The evolution of flight in Birds

Activity Key

Review Activity #1: Interpreting the Evidence

In order to explore the evolution of flight, we will look at the fossil record and interpret the evidence that we find. The following story illustrates the kinds of evidence we will be using.

Suppose that you hear a crash in the kitchen. You walk inside and find broken glass and a puddle of clear liquid that were not there only moments before. The glass and puddle are *direct* evidence of what happened. What might you *infer*? What probably happened?

Now let's see how we can use direct evidence from fossils to make inferences about past life.

Class discussion or written assignment:

Examine the *Archaeopteryx* fossil with a partner. Then respond to the questions below.

a. The fossil itself is *direct* evidence that *Archaeopteryx* existed. But look closely; there is more information to be gained from the evidence. Look at the features shown in this fossil.

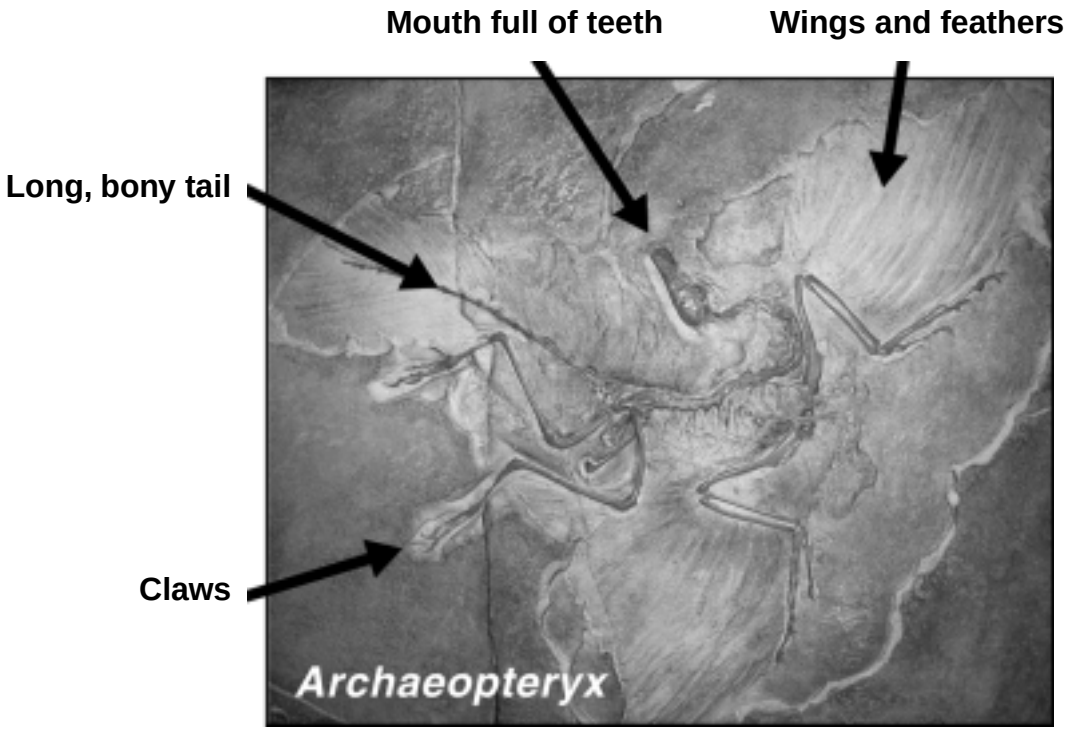
Sample: *Archaeopteryx* had wings, feathers, claws, a long bony tail, and a mouth full of teeth.

b. We can make inferences about how *Archaeopteryx* behaved, based upon these features. What inference, or hypothesis, can you make about its behavior based upon the evidence? (HINT: its claws, teeth, wings and feathers?)

Sample: Since *Archaeopteryx* had wings and feathers, it probably flew.

c. Paleontologists often make comparisons with living animals to learn more about extinct animals. Using living animals, give an example that might support your hypothesis.

Sample: Most birds that have functional wings and feathers fly, so it makes sense that *Archaeopteryx* flew.



Review Activity #2: Skeletal Features for Flight

The cladogram from Investigating Skeletal Features is below.

Class discussion or written assignment:

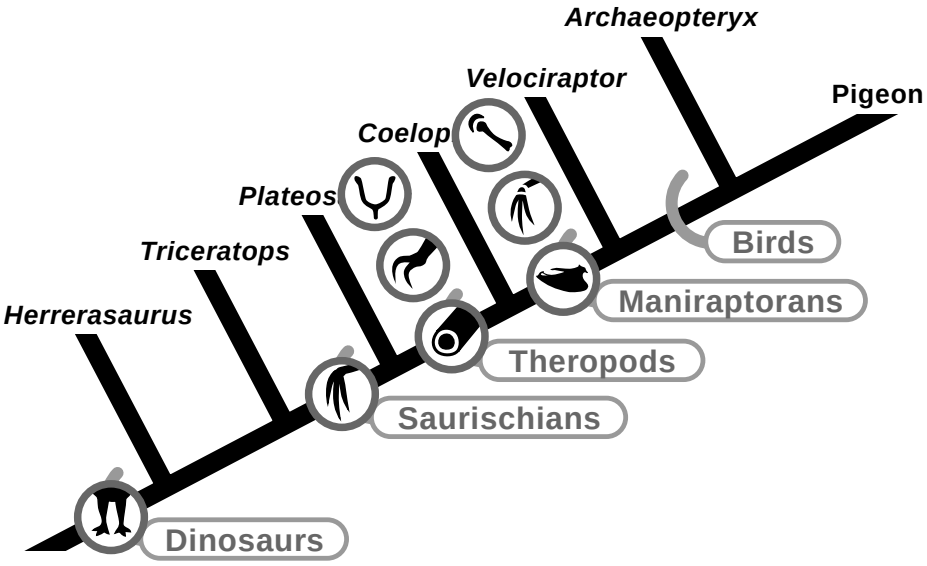
Review the information on the cladogram with your partner. Since we have direct evidence of the appearance of many of these features very early in the dinosaur lineage, we can infer that they served a function other than flight.

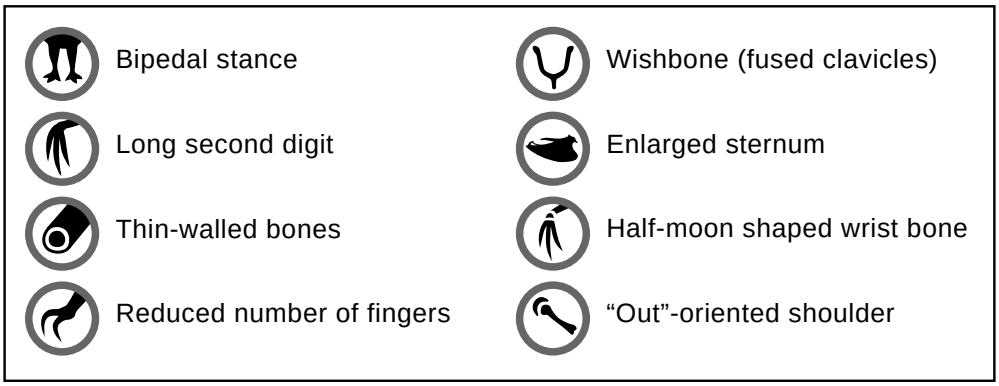
a. Select at least three of the mapped features. List the three features on your paper and suggest what function(s) they might have served other than flight. Give a reason for your suggestions.

Sample: Bipedalism—chasing after prey
Hollow bones—lighten the frame of the animal so that it can run faster
Long second digit—used for digging the marrow out of the bones of its prey

b. What other inferences can we make? Use the evidence illustrated on this cladogram to make and support a hypothesis about the evolution of skeletal features associated with flight.

Sample: The skeletal features associated with flight originally served functions other than flight. We have direct fossil evidence that many of the skeletal features appeared very early in the dinosaur lineage. For instance, bipedalism is seen throughout the lineage; a long second digit occurs in the Saurischians; thin-walled bones and a reduction in digits occurs in the theropods; and the furcula, enlarged sternum, and swivel wrists all occur in the Maniraptorans. We can assume that each of these features evolved for functions other than flight, such as the functions listed above.





Review Activity #3: Feathers

The cladogram indicating the first appearance of the four types of feathers is below.

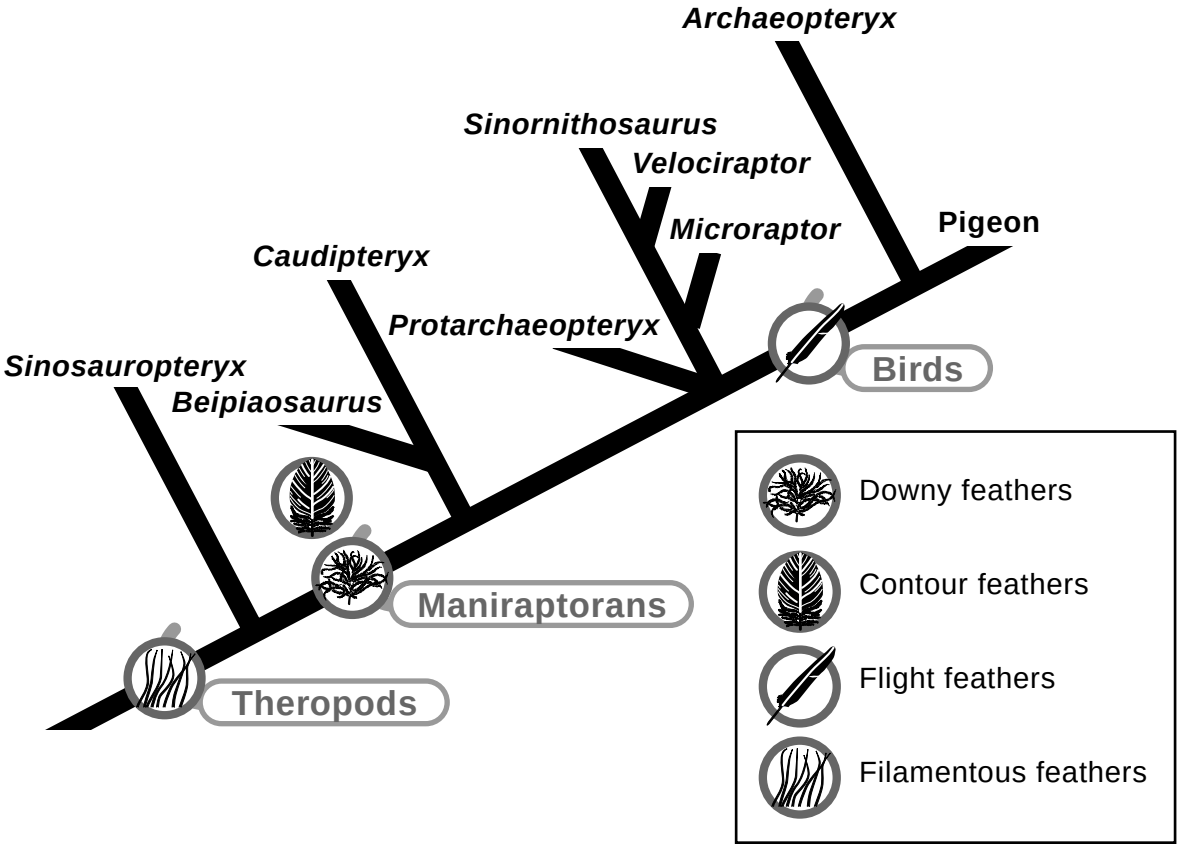
Class discussion or written assignment:

Review the information on the cladogram with your partner. Since we have direct evidence of the appearance of different types of feathers quite early in the dinosaur lineage, we can infer that they served a function other than flight.

a. Propose a hypothesis for the function of feathers in non-flying dinosaurs.
Sample: Feathers were originally used for insulation.

b. Use direct evidence to support inferences.
Sample: We have direct evidence that the earliest appearance of feathers were filamentous. Their appearance is very similar to the down feathers that we see in living birds today. Since the downy feathers are used for insulation, we can infer that the filamentous feathers were used for insulation.

c. Using living animals, give an example that might support your hypothesis.
Sample: Birds today have downy feathers that are used for insulation.



Review Activity #4: Form and Function—the Flight Stroke

The cladogram indicating the first appearance of three flight stroke features is below.

Class discussion or written assignment:

Look at the cladogram. There is direct fossil evidence that the shoulder and wrist of *Velociraptor* were capable of a wider range of motion than its earlier relatives. However, the fossil evidence does *not* indicate that the arms of *Velociraptor* were very long relative to leg length. So what might have been happening?

- If there were only a wide range of motion, was the animal capable of flight?
- If the animal was not flying, why did it have such a wide range of motion?

a. Propose a hypothesis about the evolution of the flight stroke.
Sample 1: *Velociraptor* was unable to fly.
Sample 2: *Velociraptor* used its mobile arms for scooping fish out of nearby streams.

b. Consider the questions above and use both direct evidence and inference.
Sample 1: *Velociraptor* was unable to fly because so far there is no direct evidence of wings and its arms were shorter than its legs.This would indicate that even if wing impressions were found that they would not be able to generate enough force to get *Velociraptor* off the ground. (inference)
Sample 2: The shoulder and wrist of *Velociraptor* show an increased range of motion (direct evidence). Fossil evidence also indicates that *Velociraptor* had teeth and claws (direct evidence). From this evidence we can assume that *Velociraptor* was a predator and perhaps it used its mobile arms to capture prey such as fish. (inference)