Hive Alive!
Experience the Wonder

EVERYBODY HAS A JOB!

CONSTRUCTION AND MAINTENANCE OF THE HIVE

Essential Question:

WHAT MAKES THE INSIDE OF A HONEY BEE HIVE FASCINATING?

LEARNING OBJECTIVES

- Explain how different organisms use their unique adaptations to meet their needs.
- Compare and contrast the differing ways an organism interacts with its surroundings at various stages of its life cycle.

RESOURCES

- Image, *Worker Bee Wax Abdomen*
- Reading, *Hive Building and Care*
- Video, *TBD*
- Images, *SVF Hive Detail*
- Assessment, *Hivekeeping Checklist*

MATERIALS

- Index Cards
- Printer or Construction Paper
- Colored Pencils, Crayons, etc.
- Journals, Paper, or Digital Notebooks
- Writing Utensils
- Tape

OVERVIEW OF LESSON / BACKGROUND

Although it may look chaotic to the uninformed eye, a honey bee hive is a very orderly place. In addition to the exacting specifications by which a hive is built and maintained, each bee in the system has a specific job, and those jobs change on a predictable schedule according to a honey bee's age and role.

The hive is a collection of hexagonal cells made up of wax. Bees produce wax in sheets and then chew and mold the wax into the cells of a honeycomb. The cells are used to hold eggs, larvae, and pupae as they grow, and to store honey, nectar, and pollen. Every honey bee hive follows the same internal, concentric pattern: cells housing the brood in the center, surrounded by cells filled with pollen, surrounded on the outer edges by cells filled with honey.

In order to keep the hive healthy and functional, every bee has a specific job. The single queen is responsible for communicating the health of the hive and producing eggs (more than 1,500/day); the drones exist only to fertilize a virgin queen; and the worker bees (all female) maintain and defend the hive and collect pollen and nectar. This lesson will go into the specifics about the construction and maintenance of a hive, and the various jobs that are held by each type of honey bee.

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LESSON ACTIVITY

INTRODUCTION

ENVIRONMENTAL PREPARATION

Prepare the room by writing this on the board:

> Listen to the audio playing in the room. How does this audio make you feel? *Write either 3 feelings or one descriptive sentence to answer the question.*

Search online for audio from the inside of a bee hive and have the audio playing when the students enter the room and through the introductory activity.

ACTIVITY

1. Project, display, or distribute the image ***Worker Bee Wax Abdomen***.
2. Explain: This is a photo of a worker bee's abdomen. The worker bees (all females) have special glands that allow them to secrete wax that is used to build the honeycomb. Bees take these wax sheets and chew them up until they have been softened by their saliva and are pliable enough to work with, then they form them into the cells that make the honeycomb. Wax is also used to seal off cells being used for storage. The wax from a worker bee's abdomen may be taken by another bee to chew and manipulate, or the bee may grab its own wax sheet and pass it from hind leg to fore leg and then to mouth.

3. Ask each student to write a caption for the image ***Worker Bee Wax Abdomen***. Differentiate here by encouraging students to write a factual caption or offering the option of writing a comedic or cartoon caption.

ACTIVITY

1. Show the video ***TBD***; allow students to watch without taking notes. Show it another time or two, if desired. Take a few minutes to discuss the video and the students' reactions to it.
2. Place the ***SVF Hive Detail images*** around the room and distribute the ***Hivekeeping Checklist***.
3. Ask students to roam around the room and mark their checklists by writing the number of a Hive Detail image that shows the specific bee activity. For instance, a drone sitting around (#7 on the list) can be found in the image labeled Hive Detail 4. Students may find more than one activity in each image.

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READING

1. Divide students into groups of 8 and distribute the reading ***Hive Building and Care.***
2. Have a representative from each group cut or rip the sheets into 8 parts—each of the 8 paragraphs—and have each student in the group take one of the parts.
3. Reassemble student groups according to their shared readings (i.e. all Hive Construction together, all Cleaners together, etc.).
4. Have the new groups read their particular paragraphs and make sense of the information. They will be responsible for educating their original groups about the particular role they were assigned. They might talk, take notes, or make lists, drawings, or charts to bring back to their original group—they should bring something back in writing on paper.
5. Have original groups reassemble and ask the Hive Construction representative to begin and then manage each student, giving each student 30 seconds to explain his or her role.

GAME

BUILD IT Use this challenge to allow students to demonstrate their knowledge of the areas of a honey bee hive and also to practice and demonstrate their understanding of the type of cooperative work required in one. Encourage students to be creative with the materials you have available (i.e., they could draw, color, and cut out a scale picture of a bee and insert the picture into a cell.)

1. Divide students into teams of 4 (or a small group number that works with your class size).
2. Provide students with materials to build a hive replica (index cards, tape, popsicle sticks, paper, colored penciles/crayons/markers) and explain that they will have 30 minutes to develop their replicas. Each replica should demonstrate the structure of a hive and visually represent the areas and activities within the hive. Tell students that they can use any and all of the materials and that they should be creative in their representations.

ASSESSMENT

Remind students that they have a wealth of information about bees and their jobs at varying stages of life. Have them review their notes, highlighting actions and activities of the bee, then write a multi-paragraph diary entry from the point-of-view of a worker bee at a specific age. The entry should include details about the narrator's day and an acknowledgment of her past experience and future outlook. Provide the peer-review checklist and have students partner and swap papers to provide constructive feedback. Allow time for students to incorporate peer feedback into a final draft.

EXIT CARD

On the board, a sticky note, or a slip of paper, have each student write what she thinks her favorite role/job would be if she were a honey bee worker. If desired, tally the results and provide students with a summary at the start of the next class. (Would the class survive because everyone would be filling a different role, or do you have a classful of guards?)

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DIFFERENTIATION

SUPPORTS

- Provide a list of captions to choose from for the Introduction.
- Provide pre-highlighted ***Hive Building and Care*** text.
- Read ***Hive Building and Care*** text out loud or have students read in pairs or groups.
- Allow students to focus on only the structure of the hive.

EXTENSIONS

- Have students investigate drone lifespan and activity.
- Invite students to research the discussion about the hexagonal structure of the hive and theories about what causes it.
- Allow students to create a detailed 3-dimensional model of a hive with materials of their choice.
- Encourage students to read about the relocation of a hive via spurned queen and swarm.

VIRGINIA STANDARDS OF LEARNING (SOL)

SCIENCE

4.5: The student will investigate and understand how plants and animals, including humans, in an ecosystem interact with one another and with the nonliving components in the ecosystem.

- Organisms have structural adaptations or physical attributes that help them meet a life need.
- Organisms also have behavioral adaptations, or certain types of activities they perform, which help them meet a life need.
- During its life cycle, an organism's role in the community—its niche—may change. For example, what an animal eats, what eats it, and other relationships will change.

READING

4.6: The student will read and demonstrate comprehension of nonfiction texts.
d) Identify the main idea.
e) Summarize supporting details.
j) Identify new information gained from reading.

WRITING

4.7: The student will write cohesively for a variety of purposes.
c) Use a variety of pre-writing strategies.
g) Write two or more related paragraphs on the same topic.
k) Include supporting details that elaborate the main idea.

RESOURCE HIVEKEEPING CHECKLIST

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_____ **1.** Worker bee cleaning the cells of the honeycomb

_____**2.** Worker bees communicating

_____**3.** Worker bee caring for young bees (eggs, larvae, pupae)

_____**4.** Worker bee storing honey

_____**5.** A cell with a cap on it

_____**6.** Worker bee entering or exiting to bring or get pollen/nectar

_____**7.** Drone … sitting around

_____**8.** Worker bee fanning the hive

_____**9.** Worker bee guarding the hive from invaders

____ **10.** (Something you notice)_____

RESOURCE HIVE BUILDING AND CARE

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CLEANER

A worker bee's first job is cleaning. As soon as she emerges from her cell, she turns around and begins to clean it out. When her cell is clean, she begins to clean other cells in the comb to make sure they are ready for the eggs the queen will lay. The queen inspects the cells and, if they are not clean enough, the worker bee cleans them again. Worker bees spend the first few days of their life cleaning.

UNDERTAKER

Just like any other living thing, bees die. Dead bees must be removed so the hive can keep working well. Taking dead bees out of the hive and depositing them far away is one of a worker bee's many jobs.

BABYSITTER

When a worker bee is just 3 days old, she will begin to care for the younger bees. She is in charge of feeding all the larvae. She feeds pure royal jelly (from a special gland in her head) to the queen larvae. She feeds bee bread (honey and pollen—and a little royal jelly only on the first day) to the worker and drone larvae. A worker bee doing this job may check on a single larva 1,000 times per day.

BUILDER

At about 12 days old, worker bees become master builders. They produce wax from special glands, and the wax comes out in sheets from their abdomens. The bees chew the wax to make it soft and pliable. All the builder bees work together. They even share wax to chew so everyone can contribute to the preparation. They then use the wax to build the hexagonal cells in the honeycomb. They also use the wax to make lids for cells that are being used to store honey, pollen, nectar, or eggs.

HVAC: HEATING, VENTILATION, AND AIR CONDITIONING

The temperature in a hive must be kept under control and worker bees at a certain age are in charge of temperature. If the hive is too cold in winter, they huddle together and vibrate to warm it up. It is kind of like a group hug. If the hive is too hot in summer, worker bees can use their wings as fans to cool it down. Bees even put water on each other's backs, so the fanning causes evaporation that creates their own air conditioning system.

RESOURCE HIVE BUILDING AND CARE

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GUARD

Someone has to guard the hive from intruders. Before bees get to leave the hive to find nectar and pollen, they have one last job at the entrance to the hive: guard. Worker bees that are guarding the hive buzz around the openings using their senses and their stingers to defend the hive. As bees approach, guards determine whether they belong to the hive or not through their sense of smell. Foreigners are chased away, unless they offer a successful bribe of nectar or pollen. If necessary, a guarding bee will sting a potential intruder, giving up her life for the safety of the hive.

FORAGER

A worker bee's last job is foraging: leaving the hive to collect nectar, pollen, and water in the fields. Foraging bees make as many as 10 trips in one day and fly up to 4 miles from the hive. When in the fields, they are collecting nectar and pollen from flowers and pollinating the plants as they move from one to another. They return to the hive at sunset and spend the night inside. Most worker bees die outside of the hive, while they are foraging.

QUEEN ... AND DRONES

The queen and drones have one job each for their entire lives. The queen's job is to lay eggs. She can lay up to 2,000 eggs per day. She fertilizes most of the eggs, creating worker bees. She leaves some of the eggs unfertilized, creating drones. She figures out which egg to lay based on the width of the cell the workers have created. When the time is right, she leads a swarm, which splits the hive by taking some of the bees to a new hive and leaving the current hive for a new queen. The drones' only job is to mate with the queen bee. Once his job is done, a drone dies.

QUEEN

DRONE

RESOURCE PEER REVIEW CHECKLIST

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INSTRUCTIONS

1. Exchange your work with a classmate.
2. Read this checklist **BEFORE** you review your classmate's work, so you know what you are looking for.
3. With the checklist next to the work, **READ** your classmate's work looking for the things on the list.
4. When you see evidence of an item on the checklist, **CHECK IT OFF**.
5. Feel free to write a **POLITE** and **HELPFUL** suggestion in the section at the bottom.
6. Return your classmate's work and get your own work back.
7. Consider the feedback from your classmate and revise your work, as necessary.

Writer's Name _____

Reviewer's Name _____

Title of Piece _____

Check items that are true.

_____ There is an introduction that tells me what it will be about.

_____ The supporting details help me understand the information.

_____ There is a conclusion at the end that helps me remember the whole thing.

_____ The writer kept the narrator's point-of-view all the way through.

_____ It is written carefully—is neat, has good spelling, includes punctuation.

SUGGESTION to help the writer revise the work...

_____

_____

_____

RESOURCE WAX, ABDOMEN

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RESOURCE HIVE DETAIL 1

Hive Alive!
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RESOURCE HIVE DETAIL 2

Hive Alive!
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RESOURCE HIVE DETAIL 3

Hive Alive!
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RESOURCE HIVE DETAIL 4

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RESOURCE

HIVE DETAIL 5

Hive Alive!
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RESOURCE HIVE DETAIL 6

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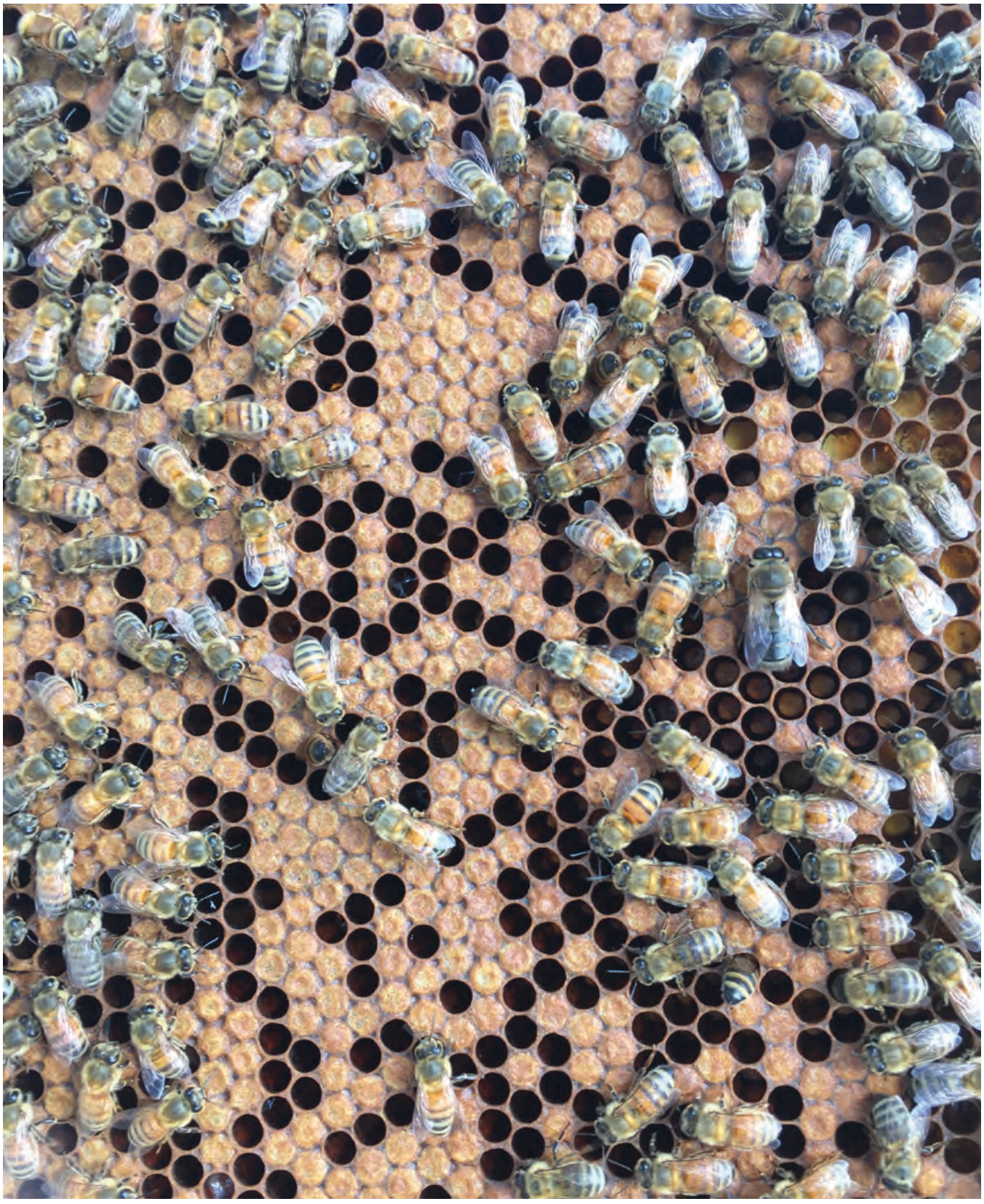

RESOURCE

HIVE DETAIL 7

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RESOURCE HIVE DETAIL 8

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RESOURCE HIVE DETAIL 9

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