Biomimicry and Genius Inventions by Montana Tribes - 4th Grade Life Science

Lesson resource on Biomimicry:
https://www.teachengineering.org/activities/view/cub_bio_lesson05_activity1

Montana Science Content Standard:

4-LS1 From Molecules to Organisms: Structures and Processes

<table>
<tr><th colspan="3">4-LS1 From Molecules to Organisms: Structures and Processes</th></tr>
<tr><td colspan="3">Students who demonstrate understanding can:
Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. [Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin. **Each structure has specific functions within its associated system.] [Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.]</td></tr>
<tr><td colspan="3">The performance expectations above were developed using the following elements from the NRC document A Framework for K–12 Science Education:</td></tr>
<tr><td>Science and Engineering Practices
Engaging in Argument from Evidence
Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).
• Construct an argument with evidence, data, and/or a model. (4-LS1-1)</td><td>Disciplinary Core Ideas
LS1.A: Structure and Function
• Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1)</td><td>Crosscutting Concepts
Systems and System Models
• A system can be described in terms of its components and their interactions. (4-LS1-1)</td></tr>
<tr><td colspan="3">Connections to other DCIs in this grade-level: N/A</td></tr>
<tr><td colspan="3">Articulation of DCIs across grade-levels: 1.LS1.A (4-LS1-1); 3.LS3.B (4-LS1-1); MS.LS1.A (4-LS1-1)</td></tr>
<tr><td colspan="3">Montana ELA Content Standards Connection:
ELA/Literacy –
Write opinion pieces on topics or texts, supporting a point of view with reasons and information.</td></tr>
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Procedure:

Divide class into groups of 4
½ of groups get handout #1: What Do These Things Have in Common #1
The other ½ of groups get handout #2: What Do These Things Have in Common #2
Both groups study pictures and try to come to consensus about what their group of pictures have in common.

Combine the two different groups (groups of 8) – they now have to explain what their group of photos have in common to the other group. When both groups are done, the students discuss what they think the whole group of pictures have in common.

Biomimicry lesson/direct instruction – IEFA connection:
Native people learn from animals and mimic animals to invent things to make their lives easier. Take a look at what you just discussed – dams, fish hooks, snow shoes, shelters, baskets, boats – all these things and so much more were built using the animals as the original engineers. The animals showed people how to thrive in the world simply by doing what the animals do best.

Break students into groups of 2, 3, or 4 depending on how your students do when grouped together for their success.

Each group – up to 7 groups total – gets a different set of animal pictures (bat, ant, salamander, snake, badger, merganser, sturgeon – all Montana native species). Give each group Handout #3 Engineering Challenge and one set of animal pictures.

The group task is to think about the animal they have been given and design what could be made to help humans based upon their animal's features or abilities. The students need to complete: a basic design/ drawing of their invention, a written explanation of their invention and how that invention helps people, and a description of how they would test their invention to make sure that it works and to improve their design.

What do these things have in common?

Student Handout #1

**Images open source unless noted*

Image credit: National Wildlife Federation, https://www.nwf.org/

Image Credit: Lloyd Bush / USFWS

What do these things have in common?

Student Handout #2

**Images open source unless noted*

Image credit: Curtis Martin

Engineering Challenge

Student Handout #3

You have been given a series of pictures with an animal. The pictures show you features that the animals has like their feet, skin, and other body parts that help the animal live successfully, like eyes, ears, and maybe wings, tails, or scales.

Your task is to look for a feature of your animal that inspires you. You'll use this feature to invent a tool or item of clothing or something else that is useful to humans. Tools help make work easier. Does the feature you chose help make life easier for that animal? Can you create something like that feature that helps humans? Clothing helps humans survive, is there something about this animal that can be used as an idea for clothing that helps humans? What other crazy ideas might you have?

Please answer all of these questions as a group. Make sure you have enough information so others will clearly understand. Make sure to include a lot of details.

The feature(s) our group chose is:

What inspired you to choose this feature?

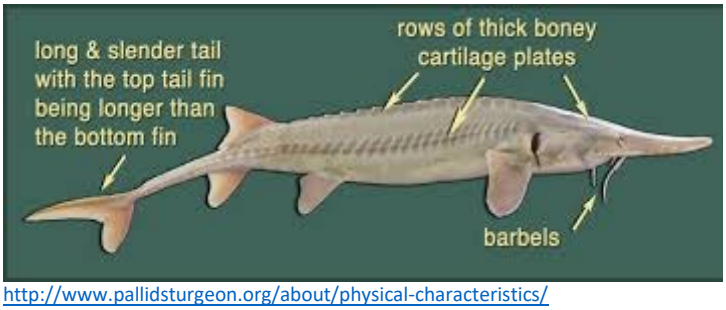
What ideas do you have for your invention?

How is your invention helpful?

Please sketch your invention and label all of the invention's parts. Include in your sketch someone using your invention.

How would you test that your invention works? What kinds of trials (experiments) would you use to test your invention? What kinds of results would show that your invention is successful?

Pallid Sturgeon (*Scaphirhynchus albus*)



http://www.pallidsturgeon.org/about/physical-characteristics/

Image credit: Ryan Hagerty/USFWS

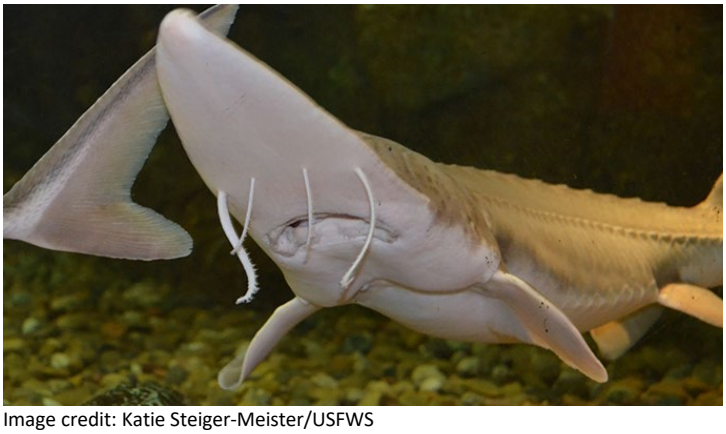


Image credit: Katie Steiger-Meister/USFWS

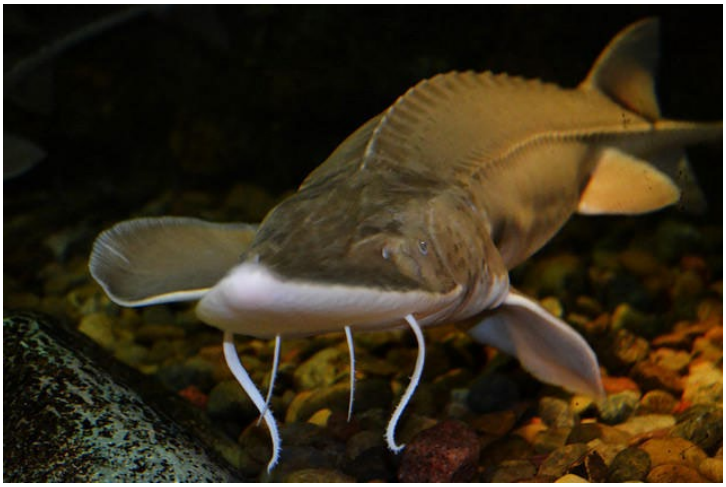


Image credit: Katie Steiger-Meister/USFWS

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Badger (*Taxidea taxus*)

**Images open source unless noted*

By Jonathunder - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=3011851

Carpenter Ant (*Camponotus pennsylvanicus*)

**Images open source unless noted*

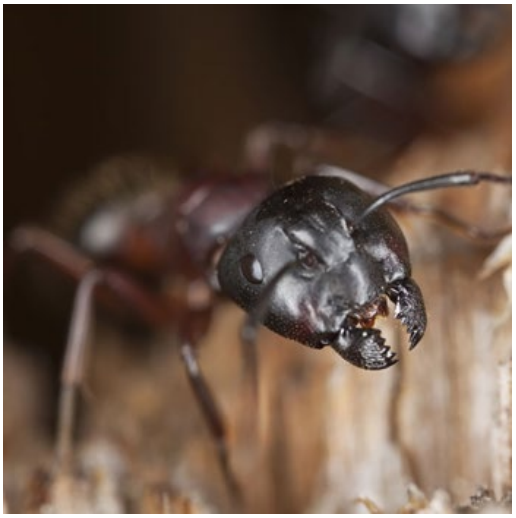

Image credit: https://bugguide.net/node/view/15740

Spotted Bat (*Euderma maculatum*)

**Images open source unless noted*

Image credit: Bat Conservation International/Minden Pictures http://www.batcon.org/

Image credit: National Park Service

Image credit: Dick DeDe, Jr and the Montana Natural History Center

Tiger Salamander (*Ambystoma mavortium*)

Image credit: Gary Nafis/USFWS

Image credit: John P. Clare axolotl.org

Image credit: Ryan Rauscher and Montana Natural Heritage Program

Image credit: John P. Clare axolotl.org

Open source image

Image credit: Montana Natural Heritage Program

Image credit: John P. Clare axolotl.org

Hooded Merganser (*Lophodytes cucullatus*)

**Images open source unless noted*

Image credit: Pieter Kleymeer

Image credit: Steve Voght

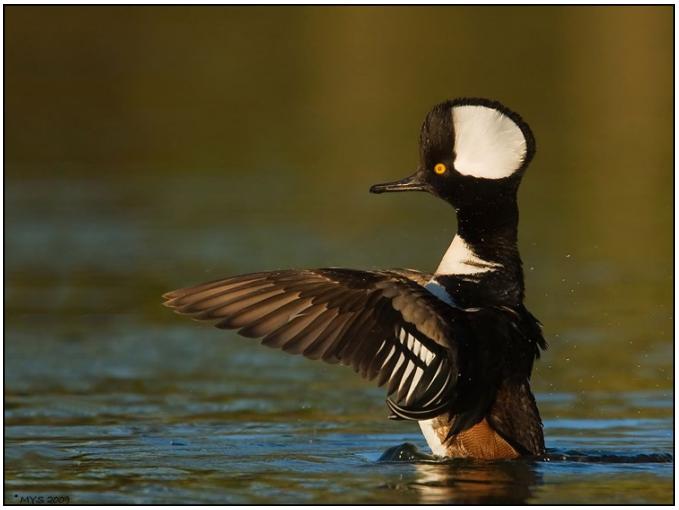

Image credit: Mike Daniels

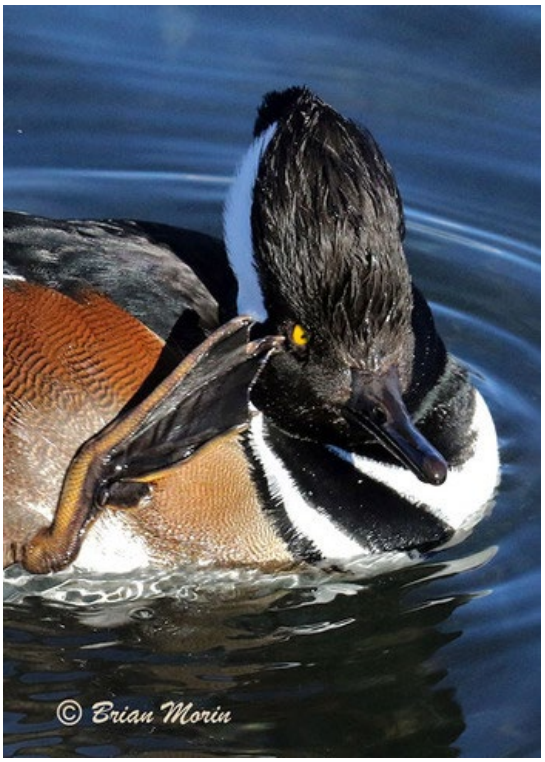

Image credit: Brian Morin

Prairie Rattlesnake (*Crotalus viridis*)

**Images open source unless noted*

Ability to rise vertically and coil

Image Credit: Mack Hitch

Rattle

Image Credit: Mack Hitch

Ability to squeeze into tight places

Image credit: Bryce Maxell

Camouflage

Needle-sharp fangs

Image Credit: Justin Lindsay

Poisonous venom

Ability to expand rib cage after swallowing prey whole

Ability to expand jaws to swallow prey whole