



WHAT IS BIOMIMICRY?

Subject: Biomimicry

Grade Level: 5-8

Topic: Introduction to Biomimicry

Time: 80 minutes

Learning Objectives

Students will:

- gain a basic understanding of biomimicry.
- analyze the qualities and design of an armadillo shell.
- create a prototype that blends the effective design of an armadillo shell and principles of architectural design.

Materials

paper, pencils, styrofoam, scissors, glue, tape, wood, cardboard and any other available recycled material, book “Invented by Animals” by Christiane Dorion and Gosia Herba

Procedure

Engage: To promote student curiosity, show students this video about an armadillo.

🌐 **Armadillos: Animals with Armor!** Discuss the benefits of the armadillo’s hard, bony shell which is called a carapace. Benefits include: protection from predators, defence against thorns or other abrasive brush, and protection from extreme weather.

Explore: To help build student understanding, Ask: *Do you know what the word biomimicry means?* Have students consider the parts of the word “bio” and “mimic” to see if they can come up with the definition. Explain to students that scientists and engineers look to nature to find solutions to problems. Ask: *What*

might an engineer be inspired to create/build based on the armadillo's tough shell? Notice the armadillo-inspired car at the top of this lesson.

Explain: Have students begin to show what they have learned by reading, "Invented by Animals" by Christiane Dorion and Gosia Herba, to the students and then allowing students to share what was most interesting to them about the animal-inspired inventions they have learned about. Lead a discussion about about any other animal-inspired inventions students know about.

Elaborate: Have students use their new knowledge by having students work on the following challenge. Have students work in groups of 2-4.

Tell students: You are an architect who is famous for using biomimicry to solve design challenges. A client in Dallas, TX hired you to build a Cowboy Hall of Fame Museum. The museum will be in an arid climate with little tree cover. The client wants a design that will maximize energy efficiency by keeping the building cool. The museum will face a busy highway, and the client wants a design that will insulate the building from the noise of traffic.

The groups must replicate the following characteristics of the armadillo to meet the client's goals:

- Reflective armor that shields from heat.
- Lightweight materials that protect from the elements.
- Overlapping plates that block out sound but allow for penetration of natural light.
- Groups are to design a model that is no bigger than 1'x 1'

Show the available materials to the class, but they must first design a scale drawing of their model before moving on to building.

Assessment

Evaluate: Evaluate student learning by having students Have each group present their models. Ask: *How did they decide on the design? Was it difficult? How was working in a group, engineers and architects often have to work together. Did any other animals inspire the design while they worked on the project?*

Extension Activities

- Visit a zoo or do a virtual zoo visit and decide how the different animals could inspire an invention.
- Look up unusual plants and decide how they could inspire an invention or a building.

NGSS Alignment

Middle School

MS-LS1-4 - Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.

MS-ETS1-1 - Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution.

MS-ETS1-2 - Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

ETS1.A - Design problems are defined by criteria and constraints such as climate, materials, size, and function.

ETS1.B - Biomimicry is used as a strategy to generate innovative design solutions inspired by nature.



Created by the The Akron Zoo