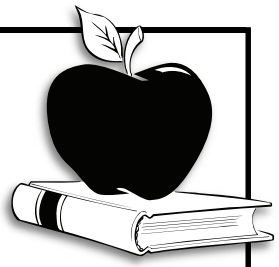
SUGGESTED GRADE LEVEL: 4

NEXT GENERATION SCIENCE STANDARDS: 4-LS1-1

SKILLS/PROCESSES: observation, classification

OBJECTIVE: Students will be able to identify the three characteristics by which birds are defined.

TEACHER'S GUIDE



UNIT 1 ■ LESSON 1

What Makes a Bird a Bird?

BACKGROUND

There are more than 9,000 species of birds in the world, with about 800 found in North America. More than 400 species have been recorded in Illinois, and more than 200 bird species have been recorded as nesting in the state.

Birds evolved from small reptiles more than 160 million years ago. They still share some characteristics with reptiles, such as laying eggs and having scales on their legs and feet. Development of the ability to fly required not only feathers and wings but good eyesight, a sense of balance and fine muscle coordination.

Like mammals, birds are **warm-blooded** vertebrates, meaning their internal body temperature is maintained at a constant level regardless of external conditions. This characteristic allows birds to maintain high levels of energy and a **metabolic rate** necessary for flight. By comparison, reptiles and amphibians are cold-blooded, meaning they rely on the temperature of the air and/or water to regulate their body temperature.

Birds have three characteristics that distinguish them from other animals: feathers; hard-shelled eggs; and hollow bones.

FEATHERS: Feathers are an adaptation of reptilian scales. They range in size from 0.05 inch on a bird eyelid to the tail feathers of a male peacock (*Pavo cristatus*) which may be five feet long. In number they range from 1,000 on a hummingbird to 25,000 on a swan, and generally comprise 15-20 percent of the entire weight of the bird. Feathers perform a variety of functions, such as flight, regulation of body temperature (**thermoregulation**), protection of the body and skin, attraction of mates and differentiation of species.

The feathers most commonly observed are contour and down feathers. **Contour feathers** cover the body of a bird and have a strong, hollow **shaft** and network of hooks or **barbules** (see diagram on page 2). The contour feathers on the tail and wings have been modified for flight. **Down feathers** are small and lie under the contour feathers. The purpose of these feathers is to insulate the bird from the cold and protect against sunburn.

Birds must take care of their feathers so they can continue to fly and remain warm. **Preening** feathers spreads oils over the feathers and "re-hooks" the barbules. Even though they are kept clean, feathers become worn and are usually replaced at least once a year. This process is called **molting**.

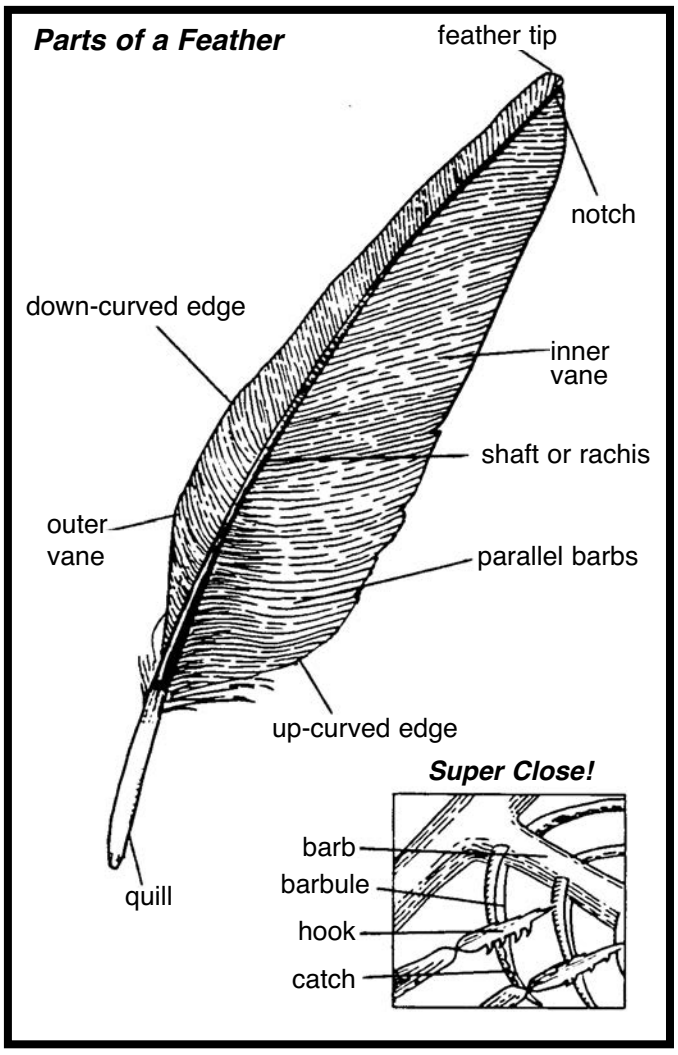
HARD-SHELLED EGGS: Birds lay hard-shelled eggs made mostly of **calcium carbonate**. The hard shell keeps an egg from **dehydrating** and allows parents to sit on the eggs during **incubation**. Even though bird eggs are hard-shelled, they possess microscopic pores which allow oxygen to pass into and carbon dioxide to exit the shell.

Eggs come in a variety of colors and patterns. Colored and speckled eggs are laid in areas where they need to be **camouflaged**. Blue or green eggs are laid by birds that nest in shady places such as trees or shrubs (American robin). Eggs in these locations are less visible in the dappled sunlight. White eggs are laid by birds nesting in **cavities** (owls, wood duck). Patterned eggs blend in with grass or small stones and are laid by birds that nest on the ground (gulls, sandpipers).

The shape of the egg is related to where the bird nests. The most common shape for eggs is oval. Birds that lay their eggs on ledges need eggs with a pointed end so they will not roll off the ledge (vultures). Round eggs are generally laid by birds nesting in a protected area, such as a cavity (owls). Birds that lay many eggs typically have eggs that are pointed, allowing incubation of several eggs in a small area (northern bobwhite). The number of eggs laid varies by species from as few as one for a seabird to nearly 30 for the northern bobwhite.

The texture of an egg may vary from smooth (smaller birds) to coarse (chicken, *Gallus gallus domesticus*). The smallest eggs (one-half inch) are laid by a hummingbird, the largest (eight inches) by an ostrich (*Struthio camelus*).

HOLLOW BONES: Simply having feathers does not permit birds to be creatures of the sky. Extremely lightweight bones are also necessary for flight. Bird bones are strong and hollow, with internal braces (see diagram in Student's Guide). Many bird bones are fused together which increases the strength of the bones.



PROJECTS AND ACTIVITIES

State and federal laws prohibit possession of **migratory** bird feathers. You can purchase feathers legally to use in this activity at a craft supply store or in the craft section of other stores.

1. By displaying a feather on an overhead projector and by using a hand lens, students will discover the major parts of a feather (quill, shaft, **vane**, barbule, **barb**).

2. After discussing background information on types of feathers, provide students with feathers or photographs of feathers and ask them to identify various types of feathers. Compare an owl feather, which has a filled shaft and fringed edges to cushion sound, with a rock pigeon feather, which is hollow.

3. Examine cleaned chicken or turkey bones which have been cracked or cut open. Discuss why most bones are hollow (aids flight).

EVALUATION

1. Ask students to make educated guesses and support their ideas about the purposes and usefulness of specific types of feathers.

2. Have students list and discuss in a paragraph the three characteristics of birds.

3. Bring a down jacket to school. Have students compare the warmth of a down jacket to another type of coat or no coat. Birds have adapted to remain warm in winter by fluffing their feathers and to not overheat in summer by compressing their feathers.

EXTENSIONS

- Invite students to attempt to crush a raw chicken egg in their hands. They'll discover it is not possible because the shape of the egg distributes the pressure points.

- Research and conduct an experiment on how natural and artificial oils and soaps affect feathers. Discuss oiled birds and how they are cleaned.

- Reconstruct a chicken or turkey skeleton and label the parts.

- Research the uses of feathers by humans through history. Include such uses as feather pens, headdresses, pillow/mattress stuffing, clothes, art and more.

- Research and discuss the theory of evolution of birds and how birds are related to reptiles.

VOCABULARY

barbs
barbule
calcium carbonate
camouflaged
cavity
contour feather
dehydrating
down feather
incubation
metabolic rate
migratory
molting
preening
shaft
thermoregulation
vane
warm-blooded

What Makes a Bird a Bird?

STUDENT'S GUIDE

There are more than 9,000 species of birds in the world. More than 400 species have been recorded in Illinois. Birds are warm-blooded vertebrates. They have three characteristics that distinguish them from other animals: feathers; hard-shelled eggs; and hollow bones.

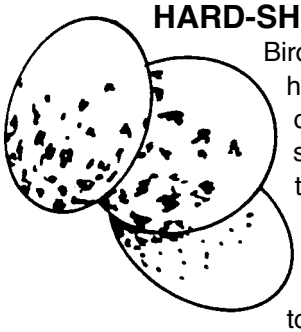
WARM-BLOODED

Like mammals, birds are warm-blooded, meaning that their body temperature stays the same no matter how hot or cold it is outside. This characteristic allows birds to maintain the high levels of energy needed for flying.

FEATHERS

Birds use their feathers in many ways, such as flight, regulation of body temperature (thermoregulation), protection of the body, attraction of mates and identification of species.

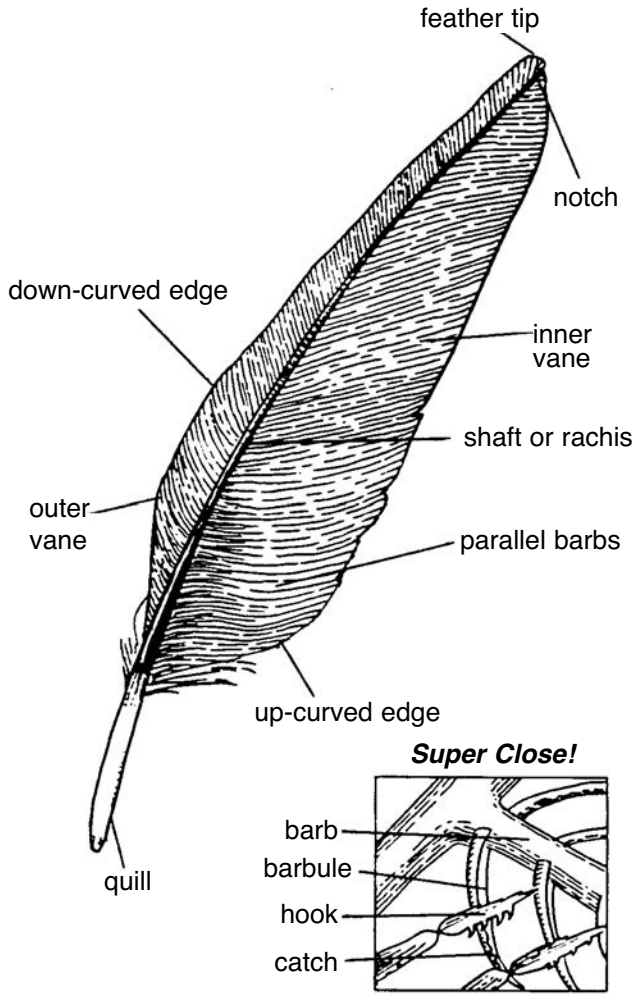
Contour feathers cover the body of a bird and have a strong, hollow shaft and network of hooks. Down feathers are small and are located under the contour feathers. The purpose of these feathers is to insulate the bird from the cold.



HARD-SHELLED EGGS

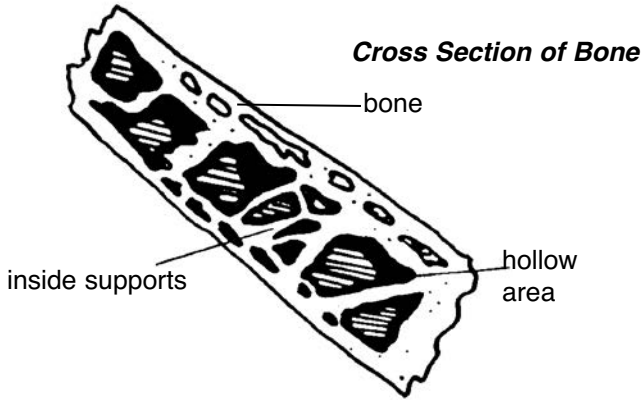
Birds lay hard-shelled eggs. The hard shell keeps an egg from drying out and allows parents to sit on the eggs during incubation. Even though bird eggs are hard-shelled, they have microscopic pores that allow oxygen to pass into and carbon dioxide to exit the shell.

Eggs come in a variety of colors, patterns, shapes and textures. Colors and patterns on eggs vary depending on the need for camouflage. The shape of the egg depends on where the bird nests. Most eggs are oval. Birds that lay their eggs on ledges need eggs with a pointed end so they will not roll off the ledge. The texture of an egg may vary from smooth (hummingbirds) to coarse (chicken, *Gallus gallus domesticus*).



HOLLOW BONES

Simply having feathers does not permit birds to be creatures of the sky. Extremely lightweight bones are also necessary for flight. Bird bones are strong and hollow with inside supports.



ACTIVITY PAGE

Oh, Bird Feathers!

How many feathers are there on a bird? Many, ranging from 1,000 or less to as many as 25,000 or more! There are different kinds of feathers with special functions, and each has many different parts.

Compare this diagram with a real feather that your teacher provides. Feathers are very complex. Label these parts: **vane; barb; barbule; shaft; quill;** and **hook**.