Biomimicry

Primary Audience: Any

Resources include the Biomimicry Institute and Design from Nature by Mary Lord

Video: Watch the video Science Now: How Do You Make Velcro?

Description: In this activity, learners will have the opportunity to investigate the question, “How does nature do it?”

Scientists have learned that many problems we face today have already been solved in nature! An in-depth analysis of how exactly these problems are solved in nature has led to some very exciting innovations. When we face challenges, it can be helpful to see how nature has solved similar challenges and use what we learn from nature to build solutions. When people model their own inventions, materials, structures, and processes after biological entities and processes, they are participating in something called biomimicry. Biomimicry is a way to mimic, or imitate, nature.

In this activity, learners will investigate some examples of biomimicry. Then, they will take a moment to step into nature and observe, looking for and appreciating the incredible structures and processes utilized by organisms every day.

Part 1: Exploring Examples of Biomimicry

Objective: Learn some examples of biomimicry as you guess what invention was inspired by each natural entity or process.

Materials:
- Biomimicry Cards (print and cut out)

Instructions:
1. Watch the video and discuss the definition of biomimicry in the description. Does anyone know of any examples of biomimicry?
2. One at a time, pick up the biomimicry description cards and read the description on the card. Discuss what you think it might have inspired.
3. Once you have read through them all, look at the answer cards and try to match them with the correct descriptions.

Extension: Do some research on your own to find other examples of biomimicry. What other examples of biomimicry can you find online? At the end of this lesson, in Additional Resources, are a few websites that might help you get started.
Part 2: Listen to Nature

Objective: Take some time to experience nature with your senses. Use a journal to detail what you see.

Materials:
- Notebook or journal
- Pen, pencil, colored pencils and/or crayons

Instructions:
1. Walk outside and find a place where you would like to observe nature. This could be at a park or even in your own backyard. Silence any distractions, like cell phones.
2. Once you have chosen your spot, close your eyes. Take a moment to be completely quiet. Adults, talk your young learners through paying attention to what they are hearing, smelling, the way the air feels on their skin, and even the ground beneath them. Organisms in nature rely on a lot of their senses besides eyesight to understand what is going on in the world around them.
3. After a few minutes, share with one another what you all observed while your eyes were closed. Did anyone feel more in-tune with what was going on around them? Discuss.
4. Now break apart, making sure everyone has their own journal and writing utensil. The goal is to quietly observe nature (with eyes open this time) while taking notes in your notebook. Instruct learners to think about the following prompts:
   a. When looking at an organism, think about what functions are most important to their survival (e.g. finding food, conserving water, keeping warm, staying camouflaged, etc.)
   b. Keeping survival strategies in mind, what strategies do you see the organism using to do those things?
   c. Record your findings in your journal in words and drawings. You may want to snap a photo of the organisms you have observed.
5. After sufficient time observing nature, come back together and share your observations. Did you learn anything from nature today?

Extension: The article “Getting to Know Nature,” from Mother Earth News, provides more detailed advice on observing and journaling about nature.

Extension: If you enjoyed this, consider keeping a more regular nature journal! You could observe nature and take notes often – you will probably learn a lot from the world around you!
Biomimicry Description Cards

1. Ever notice how water beads up on lotus leaves? Tiny, nanoscopic waxy bumps on the surface make it superhydrophobic – water will not stick to it. Dirt on the surface, however, will easily stick to the water. This has inspired many inventions. What are they?

2. Engineer Eiji Nakatsu, who was an avid birdwatcher, noted that the kingfisher is capable of diving from air into water creating nearly no ripples (which might frighten away its dinner!) He applied this technique to improve what existing technology?

3. After returning from a hunting trip in 1941, George de Mestral found himself tasked with removing burrs from his dog. His curiosity and subsequent investigation into how the burrs worked led to what invention?

4. Some desert beetles are built to get water daily with very little effort! Their backs are covered in bumps and grooves. The beetle can stand in fog with its back curved, allowing water droplets to accumulate and slide toward its mouth. What type of technology did this inspire?

Biomimicry Answer Cards

Answer:
Waterproof clothing and self-cleaning glass

Answer:
A water bottle!
This water bottle is designed for camping and can be left out at night to collect dewdrops, which will drip through a cleaning filter and into the reservoir.

Answer:
The bullet train!
(A new design reduced the loud noise, “tunnel boom” created by the sudden increase in air pressure when the train enters a tunnel.)

Answer:
Velcro

Get to Know Nature

October/November 2006 Issue #218

By Jena Ball

In today’s accelerated world, it’s important to take time to breathe. Literally, of course, but also to breathe in the sights, scents and sounds of nature: to watch a sunset, walk through a park or get away from the city lights so you can really see the stars shine. Such examples are easy ways to refresh and energize your body and mind. Also, by keeping a journal and practicing a few simple techniques, you can discover a stronger connection to nature. Not only will you observe unique events, you’ll feel more alive — awake to the world around you and attuned to your connections to it.

That we are drawn to and can be inspired by the natural world should come as no surprise. Because human beings evolved in nature, we have an “instinctive love of living things,” according to Edward O. Wilson, the renowned biologist known as “the father of biodiversity.” Wilson calls this instinct biophilia, and says our inherent capacity to “draw deep excitement and pleasure” from nature has been and always will be essential to our survival.

David Petersen, a former Mother Earth News editor and author of On the Wild Edge: In Search of a Natural Life, concurs with nature’s importance to our past, present and future. “The human species evolved alongside fellow animals of every fur and feather,” he says. “Without our fellow animals, we would not be human. Animals and what remains of the wild, natural world are central to our emotional as well as biological well-being.”

What follows are ideas to help you explore your own instinctive responses to nature and become an amateur naturalist. All you need is an open mind, a journal and a commitment to spend time outdoors. Other inexpensive tools could include books, field guides, watercolors and an assortment of colored pens and pencils.

Find a place

In his book A Sense of Place, artist and conservationist Alan Gussow says, “As humans we require support for our spirits, and this is what certain kinds of places provide. A place is a piece of whole environment that has been claimed by feeling.” Choose a place to study that touches your heart and mind — one that piques your interest and evokes a feeling of connection. Depending on where you live, your back yard may be the nearest option. Other possibilities can be almost anywhere and may surprise you — a rooftop garden or a secluded nook at a city park, for example.
Make a commitment

Like all relationships, getting to know a place takes time. The best way to do this is to regularly visit your place, whether it’s every day, once a month or whatever works for you. Even after several visits, you’ll be amazed at how many “new” things you observe each time.

Keep a journal

Keeping a journal of your experiences and observations is easy and rewarding. Journals build knowledge, help with identification of plants and animals and form the basis for reflective writing. And nature journals can include just about anything: thoughts, facts, descriptions, sketches, questions, charts or poetry. Consider these approaches:

Observe. Make a habit of noting the date, time, location, weather, wind, cloud conditions and your overall impressions each time you visit your place.

Draw. Many people hesitate to draw, but don’t worry about the artistic quality of your sketches. Drawing is a great tool for recording information and will sharpen your ability to observe, identify and pick up on subtle details — you’ll come to terms with your subjects in new ways.

- Draw things at eye and ground level.
- Draw things you see overhead.
- Draw whole landscapes.
- Do quick sketches: 15, 20, 30 seconds.
- Do detailed drawings.
- Sketch something and then write notes beside and/or around the sketch.
- Do a series of drawings on one theme, such as the moon’s phases or how your place changes through the seasons.

Make lists. Listing is a way to celebrate your discoveries, organize your thoughts and keep track of information. List what you see, smell, hear, feel, think about — lists can be about anything.

Reflect. Spend time writing about what you’ve observed and how it has affected you. Let your words flow without pausing to revise. Follow threads of thought to see where they take you.

Awaken the senses

To truly observe and appreciate nature, use all of your senses. Try these simple exercises:
Hearing. Sit in silence with your eyes closed for several minutes. Use your hearing to scan your surroundings. Then open your eyes and listen for several more minutes. Try to associate movements with sounds. Write for five minutes without stopping about what you heard.

Smell. Our sense of smell is not as developed as it is in most animals, but what we smell tends to stay with us. Try sitting quietly for five minutes. Take note of various smells and the images, impressions and feelings they evoke. Next, try walking around to see how and where smells change. Repeat this exercise at different times of day and year, and during different kinds of weather.

Touch. The natural world touches us every day, but we seldom notice it. During walks, be mindful of what you feel from wind, moisture, grass, trees, leaves, etc. Then describe the sensations in writing. Write about the texture of things you find along the way, such as rocks. Also compare and contrast opposites, such as the tops and bottoms of leaves.

Sight. There are many ways to see. For example, a specific goal (such as identifying flowers), will determine where and how you focus your attention. Your mood will also affect how and what you see. Here are some ways to change your focus:

Shift from hard to soft focus: This is a bit like daydreaming. Pick one thing and focus on it normally, but put your attention on your peripheral vision.

Focus on colors: How many different colors and shades can you identify? Come up with creative names for them and see if you can create a palette for a particular place.

Focus on outlines: Look at the edges of things?—?think of objects as pictures in a coloring book. Describe how their edges overlap and fit together.

Focus on relationships: Notice the relationships between plants, animals, insects, trees and the weather. Watch how a bee pollinates flowers while collecting pollen; how small birds chase and agitate a hawk or crow; how squirrels jump from one tree to another.

Focus on details: Take one thing — such as a flower — and examine it from all sides noting everything about it: from its color, size and shape, to the various parts and how they connect.

Focus on light and dark: If you squint you will see things as shades of dark and light rather than shapes.

Focus on spaces: Look at the space between two things, such as the gaps between two trees or the petals of a flower. Draw the spaces instead of the physical object — what do they look like?

Additional Resources:
- The Biomimicry Institute, www.biomimicry.org
- Reach out to the COSI Department of Science Content if you have any questions or comments — or if you want to share a photo of your experiment!