



4-H Honey Bee Youth Project Book I

The Buzz about Bees: Honey Bee Biology and Behavior



Virginia Cooperative Extension

Virginia Tech • Virginia State University

The beekeeping project (Books 1 - 4) will teach you the basic biology and behavior of honey bees and give you hands-on management skills. The honey bee project books begin with basic honey bee and insect information (junior level) and advance to instruction on how to rear honey bee colonies and extract honey (senior level). These project books are intended to provide in-depth information related to honey bee management, yet they are written for the amateur beekeeper, whether or not you have previous experience in rearing honey bees.

Notes

- Keep a project record-book containing answers to each activity to turn in at the end of your project.
- The resources needed for all activities in this project book might not be available in your area. If this is the case, contact your leader or Extension agent for alternative activities.

Caution

- If you know you have an allergy to bee stings, you might want to take special precautions during this project.



Introduction

Royalty fighting to the death, troves of golden treasure, thousands of slaves building massive edifices under the direction of a queen, and daring quests for the “food of the gods”; such mesmerizing tales of valor and adventure originate not from medieval Europe, ancient Greece, or the pyramids of Egypt but instead derive from a seemingly inconspicuous yet important insect: the honey bee. Honey bees are complex, fascinating insects. Managing honey bees can be fun and profitable. The Honey Bee Project Books are intended to train you in the ancient art of beekeeping. We begin by introducing you to the honey bee’s biology and foraging behavior then the dynamics of the honey bee colony. Our ultimate goal is to initiate you into the world of honey bee management.

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The Buzz about Bees: Honey Bee Biology and Behavior

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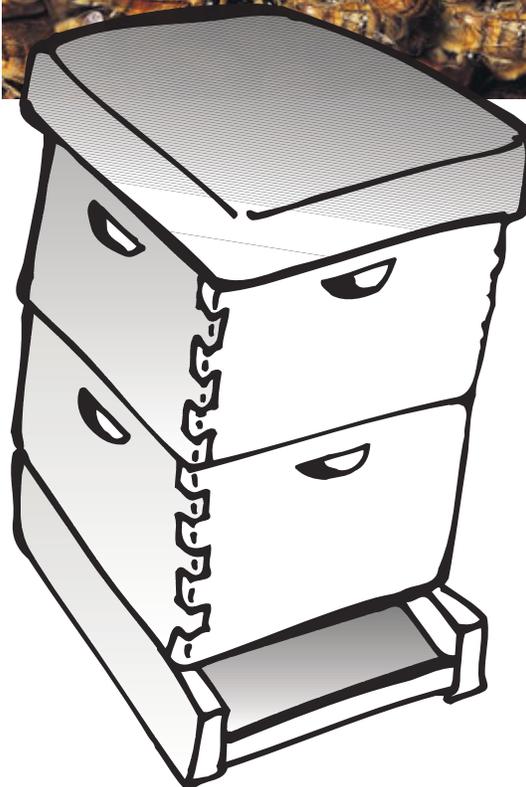


Chapter 1

A Bee in the Field Is Worth Two in a Hive:

The Importance of Bees

As you work through this unit, it is important that you understand the significance of the honey bee to our agricultural system. Honey bees produce honey, which is a valuable commodity. However, the production of honey is by no means the honey bee's most important function. The value of the honey bee comes from its ability to enhance agricultural crop production. Honey bees are the farmer's favorite insects. Honey bees travel throughout the flowering fields, moving from blossom to blossom, carrying pollen from one flower to the next. This transport of pollen from flower to flower is called pollination. Pollination is what causes plants to bear fruit. Without the work of the honey bee our agricultural crops would suffer huge losses, as the plants would produce considerably less fruit and seed. Therefore, the honey bee's commercial value comes from the role it plays in the pollination of crops.

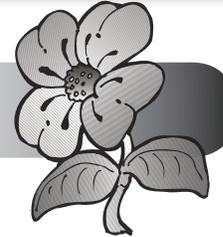




Life Skills

- Gathering Information
- Keeping Records

Activity 1-1: Food for Thought



BEE Informed!

Most people have no idea how dependent we are on bees. Much of what you eat is a product of bees doing what they do best: pollinating. If a food item originates from a plant that flowers, it may require bee pollination. In this activity, you will discover exactly just how dependent YOU are on bees for your daily meals.

BEEgin!

1. Make a list of food items you commonly eat. Find out if the foods you eat originate from flowering plants that require pollination from bees. Be careful! You may need to look into the basic ingredients that go into your foods in order to find out if they come from flowering plants.
2. Keep a log of all food you eat over a seven-day period. Record exactly what foods and how much of each food you ate in the Seven-day Food Log on the next page.
3. Find out how much each food item you ate costs at your nearby grocery store and record it on your log.
4. Find out about how many calories are in each item you ate. Most labels on foods tell you how many calories are in the foods you eat. Be sure to look at how many servings are on the label.

For example, if you ate one can of vegetable soup, the label may tell you there are two servings in each can. So you would need to multiply your calories by two.

BEE Thoughtful!

1. Which of the foods you ate require bee pollination?
2. How much money did you (or your parents) spend on foods that are bee pollinated?
3. What percentage of your calories originates from foods that require bee pollination?
4. Finish the following sentence: Each week, bees are worth _____ to me.
5. How did record-keeping help you collect and analyze the information needed?
6. Discuss another topic of interest that gathering information on would help you better understand.
7. Come up with a menu of meals for one week that would not include any bee pollinated foods. How does this menu compare to what you normally eat? Is it healthier or less healthy? Why?



Seven-day Food Log



	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Breakfast							
Lunch							
Dinner							
Snacks							

Life Skills

- Practicing Creativity
- Completing a Project



Activity 1-2: Migrate, Pollinate, or Bust!



BEE Informed!

In order for many crops to produce their fruits, bees must pollinate their flowers. In agricultural settings where large populations of bees are needed, beekeepers may actually be hired to bring their beehives temporarily to the farmers' fields. These beekeepers, sometimes called "migratory beekeepers," will move their bees from state to state for pollination or honey production. Some local beekeepers may rent their hives to different growers and thus move hives from field to field, but generally move them back to a base location. Through this activity, you will learn to appreciate the life of a "migratory beekeeper."

BEEgin!

Situation:

Your name is Gulliver. You are a honey bee in a hive of a migratory beekeeper in your local area. A migratory beekeeper owns many beehives that he moves from one farm to another so the bees can pollinate the farmers' crops. You are excited about being a migratory bee because you love to travel!

Task:

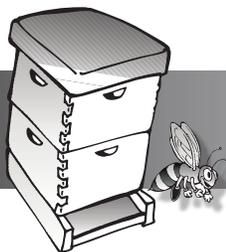
Knowing that bees in the summer only live an average of 4-5 weeks, write a timeline showing Gulliver's travels for this time period. What exciting landmarks (flowers) did you see? Where did you travel and when? Compile your timeline into a

short story titled, "Gulliver's Travels: The Adventures of a Migratory Bee."

1. Using resources such as the Internet and your local Extension agent, find out which crops are grown within about a 50-mile radius of your home. Which of those crops need pollination by bees?
2. Find out, using resources at your local library, on the Internet, and from your local Extension agent, when the bloom times (the time of the year when the crops are flowering) are for the crops in your area.
3. Now create your timeline and write your story. Remember the 4-5 week life span!

BEE Thoughtful!

1. Who or what was your best source of information to accomplish this task?
2. Why was it important to create a timeline first? How did a timeline help you organize your tasks?
3. If honey bees were confined to one area of your county, how would this affect the crops across the entire county?
4. In this activity you had to use creativity to construct your story. How can you creatively share this story to inform others?



Did you know?



It's Time to Move On

Swarming is the natural method bees use to create new colonies. Each swarm contains several thousand worker bees, a queen, and several hundred drones. When the hive, especially the brood nest area, becomes crowded, the bees build “swarm cells” (new queen cells) and the old queen leaves with a swarm. The swarming bees cluster at a nearby site. They then seek out a new nest location to start a new hive. Beekeepers try to prevent swarming in their hives by giving the bees room to expand the hive and ensuring that the colony has a productive queen. Beekeepers may decide to increase their beehives by dividing the strongest colonies into two or three. Beekeepers may also increase their hives by buying packages of bees or nucs (small nucleus or starter hives). Some beekeepers also collect “wild” swarms from trees and buildings. Or they may get them from other apiaries (groups of bee hives tended by beekeepers).





Life Skills

- Understanding Systems
- Reasoning

Activity 1-3: There's a Bee in My Bonnet

BEE Informed!

It is the act of collecting nectar and pollen that makes the honey bee such a great pollinator of agricultural crops. As the bee moves within the flower, the dusty pollen (located on the anthers or the male parts of the flower) will stick to the hairy legs and body of the bee. When the bee leaves one flower and flies to another of the same species, the pollen on its body will be brushed onto the female part (pistil) of the new flower. Placing the male pollen on the female pistil is called pollination. It will cause the flower to bear fruit. Bee-aided pollination greatly increases the yield of many crops that would have to rely on accidental pollination by the wind if there were no bees present. In this activity, you will learn about flowers and their structures.

BEEgin!

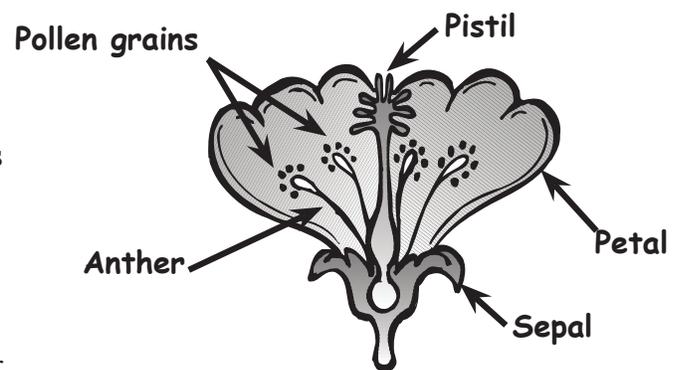
1. Find or buy a flower. Carefully separate the parts of the flower. Identify the following parts: pistil, petal, and anthers. Draw the structures you find in the space on page 11.
2. Tap the anthers onto the palm of your hand. You may be able to see the pollen left behind on your palm.

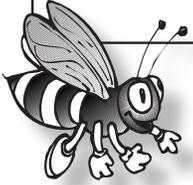
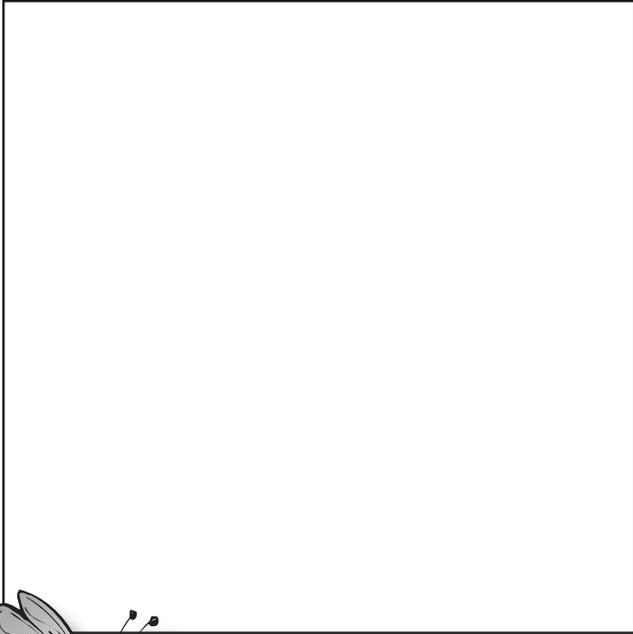
BEE Thoughtful!

1. Why is identifying the parts of the flower difficult when you have only the above drawing as a guide?
2. Why is it important to be familiar with the parts of the flower?
3. What would happen if none of the flowers on the plant had anthers? Pistils? Petals?

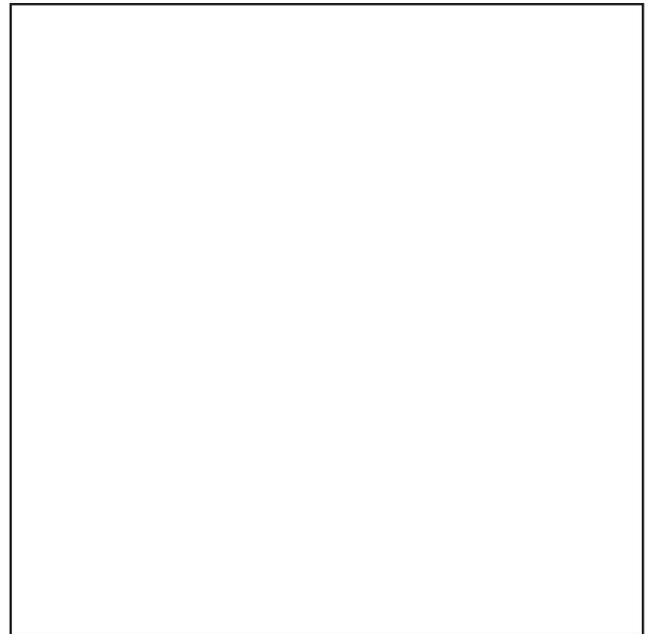
BEE Creative!

Take photos of your favorite flowers and past them on this page. Show the flower parts when possible.

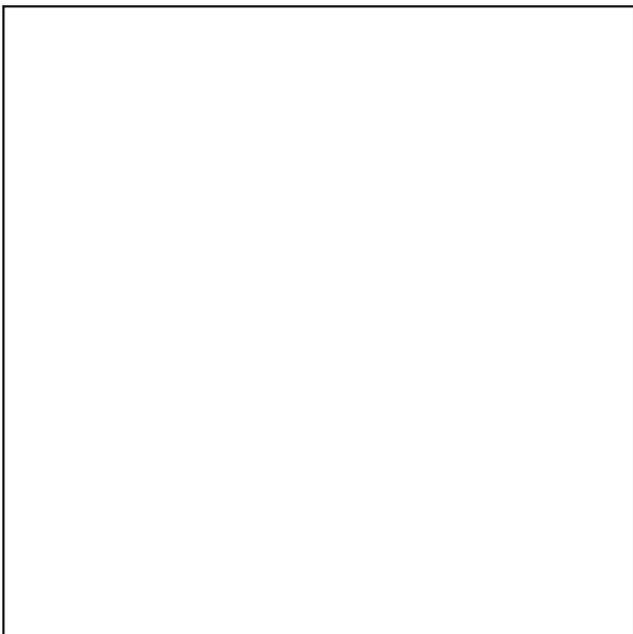




Pistil



Anther



Petal

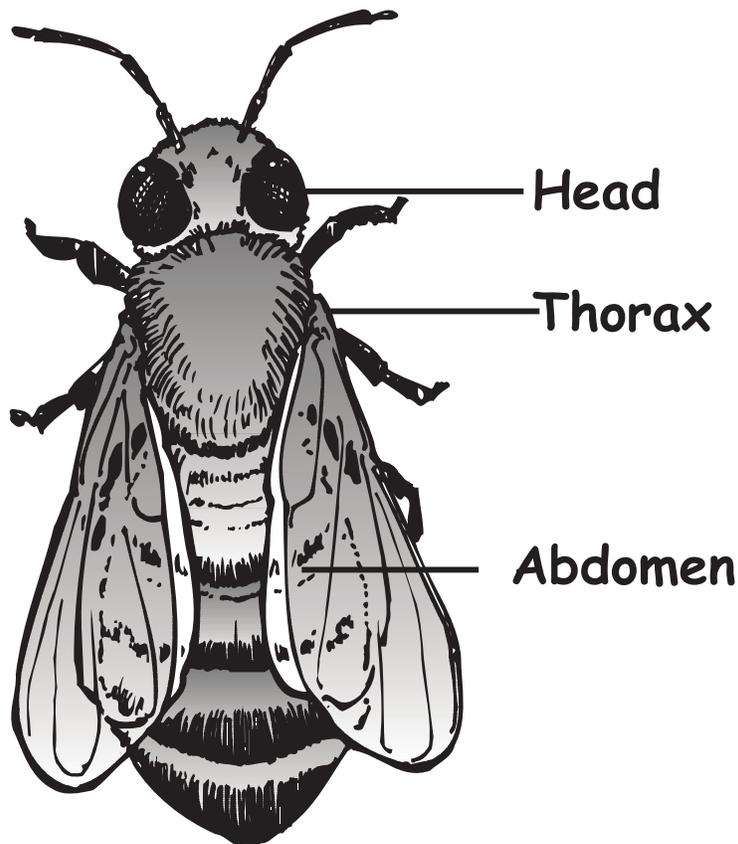


Chapter 2

The A, Bee, Cs of Bees:

Basic Bee Morphology and Development

Like the praying mantis, cockroach, and butterfly, the honey bee is an insect. Insects are a group of animals that share several characteristics. First, insects have a hard skeleton on the outside of their bodies (called an exoskeleton). This exoskeleton covers the three insect body regions: the head, thorax, and abdomen. Second, insects have six legs and four wings connected to their thorax and a pair of antennae on the head. The antennae are used to detect odors and vibrations. Learning the names and functions of the parts of a bee's body will help you better understand bee behavior and biology.



Life Skills

- Critical Thinking
- Problem Solving



Activity 2-1: A Head and Thorax above the Rest...

BEE Informed!

Not only do bees have all of the characteristics of a basic insect. They also have specialized body parts that allow them to do what they do. Some of these body parts include a sting, a corbicula, a proboscis, and a lot of hair. In this activity, you will learn about the body of a bee and determine how these structures help the bee be successful in nature.

BEEgin!

- Using resources at your local library or on the Internet, find out the function of the following bee body parts:
 - Corbicula
 - Hair
 - Proboscis
 - Sting
- Given the following environments, design an insect that would survive well in that particular environment. You can both draw the insect and label its specialized body parts or simply describe in written words how the insect looks. Remember that this is an insect, so it needs to have six legs, three body parts (head, thorax, and abdomen), wings, and antennae.
 - This particular insect lives most of its life in and around fast moving, cold rivers. Its main food source is other small aquatic insects.

- This particular insect lives underground in cool, wet forests. Its main food source is fungus and wood.
- This particular insect lives in the desert. Its main food source is the small fruits produced by cacti.

BEE Thoughtful!

- How do the body parts of a bee help it survive in its environment?
- What new body parts could you add to a honey bee to make it better suited for its environment?
- In which type of environments would bees not do well? Why?
- If you were a bee, which body part would you find most helpful? Why?
- How are you, as a human, suited to your environment?

Life Skills

- Understanding Systems
- Decision Making



Activity 2-2: My Aunt Is an Ant

BEE Informed!

Insects are divided into groups (orders) that share similar qualities. Bees, wasps, and ants share many common characteristics. For example, many bees, wasps, and ants have a stinger (called a “sting” by entomologists and beekeepers) on the end of their abdomen, but not all sting. The members of this group also have clear wings with many veins, as do queen ants; and the front wing is larger than the hind wing. Honey bees, ants, and wasps belong to an order of insects called Hymenoptera. Taxonomists are scientists who name and classify living things into common groups. In this activity, you will compare the body of a bee to the body of several other insects and group them according to their common characteristics as if you were a taxonomist.

BEEgin!

1. Cut out the pictures on the back page of this book.
2. There are nine groups (orders) of insects and one group of non-insects represented in the pictures. Based on their physical characteristics, see if you can group together those pictures that belong in the same groups. Some groups will have more than one picture while other groups will only have one. The answers are at the back of this book.

3. Make a list of characteristics common to each group that are not found in the other groups. You may wish to refer to a book about insects to find out what differences there are between groups.

BEE Thoughtful!

1. What characteristics does the bees’ group have that the other groups do not have?
2. Which group was not an insect? Why?
3. What body parts did you look at to begin your classification?
4. Describe a situation in which you might need the knowledge you learned today.



Life Skills

- Observation
- Documentation

Activity 2-3: Oh! What a Cute Little Larva!

BEE Informed!

Bees go through complete metamorphosis during their development. This means that the immature (worm-like) bee (insect) looks and behaves very differently from the adult. Similar to the butterfly, the honey bee has four developmental stages: egg, larva, pupa, and adult. The eggs of honey bees are laid in wax cells within the beehive. After hatching, the immature, worm-like bee (called a larva) remains in the wax cell and is fed by the workers within the colony. After the larva reaches a certain size, worker bees cap the cell with wax and the larva spins a cocoon around itself and becomes a pupa. During the pupal stage the worm-like larva changes into the familiar adult bee. Finally, the adult bee emerges from the wax cell ready to help out in the beehive. In this activity, you will observe and study the metamorphosis of a fly. Flies, like bees, go through complete metamorphosis.

BEEgin!

1. Buy about one pound of hamburger at the store.
2. Place the unwrapped hamburger someplace out in your yard where you can watch it over the next few days. You may want to use the following suggestions:
 - Place the meat in an area where it won't bother anyone. The meat will begin to rot and give off a foul smell, so place it far away from your house and in an area far away from your neighbor's house.

- Place some sort of protective covering over the meat to keep cats and other animals away from the meat. You can use deer or bird netting. Just make sure that flies can still get to the meat.
 - You will see more flies if you put the meat out when the weather is warm.
3. Go and look at the meat every day for 10 days. Keep a journal of what you observe (i.e. bugs on the meat) each day.

BEE Thoughtful!

1. When did flies first come to the meat?
2. When did you first start seeing eggs on the meat? Draw what they look like in your journal.
3. When did you first begin to see larvae? How do they look and act differently from the adults? Draw what they look like in your journal.
4. Have you seen any pupae? If not, why do you think you can't see them? Where could they be?
5. Did you ever see adult flies emerging from their pupal cases? If so, describe what happened. If you haven't seen them, hypothesize what might happen, based on what you know. Research to verify or negate your hypothesis.
6. In what other activities is a keen sense of observation necessary?



Did you know?



Ouch! That Hurts!

Bee stings are not a problem for 99 percent of the population. However, some people are hypersensitive to bee venom and develop an anaphylactic reaction within minutes of being stung. A person suffering an allergic reaction must receive medical attention immediately (mild swelling can be an allergic reaction, but medical attention is not needed for that). Commercial bee-sting kits are available by prescription. The kits contain a preloaded syringe of epinephrine hydrochloride and antihistamine tablets. People who have increasingly severe reactions to bee stings should keep the necessary medications available at all times. Allergy medication can be carried to relieve the sting reaction in individuals who are not dangerously sensitive.

Fortunately, most people do not experience anything other than localized swelling, redness and pain as a result of being stung. The actual bee sting can simply be removed with a knife blade or fingernail by scraping along the skin surface. Immediate removal of the sting and the application of honey from the comb will soothe the affected area. Most beekeepers develop a tolerance to bee stings and their reaction is much reduced after being stung repeatedly.





Chapter 3

Let's Buzz up Some Support: Bees as Social Insects

You have probably seen honey bees or ants working together in large numbers either foraging for food or building a nest. Many members of the Hymenoptera live in large, extended family groups called colonies. Honey bees live exclusively in family colonies. Honey bees are, therefore, termed social insects. This is because different members of the colony have specific jobs (division of labor) that help the colony function as a whole. There are three kinds of bees in a colony: the workers, queen, and drones. In the summertime, a good colony of bees will have from 50,000 to 60,000 workers, 1,000 or more drones, and one queen.

Members of the bee colony.



Drones



Queen bee



Workers



Life Skills

- Understanding Community Relationships
- Critical Thinking

Activity 3-1: I'll Scratch Your Back if You Scratch Mine

BEE Informed!

Honey bees live in social groups in order to help themselves better survive the harsh conditions in which they live. By dividing up all of the different jobs in the hive (division of labor), bees are able to do things faster and more efficiently than if they were each trying to do it alone. For example, some of the worker bees act as nurses, feeding and taking care of the queen and larvae. Other bees build the honeycomb and clean the hive. Many bees are also responsible for foraging for food, which they bring back to the hive to feed the entire bee colony. It is important for bees to work together for the betterment of the colony.

BEEgin!

Situation:

You are the queen bee in your hive and need a little help. You have heard that the local daily newspaper, *The Daily Buzz*, has a classified ad section in which you can place ads for the help you need. The positions you need to fill are as follows: worker, drone, and a queen to replace you because you are retiring.

Task:

Using resources from your local library and from the Internet, write three 100 word "Wanted" ads for the newspaper that describe the positions you have open in your hive. Use researched information you have learned about so far.

BEE Thoughtful!

1. Why do you think having a division of labor supports a healthy bee colony?
2. Where do you see humans have a division of labor? How does it help humans? Give examples of effective human division of labor.
3. Describe what it would be like if there was no division of labor among humans. What would your life be like right now?
4. How can you use what you have learned in this activity to better organize your 4-H club?



Life Skills

- Conducting Research
- Drawing Conclusions

Activity 3-2: Food Fit for a Queen

BEE Informed!

Honey bees use pollen as a source of protein and nectar as a source of carbohydrate. However, there is another very special food consumed by honey bees: royal jelly. Royal jelly is a white, jelly-like substance produced from specialized glands in the head of the worker bee. This jelly has an important purpose: to feed larvae that are destined to be queens. The royal larvae are fed this substance during their entire five-day larval period. A similar substance is fed to worker and drone larvae but for only half of their larval period. The five-day feeding of royal jelly is what causes otherwise normal larvae to develop into queens. Royal jelly is also fed to the adult queen when she is laying eggs.

Royal jelly, like honey, is a product you can actually buy and consume yourself. Some people eat royal jelly hoping it will help cure various ailments or give them more energy. In this activity, you will find out the facts about royal jelly and decide if the health claims made about royal jelly are true.

BEEgin!

1. Find, on the Internet or using other resources, five companies that sell royal jelly. Contact them and ask what they feel are the benefits for people consuming royal jelly. Make a list of these benefits.
2. Contact the following people in your area:
 - A local Extension agent
 - A professor in your local state university who knows a lot about bees
 - A local nutritionist
 - A local professional beekeeper
 - Your doctor
3. Ask them the following questions and record their responses:
 - What is the nutritional value of royal jelly?
 - Do you think royal jelly does what the royal jelly companies say it does? Why or why not?

BEE Thoughtful!

1. Describe how easy or hard it was to find companies that sell royal jelly.
2. In what ways were the companies helpful/not helpful in answering your questions about royal jelly? Think like a scientist when you answer this question!
3. Why would you buy royal jelly?
4. Do you think royal jelly does what the royal jelly companies say it does? Why?

Life Skills

- Observations
- Making Comparisons



Activity 3-3: Who's Who in the Hive

BEE Informed!

The **worker bee** is a female with undeveloped reproductive organs so she does not normally lay eggs. She has several specialized glands for the secretion of scent, wax, and food for larval bees. Her tongue is very long for lapping up nectar. Her jaws (mandibles) are flat and designed to manipulate wax for building the honeycomb. Her sting is straight and barbed. Worker bees do all of the foraging for the hive and are, therefore, the agents of pollination. They also collect materials to use in hive construction. It is the responsibility of certain workers to keep the hive clean while other workers are responsible for air conditioning. The air conditioners fan their wings to keep the hive cool. Some workers feed and care for the queen. Other workers feed drones or the larvae confined in the comb cells. Workers guard the hive against intruders. Workers normally live for only four to five weeks if they emerge in the summer (working season). However, they may live as long as six months to a year if they emerge from the pupa in the fall or winter.

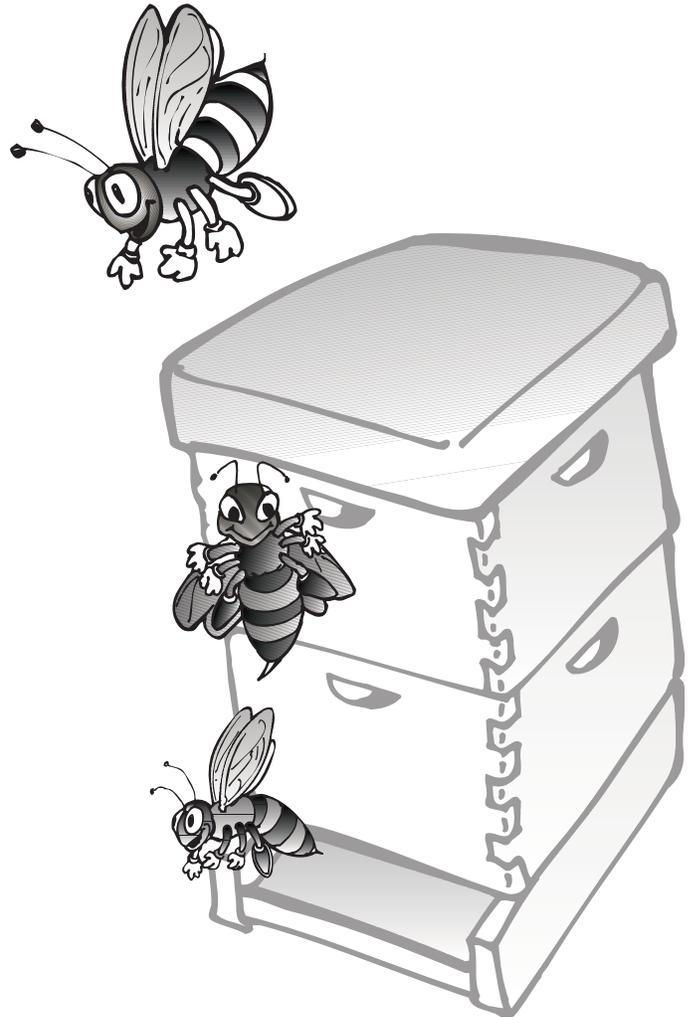
A **queen bee** has well-developed ovaries, and lays all the eggs in the colony. She lacks many of the specialized glands and pollen baskets of the worker, and her jaws are too small for manipulating wax. Her sting is not barbed but smooth and curved. She is the largest bee in the colony and has a long, pointed abdomen designed for egg laying. Her primary function is to lay eggs so that the colony can continue to exist. There is usually only one queen bee in the honey bee colony. The queen

is fed and groomed by the worker bees. However, they will cease to care for her if she fails to produce enough eggs. The queen does not rule the colony, but she regulates it. She releases chemicals (odors) from her body that maintain the social order in the colony. Without her, the bees become excited and disorganized, and the colony will soon die without a new queen. Queen bees usually live for two or three years, although some have been known to live for 10 years. Beekeepers usually replace the queen after one or two years.

Drones are male bees. They have large eyes that meet in the front of their heads. Their eyes and large bodies make them appear different from the workers and the queen. Their jaws are smaller and they have no sting. Drones are slightly smaller than the queen bee, but larger than the worker bees. Drones have heavy bodies and powerful wings. Drones have shorter mouthparts than workers and do not forage, so the workers must feed drones or the drones must feed from honey cells in the hive. Drones have no pollen baskets or specialized glands. The drones do no work in the hive; their only function in life is to mate with a virgin queen. Mating takes place outside the hive while the queen and drones are flying high in the air. The drones die immediately after mating. Colonies only produce drones during the spring and summer. Drones die at the end of the first summer season. Sometimes, workers can be seen dragging lingering drones away from the hive in the fall. In this activity you will learn how to identify the three castes of bees (queen, drones, worker) present in the beehive during a hive inspection.

BEEgin!

1. Contact a local beekeeper or professor of entomology and ask them if they have any observation hives. If they do, ask them if you can come and observe their hive. Remember that drones are not in the colony during the cold months. Therefore, it would be wise to observe during the summer.
2. Go and observe the hive for 30 minutes. Do the following while observing the hive:
 - Try to find all three castes in the colony.
 - Draw the three castes and note the differences among the three.
 - Make a list of any behaviors you saw or anything interesting you noticed.



BEE Thoughtful!

1. What was your first impression on seeing the hive?
2. What information that you learned about bees and hives did you notice immediately? What took a closer look?
3. What would happen to the colony if one caste was missing from the colony?
4. How does the activity in the hive compare to the activity in your school? In your 4-H club?



Chapter 4

Busy as a Bee: Basic Bee Behavior

There are a variety of activities taking place in the beehive, depending on the season. Workers perform almost all of the activities. Most of the time workers are collecting materials that will be used as food or for building the hive and comb. In order to perform their labors, bees have developed certain behaviors that allow them to survive. In this chapter you will learn about the basic behaviors you might see as you begin to work around bees.



Worker bee collecting water



Worker bee collecting pollen and nectar

Life Skills

- Planning and Organizing
- Wise Use of Resources
- Decision Making



Activity 4-1: All in a Day's Work

BEE Informed!

Worker bees spend most of their time foraging for materials needed in the colony. Workers collect four kinds of material for use in their hive: propolis, pollen, water, and nectar. Propolis is a kind of bee glue or varnish; it is usually a brownish colored material collected from the sticky leaf buds of certain plants. The workers use propolis to coat the walls of the hive, patch holes and cracks in the hive, and to strengthen the comb at the attachment point.

Pollen is the male sex cell of plants and is the source of protein and other nutrients for the growing bees. Pollen is collected from the flowers and carried in pollen baskets on the workers' hind legs back to the colony. In the colony the pollen will be used to feed the brood (immature bees). Pollen is stored in cells around the brood cells where young larvae are developing. Stored pollen is sometimes called beebread.

Water is used to dilute the honey that is fed to larvae and adult bees. Water is also used to cool and humidify the hive interior and to dissolve crystallized honey. Water is not stored in the hive and must be collected when needed.

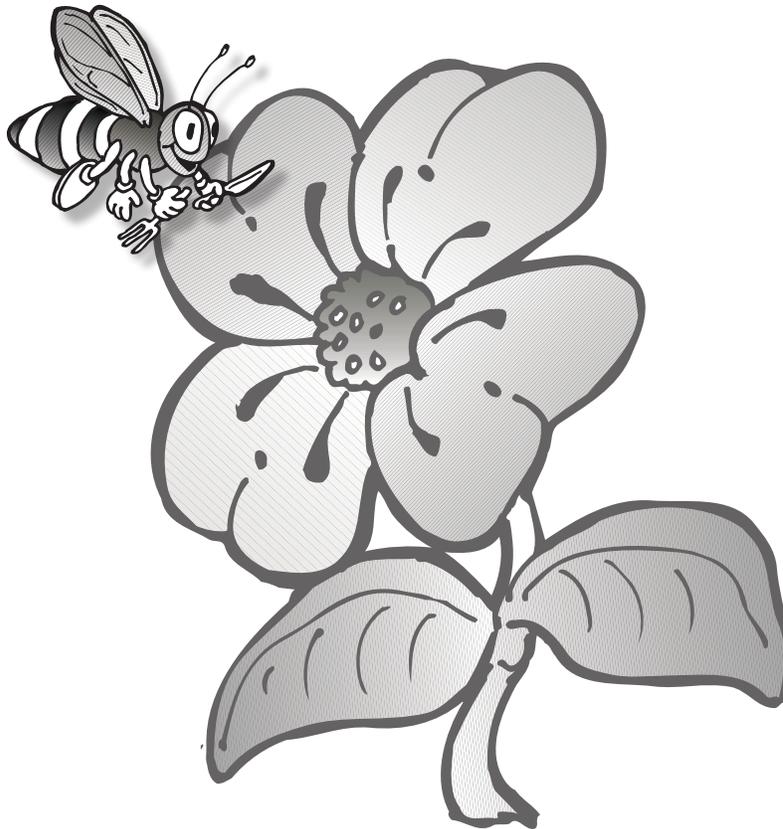
Nectar is a sweet liquid secreted by flowers of various plants and collected by bees to make honey. Nectar is a source of carbohydrates that the bees need for energy and flight.

BEEgin!

1. Find a map of your town or some nearby location. Make sure the map you are using uses a key that allows you to measure distances of one-quarter mile (~ 400 meters).
2. Using your map, locate all areas where water is found (i.e. lakes, ponds, rivers, streams, etc.) Lightly shade those areas with a blue highlighter.
3. Lightly shade all areas where flowers are found in the spring and summer (i.e. open fields, along river banks, in gardens, etc.) with a yellow highlighter.
4. Now, pretend you are a beekeeper and you have to find five locations where you can place your beehives. Mark a black dot on those places where you think you would be able to put your hives.
5. Bees normally like to forage within about 1,000 yards of their hive, but can forage at distances of several miles. Using a compass or a ruler, find out if the places you have chosen are within 1/2 mile of both a water source and a carbohydrate source (flowers). If not, can you find any other locations that fit with what the bees need?
6. What other considerations would you have to think about when deciding where to place your beehive? For example, are your beehives near any agricultural fields that might be sprayed with insecticides?

BEE Thoughtful!

1. Could you easily find suitable locations for your hives? Why or why not?
2. How did mapping potential locations by hand or a GPS unit help you determine appropriate locations?
3. Predict an outcome if your hives were located near agricultural fields that are sprayed with insecticides.
4. Deciding where to place your hives is important to the survival of your bees. What other decisions have you made lately that affect the survival of a living creature?
5. Deciding where to place your hives took a lot of planning. Map out another area of your life where you need to make an important decision.



Life Skills

- Logical Thinking
- Deductive Reasoning



Activity 4-2: A Whole New Ball of Wax

BEE Informed!

Worker bees are often seen building the honeycomb. Honeycomb forms the interior structure of the hive and is made up of six-sided cells. It is made of beeswax. The wax is secreted from four pairs of glands on the underside of the bee's abdomen. The workers remove the wax from their abdomens, chew it to make it soft, then use it to build the comb. Estimates vary widely as to the number of pounds of honey that bees must consume to make one pound of wax. Some authorities say two to four pounds; others say eight to ten pounds. The honeycomb is used for storing food, both honey and pollen. Another function of honeycomb is for rearing immature bees. The queen lays eggs, one to a cell, in the honeycomb. Inside the cell, the egg hatches and the

workers care for the young larva. Wax is used to cap both the brood cells (when the larvae pupate) and the honey cells (storage). The area in the honeycomb where the eggs are laid is called the brood nest. The brood nest is where you will find the bees densely clustered and the brood is reared. In this activity, you will gain an appreciation for the amount of work bees put into making their wax combs.

BEEgin!

1. Find or buy a candle made of beeswax.
2. Weigh the candle on a scale.
3. Fill in the chart below:

My candle weighed:	If bees had to eat 8 pounds of honey to make one pound of wax, then bees had to eat this much honey to make my candle:	If bees had to fly 50,000 miles to collect one pound of honey, then bees had to fly this many miles to make my candle:	If the circumference of the earth is 25,000 miles, then bees had to fly this many times around the earth to make my candle:
_____ lbs	_____ lbs	_____ miles	_____ times

BEE Thoughtful!

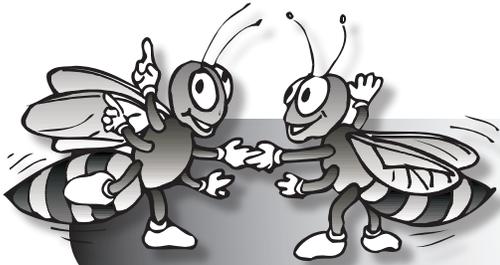
1. What, if anything, was the most difficult part of filling out the chart?
2. How is the effort a bee puts into creating the wax comb like the effort you put into the up-keep of your room or taking care of a pet?
3. How would you apply what you learned to develop a new word-type math problem about bees?
4. Create a word-type math problem and show how to solve it.

BEE Creative!

Cut out pictures of products that are made from beeswax from magazines or search the web. Glue them to this page.

Life Skills

- Communication Skills
- Relating to Others



Activity 4-3: Do You Wanna Dance?

BEE Informed!

One of the ways bees communicate is through a set of behaviors called dances. Bees tell each other where food resources are found by using these special dances. Two main types of dances have been recognized: the round dance and the waggle-tail dance. The round dance is performed to direct bees to food resources within about 100 yards of the beehive. Bees use the waggle-tail dance to indicate a food source found greater than 100 yards from the hive. In addition to distance, the waggle dance also gives information about direction from the hive. In this activity, you will discover how communication, even among humans, can be done non-verbally.

BEEgin!

1. Using resources at your local library or on the Internet, find out what the round dance and waggle-tail dance look like. How do the bees use these dances to show direction and distance?
2. Design a non-verbal way to communicate that allows you to share the following information with someone else:
 - What direction they should walk.
 - How far they should walk.

3. Teach someone else your new non-verbal language.
4. Now, test yourselves by playing a game. Try to hide something and see if you can direct each other to the hidden object using your new non-verbal language.

BEE Thoughtful!

1. As a human, is it easier to use verbal or non-verbal communication? More efficient? Why?
2. In what ways do humans use non-verbal communication to effectively communicate in their everyday lives?
3. What are three animals that use verbal/vocal communication? When and how do they do it?
4. What are three animals that use non-verbal communication? When and how do they do it?

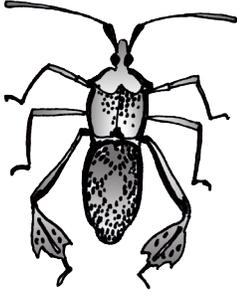
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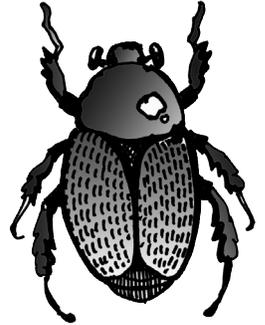
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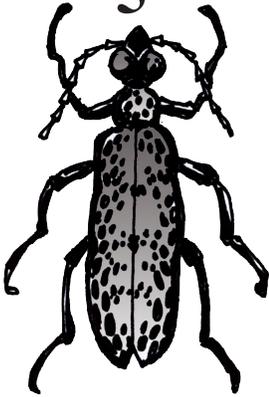
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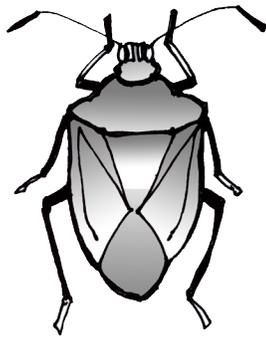
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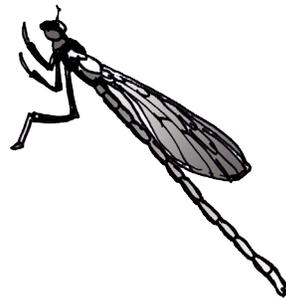
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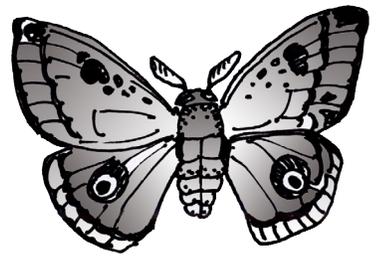
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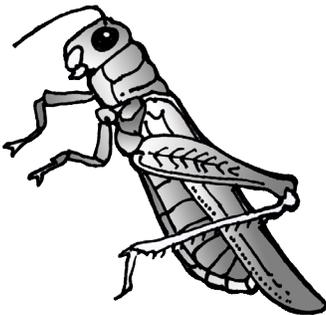
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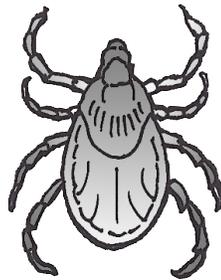
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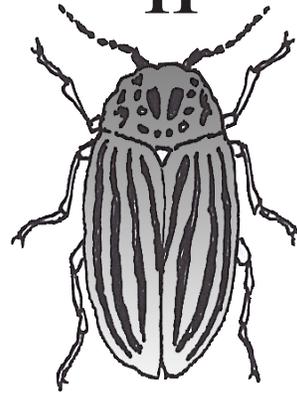
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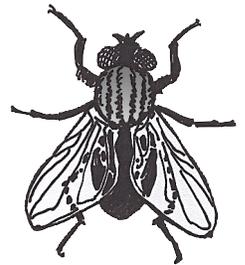
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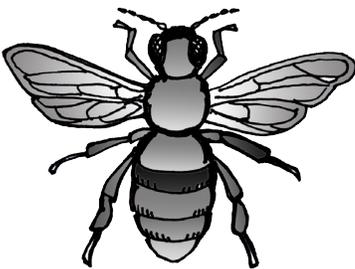
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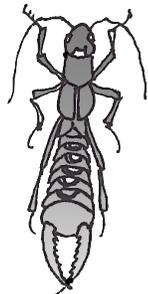
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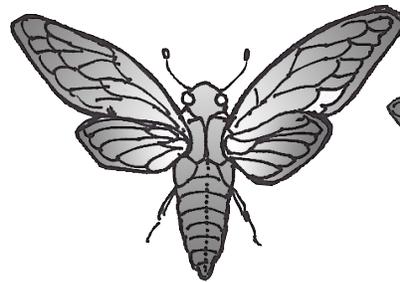
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