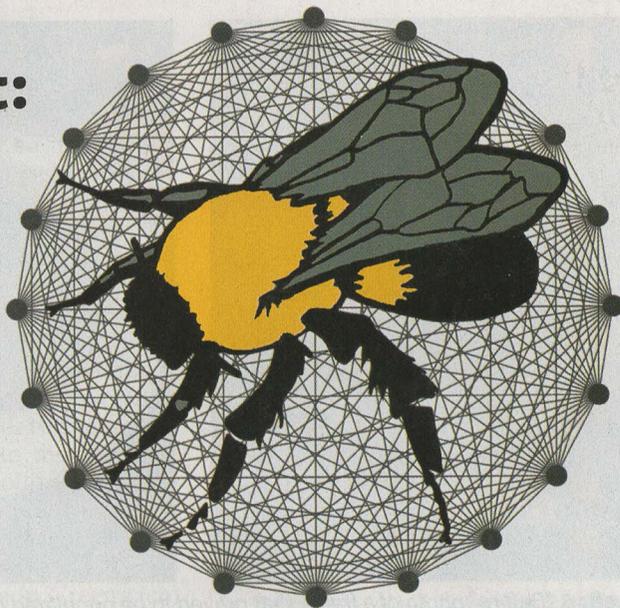


# Research Lab Spotlight: The Vermont Bee Lab

## Exciting new research measures hygienic response to “unhealthy brood odor”

by Melissa Moore



Vermont Bee Lab logo

Bees scientists deserve a mountain of respect. Field work is often sizzling hot, outfitted in beesuits and veils. Research teams must move in clockwork precision when deadlines loom. The rule for each research day in the field is one hundred percent focus. This was the case when I tagged along with Dr. Samantha Alger, Research Assistant Professor at the University of Vermont (UVM) and director of the Vermont Bee Lab. Alger and her lab technicians, Sydney Miller and Cailin Barrett, were in the field measuring the effectiveness of UBeeO™ and simultaneously collecting other hive metrics.

UBeeO is a new product developed by Dr. Kaira Wagoner, Research Scientist at University of North Carolina at Greensboro (UNCG). After 12 years

of research, her groundbreaking new tool for identifying bees with high levels of hygienic behavior (in response to “unhealthy brood odor,” or UBO) is expected to arrive on the commercial market in 2024. Wagoner, along with her former lab mate Phoebe Snyder, are the co-founders of Optera, a new company dedicated to honey bee health research, and currently focused on bringing UBeeO to beekeepers. Snyder received a master’s from UNCG with a thesis focused on hygienic behavior. Kaira and Phoebe met there and decided to join forces to launch Optera.

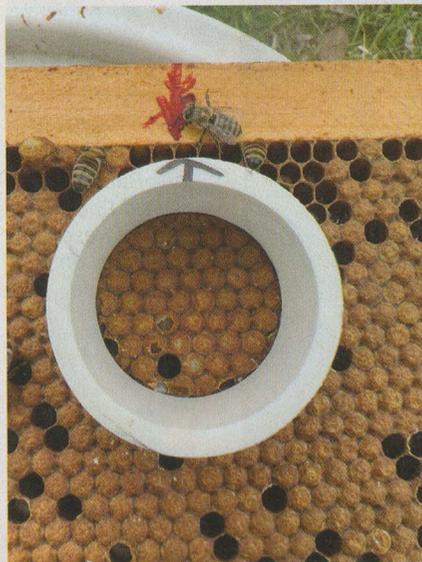
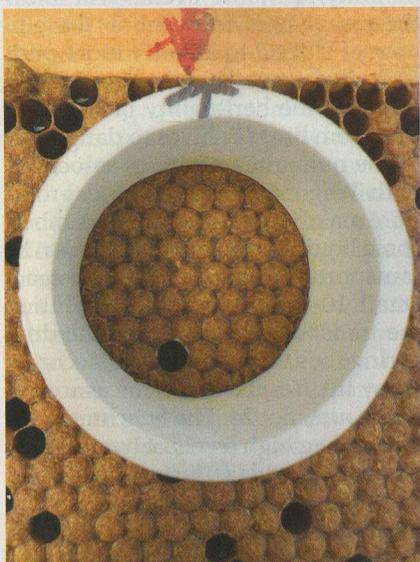
The field study brought us to two bee yards in St. Albans, Vermont, both managed by Michael Palmer of French Hill Apiaries.

### UBEEO, FUTURE MANAGEMENT TOOL?

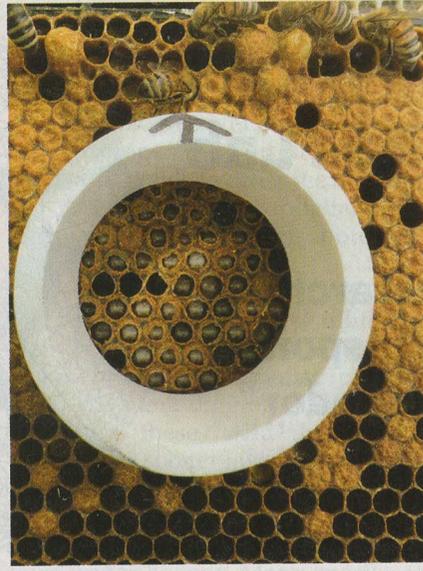
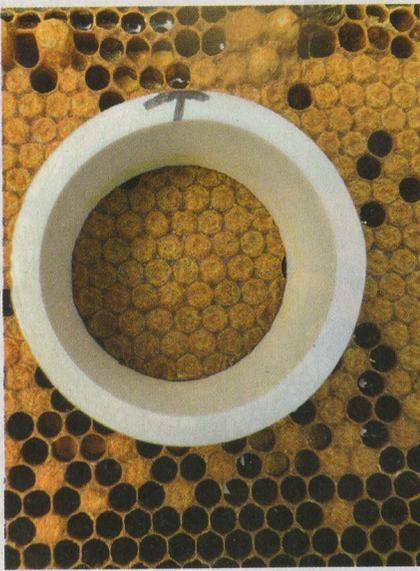
Wagoner began researching honey bee hygiene in 2011 and completed her doctorate in 2015. The result of this research was the identification of the unhealthy brood odors. Starting in 2016, a network of research partners around the world have completed field trials of her product and procedure. Samantha Alger and the UVM team have two years invested in the project. UVM secured grant funds through a U.S. Department of Agriculture’s Agricultural Marketing Service (USDA AMS) Specialty Crop Block Grant administered by the Vermont Agency of Agriculture, Food & Markets (VAAFAM). The grant covers labor and supply costs associated with participating in the trials as part of a larger project entitled “Supporting VT Bee Producers in Developing Disease and Pest Resistant Bee Stock.” The grant covers expenses for purchasing the UBeeO product, labor, an automatic-dose syringe, lab supplies for pest and pathogen testing, and more.

Alger says, “We’re so appreciative of the collaboration with Kaira Wagoner. We see this project as a way to bring important technology to Vermont and leverage the capabilities of our lab to help bee producers make selection decisions. We’re enthusiastic about the future possibilities for making headway in controlling varroa mites and managing hive health.”

The goal is to develop a population of queens and subsequent worker bees who are highly disposed to hygienic behavior and therefore better at resisting disease and pests like varroa. UBeeO is a synthetic spray that mimics naturally occurring phero-



**Left:** A “Before” photo of a frame that proved to be populated by bees with a low level of hygienic behavior. **Right:** This “After” photo shows just a few “manipulations” two hours after UBeeO was applied



**Left:** A "Before" photo of a frame that proved to be populated by bees with a high level of hygienic behavior. **Right:** This "After" photo shows a high level of manipulations two hours after UBeEO was applied

mones. When brood is compromised by varroa mites or diseases, highly hygienic bees can detect an unhealthy brood smell. The bees use these olfactory cues and some will uncapped this brood to disrupt the mite's reproduction cycle. In a nutshell, these hygienic bees conduct a "smell test" and take action.

Wagoner's procedure for identifying bees with high levels of hygienic

behavior is considered to be a test that measures this trait with a high-level accuracy and is practical in the field.

The Freeze Kill Brood (FKB) assay has merit and is one tool that has been used in the field to identify hygienic bees. But some scientists wonder if it is measuring the right trait. With FKB the brood is sprayed with liquid nitrogen and the bees die. Twenty-four hours later, researchers calculate the

number of cells where brood is removed. If, after 24 hours, 95% or more of the sprayed cells are uncapped with the pupae removed, then it's reasonable to conclude the bees are highly hygienic. However, with FKB, the bees are showing they can identify and remove dead bees, not bees compromised by the presence of varroa mites or other pests and pathogens.

Here's how the UBeEO field trial works: A frame of capped larvae or non-emerging pupae is selected from inside the hive. A PVC ring with an interior diameter of 4 cm is placed on the frame of capped cells. One pull of the automatic syringe applies a spray of the UBeEO to the surface inside the PVC collar. Two more doses are applied at 10-second intervals. A photograph is taken to serve as the baseline or "Before" photo. The time is noted on a tag which is applied to the hive outer cover when the frame is returned. The research team moves through all other hives in the bee yard and repeats this procedure.

Two hours later, the frame is pulled, an "After" photo is taken of the test area, the time is recorded and a visual inspection is made to determine how many uncapped cells, or "manipulations," appear within the surface area that was sprayed. When the number of uncapped cells meets or exceeds 60% of the cells in the test area then researchers conclude the bees in this hive are highly hygienic.

As part of the larger "Supporting VT Bee Producers" project, the team also collects samples of bees that they bring back to the lab and test for a panel of pests and pathogens. These monthly sampling events will allow the researchers to examine the efficacy of UBeEO to identify more pest- and disease-resistant colonies and measure the heritability of the UBO trait from breeder hives to daughters.

The numerous positives associated with Wagoner's product and procedure make it noteworthy. No cumbersome liquid nitrogen tanks need to be transported to the bee yard. Instead, small 10-dose vials of the solution are transported along with the dose syringe outfitted with an accurate spray tip. Results can be measured in two hours, not 24. The benchmark for identifying high levels of hygienic behavior in bees is 60% uncapped cells, not 95%. Overall, less harm is done to the bees.

In the field, researchers refer to the uncapped cells as manipulations. I can tell you from experience, there's



From left:  
Samantha Alger,  
Jack Rath, and  
David Peck,  
Director of Research  
and Education at  
Betterbee

a lot of excitement in the air when a frame is pulled, and with just one glance you know the manipulation level is 60% or better. Back in the lab, the photographs are examined closely. Even a manipulation as small as a pin prick is counted as an uncapped cell. Alger says, "The preliminary results show this test is very accurate."

#### IN THE APIARY

This year is Michael Palmer's 50th year managing bees. He manages several apiaries throughout Franklin County, one of Vermont's most northern counties. His expansive cell-builder yard is home to hundreds of mating nucs and brood factories. The 200-250 honey-producing colonies are in a variety of locations, and the bees gather nectar and pollen from a variety of wild flowers including dandelion, white clover, linden, sumac, and trefoil.

Beekeepers near and far order queens from Palmer's queen-rearing program. His participation in the UBeeO field trials, with 15 hives each in the two yards enrolled, shows his commitment to the well-being of the beekeeping industry.

It's important to remember that each yard was visited twice, and the work at the second yard had to be completed with no delay so the team could travel back to the first yard right as the countdown to the two-hour mark for observation was arriving. Total time in the field was four hours and then it was over to Palmer's cell-builder yard to collect more data.

Throughout Palmer's five decades of experience, he has seen both good times and bad in the beekeeping industry. He has a twofold interest in this current UVM project. First and foremost, he has a commitment to developing queens that will demonstrate traits like overwintering, longevity, and high honey production. In addition, his participation in identifying bees that can detect UBO will spur the development of a line of value-added queens and their daughters. When he can offer bees with the genetic disposition to self-manage hive health, it's a win-win for his own business and the beekeeping community at large. Naturally, demand for his queens and bees from his breeding program will likely spike even higher. But his educational efforts in the field of beekeeping are equally important to him.

Michael Palmer is recognized as a leader in the industry. He has men-

tored many beekeepers over the years, both in the United States and in countries around the world. Currently he has an active association with an organization he founded to promote beekeeping with youth in Mexico. Palmer says, "When I'm done, I'd like to think I'm leaving the beekeeping industry better off."

Four other Vermont beekeepers are participating in the trials. Jack Rath, owner of Hundred Acre Wood Apiary in Pawlet, and Andrew Munkres, owner of Lemon Fair Honeyworks in Cornwall, have 30 hives each enrolled in the project. New to the program this year are Adam Collins and Bianca Braman, owners of Vermont Bees, with 10 hives enrolled.

Rath, a retired veterinarian and co-owner of Betterbee in Greenwich, New York, is proficient with the instrumental insemination (II) technique of breeding queen bees. Alger is calling on his experience to support a project that will measure heritability of UBO response in open-mated and II systems. Through II and this controlled mating program, the team anticipates a population of daughter queens with a high level of hygienic genetics can be developed.

#### VT BEE LAB SERVICES FOR BIG AND SMALL STAKEHOLDERS

The Supporting VT Bee Producers project is just one program underway at UVM. This program will first help larger beekeepers who are invested in queen rearing and have built busi-



Melissa Moore

Dr. Samantha Alger holds the customized dose syringe and a 10-dose vial of UBeeO.

nesses on supplying queens and their daughters to the greater beekeeping community. As the program spreads and the genetics are more dispersed throughout the beekeeping world, beekeepers of all sizes should experience the benefits.

Alger says, "We're always striving to make our resources here at UVM available to as many Vermont beekeepers as possible, both large and small."

As a UVM graduate student, Alger focused on pollinator health and conservation. Through this work, she became convinced that the health



Melissa Moore

The UVM Bee Lab crew prepare to start the field trial in one of Michael Palmer's apiaries. Left to right: technicians Cailin Barrett and Sydney Miller, and Samantha Alger.



Samantha Alger applies UBeeO to a section of capped larvae inside a PVC ring with an inside diameter of 4 cm. A "Before" photo is taken before replacement in the hive. Then, when two hours have passed, an "After" photo is taken, and the percentage of cells that have been uncapped, or "manipulated," by the bees will indicate whether the bees have a high- or low-level hygienic response to unhealthy brood odor.

of Vermont's honey bee population had a direct impact on the population of native pollinators. She began



Sydney Miller runs frames over to the work station, while Michael Palmer opens the next hive to select a frame of capped larvae or non-emerging pupae.

searching for standardized data on hive health throughout the state and discovered the USDA-APHIS National Honey Bee Survey (NHBS), a nationwide effort to gather baseline data on bee diseases, pathogens, and pesticide exposure. To her dismay, Vermont was not one of the states participating in this valuable survey. After making inquiries at the national level, she was told Vermont could participate in the program if she obtained the blessings of the state's bee inspector and the Vermont Beekeepers Association. She was given the green light and began managing the survey for the state in 2015.

Through the Vermont Bee Lab, Alger and her tech team have continued to collect samples to support the effort. Data collected include nosema, varroa, viruses, and pesticide residues in wax and pollen. "This information represents the best standardized, annual longitudinal data we have on honey bees in Vermont," she says.

The (NHBS) started in 2009 in California and Hawaii. Due to survey protocols, only beekeepers with 10 or more hives can participate. Alger says, "When we collect the data for the NHBS the sample has to be a composite collected from eight different hives." She adds, "I soon realized that due to the survey's test protocols,

a gap existed in service for Vermont beekeepers. The smaller beekeepers were excluded from this group. This prompted me to apply for a grant to create the Honeybee Diagnostic Lab. We were able to secure the grant and that was the beginning of the Vermont Bee Lab. Through our own diagnostic lab, we're able to return real time data our beekeepers can use to manage their hives for optimal health and production."

The team receives samples from live and winter deadout colonies from beekeepers throughout the state. These diagnostic services are conducted free of charge. Six drop boxes are placed throughout the Green Mountain State to assist with access to the program. Each drop box is supplied with sample containers, instructions, and a submission form. Volunteers responsible for monitoring the drop box hand-deliver or mail the samples to the VT Bee Lab. "We process the samples as soon as possible," Alger says, "so the turnaround time is short. This way beekeepers can use the timely information to manage their hives."

In addition to her responsibilities at the Bee Lab, Alger is an instructor at the University of Vermont. The beekeeping classes she teaches combine lectures, field trips with local VT beekeepers, webinars, and field work to provide a well-rounded education in beekeeping. The students even try their hand at grafting queens.

Alger stays connected to beekeepers in her state by serving as a scientific advisor to the Vermont Beekeepers Association. She has served in this role since 2017. The VBA was first organized in 1886 and is believed to be one of the oldest beekeeping associations in the country.

For more information use this link to contact the Vermont Bee Lab at <https://vermontbeelab.com/>.

Information on Optera and UBeeO™ is available at their website [opterabees.com](http://opterabees.com).

**Melissa Moore** has been a beekeeper for four years. She is a member of her local and state bee clubs. She has written for publication in the areas of horticulture, agriculture, and environmental science. Melissa has a degree in library science and educational technology. She lives on her family's 210-acre farm, where she gains hands-on experience through her involvement with their diversified farm.

