

Day 1

What Are Bugs?





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Introduction

People who aren't [entomologists](#) use the word “bugs”^{*} to refer to all manner of creatures that creep, crawl, burrow, jump, fly, and swarm. Most of the [invertebrate](#) animals we think of as bugs are [arthropods](#), a [phylum](#) or division of invertebrates grouped together based largely on body parts. The arthropods include insects, spiders, crustaceans, and centipedes. Insects are a subgroup, or [class](#) of arthropods that have a 3-part body, six jointed legs (3 pairs), an [exoskeleton](#), compound eyes, and external mouthparts. Many insects, but not all, have one or two pairs of wings. This day focuses on what makes insects unique, where they fit into the animal kingdom, and why it's valuable to get outside and observe them.

^{*} What entomologists call true bugs — cicadas, aphids, planthoppers, leafhoppers, assassin bugs, bed bugs, and shield bugs — are insects, but not all insects are true bugs since not all insects have membrane wings and the sucking mouth parts of the true bugs.

Questions to guide explorations and experiments

- What are bugs? What are insects?
- What makes an insect an insect?
- How are bugs and insects different?
- What do insects look like?
- What do insects do?
- Why are there so many insects?

Books and activities

- **Books:** all about getting to know insects and bugs
- **Activities:** learn about the characteristics of insects and other arthropods



Children's Books

Fiction

- *Bug* by Robin Koontz (ages 4-8)
- *Bug Safari* by Bob Barner (ages 4-8)
- *Burt the Beetle Doesn't Bite!* by Ashley Spires (ages 5-8)
- *Bompa's Insect Expedition* by David Suzuki with Tanya Lloyd Kyi (ages 4-8)
- *Hank's Big Day: The Story of a Bug* by Evan Kuhlman (ages 3-7)
- *I Like Bugs* by Margaret Wise Brown (ages 3-6)
- *Super Fly: The World's Smallest Superhero!* by Todd H. Doodler (ages 7-9)

Poetry

- *Bug Off! Creepy Crawly Poems* by Jane Yolen (ages 4-8)
- *Joyful Noise: Poems for Two Voices* by Paul Fleischman (ages 9-12)
- *Cricket in a Thicket: Poems About Bugs* by Carol Murray (ages 6-10)

Nonfiction

- *Ada Magnífica, científica, investiga: ¡Todo sobre los insectos!* by Andrea Beaty and Theanne Griffith (ages 5-8)
- *Ada Twist, Scientist: Why Files #4: Bug Bonanza!* by Andrea Beaty and Theanne Griffith (ages 5-8)
- *The Book of Brilliant Bugs* by Jess French (ages 6-8)
- *The Bug Book* by Sue Fliess (ages 2-5)
- *Bug Butts* by Dawn Cusick (ages 4-8)
- *Bugs Don't Hug: Six-Legged Parents and Their Kids* by Heather L. Montgomery (ages 3-7)
- *Bugs from Head to Tail* by Stacey Roderick (ages 4-8)
- *Butterfly, Flea, Beetle, and Bee: What Is an Insect?* by Brian P. Cleary (ages 5-9)
- *Eyewitness: Insect* by DK Publishing (ages 9-12)
- *Fly Guy Presents: Insects* by Tedd Arnold (ages 4-8)
- *Hello, World! Kids' Guides: Exploring Insects* by Jill McDonald (ages 4-8)
- *I Love Insects* by Lizzy Rockwell (ages 4-8)
- *Insects and Arachnids* by Carla Mooney (ages 9 and up)



Children's Books

- *Insects in Action* by Thea Feldman (ages 5-8)
- *My Book of Butterflies* by Geraldo Valerio (ages 8-12)
- *Name That Bug!* by Demi Jackson (ages 6-9)
- *National Geographic Pocket Guide to Insects of North America* by Arthur V. Evans (ages 7-12)
- *Nature All Around: Bugs* by Pamela Hickman (ages 7-10)
- *NGS Little Kids First Nature Guide: Bugs* by Alli Brydon (ages 4-8)
- *One Million Insects* by Isabel Thomas (ages 7-10)
- *There's a Bug on My Book!* by John Himmelman (ages 4-8)
- *Ultimate Bug Rumble (Who Would Win)* by Jerry Pallotta (ages 6-9)

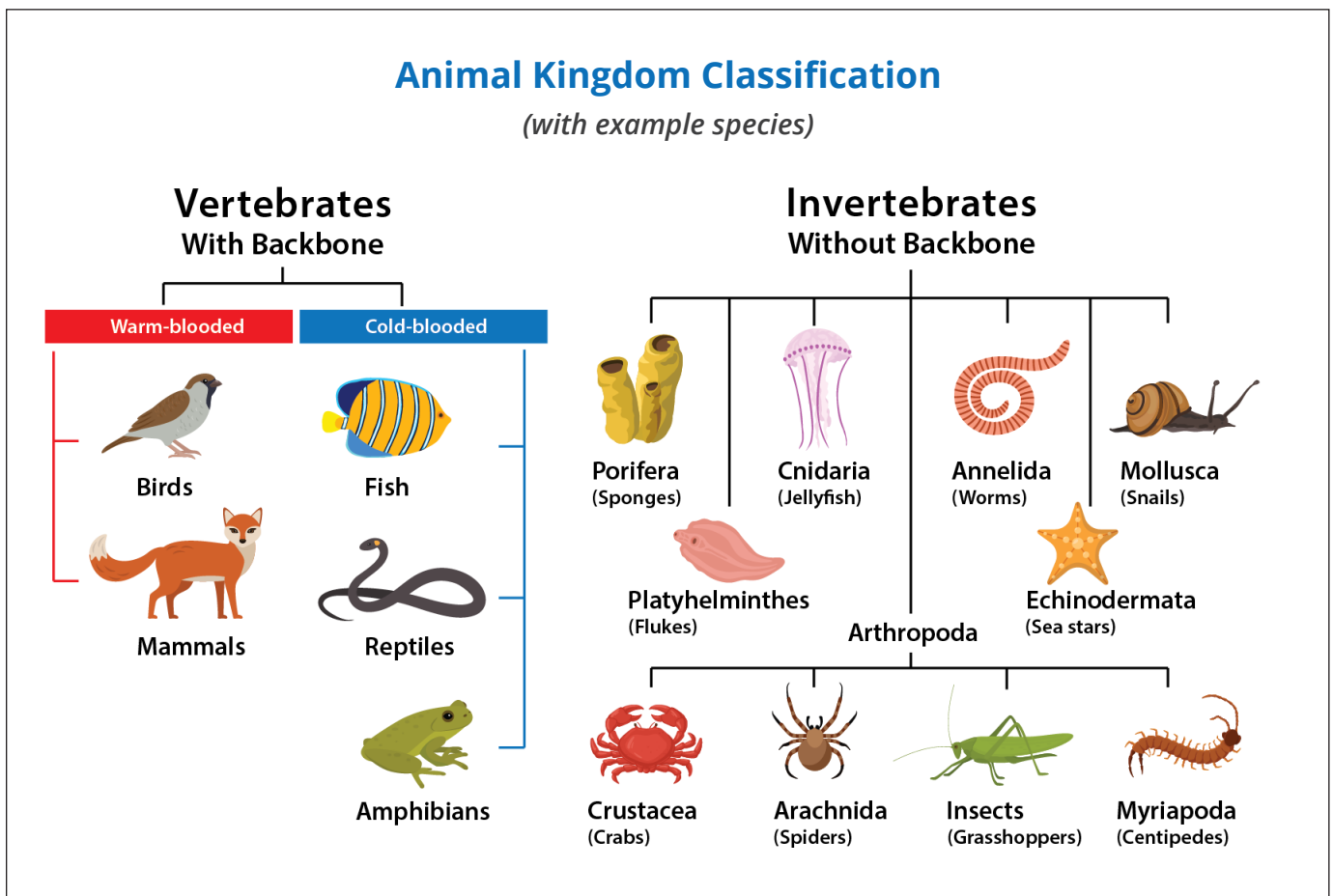


Activity 1: “Bugs” vs Insects

Introduction

When different animals have things in common with one another, it can be a clue that they are related to each other. The systematic grouping of living things based on their similarities or evolutionary history is known as **classification**. Grouping organisms by their shared characteristics helps us understand the diversity of life on Earth. Classification helps scientists and others study the origins, relationships, and roles of both extinct and living creatures on this planet. Kids can learn to identify insects and gain appreciation for and better share the world with all living creatures.

In the graphic below, you can see where insects fit into the Animal Kingdom classification system. Insects are invertebrates (no backbone) and a member of the Arthropod phylum (a subgroup of Invertebrates).





Activity 1: “Bugs” vs Insects

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Supplies

- Pencils and Bug Journals (or paper)
- Printed images of arthropods (page 18)
- Magnifying glasses (optional)
- Glue sticks or tape
- Field guide books and/or access to the Internet

Get kids thinking ...

When you see a living thing that you have never seen before, you probably automatically put it into a group without thinking too much about it. If you see something growing that’s green and has leaves, you probably call it a plant. If you see something that creeps and crawls on the ground, you probably call it a bug. How did you decide to do that? Did you look at how it looks and think about what it has in common with other living things that you know?

Ask: What makes an insect an insect? What characteristics do insects share? How would you classify an insect? How are what most people call bugs different from insects? Make a list together so that everyone can see and agree on what all insects have in common (insects lay eggs, have an exoskeleton, have three pairs of legs, have a three-part body, many have wings and fly, use antennae for sensing, etc.). While looking over the list, ask kids to think about other animals and consider how insects are different from other animals and what is unique about insects (always have three pairs of legs, three-part body, pair of antennae, compound eyes, and external mouthparts).

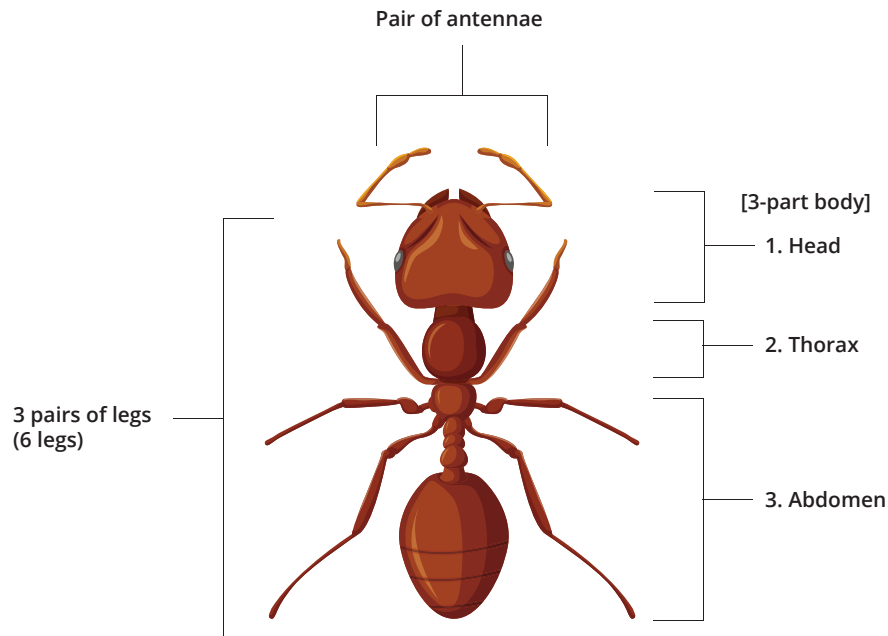
Let’s get started!

Start with a book! Share identifying features of insects from nonfiction titles such as *Nature All Around: Bugs* by Pamela Hickman, *Name That Bug!* by Demi Jackson, or *Eyewitness: Insect* by DK Publishing. Talk about the characteristics all insects share and the similarities and differences among insects — a three-part body (head, **thorax**, and **abdomen**), legs, **antennae**, and wings. Encourage kids to make notes about insect features in their Bug Journals.



Activity 1: “Bugs” vs Insects

Provide kids with images of bugs of all types. You can share our sheet (see page 18) or create your own with images of insects and other arthropods from the Smithsonian (<https://www.si.edu/search/collection-images>) or the the Insects Unlocked project on Flickr (<https://www.flickr.com/people/131104726@N02/>).



Tell kids that scientists make observations about the characteristics of organisms in order to group, or classify, them into species. Talk about why classification is important.

Ask: How would you classify or organize the animals on the sheet? Have kids recall the characteristics of insects that you read about and discussed. What were some of the unique features of insects?

Give kids time to study the animals on the sheet and ask them to identify which are insects by checking the physical characteristics visible in the images. If they want to get close up, encourage them to use a magnifying glass to aid their observations. Share questions they can ask themselves to help guide their observations:

- How many legs does the animal have? (No legs, 6 legs, 8 legs, or lots of legs)
- Does the animal have a 3-part body that includes a head, **thorax**, and **abdomen**?
- Does the animal have a pair of **antennae**?
- Does the animal have wings or no wings?



Activity 1: "Bugs" vs Insects

Once they've identified which are insects and which are other arthropods, discuss their findings as a group to see if everyone reached the same conclusions. Kids can then continue their observations to try to further identify each insect, asking more questions about shape, color, and markings and using print field guides such as *National Geographic Pocket Guide to Insects of North America* by Arthur V. Evans or *Insects and Arachnids* by Carla Mooney or online field guides like Bug Finder (<https://www.insectidentification.org/bugfinder-start.php>).

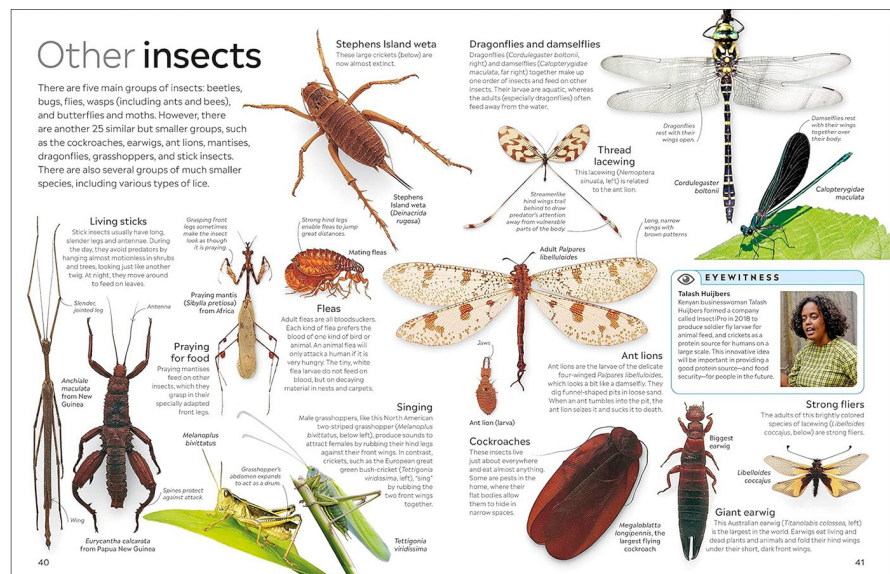
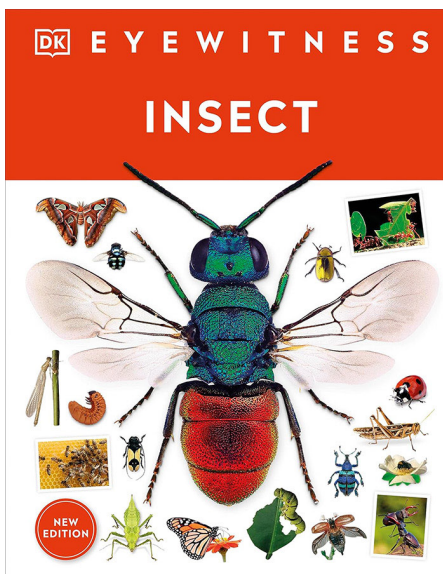
As they complete their identifications, kids can cut the images from the sheet and glue them into their Bug Journals along with what they've learned about these animals.

More activities about insect identification

Create an insect field guide with this activity from Elinor Wonders Why <https://www.pbs.org/parents/printables/is-it-an-insect>

Core Knowledge offers eight lessons and activities focused on the characteristics of insects <https://www.coreknowledge.org/free-resource/ckla-domain-08-insects/>

Make an Insect Pitfall Trap <https://www.sciencefriday.com/educational-resources/protected-pitfall-traps/>



Is it an insect?





Activity 2: Exoskeleton Challenge

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Introduction

Insects and other arthropods are invertebrates. They don't have bones that make up an internal skeleton. Instead, a hard, jointed outer shell called an exoskeleton provides a support structure and protects internal organs. Kids learn more about this insect characteristic and explore the benefits of having an exoskeleton when they design and create a protective covering for an insect made of clay.

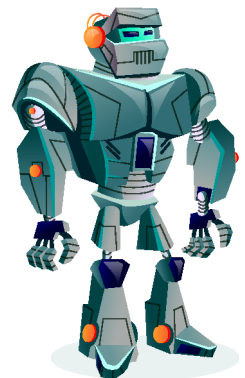
Supplies

- Clean items from the recycling bin or trash: egg cartons, clamshells and other plastic containers, cardboard tubes, styrofoam, etc.
- Twist ties, chenille stems (pipe cleaners), aluminum foil, rubber bands, craft sticks, etc.
- Modeling clay or playdough
- Scissors and tape
- Hiking boot, a brick, and other heavy flat objects
- Exoskeletons from molting insects (optional)

Get kids thinking ...

Ask: Have you ever stepped on a bug and heard a cracking or crunching sound? What do you think makes that noise? Insects and other arthropods have an exoskeleton. This hard shell is like a skeleton on the outside of their body. It is where muscles attach and it does some of the same things the skeleton you have inside does, like hold their body up. Made up of different layers, it also acts as armor and protects bugs from predators as well as from drying out.

The exoskeleton can be really tough. The exoskeletons of some insects are so hard they can survive being stepped on by a heavy boot or even run over by a car! Studying exoskeletons can help scientists and others learn how to design materials and structures that humans can use to protect themselves from impact and crushing.





Activity 2: Exoskeleton Challenge

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Let's get started!

Start with a book! *Skeletons and Exoskeletons* by Julie K. Lundgren or *Insect Bodies* by Molly Aloian can help kids understand how an insect's hard exoskeleton helps protect their soft insides. Explain how they can use this information you've read together as inspiration for designing and testing their own protective covering.



Step 1

Provide each child with a 2–3-inch soft ball of clay. Kids should form their ball roughly into the shape of the insides of the insect of their choice, essentially **molding an insect without its exoskeleton**.

Step 2

Now that they've created such a vulnerable creature, **ask kids what they could build to protect their insect from getting squished**. Show them the materials you have available for them to design and build an exoskeleton that would prevent their clay insect from getting crushed by a variety of heavy objects. Have kids look materials over, think about how the materials work, and how they are going to use them.



Activity 2: Exoskeleton Challenge

Encourage kids to test the toughness and strength of the materials that are available as they consider their designs. As they review materials and make decisions, have them sketch designs for their insect's exoskeleton.



If possible, share an exoskeleton shed by an insect during molting, such as a cicada shell, so kids can understand what it feels like and how it forms to the insect's body. Talk about how when an insect grows and gets too big for its exoskeleton, it sheds it because exoskeletons can't grow or stretch.

You can also talk about how defenseless an insect is when it molts. Much like kids' clay insects, an insect that has just shed its exoskeleton is unprotected and easy prey.

Step 3

Have them start building! Their exoskeletons should completely cover their clay insect innards and prevent any squishing of the clay when heavy objects are placed on top of them. As kids build, remind them that while they are focused on creating an exoskeleton tough enough to protect the insect's body, a real exoskeleton also has other characteristics that are important too, including being lightweight enough that the insect can get around and having a layer that keeps the insect from drying out or from getting too wet.

Step 4

When the clay insect is secure in its exoskeleton, start testing their designs. First, measure the height of their creation. Then place the lightest heavy object on the exoskeleton. Measure again for compression. Is the insect flatter? Continue testing with gradually heavier objects and checking for changes in height.

As you test, talk with kids about why they chose the materials they used. Why did or didn't their insect get squished? Ask what they might do differently or how they might refine their exoskeleton. Would they choose different materials? Encourage them to offer their ideas for revisions and, if you have time, let them reform their clay to test their solutions.



Your first Bug Out! adventure should focus on helping kids become active observers

Before you head outside, let kids know about common bugs in the area by showing them photographs from a field guide, website, or app. Take along pencils and Bug Journals or something for taking notes and drawing pictures and a field guide. You can also bring magnifying glasses to get a close up look at bugs and bug behavior.

Get kids planning for when they see insects. **Ask:** What bugs and insects do they think they might see? What would they hope to see? What can they learn by observing? Tell them when they see their first bug to take their time and take a really good look at it. Have them plan to then write down at least five things about the bug they just saw — the bug’s color, patterns, size, shape, what it was doing, where it is, or anything else they notice, wonder, or imagine about it. Let kids know that making notes like these will help them become better observers. Remind Bug Buddies not to touch or disturb insects, other animals they find.

To help facilitate bug viewing, bring a white sheet to put under a tree. Gently shake the tree and branches and encourage kids to take a close look at what falls and crawls on the sheet.





Bug Journal

Set additional purpose to field journaling by having kids use their journals for more than field observations. There are all kinds of observations to make about bugs!

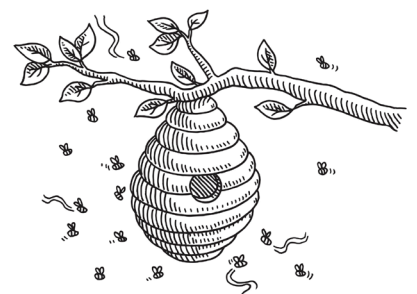
Fun with idioms

Check kids' familiarity with the expression "bug out," and share examples of how idioms work in daily life and culture.

An idiom is a phrase or sentence that does not literally mean what it says. Examples that kids might know include:

- Piece of cake — *"This model kit is a piece of cake to put together."*
- Under the weather — *"I didn't go to the birthday party because I was under the weather."*
- Raining cats and dogs — *"I'm not going out in this weather — it's raining cats and dogs!"*
- Hit the sack — *"Boy I'm tired — it's time to hit the sack."*
- Spill the beans — *"Who spilled the beans and told Mom about her birthday present?"*

See how many **idioms about bugs and specific insects** you can come up with together, like "busy as a bee" or "butterflies in my stomach" or "mad as a hornet." Make a list and talk about what these expressions mean. Have kids illustrate some of their favorites phrases with a literal interpretation in their journals.



Bee a bug buddy

A good way to start helping bugs is by first learning to appreciate them! When kids love or appreciate bugs, they can be effective advocates for them, helping to turn around the negative perceptions that others may have about insects. There are many great books for kids that show the wonders of the insect world in a positive light. As your Bug Buddies read and share books, have them **write short reviews or "shelf talkers"** to share with your public and school libraries and spread the bug love.



Kid-Friendly Digital Media

Apps

iNaturalist

<https://www.inaturalist.org/pages/getting+started>

Online games

Big Bug Memory Game

<https://www.natgeokids.com/uk/play-and-win/games/bug-memory-game/>

Insecteresting

<https://mrnussbaum.com/insecteresting-online-game>

Disney Ready For Preschool “Backyard Bugs”

<https://disney.com/games/ready-for-preschool-backyard-bugs/gm5522246356>

Websites

Bug Guide

<https://bugguide.net/>

Insect Identification

<https://www.insectidentification.org/>

Online Exhibition: Spiky, Hairy, Shiny: Insects of L.A.

<https://nhm.org/spiky-hairy-shiny-online>

Oxford University Museum of Natural History Learning Zone: Insects

<https://learningzone.oumnh.ox.ac.uk/insects>

Six-Legged Science: Unlocking the Secrets of the Insect World

<https://www.museumoftheearth.org/six-legged-science/insect-anatomy>



Kid-Friendly Digital Media

Video

Smithsonian Video for Kids: What Is an Insect?

<https://youtu.be/kdC7FHxi-Lg>

What's an Insect? | Everyday Learning

<https://www.pbslearningmedia.org/resource/ket-earlychild-sci8/whats-an-insect/>

Insects | Science Trek

<https://www.pbslearningmedia.org/resource/849cd0ed-bbc1-4d03-a3be-281c9989120f/insects-science-trek/>

What Makes a Bug a True Bug?

<https://www.pbslearningmedia.org/resource/what-makes-a-bug-a-true-bug-animation/whats-bugging-you/>

Buggin' Out | Weird But True!

<https://www.youtube.com/watch?v=S6qwdfQ7-ek>

Inspect an Insect

<https://www.youtube.com/watch?v=3166nK3Gym8>

Insect Observation

<https://youtu.be/99Ekra1hPic>

A Real Bug's Life

<https://www.disneyplus.com/series/a-real-bugs-life/4U6OnTyIVOtC>

Understanding Insect Exoskeletons

<https://youtu.be/0RNziU5YqfY>

What's Bugging You? Bizarre Arthropod Adaptations

<https://www.pbslearningmedia.org/resource/bizarre-arthropod-adaptations-animation/whats-bugging-you-animations/>

Why Is Our Skeleton on the Inside?

<https://www.youtube.com/watch?v=JhOU3FOyApM>