



Inside the Colony

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Each member of the honeybee colony has specific duties they perform in the hive. The queen is mainly to lay eggs and the drones are specifically to mate with a virgin queen of another hive. The workers do all the rest of the labor needed to keep the hive functioning. Generally, inside bees are younger and outside bees are older. They can perform any of the roles needed in an emergency, but they generally follow a progression of duties. This progression can be interrupted by the queen not laying, so nurse bees would not be necessary, or as in the case of a swarm, all bees turn to foraging or making honeycomb to build a new hive. If all the young worker bees were killed, the foragers could reactivate their food glands and wax glands. If all the foragers were killed, the young bees could learn to become foragers in a short time.

The average life span of summer bees is only six weeks. When a bee first emerges from its cell the first task it attends to is cleaning its own cell to prepare it for another egg, nectar, or pollen. These young bees are also very good at making wax and royal jelly, so they will cap brood cells and tend to the young. They will feed the queen and tend to her, which includes grooming her and spreading her pheromone throughout the hive with the other workers. As they get a little older they will receive nectar from foragers and place it into the honey storage cells. Here they warm and fan the nectar to cure it then cap it for future use. They will also remove hive debris, help to cure the pollen into bee bread, and ventilate or heat the hive according to need. Then they will become guard bees, start taking some orientation flights, and finally in the last two weeks of their lives they become full time foragers. During this whole time, the needs of the colony dictate which jobs they will perform on a given day. This flexibility is key to the survival of the hive.

Cleaning of Cells involves removal of the debris from the last cocoon and the fecal matter deposited by the developing larvae. Bees are able to remove most but not all of this debris so the cell size gradually gets smaller with every use. The wax also darkens with every use from the accumulated debris remnants. Other surfaces within the hive that are hard to clean may be covered in fresh wax or propolis, or a combination of wax and propolis. Propolis is a sticky resin that is collected from trees and shrubs and which has antifungal and antibacterial properties. The **capping** over brood is covered with a wax/propolis mixture, while honey is capped with just wax. This makes the brood areas darker in color and the capped honey lighter in color. These cleaning bees are very important to the survival of the colony. They are also the ones responsible for detecting the pheromone produced by the larvae that are currently infected with Varroa mites (Varroa Sensitive Hygiene or



New bee emerging from cell



Frame of worker brood with capped honey at top of frame.

VSH). Once a worker detects this infection in a cell, they chew a small hole to allow the brood to die (and the mites with it) or they will remove the developing brood as well as the mites that were feeding and multiplying in the cell. This behavior is extremely helpful in controlling the level of Varroa mite within the colony and protecting from the viruses they vector.

Once a young worker is 5 days old she moves on to **Feeding the Brood and Queen** since her food glands are fully developed. At this stage they are referred to as Nurse bees since they roam around the uncapped larvae and check each larvae to see if it needs more royal jelly or brood food. Glands in the head of **Nurse bees** produce royal jelly in response to them consuming large amounts of bee bread. Each larva is checked several times a day and given brood food when needed. Queen larvae will remain on this diet their whole life, while worker and drones only consume this the first three days of their development. At day three they are slowly switched over to a diet of honey/nectar and bee bread/pollen. All young larvae get mass amounts of royal jelly, but as workers and drone get to three days of development, they are only fed on an as-needed basis. A single Nurse bee will tend to two or three larvae, and on a single frame there are 3500 cells, so it takes a large population of Nurse bees to take care of the brood nest and keep it warm. In addition to taking care of all the larvae the Nurse bees also tend to the Queen. The Queen will usually be found in the brood nest looking for empty clean cells to lay

eggs. The brood nest may span five or more frames during the summer months. A healthy Queen will lay between 1500 to 2500 eggs daily which is her body weight in eggs every single day, so she needs to be fed royal jelly often. The Queen will pause her search for an empty cell long enough for a group of Nurse bees to surround her. They will feed her and groom her with their antennae and forelegs and lick her with their tongues. This is called a **retinue**. This grooming/feeding encounter only lasts between 30 to 60 seconds, and then these Nurse bees disperse throughout the hive to spread the queen pheromone they picked up on their antennae to the other members of the colony for the next 30 minutes. They will come into contact with approximately 56 other bees who then spread the pheromone to other bees. This dispersal of the queen pheromone not only allows the whole colony to know the queen is present, but also informs them of her level of pheromone. If the queen is accidentally killed or lost, the entire colony will know within 24 hours. If the queens' pheromones decline, which can be a sign of sickness or that she's low on sperm, the colony will start to prepare for replacing the queen with a new virgin queen through supercedure or swarm. If a colony has grown so large that portions of the colony aren't receiving the queen pheromone, they may start preparations for swarming by building queen cups. The old queen will leave the hive before the new queen hatches with approximately half the workers to set up a new colony elsewhere. If the queen is low quality, poorly mated, or not laying well, the colony will replace her within a few weeks.



Guard bees at entry of hive.

Important Temperatures for Beekeeping

As worker bees turn 10 days old, they will transition into receiving nectar from foragers and depositing that nectar into cells to ripen into honey. The colony likes to be 95 degrees F at all times, so if the hive gets too warm, several house bees will start fanning their wings at the entry to circulate air out of the hive while foragers bring in water to cool the hive as it evaporates. They will still help with cleaning debris from the hive as well as packing pollen pellets with nectar to allow it to ferment into bee bread, which is then consumed or covered with a thin layer of honey for later storage. Honeybees will only collect enough pollen for their needs, but they continue to collect nectar whenever it is available, which is why they create surplus honey that we can share.

By day 12, worker wax glands are fully developed so they can help with creating honeycomb to expand the colonies' ability to store food. At 15 days old they can start taking turns guarding the entrance to defend against invaders. During this time at the entry, they will start taking orientation flights by first climbing up the face of the hive a short distance then pushing off for a short circle flight and landing again. As they gain confidence in their ability to fly, they will slowly increase the length of their flights away from the hive to get used to the landmarks and scents that will guide them back home.

Finally, at 24 days old, as the foraging force declines or as more help is needed to bring resources into the hive, more workers will join the foraging bees and go out every day in search of pollen, nectar, water, or propolis as dictated by the needs of the colony. These foraging bees are the ones who will turn into scouts in the case of a swarm and help find the new home for the split colony. At the time of a swarm, most of the foragers will leave with the old queen to find a new home, this means that all the younger house bees left behind will need to assume duties sooner than they might otherwise. This flexibility in duties is key in the success of honeybee colonies.

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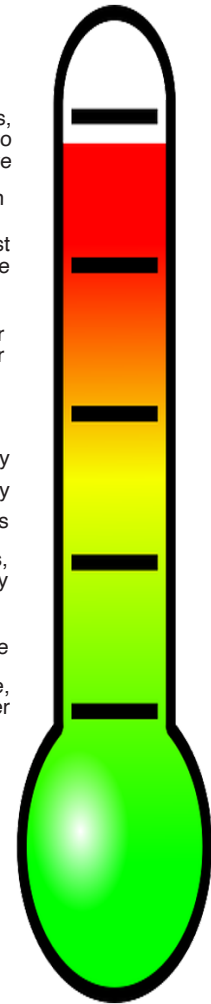
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100°	all brood rearing stops, colony needs water to cool hive
91° - 97°F	wax secretion
93° - 94°F	brood nest temperature
85°F	broodless winter cluster
68°F	queen will not fly
61°F	drones will not fly
57°F	winter cluster forms
50°F	brood rearing stops, Workers cannot fly
42°F	bees cannot move
40°F	bees die if alone, away from cluster
-40°F	bee cluster will die



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