



# Pharmaceuticals & Personal Care Products in the Environment

*April 4, 2016*

**PPCPs in the Environment Conference**

April 4, 2016

Chancellor Ballroom

I Hotel & Conference Center

Champaign, Illinois

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**ILLINOIS SUSTAINABLE  
TECHNOLOGY CENTER**  
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**I** UNIVERSITY OF ILLINOIS  
**EXTENSION**

# AGENDA

Monday, April 4

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7:30 a.m.	Check in – outside the Chancellor Ballroom
7:30 - 8:30 a.m.	Continental Breakfast – Chancellor Ballroom
8:30 a.m.	Welcome – Chancellor Ballroom
8:40 a.m.	Keynote Speakers
10:10 a.m.	Networking Break
10:25 a.m.	Keynote Speakers
11:45 p.m.	Lunch and Networking – Chancellor Ballroom
12:45 p.m.	Oral Presentations
2:45 p.m.	Networking Break
3:20 p.m.	Oral Presentations
4:45 p.m.	Closing Remarks

## Reception and Poster Session

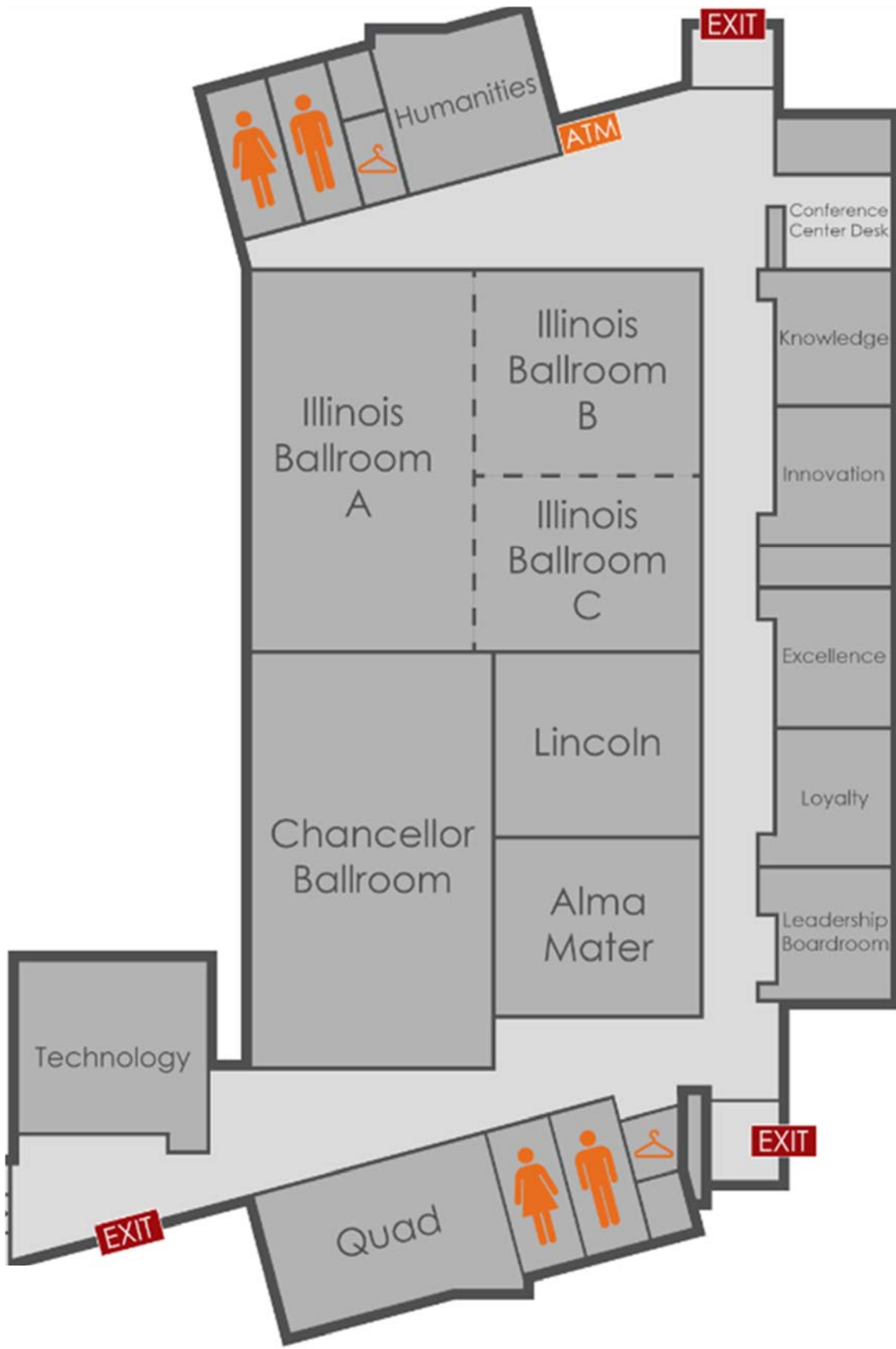
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4:45 - 6:30 p.m.	Reception and Poster Session in the Chancellor Ballroom
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# EXPANDED AGENDA

Monday, April 4

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**7:30 - 8:30 a.m. Check in & Continental Breakfast** – outside the Chancellor Ballroom

**8:30 a.m. Welcome:** Nancy Holm - Assistant Director, Illinois Sustainable Technology Center; and Laura Kammin - Outreach Program Leader, Illinois-Indiana Sea Grant

**Special Welcome:** George Czapar - Associate Dean and Director, Office of Extension and Outreach, University of Illinois Urbana-Champaign

**8:40 a.m. Dana Kolpin** - Research Hydrologist, United States Geological Survey; *Title: Contaminants of Emerging Concern: New Environmental Challenges*

**9:25 a.m. Rebecca Klaper** - Professor and Director of the Great Lakes Genomics Center at the School of Freshwater Sciences, University of Wisconsin-Milwaukee; *Title: More than Hormones: Endocrine Disrupting Impacts of Emerging Contaminants and Potential Solutions*

**10:10 a.m. Networking Break**

**10:25 a.m. Kristi Henderson** - Director, Division of Animal and Public Health, American Veterinary Medical Association; *Title: The Role of Veterinarians in Proper Pharmaceutical Disposal*

**11:10 a.m. Charlotte Smith** - Senior Regulatory Advisor and **Mary Hendrickson** - Chief Regulatory Consultant, both from PharmEcology Services, WM Sustainability Services; *Title: The Impact of Proposed EPA Regulations on the Disposal of PPCPs*

**11:45 a.m. - 12:45 p.m. Lunch and Networking Break**

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<b>12:45 p.m.</b>	Walt Kelly	PPCPs, Bacteria, and Other Contaminants in Karst Springs and Caves in Southwestern Illinois
<b>1:05 p.m.</b>	Karen Cotton	Pharmaceutical Disposal Programs
<b>1:25 p.m.</b>	Tedros Berhane	Removal of Pharmaceuticals and Endocrine Disrupting Compounds by Surfactant-Intercalated Palygorskite-Montmorillonite (PM)

<b>1:45 p.m.</b>	William Casan Scott	Emerging Water Quality Hazards in Urbanizing Texas Estuaries
<b>2:05 p.m.</b>	Melissa Lenczewski	Applying IDEXX SNAP Testing Kits to Test for Antibiotic Residues in Water
<b>2:25 p.m.</b>	Lisa Chan	Utilizing the Green Nursing Project Initiative to Educate Nurses about Health Effects Related to Exposure of Chemicals Contained in Household and Personal Care Products and to Inspire Them to Take Action

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**2:45 p.m.      Networking Break**

<b>3:05 p.m.</b>	Michael Plewa	Iodinated X-ray Contrast Pharmaceuticals Generate Highly Toxic Disinfection Byproducts in Drinking Water
<b>3:25 p.m.</b>	Pontiac Township High School	P2D2 – The Prescription Pill and Drug Disposal Program
<b>3:45 p.m.</b>	Wei Zheng	Fate and Potential Effect of Emerging Contaminants: Extending Knowledge and Mitigation Strategies
<b>4:05 p.m.</b>	Laurel Dodgen	Removal of Hormones from CAFO Water with Vegetable Oil
<b>4:25 p.m.</b>	Han Gao	Control of Pharmaceuticals, Personal Care Products, and Endocrine Disrupting Chemicals in Surface Waters: Probing the Ability of Restored Riparian and Stream Habitats to Remove Trace Organic Chemicals

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**4:45 p.m.      Closing Remarks**

**Reception and Poster Session**

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**4:45 - 6:30 p.m.      Reception and Poster Session in the Chancellor Ballroom**



## KEYNOTE SPEAKER BIOGRAPHIES

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**Dana Kolpin** is a research hydrologist for the U.S. Geological Survey in Iowa City, IA. His research interests include the fate and transport of pharmaceuticals, hormones, and other contaminants of emerging concern in the environment. He has published over 100 papers and reports on environmental contaminants. He has been the project chief of the USGS Toxic Program's Emerging Contaminants Project since its inception in 1998. He received his B.S. from Iowa State University and his M.S. from the University of Iowa, both in geology.



**Dr. Rebecca Klaper** is a professor and director of the Great Lakes Genomics Center at the School of Freshwater Sciences, University of Wisconsin-Milwaukee. Dr. Klaper and her lab study (1) the potential impact of emerging contaminants, such as nanoparticles and pharmaceuticals on aquatic life, (2) how to design these chemicals to minimize their environmental impact, and (3) links between the impact of these chemicals on the health of aquatic species and human health. She has served as a technical expert to the Alliance for the Great Lakes and the International Joint Commission regarding the potential impacts of PPCPs and other emerging contaminants on the Great Lakes. She has also served as a technical expert in reviewing the EPA White Paper on the environmental impact of nanotechnologies and their research strategy for nanotechnology. Dr. Klaper received her Ph.D. in ecology from the Institute of Ecology, University of Georgia, her M.S. in entomology from UGA, and her B.S. in honors biology at the University of Illinois.



**Dr. Kristi Henderson** is the director of the Division of Animal and Public Health at the American Veterinary Medical Association. She is the staff consultant to the AVMA Committee on Environmental Issues, which addresses pharmaceutical disposal. Dr. Henderson earned her DVM from the University of Illinois, College of Veterinary Medicine in 1996, and prior to joining AVMA staff in 2009, she utilized her degree as a private practitioner, visiting teaching associate, and federal veterinary medical officer.



**Charlotte Smith** is the senior regulatory advisor at PharmEcology Services, a business unit of WM Sustainability Services. She founded PharmEcology Associates, LLC in 2000 and sold the company to Waste Management in 2009. She co-founded Capital Returns, Inc., a nationally known pharmaceutical reverse distributor in 1991 and for 10 years served as president and chief regulatory advisor. Ms. Smith is a registered pharmacist who received her BS in Pharmacy and MS in Continuing and Vocational Education from the University of Wisconsin. She is a member of the Pharmacy Society of Wisconsin, the American Society of Health-System Pharmacists, and the International Pharmaceutical Federation (FIP). She can be reached at 713-725-6363 and at [csmith@pharmecology.com](mailto:csmith@pharmecology.com).



**Mary Hendrickson** is chief regulatory consultant at PharmEcology Services, a business unit of WM Sustainability Services. She has extensive experience in healthcare and distribution management including years of regulatory leadership experience at one of the largest reverse pharmaceutical distributors. Mary has a PharmD (Doctor of Pharmacy) from the University of Florida and a Juris Doctor from the John Marshall Law School in Chicago. She is a member of the Regulatory Affairs Professionals Society and the Food and Drug Law Institute. She can be reached at 262-649-6914 or at [MLHendrickson129@gmail.com](mailto:MLHendrickson129@gmail.com).

## ORAL PRESENTATION ABSTRACTS

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### **Keynote Speakers**

**Dana Kolpin - Research Hydrologist, United States Geological Survey; [dwkolpin@usgs.gov](mailto:dwkolpin@usgs.gov).**

*Contaminants of Emerging Concern: New Environmental Challenges*

Contaminants of emerging concern (CECs) encompass a vast array of understudied environmental contaminants (e.g., pharmaceuticals, hormones, personal care products and their transformation products) and are derived from a variety of natural, municipal, domestic, agricultural, and industrial waste sources and pathways to the environment. New analytical methods are continually being developed that are ever expanding the detection capabilities and therefore the scope and range of contaminants covered under this broad contaminant category. There is growing concern that such CECs may be bioactive and interactive (e.g., additive, synergistic, antagonistic effects) and potentially cause deleterious effects to ecosystem and human health. In particular, chronic, behavioral effects (e.g., altered predator avoidance patterns, etc.) are being documented following exposure to select CECs at environmentally relevant concentrations. This talk will summarize the latest CEC research being conducted by the USGS Toxic Substances Hydrology Program.

**Rebecca Klaper - Professor and Director of the Great Lakes Genomics Center at the School of Freshwater Sciences, University of Wisconsin-Milwaukee; [rklaper@uwm.edu](mailto:rklaper@uwm.edu).**

*More than Hormones: Endocrine Disrupting Impacts of Emerging Contaminants and Potential Solutions*

The discovery of intersex fish in freshwater systems around the world has been suggested as an indicator of the widespread occurrence of endocrine disrupting compounds in aquatic ecosystems. Multiple compounds from wastewater treatment, leaky infrastructure, and urban and agricultural runoff may potentially be the cause, however, synthetic estrogens from birth-control medications are often identified as a likely cause. However, the impact of other pharmaceuticals and emerging contaminants which have also been found in even larger concentrations in wastewater and surface waters remain largely unknown. Our research has shown that other medications as well as plasticizers and pesticides may also cause changes in hormone levels, reproduction, and behavior that impact reproduction. Metformin is one such medication. Prescribed for Type II diabetes, the prescription rates for this medication have grown significantly in the last 20 years for a variety of reasons. This talk will describe the impacts of this medication on the endocrine system of fish. In addition, the presentation will discuss the potential solutions that are being explored or could be explored to provide solutions to emerging contaminants that are found to be hazardous.

**Kristi Henderson - Director, Division of Animal and Public Health, American Veterinary Medical Association; [KHenderson@avma.org](mailto:KHenderson@avma.org).**

*The Role of Veterinarians in Proper Pharmaceutical Disposal*

The discussion will present AVMA's pharmaceutical disposal best management practices, resources, and professional and public outreach.

**Charlotte Smith - Senior Regulatory Advisor, WM Sustainability Services, PharmEcology Services; [csmith@pharmecology.com](mailto:csmith@pharmecology.com).**

*The Impact of Proposed EPA Regulations on the Disposal of PPCPs*

*Co-author: Mary Hendrickson, PharmD, JD*

The EPA recently closed the comment period on the most sweeping proposed changes to the Resource Conservation and Recovery Act (RCRA) regulations pertaining to the management of hazardous waste pharmaceuticals and personal care products since its inception in 1976. If adopted, how will these regulations alter the management of hazardous waste PPCPs? What impact will the regulations have on the disposal of non-hazardous waste PPCPs? How can the scientific community respond best to EPA's request for guidance on



totally revamping the definition of hazardous waste PPCPs? These are some of the questions this session will explore. Participants will be encouraged to enter into dialog with EPA regarding the next step in meeting its mandate by the EPA Office of Inspector General to update the list of hazardous waste pharmaceuticals based on the entry of thousands of drug entities into the marketplace in the past 40 years.

## **Afternoon Session**

**Walt Kelly – Head, Groundwater Science Section, Illinois State Water Survey, Prairie Research Institute, University of Illinois Urbana-Champaign; [wkelly@illinois.edu](mailto:wkelly@illinois.edu).**

*PPCPs, Bacteria, and Other Contaminants in Karst Springs and Caves in Southwestern Illinois*

*Co-authors: Laurel K. Dodgen, Wei Zheng, Steven J. Taylor, and Samuel V. Panno*

Karst waters are vulnerable to surface-borne contaminants in a variety of land use settings, including urban, residential, and agricultural. A series of studies in the Sinkhole Plain of southwestern Illinois, which is primarily row-crop agriculture but is undergoing increasing residential development, has indicated widespread contamination. Contaminants in the springs and cave streams are numerous, including nitrate, fecal bacteria, pharmaceuticals and personal care products (PPCPs), and steroidal hormones. The most commonly detected PPCPs were caffeine, triclocarban, carbamazepine, and gemfibrozil. Hormones were detected less frequently, with estrone being the most commonly detected. The source of the PPCPs and hormones is most likely discharge from septic systems and, in urban areas, leaking sewerage pipes. The results suggested that most samples were contaminated by a mixture of human and animal waste sources, with only a few samples showing pollution solely by humans or animals.

**Karen Cotton – External Affairs Manager, Illinois American Water; [karen.cotton@amwater.com](mailto:karen.cotton@amwater.com).**

*Pharmaceutical Disposal Programs*

Illinois American Water has helped to create over 35 pharmaceutical disposal programs across the state through a collaborative approach. The company's approach has earned both regional and national awards in not only environmental stewardship but also communications. Illinois American Water has also participated in research of pharmaceuticals in drinking water and can put into perspective both the health risk and importance to continue implementing proper disposal programs. Participants will learn how to get involved and the impact to the environment and community. They will also learn how to bring optimal awareness to their efforts to participate in proper pharmaceutical disposal.

**Tedros Berhane – Postdoctoral Fellow, Miami University (OH); [tedros.berhane@gmail.com](mailto:tedros.berhane@gmail.com).**

*Removal of Pharmaceuticals and Endocrine Disrupting Compounds by Surfactant-Intercalated Palygorskite-Montmorillonite (PM)*

*Co-authors: Jonathan Levy, PhD, Mark P.S. Krekeler, PhD, and Neil Danielson, PhD.*

Removal efficiency of the compounds at sewage treatment plants can potentially be improved by increasing the lipophilicity (sorption affinity) of clay minerals for anionic and nonionic compounds through surfactant-intercalation. The target pharmaceuticals were atenolol (cationic), ibuprofen (anionic), carbamazepine (neutral), and sulfamethoxazole (neutral). The selected endocrine disrupting compounds (EDCs) were bisphenol A and prednisolone, both neutral in charge. The following surfactants were individually intercalated with palygorskite-montmorillonite (PM) clay mineral. Two of the surfactants (RA-600 and SDS) were anionic, two (Brij-58 and Triton X-114) were non-ionic, and one (CTAB) was cationic. In general, the data better fit both the linear and the Freundlich equilibrium sorption models. PM with no surfactant performed better for atenolol but CTAB-PM had enhanced removal capacity for all of the other compounds. Ibuprofen and sulfamethoxazole sorption by RA-600- and SDS-PM was substantial. FTIR and TGA showed clearly the interactions between PM, the surfactants, the pharmaceuticals, and EDCs.

**William Casan Scott – PhD Student, Department of Environmental Science, Baylor University, TX; [casan\\_scott@baylor.edu](mailto:casan_scott@baylor.edu).**

*Emerging Water Quality Hazards in Urbanizing Texas Estuaries*

*Co-authors: Bryan Brooks, Bowen Du, Samuel P. Haddad, S. Rebekah Burket, Christopher Breed, Martin Kelly, Linda Broach, and C. Kevin Chambliss*

In the rapidly urbanizing watersheds and estuaries of the Gulf of Mexico in Texas, instream flows are increasingly influenced and dominated by reclaimed water, which inherently contain diverse mixtures of inorganic, organic and biological contaminants. Active pharmaceutical ingredients (APIs) have received increasing attention in freshwater systems over the past decade, but few studies have focused on pharmaceutical contaminants in coastal systems. We examined occurrence and bioaccumulation of selected APIs in four tidally influenced rivers along the Texas Gulf Coast over a two-year period. The common pharmaceuticals diphenhydramine and diltiazem were observed in plasma of multiple species, and diltiazem exceeded human therapeutic doses in largemouth bass, catfish, and mullet inhabiting these urban estuaries. Though this study only examined a small number of target analytes, which represent a microcosm of the exposome of these fish, coastal systems are expected to be more strongly influenced by urbanization over the next fifty years.

**Melissa Lenczewski – Associate Professor, Northern Illinois University; [lenczewski@niu.edu](mailto:lenczewski@niu.edu).**

*Applying IDEXX SNAP Testing Kits to Test for Antibiotic Residues in Water*

*Co-author: Tia Willens*

Antibiotics are an emerging environmental contaminant. Their presence is increasing in the environment due to excessive distribution of antibiotics to livestock and humans. Present antibiotics in groundwater occur at concentrations benign to humans; however the danger lies within the increased potential of antibiotic-resistant bacteria and their anthropologic and ecologic effects. Current methods to test for antibiotics take one week, require intense organic chemistry, and cost around \$500 for a 1L sample. IDEXX SNAP kits are potentially a cheap, convenient, and quick on-site testing alternative. These test kits are currently used to monitor the presence of antibiotics in milk. The purpose of this research is to determine if IDEXX SNAP kits have a viable application towards testing water. Upon completion of the project, predicted results will promote monitoring of antibiotics in groundwater as well as raise awareness of these contaminants.

**Lisa Chan, MSN, RN – UMASS Memorial Medical Center; [lchan@worchester.edu](mailto:lchan@worchester.edu).**

*Utilizing the Green Nursing Project Initiative to Educate Nurses about Health Effects Related to Exposure of Chemicals Contained in Household and Personal Care Products and to Inspire Them to Take Action*

*Co-author: Stephanie Chalupka, EdD, RN, PHCNS-BC, FAAOHN, FNAP*

Exposure to recurrent low doses or to a mixture of low doses of environmental chemicals contained in household and personal care products including carcinogens, reproductive and neurotoxins, and endocrine disruptors may pose a health risk, or compound health conditions for the general population as well as for vulnerable populations. Gaps exist in translating this information to the public and helping people understand the health effects related to chemical exposures and personal actions they could take to reduce exposures. Educating and utilizing nurses as a conduit for information-sharing related to environmental health issues could fill the gap, influence health outcomes, and contribute to sustainable communities. The Green Nursing Project is an initiative to educate nurses about environmental health literacy topics and inspire them to take personal and professional action. A speaker's bureau and hands-on interactive workshops are used to introduce chemical exposures in consumer products, adverse health effects, and risk reduction strategies.

**Michael Plewa – Professor of Genetics, University of Illinois at Urbana-Champaign; mplewa@illinois.edu.**

*Iodinated X-ray Contrast Pharmaceuticals Generate Highly Toxic Disinfection Byproducts in Drinking Water*  
Co-authors: Elizabeth D. Wagner, Justin Pals, Susan Richardson, Friedrich Wendel, Christian Luetke-Eversloh, Cristina Postigo, Thomas Ternes, and Stephen Duirk

Iodinated X-ray contrast media (XCM) such as iopamidol are widely used pharmaceuticals for medical imaging. They are excreted intact in ~24 h and are extremely stable during wastewater treatment, such that they are found at the highest levels (up to 100 ppb) of any pharmaceutical in the environment. Drinking water sources downstream can be impacted, with ppb levels of XCM measured. While XCM are non-toxic themselves, they can transform into the most toxic disinfection byproducts (DBPs) known. We used in vitro mammalian cell bioassays and high resolution-MS and tandem-MS to uncover the chlorination reaction pathways for their transformation in drinking water treatment. The resulting low molecular weight iodinated-DBPs were highly cytotoxic and genotoxic while the high molecular weight transformation DBPs were weak cytotoxins and did not induce genomic DNA damage.

**Pontiac Township High School: Steven Corrigan, Seth Cunningham, Jeffery Elem, Meghan Heller, Jacob Jiles, Zach Lee, Logan Mies, Molly Ruddy, & Connor Wolf.**

*P2D2 – The Prescription Pill and Drug Disposal Program*

Teacher Contact: Paul Ritter – Ecology Teacher, Pontiac Township High School; pritter@pontiac90.org.

Hey! If you have a passion for the environment, clean water, or just saving lives from unused medication abuse come check out P2D2! The International Prescription Pill and Drug Disposal Program (P2D2) was started in Pontiac, Illinois, as a way to prevent misuse and abuse of prescription drugs while keeping them out of our water supply. Now in 28 states and five countries, the P2D2 program established the model that is positively changing the world forever. Working alongside the P2D2 program, communities are able to establish their own medication disposal program that engages students and citizens alike. Come check us out!

[www.p2d2program.org](http://www.p2d2program.org)

**Wei Zheng – Senior Research Scientist, Illinois Sustainable Technology Center, Prairie Research Institute, University of Illinois Urbana-Champaign; weizheng@illinois.edu.**

*Fate and Potential Effect of Emerging Contaminants: Extending Knowledge and Mitigation Strategies*

Co-author: Laurel Dodgen and Nancy Holm

The widespread occurrence in watersheds of emerging contaminants, including pharmaceutical and personal care products (PPCPs) and steroid hormones, has been recognized as a critical environmental issue. Effluents from municipal sewage treatment plants (STPs) and wastewater from concentrated animal feed operations (CAFOs) are major sources of these contaminants. Results from an ongoing project supported by the University of Illinois Extension will be presented. This project uses research, education, and outreach components to address PPCP and hormone issues, including public awareness and mitigation strategies. In this project, we developed robust analytical methods to monitor the occurrence of emerging contaminants in STP effluent, CAFO wastewater, and the receiving watersheds. The degradation and transport processes of emerging contaminants in water-soil systems were investigated as well as their potential uptake and accumulation in plants. A medicine take-back program and an oil-sequester water treatment were used as mitigation strategies to reduce PPCP and hormone contamination.

**Laurel Dodgen – Postdoctoral Research Associate, Illinois Sustainable Technology Center, Prairie Research Institute, University of Illinois Urbana-Champaign; LKDodgen@Illinois.edu.**

*Removal of Hormones from CAFO Water with Vegetable Oil*

*Co-author: Nancy Holm and Wei Zheng*

Concentrated animal feeding operations (CAFOs) produce large volumes of manure-containing wastewater that contains hormones at  $\mu\text{g/L}$  concentrations. Typically, this wastewater is treated in lagoon systems and then applied to surrounding agricultural fields. However, lagoon treatments have limited efficacy at removing hormones and field applications introduce these contaminants to the environment where they may have biological effects on aquatic biota. Current methods of removal involve expensive materials and are not scaled for individual facilities. In this study, a novel, economical removal method was investigated. At a benchtop scale, vegetable oils were examined for capacity to remove estrone from water under several mixing and ratio parameters. A meso-scale system was then implemented to assess factors affecting the scale-up of the system. Finally, a working prototype was built to demonstrate feasibility of this approach to remove hydrophobic contaminants from lagoon water at a CAFO facility, thereby minimizing environmental effects from their land application.

**Han Gao – Graduate student, Northwestern University, IL; hangao2017@u.northwestern.edu.**

*Control of Pharmaceuticals, Personal Care Products, and Endocrine Disrupting Chemicals in Surface Waters: Probing the Ability of Restored Riparian and Stream Habitats to Remove Trace Organic Chemicals*

*Co-author: Jeanne Marie LaVergne, Raj Desai, Xu Zhang, Corey Carpenter, Damian Helbling, George Wells, and Kimberly Gray*

The objective of this study is to investigate the extent to which restored ecological habitats (specifically stream, pond, and riffle structures) can be employed to promote removal of pharmaceuticals, personal care products (PPCPs), and other micropollutants from surface waters and to investigate the impacts of PPCPs on associated aquatic microbial communities. We quantified >90 micropollutants (including PPCPs) using HPLC/MS/MS from 8 locations along the Des Plaines River {DPR}, including restored wetland/riffle structure and a wastewater treatment plant's effluent, over multiple time points during 2015. In parallel, high-throughput 16S rRNA sequencing revealed high diversity and pronounced shifts in community structure in water and sediment samples along the DPR transect. Ongoing efforts focus on quantifying associations of microbial community structure and function (denitrification potential) along gradient micropollutant concentrations, with the goal of assessing if PPCP metabolism is synergistic or antagonistic with other essential ecological services such as nutrient and carbon metabolism.

## POSTER ABSTRACTS

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*Note: Posters are listed in order of the author's last name. The number next to the author's name indicate where the poster is located in the conference room.*

**1. Ahmed Abdel-moneim – Graduate Student, Purdue University, IN; aabelmo@purdue.edu.**

*Screening Assay for Non-invasive Visualization of Effects of Endocrine Disruptors using See-Through Japanese Medaka (*Oryzias latipes*)*

*Co-author: Cecon T. Mahapatra and Maria S. Sepúlveda*

Water bodies receive large amounts of wastes, holding numerous endocrine disrupting chemicals (EDCs), to which exposure, particularly during sexual differentiation in fish, can cause gonadal intersex to develop. The main objective of this study is to develop a novel in vivo testing system for rapid detection of EDCs. First, we identified a gene responsive to EDC exposure in an animal model that could be sexed non-invasively very early during development (Japanese medaka SK2 line). Ovarian structural protein 1 (*osp1*) has a strong female-specific expression starting at 12 days post fertilization and its expression is down-regulated in females upon exposure to synthetic androgens. Next, we built a pOSP1-AcGFP Japanese medaka transgenic line and tested its sensitivity and specificity to putative EDCs. Finally, we are in the process of implementing this transgenic line in an in vivo high-throughput screening assay for identifying putative EDCs in a sensitive, non-lethal and cost-effective way.

**9. Stephen Davies – Student, Ball State University, IN; srdavies@bsu.edu.**

*Pharmaceutical and Personal Care Product Loss in Two Indiana Wetlands*

*Co-Authors: Melody Bernot*

Wetlands are unique ecosystems that support biodiversity, prevent erosion and flooding, provide buffers from storms, and mitigate the effects of contaminants. One emerging class of contaminants in freshwaters are pharmaceuticals and personal care products (PPCPs). However, the potential for wetlands to mitigate PPCP contaminants is virtually unknown. In this study, an urban and rural wetland was assessed to quantify PPCP degradation through monthly sampling of wetland inputs and outputs. Of the 24 analytes measured, 6 compounds were regularly detected including DEET, caffeine, triclosan, sucralose, diphenylhydramine, and tylosin. Output concentrations were less than input concentrations in the rural wetland only. Average PPCP concentrations peaked in December and were higher in winter months with the exception of diphenylhydramine which was highest in October. These data indicate that natural wetlands may not significantly degrade PPCP compounds.

**10. Adrienne Gulley – Pollution Prevention Specialist, Illinois-Indiana Sea Grant; amgulley@illinois.edu.**

*PPCPs in Great Lakes States and Beyond: Illinois-Indiana Sea Grant's Five-Pronged Approach to Pollution Prevention*

*Co-Authors: Laura Kammin, Anjanette Riley, Adrienne Gulley, Terri Hallesy, and Erin Knowles*

Illinois-Indiana Sea Grant (IISG) has been working to increase knowledge about pharmaceutical and personal care products (PPCPs) in the environment, specifically their sources, fate, and potential impacts on human, animal, and environmental health. IISG takes a multipronged approach to reducing the load of PPCPs reaching waterways within the Great Lakes Basin and beyond: (1) funded research, (2) education programs, (3) social media platforms, (4) regional and national partnerships, and (5) outreach programs facilitating the development of medicine take-back programs. Working with other organizations, we strive to use the latest science on emerging contaminants to empower people to solve problems in sustainable ways. Keywords: pharmaceuticals, personal care products, take-back programs, education and outreach.

**7. Krassimira Hristova – Associate Professor, Marquette University, WI;**

**krassimira.hristova@marquette.edu.**

*Antibiotic Resistant Bacteria and Genes as Emerging Contaminants in Urban Waterways*

*Co-Authors: Anthony Kappell and Michael Walsh*

The city of Milwaukee urban waterways represent a natural reservoir of antibiotic resistance, which may provide a source of transferable genetic elements to human commensal bacteria and pathogens. *E. coli* isolates from urban waterways demonstrated a greater incidence of resistance to higher numbers of antibiotics compared to the human-derived isolates. Of the 219 strains identified with plasmids, a 47 distinct agarose gel plasmid banding patterns were identified. Six of those were more abundant and they conferred various patterns of antibiotic resistance in their hosts. Plasmids with patterns P1 and P2 might explain the higher level of resistance to above 4 and up to 12 different antibiotics in *E. coli* isolated from the effluent sediment compared to other locations. Some of the plasmids are directly transferable between bacteria through conjugation or transformation. Class 1 or class 2 integrons were more abundant in the clinical compared to the environmental *E. coli*.

**8. Nikolai Kocherginsky – Co-Founder, Biomime, Bionum, Urbana, IL; nikolai.kocherginsky@gmail.com.**

*Broad-Spectrum Potentiometric Biosensors to Detect Pharmaceutical and Personal Care Products in Water*

*Co-Authors: Kacper Lachowski, Anisa Nuanes, and Tim Szaflarski*

Environmental control needs fast, inexpensive, and pocket-sized multi-purpose sensors to detect and measure the point-of-source concentration of broad-spectrum organic pollutants in water. These pollutants include organic cations such as those found in drugs with cardiotropic, psychotropic (i.e. methamphetamine), and anti-obesity properties. Other pollutants include charged and non-charged surfactants, detergents, herbicides, and redox active organics including antioxidants, vitamin C, and many dyes. We have addressed this challenge by developing biomimetic and polyaniline (PANI) membrane-based potentiometric biosensors. Biomimetic membranes may be used for the measurement of the concentrations of drugs and surfactants with a sensitivity of just a few  $\mu\text{M}$  in less than 60 seconds. PANI membranes are sensitive to redox active organics that cannot be measured with conventional platinum electrodes. These potentiometric biosensors allow for broad-spectrum quantitative detection of organic pollutants, which cause extensive damage to the environment if not controlled properly.

**5. Brenda Koester – Assistant Director, University of Illinois Family Resiliency Center; bkoester@illinois.edu.**

*Raising Awareness of the Role of Child Care Providers in Ensuring Children's Environmental Health*

*Co-Authors: Barbara Fiese*

The goal of the Children's Environmental Health Research Center at Illinois is to study the effect of chemicals found in the environment and personal care products on children's neurological and development. A key role of the Community Outreach and Translation Core (COTC) is to communicate findings to stakeholders including parents, policy makers, and child care providers. Child care providers are particularly important to target as most children in the United States under 5 years of age spend a significant amount of waking hours in non-parental care. We surveyed child care providers in rural, urban, and micro-urban settings regarding their current child care routines relevant to endocrine disruptor exposures and their understanding of the role these chemicals play in children's environmental health. Based on these findings, we are developing messaging targeted to care providers to reduce exposures to harmful chemicals.



**2. Keri Lydon – Graduate Research Assistant, University of Georgia; keri.lydon@uga.edu.**

*Effect of Triclosan on Bacterial Community and Vibrio Dynamics in Near Shore Coastal Environments*

*Co-author: Donna Glinski, Katy Smith, W. Matthew Henderson, and Erin K. Lipp*

One of the most ubiquitous pollutants entering coastal waters is the antimicrobial triclosan. Triclosan minimum inhibitory concentrations (MIC) were determined for *Vibrio* species (n=73) through broth microdilution assays. *Vibrio* are a growing cause of infection associated with consumption of shellfish and contact with seawater. All but two *Vibrio* strains tested were resistant to triclosan (MIC 6-300 mg/L). From these results, we hypothesized that triclosan pollution selects for *Vibrio* in coastal waters. To test this, natural seawater microcosms were exposed to low (1 µg/L) and high (5 mg/L) triclosan concentrations. High triclosan exposure treatments exhibited a significant *Vibrio* response (68-1696 fold increase) in comparison with no treatment controls. Additionally, 16S rDNA microbial community analysis showed an increase in Vibrionales from <0.5% to >5% of the reads. Investigations are ongoing to determine the direct environmental response of *Vibrio* to waste water effluent exposure with known Triclosan pollution (Glynn County, GA).

**4. Brittany Maule – Graduate Student, Ball State University, IN; bmaule@bsu.edu.**

*From Science to Science Communication: Understanding Effects and Perceptions of Pharmaceuticals in the Environment*

*Co-Authors: Melody Bernot*

One emerging group of contaminants in freshwaters is Pharmaceuticals and Personal Care Products (PPCPs). Although the abundance of PPCPs in freshwaters has been well established, compound use and degradation by aquatic organisms is not yet understood. As primary producers, algae drive both ecosystem function and community structure. However, PPCP effects on algae dynamics have not been comprehensively assessed. PPCP in the environment are a societal issue as they arise from human activities; however, a disconnect exists between scientific research and societal perceptions of these emerging contaminants. Changes in algal community structure and function were measured through in situ experimental incubations with subsequent measurement of metabolism. Patterns in gross primary production suggest PPCP effects on autotrophs are compound specific. Future efforts will quantify PPCP effects on algal community composition. Additionally, public awareness of PPCP contaminants will be evaluated to identify effective communication modes for altering behaviors contributing to freshwater pollutants.

**11. Young Hwan Shin – Graduate student, University of Illinois at Urbana-Champaign; yshin13@illinois.edu.**

*Characterizing the Fate and Transport of Chemicals of Emerging Concern (CECs) from Integrated Bioenergy and Manure Management System*

*Co-Authors: Lance Schideman, Peng Zhang, and Yuanhui Zhang*

Animal manure contains bioactive chemicals of emerging concern (CECs) such as hormones and antibiotics that potentially contribute to ecological or health effects. This study investigates the fate of CECs in novel manure management systems that simultaneously produce renewable energy and improve the quality of water resources. A mixed algal-bacterial bioreactor (MABB) was operated with adsorbents under a range of organic loading rates (OLR: 190~571mg/L/d) to remove CECs and capture organics from the liquid portion of animal manure (LPAM) into biomass. Hydrothermal liquefaction (HTL) and catalytic hydrothermal gasification (CHG) were used to convert the harvested biomass into bioenergy products under 10 different conditions (Temp: 200-450°C; Time: 30/60min; Catalyst: Ruthenium on alumina). MABB captured up to 99.4% of estradiol and 86% of organics from LPAM, and biomass productivity was increased from 274-819 mg/L/d with increasing OLR. The optimal conditions of HTL/CHG for highest energy yield were 300°C/30min & 350°C/60min which can destruct CECs up to 99.9%.

**3. Madeleine VanMiddlesworth – Graduate Research Assistant, Illinois River Biological Station, Illinois Natural History Survey, Prairie Research Institute, University of Illinois Urbana-Champaign; mmyoung1991@gmail.com.**

*Rates of Endocrine Disruption in Two Commercial Fishes, Common Carp and Channel Catfish, Along a Downstream Gradient in the Illinois River*

Endocrine-disrupting chemicals can be found in high concentrations in aquatic systems via point source discharges such as waste water effluent. Laboratory exposures suggest feminization of male fishes, e.g. intersex condition and presence of female-specific lipoprotein, vitellogenin (VTG). Field assessments of feral fishes may provide insight into the extent of endocrine disruption within a system. The Illinois River has a notable history of pollution through urbanization. We explored patterns of intersex and VTG levels in male gonads of common carp and channel catfish collected throughout a downstream gradient of sites. Histology identified feminization in male gonads and blood was sampled for detection of VTG in carp. Low rates of intersex were observed in testes from both fish species. Male VTG was consistently low or below detection in all sites. As declining population trends are determined in these commercial species, we should continue to examine the reproductive health of Illinois River fishes.

**6. Sofia K. Vielma Delano – Graduate Student, Purdue University, IN; svielmad@purdue.edu.**

*WTP for Medicine Disposal Programs in the Midwest: A Double Hurdle Approach*

*Co-Authors: Kwamena K. Quagraine*

There have been increasing concerns about the environmental impact of pharmaceutical accumulations in water over the last two decades. Several states in the U.S. have implemented medicine take-back programs to help mitigate problems associated with unwanted pharmaceuticals. This study assessed the value of a pharmaceutical collection program based on the willingness to pay (WTP) per prescription and per visit of current and potential consumers of the program. We found that 60% of the people are willing to participate in a collection program, while 40% are willing to pay to participate in the program. The estimated mean WTP is \$0.53 per prescription and \$1.03 per visit. Total annual benefits for such programs are estimated to be \$27.3 million with WTP per prescription, and \$25.5 million for a single visit per year with WTP per visit. This information will help better inform program providers, researchers, policymakers, and other interested parties.

## ABOUT THE ILLINOIS SUSTAINABLE TECHNOLOGY CENTER

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The Illinois Sustainable Technology Center (ISTC) is a division of the Prairie Research Institute on the University of Illinois at Urbana-Champaign campus. Its mission is to encourage and assist citizens, businesses, and government agencies to prevent pollution, conserve natural resources, and reduce waste to protect human health and the environment of Illinois and beyond.

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The program is funded through National Oceanic and Atmospheric Administration (NOAA), the University of Illinois and Purdue University, but IISG also works in partnerships with key organizations, institutions, and agencies in the region to reach more audiences and multiply opportunities for success. IISG brings together scientists, educators, policy makers, community decision makers, outreach specialists, business leaders, and the general public to work towards a healthy environment and economy.

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