Cornell Institute for Biology Teachers

Lab reviewed: 2/2015

Title: **The Musical World of Crickets**

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Appropriate Level: Grades 4-6

Elementary Science Core Curriculum (NYS): Standard 1: Analysis, Inquiry and Design (Mathematical Analysis): Key Idea 1: M1.1c, Key Idea 2: M2.1a,b; Key Idea 3: M3.1a; (Scientific Inquiry): Key Idea 1: S1.1a,b, S1.2a, S 1.3a; Key Idea 2: S2.3a,b; Key Idea 3: S3.1a, S3.2a, S3.3a, S3.4a.

Standard 6: Interconnectedness: Common Themes: Key Idea 2, Key Idea 3, Key Idea 4, Key Idea 5, Key Idea 6.

Standard 7: Interdisciplinary Problem Solving.

Standard 4: Physical Setting: Key Idea 2: 2.1a, (Key Idea 3: 3.1g), Key Idea 4: 4.1a,b

Standard 4: The Living Environment: Key Idea 3: 3.1a,c, 3.2b; Key Idea 5: 5.1b, 5.2b, c, d, e, f, g; Key Idea 6: 6.1e,f

Abstract: Students will make observations and record data on crickets' response to their environment. Students will use heating pads and freezer packs to manipulate the temperature in a container and observe the crickets' reactions to temperature.

Time Requirement: 60 min.

Additional Teacher Information

Objectives

Students will set up and follow a lab procedure, make predictions and draw conclusions while working on the lab; they will work cooperatively in groups of three or four, gather and analyze data, and determine the effects of temperature on cricket behavior.

Materials Needed

- Transparent plastic containers (6 Qt. shoe boxes) *
- Mosquito mesh to cover the plastic containers. One piece per container. *
- Heating pads *
- Thermometers *
- Magnifying glasses *
- Reusable freezing packs *
- Crickets and habitat (including food and water)

* = included in CIBT kit

Cricket Care & Feeding

You can buy crickets at a pet shop and set up a habitat in the classroom that includes a source of food (such as Fluker's High Calcium Cricket Diet, cornmeal, dry pet food, fruits and vegetables), and either water (they can drink from a soaked cotton ball or sponge) or cricket quenchers (such as Fluker's Original Cricket Quencher). Male crickets begin to chirp when they are six to eight weeks old. For this experiment you will need to be sure that the crickets are at least six weeks old. The pet store owner should know approximately how old the crickets are, but we suggest that you get them several weeks prior to the experiment and wait until you hear them chirp. Include a variety of foods (both fresh and dry) in their diet. When you use fresh food, be sure to replace it every couple of days before it gets moldy.

Crickets also need a place to hide. Pet shops often use portions of egg cartons to provide crickets with dark spots to hide in and rest.

Crickets do better away from direct light, so a darker corner away from the windows would be appropriate. Make sure your crickets stay warm enough (ideally around 70°F), especially if the classroom's heat is turned off overnight. They will die if the temperature drops below 50°F for extended periods of time.

Lab Set-Up

10-30 days before experiment: Buy crickets and supplies for cricket habitat. Set up habitat. Feed and water crickets daily. Listen for chirping: you can begin the experiment as soon as the crickets are chirping reguarly. Male crickets begin to chirp when they are six to eight weeks old.

Adult males of most cricket species chirp by rubbing their forewings together. This process is called *stridulation*. The adult male stridulating organ consists of a smooth scraper on one forewing that is drawn across a serrated file on the other forewing to produce a song. Because crickets spend most of their time hidden in the grass or under leaves and almost never see each other, sound is one of their most important communication tools.

Male field crickets (the ones many students may find in their backyards) have at least three songs: one that attracts females, one that woos the female after he gets her attention, and one that warns other males to back off. Some males use the chirping sounds to mark their territory. Crickets can also disguise their "voices" when in danger. By lowering his "voice," a cricket can make himself sound far away. Chirping patterns are specific to each species and females respond only to the song of their own species.

Figure 1: Female cricket's "ear"

Females hear the males through a small pit or depression on the front side of the leg, that has a thin membrane stretched over it (Figure 1). This "ear" picks up the vibrations of the chirps and helps the females find the males.

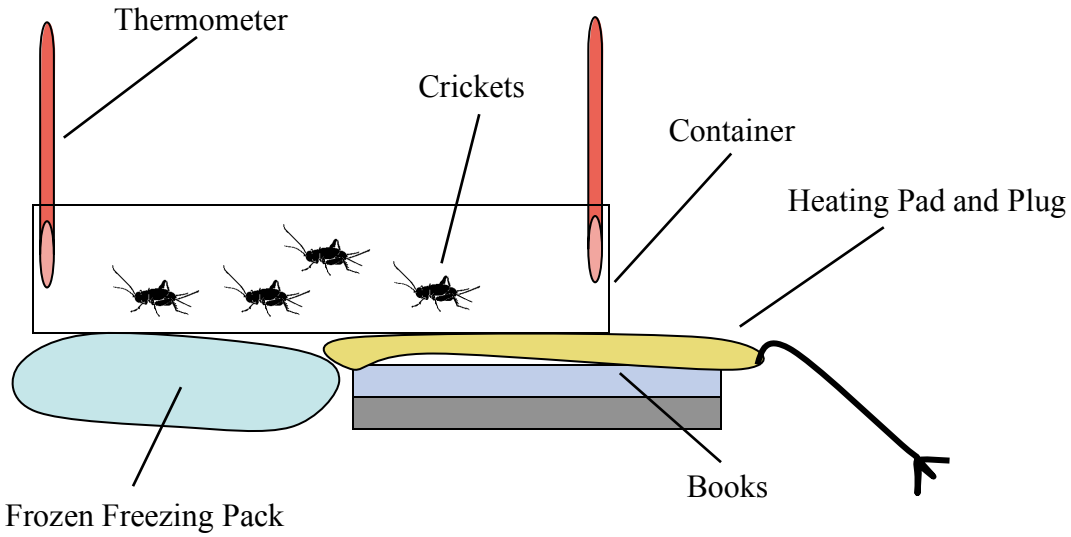
Have students browse non-fiction books or articles on crickets prior to the lab. This will familiarize them with cricket behavior, enabling them to make an informed hypothesis. Cricket books are available in a wide range of reading levels. See the Teacher Resource section for book suggestions.

2-3 days before experiment: Freeze freezing packs as flat as possible.

Day of experiment: Divide students into small groups, approximately four per group. For best results, work with at least eight crickets per group. Fewer crickets yield inconclusive results.

When helping students set up the lab, make sure the containers are leveled. This might be a little tricky, since the freezer packs can produce irregular surfaces when they freeze. A tilted container can interfere with the results of the experiment, yielding useless data: crickets might tend to remain on the lower side of the container as it will be hard to 'climb' to the higher side on the plastic surface. Half of the container should be on top of the freezer pack and the other half on top of the heating pad (see Figure 2).

Figure 2. The Musical World of Crickets Setup



For best chirping results, try to keep the heated side of the container between 27-30°C. Crickets tend to gravitate to the warmer side of the container. Make sure students set up the thermometers so that the bulbs are in the air, rather than making direct contact with the bottom of the container (i.e. the freezing pack or heating pad).

For Part I, have the students wait three minutes for the crickets to adjust to their surroundings. Then instruct them to observe the crickets for three minutes while you keep time. At the end of this interval, make sure they all stop and record the temperature on both sides of the container, as well as the number of crickets on either side of the container (on Table 1). Repeat until 12 minutes have passed.

For Part II, help students remove most of the crickets from the container, leaving only one cricket per group member. **Make sure the students leave only male crickets**, as females do not chirp (see *Getting to Know Your Cricket* for how to determine gender). Each group member will choose their own cricket to follow. Give the crickets a couple of minutes to get used to the container again. Instruct students to observe their crickets using a magnifying glass for a few moments, so they can see the crickets' chirping motion and other behaviors.

Now keep time in five-minute intervals, while students count their crickets' chirps (the number of chirps that their cricket produces during a period of 5 minutes) and record in Table 2. They will write down the number of times crickets chirp on the hot end of the container, and the number of times they chirp on the cold end of the container. They will also record the temperature in the side of the container where the cricket was chirping at the end of the 5 minute interval. Repeat the five-minute interval three more times.

Teacher Resources

Create Your Own Cricket Radio
http://www.hup.harvard.edu/features/cricket-radio/

The Cricket Classroom Page
http://telusplanet.net/public/ecade/CricketsintheClassroom/cricketsintheclassroom.html

Cricket Rearing Guide
http://insected.arizona.edu/cricketrear.htm

The Critter Catalog
http://www.biokids.umich.edu/critters/Gryllidae/

Enchanted Learning
http://www.enchantedlearning.com/subjects/insects/orthoptera/Cricket.shtml

Mr. Nussbaum
http://www.mrnussbaum.com/cricket.htm

Simon, S., *Discovering What Crickets Do*. New York: McGraw-Hill Book Co., 1973.

The Musical World of Crickets

Name:_____

Introduction

In this lab you will determine whether crickets prefer colder versus warmer areas, and how temperature affects a cricket's song (chirping). Crickets are *ectotherms*, or as some scientists like to say, variable-temperature animals. This means that a cricket's body temperature changes according to the surrounding temperature.

Adult males of most cricket species begin to chirp when they are six to eight weeks old. They chirp by rubbing their forewings together. This process is called *stridulation*. The adult male stridulating organ consists of a smooth scraper on one forewing that is drawn across a serrated file on the other forewing to produce a song. Because crickets spend most of their time hidden in the grass or under leaves and almost never see each other, sound is one of their most important communication tools.

Male field crickets (the ones you may find in your backyard) have at least three songs: one that attracts females, one that woos the female after he gets her attention, and one that warns other males to back off. Some males use the chirping sounds to mark their territory. Crickets can also disguise their "voices" when in danger. By lowering his "voice," a cricket can make himself sound far away. Chirping patterns are specific to each species and females respond only to the song of their own species.

Figure 1: Female cricket's "ear"

Females hear the males through a small pit or depression on the front side of the leg, that has a thin membrane stretched over it (Figure 1). This "ear" picks up the vibrations of the chirps and helps the females find the males.

Hypotheses

1. Make a prediction as to whether the crickets will prefer colder versus warmer areas. Be sure you have a good reason to help explain your choice. Your hypothesis will read, somewhat, as follows: "The crickets will prefer ____ areas because ____." Write it down here:

_____

_____

_____

2. Make a prediction as to how you think the crickets will react to temperature changes in terms of chirping. Be sure you have a good reason to help explain your choice. Your hypothesis will read, somewhat, as follows: "When temperature is _____ (warmer / cooler), the crickets will chirp _____ (more / less) because _____." Write it down here:

_____

_____

_____

Materials

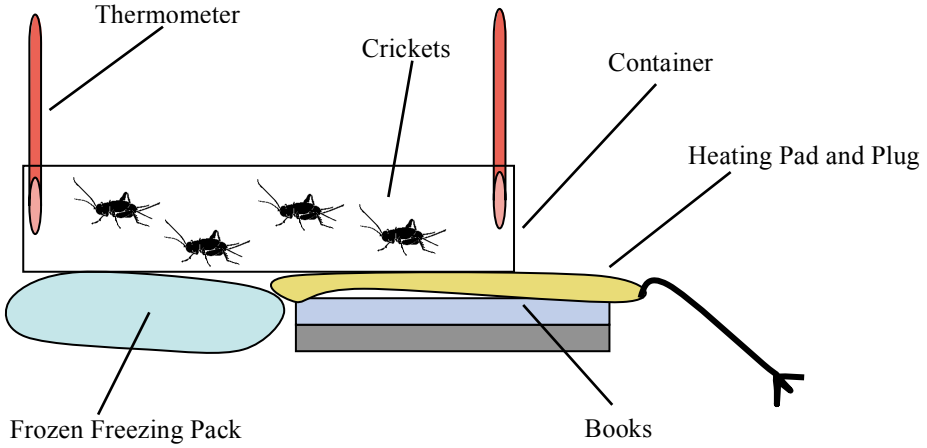
- Plastic transparent container
- Mesh (to cover container so crickets can't escape)
- Reusable freezer pack (should be frozen for the experiment)
- Magnifying glass
- Thermometers (2 per container)
- Heating pad
- At least 8 crickets, ideally all males

Part I. *Do crickets prefer cold or warm temperatures?*

Procedure

1. Tape two thermometers to the inside of the container (one on each end). Make sure that they are not touching the bottom of the container.
2. Place the crickets you will be using in the container and immediately cover with mesh so the crickets cannot escape.
3. Set the heating pad under one half of the container.
4. Place the frozen, reusable freezer pack under the other half of the container. Make sure the container is flat. This might be hard because the freezer pack may have an irregular surface, while the heating pad is very flat. Use books or notebooks to get the container nicely leveled. See Figure 1.

Figure 1. The Musical World of Crickets Setup



5. After giving the crickets three minutes to adjust to their surroundings, observe them to determine their reaction to the temperature differences. Every three minutes, stop and record the temperature on both sides of the container and count how many crickets are on either side of the container. Record your data in Table 1.

Data and Analysis

Table 1. Cricket temperature preferences

Minutes	Cold End Temperature (°C)	Hot End Temperature (°C)	Number of Crickets at the Cold End	Number of Crickets at the Warm End
3				
6				
9				
12				

1. Which part of the container did the crickets tend to move to? How might this be similar to what they do in their natural environment? Use your data to support your answer.

_____

_____

2. Why do you think crickets tend to move towards this area of the container?

_____

_____

Part II. *Crickets' Reaction to Changes in Temperature*

Procedure

1. Gently remove most of the crickets from the container, leaving only one cricket per group member. **Make sure all the remaining crickets are males**, because only males chirp. Each group member will choose their own cricket to follow.

2. Using a magnifying glass, spend a few moments watching your cricket up close. Is your cricket chirping? What parts of his body does he use to make the chirping sound?

_____

_____

3. You will now count your cricket's chirps in 5-minute intervals (the number of chirps that your cricket produces during a period of 5 minutes) in Table 2. Record the number of times he chirps on the hot end of the container, and the number of times he chirps on the cold end of the container. Make sure someone keeps track of the time (perhaps your teacher). In Table 2, record the temperature in the side of the container where the cricket was chirping at the end of the 5 minute interval.

4. Repeat Step 2 for three more 5-minute intervals, continuing to record on Table 2.

Data and Analysis

Table 2. Relationship between cricket chirping and temperature

Minutes	Hot End Temperature (°C) / Number of Chirps	Cold End Temperature (°C) / Number of Chirps
0-5	/	/
6-11	/	/
12-17	/	/
18-23	/	/

1. Did you notice a difference in the number of chirps the crickets made between the hot side of the container the cold side of the container? Explain your observations using your data.

_____

_____

_____

2. What may be some other factors that affect a cricket's ability or desire to chirp?

_____

_____

_____

3. Suppose students in a different class ran this experiment and their crickets didn't chirp at all. What would you suggest they do?

_____

_____

_____