

***Dedicated
to Reducing
Pesticides***



**University of
Connecticut**
College of Agriculture
and Natural Resources
Cooperative Extension System

Enrichment Lesson 1: Making a “Bee”line

Focus Areas: Animal Lifestyles; Science, Physical Education

Focus Skills: understanding patterns, conducting an experiment, role playing, cooperating to achieve a goal

Objectives

- To recognize that cooperative behavior is involved in successful social interactions
- To understand that bees are capable of communicating with one another

Essential Question

How do bees cooperate to find food?

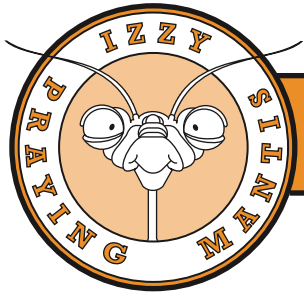
Essential Understanding

Forager bees use a pattern of movement combined with touch and smell to communicate the location of nectar to other worker bees responsible for providing food to the hive and ultimately humans too.

Background

Although bees have five compound eyes, they do not see as we do. Simply put, their sight is rather like a photographic negative because they perceive ultra violet light that we do not. In addition, they spend much of their lives in the dark hive. Therefore, when gathering information bees rely heavily on their senses of touch and smell, centered in their antennae. Pheromones, or scents, are used to identify hive members, give alarm warnings, control hive behavior, and even prevent development of new queens! In addition, smell aids in the all important task of locating food sources.

When a successful forager bee returns to the hive, she carries on her body the scent of the pollen from her find. Upon arrival back at the

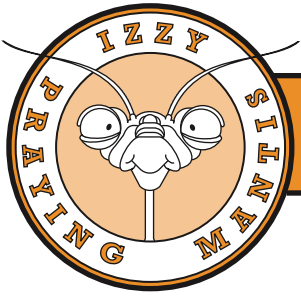


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hive, she goes directly to the platform at the hive’s mouth where other forager bees gather around her, touching her with their antennae and thus picking up the scent of the food source. Scent tells the bees what the forager has found, but not where it is! Bees combine pheromone clues with a unique series of movements called “dances” to “tell” fellow foragers where to find the nectar she discovered. Using the vertical side of the entrance platform, the returning forager begins one of two basic patterns. If the food source is within 100 yards of the hive, she moves in a circle, first one way and then the other while shaking her abdomen and fluttering her wings. The pace of her movements indicates the quality and quantity of her find. This dance sends forager bees out from the hive in all directions seeking the nectar, which is nearby.

If the discovery is farther afield than one hundred yards, a “waggle dance” is needed to add the vital information, distance and direction. Instead of a circle, the returning bee begins her gyrations with a half circle followed by a straight run up the vertical wall of the dance platform. The angle of this run is based on the sun’s position at the moment the dance begins and indicates the exact direction from the hive the departing bees should fly. Each straight run is followed by a half circle in the opposite direction so the pattern resembles a figure eight. The length of the dance indicates distance from the hive with approximately 330 feet being added for every 75 milliseconds danced. The vigor of the dance and accompanying buzz indicates quality and quantity. Not all the bees attend the dance for its duration. Depending on age and foraging experience, bees determine the message of the dancer and take off on their search and find mission. This insures not all the foragers will end up harvesting nectar from only the one source found by the dancer. Other sources found along the way in the direction indicated by the first straight run will be found by bees leaving the dance early, thus insuring maximum harvesting of nectar!

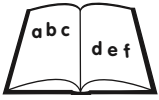
Finally, two other dances may be used in connection with supplying food. When more foragers are needed in the field, worker bees otherwise occupied are approached head on by a forager who shakes her abdomen side-to-side indicating they’re needed on the dance floor.



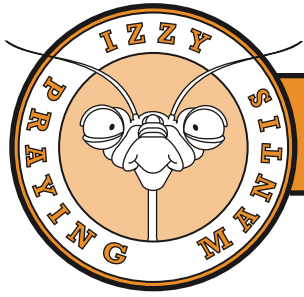
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As many as 20 bees per minute are recruited in this way. Similarly, when returning foragers have more nectar than they can process into honey, non-foragers are approached and “told” to report to pollen processing duty. This dance involves a quiver of the entire body while rocking forward and backward. For such tiny-brained invertebrates, honey bees show remarkable communication skills!

Vocabulary



abdomen	the third and largest segment of an adult insect's body
circle dance	the pattern of circular movements performed by a forager bee to indicate a nearby pollen source to others of her kind
forager bees	female worker bees who are responsible for providing nectar to the hive
hive	the place, natural or man-made, where bees live
nectar	a sweet liquid secreted by plants and used by bees in the production of honey
pheromones	a scent produced by bees affecting the hive's activities and behavior
pollen	a powdery substance produced by flowers and used by bees in the production of food
waggle dance	a series of movements resembling figure eights used to indicate direction and distance to nectar sources at some distance from the hive



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Logistics



Time: 40 minutes (**Follow Up** may be done in a separate session; two 20 minute sessions)

Group Size: 10 to 30

Space: a large open area (a playground or gymnasium) is preferred

Materials



large paper, silk, or plastic flowers, one per group of 5 to 6 children

snack bags with 5 to 8 pieces of honey comb cereal covered opaque containers (film canisters work well), 2 per group

cotton balls (8 per group)

peppermint, lemon, banana, and vanilla extract, cinnamon, vinegar, (as needed, one scent per group)

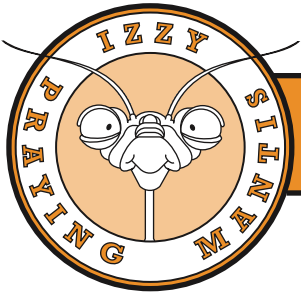
Video *The Magic School Bus: In A Beehive* * (if not shown previously)

* single copy provided

Preparation



1. Gather the materials listed above.
2.
 - a. Dip eight of the cotton balls in one of the scents.
 - b. Place two cotton balls in one container and the remaining six in the second container.
 - c. Cap both containers tightly.
 - d. Tape the two containers together lightly to prevent mix-ups.
3. Repeat container preparation (2a through 2d) using a different scent each time until enough sets are ready to accommodate each group.



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Activity

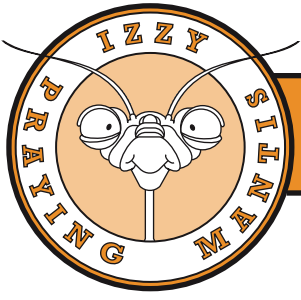


Introduction

1. Ask if anyone knows what bee food humans also like. (honey)
2. Explain that bees make honey from **nectar** found in plants.
3. a. If previous lessons have been done, review what a **social insect** is and remind the group that only some bees are responsible for finding food for the hive.
b. If previous lessons have not been done, take this opportunity to show the video, *The Magic School Bus: In A Beehive* and explain that social insects work together to provide for basic needs. Every insect has a special job to help the group.
4. Ask the group to pretend they are a bee who has found a huge field of flowers and ask how they would let other members of their food finding team know about their discovery. (accept suggestions)
5. Eliminate those suggestions not possible for bees (example: draw a map) and focus on “tell the others.”
6. Tell the group that they are going to become **forager bees** and discover how bees really “tell” other members of their hive about what they have found.

Involvement

1. Demonstrate the bee dances with the group.
 - a. Have the group form a circle and circle left one full turn; then right while wiggling and flapping their arms bent at the elbows with hands under armpits.
 - b. Explain that this “circle dance” says that there are flowers within 100 yards of the hive.
 - c. Tell the group to go faster and explain speed tells the bees how many flowers are in this location. The faster the dance the more **nectar** there is!
2. Call “Halt” and have the group sit.
3. Debrief the group by discussing what they know about the



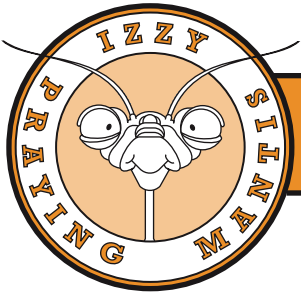
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location of the flowers. (They are close and, in general, how many there are.)

4. Ask what the bees will do now. (Fly off in all directions to find the flowers)
5. Ask what else the bees may need to know if the **nectar** is miles away from their hive. (in which direction to fly)
6. Tell the group they are going to learn another dance, the "WAGGLE", which allows bees to show the direction of the flowers from the hive.
 - a. Tell the group to stand and circle to the right while wiggling. When they have moved half way around the circle, call "Halt."
 - b. Tell them to move by taking 3 steps in a straight line toward the center.
 - c. Resume the dance to the left for a half turn and take 3 more steps directly toward the center.
 - d. Call "Halt" and have the group sit.
7. Ask what was different about this dance. (They only circled halfway around and then went in a straight line.)
8. Repeat this dance, but instead of moving toward the center, move away from the center in a straight line.
9. Have group sit:
 - a. Explain the straight line part of the dance shows the direction, N, S, E, or W in which the bees should fly to find the flowers. The dancer bee moves in the direction her teammates should fly.
 - b. Draw the pattern of the dance where the group can see it, and call attention to the resemblance it has to a figure 8.
10. Call on a volunteer to perform this waggle dance while the group watches.
11. With the group in a circle sing and move to "BEE lines" TUNE: *I Have Something in My Pocket*.

When I find some yummy nectar whether near or far away
I let my "bee buds" know it in a very special way!
I wiggle and I circle, beat my wings with all my might.
Then I run straight as an arrow so they'll get direction right!



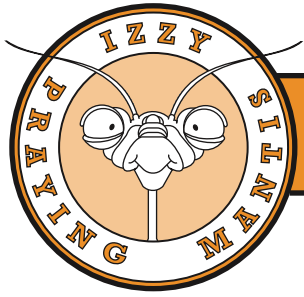
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When I dance a simple circle, the nectar is close by
But when I dance in figure eights they may have miles to fly
I wiggle and I circle, beat my wings with all my might.
Then I run straight as an arrow so they’ll get direction right!

Follow Up

1. Divide the group into food finding teams of 5 or 6 members.
(This may be done most easily by having each child draw a color coded construction paper piece numbered 1 through 5.)
 - a. Explain that each color represents a team of forager bees and that they will be looking for nectar.
 - b. Show them the flowers and tell them nectar is in flowers; different flavors in different flowers.
 - c. Ask how they would tell a rose from a lilac if they were blind folded. (touch and smell)
2. Show the group the covered containers and tell them that bees use smell to find exactly the right flowers described by the bee dance. To do this, they touch the dancer while she is dancing with their **antennae** and pick up the smell of the flowers the bee is “telling” them about. Tell them that they will watch a dance and smell the nectar and then try to find the flower described.
3. Each team’s members choose a number 1 through 5 to determine the finder bee on each team. (#1)
 - a. Give this child a flower and the two containers holding the cotton balls.
 - b. Tell these **forager bees** to hide their flower with one container (cap on) somewhere in the designated area. The flowers should be partially visible and at least 40 steps away from every other team’s flowers.
 - c. Remind them they have to remember exactly where the flower is because they will have to give directions to their team mates by running in a line toward it during the “waggle dance.”
4. Ask all but the finder bees to sit in a circle with their eyes shut and covered with their hands while the flowers are hidden.
 - a. Explain to the remaining members that when their finder bee returns, they will:





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- i. Smell the scent of their flower.
 - ii. Watch the dance to learn the direction they must go to find it.
 - b. Remind them that they must match the flower to the smell, finding any flower is not enough.
 - c. When they find a flower;
 - i. They should smell the cotton ball in the container.
 - i. If the smell matches the smell the finder bee gave them, they remove a cotton ball and return to their circle.
 - ii. If it is a different smell, they recap the container and keep looking.
5. When all the flowers are hidden, ask the teams to form a circle around their finder bee. These circles should allow space for the “WAGGLE DANCE” and have space between them.
6. The finder bee uncaps the second container and allows the team members to smell the cotton balls. She/he then does the “WAGGLE DANCE” indicating the direction of the flower from the circle by making a straight run of several steps toward it between circling right and circling left.
7. When the team members think they know where to find their flower, they may leave the circle to find it. The finder keeps repeating the dance until all team members have left to search.
8. As team members return, they check their smell with the canister of the finder bee. If it matches, they sit with the finder. If it doesn't they must go to other finder bees until they find the scent that matches the one they picked up.
9. When all bees have returned and are sitting with a group, distribute the honeycomb snacks.
10. Check to see how many teams have all their members, and how many teams have only their members. Record the results where the group can see them using hatch marks. Explain that finding other flowers happens to real bees too and that a bee who finds a flower with different NECTAR would return to the hive and do their own dance!