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*This curriculum guide is made possible through the generous support of Polk Bros. Foundation, J.P. Morgan Chase & Co., UBS, and the Institute of Museum and Library Services.*





## Using This Guide

Building science literacy on the part of students includes teaching science content as well as building familiarity with the work of scientists. Providing the opportunity to participate in inquiry-based explorations helps students identify with the scientific process and build their own research skills. They learn about the work of scientists by actively participating in the research process themselves. This guide is designed to support you as you work to build research skills among your students aligning with the established classroom curriculum. The research activities in this guide can be completed on your schoolyard, during a field trip to Lincoln Park Zoo, or a combination of the two!

This guide contains several sections. The first focuses on building student research skills such as conducting effective observations and analyzing collected data. The second section outlines two different types of research projects you can conduct with your students. Next is a lesson on how students can share the results of their research like scientists do. Finally, the guide concludes with information on how to encourage student explorations in the home. Throughout the guide you'll find information on the process of field research, tips for conducting research projects, and information about our work at Lincoln Park Zoo.

Let's get started!

# Lincoln Park Zoo Map

Spend a few minutes getting to know Lincoln Park Zoo. What exhibits do you hope to visit?

## Exhibits

- 1 Penguins, Seabirds
- 2 Vultures, Eagles, Owls
- 3 Tropical Birds
- 4 Giraffes, Rhinos, Ostriches
- 5 Polar Bear, Sun Bears
- 6 Monkeys
- 7 Lions, Tigers
- 8 Seals
- 9 Bears, Otters, Wolves
- 10 Snakes, Bats, Wallaby
- 11 Swans, Ducks
- 12 Flamingos, Geese
- 13 Chimpanzees, Gorillas
- 14 Antelope, Zebras, Kangaroos
- 15 Cows, Goats, Pigs, Ponies
- 16 Nature Boardwalk at Lincoln Park Zoo

## Food

- 17 **Safari Café\***: Tostadas, wings, flautas and ice cream novelties.
- 18 **Café at Wild Things\***: Organic fare, including paninis, salads and other green goodies.
- 19 **Eadie Levy's Landmark Café\***: Chicago-style hot dogs, fries and snacks.
- 20 **Park Place Café**: Mexican food, Italian fare, burgers, sandwiches, salads, beer, wine and more. Ice cream, too!
- 21 **The Patio at Café Brauer\***: Grilled burgers, beer and wine, sandwiches, salads and Kids' Meals.
- 22 **Ice Cream Shoppe\***: Hand-dipped ice cream, banana splits and sundaes.

## Shops

- 23 **Wild Things**: A wild selection of Lincoln Park Zoo souvenirs, apparel, plush animals and exotic gifts.
- 24 **Safari Shop\***: Make your own wild animal—inside the Kovler Lion House.
- 25 **Great Ape Gifts\***: Remember your visit with a great ape souvenir—inside Regenstein Center for African Apes.
- 26 **Wild Gifts\***

## Rides

- 27 **LPZOO Children's Train\***: Hop aboard this kid-friendly locomotive. \$2.50 per ride.
- 28 **AT&T Endangered Species Carousel\***: Take a ride with your favorite animal. \$2.75 per ride.














*Prices subject to change*

## Facilities

- 29 Gateway Pavilion Information
- 30 Judy Keller Education Center
- 31 Tadpole Room
- 32 Bus Drop-off Zone
- 33 Foreman Pavilion\*
- 34 People's Gas Education Pavilion\*

*\*Open seasonally*

## Legend

-  Information
-  Restrooms
-  Accessible Restrooms
-  Zoo Food
-  Zoo Shops
-  ATM
-  Strollers/Wheelchairs
-  Lockers
-  Picnic/Lunch Area
-  Emergency/First Aid
-  Parking
-  Conservation Center and Animal Hospital
-  Entrance





# Five Frequently Asked Questions

## 1. Our school is in the city. What do we do if there is no wildlife to observe near our school?

Even the most urban of areas will have some type of plant or animal life for your students to explore. While you may not have acres of pine trees on your campus or deer roaming through the school parking lot, there is likely a wealth of living things for students to observe. Ants, spiders, dandelions and pigeons are just a few examples of this urban wildlife.

## 2. I teach very young children. Is this too hard for them?

While this guide is geared toward learners fourth grade and above, many lessons contain a modification suggestion that would make it more appropriate for younger learners. Another option is to separate just one aspect of any activity and focus on that. For example, counting the different types of birds that come to the schoolyard or going on a schoolyard insect hunt.

## 3. How is this relevant to the required curriculum?

While the words “ethology” or “wildlife census” may not be found in national or state standards, skills such as making observations and collecting data are. As students discuss their discoveries and write their results, they’re linking to standards in English language arts. Projects that include counting frequencies or calculating percentages also link to mathematical standards.

## 4. What do we do in winter when there aren’t any animals to observe?

Many animals are active even in winter, but you may have to look a little harder to find them. Common species such as crows and pigeons can be found even when other birds have flown to warmer climates. Some animals like rabbits might be easier to spot in winter when bushes and plants are without leaves in which to hide. Another option is to allow students to observe household pets or classroom animals such as fish in an aquarium.

## 5. Can exploring animals be dangerous?

It is unlikely that dangerous animals will be found on your schoolyard. However, some insects can bite and a swooping red-winged blackbird can be unsettling to a small child. Remind students to observe animals without touching, determine a safe distance to keep, and be aware of any student allergies, especially to bee stings.

*Located near the East Gate, Gateway Pavilion can provide you with helpful information during your visit.*





## Animal Observations at Lincoln Park Zoo

Lincoln Park Zoo is a great place for research projects on animals. With over 200 species on display, there are plenty of “research subjects” to choose from. Each of our animals is interesting in its own way, but some species will be easier for students to observe than others. In this section, we’ve suggested species within each exhibit space that should be visible, active during the day, and displayed in an area that can accommodate a group of students

Because animals on exhibit can change due to husbandry needs, this list should simply serve as a guide. Having an alternative observation choice would be important for your visit. For a full list of all species that can be found in each exhibit space, visit [http://www.lpzoo.org/ani\\_front.php](http://www.lpzoo.org/ani_front.php)

### **Regenstein African Journey**

Meerkat  
Hadada ibis  
Black-and-white colobus monkey

### **McCormick Bird House and Regenstein Birds of Prey**

All species in Tropical River  
Cinereous vulture  
European white stork

### **Kovler Penguin and Seabird House**

All species

### **Flamingo Habitat and Hope B. McCormick Swan Pond**

All species

### **Regenstein Center for African Apes**

Chimpanzee  
Gorilla

### **Antelope and Zebra Habitat**

Grevy’s zebra  
Sichuan takin  
Bactrian camel

### **Helen Brach Primate House**

All species

### **Kovler Lion House**

African lion  
Amur tiger  
Puma

### **Pritzker Family Children’s Zoo**

Red wolf  
American black bear  
American river otter

### **Regenstein Small Mammal-Reptile House**

Bats  
Dwarf mongoose  
Asian small-clawed otter

### **Nature Boardwalk at Lincoln Park Zoo**

Nature Boardwalk is the perfect location for biodiversity studies as well as animal behavior observations. From recording the number of different plant species encountered to watching mallard behavior, the research possibilities are endless.





## Research Day at the Zoo

*A little preparation will ensure your research day at the zoo goes smoothly. Here are some tips to get your planning started.*

### **Make a Reservation**

We ask all school and camp groups planning a zoo visit to register online. While there is no charge for your visit to the zoo, this form helps us determine staffing needs so that we can provide our visitors with the best possible experience. Register at [www.lpzoo.org/education](http://www.lpzoo.org/education) by selecting the link “Plan a Field Trip”.

### **Plan for your Day**

Be prepared for the logistics of the day. You'll want to...

- **Allow Enough Time** – Select a departure time from your school that allows for traffic delays and parking lot congestion, and provides sufficient time for collecting data.
- **Schedule Observations First** – If student observations are the primary focus of the visit, we encourage you to schedule this as your students' first activity at the zoo. This will ensure you have enough time to complete your project.
- **Plan for Emergencies** – Bring along a cell phone as well as school and parent contact information. Should you need assistance at the zoo, please go to Gateway Pavilion near the zoo's east entrance.

- **Communicate with Parents** – The bus drop-off area can become quite congested. If parents plan to meet you at the zoo to serve as chaperones, pick an alternative meeting place and a meeting time that allows for delays.
- **Plan for Bathroom Breaks** – Bathroom locations are listed in the map provided in this guide. High-capacity restrooms for group bathroom breaks are located in the lower level of the Kovler Lion House.
- **Select Lunch Location** – There are several areas set aside for you to enjoy a bag lunch. Outdoors, you may select from picnic tables near the bus drop-off area or the sheltered Foreman Pavilion. In the event of cold weather, you may eat in the Tadpole Room, located on the lower level of the Park Place Café.

**Seating at the tables associated with our Zoo Foods locations throughout the zoo is reserved for customers only. This includes the Landmark Café, Park Place Café, Café Brauer, and the Café at Wild Things. We thank you in advance for your understanding.**



## Research Day on the Schoolyard

*A little preparation will help schoolyard research projects run smoothly. Here are some tips to get your planning started.*

### Locate an Observation Area

An ideal observation area would be within walking distance of your school. Scientists rely on multiple observations to inform their research. A nearby location allows for more frequent observations on the part of your students. Examples would be an open area on school grounds, along the sidewalks around the school, or a nearby park or nature area.

### Manage the Class Period

Be prepared for all aspects of the observation activity. You'll want to...

- **Check on Area Logistics** – Getting to your observation area may require students to leave school grounds. Determine if permission slips will be needed. Plan your route and review appropriate safety procedures.
- **Allow Enough Time** – Provide sufficient time for students to collect the desired amount of data by accounting for the transportation time needed to get to the site as well as time to settle into a new learning environment.

- **Plan for Emergencies** – Before leaving the building, notify the school administration of your plans. Be sure to bring a cell phone or radio as designated by school policy.

- **Communicate with Parents and Staff** – Ask a parent or another school staff member to join you on your observations. If a parent/school staff member plans to meet you at the observation location, pick a specific meeting space where you can easily find each other.

- **Demonstrate Care for Nature** – Nature should be left undisturbed during student observations. Prior to leaving the observation area, take a few moments to assure that it is exactly as you found it.





## Building Research Skills

Before students start an original research project, they must first build their research skills. Scientists rely on an inquiry-based approach for learning more about the world around them.

An inquiry-based approach to scientific exploration includes:

- Making observations
- Posing questions
- Examining books and other information sources
- Planning investigations
- Using tools to gather and analyze data
- Proposing answers, explanations, and predictions
- Communicating results

A single activity or lesson doesn't need all these elements to be considered inquiry-based. Aligning with even one is a great start!

# Building Research Skills

## Activity 1: Using a Field Guide

### Activity Overview

In this activity, students will learn how to use a field guide to identify different schoolyard species. This will help with later investigations.

### Objective

Students will use a simple field guide to identify local wildlife.

### Materials

- Various field guides on local wildlife
- Schoolyard Field Guide (provided)
- Field journal

### Standards Connection

Late Elementary and Middle School Illinois State Learning Goals:

#### *Language Arts*

5.A: Locate, organize, and use information from various sources to answer questions, solve problems and communicate ideas.

5. B: Analyze and evaluate information acquired from various sources.

#### *Science*

11.A: Know and apply the concepts, principles and processes of scientific inquiry.

12.B: Know and apply concepts that describe how living things interact with each other and with their environment.

### Inquiry Connections

- Making observations
- Examining books and other information sources
- Communicating results

### Procedure

Divide students into groups of three or four and explain that they will be learning more about the work of field researchers.

Start by asking students to think about what types of animals they see around their homes and school. Next, provide each group with a selection of published field guides. Field researchers use these guides to identify animals and learn a little more about them. This helps them build expertise on a particular ecosystem or habitat. Comprehensive field guides can be complex and cover a wide range of species. Targeted field guides might be shorter and focus just on a particular group of animals such as birds.



A sample field guide appropriate for the urban schoolyard is provided. It highlights species students are most likely to encounter. Provide each student with a copy of this sample field guide and lead a class discussion. Questions for the class should include:

- How is the structure of the field guide helpful for conducting observations?
- What kind of information is provided?
- How would a researcher use something like this?
- What other types of information might be helpful to have in the field?

Next, allow students to conduct an observation outside. They can identify species using their field guide and record discoveries in their field journals. Students might even want to create their own field guide highlighting additional species special to your particular school environment.

### Evaluation

Students should be evaluated on a credit/no-credit system, earning credit if they can be observed using the field guide correctly.

### Modification for Younger Students

Help students identify general groups of animals rather than specific species. For example, they might count the legs on invertebrates to identify them as spiders (eight legs) or insects (six legs).

### Extension

Encourage students to spend time observing local wildlife near their home. After recording their observations in a field journal, can they use a classroom field guide to identify the species they encountered?



# Schoolyard Field Guide

## What animals can you find in your area?

### Eastern Gray Squirrel

*Sciurus carolinensis*



**Physical Description:** Up to 20 inches, dark to pale gray coloring, white ears

**Habitat:** Tree squirrel, often found in parks and gardens

**Notes:** Most active during early morning and early evening, its long tail helps with balance

### Monarch Butterfly

*Danaus plexippus*



**Physical Description:** Wing span of 4 inches, wings are orange black and white with distinctive markings

**Habitat:** Predominately found in open country such as fields and meadows

**Notes:** Larvae feed on milkweed, adults forage for flower nectar, often seen in swarms

### Ring-Billed Gull

*Larus delawarensis*



**Physical Description:** Up to 20 inches, pale bluish-gray and white coloring, wings tipped in black with white spots, beak has a black ring

**Habitat:** Areas with sandy ground and sparse vegetation, on beaches, in wet meadows, and in urban and suburban areas

**Notes:** Opportunistic feeders, will eat almost anything, highly social

### Eastern Cottontail Rabbit

*Sylvilagus floridanus*



**Physical Description:** Up to 16 inches, long ears, dull, grayish brown fur, feet and the underside of the tail are lighter

**Habitat:** Environments between vegetation and open land

**Notes:** Solitary animals, active at night and early morning, can leap up to 5 feet

### Canada Goose

*Branta Canadensis*



**Physical Description:** Up to 40 inches, black neck, bill, and head with white strap under the chin, body is usually brownish-gray

**Habitat:** Found near waterways in open, grassy habitats, and man-made habitats such as golf courses and parks

**Notes:** Highly social, active during the day

### Eastern Chipmunk

*Tamias striatus*



**Physical Description:** Up to 9 inches, reddish brown with black and brown or white/gray stripes, visible pouches in their mouths used to store food

**Habitat:** Shallow burrows in the ground, areas near rocky crevices, decayed tree trunks, and fence corners

**Notes:** Solitary, store food and hibernate for the winter in their burrows

# Building Research Skills

## Activity 2: Creating Scientific Illustrations

### Activity Overview

Researchers often use field sketches or scientific illustrations to record their observations. Creating scientific illustrations requires good observation skills, attention to detail, and knowledge of the subject.

### Objective

Students will create a scientific illustration.

### Materials

- Plain paper
- Photographs of local wildlife
- Colored pencils

### Standards Connection

Late Elementary and Middle School Illinois State Learning Goals:

#### *Language Arts*

5.A: Locate, organize, and use information from various sources to answer questions, solve problems and communicate ideas.

#### *Science*

11.A: Know and apply the concepts, principles and processes of scientific inquiry.

13.A: Know and apply the accepted practices of science.

### Inquiry Connections

- Making observations
- Using tools to gather and analyze data
- Communicating results

### Procedures

Students may be confident they know what a sparrow or squirrel looks like. However, when they look closely enough to create a scientific illustration, it's likely they'll identify anatomical details they hadn't noticed before. Gray fur may actually be a mix of white, black and gray. Whiskers are rarely all the same length but rather many different lengths.

Begin by providing students with three blank pieces of paper. On the first, ask students to draw a common plant or animal from memory. Provide them with specific options such as a pigeon, pine cone, or butterfly. These options should be guided by what photographs you have available for use in the second part of the activity. Have students



create an illustration based on their best recollection of the species and then set it aside.

Next, provide students with a photograph of the plant or animal they drew. Allow students 10 minutes to draw a new illustration on the second piece of paper using the photograph to guide them. Once the illustration is complete, ask students to again set it aside.

Now ask students to carefully re-examine the photograph. This time, ask them to think about the following questions prior to drawing on the third piece of paper:

- What is the animal's coloring (color patterns, shades, overall color, etc)?
- What type of body covering does the animal have (fur, feather, scales, etc)?
- What is the shape of the animal's body?
- What are other distinguishing factors?

Students should now draw the animal one last time using the photograph and questions to guide them. Have students compare all three drawings and lead a class discussion about drawing from memory, drawing with a picture, and drawing aided by prompts and discussion. What did students learn?

### Evaluation

Students should be evaluated on a credit/no-credit system, earning credit if they participate in drawing a scientific illustration in each of the three ways described.

### Extension

Repeat the drawing activity outdoors by observing a local animal, rather than using photographs.





## Building Research Skills

### Activity 3: Keeping a Field Journal

#### Activity Overview

Field researchers use journals while doing field-work to keep a record of what they observe. Field journals may be kept electronically using computers or a simple notebook and pencil. A field researcher may record data in a journal over many weeks, months, or even years. Reviewing this data can help researchers see patterns over time and identify areas for future study.

#### Objective

Students will record wildlife observations in a field journal.

#### Materials

- Blank notebook
- Journal Guidelines (provided)
- Pencils
- Binoculars (Optional)

#### Standards Connection

Late Elementary and Middle School Illinois State Learning Goals:

##### *Language Arts*

3.B: Compose well-organized and coherent writing for specific purposes and audiences.

3.C: Communicate ideas in writing to accomplish a variety of purposes.

##### *Math*

10.B: Formulate questions, design data collection methods, gather and analyze data and communicate findings.

##### *Science*

12.A: Know and apply concepts that explain how living things function, adapt and change.

12.B: Know and apply concepts that describe how living things interact with each other and with their environment.

13.A: Know and apply the accepted practices of science.

**Inquiry Connections**

- Making observations
- Use tools to gather and analyze data
- Proposing answers, explanations, and predictions
- Communicating results

**Procedure**

Explain to students that before they start their research project, they will need to be comfortable using a field journal. A field journal is a place to record data to address research questions. Prompt students to consider potential research topics or questions and record their responses. Examples might include:

- Types of plants and animals in this environment
- Health of species in the environment
- Impact of weather or other variables on a plant or animal

Next, select one of these research topics for further consideration. Ask student to identify what types of data would be important to record to help them explore this research topic. For example, if students are interested in the types of plants and animals within an environment, it would be important to record:

- Specific location of the field site
- Description of each species observed
- Scientific illustrations of what they saw at the site
- Abundance of each species observed

- Environmental conditions such as weather, season, temperature, and time of day
- Observed species interactions

Next, have students identify a research focus for a sample journal entry. They may select from the suggestions identified during class discussion or identify a new focus topic. Provide students with a blank notebook of lined paper and a pencil. Attaching the provided Journal Guidelines sheet on the inside cover of the notebook can help reinforce to students the importance of detail.

Provide students with time outdoors to make observations and record data in their journals. Back in the classroom, have students discuss their journal entries in small groups. Journal entries should then be given to the teacher for evaluation.

**Evaluation**

A three-point scoring rubric can be used to evaluate completed journal entries.

3	2	1
Student records information with high level of detail	Student records information with a moderate level of detail	Student records information with minimal detail

**Modification for Younger Students**

Provide younger students with a field journal template to serve as a graphic organizer. This will guide them towards collecting all the desired data as well as help them keep all the information organized.

**Journal Guidelines**

Recording lots of detail in your field journal is important to your research. Some examples of what you might need to record include...

- Specific location of the field site
- Detailed description of observed species
- Scientific illustrations of the field site and/or species observed
- Abundance of observed species

- Location of each species in the environment
- Location of non-living elements of the environment: streams, trees, rocks, shade
- Environmental conditions: weather, season, temperature, time of day
- Observation date
- Unusual conductions or variables



## Ethology and Ethograms

Studying an animal's behavior can provide scientists with valuable information that can aid in conservation efforts. The study of animal behavior is called ethology. Scientists use ethograms to help with this research.

When scientists conduct animal observations, they rely on specific procedures in order to collect data that is as accurate as possible. Researchers use an ethogram as part of these procedures. Ethograms are a list of all the possible behaviors an animal might exhibit. Using an established ethogram helps ensure the data collected by lots of different scientists is similar enough to be compared. As you can imagine, scientists might use different ethograms for different species to capture the unique behaviors of each. Scientists might also use different ethograms for the same species. These ethograms may be more specialized and focus on types of behavior such as maternal care or social aggression.

There are many different ways to collect data on animal behavior. In interval sampling, observers note what an animal is doing at pre-set, evenly-spaced time intervals. This allows the researcher to get a clear "snapshot" of an animal's behavior at a precise moment in time. When multiple observations are combined, researchers can begin to draw conclusions about which types of behaviors might be most common for a species, or when certain types of behaviors are most likely to occur.



## Building Research Skills

### Activity 4: Using an Ethogram

#### Activity Overview

In this activity, students will learn how to use an ethogram to study animal behavior. Observations can be conducted anywhere animals can be found: a schoolyard, nearby park, or student's backyard.

#### Objective

Students will use an ethogram-based data sheet to record animal behavior.

#### Materials

- Ethogram and Observation Datasheet for Bird or Squirrel (provided)
- Information on Ethology (see page 13)
- Clipboards
- Stopwatch
- Pencils

#### Standards Connection

Late Elementary and Middle School Illinois State Learning Goals:

##### *Language Arts*

3.C: Communicate ideas in writing to accomplish a variety of purposes.

##### *Math*

10.A: Organize, describe and make predictions from existing data.

##### *Science*

11.A: Know and apply the concepts, principles and processes of scientific inquiry.

12.B: Know and apply concepts that describe how living things interact with each other and with their environment.

13.A: Know and apply the accepted practices of science.

#### Inquiry Connections

- Making observations
- Use tools to gather and analyze data
- Proposing answers, explanations, and predictions
- Communicating results

#### Activity Preparation

To prepare for the activity, first determine if students will be observing birds or squirrels. It's best to select the type of animal they will most likely encounter in the study area. We've provided data sheets for both from which to choose.

#### Procedure

Before beginning the observation, explain to students that they will be learning about ethology, or the study of animal behavior. Provide students with a copy of the selected ethogram data sheet and a clipboard. Explain they will be using interval sampling during the activity. With interval sampling, they will not write down everything they observe about the animal, but instead will record what behaviors they observe at selected time intervals. The ethogram data sheet will guide them in what behaviors to look for and record.





IMLS Grant LG-24-07-0056-07

## FIND OUT MORE

### Ethosearch Website

Students may have selected species for which an ethogram has not been included in this guide. By visiting [www.ethograms.org](http://www.ethograms.org), you can have access to ethograms for all types of species that have been created by scientists and used in actual research. Some of them might be a little too complex for younger students, but you can easily modify them to meet your own needs. There are also additional student-friendly ethograms created for use by teachers on the site.

You can now take students to the study site (school yard, park or zoo) and ask them to identify a single bird for their focus animal. More than one student can observe the same animal as long as they are not lumped too closely together. Before using their data sheets, allow students some time to simply observe the animal and discuss what they see with a peer. Discussion topics can include:

- What can you tell me about the animal's appearance and behavior?
- What do you think the animal might do next?
- What have you learned by watching the animal?
- What do you think will be the most common behavior for this animal?
- What do you think would be the least common behavior for this animal?

Students will now focus on collecting their data. Either provide students with a stopwatch or serve as the time keeper, announcing each interval "time" to facilitate data recording. Encourage students to remain quiet throughout the entire length of the observation. Loud noises may affect animal behavior.

After data is collected, return to the classroom. In the classroom encourage discussion about what students observed. Suggested discussion questions include:

- What behavior occurred most often? Is this different from what was predicted?
- What behavior occurred least? Is this different from what was predicted?
- What conclusion can be made about the animal's behavior from your observations?

### Evaluation

A three-point scoring rubric can be used to evaluate completed data sheets

3	2	1
Student data sheets are complete and clear	Student data sheets are partially complete and/or somewhat clear	Student data sheets only contain minimal information

### Modification for Younger Students

A modified data sheet will be appropriate for younger learners. Several behaviors can be combined so there are fewer categories to identify. Intervals may be increased to 30 seconds to allow more time to write.

### Extension

Challenge students to create their own ethograms for a pet or other local species. They can determine which behaviors to include based on their own observations. They can then group these behaviors into 3-5 commonly observed categories.

# Ethogram and Observation Data Sheet: Bird

Student Researcher

## Self-Preening

The bird is manipulating its own feathers with its beak, stretching, or any other maintenance behavior, including sunning.

## Feeding

The bird is foraging (looking) for or consuming food items.

## Manipulate Object

The bird is moving any object in its beak or toes, such as wood, rock or perch.

## Vocalizing

The subject is vocalizing and not performing any other active behavior simultaneously.

## Locomotion

The bird is performing any locomotor behavior such as walking, flying, pacing, hopping, running or jumping.

## Resting

The bird is inactive, possibly lying down or perched. No other behavior is occurring. Eyes may be open or shut.

## Not Visible

The bird are off exhibit or you cannot see the bird you were observing.

## Other

You see a behavior other than the ones described above.

*Ethograms that are part of this activity guide have been modified and condensed in order to be more developmentally appropriate for your students.*

Time	Self-Preening	Feeding	Manip. Object	Vocalizing	Locomotion	Resting	Not Visible	Other
0:15								
0:30								
0:45								
1:00								
1:15								
1:30								
1:45								
2:00								
2:15								
2:30								
2:45								
3:00								
3:15								
3:30								
3:45								
4:00								
4:15								
4:30								
4:45								
5:00								
Total								

## Notes

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# Ethogram and Observation Data Sheet: Squirrel

Student Researcher

## Digging/Burying

The squirrel is scratching the ground or tree, and/or manipulating an object into the ground or tree hollow.

## Locomotion

The squirrel is moving either by walking, running, jumping or climbing.

## Feeding

The squirrel is grabbing at and/or biting vegetation with their teeth.

## Grooming

The squirrel is dusting, grabbing, biting, clawing or rubbing its body.

## Alertness

The squirrel is standing in an upright position looking at its surroundings.

## Resting

The squirrel is lying on the ground, logs, rocks, etc. its eyes may or may not be opened.

## Not Visible

You are unable to see the squirrel you are observing.

## Other

You see a behavior other than the ones described above.

*Ethograms that are part of this activity guide have been modified and condensed in order to be more developmentally appropriate for your students.*

Time	Digging/Burying	Locomotion	Feeding	Grooming	Alertness	Resting	Not Visible	Other
0:15								
0:30								
0:45								
1:00								
1:15								
1:30								
1:45								
2:00								
2:15								
2:30								
2:45								
3:00								
3:15								
3:30								
3:45								
4:00								
4:15								
4:30								
4:45								
5:00								
Total								

## Notes

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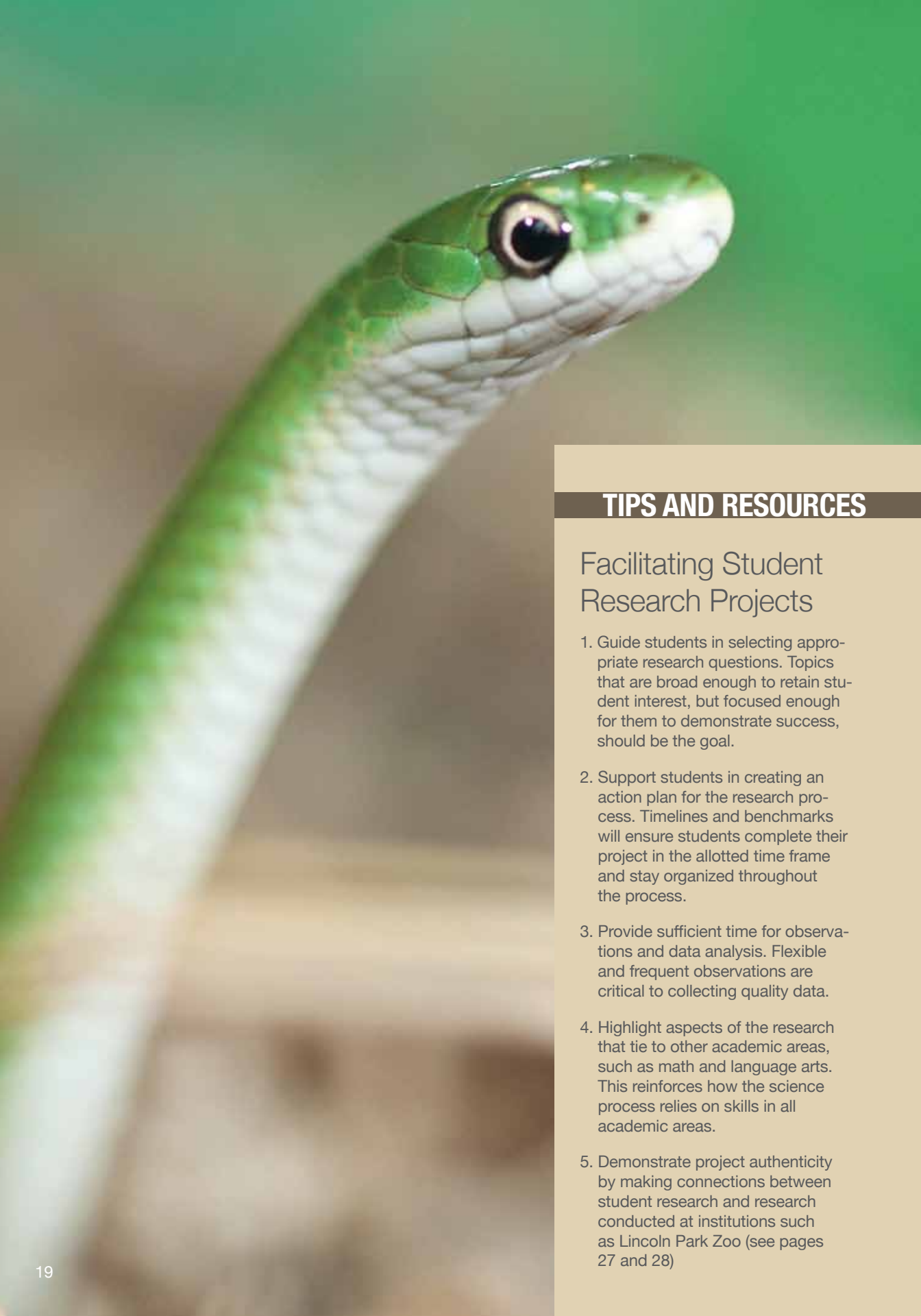


# Conducting Field Research

Now that students have practiced basic research skills, it's time to apply them to an original research project. Allowing students the opportunity to select original research questions and actively explore these topics of interest parallels the work of practicing scientists and provides an authentic view into the research process.

This next section outlines two types of research projects for you to conduct with your students. Each allows students to identify areas of personal interest on which to focus their explorations but has a standard procedure for easy implementation.





## TIPS AND RESOURCES

### Facilitating Student Research Projects

1. Guide students in selecting appropriate research questions. Topics that are broad enough to retain student interest, but focused enough for them to demonstrate success, should be the goal.
2. Support students in creating an action plan for the research process. Timelines and benchmarks will ensure students complete their project in the allotted time frame and stay organized throughout the process.
3. Provide sufficient time for observations and data analysis. Flexible and frequent observations are critical to collecting quality data.
4. Highlight aspects of the research that tie to other academic areas, such as math and language arts. This reinforces how the science process relies on skills in all academic areas.
5. Demonstrate project authenticity by making connections between student research and research conducted at institutions such as Lincoln Park Zoo (see pages 27 and 28)



# Conducting Field Research

## Activity 5: Biodiversity Study

### Activity Overview

To better understand the diversity of an area, scientists often conduct a biodiversity survey. This involves identifying the many different species of plants and animals within a particular area, the biodiversity, as well as an estimated population size or abundance of each species.

### Objective

Students will conduct a biodiversity study of their schoolyard or other local natural area.

### Materials

- Biodiversity Survey Data Sheet (provided)
- Access to schoolyard or other natural area
- Pencils
- Field Journal
- Binoculars (optional)

### Standards Connection

Late Elementary and Middle School Illinois State Learning Goals:

#### Language Arts

5.A: Locate, organize, and use information from various sources to answer questions, solve problems and communicate ideas.

#### Math

10.B: Formulate questions, design data collection methods, gather and analyze data and communicate findings.

#### Science

11.A: Know and apply the concepts, principles and processes of scientific inquiry.

12.B: Know and apply concepts that describe how living things interact with each other and with their environment.

### Inquiry Connections

- Making observations
- Posing questions
- Examining books and other information sources
- Using tools to gather and analyze data
- Proposing answers, explanations, and predictions
- Communicating results

### Procedure

Identify an area on or near your school grounds that has a variety of plant and animals species. This does not need to be a purely natural environment. Living things such as ants, spiders, and dandelions can be found in most urban areas.

Clearly define the boundaries of the study area. You might use sidewalks, fences, trees, or signposts to mark these boundaries. After the boundaries have been defined, allow students time to make general observations of the area and record these in their journals.

Once students are generally familiar with the area, they can initiate their biodiversity survey. If your study area is very large, you may use one of the sampling methods described in the Find out More section on page 22. Students can use field guides to identify species or write down simple descriptions if a species is unknown. You may elect to narrow the scope depending on students' development level to one particular group such as birds, plants or invertebrates like insects and spiders. Provide students with copies of the datasheet found on page 21 to facilitate their data collection.

After students have collected their data, provide time in class for data analysis. This can include creating a graph or chart of the data collected or the creation of an original field guide of species encountered. Allow each student to share their results with the class. Discussion on how discoveries might vary from student to student is an important part of understanding the scientific process.

### Evaluation

A three-point scoring rubric can be used to evaluate student participation in the data collection and analysis process.

#### Data Collection

3	2	1
Data sheet is complete	Data sheet is partially complete	Data sheet is incomplete

#### Data Presentation

3	2	1
Data presented accurately; there are no calculation errors	Data presented somewhat accurately; there are some calculation errors	Data presented inaccurately; calculations contain multiple errors


### Extension

There are multiple ways to extend this activity. For example, students can repeat the study at different times of year or focus on different types of species.



# Biodiversity Survey Data Sheet

Student Researcher: \_\_\_\_\_ Location: \_\_\_\_\_



**Animal Species or Plant:** \_\_\_\_\_

**Physical Description:** \_\_\_\_\_


\_\_\_\_\_

**Population Count:** \_\_\_\_\_

**Additional Observations:** \_\_\_\_\_

\_\_\_\_\_

*Scientific Illustration*



**Animal Species or Plant:** \_\_\_\_\_

**Physical Description:** \_\_\_\_\_


\_\_\_\_\_

**Population Count:** \_\_\_\_\_

**Additional Observations:** \_\_\_\_\_

\_\_\_\_\_

*Scientific Illustration*



**Animal Species or Plant:** \_\_\_\_\_

**Physical Description:** \_\_\_\_\_


\_\_\_\_\_

**Population Count:** \_\_\_\_\_

**Additional Observations:** \_\_\_\_\_

\_\_\_\_\_

*Scientific Illustration*



**Animal Species or Plant:** \_\_\_\_\_

**Physical Description:** \_\_\_\_\_

\_\_\_\_\_

**Population Count:** \_\_\_\_\_

**Additional Observations:** \_\_\_\_\_

\_\_\_\_\_

*Scientific Illustration*



## All About Sampling Methods

When researchers study a large area, they are often unable to count every species they find. Instead, they will select a small section intended to represent the larger area. Sampling the diversity and abundance of species within this selected area is then used to make generalizations about the habitat as a whole.

Line transects are one type of sampling method you can use with students. Identify straight lines that run through the study area either using landmarks or by actually stringing twine across the space. Spread students throughout the space and assign them points along the transects. Have students record whatever they see within a specified number of feet from that line and combine their findings to create a full biodiversity report for the area.

Another method of sampling is using plots to look very closely at a small area. Stretching a coat hanger into a square shape provides boundaries for a plot observation. Students will then record everything they see in the square. After estimating how many “squares” of similar habitat are present in the full study area, students can extrapolate from the numbers of species in their plots to an estimated abundance in the study site. You might want to combine both sampling methods and have students use plots spaced along a transect.





## Conducting Field Research

### Activity 6: Behavioral Research Study

#### Activity Overview

Before starting this activity, ensure students have completed Activity 4. It will be important for them to be comfortable using an ethogram before initiating an ethogram-based research study. This activity will allow students to select a research focus of their choice: either comparing the behavior of two different species or observing the behavior of a single species over time.

#### Objective

Students will utilize an ethogram to conduct an original study of animal behavior.

#### Materials

- Ethogram and Observation Data Sheet (Provided)
- Data Analysis Template (Provided)
- Access to a park, schoolyard, or nature center/reserve
- Pencils
- Clipboards
- Field journal

#### Standards Connection

Late Elementary and Middle School Illinois State Learning Goals:

##### *Language Arts*

5.A: Locate, organize, and use information from various sources to answer questions, solve problems and communicate ideas.

##### *Math*

10.A: Organize, describe and make predictions from existing data.

10.B: Formulate questions, design data collection methods, gather and analyze data and communicate findings.

##### *Science*

11.A: Know and apply the concepts, principles and processes of scientific inquiry.

12.B: Know and apply concepts that describe how living things interact with each other and with their environment.

#### Inquiry Connections

- Making observations
- Posing questions
- Examining books and other information sources
- Using tools to gather and analyze data
- Proposing answers, explanations, and predictions
- Communicating results

## Procedure

During this project, students will focus on behavior of one or two species found in the area surrounding their school or home. In preparation for the project, allow students time to take some general observations of the study site in which they will conduct their observations. Students should record their observations in their field journals, noting general facts about the environment as well as the types of species they see.

Once students gain familiarity with the animal populations that live in the area, have them select a focus species for their study. Species commonly found in urban and suburban settings include:

- Squirrels
- Pigeons
- Gulls
- Sparrows
- Rabbits
- Robins
- Chipmunks

Help students learn a little more about their species by connecting them with books, information from reliable websites, or other content sources. After students have learned a little about the behavior of their selected species, have them identify a behavior-related research question. Examples might include:

- Does the season affect squirrel behavior?
- Does a male or female sparrow spend more time being active?
- How does a rabbit spend most of its time?
- Is a squirrel more active than a pigeon?

Be sure to set aside time to review each student's research question before the data collection process. As discussed in the tips on page 19, an appropriate scope to the project is critical. In addition, ensure the research question is measurable and objective such as the examples above.

After review of their research question, but before beginning to collect data, have students record their predictions in a field journal. Review the sample observation they conducted as part of Activity 4 including the process of interval sampling and the role of an ethogram.

Depending on the species students select, you can provide them with copies of the bird or squirrel ethograms on page 16 or 17 or a copy of a species-neutral ethogram on page 25. You may also want to create your own species-specific ethogram (see Find Out More on page 15). Provide each individual student or student group with a clipboard and stopwatch, and set aside several observation sessions for data collection.

After several observations have been completed, allow students time to analyze their data. A sample data analysis template has been provided to help with this process. After students have identified which behaviors were observed most frequently, encourage them to draw conclusions from these observations. Encourage them to address:

- How these results were similar to or different from their predictions
- What these results might tell them about the species
- What other questions might be interesting to explore
- What limitations there are to their observations

## Evaluation

A three-point scoring rubric can be used to evaluate student participation in the data collection and analysis process.

### Data Collection

3	2	1
Data sheet is complete	Data sheet is partially complete	Data sheet is incomplete

### Data Presentation

3	2	1
Data presented accurately; there are no calculation errors	Data presented somewhat accurately; there are some calculation errors	Data presented inaccurately; calculations contain multiple errors

### Conclusions

3	2	1
Conclusions are well supported by data; there are no unsupported conclusions	Conclusions are partially supported by the data	Conclusions are not supported by data

## Modification for Younger Students

See Activity 4

# Ethogram and Observation Data Sheet:

Student Researcher

(species)

**Feeding**

The animal is eating food or drinking water. This includes chewing the food.

**Social**

The animal is engaging in a friendly interaction with another animal.

**Self-Groom**

The animal is engaging in grooming or other self-care activity.

**Active**

This is a behavior that the animal does on its own, such as running, playing, flying, walking or climbing.

**Inactive**

This is when the animal is sleeping, relaxing, or just sitting still not doing any other behavior.

**Not Visible**

The animal is off exhibit or you cannot see the animal you were observing.

**Other**

You see a behavior other than the ones described above.

*Ethograms that are part of this curriculum guide have been modified and condensed in order to be more developmentally appropriate for your students.*

Time	Feeding	Social	Self-Groom	Active	Inactive	Not Visible	Other
0:15							
0:30							
0:45							
1:00							
1:15							
1:30							
1:45							
2:00							
2:15							
2:30							
2:45							
3:00							
3:15							
3:30							
3:45							
4:00							
4:15							
4:30							
4:45							
5:00							
Total							

**Notes**



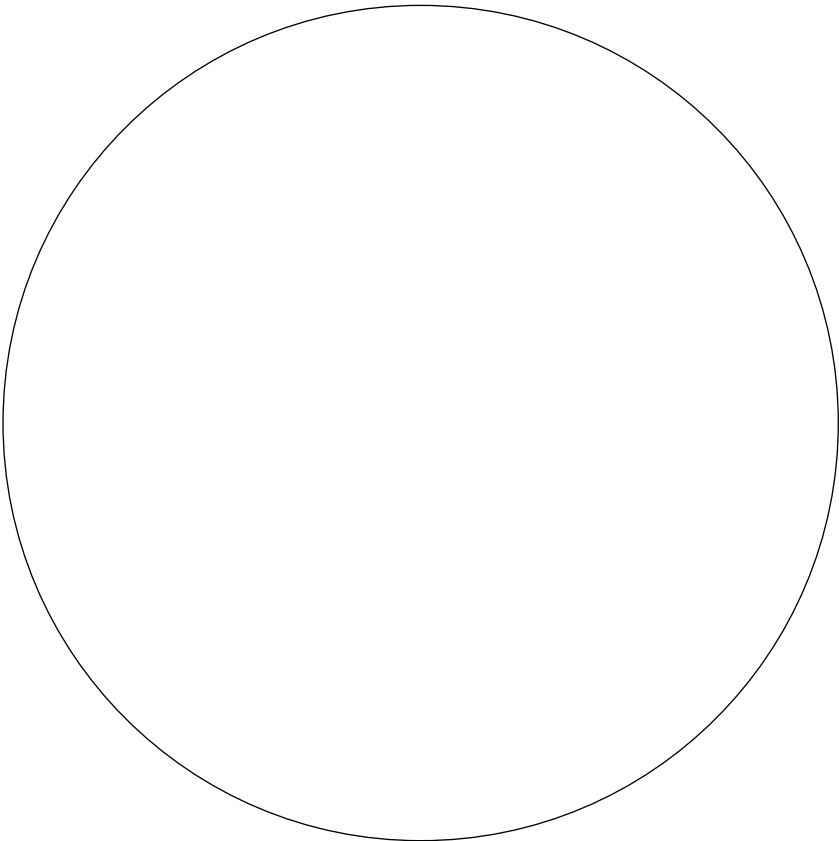
# Activity Budget:

Student Researcher

(species)

Behavior	Percentage of Observed Time (Observation 1)	Percentage of Observed Time (Observation 2)	Percentage of Observed Time (Observation 3)	Average Percentage
Feed				
Social				
Self-Groom				
Active				
Inactive				
Not Visible				
Other				

Using the circle below, create a rough estimate pie chart summarizing your data. Be sure to label each section.





## RESEARCH CONNECTION

### Ethology Studies at Lincoln Park Zoo

Scientists from the Lester E. Fisher Center for the Study and Conservation of Apes rely on ethograms to better understand primate behavior in the wild as well as here at the zoo. By studying behavior of chimpanzees and gorillas, scientists are better prepared to help conserve their populations in the wild as well as ensure their welfare in non-wild settings.

One project that Dr. Steve Ross is working on focuses on the social behavior of great apes. He has a team of interns that use hand-held electronic devices to record how apes use exhibit space every minute. They collect this data during 30-minute data collection sessions throughout each weekday. Studies conducted in the animal's former exhibit building found both species prefer to spend time near doorways, corners, and climbing structures. Zoo staff used this data to influence the design of the animals' current exhibit to provide them with the type of environment they would find most comfortable. Scientists continue to collect data on the animals in their current exhibit. Though there is still much to analyze, some of the early findings indicate that chimpanzees tend to use the outdoor areas of the exhibit more than gorillas do. Since making these discoveries, we've learned that by providing regular access to outside yards, we can create an even more healthy and engaging home for our apes.



## RESEARCH CONNECTION

### Biodiversity Studies at Nature Boardwalk


Since the opening of Nature Boardwalk, scientists from the zoo's Urban Wildlife Institute have been collecting data on the many species that are making this newly restored ecosystem their home. Wildlife Biologist Vicky Hunt spends afternoons cataloging the different types of wildlife that the pond supports, identifying size of species populations, and noting any interesting interactions between the different species.

Some of the first animals to arrive at the pond were damselflies and dragonflies. One of Vicky's projects was to identify how many different types of species of damselflies and dragonflies could be spotted at the pond. She collected her data by using field guides to identify the different species she encountered as she walked a transect around the pond. Her research indicated up to 17 species could be seen on any given day, an example of biodiversity right here in urban Chicago.

Vicky also monitors bird populations. Each day, she records the types of birds she sees at Nature Boardwalk as well as how many of each she encounters. She relies on binoculars to help her with identification. For unfamiliar species, she takes a photograph and compares the image with field guides back in her office.

This monitoring helps the zoo see trends in abundance of different species over time.





## Disseminating Discoveries

One of the most important parts of conducting research is sharing the results of this work. This can help other scientists and the public better understand the world in which we live. Some scientists may present their findings at a professional conference or write articles for scientific journals. Others may incorporate their discoveries into a new museum exhibit or even a children's book. You might see a scientist on a television show or conducting a radio interview. There are as many ways to share scientific discoveries as there are to make them!

# Disseminating Discoveries

## Activity 7:

### Students Sharing Research Results

#### Activity Overview

Once students have completed their original research activity, it's important to provide them with the opportunity to share what they have discovered. This replicates the work of practicing scientists and reinforces information learned.

#### Objective

Students will disseminate their research findings among their peers.

#### Standards Connection

Late Elementary and Middle School Illinois State Learning Goals:

##### Language Arts

3.B: Compose well-organized and coherent writing for specific purposes and audiences.

4.B: Speak effectively using language appropriate to the situation and audience.

5.A: Locate, organize, and use information from various sources to answer questions, solve problems and communicate ideas.

##### Math

10.B: Formulate questions, design data collection methods, gather and analyze data and communicate findings.

##### Science

12.A: Know and apply concepts that explain how living things function, adapt and change.

12.B: Know and apply concepts that describe how living things interact with each other and with their environment.

13.A: Know and apply the accepted practices of science.

#### Inquiry Connections

- Using tools to gather, analyze and interpret data
- Proposing answers, explanations and predictions
- Communicating results

#### Procedure

Once students have completed their research projects, inform the students that they are going to have the opportunity to present what they have learned to others. You may decide to allow them to select their dissemination method, or you may assign the

format. Some students may select multiple methods of dissemination. Suggested options include:

- Posters to be displayed on school grounds
- Written research reports that can be bound and displayed in the school library or classroom
- Culminating event such as a science celebration or classroom museum
- Website or multimedia project
- Oral presentations for small or large groups
- Children's books

Whatever the method of dissemination, you will want to require key elements to ensure the project is comprehensive. These might include:

- Title for the research project
- Student information (name, grade)
- Research question
- Student predictions
- Information about animals that were observed
- Procedure used by students
- Summary discussion of the data
- Conclusions

Encourage students to be creative and provide them with all necessary materials to be successful such as art supplies, pictures, display boards or access to a computer. Varying the project type to support younger students or students with special needs will ensure success for all learners.

#### Evaluation

A three-point scoring rubric can be used to evaluate student projects. A more detailed rubric can also be created that is specific to the mode of project delivery.

##### Presence of Required Components

3	2	1
All of the required elements	Most of the required elements	Few of the required elements

##### Quality of Data Analysis

3	2	1
Conclusions were clearly supported by data	Conclusions were partially supported by data	Conclusions were not supported by data

##### Quality of Work

3	2	1
The highest level of preparation and detail	A fair amount of preparation and detail	Little preparation and detail

# Connecting with Families

The zoo and school aren't the only locations where students can conduct research. All of the activities in this guide can easily be amended to implement at home. You may want to send a blank notebook home with each student to serve as a field journal. On the inside cover, you can provide suggestions for observations and activity prompts by using a template like the one below.



## Research at Home

Use your field journal to record observations and discoveries. Here are sample topics to get your started:

### **Ethology (Animal Behavior) Topics**

- Observe what time of day domestic animals are most active
- Compare behavior of dogs and cats
- Observe how squirrels use different areas of their environment
- Compare behavior of different types of wild birds

### **Biodiversity Topics**

- Look very closely at a patch of “grass”. How many different kinds of plants make up this green space?
- With adult help, gently turn over a rock or log. What types of tiny animals do you see? How are they interacting with each other?
- How many different types of bird species can you find by your house?
- Are there more species of birds by your house or by your best friend's house?



Date: \_\_\_\_\_

**Dear Family Members and Friends,**

We've been learning about scientific research in class and have even participated in our own research activities. Continuing these investigations at home is a great way to reinforce what students have learned as well as extend the learning experience.

Questions you may want to ask your child to learn even more about our classroom projects include:

- What was the focus of your research project?
- What did you learn about how scientists study animals?
- Did you learn any new skills?
- Did you discover a plant or animal you hadn't noticed before?

Conducting research is something you can do at home as well. Encouraging your child to keep a science journal and take notes on the different things he or she might notice in the neighborhood is a great way to reinforce these skills. Topics he or she might want to focus on could include:

- Different types of birds in your neighborhood
- Behavior of a pet cat or dog
- Number of plant species in the neighborhood
- How different animals interact with each other

You might also want to plan a trip to the Lincoln Park Zoo to practice animal observations. The zoo is open 365 days a year, including holidays and there is free admission for everyone. You can learn more about visiting the zoo at [www.lpzoo.org](http://www.lpzoo.org)

Sincerely,