Tracing Animal Branches

Use shared traits to build evolutionary trees

ZOO.1.4 "Construct cladograms or phylogenetic trees to show the evolutionary branches of an ancestral species and its descendants."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB For each animal set, underline shared new traits and circle the groups that have them. Number the new traits in the order they would appear along the tree, from earliest to latest.

Clues in the Branches

1. A cladogram is a branching model of descent, not a ladder from "simple" to "advanced" animals. A branch point represents a common ancestor whose descendants followed different evolutionary paths. Scientists compare inherited traits to propose where those points belong. A trait shared by several groups may have appeared in their common ancestor, although similar traits can also evolve independently. The most useful clues are shared traits that are new within the groups being compared. Living species sit at the tips. One living species does not turn into another living species on the diagram.

2. Consider five living vertebrate groups: sharks, salmon, salamanders, lizards, and mice. All five have backbones. Sharks have skeletons made mainly of cartilage rather than bone. Salmon, salamanders, lizards, and mice have bony skeletons. Salmon have fins, while salamanders, lizards, and mice have four limbs or inherited the four-limbed body plan. Salamander embryos develop without an amnion. Lizard and mouse embryos develop inside an amnion, a membrane that surrounds the embryo. In mice, this development happens inside the mother, not in a shelled egg. These clues can be placed along a tree without treating any living group as another's ancestor.

3. Now imagine five beetle species discovered on an island: moss, reed, sand, clay, and stone beetles. This is a made-up case for testing a tree, not a report of actual species. Each beetle has six legs and hard wing covers. Moss beetles have smooth wing covers and ordinary hind legs and antennae. Reed, sand, clay, and stone beetles have grooved wing covers. Sand, clay, and stone beetles also have enlarged hind legs. Clay and stone beetles also have forked antennae. Assume each new trait arose only once and was passed to descendants. These trait patterns provide clues to the beetles' branching order.

2 ANSWER WITH EVIDENCE

Use the passage

1. On a cladogram of the five vertebrate groups, which group would branch off before the bony skeleton trait appeared?

2. Would salmon or salamanders branch closer to the common ancestor of lizards and mice? Use a shared trait to explain.

3. Which two vertebrate groups would share the most recent branch point with each other? What trait supports that placement?

4. Where would you mark the origin of the amnion on the vertebrate cladogram? Name the branch that splits off just before it and the two groups that follow it.

3 YOUR TURN

Your own words

Draw a cladogram for the five imaginary beetle species in paragraph 3. Label each tip, mark where the three new traits first appear, and write one sentence naming the closest pair.

ANSWER KEY

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HIGH SCHOOL · ZOO.1.4

PART 1 · READ AND MARK

For each animal set, underline shared new traits and circle the groups that have them. Number the new traits in the order they would appear along the tree, from earliest to latest. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	On a cladogram of the five vertebrate groups, which group would branch off before the bony skeleton trait appeared?	**Sharks would branch off before the bony skeleton trait appeared.**
2	Would salmon or salamanders branch closer to the common ancestor of lizards and mice? Use a shared trait to explain.	**Salamanders would branch closer because salamanders, lizards, and mice share the four-limbed body plan, while salmon do not.**
3	Which two vertebrate groups would share the most recent branch point with each other? What trait supports that placement?	**Lizards and mice would share the most recent branch point with each other. Both have an amnion.**
4	Where would you mark the origin of the amnion on the vertebrate cladogram? Name the branch that splits off just before it and the two groups that follow it.	**Mark the amnion after the salamander branch splits off and before the lineage divides into lizards and mice.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Cladogram: (moss, (reed, (sand, (clay, stone)))). Mark grooved wing covers after moss branches off, enlarged hind legs after reed branches off, and forked antennae after sand branches off. Clay and stone beetles are the closest pair.

Accept any correctly oriented tree with the same branching relationships. Trait labels must appear before all groups that share each trait and after groups that lack it.