

SCIENTISTS IN THE FIELD

WHERE SCIENCE
MEETS ADVENTURE

DISCUSSION AND ACTIVITY GUIDE

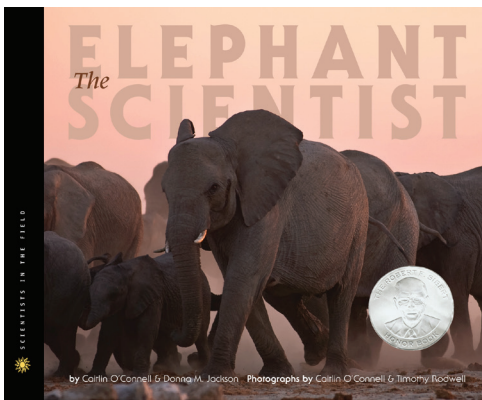
The Elephant Scientist

by Caitlin O'Connell & Donna M. Jackson Photographs by Caitlin O'Connell and Timothy Rodwell



About the Series

The Elephant Scientist is part of the award-winning Scientists in the Field series, which began in 1999. This distinguished and innovative series examines the work of real-life scientists doing actual research. Young readers discover what it is like to be a working scientist, investigate an intriguing research project in action and gain a wealth of knowledge about fascinating scientific topics. Outstanding writing and stellar photography are features of every book in the series. Reading levels vary but the books will interest a wide range of readers.



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About the Book

How does a major scientific discovery happen? In the case of Caitlin O'Connell's ground-breaking discovery about elephant communication, it began by lying in the dust observing a herd of elephants in Etosha National Park and connecting their behavior to that of walking sticks. This fascinating book traces O'Connell's careful research process leading to her important discovery and introduces readers to one of the most fascinating animals on Earth.

About the Authors and Photographers

Donna M. Jackson

Growing up in Massachusetts, Donna Jackson wanted to be a singer/songwriter but she always wanted to know the “who, what, why, when and why of things.” It was that curiosity and her love of both mystery and science books that led her to journalism and then to writing nonfiction for young people. Donna is the author of many award-winning books including *Bone Detectives*, *Bug Scientists*, *ER Vets* and *Extreme Scientists*. Her books have been awarded the Orbis Pictus Award, an ASPCA Henry Bergh Honor and a Robert F. Sibert Honor. She lives in Colorado with her husband Charlie.

Caitlin O'Connell, Ph.D.

Caitlin O'Connell has spent over twenty years devoted to the study of elephant communication. She is an acclaimed author and photographer. She is a faculty member of the Department of Otolaryngology, Head and Neck Surgery in the Stanford University School of Medicine and also teaches science writing for the University. In her spare time, Caitlin runs Utopia Scientific, a non-profit organization.

Timothy Rodwell, M.D., Ph.D.

Timothy, along with his wife Caitlin, took the photographs for this and other books and articles. Rodwell specializes in global health with an emphasis on TB monitoring and is currently involved in research on the molecular epidemiology of global TB drug resistance and TB infection control in Ethiopia. He is an Assistant Professor at UCSD, an attending physician at the Refugee Health Assessment Program in San Diego. He is also a co-founder of Utopia Scientific.

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Pre-Reading Activities:

Pick a few students and give them a message to deliver to the entire class. However, the students who have to deliver the message may not speak or write. How do the students attempt to convey the message? How does communication work? Discuss.

Find several pictures of mothers and babies (human and animal, but several pictures of each species pair) and split the pictures so that the mothers are not with their baby. Have students match the babies with the correct mother. How do we recognize other creatures? How important are senses other than sight to this process? The goal of this question is to show students our human limitations.

Put several different plush animals or rubber animals in a pile. Blind fold a student and have the student identify and sort the animals.

Discussion Questions:

Young male elephants are sometimes filled with testosterone and too aggressive. The oldest female elephant in the herd is in charge of making the most important decisions. Is this a model that only works in the animal world or is it a useful model for humans to consider?

Both carnivores and herbivores form herds or operate mostly in isolation. Can you find examples of animals that are carnivores and herbivores forming cooperative groups or operating in a solitary manner? What are the advantages for an herbivore to operate primarily in isolation? Why would carnivores form a group? What are the advantages and disadvantages of groups? Of operating in isolation?

Elephants eat between 250 and 450 pounds of food each day. They drink up to 50 gallons of water each day. They destroy farmers' crops. They destroy trees and other vegetation making it difficult for both humans and other animals. Our largest land mammal requires a lot of territory. Considering the population explosion in both Africa and Asia, does our planet have enough room for elephants?

Your curriculum guide authors are extremely surprised to learn about the sensitivity of an elephant's foot and skin.

How important are the littlest toe of a human? What about an earlobe? How does something like a little toe or an earlobe factor into our daily life (or do they)?

How many different ways do we communicate to others that do not involve speaking? Can you think of examples in which our vocal communications both match and do not match our own body language?

Applying and Extending Our Knowledge:

On page 17 we learn that the Asian elephant is divided into four subspecies: Indian, Sri Lankan, Sumatran, and Borneo. The African elephant consists of two subspecies: the African savannah or bush elephant and the African forest elephant.

- Prepare a poster or an online presentation distinguishing African from Asian elephants and then showing the distinguishing features of the two African elephants and the four Asian elephants.
- Prepare a map showing the ranges of the elephant subspecies. How many elephants live in each area?
- Are there differences in habitat, diet, behavior, etc. of the different elephant subspecies?
- Read Kipling's story, "*The Elephant's Child*." Discuss the various uses of the trunk and then have students write their own story of an elephant's trunk.
- Elephant skin is very sensitive. The folds in the skin help keep the elephant cool by trapping water. Soak two shirts in water. Take both of them out into the sun to dry. Leave one stretched out flat with no wrinkles. Leave the other one wadded up. Check the shirts in fifteen-minute increments until the class period is over or until the shirts are dry. Note the differences in the times that it takes the shirts to dry.

Common Core Connections

CCSS.ELA-Literacy.RH.6-8.7 Integrate visual information (e.g., in charts, graphs, photographs, videos, or maps) with other information in print and digital texts.

CCSS.ELA-Literacy.RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

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CCSS.ELA-Literacy.SL.7.5 Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.

On page 51 we read, “Another way elephants detect vibrations is through a pathway from the toe bones to their middle ears. ‘*With bone conduction, the toes of the listening elephant pick up the vibrations, which travel up the legs and into the skull and middle ear,*’ explains Caitlin. ‘*These vibrations shake the middle ear bones—just as an airborne sound would—and the message is sent to the inner ear and on to the brain. Humans can also hear sounds through bone conduction,*’ she says.”

- Have pairs of students hold opposite ends of a rope tightly. One student is blindfolded. The other student will need to signal to the blindfolded student when he or she needs to shout for joy, when he needs to say it is time to eat, and when he or she needs to drop the rope because danger is approaching. The blindfolded student will need to correctly respond to the rope vibrations consistently. Students may not speak except that the person delivering the code through the rope may only say, “NO,” when his or her partner responds incorrectly. This activity is designed to give students an approximation of learning by feeling (rope vibration). Students are trying to develop a code without using speech (except for the word, “no”), relying primarily on the different feelings in how the rope is moved by the partner. For fun, try doing this as a relay race. Two teams. Half of each team is on the blindfolded side, half on the code giver side. When your partner correctly identifies the code, you trade sides.
- Develop a foot tapping code for several students’ names—can you develop one for every student—and send these students out of the room. Have them come in only when they hear their code tapped. Invent other foot tapping codes.
- Try doing a similar code with tuning forks.
- The quote above ends with the suggestion that students place their fingers in their ears and listen to your voice amplified by your skull. Place your hands over your ears and talk or hum!

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On page 50 we see one of the pages in Greg’s Elephant ID book, including one in which the ears of a specific elephant are drawn. In addition to distinguishing Asian elephants from African elephants by their ears, individual ear characteristics are used to identify specific individuals.

- Take close up pictures of each ear of each class member. Make sure to identify the ears with a letter or number code. Make sure to have an answer key for which ear belongs to which student. Make a slide show (or print out pictures) of all of the ears. Make sure the slide show has the ears placed in a random order. Hand students a class list. Go through the ear photos and have the students assign the code letter or number for that ear to one of the students in the class. Ideally, when the slide show is through, each student should have two letters assigned to their name. Go through the slides again, but this time do the activity as a whole class activity or in groups. Then show the two ears that belong together and the name of the student. Compare the results for doing the activity alone and in groups. Is this easier or harder with humans than with elephants?
- Do this activity again, but insert ears that do NOT belong to anyone in the class.
- Do a variation of this activity but use footprints (barefoot).

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Our primary method of communication is with language, with words. When we are communicating in print or electronically, we lose much of the communication packet that is transmitted by visual clues (primarily). We do not have body language to help interpret the emotional core of the message. Elephants feel messages with their trunks and with their feet.

- Have students select a piece of instrumental (no lyrics) music that brings to mind elephants (if possible). Play the piece and then write the words that the music suggests.
- Use the music from above to create a dance or a skit that includes elephants communicating with other elephants and receiving messages through their feet.

Common Core Connections

CCSS.ELA-Literacy.SL.6.5 Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information.

As mentioned above, elephants consume up to 450 pounds of food and up to 50 gallons of water each day. On pages 52 and 53 we see seven bull elephants. Use this group for the activities below.

- Let's assume that each elephant consumes 350 pounds of food every day and drinks 40 gallons of water every day. Research the diet of these elephants and figure out how much food is consumed in a year of the various items the elephant consumes. How many plants will these seven elephants consume? How much land will it take to grow these plants?
- Do research on how long it takes these plants to regenerate and grow to the size in which the elephants can eat them again. What do these numbers suggest?
- Look at the geographic range of these elephants and the number of elephants listed as living in this range with these seven elephants. Calculate how much food and water all of the elephants will consume in a year. Do this calculation using the low end of consumption (250 pounds of food) and the high end (450 pounds). Is the area large enough to support the current population size of the elephants?

- Find information on the amount of water households in this area use each day. Research the average rainfall and the water table in this area. What does the research suggest in terms of the viability of elephants in this area?
- Look back at the discussion question about whether our planet has enough room for elephants and people and suggest ways to allow both elephants and people to coexist. What steps are necessary to insure the survival of elephants? What sacrifices will people need to make?
- Now look at these food and water numbers and put them in terms of human consumption. How much of each food in a typical day would one need to consume to eat as much as an elephant? How much of your normal liquids would you need to drink to drink as much as an elephant?
- Look at the elephant food and water consumption and compare that with some other animal, say, a rabbit. How many rabbits equal the food and drink consumption of one elephant? How many rabbits equal all seven? Divide the class into groups and have each group pick animals of varying sizes for this comparison.
- Research how much dung an elephant excretes as a percentage of the food it eats each day. How much dung will these seven elephants excrete in one year? To shorten the time of this activity, you may suggest that an elephant will excrete about 55% of the food it consumes. HoHowHo

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On page 57 we read, “*Bull elephants behavior is fascinating,*” says Caitlin. *‘It’s almost haunting how their social dynamics mirror ours in the way they form all-male groups—similar to fraternities—and engage in ritualized fighting, similar to wrestling matches.’*”

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- Have students observe and take field notes of males in the lunch room or at a sporting event (no names, just numbers). Look for other descriptions or videos of bull elephant behavior. How are the interactions of males in the lunch room different and how are they the same?
- Have students do the same field observations at places in the community, such as a shopping mall or a neighborhood park or hangout (no names, just numbers). Stress the importance of recording behavior without judging the behavior. Provide an example.

We learn in this book that elephants form deep relationships and depend on the adults to help curb aggressive behavior, especially with the bulls. We read in the section entitled, “*Elephants in Peril*” that young bulls are especially aggressive when it is the wet season. Scientists theorize that they have less interaction with the adults during the wet season because there are so many different choices of where to drink.

- Think of young people who get in trouble. Do they get in trouble during a “wet season”—when they have a lot of freedom of movement or during a “dry season”—when parents or other adults are often around? Discuss this in small groups and present your agreements and disagreements to the group.
- If elephants form deep relationships and if young elephants watch family members being shot and killed far too frequently, what are the likely consequences? Compare the situation with elephants with areas in our country that have much higher fatality rates than others. Is there anything we can learn from how we handle these situations with people that we can apply to the elephants or vice versa? Debate your conclusions.

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CCSS.ELA-Literacy.SL.7.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others’ ideas and expressing their own clearly.

CCSS.ELA-Literacy.SL.7.1c Pose questions that elicit elaboration and respond to others’ questions and comments with relevant observations and ideas that bring the discussion back on topic as needed.

Further Reading

Downer, Ann. *Elephant Talk: the Surprising Science of Elephant Communication*. Twenty-First Century Books, 2011.

Elephants. *Encyclopedia of Mammals, Vol. 5*, p.652-671. Marshall Cavendish, 1997.

Other Web Sites to Explore

Elephant
animals.sandiegozoo.org/animals/elephant

San Diego Zoo site with information on elephants along with videos, photographs and a live web cam of the zoo’s elephants.

International Elephant Foundation
www.elephantconservation.org/elephants/african-elephants

Extensive information on both African and Asian elephants and conservation news from the International Elephant Foundation

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