ELEVEN

Beekeeping

Question 1: Is beekeeping dangerous?

Answer: A prudent beekeeper will say that beekeeping is not dangerous, but a person who remembers a painful bee sting would probably disagree. The best answer to this question is "it depends." With careful attention to the hive and some basic knowledge of bee biology, beekeeping is not dangerous. The behavior of bees is relatively predictable; with experience, a beekeeper can safely manage the colony and keep the bees calm. Using a smoker to puff cool smoke onto the colony before it is opened is one important step in good beekeeping. In addition to using smoke, the colony will be calmer and easier to handle if the beekeeper wears light-colored clothing and moves carefully when working around the colony. Good weather conditions, ample nectar sources, plenty of food stored in reserve in the hive, and calm bees with good genetics are other key factors that help maintain safe conditions.

The beekeeper's behavior is of prime importance, and carelessness on the part of the beekeeper can elicit an aggressive response from the bees. The likelihood of arousing the bees and getting stung is increased by wearing dark-colored clothing or strong perfumes near the nest, moving quickly around the bees, or opening a colony during rain. Conditions that can destabilize a colony are a shortage of food, the proximity of pesticides or other chemicals, too much or too little water (water stress), disease, and overcrowding.

Fig. 34. A beekeeper, wearing a protective suit and veil, checks the health of the hive in a small colony in Pennsylvania. Note that gloves are not always necessary while working. *(Photo by Corey J. Flynn.)*

Question 2: What does a beekeeper's hive look like?

Answer: In the United States, the standard hive used by beekeepers is called a Langstroth hive, named after the person who discovered the "bee space"—the size of the space that the bees prefer between combs (see chapter 5, question 8: What is propolis?). An important feature of the Langstroth colony is its modularity, which means that the basic features of the colony are exchangeable, replaceable, moveable, and expandable.

Essentially, the hive is a solid wooden box measuring about 16 by 20 inches long (or about 40 by 51 centimeters), and it contains ten wooden frames in which the bees build their combs. The frames hang much like hanging file folders in a file cabinet, and the depth of the box can vary from almost 6 to over 9 inches (or about 15 to 23 centimeters). Each frame is typically supplied with a vertical sheet of beeswax or beeswax-coated plastic, called

foundation, which provides structure and support for the wax. In the wild, European honey bees normally build vertical sheets of wax to use for brood rearing and food storage; the bees in managed colonies build their wax over the foundation template, which becomes the bottom of the honeycomb that they build. Beekeepers call this process building out or drawing out the foundation. The wooden frames with a drawn-out foundation in place become very stable, a characteristic useful to efficient honey harvesting (see this chapter, question 6: How does a beekeeper take honey from a hive?).

Fig. 35. A two-story Langstroth hive on the campus of Bucknell University. This colony has one tier for brood rearing and one for honey storage. *(Photo by Debra Cook-Balducci.)*

Fig. 36. In a healthy hive, worker honey bees boil out on the top of the brood frames when the hive is opened. *(Photo by Elizabeth C. Evans.)*

A single Langstroth box is called a "hive body"—a well-managed beehive typically has one or two hive bodies where the bees rear the brood and then one or two "supers" for honey storage. Brood rearing occurs on the lower tiers of the colony, while the upper tiers serve as the pantry. The bees will also store pollen in the form of bee bread and some honey around the brood nest areas. A beekeeper doesn't need to do anything to tell the bees where to rear brood or store honey—they naturally organize their colonies in this way (see color plate A).

A wooden inner cover is set on top of the supers. The inner cover is usually made of wood and fits snugly over the Langstroth box. One surface is flat, and the other has a one-half-inch outer edge. An inner cover is typically vented with either a small notch in the wooden edge or a round or oval-shaped hole in the center or both. The flat side of the inner cover is placed against the top super with very little space between it and the top bars

of the frames, and this prevents the bees from building comb to fill in the gap between the inner cover and the top super. For the winter, when the bees hunker down in the hive, the inner cover is flipped upside down and the small lift around the outer edge creates an airspace that promotes air circulation and the evaporation of moisture that may accumulate. Without this space during the winter, the water in the hive could freeze and create unmanageable conditions for the bees.

Over the inner cover, an outer cover is placed over the entire top of the colony. Often made of wood covered in sheet metal or plastic, the outer cover is designed to protect the top of the hive from rain, snow, and wind. Lightweight outer covers are not typically used in locations with cold winters.

The stack of supers is set on a wooden bottom board that serves as the base of the hive, and the entire structure is usually set on a layer of cinderblocks or on a wooden stand or pallet. Keeping the beehive off the ground promotes good ventilation and prevents the colony from becoming waterlogged during rains.

Question 3: How do beehives vary in other countries?

Answer: The basic modular principles of the Langstroth hive are represented in other types of beekeeping equipment used in other countries, including the National hive in the United Kingdom, which is square, rather than rectangular, and just a bit smaller than the Langstroth hive. One of the advantages of these tiered hives is that they take advantage of the natural tendency for bees to build their colonies in a vertical fashion, with the honey being stored in the top regions of the colony and the brood nest kept toward the bottom—perhaps this organization allows the bees to regulate the space they can dedicate to building new comb to hold additional brood when necessary.

Top bar hives (TBHs) are usually longer than they are tall, and they offer an alternative style of beekeeping to the standard type described in this book. TBHs rely on moveable combs, rather than the traditional moveable frames; the combs hang

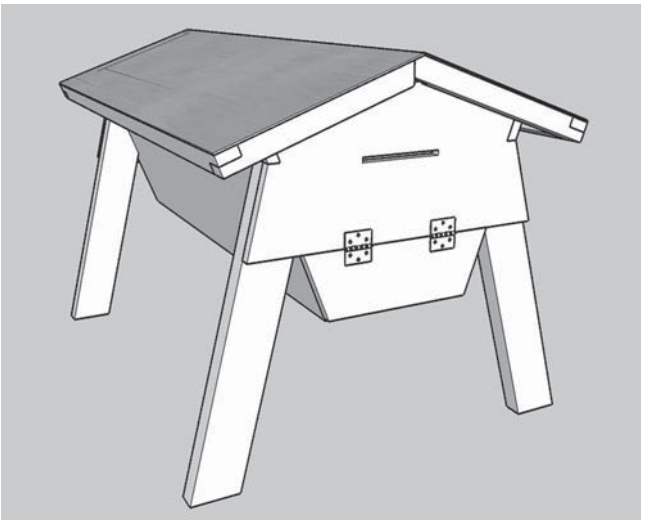

Fig. 37. Top bar hives, an alternative to the Langstroth hive, allow the bees to create free hanging combs and to develop their colonies horizontally, rather than vertically. *(Image provided by Sean Palmer.)*

down from bars across the top of the hive, and the bars fit together to make up the roof of the hive. The hive is often open underneath. These non-Langstroth hives have been used for beekeeping for hundreds of years, and they are commonly used in developing countries as they are considered less expensive to operate than traditional hives. Different management methods are required for TBHs because the combs are often destroyed when the honey is harvested. Some beekeepers believe that TBHs promote healthy bees, but to date, there haven't been many scientific studies to verify that idea.

Question 4: What is a bee skep?

Answer: A bee skep is a bell-shaped straw basket that was once used for housing bees (see color plate G). Its now familiar curved "beehive" shape was at one time a regular feature in gardens. Bees entered a skep through a small door along the

bottom edge of the basket, and due to the design, the beekeeper would have to destroy the entire colony when harvesting honey from these structures. Currently, skeps are purely decorative, and in many municipalities it is illegal to keep bees in skeps or in other non-traditional hives because they are impossible to inspect for bee health. Bee skeps inspired the iconic 1960s "beehive" hairdo.

The bee skep is a metaphor for hospitality or industriousness, often used as a logo for its symbolic value. Bee skeps are well-known objects in the state of Utah because the highway signs are in the shape of a skep, and they adorn many buildings around Temple Square in Salt Lake City. In her book on bees in American history, Tammy Horn describes the symbolism of the skep for the Mormon founders of the state as a non-religious icon representing frugality, work, and faith.

Fig. 38. Popular in the 1960s, the beehive hairdo was a creation of stylist Margaret Vinci Heldt of Elmhurst, Illinois. The shape is reminiscent of a bee skep, a primitive beehive. *(Photo by Ken "Butch" Ehlers.)*

Fig. 39. Bee and beekeeping symbols are not uncommon in the United States. State roads in Utah are marked within the image of a skep, reminding drivers of the state motto, "Industry." *(Photo by Mary Capaldi Carr.)*

Question 5: How does a beekeeper manage a hive?

Answer: A beekeeper's primary tasks in hive management are to assess the behavior of the bees, to monitor and anticipate the space needed by the colony, and to treat the colony for diseases. Beekeepers have a yearly set of activities that are required for good management of their hives. During the winter, equipment is typically repaired, painted, or replaced. In the late winter, the beekeeper will assess whether the colony has enough food to last until the spring. When the bees become active with the onset of springtime, the keeper will make sure that the brood nest is being formed in the lower tiers of the colony, remove any damaged equipment, and provide food if the colony needs an extra boost. As the weather reliably warms and flowers begin to appear, the primary task becomes monitoring the space needs of the hive. Once spring arrives, a beekeeper will visit each colony at least every two weeks to check on the bees. Honey made in the spring and early summer is removed in midsummer, and this is the

share of the honey for the beekeeper. The bees then have the opportunity to rebuild the honey stores they will need to sustain them through the winter from flowers that bloom in late summer and early autumn.

Question 6: How does a beekeeper take honey from a hive?

Answer: In past centuries, taking honey from wild colonies usually involved subduing the bees with smoke and breaking open the area of the hive where the colony was located. The honeycombs were torn out and destroyed along with the eggs and larvae. The honey was strained through a sieve or a basket to remove the broken pieces of comb and any other solids from the liquid honey. Modern beekeepers, however, have the benefit of moveable frame hives, and when the honey is removed using a hive tool and extracted from the honeycomb frames, the beeswax can be returned to the hive for refilling by the worker bees. Exactly how a beekeeper removes honey frames from beehives depends on the number of frames and the number of colonies that the beekeeper is managing. A hobby beekeeper may harvest just a few frames of honey, while a large beekeeping operation might harvest hundreds of frames.

The first challenge is to remove the bees from the frames of honey. A hobbyist may simply remove individual frames and use a soft bee brush to dust off the adult bees before taking the honey away, while a larger operation will use a machine, called a bee blower, that creates forced air to blow the adult worker bees off the honey frames. Many beekeepers use an alternative method of separating bees from honey, called a bee escape. This creates a one-way passage that is placed between the honey supers and the brood region below, allowing the bees to crawl downward through the escape, but not return back up. After the escape has been left in place for about twenty-four hours, the honey supers are typically bee free and can be removed without disruption of the frames. A final technique is the

use of chemical bee repellents, either benzaldehyde (almond oil) or butyric anhydride (known in the beekeeping industry by its brand name, Bee-Go™). A few drops of these liquids are placed on a board that is specially designed for hive fumigation, and the board is placed for two to five minutes on top of the honey frames. The bees in the honey area will move away, and the beekeeper can take the honey off but leave the bees inside the colony. If used properly, chemical repellents are effective, but if overused, they can disrupt the entire colony.

The next task is to remove the honey from the combs. Each frame of honey is capped with a thin layer of beeswax that must be removed so that the honey can be extracted. The cappings can be removed with an uncapping fork, an uncapping knife, or another mechanical tool. Next, the frames are put into a honey extractor, which works like a large salad spinner. As the extractor rotates, the honey is forced out of the frames and down into a large holding vessel, and then the honey is usually filtered to remove large bits of wax. In some larger honey-extraction fa-

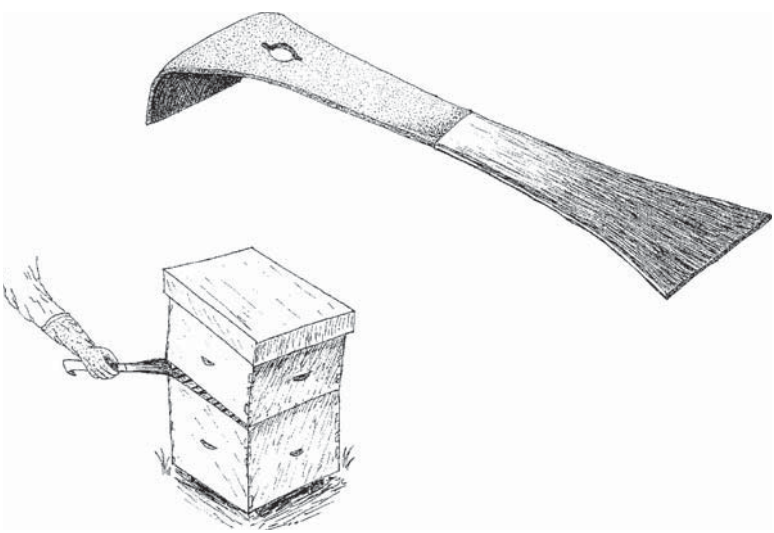

Fig. 40. A hive tool is a metal pry bar that helps beekeepers separate hive parts. It is usually painted red so that it stands out against a grassy background. *(Drawing by John F. Cullum.)*

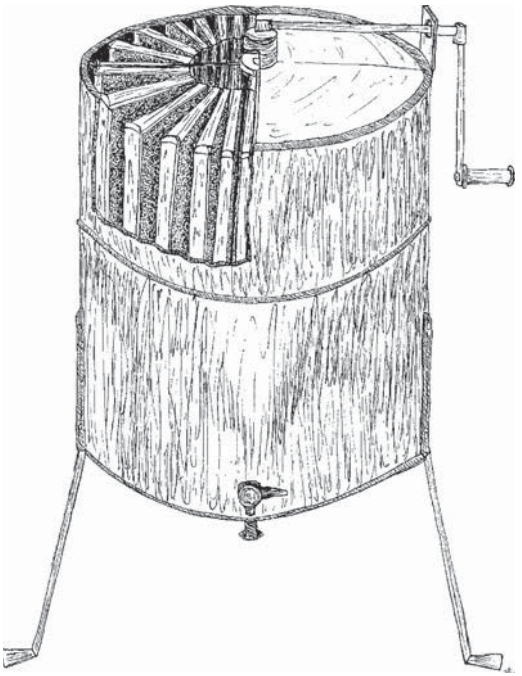

Fig. 41. A four-frame honey extractor operates via hand crank. Frames of honey spin within the chamber, spilling honey into the tank. The extracted honey is then decanted, filtered, and put into jars. *(Drawing by John F. Cullum.)*

cilities, the honey is heated so that it flows readily through the extraction and filtration process, but smaller honey extractors do not heat the honey as it is being processed.

Question 7: Can the beekeeper stop the bees from swarming?

Answer: With the use of modular beekeeping equipment, it is possible to stop bees from swarming. The bees are usually triggered to swarm because the colony is overcrowded, and if a beekeeper gives the bees extra supers to grow into, overcrowding can be controlled. Once the preparations for swarming begin (see chapter 8, question 2: What is swarming?), it is much harder to convince the bees that they don't need to swarm, and at that point just adding more space may not be enough. The beekeeper may need to put empty frames between the frames of existing

combs to be sure that the bees get the message that they can stay in their nest and expand their resources into the new space.

Question 8: Why do some beekeepers clip the queen's wings?

Answer: Some beekeepers clip the queen's wings as an extra measure of bee insurance, because if the queen swarms, she will take thousands of worker bees along with her. If the queen bee cannot fly because her wings have been clipped, any swarm that forms will return to the colony. Other beekeepers don't like this practice, and they try to use good colony management to keep the bees healthy and to discourage swarming.

Question 9: Can the beekeeper put a new queen in the hive if the old one dies?

Answer: Yes, a queen can be replaced by a beekeeper, but requeening can be a difficult process because the workers have a preference for their own queen. If the queen of a colony dies naturally, the workers will usually know that she is dying and will rear a new queen to replace her. If the queen is killed accidentally, the workers may be able to rear a replacement queen from a newly laid egg.

Under some circumstances, the beekeeper may want to replace the queen with one that has particular characteristics, such as being a better egg layer, but if a new queen is released directly into a bee colony, the workers will treat her like a stranger and forcibly remove her from the colony and possibly kill her. Normally, the guard bees learn the odor of their own colony members and prevent bees from other colonies from entering the hive. If the queen is enclosed in a small cage and introduced into a queenless colony, the bees will adjust their behavior and will come to accept her. Despite her novel odor, they will detect that she is a queen and will soon treat her as their own. Queen cages are made of wood and mesh screen, and one end has an

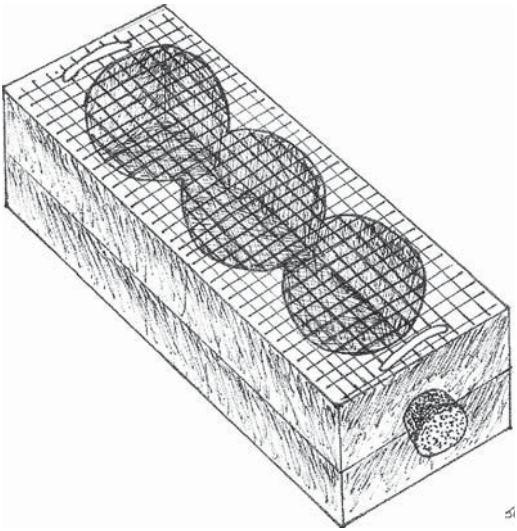

Fig. 42. A wooden queen cage has three compartments and is large enough to hold a queen and a few worker attendants. Cages hold the queen in new packages of bees and are used to re-queen a hive. *(Drawing by John F. Cullum.)*

exit hole drilled in the outer edge. This section is typically filled with a semi-soft sugar candy, and as the bees adjust to the new queen's odor, they eat the candy and free the queen by making it possible for her to crawl through the exit hole.

Question 10: What is a smoker?

Answer: A smoker is used by beekeepers to protect themselves from being stung by angry bees when the hive is opened to collect honey or wax. The smoker consists of a metal canister fitted with bellows and a small spout-like lid that can direct smoke in a particular direction. Beekeepers usually light a small controlled fire inside the smoker with a bit of newspaper and then burn smoke-producing kindling of dry pine needles, straw, cedar chips, or burlap.

The cool white smoke produced by the smoker pacifies the bees in a number of ways. First, the smoke triggers the bees to eat large quantities of honey, which engorges them and makes them sluggish. This behavior is probably an unlearned response that developed as bees evolved in areas where there was a risk that fire might destroy the colony; a full stomach would be useful

if they were chased out of their meltable home by fire. When the bee becomes engorged, it has difficulty extending its stinger, providing another safety feature for the beekeeper. Finally, just as it is more difficult to smell a particular odor in a smoky room, the smoke also makes it harder for the bees to detect the alarm pheromones that are produced when bees are provoked. Disrupting this communication between the bees helps prevent their defensive responses to the threat presented when the beekeeper opens the hive.

Fig. 43. A small fire within a smoker generates cool smoke that calms bees. Beekeepers may burn pine needles, burlap, cardboard, or cedar chips. *(Photo by Debra Cook-Balducci.)*

Question 11: How is beeswax harvested?

Answer: Beeswax is harvested when the honey is harvested. The wax cappings removed from the honey frames are collected, melted, strained to remove impurities, and put into wax molds. While the entire honeycomb is made of wax, a beekeeper will typically return the frames containing the drawn out foundation to the hive after removing the honey from them. By doing so, the beekeeper encourages the bees to make more honey, rather than asking them to rebuild the shelves of their pantry.

Question 12: How can I start my own hive?

Answer: One of the best ways to start is to learn beekeeping with an established beekeeper before initiating a solo hive. Beekeeping organizations are common in most American communities, and most beekeepers enjoy teaching their craft to "newbees." Many beekeeping clubs and many state agricultural extension agencies offer short courses or workshops about beekeeping, and they have meetings and field days where events are scheduled for those interested in bees. Along with the activities described above, they might, for example, have a guest entomologist demonstrating bee dissection procedures to inspect for tracheal mite damage, something of great concern to beekeepers (see chapter 10, question 3: What parasites and insects prey on bees?). Some universities and colleges offer classes in beekeeping or apiculture. Appendix A provides a list of beekeeping organizations that can provide local references and resources.

There are three basic ways to start a new hive: splitting a colony, capturing a swarm, or creating a colony from a package. Actually, the latter two methods are essentially the same biologically, as a package of bees is simply just a swarm enclosed in a mesh box. Most new colonies are initiated from packages because the lineage of the queen is known and, therefore, characteristics of the bees are more predictable than those of a captured swarm that may have come from a colony with undesirable characteristics.

Beehives can be very productive in a variety of environments, but they are typically put in areas that can be warmed by the sun in the early morning and that are unlikely to be flooded. Colonies typically do best when their nest entrance faces away from the primary wind direction. There are many people who enjoy rooftop beekeeping in urban environments. A source of clean water may need to be provided by an urban beekeeper, but public parks, window boxes, and backyard gardens can provide ample food, and chances are good that nearby terraces have potted plants and flowers that are good sources of nectar and pollen. Bees can learn the location of profitable food sites and they will return to them regularly (see color plates C and D).

Question 13: Are there any reasons why people should not keep bees?

Answer: Some local governments have ordinances that prohibit beekeeping activities within certain areas, but most communities are tolerant of small-scale beekeeping operations, even in residential areas. In some arid climates, bees can become serious pests at swimming pools and care should be taken to

The Story of Brother Adam

A fragile young boy named Karl Kerhle (also written Carl Kehrle) was the son of a miller in a German village. Because of his health problems, in 1910, when he was eleven or twelve years old, his mother sent him to live at Buckfast Abbey in southwestern England. He was assigned to help tend the beehives that had been part of that Benedictine monastery since around 1882. By 1919 he joined the order and became a monk named Brother Adam, and he continued to work with the bees for over seventy-eight years, becoming internationally known as a bee expert. He wrote three books about beekeeping and was awarded the Order of the British Empire and many other honors for his work.

The Story of Brother Adam

Once he became a monk, he took over responsibility for the care of the bees, and there were serious problems. Over the prior three or four years, thirty out of the forty-six colonies at the abbey and 90 percent of the hives throughout England had been devastated by what was called Isle of Wight disease, later identified as tracheal mites. Brother Adam realized that the bees that survived the disease were all of Italian origin, and that the native British black bees, the northern variant of *Apis mellifera mellifera,* had all perished. He began using cross-breeding to develop a healthy bee population that would be a good honey producer, hardy like the black bee but disease-resistant like the Italian bee.

Brother Adam traveled all over the world to learn about native strains and to import breeding stock. Over the years, he journeyed over one hundred thousand miles, and he developed an experimental breeding program that ultimately produced the Buckfast Bee, a disease-resistant, gentle bee—a good pollen gatherer that is less inclined to swarm than many other types of honey bees. He gradually improved the strain at the abbey by crossing them with bees he discovered during his travels in Europe, the Near East, and North Africa, and Buckfast queens are still valued by beekeepers worldwide. At last count there were 240 hives that were placed in nine apiaries in the vicinity of the abbey. In 2004, over four tons of honey was produced in the abbey's immaculate and modern extraction facilities.

Brother Adam gave up his bee research in 1992 because the monastery's new abbot insisted that the main function of the abbey apiaries was honey production, not research. He was ninety-three years of age, and he died soon afterwards in 1996 at the age of ninety-eight. His three books about bee breeding and the Buckfast Bee are *In Search of the Best Strains of Bees, Beekeeping at Buckfast,* and *Breeding the Honeybee.*

provide fresh sources of water to bees in these locations. Good communication between beekeepers and their neighbors can prevent misunderstandings about the perceived dangers of beekeeping, and annual gifts of local honey often smooth relationships between beekeepers and neighbors.

People for the Ethical Treatment of Animals (PETA), an animal rights group, refers to keeping bees as "bee slavery." Their policy statement says, in part, "honey bees are victims of unnatural living conditions, genetic manipulation, and stressful transportation." Actually, small beekeeping operations need to be respectful of the bees and careful to provide healthy conditions or their colonies will die, so their bees are generally comfortable and productive. Honey bees are a regular and important part of agriculture, and commercial beekeeping has become an industry. And like all industries, it has problems and needs some regulation to ensure the safety and fair treatment of its participants. Clearly, this issue is one with multiple perspectives, and the position of animal rights groups may not be the dominant one.

There are native bee movements in the United Kingdom (British Isles Bee Breeding Association, or BIBBA), Ireland (Galtee Bee Breeding Group), and Denmark. Their goal is to restore the original species, specifically, the British Black, the French Black, the Danish Black, and some other subspecies of honey bees. These groups want to preserve the genetic biodiversity of honey bee breeds and to use the original lineages to artificially select for desirable traits. This process may produce more gentle bees or bees with the ability to resist infection.

Question 14: How can I safely observe bees?

Answer: Beekeepers and their families often bring samples of their honey to be judged competitively at state and county fairs, and they sometimes bring a hive full of bees along as well. They may demonstrate such bee-related activities as candle dipping, candle-making with wax molds, honey extraction, bee dances, and mead making (see chapter 7, question 9: What is mead?).

Fig. 44. Bee scientist Dr. Jeri Wright with a "bee bikini," demonstrating that "bee beards" aren't the only way that beekeepers can manipulate a swarm of honey bees. *(Photo by Jodi Miller.)*

One especially dramatic demonstration is a person with a beard made of living bees. Bottled queen pheromone is applied to the person's face to attract bees in a controlled swarm, giving the appearance of a beard. In the old days, an actual queen in a specially constructed cage was fitted to the chin and then hidden

by the swarm that came to surround their queen. Though this stunt looks dangerous, the bees aren't inclined to sting when they sense the presence of their queen.

Many zoos, botanical gardens, garden centers, and plant conservatories have observation colonies in indoor exhibits so that visitors can appreciate the activities of bees without fear of being stung. An observation colony is essentially a beehive sandwiched between two thick panes of glass, where the bees live on frames set into the hive, just as they would in a conventional beekeeper's hive. The bees go about their business as usual, caring for the queen and flying to and from the colony through a port in the wall of the hive. Many features of bee biology have been identified by researchers using this type of structure.