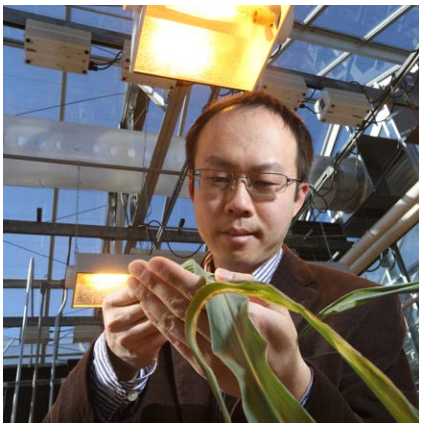
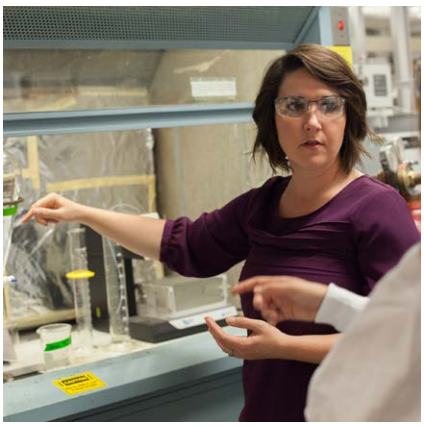
DEPARTMENT OF

AGRICULTURAL AND BIOLOGICAL ENGINEERING



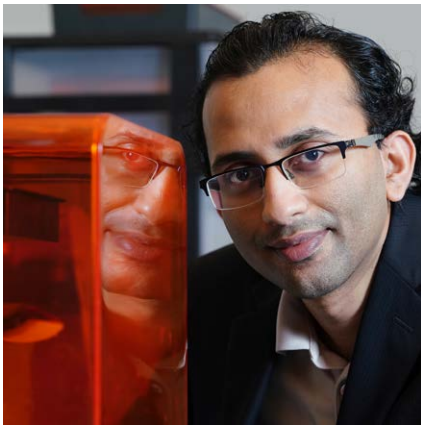
Research Overview

The Department of Agricultural and Biological Engineering (ABE) research focuses on the application of engineering principles to biological systems, resulting the creation of new products and practices that improve the quality of human life. Across the world, we need increased food production, new energy sources, healthcare solutions, and environmentally friendly technologies. ABE reserarch is advancing solutions to grand challenges such as food, energy, water, environment, and health.



Research Areas

- AGRICULTURAL SYSTEMS, SAFETY, AND HEALTH
- BIOLOGICAL ENGINEERING
- DATA SCIENCE AND DIGITAL AGRICULTURE
- ENVIRONMENTAL AND NATURAL RESOURCES ENGINEERING
- FOOD, PHARMACEUTICAL, AND BIOLOGICAL PROCESS ENGINEERING
- MACHINE SYSTEMS ENGINEERING



Research Centers

- LABORATORY OF RENEWABLE RESOURCES ENGINEERING [LORRE]
- THE MAHA FLUID POWER RESEARCH CENTER

Pictured at left from top: Dr. Keith Cherkauer, Dr. Jian Jin, Dr. Abigail Engelberth, Dr. Mohit Verma and Dr. Andrea Vacca

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Agricultural Research and Graduate Education

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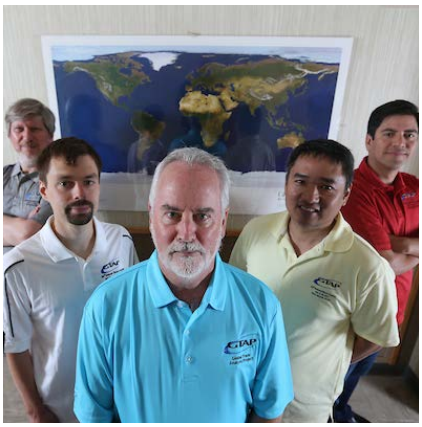
07.2024 EA/EO

DEPARTMENT OF

AGRICULTURAL ECONOMICS



Research Overview

The mission of the Department of Agricultural Economics is to acquire and transmit new economic knowledge to the citizens of Indiana, the nation, and the world to support more informed decisions.

Research Areas

- AGRIBUSINESS
- PRICES AND MARKETS
- PRODUCTION/FARM MANAGEMENT
- AGRICULTURE POLICY
- ENVIRONMENTAL/ENERGY/RESOURCES
- INTERNATIONAL TRADE AND DEVELOPMENT
- REGIONAL AND SPATIAL ECONOMICS
- SMALL BUSINESS/COMMUNITY DEVELOPMENT

"The Global Trade Analysis Project's (GTAP) network connects the department with over 12,500 policy analysts and researchers worldwide."

Research Centers

- CENTER FOR COMMERCIAL AGRICULTURE
- CENTER FOR FOOD & AGRICULTURAL BUSINESS
- CENTER FOR FOOD CONSERVATION AND WASTE REDUCTION
- CENTER FOR FOOD DEMAND ANALYSIS & SUSTAINABILITY
- CENTER FOR GLOBAL TRADE ANALYSIS (GTAP)
- CENTER FOR RURAL DEVELOPMENT
- DIGITAL INNOVATION IN AGRI-FOOD SYSTEMS LABORATORY
- INDIANA COUNCIL FOR ECONOMIC EDUCATION
- NORTH CENTRAL REGIONAL CENTER FOR RURAL DEVELOPMENT
- PURDUE INSTITUTE FOR FAMILY BUSINESS
- STATE UTILITY FORECASTING GROUP

Pictured at left from top: Dr. Mindy Mallory, Dr. Maria Marshall, Dr. Dominique van der Mensbrugghe with GTAP staff, Dr. Farzad Taheripour and Dr. Nicole Olynk-Widmar

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DEPARTMENT OF

ANIMAL SCIENCES

Research Overview

Animal Sciences focuses on research and technology transfer for efficient and sustainable production of high quality animal products optimizing animal well-being, enhancement of the human diet, and advancement of sound environmental practices.

Our faculty has expertise in the disciplines of growth and development, nutrition, breeding and genetics, physiology, management, and animal well-being and behavior.

Research Areas

ANIMAL PRODUCTION & MANAGEMENT SYSTEMS

- Nutrient Utilization
- Environmental Stewardship
- Efficiency Production
- Food Animal Product Development
- Animal Behavior and Welfare
- Improvement in Reproduction
- Genomic Selection
- Physiology
- Facility Design

GENE REGULATION, STEM CELL & DEVELOPMENTAL BIOLOGY

- Quantitaive Genetics
- Genomics
- Transgenic Biology
- Comparative Animal Health & Disease

MOLECULAR ANIMAL PHYSIOLOGY & METABOLISM

- Nutrient Utilization & Partitioning
- Digestive Physiology & Absorption
- Obesity/Diabetes
- Tissue Growth Regulation
- Physiology of Reproduction & Lactation
- Meat Science and Muscle Biology

FOOD QUALITY & FOOD SAFETY

- Pre-harvest Intervention Strategies
- Microbiome Systems
- Stress and Immunology
- Enhanced Nutrient Profiling

Pictured at left from top: Beef cattle at ASREC, Dr. Luiz Brito, Dr. Kola Ajuwon, Dr. Marisa Erasmus and Dr. Paul Ebner.

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DEPARTMENT OF

AGRONOMY

Research Overview

The mission of the Department of Agronomy is use science and technology to improve plants, soils, and our predictive ability to anticipate the impact of the environment on production. The department is fully integrated across the teaching, Extension and research which allows us to address agriculture's most pressing problems. Our students become agronomist who understand crop production, plant genetics, soil health, digital/precision agriculture, or landscape hydrology. They all have a goal of achieving efficient and sustainable agricultural production.

Research Areas

CROPS AND THE CHANGING ENVIRONMENT

Helping Feed the World Population. Gebisa Ejeta, Distinguished Professor of Agronomy, received the World Food Prize for developing drought- and parasitic weed- resistant sorghum varieties.

Enhancing Nutritional Quality. Hold promise to combat nutritional deficiency in developing countries and macular degeneration in the elderly. Agronomy plant scientists have helped to find a way to change nutritionally weak corn into corn that's rich in provitamin A carotenoids which the body converts into vitamin A.

SOIL AND LAND USE

Helping Farmers Improve Soil Health. Help famers improve soil health and resilience by integrating cover crops and no-till into their production systems. Such systems contribute to long-term sustainability.

Creating Tools that Improve Land Use & Ecosystem Services. Develop mapping, assessment and prediction tools to improve land use and increase crop yields, biomass productions, and community planning.

WATER, AIR AND CLIMATE

Helping to Improve Water Quality. Conduct water-quality monitoring studies to assess contaminant sources and design best management and remediation tools.

Saving Lives with Improved Weather Forecasting Technology. The Indiana Climate Office is the state archive of official daily and hourly weather observations recorded throughout Indiana and works in a predictive manor by using historical data to create predictive tools for the future.

Pictured at left from top: Dr. Dan Quinn, Dr. Laura Bowling, Dr. Eileen Kladivko, Dr. Gebisa Ejeta, and Dr. Ron Turco

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Unmanned aerial vehicle

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DEPARTMENT OF

AGRICULTURAL SCIENCES EDUCATION AND COMMUNICATION

Research Overview

ASEC faculty are experts in learning, communication, and public engagement. Faculty conduct research to enhance the effectiveness of formal and informal education and communication programs. A major goal is building capacity to effectively teach lifelong learners across all socioeconomic contexts, improving the quality of life for youth and adults in Indiana and throughout the world. ASEC faculty have expertise in specialized fields such as science communication, career development, experiential learning, STEM integration, and engagement of underserved populations. Our disciplinary bases span animal and plant science, education, educational psychology, communication, and sociology.

Research Areas

- PUBLIC ENGAGEMENT AND SCIENCE COMMUNICATION
- DECISION-MAKING AND RISK COMMUNICATION
- AGRICULTURAL EDUCATION
- EXTENSION EDUCATION
- PK-12 ENGAGEMENT
- TECHNOLOGY-MEDIATED TEACHING OF LIFE SCIENCE TOPICS
- EDUCATIONAL ACCESS AND EQUITY
- STEM CAREER DEVELOPMENT
- INTENTIONAL AND INCLUSIVE MENTORING
- TEACHING INTEGRATED STEM WITH FOOD AND AGRICULTURE AS A CONTEXT
- INTERNATIONAL ENGAGEMENT
- PROGRAM DEVELOPMENT AND EVALUATION

Dr. Hui-Hui Wang's research revolves around integrated STEM concepts and practices in K-12 formal and non-formal education programs using agriculture, food and natural resources as both content and context.

Pictured at left from top: Dr. Sarah LaRose, Dr. Rama Radhakrishna, Dr. Mark Tucker, Dr. Neil Knobloch, and Dr. Mark Russell

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Faculty Members and Areas of Expertise

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Effective communication and education using a systems approach towards understanding and solving the "last mile" problem of delivering science education across cultures, languages, literacy levels, technologies, and institutional networks.

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Informal science education; assessment of educational needs; development and implementation of effective electronic-based methods.

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Informal learning and curriculum development for youth; experiential learning in environmental and natural resource topic areas.

Neil Knobloch, *Professor - Ag+STEM Education*
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Experiential learning; culturally relevant learner-centered teaching and mentoring strategies; integrated STEM education; food systems thinking; teacher and student motivation; K-20 engagement and career development of underrepresented minorities in agricultural STEM disciplines; assessment of outcomes and impact in K-12 and higher education.

Sarah LaRose, *Associate Professor - Agricultural Education; C&I*
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Strategies that agricultural educators and universities can implement to increase outcomes of skilled agricultural workers, innovators, and agriculturally literate citizens capable of engaging the public in conversations about controversial issues.

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Multicultural education; diversity awareness; intercultural effectiveness and communication; service learning methods.

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Boundary spanning; higher education community partnerships; community engagement; engaged scholarship; positive youth development; program development; military youth and vulnerable populations, quantitative and survey design.

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Science communication (communicating science to non-scientists); specializing in psychological factors that influence message perception/reception, risk perception, and utilizing messaging to engage the public in science.

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Mark Tucker, *Professor - Agricultural Communication*
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Hui-Hui Wang, *Associate Professor - Extension Education; C&I*
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Integrated STEM concepts and practices in K-12 formal and non-formal education programs using agriculture, food and natural resources as both content and contexts; research-based integrated STEM through AFNR teacher education, and curriculum and instruction design to engage K-12 students' scientific reasoning and knowledge application.

DEPARTMENT OF

BIOCHEMISTRY

Research Overview

The Department of Biochemistry is committed to basic research and training undergraduate and graduate students for careers in biochemistry, molecular biology, medicine, health sciences, and other science-related careers. Our faculty, graduate students, and staff are located in the Biochemistry Building with additional offices and laboratories in the Hansen Life Science Research Building, Whistler Agricultural Research Building and Hockmeyer Hall of Structural Biology.

The research programs of the department span fundamental plant and biomedical biochemistry.

Research Areas

- METABOLIC AND NATURAL PRODUCT BIOCHEMISTRY
- OMICS: GENOMICS, PROTEOMICS AND METABOLOMICS
- CANCER BIOCHEMISTRY
- EPIGENETICS AND GENE EXPRESSION
- STRUCTURE, DYNAMICS AND FUNCTION OF BIOLOGICAL MACROMOLECULES
- BIOINFORMATICS AND COMPUTATIONAL GENOMICS

Affiliated Units

- PURDUE CENTER FOR CANCER RESEARCH
- INSTITUTE OF DRUG DISCOVERY
- CENTER FOR PLANT BIOLOGY
- INSTITUTE FOR INTEGRATIVE NEUROSCIENCE
- BINDLEY BIOSCIENCES CENTER
- INSTITUTE FOR INFLAMMATION, IMMUNOLOGY AND INFECTIOUS DISEASE

Pictured at left from top: graduate student Mackenzie Chapman, postdoc Pan Liao, Dr. Joe Ogas with students, postdoc Mohd Saleem Dar, and Dr. Mark Hall's lab group

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Faculty and Research Areas

Scott Briggs sdbriggs@purdue.edu
Epigenetics, Antifungal Drug Resistance and Fungal Pathogenesis

Clint Chapple chapple@purdue.edu
Biochemistry and molecular biology of plant secondary metabolism

Kyle Cottrell cottrellka@purdue.edu
RNA editing, post-transcriptional regulation, and cancer

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Plant Genetics

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Plant biochemistry and molecular biology

James Forney forney@purdue.edu
Regulation of differentiation in protozoa

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Structural basis for RNA function

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Regulation of DNA methylation in development and disease

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Cell cycle regulation and fungal pathogenesis

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Research area: Studying gene regulation in viral associated cancers, autoimmune disorders, and infectious diseases

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Epigenetic processes that mediate heritable modifications to chromatin

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Roles and regulations of ubiquitin-proteasome dependent protein degradation

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Gene-to Lead Drug Discovery

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Regulation of cell identity, signal transduction, chromatin remodeling

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Genetic and molecular control of photosynthetic light utilization

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Proteomics and biological mass spectrometry

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RNA helicases and Post-transcriptional gene regulation

Feng Wang
Molecular mechanisms of RNA-mediated gene silencing

Vikki Weake vweake@purdue.edu
Chromatin modifying complexes in Drosophila development as a model for neurodegenerative disease and cancer

Jen Wisecaver jwisecav@purdue.edu
The evolution of eukaryotic chemodiversity using genomics and phylogenetics

CLINICAL TEACHING FACULTY

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Clinical Associate Professor

RESEARCH FACULTY

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Molecular mechanisms of aging and neurodegenerative disease, with focus on gene expression regulation, R-loop biology, and RNA epigenetics.

JOINT/COURTESY APPOINTMENT FACULTY

Seema Mattoo smattoo@purdue.edu
(Biochemistry, Signal Transduction, and Microbiology) Investigation of Fic domain containing proteins in Cellular Signaling. Post-translational modification of proteins is a common theme in signal transduction.

John Morgan jamorgan@purdue.edu
Metabolic engineering of photosynthetic microbes and mathematical modeling of metabolism and transport of plant volatiles

Pete Pascuzzi ppascuzz@purdue.edu
Bioinformatics; research data management; chromatin organization; DNA replication

DEPARTMENT OF

BOTANY AND PLANT PATHOLOGY

Research Overview

The Department of Botany and Plant Pathology includes the disciplines of plant biology, plant pathology and weed science. Research in this department addresses both fundamental questions about the biology of plants and their pathogens as well as more applied problems focused on the management and control of weeds and plant diseases.

Research Programs

- CELL AND DEVELOPMENTAL BIOLOGY
- CROP PROTECTION
- DISEASE MANAGEMENT AND EPIDEMIOLOGY
- MYCOLOGY
- PLANT AND FUNGAL BIOCHEMISTRY
- PLANT ECOLOGY AND EVOLUTION
- PLANT GENETICS AND GENOMICS
- PLANT NEMATOLOGY
- PLANT PHYSIOLOGY
- PLANT-PATHOGEN INTERACTIONS
- WEED BIOLOGY
- WEED MANAGEMENT

Pictured at left from top: Dr. Daniel Szymanski, Dr. William Johnson, Dr. Jin-Rong Xu, Dr. M. Catherine Aime and Dr. Tesfaye Mengiste

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Faculty by Research Area

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Anjali Iyer-Pascuzzi is one of the first to examine the molecular processes that underlie infection by soil microbes.

Chris Oakley's research is driven by understanding the mechanisms of how natural plant populations adapt to local conditions.

PLANT PATHOLOGY

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DEPARTMENT OF

ENTOMOLOGY

Research Overview

The Department of Entomology's research portfolio consists of basic science that builds on strengths in insect biodiversity, insect-plant interactions, and applied pest management research focused on stakeholder needs and priorities. We work on a range of insect problems using diverse toolsets and varied disciplinary approaches.

Research Areas

- HOST PLANT-INSECT INTERACTIONS
- ARTHROPOD MOLECULAR BIOLOGY & GENOMICS
- INTERNATIONAL COOPERATION & DEVELOPMENT
- ENVIRONMENTAL & EVOLUTIONARY ENTOMOLOGY
- INSECT SCIENCE EDUCATION
- INTEGRATED PEST MANAGEMENT
- FORENSICS

Research Centers

- CENTER FOR ENVIRONMENTAL AND REGULATORY INFORMATION SYSTEMS (CERIS)
- CENTER FOR URBAN AND INDUSTRIAL PEST MANAGEMENT (CUIPM)
- NATIONAL AGRICULTURAL PEST INFORMATION SYSTEM (NAPIS)
- NATIONAL PESTICIDE INFORMATION RETRIEVAL SYSTEM (NPIRS)
- NATIONAL PLANT DIAGNOSTIC NETWORK (NPDN)
- PURDUE ENTOMOLOGICAL RESEARCH COLLECTION(PERC)

Pictured at left from top: a Varroa mite on a bee, Dr. Laura Ingwell, Dr. Catherine Hill, Dr. Linda Mason and Dr. Christian Krupke

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Signature Research Areas

I	Host Plant-Insect Interactions
II	Arthropod Molecular Biology & Genomics
III	International Cooperation & Development
IV	Environmental & Evolutionary Entomology
V	Insect Science Education
VI	Integrated Pest Management
VII	Forensics

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Field Crop Pest Management

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Horticultural Entomology

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Behavior, Food Pest IPM

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Plant-Insect Interactions

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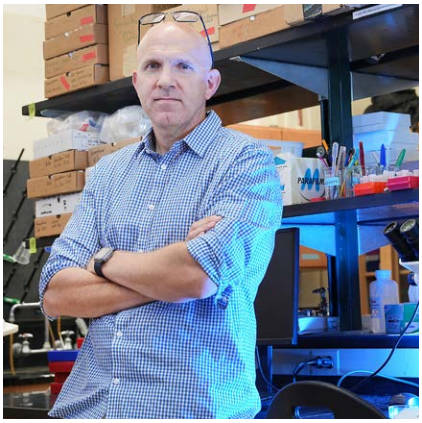
Plant-Nematode Interactions

DEPARTMENT OF

FORESTRY AND NATURAL RESOURCES



Research Overview

Research in Forestry and Natural Resources is focused on discovering new knowledge that advances the science, management, and sustainable use of natural resources. Strong interdisciplinary research addresses current issues in forest, wildlife, and fisheries management, as well as the ecology of natural systems, digital tools for assessing natural resources, genetics, hardwood products innovations, and social science in natural resource decisions. Research groups focus on:

FOREST SCIENCE

Advancing basic knowledge about forest ecosystems, as well as the physiology, genetics, and growth of hardwood trees, with the goal of providing healthy and sustainable forests in the Central Hardwood Region, including both in rural and urban settings.

WILDLIFE SCIENCE

Increasing and disseminating knowledge about key wildlife species, populations, and communities, and understanding how they relate to ecosystem structure and functioning as well as to environmental changes.

FISHERIES & AQUATIC SCIENCE

Developing and disseminating knowledge about aquatic animals and their habitats, including aquaculture, interactions between aquatic and terrestrial ecosystems, and the fates and effects of pollutants, as well as appropriate management practices for the protection and use of aquatic ecosystems.

ECOLOGY OF NATURAL SYSTEMS

Developing knowledge of factors influencing complex interactions in ecological systems at multiple scales of biological organization, ranging from physiological to community and eco-region units, with an emphasis on effects of human-related drivers such as climate and land-use change, as well as tactics for restoring and conserving ecological processes.

GENETICS

Applying advanced molecular and analytical methods to a variety of genetic questions (e.g., genetic diversity, relatedness, heritability) in populations of important wildlife and tree species.

DIGITAL NATURAL RESOURCES

Developing integrated systems of quantitative techniques for assessing and analyzing forest and associated ecosystems. Efforts focus on advancing quantitative methods related to statistical, simulation, and analytical modeling of natural systems at varying spatial and temporal scales.

NATURAL RESOURCE SOCIAL SCIENCE

Studying the social, political, and economic implications of alternative public policies with regard to the protection, management, and use of natural resources. The awareness, attitudes and behaviors of individuals and groups as these relate to natural resource management are also explored.

HARDWOOD PRODUCTS INNOVATIONS

Assisting hardwood products industry in developing new knowledge for reducing raw material costs, improving processing technologies, and encouraging innovation in product development through science and engineering.

Pictured at left from top: Dr. Brady Hardiman , Dr. Liz Flaherty, Dr. Tomas Höök, and Dr. Eva Haviarova

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Research Centers and Institutes

- CENTER FOR GLOBAL SOUNDSCAPES
- HARDWOOD TREE IMPROVEMENT AND REGENERATION CENTER (HTIRC)
- ILLINOIS-INDIANA SEA GRANT PROGRAM (IISG)
- INSTITUTE FOR DIGITAL FORESTRY
- TROPICAL HARDWOOD TREE IMPROVEMENT AND REGENERATION CENTER (TROPHTIRC)

Songlin Fei, director of the Institute for Digital Forestry, has been a pioneer in the use of remote sensing.

Faculty and Research Areas

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DEPARTMENT OF

FOOD SCIENCE

Research Overview

The Department of Food Science is committed to impacting the world food system and quality of life by educating and training students for careers in industry, government, and academia. Our mission is to engage in discovery-driven activities leading to innovative learning and outreach that: enhances health, safety, quality, and sustainability of foods; prepares the next generation of leaders in food science; and addresses stakeholder needs. The Department of Food Science has developed four key areas of expertise, each with several major thrusts.

Research Areas

FOOD CHEMISTRY, STRUCTURE, AND FUNCTION

Identifies and creates new aspects of composition, structure, and other functional properties of whole foods and food constituents using chemistry, biochemistry, and material sciences to improve the quality, nutrition, affordability, stability, and sustainability of food and food-related products

FOODS FOR HEALTH

Applies food and biological science principles to the study of whole foods, macro- and micro-nutrients, and bioactive components as a means to improve consumer health and identifies mechanisms by which these effects arise (such as the molecular interactions of food components in biological systems and the role of the gut microbiome)

FOOD PROCESSING & TECHNOLOGY DEVELOPMENT

Integrates engineering, chemistry, nanotechnology, environmental sciences, and microbiology through food processing operations to produce safe, nutritious, sustainable, and value-added products

FOOD SAFETY AND MICROBIOLOGY

Studies pathogenic, beneficial (probiotic and fermentative), and spoilage microbes and their interaction with food and the host, and develops novel inactivation and detection methods for pathogens

Pictured at left from top: Dr. Lavanya Reddivari, Dr. Stephen Lindemann, Dr. Haley F. Oliver, Dr. Bruce R. Hamaker and Dr. Eun Joong Oh

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Faculty by Research Area

FOOD CHEMISTRY, STRUCTURE, AND FUNCTION

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FOODS FOR HEALTH

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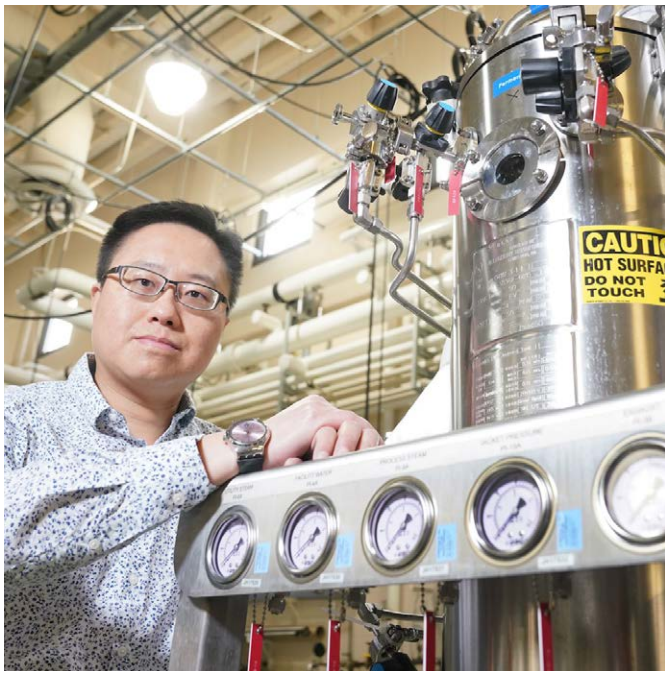
Dr. Lisa Mauer's research is aimed at improving the delivery of thiamin in food products. Their goals are to identify all factors that impact the stability of thiamin in food products (including those containing whole and refined wheat, rice, and corn) from production to storage, and to determine if new, more stable, salt forms of thiamin can be produced.



Dr. Jen-Yi Huang, Associate Professor of Food Science

FOOD PROCESSING & TECHNOLOGY DEVELOPMENT

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FOOD SAFETY AND MICROBIOLOGY

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DEPARTMENT OF

HORTICULTURE & LANDSCAPE ARCHITECTURE

Research Overview

Horticulture applies knowledge from fields of science and biology to improve production and develop sustainable practices for high value, intensively cultivated crops including those used for food, landscapes, ornamentals and medicine. In Landscape Architecture, we analyze, plan, and design the natural and built environment using science, art, and technology.

Combining knowledge from biochemistry, physiology, molecular biology, genetics and ecology with aspects of design, function, and beauty, horticulture and landscape architecture includes people with a broad range of interests.

Research Areas

- Sustainable practices for horticultural crop production
- Alternative crops and cultivars adapted to low-input and organic production systems
- Improvement of postharvest fruit quality
- Controlled environment agriculture
- Herbicide physiology, weed ecology, and mechanisms of herbicide resistance
- Plant interactions with soil microbial communities
- Plant growth and development
- Plant responses to the environment and abiotic stress
- Adapting crops to climate change
- Epigenetic regulation
- Genome editing
- Systems biology
- Plant metabolic biochemistry
- Plant natural product discovery
- Landscape systems and design; land use and planning; landscape ecology
- Plant Nutrition
- Drought Tolerance and Water Management
- Horticultural marketing
- Horticultural education

Pictured at left from top: Dr. Lori Hoagland, Dr. Paul Siciliano Jr, Dr. Aaron Patton, Dr. Ariana Torres and a Horticulture greenhouse at night

LINDA PROKOPY
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Josh Widhalm studies sea slugs to understand how some of the creatures are able to steal the organelles necessary for photosynthesis from the algae they eat.

Faculty Research Areas

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