Birds and Biomimicry

Oregon State Standards

Science
3.4D.1, 3.4D.2, 3.4D.3

4.2L.1, 4.3S.3, 4.4D.1, 4.4D.2, 4.4D.3

5.2L.1, 5.4D.1, 5.4D.2, 5.4D.3

6.4D.1, 6.4D.2, 6.4D.3

Vocabulary

- Adaptation
- Biomimicry
- Function

Summary: Students will learn about how humans look to nature for ideas to solve problems and engineer solutions.

Time: 90 minutes

Grade Level: 3rd-6th

Goals

- Experience hands-on problem solving
- Explore and observe their surroundings
- Apply their knowledge of organisms' adaptations and natural process to create solutions to human problems

Learner Objectives

Students will… .

- Understand that adaptations are for specific functions
- Practice identifying function in the biological world
- Practice observing designs in nature and applying them to functional solution to human problems and technological challenges

Materials

- General craft supplies: scissors, tape, glue, paper, pen, popsicle sticks, string, and other possibly useful items (balls, wheels, boxes, watches or other items that can be recycled)
- Photos of bird biomimicry examples
- Biomimicry worksheet
- Pencils and clipboards

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Birds and Biomimicry

Background Information

Everything in nature has evolved to meet a specific function. Young birds have fluffy down feathers to keep warm, finches have strong beaks to crack open the seeds they eat, owls have serrate primary feathers that allow for them to fly silently when hunting their prey. Each of these adaptations exists for a specific *function.*

Throughout history people have sought inspiration from nature. There are many functions in nature that we also use, (e.g. fluffy down feathers keep us warm in jackets and blankets, we have created strong nut-crackers) When we copy the designs found in natural world around us we can overcome technological challenges, and this is called *biomimicry*..

In order for young students to understand biomimicry, they must understand that function is the intersection of biology and design. Once students understand the form and behavior of things in nature exist because of a certain function, they can apply this knowledge in thinking about biological solutions to human technological challenges.

Getting Ready

- Locate an outdoor space where students may encounter an assortment of natural objects (school yard, local park, natural area)
- Encourage students to make observation about the natural world and ask "why" questions. Enabling students to ask "why" will lead them to understand *function.*

Biomimicry

If we break down this word;
bio means 'life, or nature"
mimicry means "to copy,"
we can understand that *biomimicry* is when humans copy designs in nature in order to solve problems.

Biomimicry and Sustainability

Immitating nature can allow us to come up with technological solutions that are less wasteful, cleaner for the environment, and healthier for humans.

Encourage students:
Never stop asking *why* and *how* about both the natural and built world around you. You have the power to create your future. Biomimicry is one tool that you can use to help make that future better!

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Birds and Biomimicry

Discuss!

- What is biomimicry.
- What is an adaptation, and how adaptations are related to *function*.
- Examples of biomimicry (see Bird and Biomimicry Pictures)

Investigate

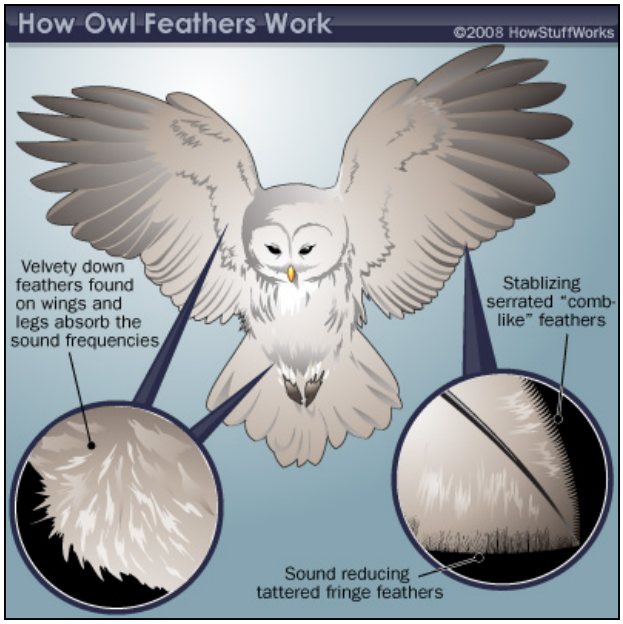
1. Have students spend 5-10 minutes searching an outdoor space (schoolyard, town park, natural area) where they can each find one natural object that comes from an organism (seeds, leaves, lichen, feathers) and appeals to them.

2. Call students back to sit in a circle. Go around and have students share what they found and encourage them to share what *function* or purpose the object has when it is part of the living organism. Encourage them to think about how this function may compare to a function that humans could use.

3. Have the students fill out the Biomimicry worksheet associated with Birds and Biomimicry.

4. Tell the students that they now have time to make their own invention using their object they found, and the observations they made on their worksheet. Have the students make their own 'invention' that applies the function of the natural object to a function that people could use. Tell the students that they can use the object along with the craft materials to make a model or make a diagram of their invention using pencil and paper. Have the students give their invention a *title,* and also at statement of its *function* or use.

For example: A student who finds an owl feather, then 'invents' how airplane wings can be designed to have serrate edges like the owls' wings. The student calls this invention "Airplane Hoots," and creates a model plane with the feather for wings, or they may draw a diagram on paper. The function of this would be to make airplanes quieter during take-off and landing.



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Birds and Biomimicry

Conclusion

1. Have those students who wish to share their invention, show and tell the class what they made. Do they have any further ideas of what they might change if they were to continue working on this invention? Can the think of how their invention relates to anyone elses'?

2. Ask students to reflect on biomimicry and its possible future effects on society.

3. Encourage students to think about how biomimicry can be part of sustainable development by creating less waste, causing less disturbance to habitat, and possibly benefiting the environment.

Classroom Extensions

- Have students further refine their inventions by conducting research on similar technologies or objects. How do their inventions compare to those that exist? What could they do to modify their initial invention and make it better? Consider having a 'Inventions Fair' where students create second draft for a poster diagram or a model of their invention and then have them out on display in the classroom.

Link to KBO lessons

Bird Beak Buffet: learn about how different birds' beaks are specially adapted to their food preferences.

Further Resources

Online Curriculum: Biomimicry Institute available online http://biomimicryinstitute.org/

Books:

Benyus, Janine. Biomimicry: Innovation Inspired by Nature New York, NY. Harper Collins Publishing, 1997

Braungart, Michael and William Donahugh. Cradle to Cradle. New York, NY. North Point Press, 2002

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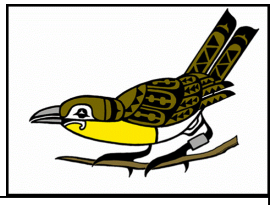

Birds and Biomimicry

Look around for something that *is* or *once was* alive, and also is something that is interesting to you. Observe its characteristics and record as much

Natural Object: _____

Characteristic of object	**Function** (What do the characteristic *do* for the organism?)	**How people can use this <u>function</u>**
Color:		
Shape:		
Texture:		
Other:		
Other:		

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Birds and Biomimicry Pictures

Humans want to fly too:
Throughout history people have been envious to birds' ability to fly. The Wright Brother are credited with inventing and building the first aircraft in 1903.

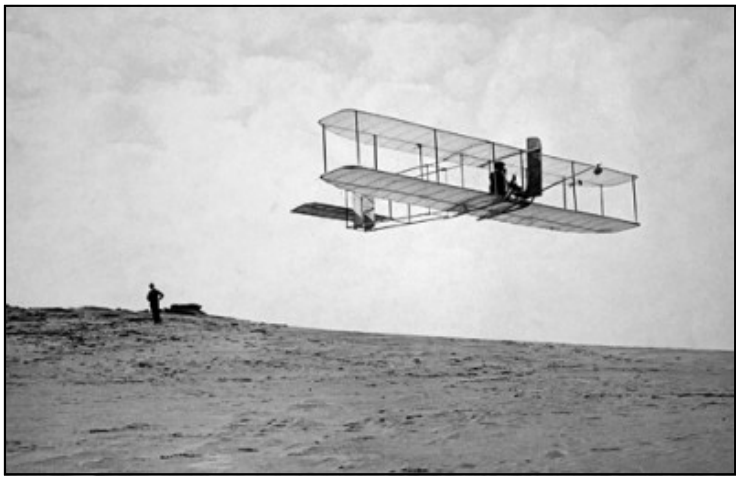

Image by Bettmann/CORBIS.

By flying in a V-formation birds can save energy by creating an updraft for the ones behind them. Some scientists are considering having airplanes do the same thing to conserve fuel use.

Image from Mother Nature Network http://www.mnn.com

High speed trains in Japan can go over 200 miles per hour, and thanks to their beak-like design in the front, they cut down on their noise pollution.

Image from http://mi2.org

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Birds and Biomimicry Pictures

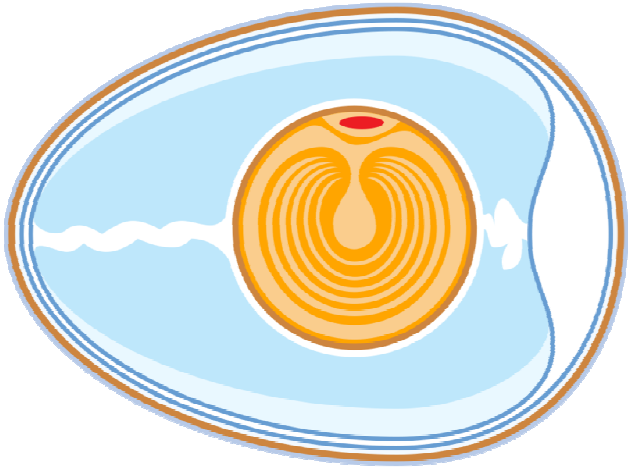
Birds' colors inspire design for lasers:
Some researchers have looked at the microscopic properties of the colors in bird feathers, extremely tiny air bubbles that trap and reflect light Sometimes these microscopic structures of the feather will make a certain color, or iridescence (like the colors in a soap bubble).

Photo copyright © 2012 Jim Livaudais

A couple of physicists at Yale University created lasers using principles of bird feathers interacting with light waves. The way these lasers are made use a natural processes similar to the formation of gas bubbles in a liquid and in result they are cheaper, faster, and easier to produce than other similar lasers. This technology could also be useful in making more efficient and solar cells, cosmetics and textiles.

From http://www.thenewnewinternet.com/

Eggs are little packages:
The embryo is surrounded by a liquid cushion called albumen, and at one end of the egg there is also an air pocket. This design prevents the egg from easily breaking again things or from changes in temperature. The shell is special because it has lots of pores that allow it to breathe. Perhaps human could use these ideas for breathable packaging, filtration systems, breathable building materials, air filters. Maybe your next bike helmet could be more like an egg!



Picture by Horst Frank, Source: http://commons.wikimedia.org/wiki/File:Anatomy_of_an_egg_unlabeled_horizontal.svg

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