

Animal Superheroes!

NGSS.1-LS1-1. 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.

[Clarification Statement: Examples of human problems that can be solved by mimicking plant or animal solutions could include designing clothing or equipment to protect bicyclists by mimicking turtle shells, acorn shells, and animal scales; stabilizing structures by mimicking animal tails and roots on plants; keeping out intruders by mimicking thorns on branches and animal quills; and, detecting intruders by mimicking eyes and ears.]

CCSS.ELA-LITERACY.SL.1.1 Participate in collaborative conversations with diverse partners about *grade 1 topics and texts* with peers and adults in small and larger groups.

Teacher Background

Plants and animals have many adaptations that help them survive in a variety of habitats. These adaptations can help them find food, survive against predators and harsh weather conditions, reproduce, and care for their young. Throughout history, humans have observed and used the adaptations of other species to their advantage. Today, scientists and engineers are still inspired by the adaptations of other species. They use this inspiration to create inventions and improve products through biomimicry. For more information on biomimicry, you can visit <https://biomimicry.org/what-is-biomimicry/#.ViovXtWrTnA>.

This science lesson encourages children to consider the various types of adaptations that animals have and apply these adaptations through biomimicry. Children will use biomimicry techniques to create a superhero with powers and features that are inspired by animal adaptations. The lesson can be done over the course of a single day or can be split up over the course of a week. Students will work through the steps of the engineering design process. To learn more about the engineering design process for elementary students, you can visit <http://www.eie.org/overview/engineering-design-process>.

1. Engage: 10-15 minutes

- a. Introduce the lesson by reading your class the story *What Do You Do With a Tail Like This?* by Steve Jenkins and Robin Page. There are also versions available to show on YouTube: <https://www.youtube.com/watch?v=du2AgfWrbGo>
- b. Explain that people can be inspired by parts of different animals. These features can give ideas to engineers for creating or improving inventions. Some examples of this are:
 - i. The mounds that termites make for their homes help engineers design new air conditioning systems.
 - ii. Understanding grassland ecosystems helps farmers grow food more carefully.
 - iii. Mosquito mouth parts help scientists create less painful needles.

2. Explore: 10-20 minutes

- a. Either using the projector as a class, or with individual computers or tablets and headphones, visit the PBS Kids Website for Wild Kratts and find the Power Suit Maker game. <http://pbskids.org/wildkratts/games/power-suit-maker/>
- b. Starting in Challenge Mode, follow instructions to build a few power suits. Discuss the different features and how they help the animal and the Kratt brother.
- c. Moving to Experiment Mode, allow children to play with different combinations for each body part. Have them pay attention to the feedback that Aviva gives them about the advantages of each part.

3. Explain: 60-90 minutes

- a. Tell children they will be working in small groups to create a suit for a superhero that uses different animal parts as powers. Each group must make a suit design that uses 2-3 animal parts (based in reality, not fantasy) for each of these two requirements:
 - i. Safety or protection (camouflage, armor, or anything that provides a defense against attack)
 - ii. Enhanced abilities (advanced speed, sight, hearing, etc.that can be used for superhero duties)

- b. Instruct children that each group will create a different type of superhero suit for a different superhero mission. You can use the mission ideas listed below, create your own, or use the missions found at:
<http://resources.sparkleboxres.co.uk/sb3678.pdf>
 - i. Group A: Underwater Rescue Mission
 - ii. Group B: Sky Surveillance Mission
 - iii. Group C: City Crime-Fighting Mission
 - iv. Group D: Secret Spy Mission
 - v. Group E: Underground Hideout Mission
- c. Assign the children to small groups.
 - i. One strategy for random assignments is to pass out index cards with the group letters written on them (five A cards, five B cards, etc.). Once the groups are assembled, you can remind each group of their superhero mission.
 - ii. If your class is composed of proficient readers, you can pass out index cards that have the actual missions written out alongside the letter of the group.
 - iii. To randomly pre-assign roles within each group, you can also include different student roles on the index cards, such as researchers, designers, engineers, suit prototype model, spokesperson/presenter, etc.
- d. Once children are settled into their small groups, they should begin discussing their superhero mission and the powers their proposed superhero will need.
- e. Ensure that group members are all given a chance to contribute to the brainstorming session by monitoring group progress. Strategies can be used to encourage discussion: each student can contribute a different part to add to the superhero and each student can have a different role in the group (either randomly assigned, as above, or determined collaboratively by the group).
 - i. Monitor students to ensure that each group is considering actual animal adaptations and not superpowers based on fantasy (such as x-ray vision). Provide each group with a variety of nonfiction books about animals and their features for inspiration and discussion. Ensure that each book has a large number of high quality color photographs or illustrations. If groups are not sure where to start or get stuck, remind them of the two categories of animal parts they should include, their group's particular mission, and

direct them to look for more ideas in the books they have available. You can also ask them the guiding questions provided for the presentation, in part (g), below.

- ii. Ensure that each group is discussing practical ways to build these adaptations into a suit. If they have great ideas but need direction, ask them, “So, how would you build this?” Provide the class with a variety of materials so each group can construct a prototype of their superhero suit. *Suggested materials: several rolls of masking tape (at least 1 per group), construction paper or cardstock, scissors, newsprint, scrap fabric, and clean recycled objects such as bottles, bottle caps, boxes, etc (students could bring them in over the course of the previous week).*
 - f. Each group should construct a prototype or model of their proposed superhero suit by adding the provided materials onto a single student in their group. These materials can represent other materials that they would really use to mimic animal adaptations. After constructing their prototype, each group should prepare to present their ideas to the class. To choose which student will model the suit and who will speak for the group, you can randomly draw names or refer back to student roles in the group determined during parts (c) or (e), above.
 - g. Taking turns, each group presents and explains their mission and superhero suit design to the class. They should explain the parts of their suit and their thought process behind each part. Groups should answer the following questions, with teacher prompting, as necessary:
 - i. Why did you choose these parts for your superhero's suit?
 - ii. How do these parts help your superhero?
 - iii. What makes these parts better than ones found on other animals?
4. Elaborate: 5-15 minutes
- a. After viewing each group’s ideas and cleaning up from their prototype construction, lead a class discussion about what the class thought were the best or most interesting animal superhero powers. They should also think about the challenges of building designs that use animal parts. Ask the class the following questions to help them through the “Improve” part of the engineering design process:
 - i. What animal parts did you find most interesting?
 - ii. What parts would provide the best protection for the superhero?

- iii. What parts would provide the most useful powers or special abilities for the superhero?
- iv. What parts could be most easily designed by humans?
- v. How did the different missions lead to different superhero suit designs?

5. Evaluate: 20-30 minutes

- a. Individually, each child should draw their own ideas for the prompt, "What animal parts would you use if you could build your own superhero suit?"
- b. For inspiration, provide access to the books that the students used during their group construction.
- c. As with the group work, ensure that students are thinking of real adaptations and practical ways to create a superhero suit.
- d. Help students add labels and descriptions to their drawings, as needed.
- e. Evaluate student work by asking each student why certain parts were chosen. Responses should reflect a specific attribute and its application to the student's goals for the suit.
- f. If some students finish work before others or later need to review animal adaptations, they may watch the following video on a computer or tablet with headphones: <https://www.youtube.com/watch?v=z4xFDjy3uT8>