

Wolfpack's Waggle



January 2014 Newsletter

NC State Apiculture Program

Dedicated to the dissemination of information and understanding of honey bee biology and management

Issue 1, January 2014

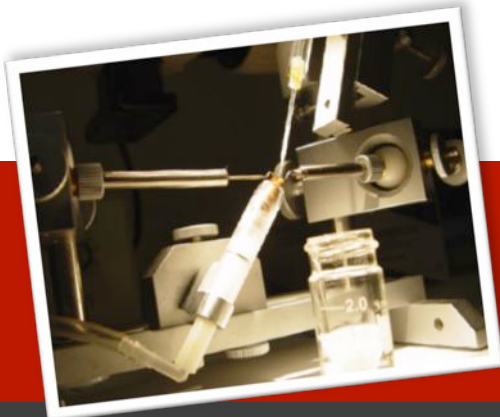


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What have we been up to?

The fall and winter seasons see our main operations move from the field into the genetics lab. After busily collecting samples and conducting studies all summer, we now have the grueling task of assaying the bees and analyzing the data. Holden quantified various measures of immune function in his feral and managed bees to see how urbanization affects their health. Carl has been busy writing code and analyzing videos of bees interacting with each other to automatically measure sub-lethal effects of pesticides. Mike and Ming have been cranking through thousands of samples measuring oxidative stress and aging. Margie has been juggling processing samples in the new Queen Clinic (quantifying sperm viability), analyzing BIP samples, genotyping Alfalfa Leafcutter Bees, and measuring viruses in queens. And great news for Ming Huang, a postdoc in our lab this past year! He's recently accepted a position with Eurofins, a company testing the impacts of pesticides on bees. Congratulations, Ming, you will be missed!

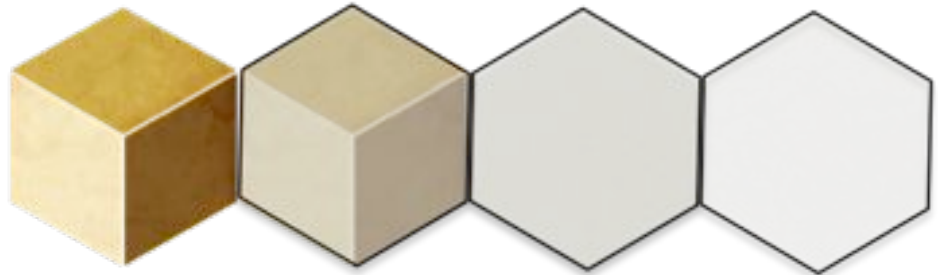


New grant funded by the USDA

Titled "Improving honey bee queen quality with in vitro artificial selection and genomics," this new grant with collaborators at U. Penn is aimed at developing a high-throughput approach to improving queen quality.

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Beekeeper Education & Engagement System



2014 BEES Bee School

Sign up today to take part in our February online beekeeping short course, only \$45 per person and includes a live online discussion

The **BEES** network is a new online resource for beekeepers at all levels. The system is entirely internet based and aims to foster an online learning community among beekeepers. The structure of the **BEES** network is broken into three ascending levels of difficulty (Beginner, Advanced, and Ambassador) and three general areas of content (honey bee biology, honey bee management, and the honey bee industry).

The format for the **BEES** bee school is for participants to take each of the three 'Beginner' mini-courses, one course per week, on their own and at their own pace. We will then hold a live Q&A session at the end as a group.

Sign up today @:

<http://entomology.ncsu.edu/apiculture/BEES.html>

Bee school schedule

Week 1: Feb. 5-11; BEES 1.01: Basic honey bee biology and life history (1.66 hours)

Week 2: Feb. 12-18; BEES 1.02: Introduction to beekeeping and hive management (1.95 hours)

Week 3: Feb. 19-25; BEES 1.03: Importance of bees and beekeeping to society (1.71 hours)

February 26th: Live online discussion through Blackboard Collaborate: Time TBD depending on participant availability.

Lab spotlight: Mike Simone-Finstrom

Dr. Michael Simone-Finstrom is a USDA postdoctoral fellow in the lab. Mike joined our group three years ago to spearhead the project on the genetic architecture of oxidative stress and aging. He has since secured his own highly competitive USDA-AFRI grant to

continue his work on the use of resins and propolis by bees as self-medication and social immunity.

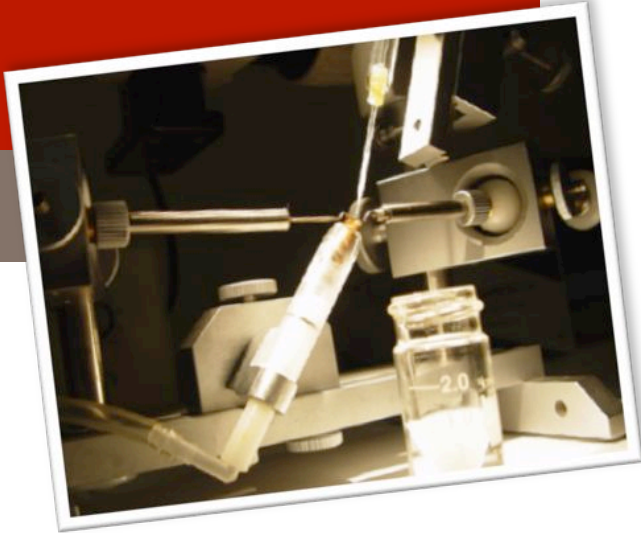
It is hard to quantify how much Mike has done for our program, both directly and indirectly. He has been incredibly involved in undergraduate advising,



highly collaborative and giving of his time, and unwaveringly positive. Mike is poised to obtain a top University position and continue to make huge impacts!

Latest grant funded by the USDA

The new grant is in collaboration with Dr. Tim Linksvayer at the University of Pennsylvania, titled “Improving honey bee queen quality with *in vitro* artificial selection and genomics.” The 4-year project is aimed at increasing “queenliness” in an effort to improve colony productivity.



We all know that declines in honey bee populations have caused serious concerns about maintaining honey bee pollinator services. Modern animal and plant breeding programs that utilize genetic information have been remarkably successful at improving an array of quality and productivity traits. Can artificial selection on queen reproductive quality—a central trait to colony productivity and health—help ensure continued pollination services? **We will use a novel *in vitro* artificial selection approach that reduces generation time, exposes genetic variation that can be hidden due to strict social regulation, and broadly circumvents factors that can stymie both natural and artificial selection to improve queen quality.**

Our overall goal is to initiate an *in vitro* artificial selection program to produce honey bee strains with increased queen reproductive quality and use new genomic and transcriptomic approaches to identify genes with innate and social effects on queen quality. As a supporting objective, we seek to identify the

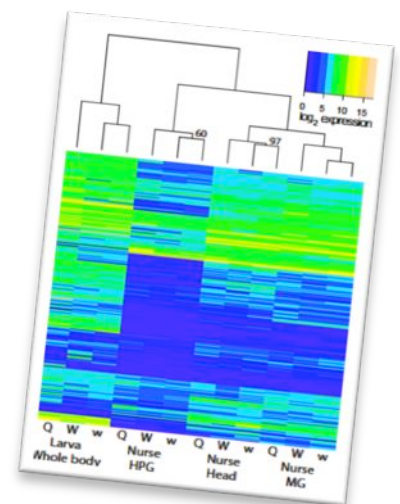
genetic basis of variation in queen quality traits among five of the best performing and most widely used honey bee strains. Our artificial selection program, coupled with marker-assisted selection using the identified genetic markers, can make progress in improving the quality of honey bee stocks that has potential to increase overall honey bee health.

The Project Director (PD) of this new project is [Dr. Tim Linksvayer](#), a rising star in social insect biology at the University of Pennsylvania. Tim has already established himself as a leader in utilizing modern molecular tools to better understand queen development and colony function. These methods are poised to provide incredible insights into honey bee biology that can help bee management.

The heart of this project is what makes a queen. Our contention is that **factors that make queens better also make colonies healthier and more productive**, a link that is borne out by our previous research. Queens vary substantially in their reproductive potential, or “quality”, and thus **anything that**

can help improve queen quality will also help improve colony quality.

We have recently begun to use the *in vitro* technique of larval rearing—raising larvae in the incubator rather than the hive. The Linksvayer lab, among others, has perfected this technique in many insightful studies. They have determined that some colonies are more varied in how worker-like versus queen-like they



Using genomic tools will be a very powerful modern approach to improve queen quality.

New USDA Grant (Continued)

become, even under the same highly-controlled rearing conditions. Thus there seems to be a genetic predisposition towards making high-quality queens.

By screening many colonies using this approach, we hope to breed strains of bees for- and against queenliness using instrumental insemination. This high-throughput system should enable us to screen for the trait without having to wait for a full colony to build up and turn over its population.

Once we conduct several rounds of selection on queenliness (and anti-queenliness), we will then take these selected genotypes and subject them to genomic analysis. This will enable us to determine the gene-by-gene genetic underpinnings of the difference between the selected lines, identifying the genes that govern queenliness.

The grant officially begins on January 1, 2014 and runs for 4 years. The overall funding is for \$454,983, and ~\$30k per year will help directly fund the NC State Apiculture Program. We will be hiring a qualified postdoctoral researcher to conduct the genomic analysis at U Penn.

We are very fortunate to have received this highly competitive grant, and we are very confident that it will lead to very important insights into queen biology.



In vitro rearing of honey bee larvae to test for “queenliness.” Photo from *J. Apic. Res.*

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[http://entomology.ncsu.edu/
apiculture](http://entomology.ncsu.edu/apiculture)

Support the NC State Apiculture Program!

Make a gift toward emerging needs – Consider supporting the program with a gift that would go toward the current area of greatest importance. Flexible funding enables the Apiculture Program to address critical needs as they emerge, often enhancing the program beyond what would be possible through restricted grant funding. Funding of any amount, from \$10 to \$10,000, will be extremely helpful.

Make a gift-in-kind – The Apiculture program is always seeking creative solutions to its material needs. If you have surplus equipment or other non-monetary assets to give (e.g., gently used honey extractors, microscopes, even vehicles), please consider donating them to the program. You will receive credit for the monetary value of the gift and the gratitude of our faculty and students.

Make an estate gift – If you are interested in planning an estate gift to benefit Apiculture, please let us know! We can provide you with the tools you and your attorney will need to ensure that your wishes are fulfilled. Please contact the lab for more information.





New Queen Clinic now open!

We're extremely excited to offer a new fee-based service to the beekeeping community.

Send us your queens—good or bad—and we will be able to accurately quantify their sperm viability and sperm counts within a matter of days. Be on the lookout for further announcements and details of this exciting new resource.

Photo by Alex Wild.



Tarpy lab in the news

Shelley Rogers, our former MS student in collaboration with Dr. Hannah Burrack's lab, has recently published the second of three major papers from her thesis studying the pollination ecology of blueberries. In doing so, we have demonstrated that a diversity of bee species is best for optimizing seed- and fruit-set, underscoring the need to take a comprehensive approach to pollination.

[LINK](#)

Random notes

New publications

Rogers, S., D. R. Tarpy, and H. J. Burrack. (2013). Multiple criteria for comparing pollinator performance in highbush blueberry agroecosystems. *Environmental Entomology*, **42**: 1201-1209.

Niño, E. L., O. Malka, A. Hefetz, D. R. Tarpy, and C. M. Grozinger. (2013). Pheromone production in two glands is differentially regulated by distinct mating factors in honey bee queens (*Apis mellifera* L.). *PLoS ONE*, **8**(11): e78637.

Rogers, S., P. Cajamarca, D. R. Tarpy, and H. J. Burrack. (2013). Honey bees and bumble bees respond differently to inter- and intra-specific encounters. *Apidologie*, **44**: 621-629.

Presentations

Ming Huang, Mike Simon-Finstrom, Holden Appler, Carl Giuffre, and David Tarpy all traveled to Austin TX in November to attend the annual Entomological Society of America (ESA) conference. In doing so, each provided presentations on their latest research.

Welcome aboard!

We are very pleased to be joined by Mark Jandricic, our newest member of the program. Mark will be spearheading our new Queen Clinic, as well as assisting with other molecular assays for our various projects.

BIP update

We just started our third season of processing samples for the Bee Informed Partnership! We have now processed over **1,400 colony samples for seven important honey bee viruses** using quantitative PCR (qPCR). Stay tuned for further insights into how virus incidence and prevalence affect colony productivity, as we are analyzing these data now.



Teacher's corner: ENT 203

An Introduction to the Honey Bee and Beekeeping

We just wrapped up another successful offering of ENT 203. Aimed at non-science majors, the course is designed to fulfill the General Education Requirement (GER) for most University majors. As such, we not only cover the interesting aspects of honey bee biology and beekeeping, we also delve into honey bees in art and literature, mythology and religion, even politics and warfare!

Next semester: no scheduled courses

<http://go.ncsu.edu/honeybees>



Tarpy's back page

The new year always brings with it change and a sense of progress. As I write, I'm on my way back from the American Honey Producers Association (AHPA) annual convention in San Antonio, where we also held our Bee Informed Partnership (BIP) annual board meeting. It's always a great way to start off the calendar year by interacting with collaborators and beekeepers. This year, we co-opted this conference to concurrently hold the annual American Bee Research Conference (ABRC), which is the scientific symposium of the American Association of Professional Apiculturists (AAPA). Such an alphabet soup of organizations, it's hard to keep everyone straight!

At these meetings, several things stood out. First, the supplies of queens and packages are even lower than usual, so their availability will be very constrained. If you need to order any new bees for this year, do so now (or, better yet, secure locally raised queens and nucs)! Second, annual losses of colonies continues to cause tremendous stress on beekeepers, not just over the winter but during the summer as well. Third, there is growing concern over pesticides, and several groups are taking action either through engagement with chemical companies or through legal action. Finally, varroa mites continue to cause terrible problems for beekeepers in keeping their colonies healthy. My new mantra is to do a sugar shake **every time** you enter your hive.

The new year is also a great time to reflect on the past year, and 2013 was a very productive year by any measure you wish to use. We conducted so many studies this past year we have no way of mentioning them all. Nonetheless, we were able to publish 10 papers and give 22 presentations (both annual records), secure several new grants, and launch our queen clinic. We can only hope that 2014 is equally productive! Sincerely, David