



## **Biomimicry: The Genius of Nature**

60 – 90 minutes

In this lesson, students are introduced to the cutting edge field of biomimicry, which is the practice of imitating nature in order to better human life. After learning about real-life examples of biomimicry in action, students choose an animal or ability from nature to develop and design their own sustainable transportation inventions.

### **Objectives**

- Students will describe biomimicry and explain how it informs sustainable design.
- Students will identify examples of modern transportation that borrow ideas from nature.
- Students will develop and design sustainable transportation inventions using the principles of biomimicry.

### **Materials**

- *Biomimicry Handout* (one copy per student)
- *Biomimicry Transparency*

### **Background**

Biomimicry is the practice of imitating nature in order to better human life. The idea of biomimicry has been around for many years. For example, our ancestors watched the birds of the sky and began to conjure ways in which humans might also fly. Today, watching how animals leap, dive, swim, or hang has given us working models for inventions that can be put to good use in the 21<sup>st</sup> century – especially in the area of human transportation.

### **Advance Preparation**

You will need computers with internet access for this lesson. Bookmark the following websites:

<http://www.greeneducationfoundation.org/resources/Amtrak/Amtrak.html>

[www.asknature.org](http://www.asknature.org)

### **Do Now**

Project the *Biomimicry Transparency*, which shows three different flying machines over time. In their notebooks, have students list all the similarities among the three images.



### Mini-Lesson

1. Place students in pairs and have them share their Do Now responses with their partners. Then, invite volunteers to share with the class.
2. Tell students that they may or may not have realized that all three of these examples were inspired by nature. Early inventors and modern engineers have looked to birds and flying insects to imitate their abilities in human flight in a practice called “biomimicry.” Let the students know they will learn more about the principles of biomimicry and how it provides us with ideas for designing more sustainable transportation.
3. Load the following website: [www.greeneducationfoundation.org/resources/Amtrak/Amtrak.html](http://www.greeneducationfoundation.org/resources/Amtrak/Amtrak.html). Project on a large screen for the class. Play the animation, which introduces students to biomimicry and highlights key examples of where modern transportation has borrowed ideas from nature.
4. Facilitate a class discussion about the animation. Ask the following questions:
  - Had you heard of biomimicry before?
  - Did you realize that our modern airplanes were modeled after birds in flight?
  - What most surprised you about the examples shown in the animation?
  - Can you think of any other examples – related to transportation or otherwise – that might have taken inspiration from nature?

### Activity

1. Explain to students that they are going to use the principles of biomimicry to create their own sustainable transportation inventions that borrow ideas from nature.
2. Tell students that one of the key principles of biomimicry is that inventions must be environmentally ethical. For example, a solar-powered vehicle might be modeled after the movement of the sand-crab. This might be a wonderful invention, but if it is used to launch harmful missiles, it is not a true example of biomimicry.
3. Assign each student to a computer and have them load the website: [www.asknature.org](http://www.asknature.org). As a class, follow these steps to find the Biomimicry Taxonomy students will use for their inventions:
  - Locate the heading, “What’s Inside?” on the right-hand side of the page and click on the first link titled, “View all 1400 strategies.”
  - Click on the heading “What is the biomimicry taxonomy?” and review the information that appears on this page.
  - Return to the previous page and click on the “Expand all” tab to reveal the entire list of 1,400 strategies used by nature, grouped by ability/function.
4. Ask the students to pretend that they are inventors who have been asked to develop a new kind of sustainable transportation that does not rely on fossil fuels. They can choose any one or more of the 1,400 strategies listed in the Biomimicry Taxonomy to inform their inventions. Tell the students that when they see something they think might be used for an eco-mobility invention, they should click



on the link to get information on this strategy as seen in nature. Once students have selected their strategies, they can begin developing and designing their inventions.

5. Distribute copies of *Biomimicry Handout* and review the directions with the students. Monitor students as they work. Allow adequate time (about 30 minutes) for students to research taxonomies and create their inventions. Encourage students to be creative, and explain that it is okay to design ideas that we don't yet know how to build.
6. When time is up, have your students share their inventions one at a time. You may want to choose a few of the strongest concepts to post around the room. If time does not permit each student a turn, finish during the next class.

### Assessment

Ask your students this question: *What did you learn about or from nature that you did not know before, especially as it relates to sustainable transportation?*

### Modifications

- Pre-teach unfamiliar vocabulary concepts to **English Language Learners**. Give them a list of important words from the lesson and have them work with a partner to create an illustrated glossary of terms. Each term should include a definition and a simple visual. Consider the following terms for this lesson: biomimicry, ethics, imitation, observation.
- Preselect entries from the Biomimicry Taxonomy that are at an appropriate reading level and length for **Learners Reading Below Grade Level**.
- For the Activity, create heterogeneous pairs to provide additional support for **Students with Special Needs**. Partners should work together to research and create their biomimicry invention.

### Extensions

- Extend this lesson by having students design inventions that address other sustainability-related concerns, such as energy use in the home, building design, landscaping, water use, and so on.