A vibrant rainforest scene with a butterfly and a praying mantis. The background is a lush green forest with sunlight filtering through the trees. A large, dark log lies on the ground. A butterfly with black and white wings and a red patch is flying in the upper right. A green praying mantis is perched on the log in the lower left.

# A Rainforest Adventure Bugs!

**Teacher's Guide**

**Journey to another world, where insects rule!**

Presented by **TERMINIX**

# Introduction



The stars of *Bugs!* a praying mantis and a butterfly, known by their Latin names, *Hierodula sp.* and *Papilio sp.*, are hatched in the same part of the rainforest in Borneo. Hierodula and Papilio are two representatives of the most diverse group of animals on the planet. Their home is the foliage around an abandoned and dilapidated shack on the edge of a river. Here, we witness Hierodula and Papilio mature and grow. Hierodula develops by incomplete metamorphosis; hatching from his egg as a mini-mantid and shedding his exoskeleton regularly on the way to gaining his adult wings. Papilio goes through a complete metamorphosis, from egg through caterpillar to butterfly via the pupal stage. As they develop, we meet a fascinating array of other insects, which share this habitat. After many near misses, the predator, Hierodula, acting on instinct, catches Papilio. In an uplifting ending we discover that Papilio managed to lay her eggs before being caught, and the film ends with her offspring hatching from its tiny egg to continue the circle of life. Although in the film Hierodula is a male, it should be noted that female mantids, along with other predatory female insects, often capture, kill, and eat insects as well. *Bugs!* is a live action nature drama filmed in 3-D. It was shot on location in Borneo and in a purpose-built studio near Oxford, England. This guide was prepared by the National Museum of Natural History, Smithsonian Institution, and SK Films to provide teachers with pre- and post-visit activities, which they can use in their classroom.



Create your own

# Insect Zoo

**B**uilding an insect zoo provides students with the basics of collecting, observing and caring for insects. Insect zoos require minimal resources and the educational potential is enormous. A zoo is a powerful educational motivator because it offers the novel opportunity of observing insects in safety and inspires everyone to take a closer look at the insect world. The activity is versatile enough to adapt to any age level, learning style or space. It serves as an excellent hands-on experience for a diverse subject ranging from science to language arts.

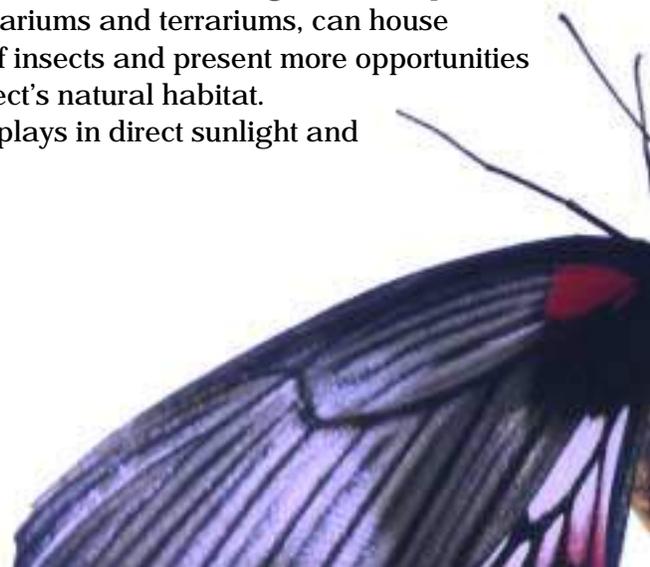
Insect zoo educational objectives:

- to learn about the life cycle of insects
- to assume the responsibility for the care of animals
- to compare insects with other animals
- to encourage cooperative learning
- to learn about the habitat of insects
- to practice the basics of journaling
- to discover the role of insects in the ecosystem

## ▶ Getting Started

If this is your first insect zoo, start out small. Select one or two species of insects or other arthropods. Decide if you are going to order your insects from a biological supply house, or if you are going to go on a field-collecting trip. If you decide to collect insects on your own, consult a published field collector's guide, or the Internet for tips and ideas about which insects to collect. Before proceeding, you need to know where you will place the displays and what types of containers you will need. Clear plastic deli containers or cups are inexpensive, small and can sit anywhere - even on a student's desk. Larger, more expensive containers, like aquariums and terrariums, can house greater numbers of insects and present more opportunities to recreate an insect's natural habitat.

\*Avoid placing displays in direct sunlight and cold drafts.



# Notes

## Zookeeping

The first job of an insect zookeeper is ensuring every display is properly labeled. Make sure to have the following information displayed: name of insect, care schedule, food, water, and maintenance schedules. In addition, there are four essentials for a successful insect zoo: a clean cage, constant temperature, proper moisture and a fresh food supply. Care instructions can be copied from a published field guide for detailed instructions.

☛ Check for fungus or fruit flies in the container. Fungus is very unhealthy. Replace any perishable food items like fruit slices frequently.

☛ Observe how long it takes for the food to be consumed. If it is consumed within an hour, add more. If little or none of the food source is consumed, the insect might be getting ready to molt or pupate.

☛ Watch the temperature. Be sure that weekend and nighttime temperatures do not fluctuate too widely.

☛ Post a realistic schedule of feeding and cleaning. The number of insects in a cage and the amount of insect droppings determine when a cage needs to be cleaned.

## Learning to Look

Have students create their own 'insect journals' to record their observations. Here are some questions to encourage close observation.

☛ How does each insect catch or search for food?

☛ Does the insect show a preference for certain foods?

☛ How does the insect eat the food?

☛ Can you identify what the insect eats?

☛ How well does the specimen blend into its natural environment?

☛ Where in the container is the insect usually found?

☛ Does the insect hide behind or under things? If so, why do you think that happens?

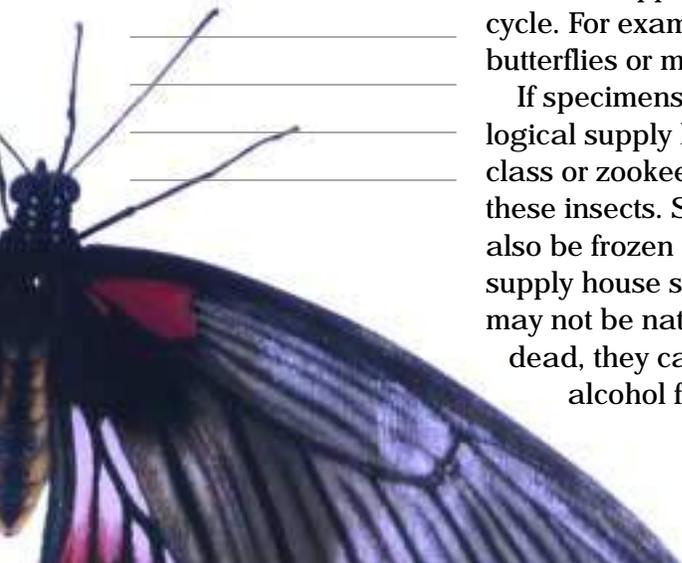
☛ How does the insect move from one place to another?

☛ Does the insect make any sounds? If so, do they vary throughout the day?

## Closing the Zoo

When it is time to close the zoo, return field collections, along with eggs or young produced in captivity, to their respective habitats at an appropriate point in their life cycle. For example, do not release adult butterflies or moths in winter.

If specimens were obtained from a biological supply house, try to find another class or zookeeper interested in observing these insects. Supply house specimens can also be frozen and preserved. **DO NOT** release live supply house specimens into your local habitat because they may not be native to your geographic region. When the specimens are dead, they can be used as compost, or preserved by drying or in rubbing alcohol for further study.



# Activities

## Crossword

**ACROSS**

1. A change in body shape shown by many animals.
2. An animal that has an exoskeleton that covers a body divided into segments.
3. Butterflies and praying mantises are each a type of \_\_\_\_\_.
4. Animals use \_\_\_\_\_ to hide from 9 down.
5. A hard and often shiny case that protects an insect pupa.

**DOWN**

6. An animal that does not have a backbone
7. The country *Bugs!* was filmed in.
8. The paired jaws of an arthropod.
9. An animal that hunts other animals.

## Word Search

- ANTENNA
- CATERPILLAR
- ARTHROPOD
- ENTOMOLOGIST
- PRAYING MANTIS
- BEEBLE
- HABITAT
- PREDATOR
- BORNEO
- PUPA
- BUGS
- LARVA
- RAINFOREST
- BUTTERFLY
- LIFE CYCLE
- SCIENCE

G K P R E D A T O R P M  
 C I R B O R N E O G I E  
 A Q A U T W H J B G E T  
 T S Y T Q A N T E N N A  
 E L I T S R F E E H T M  
 R I N E C T X V T A O O  
 P F G R I H L S L B M R  
 I E M F E R R K E I O P  
 L C A L N O B D L T L O  
 L Y N Y C P U P A A O S  
 A C T Z E O G R R T G I  
 R L I Y O D S E V T I S  
 C E S X B Z M Y A N S U  
 A R A I N F O R E S T W

# Glossary

<b>Antenna</b>	A sensory feeler on the head of an arthropod.
<b>Arthropod</b>	A jointed-leg animal that has an exoskeleton that covers a body divided into segments.
<b>Bug</b>	True bugs belong to the group of insects called Hemiptera. This group differs from other insects by the adult stage usually having forewings that are half leathery and half membranous. True bugs go through incomplete metamorphosis.
<b>Entomologist</b>	A scientist who studies insects.
<b>Exoskeleton</b>	An external skeleton that supports and protects an animal's body.
<b>Insect</b>	An arthropod that has three major body regions, six legs, and may or may not have wings as an adult.
<b>Invertebrate</b>	An animal without a backbone.
<b>Larva</b>	An immature, but independent animal that looks completely different from an adult.
<b>Metamorphosis</b>	A change in body shape shown by many animals particularly invertebrates as they grow from larva to adult.
<b>Predator</b>	An animal that catches and eats others, known as prey.
<b>Prey</b>	Any animal that is eaten by a predator
<b>Pupa</b>	In insects, a stage during which the larval body is broken down and rebuilt as an adult.
<b>Taxonomy</b>	Taxonomy is the science of classifying organisms into groups by structure, origin, and common ancestor.

# Standards

The following science standards as specified by K-8 in the *National Science Education Standards* (National Research Council, 1995) are addressed in this guide and/or the film, *Bugs!*:

## Life Science

- Characteristics of organisms
- Life cycles of organisms
- Organisms and environments
- Reproduction and heredity
- Populations and ecosystems
- Diversity and adaptations of organisms

## Science as Inquiry

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

## Science in Personal and Social Perspectives

- Types of resources
- Populations, resources and environments
- Natural Hazards

## History and Nature of Science

- Science as a human endeavor
- Nature of science

# Resources

## Books

Berenbaum, May, *Bugs in the System*. New York: Addison-Wesley, 1995.

Borror, D.J. and R.E. White, *A Field Guide to the Insects of America North of Mexico*. Boston: Houghton Mifflin Co., 1970.

Burnie, David and Don E. Wilson, *Animal*. London: Dorling Kindersley, 2001.

Center for Insect Science and Education Outreach, *Using Live Insects in Elementary Classrooms For Early Lessons in Life*. Tucson: University of Arizona, 1997.

Evans, H.E., *The Pleasures of Entomology*. Washington, D.C.: Smithsonian Institution Press, 1985.

Grissell, E., *Insects and Gardens*. Portland, Oregon: Timber Press, 2002.

Imes, R. *The Practical Entomologist*. New York: Simon and Schuster, Inc., 1992.

Stokes, D.W., *A Guide to Observing Insect Lives*. Boston: Little, Brown, and Co., 1983.

Waldbauer, G., *Insects Through the Seasons*. Cambridge, Massachusetts: Harvard University Press, 1996.

## Websites

Bugs!

[www.giantscreenbugs.com](http://www.giantscreenbugs.com)

National Museum of Natural History, Smithsonian Institution – Department of Systematic Biology, Section of Entomology

[www.entomology.si.edu](http://www.entomology.si.edu)

[www.si.edu/resource/faq/nmnh/buginfo](http://www.si.edu/resource/faq/nmnh/buginfo)





# Smithsonian Institution

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Content and Scientific Consultants: Nathan Erwin, Gary Hevel, Laura Viney

