



## 4-H Beekeeping

### Division I

# Understanding the Honey Bee

Year in Project: \_\_\_\_\_

Date Started in Beekeeping I: \_\_\_\_\_

Name: \_\_\_\_\_

Club: \_\_\_\_\_

County: \_\_\_\_\_



# 4-H Beekeeping, Division I: Understanding the Honey Bee

## Note to Parents and Volunteer Leaders:

The 4-H Beekeeping Project helps youth learn about bees and how to be a beekeeper.

Beekeeping offers many hands-on educational experiences, from learning about bees and nectar to learning to raise bees and produce honey.

The 4-H Beekeeping Project is divided into three divisions. *Division I, Understanding the Honey Bee*, covers information on the basic facts of beekeeping: the types of bees, the honey and wax they produce, the plants that attract bees, and the equipment a beekeeper needs. In the first year, youth are not required to have any bees, but prepare to take care of a honey bee colony of their own. In *Division II, Working with Honey Bees*, youth acquire a colony of bees and learn how to care for their beehive throughout the year. This will include basic beekeeping operations that result in the production of extracted, chunk, or cut comb honey. When the youth are experienced and knowledgeable in the basic care of a beehive, they should move on to *Division III, Advanced Beekeeping Methods*. The advanced topics include: increasing the number of your honey bee colonies, increasing honey production, producing special kinds of honey, learning more about the bee societies, and how to manage honey bee diseases and parasites.

The learning experiences have been planned as “experience-centered” activities. Youth are encouraged to take responsibility for their beekeeping projects. They can enhance their learning by consulting resources on the Internet, at school, and at the library, or by talking to someone who raises bees. Youth are encouraged to have an experienced beekeeper as a mentor.



**Experiential learning distinguishes 4-H youth development education from many formal educational methods. Activities are designed so youth experience a learning activity, reflect on what they did (explore the meaning of the activity), generalize what they learned (to test comprehension and appreciation of the activity), and then think about how they can apply what they learned to other situations (generalize). You can help guide youth as they explore each activity by discussing each section.**

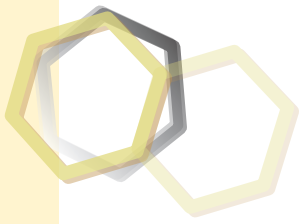
## Purpose

Division I Beekeeping is intended to help youth learn:

- about the types of bees, honey, and wax they produce;
- about the plants that attract bees;
- about the equipment that a beekeeper needs;
- how to compile beekeeping records;
- how to present the results of their work to others;
- how to develop inquiring minds—the habit of asking questions and searching for answers.

Purdue University staff who contributed to this publication:

- Natalie Carroll and Greg Hunt.
- Reviewers Tom Turpin and Larry Segerlind



# Understanding the Honey Bee

<b>Table of Contents</b>	<b>Page</b>
Beginning Beekeeping	4
Selecting an Advisor	4
History of Beekeeping	5
The Value of Honey Bees	6
Bee Stings	8
The Castes of Honey Bees	9
Races of Honey Bees	11
Honey and Honey Plants	12
Observing the Hive Entrance	14
Beeswax and Honeycomb	16
Beekeeping Equipment	19
Observing a Beekeeper	21
Demonstrations and Talks	23
Exhibits	25
Resources	25
Glossary	26



# Beginning Beekeeping

A master beekeeper who worked with honey bees for more than 50 years often said, “Every time I look into a beehive, I learn something new about the bees, and I see another reason why I like the bees so much.” This 4-H Beekeeping Project will help you learn about bees and how to be a beekeeper. It will not turn you into a “master” beekeeper, but it will help you get started.

## Selecting an Advisor

The only experience most people have had with bees is stepping on one when running barefoot through the grass. You know, of course, that there is much more to bees than stings, or you would not be taking this project. However, the “bee in the grass” experience should have taught you a fact about honey bees: they will sting if they think they are in danger.

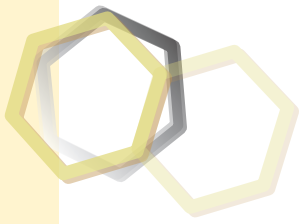
Actual experience is the best way to learn about bees. An experienced beekeeper is your best source of information about honey bees. In fact, it is almost impossible to start working with honey bees without the advice of a helpful beekeeper. Plan to watch and study a beekeeper (job shadowing) taking care of his or her hives. The more you see, the more you will understand. Ask questions. Do not be worried if the amount you have to learn seems overwhelming. There is a lot to learn, but you have time to learn it all. Beekeeping can be a lifetime vocation and hobby. You may find it helpful to purchase a journal to keep notes about what you are learning. Then you can refer back to the journal when you are not with the beekeeper and in future years. You can also use your journal to write questions that you think of so you will remember to ask them the next time you are working with the beekeeper. You can help repay the beekeeper for sharing their time and expertise with you by offering your help with the many tasks involved in beekeeping.

If you don’t already know a beekeeper, your county Extension educator may know beekeepers who live in your county or nearby and who are interested in helping you with this project. The Purdue Extension bee specialist and the Indiana beekeeping associations are also interested in helping young people get started in beekeeping. See the Resources section of this manual for contacts.

It is a good idea to learn what you can about bees before you meet your beekeeping advisor. This will help you know what questions to begin asking. You need a basic understanding of bees and their activities so you will know what your advisor is talking about and showing you.

Try to read this manual (*Understanding the Honey Bee*) and complete the questions before you meet with your advisor. The 4-H manuals give you a little information about bees and beekeeping, but you will need other resources to answer the questions in the manuals. Most of the answers to these questions are in the book *The New Starting Right with Bees* (21st Edition). This book is an excellent investment for the beginning beekeeper. You will use it in all divisions of your 4-H Beekeeping Project, and it will be useful as long as you are a beekeeper. (Ordering information for this book is in the References section at the end of this manual.) Find information about beekeeping from beekeeping journals, at your local library, or on the Internet. If you are interested in learning more about beekeeping we recommend that you take a subscription to either the *American Bee Journal* (<http://www.dadant.com/journal/> - **phone**: 217-847-3324) or *Bee Culture* ([www.beeculture.com](http://www.beeculture.com)). Both are excellent journals that will teach you a lot about beekeeping.

Some of the questions in this manual are more difficult than others. You may not be able to answer all of them until you have more experience in beekeeping. Try to answer the questions, then discuss the more difficult ones with your advisor.



# History of Beekeeping

The Native Americans who lived in America prior to 1500 had never tasted honey. This was because only people in Europe, Asia, and Africa had honey bees. There were no honey bees in this country until they were brought here by boat in the sixteenth century, about 50 years after Columbus first sighted America.

Throughout history, there has always been a close relationship between honey bees and people. Drawings on rocks found in Spain that date back 9,000 years show women taking honey from wild bee colonies. Early people took honey from hollow trees full of bees that they found in the forests. In the autumn, these early “bee-hunters” would kill or chase the bees away from their log homes so they could take all of the honey. Honey was very important, because at that time people had no other source of concentrated sugar. As humans learned more about bees, they built beehives of clay pots, straw baskets, and wooden boxes. They wanted to find ways of controlling their bees so that the colonies could survive from year to year and still produce enough honey for the needs of the beekeepers.

In the sixteenth century, scientists began studying the habits of honey bees, hoping to find new ways to control them.

However, it was not until 1851 that beekeeping became a modern science. In that year, an American minister, Lorenzo Lorraine Langstroth, discovered the importance of “bee space.” Bee space is an open space of about  $\frac{3}{8}$  inch that the bees leave between their honeycombs so that they have room to move and work. Based on the “bee space” idea, Langstroth built the first modern beehive with frames of combs that could be easily removed from a wooden box. His invention led to many improvements in beekeeping equipment. Today, beekeeping is more successful than it was before Langstroth’s movable-frame hive, because the entire hive can be inspected and manipulated.



# The Value of Honey Bees

Honey bees are valuable. They contribute to the success of American agriculture and industry. You probably already know one use of honey: as a delicious sweetener on biscuits, bread, and rolls. Honey also has several other uses that make it a very important product of American agriculture. It is a main ingredient used in the baking and candy industries. Athletes may use honey for quick energy. In the medical profession, honey has been used for its antiseptic qualities in burn ointments and in the preparation of medicines. Throughout history, honey has been used in the production of wines. Honey wine—meade—is still a very popular drink in many parts of the world.

Beeswax, another product of the honey bee, also has many important uses. The cosmetic industry uses beeswax in the preparation of products such as cold creams, lotions, rouges, and lipsticks. Beeswax is a basic ingredient in many candles. Manufacturers of pharmaceuticals include beeswax in many preparations of salves and ointments. Dentists use it for impression wax. Foundries need it for molds in precision casting. Beeswax is an ingredient in many types of polishes for floors, furniture, and shoes. Other uses include adhesives, crayons, chewing gum, inks, basketball moldings, ski wax, thread wax, ironing wax, and archer's bow wax.

If there were no honey bees in this country, American farmers could not produce nearly enough of some of your favorite foods, such as apples, peaches, almonds, and watermelons. This is because many plants must be pollinated to produce fruit. Pollen grains must be transferred from the male parts of the flowers to the female parts to make a seed. Honey bees do this by pollinating flowers. In fact, honey bees do 80 percent of all crop pollination.

There are several reasons why honey bees are such excellent pollinators. First, they are very hard workers. An individual bee may visit as many as a thousand flowers in one day. During these flower visits, the large, hairy bodies of the bees easily pick up and hold many tiny pollen grains. Second, bees visit only one type of flower on a particular trip. Third, beehives can be moved easily into areas where flowers need to be pollinated. Because of these special bee qualities, American crop producers rent millions of colonies honey bees each year to pollinate their crops.



Read Chapter I, “Suddenly You’re a Beekeeper” in *The New Starting Right with Bees*. Then answer these questions:

What basic steps should you follow to keep an unexpected swarm?

---

---

---

---

Briefly describe the nine “Directions for Hiving Your Package.”

1. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

5. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

6. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

7. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

8. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

9. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**These crops must be pollinated by bees to produce food yields:**

- |                   |                   |
|-------------------|-------------------|
| <b>Almonds</b>    | <b>Blackberry</b> |
| <b>Apple</b>      | <b>Cantaloupe</b> |
| <b>Blueberry</b>  | <b>Clover</b>     |
| <b>Cherry</b>     | <b>Pear</b>       |
| <b>Cucumber</b>   | <b>Plum</b>       |
| <b>Peach</b>      | <b>Raspberry</b>  |
| <b>Persimmon</b>  | <b>Squash</b>     |
| <b>Pumpkin</b>    |                   |
| <b>Watermelon</b> |                   |

**These crops have higher yields if the honeybee visits them:**

- |                   |                |
|-------------------|----------------|
| <b>Eggplant</b>   | <b>Grape</b>   |
| <b>Lima Bean</b>  | <b>Okra</b>    |
| <b>Pepper</b>     | <b>Soybean</b> |
| <b>Strawberry</b> |                |



## Bee Stings

A basic part of beekeeping is understanding and accepting the fact that you are going to be stung from time to time. No matter how good a beekeeper you become, occasionally you will accidentally crush a bee. You may visit the hives when the bees are disturbed by a change in the weather, by hunger, or by something else beyond your control. As a result, you may be stung.

A few people have serious reactions to bee stings. They may have difficulty breathing after being stung or have some other very dangerous reaction. If you are ever with a person who is severely allergic to a sting, take them to a doctor immediately. It is very unusual for a person to have such a bad reaction to stings. For most people, the sting of the bee is a momentary discomfort that says to slow down, be more careful, or in some way, show greater respect for those honey bees. Do not open a hive alone until you know your reactions to bee stings. If you are highly allergic to stings, you should be particularly careful when working with bees and you should go see an allergist before you consider continuing with this project.

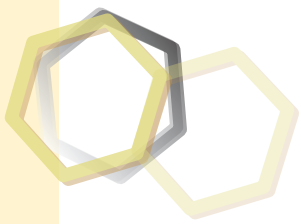
The experienced beekeeper knows what to expect when they get stung and what to do to reduce the bad effects of the sting. You don't need to be afraid of the honey bee sting. A sting always hurts. Whether it is a first sting or the thousandth, it will hurt, but not too much. A bee sting is like getting a shot from the doctor; it will hurt for 20 seconds or so, then the pain fades away.

The beekeeper knows that only the worker bee stings. Her stinger is barbed, like a fish hook. When she pushes her stinger into your skin, it catches and pulls out of her body as she flies quickly away, causing her to die soon after. What she leaves in your skin is the barbed stinger attached to a poison sac. Often part of the bee's intestine is still attached to the stinger in your skin.

You can scrape the stinger off the skin using a fingernail or hive tool. Then puff smoke from a smoker or rub dirt on the area of the sting. This covers the smell of the sting so other bees won't be disturbed.

The experienced beekeeper also knows that swelling will probably develop around the spot where the sting was and may last a day or so. Although an ice treatment may reduce the swelling, there is really not much to do for it, except to get stung again! It seems that the more a beekeeper is stung, the less of a swelling reaction will result. So, there is some good in being stung; it will not be so bad when you are stung again.



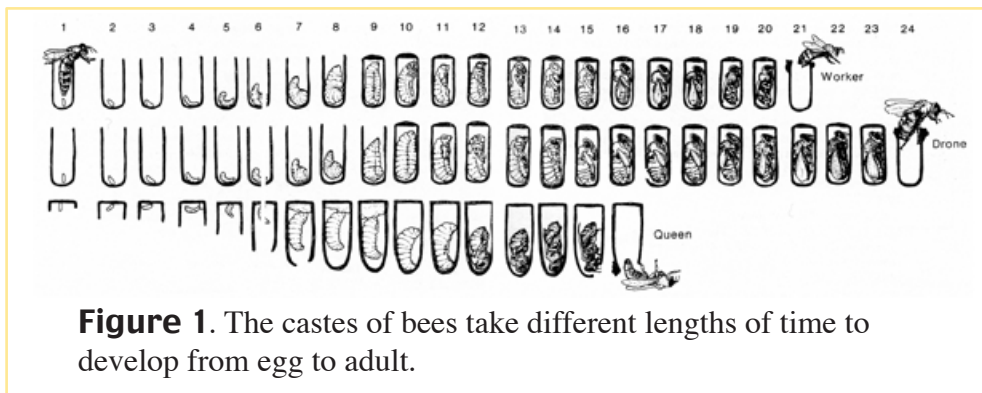


# The Castes of Honey Bees

There are three types (castes) of honey bees in every colony:

- Worker bees
- Drone bees
- A queen bee

These bees each take a different length of time to develop from the egg to the adult stage (see Figure 1).



The drone bee is the largest and the worker bee is the smallest (Figure 2).

Read Chapter IV, “Getting to Know Your Bees,” in *The New Starting Right with Bees* to learn about the kinds of honey bees.

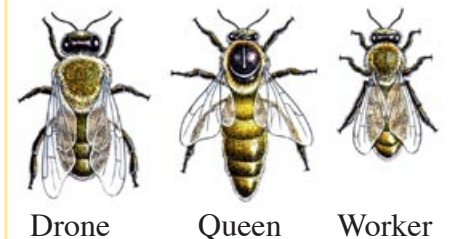
Describe the queen and tell how her body shape, wing size, and stinger are important to her work. What do you find most interesting about the queen bee?

---

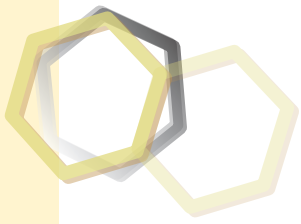
---

---

**Figure 2.** Three kinds of bees in a hive (drone, queen, worker).



It usually takes \_\_\_\_\_ days to develop a queen from the egg to the adult stage. She will remain a virgin queen for about \_\_\_\_\_ days. Within \_\_\_\_\_ or \_\_\_\_\_ days after mating, the queen begins to lay eggs. Unfertilized eggs become drones. Fertilized eggs become worker bees.



What is a drone and what does it do?

---

---

---

List the duties of the worker bees.

---

---

---

Why do some worker bees live to be six months old, and others die after only six weeks?

---

---

---

What are foragers and what do they do?

---

---

---

How is honey made from nectar? (Explain briefly.)

---

---

---



# Races of Honey Bees

Like people, bees from different parts of the world look and act differently. Variations in color, size, and habits are the bees' way of adapting to the climate and geography of an area. Today there are three different races of honey bees commonly found in America. All of them were originally brought here from other countries. These are not “pure” races because they have mingled with each other. There is great variability in bees, but each race has some particular characteristics.

## Italian Bees

These bees were imported from Italy. They are the most popular bees in the United States because of their excellent habits. Italian bees are usually gentle and are not inclined to swarm (leave the hive in a group to start a new colony). They maintain a high colony population from early spring until late fall and produce beautiful white wax cappings on their honey. Italian bees are generally yellow in color. They are a little more likely to rob honey from other hives than the two races listed below.

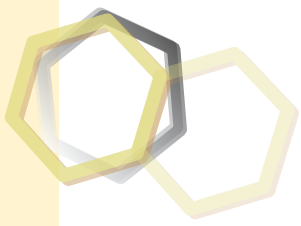
## Carniolan Bees

The Carniolan bee is almost black in color. This race of bee originated in Austria, Bulgaria, central Europe, Hungary, Romania, and Yugoslavia. They are the second most popular honey bees in this country. Like the Caucasian bees, the Carniolans are very quiet and gentle. Carniolan bees tend to increase their colony population very rapidly in the spring but the increase in colony size can make them more likely to swarm.

## Africanized Honey Bees

An African race of bees was imported into South America in 1956. These bees are highly defensive—or you could call them aggressive! They are much more likely to sting than other bees. Once disturbed, they will chase people and animals that come near their hive. However, they are not likely to sting when they are foraging on flowers away from the hive. Africanized bees are now present in some of the southern United States, but are not well adapted to the cold winters of the Midwest. They have some traits that make them well adapted to the tropics, such as a tendency for the colony to grow very rapidly and to swarm often. It is not known whether Africanized bees will adapt to our climate by mating with our European races of bees. If this happens, they may become less aggressive.

If you have a hive of bees that sting too much, even though you are careful not to be rough with them, it is best to replace the queen. They will slowly become gentler.



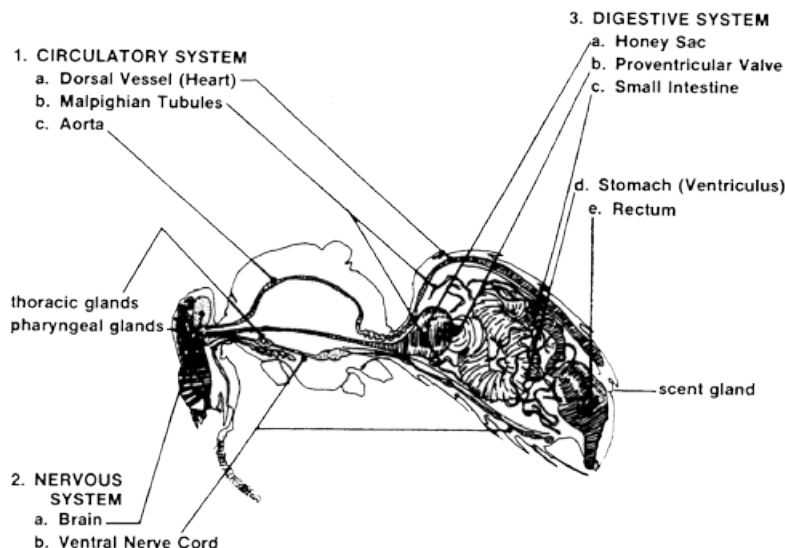
# Honey and Honey Plants

People have always valued honey, the primary food of the bees. Men and women use it for many different purposes: as a preventative and cure of disease, as a healthier substitute for sugar, as an ingredient in baking, and as a favorite sweet.

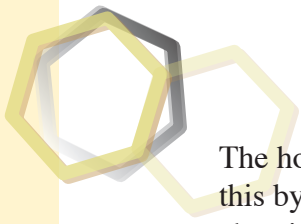
Honey begins as nectar, a sweet liquid secreted in flowers. Nectar is composed almost entirely of sugar and water. It is produced by plants to attract bees. While collecting the nectar, a bee picks up pollen with its body hairs. As the bee visits another flower for more nectar, some of this pollen rubs off. This transfer of pollen causes the fertilization of the second flower, and seeds are produced. Nectar is what the flower pays to the bee for the service of being pollinated.

Nectar usually collects in a tiny pool inside the flower. The amount of nectar the flower produces depends on the type of flower, the weather, the time of day, and the amount of recent rainfall. The visiting bee, a field worker, sucks up as much of this nectar as she can, using her long tongue (proboscis).

The honey bee has two stomachs, a honey stomach and a real stomach. The honey stomach is used only for the temporary storage of honey. It is in front of the real stomach, where the process of digestion takes place (Figure 4). The nectar sucked up by the honey bee's proboscis is held in the bee's honey stomach while she flies back to her hive. At the hive, the field worker transfers the nectar she has collected to three or more "house" bees who suck the nectar from the mouth of the field bee.



Main parts of the digestive, circulatory, and nervous systems of the worker honeybee. [Drawing from *The Hive and the Honeybee* by permission of Roy A. Grout. (Grout, Roy A., ed. 1975. 5<sup>th</sup> ed. Dadant and Sons, Hamilton, Illinois)]



The house bee changes the nectar into unripe honey. She does this by moving the nectar about in her mouth and mixing it with chemicals called enzymes. After the mixing process, which takes about 20 minutes, the house bee deposits the unripe honey in a cell for ripening. The new honey ripens through the process of evaporation. Just as water left in a glass will eventually evaporate into the air, extra water will evaporate from unripe honey that is left to sit in the cells. Then ripe honey is all that remains. The time it takes for the evaporation process depends upon factors such as the type of nectar, the air temperature, and the humidity. The bees often fan their wings to speed the evaporation.

The honey is ripe when it is less than one-fifth water. Once the honey is fully ripe, house bees cover it with a thin layer of wax. This protects the honey. The wax covering keeps the honey fresh and safe until it is needed by hungry bees or beekeepers.

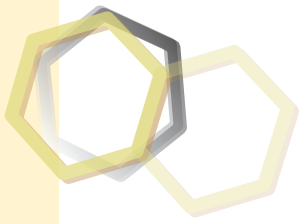
Remember that the starting point in the production of honey is in flowers that produce nectar. A beekeeper needs a good knowledge of plants and their flowers. An understanding of honey plants, the plants that produce nectar used by bees to make honey, helps a beekeeper know where to put the hives. The list below shows plants that are important for bees in Indiana. Many of the plants listed do not make much surplus honey because of the duration of the bloom or conditions in a particular year. The best way to determine which plants bees will use to make honey is to watch them. The following list will help you know which flowers to watch.

## Honey Plants

The following list (courtesy of Dr. G. Hunt, Purdue University) gives you an idea of the types of flowers that attract bees. The best way to see what your bees like is to watch them!

- apple blossom (and other fruit trees)
- asters (in fall, especially the small, white frostweed aster)
- basswood
- black locust
- blackberry
- blue vine or climbing milkweed (mostly in one area of southwestern Indiana)
- blueberry (bees are very important for blueberry pollination)
- box elder
- clover: small white (dutch), yellow sweet, and white sweet (major honey source)
- currant and gooseberry
- dandelion (important in the spring because it blooms early)
- goldenrod (late summer to fall, different kinds)
- ground ivy
- mint
- raspberry
- silver maple, red maple (maples mostly important for pollen, not honey)
- tulip poplar (tulip tree, the state flower)

Many exotic plants in people's gardens also attract bees.



## Observing the Hive Entrance

The hive entrance of a honey bee colony is very much like the front door of your house. Just as you go through it on your way to and from school, the field bees must exit and enter through the hive entrance on their trips to visit flowers. By watching a hive's entrance, beekeepers can learn a great deal about the levels of activity of their bees. Observing the hive entrance not only tells about the honey plants in bloom that are attracting the field bees, but it also tells about the work going on inside the hive. The more nectar and other supplies the field bees bring in, the busier the house bees will be, storing away and using supplies to build new comb and to care for the young bees.

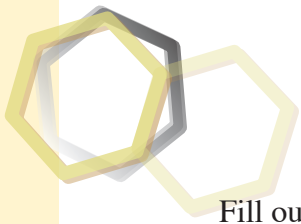
What is happening at the hive's entrance can also tell beekeepers about the health of their bees. For example:

- If you are too hot in your house, you may sit outside your front door. Bees do the same thing.
- When you are cold, you close the front door. Although the bees cannot close their hive entrance, they will remain inside, away from the entrance, when they are cold.
- When you do not feel well, you stay inside to rest. Sick bees do not leave their hives, either. However, if they are very sick they will crawl out of the hive and die.

Observe the entrance to a hive, watching closely for at least 15 minutes at least once every three weeks. Do this at different times of the day. Sit as close to the entrance as possible so that you have a clear view of the activities taking place. **Do not** sit in front of the entrance! The bees will become confused if they see you in front and won't know where to go. For each observation period, write a report of what you saw. Describe what they were doing there and what, if anything, they were carrying in or out of the hive. Make certain to include the information listed below in your reports:

- the date and time of day of your observation
- the weather conditions while you were watching
- a summary of the activities you observed at the hive entrance
- the types and approximate number of bees you saw

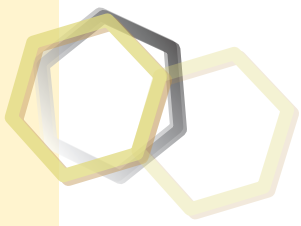
Staple your completed report to the back of this manual.



Fill out the chart below to identify the flowers blooming in your area. Begin your observations early in the spring when flowers start blooming, and continue until late autumn when you can find no more blooming flowers. Remember that you'll find blooms on many trees and vines, as well as the smaller plants you usually call flowers. Bees will fly a mile or two if they do not find what they need near their hive.

<b>Name of Plant</b>	<b>Description (Type of plant, size of bloom, color of bloom, etc.)</b>	<b>Location</b>	<b>Blooming Dates (from – to)</b>	<b>Bees on Blooms? (If so, describe their activities.)</b>

Bees get most of the nectar they use from wildflowers, especially clover in Indiana. It is important to know how much wild land is within a mile of your house. Visit these patches and watch for bees.



## Beeswax and Honeycomb

The honeycomb is the inner house of honey bees. It is where young bees are raised and where the hive's food is stored. Comb is built out of beeswax, which is produced only by young worker bees. Glands on the undersides of the bodies of these young bees can produce tiny pieces of wax. Worker bees chew these small flakes of wax and work them to form the comb. Generally, the newly constructed comb is beautifully white in color. It may be light yellow when bees are getting nectar from goldenrod or other similar flowers. The comb becomes darker over time, because as each new bee is born, it sheds its skin and this becomes part of the cell. Also, bees collect propolis, which can make the comb darker.

The comb (Figure 5) consists of many small, six-sided tubes (cells) built side by side. The floor of the cells slopes slightly downward to the bottom and is shaped like a three-sided pyramid pointing away from the cell opening. This small slope is necessary so that the substances put into the cell do not slide out of it.

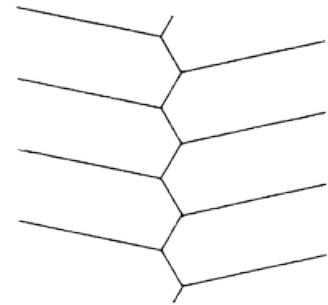
There are three different cell sizes. The large drone bee is hatched from an egg and grows to adulthood in the larger of the two cells (drone cell). The smaller, worker bee grows in the slightly smaller worker cell. Worker cells that are full of eggs, developing larvae, and pupae are usually found in the central part of the comb (brood area). The third cell size is the queen cell.

Bordering the brood area is a narrow strip of worker cells where pollen is stored. Pollen is an important food for the larva growing in the brood area cells, because it is the source of the bees' protein and because it is rich in fat. The field bees collect pollen in the form of tiny pellets from flowers and carry it back to the hive by putting it in small, basketlike pouches on their back legs. This pollen varies in color, depending on the type of flower from which it came.

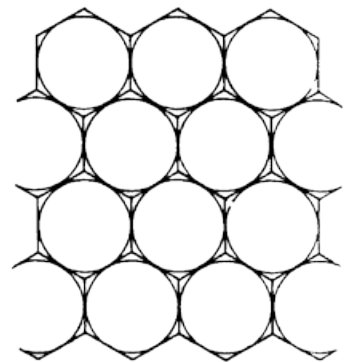
A cell is never completely filled with pollen (Figure 6). Bees generally pack the pollen in a cell until it is about 3/4 full. Sometimes they add a little honey to the pollen to preserve it. This makes the pollen look wet. This storage method maintains the freshness of the pollen for a long time. The outer edges of comb beyond the narrow pollen storage area are used for ripening and storing honey.

Between each comb, the bees leave a space about 3/8-inch wide. If the space between combs is much wider or narrower, the bees will close it up with wax and bee glue.

**Figure 5.**

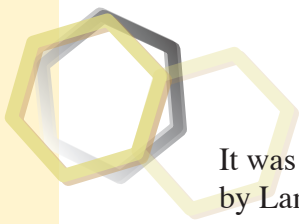


**Slope of cells from front to middle of comb.**



**The economy of the hexagonal shape for making honeycomb cells.**





It was the discovery of this important space, the bee space, by Langstroth that led to the development of the modern beehive. In the modern beehive, all the frames of comb are specially built so that they are surrounded on all sides by bee space. Because of this, the bees do not clog up the area between the frames of comb. Then the frames can be taken out and put back into the hive easily.

Besides the honeycomb, you are certain to find another important substance in the hive. This is bee glue (propolis). Propolis is a very sticky brown material that the bees use for many purposes: holding down the hive lid, covering the inside walls of the hive, fastening frames, strengthening comb, plugging holes, and, sometimes, narrowing the entrance. Field bees gather propolis from various plant buds, picking up such sticky substances as pitch from pine trees.

Name three different substances that can be found in the cells of honeycomb.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

Draw a simple picture of honeycomb.



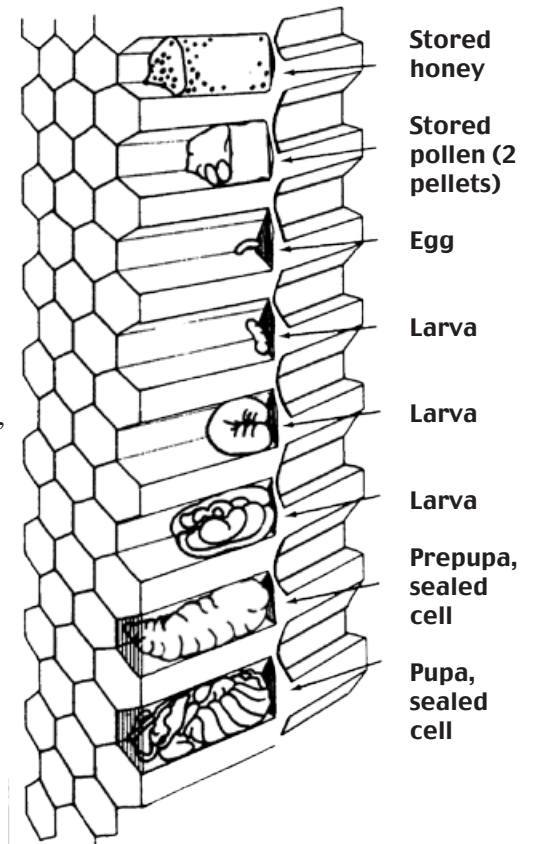
Why is it true that the older the comb is, the darker it is?

---

---

---

**Figure 6.**





Describe how bees build comb.

---

---

---

Why is a drone cell larger than a worker cell?

---

---

---

What is the brood, and where is it found?

---

---

---

Why is the brood area surrounded by pollen storage cells?

---

---

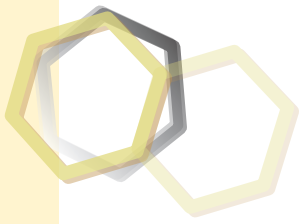
---

Give five uses of propolis.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_

Name another substance besides pine pitch that honey bees could probably use as propolis.

---



# Beekeeping Equipment

Now that you have a good basic understanding of honey bees and their activities, you are ready to begin gathering the equipment that you will need to operate your own beehive in Division II.

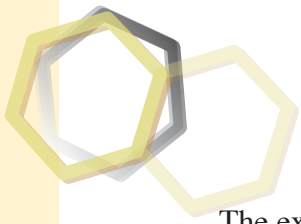
As in any business, you will find that you must make an initial investment to get the equipment to begin beekeeping. However, an advantage of beekeeping is that the amount of equipment you need is limited. And once you have it, assuming that you take good care of it, your later expenses will be small. If you are not sure you are interested enough in beekeeping to purchase your own equipment, you may be able to lease a hive from a beekeeper. Check with your county Extension educator, the bee specialist at Purdue, or the Indiana bee associations listed on the “Purdue University Beehive Website” for referrals to beekeepers who are willing to lease a hive to a 4-H'er. You can find this Web site listed in the Resources section at the end of this manual.

For a good explanation of most of the equipment you will need, read Chapter 2, “Before You Start, Equipment” and Chapter 5, “Your First Honey Flow, Other Equipment” in *The New Starting Right with Bees*.

A valuable tool of the beekeeper is a hive tool. This is a chisel-like instrument slightly curved at one end. It enables the beekeeper to pry up hive lids, supers, or frames glued tightly together with propolis. It is also a handy tool because you can use it as a scraper and a nail puller.

A beekeeper must take care to wear suitable clothing. First, you should have a good pair of leather gloves. This is especially important for the beginning beekeeper until they are experienced enough to know how to work without angering the bees and to know when the bees are unlikely to sting. Many beekeepers prefer special beekeeping gloves that cover the forearm past the elbow. Others like to wear regular gloves along with gauntlets, which are sleeves with elastic in each end extending from the wrist to above the elbow. All the beekeeper's clothing should be white or light in color. It should not be made of rough, wool-like material. Bees are angered by dark-colored and/or fuzzy material, especially if it smells like an animal!

The experienced beekeeper is careful to cover his or her ankles with light-colored socks. Because ankles are on about the same level as a hive entrance, they are often attacked first by angry bees. Even gentle bees may crawl up your pants by mistake!



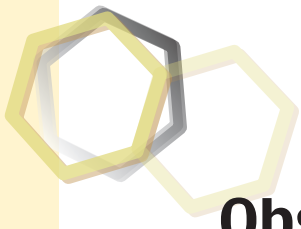
The experienced beekeeper will fasten down pant legs using bicycle clips, large rubber bands, or string to keep bees from crawling up their pant-legs. Many beekeepers like to wear white coveralls to protect their clothes and to give them added warmth on cooler days in early spring or late autumn.

Beekeeping equipment is available from several convenient sources. There are several bee supply manufacturing companies in neighboring states. Write to one, asking for their current supply catalog and the addresses of equipment dealers in Indiana. (There may be one near you.) From the catalog you can order equipment through the mail. Beekeeping equipment manufacturers are listed at the Purdue University Bee Hive site. See the Resources section for more information.

You will need the following equipment to start your hive:

<b>Item</b>	<b>Number Needed</b>
Bottom board and entrance cleat	1
Hive body and frames	2
Extracting supers with frames	2-3
Foundation	1 sheet per frame
Inner cover	1
Hive cover	1
Queen excluder	1 (optional)
Smoker	1
Bee veil	1
Hive tool	1
Gloves	1 pair
Long sleeve white shirt	1 (recommended)
Overalls	1 (recommended)

Complete the beekeeping inventory to have a record of your purchases.



# Observing a Beekeeper

As you read at the beginning of this manual, your best source of information about beekeeping is the experienced beekeeper. Having almost completed Beekeeping I, you now understand enough about the honey bee and the equipment of the beekeeper to know what questions to ask your advisor.

Carefully observe your beekeeper advisor as they check a beehive. Write a description of each step in the process of “going through” a beehive, beginning with the preparation of the necessary equipment—lighting the smoker, putting on the veil, etc.—and ending with the clean-up procedures that follow such work.

## Beekeeping Inventory

Date Obtained	Item	Number	Cost
<b>Total</b>			

What is meant by the term “movable-frame hive”?

---



---



---

What is meant by the term “crossed comb”?

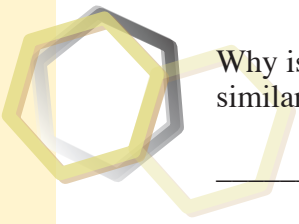
---



---



---



Why is it necessary to have a hive stand, bricks, or something similar to keep the bottom board off the ground?

---

---

---

Explain how the frames are built to maintain the “bee space.”

---

---

---

What are the advantages of using comb foundation in your hive?

---

---

---

What is the function of a smoker? Name some materials that would make good smoker fuel by burning slowly with much smoke.

---

---

---

What is the function of the hive tool?

---

---

How does a queen excluder work, and what is its purpose?

---

---

---

Explain the various types of clothing a beekeeper must wear when working with hives.

---

---



# Demonstrations and Talks

Now that you have begun learning about bees, you might want to share your knowledge with others at a 4-H club meeting or county or state fair. An action demonstration is an excellent way to teach others about bees.

## Action Demonstration Guidelines

What is an action demonstration or action demo?

An action demo is a fun way to share with others what you have learned in your 4-H project. It's a kind of "show and tell," but with more action. An action demo is not like a regular demonstration, where the audience sits and listens to a prepared talk. An action demo lets the audience get involved.

Action demonstrations can be given anywhere there are a lot of people, such as a county or state fair, shopping mall, street fair, or any 4-H event. Your job as a demonstrator is to interest the audience in your topic so that they stop and learn something new or try their hand at what you are doing.

How do you choose a topic for your action demo?

An action demo can be on almost any subject. The topic should be something that you enjoy and are knowledgeable about. Consider the following questions when choosing a topic:

- Can you complete the action demonstration in 3-5 minutes?
- Can it easily be repeated over and over again to fill the assigned time?
- Is your action demo showing something that would interest the general public?
- Is there a good way to involve your audience in your action demo ("hands-on" or answering questions)?
- Can the supplies for the "hands-on" section be used over and over again, or will they need to be replaced? (Remember, if the materials must be replaced, it will cost more to do the demonstration.)

How can you get the audience involved?

The first thing you need to do is be enthusiastic and attract people's attention as they walk by your table. You might have a colorful tablecloth or poster to spark their interest. You might ask them a question, such as: "Would you like to play this game?" or "Have you ever made pretzels? Would you like to try?" The best way to attract their attention is to have people around your table doing something. People love to do hands-on activities, so once you get a few people at your table, they will attract others. For more information on action demonstrations, see V-4-H-28.

Involve your audience by having them:

- do what you are doing
- do a "hands-on" section
- judge the quality of various items
- play a game
- answer questions

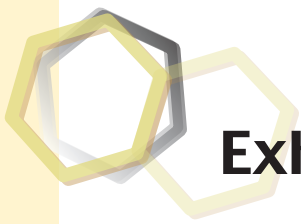
Remember, the key to a good action demo is getting your audience involved.



# Action Demo Checklist

<b>Topic</b>	<b>Yes</b>	<b>No</b>
Was the topic interesting to the general public, causing them to stop, watch, or participate?		
Did the topic stimulate questions from the audience?		
Was the topic of suitable length?		
Did the topic include something “hands-on” for the audience to do?		
<b>Organizing the Content</b>	<b>Yes</b>	<b>No</b>
Was the topic organized into short “show-and-tell” segments that were done repeatedly?		
Were segments presented in logical order?		
Were segments explained so that the audience understood why?		
Was it evident that the 4-H’er was knowledgeable about the subject and could answer questions?		
Did visuals, pictures, posters, or actual objects clarify the important ideas?		
<b>Presenting the Demonstration</b>	<b>Yes</b>	<b>No</b>
Did the 4-H’er seem enthusiastic?		
Did the 4-H’er encourage the audience to become involved in the demonstration?		
Did the 4-H’er speak directly to the audience?		
Did the 4-H’er show evidence of practice and experience?		
Did the 4-H’er show that she/he enjoys talking to the audience?		
Did the 4-H’er show enthusiasm, friendliness, and a business-like manner?		
Did the 4-H’er tell about what they learned through this 4-H project?		
<b>Comments:</b>		



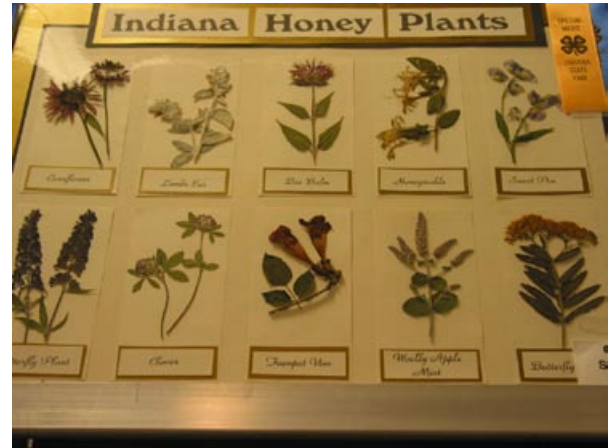


# Exhibits

You should get information about the 4-H Beekeeping exhibit from your county Extension educator. Indiana State Fair guidelines are available at the 4-H Web site ([www.four-h.purdue.edu](http://www.four-h.purdue.edu)).

Judges will evaluate your exhibit based on the following items:

1. originality
2. organization of materials
3. accuracy of information
4. interest and value of exhibit
5. depth of knowledge illustrated
6. attractiveness, neatness



## Resources

**Recommended Book:** *The New Starting Right with Bees* (21st Edition)

This book available from the publisher.

A.I. Root  
623 West Liberty  
Medina, OH 44256  
Phone: 800-289-7668

***Bee Hive*, a Purdue University Web site**

There are many beekeeping resources listed at the site:

<http://www.entm.purdue.edu/entomology/research/bee/>

Choose “getting started” under “Beekeeping Information.” You will find links to Indiana beekeeping associations, general information sites, local suppliers, contacts, journals, sources for books, videos, and slides, and more! If you do not have Internet access, check your local library or visit your county Cooperative Extension Service office.

Note: If you do not have access to the Internet you can ask your county Extension educator to help you access this information. Many public libraries also have computers you may use.



# Glossary

Afterswarms – Swarms that leave a colony with a virgin queen after a swarm of the same season has already left the hive.

American foulbrood – An extremely contagious disease of bees that affects them in the larval (worm) stage of development; caused by the bacteria *Bacillus larvae*.

Apiary – A collection of colonies of honey bees; also, the yard or place where bees are kept.

Apiculture – Beekeeping.

Bee escape – A device to remove bees from supers or buildings; constructed to allow bees to pass through in one direction but to prevent their return.

Beehive – A box or other structure for housing a colony of honey bees.

Bee space – An open space (1/4 to 3/8 inch) in which bees build no comb and/or deposit a minimum of propolis.

Beeswax – The wax secreted by honey bees from eight glands within the underside of the abdomen and used in building their combs.

Bee veil – A wire screen or cloth enclosure worn over the head and neck for protection from bee stings.

Bottom board – The floor of a beehive.

Box hive – A plain box without movable frames used for housing a colony of honey bees.

Brace comb – Small pieces of comb built between combs and the hive.

Brood – Young developing bees found in their cells in the egg, larval, and pupa stages of development.

Burr comb – Small pieces of wax built upon a comb or upon a wooden part of a hive because more than 3/8 inch space was left.

Castes – The different kinds of adult bees in a colony: workers, drone, and queen.

Cell – A single compartment in a honeycomb in which brood is reared or food is stored.

Chunk honey – A piece or pieces of comb honey packed in a jar with liquid extracted honey.

Clarification – The removal of foreign particles from liquid honey or wax by the straining, filtering, or settling process.

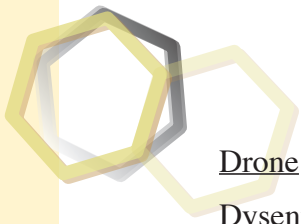
Cluster – The hanging together of a large group of honey bees, one upon another.

Colony – A community of honey bees having a queen, thousands of workers, and, during part of the year, a number of drones.

Comb foundation – Thin sheets of beeswax or plastic used to form a base on which the bees can construct a complete comb of worker cells.

Cut comb honey – Squares of honey in the sealed comb in which it was produced; cut from a shallow super-size frame of sealed honeycomb and then packaged in clear plastic.

Drifting – The return of field bees to colonies other than their own.



Drone – A male honey bee.

Dysentery – A disease of honey bees causing an accumulation of excess waste products that are released in and near the hive.

European foulbrood – An infectious disease affecting honeybees in the larval (worm) stage of development; caused by the bacteria *Streptococcus pluton*.

Extracted honey – Liquid honey.

Extractor – A machine using centrifugal force for removing honey from the comb without destroying the combs.

Field bees – Worker bees, usually at least 10 days old, that leave the hive to collect nectar, pollen, water, and propolis.

Frame – Four strips of wood joined at the end to form a rectangular device for holding honeycomb.

Granulated honey – Honey that has crystallized, changing from a liquid to a solid.

Hive – Worker bees furnished by man. As a verb, to put a swarm in a hive.

Hive body – A single wooden rim or shell that holds a set of frames. When used for the brood nest, it is called a brood chamber. When used above the brood nest for honey storage, it is called a super.

Hive cover – The roof or lid of a hive.

Hive tool – A metal tool with a scraping surface at one end and a blade at the other; used to open hives, pry frames apart, clean hives, etc.

Honeycomb – The mass of six-sided cells of wax built by honey bees in which they rear their young and store their food.

Honey flow – A time when nectar is plentiful and bees produce and store surplus honey.

House bee – A young worker bee, 1 day to 2 weeks old, that works only inside the hive.

Inner cover – A thin wooden board placed just beneath the hive cover for added protection and insulation from the elements, and to keep the hive lid from being glued to the hive body.

Job shadowing – Learning from others by following, watching, and studying what they do in their jobs.

Larva – The grublike or wormlike immature form of the honey bee in its second stage of metamorphosis.

Metamorphosis – The series of changes in form through which an insect passes; egg to larva to pupa to adult.

Movable frame – A frame of comb that can be easily removed from the hive. It is constructed to maintain a proper bee space, which prevents the bees from attaching comb or fastening it too securely with propolis.

Nectar – A sweet liquid secreted by plants, usually in their flowers, and converted into honey by bees.



Nosema – An infectious disease of the adult honey bee that infects the mid-gut, or stomach. It is caused by a protozoan parasite. Symptoms of this disease closely resemble those of dysentery.

Observation hive – A hive made mostly of glass or clear plastic to permit observation of the bees at work.

Pesticide – A general name for materials used to kill undesirable insects, plants, rodents, or other pests.

Pollen – Dustlike grains formed in the flowers of plants in which the male elements are produced. Honey bees use pollen as a protein food for their young.

Proboscis – The tongue of a honey bee.

Propolis – A kind of glue or resin collected by the bees for use in closing up cracks, anchoring hive parts, etc. It is also called bee glue.

Pupa – The third stage of a developing bee, during which it is inactive and sealed in its cell. The adult form is recognizable during this stage.

Queen excluder – A device, usually constructed of wood and wire or sheet zinc, having openings large enough for the passage of worker bees, but too small for the passage of larger drone and queen bees.

Robber bee – A field bee from one colony that takes honey from another colony.

Sacbrood – A slightly contagious disease of brood that is caused by a virus.

Sealed brood – Brood, mostly in the pupa stage, that has been capped or sealed in cells by the bees with a somewhat porous capping of wax.

Section comb honey – Honey in the sealed comb that was produced in thin wooden frames called sections.

Smoker – A device that burns slow-burning fuels to generate smoke for the purpose of keeping the bees calm while working in their hive.

Solar wax extractor – A glass-covered box for melting down beeswax by the heat of the sun.

Super – A receptacle in which bees store surplus honey placed “over” (above) the brood chamber. As a verb, to add supers in expectation of a honey flow.

Swarm – A large group of worker bees, drones, and a queen that leaves the mother colony to establish a new colony.

Travel stain – The darkened appearance on the surface of comb honey when left in the hive for some time; caused by bees tracking propolis over the surface as they walk over the comb.

Uniting – The combining of two or more colonies to form one large colony.

Virgin queen – An unmated queen.

Wax moth – A moth whose larvae feed on and destroy honeycomb.

**PURDUE**  
UNIVERSITY

*Purdue Extension*

**Knowledge to Go**

**1-888-EXT-INFO**



Revised 7/06

It is the policy of the Purdue University Cooperative Extension Service, David C. Petritz, Director, that all persons shall have equal opportunity and access to the programs and facilities without regard to race, color, sex, religion, national origin, age, marital status, parental status, sexual orientation, or disability. Purdue University is an Affirmative Action institution. This material may be available in alternative formats.

1-888-EXT-INFO • <http://www.ces.purdue.edu/marketing>