Characteristics of Birds

What do a powerful eagle, a lumbering penguin, and a dainty finch have in common? They all have feathers, wings, and a beak, which means they are all birds.

Birds share many characteristics with reptiles. Like reptiles, birds are vertebrates. Birds’ feet and legs are covered by thick scales like those that cover reptiles’ bodies. Also, bird eggs have an amniotic sac and a shell, just as reptile eggs do.

Birds also have many unique characteristics. For example, bird eggs have harder shells than reptile eggs do. And as shown in Figure 1, birds have feathers and wings. They also have a horny beak instead of jaws with teeth. Also, birds can use heat from activity in their cells to maintain a constant body temperature.

Feathers

One familiar characteristic of birds is their feathers. Feathers help birds stay dry and warm, attract mates, and fly.

Preening and Molting

Birds take good care of their feathers. They use their beaks to spread oil on their feathers in a process called preening. The oil is made by a gland near the bird’s tail. The oil helps waterproof the feathers and keeps them clean. When feathers wear out, birds replace them by molting. Molting is the process of shedding old feathers and growing new ones. Most birds shed their feathers at least once a year.

**Figure 1** There are about 10,000 known species of birds on Earth today.
Two Kinds of Feathers

Birds have two main kinds of feathers—down feathers and contour feathers. **Down feathers** are fluffy feathers that lie next to a bird’s body. These feathers help birds stay warm. When a bird fluffs its down feathers, air is trapped close to the body. Trapping air keeps body heat near the body. **Contour feathers** are stiff feathers that cover a bird’s body and wings. Their colors and shapes help some birds attract mates. Contour feathers have a stiff central shaft with many side branches, called *barbs*. The barbs link together to form a smooth surface, as shown in Figure 2. This streamlined surface helps birds fly.

✓ Reading Check  What is the function of a bird’s down feathers?

(See the Appendix for answers to Reading Checks.)

High-Energy Animals

Birds need a lot of energy to fly. To get this energy, their bodies break down food quickly. This process generates a lot of body heat. In fact, the average body temperature of a bird is 40°C—three degrees warmer than yours. Birds cannot sweat to cool off if they get too hot. Instead, they lay their feathers flat and pant like dogs do.

Fast Digestion

Because birds need a lot of energy, they eat a lot. Hummingbirds need to eat almost constantly to get the energy they need! Most birds eat insects, nuts, seeds, or meat. These foods are high in protein and fat. A few birds, such as geese, eat grass, leaves, and other plants. Birds have a unique digestive system to help them get energy quickly. **Figure 3** shows this system. Modern birds don’t have teeth, so they can’t chew. Instead, food goes from the mouth to the crop. The *crop* stores food until it moves to the gizzard. Many *gizzards* have small stones inside. These stones grind up the food so that it can be easily digested in the intestine. This grinding action is similar to what happens when we chew our food.
**Flying**

Most birds can fly. Even flightless birds, such as ostriches, have ancestors that could fly. So, it is not surprising that birds have many adaptations for flight. The most obvious characteristic related to flight is the wings. But birds also have lightweight bodies. And they have powerful flight muscles and a rapidly beating heart. The fast heart rate helps birds get plenty of oxygen-rich blood to the flight muscles. **Figure 4** describes many bird characteristics that are important for flight.

> **Reading Check** How does a bird’s heart help the bird fly?

**Figure 4 Flight Adaptations of Birds**

- Most birds have **large eyes** and excellent eyesight. Large eyes allow birds to see objects and food from a distance. Some birds, such as hawks and eagles, can see 8 times better than humans can see!

- Birds have special organs called **air sacs** attached to their lungs. The air sacs store air. Because of the stored air, a bird’s lungs have a continuous supply of air—whether the bird is inhaling or exhaling.

- Birds have a **rapidly beating heart**. The heart pumps a fast, steady stream of oxygen-rich blood to the flight muscles. In small birds, the heart beats almost 1,000 times a minute! (Your heart beats about 70 times a minute.)
**Wing shape** is related to how a bird flies. Short, rounded wings allow a bird to quickly turn, drop, and pull up, much like the way a fighter plane moves. Long, narrow wings are best for soaring, just as a glider does.

Bird skeletons are compact and strong. Some of the vertebrae, ribs, and hipbones are fused together. For this reason, bird skeletons are more rigid than those of other vertebrates. A **rigid skeleton** allows a bird to move its wings powerfully and efficiently.

Cross supports

Birds have **hollow bones**. So, birds have much lighter skeletons than other vertebrates do. The bones have thin cross supports that give strength, much like the cross supports of many bridges.

**Keel**

Birds that fly have **powerful flight muscles** that move the wings. These muscles are attached to a large breastbone called a **keel**. The keel anchors the flight muscles. It allows the bird to flap its wings with force and speed.

**Flying Far**

A certain bird flies 970 km (600 mi) when it goes south for the winter. It flies north each summer. If this bird lives for 8 years, how many total kilometers will it fly during migrations in its lifetime?
Getting off the Ground

How do birds overcome gravity to fly? Birds flap their wings to get into the air. They keep flapping to push themselves through the air. They are able to stay in the air because their wings cause lift. Lift is an upward force on a bird’s wings.

As a bird flies through the air, some of the air is forced over the top of its wings. Some air is forced underneath the wings. Figure 5 shows this airflow. Because the bird’s wings are curved on top, the air on top has to move farther than the air underneath. So, the air on top moves faster than the air underneath. The faster moving air on top creates an area of low pressure. The slower moving air underneath creates an area of high pressure and pushes the wing up. This upward force that acts on wings is called lift.

Lift is affected by flying speed and by wing shape. The faster a bird flies, the greater the lift. Also, the larger the wing is, the greater the lift. Birds with large wings can glide for long distances.

Raising Baby Birds

The way that birds reproduce is similar to the way that reptiles reproduce. Like reptiles, birds reproduce sexually by internal fertilization. Both birds and reptiles lay amniotic eggs in which there is a growing embryo. But unlike most reptiles, birds must keep their eggs warm for the embryos to live and grow.

Nests

Most birds build nests in which they lay their eggs. Figure 6 shows a bird’s nest with eggs in it. Birds keep their eggs warm by brooding. Brooding is the act of sitting on eggs and using body heat to keep them warm. Birds sit on their eggs until the eggs hatch. For some birds, such as gulls, the job of brooding is shared by both males and females. In many species of songbirds, the female broods the eggs, and the male brings food to the brooding female. In a few species, the male broods the eggs.

Reading Check

How does the process of brooding keep a bird’s eggs warm?

**Figure 5** Air moving around a bird’s wing changes in speed and direction, creating an upward force that keeps a bird in the air.

**Figure 6** This robin’s nest is only one example of a bird’s nest. Birds build nests of many different shapes and sizes.

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**Key Terms**

- **Lift** an upward force on an object that moves in a fluid
- **Brooding** to sit on and cover eggs to keep them warm until they hatch; to incubate
**Precocial and Altricial**

Some birds, such as chickens and ducks, are active soon after they hatch. These active chicks are *precocial* (pree KOH shuhl). Precocial chicks are covered with downy feathers. As soon as they can stand up, the chicks follow their parents around. These chicks depend on a mother for warmth and protection, but they can walk, swim, and feed themselves.

Some birds, such as hawks and songbirds, are weak and helpless for a while after hatching. These weak chicks are *altricial* (al TRISH uhl). When they hatch, they have no feathers and their eyes are closed. They cannot walk or fly. Their parents must keep them warm and feed them for several weeks. Figure 7 shows a parent feeding its altricial chicks.

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**Using Key Terms**

1. Use each of the following terms in a separate sentence: *lift* and *brooding*.

   For each pair of terms, explain how the meanings of the terms differ.

2. *down feather* and *contour feather*

3. *preening* and *molting*

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**Understanding Key Ideas**

4. Which of the following is NOT a flight adaptation in birds?
   a. hollow bones
   b. air sacs
   c. down feathers
   d. rapidly beating heart

5. What do birds eat? Describe the path taken by a bird’s food as it moves through the bird’s digestive system.

6. How does the air around a bird’s wings cause lift?

7. Explain the difference between precocial chicks and altricial chicks.

8. Name two ways that birds use their contour feathers. Name one way that birds use their down feathers.

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**Math Skills**

9. Suppose that a bird that weighs 325 g loses 40% of its body weight during migration. What is the bird’s weight when it reaches its destination?

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**Critical Thinking**

10. Analyzing Ideas Why can’t people fly without the help of technology? Name at least four human body characteristics that are poorly adapted for flight.

11. Applying Concepts Some people use the phrase “eats like a bird” to describe someone who does not eat very much. Does using the phrase in this way show an accurate understanding of a bird’s eating habits? Why or why not?
**Kinds of Birds**

There are about 10,000 species of birds on Earth. Birds vary in color, shape, and size. They range in mass from the 1.6 g bee hummingbird to the 125 kg North African ostrich. The ostrich is almost 80,000 times more massive than the hummingbird!

Scientists group living bird species into 28 different orders. Songbirds, such as robins or bluebirds, make up the largest order. This order includes about 60% of all bird species. But birds are often grouped into four nonscientific categories: flightless birds, water birds, perching birds, and birds of prey. These categories don’t include all birds. But they do show how different birds can be.

**Flightless Birds**

Not all birds fly. Most flightless birds do not have the large keel that anchors birds’ flight muscles. Instead of flying, some flightless birds run quickly to move around. Others are skilled swimmers. **Figure 1** shows three kinds of flightless birds.

- **Penguins** have a large keel and very strong flight muscles. Their wings have changed over time to become flippers. They flap these wings to “fly” underwater.

- **Ostrich** is the largest living bird. It can reach a height of 2.5 m and a mass of 125 kg. An ostrich’s two-toed feet look almost like hoofs. These birds can run up to about 60 km/h.

- **Kiwi** is a small, chicken-sized bird from New Zealand. Kiwis sleep during the day. At night, they hunt for worms, caterpillars, and berries.
Water Birds

Many flying birds are also comfortable in the water. These water birds include cranes, ducks, geese, swans, pelicans, and loons. These birds usually have webbed feet for swimming or long legs for wading. Figure 2 above shows three different water birds.

Water birds find food both in the water and on land. Many of these birds eat plants, invertebrates, or fish. Some water birds have a rounded, flat beak for eating plants or small invertebrates. Others have a long, sharp beak for catching fish.

**Reading Check** What are the two kinds of beaks that are common in water birds? (See the Appendix for answers to Reading Checks.)

For another activity related to this chapter, go to [go.hrw.com](http://go.hrw.com) and type in the keyword HL5VR2W.
Perching Birds

Perching birds have special adaptations for resting on branches. Songbirds, such as robins, warblers, and sparrows, make up a large part of this group of birds. When a perching bird lands in a tree, its feet automatically close around a branch. If the bird falls asleep while it is perching, its feet will stay closed. The sleeping bird will not fall off the branch. Figure 3 shows three kinds of perching birds.

✓ Reading Check  What happens to a perching bird that falls asleep while it is perching on a branch?

Parrots have special feet for perching and climbing. They open seeds and slice fruit with their strong, hooked beak.

Chickadees are lively, little birds that often visit garden feeders. They can dangle underneath a branch while hunting for insects, seeds, or fruits.

Most tanagers are tropical birds, but the scarlet tanager spends the summer in North America. The male is red, but the female is a yellow green color that blends into the trees.
**Birds of Prey**

Birds of prey hunt and eat other vertebrates. These birds may eat insects or other invertebrates in addition to mammals, fish, reptiles, and birds. Take a look at the birds in Figure 4. Birds of prey have sharp claws on their feet and a sharp, curved beak. These traits help the birds catch and eat their prey. Birds of prey also have very good vision. Most of them hunt during the day, as the osprey does. But most owls hunt at night.

**Figure 4  Birds of Prey**

- **Owls**, such as this northern spotted owl, are the only birds of prey that hunt at night. They have a strong sense of hearing to help them find their prey in the dark.
- **Ospreys** eat fish. They fly over the water and catch fish with their clawed feet.

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**Summary**

1. Some flightless birds do not have a large keel as other birds do. Many flightless birds are fast runners or swimmers.
2. Many water birds have webbed feet for swimming or long legs for wading.
3. Perching birds have feet that automatically close around a branch.
4. Birds of prey have a sharp beak and claws for catching and eating their prey.

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**Understanding Key Ideas**

1. Which of the following groups of birds includes birds that do NOT have a large keel?
   - a. flightless birds
   - b. water birds
   - c. perching birds
   - d. birds of prey

2. Why do some water birds have long legs?
   - a. for swimming
   - b. for wading
   - c. for running
   - d. for flying

3. Most birds of prey have very good eyesight. Why do you think good vision is important for these birds?

4. To which group of birds do songbirds belong? Name three examples of songbirds.

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**Math Skills**

5. How quickly could an ostrich, running at a speed of 60 km/h, run a 400 m track event?

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**Critical Thinking**

6. Predicting Consequences
   Would it be helpful for a duck to have the feet of a perching bird? Explain why or why not.

7. Making Inferences
   How could being able to run 60 km/h be helpful for an ostrich?

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For a variety of links related to this chapter, go to [www.scilinks.org](http://www.scilinks.org)

Topic: Kinds of Birds

SciLinks code: HSM0831
What? No Dentist Bills?

When you and I eat, we must chew our food well. Chewing food into small bits is the first part of digestion. But birds don’t have teeth. How do birds make big chunks of food small enough to begin digestion? In this activity, you will develop a hypothesis about how birds digest their food. Then, you will build a model of a bird’s digestive system to test your hypothesis.

Ask a Question

1. Formulate a question about how a bird’s digestive system can break down food even though the bird has no teeth. Your question may be something such as, “How are birds able to begin digestion without using teeth?”

Form a Hypothesis

2. Look at the diagram below of a bird’s digestive system. Form a hypothesis about how birds digest their food without using teeth.
**Test the Hypothesis**

3 Design a model of a bird’s digestive system. Include in your design as many of the following parts as possible: esophagus, crop, gizzard, intestine, and cloaca.

4 Obtain a plastic bag and the other materials you need from your teacher. Build your model.

5 Test your hypothesis by sending birdseed through your model digestive system.

**Analyze the Results**

1 **Describing Events** Did your model digestive system grind the birdseed? Describe what happened to the birdseed as it moved through the system.

2 **Analyzing Results** Which part of your model was most helpful in grinding? Which part of a real bird’s digestive system is represented by this part of your model?

3 **Recognizing Patterns** Does the amount of material added to your model gizzard change the gizzard’s ability to work effectively? Explain your answer.

**Draw Conclusions**

4 **Drawing Conclusions** Birds can break down food without using teeth. What conclusions can you draw about how they do this?

5 **Evaluating Results** Analyze the strengths and weaknesses of your hypothesis based on your results. Was your hypothesis correct? Explain your answer.

6 **Evaluating Models** What are some limitations of your model? How do you think you could improve it?

**Applying Your Data**

Did you know that scientists have found “gizzard stones” with fossilized dinosaur skeletons? Look in the library or on the Internet for information about the evolutionary relationship between dinosaurs and birds. List the similarities you find between the two types of animals.
Science, Technology, and Society

**Dolphins in the Navy**
Did you know that some dolphins work for the Navy? One way that dolphins help the Navy’s Marine Mammal Program is by detecting underwater mines, which are bombs that drift underwater. Most mines explode when a large object bumps into them. Dolphins can find mines safely by using a natural sonar system, called *echolocation*, which allows them to sense their surroundings even in murky waters. When dolphin finds a mine and alerts a person, experts can deactivate the mine.

**Math Activity**
Suppose that each dolphin in the Navy’s program is trained for 5 years and each trained dolphin works for 25 years. If 10 dolphins began training each year for 10 years, how many would be working at the end of those 10 years? How many would still be in training?

Weird Science

**Sounds of the Lyrebird**
Imagine that you are hiking in an Australian forest. You hear many different bird calls, beaks snapping, and wings rustling. There must be many species of birds around, right? Not if a lyrebird is nearby—all those sounds could be coming from just one bird! The lyrebird imitates the songs of other birds. In fact, lyrebirds can imitate just about any sound they hear. Many Australians have heard lyrebirds singing the sounds of chainsaws, car engines, and dog barks. Supposedly, a lyrebird once confused timber-mill workers when it sang the sound of the mill’s whistle, causing the workers to quit for the day.

**Language Arts Activity**
A lyrebird’s ability to imitate noises could lead to a lot of humorous confusion for people who hear its songs. Think about how lyrebirds could mimic human-made sounds, causing confusion for the people nearby, and then write a short story about the situation.
People in Science

Irene Pepperberg

Bird Brains Dr. Irene Pepperberg studies bird brains. She works with a little African Grey parrot named Alex. Pepperberg began her work with Alex because she wanted to see if birds that could talk could also understand what they were saying.

Pepperberg developed a new kind of communication training, with Alex as her pupil. First, Alex was rewarded with the object that he identified—not with food. This reinforced that the word represented the object. Next, two trainers acted out a kind of play to teach Alex words. One trainer would ask a question, and the other would respond with the right or wrong answer. The first trainer would reward the second for a right answer but take the object away for a wrong answer. This training showed Alex what would happen when he gave an answer.

Pepperberg’s experiment has been very successful. Not only can Alex say the names of objects but he can tell you what they are made of, what their shape is, and how one object is different from another. Pepperberg has shown that at least one parrot can pass intelligence tests at the same level as some nonhuman primates and marine mammals. She has discovered that with the right training, animals can teach us a lot about themselves.

Social Studies Activity

Writing Skill

People train pets all the time. See if you can train your pet or a friend’s pet to learn a simple behavior, such as following a command. Write up your results in a report.

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