

IGB NEWS

Upcoming Events
Monthly Profiles
Happenings at IGB

Image Of The Month
Research News
Department Announcements

Volume 12 Number 7

UPCOMING EVENTS

Genome Day

November 16, 2019, 1:00 - 5:00 p.m.
Franklin STEAM Academy
817 N. Harris Ave, Champaign

Designed for elementary and middle school children, all members of the community are welcome. Exhibits and activities will cover topics including the environment, energy use & production, health, and fundamental research at the IGB in an approachable manner for all ages. Free and open to the public.

IGB Pioneers Seminar - IGOH

Understanding symbiotic nitrogen fixation and bacterial genome organization using synergistic, multi-level approaches

November 19, 2019, 12:00 p.m.
612 Carl R. Woese Institute for Genomic Biology

George diCenzo, PhD
Queen's University;
Assistant Professor, Department of Biology

IGB Pioneers Seminar - MME

Building and Manipulating the Human Microbiome

December 3, 2019, 12:00 p.m.
612 Carl R. Woese Institute for Genomic Biology

Michael Fischbach, PhD
Stanford University,
Department of Bioengineering

Fox Family Innovation and Entrepreneurship Lecture

SOMAmers and SOMAscan: How Broad Proteomics Can Lead to More Understanding of Human Biology

December 10, 2019, 12:00 p.m.
612 Carl R. Woese Institute for Genomic Biology

Larry Gold, PhD
Founder, Chairman of the Board,
and former CEO of SomaLogic

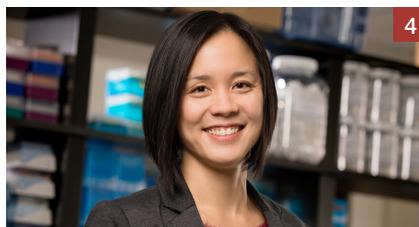
FEATURED NEWS



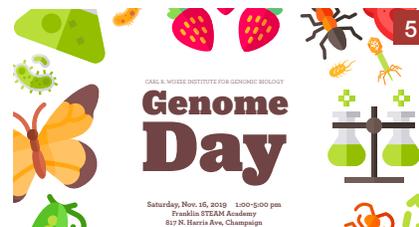
Kleinmuntz Center inaugural year



Framework for 1 billion years of green plant evolution

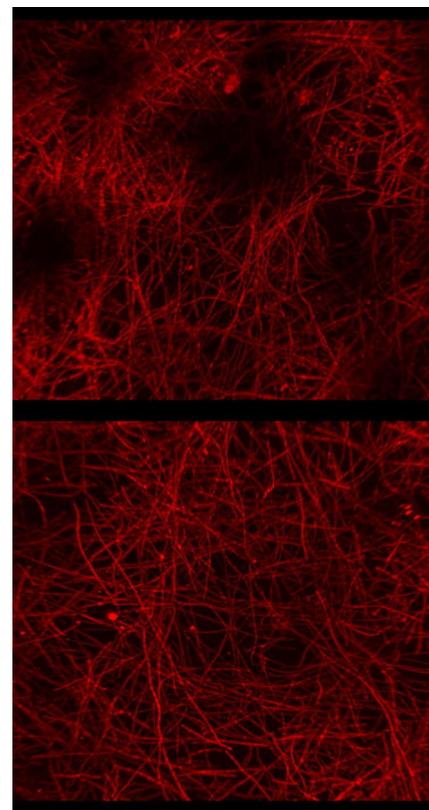


Monthly Profile:
Wendy Yang



On the Grid:
Happenings at IGB

IMAGE OF THE MONTH



This month features tissues from mouse medial prefrontal cortex, cleared by CLARITY and stained with anti-proteolipid protein. Taken on the LSM 710 with 3D renderings created using Bitplane Imapris software. This technique allows 3D visualization and quantification of myelin in the prefrontal cortex.
Top: maximal demyelination due to cuprizone neurotoxin. Bottom: partial remyelination one week later.

IGB News

Share your news with the IGB. Send ideas on stories, articles, and features to nvasi@illinois.edu.

FEATURE



Kleinmuntz Center Inaugural Year

In its inaugural year of operation, the Catherine and Don Kleinmuntz Center for Genomics in Business and Society significantly enhanced and accelerated the broader impact of the Carl R. Woese Institute for Genomic Biology's (IGB's) research and innovation by providing unique opportunities for public engagement and social impact. The Kleinmuntz's generous support allowed IGB members to share their research and its implications with professional groups and the broader public, reaching roughly 3,500 people with educational events. The Center also launched the Mikashi Awards, a proof-of-concept program supporting IGB faculty innovations during their pre-commercialization phase. Supported projects demonstrate early market viability and have the potential to positively impact millions of people through improved cancer diagnostics and treatment. In addition, the Kleinmuntz Center website and social media presence have helped communicate with IGB members, supporters, and the public about these varied programs and events.

The IGB is extremely grateful to have partnered with the Kleinmuntz Center. The support, guidance, and leadership of Catherine and Don Kleinmuntz, whose support has made possible a number of impactful professional and community activities.

Mikashi Awards

The Kleinmuntz Center is funding two IGB faculty members with their innovations through their new pre-commercialization proof-of-concept program, the Mikashi Awards, named in honor of the Kleinmuntz's children. Professor Cunningham is the Donald Biggar Willett Professor of Engineering and leads the Omics Nanotechnology for Precision Cancer Medicine (ONC-PM) theme at the IGB. Professor Hergenrother is the Kenneth L. Rinehart Jr. Endowed Chair in Natural Products Chemistry, and leads the IGB's

Anticancer Discovery from Pets to People (ACPP) theme. Both are also members of the IGB Mining Microbial Genomes (MMG) theme. Their proposals focus on aspects of cancer research, one by developing a new liquid biopsy technology called activate capture + digital counting (AC+DC) Assay Technology, and the other a novel therapeutic strategy for treating cancerous liver lesions, respectively.

World of Genomics at the National Academy of Sciences

The Kleinmuntz Center funded one of the IGB's most successful and comprehensive public engagement events, the World of Genomics, with the National Academy of Sciences - a private, nonprofit organization of the country's leading researchers. Designed to make the broadest impact on the largest possible audience, IGB researchers were able to reach more than 3,000 participants during the one-day event, showcasing the IGB's extensive research portfolio to the general public, other researchers and policy professionals.

Art of Science on the Hill

The Kleinmuntz Center sponsored the installation of an IGB Art of Science gallery, showcased on Capitol Hill at the Rayburn Office Building in Washington, D.C. The Art of Science on the Hill installation featured twenty images captured by IGB researchers in the process of performing federally funded research projects.

Professional Skills for Careers in Biosciences Series (pictured above)

Kleinmuntz Center funding allowed the IGB to offer a brand new seminar series, called Professional Skills for Careers in Biosciences (PSCB), a workshop-based certificate program that consists of thirteen sessions throughout the year and covers a variety of topics.

Genomics For™ Professionals

The Kleinmuntz Center also supported keynote speakers for the IGB's Genomics For™ Judges and Genomics For™ Journalists workshops. These three-day professional workshops were the product of newly formed partnerships with the National Courts and Sciences Institute (NCSI) and the American Association for the Advancement of Science (AAAS), respectively, and allowed IGB scientists to engage with judges and journalists to share how genomic research has an ever-growing impact across fields, as well as support these professional groups in understanding and evaluating new findings.

Alan Alda Center for Communicating Science Seminar

Kleinmuntz Center provided the opportunity for IGB researchers to attend a seminar presented by the Alan Alda Center for Communicating Science, in preparation for public-facing experiences.

Loft Lucia Center Launch Party

More than 100 guests convened to celebrate the Kleinmuntz Center on July 9, 2019 at Loft Lucia in Chicago, with speakers including Kleinmuntz Center founders Catherine and Don, University of Illinois President Tim Killeen, Interim Vice Chancellor for Research Susan Martinis, IGB Director Gene Robinson, Donald Biggar Willett Professor of Engineering Brian Cunningham, Assistant Professor of Nutrition Zeynep Madak-Erdogan, and Kenneth L. Rinehart Jr. Endowed Chair in Natural Products Chemistry Paul Hergenrother.

The IGB faculty, staff, and administration thank Catherine and Don Kleinmuntz for helping us to advance the impact of genomics research on business and society, and look forward to the future accomplishments the partnership is sure to bring. ■

RESEARCH



Green alga Lacunastrum gracillimum, female cones of gymnosperm, Gnetum gnemon, and cherry tree flower, Prunus domestica.

Study provides framework for 1 billion years of green plant evolution

Gene sequences for more than 1100 plant species have been released by an international consortium of nearly 200 plant scientists, the culmination of a nine-year research project.

The One Thousand Plant Transcriptomes Initiative (1KP) is a global collaboration to examine the diversification of plant species, genes and genomes across the more than one-billion-year history of green plants dating back to the ancestors of flowering plants and green algae.

“In the tree of life, everything is interrelated,” said Gane Ka-Shu Wong, lead investigator and professor in the University of Alberta’s Faculty of Science and Faculty of Medicine & Dentistry. “And if we want to understand how the tree of life works, we need to examine the relationships between species. That’s where genetic sequencing comes in.”

The findings, published today in *Nature*, reveal the timing of whole genome duplications and the origins, expansions and contractions of gene families contributing to fundamental genetic innovations enabling the evolution of green algae, mosses, ferns, conifer trees, flowering plants and all other green plant lineages. The history of how and when plants secured the ability to grow tall, and make seeds, flowers and fruits provides a framework for understanding plant diversity around the planet including annual crops and long-lived forest tree species.

“Our inferred relationships among living plant species inform us that over the billion years since an ancestral green algal species split into two separate evolutionary lineages, one including flowering plants, land plants and related algal groups and the other comprising a diverse array of green algae, plant evolution has been punctuated with innovations and periods of rapid diversification” said James Leebens-Mack, professor of

plant biology in the University of Georgia Franklin College of Arts and Sciences and co-corresponding author on the study.

The study inspired a community effort to gather and sequence diverse plant lineages derived from terrestrial and aquatic habitats on a global scale. Over 100 taxonomic specialists contributed material from field and living collections that include the Central Collection of Algal Cultures, Royal Botanic Gardens, Kew, Royal Botanic Garden Edinburgh, Atlanta Botanical Garden, New York Botanical Garden, Fairylake Botanical Garden, Shenzhen, The Florida Museum of Natural History, Duke University, University of British Columbia Botanical Garden and The University of Alberta. By sequencing and analyzing genes from a broad sampling of plant species, researchers are better able to reconstruct gene content in the ancestors of all crops and model plant species, and gain a more complete picture of the gene and genome duplications that enabled evolutionary innovations.

The massive scope of the project demanded development and refinement of new computational tools for sequence assembly and phylogenetic analysis.

“New algorithms were developed by software engineers at BGI to assemble the massive volume of gene sequence data generated for this project,” explained Wong.

Founder Professor of Computer Science Tandy Warnow (BCXT/CGRH/IGOH) of the University of Illinois at Urbana-Champaign and Siavash Mirarab, assistant professor of electrical and computer engineering at the University of California San Diego, developed new algorithms for inferring evolutionary relationships from hundreds of gene sequences for over one thousand species, addressing substantial heterogeneity in evolutionary histories across the genomes.

The timing of 244 whole genome duplications across the green plant tree of life was one of the interrelated research foci of the project.

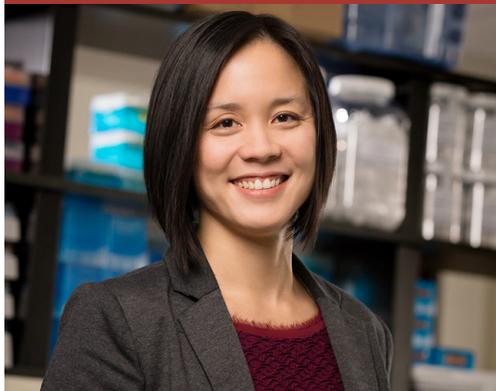
“Perhaps the biggest surprise of our analyses was the near absence of whole genome duplications in the algae,” said Mike Barker, associate professor of ecology and evolutionary biology at the University of Arizona. “Building on nearly 20 years of research on plant genomes, we found that the average flowering plant genome has nearly 4 rounds of ancestral genome duplication dating as far back as the common ancestor of all seed plants more than 300 million years ago. We also find multiple rounds of genome duplication in fern lineages, but there is little evidence of genome doubling in algal lineages.”

In addition to genome duplications, the expansion of key gene families has contributed to the evolution of multicellularity and complexity in green plants.

“Gene family expansions through duplication events catalyzed diversification of plant form and function across the green tree of life,” said co-author Marcel Quint, professor of crop physiology, at Halle University, Germany. “Such expansions unleashed during terrestrialization or even before set the stage for evolutionary innovations including the origin of the seed and later the origin of the flower.”

“The view of evolutionary relationships provided by 1KP has led to new hypotheses about the origins of key structures and processes in green plants,” said coauthor Pam Soltis, of the Florida Museum of Natural History, University of Florida. ■

Written by Alan Flurry, University of Georgia, Athens, and Katie Willis, University of Alberta, Edmonton Canada. Photo by Michael Melkonian and Walter S. Judd.



Wendy Yang is an associate professor of plant biology and geology and a member of the Carl R. Woese Institute for Genomic Biology; she is a deputy theme leader of Sustainability for the Center for Advanced Bioenergy and Bioproducts Innovation (CABBI). She was named a 2019-2020 I.C. Gunsalus Scholar.

Wendy Yang Cultivating a Sustainable Future

Wendy Yang (CABBI/GEGC) can pinpoint the origin of her passion for science, and the story is so perfect that it could serve as inspiration for the community engagement efforts of her fellow researchers.

“There was a two week summer program offered by the community college in my community, and it just kind of made me aware of environmental issues; it just made sense to me that we need to take better care of the planet and that there’s a natural intersection between my interest in science and that cause,” she said. “We run all these summer programs for kids . . . that actually worked for me.”

Yang’s awareness of environmental issues and her thirst for scientific knowledge that could help her address them did not wane; instead, they motivated her to pursue an undergraduate degree in environmental science and public policy at Harvard University, followed by a PhD in environmental science, policy and management at the University of California, Berkeley. The latter confirmed that scientific research was the right path for her.

“I want to make a difference, and I feel it’s really important for scientists to communicate their research to the public, it just wasn’t what really motivated me,” Yang said. “I realized that I was perfectly motivated to spend 15 hours, 18 hours straight in the lab and I loved it.”

Even as she moved from educational programs that encompassed both science and policy to focus exclusively on research, Yang’s work remained highly interdisciplinary. As a biogeochemist, her laboratory’s research program is informed by geology, chemistry, biology, and physics.

“What ties it all together is trying to gain this mechanistic understanding of what controls the processes happening in soil that leads to greenhouse gas emissions,” she said. “My research focuses on nitrogen cycling; I want to make a difference and I’m interested

in nitrogen cycling, so Illinois is the place to be.”

It’s the place to be for reasons that extend beyond the most obviously scientific. Not only is the Midwest an ideal location for the study of soil in agroecosystems, the collegial atmosphere among Illinois’ researchers made it easier for Yang to expand the biological component of her research program.

“I didn’t have too much exposure to genomics prior to coming to the University of Illinois, and now it’s an integral part of my research program; we collaborate closely with Angela Kent (CABBI) and Rob

*I want to make a difference
and I’m interested in
nitrogen cycling, so Illinois
is the place to be.”*

Sanford,” two microbial ecologists at Illinois, Yang said. “The diversity of microbes actually can make a difference . . . we are trying to figure out what’s the most sensible way to group out the different taxa of microbes and then figure out what’s controlling their process rates of nutrient cycling and greenhouse gas production.”

As part of her work with the CABBI, Yang and her laboratory are hoping to identify microbial properties that could be leveraged in the development of more sustainable farming practices.

“One student in my lab is looking at the compounds that are exuded from roots, and how those compounds can shape the microbial community and their activity,” she said. “If we can figure out which compounds are important, and then figure out the genetic manipulation of the production of those compounds, then we might be able to use the plant to manipulate the microbial community to have these

beneficial processes.”

The expansiveness of this area of research highlights what Yang appreciates the most about CABBI: how it has facilitated the creation of a research team that can meaningfully address many different aspects of agricultural simultaneously. She believes that this approach holds promise to drive successful innovation.

“It’s given us the resources to be able to do bigger science than we could do with individual grants . . . we talk about not just plant-microbe interactions, but plant-soil-microbe interactions, so how the context in which the plants and the microbes are interacting with each other matters,” she said. “To really get that mechanistic understanding of the controls on these processes, we have to think about the entire system, and we’re actually getting to do that through CABBI.”

Alongside her thriving research program, Yang has also maintained her connection to the larger community. Through the University of Illinois Extension, she contributes to engagement opportunities for high school students and for Midwest farmers. With the latter group, she forges connections by addressing concerns over current farming practices, nitrogen pollution, and emerging visible effects of climate change, which she says are still difficult for some to accept.

“I think mostly the way to convince people to be open-minded about alternative cropping systems or alternative management practices is to talk about the nitrate pollution,” she said. “I think that if we act as individuals that can inspire other people to act, that’s where the optimism comes in . . . the fact that other people see what we’re doing and that might inspire them to change. ■

Written by Claudia Lutz. Photo by L. Brian Stauffer.

ON THE GRID HAPPENINGS AT THE IGB

AWARDS



BRENDAN HARLEY AND HYUNJOON KONG

Brendan Harley, Professor, Chemical & Biomolecular Engineering (RBTE Theme Leader) and Hyunjoon Kong, Professor and Centennial Scholar in Chemical and Biomolecular Engineering (RBTE) have been named Robert W. Schaefer Professors, endowed Professorships in honor of Chemical and Biomolecular Engineering alumnus Robert W. Schaefer (BS Chemical Engineering, 1956).

ADVISORY



IGB FORMS EXTERNAL ADVISORY LEADERSHIP COUNCIL

The IGB undergoes regular, external review from leaders in academia, industry, and government to assess all aspects of the institute. The External Advisory Board that has previously been in place has been divided into two separate boards, to better evaluate and advise on the scientific and business facets of the IGB.

The Science Advisory Board is composed of distinguished scientists from academia and government, who meet biennially to advise on the research portfolio of the IGB and strategize synergy with our outreach and public science education portfolio.

The Leadership Council is an advisory board to the IGB composed of prominent individuals from the business world who counsel the institute annually on efforts to encourage business development, commercialization and philanthropy in support of our community engagement goals. With annual meetings including biennial gatherings on site at the institute, the IGB is grateful to the members of the council for devoting their time and expertise towards the betterment of our efforts in these areas.

The Leadership Council consists of the following members:

Richard Foster
Managing Partner
Millbrook Management Group LLC

Peter Fox
Founder and Chairman
Fox Development Corporation

Robert Fraley
Former Executive Vice President and Chief
Technology Officer
Monsanto

Larry Gold
Professor
University of Colorado Boulder

Catherine Kleinmuntz
Principal
Kleinmuntz Associates

Don Kleinmuntz
Principal
Kleinmuntz Associates

John Landgraf
Former Executive Vice President
Abbott Nutrition

Nancy Sullivan
CEO and Managing Director
Illinois Ventures

Steven Thayer
Partner
Handler Thayer, LLP



PABLO PEREZ-PINERA

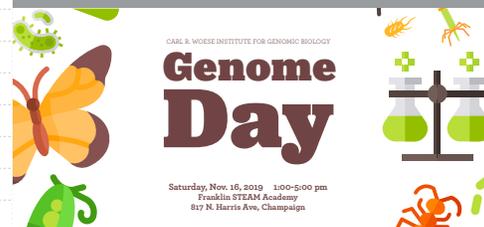
Pablo Perez-Pinera, Assistant Professor of Bioengineering (ACPP) received a 2019 Impact Award from the Parkinson's Foundation, to support his gene-editing work to alter how Parkinson's disease develops and progresses.



JONATHAN SWEEDLER

Jonathan Sweedler, James R. Eiszner Family Endowed Chair in Chemistry (BSD/CABBI/MMG) was named to the top spot on the Analytical Scientist's 2019 Power List, which highlights tremendous talent, ingenuity, and leadership in analytical science across the world.

EVENT



GENOME DAY

Join us for Genome Day! Designed for elementary and middle school children, all members of the community are welcome. Exhibits and activities will cover topics including the environment, energy use & production, health, and fundamental research at the IGB in an approachable manner for all ages. Free and open to the public.

Saturday, Nov. 16, 2019
1:00-5:00 pm Franklin STEAM Academy
817 N. Harris Ave, Champaign
Questions? Contact outreach@igb.illinois.edu

ON THE GRID HAPPENINGS AT THE IGB

NEW ARRIVALS



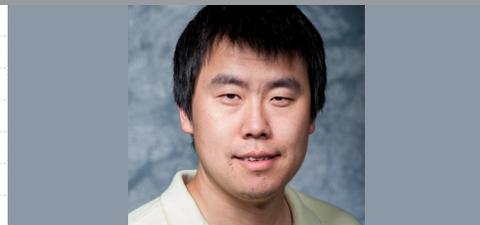
ADAM DOLEZAL

Professor Adam Dolezal has joined the IGB as an affiliate member in the Infection Genomics for One Health (IGOH) Research Theme. Dr. Dolezal is an Assistant Professor in the Department of Entomology. He received his PhD in 2012 from Arizona State University. His research interests focus in the area of how environmental stressors, like nutrition, landscape composition/ecology, viral pathogens, and sublethal pesticide exposure interact to affect bee health.



MILTON TAN

Dr. Milton Tan has joined the IGB as an affiliate member in the Gene Networks in Neural and Developmental Plasticity (GNNDP) Research Theme. Dr. Tan is a research scientist at the Illinois Natural History Survey at the University of Illinois. He received his PhD from Auburn University, and was a postdoctoral fellow, first at the Georgia Aquarium and then in the Department of Medicine at Emory University. His research focuses on how fish evolved, including understanding their relationships, the evolution of their traits such as body size, and how fish diversified.



XING WANG

Professor Xing Wang has joined the IGB as an affiliate member in the Omics Nanotechnology for Cancer Precision Medicine (ONC-PM) Research Theme. Dr. Wang is a Research Associate Professor in the Department of Chemistry. He received his PhD. from New York University in 2009, and did postdoctoral training at Princeton University. Before joining the Department of Chemistry, Dr. Wang was Assistant Professor in the Department of Chemistry and Chemical Biology at Rensselaer Polytechnic Institute. His research focuses on the design and synthesis of functional DNA/RNA aptamers, nanostructures and nano-devices, and on the exploration of their applications in chemistry, engineering, biology, and disease diagnosis and treatment.



ARACELI (ALLY) GOMEZ

Araceli (Ally) Gomez recently joined the IGB as an Account Technician I in the business office. She previously worked for Edward R. Madigan Lab in Urbana for 6 years, as a lab technician. She has worked on campus for 9 years.



AARON TIMPERMAN

Professor Aaron Timperman has joined the IGB as an affiliate member in the Omics Nanotechnology for Cancer Precision Medicine (ONC-PM) Research Theme. Dr. Timperman is a Research Associate Professor in the Department of Chemistry. He received his PhD. at the University of Illinois in 1995 under the direction of Professor Jonathan Sweedler. He previously was a member of the Department of Chemistry and Biochemistry at the University of Notre Dame where he served as the Associate Director of Research for the Advanced Diagnostics and Therapeutics Initiative. His research interests are focused on molecular and mass transport at the microscale and nanoscale and the use of these phenomena to study biological systems.



YANG ZHAO

Professor Yang Zhao has joined the IGB as an affiliate in the Omics Nanotechnology for Cancer Precision Medicine (ONC-PM) Research Theme. Dr. Zhao is an Assistant Professor in the Department of Electrical and Computer Engineering. She received her PhD from the University of Texas, Austin and then was a postdoctoral fellow at Stanford University in the Department of Materials Science. Her research focuses on bionanophotonics where she and her team develop biomimetic metamaterials and devices to manipulate electromagnetic and acoustic waves.



COREY MARKS

Corey Marks recently joined the IGB as an Account Technician I in the business office. Prior to joining the IGB, he worked as a Personal Banker at Busey Bank in downtown Urbana.

DEPARTMENT ANNOUNCEMENTS

COMMUNICATIONS

JOIN THE IGB

With faculty from over 30 departments on campus, the IGB is continually looking to involve new members to work in our multidisciplinary, thematic research themes. [Contact us](#) with any questions about becoming more involved with the IGB, or download the factsheet [here](#).

Can I join the IGB?

The IGB is a life sciences institute, but we do not limit our membership to faculty in the life sciences. We have members from such Colleges as Engineering, Law, Education, and from departments including Geology, Physics, Psychology, and many more. Any faculty member is welcome to join the IGB, usually by first identifying a [research theme](#) of interest and subsequently [speaking with](#) that theme leader or the IGB Director. Many faculty begin a career with the IGB as an affiliate member in a theme and diversify as their research progresses.

Am I limited to working with only one theme?

Not at all. Some IGB faculty are solely in one theme, while others are housed in multiple themes. Due to the team science environment, members of IGB themes are constantly working with each other regardless of theme membership or home department.

Can I talk to a theme leader? What about the IGB Director?

Yes – contact us [directly](#) and we will facilitate requests to speak with theme leaders, or to schedule a meeting with Dr. Gene Robinson, Director of the IGB. Dr. Robinson especially welcomes the opportunity to meet with new faculty interested in the IGB.

How will this benefit my career as an Illinois faculty?

There are numerous beneficial aspects to being an IGB member, including collaboration network-building with faculty from across campus,

mentorship from senior faculty outside your home department, access to new training and equipment through the IGB's microscopy suite, and opportunities for proposal and manuscript reviews, to name a few.

What if I don't work in genomics?

The beauty of genomics is that it is an incredibly diverse field, with applications that address research questions in diverse areas of life sciences, as well as everything from humanities, law enforcement, engineering, computer science – you name it. Our institute thrives on team science approaches to grand societal challenges, and is inclusive of research in all forms.

I've heard the IGB is big on public engagement.

How do I become involved?

The IGB prides itself on our [creative outreach and engagement](#) programs and we are very enthusiastic about growing our efforts. Anyone on campus can add to our engagement portfolio by volunteering to work at outreach events, develop activities, nominate staff or student ambassadors, or speak to school groups. Furthermore, the experienced and knowledgeable IGB outreach staff members can provide guidance through established procedures to more easily fulfill the public engagement requirements now expected of many campus faculty.

What kind of support is there for me at the IGB?

The IGB's wide and varied community encourages collaboration and cross-discipline support on science and research endeavors, allowing access to senior faculty for mentorship and partnership. Grant and proposal support for team science proposals submitted through the IGB Business Office is provided through the combined efforts of the IGB Business, IT and Communications offices, and a project manager with editorial and graphic resources. IGB science writers are available to create press releases on emerging research, events staff can assist with the planning and execution of seminars or symposia, and the Core Facilities microscopy suite will train in the use of new equipment, help design experiments, and interpret the resulting data.

The IGB is a dynamic and adaptive institute with significant opportunities for involvement with new faculty from across campus. [Speak with us](#) to learn what possibilities exist. ■

RECENT PUBLICATIONS

Please include your connection to the IGB in your author byline when submitting publications, as it will greatly help track potential newsworthy items and increase the possibility of coverage.

Chen, S., Chee-Sanford, J. C., Yang, W., Sanford, R. A., Chen, J., Yan, X., & Shan, J. (2019). Effects of triclosan and triclocarban on denitrification and N₂O emissions in paddy soil. *Science of the Total Environment*, 695, [133782]. <https://doi.org/10.1016/j.scitotenv.2019.133782>

McFaul, L. W., Wright, W. J., Sickel, J., & Dahmen, K. A. (2019). Force oscillations distort avalanche shapes. *Materials Research Letters*, 7(12), 496-502. <https://doi.org/10.1080/21663831.2019.1659437>

Yamamoto, K., Hackley, K. C., Kelly, W. R., Panno, S. V., Sekiguchi, Y., Sanford, R. A., ... Tamaki, H. (2019). Diversity and geochemical

community assembly processes of the living rare biosphere in a sand-and-gravel aquifer ecosystem in the Midwestern United States. *Scientific reports*, 9(1), [13484]. <https://doi.org/10.1038/s41598-019-49996-z>

Diene, S. M., Pinault, L., Keshri, V., Armstrong, N., Khelaifia, S., Chabrière, E., ... Raoult, D. (2019). Human metallo-β-lactamase enzymes degrade penicillin. *Scientific reports*, 9(1), [12173]. <https://doi.org/10.1038/s41598-019-48723-y>

Megahed, A., Zeineldin, M., Evans, K., Maradiaga, N., Blair, B., Aldridge, B. M., & Lowe, J. F. (2019). Impacts of environmental complexity on respiratory and gut microbiome community structure and diversity in growing pigs. *Scientific reports*, 9(1), [13773]. <https://doi.org/10.1038/s41598-019-50187-z>

RECENT PUBLICATIONS

Bukhari, S. A., Saul, M. C., James, N., Bensky, M. K., Stein, L. R., Trapp, R., & Bell, A. M. (2019). Neurogenomic insights into paternal care and its relation to territorial aggression. *Nature communications*, 10(1), [4437]. <https://doi.org/10.1038/s41467-019-12212-7>

Turner, B. O., Santander, T., Paul, E. J., Barbey, A. K., & Miller, M. B. (2019). Reply to: fMRI replicability depends upon sufficient individual-level data. *Communications Biology*, 2(1), [129]. <https://doi.org/10.1038/s42003-019-0379-5>

Winter, J., Luu, A., Gapinske, M., Manandhar, S., Shirguppe, S., Woods, W. S., ... Perez Pintera, P. (2019). Targeted exon skipping with AAV-mediated split adenine base editors. *Cell Discovery*, 5(1), [41]. <https://doi.org/10.1038/s41421-019-0109-7>

Wu, X., Tang, A., Bi, X., Nguyen, T. H., & Yuan, B. (2019). Influence of algal organic matter of *Microcystis aeruginosa* on ferrate decay and MS2 bacteriophage inactivation. *Chemosphere*, 236, [124727]. <https://doi.org/10.1016/j.chemosphere.2019.124727>

Mand, T. D., & Metcalf, W. W. (2019). Energy Conservation and Hydrogenase Function in Methanogenic Archaea, in Particular the Genus *Methanosarcina*. *Microbiology and molecular biology reviews : MMBR*, 83(4). <https://doi.org/10.1128/MMBR.00020-19>

Ballance, W. C., Oh, I., Lai, Y., Elhebeary, M., Saif, M. T. A., Hu, Y., & Kong, H. J. (2019). Vibration at structural resonance frequency of hydrophilic substrates enhances biofilm removal. *Sensors and Actuators, B: Chemical*, 299, [126950]. <https://doi.org/10.1016/j.snb.2019.126950>

Parkinson, E. I., Erb, A., Eliot, A. C., Ju, K. S., & Metcalf, W. W. (2019). Fosmidomycin biosynthesis diverges from related phosphonate natural products. *Nature chemical biology*, 15(11), 1049-1056. <https://doi.org/10.1038/s41589-019-0343-1>

Abueidda, D. W., Almasri, M., Ammourah, R., Ravaioli, U., Jasiuk, I. M., & Sobh, N. A. (2019). Prediction and optimization of mechanical properties of composites using convolutional neural networks. *Composite Structures*, 227, [111264]. <https://doi.org/10.1016/j.compstruct.2019.111264>

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