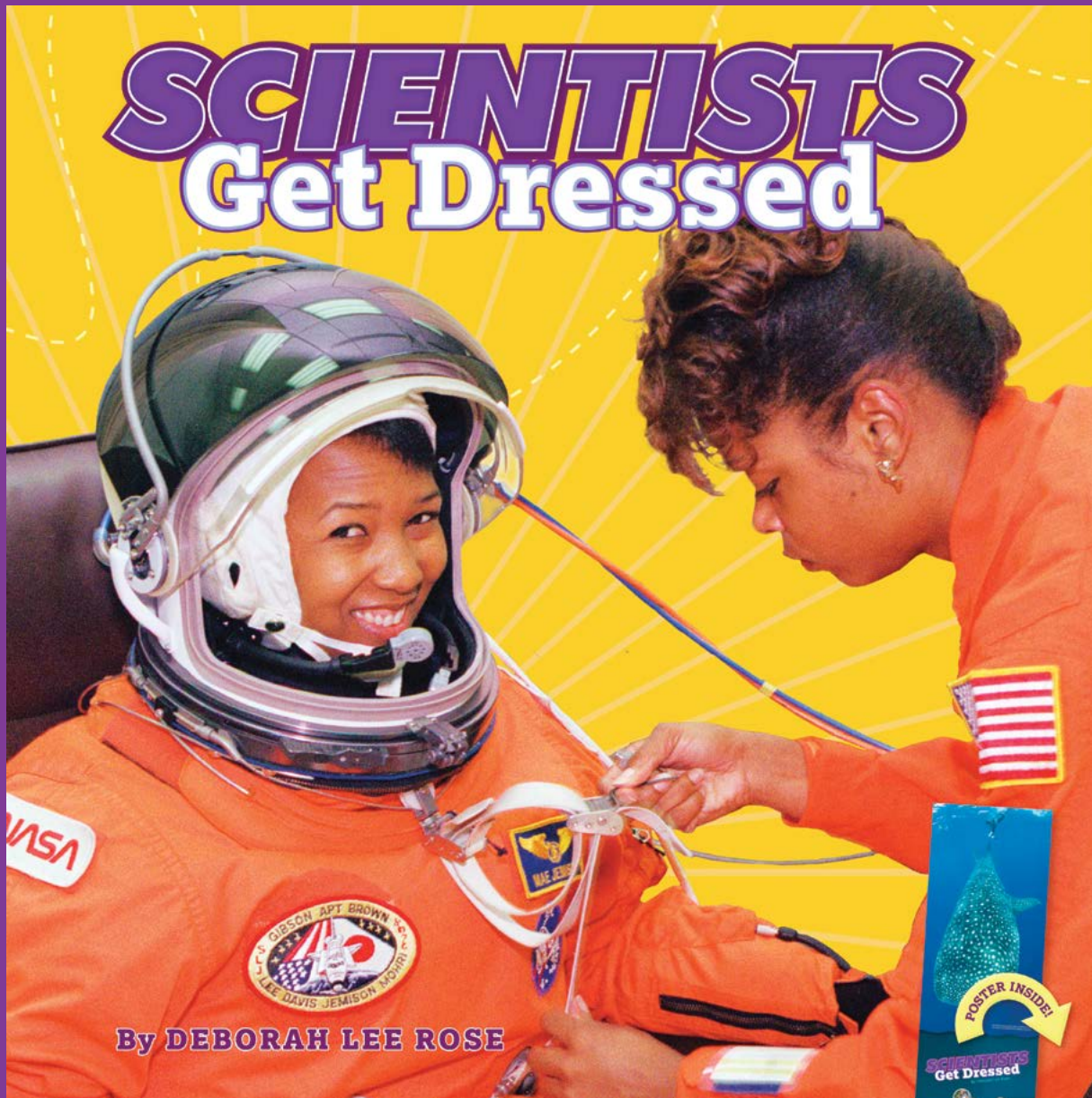


# EDUCATIONAL GUIDE

**How do scientists suit up, gown up, gear up, even dress up in costume to make new discoveries, save lives, and save our planet?**



**Book includes free poster, Scientists' Glove Challenge STEM activity, and special Citizen Science content from the Cornell Lab of Ornithology**

Deborah Lee Rose is the coauthor of the award-winning book *BEAUTY AND THE BEAK: How Science, Technology, and a 3D-Printed Beak Rescued a Bald Eagle*—[www.deborahleerose.com](http://www.deborahleerose.com)



## ABOUT THE BOOK

Whether scientists wear a lab coat, spacesuit, polar parka, waterproof waders, or panda costume, scientists' work—and even their lives—can depend on their clothing.

*SCIENTISTS GETS DRESSED* zooms in on why scientists wear such different kinds of clothing to perform a spacewalk or swim with whale sharks, to test snow and ice on a frozen glacier or collect hot lava from a burning volcano, to rescue a wild Bald Eagle or operate on a human brain. Through stunning and engaging “you are there” photos—some never published before—paired with fun-fact filled text, young readers meet real scientists and discover the challenges of what these scientists do, how they do it and why it matters. Scientists in the book include marine biologist, freshwater chemist, astronomers, raptor biologist, astronauts, glaciologist, volcanologist, paleontologist and more!

With special citizen science content from the Cornell Lab of Ornithology

Award-winning author Deborah Lee Rose presents in person, and via Skype and other platforms, to schools, libraries, conferences, and book festivals. Contact her via her website [www.deborahleerose.com](http://www.deborahleerose.com).

## NEXT GENERATION SCIENCE STANDARDS (NGSS) HIGHLIGHTS

- *SCIENTISTS GET DRESSED* can be connected to NGSS in many ways. Here are some of the major connections.  
**Science is a Human Endeavor:** Men and women of diverse backgrounds are scientists and engineers. K-2 Men and women from all cultures and backgrounds choose careers as scientists and engineers. 3-5 Science affects everyday life. Creativity and imagination are important to science.  
**Scientific Investigations Use a Variety of Methods:** Scientists use different ways to study the world. K-2 Science investigations use a variety of methods, tools, and techniques. 3-5 Science investigations use a variety of methods and tools to make measurements and observations.  
**Science Knowledge is Based on Empirical Evidence:** Science uses tools and technologies to make accurate measurements and observations.  
**Science is a Way of Knowing:** Science knowledge helps us know about the world. K-2 Science is both a body of knowledge and processes that add new knowledge. 3-5 Science is both a body of knowledge and the processes and practices used to add to that body of knowledge.

## COMMON CORE STANDARDS/ENGLISH LANGUAGE ARTS/READING

- **Informational Text:** Depending on grade, describe, explain, and or/analyze scientific ideas or concepts from information in the book's text and illustrations. **Writing/Research:** Conduct short research projects that build knowledge through investigation of different aspects of a topic. Draw evidence from the book's informational text to support analysis, reflection, and research.

**"From head to toe, and in between, scientists get dressed for the work they do and the places they do it! If you were a scientist, how would you get dressed?"**

— From *SCIENTISTS GET DRESSED*

GUIDED READING LEVEL	<b>R</b>	GRADE LEVEL EQUIVALENT	<b>4</b>
INTEREST LEVEL	GRADES <b>K-6</b>	RRL <b>N/A</b>	LEXILE <b>N/A</b>

ISBN	Book Category	Page Count	Word Count
<b>978-1-943978-48-9</b>	<b>Non-fiction</b>	<b>60</b>	<b>2,589</b>

BOOK COVER/GUIDE COVER: Astronaut Mae Jemison and Sharon McDougle: NASA; marine biologist Eric Hoffmayer and whale shark: © Andy Murch, used by permission



"While the scientists in the book include pioneers in their fields and environmental heroes, ***SCIENTISTS GET DRESSED*** captures the important fact that scientists work everywhere, and are everyday people children might encounter."

—Christine Royce, author  
"Teaching Through Trade Books" column  
*Science and Children*  
National Science Teaching Association



(Clockwise from upper left) Astronaut/biochemist Peggy Whitson spacewalking, NASA; water chemist Lucy Rose in stream: Ethan Pawlowski, © Lucy Rose; entomologist Scott McArt with bees: Lindsay France, © Cornell University; volcanologist Jessica Ball and volcanic eruption, Kyle Anderson, USGS

## READ *SCIENTISTS GET DRESSED*, AND ANSWER THESE STEM QUESTIONS

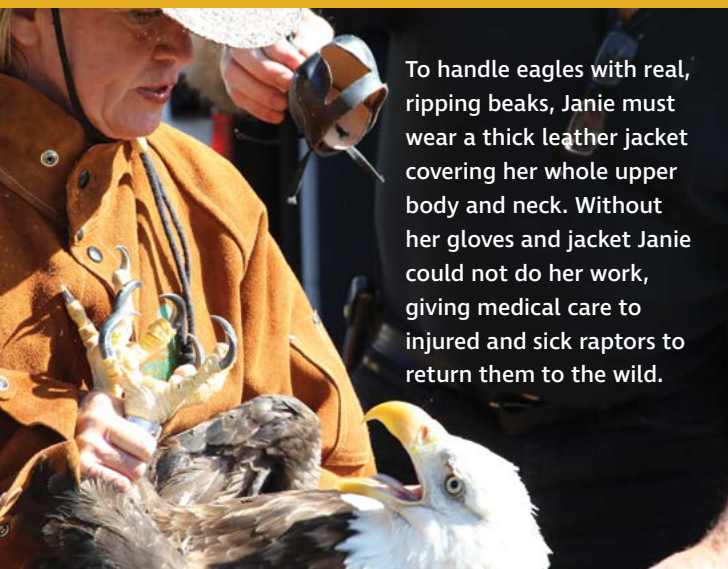
- When do astronauts need to wear their full spacesuits and helmets?
- When do bat scientists need to clean their clothing and gear?
- What would happen if astronomers watched a solar eclipse without special glasses?
- Why do volcanologists wear cotton clothing near hot lava?
- How do harnesses help scientists study the high forest canopy?
- Why would glaciologists need four pairs of mittens at one time?
- What would happen if freshwater chemists didn't wear chest waders to go into streams?
- Why is it important for space scientists and engineers to cover almost their whole bodies to work on equipment for space?
- How do entomologists protect themselves to study bees?
- When do raptor biologists need to wear puncture proof gloves?
- How does wearing camouflage or costumes help wildlife scientists and conservation biologists do their jobs?

For STEM-themed events, spoken reports about scientists and engineers, and Halloween fun, kids can get dressed like real scientists—wearing rain or snow boots, gloves of all kinds, long, white buttoned shirt for a lab coat or worn backwards for a beekeeper's jacket, parka, plastic hard hat, kneepads, snorkel, or many other easily available and low cost items.



Raptor biologist Janie Veltkamp carrying Beauty: Glen Hush, © Jane Veltkamp

**Raptor biologist Janie Veltkamp's** puncture proof gloves are lined with Kevlar, stronger and lighter than steel, which raptors' needle-sharp talons and beaks can't tear. She wears protective gloves of different lengths and thicknesses, depending on which bird of prey she's handling. For eagles, including Beauty the Bald Eagle who got a 3D-printed, prosthetic beak, Janie wears her longest, thickest gloves. The thicker the gloves, the harder it is for Janie to move her fingers, but she still has full use of her hands.



To handle eagles with real, ripping beaks, Janie must wear a thick leather jacket covering her whole upper body and neck. Without her gloves and jacket Janie could not do her work, giving medical care to injured and sick raptors to return them to the wild.

Janie Veltkamp: Keith Kinnaird, © Bonner County Daily Bee

# Scientists' Glove Challenge STEM activity

© Deborah Lee Rose from *SCIENTISTS GET DRESSED*  
Free use permitted for free educational purposes

## WHY DO SCIENTISTS WEAR GLOVES?

- To protect their hands from freezing or burning, getting cut or scraped, or being exposed to germs or chemicals
- To keep germs or dirt on their hands from reaching patients, lab samples, or sensitive pieces of equipment

## WHAT KINDS OF GLOVES DO SCIENTISTS WEAR?

All kinds! Giant mittens to keep warm on glaciers; gloves lined with Kevlar, stronger than steel, for handling rescued raptors; spacesuit gloves with fingertip warmers for outside a spacecraft; cotton gloves that won't melt on volcanoes; waterproof gloves to keep dry and warm in streams and lakes; tight-fitting, thin gloves that flex like a bare hand for working in labs or operating rooms; and more...

## ACTIVITY THEME AND PURPOSE

If you were a scientist, what gloves would YOU wear? Try different tasks wearing different kinds of gloves, to understand why scientists need specific clothing and tools to meet the real hands-on challenges of scientific work.



**Many scientists are engineers too. Glaciologist/geotechnical engineer Adrian McCallum** may wear four pairs of mittens at one time to keep his hands from freezing. He studies snow and ice on glaciers and in the world's coldest places like the Arctic and Antarctica.



Adrian McCallum: Courtesy of Martin Hartley Photography

## Which gloves work best with which tools and tasks? Why?

### WHAT YOU NEED

- Inexpensive gloves such as: thick cotton gloves to represent a volcanologist's gloves/very thin, very flexible gloves to represent a lab scientist's or surgeon's gloves/thicker, ski-type gloves to represent an astronaut's space gloves/mittens or oven mitts to represent a glaciologist's gloves/long dishwashing gloves to represent a water chemist's gloves
- Inexpensive "tools" such as: tongs to pick things up/storage container with liftoff or screw-on top/small sponge wedges/measuring tape/connectable toy bricks or other blocks/washable markers and paper/Optional: ice cubes and water in a large bowl or container

### WHAT TO DO

**Put on each kind of gloves, one kind at a time, and try to:**

Connect or build with toy bricks/Open and close a container with liftoff or screw-off top/Pick up sponge wedges or other soft objects with tongs/Measure an object of any size/Write with a marker

If you have water and ice, and two kinds of waterproof gloves, put your gloved hands briefly in the icy water,

**Activity extension from Adrian McCallum:** Test different gloves by timing yourself to see how long it takes to button or zip your coat or jacket, depending on your gloves. On a space mission or in regions like the Arctic and Antarctica, how fast scientists and engineers get dressed is critical to their safety and survival.

**You can make a video of all or part of your activity to show others. Write down and/or video your observations, for example:**

Glove Type	Tool Type	Task	Difficulty (1=very easy/5=very difficult)
mittens	tongs	grasp soft wedges	3

## Q&A with Eric Hoffmayer

NOAA marine biologist and whale shark expert featured in *SCIENTISTS GET DRESSED*

### Are whale sharks whales or sharks?

Whale sharks are sharks, not whales. They're named whale sharks due to their large size, but they have the anatomy of a shark, not a whale. For example, a whale shark has gills, rather than a blowhole, to breathe.

### How many whale sharks are there in the ocean?

It's very difficult to estimate whale shark populations, because they're large animals and swim in different regions of the ocean. However, scientists have mathematically estimated there are 119,000-238,000 whale sharks around the world.

### Where do you find whale sharks?

Whale sharks are found in all warm temperate and tropical seas, and gather in large numbers in over a dozen places around the world. In U.S. waters they come together and form large groups during the summer in the northern Gulf of Mexico, just offshore of the Louisiana coast.

### How do you get to where whale sharks are, so you can study them?

We use a combination of a spotter plane and boat to find and study whale sharks. The plane's pilot spots the sharks and directs the boat to them.

### What's the biggest number of whale sharks you have ever seen at one time?

I was in a gathering of over 100 whale sharks at Ewing Bank, off the Louisiana coast.

### What is the hardest thing about swimming with whale sharks to study them?

The hardest thing is keeping up with them. They are a lot faster than they look!

### How fast do whale sharks swim?

They usually swim about 5 miles (8 km) per hour.

### Why don't you wear SCUBA air tanks to swim with whale sharks?

It's mainly a safety concern. Whale sharks can dive from the surface to deeper water relatively quickly. If we wore SCUBA tanks and lost track of our depth while we were working, we could find ourselves in a



Free, full-size poster of this photo on reverse side of *SCIENTISTS GET DRESSED* book jacket!

Eric Hoffmayer satellite tagging whale shark:  
© Andy Murch, used by permission

dangerous situation. While we are conducting our research, we wear masks and snorkels to swim with whale sharks near the surface only.

### What do whale sharks eat?

Whale sharks are one of three known filter feeding sharks. This means they feed on what the ocean water carries into their wide--open mouths. They eat a wide variety of prey including krill, copepods, small squid, small fish like sardines and anchovies, fish eggs, and the larvae of fish and invertebrates.

### Could a whale shark ever bite you?

Yes, they could bite a human. Their teeth are really small and by themselves would not do much harm, but since whale sharks are so large, a bite could possibly cause a crushing injury. I have not heard of any significant injuries from whale shark bites.

### Do satellite tags hurt the whale sharks when you put the tags on them?

The tagging doesn't appear to hurt them—they rarely respond to us attaching the tags.

### How does a satellite tag work?

Satellite tags record the location of the whale shark when it's at the surface. The tags send data to scientists around the world. We typically attach the tag with a short line, to ensure the tag is at the surface when the shark is near the surface. These tags are battery powered and can last up to a year once they're attached. Typically a tag comes off a whale shark's body within 6 months. Scientists are actively working on better attachments to collect data for a longer time.

### Have you ever seen a baby whale shark?

No, only a few newborn whale sharks have ever been seen in the wild. This is one of the biggest mysteries about whale sharks—we have no idea where they give birth, or where the newborn whale sharks spend the first part of their lives.

### Are whale sharks endangered?

The International Union for Conservation of Nature (IUCN) has categorized whale sharks as endangered worldwide. They are considered endangered because data has shown a huge decline in Earth's total whale shark population.

### What can I do to help whale sharks?

The three biggest threats to whale sharks are collisions with ships, plastics in the ocean that get into their digestive system, and loss of habitat. To reduce the amount of plastic that ends up in the ocean, you can help by using fewer plastics, recycling plastics, and participating in beach cleanups and other events that positively impact the environment.

### What other types of sharks do you study in your job? Do you swim with them too?

I study lots of other shark species such as dusky, sandbar, bull, blacktip, silky, tiger, great hammerheads, scalloped hammerheads, bonnetheads and Atlantic sharpnose sharks. I only swim with the whale sharks.



## QUOTES

**"The brain is the most complex mass of protoplasm on this earth. It only weighs 3 pounds, but it has the capacity to conceive of a universe a billion light-years across. Isn't that phenomenal?"** Marian Diamond

**"You don't have to be in a white coat in a lab to be engaging in science or engineering—you can achieve whatever you want to in these fields."** Adrian McCallum

**"A wheelchair doesn't have to prevent me from exploring the great outdoors or contributing to our knowledge of the natural world."** Rebecca Tripp

**"Paleontology is a hands-on science. You have to get your hands dirty, and the dirtier—the farther you get into the science."** Matt Wedel

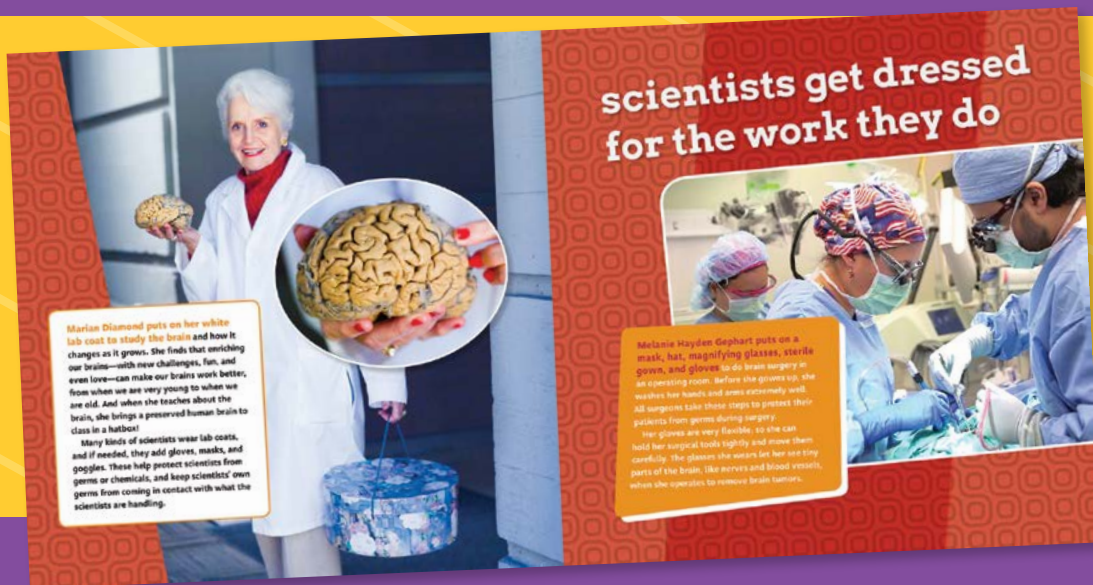
**"Science isn't all glamorous field work. It takes patience and more than a bit of stubbornness!"** Jessica Ball

Biologist Rebecca Tripp: © William R. Miller, used by permission

## WORDS

- 3D-printed
- astronaut
- astronomer
- atmosphere
- avalanche
- biologist
- blood vessels
- camouflage
- chemicals
- chemist
- citizen scientist
- clean room
- climate change
- collision
- computer program
- conservation
- corona
- crampons
- data
- donning
- echolocation
- eclipse
- ecologist
- ecosystem
- endangered
- engineer
- enriching
- entomologist
- environment
- eruption
- estimate
- expedition
- extravehicular mobility unit (EMU)
- femur
- filters
- forest canopy
- fossil
- fungi
- galaxy
- ghillie suit
- glacier
- glaciologist
- habitat
- harness
- hibernating
- illusion
- International Space Station
- investigate
- irruption
- Kevlar
- larva
- lava
- light-years
- magnifying
- marine biologist
- metabolism
- microgravity
- microscopic
- migration
- monitors
- nerves
- neuroanatomist
- neurosurgeon
- operating room
- organisms
- paleontologist
- parachute
- physicist
- polar
- pollinate
- pollution
- predator
- preserved
- prosthetic
- raptor
- respirator
- robotic rover
- satellite tag
- sauropod
- scientist
- SCUBA
- skydive
- sledgehammer
- snorkel
- sound waves
- space shuttle
- spacesuit
- spacewalk
- species
- sterile
- surgery
- survival
- talons
- tardigrade
- technology
- telescope
- totality
- toxic
- tumors
- volcano
- volcanologist
- waders
- weightlessness
- wildlife refuge





Book spread from *SCIENTISTS GET DRESSED*, © Deborah Lee Rose, published by Persnickety Press/WunderMill Books/  
neuroanatomist Marian Diamond with brain: Elena Zhukova, © UC Regents; neurosurgeon Melanie Hayden Gephart in  
surgery: Stanford Health Care/Todd Holland

## **SCIENTISTS GET DRESSED**

by Deborah Lee Rose, coauthor of the award-winning book *BEAUTY AND THE BEAK*

With special citizen science content from the Cornell Lab of Ornithology

"Rose puts an unusually diverse gallery of researchers on the figurative runway, color photos actually showing them at work studying sea turtles and volcanoes, an eclipse, whale sharks, glaciers, and honeybees...not to mention donning a spacesuit, maneuvering out of a wheelchair to gather tardigrades from a forest canopy, carrying a rescued bald eagle (previously met in the author's *Beauty and the Beak*, 2017), and doing brain surgery. So where are the white lab coats, you ask? Meet neuroanatomist Marian Diamond...An eye-opening catalog of STEM wear." — *Kirkus Reviews*

"Kids of all ages love to role play by dressing up. Through the unique lens of what scientists wear, *SCIENTISTS GET DRESSED* can inspire and encourage kids to discover STEM in new ways, and to imagine themselves getting dressed for exciting, important work." — Deborah Lee Rose, [www.deborahleerose.com](http://www.deborahleerose.com)

## **AUTHOR**

Deborah Lee Rose is the internationally published, award-winning author of *Scientists Get Dressed* and *Beauty and the Beak: How Science, Technology, and a 3D-Printed Beak Rescued a Bald Eagle* (both published by WunderMill Books). Coauthored with renowned raptor biologist Janie Veltkamp, *Beauty and the Beak* won the AAAS/Subaru SB&F Prize for Excellence in Science Books, the Bank Street College Cook Prize for Best STEM Picture Book, and the California Reading Association Eureka! Gold Award for Nonfiction. Deborah wrote the bestselling books *Into the A, B, Sea* (Scholastic Press, over a quarter million copies sold), *The Twelve Days of Kindergarten* and *The Twelve Days of Winter* (Abrams Books for Young Readers), and many other honored and cherished children's books including *Jimmy the Joey* (National Geographic, Reading is Fundamental/Macy's Multicultural Collection of Children's Literature, Notable Social Studies Trade Book for Young People). She was senior science writer for UC Berkeley's Lawrence Hall of Science and helped create the NSF-funded STEM education/activity website [howtosmile.org](http://howtosmile.org).

Educational Guide © 2019 Deborah Lee Rose/Design by Shan Stumpf

Special thanks to Eric Hoffmayer, NOAA, Adrian McCallum, University of the Sunshine Coast, Christina Nelson, Reading Partners, Kathy Rose, and Christine Royce, National Science Teaching Association