Activity 1: Name That Adaptation

Summary

Students will explore structural, physiological, and behavioral adaptations of Whooping Cranes.

Objectives:

Students will be able to:

- Define an adaptation
- Describe several Whooping Crane adaptations
- Explain how a Whooping Crane's adaptations help it survive
- Compare Whooping Crane and human morphology
- Sketch their observations

Standards:

Science F.8.2
Art & Design H.8.3

Materials Needed:

- Copies of "Name That Adaptation" worksheet
- Bucket with soil

All of the following can be found in the trunk:

- Whooping Crane skull
- Whooping Crane egg replica
- Whooping Crane leg replica
- Whooping Crane photographs
- Whooping Crane flight feather
- Photo of a cross section of a bird bone, or Whooping Crane bone fragments

Background:

The common name "Whooping Crane" probably comes from the loud, unique call that the birds make when they are alarmed, defending their territory, or reinforcing pair bonds (securing their mates). Whooping Cranes have an elongated trachea, which allows them to produce the loud and distinctive whooping calls for which they are known.

Whooping Cranes are one of fifteen species of cranes found in the world. There are only two kinds of cranes found in North America: Whooping Cranes and Sandhill Cranes. There are about 650,000 Sandhill Cranes in the world, but only about 750 Whooping Cranes. Sandhill Cranes are grayish-brown and stand about 3.5 feet tall, while Whooping Cranes are white and stand about five feet tall. In fact, Whooping Cranes are the tallest birds in North America. They have a wingspan reaching seven to eight feet across.

A Whooping Crane among several Sandhill Cranes. What might have caught their attention? Photo: Wisconsin DNR

Adult Whooping Cranes are almost entirely white. The only non-white markings on Whooping Cranes are the black wingtips, black facial markings, the bare patch of red skin on the top of their heads, and black legs and feet. Whooping Crane chicks are cinnamon brown, which helps to camouflage them. As the chicks mature during their first year, they develop the characteristic black wingtips, and their body feathers become a mix of cinnamon brown and white with black wingtips. Whooping Cranes have different types of feathers: down feathers to keep them warm, contour feathers that provide body shape and protection, and strong, stiff and much larger flight feathers (which are a type of contour feather).

Whooping Cranes depend on wetlands for their survival. Whooping Cranes use wetlands as a source of

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food, to roost (sleep), and to make nests. A Whooping Crane diet consists of minnows, insects, frogs, crabs, crayfish, snails, rodents, smaller birds, and plant material, which are all found in wetlands.

Adult and juvenile Whooping Cranes. *Photo: International Crane Foundation*

Whooping Cranes fly with their legs and neck outstretched and have black wingtips. Their wingspan is seven to eight feet across. *Photo: USFWS*

Whooping Cranes build "floating nests" made of bulrushes and other wetland vegetation that sit in the shallow water, six to ten inches deep. Building their nests in water helps to reduce the risk of egg predation by animals that are not willing to travel through the water to get to the eggs. Whooping Cranes usually lay two eggs, and both the male and the female will incubate them for 29-30 days. Both parents defend their nest and young, but the male is often more aggressive.

A "floating" wetland nest with Whooping Crane eggs in it. *Photo: USFWS*

Minnows are one type of food eaten by Whooping Cranes. *Photo: USFWS*

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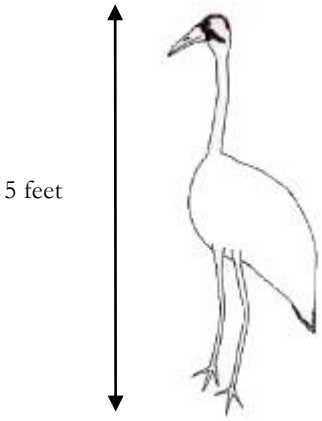
Whooping Cranes have many **adaptations** that help them survive in wetland habitats. An adaptation is a structural, physiological, or behavioral trait that increases an organism's chances of survival and reproduction and helps it become well-adjusted to its environment. For example, an owl's large eyes are an adaptation that allow it to see better at night. Because owls eat other nocturnal animals such as mice and voles, they are more likely to find food at night by being able to see better and are therefore more likely to survive.

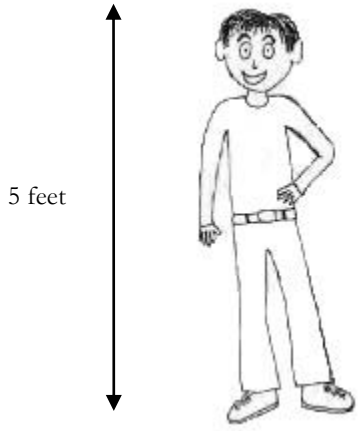
Whooping Cranes are adapted for flight. They weigh only 15 pounds, despite being five feet tall. Like all birds that fly long distances, Whooping Cranes have hollow bones filled with air. These bones make a strong yet light skeleton so that birds are able to fly!

Whooping Crane



15 pounds

Average 13 year-old U.S. boy



100 pounds; *Source: CDC-NCHS*

How does the height and weight of a Whooping Crane compare to yours? Why would a bird weight 85 pounds less than a human being of the same height?

Whooping Cranes also have feathers adapted for flying. They have flight feathers, which are a type of contour feather. Contour feathers are light, strong, and stiff and cover most of the outer surface of the bird. These feathers give the bird its shape and color and protect the bird from sun, wind, and rain. Contour feathers are made up of a hollow quill with many barbs that branch out from the quill. These barbs then branch out into barbules, which connect to each other like a zipper to form a flat, smooth surface that retains the shape of the feather. These barbs and barbules provide the resistance to air that the birds need to fly. Whooping Cranes also have down feathers, small, soft, and fluffy feathers that are under contour feathers and provide insulation for the bird.

Whooping Cranes display several behavioral adaptations. For example, males and females exhibit "dancing behavior," which consists of bowing, jumping, running, stick or grass tossing, and wing flapping. Whooping Cranes are often seen dancing during courtship, to relieve tension, and when they are prepared to migrate.

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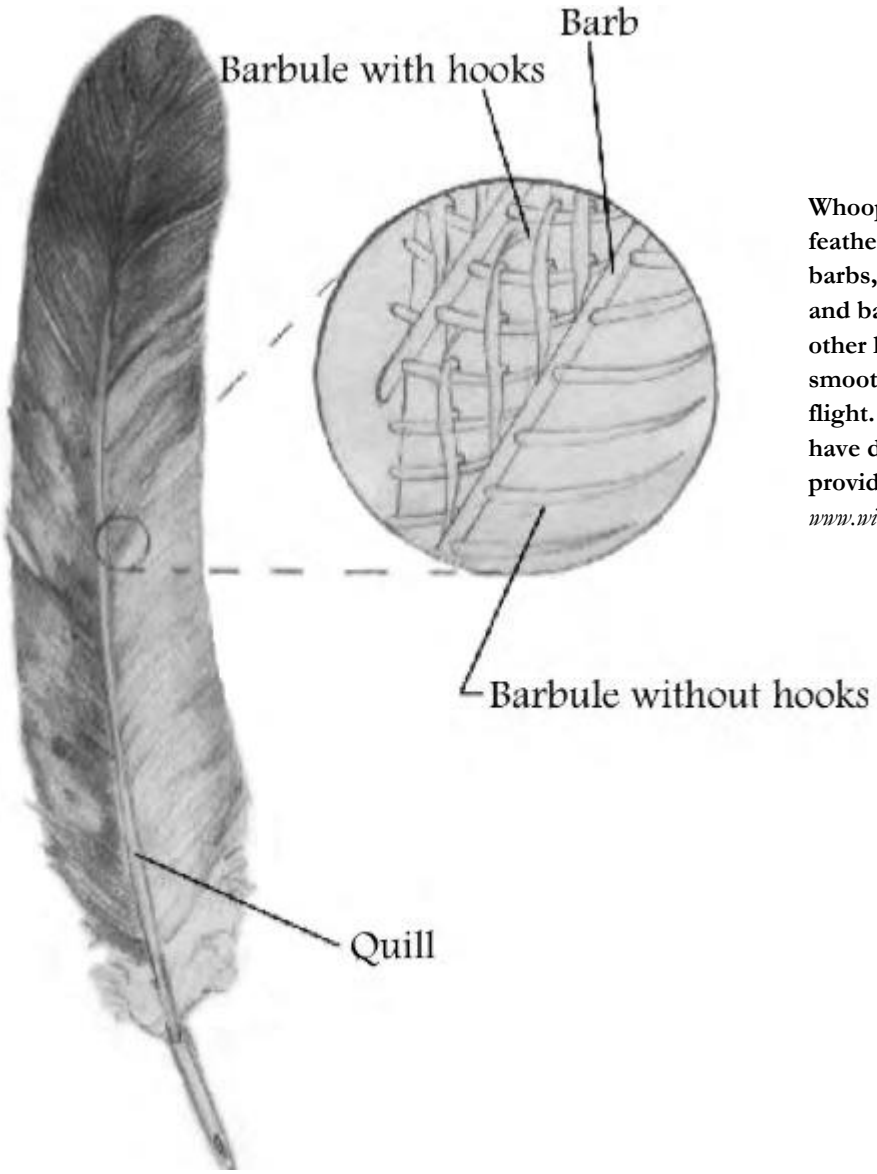
Whooping Cranes are also behaviorally adapted in their mating patterns. Whooping Cranes keep the same mate for many years, and sometimes for life.



Whooping Cranes have flight feathers, comprised of a quill, barbs, and barbules. The barbs and barbules connect to each other like a zipper to form a flat, smooth surface that allows for flight. Whooping Cranes also have down feathers which provide insulation. *Illustration: www.wings.avkids.com*

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Procedure:

1) Have students complete a webquest on adaptations. Here are some ideas for webquests:
   - For upper elementary and middle school students: "I Will Survive!" at: questgarden.com/47/15/7/070303074334/index.htm
   - For middle school science students: "Adaptations and Evolution" at: questgarden.com/127/14/1/110526073851/

2) Distribute the "Name That Adaptation" worksheet. Display the Whooping Crane skull, egg replica, leg replica, feathers, bone fragments, and photographs that are in the crane trunk. Students should examine the items and fill out the worksheet to explain how each characteristic is an adaptation and describe how it helps a Whooping Crane survive. Pages 29-32 of the Crane Trunk Manual can be photocopied and distributed to students to help them fill out the worksheet.

3) Ask the students to examine the replica of the Whooping Crane leg again. Ask students to point to where the ankle is and where the knee is.

   Many people mistake the Whooping Crane's ankle for the knee and wonder why the "knee" bends backwards. In fact, the Whooping Crane's leg joints are similar to a human's, but the proportions are different.

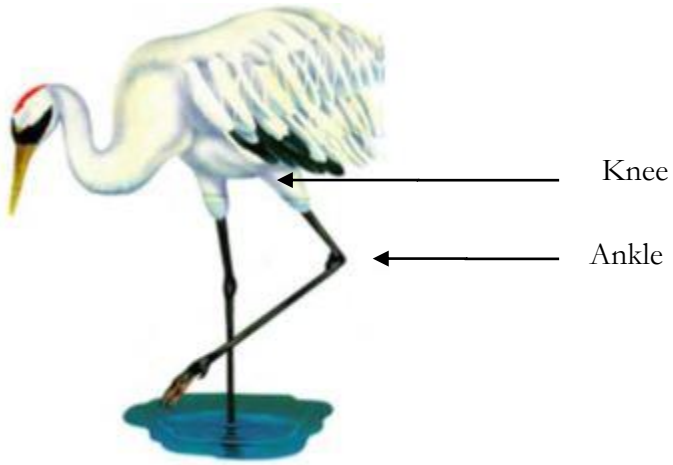

Illustration: U.S. Environmental Protection Agency

4) Have students compare and contrast the anatomy of a chicken and Whooping Crane leg by sketching a picture of each. Students should explain why the proportions of the Whooping Crane leg might be useful to an animal that wades in the water, whereas the proportions of a chicken leg are better suited to an animal that walks on land.

   Long legs help cranes wade through water and walk through tall marsh grasses. Their long toes help distribute their weight so they can easily walk on soft surfaces like mud.

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Demonstrate weight distribution by using a bucket filled with soil. Have students use their hands to imitate a crane's foot. Which sinks further, an open hand or a closed fist?

A closed fist will sink further than an open hand because its surface-area-to-volume ratio is lower. By having students open up their hands weight can be distributed more evenly, preventing the hand from sinking as deep. This is similar to how a crane's foot helps prevent it from sinking in mud in a wetland.

5) Have students research the mechanics of flight in birds. They can research in the library or on the Internet. Ask students to research on their own or in pairs how the shape of the wing and feathers provide lift for the birds. Students should then share their findings in small groups. Have them sketch a bird's wing. Does it lay perfectly flat?

Some informative websites about the dynamics of flight include:

Earthlife on the web: www.earthlife.net/birds/flight.html

A Journey North: http://www.learner.org/jnorth/tm/FlightLesson.html

A bird's wing is shaped as an airfoil. Air must travel over the top and bottom part of a wing. Because the wing is concave rather than flat, the air traveling over the top of the wing has a little farther to go than air traveling under the bottom of the wing. The arch on top causes the airflow to increase as the air travels over it and results in reduced pressure on the top side of the wing. Meanwhile, the airflow on the bottom side slows down, and results in increased pressure on the bottom side. This pressure differential allows the wing to provide lift.

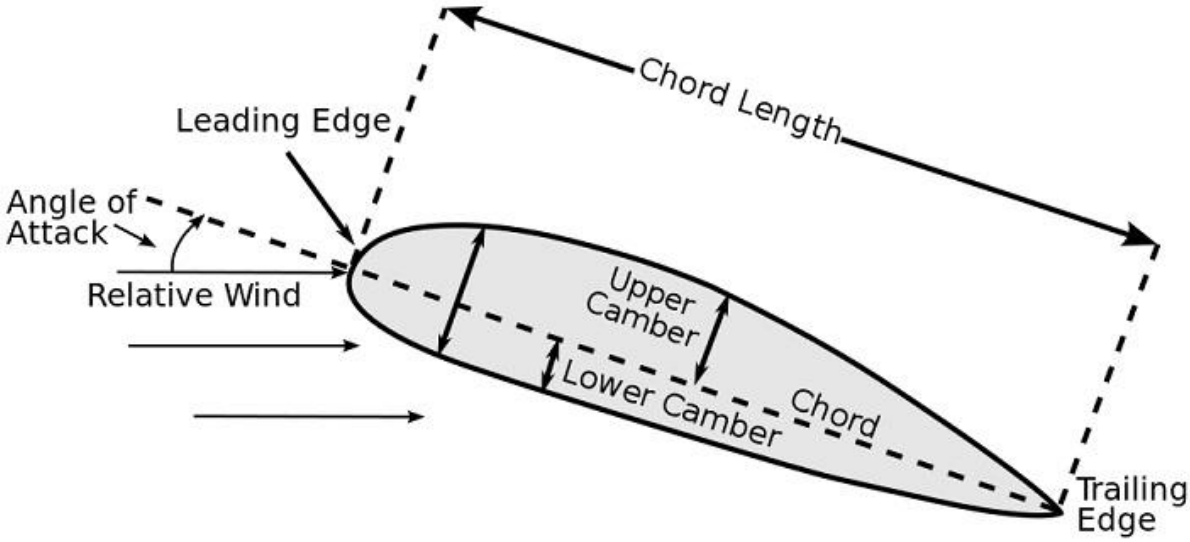

Illustration: Wikipedia.org.

6) Let students examine the Whooping and Sandhill Crane feathers using the magnifying lens. Have students sketch a Whooping Crane flight feather and label the quill, barbs and barbules. How does the structure of this feather type relate to its function?

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The flight feathers are light, strong, and stiff and provide resistance to the air. The flight feather gives the bird lift and propels it as it flies.

Extensions:

1) Divide students into small groups. Assign each group a different ecosystem (desert, rainforest, tundra, alpine forest, beach, etc.). Each group should design a plant or animal that is adapted to survive in that environment. Each group should draw their organism and describe five different adaptations that it has that help it survive in its environment.

2) Have students select an organism in a wetland to research. They may choose a plant or animal. Once students determine what kinds of adaptations their organism exhibits, have them do a brief presentation sharing these adaptations with the rest of the class.

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Name: _____

Name That Adaptation

Characteristic	**Describe the Characteristic.**	**Explain how the characteristic serves as an adaptation for the Whooping Crane.**
Example: Nest construction	*Whooping Cranes build their nests in shallow water.*	*A nest in water helps protect the eggs from predators that live on the land such as bobcats.*
Egg color		
Beak shape		
Legs		
Feet and toes		
Height		
Weight		
Elongated trachea		
Bone structure		
Mate selection		
Courtship behavior		
Feathers		

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