ARTHROPODS

Grades 7-8

STUDENT JOURNAL

This journal belongs to:

THE GOOD AND THE BEAUTIFUL

INSTRUCTIONS

This student journal accompanies *The Good and the Beautiful Arthropods* science unit. It contains all the worksheets and journal pages that are needed to complete the unit. Each student will need his or her own copy of the science journal.

The lesson extensions are also found here. These extensions are optional for older students (grades 7–8) to complete on their own. Each extension is accompanied by lined paper so the student can keep his or her work in one place.

Have each student take his or her time to create high-quality work as the activities and worksheets are completed. Students may enjoy looking back on their past discoveries when they've finished.

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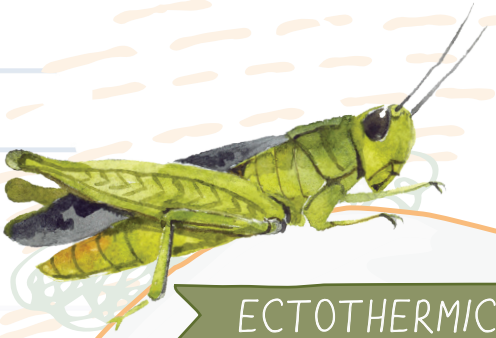
VOCABULARY REVIEW

Write the definition and draw a picture of each vocabulary word.

INVERTEBRATE



ECTOTHERMIC

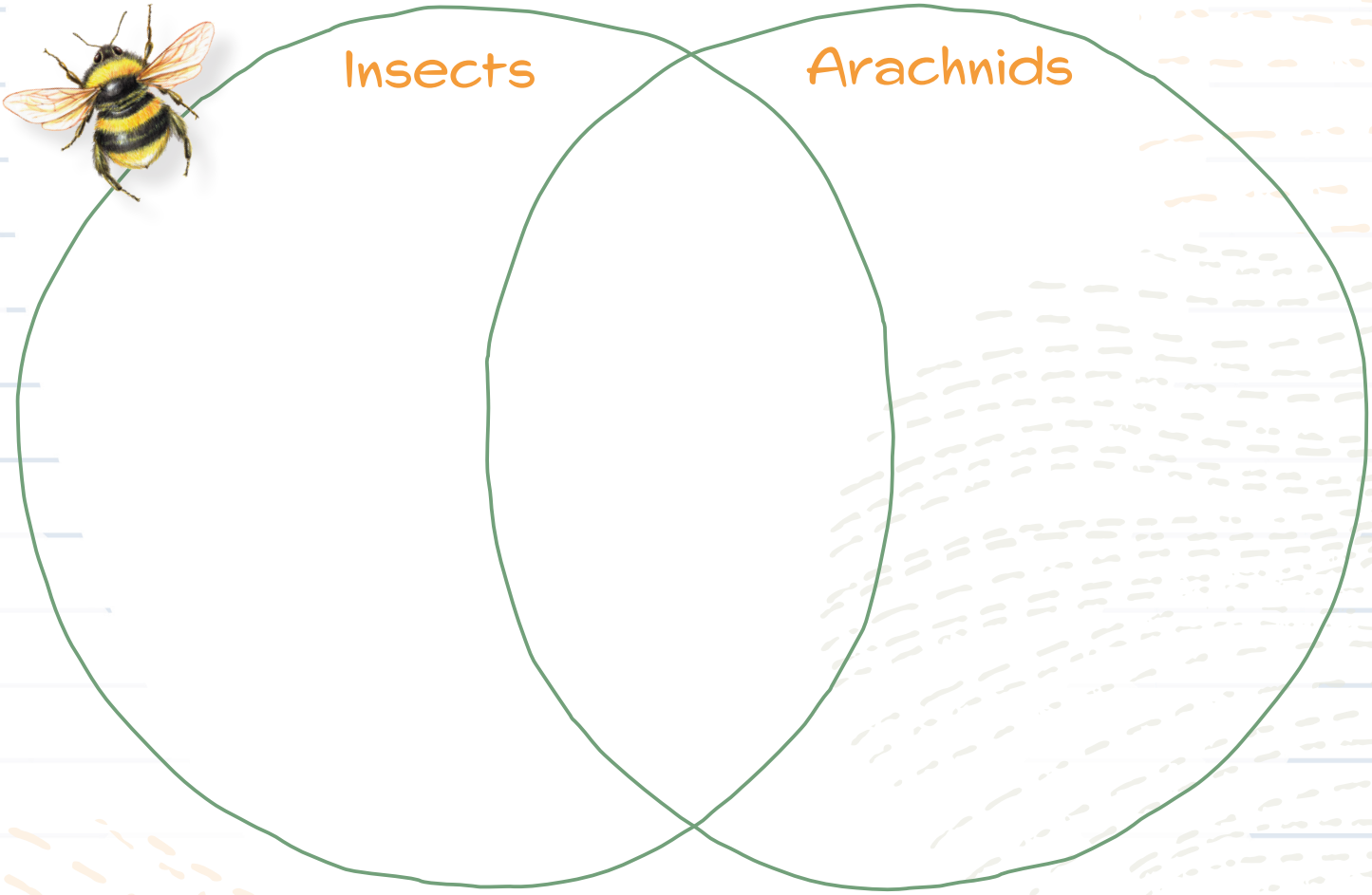
EXOSKELETON

"ANTHRAX FEVESTRATA"

BY EDWARD JULIUS DETMOLD (1883-1957), 1921

INSECTS VS. ARACHNIDS VENN DIAGRAM

Fill in the Venn diagram comparing insects and arachnids.



EXTENSION

Instructions:

1. Read the information below.
2. Find the definitions for the words *iridescent* and *mandible* and record them.
3. Choose at least one beetle to draw and color.

Beetles

Belonging to the largest insect order, Coleoptera, beetles make up a huge percentage of all the living things in the world. Some scientists estimate that one in every four animals is a beetle. Beetles can be found nearly everywhere in the world, in all climates and ecosystems. British geneticist John Haldane once said, "If one could conclude as to the nature of the Creator from a study of creation, it would appear that God has an inordinate fondness for stars and beetles."

The variety of beetles is truly astounding. Many are beautifully decorated and show a range of bright, iridescent, or even metallic coloring. ***Iridescent*** colors reflect light and seem to change colors when looked at from different angles. The smallest beetle, the scydosella, is smaller than 1 mm (0.04 in), while the titan beetle can grow to almost 16.5 cm (6.5 in). However, there are some things all beetles have in common. All have six legs and bodies divided into three sections: head, thorax, and abdomen.

Head

As you can see from the images on this page, beetle heads come in an amazing variety of shapes and sizes, but most include mandibles, compound eyes, and antennae. ***Mandibles*** are a pair of rigid, often toothlike forms that move horizontally to grasp and cut food. They can also be used in defense or to attack enemies and are typically much larger in male beetles than in female beetles.

Beetles' eyes are located on either side of the head and are made up of thousands of six-sided facets, each of which transports a small part of an image to the brain, where the entire image is reassembled like a jigsaw puzzle. This type of eye is called a ***compound eye***. With some exceptions, beetles usually have poor eyesight, and they rely on other senses for survival.

On the head of every beetle you can also find two antennae, although these can look drastically different depending on the species and are used for several different functions. Some beetles use their antennae to smell, detect motion, search for obstacles, balance, or even mate.

Thorax

The thorax is divided into its own three sections, each of which sports a pair of legs for six legs total.

Perhaps the most recognizable trait of beetles is the hardened suit of armor they wear on their backs. This is actually an outer set of wings called the ***elytra***, which protects a second set of softer hind wings. When a beetle needs to fly, it holds its outer wings to the side, allowing the hind wings to flap freely. Most beetles are clumsy fliers because of this unique wing construction. While insects like dragonflies can beat their wings more than 1,000 times a minute, a beetle usually averages only 30–60 times a minute.

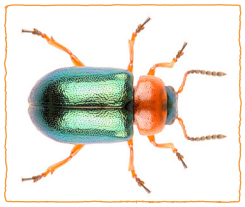
While all beetles have six legs, with each leg having five parts, each species has legs designed to achieve different purposes. These could be sharp claws for climbing, large back legs for swimming, or strong, flat front legs for digging. Some beetles even have powerful legs that allow them to jump when needed.

Abdomen

The final part of a beetle's body, located at the opposite end from the head, is the abdomen. There are no legs attached to the abdomen, but it is covered with about nine or ten hard, telescoping rings. Beetles, like all other insects, do not have lungs. Instead, small holes called ***spiracles*** are found along their sides. These tiny openings allow air to enter the beetle's body and be transported to the rest of the body through a system of tubes.






BEE RESPONSIBILITIES

Match each bee image to the correct title,
then fly each bee fact to the correct title by drawing a line.

QUEEN

WORKER BEES

DRONES

- These bees work as a team to take care of the queen and the hive
- Only one of these in a colony
- They mate with the queen bee
- These bees build, fix, and guard the hive
- Male bees
- This bee is bigger than all the other bees
- These bees fan the honey to make it thicker
- This bee lays the eggs
- These bees clean and feed the queen bee
- There are only a few in each colony
- They have big eyes and no stingers
- These bees collect nectar and pollen
- She is the leader of the colony

EXTENSION

Instructions:

1. Read the information below.
2. Write three to four sentences answering the question "Which insect or fact did you find most interesting and why?"

Bees vs. Wasps

Have you ever seen a black-and-yellow insect flying through the air and been unsure if it was a wasp or a bee? These similar insects can be hard to distinguish, but it is important to be able to identify them as some are beneficial, others mean you no harm, and a few can be quite aggressive if provoked and should be avoided. Read through the descriptions of the most common species of bees and wasps below.

Honeybees

- build their hives in hollow trees or beekeeper boxes
- can only sting once because they die when they sting an animal or person
- make more honey than they need
- have fat and somewhat furry bodies

Paper Wasps

- very thin, smooth bodies with long legs
- build hives above ground with open cells
- can be aggressive but usually do not seek to be around humans
- pollinate plants

Bumblebees

- big with furry round bodies and small wings
- don't aggressively go after intruders, but if they feel the need to sting, a single bee can sting multiple times
- have smaller colonies and usually don't make more honey than they need
- are attracted to blue and violet flowers

Yellow Jackets

- thin, smooth bodies and legs, but not as thin as paper wasps
- can sting multiple times and will group together to chase down intruders
- scavenge for food and eat insects
- build underground nests with only one entrance

Which insect or fact did you find most interesting? Let's compare honeybees and wasps more closely. Read through the Venn diagram below.

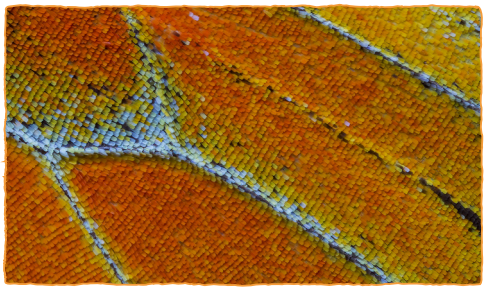
Bees and wasps are very similar. They even share a love for eating honey, and because wasps don't make their own honey, they try to steal it from bees. Wasps will not only eat honey, but they will also attack and eat honeybees. It may seem like an unfair battle because wasps are often larger than bees and are able to sting multiple times. But what bees lack in stinging power, they make up for in coordination and teamwork. Japanese bees will lure scout wasps into the hive and then swarm the wasp. Then the bees produce a high amount of heat by vibrating their flight muscles very quickly, which kills the wasp.

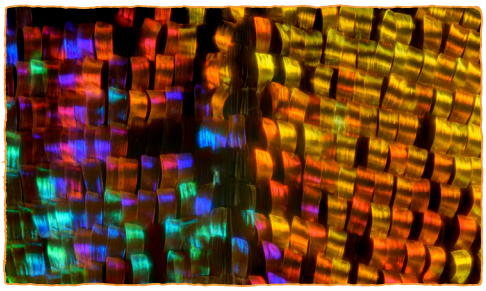
EXTENSION

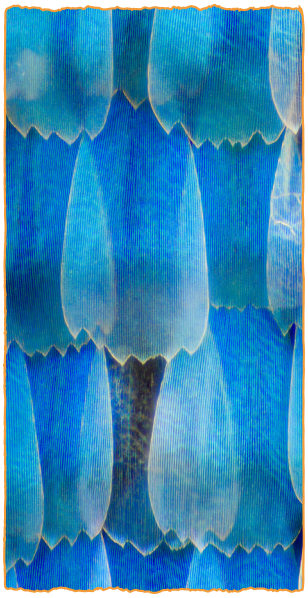
Instructions:

1. Read the information below.
2. Copy the vein patterns of at least two butterflies.
3. Ponder and write about a time when you noticed that God cared about the details in your life.

The Details of Butterfly Wings







The scientific order of butterflies is Lepidoptera. The ancient Greek translation of this name means "scaled wing." The wing part of this name makes a lot of sense, but did you realize that butterflies have scales? Look at the pattern of scales on these close-up pictures of butterfly wings at the right.

If you have ever touched a butterfly, you may have noticed shimmery, dustlike particles left behind on your fingers. These are butterfly scales!

The wings and scales of butterflies are very delicate. Be careful when catching or touching butterflies because some of their scales will shed when bumped. Butterflies shed scales throughout their lives during flight, mating, and gathering nectar; it is a natural part of a butterfly's life. But scales do not grow back. If too many scales are lost, it could inhibit a butterfly's ability to fly.

Scales can come in many shapes and colors, depending on the variety of butterfly. Some scales are more rectangular, while others are shaped like teardrops. Some types of butterflies have as many as 600 scales in a single square millimeter. Others have not nearly that many scales and can appear transparent.

Underneath the scales there is a clear, durable membrane on which the scales are attached. This transparent membrane is what can be seen when there are fewer scales on a butterfly. The membrane is durable and provides the shape and strength of a butterfly's wings.

Butterflies have two pairs (four total) of overlapping wings, designed with an arrangement of veins that extend from the base of the wing where they are attached to the thorax of the butterfly. The vein pattern is determined by the type of butterfly and is a characteristic used by scientists to classify butterflies into categories. Look at the butterflies below and compare their vein patterns.

When we look at the details God gave attention to in something as small as a butterfly, we can remember that He cares about the small details of our lives as well.

Marbled White Butterfly

Viceroy Butterfly

Black-veined White Butterfly

INSECTS PROTECT!

Complete the activity for each defense mechanism as you learn about it in the lesson.

1 CAMOUFLAGE

Color the flowers and leaves. Then color the butterfly to camouflage it into the flowers.

2 MIMESIS

Circle all the praying mantises in the picture.

3 THANATOSIS

Draw a line from thanatosis to its definition.

Thanatosis

- Playing dead
- Pretending to be asleep
- Fainting from fear

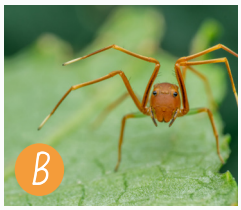
4 REPELLENCY

One of the worst-smelling insects, the shore earwig, shoots spit that smells like rotting flesh. In the circles below, rank the smells from 1 to 5, five being worst.

- ◯ bad cheese
- ◯ rotten eggs
- ◯ dirty shoes
- ◯ used diaper
- ◯ full trash bag

5 MIMICRY

Which picture below shows an ant and not a mimic? Write the letter in the box.



EXTENSION

Instructions:

1. Read the information below.
2. Write 3–4 interesting ways that arthropods are used for medicinal purposes.

Modern Medicinal Uses for Arthropods

Arthropods have been used to treat medical conditions for thousands of years, dating back to ancient times. Many of these uses have proven to be no more than folklore, such as the idea that eating a stick bug can help a person lose weight or that eating a hairy tarantula can help someone regrow hair on his or her head. However, certain arthropods like spiders, maggots, and even wasps are still used today, and scientific research continues to support the theory that some of these medicinal uses may actually be legitimate. Read through the examples of arthropods used medicinally to the right.

The most widely used arthropod material in treating ailments of all kinds is honey. Honey is truly an incredible substance. It is packed with nutrients that, when ingested, can help maintain health, and it can also be applied topically (or to the outside of our bodies). Honey is antibacterial and can help fight off germs. You can find honey in cough drops, herbal teas, lip balm, skin products, and vitamins.

Even arthropods that can cause health problems are used to treat those same problems. Some spiders and scorpions have venom that can be damaging and even deadly, but studying this venom has allowed scientists to produce what is known as antivenin. When given to individuals who have been bitten or stung, antivenin can counteract the effects and save them.

As scientists continue to research the use of arthropods in the field of human health, surprising benefits will come to light. The study of arthropods for medicinal uses has and will continue to greatly benefit humankind.

Medicinal Uses

Spider Silk

Spider silk, which spiders use to make their webs, can be used in the formation of skin grafts and ligament implants. It is stronger than steel and is being studied to improve building materials.

Fly Larvae

Fly larvae, also known as maggots, can be set upon an infected area of skin. They will eat only the necrotic tissue (cells that have died and can cause infection), which helps a wound heal faster.

Blister Beetles

These small beetles produce a blister-forming substance. Scientists have extracted it to place on warts and other bumps on the skin produced by viruses. The substance forms a blister on the affected area that signals a person's body to attack with its immune system.

Brazilian Social Wasp

The venom from this wasp found in Brazil weakens the membrane of cancer cells and eventually causes holes through which vital parts of the cell begin to leak. Without these vital parts, the cancer cell cannot live or reproduce.

Bees and Ants

The venom found in some bees and ants has been used to reduce the swelling around joints for people affected by rheumatoid arthritis.

Silkworms

A substance known as serrapeptase found in the digestive system of silkworms has been shown to help relieve back pain.

A WORLD WITHOUT SPIDERS

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pest control	violin strings	antivenin	spiders
strong silk	arachnids	web	tarantula
medical	scorpion	food source	disease

EXTENSION

Instructions:

1. Read the information below.
2. Take notes about each of the world records.
3. Explain to a parent or another person what you learned.

Spider World Records

First Arachnologist in History: Carl Alexander Clerck (1709–1765)

Although reports about spiders can be found in very old writings, such as those of Aristotle and Pliny, the father of modern arachnology (the study of arachnids) was Carl Alexander Clerck. He was the author of *Svenska Spindlar*, the first book of spiders using the binomial system of nomenclature. Clerck's book was published shortly after the seminal *Systema Naturae* of Carl von Linné (Carl Linnaeus), which marks the beginning of the binomial nomenclature.

Most Prolific Arachnologist: Eugène Louis Simon (1848–1924)

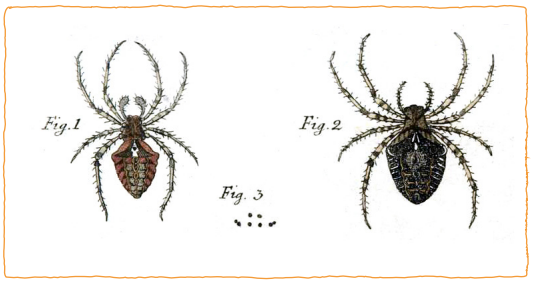
No one wrote more about spiders than Eugène Louis Simon, a French naturalist. This arachnologist (scientist who specializes in the study of arachnids) was the author of more than 270 scientific papers related to spiders. He also was the first person to name or update the status of 5,633 spider species.

Largest Living Spiders: *Theraphosa blondi* and *Heteropoda maxima*

The Goliath birdeater, *Theraphosa blondi*, is possibly the largest known spider by mass. According to Guinness World Records (2017), a single reared individual reached a leg span of 28 cm (11 in) and a weight of 170 g (6 oz). The giant huntsman spider, *Heteropoda maxima*, discovered in caves in Laos, Asia, is possibly the largest known spider by leg span—up to 30 cm (12 in). With a total body length up to 4 cm (1.5 in) and a leg span of more than 10 cm (4 in), females of *Nephila komaci* (Araneidae) are the largest known orb-web spiders.

Best Ballooners: Most Spiders

Many spiders, especially small species or immature stages, disperse by releasing one or more silk threads to catch the wind (the so-called ballooning behavior). Distances traveled by spider ballooners can reach greater than 1,000 km (621 mi), as testified by sailors who reported spiders caught in their ships in the middle of oceans. Possibly, the longest distance covered with ballooning is 3,200 km (1,988 mi) for an unidentified linyphiid spider.



Orb-Web Spiders

Eugène Louis Simon

Goliath Birdeater

ARTHROPOD OBSERVATION

By:

What shape(s) does the arthropod most closely resemble?

Where was the arthropod found?

Circle the common arthropod parts below that are found on your arthropod.


Wings


8 legs


6 legs


Antennae


Head


Thorax


Abdomen


Compound eyes


More than 2 eyes

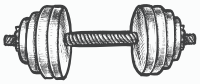

Claws

List three questions you have about the arthropod:

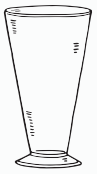
Color the icon(s) that describe how the arthropod feels to touch.

Rough

Sharp



Heavy



Smooth

Bumpy

Sticky

Light

Soft

Draw a picture of your arthropod.

EXTENSION

Instructions:

1. Read the information below.
2. Choose an arthropod you have learned about in this unit and write a paragraph about it in Jean-Henri Fabre's style.

Jean-Henri Fabre and the Life Cycle of the Field Cricket

Jean-Henri Fabre was a French entomologist in the late 1800s to early 1900s. From an early age, he was fascinated by the beauty of the butterflies and grasshoppers he observed in the natural world. As an almost-complete autodidact (someone who is self-taught), Fabre dedicated his life to the study of insects and arachnids. He focused on observation and taking detailed notes but avoided drawing general conclusions about what he noticed, as he was solely there to record the facts. His written works did not follow the typical dry, scientific structure of other factual books at the time. Fabre had a lively, biographical style to his writing. His passion for communicating the intricate details of the behaviors and life cycles of the insects he studied is manifest in his written work. Read the excerpt from his writing at the bottom of this page.

One of the insects Fabre studied in great detail was the field cricket. He prepared a flower pot with soil and a glass lid, then made careful observations, from the female laying her eggs to his failed attempt to feed lettuce to the new crickets. Eventually, Fabre released "five or six thousand crickets, an attractive flock, to be sure," into his yard and described the result as a "massacre so great that the colonies . . . were so far decimated that I could not continue my observations." In other words the crickets, no longer under the protection of the glass lid, were exterminated by their natural predators—lizards, ants, gnats, dung beetles, and wasps.

Life Cycle of the Field Cricket

The life cycle of the field cricket lasts from late spring to early fall. There are only three stages, which Fabre describes in great detail in his book *Social Life in the Insect World*. During the egg stage in late spring, the female lays 50–100 eggs in a perpendicular position a few inches into the soil. Fabre described the eggs as "a curiosity, a tiny mechanical marvel" because they have a piece like "a skull cap which forms the lid." Along the lines of this cap is where the eggs break and the nymph "issues forth like a jack-in-the-box," about two weeks after being laid.

Thus begins the second stage of the cycle. The nymph is a flea-sized cricket, "pale all over, almost white," which burrows to the surface of the soil and nimbly hops away in search of food. Once the nymph has molted 8–10 times and has grown into a "splendid ebony black" adult cricket, it has arrived at the third and final stage of its life. At this point the males begin to chirp, rubbing their back legs together in an attempt to attract a mate. Fabre's appreciation for the sounds of crickets signifying the beginning of summer is apparent in the way he describes crickets as the "choristers of spring" and compares their song to that of the crested lark, a beautiful summer bird. Once the crickets mate and the females lay their eggs, they die from the cold in the fall, and the cycle begins again.

An excerpt from *Insect Adventures* by Jean-Henri Fabre:

"Ten or twelve yellow-winged Wasps usually work together. They scrape the earth with their fore-feet like mischievous puppies. At the same time, each worker sings her glad song, which is a shrill noise, constantly broken off and rising higher or sinking lower in a regular rhythm. One would think they were a troop of merry companions singing to encourage each other in their work."