

SWEducational

ACTIVITY PACKET

BIOMIMETICS ENGINEERING EDITION

WHAT IS BIOMIMETICAL ENGINEERING?

Biomimetics Engineers study and imitate patterns, designs, and processes found in nature. For example, Velcro was created based on the design of burrs that stick to clothing, and the pattern of shark skin was imitated when creating a recently new bathing suit. Nature is all around us, and some of the best solutions to our problems can be found in and inspired by the natural world!

Do you like prizes? How about showing off your project work? Submit a photo of your **completed Industrial Engineering activity** through the link below! You'll see your project featured on the class page, and even be entered into a raffle for the chance to win a **GIFT CARD!**

PHOTO RAFFLE



Get your cameras ready and stay tuned... there will be a photo raffle in the next packet!

Gift Cards to...

- Starbucks
- XBOX
- PlayStation
- iTunes
- More!

Submit [Here!](https://forms.gle/AcEXCZkePKxmJcJA) Or type the link below:

<https://forms.gle/AcEXCZkePKxmJcJA>

IMPORTANT TERMS

Form

- The word form can also be used to describe the shape of something. One example of form we can see in nature is how the leading edge of wind turbine blades was inspired by a humpback whale's fin. The bumps on the blades make them more efficient and help them cut through the air more easily.



- In this activity you will be able to analyze the different forms or shapes of the leaves.
- Think about why the form of the leaves might change from plant to plant.

Structure

- Structure is the arrangement of things in a definite pattern of organization. One example in the biomimicry of the structure of something is a bee's honeycomb. Bee's build their nests out of a hexagonal structure which is both strong and space-efficient. Scientists and engineers looked to the bee's honeycomb structure to develop a light-weight and strong building materials.



- In this activity, if you were to look at the leaves of the plant very closely, or under a microscope, you could see the structure of the plant cells.
- What are some other uses for a strong and light-weight material which looks like a bee's honeycomb?



System

- A system is a group of things which work together and create a unified whole. We can see an example of biomimicry with a building in Africa which is modeled after termite mounds. The designer of the building was inspired by how the termite mounds have a group of tunnels and the tunnel system allows for cooling.



- In this activity you will look at plants which have a root system to help the plant get water.

ACTIVITY 1 INSTRUCTIONS

Today you will go out for a stroll through nature!

This might not be possible to do for everybody, but try to observe nature in whatever capacity you can even if it is as simple as analyzing the leaves of a potted plant or pondering why ants don't seem to hurt themselves when they fall off your table!

SUPPLIES

- Leaves
- Paper (any type or color)
- Paint (any color but you might want to have a light color if you have a dark colored paper)
- Paint tray, or a similar sized plastic tray
- Paint roller, sponge or even a large brush



STEPS

1. Our activities for this packet are focused on leaves so on your nature stroll, you can pick up some leaves on your way back. Don't pluck too many off of one plant as each and every leaf is important to the plant.
2. You may want to collect a few sizes and different types of leaves, try to look for ones where you can see the veins of the leaf.



3. At home, carefully observe the leaves, especially how the veins of the leaves branch out and multiply, all the while becoming thinner until you can't see them but they reach all parts of the leaf to supply it with nutrients and water. Nature has developed these transportation systems over millions of years. A similar network exists in our bodies too, with our blood vessels!
4. Now, you can try to sketch these out or trace them with your fingers and think about how us humans can get inspired from leaves and apply their transportation system to our water, or gas transportation systems so we can optimize our systems.



5. Here, we will show you a fun paint stamping activity with which you can learn about these systems in leaves as well as create some art!

- a. First, cover your table or work surface with a plastic or paper bag, or some newspapers as this activity might get a little messy.



- b. Take some paint and pour a little bit into a tray. Be careful not to spill paint. You might want to ask an adult to help with this step.





c. Now, take your paint roller, brush or sponge and roll or dip it into the paint.



d. Roll your roller over a leaf so that it is covered in paint. If you are using a sponge, dab it onto the leaf. Your leaf should be covered in a thin layer of paint.



e. Bring your paper closer, pick up your leaf, flip it over and press it onto your paper. When you lift the leaf up again, you should have a beautiful print of the leaf. Let the paint dry.



f. You would be surprised to see that this method shows the shapes of the veins of the leaf, but be careful not to have too much paint on the leaf as it will not show the veins well.

g. You can also play with colors here to create an ombre leaf print or a multi-colored leaf print. You can even layer different leaves to create a unique layered leaf print! Use your creativity and imagination here to create some art that you speak to you.



ACTIVITY 2 INSTRUCTIONS

In the first activity, you learned about how nature can inspire networks like water and transportation systems. In this activity, you will now explore how the physical forms and characteristics in nature can be applied to objects that people use!

SUPPLIES

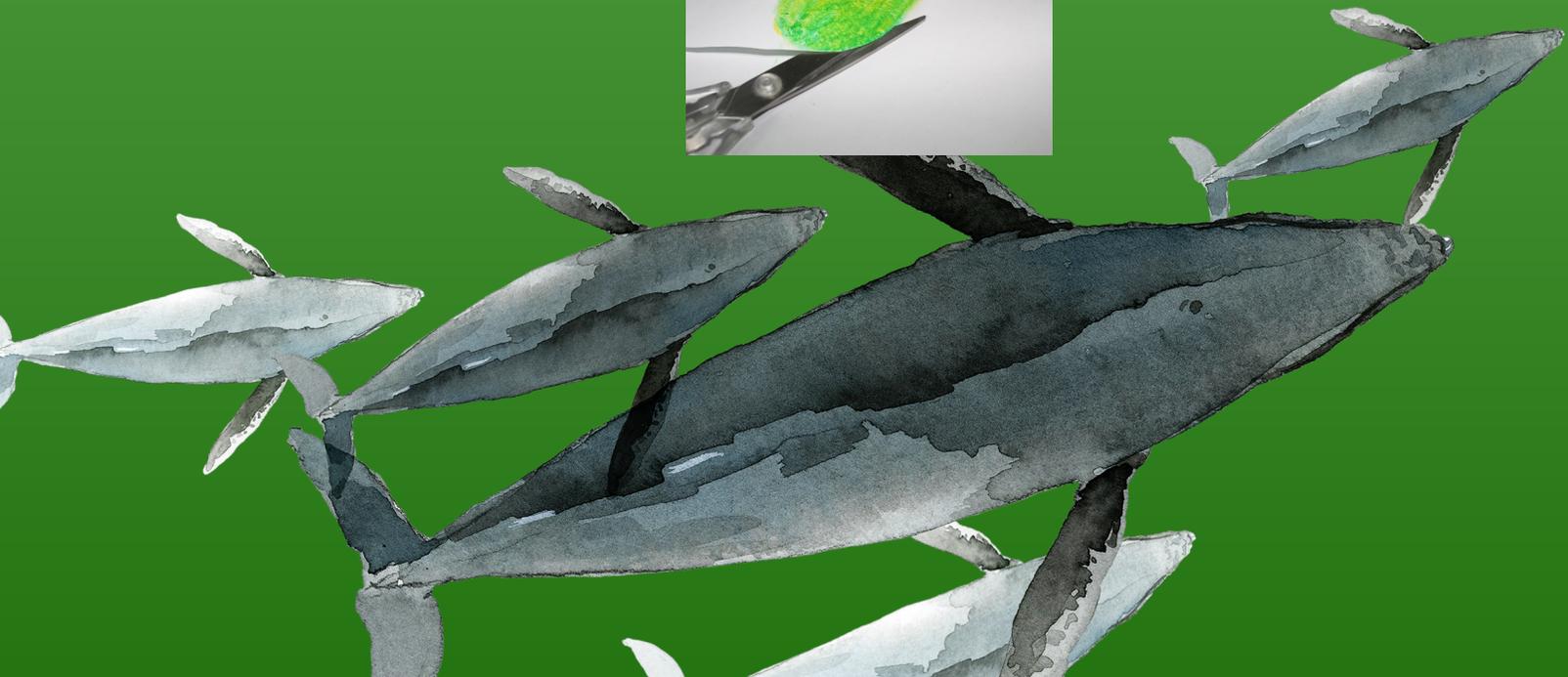
- Crayons
- Paper
- Water
- Scissors

STEPS

1. With your crayons, draw a leaf on your paper and fill it in with color. Try to press hard on the paper as you're doing this! You'll want the paper to be covered with the wax from the crayons.



2. Cut out the leaf.



3. Hold your paper leaf over the sink or place a small towel on a surface and place the paper leaf on it. Slowly pour some water on it.



- a. Slowly and carefully lift the paper to check the bottom side. Notice how the water just ran off the paper, keeping the bottom dry! This waterproofing is present in many plants! Their leaves have a waxy layer called the cuticle that lets water run off instead of getting absorbed through another side, and actually acts as a barrier to also prevent water loss in the plant. The cuticle is also seen in the exoskeleton of arthropods (like beetles)!
- b. Some things to think about:
 - I. What are examples of things people use that you think should be waterproof? What problems would waterproofing solve?
 - II. What other characteristics in nature do you think could make people's lives better or easier? What problems would they solve?

RESOURCE LINKS / VIDEOS

- Biomimicry: Waterproofing Activity -
<https://www.generationgenius.com/activities/inspired-by-nature-biomimicry-activity-for-kids/>
<https://www.youtube.com/watch?reload=9&v=HPXYMBWjIks&feature=youtu.be>
https://www.youtube.com/watch?v=4a8nGf9AXX0&feature=emb_title
- Biomimicry: when technology is inspired by nature -
<https://www.youtube.com/watch?v=HppE6ezLDqI>
- Biomimicry PowerPoint Presentation -
<https://stemazing.org/biomimicry-powerpoint-presentation/>

