



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*

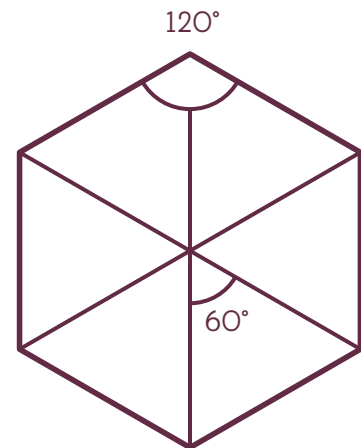
A CLOSER LOOK AT THE OBSERVATION HIVE

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 pupa 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**

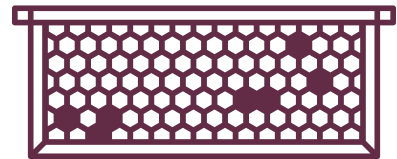
NAVIGATION AND DANCE

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



OTHER ACTIVITIES

- [Coloring Worksheet](#)
- [Q & A Worksheet](#)
- [Crafting with wool \(felted bee\) or paper \(origami bee\) or recycled materials \(bottle bee\) to make beehive 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.

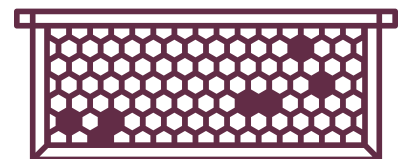
SUMMER: Nectar flow and honey production slows down, but the workers are still collecting pollen. This is the time where the population stabilizes.

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



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.

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.

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.