

Bee Role Play

Set the stage for students through a class discussion of pollination/bee communication/bee colonies/super-organisms

Waggle dance

A "hive" is constructed by positioning desks or chairs in a circle with a break in the circle serving as the entrance. Alternatively, if it's a nice day you could do this on the school field. The teacher designates each student a role within the hive e.g. queen, drone, larvae, forager (give the student a labelled card) and the students adopt the various roles. Other students are designated as flowers, positioned somewhere outside the hive, and given yellow balloons representing pollen grains. The teacher acts as a foraging scout, leaving the "hive" first and locating the "flowers." Upon collecting "pollen" the teacher returns to the "hive" and performs a waggle dance, with the direction of the waggle run pointing towards the "flowers." The rest of the "foragers" then pour out of the "hive" armed with the knowledge, gleaned from my dance, of where to find the flowers with their valuable nectar and pollen. The dance represents a horizontal abstraction however, in the hive it is performed vertically by the bee. The top of a frame represents the position of the sun. However, if this detail slips by some students, the concept hopefully will not.

Students are taught that the bees are not the only ones to benefit from their foraging foray. Many plants depend on pollination by bees and other insects for their very survival, and many people and other animals depend on the resulting fruits for food. As "foragers" collect "pollen" they are encouraged to exchange some among the "flowers." As "flowers" receive "pollen" from other "flowers," their yellow balloons are exchanged and red balloons representing the development of apples and other fruits following pollination could be given to students assigned as herbivores. A discussion of energy flow and food chains could result.

Nuptial Flight & Dance of Death

Talk students through the following sequence of events. Drone bees leave the hive (circle of desks and chairs) and fly around waiting for the virgin queen. The queen is about a week old when she sets off to mate with the drones. Mating takes place while flying, the queen and drone fly side by side. The drone passes the queen small white balloons representing sperm. A single male could deliver up to 11 million sperm cells in a single mating. The queen mates with several different drones during the nuptial flight. The drone's sperm cells are kept fresh in the queen's sperm gland for several years, she uses it to fertilise eggs throughout her life. This is the only flight the queen will experience. She returns to the hive and starts laying eggs in the combs. The student assigned as the queen should get busy because the queen lays about 1500 eggs per day (up to a million in a life time). During mating the drone's internal organs are literally ripped from his body during when the penis enters the queen. He dies shortly after mating.

Super-organism

A bee colony is considered a super-organism. Ask the students what they think it means?

Individually no single bee could survive on its own. Honey bees must co-operate with each other to ensure survival of themselves and the species. Hence, bee colonies have been described as super-organisms.

Students act out the description of their assigned role (on the card). This illustrates how busy and productive a bee colony is.

Pheromone Communication

As well as performing the waggle dance honey bees communicate using pheromones. Pheromones produced by the queen control reproduction in the hive. She emits pheromones that keep female workers disinterested in mating, and also uses pheromones to encourage male drones to mate with her. The queen bee produces a unique odor that tells the community she is alive and well. When a beekeeper introduces a new queen to a colony, she must keep the queen in a separate cage within the hive for several days, to familiarize the bees with her smell.

Pheromones play a role in the defense of the hive as well. When a worker honey bee stings, it produces a pheromone that alerts her fellow workers to the threat. That's why a careless intruder may suffer numerous stings if a honey bee colony is disturbed.

In addition to the waggle dance, honey bees use odor cues from food sources to transmit information to other bees. Some researchers believe the scout bees carry the unique smells of flowers they visit on their bodies, and that these odors must be present for the waggle dance to work. Using a robotic honey bee programmed to perform the waggle dance, scientists noticed the followers could fly the proper distance and direction, but were unable to identify the specific food source present there. When the floral odor was added to the robotic honey bee, other workers could locate the flowers.

Modified from the website: <http://insects.ummz.lsa.umich.edu/MES/notes/entnote22.html>

<http://ufgenetics.com/CMFiles/Docs/Honey%20Bees/bee%20print%20story.pdf>

<http://beekeepingtimes.com/index.php/research-&-tech/64/289-insect-societies-like-honey-bees-are-superorganisms-theory->

<http://www.dummies.com/how-to/content/understanding-the-role-of-the-worker-bee-in-a-hive.html>

Cards for students

There are 3 castes within a hive; queen, drones and workers. However, workers carry out a variety of jobs which relate to a progression in age. All worker bees are non-reproducing females. For a class of 30 students one student should be assigned the queen bee, two students drone bees and the remaining bees should be workers. Three students should be each worker role.

Worker Bee - Cleaner

You are a cleaner bee and only 1-2 days old. Brood cells must be cleaned before the next use. Cells will be inspected by the queen and if unsatisfactory will not be used. Worker bees in the cleaning phase will perform this cleaning. If the cells are not clean, the worker bee must do it again.

Cleaner



Worker Bee - Undertaker

You are an Undertaker honey bee, 3- 16 days old. Your job is to remove any bees that have died and disposes of the corpses as far from the hive as possible (50 - 100m). You also remove diseased or dead brood quickly to prevent a health threat to the colony.

Undertaker



Worker Bee - Nurse Bee

You are a nurse bee, 3 to 11 days old. You 'baby sitters' and feed worker jelly to the developing worker larvae.

When you are 6 to 11 days old you may be 'promoted' to advanced nurse bee. Advanced nurse bees feed royal jelly to developing queen larvae and drones (for 1 to 3 days).

You are very dedicated and check a single larvae 1,300 times a day!

Nurse Bee



Worker Bee - Attendant to the Queen

You are an attendant to the queen, 7 to 12 days old. Her royal highness is unable to tend to her most basic needs by herself, so you do these for her. This includes feeding and grooming the queen. You also collect QMP (Queen Mandibular Pheromone) from the queen and share it with the other worker bees so it is spread through the hive. QMP attracts drones for mating but also suppresses the reproductive systems of the queens daughters' (workers) ensuring only the queen mates.

Attendant to the Queen



Worker Bee - Temperature Control

You are a water carrier or fanning bee (12 to 18 days old) and control the temperature and humidity within the hive. When the hive is in danger of over heating you obtain water, usually from within a short distance from the hive and bring it back to spread on the backs of fanning bees. These bees fan the hive, cooling it with evaporated water. They also direct airflow into the hive or out of the hive depending on need.

Temperature Control Bee



Worker Bee - Nectar & Pollen House Collectors

You are a young bee (12 to 18 days old) and collect nectar and pollen from foraging bees when they return to the hive. You then deposit the nectar and pollen into cells earmarked for this purpose. Both the ripened honey and pollen are food for the colony.

House Collectors



Worker Bee - Builder

You are a builder, 12 to 35 days old. You exude wax from the space between several of your abdominal segments. You build cells from wax and repair old cells.

Builders



Worker Bee - Guard Bee

You are a guard honey bee, 18 to 21 days old. You wait at the entrance to the hive poised and alert, checking each bee that returns to the hive for a familiar scent. Only family members are allowed passed.

You occasionally let bees from other hives in if they bribe you with nectar!

Guard Bee



Worker Bee - Forager

You have reached the pinnacle of your career as a worker. You are 22 to 42 days old and now have the responsibility of collecting nectar and pollen for the hive. You fly at 24 km per hour and if you are hard working you may visit 2000 flowers and day.

Forger



Queen

You have been fed royal jelly and therefore have developed into the queen bee. A week after emerging from your queen cell you fly away from the hive and mate many different drones. 48 hours after mating you begin to lay eggs. You lay 1,500 eggs per day and about 1 million in a life time. You live for 3- 4 years. However, if the hive 'thinks' you are not performing they will start feeding royal jelly to a developing larvae and replace you!

Queen



Drone

You are a drone, the only male in the hive! About a week after emerging from your cell you are ready to mate with the queen. However, once you have mated with the queen you have served your purpose and died!

Drone

