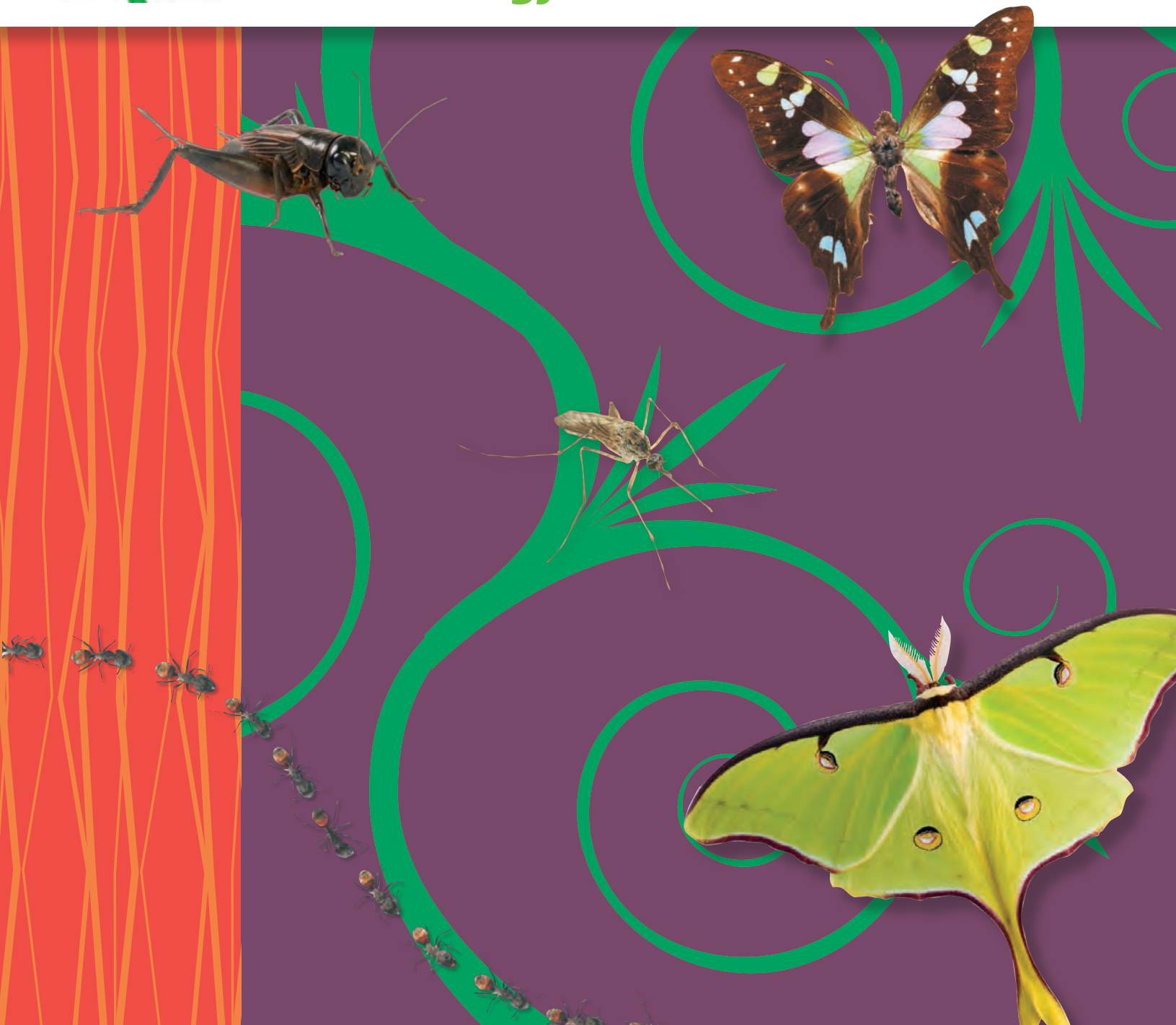
REVIEWED & RECOMMENDED
National 4-H Curriculum

NATIONAL 4-H CURRICULUM
Product Number 08440

Teaming with Insects

Entomology • Level 1 • Grades 3-5



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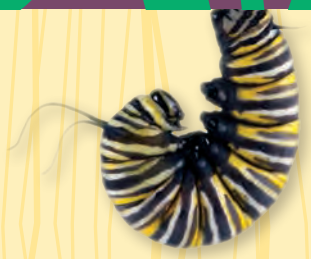

Note to 4-H Member

Have you ever chased butterflies or caught lady beetles to get a closer look at them? If so, you've been attracted by the largest group of animals on earth – insects! Studying and learning about insects is fun. They exist nearly everywhere, so you can study them wherever you live. Insects have been around for millions of years and have adapted to many different habitats. Adaptations (species changes over many generations that allow the species to become better suited to a habitat) can be seen in their legs, eyes, wings, abdomen, and antennae.

Did you know there are more different kinds of insects than all other animal life combined? In fact, there are over 1 million known species of insects, and scientists believe there may be 10 to 40 million more to identify. You can watch and learn about insects almost everywhere. They live on the earth's surface, in the soil, and in water. Insects are at home in deserts, rain forests, hot springs, snow fields, and dark caves.

The study of insects is called entomology (en•to•mol•o•gy). The *Teaming with Insects* curriculum is written for youth who enjoy learning about science and nature by studying insects. Level 1 introduces the world of insects. Activities focus on how they look and move and provide some background for studying important entomology topics. Level 2 shows you how to make insect collection tools and expands on the basic concepts of biodiversity, invasive species, integrated pest management, and forensic entomology. Level 3 delves even deeper into the basic concepts and encourages you to take control of your learning by doing your own research using the scientific method and reference materials.

Who Needs an Entomologist?

Nearly everyone! Police, working with a forensic entomologist, use insects to offer clues in criminal investigations. Doctors need insect information to help people with insect-carried diseases. Homeowners need entomologists to help prevent damage to homes and plants. Teachers use insects in the classroom to teach about living things. Farmers must understand insect biology to prevent insects from damaging crops. Writers create fascinating stories about insects to educate and entertain us. People in industry need to understand insects to manage them better. Some military scientists study exotic insects and the diseases they carry to protect our troops.

You need to know about insects because they are found everywhere, and you will be in contact with them throughout your life. The key to learning in this or any 4-H project is to enjoy your studies and to learn at your own pace. We hope this project is just the start of a lifetime enjoyment of entomology!

Acknowledgments

AUTHORS

Christian Y. Oseto, Professor of Entomology, Department of Entomology, Purdue University

Natalie J. Carroll, Professor of Youth Development and Agricultural Education, Purdue University

CONTRIBUTORS

Linda Crow, 4-H Specialist, North Dakota State University

Gary Dunn, Entomologist, Young Entomologist Society

Staci England, 4-H Specialist, University of Virginia

Corey Gerber, Entomologist, Purdue University

Tim Gibb, Entomologist, Purdue University

Cherie Gumaelius, Teacher, Salem Schools

Patricia Hendricks,4-H Specialist, Iowa State University

Kathy Heinsohn, Entomologist, Western Pest Control

Jan Hoppe, Educational Consultant

Ron Howard, 4-H Specialist, Texas A & M

Ackland Jones, Entomologist, University of Nebraska

David Keith, Entomologist, University of Nebraska

Carolyn Klass, 4-H Specialist, Cornell University

Judy Levings, Entomologist?, Iowa State University

Ina Lynn Metzger, 4-H Specialist, University of Missouri

John Meyer, Entomologist, North Carolina State University

Phil Sloderbeck, Entomologist, Kansas State University.

Tom Zurcher, 4-H Specialist

EDITING/REVIEW TEAM

Denise Dorsey-Zinn, Editor

Natalie Powell, Design and Layout

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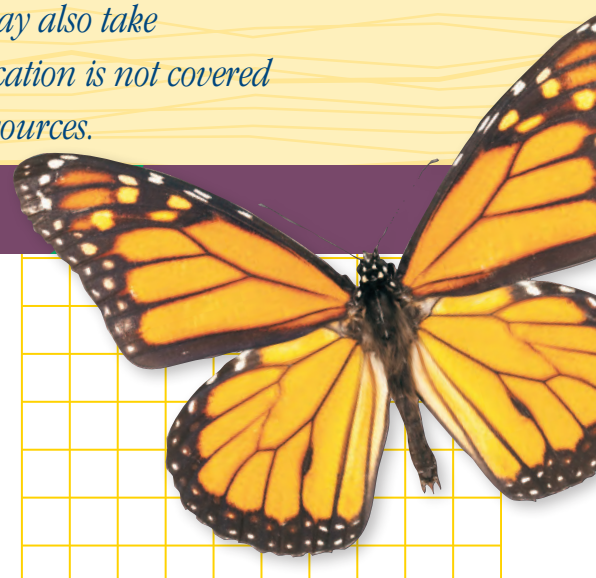
Each activity was developed to be completed in approximately 40-50 minutes. Many can be adapted for a shorter time frame if needed. Some may also take longer, particularly when completing a Dig Deeper. Insect identification is not covered in this manual. See the Resources page for insect identification resources.



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Chapter 1: Be an Entomologist

Insects are fun to watch and study. If you are interested in entomology – the study of insects – you can start by learning insect body parts and how insects see and move. While all insects have the same basic parts, there are a lot of differences in how the parts look and work. This is called diversity.

Activity 1: What Is an Insect?

What makes an insect an insect? All insects have a body that is divided into three parts (head, thorax, and abdomen), a pair of antennae, and three pairs of legs. Some adult insects have one or two pairs of wings. In this activity, you will use the main parts of insects to create a new insect.

MAKE it Mix & Match

Tool Kit

- ☐ Insect pictures
- ☐ Drawing paper
- ☐ Pencil
- ☐ Color markers
- ☐ Clear tape

Find pictures of five different insects in books or magazines.

- Using each picture as a guide, make separate drawings of each of the insect body parts listed below. You will end up with a set of drawings for each of your five pictures.

Antennae	Hind legs
Head	Thorax
Front legs	Abdomen
Middle legs	Wings (if present)

- Color the insect body parts.
- Cut out each insect body part.
- Separate the insect body parts into piles (antennas, heads, thorax, etc.) and then turn them face down.
- Then, draw out one body part from each pile and arrange the parts to make a new insect.
- Tape your new insect so it stays together.
- Label each of the insects you created with the following information.

  Title: My New Insect
  Name:
  Where it lives (habitat):
  What it eats:
  Interesting facts:

Life Skills

ENTOMOLOGY SKILL: Learning insect body parts.

SCIENCE STANDARD: Biological evolution.

SUCCESS INDICATOR: Can name the major insect parts.

Talk It Over

SHARE WHAT HAPPENED: What body parts can you name?

APPLY: How is the insect you made like a real insect? How is it different?

GENERALIZE TO YOUR LIFE: How will what you learned help you with future activities with insects?

Activity 2: Copy Cat

Insect body parts come in different shapes, sizes, and colors that result in a variety of body forms adapted to different environments, but the basic body plan of insects is the same. Insects may be small or large, drab or brightly colored, fast or slow, but they all play a role in nature.

MAKE it Insect Model

Tool Kit

Common materials found your home. For example:

- ☐ Pencil
- ☐ Rubber bands
- ☐ Pipe cleaners
- ☐ Construction paper
- ☐ Milk jug cap or bottle cap
- ☐ Dryer sheets
- ☐ Dried beans or rice
- ☐ Modeling clay
- ☐ Grass blades
- ☐ Leaves (green or dried)
- ☐ Sticks

- Find a picture of an insect you like or use one of the insects that you made in Activity 1.
- Collect common materials found in and around your home.
- Use the materials that you collected to make an insect model.
- Be sure your model includes these insect parts:

Antennae	Hind legs
Head	Thorax
Front legs	Abdomen
Middle legs	Wings (if present)

- Draw a picture, or attach a photo of the insect you created. Identify each part to your helper.

My Created Insect

Life Skills

ENTOMOLOGY SKILL: Learning insect body parts.

SCIENCE STANDARD: Biological evolution.

SUCCESS INDICATOR: Can name the major insect parts.

Talk It Over

SHARE WHAT HAPPENED: What materials did you use to create your insect and how did you assemble it?

APPLY: How could you change your insect model to be like a real insect?

GENERALIZE TO YOUR LIFE: What careers involve decision-making skills?

Activity 3: Define It

All insects have the same basic body parts. Knowing the basic parts allows you to identify insects and their relatives that are not insects. These body parts come in many different styles, sizes, and colors. The differences have evolved to allow insects to live in different habitats throughout the world.

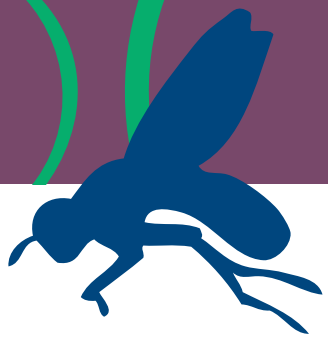
DO it: Insect Body Parts

Draw a line between the body part and its definition.

Hint: Match the body parts and definitions that you know. Then, use the Glossary to match the rest.

Body Part	Definition
Abdomen • (ab-doe-men)	• This is the middle body region between the head and the abdomen. It is divided into three segments, each with a pair of legs. If there are two pairs of wings, they are on the last two segments. If there is only one pair, it is on the middle segment.
Antenna • (an-ten-na)	• Found on the last segment of the abdomen of female grasshoppers, it is used to lay eggs.
Compound Eye •	• There are two of these in front of or between the eyes. They are used to touch, smell, hear, and, in some cases, detect moisture and temperature. The shape varies.
Head •	• Most insects have two of these, made up of many individual lenses.
Leg •	• This helps insects hear. They are found on each side of the first segment of the abdomen in grasshoppers, and on the inside of the front legs in crickets. Not all insects have these.
Ovipositor • (o-vi-poz-i-ter)	• Often the largest region, it usually has nine or 10 segments or rings.
Spiracle • (spi-ra-kal)	• Insects breathe through these small holes on the side of the thorax and abdomen. There are two pairs on the thorax and eight pairs on the abdomen in most insects.
Thorax • (thor-ax)	• An insect has three pairs of these: front, middle, and back. Not all three pairs are alike and sometimes the back pair is used for jumping (as found on a grasshopper).
Tympanum • (tim•pa•num)	• This body part is like an upside-down bowl. The compound eyes and antennae are on the top or sides. Mouth parts are on the underside.

Activity 3: Define It



Life Skills

ENTOMOLOGY SKILL: Learning insect body parts.

SCIENCE STANDARD: Biological evolution.

SUCCESS INDICATOR: Can match insect parts to their definitions.

Dig Deeper

Collect three insects and see how many insect body parts you can identify for a friend. Record your data in the graph paper section below, or download a data page from the 4-H website at www.4-H.org/curriculum/.

Talk It Over

SHARE WHAT HAPPENED: Was it easy to match the body parts with the definitions?

APPLY: How are the parts of insects similar to animals? How are they different?

GENERALIZE TO YOUR LIFE: Why are definitions important?

FACT!

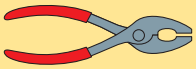
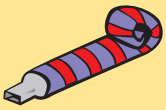
True flies have one pair of wings.
The second pair of wings are actually balancing organs called halteres.

Activity 4: Big Mouth Bugs

Insects are the most successful group of animals in the world. This is because different species are adapted to many different habitats. For example, differences in mouth types allow insects to eat many different kinds of foods. In this activity you will match the mouth types with a common object that works much the same way.

DO it Mouths to Feed

- Draw a line from the Common Object to the Mouth Type it describes.
- Draw a line from the Mouth Type to the Insect that has that mouth type.

Common Object	Mouth Type	Insect
•	• Chewing: Crushing mouth parts used to tear chunks of leaves or other types of food. •	• Mosquito
•	• Piercing/Sucking : Long thin mouth parts used to poke into food source. •	• Grasshopper
 •	• Siphoning: Long coiled tube used to suck up liquid. •	• House fly
 •	• Sponging: Soft tissues used to mop up liquids. •	• Butterfly

Dig Deeper

Collect three insects and identify the mouth type each has.

Life Skills

ENTOMOLOGY SKILL: Learning insect mouth types.

SCIENCE STANDARD: Studying form and function, biological evolution.

SUCCESS INDICATOR: Ability to describe different inset mouth types.

Talk It Over

SHARE WHAT HAPPENED: Describe different insect mouth types to a friend or helper.

APPLY: How might having different mouth types help insects survive in different habitats?

GENERALIZE TO YOUR LIFE: What tools do people use to help them eat and drink different kinds of food?

Activity 5: FACETnating

Have you ever looked at a picture with a friend and separately described what you saw? You both saw the same thing, but you probably explained the picture differently. You learn much about your world by looking. An insect has a compound eye and sees objects differently than other animals because of the way its eye is made. In this activity you will make a viewer, look through the viewer, and get an idea of how an insect sees the world through its compound eye.

MAKE it These Eyes

Tool Kit

- ☐ Drinking straws
- ☐ Tape
- ☐ Red plastic sheet (clear)

When you look at a tree or person you see the whole tree or person. Insects look at a tree or person and see them divided into several thousand parts. The number of parts depends on how many facets make up each compound eye.

- Cut a handful of drinking straws in half and hold them together.
- Wrap the straws tightly with masking tape so they can stand on their own.
- You have just made a compound eye model.

USE it These Eyes

- Look at a picture through your compound eye model.
- Draw what you see.
- Find a red object or red letters and view through the red plastic.
- Look at the red object or letters through your compound eye model with the red plastic in front of it.

Life Skills

ENTOMOLOGY SKILL: Learning about insect eyes.

SCIENCE STANDARD: Insect form and function.

SUCCESS INDICATOR: Describe how an insect sees through a compound eye.

Talk It Over

SHARE WHAT HAPPENED:

- What do you see through the "insect" eye?
- How does the picture change from what your own eyes see?
- How do the red objects change when viewed through the red plastic?

APPLY: Do you think insects would be attracted to a red flower, if they can't see the color red?

GENERALIZE TO YOUR LIFE:

- Is it easier for you to describe things with words or with pictures? Why?
- If you have to describe something to someone, which helps more—a quick look or a long, careful one? Why?

Activity 6: Insect Olympics

Human athletes compete once every four years in the Summer Olympics. Events include running, swimming, and jumping. Some athletes set new world records in their event. Insects do not have a competition in which they are tested on how fast they can fly, how far they can jump, or how fast they can swim. If insects did compete against humans in the Olympics, they might set world records! This activity helps you make comparisons between what insects and humans are able to do.

DO it Hop, Skip, Jump

Tool Kit

☐ Tape measure

☐ Stopwatch or watch with second hand

☐ Pencil

- Measure or time yourself in each event or ask a helper to record the time and distances for you.
- Record the data and complete the calculations.

Event ❶ Standing Long Jump

- Stand with your toes behind a line and jump as far as you can.

  Measure how far you jumped in inches.

  I jumped _____ inches.
- Fleas can jump 200 times their height in inches. Measure your height in inches and multiply it by 200.

  My height in inches: _____ x 200 = _____. This is how far I could jump if I were a flea!

Event ❷ Flying

- Stand with your arms out.

  Ask a helper to keep time and count how many times you can flap your arms up and down in 10 seconds.

  I can flap my arms up and down _____ times in 10 seconds.
- A biting midge can flap its wings 1,000 times in 10 seconds. Compare the number of wing flaps that you did in 10 seconds to 1,000.

Event ❸ Dash

- Measure a distance of 50 yards where it's safe to run.

  Ask your helper to time how long it takes you to run from one end and to the other.

  I can run 50 yards in _____ minutes and _____ seconds.
- A cockroach can run approximately 50 yards in 2 minutes. Compare your time in the 50-yard dash to a cockroach. Who wins the race? _____

Event ❹ Walking

- Measure the distance around the block or yard, or around the school by counting your steps as you walk.

  I took _____ steps.

  Then estimate how long your average step is in feet.

  My average step is _____ feet.

  Multiply that by the number of steps you took to determine the distance in feet.

  _____ steps x _____ feet/step = _____ feet

Now, walk that distance as quickly as you can without running. Record the time when you started and when you stopped so you know how many minutes it took you.

Activity 6: Insect Olympics

Start time: _____

End time: _____

I took _____ minutes to walk the distance.

- Ask your helper to show you how to calculate your speed (miles/hour).

To calculate your speed, divide the distance you walked by the time it took you to calculate your speed. For example, 600 steps x 2.5 feet/step = 1,500 feet. If it took you 25 minutes to do the walk, you traveled at a speed of 1,500 feet/25 minutes.

To calculate your time in miles/hour you must divide your speed (feet/min) by 5,280 (ft/mile) and multiply this by 60 (min/hour):

$$\frac{\text{feet}}{\text{minutes}} \times \frac{\text{miles}}{5{,}280 \text{ feet}} \times \frac{\text{minutes}}{\text{hour}} = \text{miles/hour}$$

Event ❺ Belly Walk

- Measure a distance of 50' in a clean hallway.

  Ask your helper to time you as you crawl on your stomach for 50' without using your hands. Record how long it took.

  Start time: _____

  End time: _____

  I took _____ minutes to crawl 50' on my stomach.

- A fly maggot (immature insect) can crawl 50' in 75 minutes. Compare your time in the belly walk to a fly maggot. Who wins the race? _____

Dig Deeper

Collect insects and their relatives such as millipedes, centipedes, and sowbugs and determine how fast they move. Make a 30.5 cm (1') long runway and release your arthropod athlete at one end. With your helper or friend, time how long it takes for the animal to travel the length of the runway. Which of the arthropods was the fastest?

You can record your data in the graph paper section below, or download a data page from the 4-H website at www.4-H.org/curriculum/.

Life Skills

ENTOMOLOGY SKILL: Learning about insect mobility.

SCIENCE STANDARD: Behavior of organisms.

SUCCESS INDICATOR: Ability to describe different insect methods of travel.

Talk It Over

SHARE WHAT HAPPENED:

- Which event was the easiest to do? Which was the hardest?
- How did your time compare to the insect athletes?

APPLY: How does having different methods of moving help insects survive?

GENERALIZE TO YOUR LIFE: How many different methods of moving (travel) do people have?

FACT! Humans have 792 muscles.
Some caterpillars may have as many as 4,000 muscles.