

Wolfpack's Waggle



April 2016 Newsletter

NC State Apiculture Program

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

Issue 2, April 2016



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What have we been up to?

It's been a busy spring thus far, and things are only just beginning! Carl successfully passed his oral exams and has now advanced to candidacy, which means he is now down the home stretch in writing up his three thesis chapters. James has launched into a new research project on queen reproductive quality and the shipping of packaged queens. Hongmei continues to make strides in her research projects on the bioinformatics of IAPV and new genomic tools. Parry, who only joined our program in November, has been making great headway into the BIP virus project by re-running all ~2,400 colony samples for better genetic information as well as analyzing the complex dataset. Hannah has done a fantastic job in coordinating all of the 18 different research stations across the state in their planting of pollinator habitats and is just now starting to collect samples from the field. Jennifer has been keeping busy in colony splits to keep ahead of the swarming season, and in doing so has already doubled our overwintered population. That means we're ready for summer!



Two major publications on 'social immunity'

By coincidence, two of our latest publications have come out in the same top-tier journal *Biology Letters*, and both happen to have the same general theme of how bees use behavioral mechanisms to combat disease.

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New developments in the BEES network

Course enrollment predictably lower with increased overhead costs

The **BEES** network has officially moved to DELTA as of January 1, 2016, and is now including a 43% overhead on each person for each course. Perhaps predictably, this has resulted in a significant decrease in enrollment for the first three months of the year: we're down 53.5% from the same period last year. We hope this trend does not continue and that enrollment will rebound later this year.

Beginner level

- BEES 1.01: Basic honey bee biology and life history (1.66 hours)
- BEES 1.02: Introduction to beekeeping and hive management (1.95 hours)
- BEES 1.03: Importance of bees and beekeeping to society (1.71 hours)

Advanced level

- BEES 2.01.02: Honey bee anatomy
- BEES 2.01.05: Queens and mating
- BEES 2.01.07: Foraging biology
- BEES 2.02.03: Pathogens, parasites, pests, and problems
- BEES 2.02.04: Varroa mite IPM
- BEES 2.02.05: Queen rearing and bee breeding
- BEES 2.03.01: Africanized bees
- BEES 2.03.07: History of beekeeping

Sign up today @:

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

Lab spotlight: Erin McDermott

We were fortunate to have recently been joined by **Erin McDermott** in the lab, who has quickly become an invaluable member of our team.

A native of Greenville, Erin graduated from NC State with a degree in Natural Resources. In doing so, she

conducted some interesting research on both aquatic and mosquito systems, which fostered her increasing interest in entomology.

Since joining our group, Erin has quickly become an expert in most of the laboratory techniques that



we employ and has been eager to help out in the field with sample collection. She is smart, engaged, positive and extremely helpful for a wide number of ongoing projects. We're really lucky to have her on board and look forward to working with her further!

Elucidating how bees use behavior to keep themselves healthy

Two of our most recent publications, which just so happened to have come out in the same issue of *Biology Letters*, highlight the importance of 'social immunity' on disease mitigation. One tests intracolony genetic diversity, the other broadly compares across taxa.



Our *in vitro* method of raising brood, modified from others and perfected by Mike Simone-Finstrom, helps us test trade-offs in disease prevention

How social insect colonies cope with disease is a central issue to their life histories. After all, groups of potential hosts all congregated in an environmentally stable nest is highly conducive to parasites of all kinds. Thus determining how bees and other social insects combat disease will help us understand how to abate them.

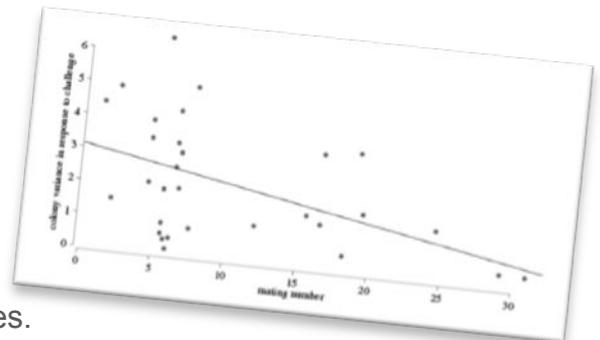
A former postdoctoral fellow in the lab, **Mike Simone-Finstrom**, worked with a former undergraduate student (**Megan Walz**) to test how honey bee colonies might trade-off fighting disease (in this case, American foulbrood) at the individual versus colony levels. Previous research has shown that increased queen mating number results in higher colony genetic diversity and lower levels of AFB, but how this happens is uncertain.

Using *in vitro* rearing of larvae, Mike and Megan challenged developing brood from colonies with increasing genetic diversity and measured their anti-microbial peptides.

Our results suggest that it is the diversity of individual immune response, and not hygienic behavior, that results in lower levels of AFB in colonies.

In a completely different study, also published in the same issue of *Biology Letters*, current postdoctoral fellow **Margarita López-Urbe** took a completely different approach by comparing different species (some eusocial, others not) for their immune responses.

At issue is the initial genomic evidence that honey bees have one-third fewer immune genes compared to solitary insects. The original



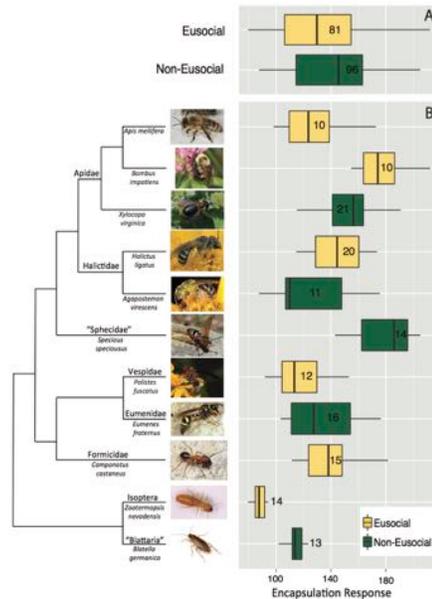
As mating number (=genetic diversity) increases, the variance in anti-microbial gene-expression goes down, which is evidence that lowered AFB levels in diverse colonies is a result of larval immune response.

supposition was that these genes were lost over evolutionary time because behavioral mechanisms of immunity compensated for individual immunity. More recent evidence suggests that this loss of immune genes predates the rise of sociality, which cast doubt on this supposition.

Social immunity publications (Continued)

Margarita’s work, however, tested actual immune response rather than just looking at all of the genes in the genome, and she found that on average individuals from eusocial species had lower immune responses than individuals from non-eusocial or solitary species.

These findings suggests that ‘social immunity’ may still compensate for a loss of individual immunity, even though the loss of immune genes happened before honey bees became eusocial. Therefore these two stories are not mutually exclusive, and it highlights the important of behavioral mechanisms in mitigating disease at the colony level.



Margarita López-Urbe tested a comparative phylogeny of eusocial (green) versus non-eusocial (red) taxonomic groups of insects, ranging from termites/cockroaches to honey- and bumble bees/carpenter bees. For each, individuals were tested for their immune response, and in most cases there was a lower immune response by social species than solitary species. This suggests that perhaps mechanisms of ‘social immunity’ may be compensating for this loss of individual immunity.

NC State Apiculture Program

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Support the NC State Apiculture Program!

The Apiculture Science fund-raising efforts operate under the auspices of the North Carolina Agricultural Foundation, Inc. a 501(c)3 organization. You will receive an official receipt for your donation.

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 A DONATION

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 click the link above for more information.



SAHRC 2016

This past Saturday, 11 of us traveled down to Clemson to attend the 12th annual student symposium of the Southern Appalachian Honeybee Research Consortium. Carl, Brooke, James, Deniz, and Jackie all presented their work and did a fantastic job. Every year, this grass-roots gathering of NC State, UNCG, UNCC, Wake Forest, VT, East TN State, and Clemson honey bee programs just gets better and better!



Tarpy lab volunteerism

Members of the lab took time from their Saturday to take part in the NCSU Service Raleigh! event at Prairie Ridge wildlife preserve. We spread mulch and pruned invasive plant species from the site. Pictured above is the group standing victorious over a huge privet bush that had met its match. Thanks to Erin for organizing the event!

Random notes

Congratulations!

Margarita López-Uribe was recently given an offer to join the faculty here at NC State, and we're delighted to say that she has accepted! She will be a full-tenure track faculty starting this fall semester, joining the Department of Entomology & Plant Pathology and filling a desperately needed niche as a molecular ecologist within the department. Needless to say, being hired directly within one's current institution is exceedingly rare, but it demonstrates her excellent work and future promise. Congratulations Margarita!

Not to be forgotten, however, are some other accolades. First, **Carl Giuffre** won his third TA of the Year award for Mathematics, which is now old hat for him. More notably, though, is that he also won the Maltbie Teaching Award for 2016, which is a really big deal. Congrats on both accounts, Carl! Second, **Hongmei Li-Byarlay** took second place in Illumina's "Go Mini" Scientific Challenge. Her award includes her very own Illumina MiniSeq DNA sequencer (costs ~\$50k!). This will really come in handy for your research and future lab, congratulations!



A sad goodbye

Many people have gotten to know one of our longest lab members out at the Lake Wheeler Bee Lab:

Lewis, our adopted and beloved lab cat.

I'm sad to say that Jennifer found him the other day in the woods, having met his match with another animal bigger than him. Thanks for the great memories, Lewis, we'll miss you!



Earth Fair booth

Hongmei Li-Byarlay and Elsa Youngsteadt (in Steve Frank's lab) put together a nice display on the NC State Brickyard on alternative pollinators.

New research funding

We've received some good news in the past couple of months, where we were awarded a couple of new grants. The first was from an internal opportunity called the BigIdeas project. Together with Derek Ham, a faculty member in the College of Design, we are going to be exploring how we might employ virtual reality (VR) in beekeeper education and training.

The second was secured by **Hongmei Li-Byarlay** and **Deniz Chen** from the National Pollinator Protection Campaign (NAPPC) to do some exploratory work on CRISPR gene silencing for virus control.

Teacher's corner: Courses at NC State

We are not teaching any courses this Spring 2016 semester at NC State, which only happens once every 6 semesters. This past fall semester, our ENT 203 course, "An introduction to the honey bee and beekeeping", regained traction and was once again at maximum enrollment of 180 students. It was a terrific set of students, some of my favorite in the last 8 years. We will take this spring and summer to gear up for yet another successful semester this fall!

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



Tarpy's back page

This is the last issue of the *Waggle* before the official merger of the Entomology and Plant Pathology departments. The fusion of two disciplines and faculties has prompted many questions about departmental and college priorities, future directions, and logistical functioning. In the past 6 months, there have been many discussions among the faculty (including a weekend retreat) in an effort to determine the new ethos that might emerge from the merger. While there remains many questions, most of which cannot be predicted or hastened, I remain hopeful that the merging of departmental units will have little impact on our program and may in fact be beneficial in the long run.

In many important ways, things will largely remain unchanged. This is particularly true for the graduate program in Entomology, which will remain separate and independent, thus our current and future students will be completely unaffected by what courses they have to take, their strengths and priorities in research, and their overall graduate experience. It also seems clear that all of insect science—not just those areas pertaining to plant systems—are to remain a priority and integral part of the department, school, and college. This is important because apiculture is a de facto animal system, even though honey bees also happen to be pollinators. As such, we remain confident that our current focus and scholarship is going to be within the vision and scope of the restructured department and college.

I write this as I take my fourth trip to California in the last 5 months, which only reminds me of just how interconnected we are at many levels. That ability to interconnect within the department, within the college, and nationally gives me hope that we are well positioned moving forward.

Sincerely, David