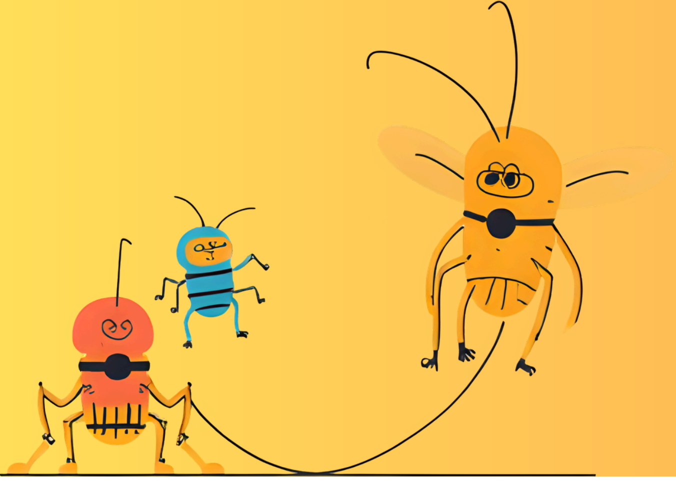
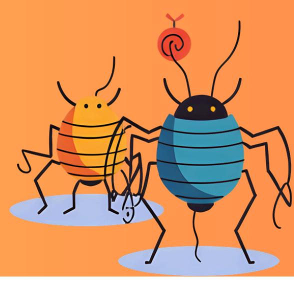


Create a Robotic Insect



Subject: Biomimicry

Grade Level: 5-8

Topic: Adaptations, Engineering Design Process

Time: 60 minutes

Learning Objectives

Students will:

- identify specific animal adaptations and the function of those features.
- explore some of the hostile environments found on earth and animals who have adapted to survive there.
- draw inspiration from animals on earth to design robots to survive in a hostile habitat.

Materials

JPL - Design a Robotic Insect Packets for each team, 17 Resilient Animals That Adapt To Their Environment, pencils, sticky notes, markers, MH cockroaches, building blocks, laptops or tablets, exit surveys.

Procedure

Engage: To promote student curiosity, begin with an animal encounter with a Madagascar hissing cockroach a video or picture will work if you do not have access to the actual insect. Cockroaches are insects that are uniquely adapted to survive very harsh conditions. Explain the adaptations that help them survive. Learn All About Madagascar Hissing Cockroaches

Explore: Help students build understanding by showing students 17 Resilient Animals That Adapt To Their Environment. Hostile earth environments require unique adaptations. Explain that these animals are uniquely adapted to survive in their extreme environments. Ask them what adaptations the animals may have to help them survive.

Explain: Have students begin to show what they have learned by having each group come up with at least 1 insect and list a few of their adaptations on a sticky note. *Ask: What insects have unique or interesting adaptations?* Have them put their sticky notes on the board for the instructor to share with the class.

Elaborate: Have students use their new knowledge by working in teams to design robotic insects. Hand out one **JPL Packet** per team. Instruct students that robots must have a distinct function and each body part must be related to a function. Have students fill out the Robotic Insect worksheets in their packet and draw their design on the supplied graph paper, build using blocks, or render it in Procreate or Tinkercad.

Assessment

Evaluate: Evaluate student learning by allowing time at the end of the session for students to share their creations and to offer feedback to other groups.

Extension Activities

Other organisms students can study include:

- **Arctic** – *Arctic hare*: Their brown coat changes color to white in winter. They have very thick fur and wide feet that act as snowshoes.
- **Oceanic hydrothermal vents** – *Yeti crab*: They live in some of the deepest areas of the ocean where very little life exists due to the very dark, cold conditions. Their bristly hairs do not keep them warm, but instead help them harvest bacteria which they eat.)
- **Mariana Trench** – *Dumbo octopus*: They have a gelatinous body that can withstand the immense water pressure of living at a depth of 13,000 feet. It uses its ear-like fins to slowly "swim," and its arms to steer. Its mouth uses suction to vacuum up worms and snails, which it swallows whole. They have very few predators, so they do not have ink sacs or the ability to use water propulsion to escape.
- **Himalayan Mountains** – *Pika*: They have thick coats and furry soles of feet to stay warm. They do not hibernate, instead they collect and dry wildflowers and grasses to store in their dens for the winter. They can quickly acclimate to lower oxygen levels as they move upslope.
- **Salt lakes** – *Alkali fly*: The larvae burrow in the microbial mat under the water to eat the bacteria/microorganisms. Adults have "hairs" on their body that are hydrophobic, creating an air bubble around their body that allows them to dive in the salty water.

NGSS Alignment

Life Science: Adaptations

MS-LS4-4 - Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

Engineering Design

MS-ETS1-1 - Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles.

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

MS-ETS1-3 - Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each.

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