

Biomimicry as an Authentic Anchor - Treasure Exploration Design Challenge (Resource Exchange)

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Biomimicry as an Authentic Anchor (Resource Exchange)



Suggested Grade Levels

Middle School (6th-8th grade)



Estimated Time

2-4 hours (depending on familiarity with the materials and tools)

Design Challenge

There are some treasures hidden underground on the beach that you need to dig for. It's tough and slow if you don't have the correct tools. To solve this problem, please design a biomimetic device that can efficiently dig on the beach to find the treasures.



Inspiration from Nature

- Pocket Gopher (Scratch digging)
- Eastern Mole (Humeral rotation digging)
- Mole Rat (Chisel-tooth digging)
- Pangolin (Hook-and-pull digging)



Learning Goals



- Use the **NGSS** crosscutting concept of **Structure and Function** to analyze how organisms **dig**.
- Build a **circuit** with a **motor** and **batteries**.
- Use simple motors, craft materials, and tools to construct a **physical prototype** with moving parts.
- Implement a **biomimetic design** process.
- Investigate the **strengths and weaknesses** of different **nature-inspired** design ideas.

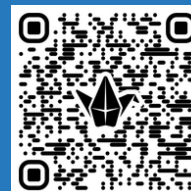
Procedure

Digging

- **Pose** the design challenge.
- **Study** natural organisms that can dig using provided resources on the Padlet.
- Explore the different digging mechanisms.
- **Analyze** their **structure and function** for bio-inspiration.
- Use the provided tools and materials to **build** the device.
- **Test** and **iterate** the design.
- **Reflect** and **share** the final design.

What is Biomimicry?

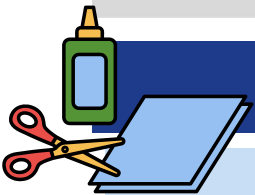
"A practice that learns from and mimics the strategies used by living organisms to solve challenges." (Biomimicry Institute, n.d.)



Design Challenge: Treasure Exploration (Digging)

Structure Function Analysis Worksheet (sample answers)

Organism	Parts that support grasping	Properties or characteristics of those parts	Action(s) enabled by parts and their properties
Gopher	Forearms, Claws	Forearms: Larger volume of muscle. Claws: Strong.	Claws: Breaks the soil. Forearms: Rapid movement. Length change: Creates scratching motion.
Common Mole	Fore feet	Spade-shaped, broad	Move sideways to create swimming movement by rotating motion.
Mole rats and Pocket gophers	Teeth, skull and jaw, forefoot and hindfoot	Teeth: strong and angled forward Skull & jaw: wide, flat, strong muscles Feet: flat pads, smooth, dry	Teeth & jaw: bite roots/soil, dig tunnels, defend, mock fight Feet: shovel soil backward
Pangolins	Claws, Fingers	Claws: Large and elongated. Fingers: Sturdy, "keel and groove" joint.	Claws: hook into cracks. Keel and groove joint: Allows front and back movement.



Tools and Materials



Craft Materials

Construction paper, cardboard, tissue paper, tracing paper, paper clips, craft sticks, pipe cleaners, florist wire, tape, rubber bands, foil, paper cups...

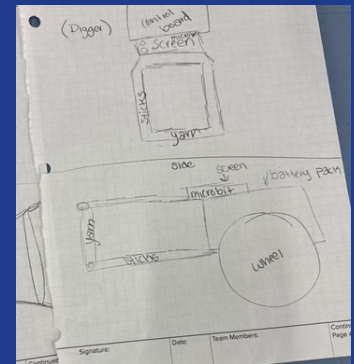
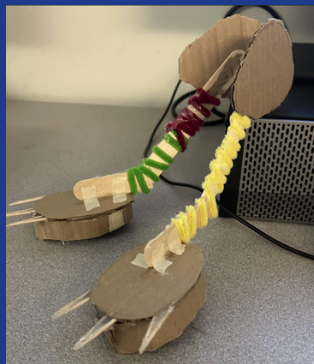
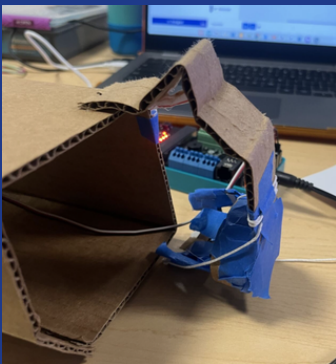
Technology Tools

3-6V DC Motors, AA battery pack, AA batteries, connecting wires... (any other educational robotics kit also works)

Craft Tools

Hole punchers, scissors, hot glue guns, glue sticks, ruler, tape measure

Student Work Examples



Students' projects

Students' worksheet



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