
Birds of a Feather

The Form, Function and Evolution of a Bird's Feathers



Purpose:

- Students will analyze the differences between feather textures, colors and shapes of varying birds so that they may learn differences in birds' adaptations for their varying habitats and lifestyles. After determining the various functions of feathers, students will propose theories on why they believe birds evolved to have feathers in the first place.

Objectives:

- Students will analyze these differences between birds and other animals. They will hypothesize why they believe birds are in a unique class of their own in small groups.
- Students will describe the differences (either by drawing or writing) in feather color, feather texture and shape using the wings and laminate cards provided.
- Students will construct a paragraph on why they believe the ancestors of birds evolved to have feathers, and what those may have looked like. Students will compare and contrast how dinosaurs might have used their feathers differently or similarly to how modern birds use their feathers.

Appropriate grades: 6-8, 9-12

Can be modified for younger grades, please see modifications.

Time Required: Two 50-60 minute classes.

NGSS:

MS-LS4-2:

Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.

HS-LS4-1:

Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

Materials:

- PowerPoint (*on flash drive*)

In Button & String Clear Envelope:

- Bird wings (5),
- Feathers (5)
- Bird head (*to show feather bristles on face, 1*)



- Riker mount of types of feathers
- Taxonomic hierarchy sheet

Activity:

Background information: Bird feathers serve a wide variety of functions, depending on the type of feather and the type of bird. Some of the major functions of feathers are power for flight, insulation for controlling body temperature, and displaying colors for communication, camouflage and mating. Feathers evolved from dinosaurs between 160-200 million years ago and birds and dinosaur feathers share many of the same functions. This activity is designed to let students discuss and discover the various functions that feathers have in birds and also hypothesize on how feathers evolved. See Background Section in the teacher's binder for more information. The PowerPoint is meant to be a guiding question activity. Students may not know the answer to some of the questions, but forming a hypothesis is an important part of being a scientist! Notes are imbedded in the PowerPoint to help facilitate such questions.

<p>Introduction</p>	<p>The introduction should take approximately 10-15 minutes.</p> <ol style="list-style-type: none"> 1) Today we will explore evolution and speciation by asking three questions: <i>What makes birds unique from other animals? Why do birds have feathers? Where did feathers come from?</i> 2) Before beginning the PowerPoint and starting the activities, have students brainstorm in small groups divisible by three and have them answer one of the three questions. Answers should be detailed and explain their reasoning. 3) Have at least three groups share their hypothesis with the rest of the class.
<p>Body</p>	<p>The body will be take approximately 80 minutes. It is recommended to break it up into two different class periods.</p> <ol style="list-style-type: none"> 1) <i>What makes birds unique from other animals? 15 min</i> <ol style="list-style-type: none"> a. Overview of where birds fit in the biological taxonomic scale. Pass out taxonomy laminate sheet for students to get a better understanding (if they are not familiar with taxonomy already). b. Go over traits that birds share with other animals (i.e., reptiles also lay eggs). c. What makes birds truly unique from other animals because is their feathers. 2) <i>Why do birds have feathers? 30 min</i> <ol style="list-style-type: none"> a. Feathers do not only allow birds to fly; they keep birds warm, waterproof, give them camouflage, are used as a form of communication, and help them attract mates. b. Because they have so many different functions, feathers come in multiple forms. This includes a variety of colors, shapes, sizes and textures.



	<ul style="list-style-type: none"> c. Different types of feathers: flight, wing, contour, semi-plumes, down and bristles. Feathers are used for mating and display, for camouflage, and even for feeling. Pass out feathers as you go over them in the PowerPoint. d. Have students feel feathers and experiment with texture, color and size. Why would some feathers be soft and others stiff? Why are some dull and others bright? Have students construct an explanation for why differences in feathers help them survive and reproduce. <p>3) <i>Where did feathers come from? 35 min</i></p> <ul style="list-style-type: none"> a. Through fossils, scientists have discovered that birds are the living relatives of reptilian dinosaurs. We will explore the origins of feathers and speculate why they could have evolved on dinosaurs. b. First fossil found in 1851—archaeopteryx (arch-e-op-ter-x) 150 mya. Archaeopteryx has full wing and tail feather impressions just like modern birds. But feathers didn't just originate on an animal one day...Does anyone have theories on how they may have started? c. Scientists believe that feathers started as a modification of a reptilian scale. (Go through perceived evolution of feathers with examples). d. While there is not complete scientific consensus, most evidence supports a hypothesis of "dino fuzz" as an origin of feathers. What would the purpose of these feathers be? e. Some adult theropod dinosaurs have been found have large, flowy wing feathers. Using modern technology, Scientists have even been able to identify that these feathers were likely very colorful. What do you think their purpose was? f. Review feather evolution briefly.
Closure	<p>Have students finish with a final essay: 20-25 min</p> <p>About 200 mya scales on some species of dinosaurs began to change and little tiny bristles now appeared on the bodies of dinosaurs known as theropods. Scientists are not in full agreement as to the purpose of this dinosaur fuzz, but fossil evidence shows the links between this fuzz and modern feathers. Using the information you have learned about modern bird feathers, hypothesize one reason why dinosaurs may have evolved this adaptation. Be sure to cite information from the PowerPoint slides.</p>



Modifications:

3rd-5th grade:

3-LS4-2: Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.

- Introduce students to any necessary vocabulary.
- Show a picture of a bird on the projector and ask students why they think birds are different from any other animal. Pass around feathers in riker mount or invite children to come up and look at them in the front. Have them write their observations about the feathers down and incorporate guiding questions on differences in colors (bright vs. dull), shapes (short and fluffy or long and tight), sizes (big, little) and textures (soft vs. stiff). Have students share their observations in small groups, and then with the class.
- Review PowerPoint slides 5-9.
- Have students write a short essay about the differences in feathers and how birds use different feathers to help them survive and find mates. Student can also draw a bird with feathers, and describe the function of each different group, or color of the bird's feathers.

Key Vocabulary:

Adaptation: The adjustment or changes in behavior, physiology, and structure of an organism to become more suited to an environment.

Evolve: Evolution consists of changes in the heritable traits of a population of organisms as successive generations replace one another. It is populations of organisms that evolve, not individual organisms.

Speciation: The evolutionary processes through which new species arise from existing species.

Taxonomic hierarchy: An ordered group of taxonomic ranks used to classify organisms from general to specific. Living species are arranged as follows: Kingdom, Phylum, Class, Order, Family, Genus, Species.

Vertebrate: refers to animals with a backbone or spinal column. Vertebrates have an endoskeleton (a skeleton inside its body), which is made of bone or cartilage.

Sources and further reading:

- 1) <https://academy.allaboutbirds.org/>
- 2) *Feathers, The Evolution of a Natural Miracle* by Thor Hansen
- 3) <https://www.nationalgeographic.com/magazine/2011/02/feather-evolution/>
- 4) <https://ed.ted.com/lessons/how-did-feathers-evolve-carl-zimmer#review>
- 5) https://evolution.berkeley.edu/evolibrary/article/evograms_06





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