Teacher's Guide

Part 2: Classroom Units and Activities
Unit 1: Insects and Arthropods

Overview

The CSI Classroom Activities link the major scientific concepts of *CSI: Crime Scene Insects* to inquiry-based exercises for students. The unit begins with an introductory exercise to pique students' interest in the topic and leads to hands-on activities to explore the principles of insect biology and forensic science.

Features of *CSI Classroom Activities*:

1. Suitable before or after students visit *CSI: Crime Scene Insects*
2. Modular design so teachers can select those that best match students' interest and needs
3. Adaptable to a broad range of grade levels (Grades 3-8)
4. Meet National Science Education Standards
5. Incorporate multidisciplinary approaches to learning including art, writing and math.
6. Offer suggestions for enrichment activities to permit advanced or individualized learning

CSI: Crime Scene Insects Classroom Activities

	Topic/Theme	CSI Activity	Description
Unit One	Insects & Arthropods	1.1 What's Your Insect IQ?	Pretest; teaser for Unit One
		1.2 Bugged by Bugs? Animal Symbols	Intro Activity on associations/reactions to bugs and how animals can become symbolic in cultures
		1.3 Build a Bug	Intro Art Activity; Insect Anatomy/Classification
		1.4 Surprise, This Dirt's Alive!	Insect Collection (soil samples) Berlese Funnel Lab with Observations

CSI Classroom Activity 1.1

Part 1. What's your "Insect IQ?"
Part 2. Check Out These Insect Facts!

Overview

Launch your students into the Crime Scene Insects Activity Series by asking them to take this quick and fun self-quiz. The survey "What's your Insect IQ?" in Part 1 tests their basic knowledge of **entomology**, the study of insects, and lets students rate themselves on their level of "expertise." Not to worry though, this is a quiz where the points don't count; it's only to stimulate interest in studying insects.

In Part 2 "Check out These Insect Facts", students consider some of the more amazing skills and structures of six-legged critters and other **arthropods**. It's an introduction to the **specialized adaptations** and record-breaking feats that are only possible in the insect world.

Both lessons serve as excellent pre-visit activities for the *CSI: Crime Scene Insects* exhibit where students see how insect anatomy and life cycle provide surprisingly vital clues in various types of crime scene investigations.

Estimated Time: 30-45 minutes depending on the level of discussion

Grade Level: Grades 3-8. Delete or modify questions and facts according to grade level

Materials

1. "What's Your Insect IQ?" Test
2. Insect Fact Sheet

Procedure

1. Review the Insect IQ test questions; select ten you think are appropriate for your class.
2. Have students take the Insect IQ test and check their own answers. Use the test to start a discussion about insects and how much students may or may not already know.
   HINT: Students might also take a "pretest", discuss, and then do a "post-test" before determining their ranking.
3. Have students read and comment on the Insect Facts to promote additional interest, discussion and positive attitudes about insects.
4. Announce that they are soon to become amateur "CSIs," that is, Crime Scene INSECT Investigators! Their "training" will include a visit to the *CSI: Crime Scene Insects* exhibit along with the unique experiments from the CSI Activities Series.

Part 1. What's Your Insect IQ?

Do you think you know insects? Well, take this quick quiz and see how you rate in your knowledge of these fascinating creatures.

1. Insects were on the Earth long before the time of
   a. dinosaurs b. VW Beetles c. birds d. all of these

2. An insect's body has how many sections (segments)?
   a. two b. three c. four d. six

3. All insects have how many total legs?
   a. two b. four c. six d. eight

4. Which of the following is NOT an insect?
   a. fly b. beetle c. dragonfly d. spider

5. "Insect" is Latin for
   a. bug b. small c. segmented d. crawls

6. Insects are a class of Arthropods, a word that means
   a. rigid toes b. stiff wing c. jointed feet d. athlete's feet

7. Many insects lay eggs that hatch into
   a. larva b. pupa c. maggots d. cocoons

8. Insects have special mouth parts that allow them to
   a. chew plants b. pierce skin c. eat other insects d. all of these

9. Insects do NOT have
   a. bones b. an exoskeleton c. jointed legs d. antennae

10. Insects have a hard outside layer (exoskeleton) made up of
    a. super glue b. bone c. cartilage d. chitin

11. The study of insects is called
    a. zoology b. insectology c. entomology d. astrology

12. Today, insects are being used to
    a. solve crimes b. clean wounds c. control crop pests d. all of these

13. The life span of a house fly is about
    a. 15 minutes b. 15 hours c. 15 days d. 15 weeks

14. Insects breathe through special holes called
    a. lungettes b. eyelettes c. spiracles d. oxygen pores

15. Most insect species are in which group (order)?
    a. flies (Diptera) b. beetles (Coleoptera) c. ants/bees (Hymenoptera)
    d. butterflies/moths (Lepidoptera).

HOW DO YOU RATE? Add up your points out of 10 questions and find out your current level of insect expertise!

TOTAL POINTS	EXPERT LEVEL	
Less than four	Neophyte	Not to worry, you are in for some great lessons on insects
Five to six	Larva	Not bad…clearly in a growth stage
Seven to eight	Pupa	Impressive…but don't think you can rest just yet
Nine to ten	Bug Brainiac	Highest level…congratulations, you're off to a great start

Discussion Questions

1. How do you rank as an "insect expert"?

2. Which answers were easiest? The hardest? The most surprising for you? Why?

ANSWERS to "What's Your Insect IQ"?

1. **d.** all of these. Insects evolved during the Silurian Period 438-408 million years ago, almost 200 million years before any dinosaurs roamed the Earth!

2. **b.** Insects have three major body parts or segments: head, thorax and abdomen. The variation within the class Insecta is enormous, however, with wings, antennae, mouthparts and legs being specially adapted to each insect's particular environment.

3. **c.** All insects have six legs, although each insect will have legs that are specialized for their environment (i.e. forelegs of a praying mantis are adapted to grab prey; hind legs of a grasshopper and flea are adapted for jumping; the legs of honeybees contain structures that collect and store pollen).

4. **d.** Spiders below to the same phylum Arthopoda, but they are in the class Arachnida--not the class Insecta. Arachnids have 1-2 body segments and eight legs; they include spiders, ticks, mites and scorpions. Besides Insecta and Arachnida, the other Arthopod classes include Crustacea (shrimp, crabs, lobsters, copepods), Diplopoda (millipedes) and Chilopoda (centipedes).

5. **c.** segmented.

6. **c.** jointed feet referring to the multiple joints found in each leg

7. **a.** The life cycle of most insects includes egg, larva (i.e. maggots/caterpillar), pupa (i.e. cocoon) and adult.

8. **d.** Depending on the insect species, the mouth parts will vary. There are different types of mouth parts that allow sucking, piercing, stinging, sponging, or chewing.

9. **a.** Classic features of insects, as well as other arthropods, include a rigid exoskeleton and jointed appendages. Various types of antennae are also present in all arthropods except the arachnids.

10. **d.** Chitin is the hard material that makes up the exoskeleton.

11. **c.** Entomology (*entoma*, G. "notched animals/insect"; logy, "the study of").

12. **d.** Despite the general association of insects with crop damage and the spread of diseases, insects have also played several beneficial roles for humans. Ladybugs are often used as natural predators of aphids to control their spread. Also in forensic entomology, police now use the age of fly larvae (maggots) or the presence of other insects to provide an estimate on the time of death at a crime scene. In the 1800s, certain types of maggots were used to clean open wounds since these fly larvae feed on only decaying tissues and leave the healthy areas alone.

13. **c.** The average housefly lives about 17 days. The process of development from egg, maggot, pupae to adult takes about 24-25 days.

14. **c.** Spiracles are the openings in the abdomen that allow gases to enter and leave an insect's internal respiratory system.

15. **b.** Beetle species in the Insect order Coleoptera outnumber all the orders of insects.

Part 2. Check out These Insect Facts!

INSECT WORLD RECORDS

1. It is estimated that the total insects on Earth outweigh humans by a factor of 12, and that there are 300 million insects for each person alive!
2. Nearly a million different insect species have been described, more than the number of ALL other animal species put together!
3. The biggest insect that ever lived: an ancient dragonfly Meganeura, a predatory insect with a wing span of two feet. Try to swat that one!
4. Today's insects range in size from tiny beetles of 0.1 mm long to tropical moths that have a wingspan of nearly 8 inches (30 cm).
5. Some flesh-eating flies can smell the scent of a rotting corpse up to one mile (1.6 km) away.
6. Fleas can wait up to one year between meals. (When they bite humans, we don't feel the bite; instead, an itch is caused by the flea's saliva that sets off an allergic response at the skin site).

AMAZING FEATS BY SIX-LEGGED CREATURES

1. Insects, along with birds and bats, are the only living animals that fly (a few other animals can glide).
2. One locust swarm in Africa can measure 30 meters deep with a front 1500 meters long, and will consume every fragment of plant material in its path.
3. A housefly beats it wings more than 330 times per sec; a bee buzzes along at 200 beats per second. Most butterflies are more relaxed fliers, with wings that move less than 5 times per second.
4. During the mating season, male house flies can race around in short bursts that reach up to 90 mph (145 kmph)!
5. Human eyes have one light-gathering lens in the center of each eye. Dragonflies have almost 30,000 lenses per eye, helping them to detect the slightest movements around them.
6. Insects that feed on fresh blood smell the carbon dioxide that their prey breathes out. This helps them to track down their victims.
7. Houseflies cannot fly upside down, but they land easily on a ceiling by flying below it, raising their two front legs and grabbing hard, then swinging forward their four back legs in order to stick solidly upside down on the ceiling.

WHO WOULD HAVE THOUGHT?

1. Up to 80% of an insect’s brain is used to understand what its eyes see and what its antennae sense.
2. Most insects use their antennae to smell and detect scents, although some use antennae to taste.
3. Flies taste food with special hairs on their feet.
4. Crickets don't have ears; instead they “hear” through large swellings on their front legs.

5. A ladybug is no lady! One ladybug can eat up to about 50 aphids a day or about 5, 000 in a lifetime. If there is not enough food, ladybugs turn cannibal and start to eat their young. Oh, and there are both female AND male "lady" bugs.
6. Ladybugs use their bright color to deter birds from eating them but also send out smelly chemicals from their knee joints to further protect themselves.

Primary Source for the Interesting Insect Facts

1001 Facts About Insects, Laurence Mound and Steve Brooks, DK Publishing, 2003.

Discussion Questions

1. What do you think was the most amazing, most funny, or most strange fact about insects?

2. Ask students if they ever heard of insects being used to help crime scene investigators? (If yes, have them describe what they know). Remind them that the *CSI: Crime Scene Insects* exhibit introduces the fascinating world of forensic entomology and shows how flies and beetles can become living evidence in solving various crimes.

CSI Activity 1.2

Part 1. Bugged by Bugs?
Part 2. So Why the Fly in the Portrait?

Overview

"Yuck! Bugs." If that's your students' reactions when introduced to a unit on insects, this activity is for them. Part 1, "Bugged by Bugs?" addresses the negative feelings and fear sometimes associated with insects. A guided classroom discussion promotes the idea that becoming more familiar with the small, six-legged creatures may counter misconceptions and even lead to a fascination with insects. The lesson prepares students for the upcoming classroom experiments where live insects are collected, raised and studied. It is also an excellent pre-visit activity for the *CSI: Crime Scene Insect Exhibit* since live beetles, flies and their larva are an important part of the displays.

Part 2 "So Why the Fly in the Portrait?" further explores the types of associations we make with insects and other animals. It begins with examining reasons for the curious insertion of a fly in a Renaissance painting showcased in *CSI Crime Scene Insects*. It ends with students considering other animal symbols or trademarks and how associations with the same animal can vary dramatically depending on one's cultural perspective.

Estimated time: One class period

Grade Level: Grades 3-8. Select or modify questions according to grade level.

Background and resources

For images of insects, use a large picture book or print images from web sites
HINT: search Google first selecting "images" and then searching by insect common names.

Materials

Compile 6-10 large photos or overheads of insect close-ups: include "good bugs" (ladybugs, butterflies), "bad bugs" (flies, grasshoppers, mosquitoes, beetles, bees), and "ugly bugs" (larvae such as caterpillars and maggots).

Renaissance portrait "Madonna and Child."

Procedure

Part 1. "Bugged by Bugs?"

1. Start the discussion by showing the photos of insects that are usually associated with positive feelings (butterflies, ladybugs). Then show grasshoppers, beetles and flies to begin to bring up possible negative thoughts about insects (crop damage, disease). The last groups of photos should include some even less popular insects (mosquitoes, bees) larvae (caterpillars and maggots). Be sure flies, beetles and maggots are included in this exercise since they will be important in subsequent activities.

2. With each photo, solicit the students' immediate associations. Help them explore why they make their particular associations and why such small animals can invoke such strongly positive or negative feelings. Evaluate why some students may have completely opposite reactions.
3. Suggest that as we learn more about insects, perhaps our biases and negative impressions may be replaced, or at least tempered, by curiosity and an appreciation for the remarkable adaptations (and even beauty!) that insects demonstrate. Have any students who especially like insects share their reasons and experiences with insects.
4. Introduce the *CSI: Crime Scene Insect* Unit, and describe some of the upcoming activities including a visit to the *CSI: Crime Scene Insects* exhibit!

Extension Activities

1. "Can You Say Coleoptera?" Along with each photo, display the insect common name, genus, species, order, class and phylum to briefly introduce insect terminology and classifications. Ask students to try to pronounce some of the more interesting names and discuss their meaning (see **Glossary**).

2. "Phobia Focus". Have the students research the medical words for "fear of insects", "fear of spiders" and other animal phobias. They might also find out how common these conditions are and how they can be treated.

Part 2: So Why the Fly in the Portrait?

1. Show a reprint of the painting "Madonna with Child" as displayed in the exhibit.

2. Ask students to look at the painting and come up with an appropriate title.

3. Do they see anything interesting or surprising?

4. Challenge the students to find the fly in the portrait. (Look at the infant's right leg).

5. Ask the students to explore reasons why the painter would include something as unlikely as a fly in this portrait.

6. Why only a single fly and why only on the infant?

7. What associations do they make with flies?

8. Introduce the idea of flies being associated with decaying food or dead animals. Explain that during the Renaissance period, a fly painted on an individual's hand, leg or body indicated death for that person. A fly was often added to a painting after the subject had died or was used as a harbinger of death.

9. Ask students why people looking at the painting in the 1400s probably didn't have to have this symbolism explained to them, but today it isn't immediately obvious what the presence of a fly would indicate.

   HINT: With little refrigeration or preservation of meat (or corpses) at that time, people were very familiar with the sight of flies hovering around the carcass or body after death. Adult flies lay eggs on the decomposing tissue and the larvae that hatch from the fly eggs develop and feed off the decaying tissue. Fly larvae are also known as maggots.

Discussion Questions

1. List and discuss other animals have are used as symbols or are associated with human traits (lions/courage; owl/wisdom; fox/sly). Class groups can compete to see how many each group can come up with in a given time.
2. How many sports teams can students list that are named after animals? What attributes do these animals portray for the team? If you had to name a team after an insect, which one would you choose and why?
3. What trademarks have been linked to animals? How about animals associated with brand names or logos? (cars/Mustang, US Post Office/eagle, Disneyland/Mickey Mouse)

Extension Activities

1. "Advanced Research-1." Research the associations other cultures had with flies or other insects. For example, compare the significance that flies had in ancient cultures (i.e. Babylonians, Phoenicians, Egyptians), mythology (Greek/Roman/Native American) or

literature (*Lord of the Flies*). Explain how different cultures could have different/similar beliefs about the same insect.

2. "Advanced Research-2." Research your official state/county animal. Find out or suggest a reason for its selection to represent your area. When was it selected? Were there alternatives considered? Is there an official insect for your state? For your school? If not, which insect would you choose for your state and school and why?

3. "Insect Ads." Review common phrase that are describe attributes of animals. (i.e. "as slow as a turtle," "as strong as an ox," "as happy as a clam"). Challenge students to come up with a slogan that would go along with a fly, a beetle or a maggot. Have them create a mini "billboard" using their phrase as an "advertisement" for this animal. Students can include their own drawings or use images cut out from magazines and newspapers in their ads.

CSI Activity 1.3
Build a Bug

Overview

This lesson uses an art project to introduce insect anatomy and classification. In Part 1, students observe a series of enlarged photos (or mounted specimens, if available) of various common insects to examine and record details of insects' basic body segments, eyes, appendages, wings and sensory structures. Students use their recorded observations to create a 3-D model of an insect of choice.

In Part 2, students research their "chosen insect" to discover and report on additional details about its habitat, life cycle and environmental impact. A comparison of all the constructed insect models, along with the insect reports, allows the students to develop a classification scheme to describe the major groups of insects and other members of the arthropod phylum.

Estimated time: Minimum of 2-4 class periods. The time will vary depending on the expected detail of the insect models, completeness of the reports and whether the students work individually or in small groups.

Grade level: Grades 3-8, depending on the complexity of the insect models and reports. Discussion questions and optional extension activities can be deleted or modified as needed.

Materials

1. Large, close-up color photos of 10-12 adult insects.

   Be sure to obtain representatives from the major insect orders. Try to get multiple views of each insect, if possible, in order to show the details of the head, wings, legs and abdomen. You might include a spider which is an arthropod but not an insect, just to stimulate a bit of controversy.

   Option: have the students or each group select an insect and locate appropriate photos and information doing a Web search.)

2. Classification Key for Classes of Arthropods
3. Major Orders of Insects
4. Balloons of various sizes and shapes (round, elongated)
5. Paper strips in various colors
6. White glue for dipping the paper strips in order to adhere to balloons
7. Wax paper
8. Cookie sheets (or counter space for drying the models)
9. For legs: pipe cleaners, coat hangers, wire
10. For wings: sections of panty hose or cellophane stretched over wire shapes
11. For eyes: wads of paper
12. Paints and paint brushes

13. Colored markers
14. Glitter, sequins, buttons
15. String or nylon thread to hang each insect model

Procedure

This activity can be done by individual students or in small groups.

Part 1. Building your insect

1. Obtain and look carefully at large, close-up photos of various insects. Select an insect that appeals to you--one that you would like to build a model of and research more details about.
2. Record as many observations as you can about your insect while looking at the photos. Make notes about all parts of the body including the major sections (segments), legs, wings, antennae, eyes and any other notable features. Describe each part or structure carefully including shape, color, relative size, texture etc.
3. Using the materials supplied in class, or other materials that you have decided to bring from home, build a three-dimensional model of your insect. The basic body can be constructed by covering balloons with paper dipped in glue. A few layers of paper should be good enough. You might use balloons of different sizes to represent the different segments of your insect.
4. Decide if you need additional features of your insect that need to be constructed with the glued-paper and apply those if necessary.
5. Place each covered balloon on a cookie sheet lined with wax paper to dry. After it is dry, pop the balloon inside using a small needle or pin.
6. After the paper dries, glue the segments together.
7. Construct and attach wings, legs, antennae to the appropriate segments of your insect.
8. Decide if your insect will look authentic, or if it will be more of a “fanciful” representation of the insect.
9. Paint, color and decorate your insect according to your decision. The only requirement is that the anatomy of the insect be correct. The colors are up to you.
10. When the insect is completed and dry, attach a thread or string to it so that it can be displayed in class.
11. Construct and attach a label card identifying your insect and its creators (you!) You should use common and scientific names for your insect, and if you like, you can give it your own personal “pet” name as well.

Part 2. Researching your insect.

1. Obtain as much information about how your insect lives, survives and behaves using web searches, the library, books from home.
2. Put together a written report describing your insect. Include: common name(s), classification (kingdom, phylum, class, order, genus and species), habitat and life cycle. Also see if you can find out how it uses its specialized sensory organs to see, taste, hear and touch. Determine what types of food it eats and what predators eat your insect. Describe any unusual activities, abilities or specialized structures of your insect.

3. After you complete the report, “introduce” your insect to the class and present your findings.

Discussion

1. Looking at all the models of insects built in class, describe the basic features of an insect's anatomy. (What segments/parts do they all have in common? What variations do you see between the insect models?)

2. Organize some classification scheme that would include and group every insect represented in the class collection of insect models.

   HINT: Before showing the students a scientific classification chart, encourage them to come up with their own groupings based on whatever criteria they think makes sense. These can be nonscientific and even funny criteria but should be based on some observations.

3. Examine the classification charts for Arthropods and Insects. Look up the meaning of the scientific names, and list a few examples of each class and order. State briefly how the other arthropods are different from insects.

4. Explain why all insects are not technically true “bugs” and why spiders are not really insects.

5. Why do scientists bother to classify organisms? Why do they use scientific genus and species names instead of common names?

Extension Activities

1. A real insect’s “skin” is not made of paper and glue. Find out what the exoskeleton of insects is composed of. Since the exoskeleton can't stretch, describe what happens to the exoskeleton as insects grow.
2. Determine the actual length/size of the insect you researched (in cm). Measure the size of your model and calculate how much larger your insect model is compared to the real animal. Attach a sticker to your insect indicating the magnification size of your model relative to the real insect.
3. Why can’t a live insect ever be the size of your model? Research this.
   HINT: exoskeleton would weigh it down; too much heat build up from increased volume; too much weight for its legs/wings; circulatory system couldn't support its nutritional needs; Where would it possibly get enough food to survive?

Source: “Build a Bug” was adapted from activities described in *The Everything Kids’ Big Book* by Kathi Wagner, Adams Media Corporation, 2003.

CSI Activity 1.4
Surprise, This Dirt's Alive!

Objective

Here's an easy laboratory exercise that lets students discover the amazing diversity of insects and other arthropods living in seemingly lifeless soil. It involves setting up a simple **Berlese funnel** to remove, collect and preserve the small soil organisms taken from various sites around the school yard. These organisms then become specimens that students observe, compare and classify to better understand Arthropods and insects.

When students visit the *CSI: Crime Scene Insect* exhibit they will see a similar type of apparatus displayed as part of a crime scene investigator's experimental tools. In fact, **forensic entomologists** depend upon the same technique described here to collect their own critical insect evidence from soils at a crime scene!

Estimated time: (3-4 class periods)

Day 1	Collect soil samples and set up funnel(s)
Day 1-3	Organisms appear in the bottom collecting jar
Day 2-4	Insect observations and identification

Grade level: Grades 3-8. Discussion questions can be deleted or modified accordingly.

Materials for funnel

1. Plastic funnel with at least a 6-8 inch (15-20 cm diameter (from auto supply or hardware stores)
2. Galvanized screen--coarse mesh, 1/8 to 1/4 inch (3-6 mm
3. Tin snips to cut the screen
4. Cheesecloth (approximately 18-24 inches square)
5. Clear, wide-mouth jar to hold the funnel; funnel should not touch the bottom of the jar
6. Small vial, larger than the mouth of the funnel to collect the insects as they leave the soil
7. Lamp with a 40-watt bulb

Option: Purchase a premade Berlese funnel from Carolina supply (# 65-4148) or smaller re-useable units from BioQuip Products (#2845)

Additional materials

1. Rulers
2. Spoons or trowels to collect soil
3. Plastic bags
4. Newspaper
5. Marking pen

6. Rubbing alcohol (70%)
7. Glycerine
8. Hand lens (10X) or dissection microscope
9. Insect Orders Chart (see reference section of *1001 Facts about Insects*; L. Mound & S. Brooks, DK Publishers; or a similar entomology text for insect classification groups)

Procedure

Adapted from "Collecting Microarthropods" by Steve Binkley; Carolina Biological Life Science Activity. See http://www.carolina.com/life_science/microarthropods.asp)

1. To make each Berlese funnel, cut the 3-6 mm mesh screen into a round disc that will fit snugly about 2/3 the way down into the throat of the funnel.

   HINT: If there is a small screen already inside the funnel, remove it since the mesh is generally too fine for this experiment.

2. Set the funnel, with the screen disc in place, into a wide-mouth jar. Be sure there are a few inches of space between the end of the funnel and the bottom of jar. Alternatively, you can support the funnel with a ring stand.

3. Line the mouth of the funnel with a single layer of cheesecloth and press it down so that it lies on top of the screen. The cheesecloth should be large enough to also drape over the funnel's top rim.

4. Collect soil samples from designated areas. Depending on the size of your funnel, a soil sample that is approximately 15 cm square by 4 cm deep is a good starting point. If the class is doing this in groups, have each group take samples from different spots.

   HINT: Moist soils around bushes or trees should yield more live organisms than dry sandy soils. Areas with rotting leaves or logs are another potentially rich site.

5. Place the collected soil in the plastic bag. Label it with date, student(s) name and a description of the collection site including whether it was in shade, partial/direct sun, was moist/dry and its color/texture.

6. If the sample is damp, let it dry on newspaper in a shoe box at room temperature for 24-48 hours before placing it into the Berlese funnel. Be sure to check for any animals that might be crawling around or away from the soil in the meantime.

7. Place the soil sample into the funnel on top of the cheescloth and screen. It is not necessary to remove any leaves or small twigs (there may be specimens on them).

8. Pour 70% alcohol into the small vial, and place it under the funnel's stem.

   HINT: You can add a few drops of glycerine per 100 ml of alcohol to keep it from evaporating if the experiment runs over the weekend.

9. Turn on the lamp. Place it about 2-3 inches (5 -7.5 cm) above the soil sample.

10. Make daily observations and records of the adult and immature specimens that appear in the alcohol.

    HINT: The animals could start to appear within a couple of hours, even minutes.

Observations

During the 2-3 days of collection time, have the students complete an expanded chart formatted like the one below. For help in identifying their organisms, see the Insect Orders Chart or check out www.edc.org/CCT/AMNH/handbk/InsectCard/artho.html.

SOIL ANIMAL OBSERVATION AND CLASSIFICATION CHART

Sketch of Organism Length (mm)	No. found	Body Segments (No,)	Pairs of Legs (No.)	Pairs of Legs per Segment	Pairs of Wings (No.)	Common Name	Arthropod Class (and Order)
1							
2							
3							
4							

NOTE: The types of insects and arthropods will vary somewhat depending on the habitat. Arthopods in the class Insecta that frequently appear include ants (Hymenoptera) pill bugs (Isoptera), beetles (Coleoptera), cockroaches (Blattodea), earwigs (Dermaptera), springtails (Collembola), and various immature insects that are frequently difficult to identify. Earthworms and non-insect arthropods like mites (Arachnida), spiders (Arachnida) centipedes (Chilopoda) and millipeds (Diplopoda) may also be present.

Discussion Questions

1. What were the most common and least common specimens in your soil sample? How do your findings compare with those of other groups?
2. What might be some of the factors that influenced the types and numbers of insects/arthropods that were found in the different soil samples? (moisture, food sources, light exposure)
3. What do you think caused the insects/arthropods to leave the soil? How would you set up an experiment to test your idea?
   HINT: Could set up a series of funnels to test the independent affect of light (no heat), heat (no light), constant moisture (no drying), drying without heat, etc.)

Extension Activities

1. “Classroom Insect Zoo.” Have the class spend a day or two collecting insects form other sites around the school or around their homes. Ask them to bring in the animals for observation and classification. This activity can be offered to multiple classes to generate a friendly competition to see who gets the most or most varied types of insects. Winners can be awarded small “SuperFly” trophies.

2. “Taxonomy Poems.” Challenge students to compose short limericks or funny poems incorporating some of the scientific names they are learning. For example:

“The Lady Bug” by Yvette H., grade 4, Ms. Jenkins' class,

> A lady who loved the garden Opera,
> Belonged to the Order Coleoptera.
> During intermission she quickly ate
> All her many small green aphid dates
> And alone she left, at half past eight.