Whales Before Whales

Weigh several kinds of evidence for common ancestry.

BIO.4.2 "Evaluate empirical evidence of common ancestry and biological evolution, including comparative anatomy (e.g., homologous structures and embryological similarities), fossil record, molecular/biochemical similarities (e.g...."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline evidence from anatomy, fossils, molecules, and geography. Number two clues that support the same ancestry claim, then circle one limit on what the evidence can show.

How Did Whales Reach the Sea?

1. A whale's flipper looks nothing like a person's arm at first glance. Yet both contain a humerus, two forearm bones, wrist bones, and digits in the same basic order. Their different shapes serve swimming and grasping, but the shared arrangement supports inheritance from a common mammalian ancestor. Whale embryos also briefly develop tiny hind-limb buds, even though adult whales do not have walking legs. Some adults retain small pelvic bones that no longer attach to a walking limb. Together, these structures make more sense as altered inherited features than as parts built from scratch for life at sea.

2. Fossils add a sequence that living anatomy cannot provide. Pakicetus, from rocks in what is now Pakistan, had legs suited for walking and distinctive ear bones seen in early whales. Ambulocetus, also found in Pakistan, had powerful limbs and features consistent with moving in water and on land. Later fossils of Basilosaurus show a fully aquatic body with tiny hind limbs that could not support walking. These fossils do not show every ancestor in a direct line. Instead, their ages and combinations of traits document changes among related populations over millions of years.

3. Molecules provide another test of the proposed relationship. Comparisons of DNA sequences place whales within the even-toed hoofed mammals, with hippos as their closest living relatives. This does not mean a modern hippo turned into a whale; both groups share an older ancestor. Geography adds context: early whale fossils in South Asia and later aquatic whale fossils in regions including North Africa show that the group eventually occupied widely separated areas. Fossil locations alone cannot trace an exact migration route, since many places have no preserved fossils. When anatomy, fossils, molecules, and distribution fit together, the ancestry claim is stronger than any single clue.

2 ANSWER WITH EVIDENCE

Use the passage

1. How do the flipper bones and the hind-limb buds together support common ancestry, despite the difference between a whale and a walking mammal?

2. What change do the three named fossils document, and why should you not treat them as a proven direct line of ancestors?

3. What does the DNA evidence suggest about whales and hippos? Explain one conclusion it does not support.

4. How do the fossil locations add to the ancestry claim, and what question can those locations not settle?

3 YOUR TURN

Your own words

A living island animal has webbed feet, an ankle bone shape shared with otters, and three rare DNA changes shared with otters but absent from other mammals tested. No fossils of the island animal have been found. In four or five sentences, evaluate the evidence for common ancestry with otters, explain a limit of the evidence, and propose one way to test the claim further.

Whales Before Whales

PART 1 · READ AND MARK

Underline evidence from anatomy, fossils, molecules, and geography. Number two clues that support the same ancestry claim, then circle one limit on what the evidence can show. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How do the flipper bones and the hind-limb buds together support common ancestry, despite the difference between a whale and a walking mammal?	**The flipper has the same basic forelimb bone order as a human arm, and whale embryos briefly form hind-limb buds. Both point to inherited mammalian structures that changed over time.**
2	What change do the three named fossils document, and why should you not treat them as a proven direct line of ancestors?	**They document a shift from walking legs to movement in water and then a fully aquatic body with tiny hind limbs. Their traits and ages show change among related populations, not that each fossil species directly descended from the previous one.**
3	What does the DNA evidence suggest about whales and hippos? Explain one conclusion it does not support.	**Hippos are whales' closest living relatives, and the groups share an older ancestor. The evidence does not show that modern hippos turned into whales.**
4	How do the fossil locations add to the ancestry claim, and what question can those locations not settle?	**Early fossils in South Asia and later aquatic fossils in places including North Africa show the group occupied widely separated areas. The finds cannot establish an exact migration route.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Webbed feet alone could have evolved independently as an adaptation to swimming. The shared ankle shape and three rare DNA changes provide stronger evidence of common ancestry with otters. The island location does not establish when or how the animal arrived, and no fossils have been found to help answer those questions. I would compare its DNA with more mammal species to test whether the changes are as rare as they appear.

Accept responses that weigh multiple independent clues rather than treating one trait as proof. A valid further test could compare additional DNA, study more anatomical traits, or search for fossils.