

**THE UNIVERSITY OF AKRON  
BIOMIMICRY RESEARCH AND  
INNOVATION CENTER**



# THE UNIVERSITY OF AKRON BIOMIMICRY RESEARCH AND INNOVATION CENTER (BRIC)

## ABOUT

[The University of Akron \(UA\) Biomimicry Research and Innovation Center \(BRIC\)](#) is an internationally recognized leader in the rapidly growing field of biomimicry. BRIC is dedicated to connecting artists, businesspeople, designers, engineers and scientists to catalyze biomimicry-based innovation. Interdisciplinary research projects draw inspiration from organisms as diverse as ants, bacteria, birds, cacti, fish, flies, geckos, mussels, snakes and spiders to inform the development of permanent/reversible adhesives, building construction techniques, color-producing additives/structures, robotic actuators/control systems, thermal management systems, water harvesting/repellent materials and more. Beyond research, BRIC activities include training next generation innovators by developing and implementing undergraduate- and graduate-level curricula, promoting awareness of biomimicry through public seminars, and, accelerating innovation through co-delivery of professional services with [Great Lakes Biomimicry](#). BRIC's vision is for biomimicry to become a driver for sustainable economic development in Northeast Ohio and beyond.

## PROFESSIONAL SERVICES

With our strategic partner, [Great Lakes Biomimicry](#), we offer:

**Professional Education** for aspiring biomimicry practitioners, ranging from lunch-hour presentations to half-day and two-day training programs. Sessions introduce the concept of biomimicry and industry-specific examples, emphasize the quantitative and qualitative value of implementation, provide training in how to apply biomimicry, and outline options for building capacity.

**Innovation Services**, where the client identifies a product, process or system design challenge, and we provide front-end biomimicry consulting. We collaborate with the client to define scope,

catalog functions, identify biological models, extract design principles and generate/refine solution concepts. Contracts typically run six months, depending on the desired outcome.

**Biomimicry Fellow Sponsorship Opportunities**, where UA doctoral students each dedicate up to 20 hours per week to advancing biomimicry initiatives within their sponsoring organizations. Intellectual property originated, conceived or made as part of the Biomimicry Fellows' activities with the sponsors is owned by the sponsors. Fellows and sponsors become members of Great Lakes Biomimicry's Corporate Innovation Council. Membership provides the sponsors with valuable knowledge and connections, special workshops and shared resources. During biannual meetings, sponsors share the ways biomimicry brings value to their organizations, e.g., generating intellectual property, embedding non-traditional thinking into teams, adding talent, creating sustainable value and providing access to biomimicry tools. Members learn from one another's challenges and successes, tap into a robust biomimicry ecosystem in Northeast Ohio, and hear from cutting-edge researchers and practitioners in the field of biomimicry. Through the Corporate Innovation Council, Great Lakes Biomimicry supports each company's unique journey as a leader in this new field.

**Independently, BRIC offers:**

**Biomimicry Design Challenge Sponsorship Opportunities**, where UA students enrolled in a one-semester Biomimicry Design Challenge course, the capstone of our Undergraduate Certificate in Biomimicry, work on a sponsor-identified challenge.

**Research and Testing Services** that allow an organization access to the intellectual expertise of BRIC faculty and staff, and/or to UA's specialized equipment to pursue a high-potential research pathway or vet a biomimetic solution concept.

## CORE TEAM

### LEADERSHIP



**Dr. Ali Dhinojwala** is the interim dean and H.A. Morton Professor of Polymer Science in the College of Polymer Science and Polymer Engineering. His research interests include adhesion, friction, wetting and

structural color. His lab developments include synthetic adhesives inspired by geckos and spiders, as well as advanced spectroscopic techniques for understanding the physical properties of molecules at surfaces and interfaces.



**Matthew Kolodziej**, a Fulbright and Pollock-Krasner recipient, is a professor of art teaching painting and drawing. Exploring the relationships between perception, materials, and way finding,

he started [Synapse](#), a series of lectures, workshops, exhibitions, and conversations at the intersection of art and science.



**Dr. Christopher M. Miller** is an associate professor of civil engineering, a licensed Professional Engineer, and owner-founder of Fontus Blue, an engineering company that works with utilities and plant personnel

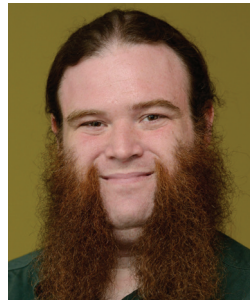
to provide high-quality drinking water. Miller specializes in drinking water plant operations optimization using machine learning, water quality modeling and collective intelligence.



**Dr. Peter H. Niewiarowski** is a professor of biology. Trained as an evolutionary biologist and physiological ecologist, Niewiarowski researches how the environment affects the physiology and population biology of salamanders and

lizards. Since 2007, he has been investigating the gecko adhesive system as it relates to the design of synthetic adhesives, specifically, and the process and practice of biomimicry, generally.

### CORE FACULTY



**Dr. Henry Astley** is an assistant professor of biology and polymer science who studies the mechanics of how animals move through the natural world. Members of his lab study a wide variety of animal species —

including fish, snakes and salamanders — using high-speed video, force sensors, and muscle physiology testing to determine the fundamental principles of their motions, mechanics and control. These fundamental principles are then implemented and tested in custom-built robots.



**Dr. Todd A. Blackledge**, Leuchtag Endowed Chair and a professor of biology, investigates how biological materials facilitate organismal function during the diversification of behaviors. His research

focuses on silks in web-building spiders, from molecular structure to evolutionary ecology, and is helping to inspire the next generation of high-performance fibers and adhesives.

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## CORE FACULTY



**Dr. Petra Gruber**, a trained architect, is an associate professor of art and biology. Her lab carries out research on spatial and functional aspects of biological structures for biomimetic innovation in architecture and the built environment.



**Dr. Hunter King**, a experimental soft matter physicist by training, is an assistant professor of polymer science and biology. His lab investigates mechanical mechanisms organisms use to manipulate and couple with their environments.



**Dr. Amir Nourhani** is professor of mechanical engineering and biology whose research interests include fluid dynamics and soft matter with a focus on microrobots and autonomous mechanosensors for potential biomedical, environmental and energy applications.

## STAFF



**Dr. Emily Kennedy** is BRIC's director of external relations. In this role, she sustains and grows BRIC's engagement with business entities and other organizations in Northeast Ohio and beyond.



**Dr. Madhavi (Kookie) Warrick** is BRIC's coordinator, responsible for website and database maintenance, accounting, event planning and other administrative duties.

## EXTENDED FACULTY NETWORK

**BRIC has an extended network of faculty we leverage to deliver professional services.**

These faculty members have appointments across campus in the Buchtel College of Arts and Sciences (BCAS), College of Business Administration (CBA), The LeBron James Family Foundation College of Education (LJFFCOE), College of Engineering (COE), College of Polymer Science and Polymer Engineering (CPSPE), School of Law (Law), and Wayne College (WC).



NAME	COLLEGE	DEPARTMENT	RESEARCH INTERESTS
<b>Dr. Steven Ash</b>	CBA	Management	human resources; organizational behavior
<b>Dr. Hazel Barton</b>	BCAS	Biology	microbial interactions and adaptations to nutrient limitation, as experienced by ecosystems in deep subsurface cave environments
<b>Dr. Carolyn Behrman</b>	BCAS	Anthropology	urbanization processes as they relate to gender, health, power, and poverty
<b>Dr. Amanda Booher</b>	BCAS	English	medical and scientific rhetoric; medical humanities and bioethics; theories of bodies, genders, and (dis)abilities; cyborgs, somatechnics, and post-humanism
<b>Kate Budd</b>	BCAS	Art	tiny carved wax and bronze sculptures that reference organic forms and ancient artifacts
<b>Dr. Alper Buldum</b>	COE	Mechanical Engineering	computational materials science; mechanical, electronic, and transport properties of nanomaterials; nanotechnology; nanotribology; modeling of advanced materials for energy storage and conversion
<b>Dr. Zhong-Hui Duan</b>	BCAS	Computer Science	fast algorithms and scientific computation; bioinformatics; computational biology
<b>Dr. R. Joel Duff</b>	BCAS	Biology	using molecular genetics tools to investigate organismal and genetic biodiversity
<b>Dr. Stephen Duirk</b>	COE	Civil Engineering	total water infrastructure sustainability
<b>Dr. James Eagan</b>	CPSPE	Polymer Science	synthesis of new polymeric materials for sustainable applications
<b>Dr. Joelle D. Elicker</b>	BCAS	Psychology	learning; feedback; organizational justice
<b>Dr. Patrick H. Gaughan</b>	Law	Law	innovation; entrepreneurship
<b>Dr. Angela Hartsock</b>	WC	Biology	bacterial ecology of energy systems with a focus on waters associated with natural gas drilling; genetics of denitrifying physiology in bacteria
<b>Dr. Gary Holliday</b>	LJFFCOE	Curricular & Instructional Studies	middle level and AYA science
<b>Dr. John Huss</b>	BCAS	Philosophy	philosophy of science, philosophy of biology, ethics, and philosophy of popular culture – especially philosophical implications of metagenomics/microbiome research, and attempts to reconstruct the geologic and evolutionary past

NAME	COLLEGE	DEPARTMENT	RESEARCH INTERESTS
<b>Dr. Li Jia</b>	CPSPE	Polymer Science	transition metal-catalyzed polymerizations and carbonylations; supramolecular elastomers and micelles; synthesis of polymeric electronic and optoelectronic materials; soft lithography via nanoparticle self-assembly
<b>Dr. Abraham Joy</b>	CPSPE	Polymer Science	synthesis and applications of peptidomimetic biomaterials (polyesters, polyurethanes, poly[ester urethane ]s); development of stimuli (light, non-covalent interactions, mechanical) responsive polymers
<b>Dr. Lingyun Liu</b>	COE	Chemical, Biomolecular, & Corrosion Engineering	anti-biofouling materials; biomaterials and tissue engineering; materials science
<b>Dr. Richard Londrville</b>	BCAS	Biology	molecular and evolutionary biology of fat in zebrafish, lizards, birds, and whales
<b>Dr. Francis Loth</b>	COE	Mechanical Engineering; Biomedical Engineering	fluid dynamics of biological flows – especially their importance in the development, progression, and diagnosis of disease
<b>Dr. Randy Mitchell</b>	BCAS	Biology	evolutionary ecology of plant pollinator interactions – especially how plant mating patterns and success are affected by pollinator behavior and abundance; wetland and restoration ecology
<b>Dr. Chelsea Monty-Bromer</b>	COE	Chemical, Biomolecular, & Corrosion Engineering	micro-scale sensors using biological mimics for the detection of toxic compounds; biomimicry for non-biological inhibition-based sensors in order to chemically amplify the response from various toxic compounds
<b>Dr. Francisco (Paco) Moore</b>	BCAS	Biology	evolutionary consequences of gene-gene interactions; theoretical population genetics; experimental evolution in bacteria; interface between micro and macro evolution; evolution of novelty
<b>Dr. Gopal Nadkarni</b>	COE	Mechanical Engineering	manufacturing and materials; product and design engineering; technology-based startups
<b>Dr. Nita Sahai</b>	CPSPE	Polymer Science	human and bacterial cell interactions with biomaterials and minerals; interfacial chemistry; bone-tissue engineering; biomineralization; origin and early evolution of life; relationship between molecular-level, nanoscale, and macroscopic properties
<b>Anthony Samangy</b>	BCAS	Art	designing user experiences through time-based or interactive narrative

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<b>Dr. Shiva Sastry</b>	COE	Electrical & Computer Engineering	automation; networked embedded systems; graph algorithms; software systems architectures; modeling; verification
<b>Dr. Marnie M. Saunders</b>	COE	Biomedical Engineering	orthopedic biomechanics; bone biomechanics; bone cell mechanobiology; lab-on-a-chip and organ-on-a-chip platforms
<b>Dr. Adam W. Smith</b>	BCAS	Chemistry	molecular organization and dynamics in biological membranes; membrane receptor clustering and its role in signaling; lipid-protein interaction dynamics
<b>Dr. Kwek-Tze (K.T.) Tan</b>	COE	Mechanical Engineering	impact, damage, and fracture of composite materials; wave propagation in acoustic metamaterials; unique behavior of mechanical metamaterials; bioinspired structures and materials
<b>Dr. Mesfin Tsige</b>	CPSPE	Polymer Science	computational polymer science and soft condensed matter physics; structure and dynamics of molecules at surfaces and interfaces; elastic and failure behavior of thermosetting polymers; molecular transport through nanostructured materials; interaction of water with surfaces
<b>Markus Vogl</b>	BCAS	Art	multiple sensory experiences combining sound, environments, and interactive installation
<b>Dr. Stephen Weeks</b>	BCAS	Biology	delineating the factors favoring the evolution of hermaphroditism from dioecy in animals; evolution of mating systems in crustaceans; mating behavior of clam shrimp; human impact on invertebrate communities in freshwater environments
<b>Dr. Chrys Wesdemiotis</b>	BCAS	Chemistry	fundamental studies and analytical applications of mass spectrometry and tandem mass spectrometry to macromolecules; synthetic polymers; biopolymers
<b>Dr. Anne Wiley</b>	BCAS	Biology	using stable isotopes and other tools to study the ecology of modern and ancient animal populations; population ecology and human-mediated changes in animal diet and distribution with focus on seabirds
<b>Dr. Yingcai (Tom) Xiao</b>	BCAS	Computer Science	computer graphics and visualization; numerical simulation and applications