

- Invite an entomologist or an entomology expert from the state Extension Service to visit the classroom and talk about insects and entomology as a career.
- Insects and other arthropods are an important source of food for many of the world's creatures, but most modern humans do not consume bugs. Some students can research and report on instances where bugs are part of the human diet, while other students can look for links in the food web that make insects important to the food supply of humans.
- Have students research the insect known as "humankind's worst enemy," and report on the ways we have tried to eradicate mosquitoes from the environment, paying attention to the problems associated with human efforts to control mosquitoes.
- The goal of studying insects should be to learn about the diversity that insects have in their anatomy, ecology and behavior, and to see live insects behaving as they normally do. Set up a classroom ant farm, beetle habitat or caterpillar environment to give the students an opportunity to observe and record in "logs" the fascinating changes which take place over time.
- Have students research the many reasons why 10,000 insects are classified as "pests." Individually or in small groups, have students select an insect pest and find an insect enemy that might control this pest. Students should list the reference where they found the answer.
- Student interest may lead to an in-depth study of pheromones. Have students choose specific types of pheromones to research, such as those used by ants for trail marking, for attracting the opposite sex or for warning the colony of danger. Purchase a pheromone trap and set it up outdoors to display the commercial use of pheromones in agriculture.

### Internet Resources

- [www.uky.edu/Agriculture/Entomology/enthp.htm](http://www.uky.edu/Agriculture/Entomology/enthp.htm)  
This site is designed for teachers, students and anyone else who is interested in natural history information about insects and their kin as well as stories and articles about the impact arthropods have had on human existence — in the arts, medicine, history and science.
- [www.ianr.unl.edu/ianr/entomol/marine\\_insects/marinehome.html](http://www.ianr.unl.edu/ianr/entomol/marine_insects/marinehome.html)  
This site focuses on the immense impact that marine insects have made upon humans, despite their relatively low numbers. The possible reasons for such a small number of insects in aquatic habitats are discussed, including the theory that crustaceans, who are arthropods that evolved millions of years before insects, beat them to it.
- [members.aol.com/YESedu/welcome.html](http://members.aol.com/YESedu/welcome.html)  
This site from the Young Entomologists Society is filled with lessons and facts for students of all ages, and has listings of entomology departments nationwide as well as a list of awards given to young people who study arthropods.

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- [www.naturalpartners.org/InsectZoo/index.html](http://www.naturalpartners.org/InsectZoo/index.html)  
Students can learn about arthropod classification and the history of insects at this site maintained in part by the Museum of Natural History.
- [lamar.colostate.edu/~gec/4Hman/contents.htm](http://lamar.colostate.edu/~gec/4Hman/contents.htm)  
The importance of insects and how scientists classify them are features of this 4-H Entomology Web site.

### Suggested Print Resources

- Fleischman, Paul. *Joyful Noise: Poems for Two Voices*. Harper & Row, New York, NY, 1988.
- Goor, Ron. *Insect Metamorphosis: From Egg to Adult*. Atheneum Press, New York, NY, 1999.
- Ricciuti, Edward. *Crustaceans (Our Living World)*. Blackbirch Press, Woodbridge, CT, 1994.
- Waldbauer, Gilbert. *The Handy Bug Answer Book*. Visible Ink Press, Farmington Hills, MI, 1998.
- Wilsdon, Christina. *Insects: National Audubon Society First Field Guide*. Scholastic, New York, NY, 1998.

### TEACHER'S GUIDE CONSULTANT

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### TITLES

- AMPHIBIANS
- ANIMAL ADAPTATIONS
- ANIMAL BEHAVIOR & COMMUNICATION
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## Insects & Other Arthropods

Grades 5–8

Students in grade 5-8 classrooms possess a wide range of background knowledge. Student response to this video program is sure to be varied, so the teachers for these grades need all the help they can get! This guide has been designed to help science teachers in grades 5-8 by providing a brief synopsis of the program, pre-viewing and follow-up questions, activities, vocabulary and additional resources.

**Before Viewing:** Extensive research tells how important it is for the teacher to discover what the students know — or think they know — about a topic, before actually starting a new unit. Therefore, after prompting discussion with the pre-viewing questions, lead your class to create a "Everything We Think We Know About..." list. You may also wish to preview key vocabulary words, and have students raise additional questions they hope will be answered.

**After Viewing:** Have your students share video excerpts that fascinated or surprised them, then challenge your students to prove or disprove the accuracy of the facts they put on their "Everything We Think We Know About..." list. Discuss what else they learned and use the follow-up questions and activities to inspire further discussion. Encourage students to research the topic further with the Internet and reading resources provided.

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## Program Summary

For over 350 million years, insects have inched their way around the Earth. While research indicates that the first insects evolved from primitive worms, adaptations have enabled insects to prosper in almost any kind of environment. Today, insects outnumber all other species of animals and plants combined!

Insects belong to the phylum Arthropoda, which is divided into several smaller groups, or classes. The largest of these groups is the class Insecta, which features classic critters such as the beetle and cockroach. Some other members of the arthropod phylum are the arachnids (spiders, ticks, mites and scorpions) and the crustaceans (crabs and lobsters).

There are a number of characteristics that differentiate the classes; all insects — unlike the other arthropods — have three body segments (head, thorax and abdomen) and six legs. Arachnids have only two body parts and most have eight legs. Some arthropods, like centipedes and millipedes, have dozens of legs. All arthropods are invertebrates and have a hard shell — or exoskeleton — for protection.

While there are over 10,000 types of insects that are classified as potentially harmful “pests,” the benefits of this class far outweigh the negatives. Without the role insects play in the pollination of plants, there would be few plants and fruits. Even the maggot plays a valuable role by helping the world recycle decaying refuse. Arthropods truly help maintain the balance of life on Earth.

## Vocabulary

The following words are included for teacher reference or for use with students. They are listed in the order in which they appear in the video.

**phylum** — A grouping or category created by scientists to classify plants or animals according to characteristics that are shared by all members of the particular category; also known as a division.

**class** — The scientific name for a group of organisms that have more characteristics in common than the members of a phylum.

**Phylum Arthropoda** — The scientific name for the group of animals with segmented bodies, jointed appendages and an exoskeleton. Arthropods are the largest phylum of animals and include true insects, arachnids, crustaceans, centipedes and millipedes.

**Class Insecta** — The scientific name for the largest category of arthropods known as true insects; these animals have bodies segmented into three parts and have six legs when mature.

**Class Arachnida** — The scientific name for the group of arthropods known as arachnids, such as spiders, ticks, mites and scorpions. These animals have eight legs.

**Class Crustacea** — The scientific name for the group of arthropods known as crustaceans, such as the crab, the lobster and the terrestrial pillbug.

**entomologist** — A scientist who studies insects.

**thorax** — The middle body segment of insects, to which the legs and wings are attached.

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**abdomen** — The hind body segment of all arthropods, containing digestive and reproductive organs, plus other specialized parts (e.g. stingers and web spinning organs).

**hunting spiders** — Arachnids such as the tarantula that hunt and chase their meals.

**web spiders** — Arachnids that spin webs in order to capture their food.

**exoskeleton** — The external, protective covering of all mature arthropods.

**chitin** — The protein- and calcium-rich substance that makes up the exoskeleton of arthropods.

**molt** — The process by which young arthropods outgrow their exoskeletons and shed them for larger ones; the shedding of the outer shell is called molting.

**pheromones** — Chemical substances that are secreted by animals under particular circumstances for a number of purposes, including communication with their own kind.

**pest** — Organisms that are considered a threat to humans in some way.

**pollination** — The fertilization of plants; many plants are dependent on arthropods for pollination.

**maggot** — The larval stage of the group of insects known as true flies.

**metamorphosis** — The process of changing form during the life cycle of an organism. Many insects undergo metamorphosis (e.g. a butterfly begins as an egg, then larva, then pupa, then adult butterfly).

**cocoon** — The silken case produced in the larval stage of certain animals to protect them during the pupal stage of development.

## Pre-viewing Discussion

Before students generate their list of “Everything We Think We Know About...” for this topic, stimulate and focus their thinking by raising these questions so that their list will better reflect the key ideas in this show:

1. What is the difference between a bug and an insect?
2. What are some common insects?
3. What are some common bugs?
4. What are some valuable contributions of insects and other bugs?

After the class has completed their “Everything We Think We Know About...” list, ask them what other questions they have that they hope will be answered during this program. Have students listen closely to learn if everything on their class list is accurate and to hear if any of their own questions are answered.

## Focus Questions

1. What type of animal is a spider?
2. What is the name of the main group, or phylum, to which insects and related animals belong?
3. What are the three largest classes of animals that belong to the phylum Arthropoda?
4. What types of creatures are found in Class Arachnida? Class Crustacea?

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5. What is an entomologist?
6. About how long have insects existed on Earth?
7. About how many species of insects are found on the Earth?
8. What does the word “insect” mean?
9. What are the body segments of an insect?
10. How do true insects and arachnids compare in numbers of body segments and legs?
11. What are some of the differences between hunting spiders and web spiders?
12. What is one kind of crustacean?
13. What are some defense mechanisms that arthropods have to protect themselves against predators?
14. What characteristics do all arthropods share?
15. What are pheromones?
16. How do honeybees use pheromones?
17. What is the role of the queen bee in the hive?
18. Why are many species of insects characterized as pests?
19. What is the role of insects and other arthropods in the pollination of green plants?
20. What kinds of specialized mouth parts have insects developed?
21. What is the process of metamorphosis?
22. How can changes in the environment increase or decrease the insect population?

## Follow-up Discussion

Research indicates that students will retain their previous misconceptions about a topic, in preference to new information, until they actively recognize and correct their own errors. Therefore, it is important to have your students re-examine the facts/beliefs they put on their “Everything We Think We Know About...” list. It might also be helpful to review the list by marking each entry with a “+” or “-” to show which facts were correct and which were incorrect.

Discussions that ensue from thought-provoking questions provide a good way to assess the overall depth of student understanding. The following are some suggested discussion questions.

1. Why are insects and other arthropods such an important part of the world’s ecology?
2. Today, arthropods outnumber all other plant and animal life combined. What characteristics of arthropods have made them so successful?
3. Why do some people say that insects “rule the world?”

## Follow-up Activities

- Create a bulletin board titled “Phylum Arthropoda.” Have students list the characteristics of the major classes of arthropods, investigate a specific order, family and genus, then place 3x5 cards in appropriate columns, each illustrating and describing individual animals.

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