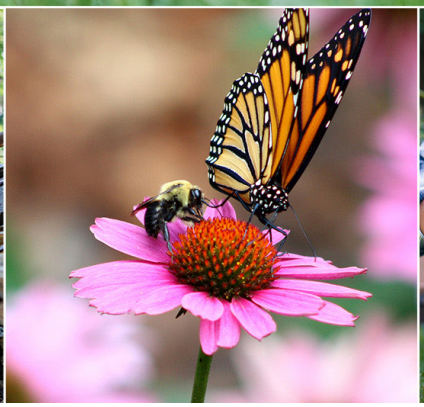
Bug Buddies

A 5-day science adventure for kids

Explore, read, invent, build, and learn — all about bugs and pollinators



Start with a Book
Read. Explore. Learn!

Brought to you by Start with a Book and Reading Rockets with support from the Park Foundation

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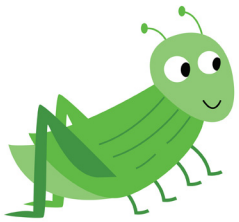


Bug Buddies

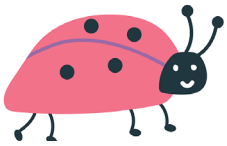
A book-based adventure about insects

Introduction

Bugs may be small, but there are more insects on Earth than any other kind of animal. According to the Smithsonian's Museum of Natural History, "at any time, it is estimated that there are some 10 quintillion (10,000,000,000,000,000,000) individual insects alive … Recent figures indicate that there are more than 200 million insects for each human on the planet!"

Insects play an important role in ecosystems and our lives, even if we don't always see them doing their jobs. They help plants grow and help dead plants and animals break down and build healthy soil. They are an important part of the food chain, providing food for some creatures and eating others. A world without insects would mean most bird and amphibian species would be extinct. There'd be no coffee, honey, or chocolate and products like waxes, lotions, cosmetics, dyes, polishes, varnishes, and inks. Scientific and medical research would be stalled. Understanding and valuing what insects contribute and make possible is crucial for maintaining our ecological health.

Some people find insects beautiful and interesting. Others might find some bugs scary. Many people of all ages are afraid of bees, wasps, or other insects that sting and bite. Some fear any kind of creepy crawly. The truth is, unless you are allergic to stings or get bitten by a bug carrying an illness, there's little to be afraid of. The more you know about insects and their fascinating lives, the more there is to appreciate. Bug Buddies provides opportunities for kids to learn about bugs and their function in nature which can help reduce any anxieties about insects and get them exploring the natural world in new ways. Bug Buddies also gets kids outside, prompts them to observe and write, and encourages them to explore and test ideas.



Welcome to Bug Buddies

The best way to get kids learning is to build on their curiosity and interests. Bug Buddies is kid-centered with an emphasis on inquiry and creativity.

We've designed the program to be user-friendly and adaptable. Use the materials each day for five days in a row, or once a week, for five weeks, (or any other way you like) to add hands-on learning to your summer, afterschool, or library programming.

Day 1: What Are Bugs?

Day 2: Bug Life

Day 3: Bug Builders

Day 4: Bugs in Our Lives

Day 5: Bugs and People

Getting yourself ready

- **Each day has an emphasis on one or more topics related to insects.** You'll find an introduction to the concepts covered and recommended books for each day, as well as a list of questions to guide explorations and activities.
- **Start by gathering books from your library** using the booklists here in the toolkit.
- **Choose both fiction and nonfiction books** from the lists provided.
- **Read them through before you read them to the kids**, so you know what happens and can spot any unfamiliar words or concepts you'll need to explain. Also, look for **places to ask questions** while you're reading to engage listeners.

- **Think about which other parts of the program you'd like to do after reading the books.** An activity is always a good idea, and you may also want to include writing, exploring related websites, videos and apps, and heading outside, too.
- **Familiarize yourself with local insects and places nearby to go to find them.** These resources may be helpful:
  - Insect Identification by State: https://www.insectidentification.org/insects-by-state-listing.php
  - County Extension offices: http://npic.orst.edu/pest/countyext.html
  - Your local nature center or your local 4-H program: https://4-h.org/about/find/
- **Get connected to scientists and others who work in entomology in your area:**
  - Cooperative Extension agencies: https://landgrantimpacts.org/extension/
  - Branches of the Entomological Society of America: https://entsoc.org/membership/branches
- **Check too with your local college or university** to see if they have an entomology department or find out what insect-related exhibits a local science, natural history, or children's museum might have.

Learning with the kids

- **Introduce the theme** for the day and ask kids what they know about it. (See "Activating background knowledge" on the next page.)
- **Start with a book.** This is key, especially for kids who may be fearful of insects. Read one or more of the books aloud and ask questions. Listen carefully to the kids' answers. By reading to them and asking questions, you'll get them thinking about bugs and what they want to learn, as well as helping them see that most insects aren't a real threat. You'll also increase their understanding and excitement, and get them ready for real-life situations with bugs.
- **Read another book and repeat.**
- **Choose a hands-on activity** to let kids explore the theme. By doing an activity, the kids get to use the concepts and new words they have learned.
- **Look for a local connection.** How can you connect the ideas in the books or the activities with the kids' personal experience? Think about walks outdoors, visiting a beekeeper, or checking on the effects of insects on animal habitats or gardens.
- **Keep asking questions** and listening carefully to the children's answers.
- **Encourage kids to write** about what they are learning or curious about by using one of the writing prompts in this toolkit, and by keeping a **Bug Journal** for observations, drawings, questions, and creative writing activities.

- **Provide access to books about the topic** for kids to look at on their own.
- **Share digital media with kids** (websites, apps, videos, and games) that they can use to learn more about the topic and give kids time to try them out.
- **Take a field trip** to further explore your topic for the day or theme for the week. Activities for each day will include a **Bug Out!** with special attention to observing insects.

You can choose any of the activities in this toolkit, all of them, or just one or two, but we recommend that you always Start with a Book.

Review and teach new words

When you are pre-reading your books or looking at activities, websites, apps, or field trips, look out for words kids might not know. Take time to talk about those words and tell kids what they mean. You can provide images, video, and real objects to help them build an understanding of unfamiliar words. You can even act words out! You can do this before you read, before you do an activity, or while you are reading or trying a hands-on activity.

If words or concepts are being repeated, ask kids if they remember what they mean and how they might be used the same way or differently in this new context.

The glossary of **Bug Words** on pages 94–98 can help you define terms that kids might not be familiar with.

Activating background knowledge

Ask kids what they know about bugs and insects as you begin this program:

- What makes an insect an insect?
- How are insects helpful or harmful?
- Why is knowing about insects important to us in our everyday lives?
- How do insects impact our world and how people live?
- What do you wonder about bugs?

Connecting the days and concepts

Children will learn more readily and remember more if you review all five days of materials in advance and decide which books and activities you want to use. Connecting the ideas and activities day to day will help them create a big picture.

At the beginning of the day, ask them, "*What did we talk about yesterday?*" Then tie their answers to the focus for the day.

You may choose to use all the days or you may select specific days for your program. You may select different activities; however, the **daily Bug Out!** is critical in helping children connect ideas with their everyday environment, as well as providing opportunities for observation and reflection.

Bug Out!

Encourage exploration and a chance for kids to discover nature when you Bug Out every day. Making bug watching a daily experience provides opportunities to practice observation and data recording skills, facilitates real-world interaction with the environment and STEM, and supports kids' connection to their own communities and the larger world. It also demonstrates, in a very concrete way, how nature, science, technology, and curiosity/exploration are part of our everyday lives. Daily resources to help Bug Buddies successfully Bug Out include ideas for observing and identifying insects and other arthropods, Bug Journal tips and writing prompts, and a Bee a Bug Buddy activity to encourage kids to help insects.

You never know quite what you are going to find when you Bug Out. To fire up kids' powers of observation before heading outside, talk about where you'll be exploring and what kinds of creatures are often found there. Encourage kids to choose an insect they really want to see. Let them take a look at the insect in a field guide and read up on its habits and habitat.

Each day you Bug Out, you can plan to visit a wide variety of habitat types or visit the same spot every day. You don't need to go far. Some of the best bug watching can be in your own backyard! Insects and other arthropods can be seen on city and suburban sidewalks as well as in parks, yards, and nature preserves.

If you Bug Out to a wildlife area, kids also need to know that it is important to stay on trails to avoid causing damage to the land, plants, and trees. Bug Buddies also need to leave rocks, plants, flowers, feathers, and other objects of interest as they find them and give others the chance to make the same exciting discoveries. If kids turn over a rock or a fallen log to look for insects, they should move it back where they found it after making their observations. Have kids make use of the Bug Journal or take a photograph to enjoy their finds. An adult can take the photographs if Bug Buddies don't have access to a camera.

Before you Bug Out

Be bug safe. Some insects sting or bite. Bug Buddies with allergies should always practice extra careful observation with an adult's supervision. Wearing long sleeves and tall socks can offer some protection to Bug Buddies. Avoid wearing bright colors, which can attract pollinators to your clothes.

Help Bug Buddies identify which bugs are best observed from a distance, such as wasps, bees, ants, and other arthropods such as spiders. Make sure that Bug Buddies know not to swat or wave their arms at bees and wasps that might fly around them, but to walk away calmly and quickly. Emphasize to Bug Buddies that they should only handle insects and other bugs that they know are safe to touch.

Set expectations. Explain to kids that they may not always see a wide variety of insects but there will be more opportunities to Bug Out and a chance to look for bugs anytime they go outside. Help Bug Buddies understand that insect observation is a slow-paced activity that may be very different from their other experiences outdoors. Set this expectation ahead of time and tell kids, "We are going to walk slowly and make many stops to listen, look, and observe." They may need to stay still for a while, alert for sound and motion, in order to see bugs. But even if they are only casually taking note of their surroundings, the more they pay attention to bugs, the more kids will notice them wherever they are. Remind Bug Buddies not to touch or disturb insects, other animals they find, or habitats. If they move a log or leaves to look for insects, remind them to gently replace it when they are done.

Talk about what an observation is and how to make them. Kids have sharp observation skills and natural abilities to use their senses. Model the behavior you expect to see as you encourage them to focus attention on their surroundings, slow down, and use their senses of hearing and sight and be curious about what they see and hear. Observation requires patience and focus.

Provide directions on how to take notes or set up Bug Journals with an observation chart that helps kids make drawings and notes about the creatures they see. Notes can include the following: number of legs, number of antennae, number of body parts, wings, small identifying details, habitat, and behavior.

Bug journal

Journaling gives kids the opportunity to use drawing and writing together to show their observations, document their discoveries, pose questions, note their ideas, and learn to see and hear more. Keeping a Bug Journal is a great way to get your Bug Buddies outdoors to explore and record their responses to and reflections about science and the natural world and keep track of what they're learning. Get kids started on their journals with information that will help them keep track of what they wonder, identify insects, and provide them with some of the words they'll need to record their observations.

Supplies:

- Blank spiral notebook or sketchbook (or fold 10 sheets of paper in half and staple along the fold to create a booklet.)
- Bug Buddies journal cover (optional) — find the printable in the Appendix
- Writing tools
- Drawing materials

Let kids know that their journals can look however they want them to look! Kids can freely draw, write, or add photographs. It can be a place to brainstorm, keep notes and vocabulary words, make lists, sketch, or write poems. Tell them it is their place to write and draw their observations, thoughts, questions, and ideas, and as a Bug Buddy, they will have a chance to make all kinds of observations and explore things that grab their curiosity.

Talk with kids about how scientists keep notes and journals of their observations, data, and experiments. Writers keep journals of their observations and feelings about people and places. As Bug Buddies, ask them how they think they could use a journal.

Each Bug Out! experience includes writing activities and prompts, but you can get kids thinking more about how they want to use their Bug Journals. Share these sentence starters:

I see ...
I hear ...
I wonder ...
I was surprised by ...
I feel ...
This drawing shows ...

Bee a bug buddy

Each Bug Out! session also includes an activity focused on helping insects or educating people about insects and their important role in our ecosystems and lives.

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Day 1
What Are Bugs?

Day 1
What Are Bugs?

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)

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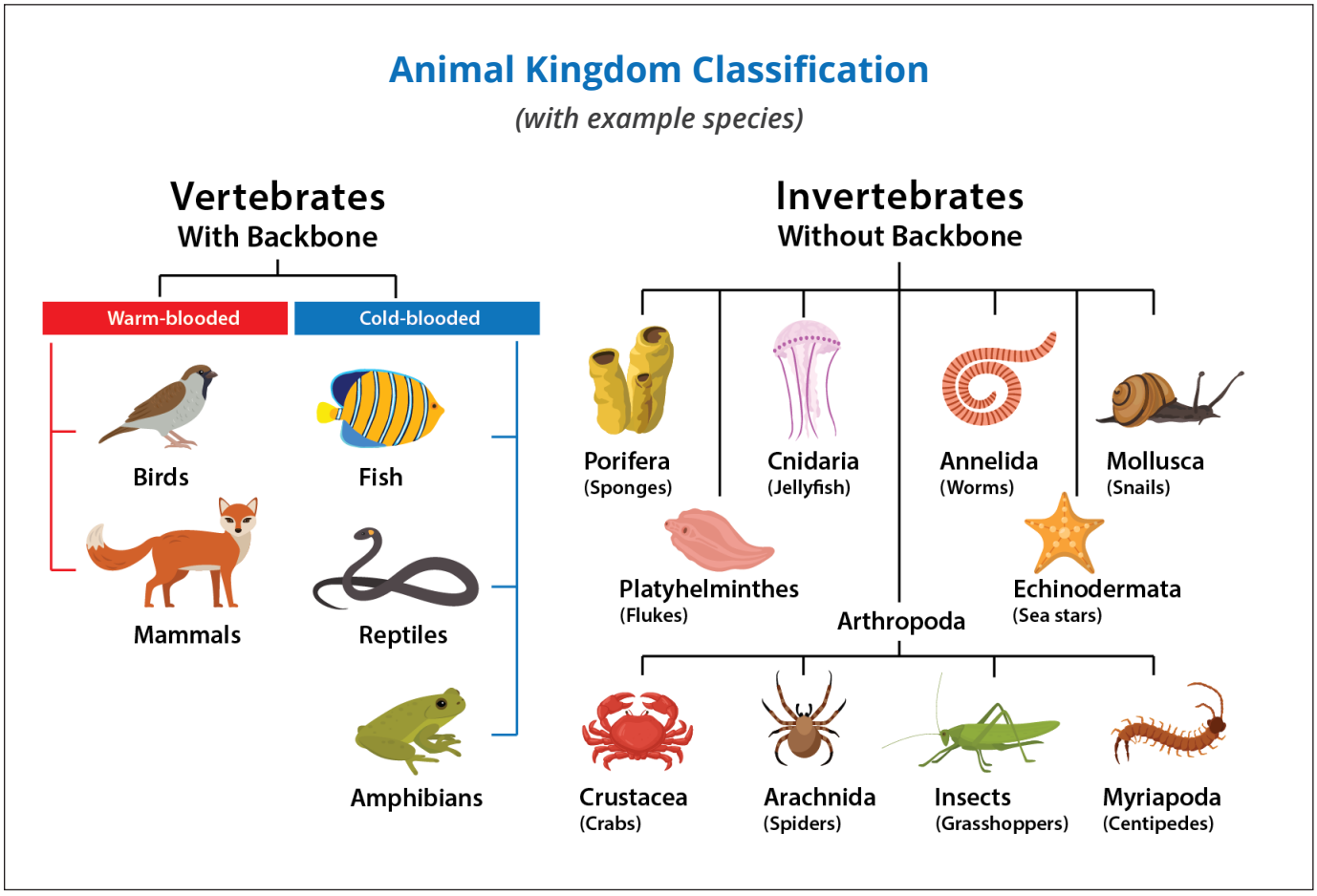
Activity 1: "Bugs" vs Insects

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 phyllum (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?

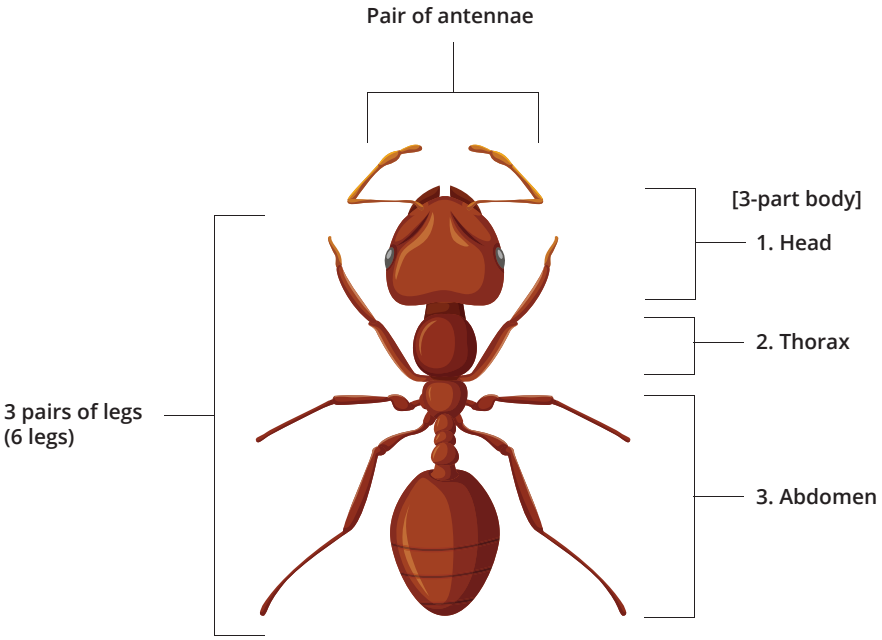
Ask: What makes an insect an insect? What characteristics do insects share? How would you classify an insect? How are what most people call bugs different from insects? Make a list together so that everyone can see and agree on what all insects have in common (insects lay eggs, have an exoskeleton, have 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?

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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).

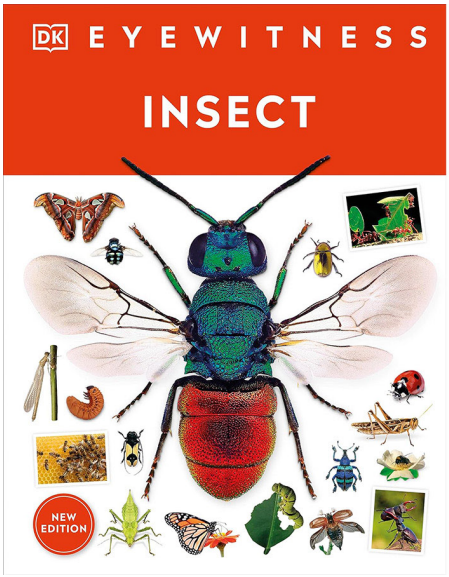
As they complete their identifications, kids can cut the images from the sheet and glue them into their Bug Journals along with what they've learned about these animals.

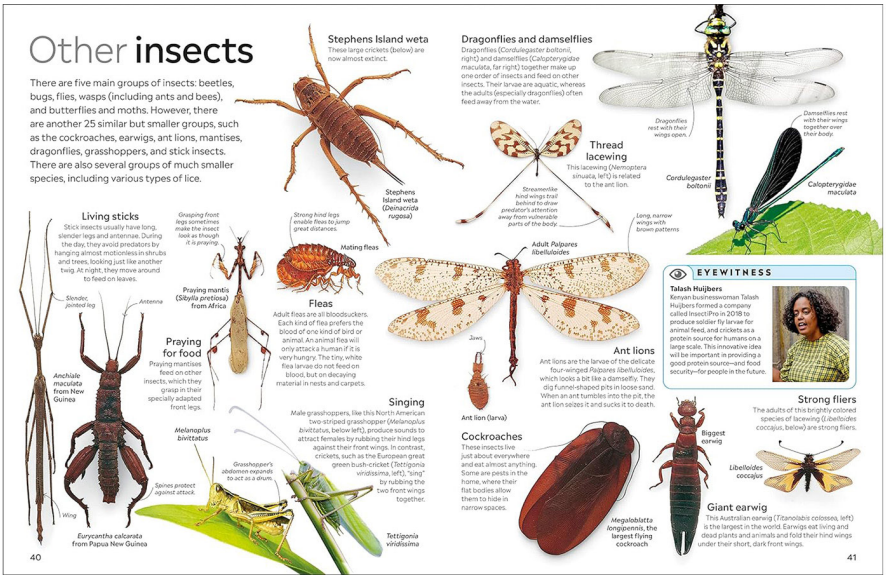
More activities about insect identification

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/

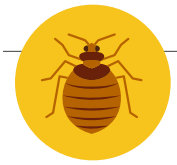
Make an Insect Pitfall Trap
https://www.sciencefriday.com/educational-resources/protected-pitfall-traps/





Cover and page spread from: *Eyewitness: Insect* by DK Publishing

Is it an insect?



Activity 2: Exoskeleton Challenge

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Introduction

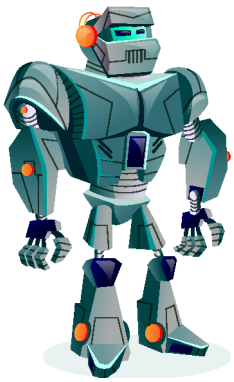
Insects and other arthropods are **invertebrates**. They don't have bones that make up an internal skeleton. Instead, a hard, jointed outer shell called an **exoskeleton** provides a support structure and protects internal organs. Kids learn more about this insect characteristic and explore the benefits 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

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.

1

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.

1

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!

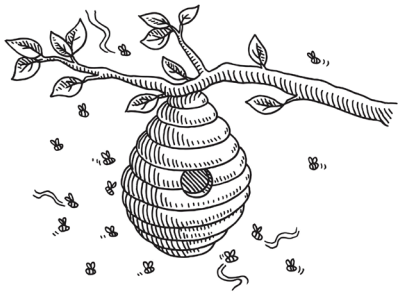
Fun with idioms

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

An idiom is 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 togther.*"
- 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://disneynow.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

Day 2
Bug Life

Day 2
Bug Life

Introduction

All living things change during their lifetimes. Your body is different now than it was when you were a baby. And it will change again. How a living thing, or **organism**, changes throughout its life is called a **life cycle**. All living things need food, too. Plants make their own food, but animals need to eat plants or other animals to grow and survive. Organisms in the same **ecosystem** — or community of living things in a shared environment — live together and sometimes eat each other, too. Organisms are linked to each other in **food chains**, where each thing feeds on the one next to it in the chain. **Food webs** are interlocking food chains in an ecosystem. This day focuses on insect life cycles and their role in ecosystems.

Questions to guide explorations and experiments

- What is a life cycle?
- What are the parts of an insect's life cycle?
- What is an ecosystem?
- What do insects do in their ecosystems?
- What is a food chain?
- What is a food web?
- What would happen to our food chain without insects?

Books and activities

- **Books:** all about insect life cycles, ecosystems, food chains and food webs
- **Activities:** explore insect life cycles and insects in ecosystems, food chains, and webs

Children's Books

Fiction

- *Addie Ant Goes on an Adventure* by Maren Morris and Karina Argow (ages 4-7)
- *A Good Place* by Lucy Cousins (ages 3-7)
- *A Perfect Spot* by Isabelle Simler (ages 5-9)
- *Secrets of the Garden: Food Chains and the Food Web in Our Backyard* by Kathleen Weidner Zoehfeld (ages 6-9)
- *Some Bugs* by Angela DiTerlizzi (ages 2-5)
- *Snug as a Bug* by Karl Newson (ages 3-7)
- *Stories from Bug Garden* by Lisa Moser (ages 4-8)
- *Wingmaker* by Dave Cameron (ages 4-8)
- *The Very Hungry Caterpillar* by Eric Carle (ages 3-5)
- *There Was an Old Lady Who Swallowed a Fly* by Simms Taback (ages 3-6)

Poetry

- *A Place to Start a Family: Poems About Creatures That Build* by David L. Harrison (ages 5-9)
- *Hey There, Stink Bug!* by Leslie Bulion (ages 7-10)
- *Insectlopedia* by Douglas Florian (ages 4-8)

Nonfiction

- *A Day in the Life: Bugs: What Do Bees, Ants, and Dragonflies Get up to All Day?* by Dr. Jessica L. Ware (ages 7-10)
- *A Web* by Isabelle Simler (ages 5-10)
- *Begin with a Bee* by Liza Ketchum, Jacqueline Briggs Martin, and Phyllis Root (ages 5-10)
- *Bella Loves Bugs* by Jess French (ages 4-7)
- *The Big Book of Bugs* by Yuval Zommer (ages 4-8)
- *The Bug Book* by Sue Fliess (ages 2-5)
- *Bug Dipping, Bug Sipping* by Marilyn Singer (ages 3-6)

Children's Books

2

- *Butterflies Are Pretty ... Gross!* by Rosemary Mosco (ages 4-8)
- *Cicada Symphony* by Sue Fliess (ages 4-8)
- *Eyewitness: Insect* by Laurence Mound (ages 9-12)
- *From Caterpillar to Butterfly* by Deborah Heiligman (ages 4-6)
- *The Girl Who Drew Butterflies:* How Maria Merian's Art Changed Science by Joyce Sidman (ages 10-14)
- *Insect Detective* by Steve Voake (ages 8-12)
- *Not a Buzz to Be Found: Insects in Winter* by Lina Glaser (ages 4-8)
- *The Secret Life of Bugs* by Moira Butterfield (ages 5-10)
- *The Secret Lives of Backyard Bugs: Discover Amazing Butterflies, Moths, Spiders, Dragonflies, and Other Insects!* by Judy Burris and Wayne Richards (ages 9-12)
- *Waiting for Wings* by Lois Ehlert (ages 4-8)
- *What's Inside a Caterpillar Cocoon? And Other Questions About Moths and Butterflies* by Rachel Ignotofsky (ages 5-9)
- *Who Eats What? Food Chains and Food Webs* by Patricia Laube (ages 5-8)

Activity 1: Bug Babies: Explore an Insect's Life Cycle

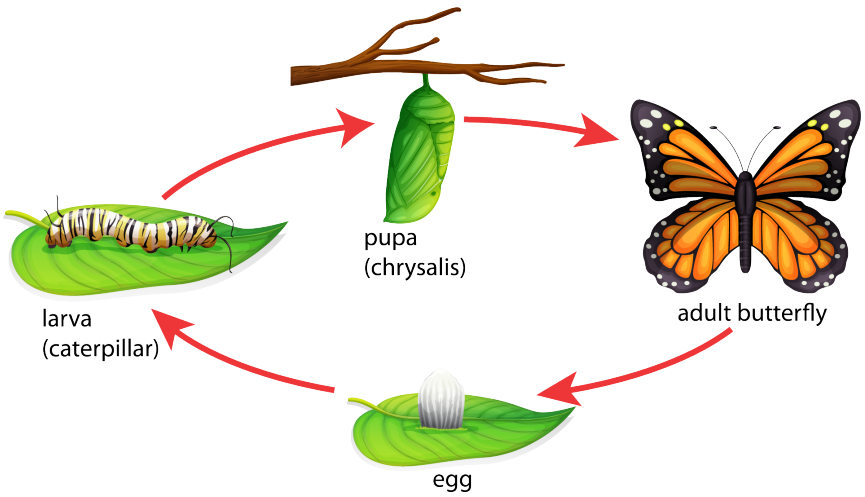
Introduction

All living things grow and change. A life cycle is the series of changes that happens to a living thing. Insects have a three- or four-part **life cycle**. They look different at each stage. They need different things at each stage to survive and get to the next stage.

Some insects go through complete **metamorphosis** in their life cycle. Metamorphosis is a big change in an animal's body during its life cycle. The change is so dramatic that the adult looks very different from the baby, like a caterpillar and a butterfly.

The 4-stage life cycle

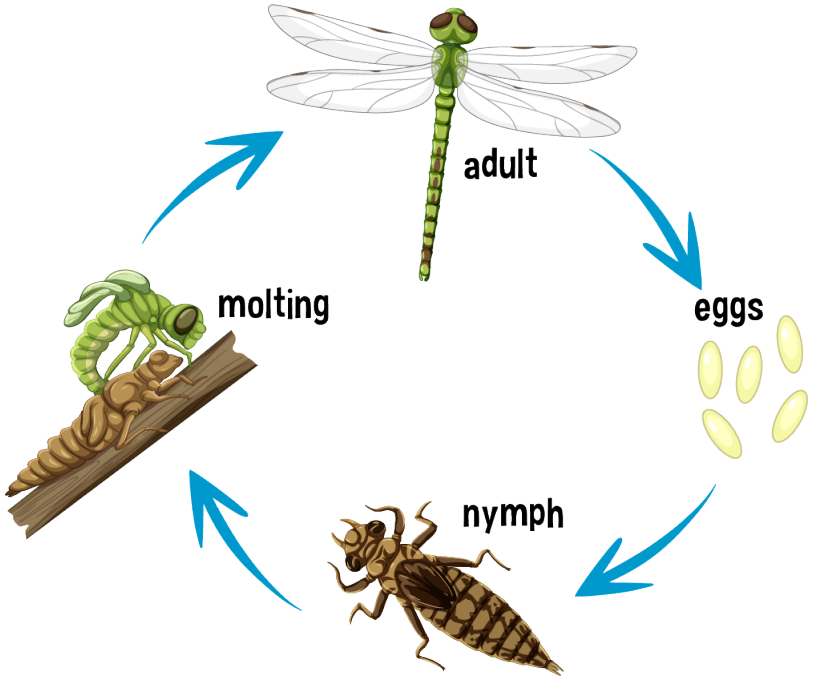
A life cycle with four stages includes complete metamorphosis. In the first stage, an insect is an **egg**. If you look carefully, you can sometimes see insect eggs on leaves or stems of plants. In the second stage, the insect egg has hatched into a **larva**. An insect larva is an immature, or young, form of an insect that often looks like a worm. Its job is to eat and grow. Caterpillars and inchworms are examples of larva. In the third stage, the larva grows a protective covering like a **cocoon** or **chrysalis**. The larva changes to a **pupa** where it develops its adult body and loses features of a larva. When the big change, or **metamorphosis**, is complete, the insect is an adult and breaks out of the protective case. That's the fourth stage: **adult**. The insect can now reproduce, or make more insects like it. Butterflies, moths, beetles, bees, wasps, ants, and flies have a four-stage life cycle.



Activity 1: Bug Babies: Explore an Insect's Life Cycle

The 3-stage life cycle

Some insects, like dragonflies, grasshoppers, earwigs, and crickets, don't go through a complete metamorphosis. They have a three-stage life cycle. In incomplete metamorphosis, they start as an **egg** and then, in stage two, they become a **nymph**. A nymph is a young insect that hatches from an egg and is similar to an adult, but smaller, and without wings. Over time, the nymph grows into an **adult**. It may grow wings, like a dragonfly (shown below), and it can reproduce. That's stage three.



Activity 1: Bug Babies: Explore an Insect's Life Cycle

Supplies

- Beads
- Chenille stems (pipe cleaners) or small pom poms
- Large bubble wrap or modeling clay
- Craft foam or origami paper
- Markers or crayons
- Scissors
- Glue
- Paper

Get kids thinking ...

Start by having kids think about how they have grown. **Ask:** How did you look different when you were a baby? What did you eat then? What do you eat now? How will your bodies be different when you are teenagers? How will you look, and be, different when you are grown up? Have kids write about or draw themselves at different stages of growth in their Bug Journals.

Then talk about how their growth compares with the growth of other living things. **Ask:** How do insects grow? How are they different at the beginning of their lives and at the end? How do insects care for their young? What does an insect life cycle look like? Where can we find insects in different stages of development?

2

Activity 1: Bug Babies: Explore an Insect's Life Cycle

Let's get started!

Start with a book! Read a book about insect life cycles such as *Waiting for Wings* by Lois Ehlert, *Cicada Symphony* by Susan Fliess, or *Begin with a Bee* by Liza Ketchum, Jacqueline Briggs Martin, and Phyllis Root. Invite kids to think and talk about the changes an insect goes through as you direct them through acting out the different life stages of an insect's life cycle.

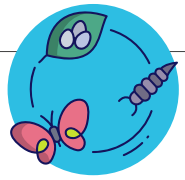
Butterfly (4 stages)

Stage 1 Egg: Curl up in a ball like an egg.

Stage 2 Larva: Scoot or inch across the floor and munch like a caterpillar.

Stage 3 Pupa: Create a cocoon or chrysalis, by wrapping your arms around you and spinning in circles. Then be very still as your body changes from pupa into an adult.

Stage 4 Adult: Push your way out of your cocoon, stretch and flap your wings. Flutter around like a butterfly.



Activity 1: Bug Babies: Explore an Insect's Life Cycle

Cricket (3 stages)

Stage 1 Egg: Curl up in a ball like an egg.

Stage 2 Nymph: Hatch from your egg as a tiny cricket. Make tiny hops and munch on plants to grow bigger. Wiggle out of your small exoskeleton when you grow bigger.

Stage 3 Adult: Make big hops and cricket sounds as an adult.

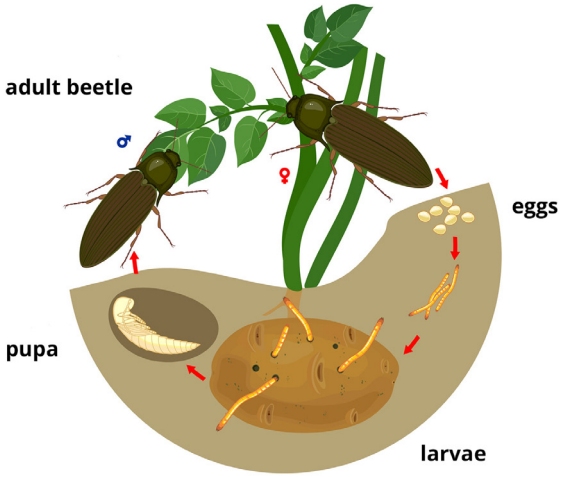
Make an insect life cycle model

Next, have kids use what they've learned to create a model of an insect life cycle using craft materials. They can choose a three-stage or four-stage life cycle to create, and pick an insect that has that life cycle. (Or do both!) Instructions below are for creating a four-stage life cycle.

Step 1: Provide kids with a sheet of paper. Have them divide it into four sections and number the sections 1–4.

Step 2: Next, have them choose a bead to glue in section 1. Have them draw a leaf, stem, or other place where they can glue the egg to rest. Have them label the egg.

Step 3: In section 2, have kids choose a small piece of chenille stem or a pom pom to represent the larva. Have them draw what the larva is crawling on, glue the larva in place, and label it.



Activity 1: Bug Babies: Explore an Insect's Life Cycle

Step 4: For stage 3, provide kids with a bubble from a large piece of bubble wrap, a piece of clay, or a wad of paper shaped like a cocoon to represent the chrysalis or cocoon. Have them draw what the chrysalis is attached to (or where it is, like in the ground for a cicada), glue the bubble in place, and label the chrysalis "Chrysalis with pupa inside" with an arrow pointing to a pupa inside.

Step 5: If kids are building an insect with wings (such as a butterfly or cicada), provide scissors and craft foam (or origami paper) for kids to cut wings that fit to the chenille stem body. Or, have them fold a quick origami butterfly (https://www.youtube.com/watch?v=VkoOrwfJPSk), draw the insect's surroundings of leaves, flowers, plants, etc., then glue it in section 4. They should label their insect "Adult."

Now, Bug Out with kids and go outdoors to have them look for insects in different stages of their life cycle or search for evidence like egg cases, empty chrysalis shells, exoskeletons that have been shed, or leaves that have been eaten. Encourage kids to write about and draw what they find in their Bug Journals.

Activity 1: Bug Babies: Explore an Insect's Life Cycle

More activities about insect life cycles

Be a citizen scientist and track monarch butterfly migration
https://journeynorth.org/projects

Fingerprint Ladybug Life Cycle Craft
http://www.readingconfetti.com/2013/04/fingerprint-lady-bug-life-cycle-craft.html

Play Go Bug! A simple card game based on the stages of metamorphosis
https://www.calacademy.org/educators/lesson-plans/go-bug

Cover and page spread from: *Cicada Symphony* by Sue Fliess

2

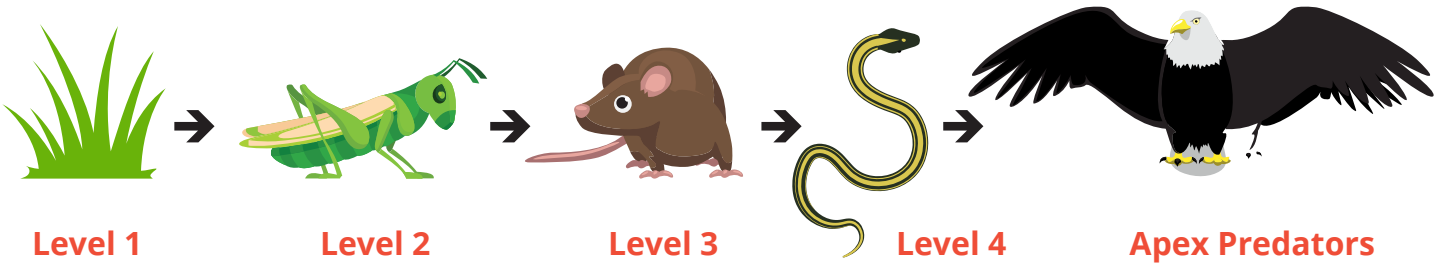
Activity 2: What's Eating You? Insects in the Food Chain

Introduction

All living things — plants and animals — need energy to live. Spring flowers need energy to grow and bloom. Birds need energy to move their wings for flight. People need energy for all kinds of things, from thinking to laughing to playing soccer to sleeping. All living things get their energy from food. Green plants use energy from the sun to make their food. Animals get their energy by eating plants or other animals.

The sun is at the beginning of every food chain. Because there are so many insects, they are most often the link between plants and other animals in a **food chain**. Insects also are often in the food chain in more than one place. Birds, frogs, lizards, snakes, bats, many mammals, and other insects eat insects. And insects often eat plants and dead animals, helping them decompose, or break down. This helps make healthy soil that plants need to grow.

The levels — or steps — in a food chain are called **trophic levels**. Here's a sample food chain with the trophic levels explained:



Level 1
Producers

Level 2
Primary Consumers

Level 3
Secondary Consumers

Level 4
Tertiary Consumers

Apex Predators
Quaternary Consumers

Decomposers

Activity 2: What's Eating You? Insects in the Food Chain

2

Plants use energy from the sun to create their own food. This process is called **photosynthesis**. The plant is the primary producer, or the first creator of energy in the chain and the first level of a food chain.

If a caterpillar eats the leaf of the plant, it is the primary consumer, or first creature to eat a plant in the chain. Most primary consumers eat only plants. They are called **herbivores**. Some eat both plants and animals. They are called **omnivores**. When something eats a plant, that's the second level of the food chain.

If a lizard eats the caterpillar, the lizard is getting its energy from the caterpillar. That makes the lizard a secondary consumer of energy from the plant. **Carnivores** are animals that eat other animals. This is the third level of the food chain. The lizard is a carnivore and a tertiary consumer.

At level four, imagine a bird eats the lizard. If a fox eats the bird and a brown bear eats the fox, that's two more levels. No more animals eat the brown bear while it is alive, so that makes the brown bear an **apex predator**. Apex means top, so the brown bear is at the top of the food chain.

When the brown bear dies, **detritivores** will eat it. Detritivores are animals that eat dead plants, animals, or animal waste. Vultures and hyenas are detrivores, but so are flies, ants, and dung beetles. Many detritivores are insects. These animals help break down dead things and turn them into soil. This adds nutrients to the soil that plants use to make food.

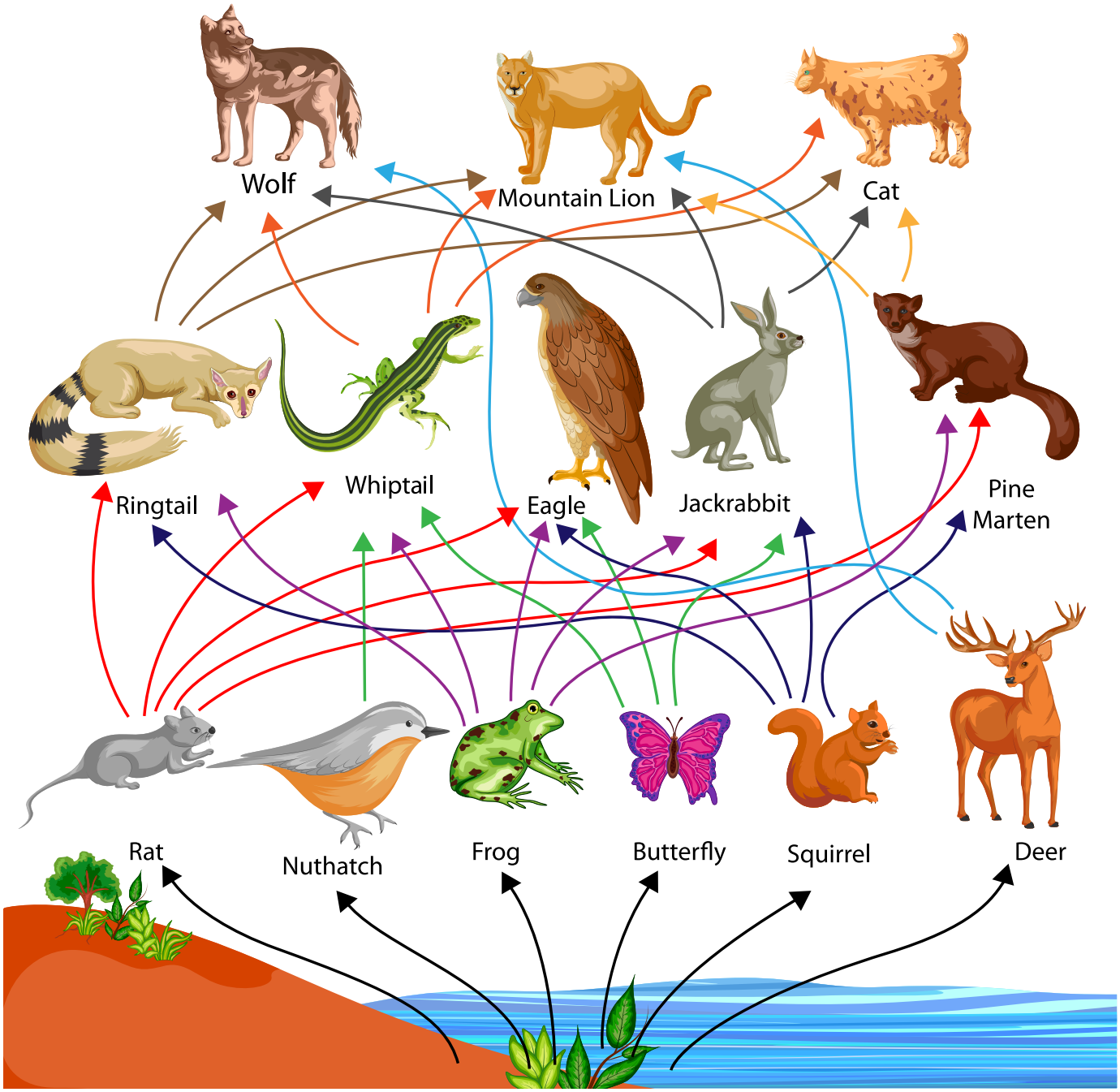
This food chain ends with flies who ate the bear who ate the fox who ate the bird who ate the lizard who ate the caterpillar who ate the plant.

A **food web** is the interlocking food chains in a community. The bird that ate the lizard may also eat some berries, a mouse, or a ladybug. The mouse and the ladybug eat several items too. If you draw the food chain of the bird, the mouse, the ladybug, and the bear, that's a food web. All of these organisms share an **ecosystem**.

Activity 2: What's Eating You? Insects in the Food Chain

2

A complex food web



Activity 2: What's Eating You? Insects in the Food Chain

2

Supplies

- Paper
- Food chain template with sun, plant, insect, bird or fish, reptile or mammal, detritivore (find the printable template after page 41)
- Scissors
- Markers, colored pencils, or crayons
- Tape or a stapler
- Books about animals and what they eat

Get kids thinking ...

Talk about how food chains and food webs show how each living thing gets its food. **Ask:** What do insects eat? Who eats insects? Can you think of an insect that eats animals other than insects? What would happen if there were no insects, or even just one kind disappeared? Have kids discuss or write their ideas about insects and food chains in their Bug Journals.

Let's get started!

Start with a book! Share a book that explores bugs in food chains, such as *Who Eats What? Food Chains and Food Webs* by Patricia Laube. Talk about what kids like to eat and ask them to think about the energy flow of their favorite foods. How are the levels similar or different from other animals?

Read *There Was an Old Lady Who Swallowed a Fly* by Simms Taback, show a video of the song (https://youtu.be/HMwO45a7Y6A), or just have kids sing it. Then talk about the silly food chain described. Talk about which animals really eat the other animals and which don't (cats eat birds, birds eat spiders, and spiders eat flies, but goats and cows and horses don't eat other mammals).

Activity 2: What's Eating You? Insects in the Food Chain

2

Invite kids to make up their own food chain song that follows a real food chain. Here's an example:

I saw a caterpillar eat a leaf. I know why it ate the leaf — for energy

I saw a lizard eat a caterpillar. I know what it ate the caterpillar — for energy.

I saw a bird eat a lizard. I know why it ate the lizard — for energy.

I saw a fox eat a bird. I know why it ate the bird — for energy.

I saw a bear eat a fox. I know why it ate the fox — for energy.

I saw some flies eat a bear. I know why they ate the bear — for energy.

I saw a plant with leaves grow. I know why it grew leaves — for energy.

Next, have kids use what they've learned to create a model of a food chain and a food web. Let them research different food chains by looking at books or kid-friendly websites. Think and talk about what their insect food web model will look like:

- It will start with the sun and a plant
- There will be insects at more than one level
- It will show how the animals are connected

Make a food chain

Instructions below are for directing kids to create a food chain, then grow it into a food web.

Step 1: Have kids create a food chain by choosing organisms to complete their food chain template: a plant, an insect that eats the plant, a bird or fish that eats the insect, a reptile or mammal that eats the bird or fish, and a detritivore.

Ask kids to write each organism on the related space on the food chain template and draw each organism on their section.

Activity 2: What's Eating You? Insects in the Food Chain

Step 2: Provide kids with scissors so they can cut the sections into strips.

Step 3: Have them create a chain by making loops with the strips and taping, gluing, or stapling them together.

Step 4: When kids are done, ask them to share their chains.

To make a food web

Ask kids if any of them have the same organisms in their chains.

Step 5: Using a blank strip of paper, have kids connect the food chains with the same animals at that animal loop to create a food web. They can also connect different chains at the plant level on one and the detritivore level on another.

Step 4: Lay the connected chains out on the floor or a table so everyone can see the relationships.

1. Plant:

Glue here

2. An insect that eats the plant:

Glue here

3. Bird or fish that eats the insect:

Glue here

4. Reptile or mammal that eats the bird or fish:

Glue here

5. Detrivore:

Glue here

Glue here

Activity 2: What's Eating You? Insects in the Food Chain

More activities about ecosystems

Insect Habitats
https://static.pbslearningmedia.org/media/media_files/ede69f5e-a79a-47f8-b788-1237ad6da87d/720ab6fd-2593-4071-9495-4e76e1f65931.pdf

Make insect food chains and webs
https://oumnh.ox.ac.uk/files/insectsinfoodchainshopeactivityoumnhpdf

Play the Web of Life game
https://www.amnh.org/explore/ology/biodiversity/web-of-life

Weaving a food web
https://www.startwithabook.org/sites/default/files/Food-Web.pdf

What's a Food Chain? | Think Garden | KET Public Television
https://www.pbslearningmedia.org/resource/thnkgard.sci.ess.chain/think-garden-whats-a-food-chain/

2

When you Bug Out!, remind kids about how to observe nature

Invite them to look carefully for insect life cycles, food chains, and ecosystem activities. Ask kids to:

- Look for insects in different stages of the life cycle or evidence, like empty exoskeletons or cocoons
- Look for insects eating or being eaten, or evidence of them eating
- Look for insects playing other roles in their ecosystem such as ants breaking up soil or bees pollinating plants

Bug Journal

Sensory exploration

Invite kids to use their senses when observing insects and then write or draw in their Bug Journals. What can they sense that is related to insect life cycles or food chains? Offer the following prompting questions to help kids make field notes about what they see, hear, and smell.

- Do you see insects in different stages of development?
- Do you hear insects calling to each other?
- Did you find evidence of an insect's life cycle or of a food chain? What did you find? Where did you find it?

2

Have kids use their senses again along with their imaginations, to create a sense poem about an insect they've observed from the point of view of a predator.

Line 1: _____ are (adjective and color).

Line 2: They look like...

Line 3: They smell like...

Line 4: They sound like...

Line 5: They feel like...

Line 6: They taste like...

Line 7: _____ make me feel...

Bee a bug buddy

Ask kids to investigate how bug-friendly their outdoor spaces are at home. Kids can talk with their parents, caregivers, or building managers about what does or could grow outside and things they can all do to make insects welcome. Have kids develop a checklist to help facilitate their conversation with topics such as leaf raking, pesticide use, native plants, and outdoor lighting. Encourage them to emphasize that even turning part of a yard or green space into an insect-friendly habitat can help curb global insect decline.

Kid-friendly Digital Media

2

Apps

Ladybug at Orchard Avenue $
https://apps.apple.com/us/app/ladybug-at-orchard-avenue/id540783849

Online games

Grandma Loves Bugs $
https://igamemom.com/fun-bug-app-kids-grandma-loves-bugs/

Bug Games: Ant Tunnel Construction and Cricket Chorus $
https://www.busybeestudios.com/games/busybeebuggames.html

Talking to Fireflies
https://www.amnh.org/explore/ology/zoology/talking-to-fireflies

You Are the Queen
https://www.amnh.org/explore/ology/zoology/you-are-the-queen

Websites

Create a game about life cycles
https://oumnh.ox.ac.uk/learn-5th-leg-a-game-of-life-cycles

Insect activities from the Oxford University Museum of Natural History
https://learningzone.oumnh.ox.ac.uk/search/site/insects?search=insects

Food webs and trophic levels
https://www.sciencepartners.info/module-8-macroinvertebrates/insect-feeding-food-webs/food-webs-trophic-levels/

Kid-friendly Digital Media

2

Video

A Day in a Bug's Life
https://education.nationalgeographic.org/resource/day-bugs-life/

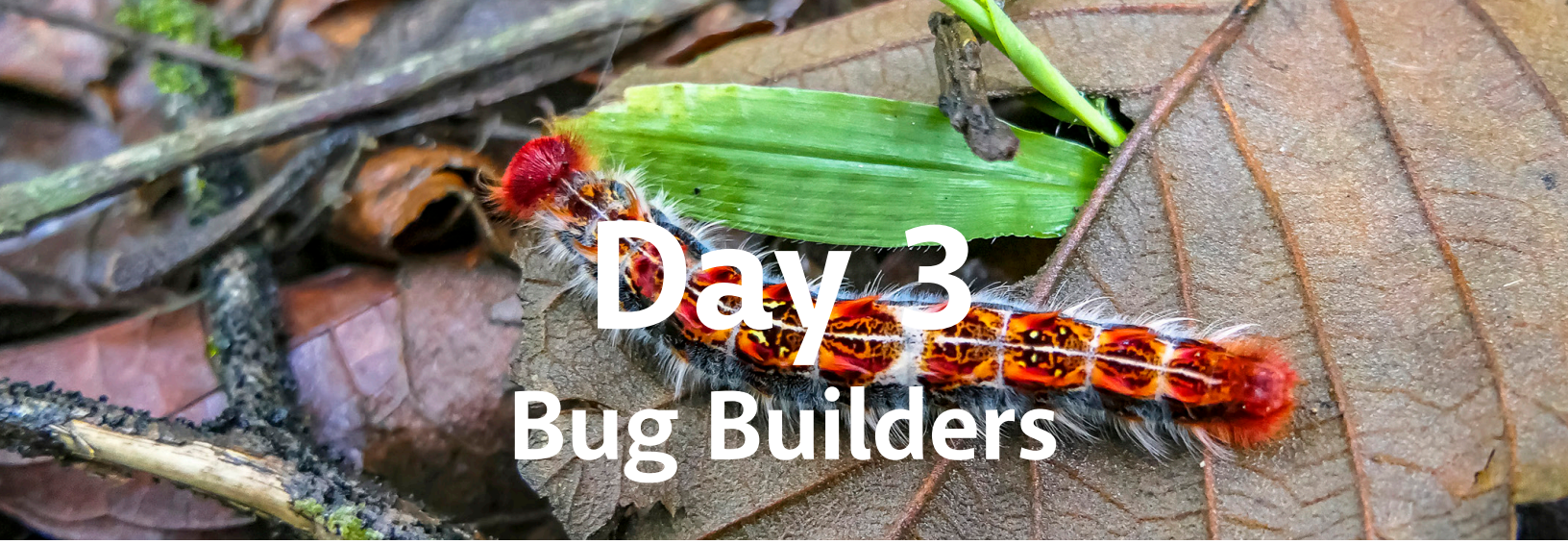
Food Chains Compilation l Crash Course
https://www.youtube.com/watch?v=CZhE2p46vJk

Food Web | Science Trek
https://www.pbslearningmedia.org/resource/idptv11.sci.life.oate.d4kfch/food-chain/

Insect Habitats
https://www.pbslearningmedia.org/resource/insect-habitats-video/nature-wy/

Vegetation Transformation (Photosynthesis) l Crash Course
https://www.youtube.com/watch?v=EstPeBt9CyU

Day 3
Bug Builders



Day 3
Bug Builders

Introduction

Bugs live everywhere! You can find insects all around us and in all kinds of **habitats**, from rainforests, to hot deserts, to grasslands, to streams and ponds, to canyons and mountains. Since we share habitats with insects, this day focuses on helping kids understand what insects need to survive and thrive in those habitats. Kids will learn about insect habitats, create a habitat for insects, and invent their own insect with adaptations for a specific habitat.

Questions to guide explorations and experiments

- Where do bugs and insects live?
- What do insects need to survive?
- Who and what else shares spaces with insects?
- How are insect habitats different or similar to those of other animals?
- Why do different habitats have different numbers and types of insects?
- How are characteristics of insects related to their habitats?

Books and activities

- **Books:** all about where bugs live and their habitat needs
- **Activities:** learn about and create insect habitats; invent a new insect

Children's Books

3

Fiction

- *Bug City* by Dahlov Ipcar (ages 4-8)
- *Bug Patrol* by Denise Dowling Mortensen (ages 4-8)
- *Busy Bug Builds a Fort* by David A. Carter (ages 4-8)
- *Camilla, Super Helper* by Judy Dillemuth, PhD (ages 4-8)
- *Dirt and Bugsy: Bug Catchers* by Megan Litwin (ages 5-7)
- *Du Iz Tak?* by Carson Ellis (ages 4-8)
- *Firefly Home* by Jane Clarke (ages 3-6)
- *The Girl Who Loves Bugs* by Lily Murray (ages 4-8)
- *Inch and Roly and the Very Small Hiding Place* by Melissa Wiley (ages 4-6)
- *James and the Giant Peach* by Roald Dahl (ages 8-12)
- *Roberto the Insect Architect* by Nina Laden (ages 4-8)
- *Violet Mackerel's Natural Habitat* by Anna Branford (ages 6-9)
- *Where Once There Was a Wood* by Denise Fleming (ages 4-8)

Poetry

- *A Strange Place to Call Home: The World's Most Dangerous Habitats and the Animals That Call Them Home* by Marilyn Singer (ages 5-8)

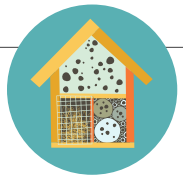
Nonfiction

- *Bonkers About Beetles* by Owen Davey (ages 7-10)
- *Bug Builders* by Timothy Bradley (ages 8-10)
- *Busy Builders* by Roxie Munro (ages 5-10)
- *Extraordinary Insects* by Matt Turner (ages 8-12)
- *Hello, World! Exploring Insects* by Jill McDonald (ages 4-8)
- *How To Build an Insect* by Roberta Gibson (ages 5-9)

Children's Books

3

- *Hustle Bustle Bugs* by Catherine Bailey (ages 4-8)
- *Insects: The Most Fun Bug Book Ever* by Sneed B. Collard III (ages 9-12)
- *Insect Superpowers: 18 Real Bugs That Smash, Zap, Hypnotize, Sting, and Devour!* by Kate Messner (ages 8-12)
- *Small Wonders: Jean-Henri Fabre and His World of Insects* by Matthew Clark Smith (ages 6-9)
- *We Build Our Homes: Small Stories of Incredible Animal Architects* by Laura Knowles (ages 4-8)
- *Where Do Insects Live?* by Molly Aloian (ages 4-8)
- *Wow! Look What Bugs Can Do!* by Camilla de la Bedoyere (ages 6-9)



Activity 1: Bug Habitats

3

Introduction

There are so many bugs that share the planet with us and other animals and plants. Like all living things, bugs need a place to call home! Many insects are able to live in many different **habitats**, including grasslands, deserts, forests, cities, suburbs, and along rivers. Some live aboveground, some underground, and some underwater. Others need plants and trees to make a home while others will build their own. Kids can explore the habitats of insects in their community and help those that need habitat support by building a bug hotel.

Supplies

- Bamboo, sticks, seed heads, dried leaves, bark, wood shavings, straw, hay, moss, and other natural materials collected off the ground (If kids help collect natural materials, avoid existing piles of leaves and sticks in case those are already being used for insect shelter.)
- Newspaper, cardboard, cardboard tubes, sturdy shoe box or other small cardboard box, or a small wooden box
- Empty, clean 1 or 2 liter plastic bottles cut in half or other plastic containers (32 oz.) with drainage holes added or ceramic flower pots with drainage holes
- Scissors and twine

Activity 1: Bug Habitats

3

Get kids thinking ...

A habitat provides food, water, shelter, and safe spaces where you can go. Have kids make some observations about their own habitat. **Ask:** Where do you get what you need to survive? Does what you need change with the seasons?

Let's get started!

Start with a book! Head outside for a read aloud of *Where Do Insects Live?* by Molly Aloian, *Busy Builders* by Roxie Munro, or *Du Iz Tak?* by Carson Ellis. After reading, talk about the things that make up habitats and have kids think about what insects need to survive. **Ask:** Where do insects get what they need? Do you see the things bugs need here, outside where we are, to make a home?

While you're outside, have kids observe insects and see if they can find their homes. As they follow all the rules for safe insect observation, kids can carefully turn over logs or stones, look in bushes and trees, check underneath leaves, or search for bug-built homes, such as anthills. Kids can use their Bug Journals to map where and how many insects they found, noting details about the bugs and their habitats.

Activity 1: Bug Habitats

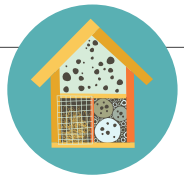
Have kids share what they found and where. Talk about how insect habitats are in use all year round and what this particular habitat should have to provide space for insects to reproduce and rear their young, offer protection from predators and cool resting places on hot days, provide food sources, and offer shelter from harsh weather. Ask kids to share their ideas for how this space could provide a habitat for insects in every season then explain how kids can help provide safe shelter for insects by building and maintaining a bug hotel.

Step 1

Remind kids about what they've observed about the homes of some bugs. Bugs aren't looking for much more than shelter and safety, so their bug hotels should be designed and built with bug appeal. Ask them to spend some time thinking like an insect about what it needs, as they sketch design ideas for their hotel. It is also important to think about location, location, location! Where will they put their bug hotel? Have them refer to their habitat map in their Bug Journal for ideas.

Step 2

Let kids explore the materials they have available for building. Talk about some basic design requirements: it needs to keep water out, air needs to be able to circulate, and it should be easy to clean — and design options: the hotel can be hung up, perched on a tree or fence, or secured on the ground.



Activity 1: Bug Habitats

Step 3

Model how to make your own bug hotel. Provide kids with some inspiration as they watch you follow these steps:

- **Think out loud:** *I love ladybugs! I learned that they like to burrow together in the gaps found in piles of twigs and small sticks.*
- **Draw** a bundle of sticks and **think out loud**: *If I layered these sticks inside something that would keep them dry, that could be a good hotel*. **Draw** a container around the bundle of sticks.
- **Choose your materials.** *I'm going to set aside the twigs and sticks I want to use and look at some different containers.*
- **Demonstrate** how to tightly pack twigs and sticks into a flowerpot or other container. Break any twigs and sticks hanging out of the container so that everything inside stays dry.
- **Think out loud** about where you will place your bug hotel outside so that it gets morning sunlight and won't be disturbed.

Step 4

Let kids start their designs and build their bug hotels. For kids building with specific bugs in mind, have books on hand for researching habitat and nesting preferences of their insects.

Step 5

Help kids place their bug hotels in appropriate dry locations outside. Have them add their bug hotels to their habitat maps in their Bug Journal.

Step 6

Encourage kids to check on their hotel guests! Plan for regular visits to the bug hotels for kids to observe visitors and make notes — and to keep an eye on its cleanliness, removing any materials that have become moldy or waterlogged.

Activity 1: Bug Habitats

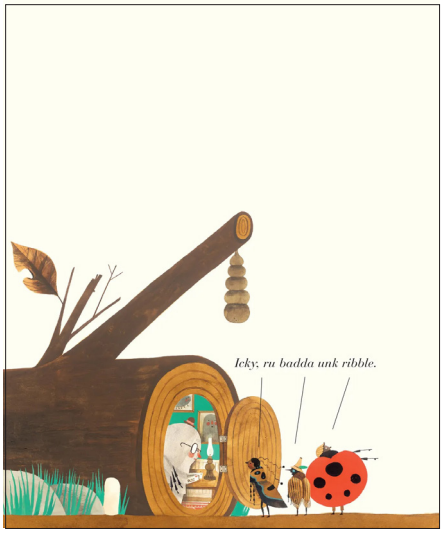
More activities to attract insects

Build a Ladybug Lodge

https://www.nhm.ac.uk/discover/how-to-make-insect-hotel-ladybird-lodge.html

DIY Butterfly Feeder

https://hudsonriverpark.org/app/uploads/2020/07/DIY-Butterfly-Feeder.pdf



Cover and interior pages from: *Du Iz Tak?* by Carson Ellis

Activity 2: Build a Bug

Introduction

Insects need food, water, shelter, and safe space to survive, but there is more to survival than just the right **habitat**. Insects have many **adaptations** that help them survive. Insect legs are adapted to work best in the insect's particular environment — dirt, sand, water, or trees. Insect mouths are adapted to what and how they eat. Wings are an adaptation that help insects get around for food, shelter, and reproduction — but they can also be a protective cover, provide camouflage, or attract a mate. Kids can explore and learn more about insect adaptations when they invent their own insect with unique adaptations for its environment.

Supplies

- Pencil and paper (or Bug Journals)
- Invented Insect Planning Sheet and Field Guide (pages 57–59)
- Drawing and coloring supplies
- Children's books and insect field guides

Get kids thinking ...

Ask kids and discuss: What else besides a habitat does an insect need to survive? How does an insect's body structures relate to its ability to survive? What happens when bugs cannot adapt to changes in their environment?

Let's get started!

Start with a book! Share *How to Build an Insect* by Roberta Gibson to remind kids about what they've learned about insect characteristics and features. Talk about how insects depend on their physical features and their behaviors to help them be successful in their habitats. Have kids look at other titles such as *Wow! Look What Bugs Can Do!* by Camilla de la Bedoyere and *Extraordinary Insects* by Matt Turner, as well as insect field guides, to find more insect adaptations to inspire their own invented insect.

Activity 2: Build a Bug

Step 1

Provide kids with the **Invented Insect Planning Sheet** (see the following two pages). Let kids know that they need to use both their imaginations and their bug knowledge to design a new insect that can survive in a habitat of their choice. Their insect must include all the parts of an insect and can also include optional parts or adaptations that will help it survive in its environment.

Step 2

After kids have completed their planning sheet, have them use those details to draft a field guide entry for their insect that includes its name, a detailed description of its appearance, habitat, range, behavior, food, predators, life cycle, and an interesting fact. Kids should also create a color sketch of what their insect looks like. You can use the Field Guide Template on page 59 or kids can develop their invented insect field guide entry in their Bug Journal.

Step 3

Have kids present their insects to each other and encourage questions.

“Invented Insect” Planning Sheet

Answer the questions below to help you create and describe your own insect:

Where does it live?

What is my insect’s habitat?

What does my insect eat? Where does it find food? How does it catch its prey?

What can eat my insect? How can my insect escape predators?

What does my insect look like (body shape, color, wings, mouth type)?

How does my insect move?

“Invented Insect” Planning Sheet

What is my insect’s life cycle?

_____

_____

How do its physical features make it well adapted for its habitat?

_____

_____

What adaptations does your insect have to give it an advantage in surviving inside its environment?

_____

_____

What are some things that make my bug special? What are the advantages to these special characteristics?

_____

_____

What is my insect’s name?

_____

“Invented Insect” Field Guide

_____

Draw your insect below:

Appearance: _____

Habitat: _____

Range: _____

Food: _____

Predators: _____

Life cycle: _____

Interesting fact about this insect: _____

_____

Activity 2: Build a Bug

3

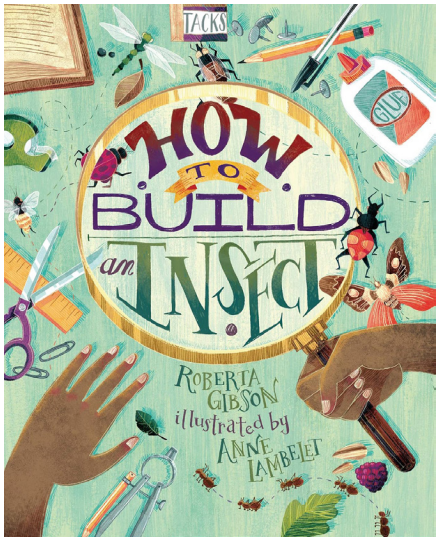
More activities about the unique characteristics of insects

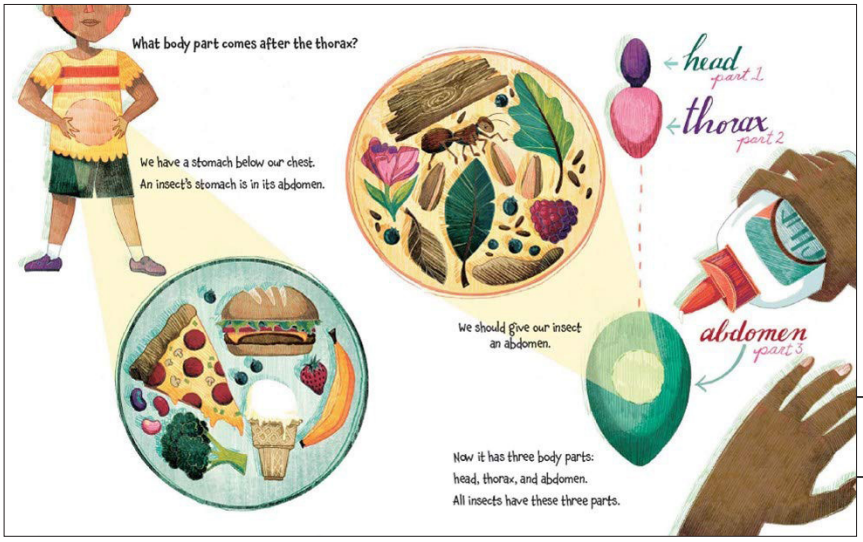
Design a robotic insect
https://www.jpl.nasa.gov/edu/learn/project/design-a-robotic-insect/

Investigate how different insects eat by experimenting with tools that are similar to insects' mouths
https://www.pnc.com/en/about-pnc/corporate-responsibility/grow-up-great/lesson-center/curious-crawlers/how-do-insects-eat.html

Learn about the relationship of insect mouth structures to what the insects eat with Mouthparts Mayhem
https://www.entsoc.org/sites/default/files/files/education-outreach/Lessons_ABCs.pdf

Walk like a bug
https://fyi.extension.wisc.edu/wi4hpublications/files/2015/10/TheBugWalk026.pdf





Cover and interior spread from: *How to Build an Insect* by Roberta Gibson

Bug Out!

3

On this Bug Out adventure, have kids pay particular attention to insect habitats

Get them to carefully search for places insects could eat, rest, shelter, or hide. Encourage them to get down on the ground and look for crawling insects but also look up high for those that might be flying by. Have them inspect leaves and gently turn them over to see what may be hiding underneath. Urge them to patiently watch and wait for insects to visit flowers or water sources. If they turn over any rocks or logs to find insects, remind them to be sure to put things back the way they found them.

Bug journal

Mapmaking

As part of your time outdoors, have kids map the space you're in and spend time observing what is there. Get them to take notes on what they see, noting all the different trees, flowering plants, shrubs, grass, etc., as well as water and food sources and access to safe spaces. After an initial survey, kids can draw and label a map of the space and use it to track how the space is being put to use as habitats for insects or to advocate for improving the space for bugs and other wildlife.

Real estate ads ... for bugs!

As kids discover insect habitats, get them to imagine how they can help bugs find the best places to stay. Having observed habitats or having made a bug hotel, ask kids to get creative and write an advertisement for bugs that promotes the very best in habitats! Kids can research a real place or use their imaginations to conceive the ideal location. But they should make sure bugs who read this ad can find out all the details about the food, water, shelter, and safe spaces that are available to them.

3

Bee a bug buddy

As kids walk around outside, have them think about what their surroundings would look to them if they were an insect.

- What is there to eat?
- Where can they stay safe from predators?
- How easy is it for them to fly or get around?

Write a persuasive letter

Have kids work in small groups to map the area, noting all the things that are there that are good for bugs and all the things that are missing or could be changed that could help them. Have them share their maps and then together come up with one list of things that would be important to do to help improve the area as insect habitat. Share their list, along with a letter they compose that advocates for change, with the managers of the location and/or local government.

Kid-Friendly Digital Media

3

Apps

Seek
https://www.inaturalist.org/pages/seek_app

Online games

Insect Generator
https://mrnussbaum.com/insect-generator-online-game

Make a Habitat Mapping Game
https://www.pbs.org/parents/crafts-and-experiments/make-a-habitat-mapping-game

Websites

Microsculpture, the Insect Portraits of Levis Biss
http://microsculpture.net/

Funny Names for Pest and Insects
https://www.pointepestcontrol.net/funny-names-for-pests-and-insects/

Videos

Arthropod Adaptations | Smithsonian Education
https://www.youtube.com/watch?v=bz4ODmqbnQA

How Insects Hide in Plain Sight
https://www.pbslearningmedia.org/resource/how-insects-hide-plain-sight-animation/whats-bugging-you/

Insect Habitats | Nature WY
https://www.pbslearningmedia.org/resource/insect-habitats-video/nature-wy/

Living Things Change: Crash Course Kids
https://www.youtube.com/watch?v=xDSFlRunlrU

The World Under a Rock!
https://www.youtube.com/watch?v=fxYp76jWxSU

Day 4
Bugs in Our Lives

Day 4
Bugs in Our Lives

Introduction

It's a good thing there are so many insects, because they have a lot of work to do! They play an important part in most **food webs** — at the beginning as a **primary consumer** and at the end, as a **detritivore**. When insects eat dead organisms, they help return nutrients to the soil so plants can use them to grow. This day focuses on how insects help with **decomposition**, or the decay or breakdown of dead organisms. It also focuses on another job insects do that is important for food production: **pollination**. In order for many plants to produce fruits, vegetables, and nuts, they need an animal's help. These insect jobs show their important role in **their ecosystems**. Other animals and plants depend on them to grow, reproduce, and help keep a balance within the ecosystem.

Questions to guide explorations and experiments

- What is pollination?
- How do insects help in pollination?
- Which insects are pollinators?
- What is ecological balance?
- What is decomposition?
- How does decomposition help an ecosystem?
- How do insects help with decomposition?
- Which insects help with decomposition?

Books and activities

- **Books:** all about pollinators, especially bees, ecosystems, and decomposition
- **Activities:** learn about how insects pollinate plants and plant anatomy, how insects help with decomposition, and how to plant a garden that supports insects

Children's Books

4

Fiction

- *A Bear, a Bee, and a Honey Tree* by Daniel Bernstrom (ages 3-7)
- *The Bee Tree* by Patricia Polacco (ages 4-8)
- *Because a Little Bug Went Ka-Choo* by Rosetta Stone (ages 2-5)
- *Camilla, Super Helper* by Judy Dillemuth, PhD (ages 4-8)
- *Doug's Dung* by Jo Rooks (Ages 4-8)
- *I Eat Poop: A Dung Beetle Story* by Mark Pett (ages 4-8)
- *100 Bugs! A Counting Book* by Kate Narita (ages 5-7)
- *A Web* by Isabelle Simler (ages 5-10)

Poetry

- *Behold Our Magical Garden: Poems Fresh From a School Garden* by Allan Wolf (ages 8-12)
- *Butterfly Eyes and Other Secrets of the Meadow* by Joyce Sidman (ages 6-12)
- *The Mighty Pollinators* by Helen Frost and Rick Lieder (ages 2-6)
- *UnBEElievables: Honeybee Poems and Paintings* by Douglas Florian (ages 4-8)

Nonfiction

- *An American Plague: The True and Terrifying Story of the Yellow Fever Epidemic of 1793* by Jim Murphy (ages 10-14)
- *A Day in the Life of Bugs* by Dr. Jessica L. Ware (ages 8-12)
- *Bee Dance* by Rick Chrustowski (ages 4-8)
- *Begin with a Bee* by Liza Ketchum, Jacqueline Briggs Martin, and Phyllis Root (ages 5-10)
- *The Book of Brilliant Bugs* by Jess French (ages 8-12)
- *Bugs and Us* by Patricia J. Murphy (ages 5-7)
- *Give Bees a Chance* by Bethay Barton (ages 4-8)
- *Insects: The Most Fun Bug Book Ever* by Sneed B. Collard III (ages 9-12)
- *Groundhog Day* by Gail Gibbons (Ages 4-8)
- *Not a Buzz to Be Found: Insects in Winter* by Linda Glaser (ages 5-8)

4

Activity 1: Decomposition: Get Down to Earth

Introduction

Insects are an important part of their **ecosystems**. They are part of food chains and webs both at the beginning and the end. At the end of an organism's life, it decays or **decomposes**. That means it breaks down into little pieces that can be absorbed back into soil. This process keeps soil healthy and helps plants grow. Many insects are **detritivores**. They eat dead organisms or their waste. They work with other detritivores including **fungi**, molds, **bacteria**, and some animals such as vultures and hyenas, to help dead things decompose and enrich the soil. Detritivores' waste has nutrients like the minerals plants need for photosynthesis.

Cockroaches, beetles, ants, some butterflies, and maggots (aka fly larvae) are examples of insect detritivores. The dung beetle is known for creating balls of animal poop and rolling them home to feed their babies! Over time, the detritivores work with the sun and water to return nutrients from dead plants and animals to the soil by eating and pooping. Some also help improve soil by digging, breaking it up and mixing in nutrients. You can see how things decompose by watching carefully, and you can help detritivores by creating compost.

Supplies

To observe decomposition

- 3 clear jars with lids
- 3 apple or pear cores (Slice up the fruit and use as a snack for kids)
- A piece of nylon screen or cheesecloth
- A rubber band

Activity 1: Decomposition: Get Down to Earth

For the composter

- Clean, empty 2-liter plastic bottle with label removed
- 3 apple or pear cores (Slice up the fruit and use as a snack for kids)
- Scissors or craft knife
- Nail
- Dirt from outside, not potting soil
- Shredded newspaper or torn paper bags
- Dry leaves, small sticks, or pine needles
- Fruit or veggie scraps, egg shells, coffee grounds, or grass clippings
- Flat dish to hold the composter
- Spray bottle with water
- Long-handled spoon

Image: PBS Parents (https://www.pbs.org/parents/crafts-and-experiments/make-a-composter)

4

Activity 1: Decomposition: Get Down to Earth

Get kids thinking ...

Ask: Have you ever rolled over a log or lifted up a rock in the woods and seen insects, roly polys, or worms underneath? Have you ever seen mushrooms in the woods or mold on an apple core? What do you think was happening with the insects, the log, the apple core, or the soil?

Remind kids about **food webs** and how insects are important at the end because they return **nutrients** to the soil when they eat dead organisms or waste. The plants use the nutrients in **photosynthesis**. In this way insect **detritivores** are the link between the end of one food chain or web and the beginning of another!

Let's get started!

Start with a book! Read "The FBI of Compost" from *Behold Our Magical Garden: Poems Fresh From a School Garden* by Allam Wolf or *The Book of Brilliant Bugs* by Jess French (pages 38-39 and page 73).

Get kids brainstorming what the FBI (Fungi, Bacteria, and Insects) need to do their jobs as detritivores. **Ask:** What would be the best conditions or environment for them? How do insects get to dead plants or animals? How do they get to food scraps? How can they help make better soil for plants near them? Help kids get a handle on what happens by having them observe some decomposition.

Part 1: Observe decomposition

Step 1: Slice up three apples or pears. Kids can eat the slices for a snack. Put each of the remaining cores into separate jars. Label each jar: Jar 1, Jar 2, Jar 3.

Step 2: Leave Jar 1 uncovered, put the nylon screen or cheesecloth over Jar 2 and attach it with the rubber band, and screw the lid tightly on Jar 3.

4

Activity 1: Decomposition: Get Down to Earth

Step 3: Invite kids to make predictions about which core will decompose first and have them write their predictions in their Bug Journals.

Step 4: Put these jars outside in the same place. Observe the jars every day. **Ask kids:** What do they see? What is happening to the cores? Do they see any insects or mold? Have kids write their observations in their Bug Journals.

Step 5: At the end of your observation time (at least 5 days), which core has decomposed most? The least? **Ask kids:** Why do they think that is so? Were their predictions correct? Invite them to write and draw in their Bug Journals. Discuss with kids how the lid or the screen would affect decomposition.

Part 2: Make a composter

Kids can observe decomposition on a bigger scale when they make a composter out of a plastic 2 liter bottle.

Step 1: Since the cutting and poking may be tricky for kids, provide them with a 2-liter bottle with the top cut off (approximately 1–2 inches below the neck of the bottle), and about 10 small air and drainage holes that you punched with a nail along the sides and bottom of the bottle. Set the top aside.

Step 2: Kids should put the empty, prepared bottle on a dish or plate. Have them add some dirt, shredded newspaper, and dead leaves to the bottom of their bottle. Give them a spray bottle to wet the newspaper and leaves. This is the compost starter.

Step 3: Have kids add materials to compost. They can layer grass clippings, fruit and vegetable peels and scraps, coffee grounds, or eggshells, ***but should not add dairy or meat***.

Step 4: Kids should take the top of the bottle that you cut off, turn it upside down, and place it in the opening of the bottle. Let kids know that this will act like a funnel for adding a little bit of water each day to keep the contents damp.

Step 5: Invite kids to draw the composter in their Bug Journals and label the items they put in it.

4

Activity 1: Decomposition: Get Down to Earth

Ask them how they think water and aeration holes will affect decomposition in their composter and to write down their ideas. If you've done the **Part 1: Observe decomposition** activity, remind them to think about how the cores in different jars decayed at different rates.

Then ask them to predict what will happen to the material in their composter.

Step 6: Have kids find a place for their composter outside where sunlight can reach it and schedule a composter check day. Have kids note (and draw) their observations about what the daily changes and smells are like in their Bug Journals.

Every few days, have kids stir the compost and add a little water, if needed, to keep the compost damp. As the compost breaks down, kids can add more food scraps or plant litter, as well as some more dirt.

Step 7: At the end of your observation time, ask kids to look back at their predictions and see if they were correct. Have them describe, in their Bug Journals, how the contents of the composter have changed. What do the food scraps, leaves, and paper look like now? Do they see insects or mold? What role did sunlight or water play?

It's okay if not a lot of changes happened. Decomposition takes time. If possible, let the composters work for several weeks for kids to see the process.

Step 8: If compost turns into healthy soil, add it to a nearby flower bed or garden or have kids place it in a pot, add a seed and some water and grow something new!

4

Activity 1: Decomposition: Get Down to Earth

More activities about decomposition

Be a Decomposition Helper, Too! (scroll to end)
https://kidspacemuseum.org/for-families-at-home/decomposition/

Decomposition Mission
https://beetlesproject.org/cms/wp-content/uploads/2021/07/Decomposition-Mission.pdf

Make a Log Hotel
https://kidsgardening.org/wp-content/uploads/2022/11/Decomposition-Activity-Pack.pdf

Why Recycling Matters: Some Things Don't Decompose
https://www.whizzpopbang.com/blog/easy-science-for-kids-decomposing-experiment/

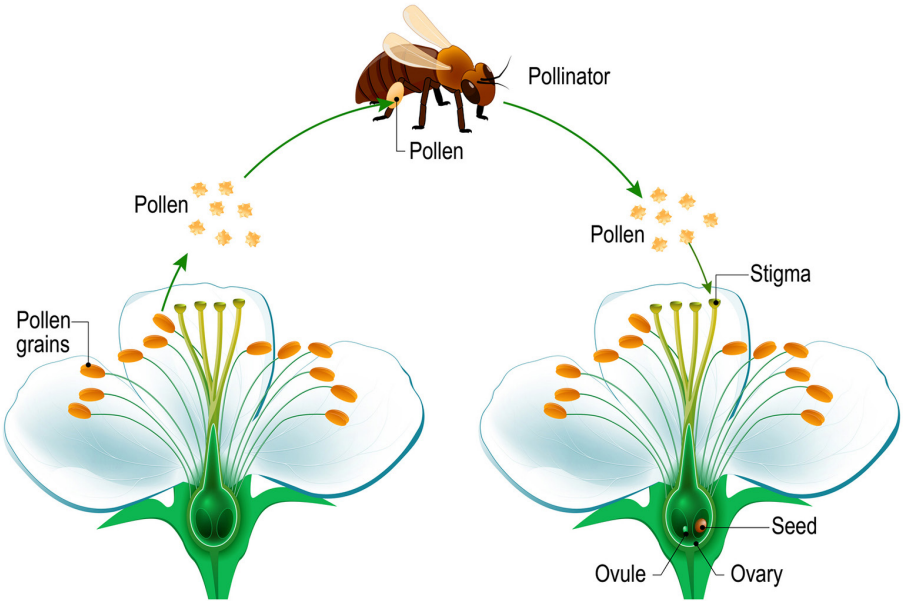
Interior spread from: *Behold Our Magical Garden: Poems Fresh from a School Garden* by Allan Wolf

Activity 2: Pollination: Be a Bee

4

Introduction

If you like apples, berries, peaches, avocados, many kinds of nuts, or vanilla ice cream, thank a bee! Bees and other insects pollinate many plants by moving pollen from one blosom to another. **Pollen** is a fine powder produced by some plants for reproduction. **Pollination** is when pollen grains move from the **anther**, where pollen granules are made, to the **stigma**, where they help to make seeds for new plants.



Apples come from trees with apple blossoms. Bees and other organisms help pollinate the apple blossoms. Apples, with seeds inside them, grow out of the pollinated apple blossoms. Someone or something eats the apple and some of the seeds end up in the ground. Those seeds can grow into a new apple tree.

Bees and other pollinating insects and animals are responsible for making some of our favorite foods. For example, bees pollinate alfalfa (a grass eaten by dairy cows) and vanilla. The cows make milk and other dairy products. People use cream and vanilla to make ice cream. Other animals, like bats, hummingbirds, and some badgers, pollinate plants, too, but insects do the most pollinating. Without them, we wouldn't have many of our favorite foods.

Activity 2: Pollination: Be a Bee

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There are more than 20,000 solitary bees native to North America. They live alone and they don't make honey, but they are important pollinators. Some bees, like the European honeybee, brought to North America in the 1600s, live in groups. When a honeybee finds a good source of pollen, it returns to its home, the **hive**, and tells the other honeybees where it is. The honeybee does a **waggle dance** that tells the other honeybees which direction to fly and how far. They also share some of the nectar they've gathered with the other honeybees so they know what the flowers smell like.

Sometimes it is hard for pollinators to find the plants they need. Some places don't support insect habitats because they lack plants or water. Some places have lots of air pollution that hurts insects' ability to smell flowers. It's important to protect insect habitats so pollinators can do their job.

Supplies

Bees and static electricity

- Balloons
- Paper
- Wool scarf or polyester material

Learn the parts of a flower

- Cotton swabs
- Markers or colored pencils
- Flowers: The best flower types for this activity include lilies, tulips, daffodils, alstroemeria, gladiolus, iris, hibiscus
- Parts of a Flower identification sheet (pages 78–79)
- Paper or journals for drawing
- Flower Dissection sheet (page 80)
- Tweezers
- Scissors
- Tape

Activity 2: Pollination: Be a Bee

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Get kids thinking ...

Ask:

- Have you ever looked closely at a flower? What did you see?
- Have you ever seen an insect, like a bee or butterfly, on a flower? Why were they there?
- What happens when an insect visits a flower?
- What is pollen and how does it work?

Let's get started!

Start with a book such as *Bee Dance* by Rick Chrustowski or *The Book of Brilliant Bugs* by Jess French, pages 34–35, or *UnBEElievables: Honeybee Poems and Paintings* by Douglas Florian. Discuss with kids how insects moving from plant to plant carry pollen with them and pollinate the plants. Have them brainstorm ways the insects could carry the pollen, which is like a powder.

Ask: Have you ever walked across a room and gotten a shock when you touched the doorknob? Has your hair ever stood up after you pulled off a wool hat? ***That was static electricity!***

Static electricity is the buildup of the electrical charge in an object when it is rubbed against another object. It can make things stick together or push apart. One of the ways a bee collects **pollen** is with static electricity. They create static electricity on their bodies when they fly. Pollen sticks to their bodies because of the static electricity.

Bees have **scopa**, or areas on their back legs or abdomen with a long fringe of hair, where they collect the pollen as they move from flower to flower. They move pollen from plant to plant, pollinating as they go. Honeybees also bring the pollen and nectar back to their hives to make honey, feed the baby bees, and care for the queen bee.

While bees are moving from flower to flower, they end up moving pollen to the part of the flower that needs it to make seeds. This is **pollination**.

Activity 2: Pollination: Be a Bee

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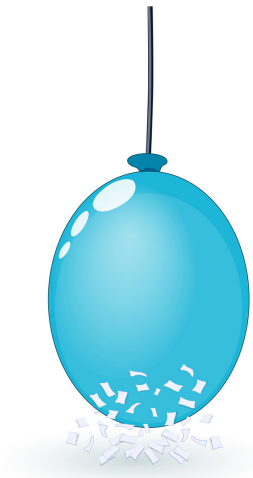
Part 1: How bees use static electricity to collect pollen

Let kids test how static electricity makes things, like pollen, stick!



Step 1: Provide kids with a piece of paper from the recycling bin and have them tear it up into tiny pieces. Have them spread out the pieces on a flat surface, like a table or the floor.

Step 2: Help kids blow up a balloon and tie it closed.

Step 3: Have kids rub the inflated balloon back and forth on clean dry hair 4 or 5 times, or rub the balloon on a wool scarf or polyester material.

Step 4: Ask: What will happen when you put the balloon near the little pieces of paper? Have them write their ideas in their Bug Journals.

Step 5: Have kids hold their balloon near to, but not touching, the paper pieces and watch what happens. **Ask:** Why did the little paper pieces leap to the balloon and sick to it? Talk about how this is similar to the way pollen grains can leap off the anther of a flower and stick to the body of a bee.

Activity 2: Pollination: Be a Bee

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Part 2: Learn the parts of a flower

Step 1: Set out the flowers you have so that kids can get an up close look, giving one to each kid if possible. Provide kids with the Parts of a Flower identification sheet. Have kids use the sheet as reference to identify the anther, where the grains of pollen are, and the stigma, where pollen grains end up and then become seeds, on the flowers.

Step 2: Give kids a cotton swab to use as a pollen basket. Have them rub the swab on anthers of their flowers to see how much pollen it picks up. Let them compare their pollen baskets with others. Ask them to note which flowers have the most pollen.

Step 3: Provide kids with the Flower Dissection sheet and tweezers and scissors to carefully take apart their flowers. As they separate the parts of their flowers, kids should draw or draw or tape the actual parts of the flower as they find them and identify them.

Step 4: Ask: If kids are dissecting different kinds of flowers, have them compare what they found. How are the same parts of different flowers the same or different? Are they different sizes, shapes, or colors? Discuss what they think makes their flowers attractive to pollinators.

Step 5: Finish by watching a video about the bees' waggle dance and then invite kids to come up with their own waggle dance to show others where to find flowers. You may want to note that bees can sense the electric field that surrounds a flower, which could make for interesting dance interpretations!

Activity 2: Pollination: Be a Bee

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More activities about pollination

Bee pollinator activities
https://dnr.maryland.gov/wildlife/Documents/LatH_Bee_Pollinator_Activities.pdf

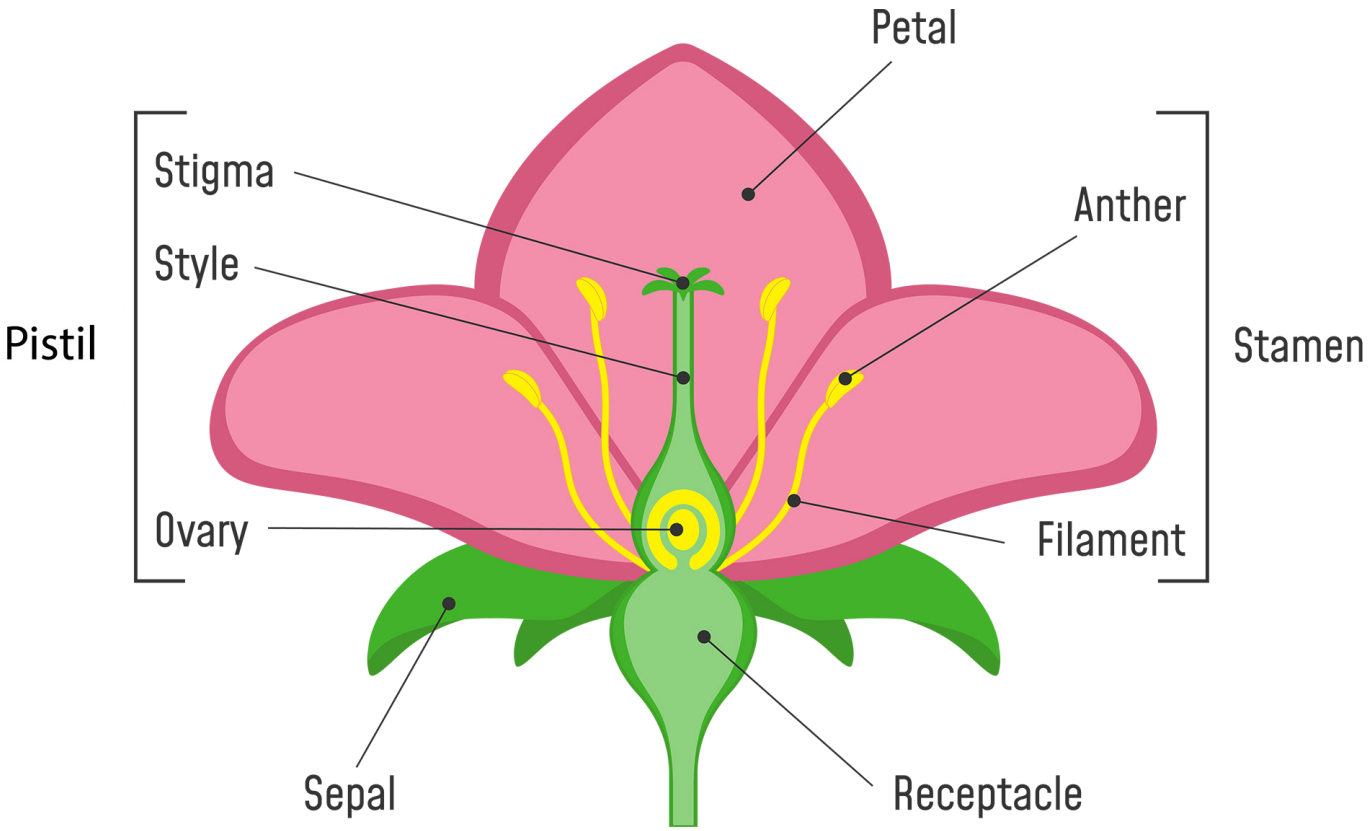
Fruit dissection (Fruit can be a snack when kids finish the activity)
https://www.exploratorium.edu/snacks/fruit-dissection

Waggle Dance Game
https://www.pbslearningmedia.org/resource/plumrx-sci-waggledance/waggle-dance/

Meet with a local beekeeper
https://www.localhoneyfinder.org/index.php#states

Cover and interior page spread from: *The Book of Brilliant Bugs* by Jess French

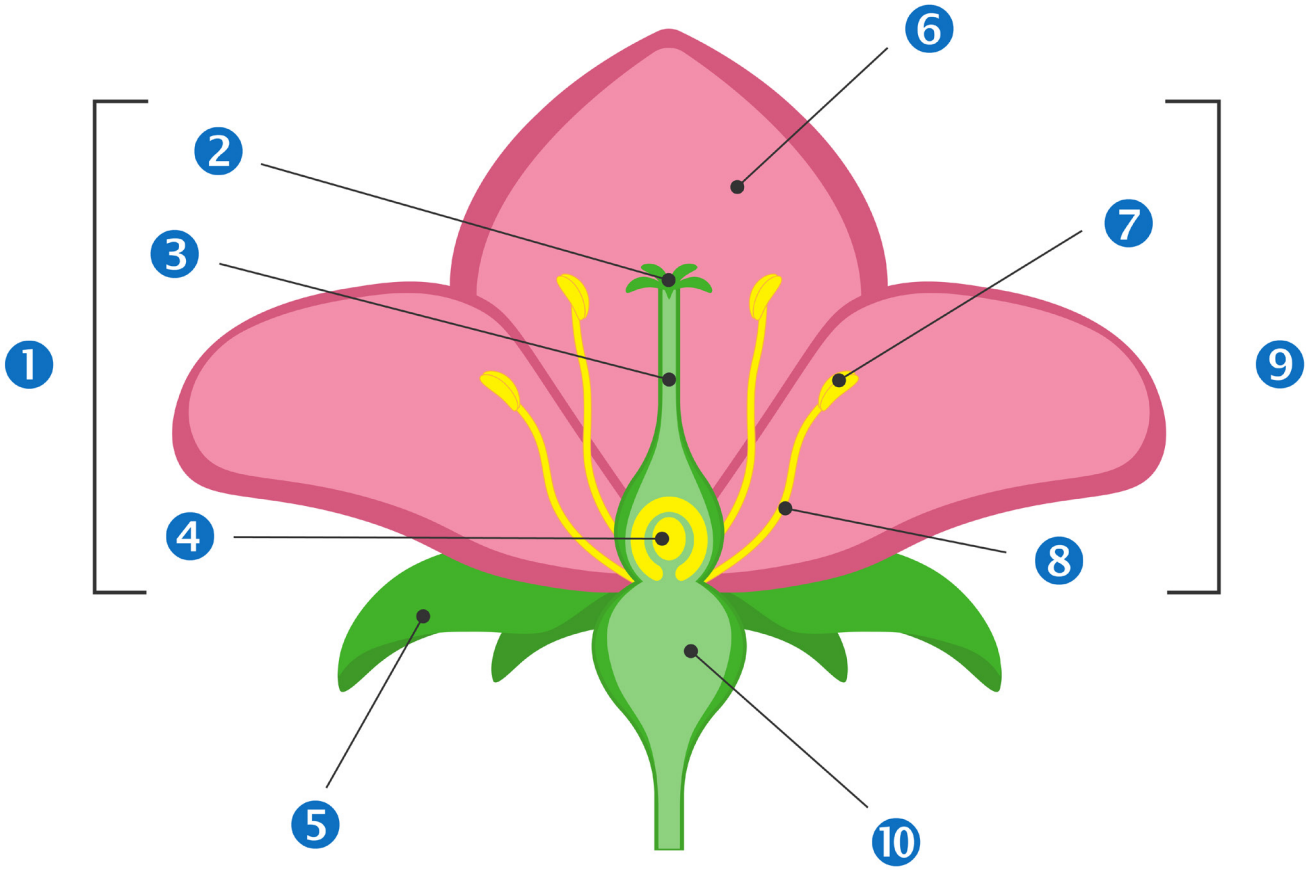
Parts of a Flower



- **Anther:** the part of a flower that produces pollen grains.
- **Filament:** the long strand that supports the anthers.
- **Ovary:** the part at the bottom of the pistil where the eggs are produced. When the ovary is mature, it is a fruit like an apple.
- **Petal:** the outer parts of a flower that often have bright colors.
- **Pistil:** the part of the flower that makes ovules, or eggs. It has a long stalk, or style, under the stigma, and an ovary at the bottom. When the egg is mature, it is a seed.
- **Receptacle:** the part of a flower stalk where the pieces of the flower are attached.
- **Sepal:** the outer parts of a flower that cover a bud.
- **Stamen:** the part of the flower that makes and holds the pollen.
- **Stigma:** the sticky top of the pistil, where pollen grains end up.
- **Style:** the long stalk under the stigma.

Label the Parts of a Flower

Anther • Filament • Ovary • Petal • Pistil • Receptacle
Sepal • Stamen • Stigma • Style



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Flower Dissection Sheet

Draw your flower

Anther

Filament

Stamen

Pistil

Stigma

Style

Ovary

Petals

Sepals

4

I spy pollinators!

Get kids outside to look for pollinators, plants that can be pollinated, and evidence of pollination — like fruit. Have them search for both insects, birds, or other animals that pollinate and flowers or other plants that need help to be pollinated or have already been pollinated and have fruit, veggies, or nuts growing. If kids find flowers, have them take time to look at the different parts of the flower and draw them in their Bug Journal.

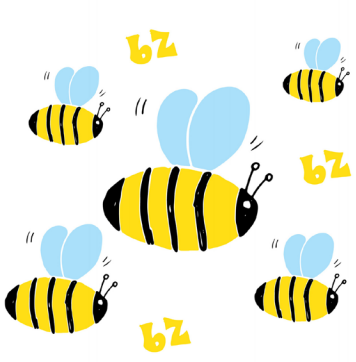
I smell decomposition!

Encourage kids to use another sense and sniff out decomposition in progress. As a decomposition detective, what evidence of decomposing can kids find on the Bug Out adventure? Where do they notice decomposition at home? Have them make a list or draw what they see and smell decomposing in their Bug Journals.

What else do they smell? Air pollution can hurt pollinators' ability to find plants. Do they see, hear, or smell any sources?

Bug journal

Musical bugs?



Have kids write about what they learned through their senses as they explored pollination and decomposition outdoors, particularly what they heard. Could they hear insects at work? Ask them to note the chirps, clicks, zips, rattles, buzzes, and trills they heard. Was it music to their ears?

Insects have inspired music for centuries. Have kids brainstorm and research songs featuring bugs, like The Itsy Bitsy Spider, The Ants Go Marching, or La Cucaracha. Have kids write song lyrics to recognize the hard working insect pollinators and decomposers.

4

Bee a bug buddy

Have kids brainstorm a place where they could plant an insect garden. It could be in an already existing garden, in a park, at school, or community center. While they'll need permission to plant a garden in public places, they could also make an insect garden in pots or window boxes. Ideal places get at least six good hours of sun per day.

To determine what to grow, have kids research pollinators in your area and the plants they like, looking for plants that are native to the region. Insects can see different colors than people, so kids should design their pollinator garden with insect color preferences in mind. This guide with information about the best flower colors to attract pollinators can help: https://extension.illinois.edu/sites/default/files/what_are_the_best_flower_colors_to_attract_pollinators-1.pdf

Kids can help map out the garden, gather supplies, and start planting! Here's a guide to help you help them plan a pollinator garden: https://kidsgardening.org/resources/lesson-plans-planning-a-pollinator-garden/. Plans in hand, have kids build their garden and watch pollinators at work.

The picture book *Camilla, Super Helper* by Julie Dillemuth also has a guide at the end.

Kid-Friendly Digital Media

4

Apps

PolliNation ID App | University of Michigan
https://umdearborn.edu/environmental-interpretive-center/community-engagement/pollination-project/pollination-id-app

Online games

Pollinator Games | Purdue University
https://extension.entm.purdue.edu/POL_Virt_Learn/virtual-learning/

Be a Pollinator Aid-er | PBS
https://pbskids.org/naturecat/games/pollinator-pathway

Food Scrap Recycling Truck
https://northamerica.novamont.com/foodscraptruck.php

Websites

Pollination | BrainPOP
https://www.brainpop.com/science/ecologyandbehavior/pollination/

Pollinator.org
https://www.pollinator.org/pollinators

Composting
https://kidsgardening.org/resources/gardening-basics-composting/

Kid-Friendly Digital Media

4

Videos

Incredible Insects | National Geographic
https://kids.nationalgeographic.com/videos/topic/incredible-insects

Who Needs Dirt? | Crash Course
https://www.youtube.com/watch?v=eCSIrlk0GTs

The Dirt on Decomposers | Crash Course
https://youtu.be/uB61rfeeAsM

Worm Bin Decomposition Time-lapse
https://www.youtube.com/watch?v=McQYDcqc0Nk

Fruit and Vegetable Decomposition Time-lapse (look for the flies!)
https://www.youtube.com/watch?v=c0En-_BVbGc

Like Fruit? Thank a Bee! | SciShow Kids
https://www.youtube.com/watch?v=txv2k7OoY7U

Perfect and Imperfect Flower Dissection
https://www.iowaagliteracy.org/Article/Perfect-and-Imperfect-Flower-Dissections

Flower Dissection
https://youtu.be/Eue0BV6VHvc

Day 5
Bugs and People

Day 5
Bugs and People

Introduction

This day focuses on bugs and people. People and bugs live together and impact each others' lives. Throughout history, bugs have played important roles. On the bad side, they have spread diseases, like **yellow fever**, **sleeping sickness**, or the **plague**, and destroyed crops, causing **famines** and **poverty**. On the good side, though, insects help people by **pollinating** plants, providing important links in **food chains**, and improving soil to help plants grow.

Insects have also provided people with silk, honey, wax, and many other useful things. Insects have been used in medicine, too! And insects inspire us. People look to insects to solve problems and make life more beautiful. **Biomimicry** is innovation inspired by nature. People observe insects and their special abilities and use what they learn to invent things.

Questions to guide explorations and experiments

- How do insects impact our lives?
- How do we impact insects' lives?
- How can insects be harmful to people?
- How can insects be helpful to people?
- What insect abilities could we imitate to solve problems?
- What would happen if we didn't have insects in our ecosystems?

Books and activities

- **Books:** all about bugs and people, history, and biomimicry
- **Activities:** learn about biomimicry and helpful bugs

Children's Books

5

Fiction

- *The Ant and the Grasshopper* by Rebecca Emberley (ages 3-8)
- *Bug Sandwich* by Brady Smith (ages 3-7)
- *Bug Scouts: Out in the Wild!* by Mike Lowery (ages 6-8)
- *Chocolate Chirp Cookies* by Jenny Goebel (ages 4-8)
- *The King of Bees* by Lester L. Laminack (ages 4-8)
- *María Mariposa* by Karla Arenas Valenti (ages 3-7)
- *Masterpiece* by Elise Broach (ages 8-12)
- *10 Little Insects* by Davide Cali (ages 9-12)
- *A Way With Wild Things* by Larissa Theule (ages 3-6)
- *Why Mosquitoes Buzz In People's Ears* by Verna Aardema (ages 4-8)

Poetry

- *Behold Our Magical Garden: Poems Fresh From a School Garden* by Allan Wolf (ages 8-12)
- *Copycat: Nature-Inspired Design Around the World* by Christy Hale (ages 6-9)
- *Crawly School for Bugs: Poems to Drive You Buggy* by David L. Harrison (ages 5-9)
- *Natsumi's Song of Summer by Robert Paul Weston (ages 3-7)*

Nonfiction

- *Beastly Bionics: Rad Robots, Brilliant Biomimicry, and Incredible Inventions Inspired by Nature* by Jennifer Swanson (ages 8-12)
- *The Bees of Notre-Dame* by Meghan P. Browne (ages 4-8)
- *Biomimicry* by Dora Lee (ages 8-12)
- *Bugged: How Insects Changed History* by Sarah Albee (ages 8-12)
- *Bugs: A Skittery, Jittery History* by Miriam Forster (ages 8-12)
- *Bugs Everywhere* by Lily Murray (ages 6-9)

Children's Books

- *Bugs for Breakfast: How Eating Insects Could Help Save the Planet* by Mary Boone (ages 8-12)
- *The Butterfly Alphabet* by Jerry Pallotta (ages 4-8)
- *The Butterfly Alphabet* by Kjell Bloch Sandved (ages 5-10)
- *Buzzkill: A Wild Wander Through the Weird and Threatened World of Bugs* by Brenna Maloney (ages 10 and up)
- *Invented by Animals: Meet the Creatures Who Inspired Our Everyday Technology* by Christiane Dorion (ages 7-10)
- *Let's Eat BUGS!* by Judy Goldman (ages 8-12)
- *Mimic Makers: Biomimicry Inventors Inspired by Nature* by Kristen Nordstrom (ages 7-11)
- *Nature Did It First: Engineering Through Biomimicry* by Karen Ansberry (ages 6-10)
- *Please Don't Bite Me: Insects That Buzz, Bite, and Sting* by Nazzy Pakpour (ages 7-10)
- *The Secret Life of Bugs* by Moira Butterfield (ages 7-11)
- *What's Your Favorite Bug?* by Eric Carle (ages 4-8)
- *What on Earth? Explorer: Bugs!* by Nick Forshaw (ages 7-11)
- *The Wonderful Wisdom of Ants* by Philip Bunting (ages 4-8)

5

Activity 1: Innovate with Insects

Introduction

Biomimicry is innovation inspired by the systems, behaviors, and other features and effects observed in nature. It is all about observing what works in nature and mimicking it in order to create a solution to a problem or to innovate. Kids can explore their own interests and make deeper connections with the world around them as they use bugs and lessons from nature as inspiration to design solutions to problems.

Supplies

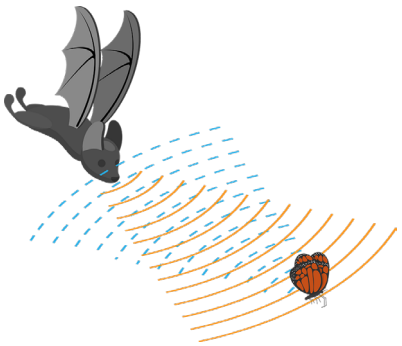
- Pencil and paper (or Bug Journal)
- Biomimicry examples (pages 91–93)
- Access to the Internet
- Materials for building prototypes (optional)

Get kids thinking ...

Ask: Can you give any examples of problems bugs or insects have had and have solved for themselves, such as what are some physical characteristics of insects that help protect them or any special body parts that help them survive? How can we use our understanding of bugs and insects to help solve a problem at home or in our community?

Let's get started!

Start with a book! Inventions and innovations inspired by insects are featured in these titles you can share with kids: *Invented by Animals: Meet the Creatures Who Inspired Our Everyday Technology* by Christiane Dorion, *Nature Did It First: Engineering Through Biomimicry* by Karen Ansberry and *Beastly Bionics: Rad Robots, Brilliant Biomimicry, and Incredible Inventions Inspired by Nature* by Jennifer Swanson.



Bat sonar (echolocation)

Activity 1: Innovate with Insects

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Talk about how people can use the characteristics and behaviors of plants and animals to develop solutions to many human-related problems, like how the spiny seeds, or burrs, that stuck to George de Mestral's pants and his dog's fur resulted in his close examination of microscopic hooks on the burr and the invention of Velcro®. Explain how biomimicry works and how scientists, engineers, and others — even kids! — look to nature and use it to help solve problems they see.

Step 1

Have kids review the biomimicry inventions you read about together, share the examples on pages 84–86, and research some additional examples. Ask kids to think about the ways bugs have helped humans solve a problem. As a group, put together a list of bug or insect characteristics or behaviors and the problems they helped solve.

Step 2

Get kids to identify a specific problem to focus on. As a group, brainstorm problems kids and their families face on a daily basis and generate a list to discuss further. These could be everyday problems at home, such as too much congestion in the bathroom in the mornings, disorganized storage or toy spaces, or needing to keep breakables safe from siblings, or issues in your community, such as areas that flood, heat islands, or keeping bodies of water clean. Have kids work in pairs or small groups to decide on the problem they want to solve and write it down.

Step 3

Next, kids should put their imaginations to use and start brainstorming solutions with their partner or small group. Because biomimicry relies on close observation, kids should have opportunities to head outside and observe or review videos of insects of interest. As they consider ideas and research insects for inspiration, remind them that they will need to come up with a design or prototype, so they need to think their solutions through carefully.

Step 4

Have kids write and/or draw what their solution looks like. Have them note what bugs and/or insects or other animals inspired them, list what materials they will use for their solution, or explain any processes they want to implement that mimic insect social behaviors.

Activity 1: Innovate with Insects

5

Step 5

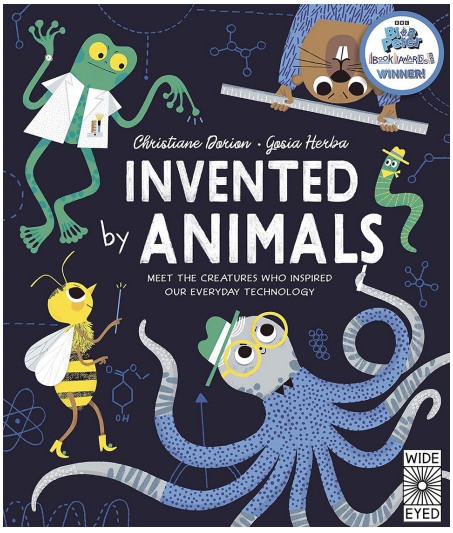
If materials are available, have kids build their prototype and test it to see how it works or what refinements it might need. Pairs or groups should share their plans and/or prototypes with everyone, get feedback, and further refine as desired.

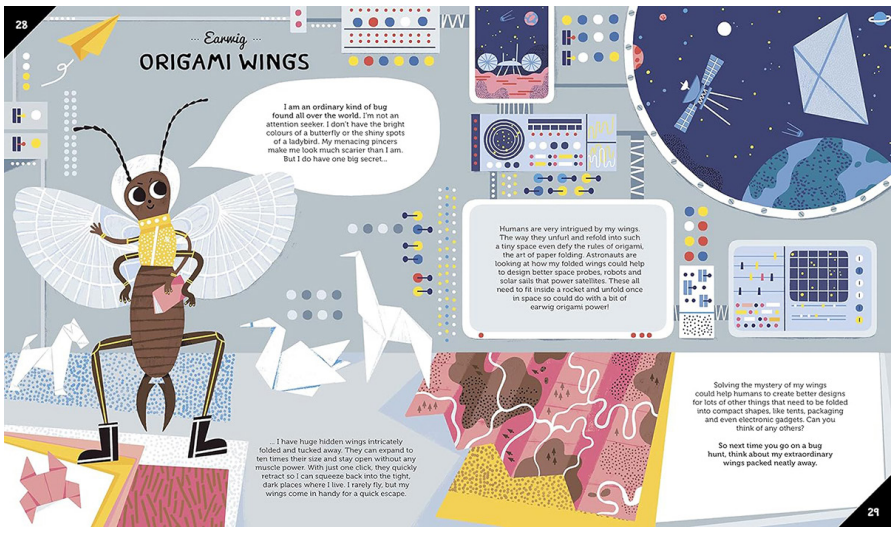
More activities about insect biomimicry

Design a helmet inspired by ladybugs
https://thinkdivebiomimicry.org/2017/09/01/design-a-helmet-inspired-by-ladybirds/

Design a tabletop supply organizer inspired by the natural home of an insect species
https://www.teachengineering.org/activities/view/uof-2359-naturally-organized-insect-design

Make beeswax wraps
https://www.wildlifewatch.org.uk/sites/default/files/2022-01/BEESWAX-WRAP-RGB.jpg





Cover and interior page spread from: *Invented by Animals: Meet the Creatures Who Inspired Our Everyday Technology* by Christiane Dorion

Biomimicry Examples

Velcro® was invented by Swiss engineer George de Mestral in 1941 when he studied how **burr seeds** stuck to the fur of his dog. Close examination revealed the microscopic hooks on the seeds.

Shark skin is made up of lots of tiny overlapping scales with small grooves that help water flow over the shark's body, reducing drag and allowing it to swim faster. Shark skin has inspired materials for faster swimsuits and special coatings for submarines and ships.

Biomimicry Examples

Have you ever seen a gecko climb a wall or "stick" to a ceiling? **Gecko feet** are covered in thousands of tiny hairs that can grip onto different surfaces; to release their grip, geckos just peel their toes away. Humans have studied these tiny hairs to invent a super strong tape that can be peeled off and used over and over again.

Wasps are master paper makers, chewing bits of wood into a soft pulp to build their annual nests. When the pulp hardens it creates a waterproof home for the queen wasp to lay her eggs. In 105 A.D., a Chinese man created paper from wood after observing the wasp's technique. We still use wood today, but big efforts have been made to recycle paper rather than cut down more trees.

Biomimicry Examples

Termite dens are the perfect home for their insect inhabitants, staying at about 87 degrees inside as the outside temperature shifts from freezing to sweltering. The architect of Eastgate Centre in Harare, Zimbabwe, studied how the chimneys and tunnels of termite dens draw in cool air at night. He applied those lessons to the building, which uses 90% less energy to heat and cool than traditional buildings.

Whales are efficient swimmers! Scientists discovered that bumps at the front edge of a **whale fin** help by reducing drag and increasing lift. Now we are using that knowledge to design more efficient wind turbine blades, cooling fans, airplane wings, and propellers.

5

Activity 2: Helpful Bugs

Introduction

A lot of people don't like bugs. They find them scary or annoying. But many bugs are helpful, and we'd be in trouble without them. Throughout history, and even now, insects help people. Some bugs eat other bugs that are harmful to people or their crops. Bugs are also a source of food for other animals, they pollinate plants, and enrich the soil. And without some special bugs, we wouldn't have silk, honey, or wax!





Bugs have played important roles in history. The demand for silk inspired an important trade route in the Middle Ages, the Silk Road, that connected China to Eastern Europe. Traders traveled to buy and sell silk, spices and other items. In ancient cultures, honey was used as a food, a preservative, and a medicine. Wax has been used to make candles, to waterproof things, and in cosmetics. Today, bugs continue to help us in many ways. Kids can learn more about helpful bugs and then create something — a poster, video, slide show, song, game, skit, or signs — to educate others and raise awareness about how bugs benefit us all.

Supplies

- Books about bugs in their ecosystems
- Paper
- Markers or colored pencils
- Materials to make their chosen project such as posters, games, or props for a skit
- Computer and printer (optional)
- Internet access to kid-friendly nature sites (optional; see page 100 for suggestions)
- Tools to make a video or digital slideshow (optional)

Activity 2: Helpful Bugs

5

Get kids thinking ...

Ask: Why do some people not like insects? What are some problems bugs create for people? What are some helpful bugs you can think of? What could you do to teach people about helpful bugs? Get kids to brainstorm about what they can do to educate others about helpful bugs.

Let's get started!

Start with a book! Try *Give Bees a Chance* by Bethany Barton or the poems "Good Bud, Bad Bug" or "We Treat Your Food Like It's Our Own" from *Behold Our Magical Garden: Poems Fresh From a School Garde*n by Allan Wolf. Discuss how people perceive bugs and how knowing more about bugs might help them change their ideas.

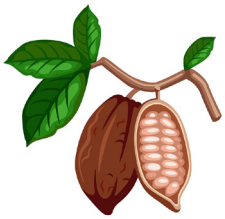
Step 1

Have kids brainstorm and then research bugs in the categories below. Encourage them to write down what they learn.

Bugs that eat other bugs.
Aphids and other bugs eat farmers' crops. Some insects like ladybugs and lacewings eat aphids. Dragonflies and damselflies eat bugs that pose direct challenges to people, like mosquitoes.

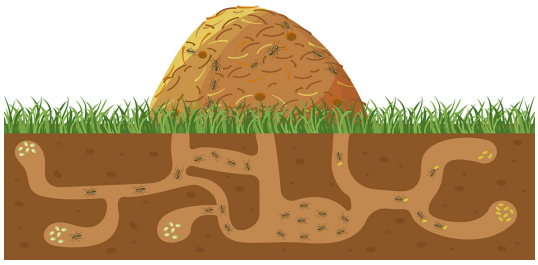
Bugs that feed other animals.
Birds, reptiles, amphibians, fish, and some mammals — even people — eat bugs. They are an important source of food for many.

Bugs that pollinate plants.
Many plants that produce fruits and vegetables need to be pollinated. Some other kinds of animals help pollinate plants, but insects do the most. Without insects, we wouldn't have many of our favorite foods like berries, apples, vanilla, potatoes, and chocolate.



Activity 2: Helpful Bugs

Bugs that help the soil.
Some bugs enrich the soil by eating dead plants and animals. Their poop provides nutrients to the soil. Others dig underground, breaking up and helping air get to the soil. Healthy soil is needed to grow plants, the first producer of food in every food chain.



Bugs that are useful to humans.
Besides pollinating, bees make wax and honey. Some other insects make wax, too! Silk worm cocoons are made into silk, a strong and light fabric. Some insects are used in medicine, such as maggots (fly larvae) in wound care or bee venom to treat infections and other diseases.

Step 2

Have kids decide what they want to do to teach others about helpful bugs. They could all work on the same project, work in groups, or each do their own thing. They could teach about every category of helpful bug, or each group could choose one category to focus on.

Some kids may want to research how to manage bugs that spread disease without using **pesticides** that could hurt helpful bugs. For example, you can reduce mosquito bites by using mosquito netting, fostering bat populations, and eliminating standing water where mosquito babies grow.

Step 3

Support kids as they create their helpful bug projects. Remind them to think about their target audience (younger kids, family members, folks in the community), and what might appeal to them. Give kids enough time to make a rough draft and a final product or to practice and revise songs or skits.

Step 4

Share the knowledge and bug love! Have the kids share their projects with each other and then with others. Help them find audiences for their projects.

Activity 2: Helpful Bugs

More activities about helpful bugs

Beneficial Bugs Scavenger Hunt

https://www.uky.edu/Ag/Entomology/ythfacts/resourc/tcherpln/bughunt.htm

Ancient Egyptian Scarab Handmade Pin Craft

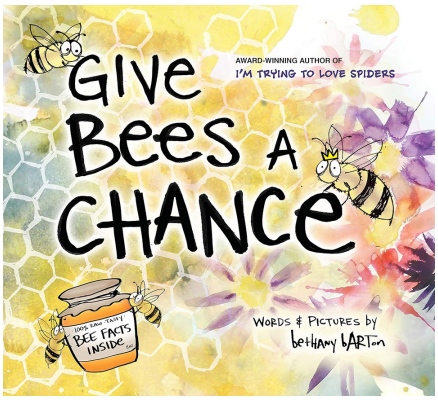
https://kidsactivitiesblog.com/237450/ancient-egyptian-scarab-handmade-pin-craft/

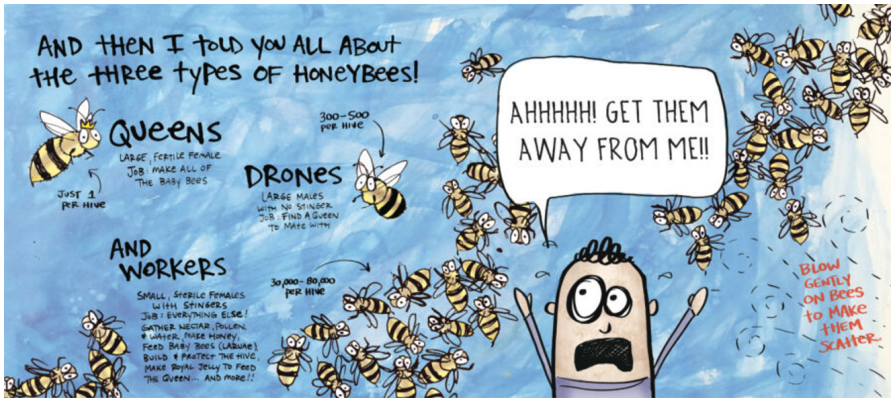
Insect Clothespin Craft

https://www.littlepassports.com/blog/craft-diy/insect-craft-for-kids/

Dragonfly Paper Craft

https://iheartcraftythings.com/dragonfly-craft-template.html





Cover and interior page spread from: *Give Bees a Chance* by Bethany Barton

5

Communities and communication

Before you Bug Out, get kids thinking about similarities between insects and people. Talk about looking outside for evidence of how, like humans, insects relate to each other. They might listen for the songs of insects looking for mates or watch for insects communicating through "dance." Or they may find ants working together to find and bring food to their nest or observe bugs fighting for territory.

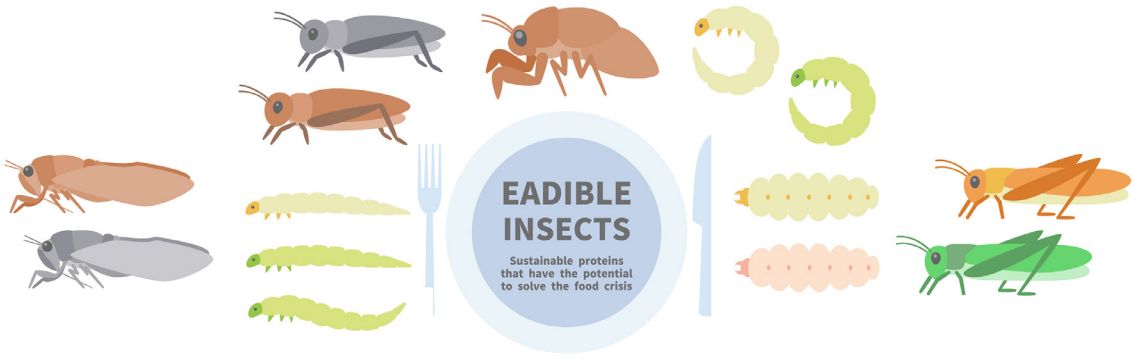
If kids have access to phones or other recording devices, encourage them to make videos of the behaviors they observe and be prepared to explain what is happening when they show their videos to everyone.

Bug journal

Bugs on the menu!

Food and eating are always a big part of everyone's daily life — people and insects alike! Bugs are a source of food for lots of organisms, even people! Have them explore how they feel about eating bugs by asking them to create a menu description for a bug-filled dish! They might imagine grasshopper tacos, ice cream with ladybug sprinkles, or pizza with insect toppings!

And while kids may not be enthusiastic about making and eating a dish with insect ingredients (like these: https://bugvivant.com/edible-insect-recipes/), if time and supplies permit, you can all work together to make and enjoy a dish named for insects like ants on a log, grasshopper pie, or one of these recipies: https://www.familythemedays.com/bugs---foods.html.



5

It's a bug's life

Have kids examine the different roles insects play: Insects are parents, siblings, workers, hunters, gatherers, community members, and innovators! Ask them to compare the day-to-day lives of insects to their own and write about it.

Bee a bug buddy

Invite kids to reflect on all the things they've learned about insects and how important they are to our ecosystems. Expand on the Helping Bugs activity to put on a community Bug Festival that raises awareness and increases insect appreciation in your neighborhood, school, or town about the importance of insects and their needs.

Ask kids to make a list of things they've learned about insects that they want to share. Then have them work in groups to brainstorm ways to share important insect information in a fun and engaging way. What are the best ways to show or tell others how to care for insects and provide information about helpful bugs? Here are some ideas:

- Guide a hands-on-activity, create a game, do a skit, or perform a waggle dance
- Demonstrate how to compost or create bug-friendly habitats and insect gardens
- Have an insect costume contest, insect face painting, and offer bug snacks
- Research and invite local master gardeners or farmers, beekeepers, entomologists, and naturalists to share their expertise

Help kids find a time and place to hold your event and get necessary permissions. Support them as they plan different activities, invite special guests, and make posters and videos to advertise the event. Assist them in spreading the word about the event to community, church, and school groups. By sharing knowledge and positive attitudes about insects, kids can help their community and the whole planet!

Kid-Friendly Digital Media

5

Apps

Seek
https://www.inaturalist.org/pages/seek_app

Online games

Bug Memory Game | National Geographic
https://scied.ucar.edu/activity/greenhouse-gas-game

Websites

How insects help keep ecosystems in balance | World Wildlife Fund
https://www.worldwildlife.org/magazine/issues/spring-2023/articles/here-s-how-insects-help-keep-ecosystems-in-balance

Beeswax Through History
https://bzzwax.com/blogs/all-beeswax/beeswax-through-history-from-prehistory-to-current-days

Ask Nature
https://asknature.org/

Videos

Biomimicry
https://youtu.be/4a8nGf9AXX0

Biomimicry: Design by Nature
https://www.youtube.com/watch?v=HPXYMBWjIks

Helpful Insects | Children's Hands-on Museum of Tuscaloosa
https://www.youtube.com/watch?v=G23U1kWHb8k

See How Termites Inspired a Building That Can Cool Itself
https://www.youtube.com/watch?v=620omdSZzBs

Appendix

Bug words

Printable templates

- Name cards
- Bug journal cover
- Certificate

Bug Words

Abdomen
The section of an insect's body where food is digested, eggs are made, and breathing holes (spiracles) are located.

Adaptation
A characteristic or skill a plant or animal has that helps them survive.

Adult
The last stage of an insect's life cycle, where the insect is a fully grown creature capable of reproduction.

Antennae
Sense organs, also called "feelers," located on an insect's head that help it touch, smell, and sometimes taste.

Apex predator
The top predator in a food chain.

Arthropods
Invertebrates, or animals that lack a backbone, and have jointed legs and hardened outer shells or exoskeletons.

Bacteria
A tiny, single-celled organism that gets nutrients from their environment.

Biomimicry
Innovation that copies, mimics, or is inspired by nature.

Carnivore
An animal that eats other animals.

Chrysalis
A wrapper surrounding butterfly pupae

Classification
Systematic process of sorting organisms, both living and extinct, into groups based on similar characteristics or evolutionary history.

Bug Words

Cocoon
Wrappers surrounding the pupae that can apply to certain moths and other insect pupae including but not limited to bees, wasps, fleas, caddisflies, etc.

Decomposition
The process where organisms begin to break down after they are dead.

Detritivore
An organism that eats dead or decaying plants or animals or their waste.

Drone
A male honeybee whose job it is to mate with queen bees from other hives.

Ecosystem
A community of living things in a shared environment.

Egg
The first stage of an insect's life cycle.

Entomologist
A scientist who studies insects.

Exoskeleton
The hard outer covering that houses and supports internal organs, muscles and other tissues and protects an insect's body.

Famine
When large numbers of people can't get enough food to eat over a long period of time.

Food chain
A series of living things that are linked to each other because each thing feeds on the one next to it in the series.

Food web
The interlocking food chains within a community.

Fungus (Fungi, plural)
A simple organism that is neither a plant nor an animal. Some examples of fungi are mushrooms, mold, mildew, and yeast.

Bug Words

Habitat
A place where plants and animals live.

Head
The front part of an insect's body, where the eyes and antennae are located.

Herbivore
An organism that eats mostly (or only) plants.

Hive
The home a group of bees builds for themselves and their queen bee.

Idiom
A phrase that means something different from the actual words.

Invertebrate
Animals without a backbone or bony skeleton.

Larva
The second stage of an insect's 4-stage life cycle where it is an immature, or young, form of an insect that often looks like a worm. Its job is to eat and grow.

Life cycle
A series of changes that happens to all living things.

Metamorphosis
A big change in an animal's body during its life cycle. The change can be so dramatic that the adult looks very different from the baby, like a caterpillar and a butterfly. Some insects experience complete metamorphosis with 4 stages. Incomplete metamorphosis has three stages including a nymph that looks like a smaller version of the adult.

Nutrient
Something in a food that is needed for growth or health. Minerals are nutrients that plants need to grow.

Nymph
The second stage of an insect's 3-stage life cycle, where the young insect hatches from an egg and is similar to an adult, but smaller, and without wings.

Bug Words

Omnivore
An animal that eats both plants and other animals.

Organism
Any living thing.

Parts of a flower

- **Anther:** the part of a flower that produces pollen grains.
- **Filament:** the long strand that supports the anthers.
- **Ovary:** the part at the bottom of the pistil where the eggs are produced. When the ovary is mature, it is a fruit like an apple.
- **Petal:** the outer parts of a flower that often have bright colors.
- **Pistil:** the part of the flower that makes ovules, or eggs. It has a long stalk, or **style**, under the stigma, and an ovary at the bottom. When the egg is mature, it is a seed.
- **Sepal:** the outer parts of a flower that cover a bud.
- **Stamen:** the part of the flower that makes and holds the pollen.
- **Stigma:** the sticky top of the pistil, where pollen grains end up.

Pesticides
Chemicals used to kill insects.

Photosynthesis
The process by which plants make food with energy from the sun.

Plague
A serious disease that is spread by flea bites.

Pollen
A fine powder made by some plants needed for reproduction.

Poverty
When people do not have enough money for basic needs like food, clothing, or shelter.

Primary producer
A plant that makes, or produces, energy from sunlight. The first level of the food chain.

Bug Words

Primary consumer
The organism that eats a plant in a food chain.

Pupa
The third stage of an insect's 4-stage life cycle where it develops its adult body and loses features of a larva.

Reproduction
How an organism makes more of itself.

Scopa
Parts of a bee that have evolved to carry pollen. This includes long hair on their back legs or on the underside of their abdomen. Honeybees have developed special scopa called pollen baskets on their hind legs.

Secondary consumer
The organism that eats a primary consumer.

Sleeping sickness
A serious disease that is spread by tsetse fly bites.

Static electricity
The buildup of the electrical charge in an object when it is rubbed against another object. It can make things stick to or repel each other.

Taxonomy
The science of naming and classifying organisms into a system that indicates natural relationships.

Thorax
The middle section of an insect's body, where the legs are attached.

Trophic levels
The levels — or steps — in a food chain or food web. The trophic level of an organism is the position it occupies in a food chain or food web.

Waggle dance
The figure-eight-shaped dance honeybees do to tell other honeybees the direction and distance of a flower patch.

Bug Buddies Name Cards

Make copies of these name tags and let child each choose their own Bug Buddies name. They can choose a particular insect name, such as Ant, Butterfly, Cricket, Dragonfly, Grasshopper, Ladybug — or choose a new vocabulary word such as Anther, Chrysalis, Detrivore, or Thorax.

My Bug Buddies name is:

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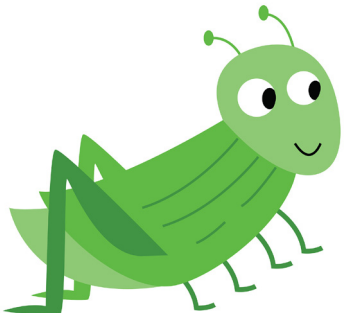

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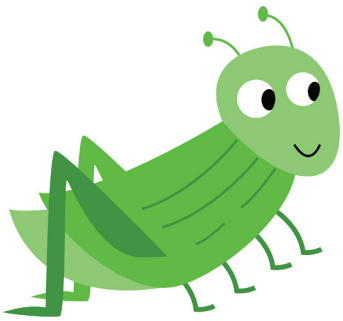

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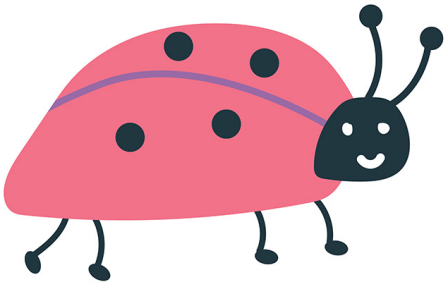

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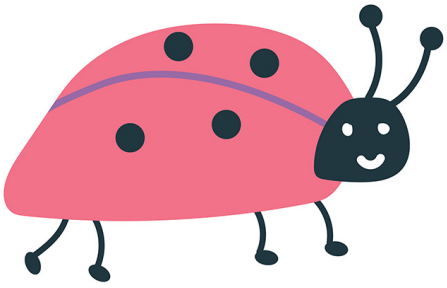

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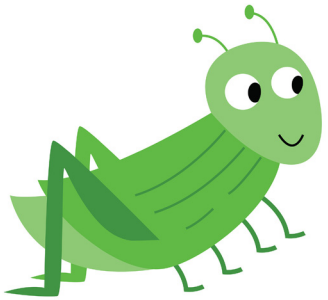
Bug Buddies

Bug Journal



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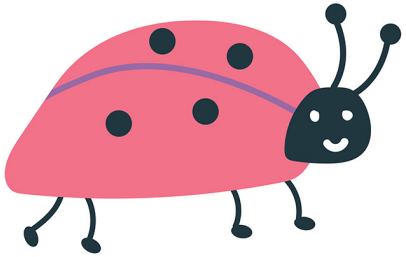
Bug Buddies

Bug Journal



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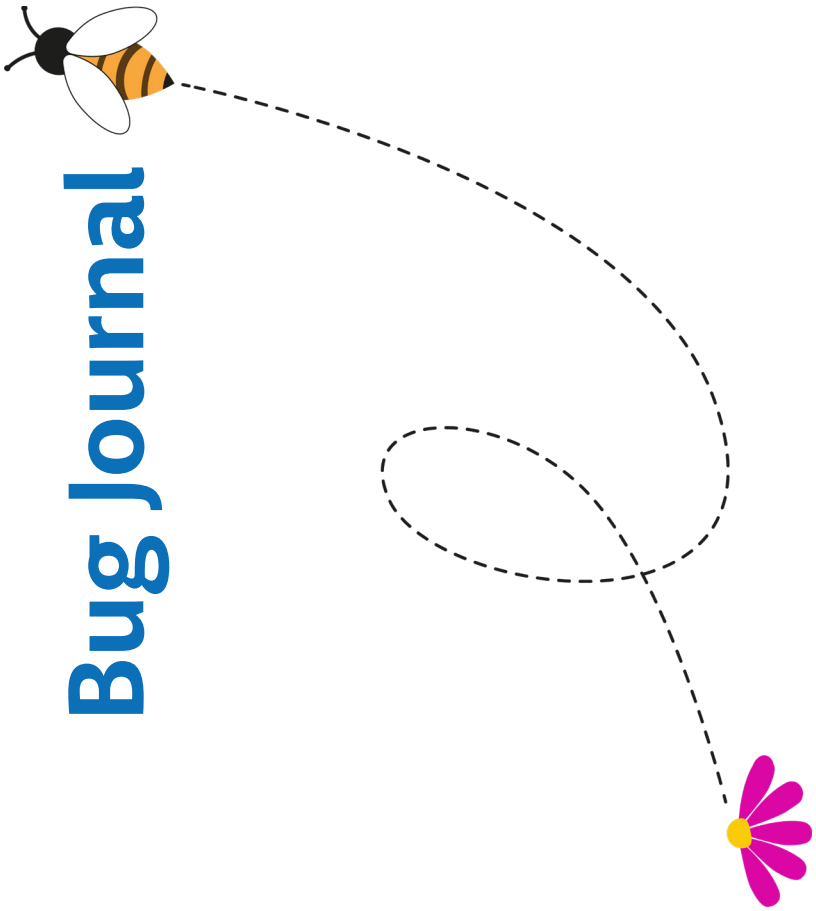
Bug Buddies

Bug Journal



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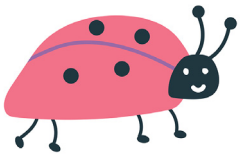
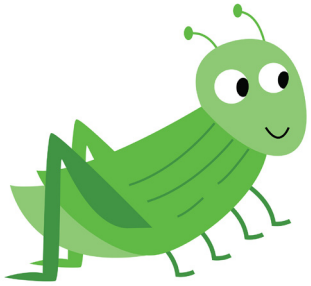
Bug Buddies

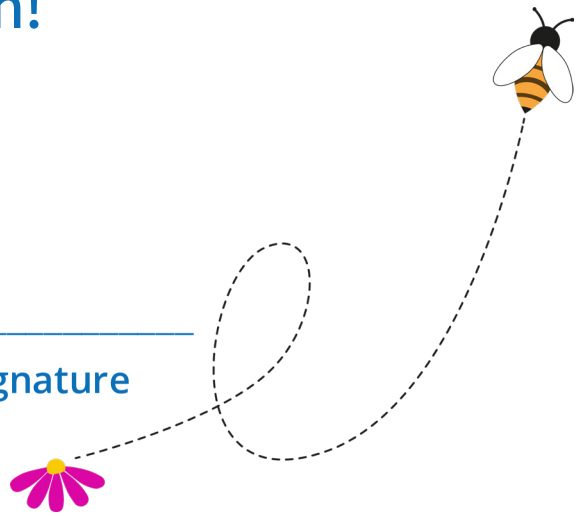




This certificate is presented to:

_____

To celebrate your participation in
the Bug Buddies program!



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Date

Signature