

Activity 4: Grades 5-8
Spider Sounds

As you observed in this segment of SAF, jumping spiders use their legs to communicate courtship interests to potential mates. The miniscule impacts of spider legs tapping against the ground surface are detected by nearby spiders. This "drumming" cadence signals the spider's reproductive interests. The female detects the low frequency vibrations through her legs. She responds by allowing the male to mount her. Without this communication, the female might consider the male's advance an aggressive or predatory move and respond with less amorous behavior.



This activity page will offer:

- Opportunity to construct a sensitive listening platform
- Activity in which to detect walking sounds of a cricket

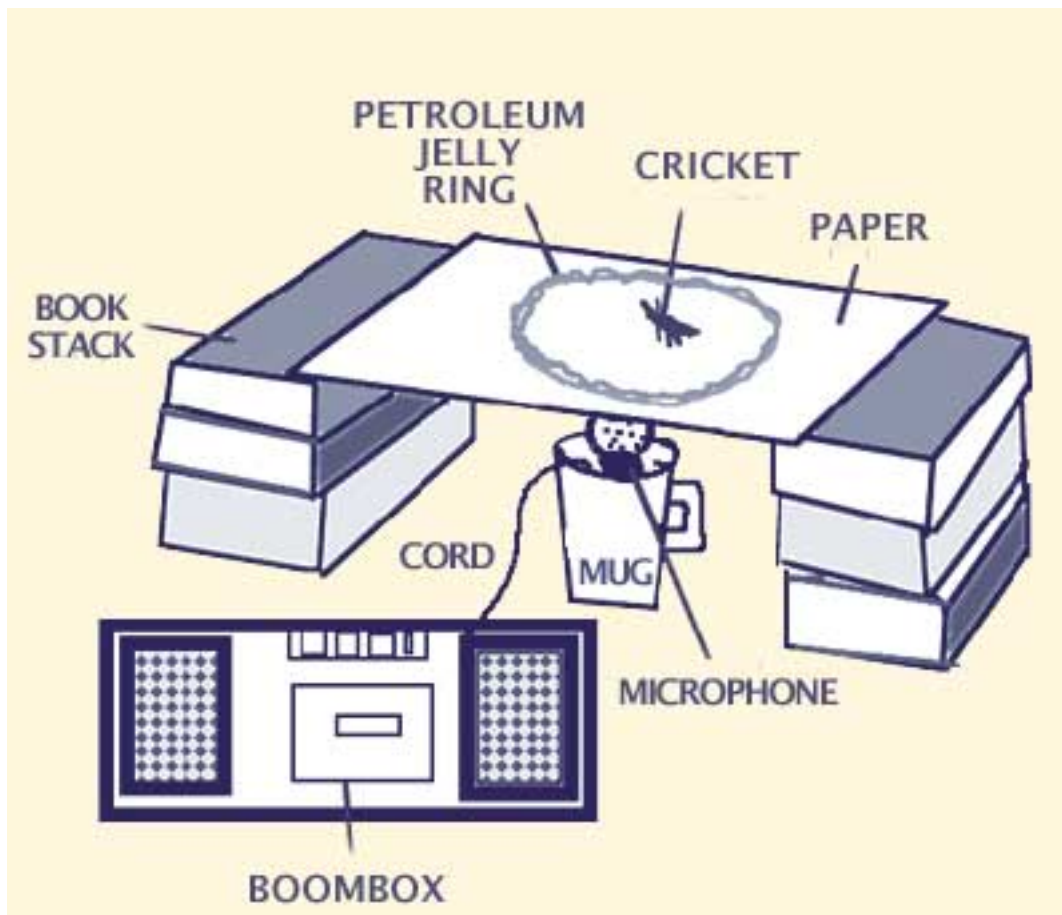
Pitter Patter of Cricket Feet

In this activity, you'll construct a device capable of detecting miniscule impacts of cricket feet. As the animal walks across a sheet of paper, the vibration energy of tiny impacts is transferred to a microphone. An electronic circuit amplifies this signal and produces an audible version of the sound. For those with access to sound processing software, the "signature" of the cricket's walk can be further analyzed and studied.

Materials

- Microphone
- Coffee mug
- Boombox
- Paper
- Scrap cardboard
- Petroleum jelly
- Laboratory cricket
- Computer
- Sound processing software (optional)

NOTE: Use only laboratory maintained crickets for this activity.



Steps (For the set-up)

1. Set a clean coffee mug in the center of a clear desktop.
2. Place a microphone in the mug so that the sound detecting element faces upwards.
3. Attach the cord of the microphone to the microphone-input jack of a boombox or other type of amplified audio system.
4. Use a thin smear of petroleum jelly to form a large ring in the center of a sheet of plain paper.
5. Position the paper (jelly side up) on microphone's sound detecting element.
6. Build up a stack of books at both ends of the paper. The paper should rest on the tops of these stacks. Make sure that the middle of the paper remains in physical contact with the microphone.
6. Have your instructor place a laboratory cricket within the central ring.
7. Turn up the volume of the boombox. Can you hear the sound of the cricket as it walks over the paper? How would you describe it? Can you detect a rhythm or pattern to the sound?
8. Connect the microphone cord to the sound input jack of a computer. Adjust the volume of the speakers. Can you hear still hear the footsteps of the cricket?
9. Open a sound-processing program. Input the cricket sound into the program. Display the "footprint" of the signal. Can you identify a pattern in the sound that corresponds to the animal's movement?
10. When you are finished with this experiment, have your instructor remove the cricket. Wash your hands and laboratory bench top

thoroughly.

Questions

1. Why was it critical to keep the paper in direct physical contact with the microphone?
2. What was the purpose of the petroleum jelly?
3. Was the connection between the observed sounds and the insect's leg movements obvious?

Courtship and Singing

Does singing play a role in human courtship behavior? If so, how? What makes a song "sexy"? What are the qualities that make a voice "sexy"? How much of this is societal and how much is part of our genetic baggage? Think about it and then compose song that addresses these issues. Use the lyrics to describe singing styles and their relationship to successful and unsuccessful courtship.

Spider Minds

Write a humorous short story in which a jumping spider in search of a mate decides to "cruise" the local insect dance bars. Remember to introduce real facts about the mating behavior of spiders and other insects. As a connection to another show segment, you might want to include bees doing the tail-waging dance.

Adaptations

Unlike the web-weaving varieties, the jumping spiders actively hunt for their prey. Since they don't depend upon a web, they must rely on other adaptations for success. Research the different adaptations of jumping spiders. Present a selection of these successful strategies to your class in an oral report. Use models to help communicate what you have learned about jumping spider adaptations.

Web Connection

[Insect Songs](http://www.naturesongs.com/insects.html)

<http://www.naturesongs.com/insects.html>

A collection of insect sound files

[Jumping Spiders by Habitat](http://tolweb.org/tree/eukaryotes/animals/arthropoda/arachnida/araneae/salticidae/na.by.habitat.html)

[http://tolweb.org/tree/eukaryotes/animals/](http://tolweb.org/tree/eukaryotes/animals/arthropoda/arachnida/araneae/salticidae/na.by.habitat.html)

[arthropoda/arachnida/araneae/salticidae/na.by.habitat.html](http://tolweb.org/tree/eukaryotes/animals/arthropoda/arachnida/araneae/salticidae/na.by.habitat.html)

A photo gallery of jumping spiders that live in North America

[Prey capture and mating behavior in jumping spiders belonging to the genus Portia](http://www.colostate.edu/Depts/Entomology/)

<http://www.colostate.edu/Depts/Entomology/>

courses/en507/papers_2001/odenbeck.htm

A scientific paper on prey capture and mating behavior of jumping spiders

Academic Advisors for this Guide:

Suzanne Panico, Science Teacher Mentor, Cambridge Public Schools, Cambridge, MA

Anne E. Jones, Science Department, Wayland Middle School, Wayland, MA

Gary Pinkall, Middle School Science Teacher, Great Bend Public Schools, Great Bend, KS

SCIENTIFIC
AMERICAN
FRONTIERS

TEACHING GUIDE



Agilent Technologies



SCIENTIFIC
AMERICAN

Activity 4: Grades 5-8

Spider Sounds



Questions

1. Why was it critical to keep the paper in direct physical contact with the microphone?
(To detect the faintest sounds, the vibrations needed to be transferred through paper, a solid medium)
2. What was the purpose of the petroleum jelly?
(It formed a ring that contained the insect)
3. Was the connection between the observed sounds and the insect's leg movements obvious?
(Accept all reasonable answers. Although a rhythm is detected, the tonality and inconsistency of the cadence makes it difficult to associate with insect leg movements.)

CURRICULUM LINKS

Life Science :

Jumping spider mating behavior

Adaptations for prey capture

Patterns in the movements of crickets

Physical Science :

Sound waves

Amplification

NATIONAL SCIENCE STANDARDS (Grades 5-8)

Science as Inquiry- Content Standard A

Students will conduct an investigation, gather data, and identify any patterns.

Students will think critically about the data and formulate cause - effect relationships.

Students will use technology to enhance the accuracy of data collection and analysis.

Physical Science - Content Standard B

Students will investigate sound energy and how it is transferred.

Life Science - Content Standard C

Students will explore the structure and function of an organism.

Students will learn that organisms respond to external and internal stimulus.

Students will uncover one organism's adaptation for methods of obtaining food.

