



# DISCOVERY GUIDE

## MISSION: ULTRA-AWESOME ANIMALS



PRE-K-2 STEM LESSONS  
FEATURING ONLINE VIDEO + ACTIVITIES



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# MISSION: ULTRA-AWESOME ANIMALS

## STEM from the START

### MEET THE QUINKS

Each video lesson in STEM from the START features the Quinks, three curious explorers from outer space – Quazar, Neutrina and Fluxx – who have come to Earth to learn more about how things on the planet work.

### SCIENCE AND ENGINEERING

Each episode in STEM from the START is presented as a mission. In each mission, learners are asked to consider phenomena in our world and observe. Students are encouraged to share their understanding and ideas through modeling (drawing or describing) using evidence from the phenomena. Children make sense of what they see and learn, collaborate with their peers to figure out relationships, make predictions and communicate their understanding. This classroom interaction and discourse are critical to their development in science. You can encourage your students to plan and conduct experiments and begin to analyze data such as their own observations about their local environment and the animals they see.

### SENSEMAKING

Sensemaking is a large part of a child's science learning. It's what scientists do everyday! The Quinks encourage all learners in this process because, just like your students, they have different personalities and think differently about things. Their explorations provide growth-oriented experiences that expand their understanding of science. They are practicing science in the learning process.

### DISCOVERY BREAKS

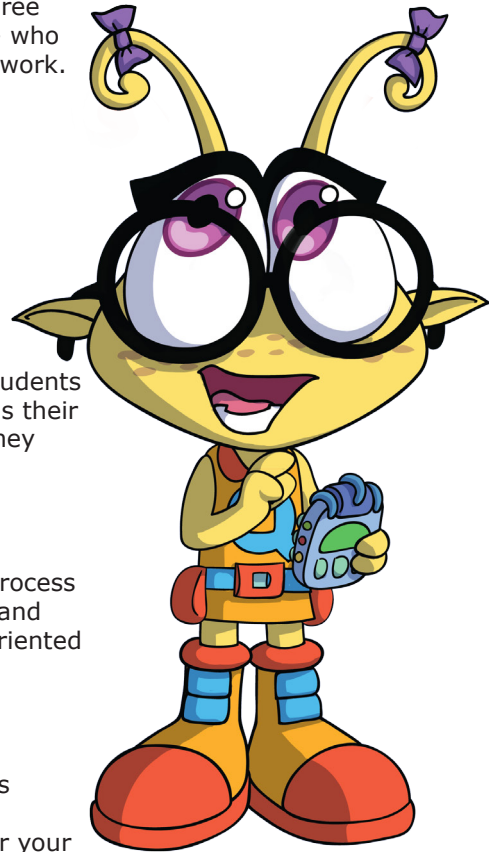
Each video lesson includes short segments where a phenomenon is presented for the Quinks and their Earth friends to explore. These segments are followed by Discovery Breaks that pose questions for your students to ponder. The video lesson is designed to be paused or stopped at this point so your learners can engage in an activity or exploration suggested in the Discovery Guide.

### SUMMARY BOARDS

After a few Discovery Break activities, it is also important for you and your students to reflect on what was figured out. A Summary Board helps to organize these discoveries and keep track of learning outcomes as well as new questions. An example is provided in the Handout Section along with a table that you can complete with your students. It is critical to address some of your students' initial questions, so a physical representation on a class bulletin board or white board will allow you to move questions from an initial Driving Question Board that are answered to the Summary Board. However, you will never be able to answer all of them - which is the beauty of science and encouraging continuous learning!

### ADAPTING ACTIVITIES

You can adapt or add to any activity so that it is more accessible or more challenging to your students. The activities and explorations in the Discovery Guide are designed so that they can easily be done with items found in most classrooms or homes. They are connected in the form of a storyline where one Discovery Break provides new outcomes or ideas that are expanded in subsequent breaks.



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## STUDENT WONDERINGS

At this level of learning, student ideas and wonderings should be encouraged and valued. This early affirmation of science learning opens their contributions and participation to science as an ongoing enterprise. It helps build autonomy for learning and honors the ideas of others even though they may be different or naïve. It is imperative that instructors not shut down student ideas but rather bring forward a collaborative culture where explanations with the evidence help guide student understanding. This can also reveal misconceptions so teachers can plan for specific opportunities where the outcomes help to drive new understanding.

## DISCOVERY CHALLENGE

In addition to Discovery Breaks, this video lesson concludes with a comprehensive Discovery Challenge that incorporates engineering. The Challenge presents a problem to be solved or a situation that needs to be improved. Educators should use these opportunities to develop communication and collaboration skills between students. They should include modeled responses (drawn or built) by the students in smaller teams. These present opportunities for students to advocate for their own ideas (explanations or argue with evidence) and listen to learn from other's ideas. They may need to have several iterations of their model before a successful solution is found.

## STEM IN THE REAL WORLD

The Quinks visit places, talk with scientists and engineers in their workspaces and gather evidence to figure things out. They try to solve problems or through experiments and observations obtain and use data to understand how things behave. This Discovery Guide offers a lesson template or storyline supportive of the NGSS with young learners. Educators and parents are encouraged to adapt and extend the ideas found in this guide and to share their experiences at [stemfromthestart.org](http://stemfromthestart.org).

## ADDITIONAL SCIENCE EDUCATION RESOURCES

OpenSciEd Teacher Handbook - [opensci.ed.org/teacher-handbook](http://opensci.ed.org/teacher-handbook)  
Framework for Science Education - [nextgenscience.org/framework-k-12-science-education](http://nextgenscience.org/framework-k-12-science-education)  
Next Generation Science Standards - [nextgenscience.org](http://nextgenscience.org)  
National Science Teaching Association Science Standards Hub - [ngss.nsta.org](http://ngss.nsta.org)

## ANIMAL AND ANIMAL TRAIT RESOURCES FOR THE CLASSROOM

Wild Kratts - [pbskids.org/wildkratts](http://pbskids.org/wildkratts)  
NatureCat - [pbskids.org/naturecat](http://pbskids.org/naturecat)  
NatureWorks - [nhpbs.org/natureworks](http://nhpbs.org/natureworks)  
PBS LearningMedia - [pbslearningmedia.org](http://pbslearningmedia.org)



# MISSION: ULTRA-AWESOME ANIMALS

## Mission Overview

Sophie Rose and the Quinks explore how animals have different traits that help them survive and thrive in a variety of environments.

Animals have traits that help them survive in their environments. Some traits have evolved over time and are inherited from their parents. Some traits are influenced by behavior or the environment. For example, the shape of a dog’s ears is an inherited trait, but a dog’s weight depends on how much she eats and moves, which depends on the environment she is in.

### Key Vocabulary

**Trait** - A characteristic of an animal or plant.  
**Orthotic** - A support or brace to help strengthen an arm or a leg that helps animals move better.

### Other Vocabulary

Ferocious	Quiver
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**Next Generation  
Science Standards**

**From Molecules to Organisms: Structures and Processes**

**Performance Expectations**

**1-LS - 1** Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow and meet their needs.

**Disciplinary Core Ideas**

**LS1.A: Structure and Function**

All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place and seek, find and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow. (1-LS1-1)

**Crosscutting Concepts**

**Patterns**

Patterns in the natural and human-designed world can be observed, used to describe phenomena and used as evidence. (1-LS1-2)

**Structure and Function**

The shape and stability of structures of natural and designed objects are related to their function(s). (1-LS1-1)

**Connections to Engineering, Technology, and Applications of Science**

**Influence of Science, Engineering, Technology on Society and the Natural World**

Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world. (1-LS1-1)

**1-LS3-1 Heredity: Inheritance and Variation of Traits**

**Performance Expectations**

Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.

**Disciplinary Core Ideas**

**LS3.A: Inheritance of Traits**

Young animals are very much, but not exactly like, their parents. Plants also are very much, but not exactly, like their parents. (1-LS3-1)

**LS3.B: Variation of Traits**

Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways. (1-LS3-1)

**Crosscutting Concepts**

**Patterns**

Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence. (1-LS3-1)

# MISSION: ULTRA-AWESOME ANIMALS

## Discovery Break One

### OVERVIEW

In the open to the lesson, Sophie Rose is looking at pictures of different animals that most learners will recognize - a cow, a bald eagle, a lady bug and a chimpanzee. She then looks at images of animals learners may not recognize - a fennec fox, a puffer fish, a roseate spoonbill and a chameleon. The Quinks then meet Sophie Rose and her dog Fluffy. Quazar is terrified of Fluffy after noticing some of the dog's traits. Sophie Rose explains what traits are and then asks students how good they are at picking out traits.

### Learning Outcomes

- Learners suggest and wonder about observable traits when shown images of different animals.
- Learners can model by drawing or describing the ways particular traits might help animals.

### Pre-viewing Activity

Have learners work in small groups and examine pictures of two different animals. Ask if they can name the ways the animals are the same and different. Ask students what they notice about the animals and what they wonder about them.

This will generate a Driving Question Board where students' questions help to drive subsequent activities. These questions and wonderings should be posted physically for young children and if possible organized for similarities.

Ask students "Does anyone else have a question like this?" Questions about fur or ears or environments could be in separate groups. Then as students engage in subsequent Discovery Breaks, the questions that get answered can be moved by the child who asked it, to a Summary Board. Keep in mind that you will never answer all the students' questions.

### Viewing

Play the video and pause at Discovery Break One - How good are you at picking out traits?

### Post-Viewing

Pass out the animal sheets featuring the animals just seen in the video found in the Discovery Guide Hand-outs section.

Have learners generate and share their questions and observations about the traits of the featured animals.

Write their questions and observations on post-it notes and put them on the board or a wall.

Ask learners if there are traits that more than one student has a question or observation about.

### Kinesthetic Activity - Animal Trait Charades

Have students pick an animal and physically demonstrate a trait of that animal and have the other students try to figure out what the trait is and what the animal is.

### Arts & Science Extra

Have learners draw (model) a picture of an imaginary animal and share what special traits that animal has and how those traits might help the animal survive. In developing and using models students diagram their ideas with both drawing and words that describe the parts or process.

### Optional Supportive Resources:

*Fish is Fish* by Leo Lionni

In this story, a tadpole and a minnow are the best of friends. Then the tadpole begins to grow legs and turn into a frog and decides to explore life on land. The minnow wishes he could explore life on land too, but discovers he doesn't have the traits to survive on land.

Ask learners what traits the tadpole and the minnow first had in common and what traits changed and which ones stayed the same when the tadpole began changing to a frog.

What were the traits that the tadpole developed that would help him survive on land?

*What Do you Do with a Tail Like This* by Steve Jenkins and Robin Page

This interactive Caldecott Honor book encourages readers to explore the amazing things animals can do with their ears, eyes, mouths, noses, feet and tails.

*Little Red Riding Hood* retold by Trina Schart Hyman  
This Caldecott Honor Book retelling of the Brothers Grimm classic includes a young girl noticing some unusual traits that her "grandmother" has.





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## Discovery Break Two

### OVERVIEW

The Quinks wonder if all dogs look like Fluffy. Sophie Rose explains that dogs come in a variety of sizes, shapes and colors. The Quinks go off to explore the variety of dogs and come back with lots of examples. Fluxx has some trouble, but Sophie Rose tells him that everyone makes mistakes sometimes and then sings the song, "It's All Right to be Wrong."

### Learning Outcomes

- Learners use patterns of different traits to organize animals.
- Learners recognize that different groups will see different patterns.
- Learners respect different ideas about how to organize animals.
- Learners begin to understand that respectful disagreement with evidence helps others to understand.
- Learners understand that making mistakes is part of learning what works.

### Pre-viewing

Ask learners if any of them have a dog or a cat as a pet. Have them share some of the characteristics their pet has (long fur, pointy ears, short tails, long tails etc.) What traits will all their pets share? What traits might be different?

### Viewing

Play the video and pause at **Discovery Break Two - Can you sort animals by their traits?**

### Post-Viewing

Arrange students in small groups of 3-4 learners. Give each group images of 15 animals. Have the learners group the animals by visible traits. (wings, fins, tails, ears, etc.) You might also ask learners if they can think of other ways to group their animals - by behavioral traits (animals that can fly, animals that eat meat, animals that live in trees) or the habitats they are found in.

After learners group their animals, you might have the other groups see if they can figure out what trait was used to group the animals.

### Additional Activities

Play animal trait bingo using the animal trait bingo game found in the Handout Section of this Discovery Guide.

Take learners outside and observe either animals or plants and identify traits they observe and the animal and plant habitats.

Have learners keep a nature observation journal where they can record the plants and animals they observe.

Have learners draw, photograph, or shoot video of different animals.

### Math Extension

Have learners conduct a school survey about the different kinds of pets people have. Facilitators might pose questions about the potential data such as "I wonder if most of the animals will be dogs?" After gathering the data, create a pie chart or bar graph with the results.

### Social and Emotional Learning

Have a discussion with students about learning new things and how hard things get easier with practice. Consider bringing in a social and emotional learning connection and explore how when scientists disagree, they use evidence to resolve it. Have children share their ideas about how they could resolve a sibling or classmate argument respectfully with evidence.

### Supportive Resources

*Can an Aardvark Bark?* by Melissa Stewart  
An exploration of the different sounds animals make.

*The Book of Mistakes* by Corinna Luyken  
An artist's splashes, blotches and other mistakes become the source for great ideas!

*I Can't Do That, Yet: Growth Mindset* by Esther Pia Cordova

A young girl has a dream where she sees all the things that she might be able to do someday.



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## Discovery Break Three

### OVERVIEW

Fluxx wonders where animals get their traits.

### Learning Outcomes

Learners discuss the ways they think animals get their traits and what evidence they have to support their ideas.

### Pre-viewing

- Ask learners to think about Fluffy the dog. Where do they think he got traits like his size, his floppy ears and his small body?
- If they have pets, ask them to think about where they think their pet might have gotten some of their traits.

### Viewing

Play the video and pause at **Discovery Break 3 - Where do you think animals get their traits?**

### Post-viewing

- Ask learners to give examples of how animals and their offspring share some visible traits.
- Can learners think of times when animals and their offspring might not share visible traits?
- Can you think of times when offspring from the same two birth parents don't look exactly alike? Do human brothers and sisters always look alike? Do puppies and kittens from the same litter always look alike?
- This is a perfect opportunity to reflect on student learning by using the Summary Board to record activities done and what students have figured out. Be sure to add any pertinent Student Questions or Wonderings from the beginning phenomenon and Driving Question Board to the "What we figured out!" column.
- Use the Match the Mama to the Baby sheet found in the Handout Section either as a handout or cut out the images and have the students match the baby animals to the adults. If you have a magnetic whiteboard or refrigerator, mount the pictures on cards (laminated if

possible) and attach magnets. This becomes a reusable matching game where you could add different animals or plants over time.

- Have students use the Flip Book Animal Creator activity found in the Handout Section to create their own animals.

### Supportive Resources:

*100 Dogs* by Michael Whaite

This rhyming book features 100 different dogs doing 100 different things.

*100 Cats* by Michael Whaite





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## Discovery Break Four

### OVERVIEW

The Quinks visit Hickory Nut Farm where they meet Sai. Sai is brushing a young goat named Tuffy. Sai introduces the Quinks to Tuffy's birth parents, Juniper and Roger. The Quinks notice traits Tuffy has that he inherited from both parents and some traits that he might have inherited from just one parent. The Quinks see a montage of clips featuring baby animals and their parents.

### Learning Outcomes

- After observing animals and their offspring, learners identify traits that might have been inherited from both parents or from just one parent.
- Learners match animals to their offspring based on observable characteristics.

### Pre-viewing

#### **Say to Learners:**

Where do you think the Quinks are going to go to learn about traits?

### Viewing

Play the video and pause at **Discovery Break 4 - The Quinks are sure learning a lot about traits. Let's see what you know about it.**

### Post-viewing

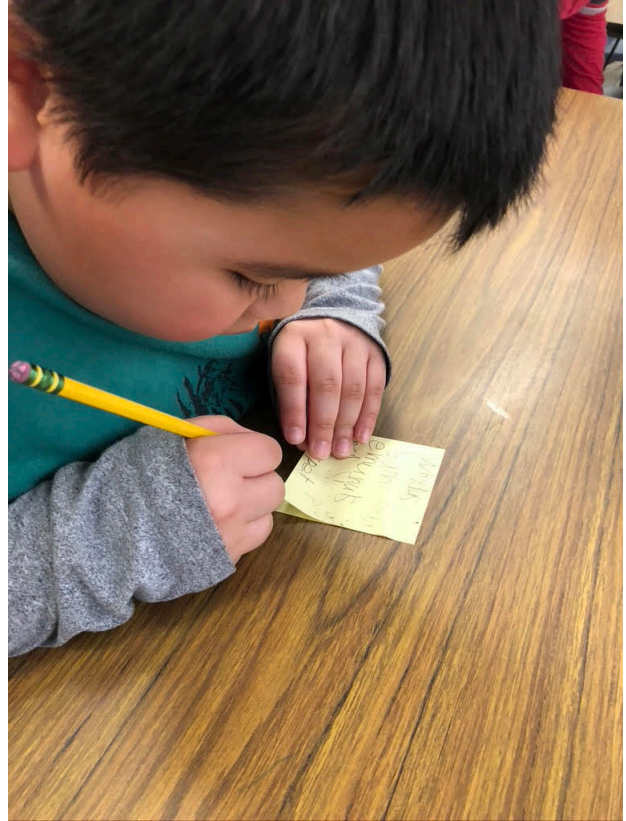
- Ask learners to describe traits they have that they might have inherited from their parents.
- Traits could involve both visual and behavioral traits. They should be distinguishing qualities or characteristics.
- Add your students understandings to the Summary Board.

### Supportive Resources:

*Is Your Mama a Llama?* by Deborah Guarino  
Lloyd the llama goes looking for his mama and asks a variety of animals - a bat, a swan, a cow, a seal and a kangaroo if they are his mama.

*Are You My Mother?* by PD Eastman

A newly hatched bird tries to find his mother, who has left the nest to find some food. The chick asks a cat, a hen, a cow and a dog if they are his mother. He goes on to wonder if a car, a boat, a plane and a crane are his mother. Eventually he is returned to his nest and his mother. Students can list traits the bird share with the animals and machines he comes across.



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## Discovery Break Five

### OVERVIEW

The Quinks share what they have learned about inherited traits with Sophie Rose. They think they have learned everything there is to know about inherited traits, but Sophie Rose shows them images of dairy goats and mountain goats. They share some traits but also look different from each other.

### Background

The mountain goat (*Oreamnos americanus*) is native to North America. While it is called a goat, it is not a member of the *Capra* genus that includes other goats. It is the only member of the *Oreamnos* genus.

The mountain goat is found in subalpine and alpine environments and is a sure-footed climber on rocky and icy slopes.

Dairy goats (*Capra aegagrus hircus*) are a subspecies of the wild goat (*Capra aegagrus*) native to eastern Europe and southwestern Asia. There are over 300 breeds of domestic goats.

Male and female goats can have horns and/or beards. Horns and beards on males are usually larger and longer than the horns and beards found on females.

Other members of the *Capra* genus include:

**Markhor** - *Capra falconeri* found in central Asia

**Siberian Ibex** - *Capra sibirica* found in central and northern Asia

**Walia Ibex** - *Capra walie* found in Ethiopia

**Alpine Ibex** - *Capra ibex* found in mountainous regions of Europe

### Learning Outcomes

- Learners observe how some traits of similar animals might be the same, or may differ.
- Learners explain why different traits might help animals survive in a particular environment.

### Pre-viewing

#### Say to Learners:

What can you share about where animals get their traits? Why do you think animals have the traits that they do?

### Viewing

Play the video and pause at **Discovery Break 5- Can You think of a reason why the goats look so different?**

### Post-viewing

- Pause the video on the images of the two different goats - dairy and mountain. Break students up into small groups and have the groups list reasons why the goats might have different traits. Have each group report their conclusions and the reasons they think the goats might have different traits.

- Show students images of other similar species or have them list other similar species for example:

Felines: lion, cheetah, bobcat, Canada Lynx

Ursines: panda, polar bear, black bear, brown bear

Canines: coyote, wolf, red fox, arctic fox

Have them list what traits the animals share and what traits are different and why they might have different traits. Is there something about a particular trait or traits that might help a species survive in a particular environment?

- Break the learners up into groups and give each group a different environment - desert, forest, shoreline, arctic, mountain etc. Have each group draw or construct a species of goat with traits that would help it survive and thrive in that environment.

- Summarize the students' ideas on traits that assist survival on the class's Summary Board.



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## Discovery Break Six

### OVERVIEW

The Quinks return and tell Sophie Rose that they think that the dairy goat and the mountain goat have different traits because of where they live. We then see a montage of different animals using their traits in ways that help them survive in their environment.

They then reexamine the domestic goat and mountain goat and identify particular traits that help each survive in its environment.

Sophie Rose then lists some traits Fluffy the dog has that help him survive.

Next, the Quinks look at some of the animals introduced in the show open - the chameleon, the fennec fox, the puffer fish and the roseate spoonbill.

### Learning Outcomes

Learners observe specific traits of a number of animals and propose reasons why that particular trait might help the animal thrive and survive in its environment.

### Pre-viewing

Ask learners what specific traits might help the mountain goat and the domestic goat thrive and survive in its environment.

### Viewing

During the examination of the traits of the chameleon, the fennec fox, the puffer fish and the roseate spoonbill, pause the video when the question mark appears on the screen. Have learners give some reasons why they think the animals might have a particular trait.

Continue the video and pause at **Discovery Break 6 - Can You think of other traits that help animals survive?**

### Post-viewing

#### Hands-On: The Best Bill for the Job

Learners will determine which "bird bill" is the best bill for gathering food.

### Materials Needed

plastic spoons  
tweezers (or two popsicle sticks, or clothes pins with springs, or thumb and index finger)  
gummy worms  
cooked spaghetti noodles  
chocolate chips  
uncooked rice  
paper cups

### Process

- Students should try out the various tools for procuring seeds, noodles, gummy worms, etc.
- In teams, students can use timed periods for collecting and report back the numbers of items they were able to collect with their simulated bird beaks.
- Ask the students in their small groups to design a chart that tallies the number and kinds of items each tool (type of bird beak) collected.
- If students share their charts, the whole group can decide which chart is most helpful (this is building a consensus model).
- The whole class data should then be compiled into the refined chart for analysis and a discussion of how the beak style or tool is best for different types of seeds.
- This learning of what works best can be added to the "what we figured out" column of the the Summary Board!





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## Discovery Break Seven

### OVERVIEW

The Quinks meet veterinarian Dr. York and see how an orthotic is used to help a dog better use one of his legs. She also shows how the traits of some animals can inspire humans to engineer some amazing innovations.

### Learning Outcomes

- Learners use animal traits to design an engineering innovation that will make human life better.
- Learners communicate their designs with peers to receive feedback on their invented solutions.

### Post-Viewing

- Provide learners with art materials, - paper, paint, crayons, markers and/or whiteboards to assist the engineering design process. Encourage them to create a an innovation inspired by an animal trait that will help humans.
- Give students the animal pictures so they can choose an animal with traits they would like to use. This could be done individually or in small teams. If white boards are available, students can more easily sketch their designs and revise or improve on those designs. Google applications like JamBoard also allow for teams of students to draw and comment on team designs. They are developing and using their models to communicate their ideas!
- Encourage students to think like engineers about problems humans have and where certain animal traits could improve their lives. For example, people who have difficulty walking might benefit with an exoskeleton like a lobster or grow new legs as with the tadpole or starfish. This can take the form of designing superheroes which can develop innovative solutions.

### Engineering Challenges

Provide learners with art materials, - paper, paint, crayons, markers and have them create a drawing of an innovation inspired by an animal trait that will help humans.

The above activity is 2-dimensional and can help prepare students to think about designs and design modifications with feedback. If you and your students are ready for more, continue on to tackle the 3-dimensional Discovery Challenge.



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## Discovery Challenge

### Engineering Scaffolding

Children may or may not have experience using different materials to construct 3-D forms. If it is possible to provide an opportunity for them to construct an orthotic for a bird, that provides a more hands-on and active problem solving experience.

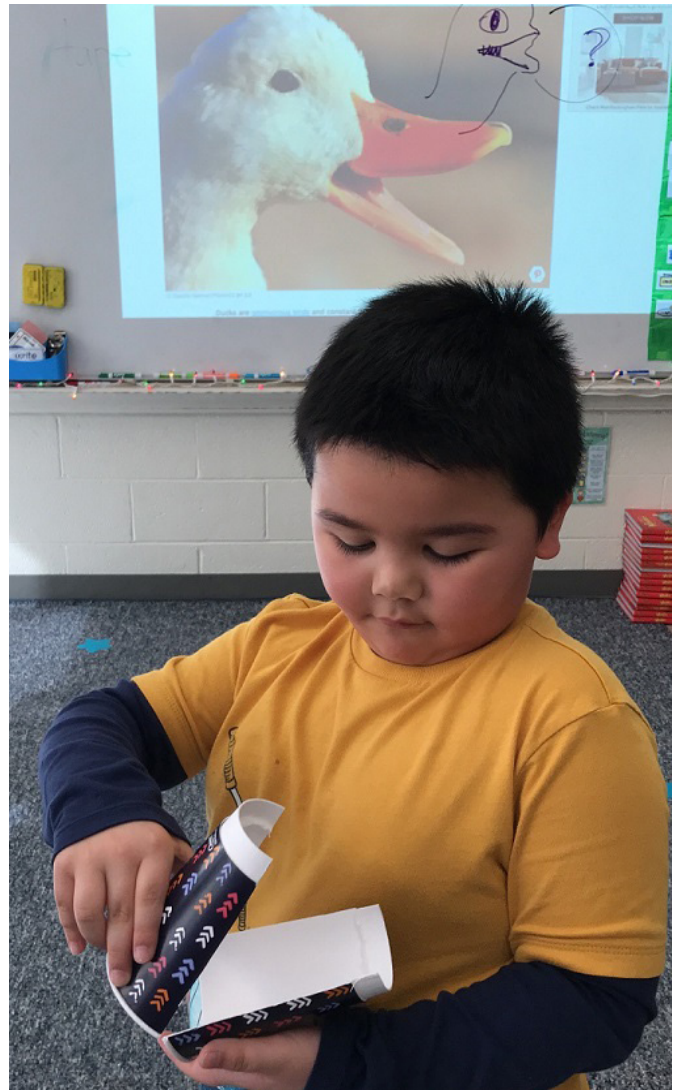
Challenge students to construct an orthotic for a duck with an injured bill that will allow the duck to gather food and eat.

### Suggested Materials

clothespins  
chopsticks hinged  
popsicle sticks  
chenille sticks  
paper towel rolls  
cardboard  
plastic spoons  
paper clips  
glue  
scissors  
rubber bands  
duct tape

### Recommendations

- Have students work in pairs and design a model of their orthotic, detailing what materials they would use and how it would work.
- Once students have a design they think will work, have them build the orthotic. They can use the hand of a student as a simulated duck jaw. Allow them time to test the ability of the bill to pick up food on solid ground and in the water. You can use the seeds, Goldfish snack crackers, Easter basket grass or other items to simulate different environments. As time permits, allow them to revise their models.
- In the end, hold a conference with all models and ask students to share what they learned from the model they constructed. Don't settle for "It didn't work" as a response. Probe deeper for students to say more about it and reference their model as evidence.
- This is an opportunity to draw out a consensus model where all students contribute ideas for the best prototype. Engineers almost always work in teams for the best results. They have other considerations as well - cost of materials, ease of production, comfort of the wearer, resiliency of the materials, etc.
- Students should at this point describe the additions to the Summary Board and reflect back to the Ultra-Awesome Animals and how they get their unusual traits for survival.





# MISSION: ULTRA-AWESOME ANIMALS

**STEM from the START** is an innovative, online video-plus-activities curriculum enhancement supporting the Next Generation Science Standards for K-2 learners. Online streaming of the video production, the Discovery Guide, and additional resources are publicly available at [STEMFROMTHESTART.ORG](http://STEMFROMTHESTART.ORG). The production features kid-friendly animated characters called QUINKS in a Discovery Mission on Earth. The goal of STEM from the START is to nurture children's natural curiosity and love of discovery, while laying the groundwork for ongoing success in Science, Technology, Engineering and Mathematics (STEM) and to expand students' career ambitions by learning about the work of scientists, engineers, and others actively learning about and improving our world.

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# CERTIFICATE OF DISCOVERY

THIS CERTIFIES THAT

\_\_\_\_\_

IS AN EXPLORER AND FIGURED OUT A LOT ABOUT ANIMAL  
TRAITS WITH THE QUINKS AND ULTRA-AWESOME ANIMALS!

DATE: \_\_\_\_\_

