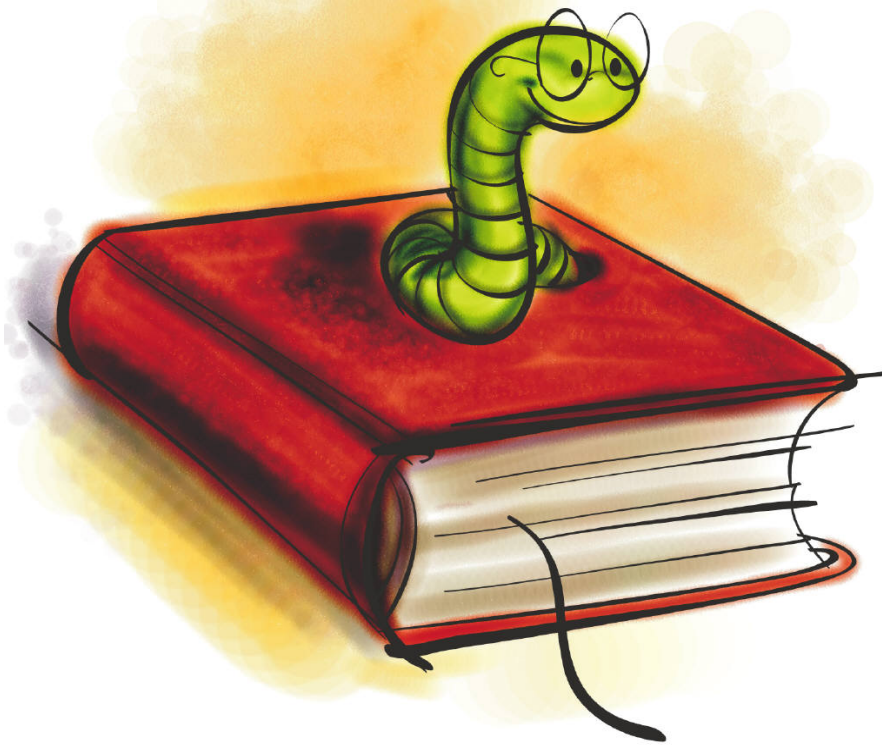


The ABC's of Entomology



UNIVERSITY OF
FLORIDA
IFAS EXTENSION

4-H Entomology School
Enrichment Project



Termite Trails

OBJECTIVES:

Youth will be able to:

- Make a simple hypothesis and prediction.
- Design an experiment.
- Define what a pheromone is and how insects use them to communicate.

BACKGROUND BASICS:

Termites are social insects that live together in large family groups, care for their young, have overlapping generations, and use a division of labor (also known as a caste structure). They communicate with each other through special scent chemicals called *pheromones*. In the wild, termites leave scent trails made up of these pheromones so that they can follow each other. By chance, the inks of Papermate® and Bic® ballpoint pens have a similar compound to the termite pheromones, so that when you place termites on a freshly drawn line made with one of these pens, the termites follow the line.

ADVANCE PREPARATION:

Termites are small, whitish insects that are commonly found throughout the year in Florida under the bark of fallen trees and logs. They live in large colonies and are sometimes mistaken for ants. Collect a few dozen termites using an aspirator (See Appendix C) and place them in a container. Place damp corrugated cardboard in the container. The termites will feed on the cardboard. Make sure the cardboard stays moist—but NOT soaking, or the termites will drown — by misting it with a water bottle until you use the termites. As long as you keep the cardboard moist, they will live several weeks to several months.

ACTIVITY INTRODUCTION:

Tell the youth that you have some very "intelligent" termites that you have taught to read. Write your name or a child's name in cursive on a piece of paper using a black Papermate® or Bic® pen, being sure to connect the lines so there are no loose ends.

Place a few termites on the paper. The termites should soon find the name and follow the lines you have drawn on the paper. Ask the children, "Can termites really read?" Brainstorm some ideas as to why the termites really follow the lines (e.g., they can feel the indentation in the paper, or they see the line, or they like black, etc.).

Let's Do:

Divide youth into groups of three or four. Discuss with the youth the process of hypothesis testing. Hand out the *Termite Trails* worksheet to each group. Have each group fill out Part I of the worksheet. If necessary, do the demonstration over, emphasizing the importance of making good observations.

After each group has completed Part I of the worksheet, have them go on to Part II by forming a workable hypothesis (that is, one that they can actually test) about why the termites follow the line. Example: Termites prefer black pens.

Next the groups should come up with a plan of how they will test their hypothesis. (Part III.) Emphasize the importance of the control, and testing for only one variable at a



MAIN IDEA: Termites use pheromones to communicate with one another.

GRADE LEVEL: 4-6

SUBJECT: Science

SETTING: Classroom with tables or desks

TIME NEEDED: 45 minutes

ENTOMOLOGY SKILL: Using the scientific method

LIFE SKILL: Recognizing Differences

SUNSHINE STATE

STANDARDS:

L.A.C.1.2.3	L.A.C.3.2.2
SC.G.1.2.1	SC.H.1.2.1
SC.H.1.2.2	SC.H.1.2.3
SC.H.1.2.4	SS.A.6.2.5

MATERIALS NEEDED:

- Layers of corrugated cardboard
- Several termites for each group
- Container for keeping termites
- Bic® or Papermate® Pens in assorted colors
- Several other types of writing utensils in assorted colors (i.e. markers, fountain pens, pencils, crayons, etc.)
- Paper
- Copies of Termite Trails worksheet for each group

CONNECTIONS:

Classification, Ecology

VOCABULARY: arthropod,

time. (You may need to remind youth what a "control" is.)

After the groups have completed Part III, they should go on to Part IV, where they must make a prediction about the outcome of their experiment.

Example:

Hypothesis: *If* termites prefer black pens

Experiment: *and I* use different kinds of black pens

Expected outcome: *then* the termites should follow all the black lines.

Help youth to design a table that will allow them to record all data from their experiment. (See example data table.)

Have the youth test their hypothesis, being sure to emphasize the importance of recording all data (even those that did not fit their prediction). You should also emphasize the importance of repeating the experiment.

Discuss the hypotheses of each group as a class and record each group's findings on a class data table, either on the board or an overhead projector.

From the class data table, ask youth to determine which type of writing utensils termites will follow. The youth should

have enough information to deduce that termites will follow Papermate® and Bic® pens (however, occasionally, you may have to do a group demonstration/ experiment to fill in missing information on the data table).

Ask youth to speculate what senses the termites might be using to follow the Bic® and Papermate® pens.

How do we know that the termites are not using sight to follow the lines? (*They didn't follow all the black pens or all the blue pens.*)

How do we know that they are not using the sense of touch? (*They followed different textures of lines; for example, a different type of ballpoint pen does not make the same indentation.*)

Explain that the termites use their sense of smell to follow the lines. Explain that termites communicate with one another through special chemicals called pheromones, and that the Bic® and Papermate® pens have a similar scent to the termite pheromones.

Explain that **pheromones** are special chemicals that many insects have to help them communicate with one another.

Explain that termites are social insects. This means that they live together in family groups just as ants and many bees and wasps do. Termites have several different types of pheromones. The pheromone, which is chemically similar to the Papermate® or Bic® brand pens, is used to mark trails. The pens give off a similar scent trail as termites do.

Example Data Table

Type of writing utensil	Termites followed the line? Yes or No (Trial 1)	Termites followed the line? Yes or No (Trial 2)
Black Bic		
Black sharpie		
Black marker		
Black pencil		
Black fountain. pen		

Example Class Data Table

Type of writing utensil	Termites followed? Group 1	Termites followed? Group 2
List all writing utensils used here	Fill in those that apply to the groups' data	

Let's Reflect:

What other types of pheromones might termites have? (*Alarm, queen, sex/ mating.*)

How do we know that termites follow the lines using their senses of smell rather than sight or touch?

Do different colors of ballpoint pens have the same scent? How do you know?

Why do you suppose termites have trail marking pheromones? When might they use them?

Let's Apply:

Review the steps of the scientific method. Explain that while knowing these steps are helpful, the scientific method is more a way of approaching problem solving than it is a set of rigid steps or rules.

What is a control and why is it important? (*A control is the test run under normal circumstances. It is used to make sure the variable being tested is actually responsible for any results.*)

What is a hypothesis? (*A possible answer to a question or an educated guess.*)

What is the purpose of a data table? Why is it useful?

How did comparing results with the class help answer the question?

When scientists compare their data and the results contradict each other, what should happen?

Think of an example or problem that you might face in everyday life. How could you use the scientific method to help you solve this problem?

Have you ever used the scientific method to solve a problem in everyday life? When?

Notes:



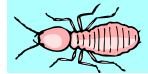
Extensions

Try this: Trail of Scent

Many social insects use pheromones to mark their trails, especially to food and to the nest. Create a “maze” that will lead youth from their “nests” to a food source. You will need 40-50 film canisters, mint (or other strong-smelling) extract, and 40-50 cotton balls. Dip 10-20 cotton balls in the mint extract and place them in film canisters. Place the film canisters in a meandering “trail” leading from one corner of the room to another. Connect the trail with masking tape or yarn. Place the rest of the cotton balls (not soaked in mint) in random places around the room. Connect these containers to the original trail with the same masking tape or yarn to make a maze. Have the youth try to follow the trail by crawling on the floor and smelling the containers.



Termite Trails



Part I. Forming a hypothesis:



Scientists make observations, then ask questions about what they are seeing. For example, you might ask the question, "What types of writing utensils create lines that termites will follow?"



Once a scientist has thought of a question, he or she then forms a **hypothesis** (a possible answer to the question). A hypothesis must be something that is actually testable.



With your group, form a hypothesis as to what types of writing utensils write lines that termites will follow.



Question: What types of writing utensils will termites follow?



Hypothesis: _____



Part II. Designing the experiment



Your group will now design an experiment to test your hypothesis.



1. Describe your **control test**.

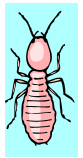
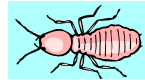
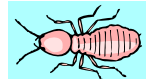
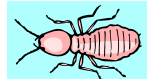
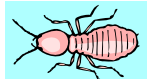
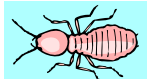
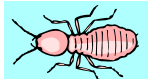




2. Describe your **experimental test**.







Part III. Making predictions

Before you actually carry out the experiment, you should **predict** what you think will happen. Making predictions is part of hypothesizing. Many times the hypothesis and prediction are phrased as an “if-then” statement.



Hypothesis: *If* (write your hypothesis here:) _____



Experiment: *and* (describe your experiment) _____



Expected outcome: *then* (write your prediction here:) _____



Part V. Carrying out the experiment

Now it is time for your group to do your experiment. Remember that part of good science is keeping good records. Design a **data table** to record your results, then carry out your experiment.

