

EDUCATOR'S GUIDE

GRADES 4-8



Birds of Paradise

AMAZING AVIAN EVOLUTION

 NATIONAL
GEOGRAPHIC
MUSEUM

The **Cornell** Lab
of Ornithology 

INTRODUCTION

This exhibition takes you and your students on an expedition to the New Guinea rainforest to witness the spectacular plumage and dazzling dance moves of the family of birds known as birds-of-paradise. You will meet and follow the adventures of two determined researchers—National Geographic photographer Tim Laman and Cornell Lab of Ornithology researcher Edwin Scholes. These two explorers made 18 trips to New Guinea over eight years to complete the first survey of all 39 known species of birds-of-paradise. The video and photographs they brought back, combined with the exhibition artifacts and interactive experiences, provide exciting learning opportunities for you and your students.



Photograph by Tim Laman

MAJOR TOPICS

Sexual Dimorphism: Physical differences—such as size, color, and shape—between males and females of the same species.

Evolution by Sexual Selection: The process by which females or males select mates based on features they find attractive, resulting in more offspring with those features and—sometimes—the development of new species.

Scientific Research: Methods used by scientists in the past and today to study birds-of-paradise, including expeditions to observe these birds in the wild.

New Guinea Geography and Culture: How New Guinea’s geography affected the evolution of birds-of-paradise, and the role birds-of-paradise play in New Guinea’s culture.

NATIONAL STANDARDS

A trip to the *Birds of Paradise* exhibition supports the following standards.

Science

Science as Inquiry

- Abilities needed for scientific inquiry

Life Science

- Characteristics of organisms
- Diversity and adaptations of organisms

History and Nature of Science

- Science as a human endeavor
- History of science

Geography

Places and Regions

- Standard 4: The physical and human characteristics of places



EXHIBITION MAP

Since *Birds of Paradise* is a traveling exhibition, the exact location of each display will vary from museum to museum.

A. Entry

- Experience the sights and sounds of New Guinea.
- Glimpse birds-of-paradise and meet the two scientists.
- Don't miss the Survival of the Sexiest animation.

B. Ground Dancing

- Watch male birds-of-paradise use fancy dance moves to court females.
- See how the dances vary from species to species.
- Learn the steps and perform your own bird-of-paradise dance.

C. Shape Shifters

- Find out how some birds-of-paradise can change their shapes.
- Try your hand at changing the shape of a Superb Bird-of-Paradise.
- Examine bird-of-paradise feathers with amazing shapes and colors.

D. Out on a Limb

- Watch birds-of-paradise perform on tree branches and listen to commentary from ornithologist Ed Scholes.
- Examine how iridescence works by observing a feathers from a breast shield.
- Discover how many different colored body parts have evolved in male birds-of-paradise.

E. Call Me

- Listen to the distinctive calls of ten bird-of-paradise species.
- Find out the purpose of the calls.

F. Victorian Study

- Study bird-of-paradise skins collected in the past century.
- Discover what skins can teach us—and what they can't.
- Learn how the use of feathers in hats led to a conservation movement.

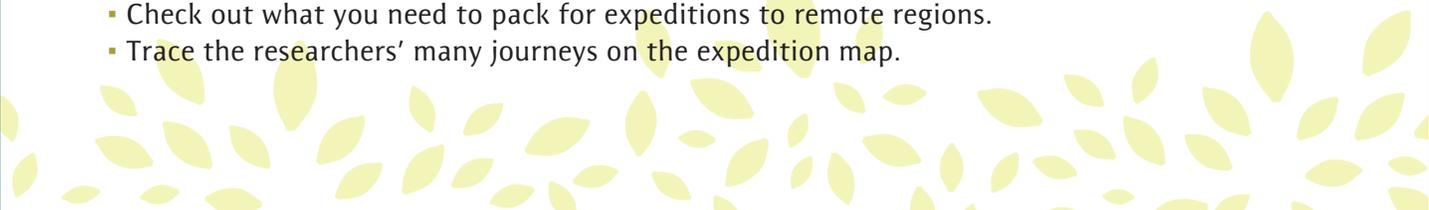
G. Modern Science

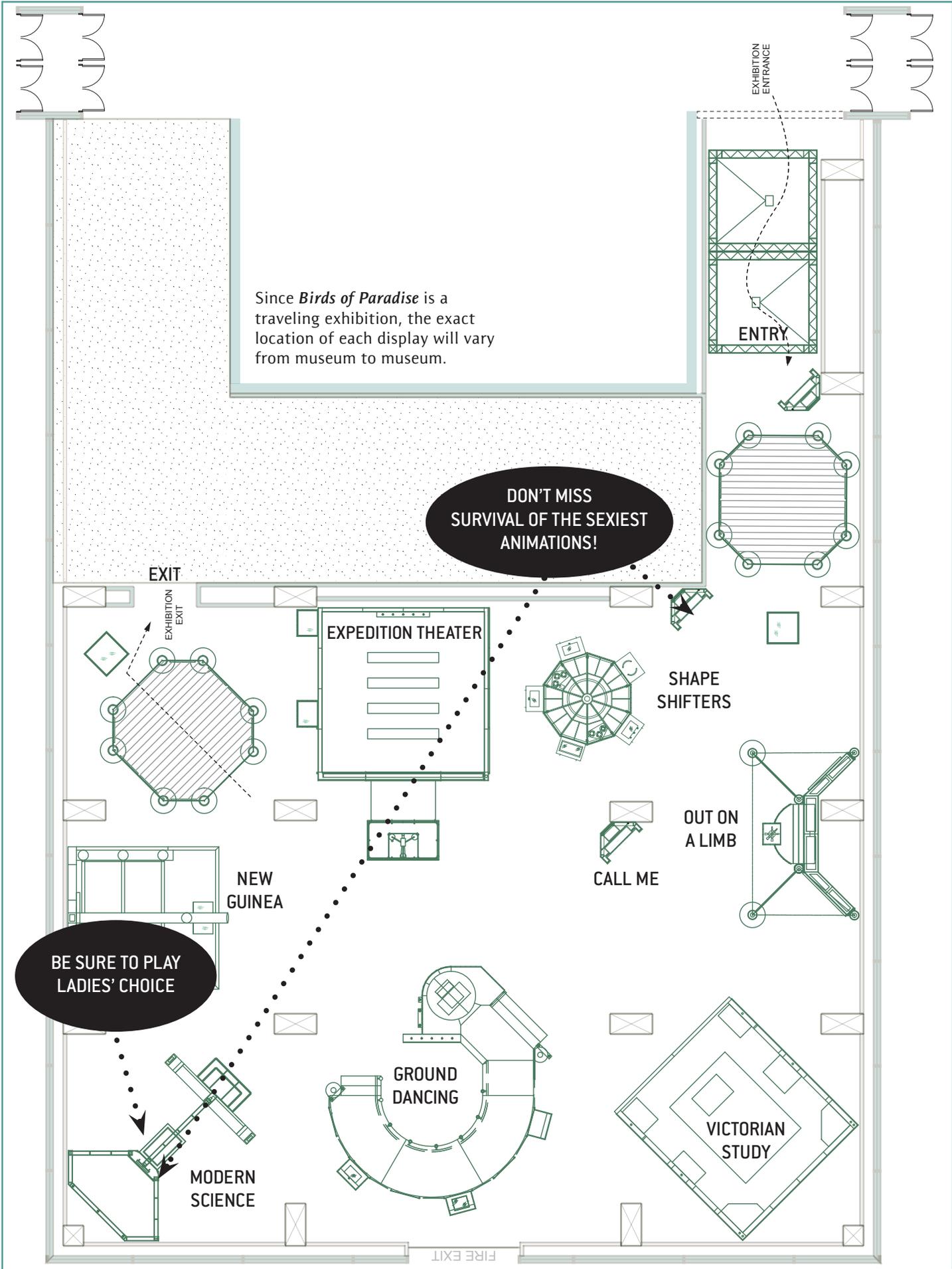
- Find out what has been learned about birds-of-paradise using modern scientific techniques.
- See how modern photographic equipment helps scientists study birds-of-paradise.
- Play the Ladies' Choice game to learn how the evolutionary process of sexual selection works.
- Check out the Survival of the Sexiest Part II animation.

H. New Guinea

- Study a map to understand how New Guinea's geography led to the evolution of so many bird-of-paradise species and cultural groups.
- Discover roles birds-of-paradise play in New Guinea culture—past and present.
- Look for bird-of-paradise images on Papua New Guinea's flag and other modern objects.

I. Expedition Theater

- Sit down and enjoy a 13-minute film about Tim and Ed's expeditions to New Guinea.
 - Check out what you need to pack for expeditions to remote regions.
 - Trace the researchers' many journeys on the expedition map.
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HOW TO USE THIS GUIDE

Before Visiting the Exhibition: Use these activities to introduce birds-of-paradise and New Guinea's geography. Explain what students will be seeing and doing in the exhibition, and answer any questions they have.

At the Exhibition: Give each student an Expedition Journal. You can download the booklet at www.ngmuseum.org/bop. The booklet contains a map of the exhibition as well as activities for students to do at all the major exhibition sections. Have students explore the exhibition in teams of 2–4, imagining that they are on a real expedition. The groups can explore the sections in any order, as long as they visit every one. Don't miss the Survival of the Sexiest Part I and II animations and the Ladies' Choice game demonstrating how sexual selection works. These two activities summarize the major themes in entertaining ways.

After Visiting the Exhibition: Select from these activities on to follow up and build on your visit. There are activities related to each major section, and activities designed to meet different curriculum needs.

Website: Images, videos, and worksheets that are underlined in this guide are available on the educator's website for your use.

Other Resources: At the end of this guide is a list of additional materials to help you plan and expand on your visit.

Have fun!

BEFORE VISITING THE EXHIBITION

Discuss what's special about birds-of-paradise

Show students a photo of a male Greater Bird-of-Paradise displaying, and ask what they notice about the bird.

Discuss the bird's colors and the long, fancy feathers on its back and tail. What do students think the bird is doing? Explain that it is displaying for a female, and show students a photo of a female Greater Bird-of-Paradise.

Discuss the differences between the male and female.

Explain that there are physical differences between males and females in other kinds of birds as well, and show students images of a male and a female red-winged blackbird as one example. In birds-of-paradise, however, these differences between males and females—called sexual dimorphism—are very pronounced. Explain that there are 39 kinds—or species—of birds-of-paradise, and that there are striking differences between the species and between males and females of most species.



Photograph by Tim Laman



Locate New Guinea and meet the expedition team

Use a world map to point out the location of New Guinea, and tell students that all 39 species of birds-of-paradise live in this region, including a few that live in northeastern Australia. Notice how large the island of New Guinea is and how it is separated from nearby continents. Explain that because the island is so isolated with varied terrain, birds-of-paradise species evolved there and did not spread elsewhere. Other islands are also home to unusual species found nowhere else. As an example, point out the nearby island of Sumatra, and show students an image of the Sumatran rhinoceros (<http://animals.nationalgeographic.com/animals/mammals/sumatran-rhinoceros/>). It is found only in Sumatra and is smaller and hairier than the more well-known African rhinoceros. Then point out the island of Madagascar, off the eastern coast of Africa, and show students an image of a ring-tailed lemur (<http://animals.nationalgeographic.com/animals/mammals/ring-tailed-lemur/>). Explain that there are 32 species of lemurs (relatives of monkeys and apes)—all found only in Madagascar. For further information about the distribution of animals refer to a National Geographic article about Alfred Russel Wallace, a 19th century naturalist, who described two faunal regions—the Indo-Malayana and the Austro-Malayan—and the deepwater gap that separates them, known as the Wallace line (<http://ngm.nationalgeographic.com/2008/12/wallace/quammen-text>).

Tell students that they are going to be learning about many amazing expeditions that two scientists made to New Guinea. Show images of the two researchers, and explain that Tim Laman is a photographer who does a lot of work for the National Geographic Society in Washington, DC, and Ed Scholes is a researcher with the Cornell Lab of Ornithology in Ithaca, New York. (Ornithology means the study of birds.) Tim and Ed made 18 trips to New Guinea over the course of eight years to study birds-of-paradise. Why do students think Tim and Ed took so many trips?

Explore New Guinea's landscape and plan an expedition

To give students a sense of New Guinea's mountainous topography, point out how much of the island is covered by rainforest and how difficult it is to get around. Have them work in small groups to explore National Geographic's interactive map of New Guinea (<http://travel.nationalgeographic.com/travel/countries/papua-new-guinea-map/>). Invite students to familiarize themselves with the map and with New Guinea's landscape by dragging the mouse and zooming in and out. Have them find the largest city—Port Moresby, capital of Papua New Guinea, the country that occupies the eastern half of the island. Then tell them to look for roads (brown lines), rivers (blue lines), and mountains.

- Are there more roads or more rivers?
- Where are most of the roads located?
- Where are the mountains?
- What are the best ways to get around the island?



If time allows, you can also have students explore the island continent of Australia and compare its much flatter topography with that of New Guinea.

Then have students find these places in New Guinea where birds-of-paradise live:

- Mamberamo Mountains Foja Reserves
- Aru Islands

Have each group plan an expedition that would include both places.

- How would they get to each site?
- How long would they spend at each site?
- How long would the whole expedition take?
- What would they bring with them?

Have students make a list of what they would pack. After visiting the exhibition, students can compare their expedition plans and packing list with the scientists' actual experience.

Give students their mission.

Tell students that they are about to go on an expedition of their own—not to New Guinea, but to an exhibition about the amazing journey Tim Laman and Ed Scholes made to study birds-of-paradise in the wild. On their expedition, students' mission will be to discover the answer to this question:

How did birds-of-paradise evolve into so many different and beautiful species?

Explain that evolve means to change over time. Students will find out how the physical features and behavior of birds-of-paradise changed over many millions of years, and how those changes led to the development of the many different species that exist today.

Show students the expedition journal they will take with them on their expedition. Explain that they will be using the scientific method—asking questions, observing, and collecting information—to accomplish their mission. Like Tim Laman and Ed Scholes, they will work in teams.



AFTER YOU VISIT THE EXHIBITION

Discuss the students' impressions and conclusions

Ask the students what they thought about the exhibition and what interested them most. Remind them of their overall mission to find the answer to this question: How did birds-of-paradise evolve into so many different and beautiful species? Ask them to recall the Ladies' Choice game and the Survival of the Sexiest animations and to share what they learned from those two activities.

- What process helped the birds-of-paradise evolve?
- Why do the males have such fancy feathers and do such complicated dances?
- What role do the females play?

Emphasize that the 39 bird-of-paradise species developed as a result of evolution—the process by which groups of living things change. Make sure students understand that evolution happens step by step, and that it can take a long time. In the case of bird-of-paradise species, it took more than 20 million years.

Referring again to the Ladies' Choice game, discuss how birds-of-paradise evolved through a mechanism of evolution called sexual selection. The males compete with each other to attract females. The females choose mates with sexy features such as fancy feathers, big beaks, and dazzling dances. Males with those features end up with more mates, and produce more offspring. As a result, over time, more birds-of-paradise are born with those attractive features, and new species may develop.

ACTIVITIES RELATED TO DANCES

Choreograph a bird-of-paradise dance

Explain that birds are the only animals with feathers, and have students brainstorm some of the different functions feathers serve. For example, feathers help birds fly and keep them warm. Feather colors and patterns can provide camouflage and help birds hide from danger. In birds that live or feed in water, feathers provide waterproofing. In some birds, like owls, feathers can direct sounds and help the birds hear.

Then discuss what function feathers serve in birds-of-paradise. One important role is to help the male birds attract females. Have students refer to examples they saw in the exhibition and to the notes in their expedition journals to describe and demonstrate how birds-of-paradise use feathers in their dances, how complicated the dances are, and how the dances are made up of different steps in a particular order.

Have students work in groups to choreograph and perform their own bird-of-paradise dances. They can use steps they saw in the exhibition as well as add new steps of their own invention. Don't forget the costumes! Have students use art supplies to make specialized feathers, colorful body parts, and shape-changing structures to add to their dances.

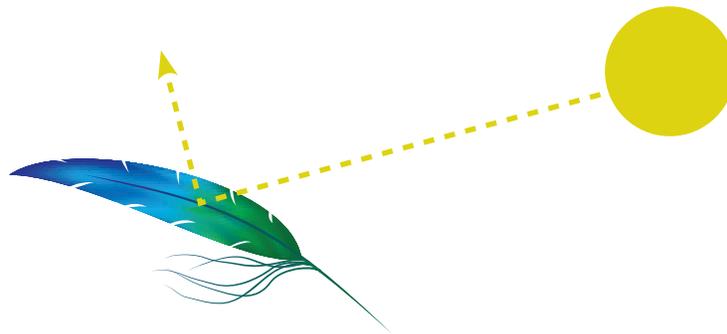


You could have students perform their dances for other classes in the school—e.g., at lunchtime or in a special auditorium program.

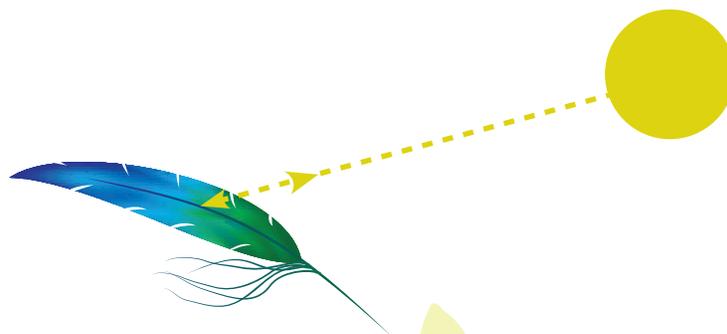
Investigate feather color

Although birds-of-paradise display unusually brilliant colors, there are many other kinds of birds with colorful feathers. Ask students to think of some examples. They might mention flamingos, bluebirds, hummingbirds, cardinals, or peacocks. Have students ever wondered what causes these colors? Explain that there are two basic causes.

- **Pigmentation:** Some colors are the result of pigments—natural coloring substances found inside the feathers. These pigments tend to produce reds, yellows, browns, and blacks. Show students a photo of a greater flamingo (<http://animals.nationalgeographic.com/animals/birds/greater-flamingo/>). Flamingos are pink or orange because they eat foods that contain pigments called carotenoids.
- **Structure:** Other colors are a result of the feather's structure and the way light interacts with this structure. Two things can happen when light hits these feathers.
 - **Refraction:** Some feathers are like prisms. When light hits them at a certain angle, it refracts—or bends—as it bounces back, producing beautiful iridescent colors. Show students the two photos of a male Ruby-throated Hummingbird. Which one shows the feathers refracting light? Do students remember seeing these kinds of color flashes in the exhibition?



- **Reflection:** Other feathers reflect light at the same angle at which it hits the feather.





Compare courtship behavior in other birds.

Birds-of-paradise are not the only family of birds in which the males court females. Have students research and watch videos of the dances and courtship behaviors of these other birds.

- Stephan's Dove
- Golden-fronted Bowerbird
- Satin Bowerbird

Come up with a list of the different courtship behaviors students observe, and discuss how they are similar to and different from the bird-of-paradise behaviors. You might have students “learn” the dances or courtship behaviors of the species they research and perform them in class.

ACTIVITIES RELATED TO BIRD CALLS

Make a sound map.

To sensitize students to bird calls and other sounds in their environment, take them outdoors to listen. Give each student a clipboard, pencil, and index card or piece of paper with an “X” in the center. The “X” indicates each student’s location. Go out to the schoolyard, a nearby park, or other natural area. Have students spread apart and sit down. Invite them to close their eyes and listen to all the sounds around them. Each time they hear a sound, they should draw a symbol or picture describing the sound on their paper—in the correct direction and at the approximate distance from the “X” where they are sitting.

After 3–5 minutes, bring students together to compare and discuss their sound maps.

- How do the maps differ based on where students sat?
- Did some students hear sounds others didn’t?
- What sounds can they identify? What sounds puzzled them?
- Did they hear any bird calls? If so, can they identify the birds from their calls?

You can have students make sound maps in both quiet, natural places and in noisy, developed locations, and compare the results. You may wish to discuss sound pollution and have students brainstorm how human-made sounds might affect birds.

Explore mystery sounds and the function of bird calls.

Tell students they are going to hear a mystery sound. Dim the lights and play the wail call of the Common Loon. Have students discuss what they think made the sound and what it meant. Then tell them they are going to hear a different sound made by the same animal and play the alarm call of the Common Loon. Ask students if they have any new ideas about the animal making the call.

Show students a photo of the bird that was making the mystery sounds—the Common Loon (<http://animals.nationalgeographic.com/animals/birds/common-loon/>). Discuss again why the loon might make the two different calls. Then explain that the first sound was made by two loons marking and defending their territory, and the second was an alarm call.



Have students think of reasons why birds might make sounds. Record their ideas on the board. Some reasons students might mention are attracting a mate, defending territory, warning off intruders, and communicating with other members of their species.

You could conclude this activity by giving students an opportunity to listen to a variety of bird calls, practice imitating them, and share their favorites with each other.

ACTIVITIES RELATED TO THE VICTORIAN STUDY AND MODERN SCIENCE

Build a classroom cabinet of curiosities

Ask students to recall the cases holding skins and other objects that they saw in the Victorian Study section of the exhibition. What are some of the specific things they remember seeing? Was there anything they found particularly curious? Explain that centuries ago, explorers brought back strange and wonderful objects from the distant lands they visited. Kings, wealthy merchants, and other collectors displayed these objects in rooms or cases that became known as cabinets of curiosities. (You may want to find an on-line image of a cabinet of curiosities to show students.) Eventually, cabinets of curiosities became the museums we visit today, with their large collections of objects.

Have students create their own cabinet of curiosities in their classroom. Set up a bookshelf or other area of the classroom for the collection. Tell students to keep their eyes open, imagine they are explorers, and each bring in 2–3 natural objects that they discovered in their local environment and that they are curious about. These could be rocks, pine cones, bird feathers, nests, leaves, seashells, etc. Have students prepare tags or cards for each object that record what it is, who collected it, where it was collected, and the date it was collected. You might also have students each show their favorite object to the class, explaining why they think the object belongs in a cabinet of curiosities and what questions they have about it.

Compare old and new methods of studying birds

Ask students to open their expedition journals to pages 5 and 6 and compare the information they collected on the two worksheets.

- What information about birds-of-paradise were they able to learn by examining skins from the past century?
- What information could they **not** obtain from the skins?
- What information could they collect from the modern photographs and video?

Come up with a list of the different courtship behaviors students observe. Then discuss how although the bird skins provide some general information about physical features such as size and color, they don't tell us about the birds' behavior or habitat. Researchers gather this kind of information by studying birds in the wild using modern technologies such as photography and video. Emphasize that scientific methods are continually changing, and that modern science builds on information learned in the past.



Meet scientific explorers from the past and present.

Like Tim Laman and Ed Scholes, other researchers—past and present—have spent many years on scientific studies. All were driven by a passion to satisfy their curiosity. But they had different goals, faced different challenges, used different techniques and technologies, and made different discoveries.

Charles Darwin, for example, spent five years (1831-1836) sailing around South America and other parts of the world collecting evidence that would lead to his formulation of the theory of evolution. Have students read the book *What Darwin Saw, the Journey that Changed the World*, by Rosalyn Schanzer. Tell students to take notes on:

- where Darwin went
- some of the unusual things he saw
- what questions he had
- what challenges he faced
- what discoveries he made
- why his work is important

Lisa Dabek has spent the past 16 years studying and helping to conserve endangered tree kangaroos in Papua New Guinea—the same country where Tim and Ed conducted their research. Have students explore the website on the Tree Kangaroo Conservation Program (<http://animals.nationalgeographic.com/animals/conservation/tree-kangaroo-conservation/>). Make sure students watch the short video entitled *Animal News: Kangaroos Get Cameras* as well as the introductory video. Have students take notes on:

- what Lisa cares about
- where she carries out her research
- what challenges she faces
- what methods she uses
- what she has learned
- why her work is important

When they have finished their research, have students compare the experiences of Charles Darwin and Lisa Dabek. What was similar and different about the challenges they faced and the methods they used? How do their experiences compare with those of Tim and Ed? Would students like to be a member of one of these expeditions? Which one—and why?

Students can learn more about birds, science, and conservation by participating in real scientific studies as citizen scientists. The Cornell Lab of Ornithology offers a citizen science program with projects for people of all ages and interests, including students. You can read about the available projects (<http://www.birds.cornell.edu>) and sign up for the one that is most appropriate for your class





ACTIVITIES RELATED TO NEW GUINEA CULTURE

Explore birds in folklore.

Tell students that in New Guinea, as in many places, people write stories about animals that are important in their culture. Often these stories end with a moral, or lesson. Show students a photo of the Brown Sicklebill and explain that you are going to read a story from New Guinea about this bird-of-paradise. Ask students to listen carefully for the moral of the story. Read “The Story of the Angry Brown Sicklebill,” then have students listen to its call. Is the call frightening? Does it sound like thunder? Explain that the call scared soldiers who heard it during World War II. They thought it sounded like a machine gun! Discuss what lesson the story teaches. You might come up with a moral such as: Try not to make big, important people jealous and angry.

Ask students if they have ever heard any other stories that use animals to teach lessons about life. They may think of fables by Aesop, such as “The Tortoise and the Hare” or “The Ant and the Grasshopper.” You could also have students write their own folktales about a bird-of-paradise or another bird or animal of their choice.

Brainstorm other ways birds are represented in culture.

Have students refer to their journals to recall some ways people in New Guinea use bird-of-paradise imagery. Do students remember the ceremonial headdress made from bird-of-paradise feathers? Tell them that the national bird of Papua New Guinea is the Raggiana Bird-of-Paradise, and discuss the images on the national flag, coffee tin, and artwork.

Then encourage students to think about the roles birds play in our own society. You might ask:

- What do you think of when you hear the word bird?
- What characteristics do you associate with birds—e.g., beauty, freedom, song, flight?
- When was the last time you saw a bird? What was the experience like?

Have students think about some ways birds are depicted in our society. For example:

- What is our national bird? What qualities do you associate with the Bald Eagle?
- Can you think of some sports teams or musical groups named after birds?
- What bird characters appear in cartoons, on TV, and in movies?

Birds have even influenced the English language. Help students think of bird-related expressions like bird brain, wise as an owl, eat like a bird, bird’s eye view, and early bird. You can also talk about things people do with birds. For example, people keep birds as pets, watch birds, hunt birds, feed birds, draw or photograph birds, and raise birds on farms.

Finally, have students think about a bird that has special meaning for them and design a t-shirt—including a slogan—featuring that bird.



ACTIVITIES RELATED TO EXPEDITION THEATER

Discuss the New Guinea expedition.

Invite students to share their reactions to the film about Tim and Ed's expedition to New Guinea.

- What did students find most interesting about the expedition? About New Guinea? About birds-of-paradise?
- What surprised or impressed them the most?
- Would they like to go on a similar expedition? Why or why not?

Then show students the list of equipment Tim and Ed packed for their expedition.

- How does it compare with the packing lists students made before visiting the exhibition?
- What was missing on their own lists that they wouldn't want to be without?
- Is there anything they would add to Tim and Ed's list?

Plan and carry out a local expedition.

Select an outdoor location where students can observe birds or other wildlife. Tell students that they are going to use what they learned in the *Birds of Paradise* exhibition to plan and carry out a scientific expedition to that location. On the expedition, they will be asking questions, observing carefully, looking for evidence that helps them draw conclusions, and sharing the results—just like Tim and Ed.

Divide the class into expedition teams of 3–5 students each, and invite each team to decide on a name (perhaps using the name of a bird). Then have students on each team decide what roles they will play—e.g., researcher, note-taker, illustrator, or photographer.

Discuss the expedition site, and show the students maps and images if appropriate and available. Brainstorm the kinds of birds, other animals, and plants students might expect to find there, and list them on the board. Encourage students to think about:

- what interests them most about the site
- what they would like to investigate
- what they need to pack.

Remind them to be prepared for surprises. Researchers like Tim and Ed are always prepared for the unexpected. That's how some of the most exciting discoveries happen.

On the day of the exhibition, provide each group with one clipboard and several pieces of paper for taking notes, and another clipboard with paper for making sketches. Give each group with a half-hour to explore and investigate. Remind them to

- observe carefully
 - take notes
 - write down their questions
 - collect evidence
- 



Back in the classroom, discuss the expedition and what students discovered. Do students have questions about what they saw? What would they study or look for if they went back to the site? Have students brainstorm the different ways scientists might share their discoveries with others. For example, they could produce written reports for magazines or newspapers, give talks at conferences, or produce displays. Let each group decide how it wants to present its findings, and give them time to plan and produce a presentation of their findings. Then have each group share its findings with the class. You could also have students share their discoveries with the rest of the school.

Resources

Books

For adults:

Birds of Paradise: Revealing the World's Most Extraordinary Birds, by Tim Laman & Edwin Scholes (National Geographic/The Cornell Lab of Ornithology, 2012)

National Geographic Field Guide to the Birds of North America, by Jon L. Dunn and Jonathan Alderfer (National Geographic, 2006)

For children:

Billions of Years, Amazing Changes: The Story of Evolution, by Laurence Pringle (Boyd's Mill Press, 2011)

Charlie and Kiwi: An Evolutionary Adventure, by The New York Hall of Science, FableVision, and Peter H Reynolds (Atheneum Books for Young Readers, 2011)

Eyewitness Explorers: Birds, by Jill Bailey and David Burnie (Dorling Kindersley, 1992)

Feathers: Poems About Birds, by Eileen Spinelli (Henry Holt and Co., 2004)

National Geographic Kids Bird Guide of North America, by Jonathan Alderfer (National Geographic, available March 2013)

Secrets of Sound: Studying the Calls and Songs of Whales, Elephants, and Birds (Scientists in the Field Series), by April Pulley Sayre (Houghton Mifflin, 2002)

She's Wearing a Dead Bird on Her Head, by Kathryn Lasky. (Hyperion Books for Children, 1995)

What Darwin Saw: The Journey That Changed the World, by Rosalyn Schanzer (National Geographic, 2009)





Articles

“Birds of Paradise: Feathers of Seduction,” by Jennifer Holland. *National Geographic*, July 2007 (<http://ngm.nationalgeographic.com/2007/07/birds-of-paradise/holland-text>)

“Build it {and they will come}” by Virginia Morrel. *National Geographic*, July 2010 (<http://ngm.nationalgeographic.com/2010/07/bowerbirds/morell-text>)

“The Man Who Wasn’t Darwin” by David Quammen. *National Geographic*, December 2008 (<http://ngm.nationalgeographic.com/2008/12/wallace/quammen-text>)

Images, Audio and Video Recordings

Cornell Lab of Ornithology Macaulay Library (<http://macaulaylibrary.org/>)

National Geographic Photo Gallery, Birds of Paradise (<http://ngm.nationalgeographic.com/2007/07/birds-of-paradise/laman-photography>)

Web sites

Birds of Paradise exhibition (www.ngmuseum.org/bop)

Cornell Lab of Ornithology (<http://www.birds.cornell.edu>)

Cornell Lab of Ornithology Bird Guide (<http://www.allaboutbirds.org/guide/search>)

Cornell Lab of Ornithology Citizen Science Program (<http://www.birds.cornell.edu/page.aspx?pid=1671>)

Tim Laman (<http://timlaman.com>)

Web sites

Cornell Lab of Ornithology, BirdSleuth (<http://www.birds.cornell.edu/birdsleuth>)

National Geographic Teaching Resources (<http://education.nationalgeographic.com>)