WELCOME
TO PURDUE

PURDUE UNIVERSITY®

Department of Biological Sciences

Game-changing discoveries, life-changing education- from atoms to ecosystems.

In the Department of Biological Sciences we are responsive to challenges that appear suddenly and need immediate attention – because we prepare persistently for the moments when our knowledge can lead the way. We are the largest department in the life sciences at Purdue University with degree-granting programs that cover the breadth of biology:

Microbiology, Immunology and Infectious Disease (MIID)
Neuroscience and Physiology (NP)
Ecology and Evolutionary Biology (EEB)
Cell and Molecular Biology (CMB)
Biology Education (BE)
Structural and Computational Biology and Biophysics (SCBB)
Genomics, Multinomics & AI (GEM-AI)

We believe that STEM education and careers should be inclusive and accessible. We are deeply committed to mentoring our students and helping them apply their knowledge and develop the skills needed to become leaders in the scientific workforce.

PEOPLE · SCIENCE · DISCOVERY

World renown research programs and award winning faculty

As part of the College of Science, we have capacity for cross-disciplinary partnerships that encourage undergraduate research experiences and empower graduate students who work and publish with renowned faculty. The diverse nature of biological sciences lends itself to collaborations in the physical sciences, agriculture, engineering, education and computational sciences. Partnerships abound as researchers from across campus work together to solve today's toughest challenges.

Encompassing six research area concentrations, the Department fosters a culture supporting collaborations linking faculty, post–doctoral researchers, graduate students, and undergraduates with colleagues both within Purdue University as well as nationally and internationally. The diverse nature of the Biological Sciences provides endless opportunity for cross-discipline partnerships with other research enterprises including those in the physical sciences, agriculture, engineering, education, and computational sciences.

Additionally, the Department has taken a leading role in establishing the research directions of two new Purdue Institutes. The Purdue Institute for Integrative Neuroscience (PIIN) was led by Professor Donna Fekete and the Purdue Institute of Inflammation, Immunology and Infectious Disease (PI4D) is led by Professor Richard Kuhn. The mission of these institutes is to advance the biological knowledge and clinical capabilities required to address the health issues associated with aging, neurodegeneration, neurotrauma, inflammation, infection, autoimmune disease, and cancer.

Across all areas of learning, discovery, and engagement, this is an exciting period for the Department of Biological Sciences.

We welcome the opportunity to share our stories with you!

BIOLOGY AT THE ATOMIC SCALE

Structural and Computational Biology and Biophysics
(SCBB)

Dr. Daisuke Kihara (Area Convener)

Welcome to the Structural and Computational Biology and Biophysics Research Area! Faculty in our area study structures, interactions, functions, and functional mechanisms of macromolecular structures and biological systems using a wide variety of experimental approaches ranging from X-ray crystallography, NMR, cryo-electron microscopy, electron tomography, and advanced spectroscopic techniques, and computational methods. It is truly fascinating to determine and observe macromolecular 3D structures by experiments and mechanistically understand how macromolecules function. It is also very exciting to design and use computational methods to model protein structures and interactions and analyze proteomics and genomics data to understand biological systems on a large-scale. We are all delighted to share our findings, knowledge, and experience in research with you. We are looking forward to meeting you!

Research focus for SCBB include topics like:

- The structure and mechanism of proteins, and RNA enzymes, protein complexes, viruses, plant cell walls

- Structure-based drug design

- Experimental and computational investigation of macromolecular interactions

- Regulation of gene expression by epigenetic mechanisms

- Genomics, transcriptomics, proteomics, and computational systems biology at the interface of experiment and computation

Graduate students in this area come from diverse backgrounds, since few undergraduate programs provide training in areas such as structural or computational biology. We provide training to students with undergraduate backgrounds ranging from biology and molecular biology to chemistry, physics, and computer science, and encourage applications from students with backgrounds outside of traditional biology programs.

SCBB FACULTY

Faculty and students in the group participate in a large number of interdisciplinary activities and shared resources including the Purdue Cryo-EM Facility, Purdue Institute for Cancer Research (PICR), Center for Basic and Applied Membrane Sciences, Energy Center, the Purdue Institute of Inflammation, Immunology, and Infectious Disease (PI4D), the Bindley Bioscience Center, and the Markey Center for Structural Biology. Major extramural funding for research is provided by the NIH, the NSF, the USDA and numerous private foundations and industry partners.

Faculty members of SCBB include:

- Peristera Paschou, Professor and Dept. Head
- Richard Kuhn, Distinguished Professor
- Carol Post, Distinguished Professor
- John Tesmer, Distinguished Professor
- Andy Mesecar, Distinguished Professor
- Ramaswamy Subramanian, Professor
- Cynthia Stauffacher, Professor
- Daisuke Kihara, Professor
- Michael Gribskov, Professor
- Barbara Golden, Professor (by courtesy)
- David Sanders, Associate Professor
- Angeline Lyon, Associate Professor
- Nicholas Noinaj, Associate Professor
- Leifu Chang, Associate Professor
- Lauren Ann Metskas, Assistant Professor
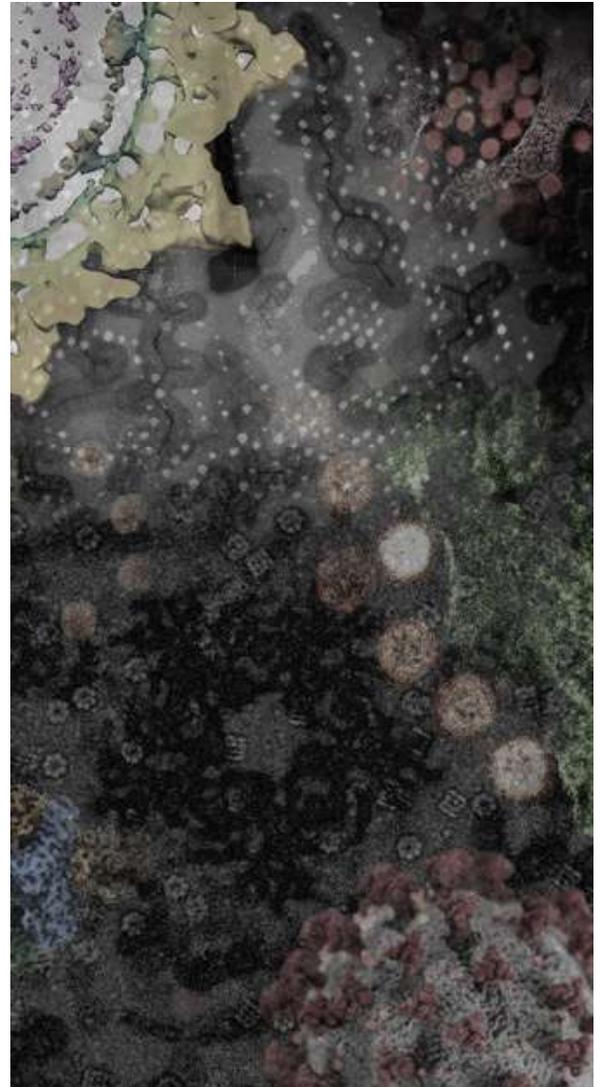
FACULTY SPOTLIGHT: *DR. LAUREN ANN METSKAS*

The Metskas lab is interested in how proteins assemble into ultrastructures in order to perform specific functions. These ultrastructures may be as simple as enzyme polymerization, or as complex as an entire virus, but they combine the intrinsic properties and motions of their subunits in order to perform a complex function that a single unit would not be capable of. We use cryo-electron tomography to visualize ultrastructures in their native environment, and subtomogram averaging to build higher-resolution maps of the subunits. We then use the information on the protein positions and orientations to build biophysical models of the functioning ultrastructure.

BIOLOGY
OF
EVOLUTION
AND LIFE

Ecology and Evolutionary Biology (EEB)

Dr. Mark Christie (Area Convener)

The Ecology and Evolutionary Biology Research Area is a dynamic and cohesive research and teaching community. Our focal research areas are Animal Behavior and Sensory Ecology, Ecological and Evolutionary Consequences of Human Impacts, Ecology of Emerging Infectious Diseases, and Evolutionary Genomics.

We use laboratory, field, and computational methods to study individuals, populations and communities in Indiana and around the world, and we strive to contribute to the important role of life scientists in effectively communicating biological principles in the classroom and beyond. A large portion of the research we do is at the Ross Biological Reserve, which is a short drive from campus.

The EEB community maintains a strong commitment to graduate and undergraduate education and training in the biological sciences.

Research focus for EBB include topics like:
- Area includes avian visual and auditory systems
- Evolutionary genetics and life history evolution
- Host-parasite interactions and evolution
- Dynamics of disease transmission
- Evolution of specialization
- Biological invasions
- Ecological impacts of climate change
- Restoration ecology and genetics

Our courses provide a firm academic foundation for our students, and our research programs provide opportunities for both graduate and undergraduate students to develop skills in a broad range of methodological approaches. Graduate students in our area work closely with faculty mentors on a diverse range of projects that may be directly aligned with their advisor's research program or designed primarily by the student.

EBB FACULTY

Faculty and students are also actively involved with other researchers at Purdue and beyond who have overlapping interests, including other departments in the Colleges of Science , Health and Human Sciences, and Agriculture, and the Center for the Environment(C4E), and the Purdue Climate Change Research Center (PCCRC).

Faculty members of EEB include:

- Ximena Bernal, Professor
- Mark Christie, Professor
- Andrew DeWoody, Professor (by courtesy)
- Esteban Fernández-Juricic, Professor
- Jeff Lucas, Professor
- Catherine Searle, Associate Professor
- Qixin He, Assistant Professor
- Brian Metzger, Assistant Professor
- Sergio Muñoz-Gómez, Assistant Professor
- Gordon NcNickle, Assistant Professor
- Dylan Wainwright, Assistant Professor
- Denise Zielinski, Senior Lecturer
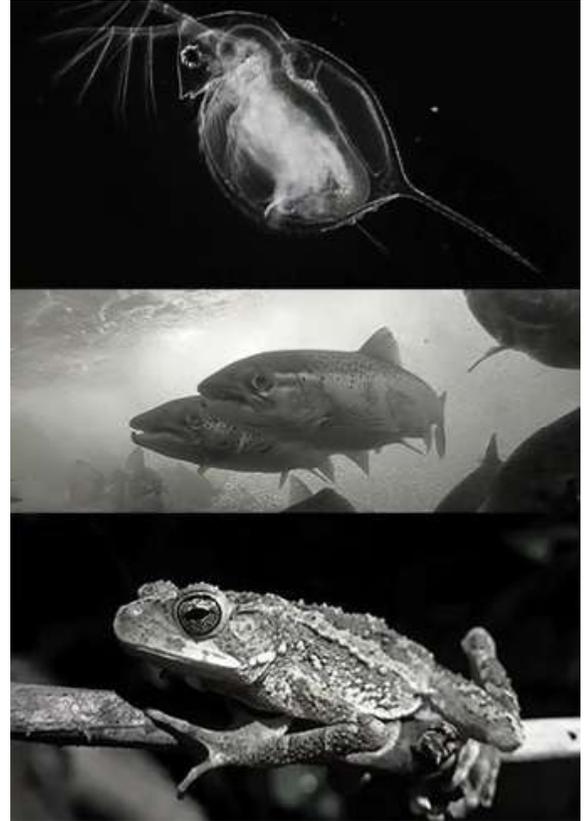
FACULTY SPOTLIGHT: *DR. BRIAN METZGER*

Dr. Metzger's lab works on the evolution and genetic basis of regulatory differences between distantly related species. His lab uses genomic approaches to systemically determine the number, identity, and effects of genetic differences between species. His lab replicates these historical changes within the laboratory using experimental evolution to generate a broader understanding of the genetic mechanisms underlying the emergence and evolution of these ancient regulatory changes.

FACULTY SPOTLIGHT: *DR. DYLAN WAINWRIGHT*

The Wainwright lab works on functional morphology and biomechanics using a combination of approaches such as 3D imaging, biomechanical performance testing, and comparative studies across species. To that end, his lab tends to work on bony fishes to better understand connections between form, function, and evolution. Dr. Wainwright's group values diverse opinions, cultures, and backgrounds and believes that inclusive and diverse groups create more supportive and effective work environments.
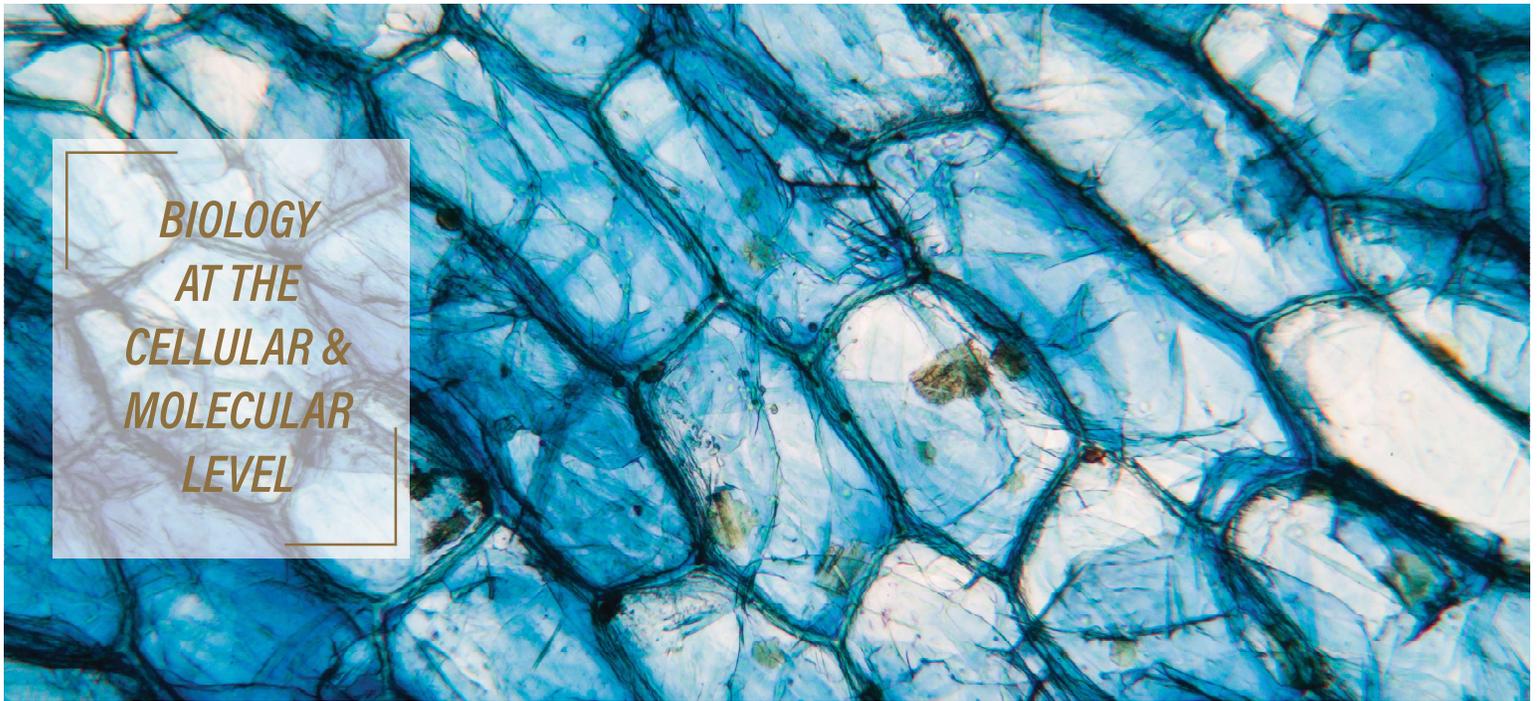
BIOLOGY
AT THE
CELLULAR &
MOLECULAR
LEVEL

Cell and Molecular Biology (CMB)

Dr. Claudio Aguilar (Area Convener)

The CMB research area is interested in understanding the molecular basis of both normal and abnormal cell and tissue biology. We have labs working on cancer biology and therapeutics, epigenetics, signal transduction, vesicular trafficking, cellular architecture, cell migration, plant biology, and bioenergetics. We investigate these topics with multidisciplinary approaches, including techniques in cell signaling and differentiation, molecular biology, proteomics, genomics and genetics, and live and advanced cell imaging.

The CMB group has a strong commitment to enhancing the educational experience of our students. We offer a host of graduate level courses to prepare students to tackle thesis research projects in many aspects of modern biomedical or plant sciences. If needed, we encourage our students to broaden their coursework to other departmental areas such as bioinformatics, structural biology and biophysics, organismal biology, neuroscience and behavior, evolutionary biology or bioremediation.

Our research activities are diverse and collaborative in nature, and our interactions span well beyond the Department of Biological Sciences. We have on-campus colleagues in the Purdue Center for Cancer Research, Purdue Center for Plant Biology, Purdue Institute on Inflammation, Immunology and Infectious Disease, Purdue Institute for Integrative Neuroscience, Purdue Institute for Drug Discovery, Bindley Bioscience Center, and departments in the College of Engineering (Biomedical Engineering, Chemical Engineering), the College of Science (Chemistry), and the College of Agriculture. Off campus, we also have collaborators all over the country and world.

This is an exciting time in CMB research. Technical and theoretical breakthroughs are opening the possibility of developing powerful applications and molecular cures for human diseases.

Welcome to our area and consider joining us on our journey!

CMB FACULTY

Our research area brings together faculty, postdoctoral fellows, and students with interests in revealing the molecular bases of both normal and abnormal cell and tissue biology. Experimental approaches in cell signaling and differentiation, molecular biology, proteomics, genomics and genetics, and advanced cell imaging are interwoven throughout these major focus areas.

Faculty members of CMB include:

- Stan Gelvin, Distinguished Professor
- Chris Staiger, Distinguished Professor
- Qing Deng, Professor
- Janice Evans, Professor
- Andrea Kasinksi, Professor
- Daniel Suter, Professor
- Daniel Szymanski, Professor
- Claudio Aguilar, Associate Professor
- Henry Chang, Associate Professor
- Angeline Lyon, Associate Professor
- Seema Mattoo, Associate Professor
- Brittany Allen-Petersen, Assistant Professor
- Jason Hanna, Assistant Professor
- Brian Metzger, Assistant Professor
- Sergio Muñoz-Gómez, Assistant Professor
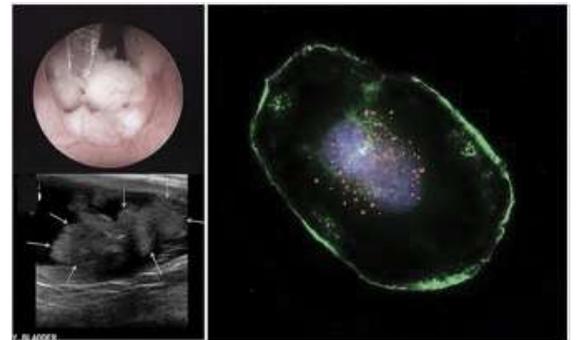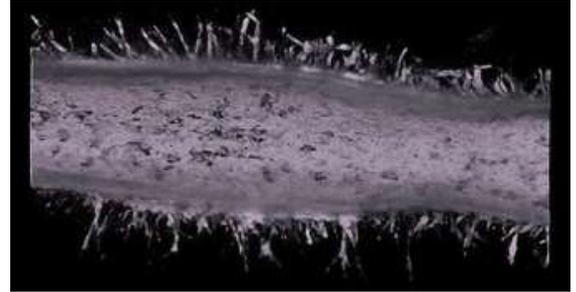
FACULTY SPOTLIGHT:
DR. SERGIO MUÑOZ-GÓMEZ

The Muñoz-Gómez lab combines experimental, computational, and theoretical approaches to address questions about the origin and evolution of mitochondria and eukaryotes, and intracellular symbiosis among microorganisms. Most recently, his interests in the origin of mitochondria have led him to the exploration of exceedingly rare symbioses with purple bacteria in nature. It is possible that the study of these symbioses might, by analogy, shed light on how mitochondria first evolved from ancestors that resembled purple bacteria.

BIOLOGY IN THE CLASSROOM & BEYOND

Biology Education (BE)

Dr. Stephanie Gardner (Area Convener)

If a faculty position that involves great scholarly teaching is your hope or ambition, our BE area will help you achieve a competitive edge. BE is for everyone who is interested in teaching, in teaching-related research, or in understanding the importance of community, a sense of belonging, and cultural relevancy for educating the next generation. We are committed to helping all students develop the advanced reasoning and problem-solving abilities that are so critical to new discoveries in the life sciences and to society.

Our common goal is to promote high quality instruction and to enhance learning by applying educational research to course and curriculum design. BE affiliates are mobilizing our department, the university, and professional societies nationwide by transcending sub-disciplinary boundaries and working across all the research areas to help answer discipline-specific questions related to teaching and learning.

Members and affiliates of BE area include:
- Research-active faculty who complement their discipline-specific research with educational innovation
- Science faculty who now mainly teach
- Non tenure-track instructors
- Faculty members whose scholarship is biology education research
- Biology graduate students who conduct biology education research for all or part of their doctoral work

BE gives all biology graduate students the opportunity to contribute to running a biology education research projects like:
- Development of Course-based Undergraduate Research Experiences (CUREs)
- Classroom and laboratory instructional innovation to improve teaching and learning
- Helping students to visualize and reason about evidence to understand the richness and complexity of data that informs biological knowledge
- Integration of engineering practice and design principles with the life sciences
- Education of and outreach to high school biology students and teachers
- Biology faculty development

BE FACULTY

When you meet our BE faculty affiliates, ask about their projects, publications, leadership, and awards of distinction.

Faculty members of BE include:
- Ed Bartlett, Professor
- Ximena Bernal, Professor
- Selcen Guzey, Professor
- Chris Sahley, Professor
- Ignacio Camarillo, Associate Professor
- David Eichinger, Associate Professor
- Stephanie Gardner, Associate Professor
- Sean Humphrey, Lecturer

FACULTY SPOTLIGHT: *DR. STEPHANIE GARDNER*

Dr. Gardner's research focuses on revealing areas of student competence with science practices including constructing mechanistic explanations and systems thinking and the effective creation of visualizations to understand and communicate data and experimental concepts. Data from this research are used to design and evaluate classroom materials and instruction to improve student learning. Dr. Gardner leads graduate student and faculty professional development workshops around inclusive and innovative instruction, including the CURE-Purdue program to support instructors as they develop and implement CURE to expand access for diverse students to research.

FACULTY SPOTLIGHT: *DR. SELCEN GUZEY*

Dr. Guzey's research focuses on integrated STEM education and provides access for students with diverse racial, ethnic, socioeconomic, and linguistic backgrounds. Specifically, her scholarship focuses on how K-12 students learn STEM content and develop interest in STEM within an integrated environment. Her work is based on the understanding that providing students with authentic and culturally relevant engineering context in which to learn STEM content also furthers students' interest and motivation in these subjects.

BIOLOGY OF THE BRAIN & NEURAL NETWORKS

Neuroscience and Physiology (NP)

Dr. Alex Chubykin (Area Convener)

> "The brain represents the external world in patterns of neural activity that guide adaptive behavior."

If that piques your interest, then you likely already know that neuroscience is at the leading edge of a grand challenge in life science, connecting genes to behavior in a seamless web. Advances in molecular biology, neurophysiology, optogenetics, imaging and data analysis, among many integrative methods, are opening research opportunities of impact and longevity; there exists enormous unmet need for insight and therapies for currently intractable neural diseases and the complexity of the brain will not be unraveled in the near future. Significant federal and private funding supports neuroscience research and rewarding career paths beckon in academic and private sector neuroscience.

The labs in our area employ recent techniques in molecular and cellular biology, advanced light microscopy, electro-physiology, transgenesis, experimental embryology, and behavior analysis to study the development, structure, function, and disorders of the nervous system in a wide variety of model systems ncluding zebrafish, mouse, rat,

Drosophila, and Aplysia. We also investigate functional and mechanistic basis of behaviors such as vision, hearing, movement, learning, and social interactions.

The group provides interdisciplinary training in a collaborative environment for undergraduates, graduate students, and postdoctoral fellows. Our research is supported by grants from the NIH, the NSF, and other extramural and intramural funding agencies. Research and graduate training in N&P labs partners with a vibrant, campus-wide neuroscience community, the Purdue Institute for Integrative Neuroscience (PIIN).

A central goal of life sciences research has been to understand how complex tissues and their substituent cells develop, function, and regenerate. Recent years have brought enormous advances in our ability to experimentally manipulate gene expression in cells, embryos, and tissues, and to analyze subtle and complex phenotypes using advanced imaging technologies.

NP FACULTY

Faculty members of NP include:

- Peristera Paschou, Professor and Dept. Head
- Ed Bartlett, Professor
- Daniel Suter, Professor
- Ignacio Camarillo, Associate Professor
- Alex Chubykin, Associate Professor
- Yuk Fai Leung, Associate Professor
- Jimmy Dooley, Assistant Professor
- Scott Pluta, Assistant Professor
- Matt Tegtmeyer, Assistant Professor
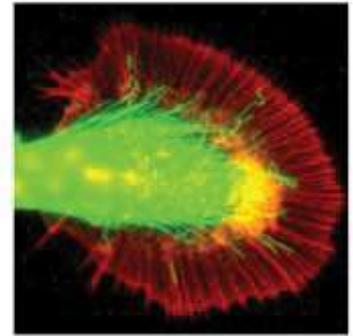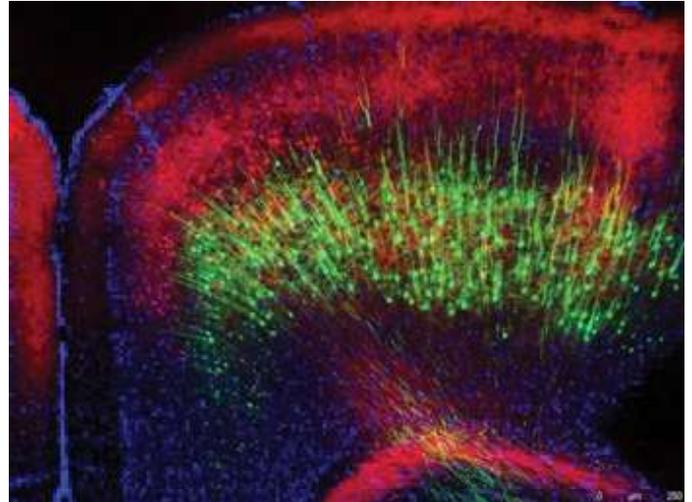
FACULTY SPOTLIGHT: *DR. JIMMY DOOLEY*

Infants continually explore and interact with the world around them, and these experiences are critical for normal sensorimotor development. Although it's generally assumed that the important movements occur while we're awake, the Dooley Lab's research calls this assumption into question. Specifically, the Dooley lab has found that myoclonic twitches (brief movements produced during REM sleep) drive neural activity throughout the brain that, in turn, promotes sensorimotor integration and development. The lab aims to understand whether this twitch-related neural activity is necessary for the development of cortically-mediated motor control. To achieve this aim, I investigate brain-behavior relations in infant rats as they cycle between sleep and wake. My research uses a variety of methods, including multichannel neurophysiology, pharmacological and optogenetic manipulations, and state-of-the art behavioral analysis.
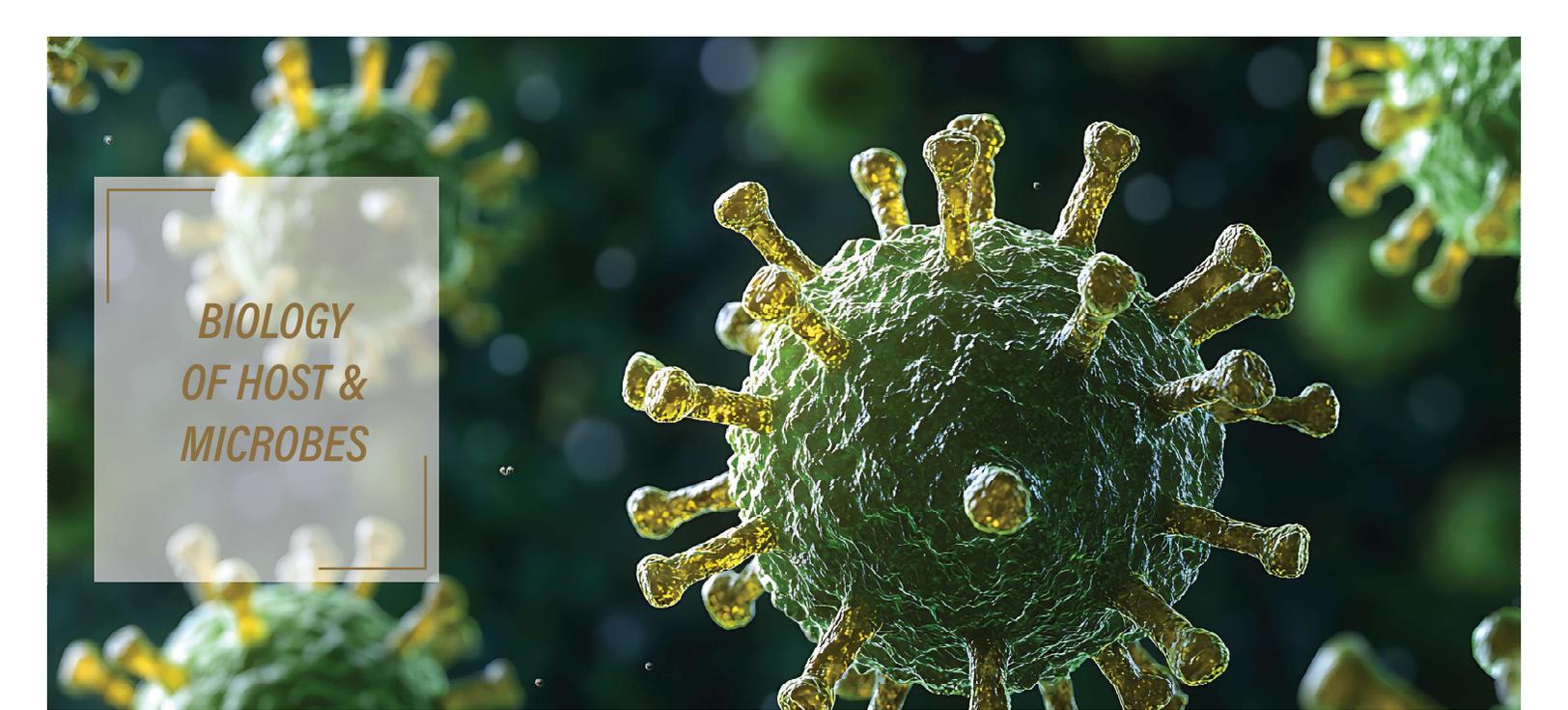
BIOLOGY
OF HOST &
MICROBES

Microbiology, Immunology, and Infectious Disease
(MIID)

Dr. Matt Olson (Area Convener)

Scientists within the MIID group conduct innovative basic research in the areas of cellular and molecular mechanisms of infectious disease, as well as the immune response and microbe-host interaction. Our research focus includes:

- The biology of microbial signaling systems, exploitation of host cell functions by pathogenic organisms, and mechanisms of protective host immune responses to infections.

- The model microorganisms used in our research are important pathogenic agents of humans, animals and plants. Examples include Legionella, Salmonella, E. coli, Agrobacterium, herpesviruses, togaviruses and flaviviruses.

- We are also interested in membrane phenomena, including energy production, transport and the structure of the key membrane-spanning protein complexes.

The group fosters high quality scholarship and provides interdisciplinary undergraduate, predoctoral and postdoctoral trainings in cellular and molecular mechanisms of infectious diseases and other aspects of microbiology, with numerous collaborative opportunities across the Colleges of Science, Veterinary Medicine, and Agriculture.

Our on-campus involvement includes a variety of centers, such as leadership in the Purdue Institute of Inflammation, Immunology, and Infectious Disease (PI4D), the Bindley Bioscience Center, Markey Center for Structural Biology, the Genomics Center and the Energy Center, and with faculty from across campus involved in the Purdue University Life Science (PULSe) graduate program.

Our research is supported by grants from the NIH, the NSF, and other extramural and intramural funding agencies.

MIID FACULTY

Faculty members of MIID include:

- Stan Gelvin, Distinguished Professor
- Richard Kuhn, Distinguished Professor
- Andy Mesecar, Distinguished Professor
- Chris Staiger, Distinguished Professor
- Bruce Applegate, Professor
- Qing Deng, Professor
- Cynthia Stauffacher, Professor
- Daoguo Zhou, Professor
- Meng Cui, Associate Professor
- Seema Mattoo, Associate Professor
- Nicholas Noinaj, Associate Professor
- Matthew Olson, Associate Professor
- David Sanders, Associate Professor
- Catherine Searle, Associate Professor
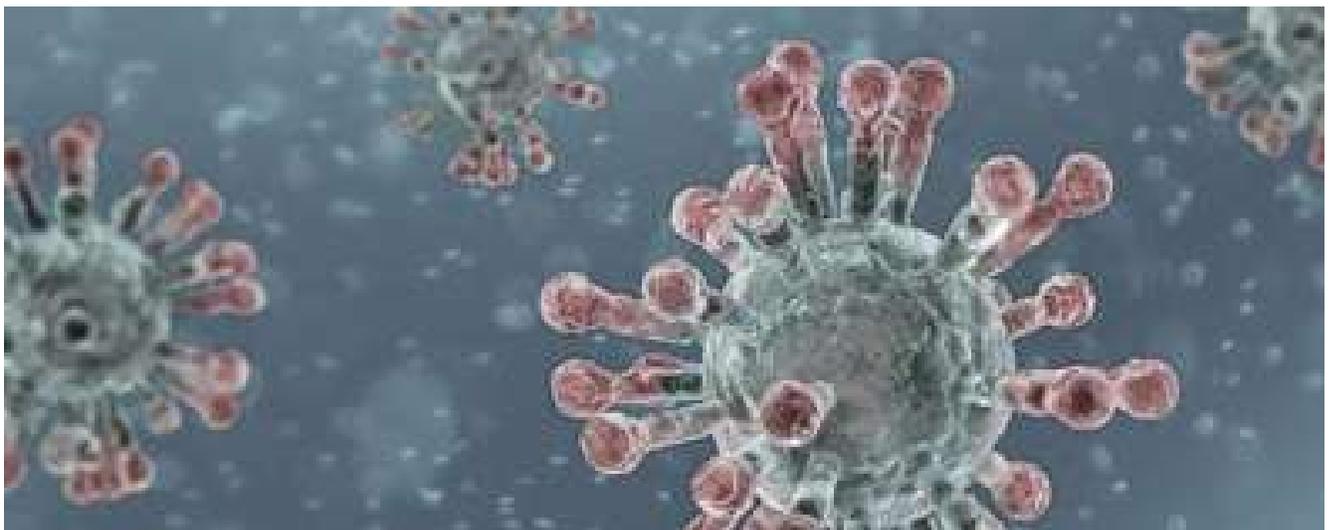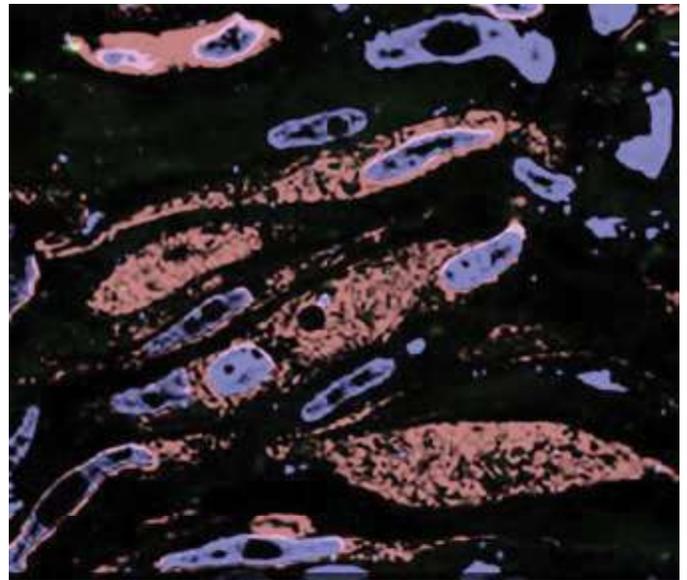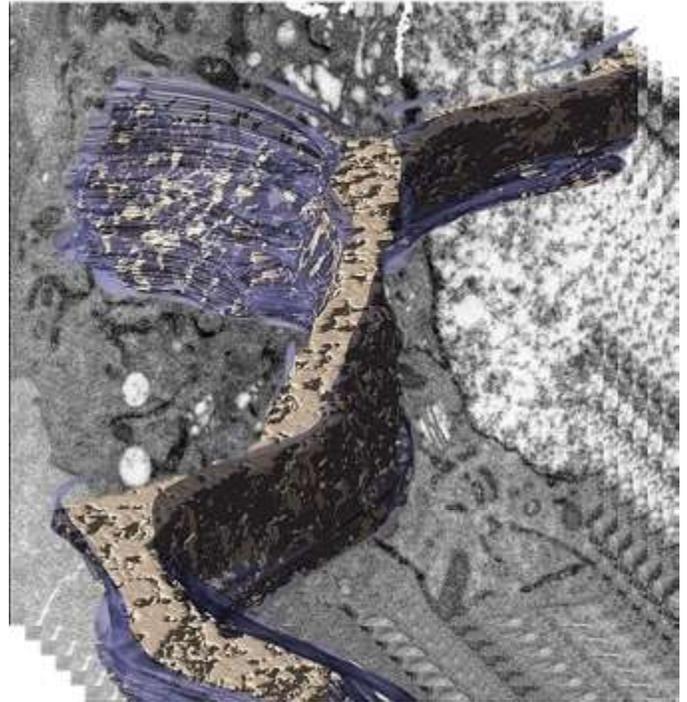
Genomics, Multiomics & AI (GEM-AI)

Dr. Geyu Zhou (Area Convener)

Genomics, Multiomics & AI (GEM-AI) brings together the power of data, biological and computational sciences to advance our understanding of life at its most fundamental levels.

Biology has become increasingly complex, with large scale genetic, molecular, and biochemical data being generated at an unprecedented rate. GEM-AI aims to lead the way in systematically exploring how genes, molecules, and systems interact to shape human health, disease, and evolution. We welcome you to GEM-AI!

GEM-AI is focused on tackling many large and important questions, including:
- How does our DNA influence our biology to drive human disease?
- How does genetic diversity across populations and ancestries give rise to diverse phenotypes and drug responses?
- How do microbes interact with their hosts and environments?
- In what ways does our DNA regulate the structure and function of proteins?
- Can human stem cells serve as proxies for living individuals to test hypotheses about genetic mechanisms of disease or treatment response?
- Can AI help us predict the best medicines for patients?

Example research projects include:
- Performing large-scale genetic analysis for genetic discovery and risk prediction in biobanks such as UK Biobank and All of Us Research Program
- Using multi-modality machine learning and AI to study tumor progression and improve treatment
- Developing mechanistic models and machine-learning methods to address complex problems in microbial communities
- Building AI-frameworks to simulate perturbation responses across diverse cellular contexts
- Using single-cell CRISPR perturbations screens in human cells to test the functional of risk variants associated with psychiatric outcomes

GEM-AI FACULTY

Faculty members of GEM-AI include:

- Peristera Paschou, Professor and Dept. Head
- Mark Christie, Professor
- Michael Gribskov, Professor
- Daisuke Kihara, Professor
- Yuk Fai Leung, Associate Professor
- Qixin He, Assistant Professor
- Boran Gao, Assistant Professor
- Brian Metzger, Assistant Professor
- Matt Tegtmeyer, Assistant Professor
- Tong Wang, Assistant Professor
- Weiru Zhang, Assistant Professor
- Geyu Zhou, Assistant Professor

The group provides interdisciplinary training in a collaborative environment for undergraduates, graduate students, and postdoctoral fellows. Our faculty are connected with all of the Purdue Life Science Institutes, and several of them have dual appointments with Statistics and Computer Science. Students will receive training by taking courses in statistics and computer science, conducting research projects with real genomics data, and collaborating with an interdisciplinary team of biologists, data scientists, and AI researchers. We expect students to be well-prepared to pursue successful careers in both academia and industry upon completing the program.

FACULTY SPOTLIGHT: *DR. GEYU ZHOU*

Dr. Zhou received his Ph.D. in Computational Biology, followed by postdoctoral training in Biostatistics at Yale University. His expertise lies in statistical genetics and computational biology. Zhou's current research centers on developing robust and efficient statistical methods for genetic risk prediction across diverse populations, contributing to more accurate and inclusive predictive models. Zhou is appointed to biological sciences 75% and statistics 25%.

FACULTY SPOTLIGHT: *DR. BORAN GAO*

Dr. Zhou earned his Ph.D. in Biostatistics from the University of Michigan in 2024 before joining Purdue. His research is dedicated to advancing statistical methods and computational tools for genetic and genomic studies. Gao's work addresses the challenges posed by large-scale, high-dimensional datasets. He is particularly focused on reducing health disparities in these datasets, which have historically underrepresented non-European populations. Through his innovative approach, Gao aims to deepen our understanding of the genetic underpinnings of complex traits and diseases across a broad spectrum of human populations. Gao is appointed to biological sciences 75% and statistics 25%.