

BOMBARDIER BEETLE

💡 BIG IDEA

Create a working model of the bombardier beetle's chemical defense mechanism—and consider how this incredible adaptation found in the natural world has inspired chemists to develop useful products.

READY...

Gather materials:

- 3, 6-inch pipe cleaners
- baking soda
- bombardier beetle photos
- colored markers
- disposable plastic pipette (optional)
- glue (optional)
- googly eyes (optional)
- paper
- plastic test tube (or aluminum foil rolled into a tube)
- plate (optional)
- pompoms (optional)
- scissors (optional)
- vinegar

SET...

Pour a small amount of vinegar into the cup. You will need 1 mL (0.0338 oz.) per bombardier beetle “explosion.” You could pour the vinegar into the tube instead of using a pipette.

GO!

1. Decorate the test tube (the beetle's body) however you wish. You can color it with markers and glue on pompoms, googly eyes, or other decorations.
2. Once the glue has dried, wrap the pipe cleaners (the beetle's legs and feet) around the test tube.
3. When the crafting is done, place the beetle in the sink or on a plate with the test tube opening angled upward.
4. Use a rolled-up piece of paper to guide the baking soda into the test tube.
5. Use the disposable pipette to add 1 mL (20 drops) of vinegar to your beetle and observe what happens. (A stream of foamy bubbles should eject from the beetle's abdomen! Just like a real bombardier beetle.)
6. You may add vinegar more than once if you want to.



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WHY IS THIS SCIENCE?

Many of the inventions that make our lives easier existed in nature long before we created them—whether scientists realized it or not. In fact, the natural world is so sophisticated that scientists have used it for inspiration for at least 3,000 years! When scientists intentionally study plants and animals with the aim of reproducing some trait—whether that is a structure, a mechanism, or a substance—it is called biomimicry. The word “biomimicry” has two important components: bio means life (as in biology, the study of life), and mimicry means imitation or copying.

The first step of solving a problem through biomimicry is to translate what you need out of a design into biological terms. For instance, what if you wanted to design a fire extinguisher with a longer range? Where in nature have organisms evolved to deal with a similar problem? Bombardier beetles might not deal with quenching a flaming stovetop, but they have evolved to squirt a heated, explosive stream of venom at predators. Once discovered, the next challenge is to take the lesson from nature and apply it back to your design. In the case of the bombardier beetle, researchers studied the insect’s use of a high-pressure “combustion chamber” in its abdomen. Designers have begun applying this discovery to existing spray technology.

Bombardier beetles are a group of 500 species of small, carnivorous beetles found worldwide (except for Antarctica—but including North Carolina!). Their name comes from their unique defense mechanism. When threatened, bombardier beetles mix two chemicals in their abdomen, causing a violent exothermic reaction that releases heat. The beetle takes aim, and a noxious, boiling liquid literally explodes onto the face of the beetle’s attacker. These two chemicals are hydrogen peroxide and hydroquinone. Since hydroquinone is carcinogenic and genotoxic (and the resulting mixture stinks), this activity uses vinegar and baking soda to create the beetle.

WITH THANKS AND FOR MORE INFORMATION, VISIT:

Information about biomimicry in this activity was adapted from “How Biomimicry Works,” *How Stuff Works* (<https://science.howstuffworks.com/life/evolution/biomimicry2.htm>).

BOMBARDIER BEETLES



Orange County, North Carolina

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Gorongosa National Park, Mozambique

Photo by Judy Gallagher (CC BY 2.0)