BEE NEWS & VIEWS

The Mississippi Beekeepers Association Newsletter

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U.S. Honey Production Down 12% for Operations with Five or More Colonies

By National Agricultural Statistics Service, USDA

United States honey production in 2015 from producers with five or more colonies totaled 157 million pounds, down 12 percent from 2014.

There were 2.66 million colonies from which honey was harvested in 2015, down 3 percent from 2014. Yield of honey harvested per colony averaged 58.9 pounds, down 10 percent from the 65.1 pounds in 2014. Colonies which produced honey in more than one State were counted in each State where the honey was produced. Therefore, at the United States level yield per colony may be understated, but total production would not be impacted. Colonies were not included if honey was not harvested. Producer honey stocks were 42.2 million pounds on December 15, 2015, up 2 percent from a year earlier. Stocks held by producers exclude those held under the commodity loan program.

Operations with Less than Five Colonies Produced 720 Thousand Pounds of Honey in 2015.

United States honey production in 2015 from producers with less than five colonies totaled 720 thousand pounds. There were 23 thousand colonies from which honey was harvested in 2015, with an average yield of 31.3 pounds harvested per colony. This yield is 27.6 pounds less than what was pulled per colony on operations with five or more colonies. Comparisons to 2014 are unavailable because no data prior to 2015 was collected for operations with less than five colonies.

Honey Prices Down 4 Percent for Operations with Five or More Colonies.

United States honey prices decreased during 2015 to 209.0 cents per pound, down 4 percent from a record high of 217.3 cents per pound in 2014. United States and State level prices reflect the portions of honey sold through cooperatives, private, and retail channels. Prices for each color class are derived by weighting the quantities sold for each marketing channel. Prices for the 2014 crop reflect honey sold in 2014 and 2015. Some 2014 honey was sold in 2015, which caused some revisions to the 2014 honey prices. Price data was not collected for operations with less than five colonies.

Honey Production 2014

State	No. Colonies	Yield per Colony (lbs.)	Avg. Price per pound	Total Value ($ million)
Mississippi	20,000	112	$2.01	4.5
South Dakota	280,000	87	$2.08	50.7
North Dakota	490,000	86	$1.99	83.9
Montana	162,000	88	$2.09	29.8
all of U.S.	2.7 million	65	$2.17	387.4

USDA, National Agricultural Statistics Service

Honey Production 2015

State	No. Colonies	Yield per Colony (lbs.)	Avg. Price per pound	Total Value ($ million)
Mississippi	15,000	83	$2.64	3.3
South Dakota	290,000	66	$1.79	34.3
North Dakota	490,000	74	$1.80	65.3
Montana	146,000	83	$1.94	23.5
all of U.S.	2.6 million	59	$2.09	327.2

USDA, National Agricultural Statistics Service

Rather than show all 50 States, I truncated data to show Mississippi and the top 3 honey-producing states

Honey Price by Color Class – United States: 2014 and 2015
[Producers with 5 or more colonies that also qualify as a farm]

	Price					
	Co-op and private		Retail		All	
	2014	2015	2014	2015	2014	2015
	(cents per pound)	(cents per pound)	(cents per pound)	(cents per pound)	(cents per pound)	(cents per pound)
Water white, extra white, white	204.6	189.0	328.5	354.2	206.2	191.0
Extra light amber	209.6	204.0	392.2	411.8	218.3	215.4
Light amber, amber, dark amber	208.8	198.8	417.1	398.4	234.2	230.5
All other honey, area specialties	255.4	238.3	535.2	647.0	317.2	330.3
All honey	207.1	195.5	405.4	409.6	217.3	209.0

Editor's comments: It strikes me that the retail price for honey should be much more than twice the wholesale price. Perhaps some of you are getting higher, but I thought that my $7.00 per pound was cheap. Mr. Wesley tells me that he pushes it as high as possible, and I encourage everyone to do the same. Your time and effort is worth the money.

Also, I am a little skeptical about the decline in both the number of colonies and the honey production for Mississippi during this two year period. I guess that a 30-pound loss in average yield would have been more apparent to me, and I just did not have the sense that production had been reduced so greatly. Of course, I could just be completely removed from reality here.

Beekeepers Meet in Greenwood

By Jeff Harris

I meet with a small group of beekeepers in Greenwood, MS on Saturday, January 8. Mr. Travis Clark is the informal leader of the group and the catalyst which stimulated the meeting. He and several other men of town have gotten into beekeeping. Most of them were brand new beekeepers, and my goal was just to give them an overview of seasonal management.

This kind of seminar is good to give in winter BEFORE it is time to actually get in the field and work with bees. We spent a good part of the morning with an informal presentation and questions and answers. This was followed by trips to actually visit colonies already owned by some of the members. Unfortunately, the weather was rainy that day, and our time in the colonies was cut short by thunder showers. I hope to continue my interactions with many of these beekeepers. My goal is to help them to successfully raise bees and sell some honey!

Queen Rearing Lecture for NE Beeks

By Jeff Harris

I presented basic queen rearing at the quarterly meeting of the Northeast Beekeepers Association in Fulton, MS on January 12. This is one of the most frequently requested topics for lectures and workshops. Most people in the audience would only ever need to produce a handful of queens at any one time, but I covered queen rearing from the commercial perspective as well.

I presented grafting of bee larvae to produce queens as the commercial standard, but I also emphasized non-grating techniques for obtaining bee larvae of an age appropriate for queen production. Probably the most important thing to remember about raising queens is that the quality of colony nutrition and the abundance of nurse bees is what determines success (see the article in this issue for more information).

Pollinator Crisis Presented to the MACD

By Jeff Harris / MACD website

I spoke about the honey bee CCD crises to the Mississippi Association of Conservation Districts, Inc. (MACD) in January. I gave my usual spiel on some of the hyperbole surrounding bee losses, while simultaneously telling them of the factors that do cause significant colony mortality. I emphasized that high mortality rates stem from multiple factors that included *Varroa* mites, viruses, *Nosema*, poor nutrition and pesticides.

Although I had heard of MACD before the talk, I really only had a vague notion of what they did. So, I thought that some of you might also wonder. MACD was established in 1945. It is a non-profit, non-governmental organization composed of the 82 Soil & Water Conservation Districts in Mississippi. MACD is governed by a thirty-one member Board of Directors and represents more than four hundred district commissioners throughout Mississippi.

What is a Soil and Water Conservation District?

During the 1930's, as Americans were recovering from the Great Depression, along came an unparalleled ecological disaster of national consequence. Americans looked out their windows to a black fog of dust, slowly moving across the entire United States. Following one of the most severe droughts in history across the Great Plains, the region's soil began to erode and blow away creating great clouds of dust, some of which began to settle in Washington, and came to the attention of President Franklin Dl Roosevelt.

Through a Presidential mandate, Congress subsequently passed legislation declaring soil and water conservation a national policy and priority. Congress realized, since about 75% of the land in the continental United States was privately owned, that the only guarantee for the success of a conservation program was to garner voluntary support from the landowners.

In 1937, President Roosevelt wrote the governors of all states recommending legislation that would allow local landowners to form soil conservation districts.

The Mississippi Legislature, in 1938, officially recognized that our soil resources were deteriorating at an enormous rate and that this was being caused by misuse or improper use of the land and the lack of applied conservation treatment or measures. It further recognized that if this were allowed to continue, the results would be disaster.

In its effort to solve the program, which was primarily soil erosion, the Mississippi legislature enacted the Soil Conservation Law (currently the Soil and Water Conservation Law), in which the State Soil Conservation Committee (currently the Mississippi Soil and Water Conservation Commission) was created. Provisions were made so that each county could organize a soil and water conservation district. A Soil & Water Conservation District's governing board is comprised of voluntary citizens who come together and represent land owners and users in their district and ensure a local voice in conservation.

Overview of Queen Production

By Jeff Harris

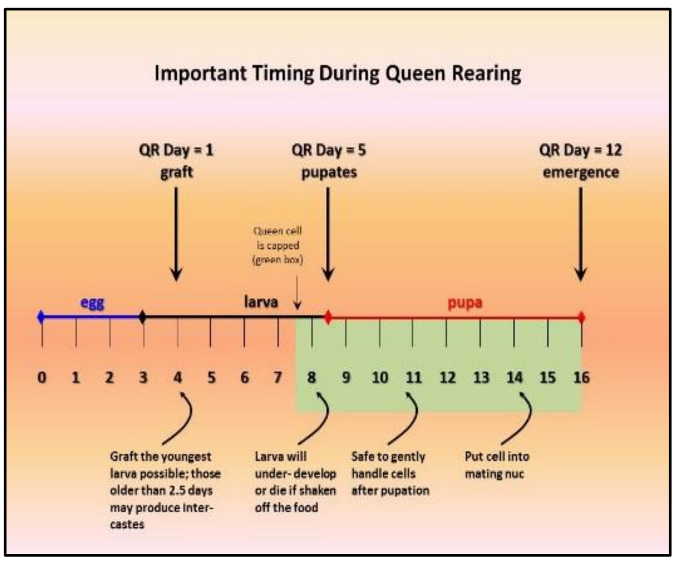
One of the first responses to loss of a queen is for a colony of bees to construct queen cells around young bipotent larvae (< 1-2 days old) and rear queens. Scientists and commercial queen producers take advantage of these natural tendencies to mass produce queens for research or for profit.

Although a queenless colony is often used to rear queens, even queenright colonies can be manipulated to produce queens. The style of queen rearing varies with beekeeper; so, I will not discuss every technique. I will emphasize the way that I learned to raise queens from a commercial mentor. If you want more detailed information, I highly recommend Harry Laidlaw's classic Contemporary Queen Rearing, the queen-rearing chapter from The Hive and the Honey Bee, or Larry Connor's Queen Rearing Essentials.

Just to give you an overview, I will outline the queen rearing process. First, one or several colonies will serve as sources of young bipotent larvae. These donor colonies are called queen mothers or breeder queens in a queen breeding program where stocks of bees are selected based on beneficial genetic characteristics. A good breeder queen can cost $500.00 or more.

The first step in commercial queen rearing is the grafting of young larvae into queen cups. These queen cups will be given to a queenless colony that already has the desire to rear queens. Often these colonies are called ‘cell starters’. In 1-2 days the young queen cells will be moved to another colony called the ‘cell finisher’ where the queen cells will be capped.

If you remember the development time of the queen (total = 16 days), the capped cells should be removed from the ‘finisher’ by the 9th-10th day after grafting to prevent virgin queens from emerging in the ‘finisher’ where they will fight and kill one another. I like to separate the cells on the 9th day because they are tough enough to survive being handled, and there is no risk that some will emerge on this day. This will give me another 2.5 days to get the cells into nucs before queens emerge from their cells.



Key Moments in Queen Rearing

Some people use a single queenless or queenright colony for cell starting and another colony for cell finishing. Most folks that I know will use a single queenless colony to start and finish queen cells. When both processes (starting and finishing) occur in one unit we call that unit a ‘cell builder.

We (at the MSU apiculture lab) emerge the virgin queens in individual vials in the incubator, but most commercial queen producers put queen cells into tiny colonies called ‘nucs’ (short for nucleus of a colony) to emerge them. Usually, only 1-2 cells are put into a single nuc in order to guarantee at least 1 queen will emerge. These nucs are designed for mating queens - the colonies are not strong enough to survive or produce a honey crop. They are kept small and queenless except for the periods of time when queens are being mated in them. Usually, many nucs are kept together and the whole collection (which may be in the 100’s) is called a mating yard.

Drones are necessary for mating virgin queens, and each queen may mate with 20-25 drones. Therefore, it is imperative that commercial queen producers supply strong drone-producing colonies to the area around a mating yard (within the mating yard and up to a distance of 1-2 miles). A good rule of thumb is to supply 4x the drones that are needed to mate a single queen, or 100 drones per queen to be mated. Since most natural colonies may only produce 800-2,000 drones in a spring season, colonies may need to be stimulated with drone foundation or drone combs to produce more drones. Many drone-producing colonies (20-50) will be needed to mate 100’s of virgin queens. The timing is important too! Drones require 24 days to develop from egg to adult, and they need 12-16 days after emerging to become sexually mature. Therefore, drone production must begin at least 40 days prior to trying to mate the first set of queens.

Also, colonies that supply drones for mating must have low varroa mite infestations. Drones are severely damaged by varroa mites, and even if they survive being raised in a brood cell with varroa mites, they very often die before reaching sexual maturity at 10-12 days post-emergence. Drones are also very sensitive to formic acid and other chemicals that are used to control varroa mites. Formic acid probably has the more toxic effect, but all chemicals or miticides can potentially harm drones.

The queens are given time to emerge from their cells and mate and then to start laying eggs, which usually occurs within 10-14 days of introducing the queen cell into the nuc (if the weather is good). Virgin queens can delay mating flights for more than 4 weeks if periods of bad weather occur. The commercial beekeeper catches the new egg-laying queen from each nuc at about 2 weeks after the cells were introduced. The beekeeper usually puts a new batch of cells into the nucs as he removes the newly mated queens (to keep the cycle going).

Each queen is usually marked with a number tag or paint, and her wings will be clipped. She is caged with 10-15 worker bees and queen candy, and then the unit is shipped to a client beekeeper. Prices vary between commercial queen breeders, but $25-$32 is the usual cost for a young mated queen.

Queen Rearing:

grafting → cell starter → cell finisher → individual cells into nucs

→ mating → initial oviposition → caged and shipped to client

Grafting

Grafting tiny bipotent larvae into commercial queen cups requires practice and patience. A grafter will lift a larva from its brood cell on a comb and transfer it to a large cup that is mounted on a wooden bar. Most cups these days are plastic. The tool for making this transfer is a grafting needle, a blade of grass or other grafting tool (e.g. Chinese grafting tool, JZ-EZ's tool). My favorite tool is a metal grafting needle made from a bicycle spoke. No two grafting needles are the same at some labs (everybody makes their own).

Injury to young and fragile bee larvae will cause a failure in the graft. Most of these needles are made to slide beneath the larva and gently scoop it out of the natural brood cell. In the past, a bee larva was gently transferred to a drop of grafting jelly (royal jelly that has been diluted with water to the consistency of tomato sauce) that has been placed on the bottom of a queen cup. We have found that a drop of distilled water works well, and it avoids the possible transmission of viral diseases that occurs with using royal jelly. This whole procedure is performed either beneath a dissecting microscope or under a large magnifying glass by old folks like me. Most experienced people (and with younger eyes) in commercial queen rearing can graft larvae without added magnification.

Usually, 15-20 cells are placed on each grafting bar. A total of 60-90 cells can be given to a strong cell builder during the swarm season in the spring when nutrition is highest from incoming pollen. Choose the youngest larvae possible: a larva that is the size of a honey bee egg is newly hatched and ideal for grafting (usually there is not much brood food around these larvae because they have only recently received attention from nurse bees). The more brood food you see under a larva, the older it is.

Procedure:

1. Select a frame of young brood from your colony.
2. Assemble 10-20 wooden bases onto a bar.
3. Place a plastic or wax cup into each base.
4. Add one small drop of water to each cup
5. Transfer a 1-day old larva from source comb into each cup.
6. When all transfers are complete, the bars are placed into a cell starter (or cell builder)

Note - it is best to hold the queen cups and jelly in an incubator or warm room for at least a half hour before the graft; the warmer surfaces will be less of a shock to the transferred larvae.

Cell Starter

One type of cell starter that is easy to use is a swarm box. The swarm box is a small five-framed colony that only contains three frames (two full honey combs and one full pollen comb). The honey combs are placed all the way to the walls of the box. The pollen is placed in the center of the box. This leaves two slots on either side of the pollen comb to receive frames that hold bars of grafted larvae. The swarm box is fitted with a screen as a bottom board, and the 3-5 lbs. of bees that are added to the box will not be permitted to fly during cell building. To keep the bees from overheating, extra space must be given to allow the cluster to expand. The bees are kept queenless. The bees used for a swarm box are usually collected 3-4 hours before a graft.

Commercially, this is the least efficient method of maintaining cell starters. However, the largest queen cells (hence, largest queens) come from using this technique. Within 1-2 days the uncapped cells are moved from this swarm box to a cell finisher. A 50%

sucrose solution is fed to the bees when they are raising queens.

Cell Finisher

The cell finisher can be a queenless colony that is given young bees and capped brood from other colonies in order to support it. The bees stay under a continual state of queenlessness for the queen-rearing season. During the peak of swarm season, cell finishers can also be queenright. Strong queenright colonies actually produce some of the largest queen cells. It is more difficult to get queenright finishers to raise queens in the early summer, but in general, it is hard to get queens raised in Mississippi after mid-June.

The uncapped cells from the starter are placed in the center of the finisher, and pollen of capped brood combs are placed on either side of each frame of grafted bars. The cells are capped in a few days, but most people wait until 8-10 days post-grafting before removing the cells. The cells are more fragile when young. We emerge many queens in an incubator, and many others in mating nucs. A cell builder is really a very strong, queenless colony that serves as both the starter and finisher. All cell builders, starters and finishers should be provided sugar syrup and pollen stores (patties or combs) during active brood rearing.

Hopkins Method

If you only need a few queen cells (e.g. 20-40), you can avoid grafting altogether and still raise nice queens needed to requeen your own colonies, or to provide queens when making splits. Probably the easiest method was developed by Hopkins in the 1880s. The idea is to confine a queen for 24 hours onto a comb made from thin foundation (like that used for comb honey production). She can be put beneath a push-in cage, and the comb is returned to her colony. She will fill all or most of the cells with eggs during her confinement.

On the following day, release the breeder queen back into her colony. The comb with eggs is moved to a queenless swarm box or cell builder. The comb is turned on its axis so that a face of comb with eggs is pointed down (see photo below). The comb is held above the top bars of the cell builder by wooden blocks as spacers. Some people build special lids of colonies that can hold these combs of eggs in the proper position. However it is done, the comb is left in this awkward position and the bees will draw many of the worker cells into queen cells. It is best to kill eggs in every other cell so that there is space for cutting away the mature cells without damaging neighboring cells.

Queen confined to push-in cage (lower left) to get eggs. Comb is then fitted to lid or special frame to hold it face down above the broodnest (top). The bees drop queen cells from surface of comb (lower right).

Bees Learn while They Sleep, and that Means They Might Dream

By Alex Riley, BBC.com

A new study suggests that bees can store information in long-term memory while they sleep, just like humans do when we dream

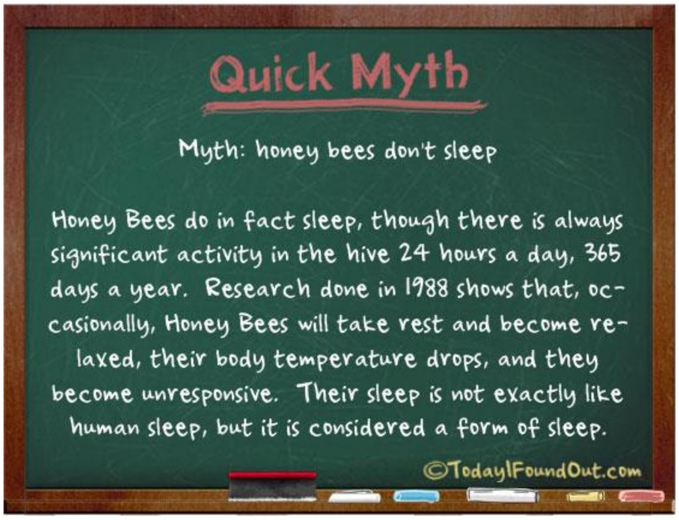
For all our obvious differences, humans and honey bees share some common threads within the fabric of life.

We are both social species. While humans speak and write to communicate, honey bees dance to one another; waggling their bodies for specific durations at angles that indicate where the best pockets of nectar or pollen are to be found outside the hustle and bustle of the nest.

But only forager bees – the eldest of several types of honey bee castes – do this. Just like in human populations, the honey bee colony is divided into different sectors of work. There are cleaners, nurses, security guards, not to mention collection bees whose sole job is to cache nectar in comb. As they age, honey bees are promoted through a diverse career, from waste disposal to the more familiar forager.

But it is not all work, work, work. Busy bees have to sleep, too.

Similar to our circadian rhythm, honey bees sleep between five and eight hours a day. And, in the case of forager bees, this occurs in day-night cycles, with more rest at night when darkness prevents their excursions for pollen and nectar.



But, given that a hive's primary purpose is productivity and yield, why should a large portion of the population seemingly waste up to a third of the day resting? What are the benefits of sleep?
Over the last few years, a handful of scientists have started to uncover why honey bees need to rest; their findings adding to the list of threads that we share.

Ever since Aristotle studied the monarchy of the honey bee colony in the 3rd Century BC, the species *Apis mellifera* L. has been studied by generations of dedicated scientists, each able to discover something entirely new.

"The bee's life is like a magic well: the more you draw from it, the more it fills with water," wrote Karl von Frisch, the German Nobel laureate who decoded their waggle dances, in 1950.

It was in 1983 that a researcher named Walter Kaiser made a new discovery: that honey bees slept. As he watched through his observation hive, Kaiser noted how a bee's legs would first start to flex, bringing its head to the floor. Its antennae would stop moving. In some cases, a bee would fall over sideways, as if intoxicated by tiredness. Many bees held each other's legs as they slept.

Kaiser's study was the first record of sleep in an invertebrate. But it was far from the last. The scuttle of cockroaches, the flutter of fruit flies, and the rhythmic undulations of jellyfishes all have temporary periods of quiescence.

"The evidence appears to align with this idea that sleep is shared across all animals," says Barrett Klein, a sleep biologist from the University of Wisconsin–La Crosse. "There's no universally-accepted exception."

Being so prevalent, sleep seems to be a very important part of complex life. To understand why honey bees sleep, a long line of scientists has been keeping forager bees up at night. How do they function sans sleep? Not well, it seems.

For one, they cannot communicate properly. Instead of performing their waggle dances with incredible accuracy, sleepy bees become sloppy. Their interpretive dances fail to translate the direction of a profitable food source.

And since their nest mates use this information as a guide for their foraging trips, they are likely to be sent slightly astray, wasting time and energy on the wing. The whole colony suffers.

Honey bee sleeping on vegetation.

Further, sleep-deprived honey bees find it difficult to return to the hive when visiting fresh flower patches, spending more time reorienting themselves with the sky and surrounding landmarks as their compass. Many even get lost and never return, so their rest becomes much more permanent. Without a good night's sleep, then, honey bees start to forget the activities that should be second nature to them. And in a study released in 2015, Randolf Menzel and his colleagues from the Free University of Berlin provided a possible explanation as to why this might be.

As is well-documented in humans, deep sleep (known as slow-wave sleep) consolidates memories, transferring them from short-term to long-term memory. Menzel and his team wanted to know whether the same was true for the humble honey bee.

First, they had to teach them something new; only then could they test the quality of their short-term to long-term memory transfer. They chose a tried-and-tested protocol, developed by Menzel himself in 1983.

When feeding, honey bees exhibit a stereotyped behavior: sticking out their long tubular mouthparts, or proboscis, to slurp up dinner. But, by presenting honey bees with a specific odor and burst of heat as they feed, this proboscis extension response (PER) can be elicited even when there is no food available.

It is the honey bee equivalent of the famous Pavlov's dog response. Rather than a bell, the bees associate the odor-heat combo with food and try to feed.
Only it is much easier to condition bees than dogs. Honey bees are quick learners, associating the odor and heat with food after one to three trials. After that, PER happened without the need for a reward.

"If you work with them, you realize very quickly that they are very smart," says Hanna Zwaka, one of the study's authors. "They are also very sweet to watch while they are learning."

Once conditioned, the bees were allowed a full night's sleep within their own personalized plastic tube. As they slept in solitude, the team exposed some of the honey bees to the conditioned odor-heat combo during different sleep stages, ranging from light sleep to deep sleep, allowing any activity in their brains to be further stimulated.

As a control, a separate group of bees were exposed to a neutral odor – paraffin oil – that would not reactivate any conditioned responses.

When the honey bees woke the next day, the memory tests could begin. Did the bees with the night-time reminders hold on to their conditioned response – sticking out their proboscis – for longer than those without?

Yes, but only when the odor and heat were presented in the deep-sleep stage, just like we would expect for a sleep-reinforced memory in humans. Presenting the odor and heat during other, lighter stages of sleep offered no advantage in memory retention.

Learning is reinforced during deep-sleep, just like we would expect in humans.

Although their bodies might be inactive during deep-sleep, honey bee brains do not seem to be. The previous day's activities are reactivated, stabilizing fragile memories and converting them into a more permanent form that can be accessed the next day – or perhaps even further in the future.

In sleeping rats, memory consolidation has been shown to work like replaying a tape: any learned responses, such as completing a complex maze, are repeated over and over again in the same sequence that they occurred; right turn by wrong turn, neuron by neuron in the brain.

Menzel and colleagues' study adds some tantalizing evidence that the same might be occurring in bees. "It's a beautifully conducted study with regard to memory," says Klein. But he has some caveats: "Whether or not the results relate to deep sleep is up for discussion." No study has yet clearly demonstrated stages or depth of sleep in insects, he says; only promising hints and suggestions.

Both labs hope to replicate these results with more streamlined, and telling, methods.
With the possibility of memory reactivation in the bees' sleepy heads, Menzel's work begs the question of whether honey bees dream.

In humans, dreams were thought to be a phenomenon of REM sleep, thus limiting the possibility of dreaming to mammals, birds, and (more recently) reptiles; animal groups that exhibit similar eye-fluttering stages of sleep.

But this is not the case. Over recent decades, studies have revealed that dreaming can also occur during slow-wave sleep, the analogue of honey bees' deep-sleep.

When woken from slow-wave sleep, people often recall basic non-narrative dreams such as a house, faces, or a pet. "[Therefore], if bees dream at all, it would be very basic dreaming," says Zwaka. "A special odor, for example. Or a color of flowers, like yellow or blue."

The magic well of bee biology is still nowhere near empty.

Lecture on Age-Related Worker Tasks to the SW Beeks

By Jeff Harris

I discussed age polyethism of worker honey bees at the monthly meeting of the Southwest Beekeepers Association in Meadville, MS on February 16. The goal was to represent the colony of bees as a complex super-animal in which proper functioning depends on the activities of many different age groups of bees. The tasks performed by workers varies with their age (see article in *Bee News & Views*, November-December 2013). Early in their lives, tasks such as comb cleaning, comb construction and feeding bee larvae are concentrated inside the heart of the broodnest. As workers age, their tasks take them closer to the entrance, until they begin to forage for food at about 3 weeks of age.

Although these task seem programmed, the jobs performed by workers can be changed in response to specific needs of the colony. For example, if something happened to eliminate thousands of foragers from the food gathering force, younger bees can actually accelerate their development to become foragers sooner than the normal course. This allows them to fill the void caused by whatever catastrophe had eliminated the foraging force. Although the talk was not on beekeeping or management, I hope the glimpse into worker biology was informative and entertaining.

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