Clues in Bones

Use living and fossil traits to infer evolutionary relationships

MS-LS4-2 "Apply scientific ideas to construct an explanation for similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. (SEP: 6; DCI: LS4.A; CCC: Patterns)"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline two shared body traits and circle two differences between organisms. Then number the three nostril positions from front to back to trace a possible pattern of change.

What Whale Fossils Reveal

1. A whale breathes air, yet its body is built for life in water. Its front limbs are flippers with an upper arm bone, two forearm bones, wrist bones, and finger bones. A living hippo has the same basic set of forelimb bones, but it uses its legs to walk and swim. Both are mammals, but shared forelimb bones alone do not show which mammals are closest relatives. To investigate, scientists compare several traits, including features preserved in fossils, and look for patterns of similarities and differences.

2. Pakicetus lived about 50 million years ago. This extinct mammal had four legs that could support its weight on land, and its nostrils were near the tip of its snout. A fossil of its ankle shows a distinctive double-pulley shape also found in living hippos. Modern whales have no walking ankles, so that clue would be missed if scientists studied only living animals. The ankle match supports a link between Pakicetus and the group that includes hippos and whales, but a single matching bone cannot establish a complete family tree.

3. Dorudon lived later, about 37 million years ago. Like modern whales, it had flippers with the familiar upper arm, forearm, wrist, and finger bones. Unlike modern whales, Dorudon still had tiny hind limbs, which were too small for walking. Its nostrils were farther back along the snout than those of Pakicetus, but not as far back as the blowhole on top of a modern whale's head. Together, these patterns support the idea that whale ancestors changed over many generations. They do not prove that either known fossil species was a direct ancestor of today's whales.

2 ANSWER WITH EVIDENCE

Use the passage

1. How are a whale's flipper and a hippo's front leg alike? Why is that match alone not enough to show they are closest relatives?

2. What does the shape of Pakicetus's ankle suggest about its relationship to hippos and whales? Why would studying only living whales miss this clue?

3. Compare the nostril positions of Pakicetus, Dorudon, and modern whales. What pattern do they suggest?

4. How do Dorudon's flippers and hind limbs help explain both a similarity and a difference between Dorudon and modern whales?

3 YOUR TURN

Your own words

Imagine a newly found fossil with four legs strong enough for walking, a double-pulley ankle, and nostrils farther back than Pakicetus's but not on top of its head. In four sentences, infer how it might relate to the organisms in the passage, using two trait comparisons, and explain one limit of your inference.

ANSWER KEY

Clues in Bones

GRADES 6-8 · MS-LS4-2

PART 1 · READ AND MARK

Underline two shared body traits and circle two differences between organisms. Then number the three nostril positions from front to back to trace a possible pattern of change. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How are a whale's flipper and a hippo's front leg alike? Why is that match alone not enough to show they are closest relatives?	**Both have upper arm, forearm, wrist, and finger bones. Scientists need to compare more traits to judge which mammals are closest relatives.**
2	What does the shape of Pakicetus's ankle suggest about its relationship to hippos and whales? Why would studying only living whales miss this clue?	**Its double-pulley ankle, like a hippo's, supports a link to the group that includes hippos and whales. Living whales have no walking ankles to compare.**
3	Compare the nostril positions of Pakicetus, Dorudon, and modern whales. What pattern do they suggest?	**Pakicetus had nostrils near the snout tip, Dorudon's were farther back, and modern whales have a blowhole on top of the head. The pattern suggests that nostril position changed over many generations.**
4	How do Dorudon's flippers and hind limbs help explain both a similarity and a difference between Dorudon and modern whales?	**Both had flippers with the same basic forelimb bones. Dorudon also had tiny hind limbs, while modern whales do not have walking hind limbs, showing a change within the whale lineage.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

The fossil may belong to a group related to early whales. Its walking legs and double-pulley ankle resemble traits of Pakicetus, and the ankle also resembles a hippo's. Its nostrils are farther back than Pakicetus's, a difference that fits the pattern seen in Dorudon and modern whales. These traits do not prove that the fossil was a direct ancestor of any of them.

Accept explanations that use the stated traits to support a possible relationship without claiming that one fossil species must be a direct ancestor. Students may describe nostril positions as a pattern, not a proven sequence of individual ancestors.