Carolina Biological Supply Company

Phenomenal Classroom Critters

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Session Objectives

- **Employ a 5E learning cycle**
- **Model an anchoring and investigative phenomenon**
- **Gain content knowledge and experience working with planaria, *Daphnia*, termites, and bess beetles**

Let a Simple Learning Cycle Shape the Inquiry

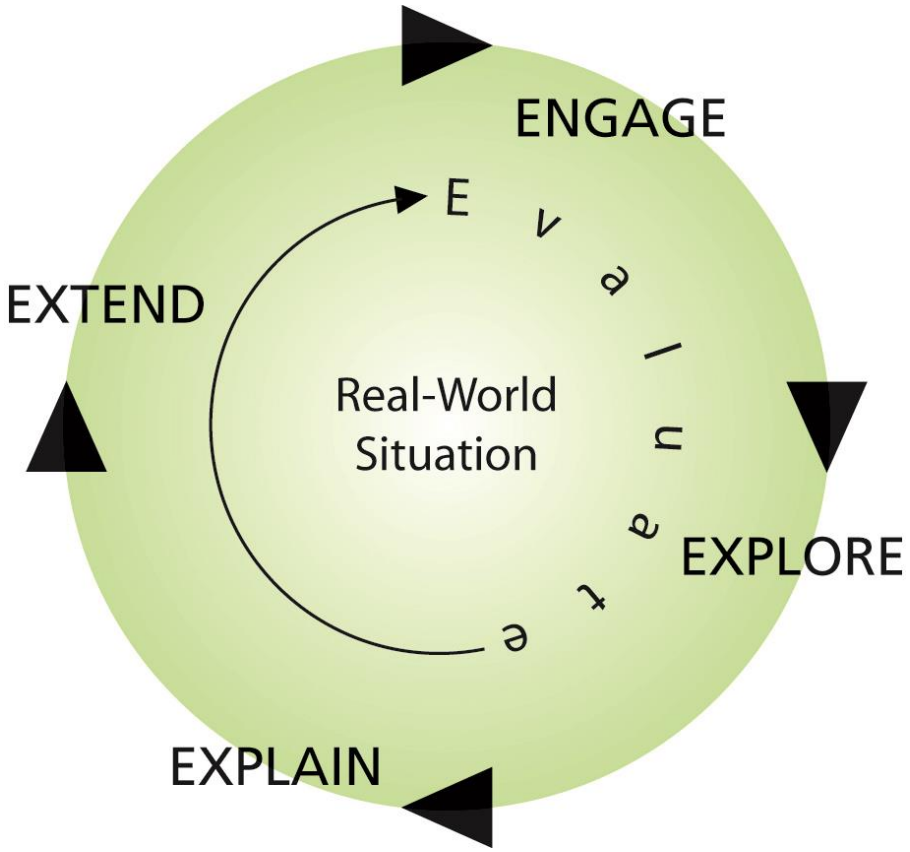
Engage

Explore

Explain

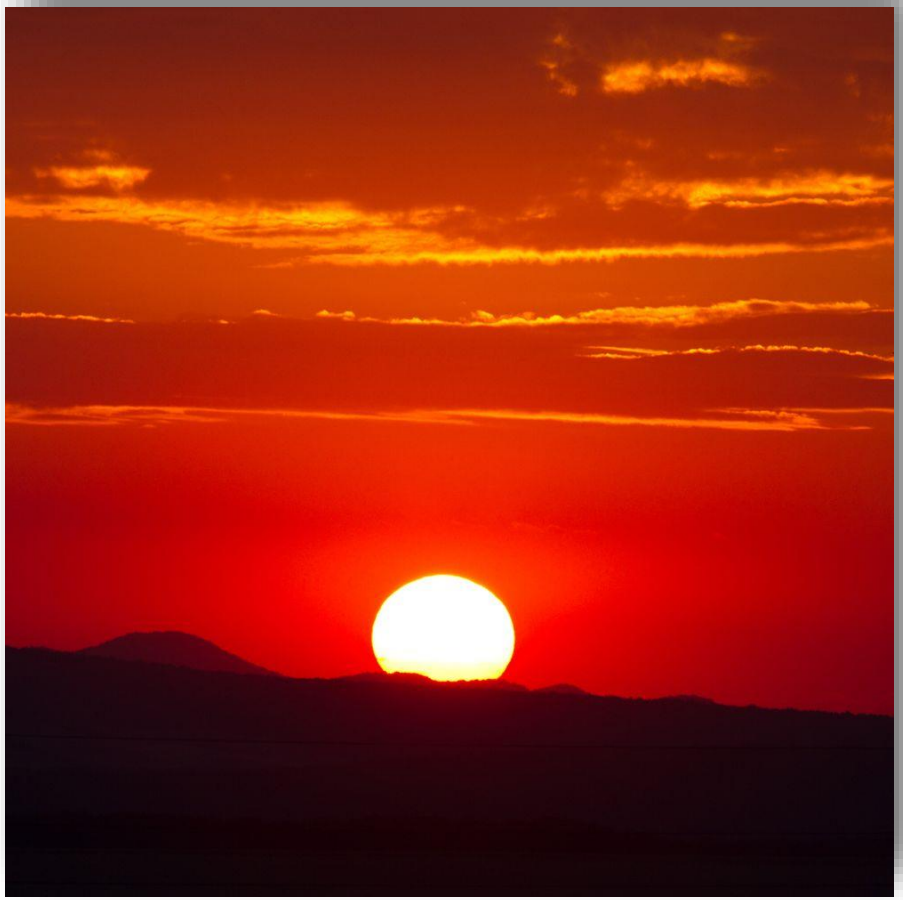
Extend

Evaluate



What Is a Phenomenon?

- **Observable event**
- **Explainable using scientific practices**
- **Context for scientific learning and research—*elicits student questions***



Types of Phenomena

- **Anchoring**
  - **Drive an entire unit**
- **Investigative**
  - **Focus a single lesson**
- **Everyday**
  - **Personally relevant to your students**

Learning Context

- **Life Science**—Animal behavior, structure and function, inquiry
- **Physical Science**—Forces, motion, friction

Building Toward 3-Dimensional Learning
Middle School Life Science

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
• Asking questions • Planning and carrying out investigations • Constructing explanations	**MS-LS1.A Structure and Function** Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cells. **MS-LS1.B Growth and Development of Organisms** Animals engage in characteristic behaviors that increase the odds of reproduction.	• Patterns • Structure and function • Systems and system models[1]

1. NGSS Lead States, *Next Generation Science Standards: For States, By States* (Washington, DC: The National Academies Press, 2013), retrieved from www.nextgenscience.org or ngss.nsta.org.

Planaria in the Classroom
Anchoring Phenomenon

Easy to maintain

- Keep in a glass or plastic dish with springwater or treated tap water
- Regular water changes needed
- Feed once a week, plenty of options for food
- Prefer room temperature (70 to 73º F)

Other observations

- Non-threatening
- Predatory organisms
- Can be observed with the naked eye
- Commonly used for regeneration

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Safety Issues

- **Personal Protective Equipment**
  Gloves and safety glasses are available.
- **Treatment of Animals**
  Treat all living organisms with care and respect.

- **Safety Tip**
  Clear your work space of phones, papers, books, and other personal items.

Activity

Observe the interactions between planaria and *Daphnia* for 10 minutes.

Tips: **When adding water to the petri dish, break the surface tension by dragging a pipette across the barrier.**

Place a piece of blank paper under the petri dish for better viewing.

Activity

What do you want to know?

Sample questions:

- **How do planaria find food?**
- **How do planaria eat food once it is found?**
- **Do planaria show a food preference?**

Applicable to PEs: K-LS1-1, 4-LS1-1, & 4-LS1-2

Repeatedly observing planaria behavior can *anchor* multiple lessons within ecosystem relationships.

Termites in the Classroom-Follow That Trail!

Easy to maintain

- Live in rotting wood
- Keep in plastic container with vented lid
- Add layers of moist cardboard and paper towels
- Add small pieces of untreated rotting wood

Other observations

- Moderate in speed
- Non-threatening
- Will not eat furniture if they escape

Investigative Phenomenon
Termites Will Trace Your Name!

Why?

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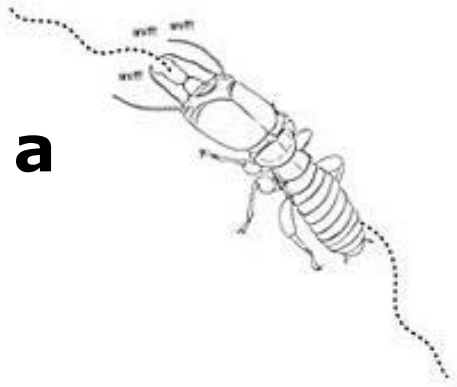
Engage

Like ants, termite workers must go out from the nest to search for water or wood.

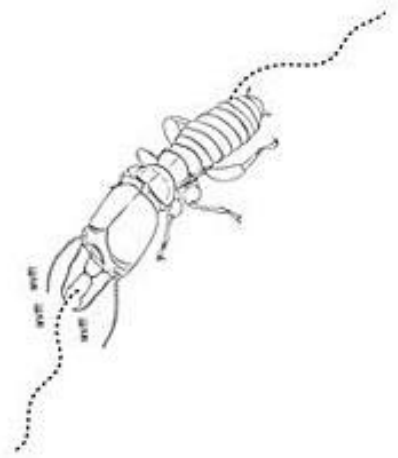
- **Do workers simply wander and eventually get lost?**
- **What does a worker do if it finds a potential food source?**
- **How does a successful forager communicate the location of a food source (e.g., a log or house wall) so that the colony can mobilize to gather it?**



Explore

What causes trail following?

- Develop hypotheses and design experiments



What cues do termites respond to?

- Consider the types of sensory input (vision, touch, hearing, smell, etc.)
- Extraneous factors, such as light

Experimental procedures:

- Select 3 variables to be manipulated
- Measure the number of followers per trail

Termite Kit Materials

Work alone

- **5 to 7 termite workers**
- **1 blank sheet of paper**
- **3 writing implements**
- **1 paintbrush**

Stop!

Termite Line Following = Many Possible Exploration Questions

- **Is marker color important? (red, blue, black, etc.)**
- **Does marker type matter? (ballpoint, gel, felt, etc.)**
- **Does brand matter? (Papermate®, BIC®, Pilot®, Pentel®, etc.)**

- **Applicable to K-LS1-1, 3-LS2-1, MS-LS1-4, MS-LS2-2, HS-LS1-1.A, HS-LS2-8**

Explain

What's different in different pens?

Most inks are formulated with either water or petrochemical solvents.

Colorants are either dyes or pigments:

- **Dyes are soluble in water**
- **Pigments are insoluble**

Inks also contain various additives:

- **Buffering agents to adjust pH levels**
- **Resin for resilience**
- **Humectants to prevent evaporation**

Extend

Original German Published Work on Ink Pen Attraction (1968)

Bundesanstalt für Materialprüfung Berlin-Dahlem,
Fachgruppe „Biologische Materialprüfung"[1]

Untersuchungen über das Verhalten von Termiten gegenüber einigen spurbildenden Stoffen

Von Günther Becker und Rolf Mannesmann

Mit 8 Abbildungen

1. Bisher Bekanntes über Spurfolgen bei Termiten und Aufgabe der Untersuchungen

Termiten folgen möglichst dem Weg eines anderen Tieres ihrer Gruppe. Wenn sie auf Suche gehen, laufen sie ein Stück des Weges, den sie sich vorangewagt haben, genau wieder zurück, benutzen denselben Pfad wieder vorwärts und erkunden ein neues Wegstück. Auf einer eigenen oder von Nestgenossen begangenen Spur bewegen sich die Tiere schneller und sicherer als in unbegangenen Gebieten, in denen ihr Lauf durch Suchbewegung unterbrochen wird. Das hat bereits W. Goetsch (1940) für *Reticulitermes lucifugus* (Rossi) beschrieben. Das Verfolgen bestimmter Wege, auch wenn sie Umwege darstellen, gilt für Futtersuche, Bautätigkeit und Flucht.

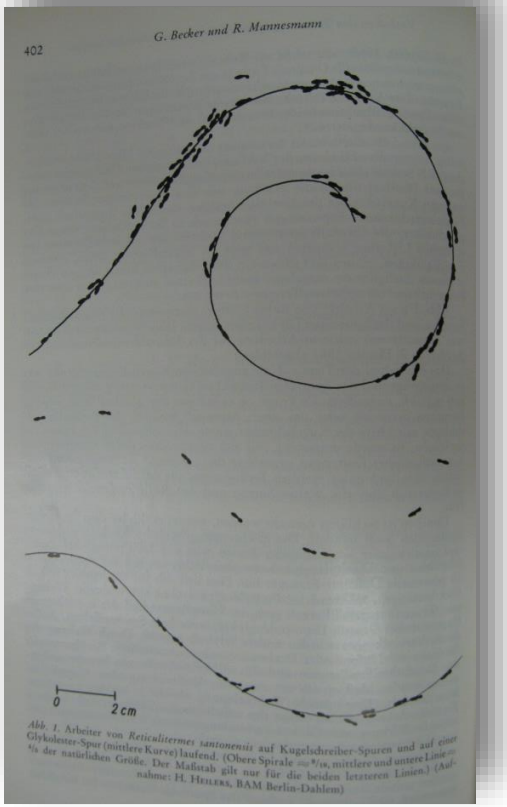


Abb. 1. Arbeiter von *Reticulitermes santonensis* auf Kugelschreiber-Spuren und auf einer Glykolester-Spur (mittlere Kurve) laufend. (Obere Spirale = 1/2, mittlere und untere Linie = 1/3 der natürlichen Größe. Der Maßstab gilt nur für die beiden letzteren Linien.) (Aufnahme: H. Heilers, BAM Berlin-Dahlem)

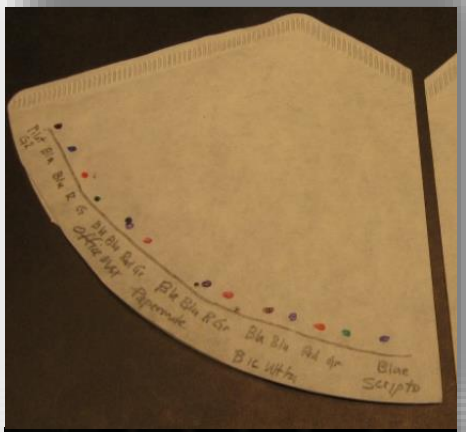
***Zeitschrift fur Angewandte Entomologie* 62(4): 399-436, 1968**

Evaluate

Try Simple Paper Chromatography to Compare Inks

Evaluate

Spot inks on coffee filters to compare. Chromatography of different brands and types of pens reveals similar ink migration profiles for those that elicit trail following.



—— **Inks followed**

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Bessbugs in the Classroom

Bessbugs (short-horned stag beetle)

Easy to maintain

- Live in moist rotting wood
- Keep moist rotting wood in a plastic container with a vented lid

Other observations

- Appear intimidating but very docile
- Slow moving

Investigative Phenomenon

A bessbug can pull >30x its own weight.

What do you want to know?

Maximizing Power: Bessbug Penny-Pull

Work in groups of 2 to 4

- Bessbugs—weigh 1.5 g
- Washers—weigh 2.4 g each
- Petri dish—weighs 8.0 g
- 1-ft piece of floss
- Cellophane tape
- Instruction sheet
- Testing materials

Applicable to PEs: MS-LS1-4, K-PS2-1, 3-PS2-1, MS-PS2-2, & HS-PS2-1

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How Much Weight Can They Pull?

Known constants:
Bessbug—1.5 g **Washer—2.4 g** **Petri dish—8.0 g**

Data and Student Artifact

Group	Beetle Traction Material	Sled Friction Material	# of Washers	Total Mass	Pulling Power (Total Mass/Beetle Mass)
1	Sandpaper	Plastic Wrap	25	68	45.3
2	Carpet	Foil	18	51.2	34.1
3	Lab Cloth	Sandpaper	16	46.4	30.9
4	Paper Towel	Carpet	15	44	29.3
5	Carpet	Foil	30	80	53.3

Note: *This is a sample data table with sample data. Students should create their own data table for this activity.*

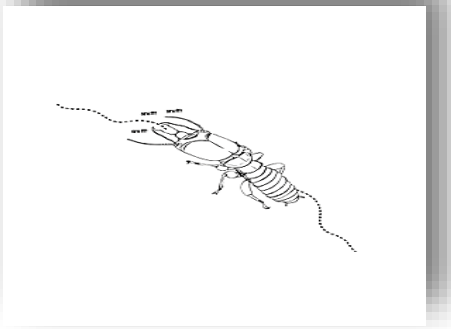
Session Wrap-Up

- **Employed a 5E learning cycle**
- **Modeled an anchoring and investigative phenomenon**
- **Gained content knowledge, comfort, and experience working with planaria, *Daphnia*, termites, and bess beetles**
- **Ready to bring new critters into my classroom!**

Kits and Materials from Carolina

Bessbug Penny-Pull Kit
Item #144145

Planaria Culture
Item #132950



Termite Behavioral Investigation: Follow That Trail! Classroom Kit
Item #143722

Daphnia magna Culture
Item #142330

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Carolina Offers Free Resources to Support Teachers

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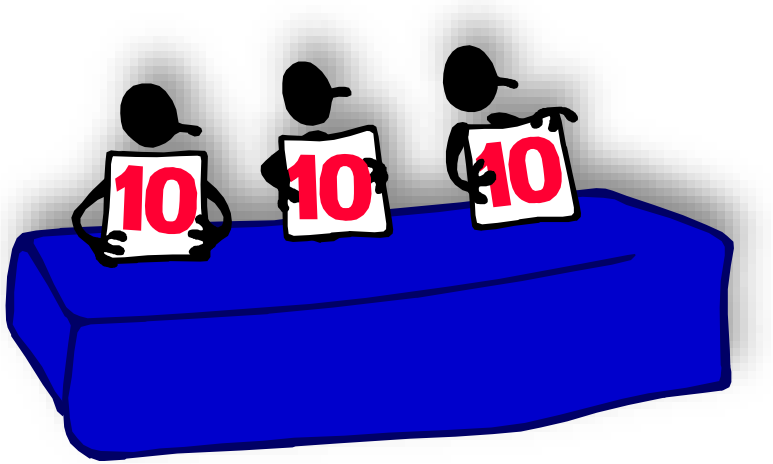
Evaluations: Share Your Thoughts

We are striving to make our workshops great!



Please evaluate this session and presenter on a scale from 0 to 10 (10 = best).

Please help us reset the room by gathering your belongings and exiting between sessions.

THANK YOU!