2024 ANNUAL REPORT

INSTITUTE FOR INTEGRATIVE TOXICOLOGY

MICHIGAN STATE
UNIVERSITY

IIT ANNUAL REPORT 2024

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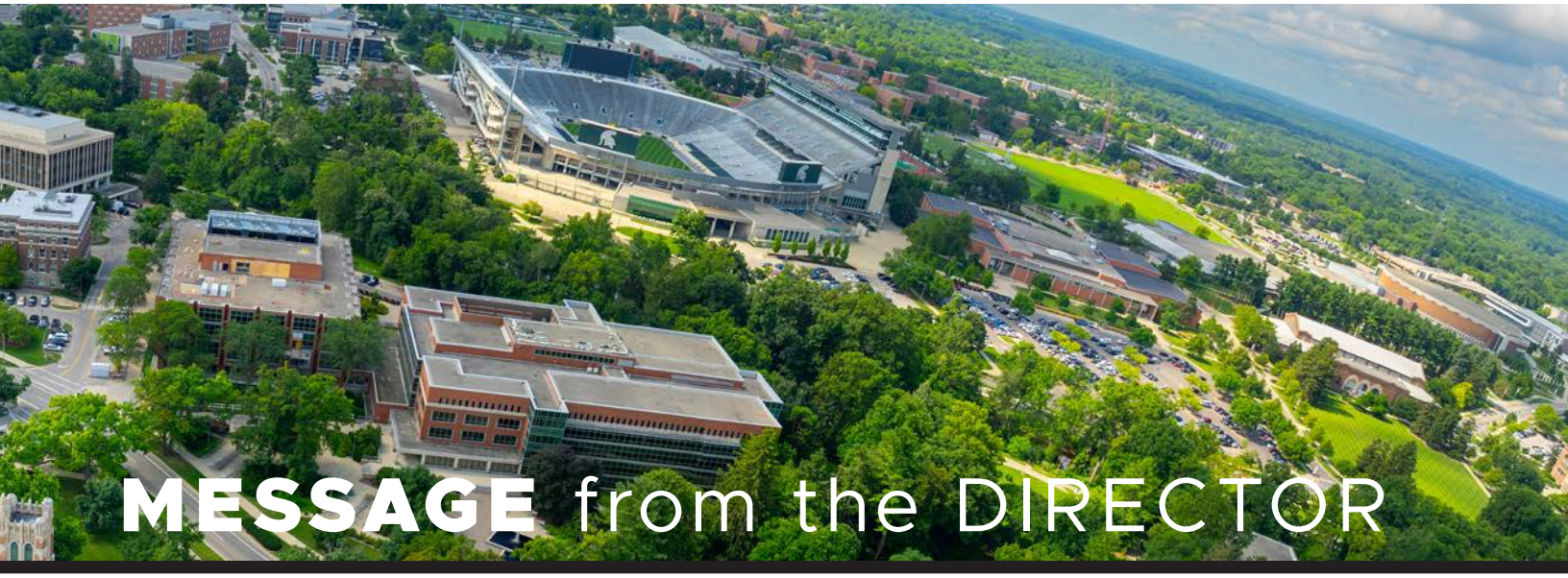
A **TRADITION** of EXCELLENCE

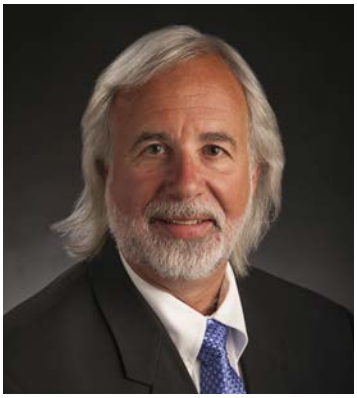
The Michigan State University Institute for Integrative Toxicology (IIT) is a multidisciplinary academic unit that supports and coordinates research and graduate education activities for faculty interested in various aspects of **toxicology**. The Institute is a **successor** to the Institute for Environmental Toxicology and the Center for Environmental Toxicology, the latter founded in 1978. While the name of the unit has changed over the years to denote changes in the **leadership** and academic position, the mission has been the same. For over 40 years, toxicology at Michigan State has provided **excellence** in training graduate students, facilitating research, and providing service to the State of Michigan when needed. The successes generated in these endeavors have resulted in **recognition** of Michigan State as a leader in academic toxicology.

The Center for Environmental Toxicology was initiated primarily to **assist** the State of Michigan with environmental contamination issues such as those arising from the PBB (polybrominated biphenyls) incident in the early 1970s. That unfortunate event was initiated by the accidental contamination of feed for dairy cattle with PBBs. These dioxin-like chemicals and dioxin itself remain a major topic of research at Michigan State University.

Several years after the founding of the Center for Environmental Toxicology, a dual-major Ph.D. program in environmental toxicology was offered in conjunction with several cooperating departments. The characteristics of the program were **unique** at that time as students were required to complete the Ph.D. requirements of a department of their choice in addition to the didactic requirements and toxicology research specified by the Center. The **quality** of this cross programmatic effort was recognized by the National Institutes of Health in 1989 with the award of a Training Grant from the National Institute for Environmental Health Sciences. This grant has been competitively renewed ever since, providing over 35 years of continuous funding. Graduates of MSU's toxicology program number over 200 and can be found in academia, industry, and governmental positions.



MESSAGE from the DIRECTOR



The Institute for Intergrative Toxicology has continued to thrive in education, research and collaboration during our 46th year.

The influence of IIT faculty's research in the field of toxicology was far-reaching this year. In 2024, several IIT faculty received nationally recognized awards for their achievements and hold positions on notable boards and committees. Our faculty have continued to conduct excellent research, successfully competing for grant funding, attending scientific meetings, and receiving news coverage on their newest discoveries. Our affiliated faculty have now grown to seventy-three specialists conducting toxicology-related research spanning investigations pertaining to the environment (air, water, soil), occupational setting, as well as food and putative therapeutic agents.

The EITS graduate program, now with thirty-four doctoral students participating, continues to be one of the premier toxicology training programs in the U.S. Students participated in workshops and seminars, not only on campus, but across the country, to further their learning and research. Five students graduated from the EITS program in 2024 and have moved on to pursue careers in academia and industry.

Our affiliated center under the IIT umbrella, the Center for Research on Ingredient Safety (CRIS), has had a productive 2024 as well. CRIS launched a new website this year, making it easier than ever to access trusted science-based insights on food, beverage and personal care products. The CRIS website recorded more than 373,000 site visits this year, with people exploring ingredient safety topics that matter to them. CRIS researchers were also featured in a variety of media publications across the country weighing in on a variety of trending ingredient safety conversations.

Lastly, a large cadre of our faculty continue to be extremely productive in their research activities and engagement with community and regulatory agencies related to work on dioxin and dioxin-like compounds as part of our NIH funded Superfund Research Center. We are now in the second full year of our most recent award period.

I look forward to seeing what 2025 brings for our institute.

Norbert E. Kaminski, Ph.D., IIT Director

2024 SEMINARS

IIT Hosts Prestigous Speakers Throughout 2024

The IIT was delighted to once again host the IIT Seminar Series this year with seven exciting seminars.

The IIT hosted **Dr. Joshua Harrill**, U.S. EPA, on January 30. He spoke on, "*High-Throughput Phenotypic Profiling with the Cell Painting Assay and Applications for Next Generation Risk Assessment.*" Harrill is a Cellular and Molecular Toxicologist at the U.S. EPA Center for Computational Toxicology and Exposure.

In February, the IIT hosted **Dr. Natalie Johnson** from Texas A&M University. Johnson's research interests include air pollution exposure, particularly effects on infants and children following prenatal exposure, including susceptibility to respiratory infections and asthma. She is interested in nutritional interventions to reduce oxidative stress associated with maternal exposures to protect against these common childhood diseases. Johnson spoke on, "*Responding to Air Pollution in Disasters.*"

In April, the IIT hosted **Dr. Jason Richardson**, University of Georgia, who is a Dianne Isakson Distinguished Professor in the Department of Physiology and Pharmacology and the Isakson Center for Neurological Disease Research. He spoke on, "*Gene-Environment Interactions in Alzheimer's Disease: A Path to Precision Prevention and Treatment.*"

The spring series ended with he 3rd Annual Jerry Hook Distinguished Lectureship given by **Dr. Jeffrey M. Peters** on May 21. Dr. Peters spoke on, "*The Mechanisms of Peroxisome Proliferator-activated Receptor-a (PPARa) Liver Carcinogenesis from Past to Present.*" Dr. Peters is a Distinguished Professor of Molecular Toxicology and Carcinogenesis, and the Deputy Director of the Penn State Cancer Institute. His laboratory studies the role of the peroxisome proliferator-activated receptors (PPARs). PPARs modulate gene expression through direct and indirect mechanisms. His laboratory group uses genetically modified mouse and human models, high affinity agonists, antagonists and selective, repressive ligands to delineate the roles of PPARs, with a particular interest in cancers.

Above: Dr. Jeffrey M. Peters with IIT Director Dr. Norbert Kaminski after giving the 3rd Annual Jerry Hook Distinguished Lecture.

The fall series began with **Dr. Imran Shah**, U.S. Environmental Protection Agency, who spoke on, "*Integrating Artificial Intelligence, Systems Modeling and Single-Cell Analysis for Advancing Chemical Safety.*" Dr. Shah's work uses artificial intelligence (AI) / machine learning (ML) and systems biology approaches to analyze large-scale heterogeneous biological and chemical datasets to model the health effects of drugs and chemicals.

On October 14, the IIT hosted **Dr. John Clarke**, to speak on, "*Microcystin-LR Hepatotoxicity in Healthy Versus Metabolic Dysfunction-Associated Steatotic Liver Disease Rodents.*" Dr. Clarke is an Associate Professor and Vice-Chair in the Department of Pharmaceutical Sciences, College of Pharmacy and Pharmaceutical Sciences at Washington State University Health Sciences Spokane.

The final seminar of the series was given by IIT-affiliated faculty member **Dr. Joseph Zagorski** on November 19. He spoke on, "*Development of a Human Hepatocyte: Endothelial Cell Coculture Model to Determine Differential Potencies of Pyrrolizidine Alkaloids.*" Currently, Zagorski is working on developing models of developmental immunotoxicology, co-culture models systems with human hepatocytes, and the utilization of 3D culture systems to predict toxicity. At the Center for Research on Ingredient Safety, his goal is to develop alternative model systems, utilizing primary human cells and tissues.

INSTITUTE HIGHLIGHTS

Dr. Jim Luyendyk

was recently elected vice president-elect for the Society of Toxicology. His election to this office at the SOT will lead to his serving as vice president and then as president of the society. Dr. Luyendyk's appointment continues a rich tradition of SOT presidents associated with our institution. He will be the tenth IIT-affiliated SOT president to hold office.

Dr. Barbara Kaplan

former IIT-affiliated faculty member and current Associate Professor at Mississippi State University, recently returned to MSU as the Department of Pharmacology and Toxicology's Kenneth E. Moore Distinguished Alumnus. Kaplan gave her award lecture on, "*From Michigan State University to Mississippi State University: Science and So Much 'Moore.*"

Dr. Gina Leinninger

was recently promoted to full professor and was also awarded the title of Red Cedar Distinguished Professor for her leadership and research achievements. The Leinninger Laboratory studies how neurons in the lateral hypothalamic area contribute to energy balance and obesity.

James Trosko

has recently been included in Marquis Who's Who which chronicles the lives of the most accomplished individuals and innovators from every significant field of endeavor, including politics, business, medicine, law, education, art, religion and entertainment. Individuals profiled are selected on the basis of current reference value.

Dr. Ilce Medina Meza

was recently promoted to associate professor. The goals of her laboratory are to elucidate molecular mechanisms governing oxidative stress, and to translate the findings to develop biomarkers for prevention and treatment of chronic diseases (e.g. cardiovascular and neurodegenerative diseases).

Dr. Kin Sing Lee

was recently promoted to associate professor. Lee's laboratory focuses on using chemical biology methods to study the interactions between dietary lipids (what we eat), environmental chemicals (what we are exposed to) and human health (our body) at the molecular level.

Dr. Karilyn Sant Joins IIT-Affiliated Faculty

The IIT is pleased to welcome Dr. Karilyn Sant as an affiliated faculty member. Dr. Sant is an associate professor in the Department of Pharmacology and Toxicology and the College of Veterinary Medicine. She received her B.S. in Biology in 2008 and her M.P.H. in Environmental Health Sciences in 2010 from the University of Michigan. Sant completed her Ph.D. in Toxicology in 2014 also at the University of Michigan.

Dr. Sant is an environmental toxicologist who specializes in the health consequences resulting from developmental exposures to emerging and common water pollutants. Most of her research has examined how exposures to endocrine disrupting chemicals (EDCs) affect embryonic and juvenile development and predispose to metabolic diseases such as diabetes, exocrine pancreatic insufficiency, and obesity later in life. Her work has demonstrated that the developing pancreas, which produces digestive enzymes and hormones such as insulin, is a sensitive target for chemical exposures during the embryonic and fetal periods and that these changes may persist throughout childhood. She uses the zebrafish model to investigate how these emerging contaminants influence both human and aquatic reproduction and health throughout the lifespan.

With her background in public health, Dr. Sant also has a number of interdisciplinary, collaborative projects investigating the toxicity of water pollutants within communities. Her research program studies contaminants as diverse as pesticides, industrial runoff, sewage, and beyond—often for compounds that have little to no toxicity data available. With community partners, chemists, engineers, veterinarians, and other collaborators, Dr. Sant helps to assess what the consequences of these unknown or unpredictable exposures may be on local wildlife and human health. Current projects include investigations of microplastics, tire wear particles, boundary water contamination at the U.S-Mexico border, runoff from cannabis and conventional crop facilities, heated tobacco products and electronic cigarettes, and emerging pollutants found in dumpsites off the coast.

EITS TRAINING PROGRAM

An overview of the current EITS training program and review of 2024 activities.

The Environmental and Integrative Toxicological Sciences (EITS) graduate program continues to be one of the premier toxicology training programs in the U.S. This MSU training program administered by the IIT and directed by Dr. John LaPres is a "dual major" format that emphasizes excellent basic science training from a graduate program at MSU coupled with didactic and research training in toxicology by IIT-affiliated faculty. Currently, 34 doctoral students are enrolled in the EITS program. Twenty-three of these students are in the Biomedical Track, seven in the Environmental Track, and four students are currently enrolled in the Food Toxicology and Ingredient Safety Track. Our students continue to demonstrate good citizenship by volunteering to serve on Society committees at the regional and national levels as well as within MSU. Students who graduated in the past year have accepted postdoctoral positions at various academic institutions in the U.S. and other countries or began careers at some of the largest corporations in the country.

The National Institute of Environmental Health Sciences (NIEHS) Training Grant, that the IIT has received with continuous funding since 1989, continued in 2024. The training grant offers stipend and tuition support for 7 predoctoral and 2 postdoctoral fellows each year. Universities compete nationally for training grant support from NIEHS. The longstanding support by NIH of the MSU-IIT is a testament to the excellence that the EITS program has maintained over three decades in training graduate students and postdoctoral fellows, many of whom have become leaders in the field of toxicology.

2024 EITS Graduates

Ankita Bhattacharya

Food Science & Human Nutrition
Mentor, Courtney Carignan

Poly- and Perfluoroalkyl Substances (PFAS) Contaminated Soils, Uptake into Foods, and Human Exposure

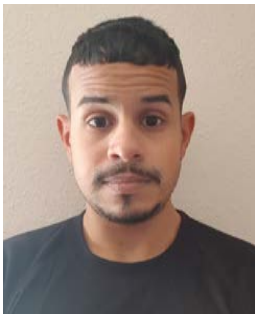
Currently: Postdoctoral Researcher, U.S. Department of Agriculture

Sierra Boyd

Pharmacology & Toxicology
Mentor, Alison Bernstein

The effects of developmental exposure to the organochlorine pesticide dieldrin on susceptibility to Parkinson's disease

Currently: Postdoctoral Researcher, U.S. EPA



Luis Rivera-Cubero

Forestry
Mentor, David Rothstein

Tree's species effect on the deposition and transport of nutrients and pollutants in urban and rural midwestern forest

Currently: Postdoctoral Research Associate, Corteva Agriscience

Erin Zaluzec

Pharmacology & Toxicology
Mentor, Lorenzo Sempere

Intraductal Delivery of an Ablative Agent as a Local Intervention for Breast Cancer Prevention In Rodent Models

Currently: Postdoctoral Researcher, University of Michigan

Bradley Ryva

Pharmacology & Toxicology
Mentor, Rita Strakovsky

Endocrine Disrupting Chemicals and Nausea and Vomiting During Pregnancy

Currently: MSU DO/ Ph.D. Program

GRADUATE SPOTLIGHTS

IIT graduates are sought for careers in industry, government and academia. Below we feature three EITS alumni and their paths after graduation.

Eleni Beli

Lecturer, Wellcome-Wolfson Institute for Experimental Medicine, Queen's University Belfast, Northern Ireland, UK

At a glance:

Department: Food Science & Human Nutrition

Mentor: James Pestka

Dissertation: "Natural killer cell responses to influenza virus infection in aged mice"

Defended: Spring 2012

Curiosity, a deep need for continuous learning and understanding how things work led Eleni Beli down the path of science from a young age. After earning her Bachelor of Science in Food Science and Technology from Aristotle University, Greece, Beli then came to the US to attend MSU to earn her Master of Science in Food Science. She followed with a Ph.D. in Food Science with a dual major in Environmental & Integrative Toxicological Sciences. Beli trained with Dr. James Pestka and completed her dissertation, "*Natural killer cell responses to influenza virus infection in aged mice*," in 2012.

Today, Beli is a lecturer at Queen's University, Belfast, in Northern Ireland, UK. Her laboratory's research is focused on understanding the mechanisms of diabetes-induced circadian disruption and its implications for a complication of diabetes that impacts eyesight, diabetic retinopathy. Using pre-clinical models, Beli and her laboratory are providing evidence that having diabetes impacts the circadian system coordination, and they are in the process of identifying the retinal pathways and mechanisms that play a role.

More specifically, Beli's laboratory provides evidence for the impact of circadian disruption to the progression of diabetic retinopathy, using both physiological models (light misalignments) and tissue specific clock knockouts *in vivo* and *in vitro*. Ultimately, Beli hopes to have identified a novel mechanism that impacts the progression of diabetic retinopathy. Most importantly, this mechanism, i.e. the circadian clock, is a druggable target that can also be easily modified with life-style interventions making it easier to apply their findings to help people with diabetes maintain healthy vision for longer periods of time.

Beli and her team hope that their research can one day help to prevent and slow down the progression of diabetic retinopathy. Some of the potential benefits of this important research include increased awareness and guidelines, potential early diagnosis, and the development of new targeted drug therapies.

Beli is thankful for the opportunities she has been afforded at Queen's University Belfast, "It is an excellent ecosystem for research in ophthalmology. A concentration of renowned ophthalmologists, epidemiologists and scientists working in vision and eye research have given me the opportunity to learn more about patient's challenges, the impact of research on people's lives and the value of scientific inquiry in novel areas of research."

Beli found her experience in the EITS program invaluable for her work as a scientist today. "Starting my scientific career as an EITS student instilled in me a picture of the importance of research excellence, collegiality, collaboration, and mentorship for success in academia," commented Beli. "I always fondly remember friends I made within the institute, the openness of talking about science with each other, the collaborative ways of working on experiments and the excitement I had when I attended my first scientific meeting with colleagues."

Geoffrey Rhodes

Toxicologist, State of Michigan, Department of Environment, Great Lakes, and Energy, Water Resources Division

At a glance:

Department: Plant, Soil & Microbial Sciences

Mentor: Hui Li

Dissertation: "Environmental fate and plant uptake of chemicals of emerging concern in agricultural systems"

Defended: Fall 2021

Ever since he was a kid, Geofrrey Rhodes spent as much time as possible outdoors. He grew up boating and fishing on inland lakes and hiking and hunting public land across the state. When he was old enough to realize he could protect the quality of Michigan's outdoor spaces as a career, he knew he didn't want to do anything else. Today, Rhodes is a toxicologist with the State of Michigan in the Water Resources Division of the Department of Environment, Great Lakes, and Energy (EGLE).

Rhodes began his college years at Michigan State University where he earned his Bachelor of Science in Biochemistry and Molecular Biology. He continued on at MSU to earn his Ph.D. in Crop and Soil Sciences with a dual major in Environmental & Integrative Toxicological Sciences. Rhodes trained with Dr. Hui Li and completed his dissertation, "*Environmental fate and plant uptake of chemicals of emerging concern in agricultural systems*," in 2021.

As a toxicologist at the State of Michigan, Rhodes evaluates the potential impact of toxicants found within surface water and groundwater and develops risk-based criteria for the protection of human health. Additionally, he coordinates surface water monitoring for contaminants which may impact human health. This involves developing monitoring plans for assessing chemical contaminants, such as PFAS, within Michigan's watersheds.

As part of developing risk-based criteria, Rhodes interprets mammalian toxicology data and uses a weight of evidence approach to determine a concentration within water that will not result in an adverse impact to human health after incidental or deliberate oral exposure to toxicants found within surface water and groundwater. For the surface water monitoring of contaminants, currently Rhodes and his colleagues are largely focused on PFAS. Rhodes identifies potential sources of PFAS to the environment, determining surface water sampling locations, collecting surface water samples, and interpreting the results of chemical analysis. His work is centered around protecting the people of the State of Michigan through preserving and maintaining the state's recreational and drinking water sources. As part of preserving and maintaining Michigan's recreational waters, Rhodes work closely with the Fish Contaminant Monitoring Program by helping to prioritize areas for fish sampling based off of surface water results.

Rhodes finds working as a toxicologist at the State of Michigan incredibly satisfying, as he is able to directly see the outcomes of his work. "Working for EGLE is exactly what I want to do career wise, it is incredibly rewarding to be able to track down a source of contamination, determine its impact to human health, and work alongside other State of Michigan staff to address the issue," commented Rhodes. "I take a lot of pride in my work, as preventing/reducing the contamination of waters of the State directly impacts the quality of recreational and drinking water sources and the health of all that utilize them."

Rhodes found his time as an EITS student extremely valuable in preparing for his current position. "The diverse coursework offered by the program gave me the background I needed to succeed in such an interdisciplinary field, and the hands-on experience conducting research on the environmental fate and transport of emerging contaminants honed the specificity of my skills," said Rhodes. "I consider myself very fortunate to have worked as a student in Dr. Hui Li's lab, as his mentorship and the experience of doing my own analytical analysis has proven immensely valuable in interpreting and analyzing the water chemistry results I see on a daily basis."

Nikita Saha Turna

Environmental Toxicologist, British Columbia Centre for Disease Control

At a glance:

Department: Food Science & Human Nutrition

Mentor: Felicia Wu

Dissertation: "Co-exposure of aflatoxin and fumonisin in Nigerian maize and the non-carcinogenic risk of aflatoxin in southwest Nigerian children and adults"

Defended: Spring 2021

Nikita Saha Turna's interest in science started with a deep curiosity about how the environment affects human health and well-being. Growing up in Bangladesh, a developing country, she witnessed firsthand the harmful effects of environmental contaminants on people's health. Those experiences shaped her outlook and sparked her curiosity about how the environment and public health are connected. Saha Turna realized that a career in science would give her the opportunity to help make communities safer and healthier, which has been her main motivation ever since. Her current path has always led with a desire to be part of the solutions that protect public health and create safer environments for everyone.

Saha Turna began her college career at Stony Brook University where she earned a Bachelor of Science in Biochemistry. She then came to Michigan State University and earned her Ph.D. in Food Science with a dual major in Environmental & Integrative Toxicological Sciences. Saha Turna trained with Dr. Felicia Wu and completed her dissertation, "*Co-exposure of aflatoxin and fumonisin in Nigerian maize and the non-carcinogenic risk of aflatoxin in southwest Nigerian children and adults*," in 2021.

Today, Saha Turna is an Environmental Toxicologist at the British Columbia Centre for Disease Control (BCCDC) in Vancouver, BC, Canada. In this role, she assesses, and addresses risks associated with environmental contaminants to ensure public health and safety within the province of British Columbia. Her responsibilities include collaborating with other provincial health authorities and government ministries, conducting research on environmental toxins, and providing expert guidance on exposure limits and risk mitigation strategies. Specifically, Saha Turna conducts risk assessments on a wide range of environmental exposures, including air, water, soil, and food. This involves addressing issues such as heavy metals in community drinking water, hydrocarbon contamination in shellfish harvesting areas, heavy metals in soil, and air contamination in residential areas from gas station leaks. Her recent research projects also include identifying health effects of exposures to wildfire smoke, road dust, and biogenic amines in fermented foods.

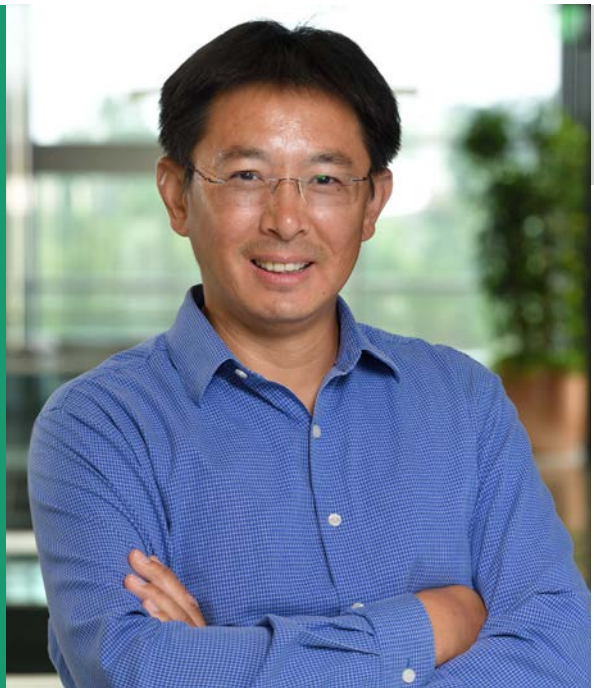
This position allows Saha Turna to respond to immediate public health concerns while aligning with her long-term career goals of contributing to public health through science-based environmental policies and regulations, ultimately creating safer and healthier communities. She also occasionally gets the opportunity to give guest lectures at the University of British Columbia, which keeps teaching as a potential future career path.

Saha Turna is enjoying her experience at the BCCDC, "I'm learning new things every day, which keeps the work engaging and challenging. Getting the opportunity to collaborate with experts in environmental health services has been a true blessing, as it allows me to deepen my expertise while contributing to meaningful public health initiatives."

Saha Turna believes being part of the EITS program greatly broadened her perspective beyond food-related topics to encompass other environmental issues. It allowed her to explore not only food safety and contaminant exposure, but also a wide range of environmental exposures, including air, water, and soil contamination. "This interdisciplinary foundation prepared me for my current role, equipping me with the skills to assess risks across multiple environmental sectors, far beyond just food," said Saha Turna. "I will always be grateful for the knowledge I gained from my advisor, Dr. Felicia Wu, and all my professors from both the Food Science and Human Nutrition department and the EITS program."

FACULTY FEATURES

The IIT is a leader in conducting diverse, interdisciplinary research, with over seventy affiliated faculty members who conduct toxicology-related research spanning investigations of environmental (air, water, soil), occupational, food-borne and pharmaceutical agents. These faculty are from twenty-two different academic departments across campus. Faculty research is primarily supported by federal agencies such as NIH, EPA, NSF and USDA as well as through partnerships with private industry. The research partnerships that MSU toxicologists have forged over the decades in conducting interdisciplinary research have been highly beneficial in the context of research productivity, education and service. This year we feature three faculty with various specialties across our program.



Honglei Chen

MSU Research Foundation Professor, Department of Epidemiology & Biostatistics

Honglei Chen firmly believes, "Epidemiology is the cornerstone of public health and medicine." After his training at Tianjin Medical University and the Chinese Academy of Preventative Medicine, Chen came to the Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts University in Boston to pursue his Ph.D. in Nutritional Epidemiology. While Chen primarily studied the potential roles of dietary factors in cancers at Tufts, he gradually developed a strong interest in understanding the aging process. Subsequently, Chen went to Harvard University for his postdoctoral training with a world-renowned neuroepidemiologist, Dr. Alberto Ascherio, to study how dietary and lifestyle factors may impact the risk of developing Parkinson's disease in older adults. This also marks the start of his scientific career of leveraging large epidemiological studies to demystify the development of neurodegenerative diseases.

When Chen began to study Parkinson's disease at Harvard about 25 years ago, there was substantial interest in studying environmental contributions to the disease risk. Chen began his research in this vein, exploring dietary (e.g., dairy intake), lifestyle (e.g., smoking, coffee drinking, and exercise), and environmental factors (e.g., pesticides) that may affect the risk of Parkinson's disease in older adults.

To further pursue this line of research, Chen took a tenure-track investigator position at the National Institute for Environmental Health Sciences, where he earned his tenure in 2013. While his research evolved there, Chen quickly recognized the importance of studying the so-called prodromal stage of Parkinson's disease. For many of the neurodegenerative diseases – Alzheimer's, Parkinson's – the underlying pathology of the disease begins to evolve many years, if not decades, before the disease's clinical diagnosis. During this time, many factors may come into play to perpetuate or slow down disease progression. It is almost impossible to prevent or delay the onset of neurodegenerative diseases without a good understanding of this prodromal stage of disease development. However, this prodromal stage of neurodegeneration is slowly progressive and often considered "insidious" until the disease's cardinal clinical presentation.

Recognizing this grand challenge about 15 years ago, Chen focused on studying the poorly understood decades-long prodromal/preclinical stage of disease development and identifying environmental factors that contribute to this process. Right around that time, it became clear that the "silent" prodromal neurodegeneration can be characterized by a variety of non-symptoms of neurodegeneration, such as poor olfaction, sleep disturbances, and constipation. As such, Chen began to assess these symptoms in three large epidemiological cohorts, aiming to use them as intermediate phenotypes to gain insights into the "black-box" of prodromal neurodegeneration and identify its triggers and modifiers.

Chen and his colleagues chose poor olfaction as their primary target of research because this symptom is highly prevalent among older adults, and the nasal pathway is the major human interface to the environment. They found that poor olfaction predicts a five times higher risk of Parkinson's disease and three times higher risk of dementia, making it one of the strongest nonspecific predictors for clinical diagnosis of both diseases. They are currently working on a project to understand if and how pesticide exposures may affect the sense of smell among farmers and how they may contribute to prodromal neurodegeneration.

As his research on olfactory evolved, Chen realized that poor olfaction may have much more to tell about the health of older adults beyond neurodegenerative diseases. Chen's current R01 project aims to determine what the health consequences of poor olfaction might be and whether poor olfaction is a facile marker of accelerated aging. Their research in the past 3 years has revealed novel associations of poor olfaction with declines in physical and mental function and higher risk of frailty, pneumonia, and stroke. "While it might be challenging to intervene upon olfaction loss per se in older adults," Chen said, "poor olfaction may serve as a "red flag" of impending adverse health issues that help one recognize them early and potentially intervene upon otherwise." Better nutrition, more physical activities, and more social interaction may go a long way for delaying the onset of neurodegenerative diseases or other adverse aging-related outcomes if those at risk can be identified early on.

Chen has valued his time at MSU for its strong research environment and collaboration opportunities. "The partnership with Henry-Ford Health, together with collaborative opportunities with the adjacent Van Andel Institute and Corewell Health, makes MSU a global hub for biomedical research to improve our health and the health of our environment."

Gina Leinninger

Red Cedar Distinguished Professor, Department of Physiology, Neuroscience Program

Leinninger's love of science blossomed early in her childhood - she could often be found swiping her older brother's toiletries from the family bathroom to make her own science experiments. Beginning her college career at University of Michigan Flint as an English major, Leinninger found she really enjoyed her science classes the most. After getting to experience a real laboratory for the first time, Leinninger realized she loved the idea of tackling big questions, the never ending puzzle of science and how the application of logic could help solve problems. She switched her major to Chemistry and earned her Bachelor of Science in 1999. A college instructor who studied growth factors and their impacts on neurons was the beginning of Leinninger's interest in neuroscience. After working in his laboratory for a bit and completing a summer internship in Canada studying growth factors and neurons, Leinninger decided to purse a Ph.D. in Neuroscience at the University of Michigan.

After interviewing for a variety of faculty positions, MSU was Leinninger's choice for the spirit of collegiality she found here. "There was a general enthusiasm for science, not only in supporting individual investigators, but as a community," commented Leinninger. "How can we make science better, stronger, faster? And I think that is something really special here at MSU, that is not necessarily everywhere else." From her first days at MSU, Leinninger began collaborating with Dr. Michelle Mazei-Robison and Dr. A.J. Robison, also part of the Neuroscience Program. "We all benefit as a programmatic whole when we are able to co-teach classes, weigh-in on each other's papers, and share our resources to make our own individual research better, which then makes our group science better," said Leinninger. Another important collaboration that has benefited Leinninger is her work with Dr. Jeff Wallace in the Department of Physiology. Where Leinninger's research focused on feeding behavior and obesity, Wallace's research focused on pain. By working together, they realized there was a common intersection between the two that had yet to be addressed in science research. They now have funding together to study the comorbidity of obesity and pain.

Today, Leinninger's research focuses on how the brain regulates behaviors that impact our body weight like what we choose to eat, how much we eat of it and how much we move. Specifically, the Leinninger laboratory studies how neurons in the lateral hypothalamic area (LHA) contribute to energy balance and obesity. The LHA is a crucial area of the brain for regulating feeding, drinking, sleep and locomotor behaviors that can directly affect weight. LHA neurons regulate some of the same brain circuits that mediate reward sensing and addiction (i.e. dopamine neurons.) There are several populations of LHA neurons that differ in their expression of neuropeptides and where they project within the brain (including populations containing neurotensin, orexin, leptin receptor and others) suggesting that these neuronal populations control different aspects of metabolic sensing and physiological output behavior. Leinninger's research lately has focused largely on the peptide neurotensin, which has been shown to suppress feeding and promote local matter activity. Leinninger's team has been working on creating novel ways to explore the neurotensin system and hope to identify neurons that have this peptide that could potentially suppress feeding and promote weight loss.

Leinninger has several currently funded grants. One project through NIH looks at how neurotensin both regulates ingestive behavior and how it might also contribute to obesity induced pain. She also has a Department of Defense grant with Dr. Kif Walloway to study the mechanisms of obesity, pain and how neurotensin might be involved. Leinninger looks forward to continuing her research in the neurotensin system and how it might be useful to treat obesity and pain, either separately, or ideally, together. Leinninger and her team are also exploring how the neurotensin system is implicated in other diseases impacting the world, for example, anxiety disorders, substance abuse disorders, and movement disorders. Neurotensin has yet to be studied in these implications and its impact could be wide-reaching.

Felicia Wu

John A. Hannah Distinguished Professor, Department of Food Science & Human Nutrition, Department of Agricultural, Food, and Resource Economics

"I've loved food for as long as I can remember, from a very early age, maybe 1 year old," said Felicia Wu at the start of our interview. She also was innately drawn to all things science. It came naturally to her to be fascinated by her 3rd grade science project detailing the biology of ants. She found that discovering the biology of the world around her sparked her love of science even further. Following a natural gift in math, Wu attended Harvard University and earned her A.B. and S.M. in Applied Mathematics and Medical Sciences. She focused her studies on the practical aspects of math rather than the deeply theoretical because she wanted the work she did, even then, to have practical use for the world.

After working with an advisor at Harvard who worked on cost-effective methods to remove the parasite Cryptosporidium in drinking water worldwide, Wu decided to pursue a Ph.D. on similar research at Carnegie Mellon University with a team that had recently received funding from the American Water Works Association. When the funding for that project ran out at the end of Wu's second year, she was fortunate to receive an EPA Science to Achieve Results (STAR) Fellowship. At the suggestion of an advisor, Wu shifted her focus to research surrounding genetically modified Bt corn. At the time, the year 2000, one type of Bt corn had been found in grocery store taco shells and corn dogs, although it was only approved for animal feed. Wu focused on finding out how the breach had happened and what the possible effects could be to human health. An unexpected finding was that Bt corn has lower levels of mycotoxins including aflatoxin – toxins produced by fungi that infect foods – hence, had unexpected benefits for food producers and consumers. Wu's interest was piqued and since that time, her research focus has been on how food – its production, safety, and nutrition - affect human health, the environment, and markets and trade.

After graduating from Carnegie Mellon University in 2002 with her PhD in Engineering and Public Policy, Wu took a position at RAND, a policy research institute. While there, Wu was able to work across multiple different science and policy issues. During this time, she worked with Dr. Bill Butz to co-write the book, "The Future of Genetically Modified Crops." In 2004, Wu was recruited to the University of Pittsburgh as a faculty member in Environmental and Occupational Health in the Graduate School of Public Health.

Visiting MSU a few times over the years to give seminars and speaking to other MSU faculty at several conferences, Wu was delighted to discover there were so many colleagues working in similar areas to her at MSU. When she was offered the John A. Hannah Distinguished Professor position in 2013, she was excited to begin her journey at MSU. "I have found this to be such an amazingly collaborative environment," commented Wu.

Wu's research interests began with striving to understand how regulation of GMOs could be improved in the US. As a graduate student at Carnegie Mellon, Wu's studies in engineering and public policy pushed her to use skills in risk analysis, applied policy analysis, statistics, and decision analysis and optimization. Everything Wu learned about toxicology and epidemiology and public health was on-the-job learning over the course of her career. Her focus on mycotoxins began with first understanding how they were controlled by genetically modified Bt corn and then how their regulations led to economic risks to low-income food exporting nations worldwide. She next began to look at diseases caused by these mycotoxins and how to control them in cost-effective ways worldwide. Since then, she has expanded to study other food contaminants, both chemical and microbial.

Today, Wu's research interests lie at the intersection of global agriculture, food safety and nutrition, and human health. She works to understand how agricultural systems affect health in different parts of the world, how food safety regulations affect global trade of food and food quality, and what the global burden of disease is caused by food contaminants. She also assesses the cost-effectiveness and feasibility of interventions to reduce those risks. The investigation of aflatoxin has been a cornerstone of Wu's research over the years, "I love to work in that area – it has the toxicology layered on to it, the risk assessment, the epidemiology. I do projects across all of these areas now and also have expanded into microbiology. It has really expanded into a global health issue and has become a huge part of my portfolio of work."

Wu has dedicated a large portion of her career to risk assessment analysis and began working with the World Health Organization (WHO) in 2010. She serves on the Foodborne Disease Burden Epidemiology Reference Group and the University of Washington's Institute for Health Metrics and Evaluation. Wu also serves on the Joint Expert Committee of Food Additives which does risk assessments of food additives and contaminants, specifically creating daily acceptable intakes for food additives and tolerable daily intakes for contaminants. In the past year, Wu was appointed to the WHO's Food-Based Dietary Guidelines Com-

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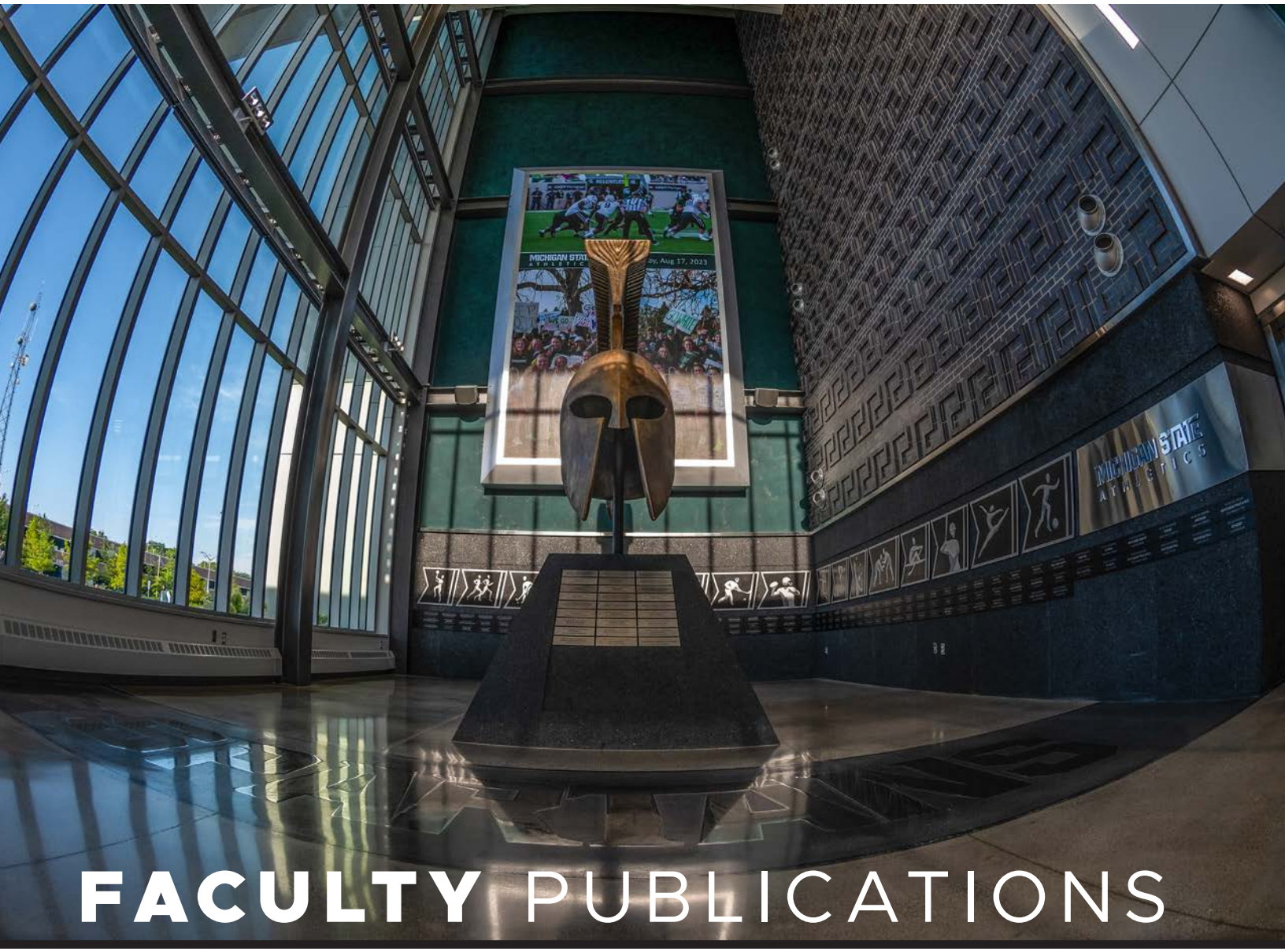

FACULTY PUBLICATIONS

During 2024, IIT affiliated faculty published more than 200 peer-reviewed articles. As a result, the IIT, and MSU research, has been highly visible in prominent peer-reviewed literature. The publications below are from January 1, 2024 to December 31, 2024.

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Schulte, A., Groeneveld, D. J., Wei, Z., Hazel, B., Bernard, M. P., Poole, L. G., & Luyendyk, J. P. (2024). Neutrophil-dependent hepatic platelet accumulation and liver injury revealed by acetaminophen dose-response studies. *Research and practice in thrombosis and haemostasis*, *8*(1), 102323. https://doi.org/10.1016/j.rpth.2024.102323

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Tiedje, James

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Trosko, James

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Uhal, Bruce

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Upham, Brad

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Wagner, James

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Zacharewski, Timothy

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Zagorski, Joseph

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Zhang, Wei

Wang, F., Xiang, L., Sze-Yin Leung, K., Elsner, M., Zhang, Y., Guo, Y., Pan, B., Sun, H., An, T., Ying, G., Brooks, B. W., Hou, D., Helbling, D. E., Sun, J., Qiu, H., Vogel, T. M., Zhang, W., Gao, Y., Simpson, M. J., Luo, Y., … Tiedje, J. M. (2024). Emerging contaminants: A One Health perspective. *Innovation (Cambridge (Mass.))*, *5*(4), 100612. https://doi.org/10.1016/j.xinn.2024.100612

FACULTY PROFESSIONAL SERVICE

The affiliated faculty of the IIT participate in many external activities that promote the development of research and science in their chosen field. These activities include editorial boards, review groups or study sections, scientific advisory boards and committees, and officers in scientific societies. The professional service activites below are for the calendar year of 2024.

Bernard, Matthew

- International Society for the Advancement of Cytometry (ISAC) SRL Content Subcommittee Member

Bhattacharya, Sudin

- Editorial Board member, Scientific Reports

Bourquin, Leslie

- Chair, NSF International Global Food Safety Advisory Council
- Technical Advisory Network Member, Food Safety Preventive Controls Alliance
- Editorial Board, Foods Journal

Buchweitz, John

- Executive Committee Board Member, American Board of Toxicology

Carignan, Courtney

- Editorial Board, Journal of Exposure Science and Environmental Epidemiology
- Chair, Fourth National Conference on Per- and Polyfluoroalkyl Substances
- Member, Environmental Health Research and Surveillance Guidance Panel, Michigan Department of Health and Human Services
- Community Engagement Scholarship Award, Michigan State University

- Distinguished Partnership Award for Community Engaged Service, College of Agriculture and Natural Resources, Michigan State University

Chen, Honglei

- Editorial board, Neurotoxicology
- Committee Member, Environmental Risk Factors of Parkinson's Disease, Michael J Fox Foundation

Copple, Bryan

- Associate Editor, Frontiers in Pharmacology
- Study section member, Hepatobiliary Pathophysiology (HBPP)

Doseff, Andrea

- Director, Post-baccalaureate Graduate Program SiGuE (Success in Graduate Education)
- Associate Editor, Journal of Pharmacology and Therapeutics
- Associate Editor Journal of Medicinally Active Plants
- Associate Editor Nutrients, Section Phytochemicals for Health
- Associate Editor Frontiers in Immunology
- Advisory Board NIH-T32 Plant and Sustainability Training Grant, Michigan State University
- Co-Chair, American Heart Association Study Section
- National Institute of Health, Study Section Immunology and Immunotherapy
- National Science Foundation study section
- American Heart Association study section
- Organizer member of the 12th American Council for Medicinally Active Plants (ACMAP) Meeting. Rutgers, New Jersey

Ewart, Susan

- Peer reviewer for NIH grants: National Institutes of Health; ZAI1 SAS-D (S1) NIAID Research Education Program Advancing the Careers of a Diverse Research Workforce (R25), Committee Chairperson, July 2024
- Peer reviewer, Journal of Veterinary Medical Education, 2024

Goodman, Jay

- Fellow, Academy of Toxicological Sciences
- Diplomate, American Board of Toxicology

Harkema, Jack

- Chair, American Thoracic Society's Environmental Health Policy Committee, 2020 – 2023
- Member, American Thoracic Society's Executive Committee, Assembly of Environmental, Occupational and Population Health 2021-2023

Hashsham, Syed

- Member, American Society for Testing Materials (ASTM) Committee on Microbial Corrosion of Concrete, C13.03
- Member, Review Panel, European Commission's Marie Skłodowska-Curie Action COFUND - ONISILOS Programme
- Member, Advisory Committee, Conference on Sustainable Development in Air and Waste Management, Department of Civil Engineering, Z. H. College of Engineering and Technology, Aligarh Muslim University, Aligarh, India, Dec 20-21, 2024

Jackson, James

- Member, American Chemical Society
- Member, National Academy of Inventors
- Vice Chair, Brownfield Redevelopment Authority, Meridian Township, MI

Jones, A. Daniel

- Review Editor, Frontiers in Plant Metabolism and Chemodiversity

Kaminski, Norbert

- External Review Committee for the Interdisciplinary Program in Toxicology at Texas A&M University
- Member, National Academy of Sciences, Committee on the Use of Emerging Science for Environmental Health Decisions
- Member, Joint Committee for NSF/ANSI Standard 500 GRAS-PAS Ingredient Review
- Member, Board of Directors, Toxicology Forum
- Editorial Board, Toxicology

LaPres, John

- Associate Editor, Toxicological Reports

Lee, Kin Sing

- Reviewer: Journal of Medicinal Chemistry, Journal of Fluorine Chemistry, ChemMedChem, ACS Neuroscience, Journal of Proteome Research, Bioorganic and Medicinal Chemistry Letter

Leinninger, Gina

- Ad hoc Reviewer in Past Year: Addiction Neuroscience, Obesity, Appetite, Nature Communications, Neuropharmacology,
- Society Service: The Society for the Study of Ingestive Behaviors Program Committee, American Physiological Society - Central Nervous System Section, Michigan Diabetes Research Center-Asst. Dir. for Regional Membership & Grants Program Advisory Council
- Abstract Reviewer: The Obesity Society, The Society for the Study of Ingestive Behaviors
- Grant Reviewer: NIH - Pathophysiology of Obesity and Metabolic Diseases (Standing Member);

Michigan Diabetes Research Center Grants Program

» Editorial Board, Neuropeptides

Li, Hui

» Guest Editor, Special Issue of PFAS in Agroecosystems—Sources, Impacts, and Opportunities for Mitigating Risks to Human and Ecological Health, Journal of Environmental Quality

» Guest Editor, Special Issue of Antibiotics and Antibiotic Resistance Genes in the Agro-Environment: Fate, Risk and Control for Environment International

» EPA Chartered Science Advisory Board Member, October 2024 to September 2027

» EPA Agricultural Science Committee member, October 2024 to September 2027

» Member on the committee appointed by the National Academies of Sciences, Engineering, and Medicine (National Academies): Assistance to the U.S. Department of Agriculture in Building a Framework for Addressing PFAS on Agricultural Land, 2024-2025

Luyendyk, James

» Vice President - Elect, Society of Toxicology

Mazei-Robison, Michelle

» Catecholamine Society, Treasurer

» Scientific Reports, Editorial Board

» NIH Study Sections (NIMH: ZMH1 ERV-G, NIDA: ZDA1 CEM-N, ZDA1 XSC-E)

McCabe, Laura

» FASEB Science Policy Committee Member

» Federal Demonstration Partnership: Foreign Influence Work Group Member, Faculty Executive Committee Member

» NIH Grant Reviewer

Medina Meza, Ilce

» Editorial Board, Food Research International

» Chair-Elect, Food Engineering Division, Institute of Food Technologist (IFT)

Paneth, Nigel

» Leadership team, National Convalescent Plasma Project (CCPP19.org)

» Co-Chair (with David Savitz, Brown University) State of Michigan Environmental Health Research and Surveillance Guidance Panel

» Scientific Advisory Group, Norwegian Mother and Child Cohort (MoBa) and Danish National Birth Cohort (DNCB) combined cerebral palsy study (MOBAND)

» External Advisor, Screening to Improve Health in Very Premature Infants in Europe (SHIPS) Study, INSERM, Paris, funded by European Commission

Robison, A.J.

» Editorial Board Member, Scientific Reports

» Editorial Board Member, Brain Research

» Associate Editor, Progress in Neurobiology

» NIH Study Sections

» NIH ZMD1 Special Emphasis Panel, NIMHD Centers of Excellence in Investigator Development and Community Engagement, P50, February 2023, ad hoc

» NIH Research Centers in Minority Institutions (RCMI), U54, June 2023, ad hoc

» NIH Molecular Cellular Neuropharmacology (MCNP), October 2023, Standing Member

Rosenman, Kenneth

» Co-Lead, Occupational Health Surveillance Work Group, Conference of State and Territorial

» Epidemiologists (CSTE)

» Secretary, Michigan Occupational and Environmental Medical Association (MOEMA)

» Secretary, MOEMA Educational Fund

» Member, Workers' Compensation Research Institute Michigan Advisory Committee

Rowlands, Craig

» US EPA Board of Scientific Counselors ad hoc panel on EPA Transcriptomic Assessment Product (ETAP)

» Board of Directors, Johns Hopkins University, Center for Alternatives to Animal Testing (CAAT)

» Texas A&M University Interdisciplinary Faculty of Toxicology T32 NIEHS Training Program In Regulatory Sciences

» Joint Peer Review Steering Committee (JPRSC) that determines whether chemicals conform to water standards criteria such as NSF/ANSI/CAN 60: Drinking Water Treatment Chemicals.

» American National Standards Institute (ANSI) Standardization Roadmap For Additive Manufacturing, Working Group 5 (WG5) Finished Material Properties

Strakovsky, Rita

» Editorial board member, Nutrition Research

» Editorial board member, Endocrine and Metabolic Science

» Publication committee, American Society for Nutrition

» Ad-hoc grant reviewer, NIEHS Career Development & Pathway to Independence in Biomedical/Clinical Research Study Section

» Ad-hoc grant reviewer, NIH Social and Environmental Determinants

of Health (SEDH) Study Section

Tiedje, James

- Member, Science Advisory Comm for Consortium for Monitoring, Technology, and Verification (Nuclear Non-proliferation)
- Science Advisory Comm for CSIRO (Australia) Future Science Platform - Microbiomes for One System Health
- American Academy of Microbiology, Chair of Colloquium Committee on Microbes and Climate Change
- American Society of Microbiology Steering Comm of Role of Microbes in Mediating Methane Emissions Colloquium
- Advisory Committee, Kansas's NSF Microbiome EPSCoR Project
- Scientific Advisor, Resistomap, a Finnish antimicrobial resistance monitoring company
- Member, NEON's Microbial Technical Working Group

Trosko, James

- Scientific Advisory Board Member, Kangstem Biotech, Seoul, Korea
- Keynote Lecturer, International Colloquium on Gap Junctions and Cancer, "Cellular Communication, Carcinogenesis and Targeted Interventions," Sao Paulo, Brazil
- Lecturer, University of Chungbuk, South Korea, Bio-Pride LMS, Chungbuk Bio-Health Innovation Industry Center

Upham, Brad

- Reviewer/Panel Member, NIH, Fellowship Review Panel: Cell Biology, Developmental Biology, and Bioengineering

Wagner, James

- Chairperson, NIEHS Special Emphasis Panel, Career Development (K99/R00, K01, K08, K23)
- Associate Editor, Inhalation Toxicology
- Editorial Board, Particle and Fibre Toxicology
- Member, Committee for Threshold Limit Values for Chemical Substances (TLV-CS); American Conference of Governmental Industrial Hygienists (ACGIH)

Wu, Felicia

- President, Society for Risk Analysis
- Commissioner of Agriculture and Rural Development for the State of Michigan
- Co-Chair, MSU Provost Search Committee
- United Nations Food & Agriculture Organization (FAO) Scientific Advisory Committee on Livestock Food Security and Nutrition, Member
- Joint Expert Committee on Food Additives (JECFA) of the FAO and World Health Organization (WHO), Member
- WHO Food-Based Dietary Guidelines Committee - Member
- Michigan Chapter Co-President, Harvard University Alumni Network of Harvard Women (ANHW)
- Harvard Agri-Food Board of Directors
- International Union of Pure & Applied Chemistry (IUPAC): US National Academy of Sciences Delegate
- Institute for the Advancement of Food and Nutrition Sciences, Scientific Leadership Council

Zacharewski, Timothy

- Editorial Board, Toxicology & Applied Pharmacology
- Standing Member, Environmental Determinants of Disease (EDD) Study Section
- Advisor - eSTAR Carcinogenomics Gene Signature Development Committee, Health and Environmental Sciences Institute (HESI)

Zagorski, Joseph

- Senior Councilor, Mechanisms Specialty Section of SOT
- Program Planning Committee, Toxicology Forum
- Review Editor, Frontiers in Toxicology – Immunotoxicology

Dr. Felicia Wu Faculty Feature cont.

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mittee. The committee works to make recommendations for optimal health at different stages of life based on food and not nutrients, so the information is more easily accessible in parts of the world where nutrient labels are not always used. Additionally, she served as the President of the Society for Risk Analysis.

Now Wu has come full circle, back to biotechnology – having been appointed as a Co-Chair of the US National Academies of Sciences, Engineering, and Medicine (NASEM) committee on the ethical, legal, and social implications of engineering biology. She is also an invited participant to the 2025 Spirit of Asilomar Conference on the risks and benefits of future biotechnologies – a 50th anniversary meeting of the 1975 Asilomar Conference on the risks of recombinant DNA (rDNA) when it was first discovered. Wu looks forward to continuing her research in foods for human health and also delving further into agricultural biotechnologies and how to make them safe, sustainable, and beneficial for agriculture and human populations.

IIT AFFILIATED FACULTY

Andrea Amalfitano, Dean, College of Osteopathic Medicine, Osteopathic Heritage Foundation Endowed Professor of Pediatrics

Eran R. Andrechek, Professor, Physiology

William D. Atchison, Professor Emeritus, Pharmacology & Toxicology, Neuroscience Program

Jamie J. Bernard, Associate Professor, Pharmacology & Toxicology

Matthew P. Bernard, Associate Professor, Pharmacology & Toxicology, Director, MSU Flow Cytometry Core Facility

Sudin Bhattacharya, Associate Professor, Biomedical Engineering, Pharmacology & Toxicology

Lance K. Blevins, Assistant Professor, Institute for Integrative Toxicology

Leslie D. Bourquin, Professor, Food Science & Human Nutrition

Stephen A. Boyd, University Distinguished Professor, Plant, Soil & Microbial Sciences

Leon H. Bruner, Adjunct Professor, Institute for Integrative Toxicology

John P. Buchweitz, Associate Professor and Toxicology Section Chief, MSU Veterinary Diagnostic Laboratory, Department of Pathobiology & Diagnostic Investigation

Lyle D. Burgoon, Adjunct Associate Professor, Institute for Integrative Toxicology; Director, Center for Existential Threat Analysis; Leader, Bioinformatics and Computational Toxicology

Steven J. Bursian, Professor Emeritus, Animal Science

Stephan A. Carey, Professor & Associate Chairperson, Small Animal Clincial Sciences

Courtney C. Carignan, Assistant Professor, Food Science & Human Nutrition, Pharmacology & Toxicology

Honglei Chen, MSU Foundation Professor, Epidemiology & Biostatistics

Karen Chou, Associate Professor, Animal Science

Rory B. Conolly, Adjunct Professor, Institute for Integrative Toxicology

Bryan L. Copple, Associate Professor, Pharmacology & Toxicology

Andrea I. Doseff, Professor, Physiology, Pharmacology & Toxicology

Susan L. Ewart, Professor, Large Animal Clinical Sciences

Jay I. Goodman, Professor Emeritus, Pharmacology & Toxicology

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Brian D. Gulbransen, MSU Foundation Professor, Physiology, Neuroscience Program

Jack R. Harkema, University Distinguished Professor, Pathobiology & Diagnostic Investigation

Syed A. Hashsham, Professor, Civil & Environmental Engineering; Adjunct Professor, Plant, Soil & Microbial Sciences

A. Wallace Hayes, Adjunct Professor, Institute for Integrative Toxicology

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James E. Jackson, Professor, Chemistry

Brian P. Johnson, Assistant Professor, Pharmacology & Toxicology, Biodmedical Engineering

A. Daniel Jones, Professor, Biochemistry & Molecular Biology

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Yun Liang, Assistant Professor, Physiology, Pharmacology & Toxicology

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Timothy R. Zacharewski, Professor, Biochemistry & Molecular Biology

Joseph W. Zagorski, Assistant Professor, Center for Research on Ingredient Safety

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» Animal Science
» Biochemistry & Molecular Biology
» Biomedical Engineering
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» Veterinary Diagnostic Laboratory

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