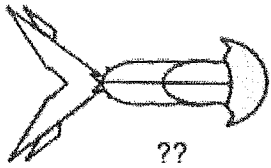
3. While keeping the fossils in the proper age order, arrange them by appearance. To help you understand the morphology of the specimen, view the diagram. Arrange the fossils using the following steps.



- a. Center the oldest fossil at the bottom of the fossil column (toward the oldest layer)
  - b. Through the chart, those fossils that appear to be the same (or close to the same) as the earlier fossils should be placed above the fossils they are similar to.
  - c. During a certain period, the fossils will split into two branches. In other words, one fossil from that period will show one type of change, and another fossil will show a different change from the common ancestor fossil. When this happens, place the fossils side by side in the appropriate time period. From this point on you will have two branches for the family tree.
4. Once all the fossils have been placed correctly according to time and morphology, tape or glue the fossils in place.

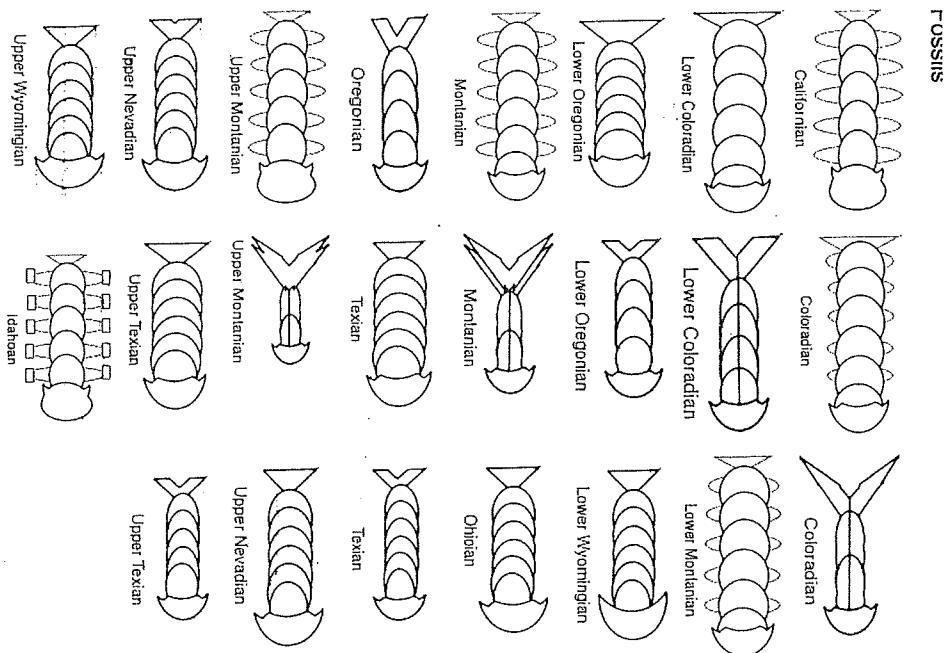
**Analysis Questions: Do on a separate sheet of paper and attach to your diagram.**

1. During which time period did the fossils differentiate into two branches?
2. Explain how the chart illustrates both punctuated equilibrium and gradualism. Use specific fossils from the chart to support your answer.
3. Examine the fossil that was unearthed in a museum. Apparently the labels and other information were lost. Using your fossil record, determine the time period this fossil is likely from. Explain your reasoning.



4. Of the two major species that arose from the parent species, which was more successful? How do you know?
5. Why do you think some species may have been successful and continued their family branch, while others just died out?

**BONUS:** Find the time period where more changes occurred. Give one logical reason why the amount of changes was greater during this time period.



Idahoan  
(30,000 - present)

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Californian  
(80,000 - 30,000)

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Montanian  
(70,000 - 80,000)

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Idoradian  
(320,000 - 170,000)

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Oregonian  
(395,000 - 320,000)

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Texian  
(445,000 - 395,000)

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Nevadian  
(545,000 - 445,000)

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Ohioian  
(745,000 - 545,000)

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Wyomington  
(795,000 - 745,000)