



## **Nature Says Do This: Solving Problems by Mimicking Nature**

Curriculum Unit 23.05.06, published September 2023

by Aliyah Hoye

### **Introduction**

---

“Look! Look! Look deep into nature and you will understand everything.” - Albert Einstein

It’s the first day of school and my kindergarten students are beginning to flood into the classroom. Some students are extremely excited, while others are shy and nervous, and some students fall in between. While their emotions may be different, one thing is completely the same about all of the students: no matter what mode of transportation my students used to arrive at school, they observed their community on their journey to school. But my students may not have realized that a vast majority of the things they see around them have somehow been inspired by nature. From machinery and tools to medicines and treatments, nature has been an inspiration for all of this innovation. Students need to understand the correlation between our lives and nature. The biggest question that I hear in kindergarten is “Why?”. Why is an excavator shaped the way it is? Why does a submarine look like that? Why does a plane look that way? The simple answer is that we have mimicked nature to create these machines. The excavator digging mechanism was influenced by the claw of a mole that easily digs through dirt, the submarine was influenced by a whale that moves quickly underwater, and the jet was influenced by birds that soar through the sky. By beginning to learn about biomimicry starting at a young age, the mindset of the student will begin to change to look at nature as a model, measure, and mentor.

### **Rationale**

---

There has been a major effort in our district to provide opportunities for students to experience, engage, enjoy, and appreciate nature in the world, specifically in Richmond, Virginia. Now that students are showing an interest in nature, I want to build on their passion to show the students how our lives have been influenced and inspired by nature. Several schools across Richmond Public Schools have community gardens, garden beds, native plants/flowers, bird feeders, and more. I would like to move my students from just engaging with nature and teach them how scientists and engineers mimic various elements of nature to help us in our daily lives.

As a general education teacher in a collaborative class setting, I am constantly looking for methods and means to make the curriculum I teach more relatable, relevant, and engaging to ALL of my kindergarten students. In the kindergarten curriculum, students will be learning about living and nonliving things; however, it does not go into depth about how living and nonliving things relate to one another. By giving students a kindergarten-level introduction to biomimicry, students will be able to make more connections between learning in the science curriculum and experiences and objects in their everyday lives. Young students, especially those with special needs, require more hands-on and personally relevant activities to further connect them to what they are learning and they will receive that from this unit.

This unit is valuable for students in urban settings because a vast majority of these students do not get the opportunity to interact, explore, and begin to discover the natural world around them. Students need to appreciate what nature has contributed to our modern society. Many of our problems whether medical or mechanical have been, and still are, being solved by mimicking nature. I hope this unit will provide some more background knowledge and answer many students' "why" questions about nature and our society.

## School Demographics

---

I will be entering my sixth-year teaching kindergarten at a Title 1 school. Like most elementary teachers, I teach the core subjects (math, reading, writing, science, and social studies) to my students. Three years ago, I began teaching in a collaborative setting, which means that I have students with disabilities in my class, as well as a special education teacher in the classroom. At our school, we have approximately 375 students total, with approximately 80 kindergarten students, which makes class sizes between 15-20 per class. About 68% of our students are Black, 8% Hispanic, 19% White, 0.5% Asian, and 4% multi-racial. About 13% of our school's population are students with disabilities, 75% of our students are economically disadvantaged, and 4% are English Language Learners.

## Overview

---

This four to five-week science unit will be a kindergarten introduction to biomimicry and its prevalence in our everyday lives. Specifically, students will learn how nature has inspired machinery, tools, medicines, and treatments. The students will observe, document, and question many items that they see in their daily lives and will learn how we have mimicked nature to create these things.

After completing this unit, students will be able to identify ways that humans have been inspired by nature, compare living things to nonliving things in our society to examine how they have been inspired by nature, compare medical practices and equipment we use in society to natural medicines/practices, and appreciate what nature has contributed to our society and existence.

## What is Biomimicry and Biodiversity and why do they matter?

---

You cannot talk about biomimicry without mentioning biodiversity because biomimicry cannot exist if there is no variety of organisms to mimic. Biomimicry is a practice that learns from and mimics the strategies found in nature to solve human design challenges. Biomimicry is about valuing nature for what we can learn, not what we can extract, harvest, or domesticate.<sup>1</sup> One thing that everyone can agree on is that nature was here before us and it will continue to be here after us. Nature is resilient and that resilience inspires innovation to solve human problems. Biodiversity is the variety of different organisms on our Earth including different plant and animal species, as well as fungi and microbes. Biodiversity is the wisdom that we have acquired by examining species that have evolved over billions of years, especially how they adapt to survive when environmental challenges arise. (Figure 2) Our daily lives depend on biodiversity from the fruits and vegetables that you eat, to the air that you breathe. For example, without trees and other organisms that undergo photosynthesis and release oxygen as a by-product, we humans would not have adequate oxygen in the atmosphere. Without organisms such as bees, bats, and other pollinators, the flowers would not be fertilized, making these plants nonexistent and removing most fruits, as well as many nuts and vegetables from animal diets. We, as humans, benefit daily from biodiversity and it has even helped us in finding different medicines and treatments for our ailments and illnesses.<sup>2</sup> By understanding we live in a biodiverse world where we (plants, animals, and humans) are connected and dependent upon each other, students will see how these interactions fit the One-Health approach as shown in Figure 1.<sup>3</sup>

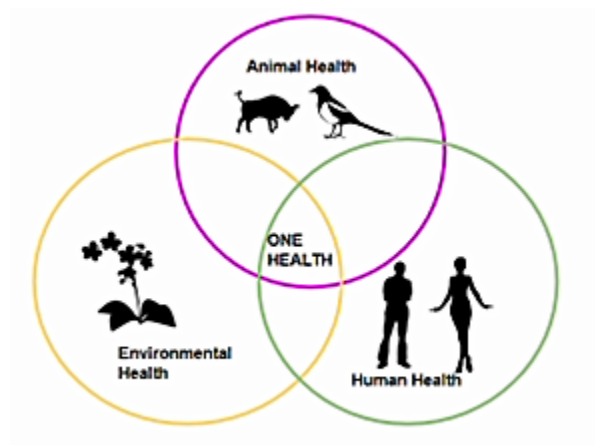


Figure 1: The One-Health Approach is an integrated and unified approach that aims to sustainably balance and optimize the health of people, animals, and ecosystems. It acknowledges that the health of people, animals, plants, and the environment are closely related and interdependent.



Figure 2: Biodiversity is the variety of life on Earth. Biodiversity does not only pertain to the different species of plants and animals, but it also includes bacteria, microbes, and the environment/ecosystems.

## Biomimicry and Medicine

<p>Yew Tree</p> 	<p>Taxol</p> 
<p>Purple Foxglove</p> 	<p>Digoxin</p> 
<p>Poppy Flower</p> 	<p>Codeine &amp; Morphine</p> 
<p>Mint Plant</p> 	<p>Menthol</p> 

Figure 3: Examples of Biomimicry and medicine. Shown on the left are the plants that have inspired different medicines. Shown on the right side are the medicines that have been created by mimicking the various plants.

It is vital to understand the definitions of traditional and herbal medicine because many times these terms are either confused with one another or thought to be one idea. Traditional medicine is the sum of total knowledge, skill, and practices based on theories, beliefs, and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvements, or treatment of physical and mental illness. Traditional medicine is used by many of the world's population and many places have integrated traditional medicine into their public health care. Herbal medicines include herbs, herbal materials, herbal preparations, and finished herbal products.<sup>4</sup> Traditional medicine, herbal medicine, and biomimicry have been combined to help treat and cure ailments both physical

and mental.

Traditional medicine can be broken up into six categories which are:

1. Legendary Traditional Medicine
2. Instinctive Traditional Medicine
3. Witchcraft Traditional Medicine
4. Empirical Traditional Medicine
5. Theoretical Traditional Medicine and
6. Integrated Traditional Medicine.

During this unit, we will focus more on empirical traditional medicine which can be described as medicine derived from or guided by direct experience or experiment rather than principles or theories. For one to practice or understand empirical traditional medicine, they are required to have certain experience such as medical experience. Medical experience is the recognition of life, health, and disease compiled by ancient ancestors in the practice of production and life.<sup>5</sup> An amazing example of this would be the use of fire and stones and combining the two to create healing stones. Our ancestors used fire to cook, stay warm, and keep animals and predators away. They eventually began sharpening the stones to use to fight the animals and predators. Through these experiences with both fire and stone, the ancestors noticed that when you apply heat to the stone it could be used to generate warmth on a certain part of the body to alleviate pain or discomfort. It was also discovered that it could be used to burn wounds to prevent infection and expedite the healing process. Ancestors also sharpened stones to make pointed edges to scrape, pick, and stab wounds for treatment, which eventually evolved into the original medical treatment method which is known as stone need therapy.<sup>6</sup>

In the wild, plants cannot defend themselves from predators as easily as other animals. It is not as if they can just get up and run away, use their claws to scratch, or teeth to bite at predators. Though some plants may have thorns or spikes which may deter predators, what about the plants that do not have these features? Simple answer: chemical warfare. Plants create chemicals that will harm their predators to stay safe. These chemicals are called “secondary compounds” which the plant creates that give way to the various flavors, smells, spices, medicines, and poisons that we can see in the plant world.<sup>7</sup> But what happened when we studied these chemicals? We were able to extract certain chemicals that could help humans medically.

It is not just enough for us to study the plants, we also need to observe how other animals interact with the plants, and for what reasons. For example, there were two populations of baboons (*Papio hamadryas*), that lived near Awash Falls in Ethiopia, studied by Jane Phillips-Conroy from Washington University. One population of the baboons was strictly feeding above the falls while the others were feeding below. It was observed that baboons below the falls were more exposed to a fluke worm that causes a debilitating disease in primates, including humans. The baboons who lived below the falls were eating a plant (*Balanites aegyptiaca*) whose berries and leaves have a compound, diosgenin, that is known to be effective against the fluke worm. It was noticed that not only do the baboons who are more vulnerable to the fluke worm were eating more of the berries and leaves than the others. The Native people of that land long ago were also using the *Balanites* to control their infections. This is what leads to the thought that animals are not just using plants as a nutritious source, but as a medical or healing source as well. Thus, leaning us toward traditional medicines taken from these plants.<sup>8</sup>

Another example of observing animals and their medicinal uses of plants is bears and traditional Navajo

teachings, studied by Harvard ethnobotanist, Shawn Sigstedt. In traditional Navajo teachings, it is said that bears gave humans medicines and many of the medicines and practices they use include the name “bear”. The Navajo observed how the bears interacted with one plant in particular: *Ligusticum porter*. This herb that has a vanilla/celery scented smell grows in the Rocky Mountain and Southwest regions of the United States and the purpose of the Navajo using this herb was to treat worms, stomachaches, and bacterial infections. <sup>9</sup>

There was a time when we specifically focused on our biodiverse planet to find drugs and that is how we found 40% of all of our prescription medicines. From the Pacific Yew Tree (*Taxus brevifolia*), we have extracted Taxol which we use to treat ovarian and breast cancer in patients. We have isolated digitalin from the Purple Foxglove (*Digitalis purpurea*) which we use to treat heart failure and other cardiac disorders. From the Poppy flower (*Papaver somniferum*) we isolated codeine and morphine that we use for pain medication. From the mint plant (*Mentha*), we use menthol to treat mild joint and muscle pain. Lastly, the thyme plant (*Thymus vulgrais*) has given us thymol that we use for medical disinfectants and fungicides. These are only a few examples of how we have used biomimicry to find solutions to human medical problems.

## Biomimicry and Tools/Machines

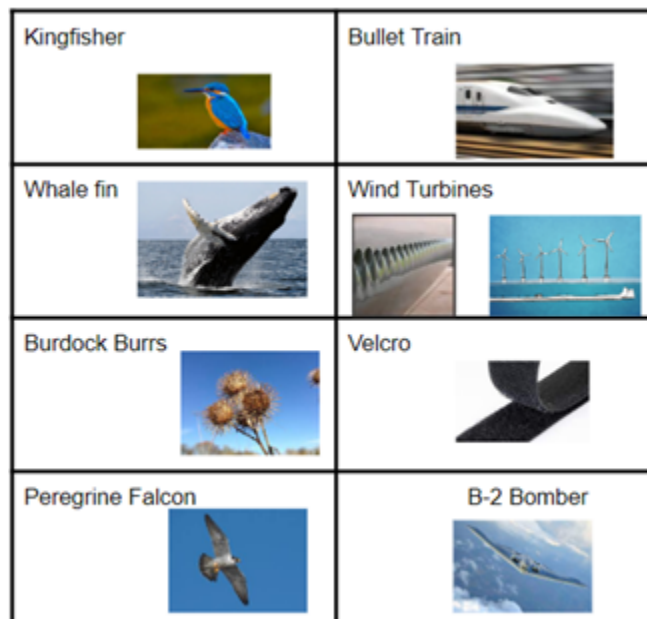


Figure 4: This chart shows examples of Biomimicry with tools and machines. Shown on the right are some examples of tools or machines that have been inspired by nature. On the left side are the inspirations found in nature.

We have been inspired by nature for more than just medicines and drugs, but the tools we use in the medical field as well. You may hear this referred to as “bioengineering.” For example, by studying marine worms that attach to substrates, scientists were able to be inspired and create a more effective surgical glue, or by studying the porcupine quill medical needles were inspired to be more effective. However, it is not just in the medical field that bioengineering is seen. When taking a look at the world around you, you may be shocked to realize how much of our world has been inspired by the natural world.

There are two ways that we are inspired by nature for technology: we may either be inspired by the function or the form of nature. During this part of the unit, I will be specifically talking about animals and their inspiration for human machinery and tools. When we are inspired by function, we are creating our machine or tool based on how that animal operates focusing more on behavior, while when we focus on the form we are inspired by how an animal may look or certain physical features that we would like to mimic. There are several animals that humans have been inspired by both in function and form.

Birds have been inspiring inventions for a very long time. Several different types of birds have been studied for many of our different airplanes as well as flight patterns. Airplanes and other flying machinery can be easily seen as one of the most obvious examples of biomimicry. The way that birds are shaped, how they use their wings, and how they sail through the air have all been studied and then mimicked in modern airplanes. Hummingbirds have been a major influence on hovering drones and how they operate. Hummingbirds are masters at moving quickly in any direction and floating or hovering over flowers to drink nectar. By studying their wing frequency, bioengineers were able to design drones to have this same ability. Another bird studied for its function as well as form was the Kingfisher bird. Kingfishers have the ability to plunge into the water, in search of food, without making a splash because of their long, pointed beaks. After studying this closely Japan's 500 series Shinkansen train, a type of bullet train, was designed after the beak of the kingfisher. Mimicking the kingfisher's beak, gave way for the train to move at a top speed of 186 mph and helps the train to be faster, quieter, and even more cost-effective because they require less fuel to use. As a last example of birds and how we have been inspired by them, let's look at the Peregrine Falcon. The Peregrine Falcon is known as a hunting bird and can dive down to get its prey with astonishing speed and when they open their wings it helps to brake their speed to catch their prey. Using what was studied about the Peregrine Falcon inspired the B-2 Bomber plane. By mimicking the B-2 bomber off of the Falcon, the bomber mimicked the sleek shape and modernized body allowing the plane to reach high speeds quickly and quietly making the bomber hard to detect by radars. <sup>10</sup>

Though not mentioned prior, the burdock plant has many different uses medically. However, the burdock burrs were also the inspiration behind what we know today as Velcro. George de Mestral, a Swiss engineer, went out hunting one day when he began to notice that burdock burrs were all over his pants as well as his dog's fur. Regardless of his dog continuously rolling in the grass the burrs would not come off. George de Mestral decided to take a look at this specimen under his microscope to try and determine how it was defying gravity and sticking to not only his pants but to his dog as well. He later discovered that the burdock burrs have an interlocking mechanism that allows them to stay connected to a surface such as animals or cloth. In the wild, when the burdock burrs are sticking to animals, this is to get the seeds to spread about through the area to grow more burdock plants. George de Mestral was inspired to create by this to create what we know today as Velcro for clothes and other uses. <sup>11</sup>

Let's take a moment to discuss how we have been inspired by marine life to create machines that have a major impact on the human world. Many people are already aware that ducks' webbed feet have been the inspiration for flippers which humans use to swim faster in water. However, many people are not aware of how many machines have been inspired by whales. Whales are an inspiration of both form and function when it comes to submarines, as well as wind turbines. Whales have the ability to move underwater with agility and ease due to their sleek bodies, which is why the design of the submarine is based on a whale. If you take a closer look the front of a submarine looks much like the head of the whale and in this front part of the submarine is where all of the mechanical hardwiring or "brain" of the submarine is housed. By studying the whale's flippers, scientists noticed that the flippers have bumps on them called tubercles. These tubercles act as an aerodynamic agent that helps the whale to swim more efficiently in the ocean. When adding tubercle-

like bumps to the backs of the fans on wind turbines it was noticed that wind turbines were more efficient and allowed for more electricity to be produced. Taking a look at one more marine life, beavers have inspired wetsuits. Contrary to whales, beavers and otters do not have layers of fat to keep them warm when they plunge into cold waters, yet they are still able to stay warm and even dry while in the water. Beavers and otters are able to trap warm pockets of air in their thick layers of fur which help to keep them warm and dry. By studying how this mechanism works in their body, bioengineers, and scientists were inspired to make suits for surfers who are constantly coming in and out of the water. <sup>12</sup>

## Now What?

---

Now that we have learned about biodiversity and biomimicry in medicines and machines, what do we do next? Now is the time to begin fostering a sense of appreciation for nature among our students. It is time to have the wonder begin to unfold in the students because the students sitting in your classroom could be the next bioengineers being inspired by nature to solve the future problems of our world. I talked a great deal about medicines used to treat physical ailments, but there are myriad studies that show when students have more access to nature as well as opportunities to interact with nature, this can drastically improve their mental health as well. Spending time in nature has been proven to increase focus, improve moods, and decrease stress. Children who have access to more green spaces in their neighborhoods have a lesser risk of developing mental disorders such as depression, schizophrenia, mood disorders, eating disorders, and substance abuse disorders. The risk of children who have the lowest level of green spaces around them was up 55% compared to children who have more access to green spaces in their neighborhoods and communities. <sup>13</sup>

## Teaching Strategies

---

The goal for this unit is to be able to meet every learner where they are while giving them an introduction to biomimicry. The following strategies will be used: project-based learning, experiential learning, cooperative learning, and comparing and contrasting. Experiential learning, cooperative learning, wonder spots, and comparing and contrasting will come together for the students to complete the project-based learning portion.

**Experiential Learning:** This will be the biggest strategy used in this unit. I want my students to have an active role in their learning as opposed to being lectured by the teacher. Students have an opportunity to be hands-on with what they are learning by going out into nature for observation, using nature to solve problems that we have in our classroom and our daily lives, and taking time to observe how different aspects of nature work with each other.

**Cooperative Learning:** Students will have the opportunity to work together on activities as well as learn from each other and their opinions about how we have been influenced by nature. Working together and having scientific conversations will not only allow the students an opportunity to interact with each other, but it will allow them to bounce ideas off of one another and gain perspectives from others who may live in a different environment from them and may see different things inspired by nature. Cooperative learning, also gives me,



as the teacher, an opportunity to hear more conversations of the students because I will be able to move about the classroom and intervene in groups when needed.

Comparing and Contrasting: Students will be comparing and contrast medicines and tools/machines with living objects in nature using anchor charts, graphic organizers, and discussion.

Wonder Spots: This strategy will allow the students to be outside and choose their own spot to listen, feel, smell, and see nature around them. Students will take the time to notice what they see in nature that is similar to what they see in their homes, classroom, and daily lives. The beauty of this strategy is that students will return to the same spot multiple times throughout the unit which will allow them to build upon their prior thoughts, opinions, and knowledge to discover different similarities between the natural world and our world.

Project-Based Learning: My students will then take the four strategies mentioned above and turn them into a project at the end of the unit. The Students will be presented with a problem that we can find a nature-based solution. They will be required to use critical thinking skills, cooperation, problem-solving skills, and a variety of communication to solve the problem that they will be given.

## **Classroom Activities**

---

The main goal for all classroom activities for this unit is for students to be engaged with each other and nature around them.

### **Activity One- Compare and Connect**

---

Objectives:

1. Students will be able to identify similarities and connections between animals, plants, tools, machines, and medicines.
2. Students will learn the definition of biomimicry and explain it in their own words.

Materials: Pictures for biomimicry (digital or printed) Classroom Timer

Plan:

This first activity will be a part of the introduction lesson for students. The most important part of this lesson is to not give the students answers or things to look for to compare and connect. The point of this activity is for students to have authentic conversations with their peers and teacher about what they notice in the pictures.

In the classroom, there are two ways that I believe will be the most effective in carrying out this lesson. The first option is whole group instruction combined with the Think, Pair, Share strategy. I will have students come to the carpet and explain to them that today we will be looking at groups of pictures and we want to compare and connect the pictures. I will project a picture of an airplane and a bird and ask the students to first think of

some attributes that are the same. I will give the students 1 minute to talk with their shoulder partner about what they noticed that was the same. While students are talking I will be circulating the carpet to hear the different discussions. After the one minute is up I will call on two pairs to share the similarities that they noticed and repeat this process for 2 more sets of pictures.

The second option is to split the students up into groups of three or four and have the pictures in different spots of the classroom and have the groups talk among each other and find the similarities between their two pictures. After the students have had time to discuss, we will come back to the carpet and each group would present the similarities that they found.

After the compare and connect. I would explain to the students that the pictures we looked at are all examples of biomimicry. I would teach the definition, have the students repeat it, and ask them to tell me in their own words. To add some literacy to our activity, I would also ask about the beginning sound of biomimicry, how many syllables the word has, etc.

## Activity 2- Mimic Matching

---

Objectives:

1. Students will be able to describe what biomimicry is.
2. Students will be able to accurately match machines and tools to the animals that have inspired the creation.

Materials: Pre-cut out pictures of machines/ tools and animals (4 matches per group; pictures may vary per group), Anchor Chart Paper, Glue sticks, and Classroom Timer

Plan:

To prepare for this activity with students, I will pre-cut the pictures and place them into a sandwich bag for each group. Each group's anchor chart paper should be divided into 4 parts. After the materials are prepared, I will have pre-planned groups for the students. The students and I will begin on the carpet and think back on the previous activity/lesson as well as review the definition of biomimicry. I will explain to the students how in the previous lesson we looked at pictures to compare and connect, but during this activity, they will be in charge of matching the correct nature inspiration to the machine or tool and explain their thinking or reasoning. I will give the students roughly ten minutes to work collaboratively on the anchor chart and discuss the reasoning behind their decisions. Once each group has completed its anchor chart and has had time to discuss their reasoning, we will meet back on the carpet for groups to share. If each group had different pictures, each group will have an opportunity to share, however, if each group had the same pictures then each group would share their favorite match. To close out this lesson, we would review some of the groups' anchor charts and review the definition of biomimicry.

## Activity Three-Mimic Who?

---

Objectives:

1. Students will be able to identify characteristics from animals that would be best mimicked to solve problems.
2. Students will be able to describe what biomimicry is in their own words.

Materials: Pictures of various animals (digital or printed)

Plan:

This activity will be game based. The students will be engaged in the game “Would You Rather? The Biomimicry Edition”. During this game, students will be posed with a problem and have to determine which animal would be better to mimic in order to solve the problem. For example, if you were trying to be a fast swimmer would you rather mimic a duck or a cow and why? Students will be given think time to answer the question independently and then using equity sticks I would call on 2-3 students to share each question.

## Activity 4- Nature Walk

---

Objectives:

1. Students will have an opportunity to enjoy and appreciate nature.
2. Students will be able to find at least one example of biomimicry while on the nature walk.

Materials: paper, clipboard, pencil/crayons

Plan:

After reviewing the past activities and the definition of biomimicry again, I will explain to the students that we will be taking a nature walk. The purpose of this walk is not only for the students to be able to identify one way that they see biomimicry in our community, but this is also to give students an opportunity to be outside to enjoy, appreciate, and observe nature and their community. Students will each have a clipboard, paper, and a writing utensil on their paper students will draw pictures of things that they see during the walk that may have been inspired by nature. After spending some time outside, I would invite the students back into the classroom and allow the students to discuss with their tables what they saw and how they felt during the walk. We will have a discussion as a class and share out many of the ideas that students saw that they thought were examples of biomimicry. I will collect the papers as well to ensure that I see work from each student, even if they did not get the opportunity to share.

## Bibliography

---

- American Museum of Natural History. 2014. "What Is Biodiversity? Why Is It Important? | AMNH." American Museum of Natural History. 2014.  
[https://www.amnh.org/research/center-for-biodiversity-conservation/what-is-biodiversity#:~:text=The%20term%20biodiversity%20\(from%20%E2%80%9Cbiological](https://www.amnh.org/research/center-for-biodiversity-conservation/what-is-biodiversity#:~:text=The%20term%20biodiversity%20(from%20%E2%80%9Cbiological).
- Anonymous. "Beaver-Inspired Wetsuits in the Works." n.d. MIT News | Massachusetts Institute of Technology.  
<https://news.mit.edu/2016/beaver-inspired-wetsuits-surfers-1005>.
- Benyus, Janine M. 2002. *Biomimicry: Innovation Inspired by Nature*. New York, NY: Perennial.
- Engemann, Kristine, Carsten Bøcker Pedersen, Lars Arge, Constantinos Tsirogiannis, Preben Bo Mortensen, and Jens-Christian Svenning. 2019. "Residential Green Space in Childhood Is Associated with Lower Risk of Psychiatric Disorders from Adolescence into Adulthood." *Proceedings of the National Academy of Sciences* 116 (11): 5188–93. <https://doi.org/10.1073/pnas.1807504116>.
- Hamilton, Tyler. 2008. "Whale-Inspired Wind Turbines." *MIT Technology Review*. March 6, 2008.  
<https://www.technologyreview.com/2008/03/06/221447/whale-inspired-wind-turbines/>.
- Liu, Wenxian, Jingling Le, and Jingcheng Dong. 2022. Review of Unprecedented Reorganization of Developmental History of Traditional Medicine: Part II 0 (January): 1–8.
- World Health Organization. 2015. "Biodiversity and Health." WHO. June 3, 2015.  
<https://www.who.int/news-room/fact-sheets/detail/biodiversity-and-health>.

## Endnotes

---

<sup>1</sup> <https://biomimicry.org/what-is-biomimicry/>

<sup>2</sup> [https://www.amnh.org/research/center-for-biodiversity-conservation/what-is-biodiversity#:~:text=The%20term%20biodiversity%20\(from%20%E2%80%9Cbiological,cultural%20processes%20that%20sustain%20life](https://www.amnh.org/research/center-for-biodiversity-conservation/what-is-biodiversity#:~:text=The%20term%20biodiversity%20(from%20%E2%80%9Cbiological,cultural%20processes%20that%20sustain%20life).

<sup>3</sup> [https://www.who.int/health-topics/one-health#tab=tab\\_1](https://www.who.int/health-topics/one-health#tab=tab_1)

<sup>4</sup> [https://www.who.int/health-topics/traditional-complementary-and-integrative-medicine#tab=tab\\_1](https://www.who.int/health-topics/traditional-complementary-and-integrative-medicine#tab=tab_1)

<sup>5</sup> Lui, 2

<sup>6</sup> Lui, 6

<sup>7</sup> Benyus, 147-149

<sup>8</sup> Benyus, 166

<sup>9</sup> Benyus, 167

<sup>10</sup> <https://chirpforbirds.com/nature-advocacy/biomimicry-and-birds/>

<sup>11</sup> <https://gardencollage.com/wander/gardens-parks/plant-behind-velcro/>

<sup>12</sup> <https://news.mit.edu/2016/beaver-inspired-wetsuits-surfers-1005>

<sup>13</sup> <https://www.pnas.org/doi/10.1073/pnas.1807504116>

## Teacher Resources

---

Benyus, Janine M. 2002. *Biomimicry: Innovation Inspired by Nature*. New York, NY: Perennial.

This is a great book to do a deep dive into learning about biomimicry to build more background knowledge.

Biomimicry Institute. 2013. "The Biomimicry Institute – Inspiring Sustainable Innovation." Biomimicry Institute. 2013. <https://biomimicry.org/>.

This website is a fantastic resource full of definitions, examples, and images to use with students.

Natterson-Horowitz, Barbara, and Kathryn Bowers. 2013. *Zoobiquity : The Astonishing Connection between Human and Animal Health*. New York: Vintage Books, A Division Of Random House, Inc.

This is a wonderful book to learn more about the idea of the One-Health Approach.

<https://www.mentalfloss.com/posts/inventions-inspired-by-nature>

This article is an easy read and will give several different examples and pictures of biomimicry.

<https://thewatershed.org/wp-content/uploads/2020/04/Natures-Copycats-Take-Home-booklet.pdf>

Here you will find some lesson plan activities to do with students as well as definitions, examples, and images.

<https://bigideas4littlescholars.com/biomimicry-for-kids-activities-and-resources-k-3/>

Here you will find some engaging activities to do with students about biomimicry.

## Student Resources

---

Nordstrom, Kristen, and Paul Boston. 2021. *Mimic Makers: Biomimicry Inventors Inspired by Nature*. Watertown, Ma: Charlesbridge.

This is a beautiful book with examples of biomimicry and even includes the inventors. This is a great book to focus on one machine/tool a day.

Ansberry, Karen. 2020. *Nature Did It First*. Dawn Publications.

This is another book with beautiful images that gives multiple examples of biomimicry and includes STEM activities as well.

Brody, Walt. 2021. *How Is a Turbine Like a Whale Fin?* Lerner Publications TM.

Here is another student-friendly book that shows examples of biomimicry.

Dorion, Christiane. 2021. *Invented by Animals: Meet the Creatures Who Inspired Our Everyday Technology*. London: Wide Eyed Editions.

This is a cute and cartoon-styled book that shows examples of biomimicry and focuses on animals.

Herba, Gosia. 2022. *Powered by Plants: Meet the trees, flowers, and vegetation that inspire our everyday technology*. London: Wide Eyed Editions.

This is another cartoon-styled book that shows examples of biomimicry and focuses on plants.

“Play the Biomimicry Memory Match Game.” n.d. LRNG. Accessed August 4, 2023.  
<https://www.lrng.org/lrng-columbus/activity/play-the-biomimicry-memory-match-game>.

This is a great extension activity, it is a memory match game with pictures for students to match the invention to the animal that has inspired it.

“LESSON PLAN INSPIRED by NATURE (BIOMIMICRY) GRADES K-2.” n.d. Accessed August 4, 2023.  
<https://www.generationgenius.com/wp-content/uploads/2019/06/Biomimicry-Lesson-Plan-GG.pdf>.

This resource has an example of a lesson plan about biomimicry that can be used for grades kindergarten through second grade.

## Appendix-Implementing District Standards

---

### Science

K.6 The student will investigate and understand that there are differences between living organisms and nonliving objects. Key ideas include:

- a. all things can be classified as living or nonliving; and
- b. living organisms have certain characteristics that distinguish them from nonliving objects.

K.10 The student will investigate and understand that change occurs over time. Key ideas include

- a. natural and human-made things change over time;
- b. living and nonliving things change over time;

## **English Language**

K.1 The student will build oral communication skills.

- b. Begin to initiate conversations.
- c. Begin to follow implicit rules for conversation, including taking turns and staying on topic.
- d. Listen and speak in informal conversations with peers and adults.
- e. Participate in group and partner discussions about various texts and topics.
- f. Begin to ask how and why questions.

K.8 The student will expand vocabulary.

- a. Discuss meanings of words

K.12 The student will write to communicate ideas for a variety of purposes.

- b. Draw pictures and/or use letters and phonetically spelled words to write about experiences.
- c. Use letters and beginning consonant sounds to spell phonetically words to describe pictures or write about experiences.
- d. Write left to right and top to bottom.

---

<https://teachers.yale.edu>

©2023 by the Yale-New Haven Teachers Institute, Yale University, All Rights Reserved. Yale National Initiative®, Yale-New Haven Teachers Institute®, On Common Ground®, and League of Teachers Institutes® are registered trademarks of Yale University.

For terms of use visit [https://teachers.yale.edu/terms\\_of\\_use](https://teachers.yale.edu/terms_of_use)