

Data Collection Activity 1: Lifestyles

Scientific Background

During an experiment, scientists make observations or measurements and collect results as they work. This information, known as data, can take many forms. Data may be written notes, a set of numbers, maps, or drawings generated during an experiment. Scientists use tables, charts, graphs and notebooks to record data. It is important to accurately record all relevant data, even data that seem surprising or wrong. Anomalies in the data may be analyzed and explained later.

Bias

In designing experiments, scientists work to reduce biases. A scientist's preconceived ideas and opinions can easily influence the design or results of an experiment. What biases might scientists working for a chemical company that manufactures pesticides bring to a study of the effects of pesticides on beneficial insects? What about scientists working for an environmental group?

Replication

Experiments must be repeatable, so that other scientists can verify the results. Sometimes an experiment will need to be repeated several times to produce accurate results. Tossing a coin once might result in heads, but repeating the coin toss experiment ten times will not likely result in ten heads.

Data Analysis

After scientists collect data, they use mathematical tools such as statistics and probability to help them analyze the data and interpret their results. Data may be arranged into a diagram such as a graph that shows how one quantity (for example, the number of Monarch caterpillars) varies in relation to another quantity (such as the number of milkweed plants in a field).

Conclusions

For many experiments, conclusions are formed based on the analysis of the data. "Do the data fit the hypothesis?" is one way to accept or reject a hypothesis. Often a statistical analysis is applied to data. Accepting a hypothesis does not guarantee that it is the correct hypothesis. It is possible to have a hypothesis that explains the observations, yet is the incorrect explanation. A hypothesis can be disproved, but never proven.

Students use the videos in ***Backyard Bugs*** to collect data about the bugs and to describe the bugs and the lifestyles they lead.

Vocabulary

Antlion	abdomen, adult, cocoon, complete metamorphosis, egg, jaws, larva, prey, pupa
Blepharicerid Larva	abdomen, adult, appendage, complete metamorphosis, diatoms, egg, graze, larva, mandibles, net-winged midge, pupa, sucker, ventral
Caddisfly	adult, camouflage, complete metamorphosis, gills, larva, mouthparts, pupa, sedge, segment, substrate, Trichoptera
Centipede	appendage, Arthropod, exoskeleton, feeler, invertebrate, jaws, jointed, poison, predator, prey, segment, simple eyes, terrestrial
Cockroach	abdomen, adapted, antennae, cerci, climate, compound eyes, exoskeleton, flexible, habitat, head, hemimetabolous, incomplete metamorphosis, jointed, leathery, membranous, molt, mosaic, nymph, ommatidia, omnivore, organ, pronotum, sensors, terrestrial, thorax
Dragonfly	adult, aquatic, compound eyes, fore wing, gills, hind wing, incomplete metamorphosis, invertebrate, labium, nymph, predator, rectum, spiracle, thorax, tissues, trachea, vein, ventilate, wing, wingspan
Giant Water Bug	aeration, breathing tube, desiccation, digest, elongate, Heteroptera, incomplete metamorphosis, internal organs, mouthparts, nymph, toxin
Hickory Horned Devil – Regal Moth	caterpillar, complete metamorphosis, eclose, larva, Lepidoptera, mate, nocturnal, predator, pupa, prolegs, Saturniidae, thorax, wingspan
Honey Bee	abdomen, cell, colony, complete metamorphosis, drone bee, forage, hive, honey, nectar, pheromone, pupa, queen bee, royal jelly, scout bee, social insect, stinger, worker bee
Luna Moth	adult, antennae, caterpillar, cocoon, complete metamorphosis, deciduous, eye spot, feathery, mate, nocturnal, overwinter, pheromone, pupa, scales, wing
Mantis	adult, camouflage, carnivore, elongate, exoskeleton, hatch, mantid, mesothorax, molt, nymph, predator, prey, prothorax, tropical
Millipede	appendage, anal valve, burrow, carbon dioxide, coil, defecation, detritus, exoskeleton, gnathochilarium, jointed, organic, poisonous, pre-anal ring, predator, segment, sexual maturity, soil, stink glands

Monarch Butterfly and Caterpillar	abdomen, adult, antennae, behavior, breed, caterpillar, chrysalis, complete metamorphosis, cremaster, egg, female, inherit, instar, knobbed, larva, latex, mandible, migration, nectar, pollinate, predator, prey, proboscis, prolegs, pupa, scales, species, sperm, spinneret, true legs, ventral, wing
Mosquito	adult, complete metamorphosis, Culicidae, Diptera, diverse, ecosystem, exoskeleton, filter feeder, generation, halteres, hatch, pierce, population, proboscis, protein, pupa, spiracle, suck
Spider	anchor, ballooning, bridge line, bristle, burrow, cephalothorax, chelicerae, claw, digest, disperse, dragline, exoskeleton, eye, fang, hub, molt, orb web, pedipalp, poison, prey, silk, spinneret, spiral, venom, vibrate
Stick Insect	camouflage, capitulum, feigning, herbivore, incomplete metamorphosis, nymph, regenerate, slender, suction pads, vegetation
Tachinid Fly	abdomen, bristle, complete metamorphosis, Diptera, halteres, host, lapping mouthparts, larva, maggot, parasite, parasitoid, vital organs
Viceroy Butterfly	adult, caterpillar, carrion, complete metamorphosis, dorsal, environment, model, Müllerian mimicry, predator, prey, unpalatable, wingspan
Whirligig Beetle	carnivore, Coleoptera, compound eyes, grasping, Gyrinidae, hind legs, paddle-like, predator, prey, scavenger, specialized

Vocabulary definitions can be found in the **Backyard Bugs Glossary**.

Thinking Question

How does having several data points help you understand the bug you collected data about?

Exploratory and Extension Activities

Additional Exploratory and Extension activities are available in the *Backyard Bugs Teacher's Guide*.

Bug Environment

Discuss the physical environment necessary for the survival of the bug you studied. Water and air are two examples of physical environment needs. Write a list of student responses on a large piece of paper. Then have students make a list to describe the physical environment of their school. Add this list to a second column on a large piece of paper.

Have students compare and contrast these two physical environments. Students can use grade level skills for this, such as drawing a picture for each idea, drawing and adding a sentence for each idea, or completing a simple written report with or without drawings, listing the comparisons and/or contrasts.

Name: _____

Data Collection Activity 1: Lifestyles

Data I collected about the _____

Scientific Name or Classification

Describe the bug's life cycle.

Describe the bug's special adaptations. How do they help the bug?

What does the bug eat?

Who are the bug's predators?

Answer Key Data Collection Activity 1: Lifestyles

Data I collected about the Student answers will vary.

Scientific Name or Classification

Scientific Name or Classification	
Antlion:	Myrmeleo
Blepharicerid Larva:	Blephariceridae
Caddisfly:	Trichoptera
Centipede:	Chilopoda
Cockroach:	Periplaneta americana
Dragonfly:	Odonata
Giant Water Bug:	Lethocerus americanus
Hickory Horned Devil/Regal Moth:	Citheronia regalis
Honey Bee:	Apis mellifera
Luna Moth:	Actius luna
Mantis:	Tenodora aridifolia
Millipede:	Diplopoda
Monarch Butterfly and Caterpillar:	Danaus plexippus
Mosquito:	Culex
Spider:	Aphonopelma
Stick Insect:	Diaperomera femorata
Tachinid Fly:	Diptera
Viceroy Butterfly:	Limenitis archippus
Whirligig Beetle:	Gyrinidae

Describe the bug's life cycle.
<p>Complete metamorphosis (egg, larva, pupa, adult): Antlion, Blepharicerid larva, Caddisfly, Hickory Horned Devil/Regal moth, Honey bee, Luna moth, Monarch butterfly, Monarch caterpillar, Mosquito, Tachinid fly, Viceroy butterfly, Whirligig beetle</p> <p>Incomplete metamorphosis (egg, nymph, adult): Cockroach, Dragonfly, Giant water bug, Mantis, Stick insect</p> <p>Other type of life cycle: Centipede, Millipede, Spider</p>

Describe the bug's special adaptations. How do they help the bug?

Student answers will vary.

<i>Antlion larva:</i>	<i>a sit-and-wait predator, digs pit to trap prey</i>
<i>Blepharicerid larva:</i>	<i>has ventral suckers to attach itself to rock surfaces in fast-moving water, scrapes algae off rocks</i>
<i>Caddisfly larva:</i>	<i>builds a case from sticks or rocks to protect itself from predators</i>
<i>Centipede:</i>	<i>claws on head contain toxins to attack and capture prey</i>
<i>Cockroach:</i>	<i>long antennae used to find food, detect predators, sense changes in temperature, fast runner</i>
<i>Dragonfly:</i>	<i>can move its wing independently, to keep body at proper temperature, large compound eyes to see prey and predators</i>
<i>Giant water bug:</i>	<i>have breathing tubes, beak to poison prey, males carry eggs on back</i>
<i>Hickory horned devil larva:</i>	<i>has horn-like structures and spikes to scare predators away</i>
<i>Honey bee:</i>	<i>performs a waggle dance to point other bees in direction of food, social insect</i>
<i>Luna moth:</i>	<i>is nocturnal, active at night to avoid predators, overwinters in cocoon</i>
<i>Mantis:</i>	<i>is a sit-and-wait predator camouflaged to blend into its environment</i>
<i>Millipede:</i>	<i>has matching legs on each side of its body to enable it to move in a smooth, gliding motion, hard exoskeleton for protection from predators</i>
<i>Monarch butterfly:</i>	<i>uses its antennae to sense chemicals and obstacles in its environment, coloration of wings to warn predators, migration to overwinter, stores fat in tissue to be able to overwinter as a butterfly</i>
<i>Monarch caterpillar:</i>	<i>eats nearly 9000 times its own weight in leaves when in its larval stage, so it can build enough energy to become a pupa, warns predators through its coloration</i>
<i>Mosquito:</i>	<i>larva live near the surface of the water and are filter feeders, straining small particles of food from the water</i>
<i>Spider:</i>	<i>has pedipalps that look like a pair of legs and are used as feelers and to taste and crush its prey, eight legs, fangs with venom to kill prey, uses silk in many ways</i>
<i>Stick insect:</i>	<i>Use camouflage, to blend in to their environment, to protect itself from predators, eggs are hard and long-lived, eats many types of leaves</i>
<i>Tachinid fly:</i>	<i>is a parasitoid when it is a larva, meaning it lives in the body of the host, free-living as adult</i>
<i>Viceroy butterfly:</i>	<i>is a Müllerian mimic of the Monarch butterfly, allowing it to avoid predators</i>
<i>Whirligig beetle:</i>	<i>compound eyes, divided into 2 parts, allows it to see above and below the water's surface at the same time, paddle-like hind legs</i>

What does the bug eat?	
<i>Antlion larva:</i>	<i>Ants and other small arthropods</i>
<i>Blepharicerid larva:</i>	<i>microscopic algae</i>
<i>Caddisfly larva:</i>	<i>algae, leaves, rotting wood and animal materials</i>
<i>Centipede:</i>	<i>earthworms and arthropods</i>
<i>Cockroach:</i>	<i>almost anything</i>
<i>Dragonfly:</i>	<i>gnats and mosquitoes</i>
<i>Giant water bug:</i>	<i>small fish, tadpoles, snails, water insects and other arthropods</i>
<i>Hickory horned devil larva:</i>	<i>ash, hickory, and walnut leaves</i>
<i>Honey bee:</i>	<i>Nectar and pollen from flowers</i>
<i>Luna moth:</i>	<i>larva eats leaves; adult does not eat</i>
<i>Mantis:</i>	<i>butterflies, moths, beetles, bees, crickets</i>
<i>Millipede:</i>	<i>dead plant material</i>
<i>Monarch butterfly:</i>	<i>nectar from flowers</i>
<i>Monarch caterpillar:</i>	<i>milkweed leaves</i>
<i>Mosquito:</i>	<i>larva eats small particles of organic matter in the water; adult females need blood to reproduce; adult males eat nectar</i>
<i>Spider:</i>	<i>insects and other small prey animals</i>
<i>Stick insect:</i>	<i>leaves</i>
<i>Tachinid fly:</i>	<i>the larva is a parasite that uses a Monarch caterpillar as a host; the adult fly eats nectar from flowers</i>
<i>Viceroy butterfly:</i>	<i>caterpillar eats willow leaves; adult drinks sap from trees, nectar from flowers</i>
<i>Whirligig beetle:</i>	<i>live, dead, and dying insects at the surface of freshwater ponds</i>

Who are the bug's predators?	
<i>Antlion larva:</i>	<i>birds</i>
<i>Blepharicerid larva:</i>	<i>fish</i>
<i>Caddisfly larva:</i>	<i>fish</i>
<i>Centipede:</i>	<i>spiders</i>
<i>Cockroach:</i>	<i>birds, rodents</i>
<i>Dragonfly:</i>	<i>nymphs are eaten by fish, giant water bug, other nymphs; dragonfly adults are prey for birds</i>
<i>Giant water bug:</i>	<i>fish</i>
<i>Hickory horned devil larva:</i>	<i>birds, rodents</i>
<i>Honey bee:</i>	<i>mantids, hive raiders such as skunks and bears</i>
<i>Luna moth:</i>	<i>birds, rodents</i>
<i>Mantis:</i>	<i>birds, larger mantids</i>
<i>Millipede:</i>	<i>spiders, birds, rodents</i>
<i>Monarch butterfly:</i>	<i>ants, spiders, birds, rodents</i>
<i>Monarch caterpillar:</i>	<i>tachinid flies</i>
<i>Mosquito:</i>	<i>fish</i>
<i>Spider:</i>	<i>birds</i>
<i>Stick insect:</i>	<i>birds</i>
<i>Tachinid fly:</i>	<i>frogs, birds</i>
<i>Viceroy butterfly:</i>	<i>birds, rodents</i>
<i>Whirligig beetle:</i>	<i>larger insects, crayfish, fish, birds</i>