**Center for Pollinator Research**

**2016 Newsletter**

|  |
| --- |
|  |
| New Students & Post-docs | Events |
| **Tyler Jones**, PhD student **Emily Erickson**, MSc student **Ryan Reynolds**, MSc student **Doug Sponsler**, Post-doctoral researcher**Stephanie Gage**, Post-doctoral researcher**Margaret Douglas**, Post-doctoral researcher**Anthony Vaudo**, Post-doctoral researcher**Gabe Villar**, Post-doctoral researcher Recent Graduates **Anthony Vaudo**, PhD**Gabe Villar**, PhD**Julia Fine**, PhD | **ANNUAL CPR SYMPOSIUM****May 16, 2017****CPR SPRING SEMINAR SERIES****Junpeng Mu (Mianyang Normal University)**February 13 th, 4-5pm, 105 Wartik**Shalene Jha (UT Austin)­­**February 17th, 11:15-12:15, 101 ASI**Hollis Woodard (UC Riverside)**April 14th, 11:15-12:15, 101 ASI |
| New Faculty**Etya Amsalem,** Assistant Professor in Entomology, will focus on the evolution of sociality in bumble bees and fire ants.**Margarita López-Uribe,** Assistant Professor in Entomology, will focus on molecular approaches to evaluating wild and managed bee populations |
|  |

**Pollinator News at Penn State**

**Please click on the titles for links to the full articles!**

[**Cell phones could be a lifeline for honey bees and beekeepers in Africa**](http://news.psu.edu/story/376506/2015/10/21/research/cell-phones-could-be-lifeline-honey-bees-and-beekeepers-africa)

A new Penn State project aimed at improving the food system in East Africa by enhancing pollination services and promoting bee-derived products has received a Food Systems Innovation Grant from the Global Center for Food Systems Innovation, based at Michigan State University.

The long-term goal of the two-year project is to create an information-gathering and decision-support system that combines global positioning systems, geographic information systems and cell phone technologies to translate field data into reliable, evidence-based management recommendations for smallholder farmers. Researchers will test the effectiveness of this approach by applying it to the management of honey bees, said lead investigator Maryann Frazier, senior extension associate in entomology, Penn State College of Agricultural Sciences.

# [Pollinators, pesticides in focus at Fruit Research and Extension Center](http://news.psu.edu/story/417369/2016/07/15/impact/pollinators-pesticides-focus-fruit-research-and-extension-center)

An apple orchard in full bloom: for many, a simple harbinger of spring. But for David Biddinger and his colleagues and graduate students at Penn State’s Fruit Research and Extension Center, the delicate blooms carry the promise of a future in which bees and pesticides can do their work in harmony at fruit farms across the nation. Their work is part of ongoing efforts across the College of Agricultural Sciences and throughout the University to develop a holistic approach to pollinator health, an area in which Penn State has built a strong reputation.

Even in low doses, some pesticides have been found to have negative effects on bees and their offspring, said Biddinger, who is an associate professor in Penn State’s Department of Entomology. At the core of the research whether subtle alterations in the timing of early-spring pesticide applications or choice of pesticide can reduce or even eliminate bees’ exposure.

# [Picky eaters: Bumble bees prefer plants with nutrient-rich pollen](http://news.psu.edu/story/415996/2016/06/27/research/picky-eaters-bumble-bees-prefer-plants-nutrient-rich-pollen)

Bumble bees have discriminating palates when it comes to their pollen meals, according to researchers at Penn State. The researchers found that bumble bees can detect the nutritional quality of pollen, and that this ability helps them selectively forage among plant species to optimize their diets.

"Populations of many bee species are in decline across the world, and poor nutrition is thought to be a major factor causing these declines," said Christina Grozinger, director of the Center for Pollinator Research, Penn State. "Our studies can help identify plant species and stocks that provide high-quality nutrition for bumble bees and potentially other bee species, which will help in the development of pollinator friendly gardens and planting strips." According to Anthony Vaudo, a graduate student in entomology who led the study, scientists previously believed that bees' preferences for flowering plants were driven by floral traits, such as color, scent, morphology or nectar concentration. "Here we show that bumble bees actually choose a plant for the nutritional quality of its pollen," said Vaudo. "This is important because pollen is bees' primary source of protein and lipids."

# [Wyman’s of Maine and Penn State Center for Pollinator Research join together to help save the honey bees](http://ento.psu.edu/news/2016/wyman2019s-of-maine-and-penn-state-center-for-pollinator-research-join-together-to-help-save-the-honey-bees)

This month, Wyman’s of Maine, one of the country’s leading wild blueberry growers, joins Penn State’s Center for Pollinator Research’s newly formed Stakeholder Advisory Board. The primary initiative of the group focuses on pollinator health to help conserve and expand honey bee populations. Bees are responsible for pollinating approximately one third of the major global food crops. Each year, however, US beekeepers experience substantial losses of their honey bee colonies, and populations of many wild bee species are in decline.

“Wild blueberries are 100% dependent on honeybees for pollination, so it’s a pretty simple business equation for us,” said Ed Flanagan, president and CEO of Wyman’s of Maine. “No bees equals no blueberries. We cannot afford to sit and wait for others to figure this out. We need to step up and bring our experience and voice to the table with the beekeepers, scientists and other committed stakeholders. Tackling climate change, for example, is beyond Wyman’s, but tackling bee losses is within our sustainability footprint.”

# [Bees' ability to forage decreases as air pollution increases](http://news.psu.edu/story/416642/2016/07/06/research/bees-ability-forage-decreases-air-pollution-increases)

Air pollutants interact with and break down plant-emitted scent molecules, which insect pollinators use to locate needed food, according to a team of researchers led by Penn State. The pollution-modified plant odors can confuse bees and, as a result, bees' foraging time increases and pollination efficiency decreases. This happens because the chemical interactions decrease both the scent molecules' life spans and the distances they travel. While foraging for food, insects detect floral scent molecules in the air. Wind currents can carry these molecules up to thousands of feet from their original source to where bees have their hives.

"Many insects have nests that are up to 3,000 feet away from their food source, which means that scents need to travel long distances before insects can detect them," said Jose D. Fuentes, professor of meteorology and atmospheric science, Penn State. "Each insect has a detection threshold for certain kinds of scents and they find food by moving from areas of low concentrations of scents to areas of high concentrations." Plant-emitted hydrocarbons break down through chemical interactions with certain air pollutants such as ozone. This breakdown process results in the creation of more air pollutants, including hydroxyl and nitrate radicals, which further increase the breakdown rate of plant odors. The researchers sought to understand how these chemical interactions, which start with the presence of air pollutants, would impact bees' ability to find food.

# [Common insecticides are riskier than thought to predatory insects](http://news.psu.edu/story/440914/2016/12/07/research/common-insecticides-are-riskier-thought-predatory-insects)

Neonicotinoids -- the most widely used class of insecticides -- significantly reduce populations of predatory insects when used as seed coatings, according to researchers at Penn State. The team's research challenges the previously held belief that neonicotinoid seed coatings have little to no effect on predatory insect populations. In fact, the work suggests that neonicotinoids reduce populations of insect predators as much as broadcast applications of commonly used pyrethroid insecticides. "Predatory insects contribute billions of dollars a year to agriculture through the elimination of crop pest insects," said Margaret Douglas, postdoctoral researcher in entomology, Penn State. "We have found that neonicotinoid seed coatings reduce populations of these natural enemies 10 to 20 percent."

[**Weighing the costs and benefits of pesticide use**](http://www.beeculture.com/catch-the-buzz-weighing-the-costs-and-benefits-of-pesticide-use/)

There has been considerable discussion about the impact of pesticides – particularly neonicotinoids – on biodiversity in general and pollinator health specifically. While we have made significant progress in understanding these impacts, often missing from these discussions is whether the current neonicotinoid usage patterns actually benefit growers. As we all know (but often do not discuss), it is not simply a question of either using pesticides with no restrictions or banning them completely – the best approach is to use them in a way that maximizes the benefit while minimizing the cost to growers, consumers, and the environment.

Recently, extension specialists and scientists at 12 land grant universities in the US developed a fact sheet describing why neonic seed treatments in soy are largely ineffective, particularly in northern climates. This comes on the heels of a recent meta-analysis by the US EPA which also found little benefit to the use of these seed treatments in soy. Indeed, it has been recently demonstrated that these seed treatments can actually lead to decreases in yield, by offsetting existing biocontrol mechanisms that reduce pest levels. And yet use of seed treatments in soy and other field crops has increased dramatically in recent years.

**New Grant Awards and Initiatives**

# [Landscape](http://news.psu.edu/story/417308/2016/07/15/research/penn-state-bee-research-pollinates-next-generation-scientists)s for Bees, Tyler Jones

It is becoming increasingly apparent that location can greatly impact survival and productivity of honey bee colonies. However, the landscape features most important for determining honey bee health remain to be determined. To assess the impacts of a wide variety of landscapes—including urban, agricultural, and undisturbed—we are developing a partnership with a diverse group of beekeepers across Pennsylvania and the eastern US. We are working with beekeepers to assess colony health parameters including weight, mite loads, and queen health in the fall, winter, and spring. Those factors will be correlated with surrounding landscape features including land use and cover, forage quality, climate, and meteorological data obtained from existing databases (e.g. the National Land Cover Database and Community Collaborative Rain, Hail, and Snow Network). We are developing models to determine which features are most associated with bee health to develop recommendations for selecting and managing landscapes to optimize honey bee health. The results of this project will help beekeepers understand which landscape features are critical for honey bee colony health, survival and productivity, and will provide a framework for understanding factors impacting wild pollinator health as well. **If you are interested in participating, please email Tyler at** **PSULand4Bees@gmail.com**

# [Tracking](http://news.psu.edu/story/417308/2016/07/15/research/penn-state-bee-research-pollinates-next-generation-scientists) Feral Honey Bee Health, Margarita López-Uribe

Beekeepers are facing serious challenges that threaten their economic viability. One of the major problems honey bees are dealing with is the large cocktail of parasites and pathogens that attack them. Currently, most managed honey bee colonies cannot survive the winter without disease treatment, and even with intensive management regime, beekeepers nationwide are losing on average 40% of their colonies, with Pennsylvania being among the worst. On the contrary, some feral (unmanaged) bee populations have been reported as stable through time despite the lack of beekeeper assistance, suggesting that these colonies may have adapted to be resilient to these multiple disease stressors. In 2017, we are starting a project that aims to compare the levels of immune gene expression and loads of viral pathogens to test whether feral honey bees have stronger immune systems than managed honey bees. Our first goal is to identify the location of feral honey bee colonies across Pennsylvania. About 50 foraging bees will be collected at each site, but the colony will remain unharmed. By identifying feral colonies with stronger immune systems, we are hoping to identify genetic stocks of locally adapted bees that could be used for breeding programs. If you are aware of an unmanaged or feral honey bee colony, please share with us information regarding its location through our website: http://lopezuribelab.com/tracking-feral-bee-health/. All information that you share with us is confidential.

**Authentic Plant Pollinator Landscape Research for Educators (APPL-RED)**

This program will provide the necessary framework for secondary school teachers to help their students understand the integrative, transdisciplinary, systems-nature of scientific research, particularly research in the areas of food, agriculture, and natural resources. Best practices for K-12 STEM teachers involve using the approaches of researchers to teach basic concepts in science, but teachers often lack the ability to generate an authentic research environment, where questions and hypotheses are not developed a simple, linear fashion by individual investigators but rather by dynamic, interactive collaborations that integrate multiple perspectives. We will use the challenge area of Food Security, particularly the crucial role of ecosystems services of pollinators on food production, to provide this framework. We will recruit middle and high school teachers from rural and urban communities that work with underserved populations to participate in a one-week summer workshop. Teachers will participate in an array activities and research projects which integrate concepts from systematics, insect biology, landscape ecology, and evolutionary biology.



Teachers will be subsequently encouraged to develop their own research activities. The PIs will evaluate the efficacy of the PI-designed and teacher-designed activities during site visits to schools. Teachers and PIs will discuss their results in follow-up workshops and use this information to refine their activities. The tested and validated educational programming from this project will be disseminated broadly to multiple communities through conferences and literature for agricultural professionals and educators, and posted on the Penn State and Pollinator Partnership websites.

# [New graduate training program in Integrative Pollinator Ecology](http://ento.psu.edu/news/2016/new-graduate-training-program-in-integrative-pollinator-ecology)

# The Integrative Pollinator Ecology program will train graduate Fellows to holistically tackle issues in pollinator health and ecology. Fellows will develop integrative research, education and outreach programs that span multiple disciplines - from genomics to land management – and interface with diverse stakeholder groups. Fellows will develop skills to respond to current and emerging challenges in pollinator health, sustainable, agriculture and conservation. The IPE program is funded by the Penn State College of Agricultural Sciences Strategic Network Initiative Program.

# [Patch and Grozinger are part of a nationwide team awarded $2.85 million from the USDA-SCRI program to study pollinator interactions with ornamental plant species](http://ento.psu.edu/news/2016/patch-and-grozinger-are-part-of-a-nationwide-team-awarded-2-85-million-from-the-usda-scri-program-to-study-pollinator-interactions-with-ornamental-plant-species)

On Tuesday August 2, 2016, Secretary of Agriculture Tom Vilsack announced this year's Specialty Crop Research and Extension Investments (SCRI) funded projects. These grants are funded through the USDA National Institute of Food and Agriculture (NIFA). IR-4's Executive Director, Jerry Baron, is proud to announce that two of these projects were awarded to IR-4's Ornamental Horticulture Program based at Rutgers University. The first project is titled, "Protecting Pollinators with Economically Feasible and Environmentally Sound Ornamental Horticulture". This 5-year grant, which is funded for the first two years at $2,849,975, will support 21 scientists and extension experts at 12 different institutions.

**NSF awards Pitt environmental engineering professor with grant to study decline of pollinating insects**

The National Science Foundation (NSF) has awarded Vikas Khanna, assistant professor of civil and environmental engineering at the University of Pittsburgh Swanson School of Engineering, with a $259,582 grant to investigate the impact of declining insect-mediated pollination on the United States economy. Previous studies on insects that carry pollen from flower to flower generally focus on agricultural yields. “Collaborative Research: Quantifying the Critical Importance of Insect-mediated Pollination Service for the U.S. Economy” will expand the research to the impact of these insects on associated industrial sectors.

“Economic sectors that are directly impacted by insect-mediated pollination are the agricultural sectors, for example: fruit, tree nut, vegetable and melon farming,” said Khanna. “However, there are other sectors that are indirectly dependent on insect-mediated pollination. These include sectors that provide raw materials and inputs to agricultural sectors such as fertilizer manufacturing, pesticides and agricultural chemical manufacturing and even power generation.” Christina Grozinger, distinguished professor of entomology and director of the Center for Pollinator Research at Penn State University, will join Khanna on the study.

**Student Spotlight**

# [Penn State bee research pollinates next generation of scientists](http://news.psu.edu/story/417308/2016/07/15/research/penn-state-bee-research-pollinates-next-generation-scientists)

# Elina Lastro Niño's curiosity about honey bees dates back to her childhood in Bosnia, where her father kept bees for a time. After perhaps one bee sting too many, her father gave up his bees, and Niño's interest in honey bees waned — but not her fascination with insect biology. Fast forward several years to Niño's time as a master's degree student in entomology at North Carolina State University, where she studied dung beetles. While looking for a research program in which to pursue a doctorate, she visited with N.C. State entomologist Christina Grozinger, whose lab was becoming known for its research on honey bees and other pollinators.

# "I thought the work she was doing with bees was amazing, and that's when I really got hooked on bees," Niño said. When Grozinger, now a Distinguished Professor of Entomology in Penn State's College of Agricultural Sciences, left for Penn State, Niño followed. There, she conducted research on honey bee queen reproductive health, earned her doctorate and served as a USDA-AFRI postdoctoral fellow. She parlayed that into a position as an apiculture researcher and extension specialist at the University of California, Davis, where she has worked since 2014.While Penn State has developed a reputation as a leader in pollinator research, the experiences of Niño and a fellow entomology Ph.D. alumna, Holly Holt, illustrate another key contribution to pollinator health. Penn State is playing a critical role in training the next generation of scientists to address problems — such as parasitic mites, diseases and pesticide effects — that are likely to take longer to solve than the duration of a research grant or even an entomologist's entire career.

# [Uh huh, honey: How Penn State's Beekeepers Club is taking care of over 100,000 honey bees](http://www.collegian.psu.edu/news/campus/article_cab48d2c-7aff-11e6-b614-d358a9c3dab4.html)

# During this time of year, thousands of students and alumni gather around Beaver Stadium to tailgate the afternoon away before a home football game. Just a few feet away from the tailgating grounds, some smaller members of the Penn State community are working hard not to grill burgers, but to produce honey. The Penn State Beekeepers Club oversees and cares for over 100,000 honey bees that reside at the MorningStar Solar Home, just a short walk away from the gates of Beaver Stadium.

# The start of football season is the start of a honey flow season for the bees, Grace Billy, the president of the club, said. The members of the club, which started two years ago, work together to extract the honey from the hives and bottle it. “Honey extraction tends to be once a year, sometimes you can do two times,” Billy (sophomore-environmental resource management) said. “They definitely make us a good 30 pounds of honey, but probably more.” Billy said that the honey is distributed among members based off a point system, but they are also looking into selling the honey to the public in the future. Gathering delicious honey isn’t the only responsibility this club has; they are also full-time beekeepers. “We have classroom style meetings biweekly where we teach people the basics of beekeeping, information about bees and what it takes to be a beekeeper,” Billy said.

# [Be the Bee](http://www.psu.edu/feature/2016/11/14/be-bee)

# What made these women strap on bee bonnets and venture into the world of another species? An undergraduate research project examines the sting of undervalued gender-related labor. What do domestic work and the traditional gender roles of women have in common with the non-visible labor of honeybees? In a multimedia project in which women performed the work of honeybees, undergraduate Christina Dietz found that, in both subjects, the value of labor is lessened based on its lack of visibility. “I hope to bring attention to the occurrence of a shift in perceived importance when the member that performs a specific labor changes," said Dietz.

# As part of her project, "Honeybees and Homemakers: Pollination and Gendered Labor," Dietz built a small, house-like structure. She installed two observation hives in the windows of the house, allowing viewers to glimpse what goes on inside a beehive. She also created a video that follows three young women in their imagined work day as they perform the task of pollination.

# [2016 Apes Valentes Awards Support Undergraduates in Bee Research and Outreach](http://ento.psu.edu/news/2016/2016-apes-valentes-awards-support-undergraduates-in-bee-research-and-outreach)

# Do you know where your food comes from? If you enjoy crisp apples, juicy tomatoes, and plump berries, thank a farmer, thank a scientist, and thank a bee. We need strong, healthy and diverse bee populations to provide pollination for us to eat our most healthful foods. While we can all thank a bee, the Penn State undergraduate students who received the 2016 Apes Valentes Undergraduate Research awards directly contributed to our understanding of how to keep bees healthy.

# The Penn State Center for Pollinator Research has worked for years to better understand what helps and hurts bees. The Apes Valentes (Latin for “healthy bee”) was made possible by a generous donation to the Center and is competitively awarded to students interested in pollinator research, extension, education, and outreach. These awards provide students the opportunity to work in cutting-edge research labs, develop their passion for science and outreach, and build communication and organization skills. Students worked with faculty, staff, or graduate student mentors to develop their proposals, implement a project plan, and see it come to fruition.

# [2016 Dutch Gold Honey Undergraduate Scholarship Recipient Gives Overwintering Honey Bees a Boost](http://ento.psu.edu/news/2016/2016-dutch-gold-honey-undergraduate-scholarship-recipient-gives-overwintering-honey-bees-a-boost)

# Sarah McTish, a senior in Agriculture Sciences, minor in Entomology at Penn State, and current Pennsylvania Honey Queen was awarded the 2016 Dutch Gold Honey Scholarship. Thanks to the generous donation of William and Kitty Gamber from Dutch Gold Honey in Lancaster PA, undergraduate students each year are afforded the opportunity to work in a premier honey bee research lab and receive a scholarship. Sarah worked with PhD student Mali Doke and Professor Christina Grozinger over the fall. She studied how a honey bee colony “knows” to produce long-lived “winter” bees and stockpile food resources to survive the long cold Pennsylvania winters.

**­**

**New Publications in 2016**

Kammerer, M.A., Biddinger, D.J., Rajotte, E.G. and Mortensen, D.A., “Local Plant Diversity Across Multiple Habitats Supports a Diverse Wild Bee Community in Pennsylvania Apple Orchards.” Environmental Entomology. 45(1): 32-38 (2016). [(link)](https://www.researchgate.net/profile/Melanie_Allen2/publication/282044433_Local_Plant_Diversity_Across_Multiple_Habitats_Supports_a_Diverse_Wild_Bee_Community_in_Pennsylvania_Apple_Orchards/links/56c5ea1508ae408dfe4c9fb3.pdf)

Padilla, M., Amsalem, E., Altman, N., Hefetz, A. and Grozinger, C.M. “Chemical communication is not sufficient to explain reproductive inhibition in the bumblebee Bombus impatiens.” Open Science. 3(10): 160576 (2016). [(link)](http://rsos.royalsocietypublishing.org/content/royopensci/3/10/160576.full.pdf)

Joshi, N.K., Otieno, M., Rajotte, E.G., Fleischer, S.J. and Biddinger, D.J. “Proximity to Woodland and Landscape Structure Drives Pollinator Visitation in Apple Orchard Ecosystem.” Front. Ecol. Evol. 4: 38 (2016). [(link)](https://www.researchgate.net/profile/Neelendra_Joshi/publication/301594890_Proximity_to_Woodland_and_Landscape_Structure_Drives_Pollinator_Visitation_in_Apple_Orchard_Ecosystem/links/571cbc1f08ae408367be4f43.pdf)

Kammerer, M.A., Biddinger, D.J., Joshi, N.K., Rajotte, E.G. and Mortensen, D.A. “Modeling local spatial patterns of wild bee diversity in Pennsylvania apple orchards.” Landscape Ecology. 31(10): 2459-2469 (2016). [(link)](http://download.springer.com/static/pdf/161/art%253A10.1007%252Fs10980-016-0416-4.pdf?originUrl=http%3A%2F%2Flink.springer.com%2Farticle%2F10.1007%2Fs10980-016-0416-4&token2=exp=1479914744~acl=%2Fstatic%2Fpdf%2F161%2Fart%25253A10.1007%25252Fs10980-016-0416-4.pdf%3ForiginUrl%3Dhttp%253A%252F%252Flink.springer.com%252Farticle%252F10.1007%252Fs10980-016-0416-4*~hmac=ecd663b276a39f0bf13aadb76393b149159a35ab25f499e0c9628fc2a505ba23)

Bohnenblust, E.W., Vaudo, A.D., Egan, J.F., Mortensen, D.A. and Tooker, J.F. “Effects of the herbicide dicamba on nontarget plants and pollinator visitation.” Environmental Toxicology and Chemistry. 35(1): 144-151 (2016). [(link)](http://onlinelibrary.wiley.com/doi/10.1002/etc.3169/full)

Li, W., Evans, J.D., Huang, Q., Rodríguez-García, C., Liu, J., Hamilton, M., Grozinger, C.M., Webster, T.C., Su, S. and Chen, Y.P. “Silencing the Honey Bee (Apis mellifera) Naked Cuticle Gene (nkd) Improves Host Immune Function and Reduces Nosema ceranae Infections.” Applied and Environmental Microbiology. 82(22): 6779-6787 (2016). [(link)](http://aem.asm.org/content/82/22/6779.abstract)

Holt, H.L. and Grozinger, C.M. “Approaches and challenges to managing Nosema (Microspora: Nosematidae) parasites in honey bee (Hymenoptera: Apidae) colonies.” Journal of Economic Entomology. 109(4): 1487-1503 (2016). [(link)](https://www.researchgate.net/profile/Christina_Grozinger/publication/304400249_Approaches_and_Challenges_to_Managing_Nosema_Microspora_Nosematidae_Parasites_in_Honey_Bee_Hymenoptera_Apidae_Colonies/links/577278ed08ae07e45db21a6e.pdf)

Vaudo, A.D., Patch, H.M., Mortensen, D.A., Tooker, J.F. and Grozinger, C.M. “Macronutrient ratios in pollen shape bumble bee (Bombus impatiens) foraging strategies and floral preferences.” Proceedings of the National Academy of Sciences. 113(28): 4035-4042 (2016). [(link)](http://www.pnas.org/content/113/28/E4035.abstract)

Grozinger, C. “Cooperation and conflict in social insect societies: from genes to pheromones.” Integrative and Comparative Biology. 56: 81 (2016).

Rittschof, C.C., Grozinger, C.M. and Robinson, G.E. “Social cues and diet restriction may act through similar mechanisms to affect aggression in honey bees (Apis mellifera).” Integrative and Comparative Biology. 56: 184 (2016).

Galbraith, D.A., Kocher, S.D., Glenn, T., Albert, I., Hunt, G.J., Strassmann, J.E., Queller, D.C. and Grozinger, C.M. “Testing the kinship theory of intragenomic conflict in honey bees (Apis mellifera).” Proceedings of the National Academy of Sciences. 113(4): 1020-1025 (2016). [(link)](http://www.pnas.org/content/113/4/1020.full.pdf)

Vaudo, A.D., Stabler, D., Patch, H.M., Tooker, J.F., Grozinger, C.M. and Wright, G.A. “Bumble bees regulate their intake of the essential protein and lipid pollen macronutrients.” Journal of Experimental Biology. (2016). [(link)](http://jeb.biologists.org/content/jexbio/early/2016/10/13/jeb.140772.full.pdf)

Manfredini, F., Shoemaker, D. and Grozinger, C.M. “Dynamic changes in host–virus interactions associated with colony founding and social environment in fire ant queens (Solenopsis invicta).” Ecology and Evolution. 6(1): 233-244 (2016). [(link)](http://onlinelibrary.wiley.com/doi/10.1002/ece3.1843/epdf)

Brasero, N., Martinet, B., Lecocq, T., Lhomme, P., Biella, P., Valterova, I., Urbanova, K., Cornalba, M., Hines, H. and Rasmont, P. “The cephalic labial gland secretions of two socially parasitic bumblebees Bombus hyperboreus (alpinobombus) and Bombus inexspectatus (thoracobombus) question their inquiline strategy.” Insect Science. (2016). [(link)](http://onlinelibrary.wiley.com/doi/10.1111/1744-7917.12408/abstract)

Nadeau, N.J., Pardo-Diaz, C., Whibley, A., Supple, M.A., Saenko, S.V., Wallbank, R.W., Wu, G.C., Maroja, L., Ferguson, L., Hanly, J.J. and Hines, H. “The gene cortex controls mimicry and crypsis in butterflies and moths.” Nature. 534(7605): 106-110 (2016). [(link)](http://www.nature.com/nature/journal/v534/n7605/pdf/nature17961.pdf)

Youngsteadt, E., Moylett, H., López-Uribe, M.M. and Hamblin, A. “TB Mitchell: The Man Behind The Bees of the Eastern United States.” American Entomologist. 62(3): 157-162 (2016). [(link)](http://ae.oxfordjournals.org/content/ae/62/3/157.full.pdf)

López-Uribe, M.M., Sconiers, W.B., Frank, S.D., Dunn, R.R. and Tarpy, D.R. “Reduced cellular immune response in social insect lineages.” Biology Letters. 12(3): 20150984 (2016). [(link)](http://rsbl.royalsocietypublishing.org/content/12/3/20150984.full.pdf)

Traynor, K.S., Pettis, J.S., Tarpy, D.R., Mullin, C.A., Frazier, J.L. and Frazier, M. “In-hive Pesticide Exposome: Assessing risks to migratory honey bees from in-hive pesticide contamination in the Eastern United States.” Scientific Reports. 6:33207 (2016). [(link)](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5024099/pdf/srep33207.pdf)

Mullin, C.A., Fine, J.D., Reynolds, R.D. and Frazier, M.T. “Toxicological risks of agrochemical spray adjuvants: organosilicone surfactants may not be safe.” Frontiers in Public Health. 4:92 (2016). [(link)](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4862968/pdf/fpubh-04-00092.pdf)

Russo, L. and Shea, K. “Deliberately increased network connectance in a plant-pollinator community experiment.” Journal of Complex Networks. (2016) [(link)](http://comnet.oxfordjournals.org/content/early/2016/09/20/comnet.cnw024.short)

Russo, L., Nichol, C. and Shea, K. “Pollinator floral provisioning by a plant invader: quantifying beneficial effects of detrimental species.” Diversity and Distributions. 22(2): 189-198 (2016). [(link)](http://onlinelibrary.wiley.com/doi/10.1111/ddi.12397/full)

Feazel-Orr, H.K., Catalfamo, K.M., Brewster, C.C., Fell, R.D., Anderson, T.D. and Traver, B.E. “Effects of Pesticide Treatments on Nutrient Levels in Worker Honey Bees (Apis mellifera)." Insects. 7(1): 8 (2016). [(link)](http://www.mdpi.com/2075-4450/7/1/8/htm)

Russo, L. “Positive and Negative impacts of Non-Native Bee Species around the World.” Insects. 7 (4): 69 (2016). [(link)](http://www.mdpi.com/2075-4450/7/4/69/html)

**This publication is available in alternative media on request.**

Where trade names appear, no discrimination is intended, and no endorsement by Penn State Extension is implied.

The University is committed to equal access to programs, facilities, admission, and employment for all persons. It is the policy of the University to maintain an environment free of harassment and free of discrimination against any person because of age, race, color, ancestry, national origin, religion, creed, service in the uniformed services (as defined in state and federal law), veteran status, sex, sexual orientation, marital or family status, pregnancy, pregnancy-related conditions, physical or mental disability, gender, perceived gender, gender identity, genetic information, or political ideas. Discriminatory conduct and harassment, as well as sexual misconduct and relationship violence, violates the dignity of individuals, impedes the realization of the University’s educational mission, and will not be tolerated. Direct all inquiries regarding the nondiscrimination policy to Dr. Kenneth Lehrman III, Vice Provost for Affirmative Action, Affirmative Action Office, The Pennsylvania State University, 328 Boucke Building, University Park, PA 16802-5901; Email: kfl2@psu.edu; Tel 814-863-0471.

