

The Buzz About Bees!

Student Booklet



Texas AgriLife Extension
Part of the Texas A&M University System



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Preface

The honey bee may be the most misunderstood insect. Many people are afraid of the honey bee because of its sting. Often a honeybee is called a bumblebee. Some think a bee is a wasp and some think a wasp is a bee. In addition to getting to know how to identify these insects, we need to learn how important they are to agriculture and our well being.

The U.S. Department of Agriculture estimates that approximately 36 percent of honey bee hives disappeared in 2007-2008. The loss of the honey bee population attracted a lot of attention because of the importance of honey bees to our food supply. Due to this unexplained loss it is important to get to know this insect better.

In this book we will learn the special body parts of the honey bee that help them do all the important jobs they have. We will explore the importance of honey bees' role in pollination.



*** All photos within this booklet taken by Travis Cole

Lesson 1 – Introduction to Honey bees

Reading Exercise:

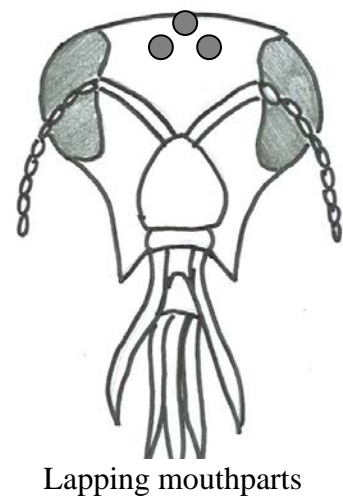
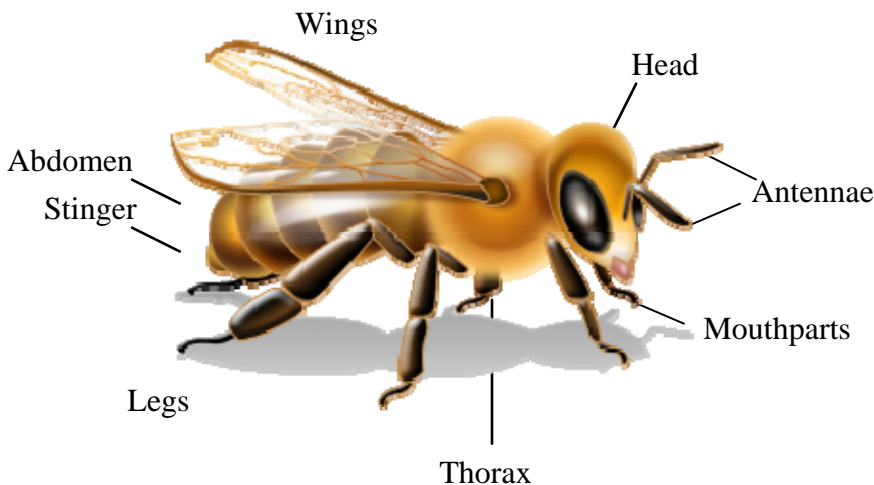
Honey bees are hairy **insects** that live in a **colony** made of wax. Insects are animals that have six legs, three body parts, and antennae. The three body parts of insects are the **head, thorax, and abdomen**.

The insect **head** has the **antennae**, eyes, and mouthparts. Antennae help insects communicate, smell, see, hear, and move around in the world. Bees have very large eyes to help them search for flowers. Bees also have **lapping mouthparts** that help them lick up nectar and pollen. Lapping mouthparts are like a tube with a tongue at the end. They move their tongue back and forth to lick up nectar. A bee has five eyes. They have three small eyes on the top of their head. They also have two large eyes on the sides of their head. The large eyes are called **compound eyes** and are made of up of many tiny eyes. It is like having many eyes in one. This helps the bee see in all directions at the same time.

The insect **thorax** is the middle part of an insect and holds the wings and legs. All insects have six legs, but only some insects have wings. Bees have two pairs of wings or four wings.

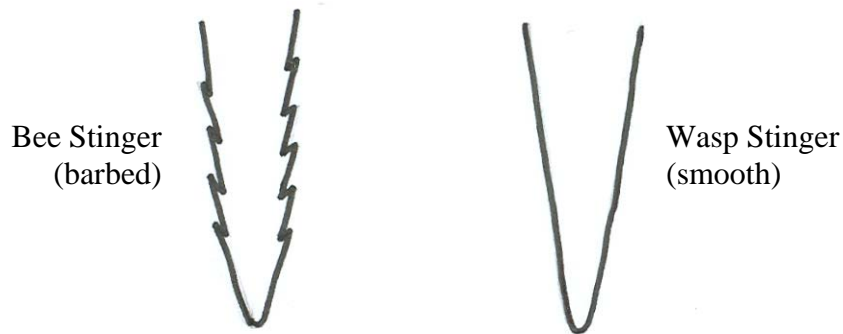
The **abdomen** is usually the largest part of an insect. In insects like bees, the **stinger** is found at the end of the abdomen. Only worker bees have a stinger. They use their stinger to protect themselves when they feel **threatened**. Many people are afraid of bees, but if you leave them alone, they will not hurt you. Bees sting when they think their queen, food, or nest is in danger.

Glossary Words
Agriculture
Abdomen
Antennae
Barbed
Compound Eyes
Head
Lapping Mouthparts
Thorax
Threatened
Stinger



When a bee stings something, it will lose its stinger and die soon. This is because bee stingers are **barbed**. When a bee stings, the stinger gets stuck and it is pulled out of their body. They cannot survive after this happens.

Wasps are different from bees because their stinger is smooth and does not get pulled out of their body when they sting. Wasps are also different because their bodies are smooth and hairless. Bees are extremely hairy.

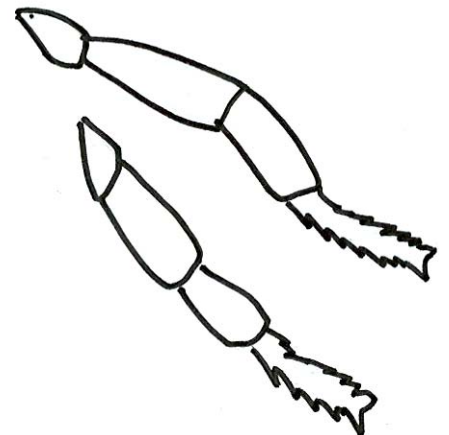
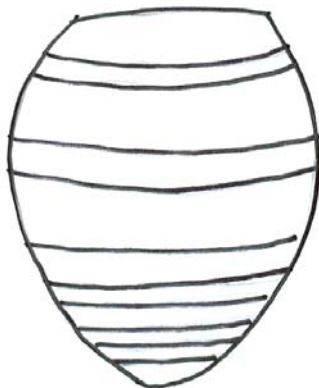
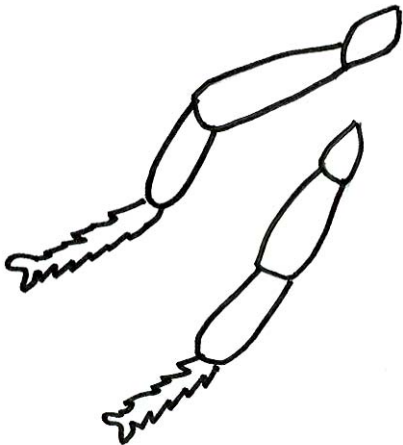
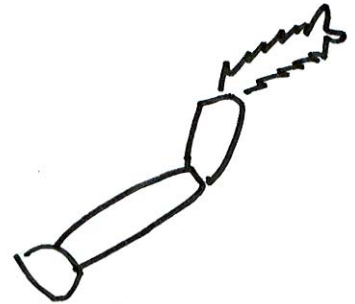
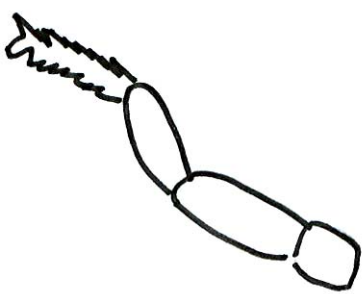
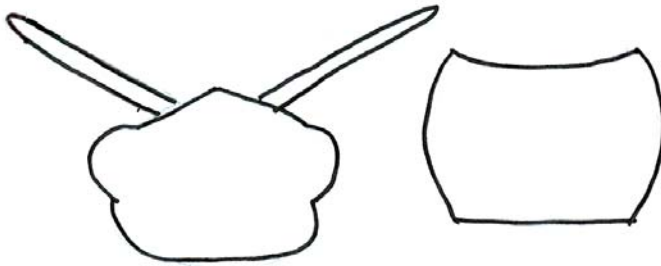
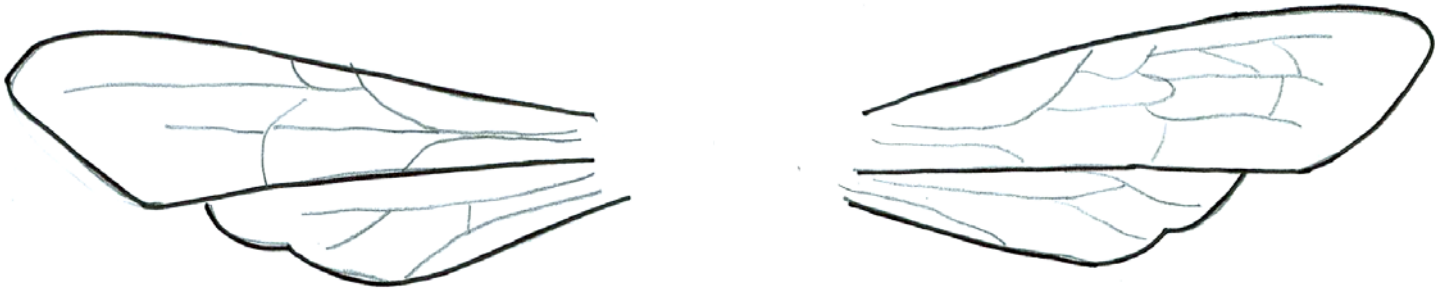


Bees are very important insects. Bees are especially important in **agriculture**. They help plants grow and give us all the fruits and vegetables we enjoy eating. Nearly everything we eat is possible thanks to bees!



Activity 1.1 – Build a Bee

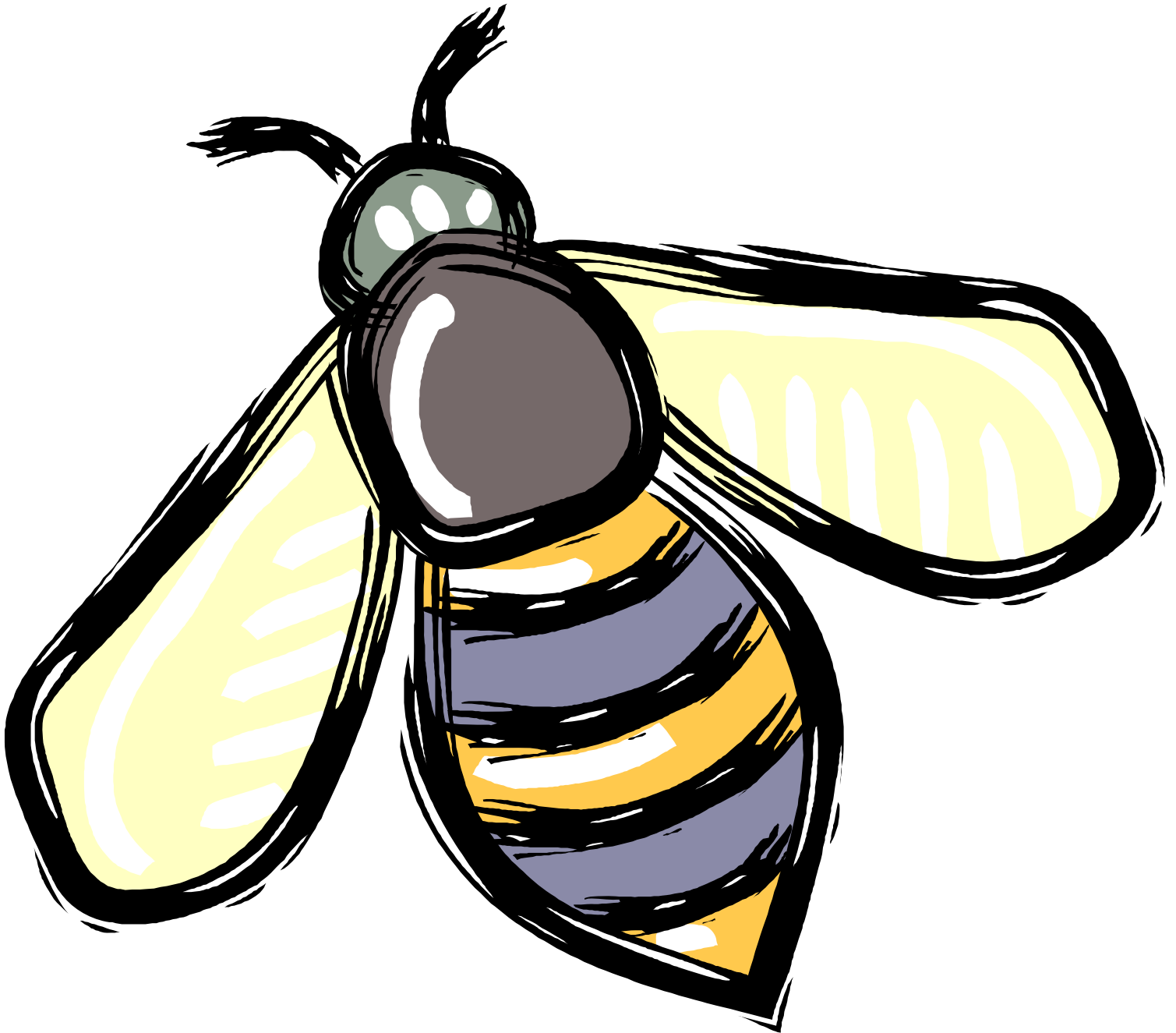
Cut out the body parts of the honey bee below and glue them together correctly to build a proper honey bee.



Activity 1.2 – Pin the Stinger on the Bee

Make a copy or cut out the picture below. The picture may be too small, so you may want to expand it on a copier.

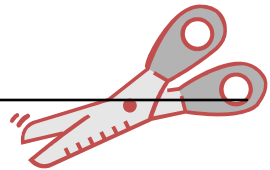
Cut out the stingers and make copies if needed. Color the stingers if you desire. Blindfold yourself and your classmates and try to pin the stinger on the bee. The student who gets the closest to the end of the abdomen is the winner!





Activity 1.3 – Parts of a Bee

Cut out the body part labels and glue them to the correct location on the honey bee.



Head

Thorax

Abdomen

Antennae

Eyes

Mouthparts

Stinger

Wings

Legs

Lesson 2 – The Honey Bee Caste System

Reading Exercise

The honey bee is an amazing insect. Bees are **social** insects. They live with thousands of other bees and one queen in a colony made of wax. Each bee has a special job and this is what keeps the colony alive and going strong. If the bees did not do their special job, the colony could not survive. When insects live in a colony and each insect has a job, this is called a **caste system**. The castes of the honey bee caste system include the queen, drones, workers, and brood.

Brood

Before any bee becomes an adult, it is part of the **brood**. The brood of the colony is made up of **eggs, larvae, and pupae**. This is a **complete lifecycle** because there are four stages. The queen lays eggs, which hatch into larvae. The larva's job is to eat and grow. Larvae are fed by workers and will shed their skin a few times as they grow. When they are ready, the larvae will shed their skin one last time and emerge as a pupa. The pupa prepares for life as an adult. When the pupa has rested and gone through all the changes it needs, it will emerge as an adult. There are three types of adult bees that live in the hive: **worker bees, drones, and one queen bee**.

Worker Bees

Worker bees are all **female**. Worker bees do all the work in the hive and they have many different jobs. A worker bee takes about 21 days to go from egg to adult and she lives about 6 weeks. Her job will change as she gets older. A worker bee has a very special body to help it do its job.



When worker bees first emerge from the pupa case, their job is to clean the nest. They are called **house bees**. House bees clean the nest for the first 2 days of their lives as adults.

Workers who are 3-12 days old work as **nurses**. Their job is to feed and take care of the larvae.

When workers are 12-17 days old, they are **construction workers** and build and repair the cells of the nest. They can make wax with special wax glands on the bottom of their abdomen. They have small spurs on the backside of the legs that they use to pull the wax off to be used for construction. They also store nectar and pollen brought in by other bees.



Glossary Words
Brood
Caste System
Complete Lifecycle
Construction worker bee
Eggs
Guard bee
Female
Forager
House bee
Larvae
Male
Nurses
Pollen basket
Pollination
Pupae
Queen
Worker bee

Guard worker bees are 18-21 days old. They protect the hive from enemies and invaders. They also inspect any worker bees entering the nest to make sure they are not from another colony. If they don't smell right, they don't get allowed in!



The oldest of the worker bees are called **foragers**. They are 22-42 days old and this is the last job they will have before they die. Foragers have the very important job of gathering nectar and pollen for the colony. They are the only workers to fly away from the nest. The reason the oldest workers are allowed to leave, is because they will die soon, and if they are killed while gathering food, it is not a big loss to the colony.

Worker bees have **pollen baskets** on their hind legs. When a forager visits a flower, it packs pollen into the pollen baskets. Next time you see a bee visiting a flower, look for the pollen basket. A full pollen basket is yellow and round. Pollen baskets are used to store pollen so the bee can carry as much as possible back to their hive. Sometimes pollen is picked up on their body and dropped off at another flower. This is called **pollination**.



Worker bees also suck up nectar with their lapping mouthparts. Parts of their lapping mouthpart are like a long tongue with a spoon at the end. They take the nectar back to the hive where they store it in a honey cells. Once the cell is full they cap it and the nectar will turn into honey.

Drones

The drones are the only **male** bees in the colony. They are bigger than the worker bees, but smaller than the queen. It takes them the longest to go from egg to adult – 25 total days. They are lazy and do nothing except eat and mate with the queen. Drones hatch in the spring and are killed off by worker bees before the winter months.



Queen

There is only one **queen** in a hive and she is the most important bee. She is the largest bee in the hive and lives the longest, but it takes her less time to go from egg to adult (only 16 days!). This is because she is fed a special diet of royal jelly. The queen does not have an easy life. She keeps busy laying eggs all day. A strong queen can lay up to one thousand eggs or more a day and can live as long as six years!

Activity 2.1 – Busy as a Bee

Within your group, cut out the castes (on the left) and job descriptions (on the right). Try to match the caste to the job description. The first team to correctly match all castes to their job description is the winning team.

Forager Bees

This bee is very lazy and does not have many jobs. It is usually killed off in winter months.

Queen Bees

Worker bees have this job for the longest period of time. They are responsible for feeding the brood and caring for everyone.

Construction
Worker Bees

These bees are the oldest. They are the only ones that leave the nest. Their job is to look for food to bring back to the hive.

Drone Bees

There is only one of this kind of bee. She lives the longest and is in charge of the entire colony.

House Bees

These bees are 18-21 days old. They protect the colony by inspecting bees that enter.

Nurse Bees

These bees are responsible for building and repairing the wax cells of the hive. They are 12-17 days old.

Guard Bees

These are the youngest worker bees. Their job is to never leave the nest and clean the hive.

Activity 2.2 – What Bee Am I?

Get into teams or groups (7 if there are enough students). Each team is a caste (queen, drone, house, nurse, construction worker, guard, or forager bee). Do not tell the other teams what caste you have been assigned. Each group must come up with a job description to tell to the class – do not slip and give away your job!

Within each team, designate a recorder and reader. The recorder must write down the job description. The reader will read the job description aloud to the other groups. Tape your job description up on the wall so that groups can re-read if needed.

Each group will then guess which type of bee each team is describing. Ballots can be kept secret until the end of the descriptions or guessed aloud during the course of the activity.

Example Ballot

Group (Student Names)	Description/Clues	Which Caste do you think they are describing?
<i>My team</i>		

Lesson 3 – Bee Dances & Bee Communication

Reading Exercise

Did you know that honey bees have a special language? Honey bees need to be able to communicate with one another to keep their colony organized and going strong.

One way honey bees communicate is through chemical smells, called **pheromones**. The queen bee uses pheromones to tell her workers what to do.

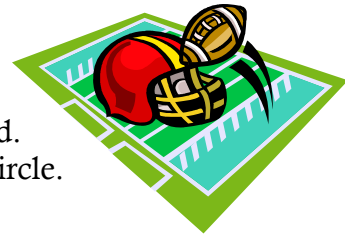
Bees also communicate using dances. Forager bees use special dances to tell other foragers where to find flowers with nectar and pollen or water. Scientists have discovered two main types of bee dances: the round dance and the waggle dance.

Glossary Words

Pheromones
Round Dance
Scout Bees
Waggle Dance

Round Dance

The round dance is used when food is only a short distance away from the hive. This dance is used when food is less than 35 yards away, which is less than half the length of a football field. When a honey bee does a round dance, they dance around in a circle.



Waggle Dance

The waggle dance is a little more complicated than the round dance. Honey bees use this dance when the food is further away from the hive. Honey bees move in a figure eight. They dance in a half-circle, then waggle their abdomens, then make another half-circle (see Figure 1). The farther away the food, the longer the honey bee will waggle.

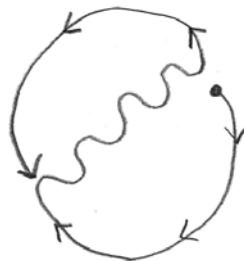


Figure 1. Waggle Dance

Honey bees also use the sun to help tell the direction of the food. The direction they point to when they waggle, tells the other forager bees where to go for the food. If they waggle to the right of the sun, then the forager knows to fly off to the right. If they waggle to the left of the sun, then the foragers know the fly off to the left.

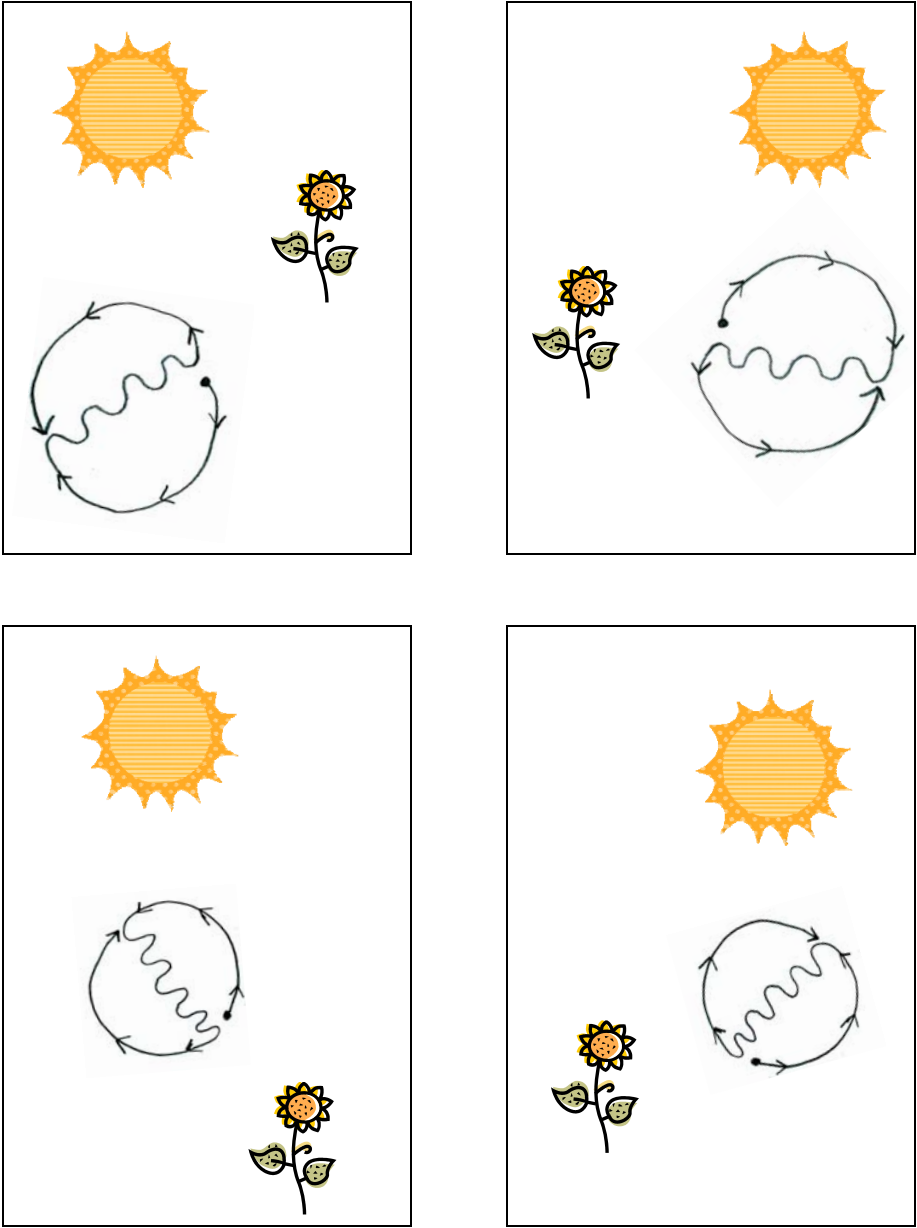
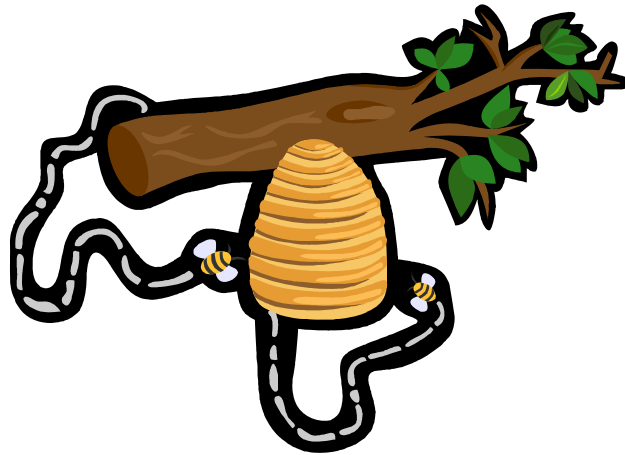


Figure 2. Examples of Waggle Dances

Scientists also believe that honey bees use their waggle dance if they find a great new place to build their hive.

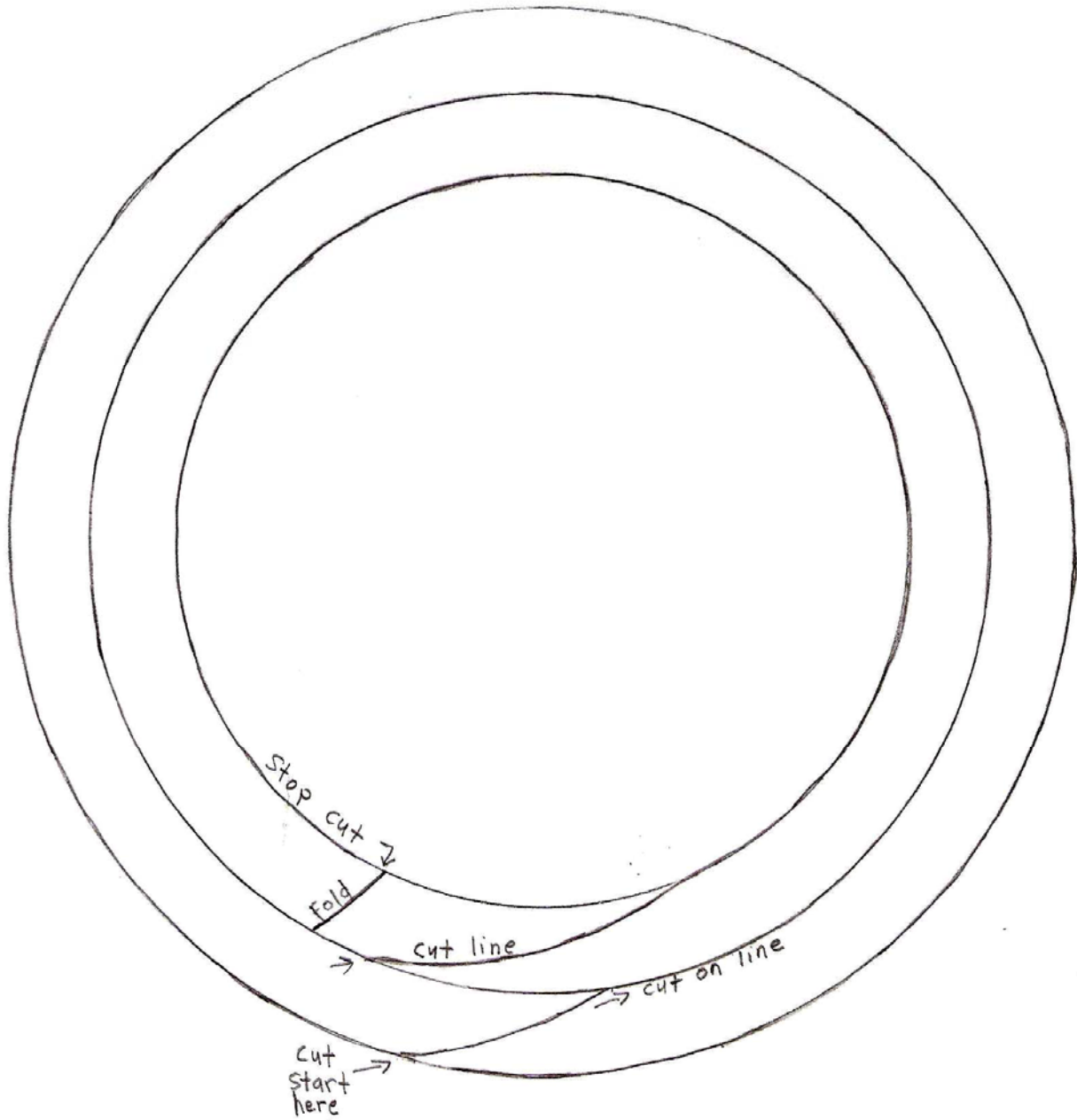
Sometimes bees out grow their hives. There are just too many workers to fit, and they need to find a larger place to live. If this happens, worker bees, called **scout bees**, will go looking for a new home. If they find one, they will come back to the hive and use the waggle dance to show the rest of the colony where to go. Other bees will visit the new home and then vote by dancing, until only one site is chosen!

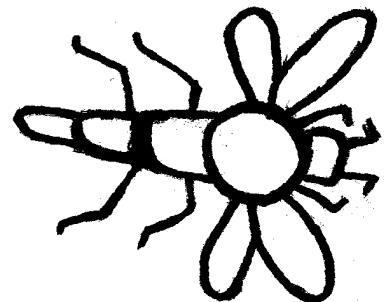
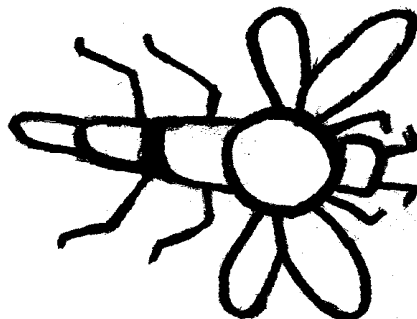
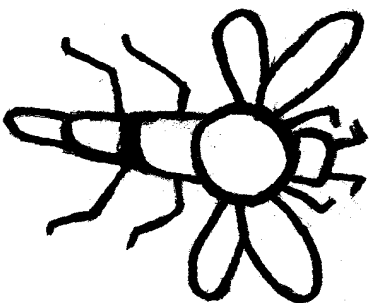
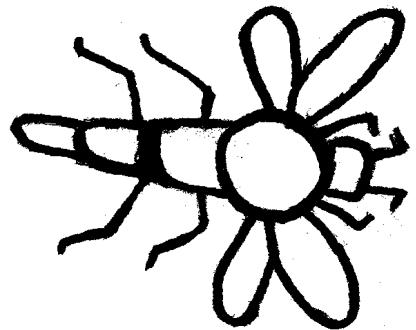
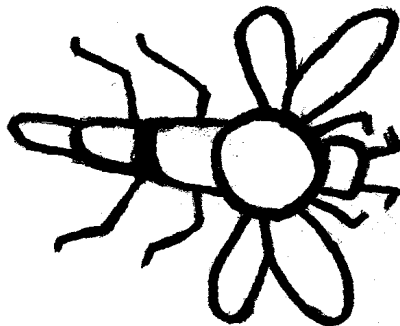
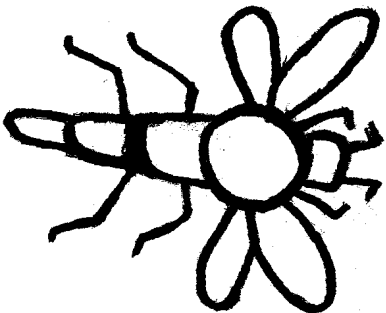
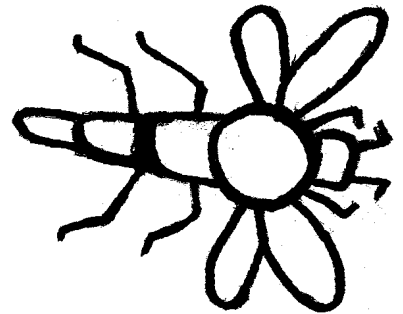
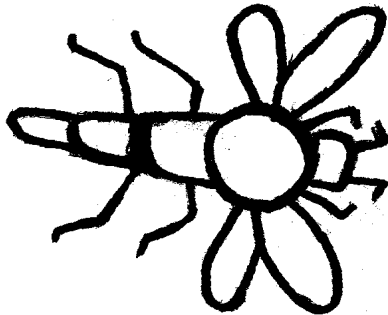
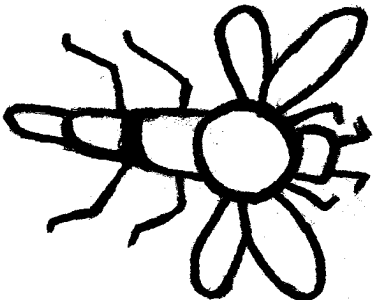
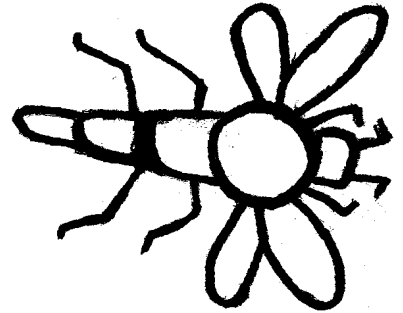
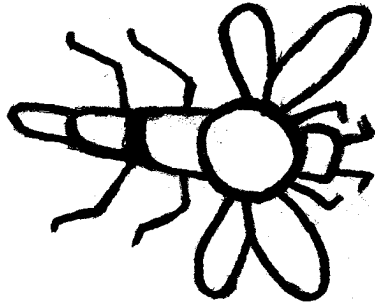
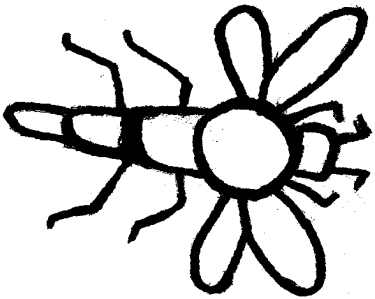
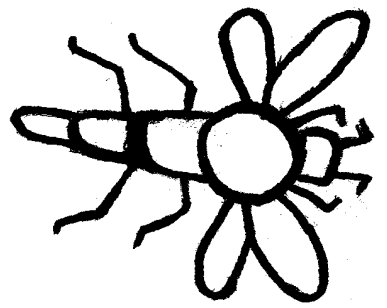
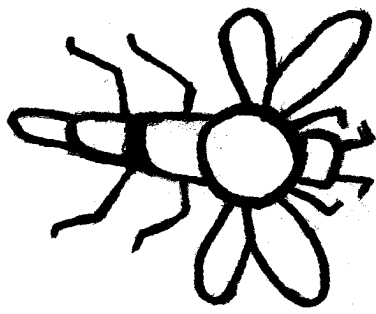
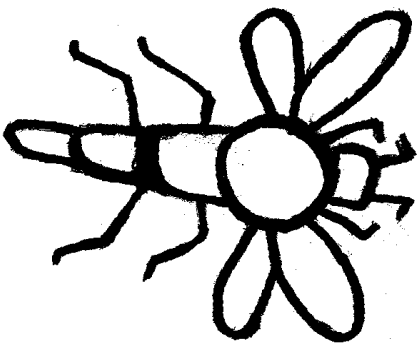
When the queen leaves, she does not always leave the nest empty. The queen will tell her workers to build a special queen cell and she lays an egg in it. That larva is fed only royal jelly by the nurse bees. This special food makes a queen bee. Half the colony will leave the nest with the old queen, and half will stay to take care of the new queen.



Activity 3.1 – Honey Bee Swarm

Cut out the honey bees swarm spiral using the template below, or making a three ring spiral of your own. It works best on card stock, a paper plate, or other thick paper. Color the rings blue like the sky and color the middle circle like the sun. Next, cut out the bees, color, and paste to the spiral.





Activity 3.2 – Waggle Dance

Materials Needed:

1. Paper bag or box (something that cannot be seen through)
2. Treats (something students would like / candy, toys, food, etc.)
3. Non-treat items (ie: stapler, rubber bands, pens, etc.)
4. An object that will represent the sun.

Instructions:

1. Place one to two treat bags and two or more non-treat bags randomly in the room. (Do not let students know which bag is which)
2. Choose a student to take the role of the forager bee.
3. Instruct the forager bee to peek into each bag. They must choose which bag they think the members of their hive will prefer.
4. The forager bee must then perform the waggle dance to instruct her hive where to search for food.
5. Be sure to use the sun to waggle the correct direction.
6. Choose one student who thinks they know which bag the forager is pointing them to.
7. If this student is correct, rearrange the bags and designate this student as the new forager.
8. Repeat as you like.

Lesson 4 - The Importance of the Honey Bee

Reading Exercise:



As the honey bees go about collecting nectar and pollen they play a very big role in helping crops make better fruit. Bee **pollination** makes about 15 billion dollars of food in the United States every year! Scientists say that one in every three bites of food we eat is possible because of honey bee pollination. That means, if we didn't have bees anymore, we would have 1/3 less food each day!

Glossary Words

Africanized bee
Beekeeping
European Honey Bee
Pollination

Honey bees also make it possible for us to have other agriculture products such as honey, bee pollen, bees wax, and royal jelly. Honey, bee pollen and royal jelly have vitamins, minerals, and other things that help keep us healthy. Bees wax is used to make soap, candles, and cosmetic products. Did you know the lip balm you use might have bees wax in it? A lot of makeup is also made of bees wax!



Even the venom of the honey bee can be used by humans. Bee venom that is used for diseases and illnesses is called bee **venom therapy**. It is used for helping with people diseases such as arthritis and Multiple Sclerosis.



Beekeeping is also a part of agriculture. The main thing used from beekeeping is honey, but beekeeping farmers also use their bees to pollinate orchards, farms, and other agricultural areas.

Almond growers or farmers have the largest managed pollination event in history! In about 22 days, 600,000 acres of almond orchards must be pollinated. This is impossible to do without bees. It takes more than half the honey bees in the United States - that is more than one million bee hives and 40 billion bees!



A beekeeper with his bee hive box.

The **Africanized bee** is a very aggressive type of bee from Brazil. It arrived in the United States in the 1990's. The Africanized bee is a cross between an African bee and **European honey bee**. Brazilian scientists were trying to make breed of bee that was very good at making honey and could live in warm environments.

One bad side effect of crossing an African and European honey bee is that they are very aggressive! Africanized bees feel threatened easier, and are quicker to sting. The good thing about Africanized bees is that they build their hives, combs, and store honey faster than European honey bees.



You should always be careful around honey bees, because you never know if they are European or Africanized bees. There is no way to tell the difference between European and Africanized bees with your eyes – they look exactly the same! In Texas, we have Africanized bees all over our state, so chances are, you have seen one. Remember: bees only sting if they feel threatened. If you don't bother them, they won't bother you!



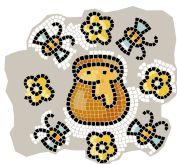
You should never try to bother a honey bee hive, because they may come after you and sting!



Fun Bee and Honey Facts



- A honey bee can fly up to 15 miles per hour.
- A honey bee worker only makes an average of 1/12 of a teaspoon in her lifetime.
- One ounce of honey would fuel a bees flight around the world.
- A pound of honey is made by 2 million flower visits. The bees fly 55,000 miles back and forth to bring that honey.
- A honey bee visits 50-100 flowers in one trip.
- Honey comb is hexagon (six-sided) shaped. The wall of comb is 2/1000 inch thick, but can support 25 times their own weight.
- Honey bees beat their wings 11,400 times per minute. The beating of wings makes the buzzing noise.
- Honey bees never sleep.
- An average hive has 50,000 to 60,000 worker bees.
- The honey bee is the only insect that produces food for humans.
- Honey keeps very well. A pot of honey was found in good condition in King Tut's tomb.
- Honey is full of a variety of vitamins and essential minerals, antioxidants, and amino acids.
- Eating honey is a natural way to get an energy boost. It is a mixture of simple sugars glucose and fructose. Studies have shown that this works best in preventing fatigue and enhancing athletes performance.
- Honey is an antimicrobial agent and can be used effectively on minor burns or scrapes. It has been shown to speed the healing of wounds.



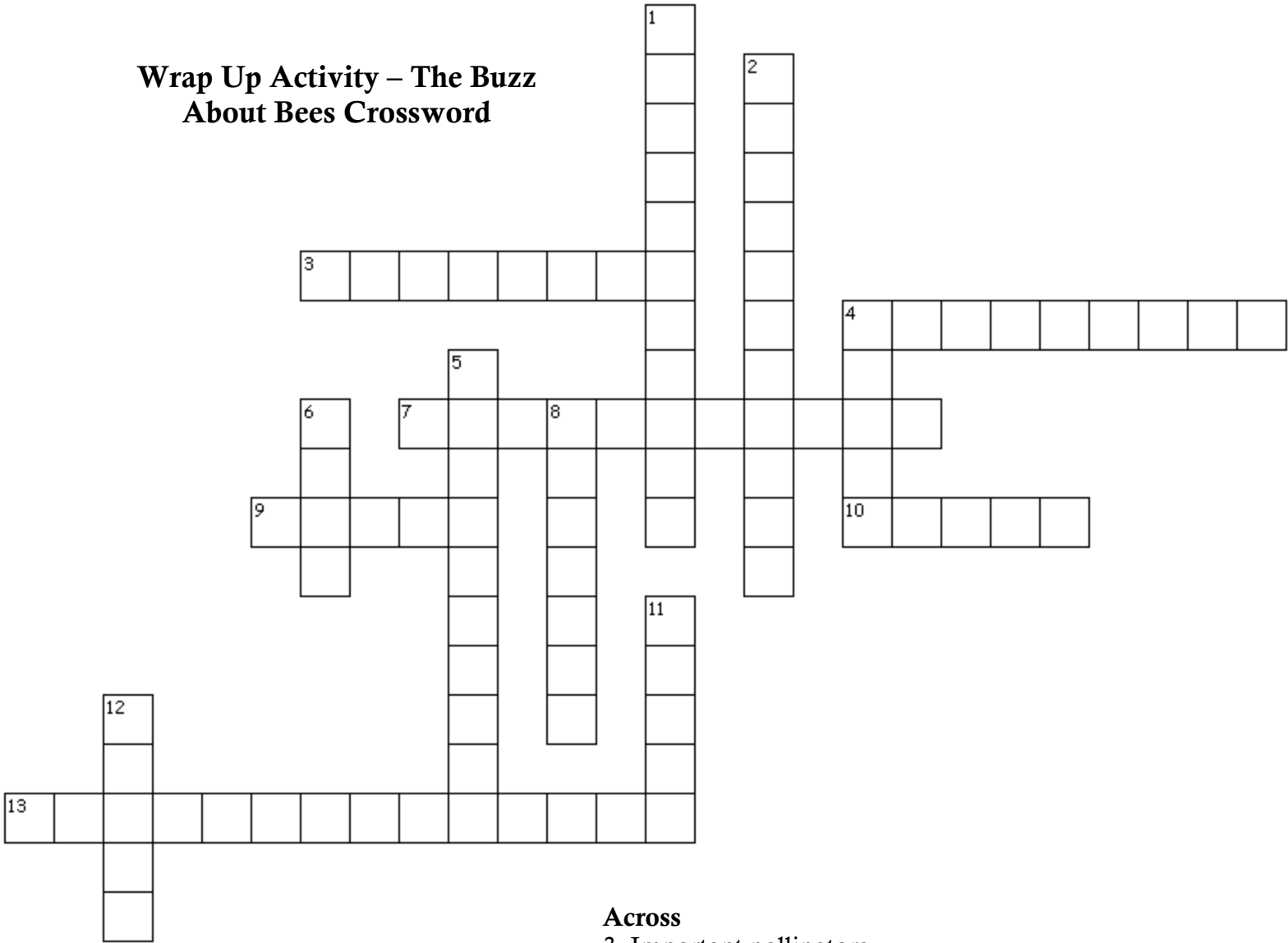
Wrap Up Activity – The Buzz About Bees Word Search

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 N P N T V G N N R M B K E R N U U W E R Y H G M N E L L O P
 R F S I J C A W T F G S X V H H H N W V K Q O Q E L R P V W
 L A H C O V R D W S P R C O N S T R U C T I O N J N X H A Z
 C A N T G X P D K Z D E C N A D D N U O R L B N E H W G E Y
 V Z I V M F I T Z T O O F L T R C N U Y I T F I M Y G S G T
 Y H Y C M J P Y L H X C X W C G V N C S E O Z K K L F I O R
 M P T Z O X J Q K A K O O L O T Q V C K E Z O I E P J T H L
 W P Y C D S Z G C X S L J A K U S C Y K P D E D D L T A R U
 X A O Y J F N K C A R O S A E U U L B G U L A F S U J A W Y
 L I L Y O F P L I D E N B E X M H I K G K N P B F X H Y C T
 N J U E B L R O F K V Y N B E E C R E L C A U Z C B C F F N
 I S K B V L B G C C U X M B U P V B U E S M P M W U K N I X
 U C N R Q P M Z R Z F K Q G T U V D D V N W S F G I U X T N
 K O N F L J P T X B J E P D V U V K D P P V C I V J J M Z I
 K U Y Y D V B C Q Y J G V I K X B W L T W I S K E Y G U E R
 F Q O U B Q D P G O K C A N R Z O T T H T B E C G T Q J L K
 H R C V Y F I E D F U S C W M R T A I R Q U U G J R F X Z N
 Z A P Y Y P P A S L W C D P K O V Z C W N F X J R Z A E Z F
 C S E M B P L Z Z V B R M E Y E Y Y Z X H K F Q K M D Q I L
 F T A V R A L D V F T M R Z F K V G T E P X E A S T J N I V

Word Bank

ABDOMEN	HIVE	ROUND DANCE
AGRICULTURE	HONEY	SOCIAL
BEE	LAPPING	STINGER
BEEKEEPER	LARVA	THORAX
CASTE	NURSE	VENOM
COLONY	POLLEN	WAGGLE DANCE
CONSTRUCTION	POLLINATION	WORKER
DRONE	PUPA	
FORAGER	QUEEN	

**Wrap Up Activity – The Buzz
About Bees Crossword**



- | |
|--|
| <p>Word Bank
 Africanized Bee
 Beekeeper
 Brood
 Drone
 Four
 Honey bee
 House
 Lapping
 Nurse
 Pollination
 Queen
 Round Dance
 Waggle Dance</p> |
|--|

Across

- 3. Important pollinators
- 4. Farmer who maintains honey bees
- 7. When pollen moves from one flower to another and one reason bees are so important
- 9. The most important bee in the hive
- 10. Male honey bee
- 13. A cross between African honey bees and European honey bees

Down

- 1. A dance bees do when food is far
- 2. Farming crops or livestock
- 4. The egg, larva and pupa in the bee hive
- 5. A dance bees do when food is close
- 6. Number of life stages bees have
- 8. The type of mouthparts honey bees have
- 11. A worker bee that cleans the nest
- 12. A worker bee that feeds the larvae

Glossary

Africanized Bee – a very aggressive type of bee that is a cross between African honey bees and European honey bees.

Agriculture – the science of producing crops and livestock. Farming.

Abdomen – the last body part of an insect. Where the stinger is found in bees.

Antennae – structures found on an insect's head that help them sense, feel, smell, communicate, hear, and taste.

Barbed – is not smooth. In honey bees, the stinger is barbed, with tiny hooks that stick to the skin of the animal they sting. The barbs remove the stinger from the honey bee's abdomen.

Beekeeping – a type of agriculture where farmers maintain and keep honey bee hives.

Brood – the eggs, larvae, and pupae of a colony.

Caste System – a community of insects that live together, care for each other, and have specific jobs.

Colony – a community of individuals that have a common interest. In honey bees, a group of bees that were born from the same queen and live together in a hive.

Complete Life Cycle – a type of life cycle insects have with four stages: egg, larvae, pupae and adults.

Compound Eye – large eyes on insects that are made up of many tiny eyes.

Construction worker bee – worker bees 12-17 days old that build and repair the cells of the nest.

Drones – male bees

Egg – the first life stage of an insect with a complete life cycle.

European Honey Bee – a species of honey bee used by beekeepers in the United States. A species of bee brought to the United States from Europe for their pollination. The common honey bee we think of in the United States.

Female – girl

Forager Bees – worker bees 22-42 days old that gather nectar and pollen and water for the colony.

Guard Bees – worker bees 18-21 days old that protect the hive from invaders.

Head – the first body part of an insect. Has the eyes, antennae, and mouthparts.

House Bees – worker bees up to 2 days old that clean the nest.

Insects – an animal that has an exoskeleton, six legs, and three body parts (head, thorax, and abdomen).

Lapping Mouthparts – the type of mouthparts a honey bee has. Tube shaped with a tongue at the end. By moving the tongue back and forth, honey bees can move nectar up through their mouthparts and inside their body.

Larvae – the second life stage of an insect with a complete life cycle. In honey bees, larvae do not have legs and live in cells in the hive and are fed by worker bees.

Male – boy

Nurses – worker bees that are 3-12 days old and feed and take care of the larvae.

Pheromones – a chemical that insects release to communicate with one another. It is picked up in the air by the antennae of other insects.

Pollen Basket – a special body part on the hind legs of honey bee workers that allows them to pack pollen to bring back to the colony.

Pollination – occurs when pollen from one flower is given to another flower. This allows a new seed to be formed.

Pupae – the third life stage of an insect with a complete life cycle. Commonly called the resting stage, but many things are happening and the insect is changing to become an adult.

Queen – the largest bee in the honey bee colony, a female that can lay eggs. There is only one queen in the hive.

Round Dance – a form of communication bees do by dancing in a circle. Tells the other foragers there is food less than 35 yards from the hive.

Scout Bees – worker bees that search for a new place to make a hive.

Social – meaning to live near and with other individuals. Honey bees are social because they live as a colony with other bees in a hive and work together.

Stinger – a sharp structure found on the abdomen of honey bees. Used when the honey bee feels it is threatened.

Thorax – the middle body part of an insect. Where the legs and wings are attached.

Threatened – a feeling that one is in danger.

Venom Therapy – When venom of bees or other stinging insects is used to help with diseases or ailments.

Waggle Dance – a form of communication bees do by dancing in a figure eight. They make a half circle, waggle their abdomens in a straight line, and then another half circle to make a figure eight. It tells the other foragers the direction they can find food that is more than 35 yards from the hive.

Worker Bees – female bees that have a stinger and cannot lay eggs. They do all the work in the colony to keep it clean, everyone fed, guarded, and supplied with food.

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