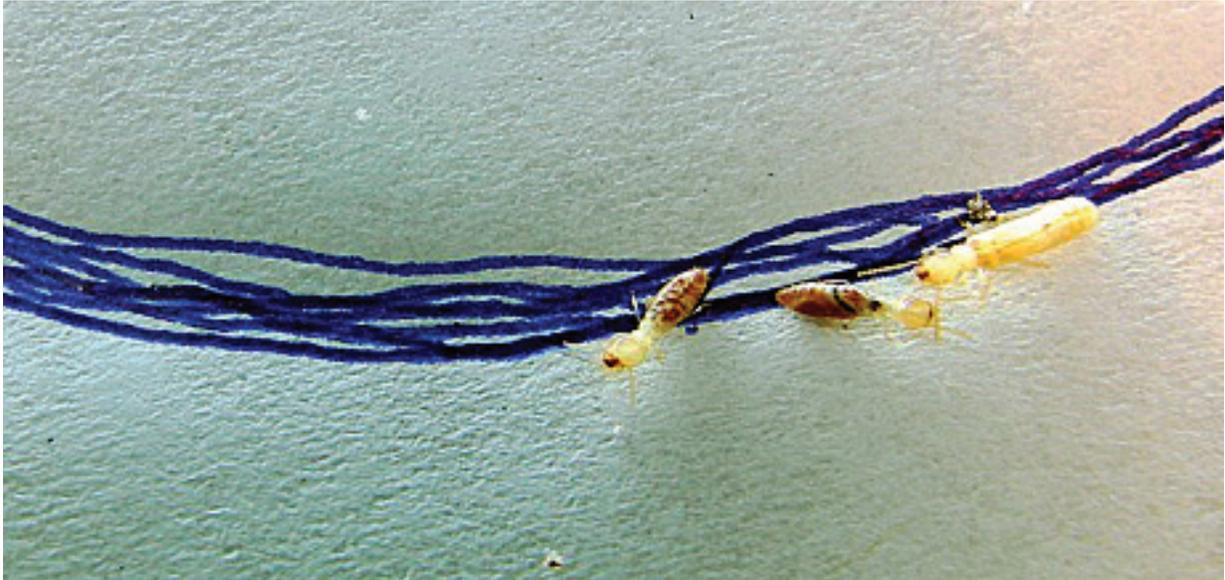


HEADING INTO THE 1st DIMENSION:

Science and Engineering Practices

March 3, 2018 | Pier 15, San Francisco, CA



Termites and Bic Pens

Form testable questions and design investigations by observing termites and ink.

Help students form testable questions and design investigations after observing the behavior of termites around the ink from Bic™ pens.

Tools and Materials

- White paper
- Tray with tall sides
- Assorted writing implements (pens, pencils, crayons, markers): These can be different brands and different colors, but be sure to include a number of different Bic-brand pens.
- Termites: These can be ordered from Carolina Biological Supply or any other scientific supply house. You may also obtain them locally from under a woodpile in your own backyard. Make sure the termites are fresh!
- Paint brushes or Q-tips (to handle the termites and move them gently without squishing them)

Assembly

Draw a figure eight in the center of a piece of white paper with a black Bic pen and place the paper into a tray. Using a paintbrush or Q-tip, transfer five termites onto the white paper near the figure eight. Observe the termites' behavior for a few minutes.

To Do and Notice

After observing, list some things you think may be causing the termite behavior that you see. Some ideas that may come up include: the color of the ink, the shape you drew, the brand of pen, or the type of writing implement. Pick one (and only one) of these variables to test. The other items listed must remain the same in each testing trial. For example, if you choose to test the effects of changing the color of the ink, then for each trial, you'll need to draw the same figure eight and use the same brand and type of pen (in different colors). If you choose to test the effects of different types of writing implements, you'll need to use the same color and draw the same figure eight. For each trial that you run, make observations about what you notice about the termites and their behavior. This way of setting up your experiment will allow you to make a stronger claim about what impacts the behavior of these termites.

What's Going On?

Termites live in colonies with organized social structures, similar to ants and bees. Each class of termites performs specific tasks that benefit the whole colony. Most termites in a colony are workers who forage outside of the nest, help store food, maintain the nest, and defend the colony from potential invaders. Termite workers are blind and deaf, so how do they know where they're going to perform these complex tasks?

Termites don't need functioning eyes to navigate the world around them—instead, they use chemical signaling compounds called pheromones. Pheromones are secreted from glands on the termites' bodies. Different pheromones indicate different messages: finding a mate, warning of imminent danger, locating food sources, etc. Each pheromone has a different structure that is detected by a different receptor located on the termite's antennae. Trail pheromones, for example, are secreted by termite workers leaving the colony to find food. Other termites use the chemoreceptors on their antennae to detect the trail pheromones and “see” the path to the food and the path back home.

It turns out that the ink inside some Bic ballpoint pens includes a chemical compound that mimics the shape and structure of one of the trail pheromones secreted by termite workers. When termites are placed near a doodle drawn with this ink, they follow the lines drawn on the paper as if they were following a path to a food source. You may have noticed that termites do not follow all ink trails. That's because this false pheromone is not found in all pens, just ballpoint pens of a specific brand.