

Pheromones and Termite Behavior

Introduction

Reticulitermes flavipes is just one of several species of subterranean termites native to North America.

Termites are an important part of the decomposer food chain as they help decompose cellulose into nutrients that enter the soil. Subterranean termites have a complex caste system characteristic of a eusocial species. Each member of the colony must be able to communicate with other colony members in order for the entire colony to thrive.

Concepts

- Animal behavior
- Communication
- Pheromones

Background

Termites use pheromones, vibrations, and physical contact to communicate with each other. For example, termites move around and bump into each other and the sides of the colony to transmit alarm to the other members of the colony and to bring soldiers to that area. Special chemicals called *pheromones* may also be used to transmit alarm. Termites produce many different types of chemical pheromones. Some are volatile and become airborne. Others are not as volatile and remain on surfaces where other colony-mates touch them. So their message is transmitted by contact. The alarm pheromone is a volatile type. The pheromone diffuses quickly to give the alarm and then disappears. Volatile pheromones are useful to the colony but it is the longer lasting contact pheromones that humans exploit. For example, contact-pheromone mimics are used as bait by exterminators.

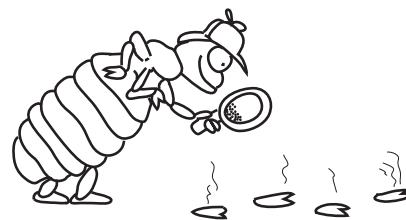


Figure 1.

Contact pheromones eventually dissipate so each termite that successfully follows the trail lays down another layer of pheromone as it returns to the colony. If the termite did not locate food, moisture, or building materials, no new pheromones are deposited so the trail eventually fades and the termites stop following it.

Materials (for each student group)

- | | |
|-----------------------------------|--|
| Water, spring | Pens and pencils, various types and colors |
| Termites | Brush, camel-hair |
| Petri dishes | Paper, various types and colors |
| Filter paper, to fit Petri dishes | |

Safety Precautions

Always treat live organisms with respect and proper care. Termites exhibit negative phototaxis and will dehydrate quickly. Do not allow any termites to escape the testing area. Wash hands thoroughly before leaving the lab. Follow all laboratory safety guidelines.

Preparation

Place a filter paper into each Petri dish and dampen with spring water.

Procedure

1. Choose a sheet of paper and a pen or pencil from the lab supplies provided. Record your choices on the worksheet.
2. Draw a circle on the paper.
3. Use a brush to transfer a termite from the culture jar into a Petri dish containing dampened filter paper. The covered Petri dish will help keep the termite from becoming dehydrated between trials. Return the termite to the original cul-

Pheromones and Termite Behavior *continued*

ture jar as soon as possible.

4. Transfer the termite from the Petri dish to the circle.
5. Observe the termite's behavior for 2–3 minutes and record the observations on the worksheet. Return the termite to the Petri dish between trials.
6. Consider the list of behavior questions below.
7. Choose two to test.
8. Rewrite each chosen question on the worksheet.
9. Record your experimental procedure and observations on the worksheet.
 - a. What type of pencil, ink, paper or other item acts as a pheromone mimic?
 - b. Does the color of the pencil or ink line affect the termite's behavior?
 - c. Does the thickness of the pencil or ink line affect the termite's behavior?
 - d. Does the color of the paper affect the termite's behavior?
 - e. Does the thickness of the paper affect the termite's behavior?
 - f. Does the space between markings affect the termite's behavior?
 - g. Does the time between making marks and starting the experimental trial affect the termite's behavior?
 - h. Do environmental factors such as light, temperature or humidity affect the termite's behavior?

Disposal

Never release live animals into the local environment. They may harbor pathogens that could decimate the local population. Deceased animals may be disposed of according to Flinn Suggested Biological Waste Disposal Method Type IV. Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures, and review all federal, state and local regulations that may apply, before proceeding.

NGSS Alignment

This laboratory activity relates to the following Next Generation Science Standards (2013):

Disciplinary Core Ideas: Middle School

MS-LS1 From Molecules to Organisms: Structures and Processes

LS1.A: Structure and Function

LS1.B: Growth and Development of Organisms

LS1.D: Information Processing

MS-LS2 Ecosystems: Interactions, Energy, and Dynamics

LS2.A: Interdependent Relationships in Ecosystems

Disciplinary Core Ideas: High School

HS-LS1 From Molecules to Organisms: Structures and Processes

LS1.A: Structure and Function

HS-LS2 Ecosystems: Interactions, Energy, and Dynamics

LS2.A: Interdependent Relationships in Ecosystems

Science and Engineering Practices

Asking questions and defining problems

Planning and carrying out investigations

Constructing explanations and designing solutions

Crosscutting Concepts

Cause and effect

Energy and matter

Structure and function

Tips

- Termites purchased from Flinn Scientific are not able to reproduce. Termite colonies attack members of another colony so any escapees will perish from attack or dehydration.
- Classic ballpoint pens from Bic®, Papermate®, and Scripto® all contain the pheromone mimic.
- Termites are unable to digest cellulose without the assistance of symbiotic gut microbes. Extend the lesson by discussing this relationship, then use the same termites as the lab specimens for that lab activity. For more information contact Flinn Scientific.
- For further information regarding proper termite care, contact Flinn Scientific for BioFax 11225, *Care of Termites*.

Materials for *Pheromones and Termite Behavior* are available from Flinn Scientific, Inc.

Catalog No.	Description
FB2098	Follow Those Pheromones Super Value Guided-Inquiry Kit
LM1247	Termites, pkg of 30
AB1470	Petri dishes, pkg of 20
AP3100	Filter paper, 5.5 cm
AB1419	Brushes, camel hair, pkg of 6

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices. Pheromones and Termite Behavior Worksheet

Pheromones and Termite Behavior Worksheet

Initial Trial

Type of paper, pen or pencil

Observations

Behavior Question 1

Procedure

Observations

Behavior Question 2

Procedure

Observations