

Station News

The Connecticut Agricultural Experiment Station
Volume 7 Issue 3 March 2017



The mission of The Connecticut Agricultural Experiment Station is to develop, advance, and disseminate scientific knowledge, improve agricultural productivity and environmental quality, protect plants, and enhance human health and well-being through research for the benefit of Connecticut residents and the nation. Seeking solutions across a variety of disciplines for the benefit of urban, suburban, and rural communities, Station scientists remain committed to "Putting Science to Work for Society", a motto as relevant today as it was at our founding in 1875.



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The Connecticut Agricultural Experiment Station

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ADMINISTRATION

DR. THEODORE ANDREADIS attended a Board Meeting of the Experiment Station Associates held at the Station (February 1) and attended the 83rd Annual Meeting of the American Mosquito Control Association held in San Diego, CA to recruit and interview Postdoctoral scientists for the Northeast Regional Center of Excellence in Vector-Borne Diseases (900 attendees) (February 13-17).

ANALYTICAL CHEMISTRY

DR. JASON C. WHITE along with all Department staff hosted Maeve Taylor of Cheshire High School for a half-day shadowing program (February 2); participated in a WebEx discussion with members of the multi-university Center for Sustainable Nanotechnology to discuss collaborative research and their funding of a CAES Post-doctoral researcher (February 2); attended the monthly Laboratory Preparedness meeting at the CT Department of Public Health Laboratory in Rocky Hill CT (February 6); met with Professor Saion Sinha of the University of New Haven to discuss ongoing collaborative research (February 8); spoke by phone with Professor Navid Saleh of the University of Texas Austin regarding custom-synthesized nanomaterials that he is providing for CAES experiments (February 8); along with **DR. BRIAN EITZER** participated in the monthly FDA FERN cCAP teleconference call (February 9); participated in an APHL-sponsored teleconference call regarding a peer reviewed manuscript submission focused on nanotechnology and water treatment to the *Journal of the American Water Works Association (JAWWA)* (February 10); participated in the APHL-sponsored Winter Agricultural/State Chemist Laboratory call (February 10); participated in a NIST-sponsored conference call to discuss a joint manuscript being prepared with assesses and protocols for determining nanomaterial accumulation in animals and plants (February 13, 16); along with **DR. NUBIA ZUVERZA-MENA** met with the Department of Agriculture Commissioner Steven Reviczky and other DoAg staff to discuss ongoing and new joint FDA programs (February 14); provided a welcome presentation to the CAES Experiment Station Associates Behind the Scenes tour and also discuss the Department of Analytical Chemistry programs and research (15 attendees) (February 15); spoke by phone with Professor Greg Lowry of Carnegie Mellon University to discuss a collaborative NSF grant proposal (February 15); participated in FDA FERN Chemistry conference call focused on Triage SOP Development for samples with unknown hazards (February 15); attended a meeting at the CT Farm Bureau to discuss a new report entitled “Economic impacts of Connecticut’s agricultural industry” (February 16); hosted Professor Phillip Demokritou of Harvard University as a Lockwood Lecturer (February 17); spoke with Professor Jorge Gardea-Torresdey of the University of Texas El Paso regarding a grant application to the US FDA (February 21); gave a webinar entitled “Nanomaterials and the food supply: Assessing the balance between applications and implications” to the Florida Department of Agriculture and Consumer Services “Ag Science Café” (50 attendees) (February 23); gave a tour of Analytical Chemistry Department facilities and programs to Ms. Makayla McLaughlin (February 24); gave an invited lecture at the University of Connecticut Department of Nutritional Sciences seminar series entitled “Nanomaterials and the food supply: Assessing the balance between applications and implications” (20 attendees) (February 27); and participated in a conference planning call for the upcoming 14th International Phytotechnology Conference to be held in Montreal Canada in late September (February 28).

DR. BRIAN D. EITZER was a participant in the NACRW organizing committee conference call (February 9).

ENTOMOLOGY

DR. KIRBY C. STAFFORD III was interviewed about gypsy moth in 2017 by Shawn Bourgeois, WINY-AM radio, Putnam (February 2); participated in a gypsy moth PSA meeting call with CTPA and DEEP (February 2); presented a talk on ticks and tick management at the NOFA Land Care course at Three Rivers Community College in Norwich (30 attendees) (February 10); and was interviewed by Evan White, WFSB-TV, about winter tick activity (February 27).

MS. KATHERINE DUGAS staffed the CAES booth at the CT Flower Show in Hartford. The display included Station information, a display on honey bees, and invasive insects (February 24-25).

MR. MARK H. CREIGHTON spoke on honey bees role in pollination at the Milford Women’s Club in Milford (30 attendees) (February 6); spoke at the Connecticut Beekeepers Association at CAES (98 attendees) (February 11); spoke before the Wallingford Zoning Commission on proposed change in a local ordinance to allow bee keeping within the town, which passed 7 to 0, allowing beekeepers to have two hives on property under 5 acres (February 15); met with students at Common Ground High School in New Haven to plan spring activities in further development of the new apiary at West Rock Nature Center (February 16); was interviewed by The Events Magazine for the Town of Old Lyme on bees and beekeeping (February 17); spoke with The New Haven Land Trust and received permission on having students from the Youth Minority Beekeeping initiative to develop and maintain apiaries at Community Gardens in New Haven (February 20); was interviewed by Matthew Zabierk of The Record Journal on bee health related topics (February 21); staffed a booth at the Hartford Garden and Flower Show and provided information about CAES programs and honey bee information to several hundred attendees (February 23-25); spoke at Shagbark Lumber and Supply in East Haddam on preparing honey bees for the spring and on bee health topics (40 attendees) (February 25); and attended a meeting with faculty members at Wilbur Cross High School on the prospect of developing a honey bee program at the school (February 28). The prospect of having a beekeeping program was well received and we agreed to meet again to develop the project. This program will be an extension of the Youth Minority Beekeeping initiative started at Common Ground High School.

DR. CLAIRE E. RUTLEDGE taught “Insects and Trees” at the CT Tree Protective Association’s Arboriculture 101 course in Wallingford (45 attendees) (February 8) and presented a talk titled “Biosurveillance: Using a native wasp to catch a native beetle” to Master Gardeners in Bethel (60 attendees) (February 16).

DR. KIMBERLY A. STONER spoke to the Fairfield County Regional Conservation Partnership on “Pollinator Health and Habitat” at the Wilton Public Library (60 attendees from 19 towns in Fairfield County) (February 22) and a story about her presentation by Jeannette Ross was featured in the Wilton Bulletin (March 2).



Ms. Katherine Dugas and Ms. Rose Hiskes at the CAES booth (left) and the beekeeping display at the CAES booth at the Connecticut Flower and Garden Show (right)

ENVIRONMENTAL SCIENCES

DR. JOSEPH PIGNATELLO dined with and met privately to discuss collaborative research with seminar speaker, Prof. Joel Pedersen, Department of Chemical and Environmental Engineering, Yale (February 22) and met with Lockwood lecturer Prof. Phillip Demokritou, Chan School of Public Health, Harvard University to discuss mutual interests in research (February 17).

DR. PHILIP ARMSTRONG gave the lecture “Dengue, Zika, and Other Arboviral Diseases” for the Principles of Infectious Diseases course held at the Yale School of Public Health (20 student attendees) (February 7); with **DR. THEODORE ANDREADIS**, **DR. DOUGLAS BRACKNEY** and **DR. GOUDARZ MOLAEI**, hosted Dr. Scott Halstead, Emeritus Professor of Preventive Medicine, Uniformed Services University of the Health Sciences, to discuss research on arboviruses at CAES (February 10).

DR. GOUDARZ MOLAEI, hosted Dr. Scott Halstead, Emeritus Professor of Preventive Medicine, Uniformed Services University of the Health Sciences, to discuss research on arboviruses at CAES (February 10); hosted members of the Experiment Station Associates in the Tick Testing Laboratory and discussed research initiatives on mosquitoes and ticks and services offered by the Laboratory (12 attendees) (February 15); discussed potential research topics with a student from the Quinnipiac Frank H. Netter School of Medicine that could be performed under his direction in the Capstone mentorship program (February 24, 2017); and presented a short talk on his research and services offered at the CAES Tick Testing Laboratory and discussed collaborations with faculty and internship opportunities for students the Central Connecticut State University Biology Internship/Career Fair (approx. 55 attendees) (February 27).

MR. GREGORY BUGBEE gave a seminar on “Soil Health” as part of the “Accelerated Arboriculture Program” at the Bartlett Arboretum in Stamford (approx. 12 attendees) (February 8).

MR. MICHAEL THOMAS assisted a Greenwich High School student on several occasions during the month with a Connecticut Science Fair Project titled: “Rapid Colorimetric Field Monitoring System for Zika Virus in Mosquito Populations via DNAzyme-Functionalized Gold Nanoparticles.”

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STATION NEWS

FORESTRY AND HORTICULTURE

DR. JEFFREY S. WARD met with David Beers, Connwood, Inc., in Rockfall to discuss forest management and regeneration (February 3); met with Kristen Richardson, Lyman Orchards, to help identify twigs found in frozen blueberries (February 3); spoke on "Oak health and mortality after gypsy moth defoliation and drought" at the CT Society of American Foresters winter meeting in Rockfall (24 attendees) (February 27).

DR. ABIGAIL A. MAYNARD visited and discussed the New Crops Program at Hindinger's Farm in Hamden (February 1); discussed collaborative research with Dr. Rebecca Salidy from Southern Connecticut State University (February 3); gave a talk on composting and utilization of compost to a Sustainability class at Hamden Hall Country Day School (16 students, 1 teacher) (February 13); gave a talk on unusual garden vegetables to the Suburban Garden Club in Cheshire (53 adults) (February 15); assisted planning of lower school vegetable garden at Hamden Hall Country Day School (6 teachers) (February 27); visited and discussed the New Crops Program at Cold Spring Farm in East Haddam (February 27).

DR. SCOTT C. WILLIAMS, with **MS. MEGAN LINSKE** and **MR. MICHAEL SHORT**, hosted a Station visit for former CAES seasonal employee Emily Picard's Lyman Hall High School sophomore environmental career class (12 students, 1 teacher) (February 14).

MR. JOSEPH P. BARSKY participated in the triennial review of the Westhill High School Agriscience Program in Stamford (40 students, 9 teachers, 12 parents) (February 7 & 28) and participated in the CT Society of American Foresters winter meeting in Rockfall (February 27).

GRISWOLD RESEARCH CENTER

MR. ROBERT DURGY attended as a member of the steering committee and ran the audio-visuals at the Connecticut Vegetable and Small Fruit Grower's Conference in Windsor (273 attendees) (January 9); taught Vegetable Production for Small Scale Farming in Windham (40 attendees); taught a University of Connecticut Master Gardener Program class on vegetables in Bloomfield (46 attendees) (February 8), in Haddam (51 attendees) (February 14), in Bethel (44 attendees) (February 23) and in Stamford (31 attendees) (February 27); taught Math Calculations and Calibration for Pesticide Applicator's Training in West Hartford (46 attendees) (February 21).

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PLANT PATHOLOGY AND ECOLOGY

DR. WADE ELMER met with Mr. Andrew Bramtee and Heather Li from Greenwich High School to discuss possible project for student (February 14); visited the University of Texas (El Paso, TX) to present a seminar entitled “Use of Nanoparticles to suppress soilborne diseases of vegetables” (21 students 4 adults) (February 16) and conferred with Mr Ishaq Adisa, a graduate student, on a joint project.

DR. YONGHAO LI presented a talk titled “Disease Management in Organic Vegetable Gardens” for the Caudatowa Garden Club in Ridgefield, CT (25 Adults) (February 14); along with **MS. LINDSAY PATRICK**, spoke to the Experiment Station Associates about The Plant Disease Information Office during the CAES tour in New Haven, CT (12 Adults) (February 15), presented a lecture “Tree Diseases and Their Management” for the Stamford Arboretum Arboriculture 101 Class in Stamford, CT (7 Attendees) (February 27)

MS. LINDSAY PATRICK staffed a CAES booth with ROSE HISKES at the Connecticut Grounds Keepers Association Turf and Landscape Conference in Cromwell (February 23), and staffed a CAES booth with **MS. PAMELA SLETTEN** at the Connecticut Flower and Garden Show in Hartford (February 26).

DR. NEIL SCHULTES participated in the Yale Office of Career Strategy Spring 2017 Workshop to highlight opportunities at CAES (15 students) (February 7).

DR. QUAN ZENG hosted a job shadow for two Cheshire high school students, Mr. Drew Bellina and Ms. Catherine Goncalves (February 3).



DR. RICHARD COWLES presented “Neonics and bees, is it time to change?” at the New Jersey Vegetable Growers Association meeting in Atlantic City, NJ (80 attendees) (February 7); discussed “Neonics and bees” for the CAES seminar series (60 attendees) (February 15); and presented “Neonicotinoid update, and what the Rockettes have to do with your business” to the CT Grounds Keepers Association winter meeting in Cromwell (300 attendees) (February 23).

MS. ROSE HISKES with **MS. LINDSAY PATRICK**, staffed an Experiment Station booth at the Connecticut Grounds Keepers Association winter meeting in Cromwell (February 23) and with **MR. MARK CREIGHTON** and **MS. KATHERINE DUGAS**, staffed an Experiment Station booth at the Hartford Flower Show (February 25).

DR. JAMES LAMONDIA hosted and attended the CT Hop Growers Association Hop 101 meeting (40 attendees) and participated in the quarterly Board meeting (26 attendees) (February 16); spoke about management of tobacco pathogens including Fusarium wilt, viruses, black shank, target spot, cyst nematodes and blue mold and spoke about strategies to reduce pesticide residues in broadleaf and shade tobacco wrapper leaves while managing fungicide resistance (120 attendees) (February 21); taught a class on identification, biology and management of tree diseases to students in the Connecticut Tree Protective Association’s Arboriculture 101 class in Wallingford (38 attendees) (February 22); participated in a meeting of the Connecticut Agricultural Information Council at the Valley Laboratory to select the Connecticut Outstanding Young Farmer Award winner and prepare for Ag Day at the Capitol (February 24); and spoke about research and services at the Station and Valley Laboratory summer employment opportunities at the Central Connecticut State University Biology Department Career Fair (40 attendees) (February 27).

Krol, W.J.; Eitzer, B.D.; Arsenault, T. White, J.C.; Fontana, J.; Sloan, E.; Lin, L.A.; Robinson, S. 2017. A Targeted Study of Pesticide Residues in Fresh and Dried Herbs Sold in Connecticut 2011. CAES Technical Bulletin 15.

Abstract: The Department of Analytical Chemistry at the Connecticut Agricultural Experiment Station (CAES), along with the Connecticut (CT) Department of Consumer Protection (DCP), has collaboratively conducted an annual market basket survey of produce sold in Connecticut for pesticide residues, and published the findings, at least in part, since 1963. The goals of this program continue to ensure that: 1) pesticides are used in accordance with their label and 2) the public is protected from the deliberate or accidental misuse of pesticides. Our program has gone through significant enhancements and improvements since its inception. The most notable improvements to the program occurred in 2006 when new methodology for the extraction of pesticide residues from produce and liquid chromatography with mass spectrometry (LC/MS) were introduced for the analysis of these extracts. In 2010, CAES began an ongoing collaboration with the Connecticut Department of Public Health (DPH) in which samples undergoing pesticide residue analysis were also screened for potential microbial contamination. Initially in 2011, as part of this joint screening effort with the DPH, fourteen samples of fresh herbs were tested. All but one sample, including the one organic sample tested, were found to contain at least one pesticide residue. Notably, 74 different pesticide residues found on these fourteen samples, only 26 of the residues were permitted by the EPA tolerances. In other words, only 35% of the residues found were permissible under current US law. Of the fourteen samples tested, eleven (78.6%) contained violative pesticide residues. Based upon these findings, we chose to undertake a targeted survey of the 45 samples of fresh and dried herb commodities included in this report. During the course of this work, the Food and Drug Administration (FDA) Forensic Chemistry Center (FCC) joined the study. Thirty-one samples in this report were split and tested concurrently at the CAES and at the FDA/FCC for pesticide residues. The FDA/FCC was interested in comparing the sensitivity of their Direct Analysis in Real Time (DART) mass spectrometer (MS) to our conventional LC/MS results.

Yue, L.; **Ma, C.;** Zhan, X.; **White, J.C.;** Xing, B. 2017. Molecular mechanisms of maize seedling response to La₂O₃ NPs exposure: Water uptake, aquaporin gene expression and signal transduction. *ES: Nano* DOI: 10.1039/c6en00487c.

Abstract: Due to its increasing demands for use in medical, industrial, and agricultural products, concerns over the risks of lanthanum oxide nanoparticle (La₂O₃ NPs) exposure have increased. As the dominant primary producers in terrestrial ecosystems, higher plants represent a sensitive receptor of concern but the mechanisms of La₂O₃ NPs phytotoxicity remain unknown. In the present study, maize was selected as a model plant and the mechanisms underlying growth inhibition and reduced water uptake upon hydroponic exposure to La₂O₃ NPs (50-500mg L⁻¹) were investigated. The root and shoot abscisic acid (ABA) content was increased significantly (1.31-7.47 fold) upon exposure to 50 mg L⁻¹ and 250 mg L⁻¹ La₂O₃ NPs for 1.5 and 3 d. The relative expression of most aquaporin (AQPs) genes in both roots and shoots was down-regulated after 3 and 6 d of exposure. Compared to the control, the expression level of PIP2;5 at day 3 was decreased by 93% in roots exposed to 250 mg L⁻¹; the expression level of PIP1;2 was decreased by 90% at day 6 in shoots exposed to 250 mg L⁻¹ La₂O₃ NPs. The downregulation of AQPs genes led to the reduction of water uptake, subsequently causing significant growth inhibition. For example, maize root biomass upon exposure to 50 mg L⁻¹ La₂O₃ NPs was decreased by 22.73% ($p \leq 0.05$) at day 6 as compared to the control. Additionally, root morphology was severely altered upon exposure to 250 mg L⁻¹ La₂O₃ NPs as determined by root thickness, length, and surface integrity. To our knowledge, this is the first study evaluating the molecular basis of plant response to La₂O₃ NPs exposure as measured by signal transduction, gene expression and water uptake.

Rodrigues, S; Dokoozlian, N; Hendren, C.O.; Karn, B.; Mauter, M.; Sadik, O.; Safarpour, M.; Unrine, J.; Viers, J.; **White, J.C.**; Wiesner, M.R.; Lowry, G.V. 2016. Nanotechnology for sustainable food production: High value opportunities and scientific challenges. *ES: Nano* DOI: 10.1039/C6EN00573J.

Abstract: The agro-ecosystem is under enormous pressure due to rapid population growth, increasing global food demand, increasing fresh water withdrawals and energy consumption, excessive food waste, inefficient use of agrochemicals, environmental degradation and climate change. Nanotechnology offers opportunities to make food production more sustainable by providing 1) better sensors for monitoring physical, chemical, or biological properties and processes, 2) technologies for controlling pathogens to increase food safety and minimize food waste, 3) improved membranes and sorbents for distributed water treatment and resource recovery, 4) novel materials for timed and targeted delivery of agrochemicals, and 5) new materials for monitoring and improving animal health. This perspective summarizes the opportunities of greatest potential determined through an NSF-funded interdisciplinary workshop of ~50 experts from the U.S. and the EU in the areas of nanotechnology, energy, water, agriculture, systems engineering, data integration and analysis, and social science. This paper also presents some specific opportunities and the remaining scientific and engineering challenges that must be overcome to realize the benefits.

Soghigian J., Valsdottir L.R., Livdahl T.P. A parasite's modification of host behavior reduces predation on its host. *Ecol. Evol.* 2017;7:1453–1461. <https://doi.org/10.1002/ece3.2748>

Abstract: Parasite modification of host behavior is common, and the literature is dominated by demonstrations of enhanced predation on parasitized prey resulting in transmission of parasites to their next host. We present a case in which predation on parasitized prey is reduced. Despite theoretical modeling suggesting that this phenomenon should be common, it has been reported in only a few host–parasite–predator systems. Using a system of gregarine endosymbionts in host mosquitoes, we designed experiments to compare the vulnerability of parasitized and unparasitized mosquito larvae to predation by obligate predatory mosquito larvae and then compared behavioral features known to change in the presence of predatory cues. We exposed *Aedes triseriatus* larvae to the parasite *Ascogregarina barretti* and the predator *Toxohrychites rutilus* and assessed larval mortality rate under each treatment condition. Further, we assessed behavioral differences in larvae due to infection and predation stimuli by recording larvae and scoring behaviors and positions within microcosms. Infection with gregarines reduced cohort mortality in the presence of the predator, but the parasite did not affect mortality alone. Further, infection by parasites altered behavior such that infected hosts thrashed less frequently than uninfected hosts and were found more frequently on or in a refuge within the microcosm. By reducing predation on their host, gregarines may be acting as mutualists in the presence of predation on their hosts. These results illustrate a higher-order interaction, in which a relationship between a species pair (host–endosymbiont or predator–prey) is altered by the presence of a third species.

Slack, S.; **Zeng, Quan**; Outwater, C.; and Sundin, G.W. 2016. Microbiological examination of *Erwinia amylovora* exopolysaccharide ooze. **Phytopathology**. doi: <http://dx.doi.org/10.1094/PHYTO-09-16-0352-R>

Abstract: Fire blight, caused by the pathogen *Erwinia amylovora*, is the most devastating bacterial disease of pome fruit in North America and worldwide. The primary method of dispersal for *E. amylovora* is through ooze, a mass of exopolysaccharides and bacterial cells that is exuded as droplets from infected host tissue. During the 2013 and 2014 field seasons, 317 ooze droplets were collected from field-inoculated apple trees. Populations of *E. amylovora* in ooze droplets were 10^8 CFU/ μ l on average. Ooze droplets harboring larger ($>10^8$ CFU/ μ l) cell populations were typically smaller in total volume and had darker coloring, such as orange, red, or dark red hues. Examination of apple host tissue at the site of emergence of ooze droplets using scanning electron microscopy revealed that ooze was not exuding through natural openings; instead, it was found on erumpent mounds and small (10- μ m) tears in tissue. These observations suggested that *E. amylovora*-induced wounds in tissue provided the exit holes for ooze extrusion from the host. Analyses of *E. amylovora* populations in ooze droplets and within the stems from which ooze droplets emerged indicated that approximately 9% of the total bacterial population from infected stems is diverted to ooze. Gene expression analyses indicated that *E. amylovora* cells in stem sections located above ooze droplets and in ooze droplets were actively expressing critical pathogenicity genes such as *hrpL*, *dspE*, and *amsK*. Thus, our study identified ooze as a source of large, concentrated populations of *E. amylovora* that emerged from the host by rupturing host tissue. Because the cells in ooze droplets are expressing genes required for pathogenesis, they are already primed for infection should they be dispersed from ooze to new infection courts.

Sundin, G.; Castiblanco, L.; Yuan, X.; **Zeng, Quan**; and Yang, C.H. 2016. Bacterial disease management: Challenges, experience, innovation, and future prospects. **Mol. Plant Pathol.** DOI: 10.1111/mpp.12436

Abstract: Plant diseases caused by bacterial pathogens place major constraints on crop production and cause significant annual losses on a global scale. The attainment of consistent effective management of these diseases can be extremely difficult, and management potential is often affected by grower reliance on highly disease-susceptible cultivars because of consumer preferences, and by environmental conditions favouring pathogen development. New and emerging bacterial disease problems (e.g. zebra chip of potato) and established problems in new geographical regions (e.g. bacterial canker of kiwifruit in New Zealand) grab the headlines, but the list of bacterial disease problems with few effective management options is long. The ever-increasing global human population requires the continued stable production of a safe food supply with greater yields because of the shrinking areas of arable land. One major facet in the maintenance of the sustainability of crop production systems with predictable yields involves the identification and deployment of sustainable disease management solutions for bacterial diseases. In addition, the identification of novel management tactics has also come to the fore because of the increasing evolution of resistance to existing bactericides. A number of central research foci, involving basic research to identify critical pathogen targets for control, novel methodologies and methods of delivery, are emerging that will provide a strong basis for bacterial disease management into the future. Near-term solutions are desperately needed. Are there replacement materials for existing bactericides that can provide effective disease management under field conditions? Experience should inform the future. With prior knowledge of bactericide resistance issues evolving in pathogens, how will this affect the deployment of newer compounds and biological controls? Knowledge is critical. A comprehensive understanding of bacterial pathosystems is required to not only identify optimal targets in the pathogens, but also optimal seasonal timings for deployment. Host resistance to effectors must be exploited, carefully and correctly. Are there other candidate genes that could be targeted in transgenic approaches? How can new

technologies (CRISPR, TALEN, etc.) be most effectively used to add sustainable disease resistance to existing commercially desirable plant cultivars? We need an insider's perspective on the management of systemic pathogens. In addition to host resistance or reduced sensitivity, are there other methods that can be used to target these pathogen groups? Biological systems are variable. Can biological control strategies be improved for bacterial disease management and be made more predictable in function? The answers to the research foci outlined above are not all available, as will become apparent in this article, but we are heading in the right direction. In this article, we summarize the contributions from past experiences in bacterial disease management, and also describe how advances in bacterial genetics, genomics and host-pathogen interactions are informing novel strategies in virulence inhibition and in host resistance. We also outline potential innovations that could be exploited as the pressures to maximize a safe and productive food supply continue to become more numerous and more complex.

McNally, R.; **Zeng, Quan**; and Sundin G.W. 2016. HrcU and HrpP are pathogenicity factors in the fire blight pathogen *Erwinia amylovora* required for the type III secretion of DspA/E. BMC Microbiol. 16:88.

Abstract: Many Gram-negative bacterial pathogens mediate host-microbe interactions via utilization of the type III secretion (T3S) system. The T3S system is a complex molecular machine consisting of more than 20 proteins. Collectively, these proteins translocate effectors across extracellular space and into the host cytoplasm. Successful translocation requires timely synthesis and allocation of both structural and secreted T3S proteins. Based on amino acid conservation in animal pathogenic bacteria, HrcU and HrpP were examined for their roles in regulation of T3S hierarchy. Both HrcU and HrpP were shown to be required for disease development in an immature pear infection model and respective mutants were unable to induce a hypersensitive response in tobacco. Using in vitro western blot analyses, both proteins were also shown to be required for the secretion of DspA/E, a type 3 effector and an important pathogenicity factor. Via yeast-two hybridization (Y2H), HrpP and HrcU were revealed to exhibit protein-protein binding. Finally, all HrcU and HrpP phenotypes identified were shown to be dependent on a conserved amino acid motif in the cytoplasmic tail of HrcU. Collectively, these data demonstrate roles for HrcU and HrpP in regulating T3S and represent the first attempt in understanding T3S hierarchy in *E. amylovora*.

JOURNAL ARTICLES APPROVED FEBRUARY 2017

Armstrong, Philip M., Theodore G. Andreadis, John J. Shepard, and Michael C. Thomas. Northern range expansion of the Asian tiger mosquito (*Aedes albopictus*): Analysis of mosquito data from Connecticut, USA. *PLOS Neglected Tropical Diseases*

Benton, Elizabeth and **Richard S. Cowles.** Optimized insecticide dosage for hemlock woolly adelgid control in hemlock trees. *Outreach*, online journal, Warnell School of Forestry & Natural Resources, University of Georgia,
<https://www.warnell.uga.edu/sites/default/files/publications/WSFNR-17-01%20Benton.pdf>

Cheah, Carole. Update on ongoing hemlock research at Steep Rock. *The Steep Rock Vista*, Winter 2016-2017, p. 4 (online journal), <http://www.steeprockassoc.org/about/news-and-publications/newsletters/>

Gent, Martin P. N. and Wade H. Elmer. Influence of partial saturation ebb and flow irrigation and of silicon to suppress Pythium root rot of poinsettia. *Crop Protection*

Krol, Walter J., Brian D. Eitzer, Terri Arsenault, Jason C. White, J. Fontana, S. Kinney, L. A. Lin, S. Robinson, and E. Sloan. A targeted study of pesticide residues in fresh and dried herbs sold in Connecticut 2011. *CAES Technical Bulletin*

Leach, J. E., **Lindsay R. Triplett**, C. Argueso, and P. Trivedi. Communication in the phyto-biome. *Cell*

Pagano, Luca, F. Pasquali, **Sanghamitra Majumdar, Roberto De La Torre-Roche, Nubia Zuverza-Mena**, M. Villani, A. Zappettini, **Robert E. Marra**, S. M. Isch, M. Marmiroli, E. Maestri, O. P. Dhankher, **Jason C. White**, and N. Marmiroli. Exposure of *Cucurbita pepo* to binary combinations of engineered nanomaterials: physiological and molecular response. *Nanotoxicology*

Soghigian, John, Gale E. Ridge, Kirby C. Stafford III, and Goudarz Molaei. The first evidence of nanism in *Ixodes (Ixodes) scapularis* Say (Acari: Ixodidae), from a human-biting tick. *PLOS One*

Stafford, Kirby C., III. and Scott C. Williams. Deer-targeted methods: a review of the use of topical acaricides for the control of ticks on white-tailed deer. *Journal of Integrated Pest Management*

Stafford, Kirby C., III., Scott C. Williams, and Goudarz Molaei. Integrated pest management (IPM) in controlling ticks and associated diseases. *Journal of Integrated Pest Management*

Tobacco Research Meeting

One hundred and twenty people attended the Connecticut Agricultural Experiment Station's annual Tobacco Research Meeting held at the East Windsor Scout Hall on February 21, 2017. Dr. Jim LaMondia welcomed growers and spoke about recent developments at the Experiment Station. The meeting addressed a wide variety of issues of concern to growers. Jim LaMondia spoke about management of tobacco pathogens including Fusarium wilt, poty viruses, black shank, target spot, cyst nematodes and blue mold and presented strategies to reduce pesticide residues in broadleaf and shade tobacco wrapper leaves while managing fungicide resistance. He provided an overview of the breeding program with the objective of incorporating plant resistance to pathogens through traditional breeding techniques. Thomas Rathier spoke about the effects of cultural practices, the environment and weather events on soils, soil microbes and tobacco growth. Christina Berger of the CT DEEP gave growers an update on EPA Worker Protection training changes and licensing. Andrew Urbanowicz, Dave Arnold and Paul Polek presented an update on the Connecticut-Massachusetts Tobacco Growers Association. Colleen Kisselburgh discussed tobacco insurance program changes and Martha Dorsey of the Farm Services Administration provided updates on FSA services to growers. Jane Canepa-Morrison, Jim Preste and Nathaniel Child assisted with much of the behind the scenes work for the meeting. The meeting qualified for pesticide applicator recertification credit in Connecticut and Massachusetts and 67 persons received credit.

Ayse (Case) Adams, graduate student at Central Connecticut State University with Dr. Barbara Nicholson, received an Outstanding Scholar Award from CCSU on February 9, 2017 for research being conducted toward her M.A. in Biological Sciences. Ayse's research on 'the induction of tobacco cyst nematode hatching by hydroponic *Solanum* root diffusates' is being done in collaboration with **DR. JAMES LAMONDIA**.



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