Feathers in Stone

Trace the fossil clues linking birds and theropods.

ZOO.9.2 "Describe the fossil evidence that indicates that birds evolved from two-legged dinosaurs called theropods."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline three fossil observations that connect birds to theropods, and number them 1 to 3 so you can track the evidence behind the conclusion.

A Connection Preserved in Fossils

1. At a quarry in Germany, a slab of limestone split open to reveal *Archaeopteryx*, an animal that lived about 150 million years ago. Fine marks around its arms and tail show the shapes of feathers. Yet its skeleton also held teeth, three clawed fingers on each hand, and a long bony tail. Those features differ from the short tails and toothless beaks of living birds. A single fossil thus preserves a mix of birdlike and dinosaur-like traits. Scientists do not need to call this animal a direct ancestor of today's birds to see why the mix matters.

2. Other fossils place feathers on animals clearly classified as theropod dinosaurs. *Microraptor*, a small, two-legged theropod, left fossil impressions of long feathers on its arms and legs. In *Velociraptor*, raised bumps along a forearm bone mark places where large feathers once attached. No feather impressions survive on that particular bone, so the bumps provide a different kind of evidence. Feathers alone, then, cannot separate every bird from every nonbird dinosaur. These finds show that feathered forelimbs appeared among theropods, not only among animals with the short tails and beaks of living birds.

3. Bones provide another line of evidence. Fossils of some theropods preserve a wishbone, a bone made from fused collarbones that living birds also have. Many theropods walked on two legs and had three-fingered hands, traits visible in the *Archaeopteryx* skeleton as well. Each shared trait is a clue, but a single resemblance could mislead. Together, feathers, wishbones, and similar limb bones form a pattern across different fossils. That pattern supports the conclusion that birds evolved within the theropod dinosaur group. It does not prove that any one fossil species was the direct ancestor of all living birds.

2 ANSWER WITH EVIDENCE

Use the passage

1. How do the feathers and long bony tail of *Archaeopteryx* help show a connection between birds and dinosaurs?

2. What different fossil evidence from *Microraptor* and *Velociraptor* shows that theropods had feathers?

3. How does the fossil wishbone add to the feather evidence for a bird-theropod connection?

4. Why is the pattern across several fossils stronger evidence for bird origins than one shared trait alone?

3 YOUR TURN

Your own words

A museum receives a newly found fossil with feather impressions, a wishbone, three clawed fingers, and a long bony tail. Write a four-sentence museum label explaining how its traits support a bird-theropod connection and why they do not identify it as a direct ancestor of living birds.

Feathers in Stone

PART 1 · READ AND MARK

Underline three fossil observations that connect birds to theropods, and number them 1 to 3 so you can track the evidence behind the conclusion. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How do the feathers and long bony tail of *Archaeopteryx* help show a connection between birds and dinosaurs?	**Its feathers are birdlike, while its long bony tail is dinosaur-like. Both traits occur in the same fossil.**
2	What different fossil evidence from *Microraptor* and *Velociraptor* shows that theropods had feathers?	***Microraptor* fossils have feather impressions. A *Velociraptor* forearm bone has bumps where large feathers attached.**
3	How does the fossil wishbone add to the feather evidence for a bird-theropod connection?	**Some theropod fossils preserve a wishbone like the one living birds have, so a skeletal trait supports the connection as well as feathers.**
4	Why is the pattern across several fossils stronger evidence for bird origins than one shared trait alone?	**A single resemblance could mislead, but feathers, wishbones, and similar limb bones appear across different fossils and support the same connection.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

The feather impressions show that this animal had feathers, a trait shared by birds and some theropods. Its wishbone and three clawed fingers add skeletal evidence connecting it to those groups. The long bony tail shows that it was unlike living birds despite its birdlike features. Together, these traits support a bird-theropod connection, but they do not prove this animal was a direct ancestor of living birds.

Accept equivalent explanations that connect specific fossil observations to the conclusion. For the museum label, look for four sentences that use the new fossil's traits and distinguish evidence of a connection from proof of direct ancestry.