SOLE Sciences of Life Explorations: Through Agriculture Grades 4 and 5





Teacher Guide Unit: Insect Anatomy

UNIT PLAN

UNIT TITLE Insect Anatomy

GOAL

In this lesson, students will learn what **anatomy** means and the interesting physical characteristics of insects. They will learn that all insects have three major body regions, and three pairs of jointed legs.

OBJECTIVES

Students will:

- 1. Calculate, using basic mathematical computations, numbers of insects, body segments, and wings. (NYS Learning Standard 3a: Universal Foundation Skills, Elementary 1)
- Complete a symmetry activity by listening to a set of words and noting which letters they begin and end with. (NYS Learning Standard 1: Language for Information and Understanding, Elementary 1)
- 3. Identify and categorize insects vs. non-insects using a chart to compare their **anatomy**. (NYS Learning Standard 1: Language for Information and Understanding, Elementary 2)
- Demonstrate comprehension of vocabulary related to insect **anatomy** by constructing both simple and complex sentences in conversation, in a variety of tenses. (NYS Learning Standard 1: Communication Skills, Checkpoints A and B)
- 5. Inquire about the differences in **anatomy** between insects, using "why" questions. (NYS Learning Standard 1: Analysis, Inquiry and Design, Elementary 1)
- 6. Describe the characteristics of, and variations between, insects, primarily focusing on insect **anatomy**. (NYS Learning Standard 4: Science, Elementary 1)
- 7. Recognize that all insects have three major body regions, three pairs of jointed legs, and an **exoskeleton**. (NYS Learning Standard 4: Science, Elementary 1)

TERMS

These terms are highlighted in **bold** throughout the lesson pages.

- **abdomen** the last segment of an insect's body; it contains organs that are important to digestion
- **amateur** a person who does something just for pleasure, but does not get paid for it
- **anatomy** the structure of an animal or plant
- antennae a pair of flexible feelers on the head of an insect used to sense the environment
- **arthropod** a group of animals that has a three-part body, jointed legs, no skeleton, and a hard outer covering
- bug an insect with thickened wings and mouthparts used for piercing and sucking
- **compound eye** the type of eye of most insects, made up of many smaller parts that are each able to see part of the image.
- entomologist a scientist who studies insects
- exoskeleton a hard covering on the outside of organisms such as insects, that provides structural support and protection
- insect an arthropod with three body segments (head, thorax and abdomen) and three pairs of jointed legs
- mammals warm-blooded animals with skeletons; their skin is covered with hair or fur and they produce milk to feed their young
- **molt** to shed an outer covering that is replaced by a new one; birds **molt** feathers, snakes skins, and insects molt exoskeletons molt
- **mouthparts** the parts of an insect's mouth especially adapted for a specific way of feeding
- **muscle** a body tissue made of fibers that is able to relax or contract; shortening and lengthening muscles causes parts of the body to move
- **nectar** a sweet liquid made by plants, which attracts and feeds various insects.
- **passive** something that does not act on its own, but only when something else acts on it.
- **pollen** a fine powder produced by plants for reproduction
- **symmetry** sameness on both sides of a dividing line
- **thorax** the middle body segment of an insect between the head and the **abdomen**.
- **ultraviolet** a color of light that humans can't see but some animals can

Integrated Pest Management is a specialized form of environmental management wherein scientific research and real world application work together to reduce pests such as insects, diseases or weeds.

- 1. Properly identify pests
- 4. Determine an action threshold
- 2. Learn the pest/ host biology
- *3. Sample the environment for pests 6. Evaluate results*
- 5. Choose the best tactic

SAFETY

General classroom safety practices should be followed. Use caution when handling insects.

Standards Matrix for this Lesson:

	Standards:									
Month	Unit	Math/Science/and Technology	English Language Arts	Social Studies	НЕАЦТН	ARTS	Food & Fiber Literacy	CDOS	Other Languages	Interconnectedness
3	Insect Anatomy	3a:2 e1	1:3 e1							
		1:7 e1	1:3 e2							
		4:10 e1	1:6 A							
			1:6 B							

Matrix Key: NYS Learning Standards arranged by Standard: Category, Level e = elementary i = intermediate

Categories:

- 1 Career Development
- 2 Universal Foundation Skills
- 3 Language for Information and Understanding
- 4 Language for Literary Response and Expression
- 5 Language for Social Interaction
- 6 Communication Skills
- 7 Analysis, Inquiry, and Design
- 8 Information Systems

- 10 Science
- 11 Technology
- 12 Interconnectedness: Common Themes
- 13 Interdisciplinary Problem Solving
- 14 History of the United States and NY
- 15 World History
- 16 Geography
- 17 Economics

ADDITIONAL RESOURCES

Bugs and Other Insects by Bobbie Kalman and Tammy Everts ISBN-10: 0-86505-713-3 ISBN-13: 9-780865-057135 Cornell University's IPM Program: www.nysipm.cornell.edu (Request an educational trunk for your class!)

SUPPLIES AND EQUIPMENT

Crickets (pet supply stores commonly have crickets for sale approx. \$ 0.10/ea) Clear containers for circkets (with lids) Magnifying glasses Books about insects Ice cubes (optional) Pencils Craft wire

Paper Pictures of various insects Scissors Pipe cleaners Feathers Plastic beads Sequins Glue

BACKGROUND FOR TEACHERS

Bugs

"**Bug**" is a term we use for many small creatures that crawl or fly, many of them **insects**. However, not all **bugs** are **insects** and not all **insects** are **bugs**. Many of us do not like **bugs** or **insects**, especially when they surprise us in a chance encounter. The centipede is a good example. Ticks and mites look like **insects** but on close inspection we see they have eight legs. Millipedes look like the larvae of some moths, but hey are not true **insects**, either.

Insect Anatomy

Insects are **arthropods**, and so are mites, scorpions, crabs and centipedes. **Arthropods** are a group of animals with a hard **exoskeleton**, segmented bodies, and segmented appendages. There are some very basic facts that apply to the **anatomy** of all **insects**, regardless of their highly individual characteristics. They have three major body regions; head, **thorax** and **abdomen**: three pairs of jointed legs; and most have wings for at least part of their life cycle. They have an **exoskeleton** on the outside rather than an endoskeleton on the inside. This **exoskeleton** is a hard but somewhat flexible outer shell, made of a protein substance called chitin (pronounced KITEin) and no bones inside. **Arthropods molt**, or shed their **exoskeleton**, as they grow.

Body Regions

The mouth, eyes and **antennae** are on the head of the **insect**. **Mouthparts** vary among **insects**; they may be specialized for chewing (grasshopper), sponging (fly), sucking (butterfly), or piercing and sucking (aphid). The **antennae** are special feelers that do the work of a nose and hands - **insects** use their **antennae** to smell food and to avoid enemies. The **thorax** is the centeral body region. The wings and all three pairs of legs are attached to the **thorax**, not the **abdomen**. The **abdomen** is usually the largest part of the **insect**.

Wings

Insects can have one or two pairs of wings. In some cases, the hard wings (forewings) do not really help during flight but are there to protect the soft wings (hindwings). Students may not have previously considered the difference between the types of wings used for flight. The importance of **insect** wings is that they are **passive** - they're not moved by specific **muscles** but are flapped by the compression of the **thorax**. **Insects** expand and contract their **thorax** which in turn moves the wings. Small **muscles** on the **thorax** can change wing angle and position during flight.

Eyes

Insects' eyes are a fascinating part of their body. **Insects** can see colors that we cannot, because they can see **ultraviolet** light. This enables them to find **pollen** and **nectar** on flowers more easily. **Insect** eyes are called **compound eyes**, because each of the two large "eyes" is really made up of many small ones that see only a fraction of the whole picture. Because the **compound eye** can wrap all the way around the head in many **insects**, they can detect motion at any angle, making it very difficult to sneak up on them. All adult **insects** have a pair of **compound eyes**, as do nymphs of **insects** that undergo gradual metamorphosis, such as grasshoppers.

Insects may also have simple eyes, each of which has a single lens that detects light. Larvae of **insects** that undergo complete metamorphosis, such as caterpillars, lack **compound eyes** and have up to six very tiny simple eyes. These can see color, but are generally worse at seeing shapes than the **compound eyes**.

Insects are all around us, in all regions of the world, regardless of heat, cold, humidity, or arid conditions. Some scientists estimate that nine out of every ten "animals" is an **insect**. Millions can exist on a single acre of land. They interact with plants and animals, including humans, and with each other. Many are consumers and recyclers of plant and animal material. They help break it down into soil. **Insects** are a major food source for other animals.

QUESTIONS FOR STUDENTS

What is the difference between a bug and an insect?
What makes something an insect?
How many legs does an insect have?
What does anatomy mean?
Do all insects have the same body parts?
What kind of mouthparts do insects have?
How do insects see?

INTEREST APPROACH ACTIVITIES

CRICKETS: UP CLOSE AND PERSONAL

Adapted from www.lessonplanspage.com/ScienceLAInsects-ObservingACricketK3.htm

Teacher Background:

Crickets are insects closely related to katydids, but many times confused with grasshoppers due to their similar **anatomy**. Crickets are known for their chirp which is produced when males rub their forewings together. One wing has ridges and the other has a hardened scraper. Crickets have two types of songs: a calling song and a courting song. Interestingly crickets are considered to be natural thermometers because



they chirp at different rates depending on the temperature of their environment. Most species chirp at higher rates the higher the temperature is. In order to hear the songs of other crickets, crickets have ears on their legs!

Crickets, like many other insects, can be safetly immobilized by being cooled down in a refrigerator or freezer. Cooling the insect down slows body functions and allows students time to investigate the insect with a magnifying glass. The amount of time required to immobilize the insects depends upon the environment the cricket was taken from (the warmer the environement, the longer it will take to cool the cricket). On average, crickets placed in a freezer for 3-4 minutes will be sufficiently immobilized. The crickets will begin to become mobile within a few minutes of warming up (about 5 minutes after coming out of the freezer) To keep the insects immobile longer they can be placed on ice cubes while the students observe them.

Safety:

Because the cricket is a living thing, remind students to treat it gently

Materials:

Magnifying glasses	Pictures of insects
Crickets	Ice cubes (optional)
Clear containers for circkets	Drawing supplies
Books about insects	Access to a freezer

Procedure:

- 1. Place crickets in the freezer for 3-4 minutes
- 2. Ask students if they can describe what a cricket looks like
- 3. Tell them that they are going to be scientists and observe a cricket.
- 4. Divide students into groups of four or fewer
- 5. Show students the cricket and remind them to handle it gently.
- 6. Pass out magnifying glasses and crickets (in plastic containers with ice cubes)
- 7. Allow approximately 5-10 minutes for observations.
 - A. Have students draw a picture of their cricket.
 - B. Warn students that the crickets may begin to wake up and they should have a lid handy.
- 8. Bring class together and ask questions
 - A. What were your observations?
 - B. Do crickets' body parts look like ours?
 - C. What are some cricket body parts that are different from ours?
 - D. List students' answers on the board

9. Class discussion

- A. What are the characteristics of insects?
- B. They have three main parts (head, **thorax**, and **abdomen**)
- C. They have a pair of feelers on the top of their head called antennae
- D. They have 6 jointed legs. Some use their legs for jumping, swimming, or grasping
- E. Instead of skin they have an outer covering called an exoskeleton
- F. Insects can have two sets of wings, one set of wings, or no wings at all.

(For related activities refer to student worksheets #3 through #7)

BODACIOUS BUGS

Adapted from http://www.saxarts.com/resources/lessonPlans/bodaciousBugs.jsp

Teacher Background:

The shapes of insects are fascinating. There are many wonderful features about insects that give them their abilities in flight and survival. The body of an adult insect has 3 main parts - the head, the **thorax** (chest) and the **abdomen**. Almost all adult insects have a pair of feelers or **antennae** at the front of the head. Every adult insect has six legs and most of them have one or two pairs of wings. The **thorax** is the locomotion center. It is packed with powerful **muscles** which operate the insect's 6 legs as well as its wings.

An adult insect wears its skeleton on the outside, in the form of a hard outer coating. This tough shell is light enough not to prevent the insect from flying. The **exoskeleton** also acts like a raincoat and keeps water from soaking into the body. It keeps the body from losing water. It helps the insect live and fly through long dry or rainy spells. It also protects the insect from some of its enemies.

Materials:

Pictures of various insects Scissors Pipe cleaners Craft feathers Plastic beads Sequins Glue Craft wire

Procedure:

- Examine a picture of an insect. How big are the abdomen and thorax? How many legs does it have? What shape are the wings? Have student make a small drawing as a guide.
- 2. To begin, cut a pipe cleaner the entire length of the insect. This will act as a base which other elements can be added to.
- 3. Wind pipecleaners around the base to create the three main parts of the insect (head, **thorax**, and **abdomen**).
- 4. Cut feathers to size and stick the enda into the wound pipecleaners as wings. Add a drop of glue to secure.
- 5. Glue beads on the head of the insect for eyes. Sequins make wonderful **compound eye**s.



- If antennae are needed, they will stick out best if the wire is embedded or wound into the pipecleaner at the head. Craft wire can be used for delcately shaped antennae.
- 7. When the insects are completed they can be hung around the classroom for display.

(For Iredagte charothis these tester to estavoleest lass the Please #2, #6, & #7)

I. Don't **bug** me!

- A. Gets students thinking about **bugs** and **insects**, and emphasizes that they are all around us.
- II. What do you know about insects?
 - A. Questions and basic facts about insects.
- III. What is an insect?
 - A. Students are asked pick insects out of a group of similar creatures
 - B. Terms include entomologist and amateur
- IV. Test your knowledgeA. Questions related to insect identification.
- V. How many legs does an insect have?
 - A. Complete a chart in order to identify insects.
- VI. What does **anatomy** mean?
 - A. Label the parts of a ladybug.
 - B. The reading explains antennae, abdomen, exoskeleton, and molt.

VII.More insect parts!

A. Label the parts of a butterfly.

VIII.Wings

- A. Compares the types of wings used for flight.
- B. Terms include **mammals**, **passive**, **membrane**, and **muscles**.

IX.Mouthparts

A. Illustrations and discussion about types of **mouthparts**

i. Chewing

- ii. Sucking
- i. Piercing and sucking

I. Don't **bug** me!

- A. Discuss this page as a class to start discussion on **bugs** and **insects** and stimulate interest.
- II. What do you know about insects?
 - A. Use the questions provided as discussion points in class.
- III. What is an insect?
 - A. Read the first paragraph together.
 - B. Students may complete the page individually.
- IV. Test your knowledge
 - A. Students may complete this page individually.
 - A. Discuss responses as a class.
- V. How many legs does an insect have?
 - A. This could be completed individually or as a class
- VI. What does **anatomy** mean?
 - A. This could be completed individually or as a class.

VII.More insect parts!

A. This could be completed individually or as a class.

VIII.Wings

- A. Students could take turns reading aloud.
- A. Students could compare the human **thorax** to the insect **thorax**.

IX.Mouthparts

- A. Students could label the piercing and sucking **mouthparts** illustration and compare it to the other two types of mouths.
- B. Discuss how other animals' mouths are designed to eat specific foods
 - i. Wlid cats sharp teeth for raw meat
 - ii. Baleen whale dental comb to strain plankton

TEACHING- LEARNING ACTIVITIES

X. Symmetry

- A. Addresses the concept of **symmetry**, using a ladybug as an example
- XI. Left and Right
 - A. Oral/aural activity in which students create word lists of equal length to further illustrate **symmetry**

XII.Eyes

- A. Discusses how insects' ability to see ultraviolet colors helps them find pollen and nectar
- B. Describes the different types of eyes of **insects**.
- C. Terms include **compound eyes** and **ultraviolet**

XIII.Test your knowledge

A. Questions to gauge student understanding of **insect anatomy**

XIV.Vocabulary

A. Provided for student reference

X. Symmetry

- A. Students draw the other half of the ladybug to illustrate **symmetry**
- XI. Left and Right
 - A. Choose a word list to read aloud to students Students write the words on each side of the ladybug
 - B. Both sides should have an equal number of words

XII.Eyes

- A. Students may take turns reading sections of the page aloud.
- B. Students are asked to locate the areas of the flowers where the **ultraviolet** colors are located (center)
- C. Discuss which types of eyes certain **insects** may have

XIII.Test your knowledge

- A. Students complete individually
- B. May be used as a quiz grade

XIV.Vocabulary

A. Provided for student reference

TEACHING- LEARNING ACTIVITIES

Student Lesson: Insect **Anatomy** Don't **Bug** Me!



"**Bugs**" is a term we use for manythings, including many **insects**. A lot of people don't like things that crawl or fly, but **insects** are really interesting, hardworking, and absolutely necessary!

We hope you learn something about **insects** that you don't know, and maybe you'll even learn to like them!

Not all **bugs** are **insects** and not all **insects** are **bugs**. You will learn the difference.

There are more kinds of **insects** in the world than any other kind of living creature. **Insects** live in all regions of the world regardless of heat, cold, dry or wet conditions. Because there are over a million species of **insects**, scientists have divided them into 32 orders (groups).



Student Worksheet 1

Student Lesson: Insect **Anatomy** What do You Know about Insects?

When you're finished with this unit, you'll be able to answer these questions:

- 1. Is there a difference between a **bug** and an **insect**?
- 2. What makes something an insect?
- 3. How many legs does an **insect** have?
- 4. What does anatomy mean?
- 5. Do all **insects** have the same body parts?
- 6. What is **symmetry**?
- 7. Are **insect** wings like other animal wings?
- 8. What kind of **mouthparts** do **insects** have?
- 9. How do insects see?



Insects have three major body parts.

Insects have three pairs of jointed legs.

Most insects have wings, for at least part of their life cycle.

Insects have have an **exoskeleton** instead of a skeleton like ours. This means they have a hard outer shell and no bones inside.



Student Lesson: Insect **Anatomy** What is an insect?

Is there a difference between a **bug** and an **insect**? You bet! "**Bugs**" is a term we often use to talk about *any* small creatures that crawl or fly, and that we sometimes don't like!

But, some people like insects so much they make a career out of studying them. They are called **entomologists**. You can be an **amateur entomologist** starting right now. Your first lesson is to learn what an **insect** is.

- 1. Fill in the blanks: **Insects** have ______ jointed legs, _____major body regions, and an **exoskeleton**. They may have one or two sets of wings.
- 2. Circle the **insects** below:



name_____

Student Lesson: Insect **Anatomy** Test Your Knowledge!

- 1. How many **insects** did you circle on the previous page?
 - ____5 ____7 ____9 ____10 ____12
- 2. Circle the **insect** at right.



3. Count the segments on the caterpillar below.



4. **Insects** can have one pair of wings or two pairs of wings.

A. If an **insect** has one pair, how many wings does it have? _____

- B. If an **insect** has two pairs, how many wings does it have? _____
- 5. Circle the insect that is different from the other two, in regard to wings



Student Lesson: Insect Anatomy

How Many Legs Does an Insect Have?

Answer yes or no for each question, for each creature.

	6 LEGS	3 MAIN SEGMENTS?	INSECT?
BUTTERFLY			
ANT			
SPIDER			
тіск			
MILLIPEDE			
GRASS- HOPPER			
CENTIPEDE			

Student Lesson: Insect **Anatomy** What Does **Anatomy** Mean?

Anatomy means learning about the parts of the body. Read a little about insect **anatomy** and then label the parts of the bee.

The mouth, eyes and **antennae** are on the head, which is at the front. The **antennae** are special feelers that do the work of a nose and hands - they use their **antennae** to find food and to avoid enemies.

The **thorax** is the center of the three body regions. The wings and all three pairs of legs are attached to the **thorax**, not the **abdomen**.

The **abdomen** is usually the largest part of the **insect**. It is at the opposite end from the ehad, and contains organs for digestion.

Insects do not have bones. They have an **exoskeleton**. The outside of their body is rigid and tough. As they grow, they may **molt** (shed their **exoskelton**). Most **insects** have one or two pairs of wings. Often, **insects** only have wings during part of their lives.

There are tiny hairlike fibers on an insect's legs - this is what they use to pick up **pollen** from flowers.

Below, label the head, **abdomen**, **thorax**, **antennae**, legs, and wings.



name_____

Student Lesson: Insect **Anatomy** More Insect Parts!

Some insects have two pairs of wings. When this is the case, the front pair is called the forewings, and the back pair is called the hindwings.

Butterfly **Anatomy**:

Below, label the forewings, hindwings, eyes, head, **antennae**, **thorax**, **abdomen**, and legs.



Student Lesson: Insect **Anatomy** Wings



Bats are **mammals** that fly. Their wings are unlike any bird or **insect**. They fly with their hands and a special **membrane** (like thin skin) that stretches from their "fingers" to their "ankles." They move their wings like a swimmer doing the butterfly stroke.

Birds' wings are covered with feathers and are shaped differently on different types of birds. They use strong **muscles** in their chests to move the wing. What are some other functions of feathers?

An **insect** expands and contracts its **thorax**, which in turn moves the wings. Small **muscles** on the **thorax** can change wing angle and position during flight. Insect wings are **passive**; they don't move on their own.





Long ago, people watched **insects** and birds and tried to design flying machines that worked the same way. The airplane wasn't invented until 1903! But plane wings don't flap, do they? How is the flight of an airplane powered?

Insects can have one or two pairs of wings. This ladybug shows two pairs: The hard forewings protect the soft hindwings, which are used for flight. The hard wings aren't used in flight, but only for protection.

Student Lesson: Insect Anatomy Mouthparts

Insects can have a variety of **mouthparts**, depending on the use of the mouth in feeding. The mouth is suited to the kind of food the insect prefers.

Grasshoppers and beetles have chewing **mouthparts**.

On the right is the head of a cicada, one of the insects known as "true **bugs**." The long, sharp **mouthpart** is used to pierce the body of prey or into a plant. It is called a "piercing and sucking" **mouthpart**. This type of **mouthpart** is the main thing that sets "**bugs**" apart from "**insects**."





On the left is the head of a butterfly. It has **mouthparts** that are used to drink **nectar**. It is called a "sucking" **mouthpart** because it works like a bendy straw.

Animal	Type of Mouthparts
Fly	Sponging
Beetle	Chewing
Butterfly	Sucking
Aphid	Piercing and sucking

Student Lesson: Insect Anatomy Symmetry

Draw the rest of this ladybug's body. It is the same on both sides. This is **symmetry**. Are humans symmetrical?



Student Lesson: Insect **Anatomy** Left and Right

Listen as your teacher reads words that either begin or end with the letter G. When you hear a word that *starts* with G, write it down in the left side of the ladybug. When you hear a word that *ends* with a G, write it down in the right. If you have listened correctly, your ladybug will have **symmetry**. Both sides will have the same number of words.



Student Worksheet 11

name

Student Lesson: Insect **Anatomy** Eyes!



Insects are drawn by bright **ultraviolet** colors, which surround the **pollen** and **nectar** areas like the lights on an airport runway.

Color the flowers above. Use a bright violet or bright blue to indicate the part of the flower that attracts **insects**.

Most **insect** eyes are called **compound eyes**, because each eye is really a group of many small eyes. Each little eye sees only a small part of the picture. Some **insects** have "simple eyes," each of which has a single lens that detects light. On the right is a picture of a **compound eye** **Insects** see some things better than you do! Their eyes see colors better than human eyes, but their vision is not good with shapes.

Insects can see some colors that we can't see at all. Have you heard of **ultraviolet** colors? A flower may look yellow to you, but an insect can also see the bright **ultraviolet** colors on it which lets them know where **pollen** and **nectar** are. That is what **insects** are most interested in. Where do you think the **pollen** and **nectar** are on these flowers? That's the part of the flower an **insect** will head straight for!



Student Lesson: Insect **Anatomy** Test Your Knowledge!

1. An **insect** has _____ main body regions and _____ pairs of jointed legs.

2. Circle the parts found in an **insect's anatomy**.

head	thorax	hands		
antennae	abdomen	legs		
skeleton	nose	eyes		

3. Symmetry of body parts is found in both insects and mammals.

_____ true _____ false

4. Insects can have one or two pairs of wings.

_____ true _____ false

5. What part of an **insect's anatomy** helps it detect food or predators?

6. Some insects have chewing mouthparts or sucking mouthparts.

_____ true _____ false

7. Name an **insect** and the kind of **mouthpart** is has (chewing, sucking, sponging)

8. Some **insects** can see colors we can't see.

_____ true _____ false

name

Student Lesson: Insect Anatomy Vocabulary

- abdomen the last segment of an insect's body; it contains organs that are important to digestion
- **amateur** a person who does something just for pleasure, but does not get paid for it
- **anatomy** the structure of an animal or plant
- antennae a pair of flexible feelers on the head of an insect used to sense the environment
- arthropod a group of animals that has a threepart body, jointed legs, no skeleton, and a hard outer covering



- bug an insect with thickened wings and mouthparts used for piercing and sucking
- **compound eye** the type of eye of most insects, made up of many smaller parts that are each able to see part of the image.
- entomologist a scientist who studies insects
- exoskeleton a hard covering on the outside of organisms such as insects, that provides structural support and protection
- insect an arthropod with three body segments (head, thorax and abdomen) and three pairs of jointed legs
- mammals warm-blooded animals with skeletons; their skin is covered with hair or fur and they produce milk to feed their young
- **molt** to shed an outer covering that is replaced by a new one; birds **molt** feathers, snakes skins, and insects molt exoskeletons molt

mouthparts - the parts of an insect's mouth especially adapted for a specific way of feeding

- **muscle** a body tissue made of fibers that is able to relax or contract; shortening and lengthening muscles causes parts of the body to move
- **nectar** a sweet liquid made by plants, which attracts and feeds various insects.
- **passive** something that does not act on its own, but only when something else acts on it.
- **pollen** a fine powder produced by plants for reproduction
- symmetry sameness on both sides of a dividing line
- **thorax** the middle body segment of an insect between the head and the **abdomen**.
- ultraviolet a color of light that humans can't see but some animals can

Integrated Pest Management is a specialized form of environmental management wherein scientific research and real world application work together to reduce pests such as insects, diseases or weeds.

- 1. Properly identify pests
- 2. Learn the pest/ host biology
- 4. Determine an action threshold
- 6. Evaluate results
- 3. Sample the environment for pests
- 5. Choose the best tactic

Teacher Information for Student Workseets

Student Worksheet 1

Don't Bug Me!

Insects are all around us. Millions can exist in a single acre of land. Many **insects** are consumers and recyclers of plant and animal material. This helps our soil. **Insects** are a major food source for other animals. When a mosquito is pestering you or something is eating the leaves of your favorite plant, your opinion of **insects** may be low. But they are an important part of our world; highly valuable in the food chain. Our environment would not exist as we know it without **insects**!

Student Worksheet 2

What Do You Know About Insects?

ts very common for people to use the term "**bug**" to describe insects in general, plus other creatures that crawl or fly. The goal of these activities is to teach what exactly an insect is, and how varied and interesting insects can be. It is the variety of ways insects interact in their environment that makes them as successful as they are. When we take the time to learn about something, our fear lessens and our appreciation increases.

Student Worksheet 3

What Is an Insect?

Students will use this sheet to test their knowledge of **insects**. Remind them that **insects** have three main body regions (which are not always easy to detect) and three pairs of jointed legs. Remind students that different life stages will not seem to follow those rules. Caterpillars, for example, have a version of the three body regions rule, and they do have three pair of true legs attached to the **thorax**. However, caterpillars have additional stubby limbs, which are not true, jointed legs.

Answers:

1. 6, 3

2. Dragonfly, Fly, Grasshopper, Ant, Butterfly, Mosquito, Beetle, Praying Mantis, Caterpillar, Bee



Student Worksheet 4

Test Your Knowledge

Answers:

- 1. 10
- 2. Mosquito
- 3. 13
- 4. A.) 2 B.) 4
- 5. Fly because it only has one pair of wings, and the others have 2

All flies have one pair of wings only. As students learn more about **insects**, they will begin to look for some of these parts of their **anatomy** that help describe them. A very beneficial **insect** called the hover fly eats **insect** pests from flowering plants. It resembles some bees or wasps, because of its coloring. But upon closer examination, you can see it has one pair of wings. Understanding and identifying **insects** helps you determine if it is a pest or a beneficial **insect** and is an important part of integrated pest management.



Student Worksheet 5

How Many Legs does an Insect Have?

Students practice using a chart to reinforce what they are learning about **insect anatomy**. Of the garden creatures depicted, only the butterfly, the ant, and the grasshopper are **insects**. Spiders, ticks, millipedes and centipedes do not follow the rule of three pairs of legs. You may use this to continue the discussion of **bug** vs. **insect**.

Student Worksheet 6

What Does Anatomy Mean?

Using the six **anatomy** words given, students will label the body parts of the ladybug.

Student Worksheet 7

More Insect Parts!

Students are asked to label the **anatomy** of the butterfly.

Student Worksheet 8 Wings!

The importance of **insect** wings is that they are **passive** - not directly moved by **muscles** but flapped by the compression of the **thorax**. Students may compare this to the human **thorax**, as the chest expands and contracts during breathing.

The ladybug is a beetle with two pairs of wings. The forewings are rigid and protective and do not assist flight. The hindwings are soft and flexible and are folded under the forewings for protection.

Although it sometimes appears that **insect** legs are attached to the **abdomen**, remind students that they are always attached to the **thorax**.

Student Worksheet 9

Mouthparts!

It is easy to see why the mouthparts of the true bug are called "piercing and sucking."

The eye takes up a large portion of the butterfly's head - why? Students may guess it is because the adult butterfly is so dependent on visual clues to find its food source, **nectar**. Notice the straw-like **mouthpart** of the butterfly, used for drinking **nectar**, and how it differs from the **mouthparts** of the true **bug**.

Some type of **insect** feeds on almost everything, and almost every **insect** is food for something else. Herbivorous **insects** are plant eaters; carnivorous insects feed on other **insects** and animals. Ask students to consider other animals and how their mouths are adapted to the specific foods they eat. What characteristics of their own mouth allow them to eat what they do?

Student Worksheet 10

Symmetry

Some lady**bugs** have two spots and some have seven, but there is always an equal number on each side. This is a good example of **symmetry**. How can a ladybug have seven spots and still be **symmetrical**?

The center spot is divided between two wings. Are humans symmetrical? Most animals are symmetrical. What living things are not? (plants)

Student Worksheet 11

Left and Right

Two word lists are provided to read aloud. Students will write each word in the left or right side of the ladybug, depending on whether it begins or ends with G. When they are finished, they should have an equal number of words on each side of the ladybug. Instruct students to listen carefully, since some of the words are "trick questions" and do not begin or end with G at all! Remind them that G can make a hard or soft sound. You can adapt this activity to your class's skill level by adding or subtracting words.

Here are two word lists for this activity:

Easier List:		More challenging list:			
gray	gravy	giraffe	log		
bug	wing	guideline	flying		
go	golf	gratitude	begin		
sock	plug	grasshopper	hindwing		
book	cat	biology	ladybug		
dog	beetle	јоу	chewing		
ground	egg	glow	agent		

Student Worksheet 12

Eyes

Direct students to locate the part of the flower that contains the **pollen**. **Pollen** is held on the tips of the anthers where **insects** are likely to brush against them. **Nectar** is secreted by glands at the base of the flower around the ovary. When the **insect** goes to the next flower to drink **nectar**, some of the **pollen** it has picked up from the first flower will be brushed against the stigma on the second flower. This is fertilization by **insects**.

Remind students that the **pollen** is in the center of the flower, but that the **ultraviolet** color is encircled around the center and acts as a target or landing strip to bring the **insect** right to the **pollen**.

All adult **insects** have a pair of **compound eyes**, as do nymphs of **insects** that undergo gradual metamorphosis, such as grasshoppers. Larvae of **insects** that undergo complete metamorphosis, such as caterpillars, lack **compound eyes** and have up to 6 very tiny simple eyes. These can see color, but are generally worse at seeing shapes than the **compound eyes**. A **compound eye** can have thousands of lenses; a big dragonfly can have 30,000!

Because the **compound eye** can wrap all the way around the head in many **insects**, they can detect motion all the time. That makes it very difficult to sneak up on them. For **insects** that depend on collecting **nectar** and **pollen**, the ability to direct their searching to the important part of the flower enables them to get down to business efficiently. The outer portion of the petals serve as a landing platform.

Student Worksheet 13

Test Your Knowledge

Use this page to gauge what students have learned through their activities. It could count as a quiz grade.

Answers:

- 1. 3, 3
- 2. head, thorax, antennae, abdomen, legs, eyes
- 3. true
- 4. true
- 5. antennae
- 6. true
- grasshopper chewing butterfly - sucking fly - sponging ladybug - chewing aphid - piercing/sucking
- 9. true

Student Worksheet 14

Vocabulary Provided for student reference