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SCIENCE ★ TECHNOLOGY ★ ENGINEERING ★ MATH
PRESENTED BY: girlstart

Mimic Manufacturing

Grab a friend to create a device that mimics the hearing of animals with large ears! Your goal is to construct a device that helps your friend hear better when sounds are far away or very soft. Can you think of other products or designs that mimic plant and animal adaptations?
(Example: Velcro mimics how a sticker burr attaches to clothes and skin.)

TEKS:

4.10A Explore how adaptations enable organisms to survive in their environment such as comparing birds' beaks and leaves on plants.

5.10A Compare the structures and functions of different species that help them live and survive such as hooves on prairie animals or webbed feet in aquatic animals.

Materials:

To make different hearing devices

- (2) 3 oz. dixie cups
- (2) 6 oz. styrofoam cups
- (2) 12 oz. styrofoam cups
- (2) 24 oz. styrofoam cups
- Plastic headbands (one per hearing device)
- Heavy plastic tape or duct tape
- Scissors

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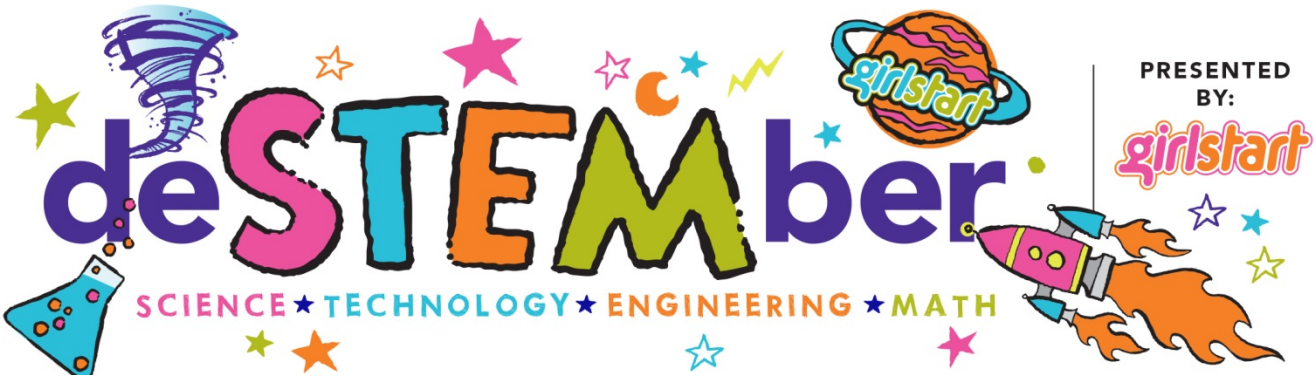
How To:

1. Cut out the bottom of each cup.
2. With a partner, test the different sizes of cups to see which will funnel sounds better into the ear (make sure to conduct the hearing test in a quiet area with no outside noise). One person should hold a cup up to their ear, while their partner stands 5 feet away, either speaking or whispering the same phrase repeatedly.
3. The speaker should keep whispering or speaking the same phrase at the same volume, while the tester moves farther away from the speaker until no sound can be heard.
4. Test all four cup sizes, seeing which cup allows the tester to move furthest away from the speaker while still being able to hear.
5. Using the two cups that allowed for the best hearing, construct your hearing device by attaching the cups to a headband using tape. Make sure the cups are placed so that they cover your ears when the headband is worn.
6. Decorate your hearing device, give it a name, and wear your new device to hear soft or far away noises!

Why Does It Work?

Animals with large ears such as dogs, cats, rabbits and foxes have better hearing than people because the structure of their ears allows sound waves to be 'funneled' into their ears. The cups act exactly the same way, 'funneling' sound into your ears and allowing it to be heard more accurately.



Career Connection:

Biomimicry Careers: The field of biomimicry brings together teams of highly skilled people such as physicists, chemists, biologists, and engineers. Engineers must work with scientists to understand how natural occurrences and adaptations can be used to develop new inventions.

Resources:

- Seven Amazing Examples of Biomimicry: http://www.mnn.com/earth-matters/wilderness-resources/photos/7-amazing-examples-of-biomimicry/sharkskin-swimsuit
- How Biomimicry Works: http://science.howstuffworks.com/environmental/life/evolution/biomimicry2.htm
- The 15 Coolest Cases of Biomimicry: http://brainz.org/15-coolest-cases-biomimicry/
- Hearing Range: http://en.wikipedia.org/wiki/Hearing_range

Additional Resource:

- Explore biomimicry further with another fun activity! Cut out the cards below, mix them up, and try to match the product to the animal or plant adaptation that it is based upon!

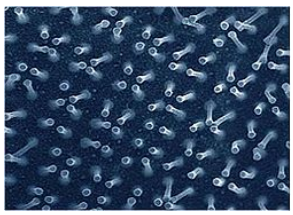
Product: Velcro

Velcro was invented by an engineer who got the idea from removing burrs from his dog's hair. Velcro uses strips or patches of a hooked material opposite strips or patches of a loose-looped weave of nylon that holds the hooks.

Plant: Cocklebur

The tiny hooks on the end of the burr's spines catch on anything with a loop such as clothing, hair, or animal fur.

Product: Gecko Tape



This special tape is covered with tiny, flexible hairs that exert a special force to provide a powerful adhesive effect. Gecko tape is reusable and does not leave any residue behind. Will people be able to walk up walls in the future?

Animal: Gecko Lizard

Millions of tiny nanoscopic hairs cover the lizard's feet. The tiny, flexible hairs exert a force that provides a powerful adhesive effect and allows the lizard to stick to vertical surfaces.

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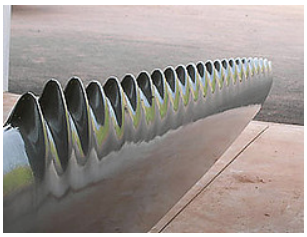
Product: Wind Turbine



Companies have developed turbine blades with bumps on the leading edge to increase the amount of energy that wind and hydroelectric turbines produce. The bumpy blades are able to cut through air more easily, making the turbines more efficient.

Animal: Whale

The bumps at the front edge of a whale fin greatly increase its efficiency, allowing it to move through water with less resistance. Whales are able to dive hundreds of feet below the surface of the water and stay there for hours.

Product: Glow sticks

When the glow stick is twisted, a small vial breaks and releases chemicals. When the two chemicals inside the tube mix together, a chemical reaction occurs and produces light.

Animal: Fireflies

Fireflies glow because of bioluminescence, a chemical reaction that occurs when chemical energy is converted to light energy.

31 Days of STEM Fun!

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Product: Swimsuit

The swimsuit is designed with built-in ridges that help reduce drag in the water, allowing the swimmer to swim faster.

Animal: Shark Skin

The shark can swim quickly because of the ridges on its skin. The ridges decrease drag around the shark's body allowing the surrounding water to pass over the shark more effectively.

Product: Paint

A special paint has been developed that pushes away dust and dirt and reduces the need to wash the outside of a house.

Plant: Lotus Leaves

The surface of the lotus flower repels (keeps away) dust and dirt particles, keeping the petals sparkling clean. The surface of a lotus leaf is bumpy, which causes water to bead, as well as pick up surface contaminates. When the water rolls off the leaf, it takes the contaminates with it.

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Product: Airplanes

The wings on an airplane are curved so that the air passing over the top surface of the wing flows much faster than the air below the surface of the wing. The difference between the top and bottom surfaces creates a force that lifts the airplane off the ground.

Animal: Birds

The wings on a bird can take on a special shape that makes the air flow much faster over the top surface of the wing than it flows below the surface of the wing. The difference between the top and bottom surfaces creates a force that lifts the bird off the ground.

Product: Office Buildings

Engineers design buildings with chimneys and tunnels that allow air to circulate and flow so that a constant temperature can be maintained.

Animal: Termite Mounds

African termites construct air vents in their mounds. The vents constantly move air throughout the mound, cooling or heating it to a steady and comfortable temperature.

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Product: Radar

Radar uses electromagnetic waves to determine the location, size, and shape of objects like planes and ships.

Animal: Bats

To echolocate, bats send out sound waves from their mouth or nose. When the sound waves hit an object, they produce echoes. The echo bounces off the object and returns to the bat's ears. Bats listen to the echoes to figure out where the object is, how big it is, and its shape.

Answer Key (Product → Plant/Animal):

1. Velcro → Cockleburr
2. Gecko tape → Gecko lizard
3. Wind turbine → Whale
4. Glow sticks → Fireflies
5. Swimsuit → Shark skin
6. Paint → Lotus leaves
7. Airplanes → Birds
8. Office buildings → Termite mounds
9. Radar → Bats

