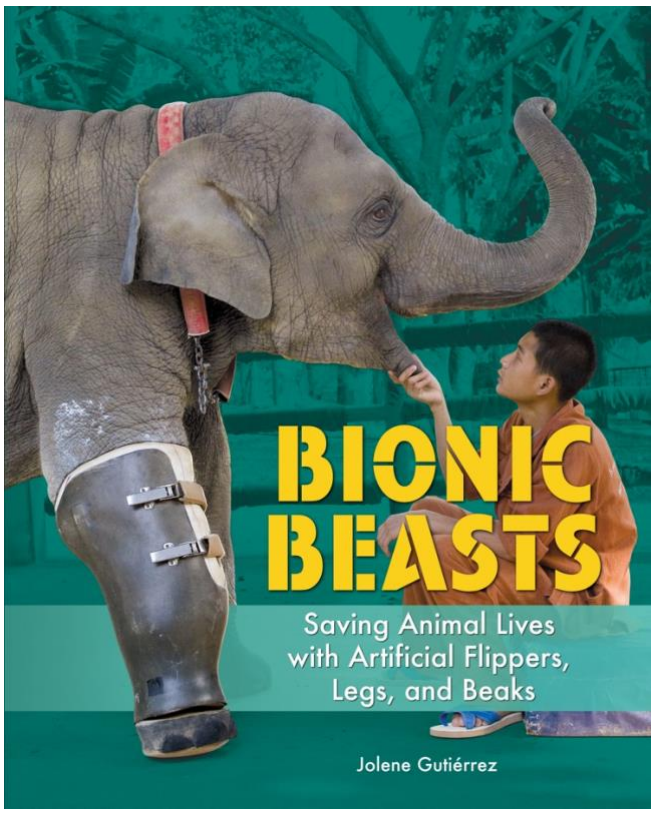
A Teacher's Guide to

Bionic Beasts:

Saving Animal Lives with Artificial Flippers, Legs, and Beaks



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 This classroom guide has been created for use with *Bionic Beasts: Saving Animal Lives with Artificial Flippers, Legs, and Beaks*. Feel free to adjust and differentiate any of the activities within this guide to fit the needs of your students.

Title: *Bionic Beasts: Saving Animal Lives with Artificial Flippers, Legs, and Beaks*
Author: Jolene Gutiérrez
Ages: 9-14 years; 4th-8th grade
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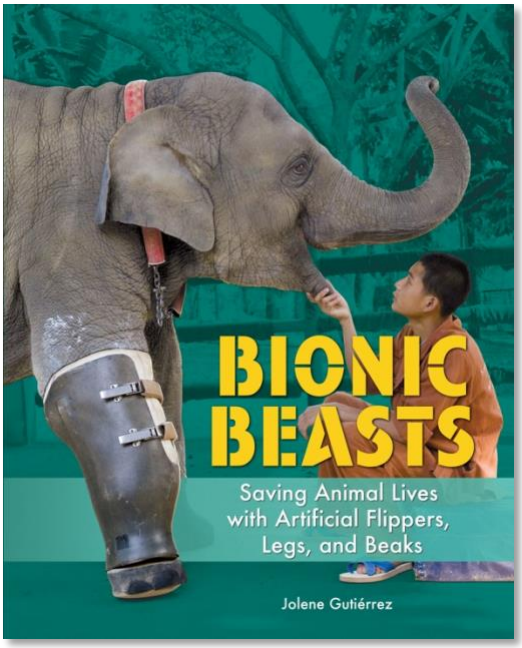
KEYWORDS: STEM, science, technology, engineering, math, inventions, prosthetics, animals, sea turtle, elephant, goose, dog, pig, veterinarian, surgeon, orthotist, prosthetist.

REVIEWS: "Scientifically inclined readers will enjoy this in-depth application of STEM to disabled animals." —*Kirkus Reviews*

"Examining environmentalism, animal rescue, and technological possibility, this science-filled book for upper-elementary to middle school readers entertains in many forms."—*School Library Journal*

SUMMARY: What happens when a young elephant steps on a buried land mine? What happens when a sea turtle's flipper is injured by a predator? Thanks to recent advances in technology, we have new ways to design and build prosthetic body parts that can help these animals thrive.

Meet an Asian elephant named Mosha, a Kemp's ridley sea turtle named Lola, a German Shepherd named Cassidy, a greylag goose named Vitória, and Pirate, a Berkshire-Tamworth pig. Each of these animals was struggling, but through a variety of techniques and technologies, humans created devices that enabled the animals to live and move more comfortably. Discover the stories of how veterinarians, doctors, and even students from around the world used 3-D printing and other techniques to build bionic body parts for these amazing animals.



About the Book:

What happens to a goose with no beak? Is it possible for a heavy animal like an elephant or a pig to walk on only three legs? Can a turtle with one flipper survive in the ocean?

Readers are introduced to the stories of five different animals from around the globe that are thriving thanks to prosthetic body parts. There's Lola, a Kemp's ridley sea turtle, Mosha, an Asian elephant, Cassidy, a German shepherd, Vitória, a greylag goose, and Pirate, a Berkshire-Tamworth pig.

Each of these animals was at risk of dying due to their circumstances, but humans intervened, and using a variety of techniques and technologies, they were able to create prosthetics that enabled these animals to survive. Discover the amazing true stories of animals that have survived thanks to their prosthetic body parts.

About the Author:

Jolene grew up on a farm, surrounded by animals, plants, and history. She has helped care for animals like pigs, cows, horses, donkeys, cats, dogs, chickens, rabbits, toads, lizards, parakeets, fish, hamsters, ferrets, squirrels, hedgehogs, and guinea pigs!

Jolene is an award-winning teacher-librarian and has been working with diverse learners at Denver Academy for the past 25 years. She holds a Master's degree in Library Science. She's a wife of 22 years and mama to two teenage humans, three preteen dogs, and a rescued squirrel. Learn more about Jolene and her books at www.jolenegutierrez.com.

About the Discussion Guide:

Created by award-winning teacher-librarian and author Jolene Gutiérrez, this teacher's guide offers discussion questions, activities, and opportunities to extend learning.

About the Animals, People, and Organizations:

Lola the Kemp's ridley sea turtle lives at the **Key West Aquarium** in Florida, https://www.keywestaquarium.com/, with Rocky and many sharks, fish, and other creatures. The aquarium also teaches visitors about conservation and preservation of the Florida Keys ecosystem, which includes many endangered species and houses the only living barrier reef system in North America.

Mosha and Motala the Asian elephants live in Thailand. **Soraida Salwala** has dedicated her life to elephants and created the **Friends of the Asian Elephant,** http://www.friendsoftheasianelephant.org/en/. Salwala and wonderful volunteers like Jivacate have helped thousands of elephants at the elephant hospital, and Salwala has fought for the rights of elephants in Thailand and promoted conservation for decades.

Cassidy the German Shepard mix was adopted by **Stephen and Susan Posovsky**. The Posovsky's favorite dog rescue is the **Redland Rock Pit Abandoned Dogs Project,** https://www.redlandrockpit.org/. Southwestern Dade County in Florida is known as a dog dumping ground, a place where thousands of dogs have been abandoned by their owners. The Posovskys support the Redland Rock Pit Abandoned Dogs Project by volunteering their time, donating resources, and adopting special needs and senior animals.

Vitória the Greylag goose was rescued by **Cristian Negrão** at the **Amigos do Mar sanctuary**. She met her mate Vitório at the sanctuary and was able to raise goslings.

Pirate the Berkshire-Tamworth pig is cared for by **Lucie Cerny**. Cerny founded the **Rescue And Sanctuary for Threatened Animals (RASTA),** http://rastarescue.org/. RASTA provides a safe place for abandoned and abused animals for the rest of their lives, and Cerny and her organization educate people and advocate for animal rights. RASTA also partners with local vegan restaurants to teach their community that veganism helps end animal suffering.

Sensitivity readers Karen, Mike, and Selah Gilbert founded **NUBTribe,** https://www.nubtribe.com/. NUBTribe provides information about limb difference and support to individuals with limb differences.

Mosha. Photo permission: Friends of the Asian Elephant Foundation

English Language Arts

Reading Comprehension

Before reading from *Bionic Beasts: Saving Animal Lives with Artificial Flippers, Legs, and Beaks*, explore the front cover.

- What do you think this book might be about?
- What do you think *Bionic Beasts* means?
- What are some things you notice about the photo on the cover?
- Do you think this is a nonfiction (true) book or a fiction (fake) book? Why?

Look at the back cover. Read the description.

- Does the blurb on the back cover match what you thought the book might be about?
- Do you think this book is only about Mosha? Why or why not?

Pre-Reading discussion:
Have you ever seen an animal that needs help? If so, what kind of help did that animal need?
Was someone able to help the animal? If so, how did they help the animal?
Was a specialist like a veterinarian or surgeon involved?
Have *you* ever helped an animal? Would you like to?

Our author, Jolene Gutiérrez, grew up on a farm and saw animals that needed help sometimes. Jolene is excited that animals are being helped every day thanks to technology, creativity, and kind people!

As you listen to or read this book, think about ways you might offer help to animals.

Post-Reading discussion:
List some of the ways humans helped animals throughout the book. Based on what you read, do you think you could become a person who helps animals? If so, how would you help?

What would you like to know more about? Check with your school or public librarian to see if they can help you find resources to extend your learning.

Cassidy. Photo permission: Steve Posovsky

Language Activities: Vocabulary

- The Greek word *prosthetikós* means "giving added power." Based on that information, read the following sentences and discuss the meanings of the words *prosthetic*, *prosthetist*, and *prosthesis*.

    "Soon Lola was wearing her *prosthetic* flipper all day."
    "She spoke to the *prosthetist* who made her own prosthetic leg."
    "The *prosthesis* takes much of the strain off of Motala's spine and remaining foreleg."

- The word *biomimetic* means "something that imitates nature." The word *bioplastic* means "a type of plastic made from natural sources." Based on these definitions, what might the prefix *bio*- mean?

- Some of the meanings for the prefix *trans*- are "under" or "through." The root word *-derm* means "skin." Based on this information, what does the word *transdermal* mean?

- Create a Venn diagram comparing and contrasting vocabulary words orthosis and prosthesis. How are they different? How are they the same?
    - **orthosis:** (plural: orthoses) A brace or device that helps support a part of the body. From the Greek word *orthosis*, meaning "straightening."
    - **prosthesis:** (plural: prostheses) an artificial limb or body part. From the Greek word *prosthetikós,* meaning "giving added power."

Writing Activities

- Choose one of the animals from *Bionic Beasts*. Pretend that you're Lola, Mosha, Cassidy, Vitória or Pirate. Write about your best day. What is your favorite food? What do you like to do in your free time? Who are your friends? What are you thankful for?

- Write a letter to one of the shelters, hospitals, sanctuaries, or people mentioned *Bionic Beasts*. Ask an adult for support with researching the address. Be sure to start your letter with a salutation or greeting. In the body of the letter, tell the person you're writing to what you learned about the animal they helped. Ask any questions you might have. End your letter with a closing and your signature.

- Write a book report or review of the book. What did you like about the book? What did you learn from the book? What might you have done differently if you were the author? You can ask an adult for help sharing your review online.

Art/Media

- Create two pencil sketches of one of the animals featured in *Bionic Beasts*: one drawing of the animal *without* their orthosis or prosthesis and one drawing of the animal *with* their orthosis or prosthesis.

- Using modeling clay, clay, or a modeling dough, sculpt one of the orthotic or prosthetic devices shown in *Bionic Beasts*.

- Think about the habitat that Lola, Mosha, Cassidy, Vitória or Pirate live in. What kind of plants and other animals might be in that habitat? Ask an adult to help you find photographs online or within magazines and create a collage of images that represent one of the animals from *Bionic Beasts*.

Pirate. Photo permission: Tim Witoski and RASTA Sanctuary

Science

- Each of the animals in *Bionic Beasts* represents a species that falls under a larger family type. For example, Lola the Kemp's ridley sea turtle is a type of sea turtle. A bigger category than sea turtle to describe Lola would be turtle. A larger category than turtle would be reptile. If you love taxonomy, or putting animals in categories, and would like to learn more, including the proper Latin names for these categories, visit Mensa's taxonomy lesson: https://www.mensaforkids.org/teach/lesson-plans/classifying-animals/

- Choose two animals from *Bionic Beasts* and create a Venn diagram to compare and contrast them. How are they different? How are they the same?

- Choose one of the animals from *Bionic Beasts* and research the habitat they live in. What type of vegetation is found in their habitat? What other types of animals? What is the climate like there? What dangers do animals living in this habitat face? What types of food are available for animals in this habitat? Create a sketch, a chart, or write a paragraph about the information you found.

Math

- After Mosha was injured by a landmine, it took two days for the truck moving her to the Friends of the Asian Elephant hospital to transport her the approximately 300 kilometers (186 miles). How many kilometers (miles) per day did the truck carrying Mosha travel?

- If Mosha needs a new prosthetic leg every 6 months and captive Asian elephants live approximately 80 years, how many prostheses might Mosha go through in her life?

- On July 27, 2002, Lola the Kemp's ridley sea turtle weighed 1 ounce (28 grams). On June 4, 2003, she weighed 8 pounds (3.6 kilograms). By April 12, 2008, she weighed 55 pounds (25 kilograms). If Lola continues gaining weight at the rate she did from 2002 through 2008, when will she reach the average maximum weight for a Kemp's ridley of 100 pounds (45 kilograms)?

- Flip through the book and examine the photographs. Estimate the weight of one or more of the animals. Research the type of food the animal in your photograph might eat. Estimate the amount of food your animal would eat and the approximate cost of that food per week.

Lola. Photo permission: Key West Aquarium

Social Studies

- The animals in *Bionic Beasts* are located in different areas in the world. Plot the locations for Lola, Mosha, Cassidy, Vitória, and Pirate on a map of the world. Which continents are the animals located on? Which countries are they located in? What language(s) would humans in these countries speak?

- Sea turtles are facing problems like poachers, pollution, and destruction of their nesting sites. Brainstorm new laws or policies that governments could implement to try to protect endangered turtles like Lola.

- Asian elephants are very important in Thai culture and religion—in fact, they're the national symbol for the country! Use print or digital resources to learn more about why elephants are so important in Thailand. Write or draw your findings.

Social Skills

- Learn more about people-first and animal-first language and use this type of language when talking with or about a person or an animal with a disability. When using people-first or animal-first language, always start with the person or animal and then use language to describe the person or animal. For example, you would say, “An animal with a limb difference,” rather than “A limb-different animal.” You can learn more about person-first language from the PACER (Parent Advocacy Coalition for Educational Rights) Center: https://www.pacer.org/parent/php/PHP-c31.pdf.

- Learn more about disability etiquette and think about or discuss why it would be inappropriate to touch another person’s prosthesis or wheelchair. Visit this document from the United Spinal Association and focus on pages 4-10 for our purposes (but the entire document includes valuable information): https://www.unitedspinal.org/pdf/DisabilityEtiquette.pdf.

Vitória and goslings. Photo permission: Cícero Moraes