BEE CAUSE: 6 WEEK BEE UNIT

GETTING TO KNOW THE BASICS OF BEES

A CURRICULUM GUIDE FOR EDUCATORS OFFERED BY

THE BEE CAUSE &

WHOLE KIDS FOUNDATION

WELCOME LETTER FROM THE BEE CAUSE

Welcome to the **Bee Cause: 6 Week Bee Unit. Getting to Know the Basics of Bees!** Teachers and students will be buzzing with excitement about these interactive learning experiences. The lessons are designed for exploring the natural world and making important scientific discoveries about the honey bee. This curriculum is packed full of Information, Materials, Digital Support, Step-by-Step Instructions, Lesson Plans, Resources, Assessments, and more. Teachers and homeschooling parents can use this curriculum in a classroom or in a home study environment. **The Bee Cause: 6 Week Bee Unit** is a true learning path based on the most important living species on the planet -- the honey bee!

It is important to note that LIVE bees are not required to benefit from this deliverable.

For more information about the Bee Grant and other BeeCause initiatives please visit our website at www.thebeecause.org OR email info@thebeecause.org.

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Educator Guide

Welcome to the **Bee Cause: 6 Week Bee Unit.** Getting to Know the Basics of Bees! Teachers and students will be buzzing with excitement about these interactive learning experiences. The lessons are designed for exploring the natural world and making important scientific discoveries about the honey bee. This curriculum is packed full of Information, Materials, Digital Support, Step-by-Step Instructions, Lesson Plans, Resources, Assessments, and more. Teachers and homeschooling parents can use this curriculum in a classroom or in a home study environment. **The Bee Cause: 6 Week Bee Unit** is a true learning path based on the most important living species on the planet – the honey bee!

- ***NO LIVE BEES REQUIRED!*** Each unit has a link to a live feed of a bee hive, as well as video links that explain the important targeted concepts.
- Schools that have Observational Hives will be able to utilize video links and live feeds to support the curriculum. The curriculum also provides a Hive Observation Log for student use.
- The lessons do not have to be completed in order. They are designed to build on each other for content or they can stand alone. Educators can choose what works best for student's needs in the classroom or through digital learning.
- Each lesson is mapped to the Next Generation Science Standards and ELA Common Core Standards for 3rd, 4th, and 5th grades but can be modified for other grade levels.
- Includes a pre and post-assessment.
- Includes a KWL (Know-Wonder-Learn) resource and example that can be used for all lessons.
- Many of the lessons can be done outside in the natural classroom.
- Each lesson has a list of materials with links to purchase items.
- Each unit has multiple video links to support the teacher delivering quality instruction.
- Many lessons include video links to songs for dance and movement for students.
- All of the full-color pictures and illustrations can be reproduced for quick reference as part of the teacher's tool kit.
- Many lessons include extra resource templates.*
- The unit also includes a Literature Circle Teacher's Guide for further reading and discussion of fiction or nonfiction bee-based text.
- The unit also includes a comprehensive glossary for quick reference as well as Reproducible Glossary Materials with high-quality photographs.

Suggestions for use of the Reproducible Glossary Materials:

- The teacher should print two sets of cards, preferably in color and laminated.
- One set of cards is the glossary word, definition, and photographs. These are presentation cards for introducing new terms and should be displayed in the classroom as the lessons progress. Students should use this set of cards as reference material.
- The second set of cards should be cut in half to separate the pictures from the definition. Students should use this set of cards for manipulation by matching glossary words to corresponding pictures.
- A few or all of the glossary words can be used by the students to demonstrate knowledge of terms.

- For more information about this grant or another Bee Cause Project initiative, please visit www.thebeecause.org or send us a message at info@thebeecause.org.

- Please check in with our Bee Cause Blog for any updates to Live Feeds/Videos.

** Disclaimer: Some links within the 6 Week Bee Cause Curriculum may require a subscription, please follow all licensing rules required by individual companies.*

Name _____ Date _____

HONEY BEE PRE/POST ASSESSMENT

1. Which picture shows a honey bee?

A. 

B. 

C. 

D. 

2. Which of the following is NOT a job of a worker bee?

A. nurse bee (feeds the baby bees)

B. taste-tester bee (makes sure the honey is safe)

C. cleaner bee (cleans the cells)

D. guard bee (protects the hive entrance)

3. Every hive has

A. two queen bees and many worker bees.

B. one queen bee and more male bees than female bees.

C. one king and one queen bee plus worker bees.

D. one queen bee, female worker bees, and male bees (drones).

4. True or False: All worker bees are female.

A. True

B. False

5. Pollination is when

A. honey bees store pollen in their pollen baskets.

B. honey bees eat pollen.

C. honey bees bring pollen back to the hive.

D. honey bees spread pollen from one plant to another plant.

6. The average lifespan of a worker honey bee is

A. about 6 weeks.

B. about 1 year.

C. about 10 years.

D. about 50 years.

7. Honey looks and tastes different depending on

A. the weather.

B. the size of the hive.

C. the season that the honey was harvested.

D. the type of bee that collected the nectar.

8. True or False: Honey bees are aggressive by nature and will always sting you.

A. True

B. False

9. The honey bee waggle dance happens when

A. a forager honey bee communicates the location of a pollen source.

B. a male honey bee is trying to attract a female honey bee.

C. all the bees in the hive get together for an epic dance party.

D. a honey bee is about to die.

10. Why are honey bees important to our planet?

_____

_____

_____

_____

_____

UNIT FOR WEEK 1

INSIDE THE HIVE

MEET THE HONEY BEE

ASK THE AUDIENCE

- Who has seen a honey bee outside of the hive?
- Has anyone heard stories or seen movies about bees?
- Has anyone ever seen a queen bee?

FUN FACTS ABOUT HONEY BEES

The honey bee has been around for about 30 million years.

Honey bees are one of the few bees with hairy compound eyes.

The honey bee's wings stroke over 200 times a second! This fast motion is what creates the distinctive honey bee buzz.

During honey production periods, spring and summer, a worker bee's life span is about 6 weeks.

The average honey bee will actually make only one twelfth of a teaspoon of honey in its lifetime... About the size of your pinky fingernail.

Bees die after they sting! The stinger has a barb that is attached to the abdomen; so, when they sting they lose part of their abdomen and die.

Honey bees can perceive movements that are separated by 1/300th of a second. Humans can only sense movements separated by 1/50th of a second. Were a bee to enter a cinema, it would be able to differentiate each individual movie frame being projected.

Queens will lay almost 2000 eggs a day at a rate of 5 or 6 a minute. Between 75,000-200,000 eggs are laid per year.

BEE HIVE MEMBERS

QUEEN: She is just that, the queen of the hive. There is only one queen in a colony of bees, and she serves as the central focus of the **colony**. She is a completely developed female and is the only honey bee that lays eggs. The queen is also the only honey bee without a barb on her stinger. This means that she can sting repeatedly without dying. This feature allows her to kill other queens who may venture into the hive.

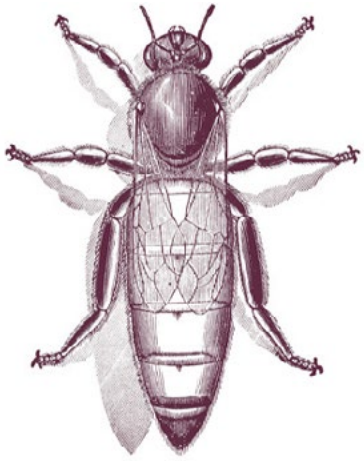
While she starts out the same as all the other worker bees as a simple egg, the queen is cared for differently. When her egg is selected to become the queen, the **larva** is fed a rich diet of **royal jelly** (a milky, rich bee secretion) for the entire time that she is developing into a mature bee... a total of 16 days. This is the reason that her abdomen is 2-3 times larger than all of the other bees, for they only receive royal jelly for 3 days. Usually, the colony produces several queens for security of survival. If so, when the queens hatch, they fight to the death so that one queen lives to reign over the hive.

A queen's productive life span can be 3-5 years. She is usually born in the spring and will stay with her hive for an entire year; however, after a full year, she will leave her hive and start a new hive. The queen will **swarm** by taking about half of the colony with her, leaving the remaining bees with a newborn queen. This is the honey bees' way of expanding their population.

WORKER BEES: Worker bees are all female bees! They do have developed ovaries but do not normally lay eggs. Nearly all of the bees in a hive are worker bees. A hive consists of 20,000 - 30,000 bees in the winter, and 60,000 - 80,000 bees in the summer.

The worker bee has many different tasks within the hive. When a worker bee is born, her first job is to clean out the cell in which she was born. After that, her job and duties in the hive depend on her age.

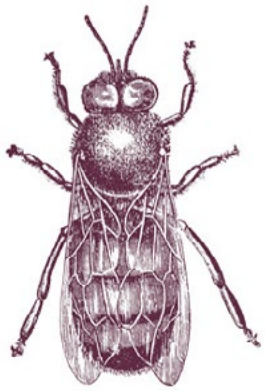
The **nurse** duties are to care for the **brood**, the developing bees in various life stages. They protect the eggs, feed the larvae, and cover the cells for the pupae to develop. If the young are



Queen Bee

Worker Bee

Days Old	Job Title
1-2	Cleans cells and keeps the brood warm.
3-5	Feeds older larvae, immature bees.
6-11	Feeds youngest larvae
12-17	Produces wax, builds comb, carries food, removes debris and dead bees from the hive.
18-21	Guards the hive entrance.
22+	Leaving the hive begins: pollinates plants, collects pollen, nectar.



Drone Bee

not healthy, they will not feed them. Housekeeping is a very important duty.

The workers will remove dead bees and anything that is not a part of the hive colony in order to prevent disease. They will also spend time building new combs cell-by-cell, organizing food stores, producing wax, producing royal jelly, secreting **propolis**, and making honey.

The **guard** duties are to protect the hive. With its stores of honey and brood, the hive is attractive to many other insects and bees from other hives, so the bees guard the entrance of the hive checking to see that an arriving bee is a member of the hive and not a robber. They also will sting anything that threatens the hive (like bears or people or other animals) and release a pheromone (a smell like bananas) that will alert other workers of the threat.

Finally, the worker bee will spend most of her lifetime gathering pollen and nectar from nearby flowering plants. A worker's life expectancy during the active summer months when they are producing honey is only 6 weeks (they literally work themselves to death); however, they can live for 4-9 months during the relatively inactive winter period.

DRONES: Drones are male bees that are made from unfertilized eggs. They are slightly larger and usually darker than the worker bees. They have bigger eyes and a thicker body. They actually do not serve a purpose within the hive itself. Drones are produced for the benefit of the greater honey bee population. They cannot mate with their own queen, their mother, but they do leave the hive and mate with queens who are on their voyage to create new colonies. After mating, the drone dies.

Drones make up a very small percentage of the total colony. There are only 300-3000 drones in a hive. These male bees are fed by the workers and allowed to stay in the hive during the summer, fruitful months. However, they are of no use once mating season is over; so, the drones are expelled from the hive in the autumn by the female worker bees.

Finally, drones do not have a stinger! You can safely handle a drone bee with no fear of getting stung.

BECOME A BEE HIVE LESSON

SUMMARY/BIG IDEA:

Students will learn about the three types of bees in the hive and then act out various worker bee jobs.

MATERIALS & RESOURCES:

- Queen, worker, and drone bee images
- Bee Job Chart
- **The Magic School Bus: Inside a Beehive,** by Joanna Cole
- Life Size Honey Bee (optional)
- The Magic School Bus: Inside a Bee Hive video
- Queen Bee getting Royal Jelly
- Visual for size comparison for 3 types of honey bees
- Bee Landing Pad, live cam

STEPS:

PART ONE:

1. Read the book, **The Magic School Bus: Inside a Beehive** by Joanna Cole, to the class.
2. Show students a picture of a queen bee and tell them: only one queen per hive, fed royal jelly when she is a larvae to make her abdomen longer and to enable her to live 3-5 years, no barbs on stinger so she can sting repeatedly without dying, lays up to 2,000 eggs a day, only leaves the hive once for a mating flight.
3. Show students a picture of a drone bee and tell them: male bee, only job is to mate with a queen bee, dies after mating, no stinger, larger body and larger eyes.
4. Show students a picture of a worker bee and tell them: all female bees, work as a team, participate in each job during their short, 6 week lifespan.

PART TWO:

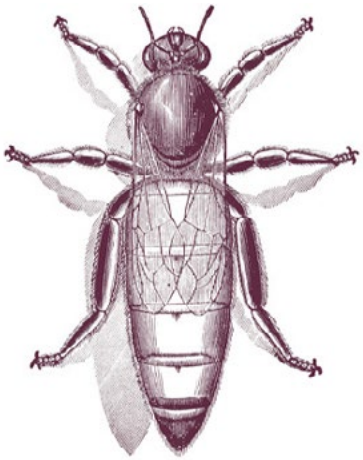
1. Show the bee job chart of worker bee jobs throughout their life.
2. Tell the students that you want to turn the classroom into a bee hive! Have students work in groups to suggest how they can act out each part of a working bee hive. Remind students that each hive has one queen, a few drones, and many workers. For example, a cleaner bee can use a broom to sweep the classroom floor "cells", a nurse bee can use a water bottle to feed nectar and pollen to a baby bee, a forager bee can carry pieces of yellow paper and do a waggle dance to show other foragers where to find the pollen, and a guard bee can stand at the classroom door "hive entrance" to make sure only your class bees come in and out. Continue switching roles while the teacher brings three students at a time to the observation hive to complete the assessment.

ASSESSMENT/REFLECTION:

Bring three students at a time to the observation hive. Ask each student to point out the queen, a drone, and a worker bee. Ask the students to work as a team to find a worker bee doing each one of the jobs they learned about. No Live Bees Required: use this link to observed a live feed bee hive

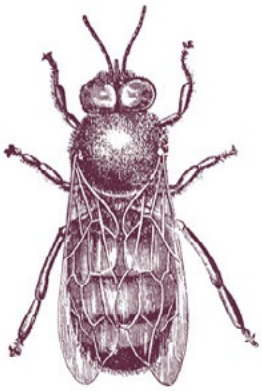
Bee journal entry- Draw a picture of a worker bee performing each job. Then write a short story about the jobs from the bee's perspective.

LESSONS ON THE HONEY BEE

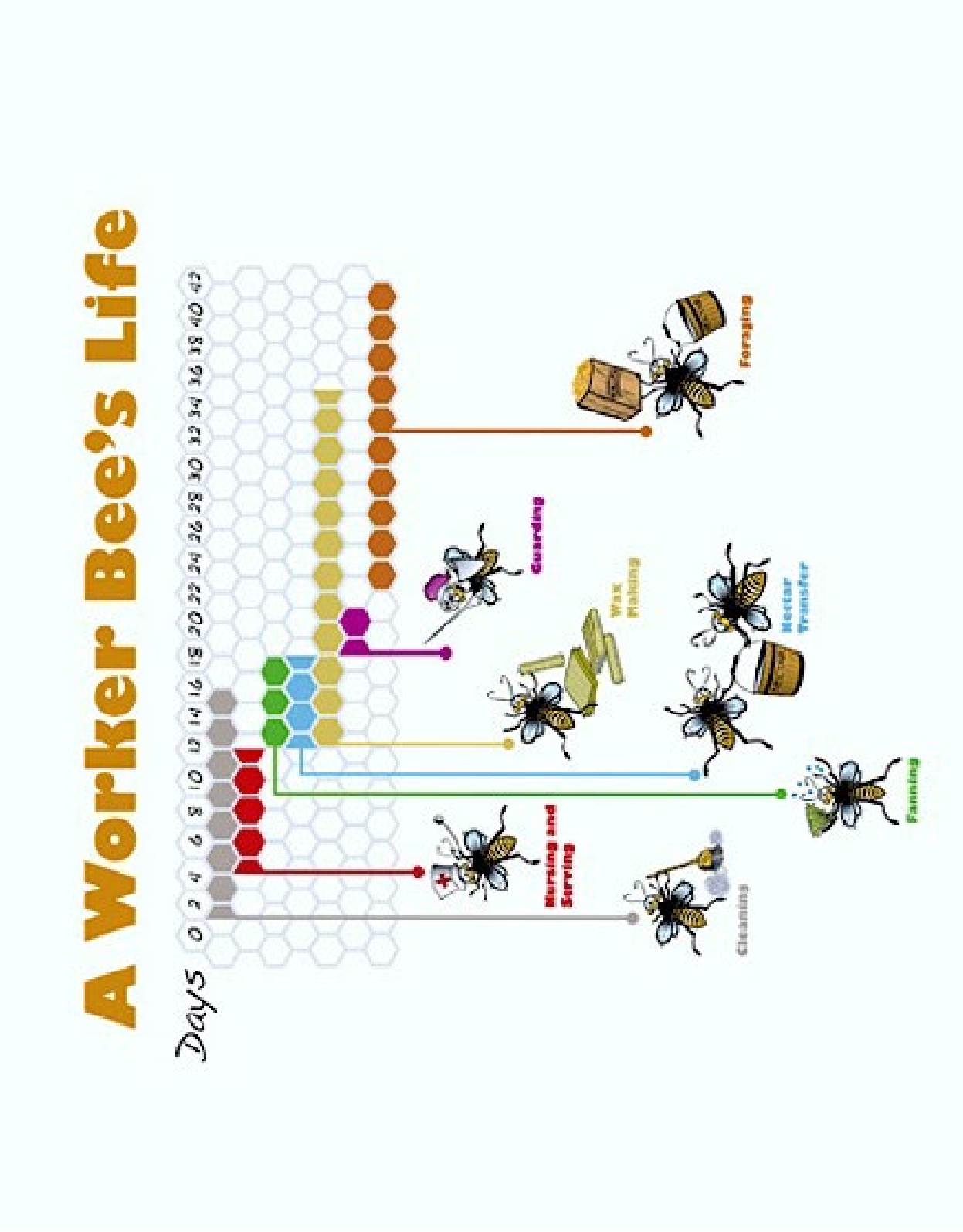


Queen Bee

Worker Bee



Drone Bee


A Worker Bee's Life
Days
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42
Nursing and Serving
Cleaning
Guarding
Wax Making
Nectar Transfer
Fanning
Foraging

BECOME A BEE HIVE LESSON STANDARDS

NEXT GENERATION SCIENCE

3-LS2-1; 3-LS4-2;

4-PS3-2; 4-PS4-3; 4-LS1-2

ELA COMMON CORE

RI.3.1; RI.3.2; RI.3.3; W.3.3

RI.4.1; RI.4.2; RI.4.3; W.4.3

RI.5.1; RI.5.2; RI.5.3; W.5.3

BEE PHEROMONES LESSON

SUMMARY/BIG IDEA:

Bees use smells to communicate.

MATERIALS & RESOURCES:

- Bee Phermones
- The Nasonov Gland
- The Alarm Pheromone
- Bee Landing Pad, live cam
- 16 Clear film containers
- 16 Cotton balls
- Baking flavoring (vanilla, orange, peppermint, strawberry) or essential oils

STEPS:

PART ONE:

1. Explain that bees use the nasonov pheromone to help orient the bees to the hive. Each hive has its own scent, or pheromone, and they release it into the air so the foragers know which hive to come back to.
2. Show both videos of honey bees releasing the nasonov pheromone at the hive entrance. Point out the gland in the second video, which is the white spot at the base of the bee abdomen.
3. The guard bees will only let bees with the same scent inside the hive (unless the stranger bee has a lot of pollen to give to the hive).
4. Tell the students that today they will all be honey bees looking to find their sister bees with the same pheromone.
5. Give each student a container with a scented cotton ball. Demonstrate how to silently fly to another student, smell their container and either shake your head yes (if it smells the same) or no (if it smells different).
6. If it smells the same, the students link arms and fly together to a new student forming a bee chain. Once all four bees have made a chain they sit down on the floor and wait for the other hives to find each other.
7. Once every bee family is sitting together the teacher checks to make sure the scent (pheromone) is the same for each one.

ASSESSMENT/REFLECTION:

Ask students how humans use smell (smell is a large factor in tasting food; smell triggers memories; human families have different smells, etc.).

Bee Journal Entry- Close your eyes and imagine the smell of a banana. Write about the first memory that comes to mind when you imagine that smell.

BEE PHEROMONES LESSON STANDARDS

NEXT GENERATION SCIENCE

3-LS3-1

4-LS1-2

ELA COMMON CORE

W.3.3; W.4.3; W.5.3

UNIT FOR WEEK 2

LIFE CYCLE

LIFE STAGES

The four life stages are egg, larva, pupa and adult. The queen produces all of the eggs. Before she starts egg production, she mates only once with up to 15 different male, drone bees from several other hives, which makes her fertile for life. The variety of mates for the queen assures a healthy diversity of the bee population in the colony.

Back in the hive, she lays up to 2000 eggs per day! The eggs are deposited one per cell in the brood comb. After 4 days, the larva (a small, white, grub-like form) hatches. The worker nurse bees feed the larva royal jelly (a milky, rich bee secretion) for 3 days. They then feed the larva beebread, a combination of pollen, nectar, and enzymes for the remaining 3 days. The cell is then capped, and the pupa (developing bee) forms and grows within the cell. It takes a total of 23 days from the time the egg was deposited for the honey bee to become fully developed and ready to exit the cell.

Fertilized eggs become female, worker bees, and unfertilized eggs become male, drone bees. When the queen dies or becomes unproductive, the other bees will "make" a new queen by selecting a young larva and feeding it a diet of royal jelly for its entire larva stage. For queen bees, it takes 16 days from egg to emergence.

LIFE STAGES TABLE

	Queen	Worker	Drone
Gender	Female	Female	Male
Fertilized Egg	Yes	Yes	No
Egg	3 Days	3 Days	3 Days
Larva	5.5 Days	6 Days	6.5 Days
Pupa (Capped Cell)	7 Days	12 Days	14.5 Days

HONEY BEE LIFE CYCLE LESSON

SUMMARY/BIG IDEA:

Students will use manipulatives to learn about the honey bee life cycle.

MATERIALS & RESOURCES:

- Five sets of honey bee life cycle figures or five sets of color copied, laminated life cycle stages cut apart for students to manipulate.
- Five sets of laminated cards with the labels egg, larvae, pupa, and adult bee for students to match to picture cards or figures.
- Time-Lapse Life Cycle Video
- Ted Talk First 21 Days of a bee's life
- Lifecycle of a bee template

STEPS:

PART ONE:

1. Pass out honey bee life cycle figures OR color copied, laminated life cycle stages to each group.
2. Ask students to hold up the figure that they believe is the first step in the life cycle (egg).

   Hold up the egg and use the figures to demonstrate how the queen places her abdomen in the hive to lay one egg in each cell (can lay up to 2,000 eggs a day). Ask students why the queen lays less eggs in winter (less flowers so she doesn't need as many worker bees).
3. Ask students to hold up the next step (larvae).

   Hold up the larvae and explain that when you see a worker bee's abdomen sticking out of a cell it is either cleaning the cell or feeding nectar and pollen to a baby bee larva.
4. Ask students to hold up the next step (pupa).

   Hold up the pupa and explain that after the larva gets as big as the cell they close the cell and begin developing into an adult bee (wings, eyes, legs, and antennae). What does this remind you of? Butterflies changing from caterpillars into adult butterflies!
5. Ask students to hold up the last step (adult bee).

   Hold up the adult and explain that after the bee is completely done metamorphosing they chew their way out of the cell and begin working!

PART TWO:

6. Show students the time-lapse video of the honey bee life cycle. Remind them that this is fast forward and that it actually takes about 20 days for this entire process to happen.

PART THREE:

1. Act out the honey bee life cycle. Students begin as a tiny egg curled up on the classroom floor. Then they slowly curl out into a bee larva and pretend to eat pollen and nectar from nurse bees. Then they puff air in their cheeks and use their arms to show the larva getting bigger and bigger. As a pupa they develop wings, eyes, and antennae. Finally, as an adult bee, they stand up and chew their way out of the cell, stretching their wings and testing out their new legs.

ASSESSMENT/REFLECTION:

Students work in groups of four to put the life cycle figures in the correct order (#1 places the egg first, #2 places larva second, #3 places pupa third, and #4 places adult last).

Bee Journal Entry- Beginning with the first step in the bee life cycle (egg), write how you feel during each stage of the life cycle if you were a honey bee. What changes are you undergoing? What do you feel like? What do you look like?

HONEY BEE LIFE CYCLE LESSON STANDARDS

NEXT GENERATION SCIENCE

3-LS1-1

ELA COMMON CORE

W.3.3; RI.3.7

W.4.3; RI.4.7

W.5.3; RI.5.7

HONEY BEE ANATOMY LESSON

SUMMARY/BIG IDEA:

Students will dissect a honey bee to learn more about the bee body.

MATERIALS & RESOURCES:

- Bee anatomy image copied for each student or group of students
- Dead bees (collected the day before from around the observation hive entrance) or purchased from Dead organic honey bees
- Scotch tape, magnifying glasses, tweezers, and scissors
- Magnifying glass and tweezer set
- Magnifying glasses set of 15
- Set of 12 Tweezers for kids
- Printable bee with parts labeled
- Bee for Students to label
- Bee for Students to label (younger ages)
- Video of Honey Bees flying and in the hive
- Bee Bits: Parts of a Honey Bee Video
- Song for Kids about Honey Bees

STEPS:

PART ONE:

1. Tell students that they will dissect a honey bee today to learn more about the bee body.
2. Begin by reminding students that one of the worker bees jobs is to take the dead bees out of the hive and since bees only live six weeks there are a lot of dead bees under the entrance of the observation hive.
3. Give each student a dead bee and a magnifying glass. Ask students to use the magnifying glass to observe the outside of the bee.
4. What parts do they recognize? (head, thorax, abdomen, 6 legs, wings, antennae, 2 compound eyes, tongue sticking out).
5. Ask students to stand up and sing, "Head, Thorax, Abdomen" to the tune of "Head, Shoulders, Knees, and Toes". Instead of "eyes, and ears, and mouth, and nose" sing "compound eyes, antennae, and 6 legs".
6. Pass out the Bee Anatomy page and label the bee body parts as a group.
7. Allow students to use tweezers and scissors to cut off the bee parts and tape them in the appropriate spot on the Bee Anatomy page. Be sure to COMPLETELY cover the bee part with scotch tape to keep it from decomposing.
8. Explain that it will be hard to get every single bee part because honey bees are so small. Encourage students to get the basic parts (head, thorax, abdomen, stinger, wings, tongue, and antennae).

ASSESSMENT/REFLECTION:

No Live Bees Required: *use this link to observe a live feed bee hive.*

Bring small groups over to the observation hive to point out bee anatomy on the living bees. Compare body size, shape, and coloring. See if they can point out a worker and a drone. Ask students why some worker bees are larger than others (younger bees are smaller). Ask students why the coloring is not exactly the same on each worker bee (all have same queen as a mom but some have different dads). Teacher may also want to use resource links provided to have students label their own bee.

Bee Journal Entry- Compare your body to a honey bee body. What is similar? What is different? Why? Include illustrations to accompany your writing.

BEE BIOLOGY IN BRIEF

Honey bee Anatomy (scientific name, Apis mellifera)- Honey bees have two antennae, two compound eyes, two pairs of wings (4), three pairs of legs (6), a nectar pouch or honey sac, and a segmented abdomen. At the end of the abdomen is the stinger with a barb, which anchors the stinger in the victim's body. The bee leaves its stinger and venom pouch behind and soon dies from abdominal rupture.

HEAD

The head of the bee contains the brain, the eyes, the proboscis, & the mandibles - the 2 antennae are attached to the head.

COMPOUND EYE

One of two large eyes that are made up of many hexagonal lenses.

ANTENNAE

UPPER LIP

JAW

LOWER LIP

MANDIBLES

A pair of plier-like jaws - located on the lower sides of the head. They are used to carry things, construct and clean the hive, hold enemies, and release pollen from flowers.

THORAX

Body section between the head and abdomen - the legs and wings attach to the thorax.

FORE WING

FORELEG

MIDDLE LEG

HIND LEG

ABDOMEN

Segmented tail area of a bee, that contains the heart, reproductive organs, wax glands, & most of the bee's digestive system.

STINGER

A sharp shaft located at the end of the abdomen and used for defense - only present on females.

POLLEN BASKETS

Areas located on the hind legs. Used for carrying pollen back to the hive.

HONEY BEE ANATOMY LESSON STANDARDS

NEXT GENERATION SCIENCE

3-LS4-2

4-LS1-1

ELA COMMON CORE

W.3.2; W.4.2; W.5.2

UNIT FOR WEEK 3

POLLINATION

INSIDE THE HIVE

ASK THE AUDIENCE

- What are some different ways that we communicate with each other?
- What shapes do we use to build our homes?
- Have you ever seen a honeycomb?
- What are different ways to navigate and find your way?

THE SOCIAL ORGANISM

A single bee is alive, that is true, but bees are not like you and I. Though a single bee can fly and move, gather and perform many tasks, no bee lives for itself. It is not quite a cell either. It is a member of a society that forms the larger organism, the colony. It is the colony of honey bees, which inhabits the box in the yard. Single bees do not make decisions. Single bees do not determine if the colony leaves or stays. No single bee raises another bee. The only bee capable of performing her function alone, the queen, is in fact the product of the collaboration of many bees together. Honey bees exist in colonies, and it is the colony that lives or dies. The colony grows strong and the colony weakens. They will live together in the warm summer. If they starve in the winter, they do so as one. The story of each bee is really the story of all. Together they form the story of the colony, and it is the voice of the colony we choose to listen to.

Excerpt from voiceofthehive.com

ON DEMOCRACY IN THE HIVE

Honey bees make decisions collectively--and democratically. Every year, faced with the life-or-death problem of choosing and traveling to a new home, honey bees stake everything on a process that includes collective fact-finding, vigorous debate, and consensus building.

Excerpt from Thomas D. Seeley, Honey Bee Democracy

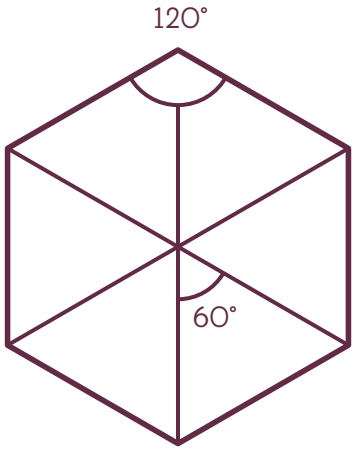
A CLOSER LOOK AT THE OBSERVATION HIVE

COMBS: Combs are made from beeswax. Honey bees produce beeswax from eight paired glands on the underside of their abdomen. The brood combs are found in the bottom half of the hive, and are darker in color. This is where the majority of the activity is happening in the hive, feeding the growing larvae and caring for the pupae. You may observe bees feeding larvae, sealing the cells to allow the pupae to grow, or helping a newborn get out of the cell.

The nectar and honey stores are in the combs on the top half of the observation hive and will be tended to by bees that are making honey or collecting honey to feed to others. Honey and pollen storage also occurs on the edges of the brood comb so as to have easy access when feeding the brood.

CELLS: With beeswax, the bees build precise hexagon cells, which are the building blocks to the comb. These hexagons are the strongest and most efficient shape for the hive to store its honey and pollen and to house the nursery cells for new baby bees. The cells may differ slightly in size depending on their use, but they are always hexagonal in shape.

LESSONS ON THE HIVE



A HEXAGONAL CELL

Perfect hexagonal tubes in a packed array. Bees are hard-wired to lay them down, but how does an insect know enough geometry to lay down a precise hexagon? It doesn't. It's programmed to chew up wax and spit it out while turning on its axis, and that generates a circle. Put a bunch of bees on the same surface, chewing side-by-side, and the circles abut against each other - deform each other into hexagons, which just happen to be more efficient for close packing anyway.

PETER WATTS
BLINDSIGHT

NAVIGATION AND DANCE

Bees use the sun as a compass. Even when clouds obscure the sun, bees can detect its position from the light in brighter patches of the sky. Scientists have also studied bee behavior and have learned that the worker bees dance for each other as a way to communicate the direction and distance to the source of nectar and pollen.

OBSERVATIONS OF THE BEE

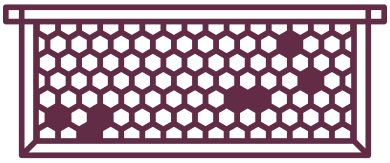
1. Using the Observation Hive, identify the different hive members; try to find the queen (she may be marked with a colored dot) and the drones; notice all the workers and how they may differ slightly in color.

2. Look for the different life stages of the eggs, larvae and pupae in the brood comb. You may need a magnifying glass to see an egg. A larva would be the easiest to spot, as it is larger and white and uncapped in the comb. A pupa should be capped with a darker shade of beeswax.

3. Put your ear to the hive wall and see if you can hear the buzz of the colony. How fast can you move your arms in a second?

4. Find the ventilation holes and smell the hive. Do you sense floral tones or sweetness?

INTERACTIVE WITH THE HIVE



No Live Bees Required: *use this link to observe inside the hive and this link to observe outside of the hive.*

OTHER ACTIVITIES

- Coloring Worksheet
- Q & A Worksheet
- Crafting with wool (felted bee) or paper (origami bee) or recycled materials (bottle bee) to make bee hive members

The Round Dance

The Waggle Dance

ALARM PHEROMONE

In addition, because the familiar scent of home is on all the worker bees in the hive, the guard bees can smell when there is an invader bee approaching the hive. Because bees' sight is not reliable, this pheromone is very important for the survival of the hive. Unlike the queen pheromone in which only the queen emits, any worker bee can set off the alarm pheromone. When a bee stings a predator it emits the alarm pheromone and alerts the other bees. Interestingly, the alarm pheromone smells like bananas!

BEE BEHAVIOR WITHIN THE HIVE

COMMUNICATION: One way bees can communicate is through dancing. The dances indicate the location of flower sources around the hive. The other bees follow the pattern of the dance to receive the directions to the food sources. There are two distinct dances you may be able to see in the hive.

The **Round Dance** is a simpler dance that indicates the flower source is near the hive. The bees dance in a circular pattern as displayed in the diagram.

The **Waggle Dance** is more complicated. This dance resembles a figure eight and represents that the flower source is farther away. In the middle of the figure eight, the bee "waggles" for different amounts of time to correlate to a specific distance of the source. The angle that the honey bee waggles correlates to the direction of the source.

Another way bees communicate is through **pheromones**, a chemical substance produced and released into the environment affecting the behavior or physiology of the other bees. There are several important pheromones including the **queen pheromone** and the **alarm pheromone** with which the bees use to communicate.

The queen emits a pheromone that lets the hive know of her presence. If the queen dies or has left, the hive notices that the queen pheromone is no longer present and will start a new queen.

REGULATING TEMPERATURE: Bees must maintain the hive temperature at a balmy 93.5 degrees! This means that in the summer they need to cool the hive. They use water and fanning their wings to help keep the temperature from getting too hot. In the winter, they will compact themselves more towards the center and use propolis, a resinous mixture collected from tree buds and sap flows, to seal any drafty gaps.

DAILY AND SEASONAL ACTIVITY: The hive is always busy, but the journey out of the hive only occurs during daylight hours. So from sunrise to sunset you may see activity near the entrance. However, the bees generally do not venture out if the temperatures are below 57°F or above 100°F.

WINTER: You may see little or no activity near the entrance. The bees will cluster near the brood to help keep the colony warm.

SPRING: They start out again. With the very first flowering of trees and plants each year, the bees recognize the arrival of spring and energize the colony to produce many new worker bees to capture the new pollen and nectar for their hive while it is available. This is the time when most swarms take place.

SUMMER: Nectar flow and honey production slows down, but the workers are still collecting pollen. This is the time where the population stabilizes.

FALL: The population dramatically reduces as the bees are preparing for winter. In addition, the remaining drones are kicked out of the hive so that they may not be a burden to feed during the winter. It is not good to remove a large amount of honey during this time, for the bees need it to survive the winter months.

IN DEPTH OBSERVATION

1. Looking at the hive, identify the different comb types, find cells of different sizes, and notice the hexagonal shapes.

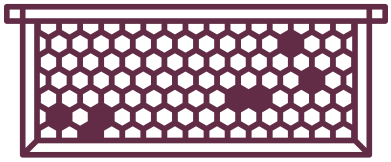
2. Look in the hive for bees doing the "waggle dance" or "round dance".

3. Use beeswax for molding and to create shapes. Warm it in your hands for easy molding. Imagine what its like for the bee to form the hexagonal shapes for the cells in the comb.

4. Try some beeswax or honey comb to chew. What is its texture and flavor?

5. Note the weather and how it may be affecting bee activity.

INTERACTIVE WITH THE HIVE



No Live Bees Required: *use this link to observe inside the hive and this link to observe outside of the hive.*

OTHER ACTIVITIES

- Play challenge games with a group. Work together like honey bees. Hold hands and tangle yourselves, then try to untangle by using good communication.

POLLINATION LESSON

SUMMARY/BIG IDEA:

Students will learn what pollination is and why it is important. Then they will act out pollination as a honey bee.

MATERIALS & RESOURCES:

- Pollination image printable
- The Beauty of Pollination video
- Large flower printable
- Cheetos
- Almonds
- Bees Wax Bars
- Bee dance including waggle and stop signal
- Waggle dance, how it works and what it looks like
- Why do honey bees dance
- Round Dance and Waggle Dance
- Do the Waggle Dance: movement for students
- Video of Pollen Baskets
- Slow Motion of Bees Collecting Pollen
- Comic Book Strip template for pollination

STEPS:

PART ONE:

1. Show the "Beauty of Pollination" video. Ask students what they observed (insects and bats visiting flowers and spreading pollen to create new flowers).
2. Explain that every flower has male and female parts. The pollen is the male part and the tall sticky center of the flower is the female part. When the pollen lands on the tall sticky female part, pollination takes place and new seeds are formed. Without pollination we would not have new plants.
3. Bees (and butterflies and bats) help this process by spreading pollen when they go flower to flower drinking nectar.
4. Honey bees are responsible for pollinating 1/3 of all fruits and vegetables that we love to eat. Give each child an almond to eat (check for nut allergies first!) Explain that almond trees depend solely on the honey bee for pollination. Without honey bees we would not have almonds.
5. Invite the entire class over to the observation hive. Ask students to look for bright yellow or orange balls on the bee's legs. These are the pollen baskets where the honey bees store the pollen before dropping it off in one of the cells (bees eat pollen and honey but in the process of collecting pollen and nectar they end up pollinating millions of flowers). This is also a good time to point out the bee waggle dance that honey bees do to communicate where she collected the pollen. The bees with filled pollen baskets should be doing a dance in the direction of the flowers with the correct angle to the sun to tell the other foragers where to go (different flowers have different colored pollen with different smells).

   No Live Bees Required: *Teacher can use links in Materials & Resources to show bees gathering pollen into pollen baskets as well as the waggle and circle dances.*

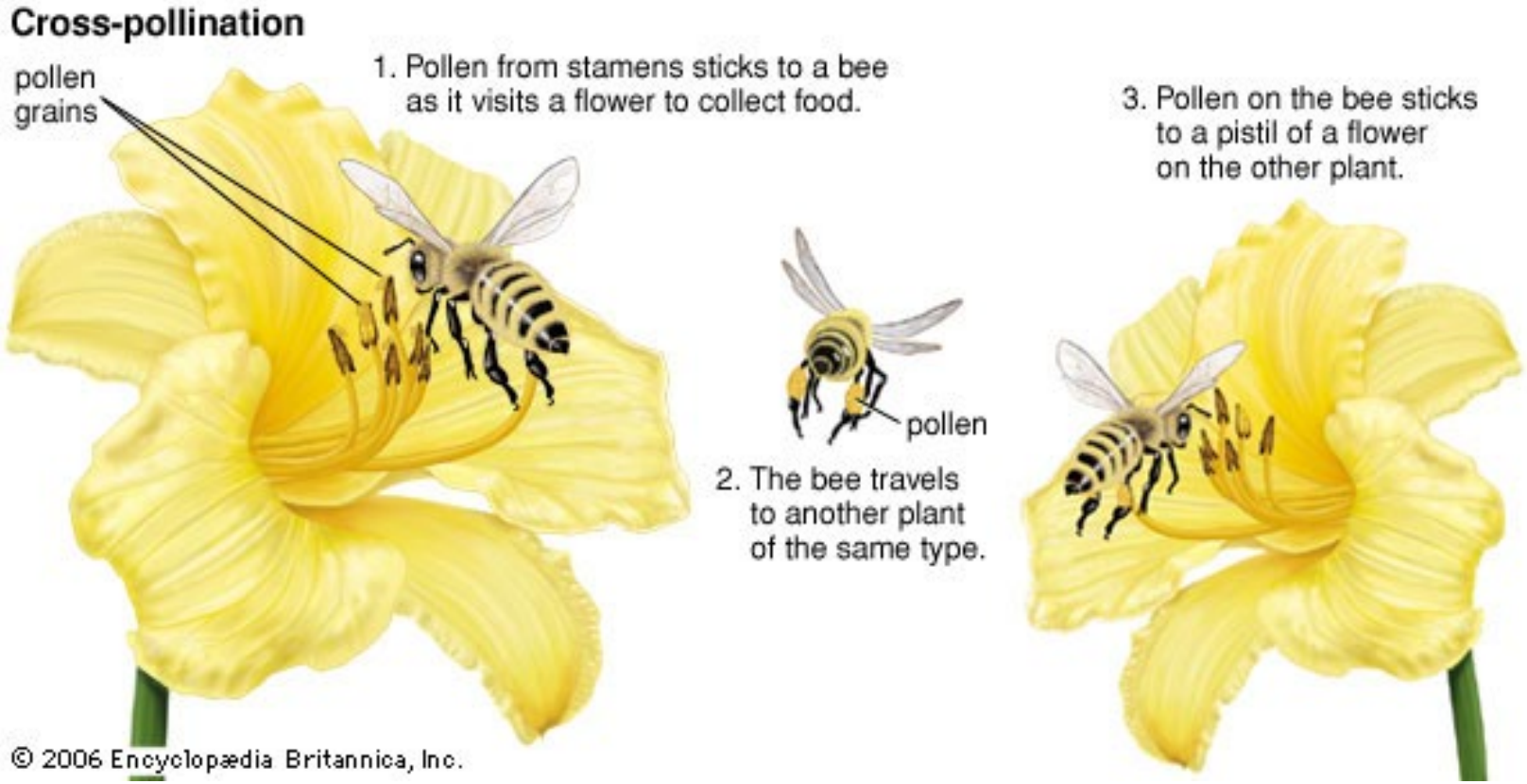
PART TWO:

1. Today you will all become honey bees and participate in pollinating multiple flowers.
2. Place one large flower printable between each pair of students with a pile of Cheetos in the center each paper flower.
3. Demonstrate how to silently land on a flower, pick up and eat a Cheeto, and fly to a new flower at another table. When you land on the new flower, the "pollen" or male part should rub off on the center of the flower (female part). Pick up another Cheeto and repeat until all of the Cheetos are gone.

ASSESSMENT/REFLECTION:

Ask students what the orange fingerprints on the flower represent? Why is pollination important? Teacher can also have students demonstrate understanding of how pollination is carried out by having students illustrate step-by-step using the comic strip template link provided.

Bee Journal Entry - What would happen if there were no more pollinators? How would our planet be affected? Why do humans need plants?


Cross-pollination
pollen grains
1. Pollen from stamens sticks to a bee as it visits a flower to collect food.
pollen
2. The bee travels to another plant of the same type.
3. Pollen on the bee sticks to a pistil of a flower on the other plant.
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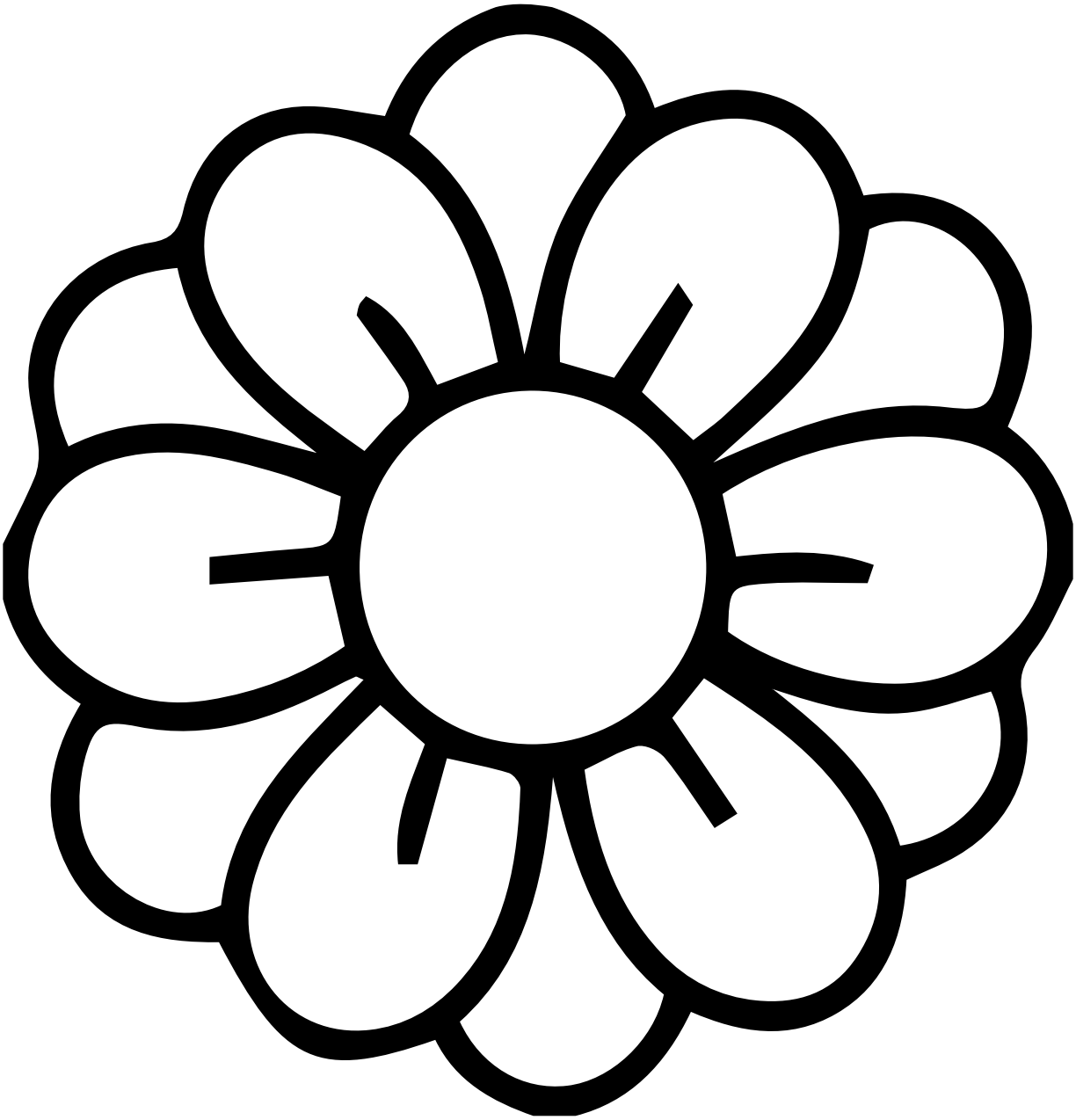


POLLINATION LESSON STANDARDS

NEXT GENERATION SCIENCE

3-LS3-1

4-PS4-2; 4-LS1-2

5-PS3-1; 5-LS2-1

ELA COMMON CORE

W.3.1; RI.3.7

W.4.1; RI.4.7

W.5.1; RI.5.7

BEE GARDENS

Whether it is a natural area in which plants tangle and flowers scramble or a more formally designed landscape, a school garden can provide both a source of inspiration and a learning resource that can be integrated through the school. A garden offers a direct way for students to learn about the environment and is somewhere to find a quiet place. Many gardens become a focal point for community engagement, a project that brings families and local businesses together.

Pollinators are easy to incorporate into a school garden. All that is needed is careful choice of plants and provision of nesting or egg-laying sites. Pollinators can be the subject of many lessons. The resources listed on this page will help you plan and design a garden, introduce you to the diversity of insect pollinators, and provide lesson plans and other teaching materials.

XERCES.ORG

HELP THE HONEY BEES IN EVERYDAY LIFE

1. Check the Observation Hive for healthy population levels. There should be bees on almost every frame. Check on Live Feed link to observe healthy population and bee activities.
2. Identify flowers that bees visit.
3. Buy pesticide free foods and products.
4. Create **Integrated Pest Management** projects.
5. Plant a vegetable garden or Pollinator Garden.

BEE BENEFICIAL GARDENING

BELOW IS A LIST OF FLOWERING PLANTS WHEN CONSIDERING A POLLINATOR GARDEN

Ask your local nursery about the local species of flowering plants.

NATIVE SOUTHEAST FLOWERING PLANTS THAT ARE BENEFICIAL TO HONEY BEES

Aster, Beardtongue, Beebalm, Blanketflower, Blazing Star, Blueberry, Carolina Rose, Chaffhead, Crownbeard, Giant Ironweed, Goldenrod, Joe Pye Weed, Magnolia, Milkweed, Mountain Mint, Partridge Pea, Rattlesnake Master, Redbud, Rosinweed, Sourwood, Sunflower, Twinberry, Tuliptree, and Wild Plum.

GARDEN PLANTS TO SUPPLEMENT THE NATIVES

Basil, Catnip, Cosmos, Giant Hyssop, Lavender, Majoram, Mexican Sunflower, Oregano, Purple Coneflower, Pincushion Flower, and Rosemary.

BELOW ARE SOME OF THE TOP PICKS FOR POLLINATORS

BLAZING STAR

With its showy, electric pink or purple flower spikes, blazing star is a magnet for bees and butterflies. Its foliage is usually attractive, too, and the plant's tidy appearance makes it a great choice for gardens and landscaping. Over 30 species of blazing star are native to the United States, east of the Rockies only. All are perennial. Blazing star flowers in mid to late summer and sometimes into the fall.

BUTTONBUSH

This plant blooms at a time when some gardens have little else to offer pollinators. In addition to its gorgeous, spherical flowers, it grows well in dry to wet conditions, establishes easily, is a pollinator magnet, and its seeds also benefit other wildlife. Because it is adapted to wetter soils, it also serves as fantastic protection for riparian buffers, helping to keep soils from eroding.

HUBAM SWEET CLOVER

Hubam is an annual species that produces flowers in the first year. It is a great option for warm season cover cropping, especially on dry, heavy clay, saline, and other marginal soils. It grows in full sun, and is a fantastic soil-building cover crop. As an introduced species, it should not be considered a replacement for actual native plant restoration in natural areas, but it's wonderful for use in gardens and farms.

SEED BOMBS AND BEE FRIENDLY GARDENS LESSON

SUMMARY/BIG IDEA:

We can help bees and the environment around us by planting flower gardens.

Plants need air, water, sunlight, and space to survive.

MATERIALS & RESOURCES:

- Potting soil, trays for drying
- Powdered Red Clay for Seed Bombs
- Wildflower Seed Vendor
- Life cycle of a Flowering Plant print out
- Flowering Plant Lifecycle PDF
- Bee Landing Pad, live cam

STEPS:

1. Review the life cycle of a plant.
2. Review what all plants need to survive (air, water, sunlight, and space).
3. Explain that each student will make seed bombs today that with the right conditions will create a beautiful bee garden full of flowers.
4. Mix one part moist soil and one part powdered clay.
5. Mix in seeds.
6. Roll mixture into 1 to 2 inch balls and allow to dry for at least 24 hrs.
7. Take a walk with students and throw your seed bombs in areas that need some beautification. Seed bombs can also be put in garden beds.
8. Options:
    - Have students package seeds bombs to give out to faculty, family, friends.
    - Decorate packets, fill with bee friendly flower seeds, and distribute.

ASSESSMENT/REFLECTION:

Have students document and share about the places where they spread seeds. Brainstorm other ways to improve the environment for the bees.

Bee Journal Entry - Close your eyes and imagine one of the areas that you planted seeds today. What do your seeds need now to grow and survive? Now imagine what it will look like 6 months from now. Write a journal entry describing your new garden using all of your senses (what do you see, hear, smell, taste, and feel)?

SEED BOMBS AND BEE FRIENDLY GARDENS LESSON STANDARDS

NEXT GENERATION SCIENCE

3-LS3-1

5-LS1-1; 5-ESS3-1

ELA COMMON CORE

W.3.3; W.3.7

W.4.3; W.4.7

W.5.3 ; W.5.7

UNIT FOR WEEK 4

HONEY

I EAT MY PEAS WITH HONEY

I eat my peas with honey
I've done it all my life
It makes the peas taste funny
But it keeps them on the knife!

Ogden Nash

ON THE PATH TO HONEY

ASK THE AUDIENCE

- Have you ever seen a bee on a flower?
- Do you eat honey?
- What are some of your favorite products made from honey?
- What are some of your favorite fruits and vegetables?

THE POLLEN NECTAR HONEY CYCLE

The honey bees collect pollen and nectar; they store pollen and make honey from the nectar; they use the pollen and honey as nourishment to help make more bees and as energy to collect more pollen and nectar...and the cycle continues. It is because of this cycle that we are able to benefit from the honey produced by the colony!

POLLEN AND NECTAR

COLLECTING POLLEN & NECTAR: Using the sun as navigation and information from the round dance or waggle dance, the worker bees will forage for pollen and nectar all day. They fly from flower to flower collecting pollen and sweet nectar. The pollen is trapped in pollen baskets on the legs and abdomen, and the nectar is extracted through the bee's proboscis, or tongue, which functions like a straw. The nectar is stored in her honey sac, which is like a second stomach.

POLLEN IN THE HIVE: When the bees return to the hive, the pollen is removed from the bee's legs by worker bees that will pack it into the comb cells using their heads. The pollen is usually mixed with honey or nectar and enzymes to make a hard pack beebread. This is their main food source and a great source of protein for all hive members. It is also used to nourish the developing larvae.

MAKING HONEY: Once the bee returns to the hive, the nectar load is sucked from her nectar pouch, honey sac, by other worker bees through their proboscises. The workers then "chew" the nectar, which adds enzymes from the bee. Basically, honey is nectar that the bees have spit up and eaten over and over many times.

The bee then deposits the honey from her mouth into one of the cells in the honeycomb. The worker bees get as much water out as possible by fanning the honey with their wings The honey bee is not born knowing how to make honey; the younger bees are taught by the more experienced ones. The reason the bees make honey is so that they can have food in the future and during the winter when there are no flowers blooming.

LESSONS ON POLLEN AND NECTAR

THE FOLLOWING FORMULA BEST DESCRIBES HONEY

Sucrose (nectar) + invertase (bee enzyme) = fructose + glucose = Honey!

BuzzAboutBees.net

HONEY FACTS

Honey is the only food on the planet that will not spoil or rot.

Honey has been used for millennia as a topical dressing for wounds since microbes cannot live in it. It also produces hydrogen peroxide. Honey has even been used to embalm bodies such as that of Alexander the Great.

When left in a cool dark place for a long time, honey may start to "crystallize". When this happens, loosen the lid, boil some water, place the honey container in the hot water, turn off the heat and let it re-liquefy. It is then as good as it ever was. Never bring the honey to a boil or put it in a microwave,doing so will kill the beneficial enzymes.

Fermented honey, known as Mead, is the most ancient fermented beverage. The term "honey moon" originated with the Norse practice of consuming large quantities of Mead during the first month of a marriage.

To make one pound of honey, workers in a hive fly 55,000 miles and tap two million flowers.

It takes one ounce of honey to fuel a bee's flight around the world.

Honey is nectar that bees have repeatedly regurgitated and dehydrated.

POLLINATION

Once a honey bee discovers a good source of nectar, she will continually return to that same type of flower. Because she prefers to collect nectar from one kind of flower, she spreads pollen from one plant to another individual of the same variety. The pollen sticks to the bee's legs and gets dusted onto the next plant that the bee visits. This is called pollination. A flowering plant must get pollen from a flower other its own in order to have fertilization and produce fruit and nuts. This makes us very dependent on bees and other pollinators for our food!

In North America alone, honey bees pollinate nearly 95 kinds of fruits, including almonds, apples, avocados, blueberries, cranberries, cherries, kiwi fruit, macadamia nuts, asparagus, broccoli, carrots, cauliflower, celery, cucumbers, onions, legume seeds, pumpkins, squash, and sunflowers. Farmers are dependent on the bees visiting their crops to maintain good production levels.

> In Spain, hilly terrain and antiquated planting and harvest practices keep farmers from retrieving more than about 100 pounds [of almonds] per acre. Growers in the Central Valley, by contrast can expect up to 3000 pounds an acre. But for all their sophisticated strategies to increase yield and profitability, almond growers still have one major problem - pollination. Unless a bird or insect brings the pollen from flower to flower, even the most state-of-the-art orchard won't grow enough nuts. An almond grower who depends on wind and a few volunteer pollinators in this desert of cultivation can expect only 40 pounds of almonds per acre. If he imports honey bees, the average yield is 2,400 pounds per acre, as much as 3,000 in more densely planted orchards. To build an almond, it takes a bee.
>
> **Hannah Nordhaus, The Beekeeper's Lament: How One Man and Half a Billion Honey Bees Help Feed America**

HOW SWEET IT IS

No Live Bees Required: *use this link to observe inside the hive and this link to observe outside of the hive.*

1. Look in the Observation Hive and find bees with pollen on their legs and abdomen. Notice how these bees are greeted by other worker bees that remove and transfer the pollen.

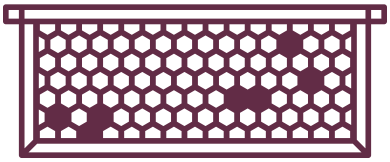
2. Look for cells with nectar (more clear) and how they differ from the honey cells (more dense and usually capped).

3. Look for the pollen stores, vibrant yellow-orange cells. Identify foods dependent on honey bees.

4. Research and share recipes that highlight the use of honey in cooking. It can often be substituted for sugar.

5. Write your own poem about bees.

INTERACTIVE WITH THE HIVE



HONEY BEE RELAY RACES LESSON

SUMMARY/BIG IDEA:

Students feel what it is like to be a forager honey bee as they quickly collect nectar and pollen and bring it back to the hive.

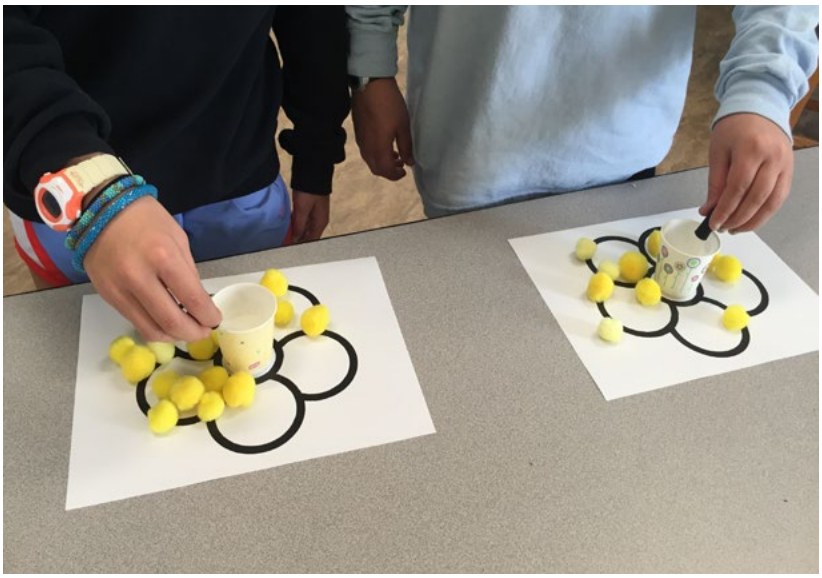
MATERIALS & RESOURCES:

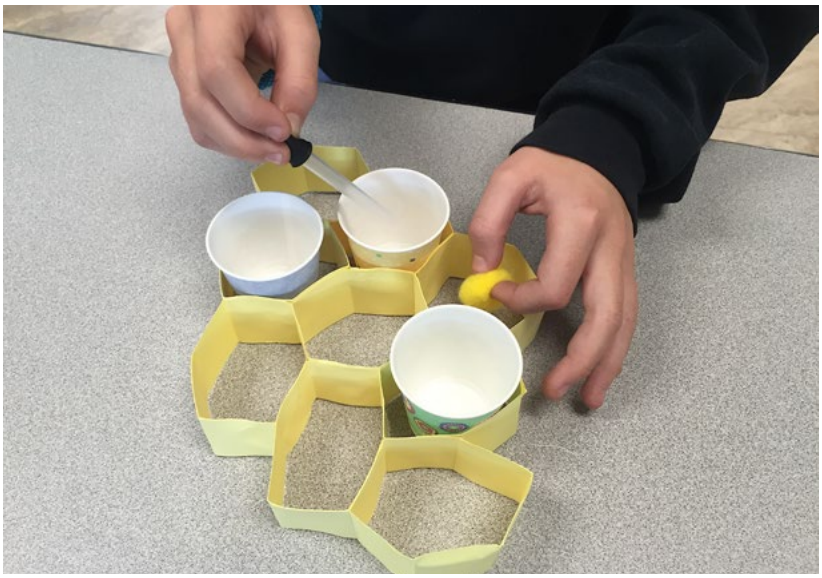
- Cardboard bee hive cells (one per group)
- How to make a cardboard bee hive cell (for teacher)
- Paper cups with flower pattern
- Yellow Pom-poms
- Eye droppers, set of 20
- How the honey bee make beebread as part of pollination
- Bee pollen slow motion

STEPS:

PART ONE:

1. Remind students that the final job of a worker bee is to go outside of the hive and collect nectar and pollen. We call that a forager bee.
2. Use observation hive to show students the yellow cells filled with pollen, the liquid cells filled with nectar, and the forager bees entering hive with nectar and pollen. Teacher can use video from Materials & Resources to show the students the pollen use in the hive.
3. Today you will all be forager bees and participate in a pollen and nectar relay race! Divide the class into four different hives.
4. Set up four different cardboard bee hives on one side of the room. Place an empty paper cup in three of the cells (this is where they will store the "nectar"- water). Leave the rest of the cells empty (this is where they will store the "pollen" – yellow pom-poms).
5. On the other side of the room set up four "gardens". Place one paper cup half filled with water on each flower printable. Sprinkle twenty yellow pom-poms around the paper cup.
6. Have each group line up single file in front of their hive.
7. Demonstrate what a student does on his/her turn:
    - Walk fast (fly) to the garden and use the dropper (bee proboscis) to suck up water from the cup (flower nectar)
    - Place one yellow pom-pom in your pocket or hand (pollen basket)
    - Walk quickly back to your bee hive and deposit the nectar in one of the paper cup cells. Drop the pollen in one of the other cells.
    - Then the next member of your bee family repeats those steps.
    - Continue until all of the nectar and pollen is gone from your garden.
    - The bee family that finishes first is the winner.





ASSESSMENT/REFLECTION:

Ask students to fan the cups of "nectar" to help turn it into honey. Bees also use a special enzyme to turn nectar into honey. Show students 1/12th of a teaspoon. That is how much honey an average worker bee makes in her lifetime. Honey bees travel 112,000 miles and visit 4.5 million flowers to make a 16 oz jar of honey.

Bee Journal Entry - Imagine you are a forager bee. Where do you get the energy to fly and collect pollen and nectar? Where do plants get their energy from? Write a short story about your day collecting pollen and nectar.

HONEY BEE RELAY RACES LESSON STANDARDS

NEXT GENERATION SCIENCE

4-PS4-3; 4-LS1-2

5-PS3-1

ELA COMMON CORE

W.3.3; W.4.3; W.5.3

POLLEN AND NECTAR COLLECTION LESSON

SUMMARY/BIG IDEA:

Honey bees collect pollen and nectar and deposit it in the cells of the comb in the hive.

This is a labor-intensive job. Ideal activity for younger students to develop fine motor skills.

MATERIALS & RESOURCES:

- Yellow pompoms, hex hive piece, tongs or pinchers
- Yellow 'nectar' water
- Hexagon Silicone Hot Pad
- Eye droppers, set of 20
- Honey Bees - BrainPOP
- Bee pollen slow motion

STEPS:

PART ONE:

1. Before the lesson; prepare hexagon cells from card stock and water dyed with food coloring for nectar.
2. Remind students that the final job of a worker bee is to go outside of the hive and collect nectar and pollen. We call that a forager bee.
3. Bring the class over to the observation hive to show students the yellow cells filled with pollen, the liquid cells filled with nectar, and the forager bees that are entering the hive with nectar and pollen. Teacher can use video from Materials & Resources to show the students the pollen use in the hive
4. Students use tongs to collect pompom pollen from flower and place in each cell of the comb.
5. Students use droppers to collect nectar/water from flower and put drops in each cell of the silicone hive.

ASSESSMENT/REFLECTION:

Have students describe what they are doing as if they are the bees. Use activity to assess fine motor skills for younger children.

Bee Journal Entry - Draw a map of your campus with a bee hive, the sun and a nearby garden. Draw a dashed line showing the quickest way for the bees to reach the flowers from the bee hive. Switch journals with a friend and act out the waggle dance to show your friends the way to the garden (shorter steps for a close garden and longer steps for a garden farther away; more wiggles for lots of pollen and less wiggles for only a little bit of pollen).

POLLEN AND NECTAR COLLECTION LESSON STANDARDS

NEXT GENERATION SCIENCE

4-LS1-2

ELA COMMON CORE

W.3.7; W.4.7; W.5.7

HONEY TASTING LESSON

SUMMARY/BIG IDEA:

Honey flavors vary depending on the season and type of flowers that the bees have visited to collect nectar.

MATERIALS & RESOURCES:

- Variety of honey, cups or containers for honey samples
- Stir sticks to taste each honey
- Lab sheets to note which type of honey students think each sample is
- Honey Vendor
- Beebread visual examples

STEPS:

PART ONE:

1. Prepare samples in numbered cups or squeeze bottles prior to lesson.
2. Discuss what makes each honey taste differently.
    - Note that honey from a single hive can look and taste differently each season based on the different kinds of flowers in season.
    - Use honeys that are naturally different rather than honey that is processed and flavored artificially.
3. Have students taste honeys one at a time. Identify each, discuss and describe what each tastes like.

ASSESSMENT/REFLECTION:

Ask students to share their thoughts on the different honeys. Do they have a favorite? With what foods might they use honey?

Bee Journal Entry - Why do different bottles of honey look and taste different?

HONEY TASTING LESSON STANDARDS

NEXT GENERATION SCIENCE

5-PS1-3

ELA COMMON CORE

W.3.7; W.4.7; W.5.7

LIP BALMS AND SOAPS LESSON

SUMMARY/BIG IDEA:

Introduce students to some of the many products that depend on honey bees for their ingredients.

Review the properties of matter.

Investigate mixing two or more substances.

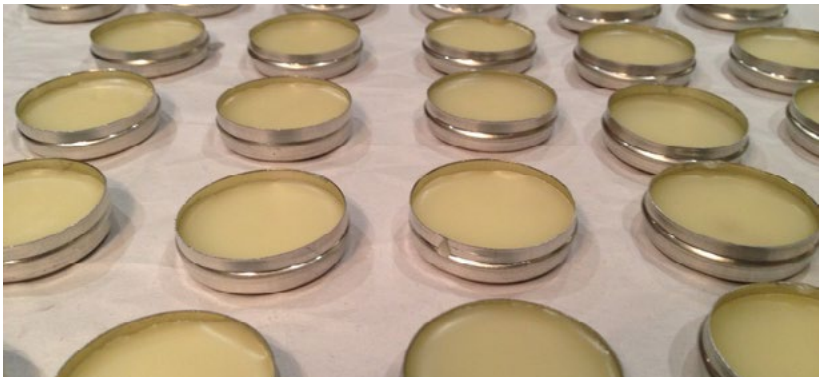
MATERIALS & RESOURCES:

- Collect some example products to show students
- Choose recipes that are manageable in your setting
- Bee wax for lipbalms
- Lip balm containers
- Soap base
- Soap mold

STEPS:

PART ONE:

1. Discuss the many uses of honey, beeswax, and propolis.
2. Collect the materials and supplies needed for your recipe.
3. Review the properties of matter and ask students to classify the materials based on their properties (color, texture, hardness, etc).
4. Students classify materials as a solid, liquid, or gas in Bee Journal.
5. Students record their prediction on whether they will make a new substance when combining the materials.
6. Allow students to participate in the process as much as is reasonable.
7. General lip balm recipe:
    - Melt wax in a double boiler or microwave according to directions on package.
    - Stir in honey and essential oils until all is incorporated.
    - Spoon or pour liquid into tins or tubes and allow mixture to cool.
    - Label and enjoy!
8. General soap recipe
    - Melt soap base according to directions on package.
    - Stir in honey and essential oils until incorporated.
    - Pour into soap molds and allow mixture to cool.



ASSESSMENT/REFLECTION:

Bee Journal Entry - Did you make a new substance? Is it a solid, liquid, or gas? How do you know?

Discuss benefits of natural products versus others. Brainstorm list of the many things made from honey, wax and propolis.

LIP BALMS AND SOAPS LESSON STANDARDS

NEXT GENERATION SCIENCE

5-PS1-3; 5-PS1-4

ELA COMMON CORE

W.3.7; W.4.7; W.5.7

UNIT FOR WEEK 5

SAVE THE BEES

BEYOND THE HIVE

ASK THE AUDIENCE

- Do you know what it feels like to be stressed?
- Do you have any pests in your life?
- Do you have a vegetable garden or any flowers in your yard?

Bees live as people should live: naturally, symbiotically, and in a manner that only contributes positively to the world around them.

TED DENNARD
BEEKEEPER

STRESSES ON THE HONEY BEE

Several factors may create stress in the hive, which can cause a decrease in population. Below are some of those possible contributors. All of these effects on the colony can be observed, some more easily than others, in the Observation Hive.

VARROA MITES: The **Varroa mite** is a **parasitic**, invasive species that was introduced to the United States in the 1980's . It originated in Asia and the western honey bee has no resistance. The mated adult female Varroa mites enter the brood cells right before the bees cap the pupae and feed on the growing bee. The bee will hatch with deformities such as misshapen wings that result in an inability to fly.

SMALL HIVE BEETLES: Hive beetles are pests to honey bees. They entered the United States in the late 90's. Most strong hives will not be severely affected by the beetle; however, if the hive beetle becomes too overbearing, the colony will desert the hive. The beetle tunnels in the comb and creates destruction in the storage of honey and pollen. Ways to identify a beetle problem is a smell of fermented honey, a slimy covering of the comb, and the presence of beetle maggots.

DISEASE: although bees keep their hive very clean and try to maintain sanitation as best as possible, there are many **pathogens**, disease causing microorganisms, which can infect the bees. These include: American foulbrood, European foulbrood, Sacbrood, Nosema, Chalkbrood. The resulting diseases are very serious, as they are highly contagious. In these particular cases, a state beekeeper should be notified, and the hive would need to be disposed of carefully and properly.

ROBBERS AND PREDATORS: A hive will have robbers that want to steal honey or eat the brood of the honey bee. These are animals or other insects that can smell the food sources. While other honey bees or wasps are after the honey and pollen, natural predators are usually after their brood, not their food. The natural predators of the honey bee brood include the skunks, bears, and mice. Birds, toads, lizards, dragonflies, and spiders will catch and eat the adult bees.

HARMFUL PESTICIDES: The use of pesticides and other chemicals for growing food and for landscaping can be a serious stress to the honey bee. If they do not directly kill the bee, they can compromise the bee's immune system, and hence compromise the entire colony.

COLONY COLLAPSE DISORDER

Colony Collapse Disorder (CCD) is a recent phenomenon where the adult worker bee population disappears from the hive, leaving behind only a few young bees and the queen with the remaining brood, pollen, and honey. The term was coined in 2006 after a drastic decline in the population of commercial honey bees. Scientists are still trying to determine the exact cause of this behavior; however, many speculate that certain insecticides containing **neonicotinoids** are a main cause. This insecticide affects the central nervous system of insects, including the honey bee.

While it is known that pesticides and insecticides can directly affect the honey bees, they may also affect the bees' immunity and prevent them from naturally resisting other stresses. Many countries have banned such chemicals harmful to the honey bee, but in the United States they are still widely used. It is important to practice chemical-free landscaping and gardening, especially in the area near the entrance to the Observation Hive.

Global warming may also be a contributing factor. With newly recorded warmer temperatures, plants may bloom earlier, shifting the cycle of foraging for the honey bee. Also, warmer weather seems to be advantageous to several parasites, allowing for large increases in such pest populations.

Finally, the beekeeper himself may be at fault. Very large, commercial beekeeping operations must move the bees from one **monoculture** crop to another. The changing environment and transportation that the bees endure may add to stress on the honey bee colony.

LESSONS ON BEES IN OUR ENVIRONMENT

> A human being is a part of the whole...our task is to free ourselves by widening our circle of compassion to embrace all living creatures and the whole of nature in its beauty.
>
> **ALBERT EINSTEIN**

BEE FOUNTAINS LESSON

SUMMARY/BIG IDEA:

Like all living things, honey bees need water to live, but they have some unique requirements for taking in water.

MATERIALS & RESOURCES:

- Shallow dishes
- Stones
- Glass marbles
- Planter trays
- OR open ended for STEAM approach to providing water for honey bees

STEPS:

PART ONE:

1. Review/discuss fact that all living things need water to survive.
    - Honey bees cannot swim. They will drown in standing water, ponds, etc.
    - Honey bees cannot fly if their wings get wet.
2. Brainstorm ways to provide water for the honey bees.
3. Have students plan and construct bee fountains. Challenge: self-filling fountains. OR
4. Students choose shallow dishes, fill with beads or stones.
5. Choose appropriate locations around your school campus to place the fountains. Fill water to just below top of the beads or stones.
6. Have students monitor the fountains for water level. Rain can overfill the containers. Water evaporates quickly from the shallow dishes.

ASSESSMENT/REFLECTION:

Have students take action by placing bee fountains at home. Share their experiences with classmates. If done as a STEM activity, does the fountain function as planned.

Have students fold a sheet of white paper into four equal parts. Then have the students label each square with the lables FOOD, WATER, AIR, and SHELTER. Allow students to draw how the honey bee gets each of her needs met in the correct square.

Bee Journal Entry - All living things need food, water, air, and shelter to survive. How are these four things changing and threatening the current bee population? What can you do to help?

BEE FOUNTAINS LESSON STANDARDS

NEXT GENERATION SCIENCE

3-5-ETS1-1

ELA COMMON CORE

W.3.7; W.4.7; W.5.7

BEE CREATIVE WITH PAINT AND CLAY LESSON

SUMMARY/BIG IDEA:

Students review the structure of a bee body and demonstrate the aesthetic of the honey bee through painting and sculpture.

Students review the stresses on honey bees and create something to demonstrate how we can help the bee population.

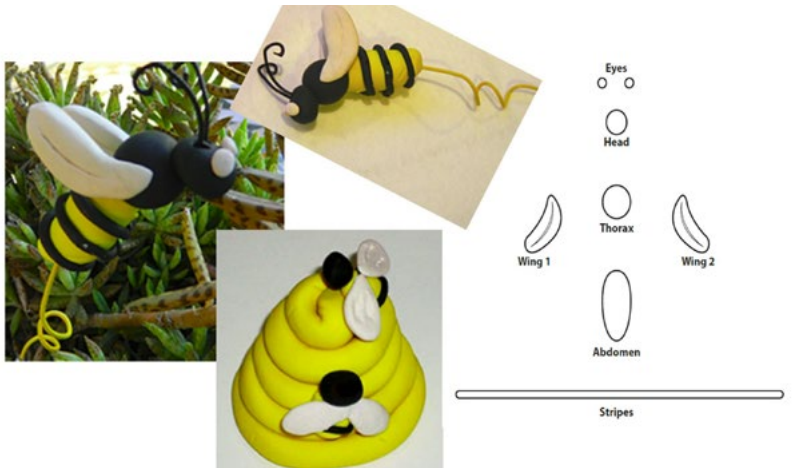
MATERIALS & RESOURCES:

- Paint, brushes, paper
- Clay – your preference - modeling, polymer, air dry, kiln fire
- 34 best bee crafts for kids
- Example of how to turn labeling the bee into an art project
- Inside the Hive Live Bee Cam with Infrared Camera

STEPS:

PART ONE:

1. Open the link called **Inside the Hive Bee Cam with Infrared Light.** Have playing where students can see the bees moving in the hive for inspiration as they work.
2. Set up painting and clay materials.
3. Review the parts of a honey bee including the difference between the queen, worker, and drone.
4. Provide images of bees including photographs and artist's work.
5. Review the stresses on honey bees.
6. Discuss ways we can use paint or clay to teach others about the stresses on honey bees and how we can help.
7. Studio time for painting and sculpting.
8. For students who are interested in labeling their bee's body parts: label and tape small flag-like sheets of paper to toothpicks, place the toothpick into the clay while still soft, remove toothpicks before painting the bee, replace toothpicks with correct labels when the clay is dry.



ASSESSMENT/REFLECTION:

Have students share what they created and identify what parts accurately represent a bee. Discuss how art can teach and engage people in conversations about the honey bee population.

Bee Journal Entry - What materials did you use today? Classify the materials as a solid, liquid, or gas. What do you feel is the biggest problem that honey bees face today? Why?

BEE CREATIVE WITH PAINT AND CLAY LESSON STANDARDS

NEXT GENERATION SCIENCE

5-PS1-3; 5-ESS3-1

ELA COMMON CORE

W.3.1; W.3.8

W.4.1; W.4.8

W.5.1; W.5.8

UNIT FOR WEEK 6

BEE KEEPING 101

HIVE ORIENTATION

ASK THE AUDIENCE

- Has anyone seen a colony of bees?
- Has anyone ever seen a bee hive that looks like a white box?
- Has anyone ever seen an observation hive?
- Has anyone ever been stung by a bee?

Although I've been a beekeeper for a long time, I will never forget my very first taste of fresh honey straight out of the bee hive. Almost ten years ago a neighbor, Mr. B, invited me to his apiary to meet his honey bees. I was apprehensive about the offer. I thought to myself, "Sure, I like honey, but I'm not so sure I like honey bees." Suddenly I imagined myself surrounded by a swarm of hundreds of buzzing bees. The idea scared me, as I think it would most people. But I was ready for a new adventure, so I accepted Mr. B's invitation.

It was a perfect early spring day when I showed up at Mr. B's home to meet his honey bees. In his backyard stood three tall boxes that looked like painted white file cabinets; these were his bee hives. As Mr. B greeted me, he handed me a beekeeper's veil to put over my head for protection. Then he donned his own veil and walked toward the hives. As I followed him, heart pounding in my ears, he explained that honey bees, although quite docile, were also curious creatures. They liked to crawl into nooks and crannies and into our clothing. The veils should stop them from stinging our faces. "Stinging our faces?" I wondered what I was getting myself into. By the time we arrived at the hives, I was trembling. Mr. B lit his bee smoker, a small tin container that looked a little like a coffee can, and blew a few puffs of smoke into the front entrance of the first bee hive. Then he lifted the cover to direct the smoke at the bees inside. He explained that the smoke calmed the bees and distracted them from our presence.

He then gently removed the cover completely from the hive and placed it on the grass. I craned my neck to peer inside, still trying not to get too close. Hundreds, maybe thousands, of honey bees crawled across the top of the ten perfectly positioned wooden frames that sat vertically inside the box. I was utterly surprised and relieved to see that the bees were indeed quite calm. With his bare hands, Mr. B, slowly removed a single wooden frame covered with bees. I watched with amazement as the bees walked across his fingers, then his hands, and onto his sleeve. But Mr. B took no notice. "These are Italian honey bees," he said. I had to smile. Since I am of Italian ancestry, I liked the idea of Italian honey bees. Out of nowhere came thoughts of telling my friends, "I raise Italian honey bees."

Mr. B inspected the frame and pointed out the different kinds of bees: the female worker bees that gathered the nectar and made the honey, and the male drone bees whose primary job was to mate with the queen. He told me that there was one queen bee in every hive and that all hive activities revolved around her egg-laying schedule. The female ruled the hive –I liked the way that sounded.

When Mr. B announced that it was my turn to hold the frame, I shrank back. But his gentle handling of the bees and his calm demeanor somehow gave me the courage to accept the frame from him with my own bare hands. Bees were everywhere–dozens of them crawling on my fingers and making their way onto my sleeves. I took a deep breath and held the frame firmly so as not to make any sudden movements and upset them. "I can do this bee thing," I said to myself. "I am fearless."

As I held the frame, Mr. B pointed out the perfectly formed honeycomb, made of beeswax, that filled the center of the frame. The honeycomb was where the queen laid her eggs and the worker bees stored their pollen and honey. When I held the frame up to the sunlight, the honeycomb looked like a beautiful stained-glass window. Mr. B poked his finger into the hexagon-shaped cells. Sparkling amber liquid oozed out of the cells and drizzled down the frame. Mr. B stuck his fingers under his veil and carefully licked off the precious honey. He invited me to do the same. Careful not to disturb a single bee, I poked my finger into a new cell to expose more of the pristine honey. As I excitedly drew my finger up to my mouth, I forgot about my protective veil and smeared it with the honey. Mr. B chuckled. I captured another dollop of honey, this time managing to bring my finger underneath my veil. It tasted glorious and exquisite, heavenly and perfect. It was like nothing I had ever savored. At that moment, I knew I wanted to keep Italian honey bees that made this divine treasure called honey.

Excerpt from Honey bee by C. Marina Marchese

HIVE STRUCTURE AND FUNCTION

Check out our website for information about the Bee Grant.

THE OBSERVATION HIVE

The Observation Hive is unique in that bees can be observed and studied without disrupting the colony. The hive case is made of solid wood and Plexiglas, a shatterproof material, and is secure.

The hive consists of eight frames arranged in stacking pairs. Each removable, wooden frame offers a base structure, a foundation made of thin sheets of beeswax imprinted with a pattern of honeycomb. The bees use this form to build their own combs out of beeswax. The combs are created for raising new bees, storing pollen and nectar and storing honey.

The entrance to the hive can be at the top or bottom of the hive near the mounting wall. Please assemble your hive and mount PRIOR to drilling the hole in the wall - noting whether your hive's bee entrance is at the top or bottom. The bees find their way from the outside through a tube to the entrance. There are ventilation holes on the sides, screened for your protection. It is important that the hive has good ventilation to keep it healthy. A feeding station is located on the top surface of the Observation Hive. Your beekeeper will instruct you if the bees need supplemental food before winter.

Finally, the Observation Hive moves! It is mounted to rotate so that both sides of the hive can be observed. This feature allows for better viewing and study.

THE BEES INSIDE

Remember that the Observation Hive has pairs of frames. This means that the space sandwiched between the frames, or bee space, is not visible to the observer. Since the bees like to work in a darker environment, they may be more concentrated in these spaces. But, don't worry; there will be plenty of exciting activity to observe!

Right away, you should notice that the bees are busy. Every bee has a mission and is actively working to get the job done...which is never done! Some frames will have more bees on them than others. This is dependent on the purpose of that frame...the brood combs on the bottom half of the hive are usually more active than the others.

When you are near the hive, both a noise and an odor may be apparent. There will be a noticeable, gentle hum in the space shared with the hive, especially during the busy spring and summer foraging season. There may also be a slight fragrance from the hive, dependent on the type of bloom on which the bees are foraging. You may notice that the hive glass is warm to the touch, especially during brood season, which is late spring and early summer.

MAINTENANCE

Generally speaking bees will take care of themselves, and bees know best what is good for bees. Once your bees are installed in your hive case, the colony of bees will forage food and will create the perfect habitat needed for its well-being. A colony will instinctively self-adjust its work flow and life cycles to the seasons; creating brood, reproducing itself by swarming; collecting pollen and nectar, storing honey, and clustering for winter. In the low country, the colony will need minimal attention. Your beekeeper mentor will want to check for colony strength and honey/brood balance in both the fall and the spring.

COVERING THE HIVE WHEN IT IS NOT BEING OBSERVED IS HIGHLY RECOMMENDED

As honey bees prefer a dark environment, they will be more productive if covered. In addition, the hive can more easily maintain an ideal temperature if it has slight insulation. This can be accomplished with poster board cover panels or a draped tapestry or blanket.

In the winter, if there is not enough honey stored to sustain the bees through the season, the beekeeper may recommend feeding the bees a supplement of simple syrup or honey. A hive top feeding station that houses a glass mason jar makes easy work of this task without removing the Observation Hive to the outdoors.

A great advantage of the Observation Hive is that you can see inside and keep an eye on the health of the hive without having to open the hive and disrupt the bees.

I hadn't been out to the hives before, so to start off she gave me a lesson in what she called 'bee yard etiquette'. She reminded me that the world was really one bee yard, and the same rules work fine in both places. Don't be afraid, as no life-loving bee wants to sting you. Still, don't be an idiot; wear long sleeves and pants. Don't swat. Don't even think about swatting. If you feel angry, whistle. Anger agitates while whistling melts a bee's temper. Act like you know what you're doing, even if you don't. Above all, send the bees love. Every little thing wants to be loved.

SUE MONK KIDD
THE SECRET LIFE OF BEES

IF YOU ARE ALLERGIC TO BEES USE YOUR RECOMMENDED TREATMENT

In the year 2000, the World Health Organization reported 54 deaths from bee stings in the USA. This means that you are more likely to be killed by lightning, which causes 90 deaths per year, than by bee stings!

BUZZABOUTBEES.NET

SAFETY RULES

SIGNAGE: All Observation Hives come with a sign to be posted near the bee hive entrance on the exterior of the building. This helps alert visitors to the fact that there are bees in the area. Also, it helps to remind people about not using harmful chemicals, especially near the Observation Hive.

BEE ENTRANCE: For the Observation Hive, the bees enter and exit on the outside of the building. If you are outside, please stay clear of the entrance. Bees need about 4 to 5 feet of clearance before they fly up towards the sky! It is a good idea to give them a safe, 10-foot perimeter so that their flight is uninterrupted.

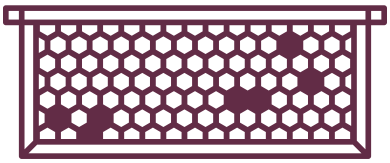
SWING ARM: This feature is integral in the purpose of the Observation Hive. When moving the hive, be sure to do so with care. Slowly rotating the hive for better observation is welcomed. Avoid swinging the hive quickly or with a jerky motion, and never hang on the hive.

BEES INSIDE THE CLASSROOM OR OFFICE:
Frankly there's not much to be concerned about. The hive case is a sturdy and secure container. Bees cannot fly out, climb out, or chew out. In the rare incident where a bee may have found its way into the building without using the bee entrance, you may gently place a cup over the bee and slide a piece of paper between the cup and surface on which the bee landed. The bee may then be transferred outside.

BEE ETIQUETTE: The honey bees are very busy, and for the most part, will not notice you near the Observation Hive. Please keep it that way. Strong vibrations or very loud noises may agitate the bees, and in order to protect the hive, they may sting someone outside. Help the bees feel at home by providing an environment void of extremes in temperature and noise.

A BEE STING: If you do get a bee sting, make sure the stinger is removed as quickly as possible. A fingernail or credit card can be used to effectively remove the stinger. Bentonite Clay, Baking Soda, or peppermint oil will help soothe and reduce swelling. A cold compress will also relieve some of the pain. Do not rub or scratch the site, as this will produce more histamine, which causes itchiness and swelling. Evidence of the sting will disappear in a few days.

INTERACTIVE WITH THE HIVE



No Live Bees Required: *use this link to observe inside the hive and this link to observe outside of the hive.*

HOW TO CARE FOR THE HIVE

1. Log the temperature in the room and the temperature outside...note the difference from the temperature inside the hive, 93.5 degrees. If there is a large temperature difference, hive panels or case covers may be needed to improve colony health.

2. Look at each frame and note any changes in population. Report a significant decrease to the beekeeper.

3. Look for insects other than bees in the hive. You may see mites or hive beetles. Report any sightings to the beekeeper.

4. Are any of the combs broken or sagging? This may indicate a temperature regulation problem or trauma to the hive. Let your beekeeper know.

5. If needed, your beekeeper may teach you how to feed the bees a mixture of sugar water and special tea blend.

6. Keep the hive covered when not used for observation.

BEEKEEPER FOR A DAY LESSON

SUMMARY/BIG IDEA:

Host a beekeeper to tell students about the work of bee keeping, show the tools they use, and to demonstrate the protective clothing.

MATERIALS & RESOURCES:

- Borrow student size bee suits and gloves
- Invite beekeeper and ask them to bring equipment for demonstration

STEPS:

PART ONE:

1. Have your guest beekeeper show; protective clothing, hive tool, smoker, and a hive box with some frames.
2. Have beekeeper describe what is done in a hive inspection, honey harvest, and so on.
3. Provide time for students to try on bee suits.
4. Have students try using the hive tool to get frame out of the hive.

ASSESSMENT/REFLECTION:

Bee Journal Entry - Write an opinion piece on whether or not you would like to be a beekeeper. Include reasons to support your decision.


Beekeeper's
Handbook

BEEKEEPER FOR A DAY LESSON STANDARDS

NEXT GENERATION SCIENCE

3-LS4-2

ELA COMMON CORE

W.3.1; W.4.1 ; W.5.1

HIVE OBSERVATION LOG

Date _____

WHAT TO LOOK FOR...	OBSERVATIONS	INITIALS
Hive temperament: (C)alm, (N)ervous, (A)ggressive		
Traffic at entrance (H)igh, (M)edium, (L)ow		
Saw the queen? (Y)es, (N)o		
Population (H)eavy, (M)oderate, (L)ow		
Do bees appear crowded? (Y)es, (N)o		
Laying pattern? (U)niform and solid, or (R)andom		
See eggs? (Y)es, (N)o		
See larvae? Is there open brood? (Y)es, (N)o		
Signs of disease? Hive (B)eetles, (M)ites		
Bees crawling on the ground? (Y)es, (N)o		
Queen cells? (Y)es, (N)o		
Drone cells? (L)ow 30, (A)vg. 30-100, (H)igh 100+		
Open nectar in cells? (Y)es, (N)o		
Bees bringing in pollen? (Y)es, (N)o		
Honey stores: (H)igh, (A)verage, (L)ow		
Need to feed hive? (Y)es, (N)o		
Other notes:		

Next Generation Science Standards 3-ESS2-1

Common Core ELA W.3.7; W.4.7; W.5.7

SUPPLEMENT

BEE GLOSSARY

GLOSSARY
A-C

ALARM PHEROMONE: A chemical secretion from the worker bee that warns others of a threat to the hive. It smells like bananas.

APIARY: A place where bees are kept; a collection of bee hives.

APITHERAPY: The use of products derived from bees for medicine, including venom, honey, pollen, propolis, and royal jelly.

BEE SPACE: The crawl space needed by a bee to pass easily between two structures about 3/8 of an inch. If the space between any two surfaces in the hive is too small for a bee to pass through easily, the bees will seal it with propolis.

BEEBREAD: A hard-packed mixture of pollen, nectar, and enzymes from the bee.

BEE HIVE: A structure in which bees are kept, typically in the form of a dome or box. In nature, this may be a tree hollow.

BEESWAX: Waxy material produced by worker bees and used to build combs.

BROOD: The immature, developing bees. Includes all life stages of the bees before adult.

BROOD COMB: The comb dedicated to raising the brood.

CELL: A hexagonal shaped structure that holds brood and food. The cells are built wall-to-wall and make up the comb.

COLONY COLLAPSE DISORDER: A recent phenomenon where worker bees disappear from the hive. They abandon the honey and their queen.

COLONY: The term used to describe the group or "family" of bees within the hive that are socially organized around the queen bee. A colony can reach up to 80,000 bees.

COMB: The beeswax structure comprised of individual, hexagonal cells that are shaped within a frame or border.

GLOSSARY
D-M

DRONES: Male bees, whose main function is to fertilize the queens outside of their hive. Drones make up a very small percentage of the total colony. In the autumn drones are expelled from the hive by the female worker bees.

FOUNDATION: Thin sheets of beeswax imprinted with a pattern of honeycomb. The beekeeper installs these sheets into wooden frames as "starters" for the bees in making uniform combs.

FRAMES: The removable wooden structures, which are placed in the hive. The bees build their comb within them. The removable quality allows the beekeeper to easily inspect the colony.

GLOBAL WARMING: A gradual increase in the overall temperature of the earth's atmosphere generally attributed to the greenhouse effect caused by increased levels of carbon dioxide, chlorofluorocarbons, and other pollutants.

GUARD: Describes the worker bee that protects the hive from invaders or predators.

HIVE BEETLE: A small dark beetle that is a major threat to hive health, as they consume brood, pollen and honey. The beetle larvae can ruin the combs full of honey as they tunnel, defecate, and produce slime over them.

HONEY: The sweet, viscous product created by bees from nectar.

INTEGRATED PEST MANAGEMENT: An ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties.

LARVA: The grub-like, immature form of the bee, after it has developed from the egg and before it has gone into the pupa stage.

MONOCULTURE: Agriculture practice of growing one crop throughout a large area.

GLOSSARY
N-P

NATIVE BEES: Usually the best pollinators for plants that are native to the same region. Squash bees (Peponapis) and bumble bees (Bombus) are an excellent example of bees that pollinate plants native to the Americas.

NECTAR: Sweet fluid produced by flowers is 60% water and 40% solids. This is collected by the bees and converted into honey at 17%-18% moisture content.

NEONICOTINOIDS: A relatively new class of insecticides that share a common mode of action that affect the central nervous system of insects, resulting in paralysis and death.

NURSE: Describes the worker bee that cares for the brood.

PARASITE: An organism that lives in or on another organism (its host) and benefits by deriving nutrients at the host's expense.

PATHOGEN: A bacterium, virus, or other microorganism that can cause disease.

PHEROMONE: A chemical produced and secreted into the environment that prompts a social response within a species.

POLLEN: Very small dust-like grain produced by flowers. These are the male germ cells of the plant. This provides a protein source for the honey bees.

POLLINATION: The transfer of pollen from the anther (the male part) of one flower to the stigma (female) of another flower in the same species. This occurs by way of wind, honey bees, and other pollinating insects. This process ensures fertilization of the plant.

PROBOSCIS: An elongated sucking mouthpart that is typically tubular and flexible. Bees use their proboscis to extract nectar from flowers, like a using a straw.

PROPOLIS: Sticky, brownish gum gathered by bees from trees and buds, used to seal cracks and drafts in the hive. Also called "bee-glue." Propolis has anti-viral properties and is used medicinally.

PUPA: The immature form of the bee (following the larval stage) while changing into the adult form.

GLOSSARY
Q-Z

QUEEN PHEROMONE: Communicates the presence of the queen to the hive.

QUEEN: The only fertile female bee in a colony. She lays all of the eggs and serves as the central focus of the colony. There is only one queen in a colony of bees. A healthy queen's productive life span is 3-5 years.

ROUND DANCE: A circular dance that communicates a flower source is near the hive.

ROYAL JELLY: A jelly that is secreted from the glands in the heads of young nurse worker bees and is fed to all bee larvae. After three days, only the queen larvae will continue to be fed this special substance throughout her development.

Superorganism Example 1
Colony of honey bees that live to promote the health of the entire hive, as well as other hives.

Superorganism Example 2
Grove of Aspen trees whose roots are interconnected and shared.

SUPERORGANISM: A form of life composed of mutually interdependent parts that maintain various vital processes for the benefit of the whole. The well-being of the whole is more important than the individual.

SWARM: A queen and about half of her colony that have left the hive and are in the process of finding a new hive. The swarm is kept intact with the queen's pheromone.

SWARMING: The action of a colony finding a new home. This is how the honey bees expand their population.

VARROA MITE: A mite that attaches itself to the honey bee, usually on its back. If the bees are not mite resistant, this debilitating parasite can cause death in the hive.

WAGGLE DANCE: A complex dance that expresses the direction and distance of a flower source.

WORKER: A completely developed female bee that has developed ovaries but does not normally lay eggs. The workers do all of the work in the hive and forage for food. A worker's life expectancy is only several weeks during the active summer months; however, they can live for many months during the relatively inactive winter period.

ALARM PHEROMONE

A chemical secretion from the worker bee that warns others of a threat to the hive. It smells like bananas.

Photo Credit: "Fanning pheromones." by Microecos is licensed under CC BY-NC 2.0

THE BEE CAUSE PROJECT

APIARY

A place where bees are kept; a collection of bee hives.

Photo Credit: "Pastel Apiary" by Jay Mac 3 is licensed under CC BY-NC-ND 2.0

THE BEE CAUSE PROJECT

APITHERAPY

The use of products derived from bees for medicine, including venom, honey, pollen, propolis, and royal jelly.

Photo Credit: "Bed for api-therapy 8963" by Archnetwork is licensed under CC BY 2.0

THE BEE CAUSE PROJECT

BEE SPACE

The crawl space needed by a bee to pass easily between two structures about 3/8 of an inch. If the space between any two surfaces in the hive is too small for a bee to pass through easily, the bees will seal it with propolis.

Photo Credit: "Frames from Langstroth hive" by Butts Bees is licensed under CC BY-NC 2.0

THE BEE CAUSE PROJECT

BEEBREAD

A hard-packed mixture of pollen, nectar, and enzymes from the bee.

Photo Credit: https://www.keltronixinc.com/wp-content/uploads/2016/05/Bee-Pollen-to-bee-bread-EyesOnHives.jpg

THE BEE CAUSE PROJECT

BEE HIVE

A structure in which bees are kept, typically in the form of a dome or box. In nature, this may be a tree hollow.

Photo Credit: "Houghton Hall - Walled Garden - Herb Garden - Bee hive" by ell brown is licensed under CC BY 2.0

THE BEE CAUSE PROJECT

BEESWAX

Waxy material produced by worker bees and used to build combs.

Photo Credit: "Beeswax" by practicalowl is licensed under CC BY-NC 2.0

THE BEE CAUSE PROJECT

BROOD

The immature, developing bees. Includes all life stages of the bees before adult.

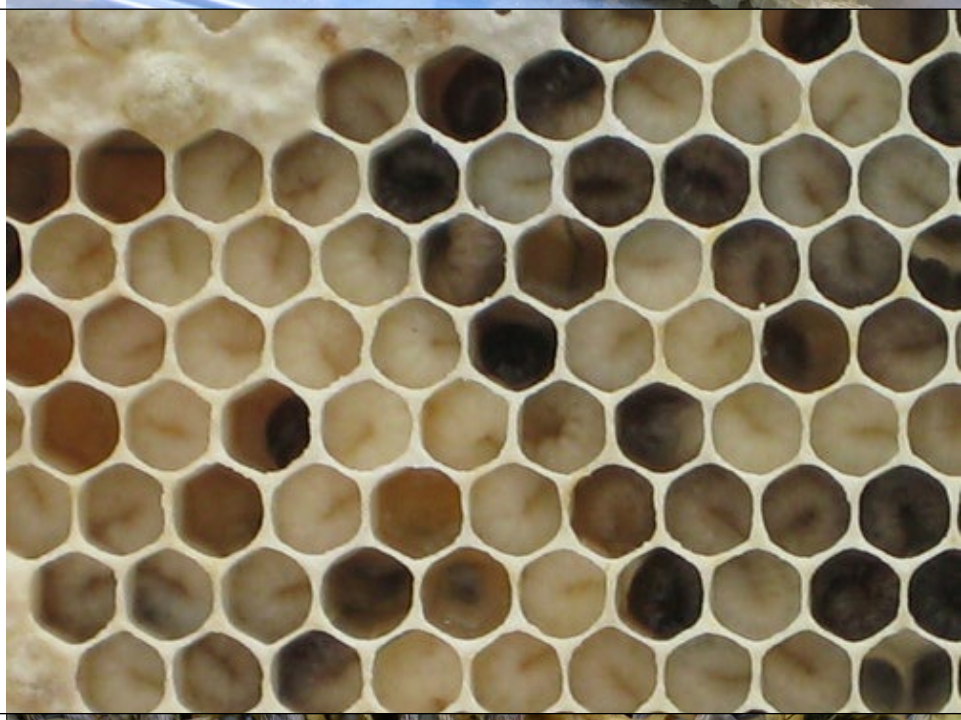


Photo Credit: "Bee Brood larvae" by aperte is licensed under CC BY 2.0

THE BEE CAUSE PROJECT

BROOD COMB

The comb dedicated to raising the brood.

Photo Credit: https://www.flickr.com/photos/rjleaman/39140482258/in/photolist-6XSwbE-6yFLm3-9NGpU4-5dCeGu-4AWq61-bDFbKs-bSzVjH-fwX1A-6TwTD7-yQkQu9-yA3wJG-xVC8pL-yA94K8-6zmNmU-6TsSMg-djVtUu-xVLzUc-g1afjr-6Ae2v3-eHynGW-9P5ZcY-eHsiGk-xcrJr7-c6ANud-6sbbPp-5dCeH5-6wmWEU-yA93BX-6zmPdE-dPqySA-6wmW8S-5D4K5k-6CjqqU-yA92XF-7UXMMe-6BSet7-7UXNgn-yREgyS-7V22o3-86X9mn-yTresF-yTrdCz-xVLCux-c6ANmN-c6ANEj-c6ANX7-c6AN3Y-iz2ez-c6ANdo-cfkH8S

THE BEE CAUSE PROJECT

CELL

A hexagonal shaped structure that holds brood and food. The cells are built wall-to-wall and make up the comb.

Photo Credit: "Honeycomb" by justus.thane is licensed under CC BY-NC-SA 2.0

THE BEE CAUSE PROJECT

COLONY COLLAPSE DISORDER

A recent phenomenon where worker bees disappear from the hive. They abandon the honey and their queen.

Photo Credit: "Dead Bees" by wayneandwax is licensed under CC BY-NC-SA 2.0

THE BEE CAUSE PROJECT

COLONY

The term used to describe the group or "family" of bees within the hive that are socially organized around the queen bee. A colony can reach up to 80,000 bees.

Photo Credit: "Honey Bee Swarm" by kaibara87 is licensed under CC BY 2.0

THE BEE CAUSE PROJECT

COMB

The beeswax structure comprised of individual, hexagonal cells that are shaped within a frame or border.

Photo Credit: "Honeycomb" by justus.thane is licensed under CC BY-NC-SA 2.0

THE BEE CAUSE PROJECT

DRONES

Male bees, whose main function is to fertilize the queens outside of their hive. Drones make up a very small percentage of the total colony. In the autumn drones are expelled from the hive by the female worker bees.

Photo Credit: "Not long for the drones ..." by Max xx is licensed under CC BY-NC-SA 2.0

THE BEE CAUSE PROJECT

FOUNDATION

Thin sheets of beeswax imprinted with a pattern of honeycomb. The beekeeper installs these sheets into wooden frames as "starters" for the bees in making uniform combs.

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Photo Credit: "bee-frame2" by nicephotog is licensed under CC BY-ND 2.0

THE BEE CAUSE PROJECT

FRAMES

The removable wooden structures, which are placed in the hive. The bees build their comb within them. The removable quality allows the beekeeper to easily inspect the colony.

Photo Credit: "Beekeeper taking out a new bee hive frame" by Ivan Radic is licensed under CC BY 2.0

THE BEE CAUSE PROJECT

GLOBAL WARMING

A gradual increase in the overall temperature of the earth's atmosphere generally attributed to the greenhouse effect caused by increased levels of carbon dioxide, chlorofluorocarbons, and other pollutants.

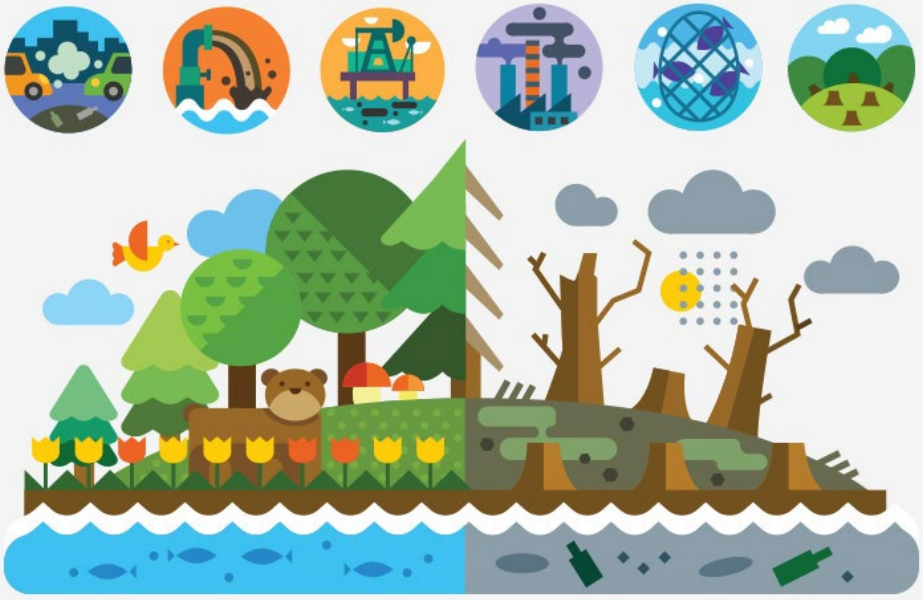

Photo Credit: "Calfing Glacier - Global Warming?" by Len Radin is licensed under CC BY-NC-SA 2.0

THE BEE CAUSE PROJECT

GUARD

Describes the worker bee that protects the hive from invaders or predators.

.

Photo Credit: "Italian Honey Bees at Hive Entrance I" by buildakicker is licensed under CC BY-NC-SA 2.0

THE BEE CAUSE PROJECT

HIVE BEETLE

A small dark beetle that is a major threat to hive health, as they consume brood, pollen and honey. The beetle larvae can ruin the combs full of honey as they tunnel, defecate, and produce slime over them.

Photo Credit: "File:Small hive beetle.jpg" by James D. Ellis is licensed under CC BY 3.0

THE BEE CAUSE PROJECT

HONEY

The sweet, viscous product created by bees from nectar.

Photo Credit: "Farmer's Market" by Melissa Hillier is licensed under CC BY 2.0

THE BEE CAUSE PROJECT

INTEGRATED PEST MANAGEMENT

An ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties.

Photo Credit: "Gardening fighting pests with pests, not pesticide" by DES Daughter is licensed under CC BY-NC-SA 2.0

THE BEE CAUSE PROJECT

LARVA

The grub-like, immature form of the bee, after it has developed from the egg and before it has gone into the pupa stage.

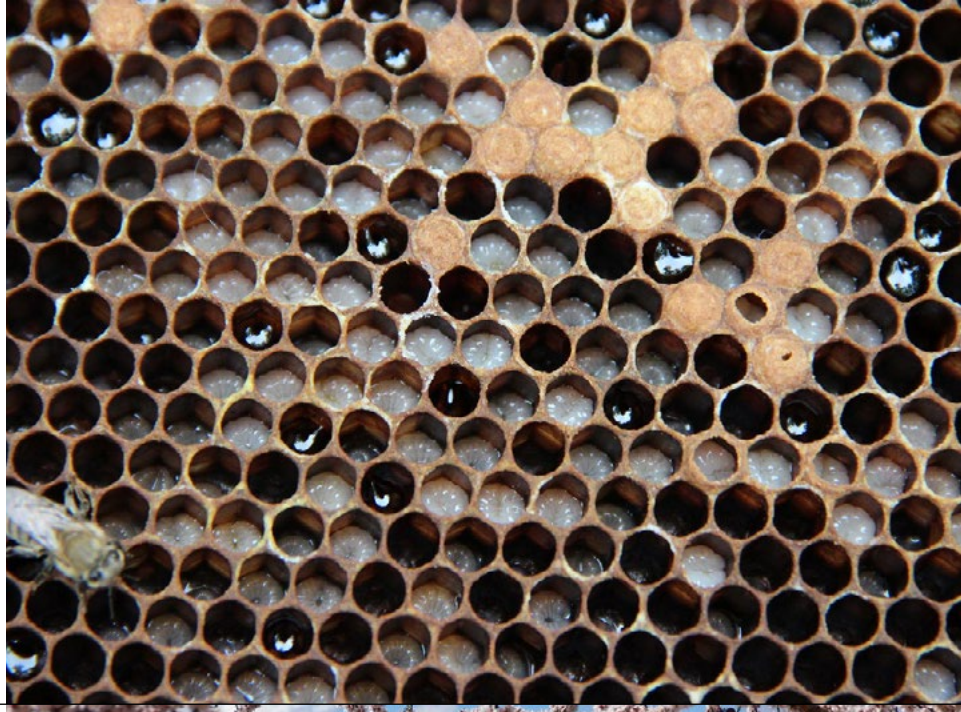

Photo Credit: "IMG_4704-bee-larvae" by dreamexplorer is licensed under CC BY-NC-SA 2.0

THE BEE CAUSE PROJECT

MONOCULTURE

Agriculture practice of growing one crop throughout a large area.

Photo Credit: "Almond trees' field" by pepa_carbassa is licensed under CC BY-NC-SA 2.0

THE BEE CAUSE PROJECT

NATIVE BEES

Usually the best pollinators for plants that are native to the same region. Squash bees (Peponapis) and bumble bees (Bombus) are an excellent example of bees that pollinate plants native to the Americas.

Photo Credit: "Bumble Bee" by MattX27 is licensed under CC BY-SA 2.0

THE BEE CAUSE PROJECT

NECTAR

Sweet fluid produced by flowers is 60% water and 40% solids. This is collected by the bees and converted into honey at 17%-18% moisture content.

Photo Credit: "Nectar" by Georgie Sharp is licensed under CC BY-NC 2.0

THE BEE CAUSE PROJECT

NEONICOTINOIDS

A relatively new class of insecticides that share a common mode of action that affect the central nervous system of insects, resulting in paralysis and death.

Photo Credit: "Let's Bee Clear" by greensefa is licensed under CC BY 2.0

THE BEE CAUSE PROJECT

NURSE

Describes the worker bee that cares for the brood.

Photo Credit: "Inside the hive" by rachaelbonoan is licensed under CC BY-NC 2.0

THE BEE CAUSE PROJECT

PARASITE

An organism that lives in or on another organism (its host) and benefits by deriving nutrients at the host's expense.

Photo Credit: "Varroa destructor on a bee nymph" by Gilles San Martin is licensed under CC BY-SA 2.0

THE BEE CAUSE PROJECT

PATHOGEN

A bacterium, virus, or other microorganism that can cause disease.

Photo Credit: "pathogens and parasites tile pink on grey" by _foam is licensed under CC BY-SA 2.0

THE BEE CAUSE PROJECT

PHEROMONE

A chemical produced and secreted into the environment that prompts a social response within a species.

Photo Credit: "A honey bee queen surrounded by her retinue (image by Helga Heilmann, BeeGroup Würzburg)" by dullhunk is licensed under CC BY-NC-ND 2.0

THE BEE CAUSE PROJECT

POLLEN

Very small dust-like grain produced by flowers. These are the male germ cells of the plant. This provides a protein source for the honey bees.

Photo Credit: "Macro Bee Pollen" by ForestWander.com is licensed under CC BY-SA 2.0

THE BEE CAUSE PROJECT

POLLINATION

The transfer of pollen from the anther (the male part) of one flower to the stigma (female) of another flower in the same species. This occurs by way of wind, honey bees, and other pollinating insects. This process ensures fertilization of the plant.

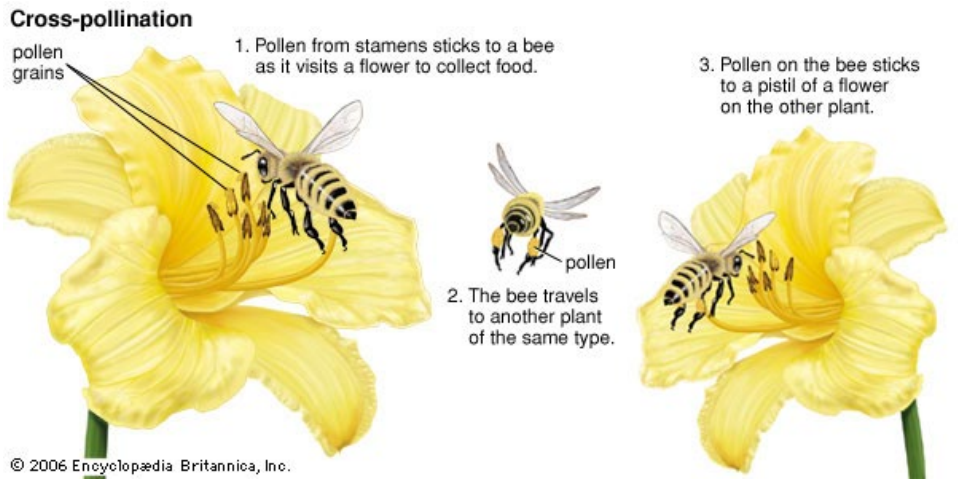

Photo Credit: https://cdn.britannica.com/88/95388-004-6E2508A9/process-cross-pollination-animal-pollinator.jpg

THE BEE CAUSE PROJECT

PROBOSCIS

An elongated sucking mouthpart that is typically tubular and flexible. Bees use their proboscis to extract nectar from flowers, like a using a straw.

Photo Credit: "Nectar so good..." by bob in swamp is licensed under CC BY 2.0

THE BEE CAUSE PROJECT

PROPOLIS

Sticky, brownish gum gathered by bees from trees and buds, used to seal cracks and drafts in the hive. Also called “bee-glue.” Propolis has anti-viral properties and is used medicinally.

Photo Credit: “Propolis” by OBA TTP is licensed under CC BY-NC-ND 2.0

THE BEE CAUSE PROJECT

PUPA

The immature form of the bee (following the larval stage) while changing into the adult form.

Photo Credit: “Apis melliferapupae 2_2019-09-06-19.23.35 ZS PMax UDR” by Sam Droege is marked with CC PDM 1.0

THE BEE CAUSE PROJECT

QUEEN PHEROMONE

Communicates the presence of the queen to the hive.

Photo Credit: “A honey bee queen surrounded by her retinue (image by Helga Heilmann, BeeGroup Würzburg)” by dullhunk is licensed under CC BY-NC-ND 2.0

THE BEE CAUSE PROJECT

QUEEN

The only fertile female bee in a colony. She lays all of the eggs and serves as the central focus of the colony. There is only one queen in a colony of bees. A healthy queen's productive life span is 3-5 years.

Photo Credit: "Queen Bee" by Kairon Gnothi (Opportunity Knocks) is licensed under CC BY-NC 2.0

THE BEE CAUSE PROJECT

ROUND DANCE

A circular dance that communicates a flower source is near the hive

Photo Credit: The Bee Cause

THE BEE CAUSE PROJECT

ROYAL JELLY

A jelly that is secreted from the glands in the heads of young nurse worker bees and is fed to all bee larvae. After three days, only the queen larvae will continue to be fed this special substance throughout her development.

Photo Credit: "Queen cell with royal jelly" by Gord Campbell is licensed under CC BY-NC-SA 2.0

THE BEE CAUSE PROJECT

SUPERORGANISM

A form of life composed of mutually interdependent parts that maintain various vital processes for the benefit of the whole. The well-being of the whole is more important than the individual.

Photo Credit: "Wild bee colony" by 57Andrew is licensed under CC BY-NC-ND 2.0

THE BEE CAUSE PROJECT

SWARM

A queen and about half of her colony that have left the hive and are in the process of finding a new hive. The swarm is kept intact with the queen's pheromone.

Photo Credit: "Bees swarming" by Lars Plougmann is licensed under CC BY-SA 2.0

THE BEE CAUSE PROJECT

SWARMING

The action of a colony finding a new home. This is how the honey bees expand their population.

Photo Credit: "bees swarming" by hans s is licensed under CC BY-ND 2.0

THE BEE CAUSE PROJECT

VARROA MITE

A mite that attaches itself to the honey bee, usually on its back. If the bees are not mite resistant, this debilitating parasite can cause death in the hive.

Photo Credit: "varroa mite on bee with DWV" by Shawn Caza is licensed under CC BY-NC-SA 2.0

THE BEE CAUSE PROJECT

WAGGLE DANCE

A complex dance that expresses the direction and distance of a flower source.

Photo Credit: The Bee Cause

THE BEE CAUSE PROJECT

WORKER

A completely developed female bee that has developed ovaries but does not normally lay eggs. The workers do all of the work in the hive and forage for food. A worker's life expectancy is only several weeks during the active summer months; however, they can live for many months during the relatively inactive winter period.

Photo Credit: "The common Worker Bee" by williamcho is licensed under CC BY-SA 2.0

THE BEE CAUSE PROJECT

SUPPLEMENT

STANDARDS MAPPING

BEE CAUSE STANDARDS MAPPING

Lesson	Next Generation Science Standards[1]	Common Core ELA[2]
Become a Beehive	3-LS2-1; 3-LS4-2; 4-PS3-2; 4-PS4-3; 4-LS1-2	RI.3.1; RI.3.2; RI.3.3; W.3.3 RI.4.1; RI.4.2; RI.4.3; W.4.3 RI.5.1; RI.5.2; RI.5.3; W.5.3
Bee Pheromones	3-LS3-1 4-LS1-2	W.3.3; W.4.3; W.5.3
Honey Bee Life Cycle	3-LS1-1	W.3.3; RI.3.7 W.4.3; RI.4.7 W.5.3; RI.5.7
Honey Bee Anatomy	3-LS4-2 4-LS1-1	W.3.2; W.4.2; W.5.2
Pollination	3-LS3-1 4-PS4-2; 4-LS1-2 5-PS3-1; 5-LS2-1	W.3.1; RI.3.7 W.4.1; RI.4.7 W.5.1; RI.5.7
Seed Bombs and Bee Friendly Gardens	3-LS3-1 5-LS1-1; 5-ESS3-1	W.3.3; W.3.7 W.4.3; W.4.7 W.5.3 ; W.5.7
Honey Bee Relay Races	4-PS4-3; 4-LS1-2 5-PS3-1	W.3.3; W.4.3; W.5.3
Pollen and Nectar Collection	4-LS1-2	W.3.7; W.4.7; W.5.7
Honey Tasting	5-PS1-3	W.3.7; W.4.7; W.5.7
Lip Balms and Soaps	5-PS1-3; 5-PS1-4	W.3.7; W.4.7; W.5.7
Bee Fountains	3-5-ETS1-1	W.3.7; W.4.7; W.5.7
Bee Creative with Paint and Clay	5-PS1-3; 5-ESS3-1	W.3.1; W.3.8 W.4.1; W.4.8 W.5.1; W.5.8
Beekeeper for a Day	3-LS4-2	W.3.1; W.4.1 ; W.5.1
Hive Observation Log	3-ESS2-1	W.3.7; W.4.7; W.5.7

SUPPLEMENT

LITERATURE CIRCLE GUIDE

Literature Circle Teacher's Guide

What is a Literature Circle?

A literature circle is a small group of students who work together and take on individual roles or jobs to help further discussion about an assigned text. Typically the teacher has assigned the text based on the student's reading levels, interest, or as an extension of a curriculum topic.

What is the purpose of a Literature Circle?

Engagement! Students are assigned (or may choose) rotating roles to supplement the reading assignment. The roles are designed to give each student a way to engage with the text and have talking points for discussion. Literature Circles build community, foster critical thinking skills, and lay groundwork for strong oral and listening behaviors.

How does this tie in with the Bee Cause Lessons?

Combining science and literature can help students make more meaningful connections with both. When a teacher uses the Bee Cause lessons, students are already excited to work with living, stimulating, interactive subject matter -- bees! By adding source texts rich with facts and vocabulary, any teacher can make cross-curricular connections resulting in more student engagement as well as fostering a love of reading.

How can this be done with digital learning?

Teachers can host Literature Circles easily and effectively with the support of online tools. Clever, Epic!, MackinVia, and Tumblebooks are some of the options for assigning digital reading. Teachers can send Literature Circle Roles to students via the school's chosen Learnintg Management Systems, i.e. Google Classroom, No Red Ink, Seesaw, or Canvas. Discussions can continue on a regular schedule between teacher and students with video conferencing tools as well. The Literature Circle Roles can be presented by the students with paper and pencil or with digital components both in the classroom and via digital learning.

How to get started on your Literature Circle:

THE BOOK

- For the first Literature Circle lesson, the teacher may want to choose a book that is slightly below the reading level of the group to get them started. A good selection will allow them to be successful at executing the roles free of excessive challenges. The students should be able to interpret and comprehend the information.
- The teacher should increase the challenge as he/she moves through titles and through the Bee Cause lessons. Whether using Lexile levels, DRA levels, or Guided Reading levels, there are many quality fiction and non-fiction texts to support the science of bees.

THE GROUPS

- It is important to group students by reading level as well as ability to get along. Consider the strong thinkers and strong talkers when selecting groups.
- A teacher can have multiple Literature Circle groups going on each week with a different text.

WHOLE KIDS FOUNDATION The Bee Grant program materials are sponsored and supported by the Whole Kids Foundation.

- Students should be held accountable for their role in each meeting.
- Consider modeling how to have productive conversations about the text, including how to listen, give and take thinking time, how to ask questions, and how to use the Literature Circle Roles sheets.

THE ROLES

- The teacher should set the reading assignment as well as the meeting time for each week. Consistency is key.
- The book can be broken up into multiple readings and multiple roles depending on the length. This means that roles can rotate each week to different students for the same book.
- A reading group can be successful using all of the roles, or only a few that the teacher feels will get the students motivated. Roles can be substituted in or out as the teacher deems the role more or less valuable with the content of the book.

Literature Circle Group Roles Description

CONNECTOR

Your job is to find connections between the book and the world outside. This means you connect the reading to:

- Your own life
- Happenings at school or in the community
- Similar events at other times and places
- Stories in the news
- Other people or problems
- Other books or stories
- Other writings on the same topic

QUESTION ASKER

Your job is to write down some good questions for your group to talk about. These could be questions:

- You had while you were reading
- About a character
- About the story
- About a word
- You'd like to ask the author

LITERARY LUMINARY

Your job is to pick parts of the story that you want to read aloud and talk about in your group. These can be:

- Good parts
- Interesting parts
- Funny parts
- Scary parts
- Parts with good writing
- Parts with good description

Be sure to mark the parts you want to share with a post-it note or bookmark.

ARTFUL ARTIST

Your job is to draw anything about the story that you liked:

- A character
- The setting
- A problem
- An exciting part
- A surprise

- A prediction of what will happen next
- Anything else

Draw on a piece of printer paper or poster board if you need it. When your group meets, don't tell them about it, let them discuss it and talk about it first. Then you can tell them about it.

WORD WIZARD

Your job is to look for special words in the story. You can find words that are:

- New
- Strange
- Funny
- Interesting
- Important
- Hard

When you find a word that you want to talk about, mark it with a post-it note or write it down (make sure to include page numbers and paragraph numbers so you can easily find the words you need).

When your group meets, help your friends talk about the words you have chosen. You can discuss:

- How does this word fit into the story?
- Does anyone know what this word means?
- Shall we look it up in the dictionary?
- How does this word make you feel?
- Can you draw this word?

SUMMARIZER

Your job is to prepare a brief summary of today's reading. Your group discussion will start with your 1-2 minute statement that covers the key points, main highlights, and general idea of the reading assignment.

TRAVEL TRACER

(designed to be used with fiction text)

When you are reading a book in which characters move around often and the scene changes frequently, it is important for everyone in your group to know where things are happening and how the setting may have changed. That's your job: carefully track where the action takes place during today's reading. Describe each setting in detail, either in words or with an action map or diagram. *Always give the page locations where the scene is described.*

RESEARCHER

Your job is to find background information on any relevant topic related to your book. This might include:

- The geography, weather, culture, or history of the book's setting
- Important information about the author and other related works
- Information about the time period in the book
- Information on any topics or events that occur in the book
- Information on any topics or events that may have influenced the author
- Pictures, objects, or materials that illustrate elements of the book
- The history of words or names used in the book
- Information about any character that is based on a historical person
- Information you found interesting and wanted to learn/share more about

LITERATURE CIRCLE GROUP ROLES

Connector

YOUR JOB is to find connections between the book and the world outside. This means you connect the reading to:

- Your own life
- Happenings at school or in the community
- Similar events at other times and places
- Stories in the news
- Other people or problems
- Other books or stories
- Other writings on the same topic

DIRECTIONS

Read the assigned section of the book. Find three connections between the book and the world outside. Write the three connections that you found on the lines below. ***Be sure to write in full sentences beginning with a capital letter and ending with a period!***

Question Asker

YOUR JOB is to write down some good questions for your group to talk about. These could be questions:

- You had while you were reading
- About a character
- About the story
- About a word
- You'd like to ask the author

DIRECTIONS

Read the assigned section of the book. Write at least three questions for the group. Try not to ask questions that have a simple yes or no answer. Write the three questions on the lines to the right. ***Be sure to write in full sentences beginning with a capital letter and ending with a period!***

Artful Artist

YOUR JOB is to draw anything about the story that you liked:

- A character
- The setting
- A problem
- An exciting part
- A surprise
- A prediction of what will happen next

DIRECTIONS

Read the assigned section of the book. In the space to the right, draw anything about the story that you liked.

LITERATURE CIRCLE GROUP ROLES

Word Wizard

YOUR JOB is to look for special words in the story. You can find words that are:

- New
- Strange
- Funny
- Interesting
- Important
- Hard

When you find a word that you want to talk about, mark it with a post-it note or write it down (make sure to include page numbers and paragraph numbers so you can easily find the words you need).

- When your group meets, help your friends talk about the words you have chosen. You can discuss:
- How does this word fit into the story?
- Does anyone know what this word means?
- How does this word make you feel?
- Can you draw this word?

DIRECTIONS

Read the assigned section of the book. Write at least three words that you want to share with the group. Write the three words on the lines below. Then look up the words in the dictionary or on a dictionary app and write the definition of the word on the lines to the right. ***Be sure to write in full sentences beginning with a capital letter and ending with a period!***

Summarizer

YOUR JOB is to prepare a brief summary of today's reading. Your group discussion will start with your 1-2 minute statement that covers the key points, main highlights, and general idea of the reading assignment.

DIRECTIONS

Read the assigned section of the book. Write at least three sentences summarizing this section of the book. ***Be sure to write in full sentences beginning with a capital letter and ending with a period!***

LITERATURE CIRCLE GROUP ROLES

Literary Luminary

YOUR JOB is to pick parts of the story that you want to read aloud and talk about in your group. These can be:

- Good parts
- Interesting parts
- Funny parts
- Scary parts
- Parts with good writing
- Parts with good description

Be sure to mark the parts you want to share with a post-it note or bookmark.

DIRECTIONS

Read the assigned section of the book. Mark your parts that you want to read aloud and share. Be prepared to discuss with your group. Feel free to make any notes that will help you when speaking. ***Be sure to write in full sentences beginning with a capital letter and ending with a period!***

LITERATURE CIRCLE GROUP ROLES

Travel Tracer

(designed to be used with fiction text)

When you are reading a book in which characters move around often and the scene changes frequently, it is important for everyone in your group to know where things are happening and how the setting may have changed. **THAT'S YOUR JOB:** carefully track where the action takes place during today's reading. Describe each setting in detail, either in words or with an action map or diagram. *Always give the page locations where the scene is described.*

DIRECTIONS

Read the assigned section of the book. Describe the setting in detail and include page numbers to go with the scene. If you would like to use an action map, please draw on the back of this sheet.

LITERATURE CIRCLE GROUP ROLES

Researcher

YOUR JOB is to find background information on any relevant topic related to your book. This might include:

- The geography, weather, culture, or history of the book's setting
- Important information about the author and other related works
- Information about the time period in the book
- Information on any topics or events that occur in the book
- Information on any topics or events that may have influenced the author
- Pictures, objects, or materials that illustrate elements of the book
- The history of words or names used in the book
- Information about any character that is based on a historical person
- Information you found interesting and wanted to learn/share more about
- Be sure to mark the parts you want to share with a post-it note or bookmark.

DIRECTIONS

Read the assigned section of the book. Write at least three sentences about your research. Please include the resource that you used. ***Be sure to write in full sentences beginning with a capital letter and ending with a period!***

STANDARDS MAPPING FOR 3RD, 4TH, AND 5TH GRADES

Literature Circle Role	Informational Text: Common Core ELA$_2$	Literature: Common Core ELA$_2$
Connector	RI.3.6; RI.3.9; SL.3.1; SL.3.4; SL.4.1; RI.4.6; SL.5.1; RI.5.6;	RL.3.6; SL.3.1; SL.3.4; SL.4.1; RL.4.6; SL.5.1
Question Asker	RI.3.1; SL.3.1; SL.3.4; SL.4.1; SL.5.1; RI.5.1	RL.3.1; SL.3.1; SL.3.4; SL.4.1; RL.4.1; SL.5.1
Literary Luminary	RI.3.6; SL.3.1; SL.3.4; SL.4.1; SL.5.1	SL.3.1; SL.3.4; SL.4.1; SL.5.1
Artful Artist	RI.3.6; SL.3.1; SL.3.4; SL.4.1; SL.5.1	RL.3.7; SL.3.1; SL.3.4; SL.4.1; SL.5.1
Word Wizard	RI.3.4; SL.3.1; SL.3.4; SL.4.1; RI.4.4; SL.5.1; RI.5.4	RL.3.4; SL.3.1; SL.3.4; SL.4.1; RL.4.4; SL.5.1; RL.5.4
Summarizer	RI.3. 2; SL.3.1; SL.3.4; SL.4.1; RI.4.2; SL.5.1; RI.5.2	RL.3.2; SL.3.1; SL.3.4; SL.4.1; RL.4.2; SL.5.1; RL5.2
Travel Tracer	RI.3.3; SL.3.1; SL.3.4; SL.4.1; RI.4.3; SL.5.1; RI.5.3	RL.3.3; SL.3.1; SL.3.4; SL.4.1; RL.4.3; SL.5.1
Researcher	RI.3.3; SL.3.1; SL.3.4; SL.4.1; RI.4.3; SL.5.1	SL.3.1; SL.3.4; SL.4.1; SL.5.1

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