Station News

The Connecticut Agricultural Experiment Station
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This Issue

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.

CAES

The Connecticut Agricultural Experiment Station

Putting Science to Work for Society since 1875

GRANTS RECEIVED APRIL 2022

DR. GOUDARZ MOLAEI submitted a research proposal titled "Monitoring Ticks and Tick-borne Pathogens to Better Guide Public Health Action" to the U.S. Congressional Appropriation Committee (April 14).

ADMINISTRATION

DR. JASON C. WHITE, with **DR. YI WANG** and **DR. WADE ELMER**, met by Zoom with collaborators from the University of Massachusetts to discuss collaborative research on a joint USDA nanoscale sulfur project (April 1); with **DR. WADE ELMER** and **DR. CHRISTIAN DIMKPA**, met by Zoom with collaborators at the University of Central Florida to discuss joint experiments with nanoscale zinc oxide (April 1); co-hosted a USDA-funded workshop titled "Toxic Metals in Food: Identification of Critical Knowledge Gaps to Ensure a Safe Food Supply" on Zoom (April 4-5); gave a presentation titled "Tuning Agrochemical Chemistry at the Nanoscale to Enhance Stress Tolerance, Crop Nutrition, and Yield" at the US-NA Nanotechnology Convergence for Energy, Environment, and Health (remote) (April 6); participated in the NSF Center for Sustainable Nanotechnology (CSN) weekly All-Hands call (April 6, 27); participated by Teams in mandatory ethics training for senior agency staff (April 7); hosted a Zoom call with collaborators at Auburn University and Louisiana State University to discuss a joint grant being submitted to the USDA SCRI (April 7; 21); with **DR. NUBIA ZUVERZA-MENA**, hosted a Zoom call with collaborators at the University of Texas El Paso to discuss a joint grant proposal to the USDA AFRI program (April 8); with **DR. SARA NASON** and **DR. NUBIA ZUVERZA-MENA**, participated in a NIEHS sponsored Zoom call to establish a PFAS Analysis Working Group (April 8); traveled to Atlanta to participate in the annual CSN All-Hands in-person meeting (April 11-12); participated in an FDA-sponsored call of the FDA LFFM to discuss an upcoming presentation on violative food samples in Connecticut (April 13); with **DR. SARA NASON** and **DR. NUBIA ZUVERZA-MENA**, spoke by Zoom with staff of Senator Christine Cohen to discuss PFAS (April 14); spoke by Zoom with Wilanyi Alvarez of the University of Minnesota about her PhD research project (April 14); spoke by Zoom with USDA NIFA staff regarding a presentation at an upcoming USDA Public Meeting (April 15); participated by Zoom in an NIEHS-sponsored webinar on Approaches to Enhance Bioremediation (April 15, 29); spoke by Zoom with Prof. Soledad Peresin of Auburn University about a collaborative grant submission to USDA SCRI (April 16); with Department of Analytical Chemistry staff, participated in a Zoom call with CT Department of Agriculture staff to discuss sampling for the next year (April 18); with **DR. NUBIA ZUVERZA-MENA**, spoke with collaborators at Arizona State University about hemp-related phytoremediation research (April 18); with **DR. WADE ELMER, DR. CHAOYI DENG**, and **DR. CHRISTIAN DIMKPA,** met by Zoom with collaborators at the University of Central Florida (April 19); with **DR. SHITAL VAIDYA, DR. CHRISTIAN DIMKPA**, and **DR. WADE ELMER**, hosted a Zoom call with collaborators at Johns Hopkins University to discuss progress on a joint USDA research project (April 19); hosted the quarterly meeting of the CAES Board of Control (April 20); participated in an FDA Webinar on "Interesting Year 2 Samples" (April 20); gave a Director's Report at the annual meeting of the Experiment Station Associates in Jones (April 20); participated in the monthly CSN faculty meeting (April 21); gave a presentation by Zoom to the University of Massachusetts Stockbridge School of Agriculture titled "Tuning Agrochemical Chemistry at the Nanoscale to Enhance Stress Tolerance, Crop Nutrition and

yield" (April 26); gave a presentation titled "Toxic Elements in Food: Identification of Critical Knowledge Gaps to Ensure a Safe Food Supply" at a USDA Public Meeting (April 27); with Department of Agriculture staff, participated in a Teams call with DCP Drug Control staff about adult use cannabis testing (April 28); and hosted the monthly CAES J-1 Visa recipients meeting (April 29).

ANALYTICAL CHEMISTRY

DR. CHRISTINA ROBB attended the LCGC Data Integrity symposium (April 4); participated in the Eastern Analytical Symposium (EAS) Executive Committee meetings (April 4, 11, 18, 25); attended the Select Science "Emerging Trends and Future Directions in Food Testing" webinar (April 7); participated in the Association of Public Health Laboratory (APHL) Chemistry workgroup meeting (April 13); and participated as a subject matter expert for the APHL Laboratory Chemistry Framework (LCF) Chemistry track in defining the knowledge, skills and abilities and constructing competencies for a mid-level analytical chemist performing gas chromatography (April 11-14).

DRS. SHITAL VAIDYA, **YI WANG**, **CHAOYI DENG**, and **PHILIP ZHENGYANG** (from the Dept. of Environmental Sciences) visited the USDA Agricultural Research Center in Beltsville, Maryland (April 1). The visit was to receive training on the preparation of biological samples for Transmission Electron Microscopy, TEM, imaging. The training focused specifically on sample embedding methods, ultramicrotomy, and TEM imaging. Training was provided by Dr. Joseph Mowery.

From left to right: **Dr. Yi Wang**, **Dr. Philip Zhengyang Wang**, Dr. Joseph Mowery, **Dr. Chaoyi Deng**, and **Dr. Shital Vaidya**.

DR. NUBIA ZUVERZA-MENA met with **DRS. JASON WHITE**, **WADE ELMER**, and **CHRISTIAN DIMKPA** to discuss details on a new study with Zinkicide, a commercial product in the process of registration (April 1); with **DR. JASON WHITE** and **DR. SARA NASON**, attended a virtual group meeting on the nanomaterials-enhanced phytoremediation project with collaborators from Yale and the University of Minnesota (April 6); met with **DRS. SUSANNA KERIÖ**, **LEIGH WHITTINGHILL,** and **JEFFREY WARD** on the recruitment of a postdoctoral researcher to work on the early detection of urban maple trees decline syndrome (April 7,

19, 22, 28); participated in a virtual meeting with **DR. JASON WHITE** and faculty from The University of Texas at El Paso about a potential collaboration on the USDA Nanotechnology for Agricultural and Food Systems Program (April 8); with **DR. SARA NASON**, attended a virtual NIEHS meeting that had the purpose of assembling an analytical networking group (April 8); with **DR. SARA NASON** and **DR. JASON WHITE**, attended an online meeting with Ms. Alice Kwak to discuss per- and polyfluoroalkyl substances (PFAS) research at CAES, envisioning possible policy solutions that address PFAS (April 14); attended the NIEHS "Progress in Research" virtual webinar (April 15, 29); discussed a potential collaboration on hemp phytoremediation with **DR. JASON WHITE** and faculty from the University of Arizona (April 18); attended the Association of Public Health Labs - Human and Animal Food subcommittee virtual meeting (April 19-21); met virtually with upcoming visiting researcher Dr. Ileana Vera-Reyes (April 21); and with **DR. CARLOS TAMEZ** and **DR. SARA NASON**, met with USGS staff and coordinated remotely the sampling of soil and plants for future PFAS analysis, to address the concerns of Tribal Nations in Maine about the safety of fiddleheads (April 26).

ENTOMOLOGY

DR. KIRBY C. STAFFORD III was interviewed about the spongy moth (previously known as the gypsy moth) by Robert Miller from the *News-Times* (April 20); presented an online talk about ticks to master gardeners (32 attendees) (April 22); assisted with a meeting of the Connecticut Entomological Society in Jones Auditorium (April 22); and presented and participated in a meeting of the Tick-Borne Disease Working Group (28 attendees) (April 27-28).

DR. MEGAN LINSKE attended the Annual Northeast Fish and Wildlife Agencies Conference (April 4-5); lead the Northeast Section of the Wildlife Society (TWS) annual Spring meeting as Section President (April 13); participated in the TWS Diversity, Equity and Inclusivity networking call as a committee member (April 18); participated in the field season planning call for a Department of Defense collaborative project (April 25); reviewed and submitted the final selection of 10 individuals for the Class of 2022 TWS Leadership Institute from 65 applications as a committee member (April 26); and reviewed and submitted the final selection of the TWS 2022 Publication Award recipients from 107 nominated submissions in five categories as a committee member (April 29); and attended the Ph.D. dissertation defense of Rebecca Bingham titled "Lyme Disease: Risk, Prediction and Vaccine Deployment Model Development" as a doctoral committee member (April 29).

DR. GOUDARZ MOLAEI was interviewed by Ashley of Chaz & AJ PLR 99.1 Radio on the public health challenges associated with ticks and tick-borne diseases in Connecticut; and preventing tick bites (April 11); was interviewed by Dennis Valera, of Channel 3 WFSB Eyewitness News, in an article titled, "Experts Warn of Rising Tick Population in CT," https://www.wfsb.com/2022/04/18/experts-warn-rising-tick-population-ct/ (April 18); presented an invited talk titled, "Bracing for the worst--Climate and ecological changes, accelerating range expansion of tick vectors, and rising tide of tick-borne diseases," to the Connecticut Entomological Society (April 22); was interviewed by Jesse Leavenworth, a reporter for the *Hartford Courant*, in an article titled, "Ticks Are on the Rise in Connecticut: Here Is What They Look Like and the Diseases They Carry," https://www.courant.com/news/connecticut/hc-news-ct-tick-update-20220427-jfkcddpfgfg3fhj5gyrffxolwi-story.html

(April 27); was interviewed by Jennifer Joas, a reporter for NBC Connecticut, in an article titled, "Busy Tick Season Expected in Connecticut," https://www.nbcconnecticut.com/news/local/busy-tick-season-expected-in-connecticut/2773293/ (April 29); and directed the CAES Tick Testing Laboratory; of the 431 submissions, blood-engorged adult blacklegged ticks were tested for Lyme disease, babesiosis, and anaplasmosis, and results were reported.

DR. VICTORIA L. SMITH participated in the 96th meeting of the Eastern Plant Board, held at the Otesaga Resort Hotel in Cooperstown, NY (April 4-7).

ENVIRONMENTAL SCIENCES

DR. JOSEPH PIGNATELLO met with Christopher Conners, Technology Commercialization Services, University of Connecticut, and representatives from Douglas Products to discuss patent and licensing opportunities for an invention (April 1, 6, 12); met virtually with co-investigators from the University of Maryland and GeoSyntec Corp. on a SERDP grant (April 5); attended the M.S. oral thesis defense of Tyler Swanson at Central Connecticut State University, New Britain (April 20); met virtually with co-investigators from Villanova University, Pacific Northwest National Laboratory, and Oregon Health and Science University on a SERDP grant (April 25).

DR. WAEL ABDELRAHEEM was named one of the 2022 "40 Under 40" winners of the American Academy of Environmental Engineers & Scientists (AAEES), recognized as an individual or team member for helping to advance the fields of Environmental Science or Environmental Engineering in a demonstrable way in business successes or civic/philanthropic activities within the past year (April 11).

MS. ANGELA BRANSFIELD participated virtually in Yale's Biosafety Committee Meeting (April 21); provided animal training to ABSL3 and mosquito lab personnel (April 27); and co-chaired a CAES DEI Committee Meeting (April 28).

MR. GREGORY BUGBEE gave a talk titled "Composting" to the Newtown Horticulture Club at the Newtown Community Center (approx. 40 attendees) (April 14); gave a talk titled "Container Gardening Indoors and Out" to the West Haven Garden Club at the West Haven Public Library (approx. 30 attendees) (April 19); judged the Quinnipiac University Science Fair (April 25); updated the National Aquatic Nuisance Species Control panel on hydrilla in the Connecticut River (April 26); and participated as a panelist on the National Aquatic Nuisance Species Research panel (April 29).

DR. ANDREA GLORIA-SORIA attended the Arthropod Genetics Symposium virtual Session III: Arthropod Genomics and Genome Engineering (April 12); participated virtually on a grant review panel for the AAPG2022, CE15 - Immunologie, Infectiologie et Inflammation, from Agence Nationale de la Recherche, France (several days in April); participated in the CAES DEI Committee Meeting (April 28); and helped organize a ceremony commemorating the 150th anniversary of the Arbor Day creation at Church St. Elementary School in Hamden, together with the US Forest Service Northern Research Station during Arbor Day (300 participants) (April 29).

DR. REBECCA JOHNSON judged undergraduate presentations for the virtual Quinnipiac Chapter Sigma Xi Student Research Conference (April 25).

DR. SARA NASON presented a seminar titled "Collaborative PFAS Research Using High Resolution Mass Spectrometry: Challenges and Progress" for the Syracuse University Department of Civil and Environmental Engineering and met with Dr. Teng Zeng and students (April 1) (31 attendees including 23 students); attended virtual meetings of the Benchmarking and Publications for Non-Targeted Analysis working group (April 7, 14, 19, 28); attended the virtual inaugural meeting of the NIH SRP PFAS analysis networking group (April 8); and met virtually with members of the USGS PFAS capability team to discuss a collaborative project this summer (April 26).

DR. ZHENGYANG (PHILIP) WANG underwent training for electron microscopy biological sample preparation at the USDA Agricultural Research Service in Beltsville, MD and discussed potential collaboration with Joseph Mowery, the EMS specialist (April 1).

FORESTRY AND HORTICULTURE

DR. JEFFREY S. WARD participated in a Connecticut Forest and Park Association (CFPA) Master Woodlands Managers Partner's meeting (April 5); spoke about the impact of tree diseases on forest dynamics at Naugatuck State Forest for the Yale Forest Health class (9 attendees) (April 8); spoke on forest regeneration for the CFPA's "Walk with a Forester" at Field Forest in Durham (11 attendees) (April 9); participated in a Forest Ecosystem Monitoring Cooperative (FEMC) Steering Committee Meeting (April 11); gave an invited lecture titled "A Short History of the Connecticut Forest" for the Cherry Brook Garden Club in Canton (25 attendees) (April 12); participated in a CFPA's Governance Committee meeting (April 12); participated in the FEMC State Coordinators virtual meeting (April 14); organized, hosted, and spoke at the FEMC Connecticut State Partnership (CT SParC) organizing meeting (18 attendees) (April 26); with **MR. JOSEPH P. BARSKY**, advised Andrew Hubbard (MDC) on the status of old-growth forest in Sandisfield, MA (April 27); attended the McIntire-Stennis Cooperative Forestry Research and Renewable Resources Extension Act Program FY2021 virtual Administrative Meeting (April 28); and spoke about the impact of tree diseases on forest dynamics in Madison and Deep River for the Yale Forest Health class (9 attendees) (April 29).

DR. SUSANNA KERIÖ participated in a Zoom meeting to discuss collaboration with USFS related to sentinel trees (April 7, 27); presented a webinar on chestnut research plans in The American Chestnut Foundation's (TACF) Science and Tech committee meeting (40 attendees) (April 8); served on a Connecticut Urban Forest Council (CUFC) conference planning meeting (April 13); served on a CUFC grant review panel (April 19); served on the Yale Biosafety Committee (April 21); judged posters for the Quinnipiac Chapter of Sigma Xi Student Research Symposium (posters) (April 25); gave a talk entitled "Right Tree for the Right Place" for the Daytime Gardeners of North Haven meeting (15 attendees) (April 26); and discussed chestnut-related research with TACF collaborators (April 29).

DR. LEIGH WHITTINGHILL attended a planning meeting for the 2023 Connecticut Vegetable and Fruit Conference (April 1); met with Doreen Abubakar to discuss her projects at the Newhallville Learning Corridor and potential partnerships

with CAES (April 1); reviewed CT DoAg Transition Grant proposals with the review panel for New Farmer micro Grants and Research and Development Grants (April 5); met with Diane Litwin at Common Ground for the first farm visit of Dr. Whittinghill's on-farm monitoring pilot project; and met with Jonathon Savage at Gather New Haven at the 613 Ferry Street farm for the first farm visit of Dr. Whittinghill's on-farm monitoring pilot project (April 8); participated in a thesis defense for Turquoise Brown-Patterson, a Masters of Environmental Science student at Kentucky State University (April 14); participated in a thesis defense for Jacob Brown, a Masters of Environmental Science student at Kentucky State University (April 19); judged student posters/presentations for the Quinnipiac Chapter of the Sigma Xi Student Research Symposium (25 posters) (April 25); and participated in a meeting of the Soil Health Committee of the CT Council on Soil and Water Conservation; the committee is currently formulating a Soil Health Plan for the state (April 27).

DR. SCOTT C. WILLIAMS virtually attended the 77th Annual Northeast Fish and Wildlife Conference (April 4-5); as a graduate committee member, attended the successful virtual thesis defense of Cornell University master's student Joseph Poggi (April 6); as Executive Treasurer, attended the virtual members meeting of the Northeast Section of The Wildlife Society (April 13); with **DR. MEGAN LINSKE**, hosted a visit to CAES by collaborator David Poche of Genesis Laboratories, Inc., to showcase joint research endeavors (April 21-22); and virtually attended a conference call for a collaborative Department of Defense-funded integrated tick management project (April 25).

MR. JOSEPH P. BARSKY spoke on the history of Naugatuck State Forest for a Yale Forest Health class (9 attendees) (April 8); gave a presentation on tree identification to attendees of the Spring Workshop of the Tree Warden's Association of Connecticut in Pomfret (35 attendees) (April 14); gave a presentation on trees and vines to 3rd grade students at St. Thomas's Day School in New Haven (15 students, 1 teacher) (April 20); and attended the Forest Ecosystem Monitoring Cooperative State Partnership Meeting (April 26).

PLANT PATHOLOGY AND ECOLOGY

DR. WADE ELMER, with **DRS. JASON WHITE** and **CHRISTIAN DIMKPA**, Zoom conferenced with **DR. SWADESH SANTRA** about nano fertilizers; (April 15); with Carlos Mendez, attended via Zoom the Nano Plant meeting for the Center for Sustainable Nanotechnology (11 attendees) (April 13); along with **DR. JASON WHITE** and **MIKE LAST** attended the Board of Control meeting in the director's board room in Slate building; (April 14); participated as a member of the UConn search committee for the PSFL department head via WebEx in the candidates' interviews; with **DRS. CHRISTIAN DIMKPA,** Ishaq Adisa, and Carlos Mendez, visited with Dr. Ben Hsiao of Stony Brook University, New York, about nano fertilizers (April 15); attended via Teams the CT Management Advisory Council Monthly Meeting (April 21); participated via Zoom in the American Phytopathological Society Foundation meeting (April 21); participated as a member of the UConn search committee for the PSFL department head via WebEx in Dr. Mengmeng Gu's interviews (April 27-28); and attended the NIFA POW reporting webinar (April 28).

DR. ROBERT MARRA presented his fourth lecture on root/butt rots and foliar diseases of trees for the Forest Health class at the Yale Forest School, as part of

the Forestry M.S. program (15 adults) (April 4); with **DR. JEFFREY WARD** and Talbot Trotter (USFS), co-led a field trip to Naugatuck State Forest for the Forest Health class (15 adults) (April 8); presented a talk titled "Beech Leaf Disease and Oak Wilt" at the annual meeting of the Experiment Station Associates held in Jones Auditorium (20 adults) (April 20); with **DR. JEFFREY WARD** and Talbott Trotter, co-led a field trip for the Yale Forest Health class to the Killingworth and Cockaponsett State Forest (15 adults) (April 29).

DR. YONGHAO LI attended the 2022 Yankee District Rose Convention in Mystic (April 2); presented "Plant Propagation" to Branford Garden Club members in Branford (18 adults) (April 5); instructed "Phytophthora Bleeding Canker" in the Review Night of the Connecticut Tree Protective Association's Arboriculture 101 Course in Jones (24 adults) (April 7); attended the Northeastern American Phytopathological Society virtual meeting and presented "Ornamental Disease Updates" (26 adults) (April 21); and attended the 2022 National Plant Diagnostic Network National Meeting via Zoom (April 27-28).

DR. WASHINGTON DA SILVA presented a seminar for the Department of Plant Pathology at Cornell University titled "Nano-enabled Technologies: Prospective Weapons to Tackle Destructive Plant Viruses" (75 attendees) (April 26).

MS. ROSE HISKES conducted a Connecticut Invasive Plant Working Group (CIPWG) Symposium planning committee meeting via Zoom (16 attendees) (April 7); and staffed a CIPWG booth at the Hamden Earth Day Celebration at Hamden Middle School (approx. 50 visitors) (April 23).

DRS. NEIL SCHULTES, MOHAMED-AMINE HASSANI, RAVI PATEL, and **MS. REGAN HUNTLEY** from the Department of Plant Pathology and Ecology, **DRS. SUSANNA KERIÖ** and **LEIGH WHITTINGHILL** from the Department of Forestry and Horticulture, **DR. CHARLES VOSSBRINCK, DR. BECKY JOHNSON**, and **MR. GREG BUGBEE** from the Department of Environmental Sciences, and **DR. DEWEI LI** from the Valley Laboratory served as judges for the Quinnipiac Chapter of Sigma Xi's Student Research Symposium (42 participants) (April 25).

VALLEY LABORATORY

DR. JATINDER S. AULAKH, in collaboration with Cristina Rodriguez, Senior Registration Manager, FMC corporation, got approval for a special local need label for Zeus XC (Sulfentazone) herbicide for haircap moss control in Connecticut cranberries (April 2); and submitted a grant proposal to the Connecticut Christmas Tree Board for a project titled "Horsenettle Control with Woodchips and Pre - and Post-emergence Herbicides" (April 27).

DR. RICHARD COWLES presented "Climate Change Basics and Threats to Growing Roses" to the regional meeting of rose growers hosted by the CT Rose Society in Mystic (60 participants) (April 2).

DR. JAMES LAMONDIA participated in a research discussion about Beech Leaf Disease with personnel from Bartlett Tree, Davey Tree, and Cleveland Metroparks (April 18).

DEPARTMENTAL RESEARCH UPDATES APRIL 2022

ADMINISTRATION

1. Deng, C., **Wang, Y.**, Cantu, J. M., Valdes, C., Navarro, G., Cota-Ruiz, K., Hernandez-Viezcas, J. A., Li, C., **Elmer, W. H.**, **Dimkpa, C. O.**, **White, J. C.**, Gardea-Torresdey, J. L. (2022). Soil and foliar exposure of soybean (*Glycine* max) to Cu: Nanoparticle coating-dependent plant responses. *NanoImpact*, *26*. DOI: 10.1016/j.impact.2022.100406

Abstract: In this study, we investigated the effects of citric acid (CA) coated copper oxide nanoparticles (CuO NPs) and their application method (foliar or soil exposure) on the growth and physiology of soybean (Glycine max). After nanomaterials exposure via foliar or soil application, Cu concentration was elevated in the roots, leaves, stem, pod, and seeds; distribution varied by plant organ and surface coating. Foliar application of CuO-CA NPs at 75 mg/L increased soybean yield by 170.1% compared with the control. CuO NPs through a foliar exposure at 300 mg/L also increased soybean yield (by 169.5%) but decreased protein content of soybean seeds by 56.3%. In contrast, foliar and soil exposure to ionic Cu with all treatments (75 and 300 mg/L) had no impact on yield. Additionally, CuO -CA NPs at 300 mg/L significantly decreased Cu concentration in seeds by 46.7%, compared to control; and by 44.7%, compared to equivalent concentration of CuO NPs. Based on the total Cu concentration, CuO NPs appeared to be more accessible for plant uptake compared to CuO-CA NPs, and inhibited plant height by 27.9% at 300 mg/kg under soil exposure. The translocation of Cu from leaf to root and from the root to leaf through the xylem was imaged by two-photon microscopy. Evidence from agronomic parameters indicate that coating with citric acid reduced CuO NPs toxicity in soybean, demonstrating that surface modification may change the toxic properties of NPs. This research provides direct evidence for the positive effects of CuO-CA NPs on soybean, including accumulation and in planta transfer of the particles, and provides important information when assessing the risk and the benefits of NPs use in food safety and security.

2. Teng, M., Zhao, X., Wang, C., Wang, C., **White, J. C.**, Zhao, W., Zhou, L., Duan, M., Wu, F. (2021). Polystyrene nanoplastics toxicity to zebrafish: Dysregulation of the brain-intestine-microbiota axis. *ACS Nano*. DOI: 10.1021/acsnano.2c01872

Abstract: In animal species, the brain-gut axis is a complex bidirectional network between the gastrointestinal (GI) tract and the central nervous system (CNS) consisting of numerous microbial, immune, neuronal, and hormonal pathways that profoundly impact organism development and health. Although nanoplastics (NPs) have been shown to cause intestinal and neural toxicity in fish, the role of the neurotransmitter and intestinal microbiota interactions in the underlying mechanism of toxicity, particularly at environmentally relevant contaminant concentrations, remains unknown. Here, the effect of 44 nm polystyrene nanoplastics (PS-NPs) on the brain-intestine-microbe axis and embryo-larval development in zebrafish (*Danio rerio*) was investigated. Exposure to 1, 10, and 100 μg/L PS-NPs for 30 days inhibited growth and adversely affected inflammatory responses and intestinal permeability. Targeted metabolomics analysis revealed an alteration of 42 metabolites involved in neurotransmission. The content of 3,4-dihydroxyphenylacetic acid (DOPAC; dopamine metabolite formed by monoamine oxidase activity) was significantly decreased in a dose-dependent manner after PS-NP exposure. Changes in the 14 metabolites correlated with

changes to 3 microbial groups, including Proteobacteria, Firmicutes, and Bacteroidetes, as compared to the control group. A significant relationship between Firmicutes and homovanillic acid (0.466, Pearson correlation coefficient) was evident. Eight altered metabolites (l-glutamine (Gln), 5-hydroxyindoleacetic acid (5-HIAA), serotonin, 5-hydroxytryptophan (5-HTP), l-cysteine (Cys), l-glutamic acid (Glu), norepinephrine (NE), and l-tryptophan (l-Trp)) had a negative relationship with Proteobacteria although histamine (His) and acetylcholine chloride (ACh chloride) levels were positively correlated with Proteobacteria. An Associated Network analysis showed that Firmicutes and Bacteroidetes were highly correlated (0.969). Furthermore, PS-NPs accumulated in the gastrointestinal tract of offspring and impaired development of F1 (2 h post-fertilization) embryos, including reduced spontaneous movements, hatching rate, and length. This demonstration of transgenerational deficits is of particular concern. These findings suggest that PS-NPs cause intestinal inflammation, growth inhibition, and restricted development of zebrafish, which are strongly linked to the disrupted regulation within the brain-intestine-microbiota axis. Our study provides insights into how xenobiotics can disrupt the regulation of brain-intestine-microbiota and suggests that these end points should be taken into account when assessing environmental health risks of PS-NPs to aquatic organisms.

3. Hou, J., Hu, C., Wang, Y., Zhang, J., **White, J. C.**, Yang, K., Lin, D. (2022). Nano-bio interfacial interactions determined the contact toxicity of $nTiO_2$ to nematodes in various soils. *Sci. Total Environ. 835*. DOI: 10.1016/j.scitotenv.2022.155456

Abstract: The toxicity of soilborne nanomaterials (NMs) is a manifestation of soil -NM-bio interactions. Soil environmental factors are known to restructure NMs surfaces and thus influence the nanotoxicity. However, the mechanisms by which environmental factors affecting nano-bio interactions to aggravate or alleviate nanotoxicities are poorly understood. We compared the toxicity of TiO_2 NMs ($nTiO_2$) in five soils using the model nematode (Caenorhabditis elegans), and investigated the variation of nano-bio interactions under different conditions. A correlation analysis showed that pH and dissolved organic matter (DOM) were the dominant regulators of $nTiO_2$ toxicity. At the nano-bio interface, low pH led to $nTiO_2$ adhesion to micron-sized furrows and aggravated dermal wrinkling, while humid acid (HA) alleviated these impacts. Mechanically, low pH increased $nTiO_2$ adhesion through enhanced electrostatic attraction and subsequent stimulation of mucin synthesis and collagen deposition, resulting in a positive feed cycle of pH-dependent contact nanotoxicity. HA not only prevented $nTiO_2$ adhesion onto the epidermis due to its negative charge, but also relieved the overstimulation of stress response pathways at the molecular level under acidic conditions, thereby alleviating toxicity. These findings broaden our knowledge of how NMs induce contact toxicity in soil invertebrate species through specific biointerfacial interactions, and highlight the important role of DOM in alleviating the combined hazards of nano-contamination and soil acidification.

4. Wang, Y., **Borgatta, J.**, **White, J. C.** (2022). Protecting foods with biopolymer fibres. *Nature Food*. DOI: 10.1038/s43016-022-00519-6

Abstract: A cost-effective, high-throughput fiber-based food packaging approach using non-toxic, biodegradable biopolymer materials offers a strategy to significantly promote food safety and security while minimizing food waste.

5. Yue, L., Feng, Y., Ma, C., Wang, C., Chen, F., Cao, X., Wang, J., **White, J. C.**, Wang, Z., Xing, B. (2022). Molecular mechanisms of early flowering in tomato induced by manganese ferrite ($MnFe_2O_4$) nanomaterials. *ACS Nano*, *16*(4), 5636–5646. DOI: 10.1021/acsnano.1c10602

Abstract: Nanomaterials (NMs) have demonstrated enormous potential to improve agricultural production. Ten mg L^{-1} customized manganese ferrite ($MnFe_2O_4$) NMs were selected as the optimal doses based on its outstanding effects on promoting tomato flowering and production. After the foliar application before flowering, the leaf chlorophyll content was increased by 20% and the expressions of *ferredoxin*, *PsaA*, and *PsbA* in leaves were significantly upregulated, likely by serving as an electron donor, leading to a significant increase in photosynthesis efficiency by 13.3%. Long distance transport of sucrose was then confirmed by the upregulation of sucrose transporter LeSUT1 and LeSUT2 in NM-treated leaves and meristems. The genes associated with gibberellin biosynthesis, including GA20ox2, GA20ox3, and SIGAST, and a flowering induction gene SFT, were also significantly upregulated. Importantly, the flowering time was 13 days earlier by $MnFe_2O_4$ NMs over control. At reproductive stage, $MnFe_2O_4$ NMs increased pollen activity and ovule size, leading to the great elevation of the fruit number fruits per plant, single fruit weight, and fruit weight per plant by 50%, 30%, and 75%, respectively. Metabolically, a significant increase of glucose-6-phosphate, phenylalanine, rutin and ascorbic acid (vitamin C), as well as a significant decrease of tomatine and methionine, demonstrated that tomato fruits had more nutritional value. A verified companion field experiment showed an increase of 84.1% in total tomato production with $MnFe_2O_4$ NM amendment. These findings highlight the significant potential of $MnFe_2O_4$ NMs as a sustainable strategy for yield improvement in agricultural systems.

6. Curtis, B., Niemuth, N. J., Bennett, E., Schmoldt, A., Mueller, O., Mohaimani, A. A., Laudadio, E. D., **Shen, Y.**, **White, J. C.**, Hamers, R. J., Klaper, R. D. (2022). Cross-species transcriptomic signatures identify mechanisms related to species sensitivity and common responses to nanomaterials. *Nature Nano*. DOI: 10.1038/s41565-022-01096-2

Abstract: Universal impacts of engineered nanomaterial (ENM) exposure, e.g., oxidative stress, have been documented across separate studies involving various organisms. However, significant impacts exerted by the same ENM may differ by orders of magnitude across species. Potential explanations include different species-specific biochemical mechanisms, degree of response of similar pathways, or exposure and uptake of nanomaterials. Cross-species comparisons utilizing available literature are confounded by a lack of uniform exposure media and duration, and differences in nanomaterials from varying sources. In this study we examined mechanisms of response across three model species (*Danio rerio*, *Daphnia magna*, and *Chironomus riparius*) upon interaction with a complex metal oxide nanomaterial (lithium cobalt oxide nanosheets) in the same experiment using a single source of nanomaterials. RNA-Seq was used to identify shared and distinct impacted pathways and physiological functions, including those commonly identified as ENM responses, and novel pathways of impact. Unifying mechanisms found across species included pathways involved in stress, energy and general metabolism, apoptosis, general, and injury or immune functions, while lesser-documented responses involved cardiovascular system, sexual maturation and reproduction, neuronal development and neurological function impacts. Differences across species manifested in both the magnitude of response and pathways impacted. Nanomaterial-specific responses not replicated by ion

exposures presented in all species. Our results indicate uptake may play a role in gene expression but does not explain cross-species differences. This comparison demonstrates new common and potentially universal mechanisms of ENM toxicity and provides insight into biomolecular response variation across species with varying sensitivity to nanomaterials.

7. Xu, T., **Wang, Y.**, Aytac, Z., **Zuverza-Mena, N.**, Zhao, Z., Hu, X., Ng, K. W., **White, J. C.**, Demokritou, P. (2022). Enhancing agrichemical delivery and plant development with biopolymer-based stimuli responsive core -shell nanostructures. *ACS Nano*, *16*(4), 6034–6048. DOI: 10.1021/acsnano.1c11490

Abstract: The inefficient delivery of agrichemicals in agri-food systems is linked to serious negative planetary and public health impacts. Much of this inefficiency results from the inability to deliver the active ingredients at the right place (target), right time, and right dose. In this study, a scalable, biodegradable, sustainable (non-toxic), biopolymer-based multi stimuli responsive nanoplatform (i.e., core/shell nanostructure) was developed by a "green" electrospray approach for smart agrichemical delivery. The shell polymer was designed to be responsive to different triggers such as pH and microbial enzyme activity, and the core polymer was designed to continuously release the agrichemicals over the longer term. Core/shell nanostructure with spherical morphology and an average diameter from tens to hundreds of nanometers were successfully synthesized by coaxial electrospray. The pH and enzyme responsiveness was demonstrated by the analyte release kinetics as a function of nanostructure chemical composition. Finally, the efficacy of the stimuli responsive nanostructures was evaluated in soil-based greenhouse studies using soybean and wheat. Amendment of the responsive nanostructure to soil resulted in enhanced photosynthetic parameters in both soybean and wheat, as compared to conventional fertilizer controls. Moreover, the Zn and Na content in the leaves of 4-week old soybean seedlings were significantly increased with nanostructure amendment, indicating that NPK and Cu in this nanoscale form can potentially be used to modulate the accumulation of other important micronutrients through a potential biofortification strategy. This responsive core/shell nanostructure represents a novel and significant advance in the development of precision sustainable agriculture.

8. Shen, Y., **Borgatta, J.**, Ma, C., Singh, G., **Tamez, C.**, **Schultes, N. P.**, Zhang, Z., Parkash Dhankher, O. P., **Elmer, W. H.**, He, L., Hamers, R. J., **White, J. C.** (2022). Role of foliar biointerface properties and nanomaterial chemistry in controlling Cu transfer into wild-type and mutant *Arabidopsis thaliana* leaf tissue. *J. Agric. Food Chem.* *70*(14), 4267–4278. DOI: 10.1021/acs.jafc.1c07873

Abstract: Seven *Arabidopsis thaliana* mutants with differences in cuticle thickness and stomatal density were foliar exposed to 50 mg L^{-1} $Cu_3(PO_4)_2$ nanosheets (NS), CuO NS, CuO nanoparticles and $CuSO_4$. Three separate fractions of Cu (surface-attached, cuticle, interior leaf) were isolated from the leaf at 0.25, 2, 4 and 8 h. Cu transfer from the surface through the cuticle and into the leaf varied with mutant and particle type. The Cu content on the surface decreased significantly over 8 h but increased in the cuticle. Cu derived from the ionic form had the greatest cuticle concentration, suggesting greater difficulty in moving across this barrier and into the leaf. Leaf Cu in the increased-stomatal mutants was 8.5-44.9% greater than the decreased stomatal mutants, and abscisic acid to close the stomata decreased Cu in the leaf. This demonstrates the importance of

ANALYTICAL CHEMISTRY

1. Prajapati, D., Pal, A., **Dimkpa, C.**, Harish; Singh, U., Devi, K. A., Choudhary, J. L., Saharan, V. (2022). Chitosan nanomaterials: A prelim of next-generation fertilizers; existing and future prospects. *Carbohydrate Polymers*, *288*. DOI: 10.1016/j.carbpol.2022.119356

Abstract: Global agriculture is urgently seeking ways to mitigate the detrimental effects of conventional chemical fertilizers on the environment. Biodegradable, eco-friendly, renewable energy-sourced next-generation fertilizers could be an answer, allowing for improved nutrient use efficiency and a lower environmental footprint. During the last decade, agricultural research on chitosan nanomaterials (NMs) has expanded, demonstrating their usefulness in enhancing agricultural output not only as plant immune boosters but also via slow, controlled and target delivery of nutrients to plants. Chitosan NMs natively act as an abundant nutrient source of C (54.4–47.9 wt%), O (42.3–30.19 wt%), N (7.6–5.8 wt%), and P (6.1–3.4 wt%) to plants. Moreover, chitosan NMs can further functionalized by more nutrients payloads through its functional groups. The current review investigates the technical features of chitosan NMs as prospective next-generation fertilizers based on rationales. The review offers crucial insights into future directions, sources, production capacity of chitosan-based next-generation nanofertilizers for industrial-scale manufacturing.

ENTOMOLOGY

1. Dr. Goudarz Molaei, with Lars M. Eisen, Keith J. Price, and Rebecca J. Eisen, submitted the following manuscript: "Range Expansion of Native and Invasive Ticks, and Looming Public and Veterinary Health Threats" to the *New England Journal of Medicine* (April 5).

ENVIRONMENTAL SCIENCES

1. Shabtai, I. A., Das, S., Inagaki, T. M., Azimzadeh, B., Richards, B., Martínez, C. E., Kögel-Knabner, I., Lehmann, J. (2022). Soil organic carbon accrual due to more efficient microbial utilization of plant inputs at greater long-term soil moisture. *Geochimica et Cosmochimica Acta*. DOI: 10.1016/j.gca.2022.04.028

Abstract: High long-term soil moisture may either stimulate or inhibit soil organic carbon (SOC) losses through changes to mineral and chemical composition, and resultant organo-mineral interactions. Yet, the trade-off between mineralization and accrual of SOC under long-term variation in unsaturated soil moisture remains uncertain. We tested the underexplored relationships between long-term soil moisture and organo-mineral chemical composition and its implications for SOC persistence in an experimental field in New York, USA, with differences in long-term mean soil volumetric water content (0 - 0.15 m depth) ranging from 0.4 - 0.63 (v/v) during the growing season. Long-term soil moisture across 20 subplots on four fallow plots were positively correlated with SOC (R^2 = 0.228; P = 0.019, *n* = 20), mineral-associated organic matter (MAOM) content (g fraction/g soil) (R^2 = 0.442; P = 0.001; *n* = 20) and occluded particulate organic matter (oPOM) content (R^2 = 0.178; P = 0.033; *n* = 20). Higher long-term soil moisture was associated with a decrease in the relative content of sodium pyrophosphate extractable Fe (R^2 = 0.33; P < 0.005; *n* = 20), an increase in sodium dithionite extractable Fe (R^2 = 0.443; P < 0.001; *n* = 20), and an increase in SOC retention by non-crystalline Al pools (R^2 = 0.513; P = 0.0002 for sodium

pyrophosphate extracts, R^2 = 0.411; P = 0.0014 for hydroxylamine hydrochloride extracts; *n* = 20 for both). Increasing long-term soil moisture was associated with a four-fold increase in microbial biomass C (per unit SOC) and lower metabolic quotient (R^2 = 0.557, P < 0.001). MAOM fractions of high-moisture soils had lower C:N (from C:N 9.5 to 9, R^2 = 0.267, P = 0.011, *n* = 20). Consistent with decreasing C:N, increasing decomposition with increasing moisture was reflected by a 15% and 10% greater proportion of oxidized carboxylic-C to aromatic-C and O-alkyl C, respectively, as measured with ^{13}C-NMR, and a more pronounced FTIR signature of N-containing proteinaceous compounds in high-moisture MAOM fractions, indicative of microbial metabolites and transformation products. A partial least squares regression showed that SOC content increased with greater long-term moisture (P = 0.019), pyrophosphate-extractable Al (P = 0.0001), and exchangeable Ca (P = 0.013). Taken together, our results show that higher long-term soil moisture resulted in SOC accrual by enhancing conversion of plant inputs into microbial biomass that interacts with reactive minerals.

PLANT PATHOLOGY AND ECOLOGY

1. Jiang, D., **Zeng, Q.**, Banerjee, B., Lin, H., Srok, J., Yu, M., and Yang, C. H. (2022). The phytopathogen *Dickeya dadantii* 3937 *cpxR* locus gene participates in the regulation of virulence and global c-di-GMP network. *Mol. Plant Path.* DOI: 10.1111/mpp.13219

Abstract: Bacteria use signal transduction systems to sense and respond to their external environment. The two-component system CpxA/CpxR senses misfolded envelope protein stress and responds by up- regulating envelope protein factors and down- regulating virulence factors in several animal pathogens. *Dickeya dadantii* is a phytopathogen equipped with a type III secretion system (T3SS) for manipulating the host immune response. We found that deletion of *cpxR* enhanced the expression of the T3SS marker gene *hrpA* in a designated T3SS-inducing minimal medium (MM). In the Δ*cpxR* mutant, multiple T3SS and c-di-GMP regulators were also up-regulated. Subsequent analysis revealed that deletion of the phosphodiesterase gene *egcpB* in Δ*cpxR* abolished the enhanced T3SS expression. This suggested that CpxR suppresses EGcpB levels, causing low T3SS expression in MM. Furthermore, we found that the Δ*cpxR* mutant displayed low c-di-GMP phenotypes in biofilm formation and swimming. Increased production of cellular c-di-GMP by in trans expression of the diguanylate cyclase gene *gcpA* was negated in the Δ*cpxR* mutant. Here, we propose that CpxA/CpxR regulates T3SS expression by manipulating the c-di-GMP network, in turn modifying the multiple physiological activities involved in the response to environmental stresses in *D. dadantii*.

VALLEY LABORATORY

1. Kodati, S., Cowles, R., and **LaMondia, J.** (2022). Survival of conidia of the boxwood blight pathogen *Calonectria pseudonaviculata* under different relative humidity conditions. *Plant Health Progress*. DOI: 10.1094/PHP-12-21-0142-RS

Abstract: Boxwood blight, caused by *Calonectria pseudonaviculata*, is a significant disease affecting both nursery production and landscape boxwood plantings. *C. pseudonaviculata* conidia are produced in clumps in an extracellular mucilaginous matrix. Local spread of the pathogen is by dispersal of conidia in water splash or direct contact dispersal, but the effects of relative humidity (RH)

on survival and germination of dispersed conidia over time is unknown. We investigated the effects of 15, 40, 80, and 100% RH on survival of individual conidia or conidia aggregated in clumps over time. Conidia were transferred to a dry glass surface and scored for the incidence of survival and percentage germination over 3, 6, and 9 days. Conidia in clumps had higher incidence of survival and percent germination than individual conidia. RH significantly and positively influenced germination, and survival, as measured by presence/absence of germination by individual conidia, but not by clumps of conidia. Individual conidia survived for at least 6 days at all RH tested. No germination was observed for any individual conidium exposed to 15% RH for 9 days, whereas conidia in clumps survived and germinated at all RH levels for at least 9 days. This study indicates that simply pruning or working in infected boxwoods under dry conditions may be insufficient to limit the spread of the pathogen and ultimately, disease. Further measures such as frequent disinfestation of tools with alcohol or fungicide application before or after possible spread of conidial clumps may be necessary.

2. Si, Y.-Z., **Li, D.-W.**, Zhong, J., Huang, L., Zhu, L.-H. (2022). *Diaporthe sapindicola* sp. nov. causes leaf spots of *Sapindus mukorossi* in China. *Plant Disease*, *106*(4), 1105-1113. DOI: 10.1094/PDIS-04-21-0777-RE

Abstract: *Sapindus mukorossi* Gaertn. (Sapindaceae), or soapberry, is an important biodiesel tree in southern China. In recent years, leaf spot disease on soapberry has been observed frequently in a soapberry germplasm repository in Jianning County, Sanming City, Fujian province, China. The symptoms initially appeared as irregular, small, yellow spots, and the centers of the lesions became dark brown with time. Three fungal isolates from lesions were collected. Koch's postulates were performed, and their pathogenicity was confirmed. Morphologically, α-conidia from diseased tissues were single-celled, hyaline, smooth, clavate or ellipsoidal, and biguttulate, measuring 6.2 to 7.2 × 2.3 to 2.7 µm. In addition, the three isolates in this study developed three types (α, ß, and γ) of conidia on potato dextrose agar, and their morphological characteristics matched those of *Diaporthe*. A phylogenetic analysis based on internal transcribed spacer, *TEF*, *TUB*, *HIS*, and *CAL* sequence data determined that the three isolates are a new species of *Diaporthe*. Based on both morphological and phylogenetic analyses, the causal fungus, *Diaporthe sapindicola* sp. nov., was described and illustrated.

3. Zhang, Y.-Z., Li, B., Pan, Y.-T., Fang, Y.-L., **Li**, **D.-W.** Huang, L. (2022). Protein phosphatase CgPpz1 regulates potassium uptake, stress responses and plant infection in *Colletotrichum gloeosporioides*. *Phytopathology*, *112*(4), 820-829. DOI: 10.1094/PHYTO-02-21-0051-R

Abstract: Protein phosphatases play important roles in the regulation of various cellular processes in eukaryotes. The ascomycete *Colletotrichum gloeosporioides* is a causal agent of anthracnose disease on some important crops and trees. In this study, *CgPPZ1*, a protein phosphate gene and a homolog of yeast *PPZ1*, was identified in *C. gloeosporioides*. Targeted gene deletion showed that CgPpz1 was important for vegetative growth and asexual development, conidial germination, and plant infection. Cytological examinations revealed that CgPpz1 was localized to the cytoplasm. The Δ*Cgppz1* mutant was hypersensitive to osmotic stresses, cell wall stressors, and oxidative stressors. Taken together, our results indicated that CgPpz1 plays an important role in the fungal development and virulence of *C. gloeosporioides* and the multiple stress responses generated.

JOURNAL ARTICLES APPROVED APRIL 2022

Ahmad, M. A., Adeel, M., Ishfaq, M., Peng, Y., Shakoor, N., Zain, M., Azeem, I., Ali, I., Usman, M., Wu, Z., Gohari, G., Ming, X., **White, J. C.**, Deng, X. Modifying engineered nanomaterials for enhanced environmental sustainability and benefit. *Nature Nanotechnology*.

Barry, A., Ooi, S. K., Helton, A. M., **Steven, B.**, Elphick, C. S., Lawrence, B. A. Tidal marsh plant-mediated carbon turnover overrides effects of sea-level rise in a marsh organ experiment. *Journal of Applied Ecology*.

Cao, X., Luo, X., Wang, C., Yue, L., **White, J. C.**, Wang, Z., Zing, B. Nano/microplastic enhanced the occurrence of bacterial wilt in tomatoes (*Solanum lycopersicum*). *Nature Nanotechnology*.

Dai, Y.-C., Wu, Y.-D., Wang, Y.-R., Zhou, M., Qui, J.-Z., **Li, D.-W.**, Vlasák, J., Yuan, Y. Two new forest pathogens in *Phaeolus* (Polyporales, Basidiomycota) on Chinese coniferous trees confirmed by molecular phylogeny. *Frontiers in Microbiology*.

Gloria-Soria, A., Shragai, T., Ciota, A. T., Duval, T. B., Alto, B. W., Martins, A., Westby, K. M., Medley, K. A., Unlu, I., Campbell, S. R., Kawalkowski, M., Tsuda, Y., Higa, Y., Indelicato, N., Leisnham, P. T., Caccone, A., **Armstrong, P. M.** Population genetics of an invasive mosquito vector; *Aedes albopictus* in the Northeastern USA. *Neobiota*.

Kandhol, N., Singh, V. P., Mochida, K., **White, J. C.**, Tran, L.-S. P., Tripathi, D. K. Plant growth regulators under nanomaterial exposure: Linking development to defense. *Plant Cell Physiology*.

Molaei, G., Eisen, L. M., Price, K. J., Eisen, R. J. Range expansion of native and invasive ticks, and looming public and veterinary health threats. *New England Journal of Medicine*.

Nogueira, G. A., Conrado, V. S. C., Freires, A. L. A. … **da Silva, W.**, Ambrosio, M. M. Q. Aggressivity of different Fusarium species causing fruit rot in melon in Brazil. *Plant Disease*.

Stoner, K. Protecting pollinators from pesticides. *CAES Fact Sheet*.

Taerum, S. J., **Steven, B.**, Gage, D., **Triplett, L. R.** Dominance of Ciliophora and Chlorophyta among phyllosphere protists of Solanaceous plants. *Phytobiomes*.

Wan, Y., **Li, D.-W.**, Si, Y.-Z., Li, M., Huang, L., Zhu, L.-H. Three new species of Diaporthe causing leaf blight on *Acer palmatum* in China. *Plant Disease*.

Zhao, L., Bai, T., Wei, H., Gardea-Torresdey, J. L., Keller, A., **White, J. C.** Enhancing plant stress tolerance against a changing climate: Balancing ROS-mediated hormesis and toxicity. *ACS Nano*.

Zhou, P., Zhang, P., Adeel, M., Shakoor, N., Jiang, Y., Zhao, W., Liu, W., Li, Y., Azeem, I, Rui, Y., Tan, Z., Guo, Z., **White, J. C.**, Lynch, I. Nickel oxide nanoparticles improve soybean yield and enhance nitrogen assimilation. *Environmental Science & Technology*.

NEW STUDENTS, STAFF, AND VOLUNTEERS APRIL 2022

DR. ZHIHAO CHEN joined The Station as a Postdoctoral Research Scientist in March 2022. He previously worked as a Research Fellow studying the advanced oxidation process aspect at the National University of Singapore between May 2019 and January 2022. Dr. Chen obtained his Ph.D. degree in the aquatic environmental chemistry area in March 2019 from Nanjing University, China. His Ph.D. research focused on the photochemical redox conversion of oxyanions in the halogen group. He got his master's degree in June 2014 from Nankai University, China, working on the preparation of activated carbon materials used as air-cathode in microbial fuel cells. He will work under Dr. Joseph Pignatello at The CAES in the Department of Environmental Sciences. As a postdoctoral researcher, his main target is to find efficient methods to treat sulfuryl fluoride gas. Sulfuryl fluoride is primarily used for fumigation and has been found to be a greenhouse gas stronger than carbon dioxide. Both the removal performance and reaction mechanism will be explored.

DR. RAJA MUTHURAMALINGAM joined the **da Silva** lab as a postdoctoral scientist to work on developing nanocarriers of dsRNAs for plant virus control. This is a collaborative effort between **Dr. da Silva** and **Dr. Nubia Zuverza -Mena** funded by USDA-NIFA. **Dr. Muthuramalingam** holds a Ph.D. in Biotechnology from the University of Madras, Chennai, India, and was previously a SERB National Postdoctoral fellow at ICAR-Sugarcane Breeding Institute, Coimbatore, India, working on NanoMolecular diagnoses.

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Station News was prepared and edited by Dr. Jason White, Ms. Vickie Bomba-Lewandoski, Ms. Sandra Carney, and Ms. Kelly Fairbrother.

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