



Cabrillo Marine Aquarium Lesson Plan

Grade Level: Second through Fourth Grades

Title: **Birds 101: A Lesson on Bird Feather Anatomy**

Objective: Students will compare types of feathers by examining structure and function

Next Generation Science Standards: 1-LS3-1, 1-LS1-2, 3-LS3-2, 3-LS1-1, 3-LS3-1, 3-LS4-3, 4-LS1-1

Time to Complete: 45-60 minutes

Materials Provided by CMA to enhance distance learning: *Worksheet: Bird Coloring Sheet, Worksheet: Parts of a Feather, Worksheet: Types of Feathers, Worksheet: Parts of a Bird*, Bird Photos

It is ideal for students to have printed copies of worksheets. However, if students do not have access to a printer see the following recommendations:

- Edit worksheets digitally
 - PDF editor apps such as Adobe
 - MS Paint: worksheets must be converted to JPEG File

Student Materials: Students should at least have paper and pencil to perform the lesson. Colored pencils are highly suggested but not required.

Lesson Background – Adaptation for NGSS & Distance Learning

Distance Learning Adaptation: In these times of distance learning, this lesson can be modified in the following ways:

- Synchronous live discussion on a video conferencing platform (zoom, google meet, etc.) If your classroom is currently using class discussions, then this lesson can be introduced with the following conversation to introduce the concept.
 - You can host the entire lesson “live” via the mentioned video conferencing platforms. To enhance the lecture portion, display the provided media either through share screen, or utilizing a virtual white board like JamBoard, which is compatible with GoogleClassroom or ZiteBoard.
- A-synchronous / self-pace assignment. If your classroom is using an asynchronous model for instruction (such as take-home packets, or self-paced online modules) this lesson can be easily adapted. This lesson can be based on a pre-recorded video or a hard copy worksheet.
- For take home packets, we would suggest synthesizing the lecture to a few key questions and facts for students to read along with family.



- For prerecorded video, we would recommend the educator recording themselves to ask these questions, and guide students to the same conclusions.
- If your classroom is using EdPuzzle (online learning video tool) Educators can easily use the voiceover function over our provided content and include questions during the course of the video.

Vocabulary: Keratin, barb, down, barbule, plumage, vane, rachis, afterfeather, calamus, shaft, contour feathers, downy, semiplume, filoplume, bristle, molting, insulation

- If using an online white board, display these words as they come up in the lecture.

Background Information: Birds come in different shapes and sizes, but the one thing they have in common is feathers. No other animals have feathers, except birds. They are similar to mammals, reptiles, fish, and amphibians in that they are vertebrates. They are warm-blooded and have a four-chambered heart that regulates their core body temperature just like mammals. However, feathers distinguish birds from the rest.

Feathers play three (3) main roles in birds' lives:

1. Feathers provide **insulation**, allowing birds to maintain their body temperatures in a wide variety of environmental conditions.
2. Certain feathers are instrumental in allowing birds to fly.
3. Because they come in different shapes and colors, feathers provide individual **plumage** that can serve to camouflage a bird or attract a mate.

What are feathers? (refer to Worksheet: Parts of a Feather)

Educators should screen share the worksheet as they discuss the different parts of feathers

Feathers are made up of **keratin**, the same protein that makes up scales, beaks, and claws.

In general, feathers consist of the following structures:

- **calamus** - the hollow shaft of the feather that attaches it to the bird's skin
- **rachis** - the central shaft of the feather to which the vanes are attached
- **vane** - the flattened part of the feather that is attached on either side of the rachis (each feather has two vanes)
- **barbs** - the numerous branches off the rachis that form the vanes
- **barbules** - tiny extensions from barbs that are held together by barbicels
- **barbicels** - tiny hooks that interlock to hold the barbules together

Birds have several different types of feathers and each type is specialized to serve a different function. (refer to Worksheet: Types of Feathers)

Educators should screen share worksheet as they discuss the different types of feathers

In general, feather types include:

- **primary flight** - long feathers located at the tip of the wing
- **secondary flight** - shorter feathers located along the trailing edge of the inner wing
- **tail** - feathers attached to the bird's rump
- **contour** - feathers that line the body and provide streamlining, insulation, and waterproofing
- **downy** - fluffy feathers located under the contour feathers that serve as insulation
- **semiplume** - feathers located under the contour feathers that serve as insulation (slightly larger than down feathers)
- **filoplume** - simple, hair-like structures that grow in circles around the base of contour or down feathers
- **bristle** - long, stiff feathers around the bird's mouth or eyes

Feathers suffer wear and tear as they are exposed to the elements. Over time, the quality of each feather deteriorates and compromises its ability to serve the bird in flight or to provide insulation qualities. So to prevent feather deterioration, birds shed and replace their feathers periodically in a process called **molting**.

What is molting?

Birds must spend a great deal of time caring for their feathers, since their lives depend on them. Preening, bathing, dusting, and other feather care operations, however, cannot prevent the feathers from wearing out. Because formed feathers (like our fingernails) are lifeless, horny structures, incapable of being repaired, worn feathers must be replaced. This process of replacement is termed molting. The old, worn feathers are loosened in their follicles (sockets) by the growth of new intruding feathers, which eventually push them out. Molting occurs in regular patterns over a bird's body. The majority of adult birds molt once or twice a year. Feathers of species that migrate enormous distances or live in thick brush, dodging among twigs and spines, wear more rapidly than those of birds residing in one place or living in open country.

Molting is timed to meet various needs. For example, resident temperate-zone birds require more insulating feathers in the winter than in the summer. The number of feathers can change in the process of molting; winter plumage may contain more than twice as many feathers as summer plumage. Since the feathers, which carry the colors of birds, are "dead," a bird cannot totally change its colors without changing its feathers (although its appearance can change substantially just from wear). Therefore a male bird usually molts into his most colorful plumage prior to the breeding season.

Some birds, such as ducks, swans, grebes, pelicans, and auks, are "synchronous molters" and they change their feathers all at once in a period as short as two weeks, but sometimes stretching over a month. During this period, they cannot fly, and males, in particular, often complete the process on secluded lakes in order to minimize their vulnerability to predators.

Lesson Outline:

- Ask students to think about what comes to mind when they hear the word “bird.”
- List characteristics on the virtual whiteboard: **flight, eggs, beaks, feet, warm-blooded, feathers**
- Ask students which of the characteristics listed are not unique to birds.
- Discuss as you cross off from the list each characteristic that is not unique.
- The remaining feature should be **feathers**.
- No other animal on the planet has feathers.
- Show feather diagram & discuss the **basic structure of a feather**.
- Show students an example of **contour and down feathers**.

Lesson Procedures:

- Divide students into teams of two or three.
 - For distance learning, teamwork is still possible. Students can work with each other outside of the class conference.
 - If this is not possible, or not suitable for your class, this can be adapted to be a class discussion.
- Hand out **feathers, Worksheet: Parts of a Feather** and **Student Journals**.
- Ask students to examine photos of feathers and birds
- Have students guess which bird the feather is from.
- Have students try and identify which type of feather it is (e.g., contour, down).
- Have students sketch & label the parts of the feather.
- After time has elapsed, ask students to share their interesting observations.
- Discuss their findings and feather ID guesses.

Activity 1: Bird Features & Feather Worksheets

- Hand out the **Worksheet: Parts of a Bird, Worksheet: Parts of a Feather** and **Worksheet: Types of Feathers** and review the answers together as a class.

Activity 2: Godwits in Flight Video Clip

- Have students listen and watch as Massey University’s Dr. Phil Battley describes Godwits in flight including flapping ability, speed, flying altitudes, streamlining, time taken for non-stop flight and V-formation flight.
- <http://www.sciencelearn.org.nz/Contexts/Flight/Sci-Media/Video/Godwits-in-flight>

Activity 3: Plumage is Not Just for Pretty! (refer to Bird Photos)

- Ask students 2-3 questions to re-cap lesson.
 - Describe what plumage is on a bird? **Plumage is the covering of feathers on a bird. Many birds like the Brown Pelican have dull plumage during the winter season & brighter plumage during the breeding season in the spring & summer months.**

- Ask students why they think it birds would want different plumage for breeding season?
- Ask students to guess if it is the male or female that has the more colorful plumage? (It's the males.) Ask students to explain why.
 - Males have more colorful plumage to attract females. In this instance, males have to compete to the best bird to find a female to mate with. Bright plummages can signify a male being a good hunter, and being able to provide for the female bird and their potential offspring.
 - Show photos of birds with different mating plummages.
- What is the function of feathers? **Feathers perform a variety of functions for a bird including insulation, protection, mating attraction, and flight management.**
- Describe the function of the plumage of a local bird species. **In adult Brown Pelicans the plumage plays a significant role in communication. During the breeding period, prior to nesting, the hind neck becomes vibrant dark reddish brown. In the winter or during the non-breeding period the head and neck are mainly white.**

Lesson Wrap-up:

- Feathers serve many functions in birds but most notable is the critical role feathers play in enabling birds to fly. Feathers have enabled birds to refine flight to an art form matched by no other organism alive today.
- Feathers also provide protection from the elements. Feathers provide birds with waterproofing and **insulation** and even block harmful UV rays from the skin
- Feathers provide individual **plumage** that can serve as camouflage or attract a mate.

Lesson Extensions: Go Outside!

- Take students on a virtual field trip to observe the “plumage” of birds and to look for feathers. There are plenty of nature documentaries online available to stream. Students can learn about birds from around the world! If watching different videos or documentaries, have students compare and contrast the body-plan of different birds and their habitat. (Ask students to observe the different types of plumage and discuss the function of plumage (e.g., camouflage, for displaying and attracting a mate, etc).
- Have students record their observations with bird sketches, color patterns, flight behaviors. This can be submitted later as a virtual assignments. Students can take pictures of their hand-drawings and upload as attachments.

Further Student Exploration:

- Have student’s research feather conservation and the **Migratory Bird Treaty Act of 1918**. Have them write a report and create a poster to share with the class.

References:

- Basin & Range Birding Trail Education Kit
<http://www.KlamathBird.org/Education/BRBT>
- U.S. Fish and Wildlife: link:
http://www.ms-starship.com/sciencenew/brown_pelican.htm
- Science Learning: Spark Fresh Thinking
<http://www.sciencelearn.org>

