

## Investigation 4

# Bird Building

**Authors**

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**Subject**

Life Science

**Grade Level**

Grades 3-6

**Driving Question**

How do physical characteristics help birds survive in their environment?

**Abstract**

Student groups examine specific objects, naming their uses. They then relate these objects to bird adaptations. Next, they find a bird in Michigan that has each of these adaptations. Then they are given three slips of paper describing foot, beak and body adaptations, and their group draws a bird with those particular adaptations. The group next goes to a Web site and prints a computer-generated version of a bird with those particular adaptations. For the student-designed investigation, student groups pose a question related to physical characteristics and survival of a bird or birds that live(s) in Michigan. Groups develop a hypothesis, do research, and present their information to the class. Finally, they list and possibly investigate additional student-generated questions.

**Michigan Curriculum Framework Science Benchmarks**

<http://www.miclimb.net/content/main.html>

**Constructing New Scientific Knowledge Benchmarks:**

I.1.E.1 Generate questions about the world based on observation.

*Key concepts:* Questions lead to action, including careful observation and testing; questions often begin with, “What happens if...?” or “How do these two things differ?”

*Real-world contexts:* Any in the sections on Using Scientific Knowledge.

I.1.E.2 Develop solutions to problems through reasoning, observations, and investigations.

*Key concepts:* Observe, predict, collect data, draw conclusions, conduct fair tests; prior knowledge.

*Real-world contexts:* Any in the sections on Using Scientific Knowledge.

I.1.E.5 Develop strategies and skills for information gathering and problem solving.

*Tools:* Sources of information, such as reference books, trade books, magazines, web sites, other people’s knowledge.

*Real-world contexts:* Seeking help from or interviewing peers, adults, experts; using libraries, World Wide Web, CD-ROMs and other computer software, other resources.

I.1.E.6 Construct charts and graphs and prepare summaries of observations.

*Key concepts:* Increase, decrease, no change, bar graph, data.

*Tools:* Graph paper, rulers, crayons.

*Real-world contexts:* Examples of bar charts like those found in a newspaper.

### **Reflecting on New Scientific Knowledge Benchmarks:**

II.1.E.1 Develop an awareness of the need for evidence in making decisions scientifically.

*Key concepts:* (3-5) data, evidence, sample, fact, opinion

*Real-world contexts:* Deciding whether an explanation is supported by evidence in simple experiments, or relies on personal opinion.

II.1.E.2 Show how science concepts can be illustrated through creative expression such as language arts and fine arts.

*Key concepts:* Poetry, expository work, painting, drawing, music, diagrams, graphs, charts.

*Real-world contexts:* Explaining simple experiments using paintings and drawings; describing natural phenomena scientifically and poetically.

II.1.E.4 Develop an awareness of and sensitivity to the natural world.

*Key concepts:* Appreciation of the balance of nature and the effects the organisms have on each other, including the effects humans have on the natural world.

*Real-world contexts:* Any in the sections Using Scientific Knowledge appropriate to elementary school.

### **Using Life Science Knowledge Benchmark:**

Evolution III.4.E.2 Explain how physical and behavioral characteristics of animals help them to survive in their environments.

*Key concepts:* Characteristics—adaptation, instinct, learning, habit. Traits and their adaptive values—sharp teeth or claws for catching and killing prey, color for camouflage, behaviors.

*Real-world contexts:* Common vertebrate adaptations, such as white polar bears, sharp claws and sharp canines for predators, changing colors of chameleon; behaviors, such as migration, communication of danger.

### **Big Idea**

Physical and behavioral characteristics of animals (adaptations) help them survive in their environments.

### **Prerequisites For Students**

Students need to know the requirements for survival of living things. Lead a class discussion to create a list of what living things need to survive (food, water, space, shelter).

**Estimated Time Needed**

Four class periods of approximately 55 minutes each.

**Background Information**

Over the course of evolution, animal species have developed an amazing variety of adaptations. Successful adaptations help the animal to survive. Adaptations specialize an animal: They make that animal able to eat a certain type of food, live in a certain habitat, or reproduce in a certain way. Birds give clear illustrations of animal adaptation, particularly with their feet and beaks. Feet are adapted for many types of transport and food-getting behaviors. Beaks determine the types of food a bird is able to eat.

Birds use their beaks mainly to gather food and drink water. Many birds also use their beaks to tear their food into pieces they can swallow. But birds also use their beaks to collect nesting materials, preen their feathers, scratch their bodies, attack enemies, caress their mates, and feed their young.

Hummingbirds have hollow beaks that are long, like straws. These are perfect for poking into the nectaries of flowers. Their tongue comes down through the straw-like beak and slurps up the nectar. Many shorebirds have very long beaks that they poke into mud and water looking for insects, worms, crustaceans, and other animals. Spoonbills and pelicans have trademark bills that are used as scoopers. They scoop their food out of the water with these long bills. Many ducks use their bills as strainers to filter out tiny plants and animals from the water. Swallows and their kin have large mouths. They fly quickly through the air with their mouths open and catch insects in them. Warblers have small, sharp, pointy beaks with which they snatch insects from vegetation. Woodpeckers have strong beaks that can drill into trees to find the insects beneath the bark. Woodpeckers also use their beaks to communicate by making drumming noises. Toucans are birds with a huge, extremely strong beak used for plucking fruit from trees. There are even more types of beaks. Each is designed for one or more functions.

Another adaptation is readily apparent on the feet of birds. Birds use their feet for walking, perching, swimming, running, climbing, and grabbing. Woodpeckers have two toes in front and two in back. This allows them to climb up and down trees. Hawks, owls, and other birds of prey have large, curved, sharp claws that can close in on a live animal. Their feet help them catch the animal and hold it if they lift it into the air. Birds called passerines – the songbirds – have three toes in front and one in back. This helps them perch. Ostriches, killdeer (found in Michigan), and roadrunners are all running birds with toes that point forward to help them run fast. Birds like grouse, chickens, and quail have toes that are like rakes that can scratch the soil. Ducks and other water birds have webbed toes that help them paddle through the water.

This web site has easy-to-understand drawings and descriptions of bird feet and beaks:

[www.normanbirdsanctuary.org/creatabird.shtml](http://www.normanbirdsanctuary.org/creatabird.shtml) .

**Materials List*****For each student group***

Newsprint

Set of colored markers

Graph paper

Ruler

*Several things from the following list (three or more for each group):*

Tongs

Nut cracker

Toy boat

Eye dropper

Strainer

Scoop

Slotted spoon

Spoon

Pliers

Staple Remover

Tweezers

Coffee stirrer straw

Swim fins

Hand garden prong

Grasper

Three-prong plug

Piece of camouflage material

Wing from a balsawood glider

Snowshoes or picture of snowshoes

Stilts or picture of stilts

***For the class***

Internet access and printer

One copy of Teacher Page 4-1a, 4-1b and 4-1c, cut apart

Photos of several very different birds, including robins, woodpeckers, eagles and cranes (see the listing in the Teacher Background Information). Use magazine photos or find appropriate photos at <http://www.birds.cornell.edu/programs/AllAboutBirds/BirdGuide/> This web site allows you to choose various birds from a drop-down alphabetical list. You could show the birds on the computer or right-click on each bird photo and save-as to your hard drive, then insert them into a word-processing document and make an overhead.

**Advance Preparation**

Cut apart the bird characteristics on Teacher Pages 4-1a, 4-1b and 4-1c. Put them in three piles: one for beaks, one for feet, and one for body types.

**Procedure****Part 1: Student Exploration****Activity 1**

1. Place students into groups of three or four. Tell them you are going to give each group some items. They are to discuss what kinds of jobs can be done or made easier by using the items.
2. Give each group three or more of the items listed in “Materials List” and let them manipulate the items and discuss and decide as a group what kinds of jobs can be done or made easier by them.
3. On a piece of newsprint, have students direct you in making a class chart of each item and its use. Make an extra, empty column in the chart.
4. Fill in the chart as students describe their item and its use.

5. Show several photos of different kinds of birds, such as robins, eagles, woodpeckers and cranes – birds with very different types of features. Point out the features of each bird, including their beaks, wings, legs and feet.
6. Discuss these questions as a class:
  - How are your items like a bird feature?
  - How is it useful for the bird to have this feature?
  - How does this item represent the way a bird uses its physical characteristic?
7. Label the blank column “Bird feature” and let students write down on the chart what bird feature each item represents (such as beak, wing, foot).

**Activity 2**

1. Tell students that for each item that their group has, they are to:
  - Identify one Michigan bird that has a physical characteristic that imitates a function of the item.
  - Describe what type of habitat that kind of bird is found in.
  - Describe how that physical characteristic of each bird enables it to survive in its environment.
2. Ask students where they could get this information. They may come up with such information sources as the library, interviews with individuals, observations, classroom resources, resources at home, and the Internet. Some web sites they may want to use are <http://www.ummz.lsa.umich.edu/birds> and <http://www.birding.com/wheretobird/Michigan.asp>
3. After answering the questions, have the class design a chart to organize the information collected by all the groups. The chart should list the following: Michigan birds, the item in question, the physical characteristic it represents, its uses, and that bird’s habitat. It may look something like this:

| <i>Bird</i> | <i>Item</i>  | <i>Phys. Char.</i> | <i>Habitat</i> | <i>Use/ Function</i>          |
|-------------|--------------|--------------------|----------------|-------------------------------|
| Pheasant    | Garden Prong | Foot               | Field          | Scratch ground for seeds/bugs |

4. Have the class fill out the large chart for all the items. Drawings on the class chart are encouraged. Post it somewhere that those outside the classroom can see it, too.

**Activity 3**

1. Break students into groups of four or five. Give each group a sheet of newsprint and some colored markers. Tell them you will be giving each group three slips of paper. Based on their slips of paper, student groups will come to agreement on what a bird with these characteristics will look like and draw a picture of their bird on the newsprint.
2. Distribute the slips of paper cut from Teacher Page 4-1 in sets of three (one card for each type of characteristic). Give each group time to draw its bird.

3. Tell each group to visit the web site <http://www.normanbirdsanctuary.org/creatabird.shtml> and build the computer-generated representation of their bird using its slips of paper. Each group should print out the computer-generated picture of its bird.
4. Each group should discuss and record how its drawn bird compares to the computer-generated bird.

### **Part 2: Question or Statement**

1. Ask, “Why do birds have such different features?” Elicit responses having to do with how the bird uses the feature to get what it needs to live – food, water, shelter, etc.
2. Explain, “These specialized characteristics are called adaptations. Birds have adaptations that help them survive in their environments by getting what they need.”
3. Explain that students will be investigating the answer to the question, “How do birds’ physical characteristics – their adaptations – help them survive in their environment?”
4. Based on the work it has done with birds and adaptation, each group will ask a question related to physical characteristics and survival of a bird or birds that live(s) in Michigan. It will investigate the answer and present it to the class. Help each group come up with a research-able question. Possible student questions may include:
  - Why are vultures’ heads bald?
  - Why do herons have such long legs?
  - Why do some birds run instead of fly?
  - Why is the goldfinch so brightly colored?
  - How does a chickadee’s beak help it eat?
5. Explain that student groups will be researching and presenting the answer to a group question about bird adaptations.

### **Part 3: Method for Gathering Data**

1. Ask student groups how they will find the answer to their questions. Students may suggest using library books, encyclopedias, the Internet, etc. They might also want to interview bird experts. Tell them they will need to keep track of the sources they used.

Some groups might want to observe birds in order to find answers to their question. Encourage this. Bird observation is difficult because simply sighting the bird does not guarantee that it will be using the feature of interest at that time. If students decide to make observations, have them construct a bird-watching journal where they can keep track of dates and times, write notes and make drawings if helpful.

They should develop a method for making observations that might lead to drawing conclusions about the use of the feature they are studying. For instance, if they are studying

the bird's beak, they might set out appropriate food and observe how the bird uses its beak for breaking seeds, etc. Other observation techniques should reflect the way in which they expect the bird to use that feature.

#### **Part 4: Prediction**

1. Have each group come up with a prediction or possible answer to its question, based on the type of data they will collect.
2. Distribute the Investigation Design student page and have students fill them out in groups. See Teacher Page 4-2 with sample student responses.

#### **Part 5: Research Details**

1. Have each group write down the steps they will take to perform their investigation in a step-by-step process on a page they create and title "Research Methods." This list of steps should expand on what students wrote on their Investigation Design pages under "What will we do?" and "What data will we collect."
2. Review the groups' Research Methods and Investigation Design pages to determine if their investigations are feasible given time and resources. Check to make sure that the Research Methods will result in data that may support or not support the prediction. Give guidance as you review the materials, but try not to dictate specific changes. This is best done by asking critical questions such as, "How will you measure that?" and "What things will you keep the same?" Then groups can come up with changes that answer your questions and critiques.
3. Return the Student Pages and Research Methods with your comments and let groups re-design or alter them if needed.
4. Many times the observations and results of an open inquiry activity drive the next step in an investigation. Tell students that this is OK. If student groups add steps or change things as they perform their investigation, they should write these down, too. Have extra copies of Student Page 3-1 available, in case students want to make major changes.

#### **Part 6: Data Collection**

1. Let each student group perform their investigation as they have written it and with your guidance. If they make changes as they go, they should record them on their written methods. They should record their results on a page they create and title "Data Collection."
2. Tell the class that each student in all groups must contribute to the research and final presentation. Each student must be able to explain to the teacher what part or parts of the presentation she or he worked on.

**Part 7: Data Analysis, Use and Communication of Results**

1. Have each group discuss their data and decide whether their prediction is supported by the data or not. For those groups whose predictions are not supported by the data, encourage them to draw conclusions about their bird's adaptation from the data they collected, even if they are opposite to their original prediction. Help them see that they can always learn something from their investigations.
2. Ask groups to complete Student Page 4-2, their formal conclusion. Circulate among the groups and review their work, making suggestions as needed to clarify their answers.
3. Explain to student groups that you would like them to prepare a presentation to the class, in order to share their data and conclusions. Each presentation should basically review the formal conclusion page, going over each point with the class. Give students time to prepare the group presentations. They should decide who will present each part of the formal conclusion, and whether they want to use any visuals (such as photos from web sites or drawings from their own observational research).
4. Have each group give its presentation to the class, and to a wider audience (such as parents, a different classroom, etc.), if possible. If desired, you may have students prepare a posterboard display to place in areas of the school where others will see them.

**Part 8: Guided Questions for Reflection**

1. These types of questions can be asked of each student group when they do their group presentation, to help them synthesize their knowledge and deepen their understanding:
  - How does this adaptation help your bird survive in its environment?
  - How would the lives of these birds be different if they did not have this adaptation?
  - Do other birds or animals have similar adaptations?
2. These questions can be asked of the whole class:
  - How can specialized beaks help some birds stay alive? (A bird with a specialized beak can often eat a type of food that no other bird can eat.)
  - How can specialized feet help birds stay alive? (Feet can allow birds to eat certain types of food (such as the grasping feet of hawks, owls, and other predators), to climb trees and hunt for food (woodpeckers), to run fast (ostriches, roadrunners, and even killdeer), to swim (ducks and other water birds), and to perch in safe places (robins, doves, and cardinals).)
  - How might a specialized beak hurt a bird? (If the bird's habitat changes and its food is no longer available, the bird might die because it can't eat anything else.)
  - Can any kinds of birds use their beaks to eat more than one type of food? (Some birds, such as crows, have very versatile beaks. Crows can eat fruits, nuts, berries, dead animals, and even fish and small rodents.)
  - How does having a versatile beak help a bird? (If one type of food is not available, they can always eat something else.)

- Could specialized feet be harmful to a bird? (The type of feet a bird has limit the kind of habitat it can live in. If that type of habitat is unavailable, it may not survive.)
- Give an example of this.
- What are some adaptations humans have that help us survive? (Two-leggedness, having an opposable thumb that allows us to hold tools, large brain, etc.)
- What are some other bird adaptations? (Feathers, warm-bloodedness, hollow bones, a crop, etc.)

### **Part 9: Student Questions for Additional Inquiry**

1. Ask each group what additional questions they have about their birds and/or adaptations. List them on the board.
2. Ask how they might find the answers to these questions. If at all possible, let students research and present the answers to these questions.

### **Assessment**

The group presentations can be assessed for knowledge of conducting investigations, as well as for content knowledge. Review the Michigan Benchmarks listed at the beginning of the investigation to know what to look for.

You can conduct an individual assessment by giving students the following scenario, and assessing their answer to the questions:

Scenario: Your class is taking a field trip to a Michigan farm which has a pond, located near woods and a field. Seeds, mice, insects, grubs, pond weed, and fish are some of the foods found in this environment.

- Describe a possible physical characteristic of three birds that each eat one of these foods.
- How could you find out what kinds of birds eat these food types?

*Bird Parts—Feet*

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**Perch in trees**

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**Climb up and down trees**

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**Fly with prey held in its feet**

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**Paddle in water**

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**Wade in shallows**

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**Walk in soft mud**

***Bird Parts—Body Types***

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**Stands out in a crowd**  
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**Has a tail like a prop**  
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**Has wings for soaring**  
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**Floats like a boat**  
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**Is blue-green in color**  
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**Blends into the forest floor**

***Bird Parts—Beaks***

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**Eat tough seeds**

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**Eat insects under tree bark**

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**Slice open fish and animals**

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**Spear fish and frogs**

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**Dig insects underground**

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**Scoop food out of the water**

Names \_\_\_\_\_

## Investigation Design

1. What is our question?

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2. What do we know? (about birds and their features)

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3. What will we do? (How will we find out about bird adaptations?)

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4. What data will we collect?

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5. What is our prediction?

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6. The things we keep the same on purpose are:

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Names \_\_\_\_\_

## Conclusion

Answer all of these questions in your conclusion:

1. What was the purpose of the investigation?
2. What did you find out?
3. Was the prediction supported by the data?
4. How can you explain what you found out?
5. Did other researchers come to the same conclusions?
6. Why was it important to keep certain things the same during the different trials?
7. What else would you like to do with this investigation, and how would you make it better?

Names (sample student responses)

## **Investigation Design**

1. What is our question? How does a sparrow's beak help it eat?
2. What do we already know? (about birds and their features) Birds' beaks are hard and shaped like scoopers.
3. What will we do? (How will we find out about bird adaptations?) We will observe sparrows eating bird seed that we place outside our classroom window, on at least two occasions. We will also do research on sparrows on at least two web sites.
4. What data will we collect? We will observe what sparrows do with their beaks when they eat and record our observations. We will record any information on web sites about how birds use their beaks.
5. What is our prediction? We predict that birds use their beaks to scoop up seeds and then crack them.
6. The things we keep the same on purpose are: We will always observe sparrows eating the same kind of seeds. We will also make sure that the web sites we use are from sources that are believable, like universities or museums.