



Icons

The success of the IGB depends on collaborations that transcend traditional disciplines and involve close partnerships between researchers and support staff. Throughout this annual report, we have used the icons below to indicate connections between the research and its impact areas.

We have used hashtags (denoted by #) to refer to related stories and bring in an element of fun for our eagle-eyed readers.



#Health #Wellness

Research that seeks to understand the origins and mechanisms of disease and discovers new ways to promote wellbeing.



#Agriculture #Energy

Research that explores and protects ecosystems, especially those we rely on for food and fuel.



#Technology #Society

Research that imagines, develops, and refines new tools that enable discovery and create solutions to worldwide challenges.



Website link

You can access a more comprehensive version of the story by using the link that has been listed.



Likes

Feel free to express your appreciation for a story by using the sticker sheet.

Acronyms

Funding agencies

| |
|--|
| ACS: American Chemical Society |
| ADA: American Diabetes Association |
| ASF: Austrian Science Fund |
| BCRF: Breast Cancer Research Foundation |
| Beckman: Beckman Institute for Advanced Science and Technology |
| Carle: Carle Illinois College of Medicine |
| CarverCharitableTrust: Roy J. Carver Charitable Trust |
| CIFAR: Canadian Institute for Advanced Research |
| CPRC: Canadian Poultry Research Council |
| DamonRunyonFoundation: Damon-Runyon Cancer Research Foundation |
| DoD: US Department of Defense |
| DoE: US Department of Energy |
| FCDO: UK Foreign, Commonwealth and Development Office |
| Gates Foundation: Bill & Melinda Gates Foundation |
| ISI: Illinois Sociogenomics Initiative |
| LevinFoundation: The Charles and Margaret Levin Family Foundation |
| NASA: National Aeronautics and Space Administration |
| NIH: National Institutes of Health |
| NSF: National Science Foundation |
| ODNI: Office of the Director of National Intelligence |
| ONR: Office of Naval Research |
| SFPUC: San Francisco Public Utilities Commission |
| SSC: Student Sustainability Committee |
| SSHRC: Social Sciences and Humanities Research Council of Canada |
| USDA: US Department of Agriculture |
| ZJU: Zhejiang University Joint Research Center |

Journals

| |
|---|
| BJC: British Journal of Cancer |
| FrontMicrobiol: Frontiers in Microbiology |
| FrontSustainFoodSys: Frontiers in Sustainable Food Systems |
| JAmChemSoc: Journal of the American Chemical Society |
| JXB: Journal of Experimental Botany |
| MolBiolEvol: Molecular Biology and Evolution |
| MolCancer: Molecular Cancer Research |
| NatComms: Nature Communications |
| NatMicrobiol: Nature Microbiology |
| PhysiolJ: Journal of Physiology |
| PNAS: Proceedings of the National Academy of Sciences |
| ProcBiolSci: Proceedings of the Royal Society B: Biological Sciences |
| SciRep: Nature Scientific Reports |



Director's Message_01



About IGB_04



#Health #Wellness_08



#Agriculture #Energy_38



#Technology #Society_52



#15YearsOfIGB_84



2022 Numbers_88



Credits_95

“From stories about our scientific discoveries, our outreach programs both in the community and beyond, and our diversity and inclusion efforts, it’s clear that the IGB continues to be a leading source of scientific excellence and inspiration worldwide.”





Our Annual Reports have always been a cornerstone for reflecting on our accomplishments, from new grants secured, to important findings published, to the impact of our outreach programs. This past year was also unique because we celebrated the 15-year anniversary of the IGB.

To this end, we published monthly articles on our website and social media pages highlighting the achievements of the institute, both past and present. As researchers, we recognize that it is worthwhile to take a step back and appreciate the whole picture that has been meticulously crafted one day at a time. The same holds true in our Annual Report; although each year's accomplishments are worth recognizing, it is also important to appreciate the journey that has led us to this point.

So much has changed in the 15 years since the IGB's establishment. The growth of the internet and the rise of social media has fundamentally changed the way scientists connect with each other and the public about their research. The importance of being clear, concise, and captivating is essential to spreading our message. Embracing and expanding this approach over the years has been a testament to our commitment to public engagement. We believe posts and pictures can tell a story in a way that words alone cannot always do. You will see this belief reflected in this year's Annual Report, which borrows a captivating style of colorful photos paired with succinct, yet compelling, written pieces.

Looking back through our history, I am very proud of where we have come from, and who we as an institute have become. From stories about our scientific discoveries, our outreach programs both in the community and beyond, and our diversity and inclusion efforts, it's clear that the IGB continues to be a leading source of scientific excellence and inspiration worldwide. That's why it is my pleasure to introduce this year's Annual Report, which is dedicated to our history as an institute. Together, the stories over the following pages describe the journey of where we started, what we've accomplished, and how much we have grown. I join you in looking forward to watching the IGB continue to flourish in the coming years.

Gene E. Robinson
Gene E. Robinson
Director, Carl R. Woese Institute for Genomic Biology





♡ #RecreatingMemories #BeeKeepingClass #CommunityEngagement
#DifferentBeesSameGene #15YearsOfIGB



Carl R. Woese Institute for Genomic Biology

An interdisciplinary life sciences research institute using team-based strategies to tackle grand societal challenges. #IGBIllinois #IllinoisResearch

 Urbana, Illinois

 Founded March 29, 2007

Strategic Partnerships

Genomics and Eco-evolution of Multi-Scale Symbioses focuses on the classical species interaction between clover and honey bee pollinators as a model to understand the impact and dynamics of the myriad of microbes nested within them. GEMS takes an integrative approach to understand how molecular interactions impact the ecosystem. #Technology #Society

High Performance Biological Computing was created to address the need for a structure that could supply infrastructure, user support and training, and R&D capability in computational genomics to the Illinois research community. HPCBio provides a single, straightforward point of access, open to researchers from all campus units, helping them to find solutions to their biomedical data management and analysis problems. #Technology

Microbial Systems Initiative The goal of the MSI is to sustain a vibrant microbial sciences research and training enterprise at Illinois. Microbial systems research addresses critical problems in health, agriculture, energy, and many other sectors. The MSI carries out ongoing activities to build collaboration across disciplines, provide world class training opportunities, and build environments of inclusive excellence. #Health #Wellness #Agriculture #Energy #Technology

Molecule Maker Lab Institute is an interdisciplinary initiative with leaders in artificial intelligence and organic synthesis intensively collaborating to create frontier AI tools, dynamic open access databases, and fast and broadly accessible small molecule manufacturing and discovery platforms. Advanced AI and machine learning methods enable the MMLI to

achieve AI-enabled synthesis planning, catalyst development, molecule manufacturing, and molecule discovery. #Technology

Personalized Nutrition Initiative is a campus-wide initiative under the leadership of the Office of the Vice Chancellor for Research and Innovation, in partnership with the IGB and the College of Agricultural, Consumer and Environmental Sciences, to facilitate transdisciplinary collaborative efforts across campus to answer fundamental questions regarding how nutrition modulates health and disease across the lifespan and to translate that information to clinical care and to the public. #Health #Wellness #Agriculture #Energy #Technology #Society

Research Themes and Centers

Anticancer Discovery from Pets to People (ACPP)

Develops cancer treatments in pet animals that translate to human disease. #Health #Wellness #Technology

Biosystems Design (BSD) Applies engineering principles to real and artificial biological systems. #Health #Wellness #Energy #Agriculture #Technology

Center for Advanced Bioenergy and Bioproducts Innovation (CABBI) Develops ways to grow bioenergy crops, transform biomass into valuable chemicals, biofuels, and bioproducts. #Energy #Agriculture #Technology

Center for Artificial Intelligence and Modeling (CAIM) Uses computational science and modeling to address complex biological questions. #Health #Wellness #Technology

Center for Genomic Diagnostics (CGD) Identifies reliable biomarkers of disease and develops technologies to detect those biomarkers. #Health #Wellness #Technology

Center for Indigenous Science (CIS) Addresses societal and environmental issues using Indigenous Science frameworks. #Health #Wellness #Society

Environmental Impact on Reproductive Health (EIRH) Studies reproductive function and fertility disorders and develops therapeutic tools. #Health #Wellness #Technology

Genomic Ecology of Global Change (GEGC) Studies the intersection of plant genomics and global climate change. #Health #Wellness #Energy #Agriculture #Technology

Gene Networks in Neural and Developmental Plasticity (GNDP) Examines the effects of coordinated gene activity on biological diversity. #Health #Wellness #Technology

Genome Scale Engineering Center (GSE) Develops tools to allow rapid engineering of new organisms for the production of industrial compounds. #Energy #Agriculture #Technology

Genomic Security and Privacy (GSP) Considers the implications of genomic applications on an individual's security and privacy. #Health #Wellness #Society

Infection Genomics for One Health (IGOH) Examines how microbes in human-inhabited environments influence health and disease. #Health #Wellness #Energy #Agriculture #Technology

Microbiome Metabolic Engineering (MME) Explores the relationships between human microbiota, environment, and health. #Health #Wellness #Energy #Agriculture #Technology

Mining Microbial Genomes (MMG) Discovers small molecules that might provide new medical solutions. #Health #Wellness #Energy #Agriculture

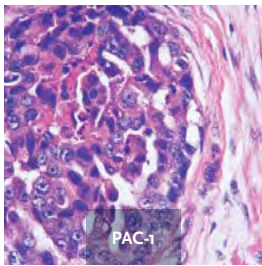
Multi-Cellular Engineered Living Systems (M-CELS) Develops in silico, cellular, and artificial components for precision assembly of biomachinery and computing processors. #Health #Wellness #Technology

Regenerative Biology and Tissue Engineering (RBTE) Studies the replacement and regeneration of tissues and organs. #Health #Wellness #Technology

“When the Institute for
Genomic Biology first
opened its doors, we were
a dream; we were a vision;
we were an inspiration;
we were an idea.”



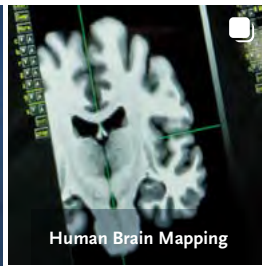
#Health #Wellness
29 stories



PAC-1



Cancer Cells



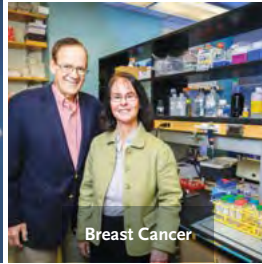
Human Brain Mapping



Mars Exploration



Cancer Cells



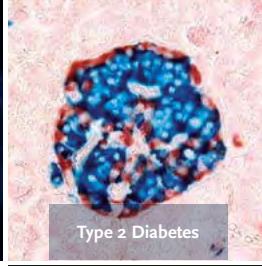
Breast Cancer



Black Death



Fruit Fly Brains



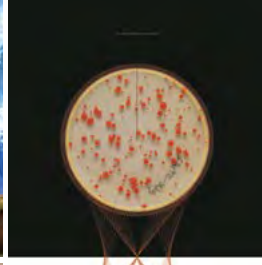
Type 2 Diabetes



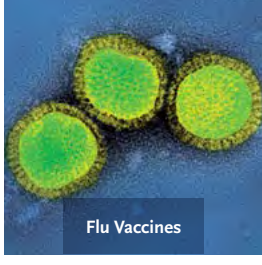
Alginate Hydrogels



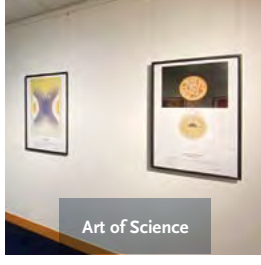
Honey Bees



Music of the Spheres



Flu Vaccines



Art of Science



Antimicrobial Use and Resistance



Microbiomes of Dogs



Canine Melanoma



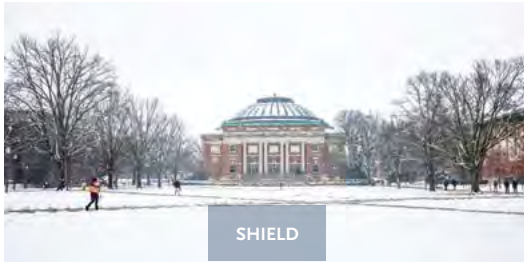
Identifying Genes



Anemia



COVID-19



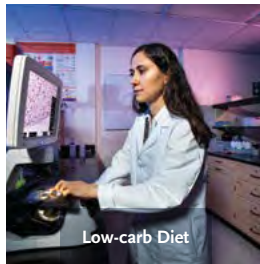
SHIELD



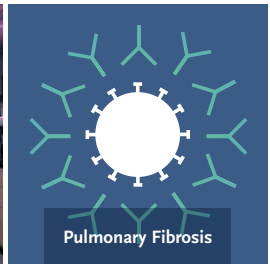
Cancer Drugs



Muscle Recovery



Low-carb Diet



Pulmonary Fibrosis



Reducing Seizures



Circadian Rhythm



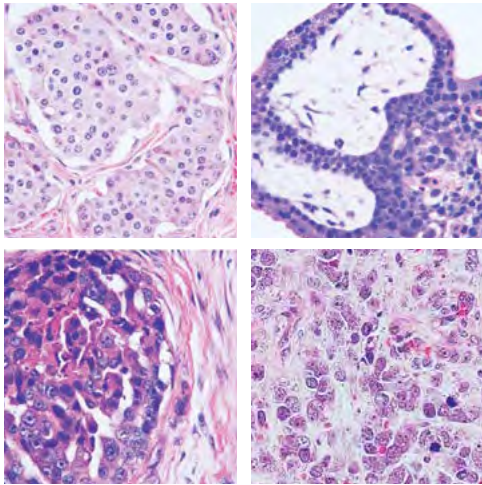
Molecular Velcro



Cancer Biomarker



COVID Virus Particles



First test of anti-cancer agent PAC-1 in human clinical trials shows promise



A phase I clinical trial of PAC-1, a drug that spurs programmed cell death in cancer cells, found only minor side effects in patients with end-stage cancers. The drug stalled the growth of tumors in the five people in the trial with neuroendocrine cancers. The drug was first identified and developed as an anti-cancer agent by scientists at the University of Illinois Urbana-Champaign.

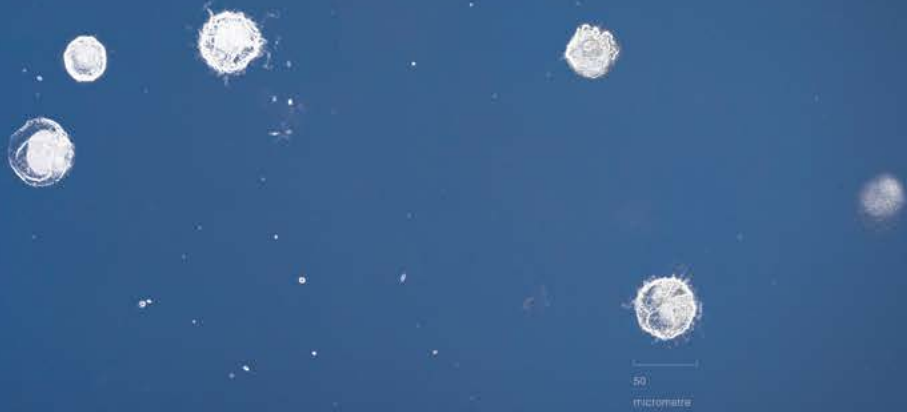
The findings from the clinical trial are noteworthy because the drug was tested in patients with advanced disease. The clinicians are currently seeking further funding to move the drug into phase II clinical trials, which would involve healthier patients with very similar cancer profiles to one another.

If clinical trials reveal that PAC-1 is therapeutic against one or more cancer types and the drug is approved for use in those populations, it will be less costly to test it against other cancers. An approved drug also can be prescribed for “off-label use” by doctors who think their patients might benefit from adding it to their cancer-treatment protocols. However, it can take many years for the results of new clinical trials to be available, and longer still before a new drug like PAC-1 is approved for cancer treatment, the researchers said.

[#ACPP](#) [#MMG](#) [#CGD](#) [#BJC](#) [#VanquishOncology](#) [#Illinois](#) [#NIH](#)
[#EngdahlFamilyFoundation](#)



#Health #Wellness



Many processes within the body are changed by the presence of cancer. These images show the response of microglia, immune defense cells in the brain, to cancer cells. #AWorldWithoutCancer #CellWars #NIH





#Health #Wellness



Network neuroscience theory best predictor of intelligence



Scientists have labored for decades to understand how brain structure and functional connectivity drive intelligence. A new analysis offers the clearest picture yet of how various brain regions and neural networks contribute to a person's problem-solving ability in a variety of contexts, a trait known as general intelligence.

The study used "connectome-based predictive modeling" to compare five theories about how the brain gives rise to intelligence. To test their ideas, the team recruited a demographically diverse pool of 297 undergraduate students, asking each participant to undergo a comprehensive battery of tests designed to measure problem-solving skills and adaptability. They then collected resting-state functional MRI scans of each participant.

The researchers found that taking into account the features of the whole brain produced the most accurate predictions of a person's problem-solving aptitude and adaptability.

#GNDP #HumanBrainMapping #ODNI #DoD #TellUsAboutZombies

December 16

People Mentioned

Aron Barbey,
Professor of
Psychology,
Bioengineering and
Neuroscience



Yurii Vlasov's team

NIH BRAIN Initiative supporting development of a probe to monitor brain chemistry

Received a \$3.2 million grant to develop smaller neural probes.

#ResearchersToRecognize #BigBrainBiggerGrant





Research to boost astronaut fitness on NASA's mission to Mars



[Marni Boppart](#) and her colleagues received a \$1M grant to explore the regenerative power of cells in space. Their research will help protect human health aboard Orion, the spacecraft destined to ferry astronauts from the Earth to the moon and Mars.

[#RBTE](#) [#GNDP](#) [#M-CELS](#) [#MMG](#) [#CABBI](#) [#BSD](#) [#NASA](#)

December 15

People Mentioned

Marni Boppart, Professor of Kinesiology and Community Health (pictured, right)

Justin Rhodes, Professor of Psychology (pictured, center)

Jonathan Sweedler, James R. Eiszner Family Endowed Chair in Chemistry (pictured, left)



Experts boost activity of potential therapeutic target in triple-negative breast cancer



Less than 20% of diagnosed breast cancers are designated “triple-negative,” meaning that the affected tissues lack three types of receptors often found in other breast cancer types. However, TNBCs are often aggressive with a higher risk of recurrence, metastasis and mortality. In a study led by [Benita Katzenellenbogen](#) and [John Katzenellenbogen](#), researchers found that targeting a specific estrogen receptor that is sometimes present in TNBCs alters the activity of dozens of cancer-related genes and slows the growth and metastasis of these breast cancers in both TNBC cells and in a mouse model.

The study details many of the gene regulatory changes and anticancer molecular pathways that are activated in response to stimulating and upregulating estrogen receptor beta. The experiments revealed that hundreds of genes are regulated differently in cells or tumors expressing high levels of ER beta. Some of those genes contribute to—or suppress—cancer proliferation and metastasis. In mice with TNBC tumors containing higher levels of ER beta, the team saw greater reductions in tumor growth and metastasis.

This research may also be useful in the treatment of other cancer types in tissues that also express good levels of ER beta receptors.

[#CGD](#) [#Endocrinology](#) [#BCRF](#) [#NIH](#) [#Illinois](#) [#AWorldWithoutCancer](#)

People Mentioned

Benita Katzenellenbogen,
Professor of Molecular
and Integrative
Physiology (pictured,
right)

John Katzenellenbogen,
Professor of Chemistry
(pictured, left)



Researchers determined genetic variants that offered protection during Black Death

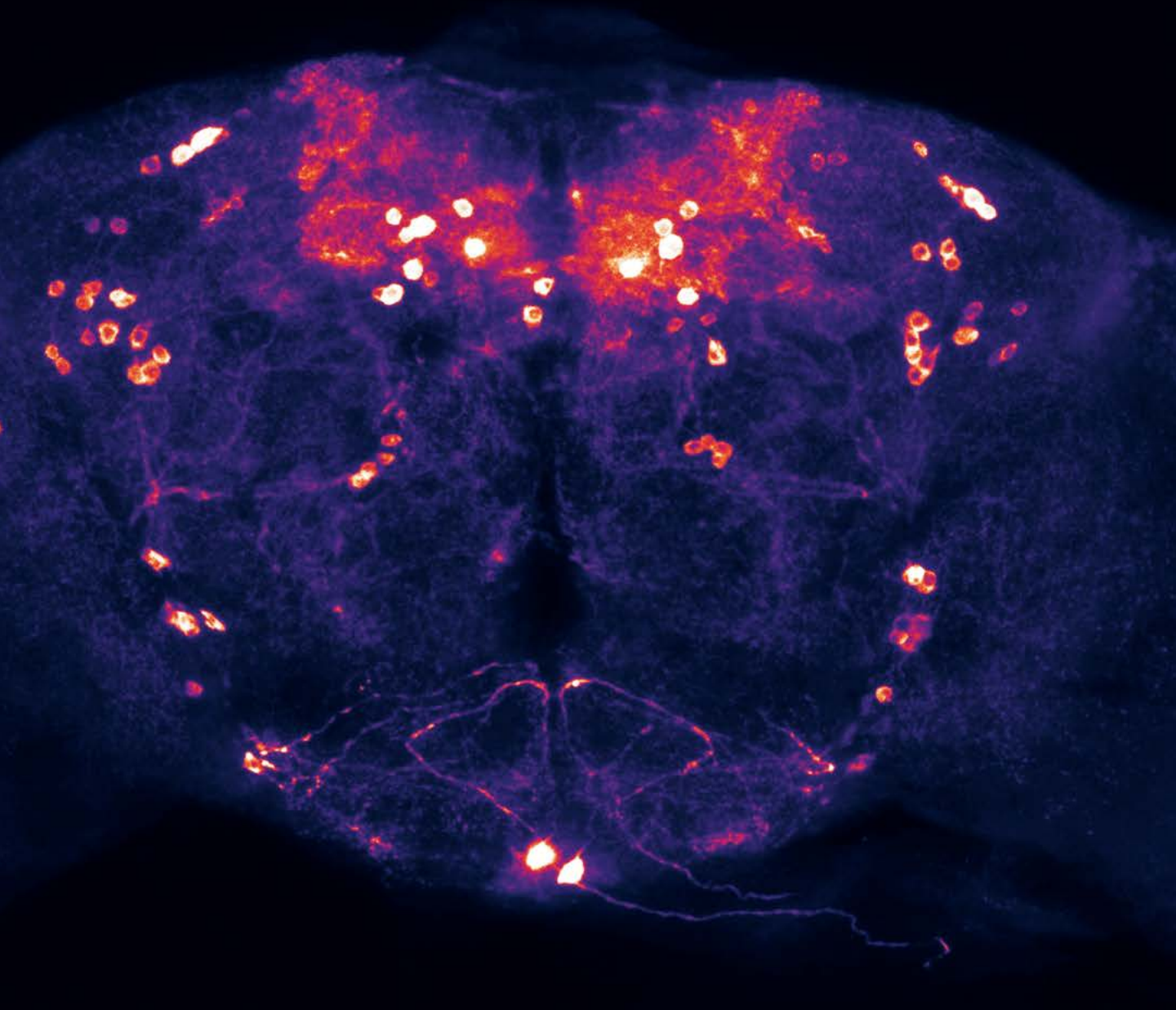
The Black Death remains the most devastating pandemic in recorded history. It was caused by *Yersinia pestis*, a contagious and deadly bacterium that quickly spread across the eastern continents. How did this plague alter the population's genetic composition, and did any alleles confer protection in those that survived?

To answer these questions, researchers collected ancient DNA across London and Denmark from individuals who died either shortly before, during, or after the Black Death. The DNA was sequenced, and targeted immune genes were examined across the three time points to look for large changes in variant frequency over time. The researchers found that 4 gene loci, including variants near ERAP2 and TICAM2, matched this pattern.

The researchers also showed that genetic variation near ERAP2 and TICAM2 in live macrophages may improve detection of and resistance to *Y. pestis*. This likely protected people with these variants during the Black Death, increasing their chance of survival. Although variants near ERAP2 and TICAM2 help against an array of other pathogens, higher expression of ERAP2 is associated with autoimmune disorders in modern day humans, including Crohn's disease. This balancing selection likely explains why different variants for these genes are still present in the population today.

#IGOH #GNBP #Nature #NIH #Wenner-GrenFoundation
#UniversityChicago #SSHRC #CIFAR



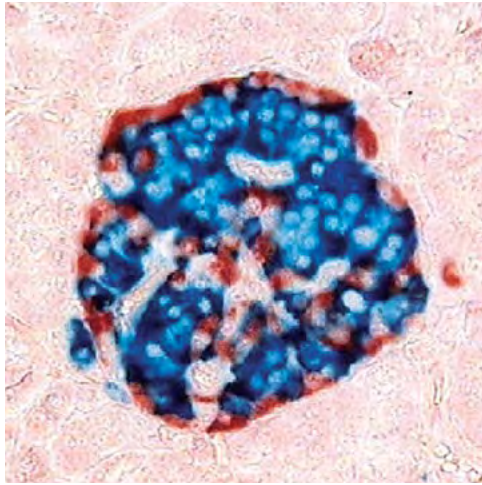


Researchers investigate neuron differentiation in fruit fly brains

Brains contain a diverse array of neuron types with different functions, but when these form during embryonic development there is initially only a small pool of cell types to work with. How do neurons diversify over the embryo's development? Researchers measured the expression pattern of genes within the optic medulla of fruit fly brains during development to try to understand how temporal transcription factors lead to different neuron fates.

#GNBP #eLife #NIH #FruitFlyBrains #TotallyNotZombies





Understanding the differences between healthy and type 2 diabetes-affected pancreatic islets



Although previous studies have looked at how pancreatic cells communicate with each other, the nature of these chemical signals has remained unknown. In a new study, researchers measured a new set of molecules to determine how cell-to-cell communications change in healthy and type 2 diabetes-affected islets and to identify therapeutic targets.

#BSD #CABBI #MMG #Metabolites #ADA #NIH #CuringDiabetes

November 21, 2022



Aleczandria Tiffany

Tiffany proposed to develop a material that mimics bone growth plates.



Vasiliki Kolliopoulos

Kolliopolus proposed to develop a platform to screen biomaterials for bone injuries.



Victoria Kriuchkovskaia

Kriuchkovskaia proposed to develop screening drugs for complex brain tumors like glioblastoma.





Developing alginate hydrogels that can support cell growth



Encapsulating cells—both prokaryotic and eukaryotic—allows researchers to carry out experiments in hydrated environments over prolonged periods of time. However, cell growth under these conditions can exert a lot of pressure on the encapsulating shells, resulting in cell leakage. Hydrogel capsules have been utilized for over 50 years. There are many different types that can be made by combining different kinds of cells in different hydrogel environments,” said [Yoon Jeong](#). “The problem with combining microorganisms with hydrogel capsules is that they leak out.”

To address this problem, Jeong decided to focus on alginate, a naturally occurring, edible compound found in brown algae. Jeong tested his system with genetically-modified *Lactococcus lactis* and saw that without the layer, the bacteria leaked out and were unable to form biofilms. However, *L. lactis* colonies inside the modified hydrogels were able to grow for over 10 days.

The researchers are also interested in continuing their tests in human and cancer cells, with the hope that the hydrogels will be able to provide a reliable platform for a wide range of applications.

[#CGD](#) [#EIRH](#) [#BiosensorsAndBioelectronics](#) [#NIH](#)
[#MakingBlobsHappen](#)

People Mentioned

Yoon Jeong,
Graduate Student
in Joseph
Irudayaraj's lab



Honey bees prosper with quality, not quantity, of food



Honey bees typically forage from up to 1-2 miles away from the hive, though sometimes they travel even further. However, much of the modern landscape consists of agricultural fields, which limits their foraging options. Furthermore, it is unclear how agricultural landscapes impact the type of food the honey bees bring in, and if this food affects the queen's egg production. [Adam Dolezal](#) and [Ashley St. Clair](#) explored these questions in a new paper.

The researchers first placed honey bee colonies across differing agricultural vs wildflower prairie landscapes, and measured the species

People Mentioned

Adam Dolezal,
Professor of
Entomology
(pictured)

Ashley St. Clair,
Postdoctoral
Researcher in Adam
Dolezal's lab

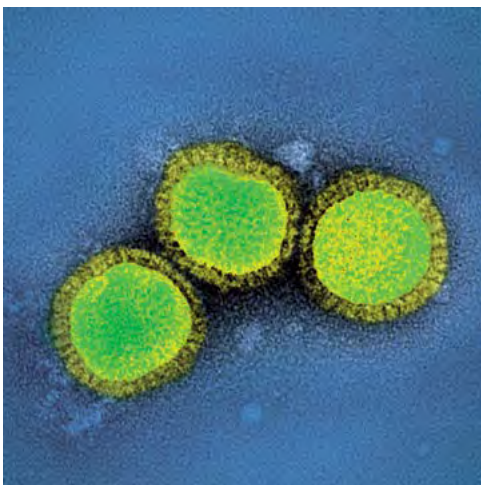


and amount of pollen collected, and the number of eggs laid by the queen. For the second part of the study, they tested the nutritional impacts on egg laying in a controlled laboratory setting.

In line with what was found in the field, queens laid more eggs under the prairie diet compared to the crop diet. The results from both the field and lab components of the study suggested that honey bee colonies do better when given a diverse diet, as would be found in a field of prairie flowers, compared to a less diverse diet of crops.

#IGOH #FrontSustainFoodSyst #USDA #EasternApiculturalSociety #YasQueen

November 7



Researchers explore gene interactions in influenza to help improve accuracy of flu vaccines



The influenza virus, which causes the flu, infects millions of people and costs \$10 billion in direct medical costs in the U.S. annually. Most research efforts for vaccination focus on the evolutionary potential of the surface protein hemagglutinin, which binds to cell surface receptors, allowing the virus to enter and replicate. However, another surface protein called neuraminidase has been largely overlooked. NA is important for later in the virus life cycle, when it destroys the receptors originally used for entry, cleaving the cell, and releasing the virions inside.

HA and NA are highly functionally involved with each other because they are both necessary for the virus to infect cells and spread. In a new paper, [Brooke's team](#) explored how changes in NA activity affected the evolutionary potential of HA. They determined that virus strains with reduced NA activity had higher mutational tolerance in changes in HA.

People Mentioned

Christopher Brooke,
Associate Professor
of Microbiology



The evolution of HA is mainly studied in isolation from other genes in influenza vaccine research, but Brooke says this data demonstrates the need to look at the interactions between HA and genes for other proteins, like NA, to better predict how HA will evolve depending on mutations in these other genes across strains.

[#IGOH](#) [#MMG](#) [#CellHostMicrobe](#) [#NIH](#) [#CarverCharitableTrust](#)

October 6



IGB's "Art of Science" exhibit at the Keck Center



The Cultural Programs of the National Academy of Sciences displayed "Art of Science," an exhibition of artwork from the IGB from September 2022 through January 2023 at the Keck Center of the National Academies in Washington, D.C.



#Health #Wellness

The exhibit featured artwork across the 12-year span since Art of Science was established, bridging science and art to accomplish two goals: One, to emphasize the diversity of research at the IGB, and two, present the research in a way that is both eye-catching and understandable to everyone. In doing so, the exhibits take the scientific endeavors at the IGB and highlight their wonder and beauty. [Julia Pollack](#), Art of Science curator at the IGB, works with researchers to enhance their images and emphasize the beauty and importance of their scientific work.

The Art of Science features subjects ranging from the microscopic to the perceptible, including physical phenomena as well as abstract representations of research.

“It is our hope that the visitors to our space will find inspiration from our exhibits and be reminded of the human connection we all have with science—its beauty, elegance, and inspiration, as well as its significance and impact on society,” said J.D. Talasek, Director of Cultural Programs of the National Academy of Sciences.

[#SciencelsFun](#) [#ArtOfSciencelsMoreFun](#)

September 22

People Mentioned

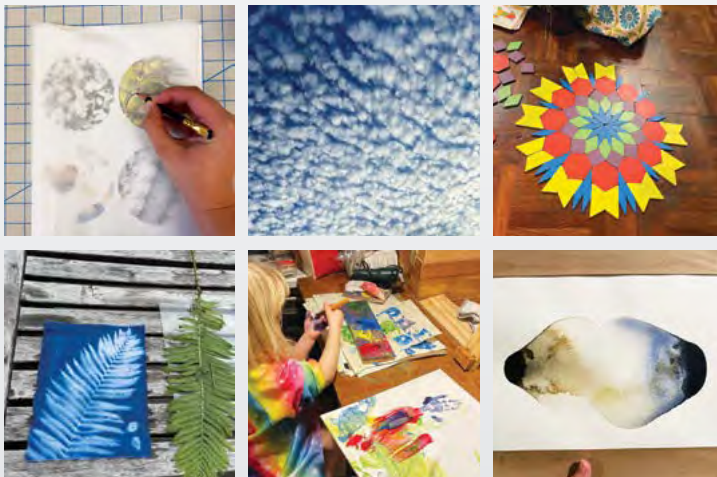
Julia Pollack,
Art of Science
Curator, IGB Creative
Program Manager



Julia Pollack

IGB Creative Program Manager

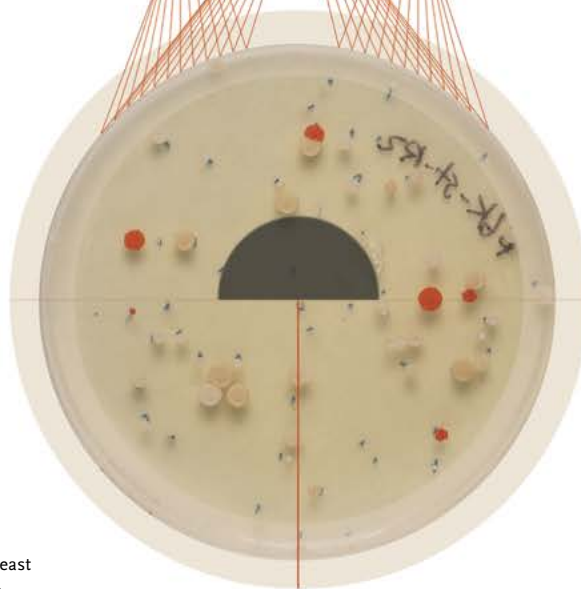
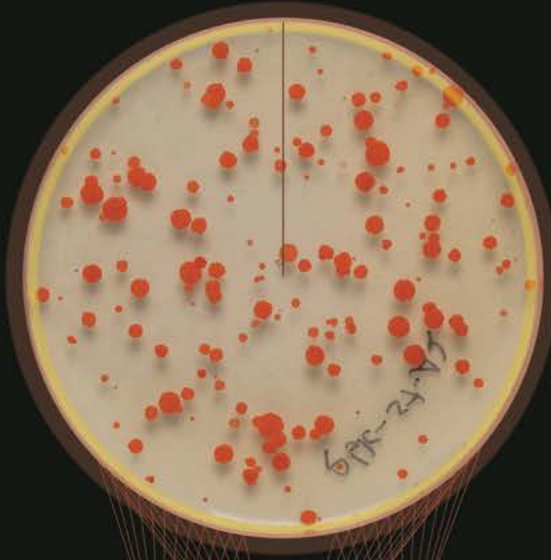
[#PeopleToFollow](#) [#ADayInTheirLife](#)





#Health #Wellness

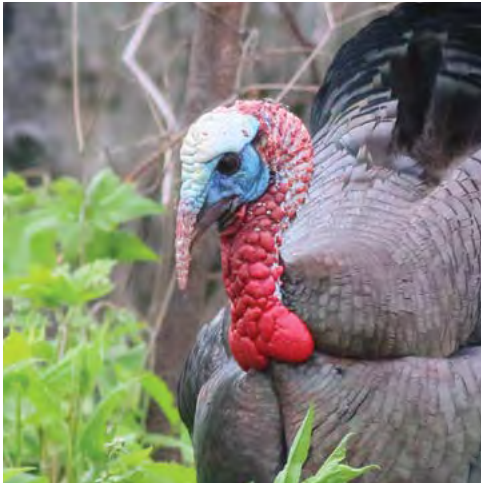
Rhodospiridium toruloides



These images compare a yeast that naturally produces the reddish pigment beta-carotene with its gene-edited cousin that has been modified to lose this capability. This work demonstrates the opportunity to guide and design the molecular activities of yeast. #SciencelsFun #DoE

CRISPR Cas9 gene edited





Modeling antimicrobial use and resistance in Canadian turkey flocks



Antimicrobial resistance in gut bacteria is constantly being detected on poultry farms, including in turkey flocks. Concerningly, studies on the associations between antimicrobial resistance and antimicrobial use have been scarce. In a new study, researchers have modeled how antimicrobial use impacts the emergence of antimicrobial resistance in *Escherichia coli* isolated from Canadian turkey flocks.

[Csaba Varga](#) and his research group used fecal sample data that had been collected from turkey farms by the Canadian Integrated Program for Antimicrobial Resistance Surveillance. The researchers examined the association between antimicrobial use and resistance using new modeling techniques that considered the disease indications for antimicrobial use, the quantity of antimicrobials used, the length of treatment, the weight of birds, and the administration route.

#IGOH #FrontMicrobiol #GovernmentOfCanada #CPRC #Illinois

September 13

People Mentioned

Csaba Varga,
Assistant Professor
of Epidemiology



Tandy Warnow

College Award for Excellence in Faculty Mentoring from the Grainger College of Engineering



Cecilia Leal

College Award for Sustained Excellence in Diversity, Equity and Inclusion from Grainger College of Engineering





Immunotherapy trials show promise for treating canine melanoma



According to the American Veterinary Medical Association, almost half of dogs over the age of 10 will develop cancer. **Timothy Fan** is leading two clinical trials to treat dogs with malignant melanoma. The novel approaches have yielded encouraging results and human trials are expected to begin in 2023.

Started in 2021, the first trial involved a course of injections of cytokines—proteins that help control the immune response—that bind with collagen, a protein that surrounds and promotes the growth of cancer cells. In contrast to the low survival times for dogs undergoing traditional treatment, all 13 dogs demonstrated measurable tumor shrinkage.

The second canine clinical trial, launched in June 2022, builds on the success of the first. This trial is sponsored by Ankyra Therapeutics, a Boston-based biotech company. The approach uses a cytokine drug attached to an inert “anchor” that retains the drug within the cancer cell microenvironment triggering an immune response to attack the cancer, and avoids side effects.

The two trials will yield a lot of information about how effective this novel treatment is. Findings will be evaluated to improve patient care, inform human trials, and advance knowledge of cancer biology.

[#ACPP](#) [#AnkyraTherapeutics](#) [#MakeDogsImmortal](#)

August 9

People Mentioned

Timothy Fan,
Professor of
Veterinary Clinical
Medicine (pictured)



New tool to identify genes associated with coronavirus



A recent paper investigated transcription regulatory sequences of COVID-19, and found that TRSs play a critical role in discontinuous transcription in coronaviruses. The group created an algorithm to identify TRS sites in coronavirus strains to “solve the problem to optimality in polynomial time,” said [Mohammed El-Kebir](#).

[#MolBiolEvol](#) [#IGOH](#) [#NSF](#) [#ReduceTheSpread](#) [#CovidDetectives](#)

July 18

People Mentioned

Mohammed El-Kebir,
Professor of
Computer Science



Small molecule transports iron in mice, human cells to treat anemia



Researchers found a small natural molecule derived from cypress trees can transport iron in live mice and human cells lacking the protein ferroportin that normally does the job, easing buildup of iron in the liver and restoring hemoglobin and red blood cell production. This offers a potential treatment for ferroportin disease and anemia.

[#PNAS](#) [#MMG](#) [#NIH](#) [#IronRecycling](#)

June 27



New study investigates the microbiomes of dogs across the world

Although the microbiome—the collection of all microbes that live in the body—of dogs has been investigated extensively, those studies have mostly been limited to domesticated dogs. In a new study, researchers have sampled the fecal microbiomes across diverse geographical populations to better understand what they look like around the world.

“A lot of the studies look at how different diets affect dog microbiomes. Although they are extensive, they work with dogs in veterinary centers, which lead a very different life from dogs that don’t live as pets,” said Karthik Yarlagadda.

The researchers collected fecal matter from three geographical locations: pets from South Africa, stray dogs and shelter dogs in India, and dogs from a rural village in Laos. The samples were collected on FTA cards, which preserve the DNA so it can be sequenced and analyzed later.

Interestingly, although the microbiomes among the different populations differed, functionally they were the same. The researchers also contrasted these samples with ancient microbiomes, obtained from fossilized dog feces. They found that the microbiomes from ancient dogs closely resembled the non-U.S. populations, potentially due to overlapping diets and more environmental exposures.

#ProcBiolSci #GNBP #GSP# IGOH #USDA #Illinois
#WhatTheDogDoin

June 21

People Mentioned

Karthik Yarlagadda,
Former Graduate
Student in Ripan
Malhi’s Lab

Ripan Malhi,
Professor of
Anthropology





15 Years of IGB: SHIELDing the Illinois community against COVID-19

In the earliest months of 2020, [Nigel Goldenfeld](#) and [Sergei Maslov](#) built a mathematical model of Urbana and Champaign to predict what would happen to the community if students were allowed to return to campus after spring break. The model predicted that there would be a huge wave of infections. They immediately contacted the university provost and on March 11th the students were told that their classes would be online. The model also convinced Governor J.B. Pritzker to issue a statewide stay-at-home order.

The second step that was taken to protect the Illinois community was implementing SHIELD Illinois—a COVID-19 testing program designed to safely open schools, protect workplaces, and save lives. The procedure was simple, non-invasive and the results were available within 24 hours.

The SHIELD team also developed a new resource—the K-12 Shield Playbook—to help guide teachers and school administrators as they reopened schools during the pandemic. In recognition of SHIELD's efforts, Tim Killeen, the President of the University of Illinois, honored 28 key leaders of the system's COVID-19 response with the Presidential Medallion in August 2021.

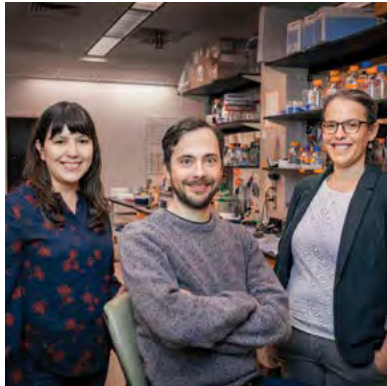
[#BCXT](#) [#GNDP](#) [#CABBI](#) [#MMG](#) [#CGD](#) [#ACPP](#) [#ReduceTheSpread](#)
[#NotAllHeroesWearCapes](#) [#15YearsOfIGB](#)

People Mentioned

Nigel Goldenfeld,
Former Swanlund
Endowed Chair and
Professor of Physics

Sergei Maslov,
Professor of
Bioengineering and
Bliss Faculty Scholar





Study tracks COVID-19 infection dynamics in adults



Researchers tracked SARS-CoV-2 in newly infected people over time using repeated sampling and different testing methodologies. They found that individuals shed live virus anywhere from only a day or two, to up to nine days after infection. This research is key to understanding how the virus spreads and persists in a population.

[#NatMicrobiol](#) [#IGOH](#) [#NIH](#) [#ReduceTheSpread](#)

April 28



15 Years of IGB: Developing new drugs to battle cancer



Figuring out which drugs can help cure cancer is a laborious process, often requiring decades of careful research and multiple phases of clinical trials. To this end, the Anticancer Discovery from Pets to People research theme at the IGB has painstakingly worked on getting two drugs into clinical trials: PAC-1 and ErSO to treat brain and breast cancer respectively.

Researchers discovered PAC-1's anti-cancer capabilities in 2006, when PAC-1 was found to activate the cellular enzyme procaspase-3, which triggers a series of reactions that causes only cancer cells to self-destruct,

People Mentioned

Christopher Brooke,
Associate Professor
of Microbiology
(pictured, center)

Pamela Martinez,
Assistant Professor
of Microbiology
(pictured, left)

Rebecca Smith,
Professor of
Epidemiology
(pictured, right)



#Health #Wellness

sparing healthy cells. Currently in human trials, PAC-1 has been cleared for use in a clinical trial of patients with certain cancers of the brain.

In 2021, the researchers discovered a small molecule ErSO that had powerful anticancer effects, killing 95-100% of the cancer cells and shrinking large tumors to undetectable levels without side effects in mice. ErSO works by binding to the estrogen receptor, upregulating the anticipatory Unfolded Protein Response or a-UPR, which kills cancer cells.

Unfortunately, patients with certain cancers still eventually succumb to the disease, even with treatment. Hopefully, as we learn more about these drugs, we will get closer to finding better weapons that can help us treat cancer.

#ACPP #CGD #MMG #AWorldWithoutCancer #15YearsOfIGB

April 11



New approach enhances muscle recovery in aged mice



Scientists have developed a new method to combat age-related losses in muscle mass that often occur after an injury or illness. Their technique involves collecting extracellular vesicles from cells of young, healthy mice and injecting them into aged mice. These EVs contain factors that combat stress and enhance healing, and can be used therapeutically.

#PhysiolJ #NIH #RBTE #Beckman #SwoleMice

April 11



Hee-Sun Han

Amy L. Devine Award for commitment to student learning

Han received an award for going above and beyond in her teaching.

#ResearchersToRecognize #TeacherAppreciation





Treatment of liver metastases in breast cancer patients improved by low-carb diets



A new study by [Zeynep Madak-Erdogan](#) and her team have found a new mechanism of endocrine resistance in breast cancers metastasized to the liver. Specifically, they found that liver metastases rely on increased amounts of glucose, revealing the possibility of a dietary intervention to reduce tumor burden and increase treatment efficacy.

Approximately one-third of breast cancer patients will later present with metastatic disease. Patients with liver metastases are often resistant to endocrine treatment and suffer from a reduced quality of life and poor survival rates. The unique nature of the liver tissue environment, with its high nutrient and lower oxygen composition, may be providing metastatic tumors with an advantage over other tissues.

People Mentioned

Zeynep Madak-Erdogan, Associate Professor of Food Science and Human Nutrition (pictured)



#Health #Wellness

The study began by observing differences in the breast cancer patient population and found that patients with liver metastases typically did not respond to the standard of care endocrine therapy. By using mice fed various carbohydrate diets, the researchers discovered that liver metastases decreased with carbohydrate levels, and low-level carbohydrate diets restored the efficacy of Fulvestrant, the standard of care endocrine therapy, in reducing metastatic tumor burden in mice.

#MolCancer #CGD #EIRH #GSP #USDA #Illinois #LowCarbDiet

March 28



New tests and treatments developed in mice for pulmonary fibrosis



Scientists at the University of Illinois Urbana-Champaign and Mie University in Japan have developed monoclonal antibodies that prevent lung cell death in mouse models for idiopathic pulmonary fibrosis and acute respiratory disease syndrome. This could be a critical step in treating the deadly diseases, for which few effective therapies currently exist.

#NatComms #MME #BCXT #LevinFoundation #NewDiagnosticTools



Huimin Zhao
ACS Synthetic Biology

The Publications Division of the American Chemical Society appointed Zhao as editor in chief of *ACS Synthetic Biology*.

#ResearchersToRecognize #BusyMuch? #iBioFabulous





Team identifies compound with potent antiseizure effects



Researchers studying epileptic seizures of the temporal lobe—the most common type of epilepsy—discovered a compound that reduces seizures in the hippocampus, a brain region where many such seizures originate. The compound, known as TC-2153, lessened the severity of seizures in mice.

“We found that TC-2153 ultimately reduces seizure severity in mice by decreasing the activity of hippocampal neurons,” said [Jennifer Walters](#), who led the research with [Hee Jung Chung](#).

The hippocampus plays a central role in learning and memory, so anything that damages it can have devastating consequences for the individual. The strength of synaptic communication between neurons and the excitability of individual neurons can affect the likelihood that seizures occur, Chung said.

People Mentioned

Hee Jung Chung,
Professor of
Molecular and
Integrative
Physiology

Jennifer Walters,
Graduate Student
in Hee Jung
Chung's lab
(pictured)



#Health #Wellness

The finding that TC-2153 lessened the occurrence of seizures was a surprise, the researchers said, because it is known primarily as an inhibitor of a brain-specific protein called STEP that reduces the strength of synaptic communication between neurons.

“We hypothesized that seizure activity would increase when we used TC-2153 because STEP inhibition would increase synaptic communication,” Walters said. “But we found that it actually reduced seizure severity in both male and female mice.”

Follow-up experiments in mouse brains and in neuronal culture revealed a possible mechanism by which TC-2153 decreases seizure severity. The team found that the compound reduced the excitability of individual neurons, suggesting a novel function of STEP, Chung said. Further studies will explore how TC-2153 works and will test its effects in human neurons.

#M-CELS #NIH #IllinoisCollaborative #SurpriseFinding

March 22

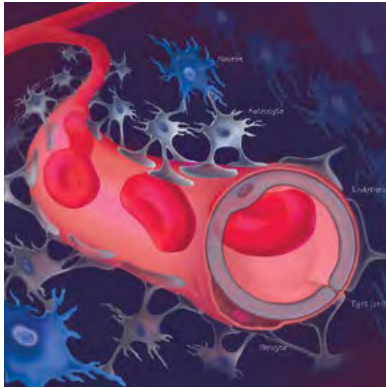


Jennifer Walters

Graduate Student in Hee Jung Chung's lab

#PeopleToFollow #ADayInTheirLife





Circadian rhythm and the blood-brain barrier



An interdisciplinary team received a grant to study the circadian dynamics of the blood-brain barrier, including how time of day affects its permeability to hormones and drugs. Using a scaffold derived from human stem cell lines, the team will fabricate a biomimetic blood-brain interface to test responses to blood leakage and day-night cycles.

#NIH #DoD #MolecularClocks

February 23



'Molecular Velcro' enables tissues to sense, react to mechanical force



Cadherins are Velcro-like cellular proteins that hold cells and tissues together and also perform critical functions when they experience increased tension. A new study led by [Deborah Leckband](#) observed that when tugged upon in a controlled manner, these proteins communicate with growth factors to influence in vitro tumor growth in human carcinoma cells.

When bound to cadherin molecules in normal tissue, growth factor receptors cannot communicate with growth factor proteins—the substance

People Mentioned

Deborah Leckband,
Professor of Chemical
and Biomolecular
Engineering
(pictured)



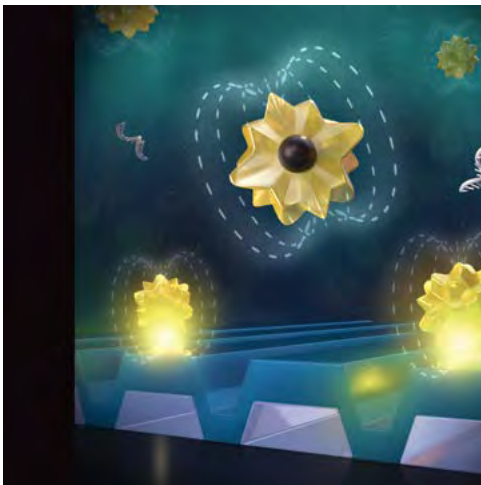
they need to promote tissue growth. However, researchers found that changes in tensional stress on cadherin bonds disrupt the cadherin-growth factor interaction and switch on growth signals in tissues.

To determine this, the team used a self-built “cell stretcher” in which the carcinoma cells are grown in a thin layer on the surface of a flexible medium. When the cells were stretched, the researchers observed changes that could increase tissue growth and tumorigenesis.

“This study confirms that cadherins use force to switch on biochemical growth signaling,” Leckband said. “By confirming these force-induced disruptions, we may be able to find a way to mutate cadherin molecules in order to prevent certain types of tissue growth, such as metastatic transformation and tumorigenesis.”

#RBTE #PNAS #NIH #StretchyCells #FeelTheTension

February 9



Acceleration of cancer biomarker detection for point of care diagnostics



The detection and quantification of cancer-associated molecular biomarkers in body fluids, or liquid biopsies, prove minimally invasive in early cancer diagnostics. Researchers in the [Cunningham lab](#) have developed an approach that accelerates the detection of cancer biomarkers in these samples.

The study focused on the detection of a group of molecular biomarkers called microRNAs, small, single-stranded and noncoding RNAs that play important roles in gene expression and regulation, and have been linked to certain cancer types and stages.

“Conventional detection methods take up to several hours for the person to get the result so our motivation was to accelerate the response time and make it shorter,” said [Congnyu Che](#), the first author of the paper.

People Mentioned

Congnyu Che,
Graduate Student
in Brian
Cunningham's lab

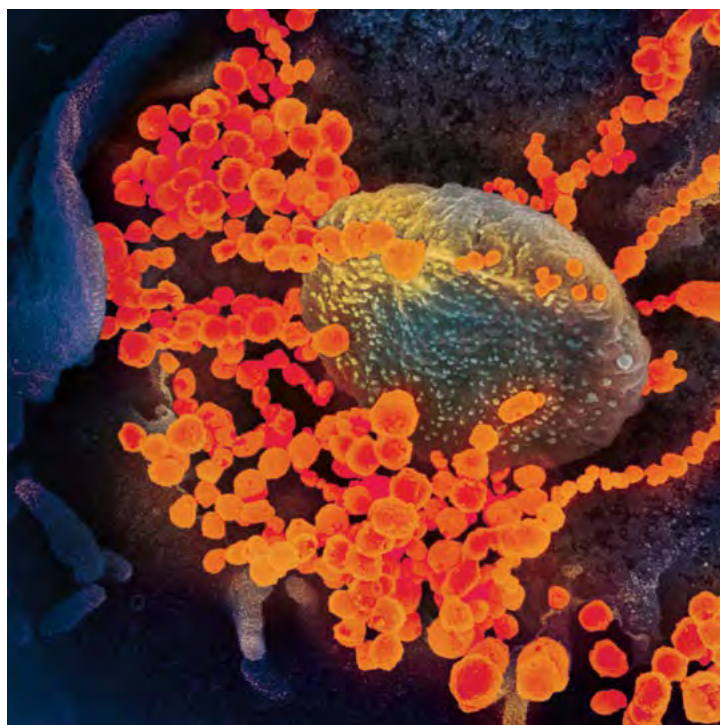
Brian Cunningham,
Intel Alumni
Endowed Chair
of Electrical
and Computer
Engineering



Previously, the Cunningham group developed a technique to capture miRNA biomarkers, called Photonic Resonator Absorption Microscopy, that is capable of visualizing gold nanoparticles bound to target miRNAs. Using gold-only nanoparticles, it would take between 1-2 hours before the nanoparticles found their way to the biosensor. To accelerate the process, Che synthesized magnetic-plasmonic nanoparticles that incorporated iron materials that could then be attracted by a stationary magnet placed under the biosensor. The detection time was reduced to just one minute.

#ACSNano #CGD #MMG #NIH #NSF #ZJU #IGB

January 27



New detection technique counts covid virus particles in saliva, breath



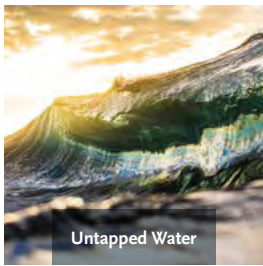
Researchers design a new approach, called label-free detection, for testing for COVID-19. This methodology utilizes a biosensor and detection instrument called Photonic Resonator Interferometric Microscopy, to digitally count intact virus particles in saliva or exhaled breath at a lower cost and reduced time to diagnose an infection.

#JAmChemSoc #CGD #MMG #NIH #NSF #ZJU #IGB
#ReduceTheSpread

January 14



#Agriculture #Energy
11 stories



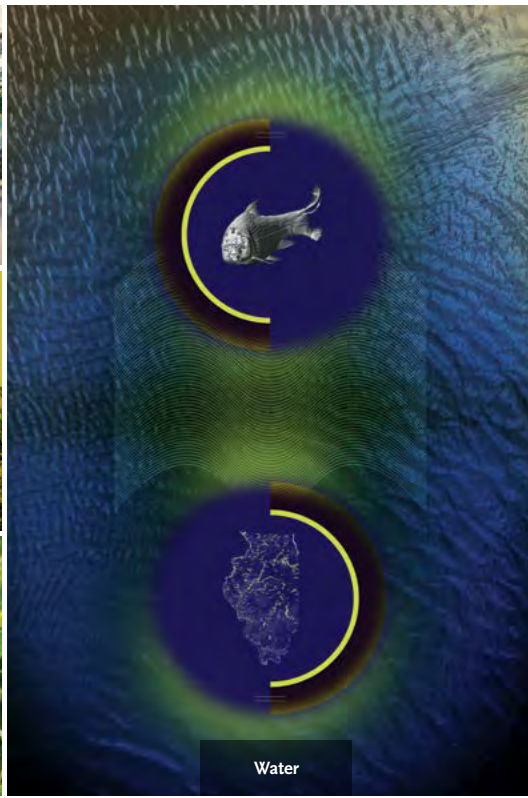
Untapped Water



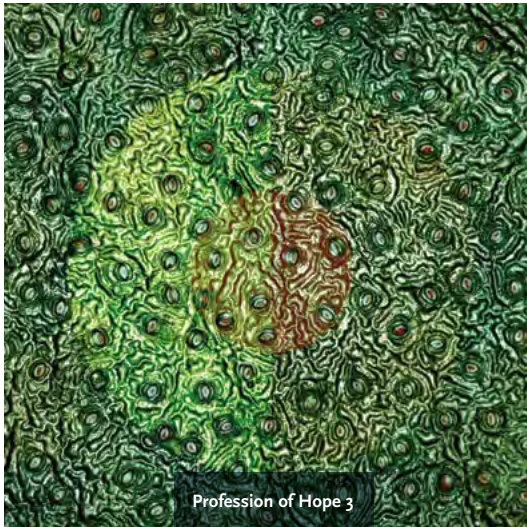
Next-Gen Bioenergy Crop



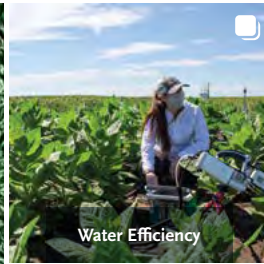
Improving Photosynthesis



Water



Profession of Hope 3



Water Efficiency



Plant Symbionts



15 years: EBI



Plasmid Automation



Cowpea



15 years: RIPE



Researchers propose new structures to harvest untapped source of fresh water



An almost limitless supply of fresh water exists in the form of water vapor above Earth's oceans, yet remains untapped. A new study from the University of Illinois Urbana-Champaign is the first to suggest an investment in new infrastructure capable of harvesting oceanic water vapor as a solution to limited supplies of fresh water in various locations around the world.

The study, led by [Praveen Kumar](#), evaluated 14 water-stressed locations across the globe for the feasibility of a hypothetical structure capable of capturing water vapor from above the ocean and condensing it into fresh water—and do so in a manner that will remain feasible in the face of continued climate change.

The researchers performed atmospheric and economic analyses of the placement of hypothetical offshore structures 210 meters in width and 100 meters in height. Through their analyses, the researchers concluded that capturing moisture over ocean surfaces is feasible for many water-stressed regions worldwide. The estimated water yield of the proposed structures could provide fresh water for large population centers in the subtropics.

The researchers said this study opens the door for novel infrastructure investments that can effectively address the increasing global scarcity of fresh water.

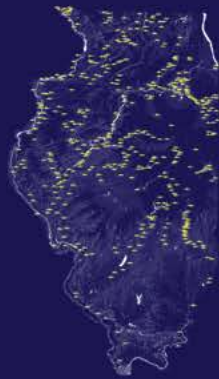
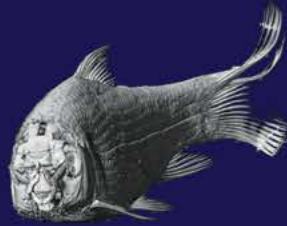
[#SciRep](#) [#Illinois](#) [#NSF](#) [#GEGC](#) [#DrinkUp](#)

People Mentioned

Praveen Kumar,
Professor of Civil
and Environmental
Engineering



#Agriculture #Energy



The shorthead redhorse, *Moxostoma macrolepidotum*, is commonly found in large creeks and rivers across Illinois.

The Illinois Natural History Survey contains specimens of fish that have been collected over the past 150 years. #JustKeepSwimming #IllinoisNaturalHistorySurvey





#Agriculture #Energy

CABBI team adds powerful new dimension to phenotyping next-gen bioenergy crop

Researchers at CABBI demonstrated how unmanned aerial vehicles combined with cutting-edge machine learning can assist the selection of the best candidate genotypes in miscanthus, a type of grass, breeding programs. This is especially important in highly productive perennial grasses where in-field phenotyping is more challenging, but more rewarding.

It was the first attempt to use data-intensive monitoring of large, genetically diverse populations of miscanthus using digital technologies. For their assessment, researchers used drones to capture high-resolution images of crops during the growing season, together with ground-based data for thousands of miscanthus genotypes, to determine their flowering time, height, and biomass yield. The imaging combined photogrammetry, which provides digital surface models, and multispectral sensing technology that can obtain images not visible to the human eye.

“This is an exciting step toward developing digital applications for selecting the best candidate genotypes for a fraction of the cost of traditional manual screening,” said [Andrew Leakey](#). “That is just one key step in the broader work CABBI is doing to deliver the scientific understanding and technological advances needed to make environmentally beneficial and profitable bioenergy a reality for the Central U.S.”

[#RemoteSensing](#) [#DoE](#) [#GEGC](#) [#SpyingOnMiscanthus](#)

November 7

People Mentioned

Andrew Leakey,
CABBI Director
and Professor of
Plant Biology





RIPE researchers prove for first time ever bioengineered photosynthesis increases yields in food crops



In 2021 nearly 10% of the world population was hungry, a situation that has been steadily worsening over the last few years and eclipsing all other threats to global health in scale. Two of the major causes of this are inefficient food supply chains and harsher growing conditions due to climate change.

In this first-of-its-kind work, RIPE researchers improved the VPZ construct within the soybean plant to improve photosynthesis, and then conducted field trials to see if yield would be improved as a result. The research showed the plant achieved more than a 20% increase in yield, and seed quality was not impacted.

“Our research shows an effective way to contribute to food security for the people who need it most while avoiding more land being put into production. Improving photosynthesis is a major opportunity to gain

People Mentioned

Amanda De Souza,
Postdoctoral
Researcher in Stephen
Long’s Lab (pictured,
top right, bottom left)

Stephen Long,
Ikenberry Endowed
University Chair of
Crop Sciences and
Plant Biology (pictured,
bottom right)



#Agriculture #Energy

the needed jump in yield potential,” said [Amanda De Souza](#), lead author on the paper.

“This has been a road of more than a quarter century for me personally,” said [Stephen Long](#). “After years of trial and tribulation, it is wonderfully rewarding to see such a spectacular result for the team.”

[#Science](#) [#Illinois](#) [#GatesFoundation](#) [#FCDO](#) [#IGB](#) [#NSF](#) [#CABBI](#) [#BSD](#) [#GEGC](#)

August 18



Researchers show potential for improved water-use efficiency in field-grown plants



Water deficit is currently one of the most significant limiting factors for global agricultural productivity, a factor further exacerbated by global climate change. In a recent study, researchers found that they could improve intrinsic water-use efficiency (iWUE) without decreasing photosynthetic rates or biomass production in field-grown tobacco plants. For farmers, this could decrease soil water depletion throughout the growing season and reduce reliance on irrigation.

During photosynthesis, plants open tiny pores in their leaves, called stomata, to take in CO₂. However, when the pores are open, water is

People Mentioned

Liana Acevedo-Siaca,
Former Postdoctoral
Researcher in Stephen
Long's lab

Johannes Kromdijk,
Assistant Professor of
Plant Sciences at the
University of Cambridge



#Agriculture #Energy

Depicted as small mouths, stomata are microscopic doughnuts that help plants breathe and control their moisture levels. The central circular pore is bound by two guard cells that can swell or shrink to open or close the pore.
#PlantLife #DoE





#Agriculture #Energy

also allowed to escape through transpiration. This leaves plants with a trade-off between losing too much water for the sake of taking in CO₂.

“Previous studies have shown that genetic manipulation of signal elements that trigger stomatal movement, such as overexpressing *Arabidopsis Hexokinase 1* in the guard cells, can stimulate stomatal closure and adjust that trade-off for plants,” said [Liana Acevedo-Siaca](#), who led this study at Illinois.

“Our results confirmed that constitutive overexpression of *AtHXX1* decreases productivity. We also showed that guard-cell-targeted overexpression of *AtHXX1* could improve iWUE relative to wild-type without negatively impacting CO₂ assimilation,” said [Johannes Kromdijk](#), who started this study in 2018.

[#JXB](#) [#Illinois](#) [#GatesFoundation](#) [#FCDO](#) [#LessWaterMorePlants](#)

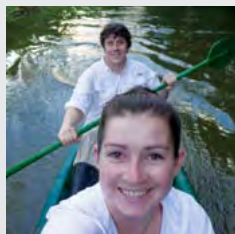
August 10



Coralie Salesse-Smith

Postdoctoral Researcher in Stephen Long's lab

[#PeopleToFollow](#) [#ADayInTheirLife](#)





Understanding cooperation and conflict in plant symbionts



In the traditional idea of symbiosis, participants mutually benefit each other. However, researchers have debated whether this is true.

To investigate this question, the [Heath lab](#) examined 191 strains of naturally occurring microbial symbiont *Sinorhizobium meliloti*, paired with its host *Medicago truncatula*, a clover-like plant that is native to the Mediterranean region. The microbe resides in the root nodules of the plant and supplies it with nitrogen. The group paired each microbial strain with an individual plant and also used a mix of different strains and infected the same plant, a competitive situation that often occurs in nature.

The researchers sequenced the genomes of the microbial strains and, using a technique called genome-wide association, found that almost 80% of the symbiont genes do actually align with the host's interest.

[#ProcBioSci](#) [#NSF](#) [#IGB](#) [#IGOH](#) [#PlantMicrobeLove](#)

August 1

People Mentioned

Katy Heath,
Professor of
Plant Biology

47



Huimin Zhao

2022 AIChE Award

Zhao received the 2022 Food, Pharmaceutical and Bioengineering Division Award in Chemical Engineering from the American Institute of Chemical Engineers.





15 Years of IGB: Using biology to solve energy problems



Over the past few decades, it has become increasingly obvious that fossil fuels are the biggest contributors to global climate change, accounting for over 75% of greenhouse emissions. If we want to avoid the catastrophic impacts of climate change, these emissions need to be reduced by almost half by 2030 and reach net zero by 2050. This goal can only be achieved if we invest in alternative sources of energy that are sustainable and reliable, a realization that led to the establishment of the Energy Biosciences Institute.

The EBI had several goals, including finding and improving plant sources that could serve as biofuels; efficiently extracting fuel from these crops; assessing the environmental, social, and economic impacts of developing biofuels; and improving the energy yields from fossil fuels.

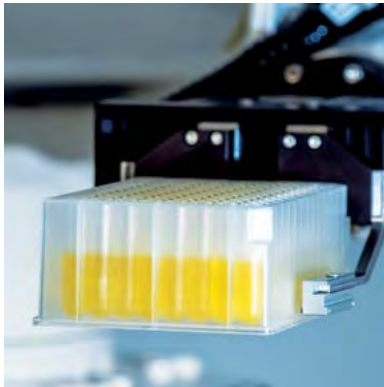
The EBI paved the way for several important collaborations that enabled scientists to take a holistic approach to developing alternative fuels. Although the funding for the EBI ended in 2014, the University



of California, Berkeley, Lawrence Berkeley National Laboratory, and the University of Illinois Urbana-Champaign are all still actively pursuing the research questions that the EBI proposed. Hopefully their efforts will help move us away from fossil fuels into a biofuel-reliant world.

#EBI #Illinois #CleanGreenEnergy #15YearsOfIGB

July 18



CABBI team develops automated platform for plasmid production



Plasmids have extensive use in basic and applied biology. These small, circular DNA molecules are used by scientists to introduce new genes into a target organism, and have applications in the production of therapeutic proteins like insulin. However, designing and constructing plasmids remains one of the most time-consuming and labor-intensive steps in biology research.

To address this, [Behnam Enghiad](#), [Pu Xue](#), and other University of Illinois Urbana-Champaign researchers at the Center for Advanced Bioenergy and Bioproducts Innovation have developed a versatile and automated platform for plasmid design and construction called PlasmidMaker, which researchers can use to intuitively visualize and assemble the perfect plasmid for their needs.

Once the plasmid has been designed, it is submitted to the PlasmidMaker team, and an order for the plasmid to be built is placed at the Illinois Biological Foundry for Advanced Biomanufacturing, a fully integrated computational and physical infrastructure that supports rapid fabrication, quality control, and analysis of genetic constructs. The plasmid build process is automated: samples are prepared through polymerase chain reaction and purification, the DNA sequence is assembled and transformed, and the plasmids are confirmed and frozen, all with little human involvement.

#CABBI #DOE #NatComms #iBioFAB #PlasmidsAPlenty

May 16

People Mentioned

Behnam Enghiad,
Postdoctoral
Researcher in
Huimin Zhao's lab

Pu Xue, Former
Graduate Student in
Huimin Zhao's lab



15 Years of IGB: The RIPE Project

Scientists have been breeding plants for over a century with the goal of feeding people across the world, but these increases will not be enough in a few decades.

“The UN Food and Agricultural Organization predicts that the world will need to increase staple crop yields 70% by 2050,” said **Stephen Long**. To catch up, the international Realizing Increased Photosynthetic Efficiency project was started in 2012. The goal is to produce staple food crops that have increased productivity with fewer inputs.

The project has nine research objectives that broadly fall into three categories: understanding the nuances of photosynthesis, improving its efficiency by manipulating model crops, and transforming the target crops to boost their yields. Researcher’s efforts have resulted in more than 80 research papers in the last 10 years that cover a range of topics including determining which of the 170 steps in photosynthesis can be tweaked to make the process more efficient.

“While no single strategy will overcome the hurdles facing the industry, our success in RIPE and our sponsors’ continued support give me hope that the future of agriculture is bright,” said Long.

[#RIPE](#) [#GatesFoundation](#) [#FCDO](#) [#BSD](#) [#CABBI](#) [#GEGC](#) [#RIPEForever](#)
[#FeedingTheWorld](#) [#15YearsOfIGB](#)

People Mentioned

Stephen Long,
Ikenberry Endowed
University Chair of
Crop Sciences and
Plant Biology





Collaborative RIPE team prove leaf width-biomass correlations in cowpea



In a collaboration between RIPE researchers, cowpea breeders from Ahmadu Bello University, and the International Institute of Tropical Agriculture, the width of cowpea leaves was found to correlate with above-ground biomass across diverse germplasm and environmental conditions. This trait can be readily used for selection in breeding programmes for cowpea biomass in Nigerian fields.

“Cowpeas are a key source of rich protein for millions of people in sub-Saharan Africa and beyond,” said Saba Mohammed, Senior Research Fellow for the Institute for Agricultural Research of Ahmadu Bello University. “Developing cowpea varieties that can produce both grain and fodder optimally is vital, especially since there is a big market for the sale of both the grain and fodder in Nigeria and other areas in West Africa.”

While looking at productivity differences among the germplasms, the group from Lancaster, led by Elizabete Carmo Silva, found that in their greenhouse, the cowpea with wider leaves tended to produce more biomass. The Illinois-based team of [Lisa Ainsworth](#) and [Anthony Digrado](#) collected leaf size and above-ground biomass measurements, finding a correlation between those traits when measured in the field.

[#LegumeScience](#) [#GatesFoundation](#) [#FCDO](#) [#CABBI](#) [#GEGC](#)
[#RIPEForever](#) [#FeedingTheWorld](#)

March 21

People Mentioned

Lisa Ainsworth,
Adjunct Professor of
Plant Biology

Anthony Digrado,
Postdoctoral
Associate in Lisa
Ainsworth's lab
(pictured)



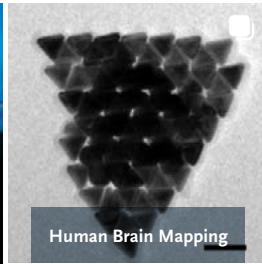
#Technology #Society
29 stories



15 Years of Outreach



Outreach



Human Brain Mapping



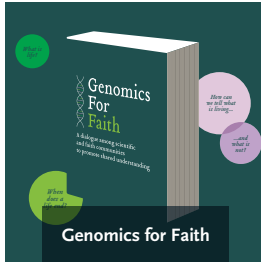
Indigenous Frameworks



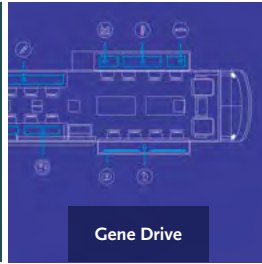
15 Years of Collaboration



Miniflux Microscope



Genomics for Faith



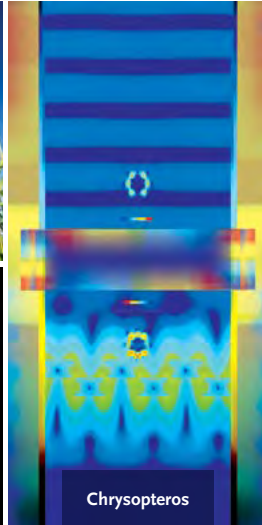
Gene Drive



Solving the Nitrate Problem



15 Years of Centers



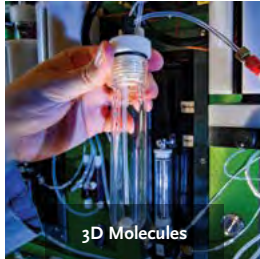
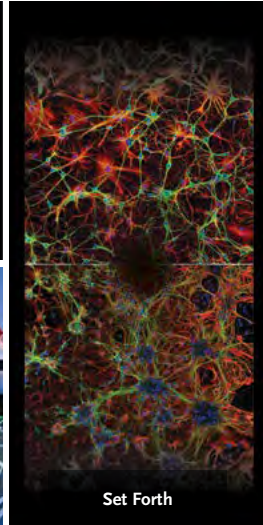
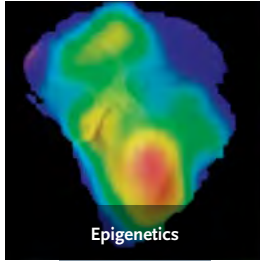
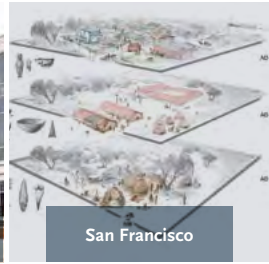
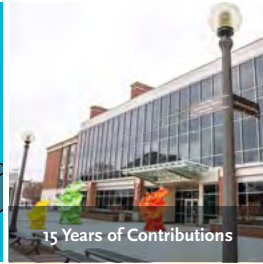
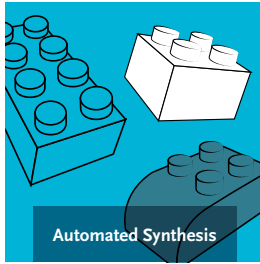
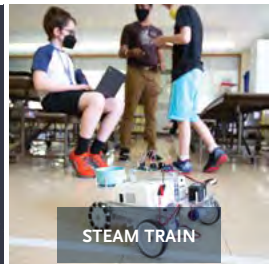
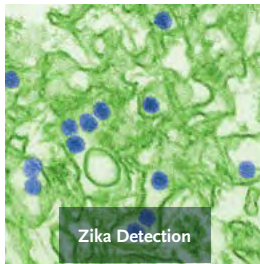
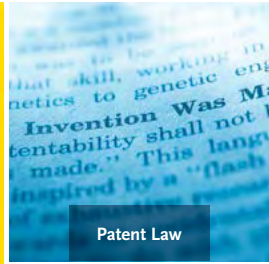
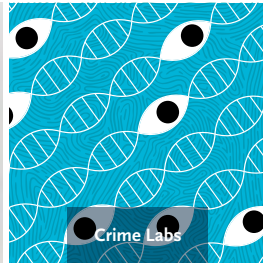
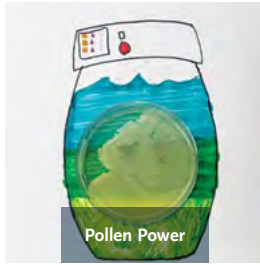
Chrysopteros



Machine Learning



15 Years of Institutes





15 years of IGB: Integrating science and society through outreach



Since its inception, the IGB has been active in communicating its research and discoveries with the public, and promoting scientific thinking to encourage a new diverse generation of scientists and science-informed citizens through various programs.

World of Genomics, Game Day Genomics, and Genome Day focus on people of all ages. Through activities and games, participants learn about a variety of scientific disciplines and research happening at the IGB. The outreach team also created materials to educate all the community members about the benefits and safety of vaccinations during the pandemic.

The Art of Science program is a celebration of common ground between science and art. The program's goal is to emphasize the diversity of research at the IGB through art, and present research in an eye-catching and understandable way to everyone.

The Pollen Power camp, STEAM TRAIN, and the partnership with Osher Lifelong Learning Institute and the Beckman Institute enable different community members to participate in hands-on research with the help of IGB researchers and outreach staff.

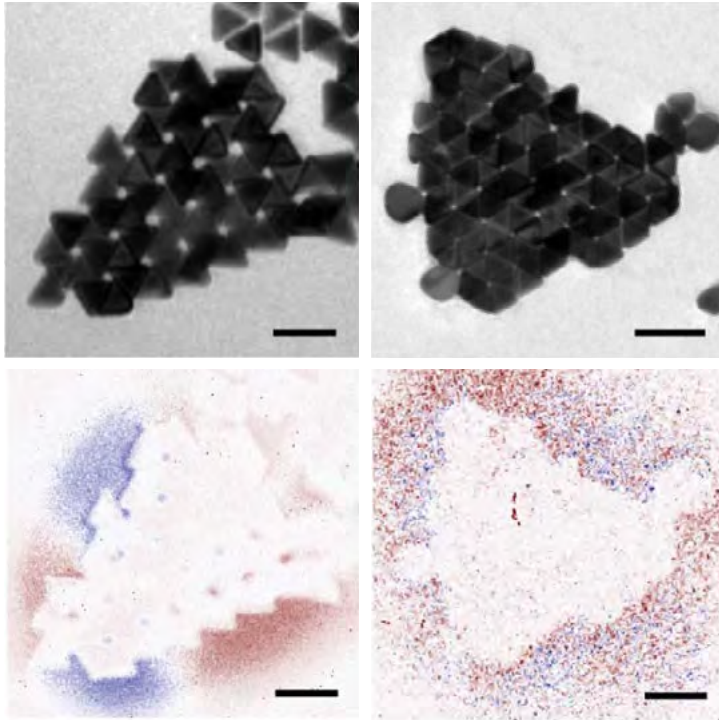
Genomics for Professionals aims to teach basic concepts of biology and genomics to professional groups within a specific public sector to be better equipped for addressing questions of a genomic nature when the need arises in their specific areas.

[#SciencelsEverywhere](#) [#CommunityScience](#) [#AllAgesWelcome](#)
[#15YearsOfIGB](#)



#Technology #Society





Organizing nanoparticles into pinwheel shapes offers new twist on engineered materials



Researchers have developed a new strategy to build materials with unique optical, magnetic, electronic, and catalytic properties. These pinwheel-shaped structures self-assemble from nanoparticles to create materials that are designed to interact with their surroundings. “The resulting lattice can be seen with the naked eye,” said [Shan Zhou](#).

People Mentioned

Shan Zhou,
Former Postdoctoral
Researcher in Qian
Chen's lab

[#M-CELS](#) [#Nature](#) [#ONR](#) [#AlfredSloanFoundation](#) [#DoE](#)
[#NanoPinwheels](#)

November 29



Madhu Khanna
Director of iSEE

Khanna was named Alvin H. Baum Family Chair and Director of the Institute for Sustainability, Energy, and Environment.





New IGB center uses Indigenous Science frameworks for equitable and inclusive research



The Center for Indigenous Science is headed by [Jenny Davis](#) and [Ripan Malhi](#), the co-Chairs of the Center.

Indigenous Science consists of the oldest models of science in the Western hemisphere, yet these models are underrepresented in current academic spheres. Furthermore, benefits derived from predominantly white models of science are not equally distributed throughout society, prompting the need for alternative inclusive and equitable models. The new center provides a welcoming environment where Indigenous peoples can work together with scientists, and promote research that is ethical, sustainable, and community-focused.

The Center covers multiple disciplines using Indigenous Science to address areas of concern for Indigenous peoples, including environment, health and history. The center also works to revitalize knowledge impacted by colonial disruptions and create pipelines for Indigenous students to become scholars.

Creation of the center is another step towards equity and inclusion on campus, and builds upon other efforts including creation of a campus-wide Native American Graves Protection and Repatriation Act (NAGPRA) office in 2020, the Commission on Native Imagery and subsequent Native American Representation and Reciprocity Initiative, and the hiring of an Associate Vice Chancellor for Native Affairs in 2021.

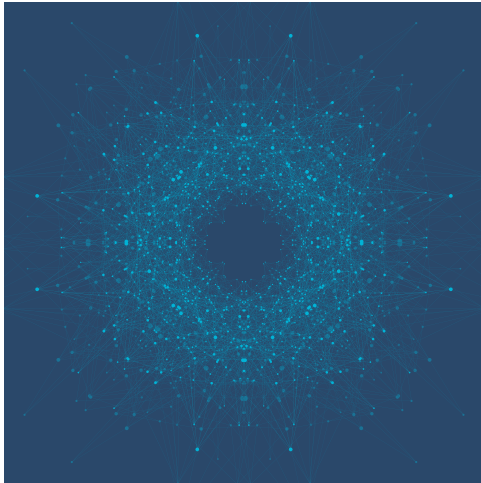
[#GNBP](#) [#GSP](#) [#IGOH](#) [#InclusiveResearch](#)

November 21

People Mentioned

Jenny Davis,
Associate Professor
of American Indian
Studies

Ripan Malhi,
Professor of
Anthropology



15 Years of IGB: Collaborative initiatives at the forefront of science



One of IGB's main goals is fostering partnerships between departments across campus to encourage more transdisciplinary research. Initiatives provide an avenue for this goal, bringing together researchers across departments, study systems, and disciplines, and encouraging collaborative research.

The CompGen Initiative was created to combine the strengths of genomics research with the high-performance technology and computational abilities of computer scientists. The initiative created new instruments for genomic data storage and analysis, and a community database of genomic data. This database, the Knowledge Network, serves as a resource of genes and networks embedded in an analysis platform called KnowEnG, that is used for genomic information management.

The Personalized Nutrition Initiative was established to facilitate transdisciplinary collaborations across campus to research individualized nutrition, and create a source for information on how nutrition impacts health and disease. The goal of the program is to provide tailored recommendations on nutrition that take into account a patient's history, genetics, microbiome, and metabolome.

The Microbial System Initiative was established to bring together microbial researchers across campus and create an integrative, collaborative community. Thus far, MSI has led to new methods for detection of microbial diseases, novel disease treatments, and a better understanding of how microbiomes influence health.

[#CompGen](#) [#PNI](#) [#MSI](#) [#CrossCampusCollaborations](#)



New Minflux microscope improves molecule tracking in live cells



The invention of fluorescence microscopy allowed researchers to color-label specific cellular components and observe them in live cells. The new two-color 3-D Minflux microscope is a vast improvement on traditional fluorescence microscopy because, for the first time, researchers can track how two molecules can interact with each other on the size scale of the molecules themselves.

“The Minflux microscope will provide 100 times better resolution than typical confocal microscopes and ten times better resolution than many single molecule localization images,” said [Glenn Fried](#).

People Mentioned

Kingsley Boateng,
Assistant Director of
Bioscience Research and
Microscopy (pictured, left)

Glenn Fried, Director of
Core Facilities at the IGB

Gopika Gopan,
Graduate Student in
Martin Gruebele's Lab
(pictured, center)



Housed in the IGB, the complete Minflux instrument acts as a regional research hub as well as a demonstration site for other users, finally moving the bar of 'single molecule' tracking to be able to look at biomolecular interactions. The microscope will be the third of its kind in the United States, the other two being at the National Institutes of Health, Maryland, and Scripps Research Institute, California.

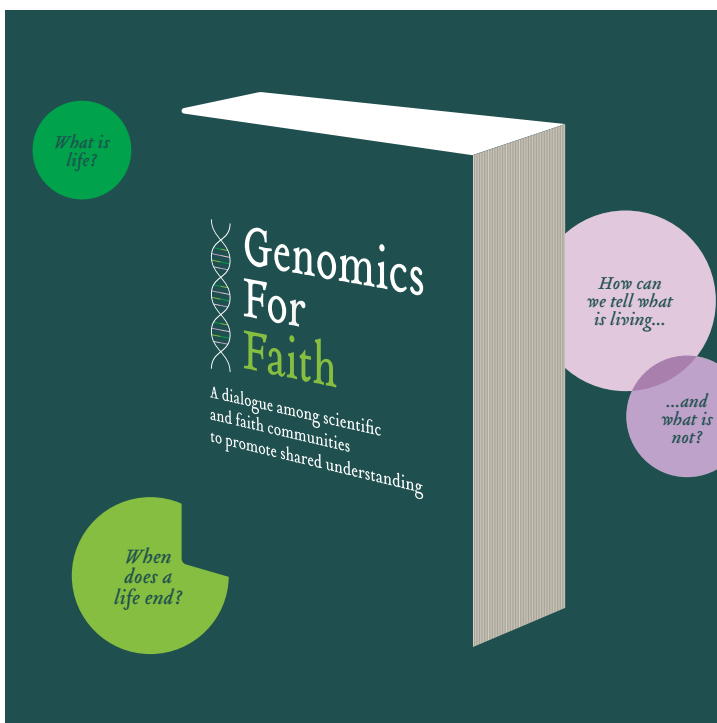
"We are ideally located to become the go-to place for single particle tracking in the Midwest, while putting our biophysics and cell biology groups at the forefront of in-cell dynamics research," said [Martin Gruebele](#).

[#BCXT](#) [#CarverCharitableTrust](#) [#PeekingInsideCells](#)

November 10

Martin Gruebele,
James R. Eiszner
Endowed Chair in
Chemistry

Yuhan Wang,
Graduate Student in
Martin Gruebele's
Lab (pictured, right)



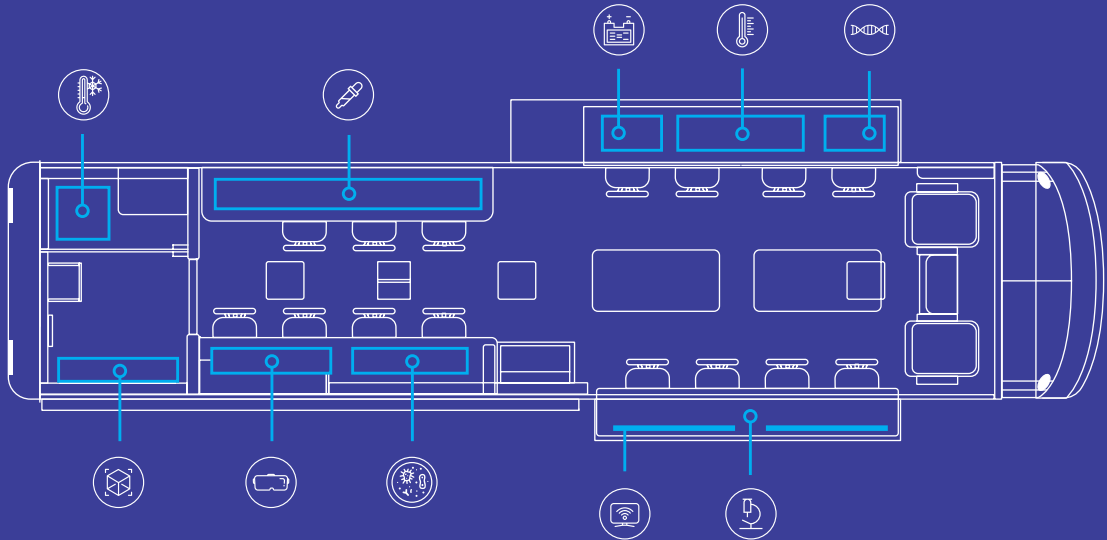
Fostering dialogue between scientists and faith communities



The IGB, in collaboration with faith groups, will organize a workshop series—Genomics for Faith Leaders—to create an open dialogue between the local community and our scientists. Each workshop will be planned with input from both scientific content experts and faith leaders to encourage frank and productive discussions.

[#GNBP](#) [#WayfarerFoundation](#) [#GenomicsForFaith](#)

October 26



IGB Gene Drive aims to broaden science accessibility

The IGB has always been interested in public engagement, conducting a diverse range of activities over the past seven years which have catered to over 10,000 participants. The outreach team is now planning to construct, staff, and operate a mobile STEM lab. With this new approach the team aims to clarify the role of genomics in all aspects of life, stressing the importance of science literacy for non-scientists.

With the help of a \$26,900 grant from Illumina Inc. and the Illumina Corporate Foundation, the IGB Gene Drive will deliver hands-on engagement with genomics research in areas including genetically modified organisms, microbiomes, antibiotic resistance, CRISPR, and personalized health.

“Illumina has also generously donated an iSeq 100 Sequencing System for our mobile lab,” said [Daniel Urban](#), who worked with Illumina to secure the grant.

The IGB Gene Drive’s mission is to provide research experiences for populations that have been traditionally underserved in STEM education. They will focus on the urban core of Chicago and St. Louis, and rural areas throughout the Midwest. To this end, the team will be partnering with the Champaign-Urbana Mass Transit District, who have agreed to provide a bus for these efforts.

[#Illumina](#) [#PartyBus](#) [#JustForScienceParties](#)

People Mentioned

Daniel Urban,
IGB Senior Outreach
Coordinator





iGEM 2022 team: Seeking solutions to the nitrate problem



Modern agriculture has become a major source of pollution. Nitrates are used in fertilizers as a source of nitrogen, but excess nitrates often end up in waterways, where they can cause harmful ecological problems. A team of seven undergraduates developed a project, called Curli Capture, as a possible solution to nitrate pollution. Inspired by catalytic biofilms that capture heavy metals, they planned to engineer a biofilm that can capture excess nitrate in bodies of water—a solution with the potential to be cost-effective and environmentally friendly.

#IGB #CABBI #CurliCapture #NitratesAreTerrible #PrettyPicture
#PrettyPolluted

October 14



Tracy Parish

Director of External Relations and Strategic Partnerships

Parish helps IGB partner with companies, tech-incubators, foundations, and philanthropists.





15 Years of IGB: Centers of the Institute



The IGB's centers work together with multiple institutions and companies, producing interdisciplinary research that is then translated into real-world solutions. They include the Big Data to Knowledge Center of Excellence, the Center of Advanced Bioenergy and Bioproducts Innovation, the Center for Nutrition, Learning, and Memory, the Center for Genomic Diagnostics, the Genome Scale Engineering Center, and the Catherine and Don Kleinmuntz Center for Genomics in Business and Society.

The focus of **BD2K** was to develop computer software up to the scale of genomic data, and create a platform with an intuitive user interface with an open access design.

CABBI seeks to create a new generation of bioenergy crops, biofuels, and bioproducts that are sustainable, resilient, and cost-effective.

Using brain imaging and supercomputing technologies, **CNLM** researchers explored the mechanisms underlying nutritional enhancement of learning and memory.

CGD develops non-invasive genomic “liquid biopsies” which measure micro-RNAs in the blood of patients, allowing for quick, easy, and reliable testing for certain diseases.

The goal of **GSE** is to develop genome scale engineering tools that allow for rapid testing of microorganisms for new industrial compounds.



#Technology #Society

The **Kleinmuntz Center** provides opportunities for scientists to engage with businesses and develop their research to become innovative and commercial.

[#CrossCampusCollaborations](#) [#SoManyCenters](#) [#15YearsOfIGB](#)

October 10



New IGB center dedicated to machine learning and predictive modeling



A new Center for Artificial Intelligence and Modeling has been established at the IGB. It is led by [Sergei Maslov](#) and [Olgica Milenkovic](#). The goal of CAIM is to provide biological groups with appropriate expertise in computational sciences.

“We were part of the Biocomplexity theme, which historically introduced people with quantitative backgrounds, such as computer science, physics, and mathematics, with biologists so they could work on problems together,” Maslov said. “We wanted to do something along those lines and decided to focus on machine learning and computational modeling.”

CAIM has participants from across the campus including experts from electrical and computer engineering, bioengineering, physics, computer science, mathematics, statistics, and civil and environmental engineering. The biological projects includes members from food science and human nutrition, chemistry, physics, bioengineering, and cell and developmental biology.

The goal of CAIM is to combine modeling and learning in areas including microbiome analysis, single-cell data analysis, multiomics, spatial transcriptomics, and neural networks. Maslov and Milenkovic hope that the center will help generate more research topics based on the collaborations that are forged.

[#CABBI](#) [#BSD](#) [#CGD](#) [#GNBP](#) [#CrossCampusCollaborations](#)

September 26

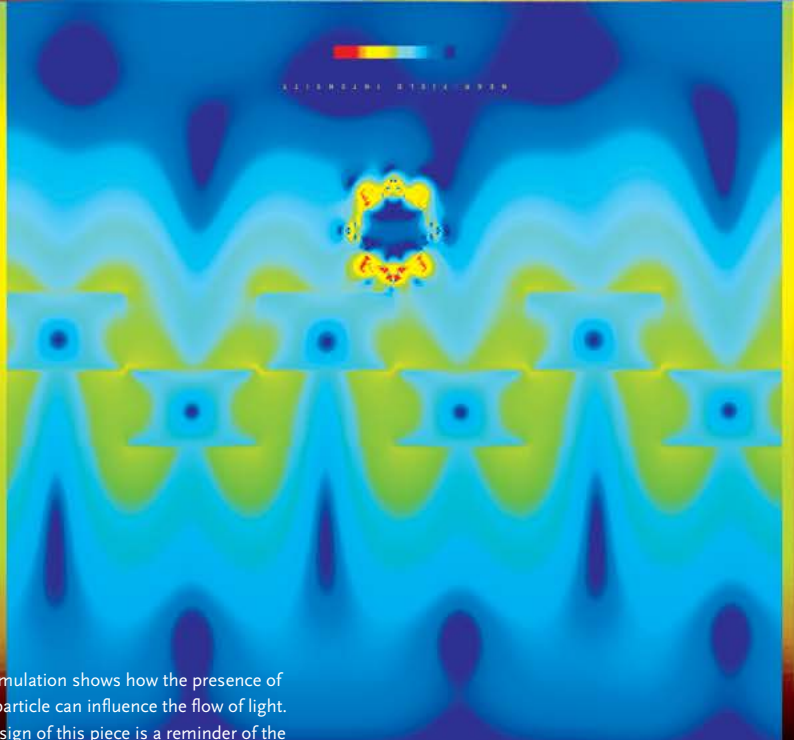
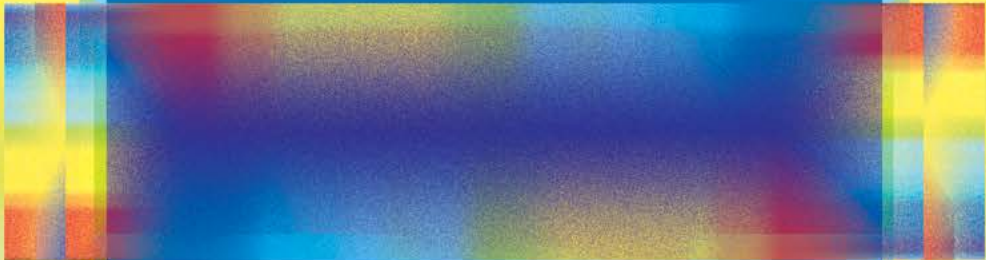
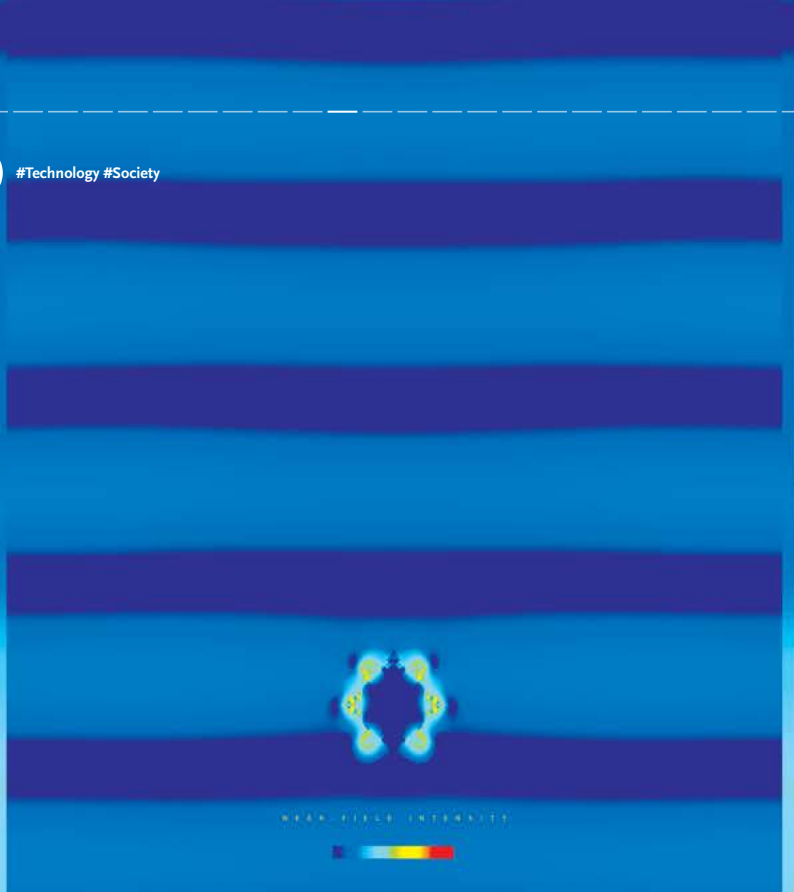
People Mentioned

Sergei Maslov,
Professor of
Bioengineering and
Bliss Faculty Scholar

Olgica Milenkovic,
Donald Biggar
Willett Scholar and
Franklin Woeltge
Professor of Electrical
and Computer
Engineering

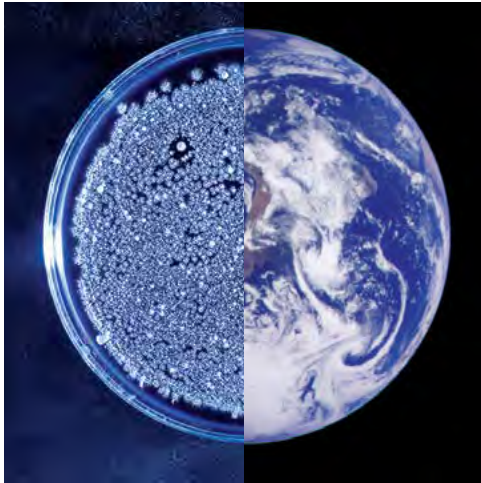


#Technology #Society



This simulation shows how the presence of a tiny particle can influence the flow of light. The design of this piece is a reminder of the dimensionality of light's movement and the power of visual information. #PhotonicCrystals #RainbowsMakeUsHappy #NIH #IGB





15 Years of IGB: Highlights from IGB institutes past and present



At the IGB, scientific questioning occurs across a wide scale—including the creation of the smallest molecules, interactions between plants and animals, and the exploration of life on distant planets. The major institutes that have been involved in conducting this research are the Molecule Maker Lab Institute, the Genomics and Eco-evolution of Multi-scale Symbioses, and the Institute for Universal Biology.

MMLI combines advanced artificial intelligence with machine learning methods to design, synthesize, and characterize small molecules.

The inspiration behind **GEMS** is to integrate biology, as fields of biology are often siloed by funding, approach, and culture. Since microbes lie at the interface between these spheres, GEMS brings the natural microbial world into view.

The **IUB** team combined theoretical work with microbial and genomic experiments to study how cells sense, respond, and adapt to their ever-changing environments. By studying the evolution of life on our planet, researchers can infer whether any distant planets could also be vectors for life.

#BSD #GSE #CABBI #CGD #MMG #IGOH #BCXT
#ManyThemesManyHashtags #15YearsOfIGB

September 13



Sihai Dave Zhao

Director of Computational Genomics

Zhao (GNDP) works on analysis strategies, statistical applications, spatial transcriptomics, and behavioral genomics.





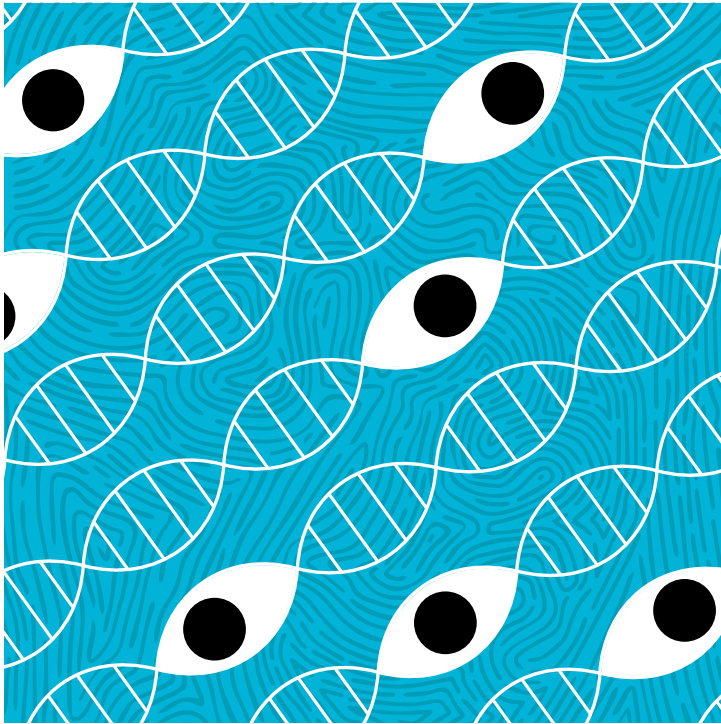
Pollen Power back in season at Unit 4

The Pollen Power camp targets students from underrepresented populations in STEM and teaches them to observe their surroundings with a scientific mindset. The activities were organized at the University of Illinois Urbana-Champaign and the Stratton Academy of the Arts, and included visiting the Illinois greenhouses, tasting different honey, growing bacteria, and creating cyanotypes.

[#Achoo](#) [#MicrobeArt](#) [#BuddingResearchers](#)

September 12





Helping crime laboratories become more efficient



Created by state law in August 2021, the Illinois Forensic Science Commission includes the director of the Illinois State Police, law practitioners, forensic scientists, victim and other community advocates, and an academic researcher. [Cris Hughes](#), an Illinois professor and deputy forensic anthropologist for the Champaign County Coroner's Office, is the academic member of IFSC.

IFSC deals with a backlog of forensic evidence processing by overseeing laboratories such as Northeastern Illinois Regional Crime Laboratory, DuPage County Forensic Science Center, and the Illinois State Police forensic laboratory system.

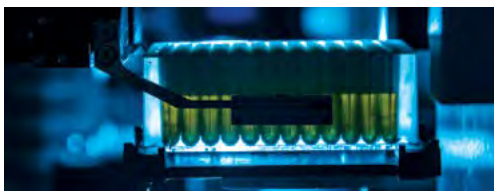
"With forensic sciences being such an integral part of the work that our State Police do to provide justice for crime victims, we must do everything we can to ensure these services are being delivered timely and as professionally as they possibly can," said State Rep. Lakesia Collins (D-Chicago) when the commission was signed into law.

Hughes also had conversations with Brendan Kelly, director of Illinois State Police and commissioner of IFSC, about the ethical, legal, and social implications of obtaining new genomic technology, as well as how partnerships can be leveraged between state labs and universities for the benefit of forensic science in practice.

[#GSP](#) [#TrueCrime](#) [#GenomicsForPolice](#)

People Mentioned

Cris Hughes,
Professor of
Anthropology



15 Years of IGB: Accelerating biological engineering through automation and artificial intelligence



One of the biggest challenges in traditional laboratory settings is performing countless hours of error-prone lab work. The Illinois Biological Foundry for Advanced Biomanufacturing was established in 2014 to bypass these cumbersome procedures and support a broad array of research goals.

Developed under the leadership of [Huimin Zhao](#), iBioFAB is a precisely engineered set of robotic components combined with a highly adaptable

People Mentioned

Huimin Zhao,
Steven L. Miller
Chair of Chemical
and Biomolecular
Engineering



software platform. Based in the Concourse research lab of the IGB, iBioFAB integrates artificial intelligence and machine learning with automation, and features a robotic arm that travels along a 5-meter-long track to transfer microplates among more than 40 instruments installed on the platform. At its maximum capacity, iBioFAB can generate thousands of output samples each day using custom-designed workflows.

Together with PlasmidMaker and BioAutomata, iBioFAB can synthesize and edit DNA, helping IGB researchers with complicated projects. Illinois is the founding member of the global biofoundry alliance that consists of over 30 institutions around the world.

#BSD #GSE #CABBI #MMG #CGD #ItsARobot #ItsNotTheTerminator
#15YearsOfIGB

August 24





Young Innovator Program successfully concludes its second year



The Young Innovator Program helps trainees become innovative leaders in their fields. At the end of the program, the students participated in an idea competition, showcasing their projects. They were evaluated based on how well they identified a problem, its solutions and market attractiveness, and whether they could complete the project within the proposed budget and time frame. The top three participants were awarded tiered funds ranging from \$5,000-\$20,000 to advance their projects. The winners were [Skye Shepherd](#), [Alejandra Zeballos](#), and [Jason Wang](#). The other participants included [Amanda Bacon](#), [Devyani Swami](#), and [Ruben Sanchez Nieves](#).

#CGD #MMG #BSD #GNBP #M-CELS #ACPP #IGOH
#BuddingResearchers

August 23

People Mentioned

Amanda Bacon,
Graduate Student
in Brian
Cunningham's lab

Ruben Sanchez Nieves, Graduate Student in Rachel Whitaker's lab

Skye Shepherd, Graduate Student in Brian Cunningham's lab (illustrated, top right)

Devyani Swami, Postdoctoral Researcher in Pablo Perez-Pinera's lab

Jason Wang, Graduate Student in Hyunjoon Kong's lab (illustrated, top left)

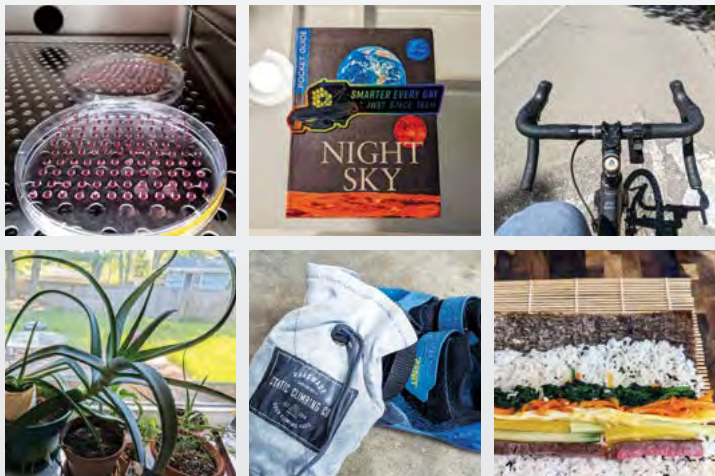
Alejandra Zeballos, Graduate Student in Thomas Gaj's lab (illustrated, bottom)



Jason Wang

Graduate Student in Hyunjoon Kong's lab

#PeopleToFollow #ADayInTheirLife





Valuable antibody patents vulnerable to overly broad doctrinal shift in patent law



The U.S. Court of Appeals for the Federal Circuit is aiming to strengthen areas of patent law that cannot deal with the molecular complexity of antibodies. [Jacob Sherkow](#) advocated for a middle ground to grant inventors control over true substitutes without blocking improvements by competitors.

People Mentioned

Jacob Sherkow,
Professor of Law

[#GSP](#) [#YaleLawJournal](#) [#CourtsLearningScience](#)

August 17



Students selected for the 2022 Tracy Undergraduate Research Fellowship





Two undergraduate students were selected for a 10-week summer program to carry out research at the IGB. [Karan Samat](#) worked in the Irudayaraj lab to develop mathematical models of oxygen diffusion, and [Katy Wolhaupter](#) worked in the Wang lab to optimize diagnostic tools using DNA nanostructures.

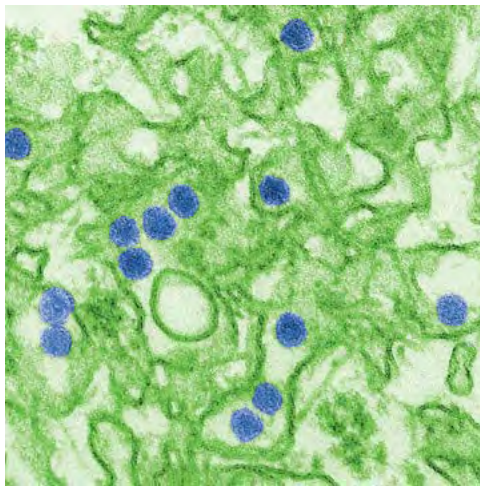
[#CGD](#) [#EIRH](#) [#MME](#) [#BuddingResearchers](#)

August 11

People Mentioned

Karan Samat,
Undergraduate
Researcher in Joseph
Irudayaraj's lab

Katy Wolhaupter,
Undergraduate
Researcher in Xing
Wang's lab



New smartphone clip-on can detect Zika virus in blood samples



Detection methods that are rapid, simple, accurate, and sensitive are vital for detecting viral pathogens and controlling the spread of infectious diseases. Unfortunately, most involve complex procedures, but researchers have developed an instrument that can be clipped onto a smartphone to rapidly test for Zika virus in a single droplet of blood.

[#CGD](#) [#MMG](#) [#Analyst](#) [#NIH](#) [#NSF](#) [#SmartPhonesInMedicine](#)

July 25



Martin Burke

Elected to National Academy of Medicine

Burke was elected for creating a modular molecular synthesis platform.





15 Years of IGB: Welcoming increased representation through DEI efforts

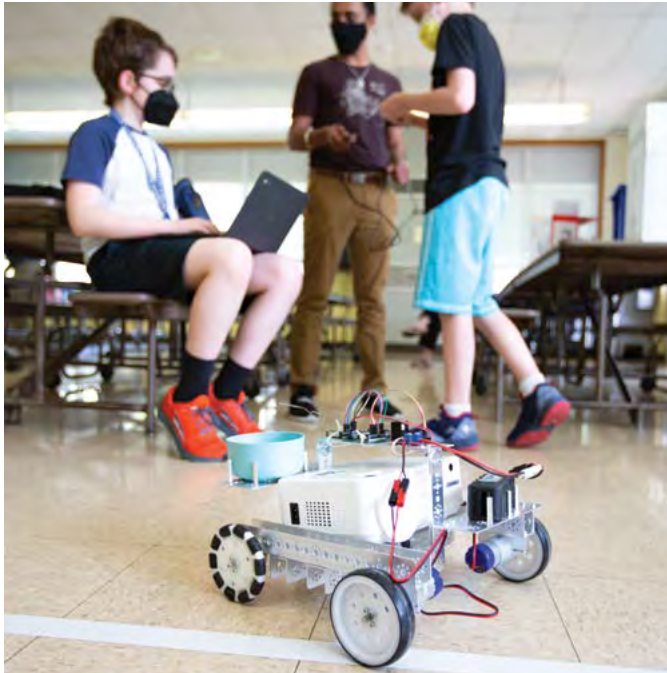
Scientific pursuits often require examining a problem from different angles in order to gain a complete understanding. But what happens when certain voices are ignored over and over, in favor of others? It breeds inequality that weakens our science and our sense of community.

Diversity, equity, and inclusion have always been valued at the IGB. We recognize that investigators, students, and staff from diverse backgrounds bring their lived experiences and unique perspectives together, improving our ability to solve problems and be responsive to societal needs. To this end, the IGB Committee on Diversity was established in 2018 with the goal of creating a more inclusive, diverse, and welcoming environment within our community.

Spurred by concerning events of racism in the community, the COD Task Force was formed in 2020 to gather more individuals to take action on the COD's ideas and bring new initiatives to light. Their efforts include developing additional programs to diversify the practice and practitioners of science; creating change internally by increasing dialogues through workshops, panels, and hiring practices; funding new initiatives to help eliminate institutional racism and other inequities at the IGB; and creating change externally by working with campus units in strengthening intercultural relationships focused on DEI.

[#MoreVoicesHeard](#) [#DiversityIsKey](#) [#COD](#) [#15YearsOfIGB](#)





STEAM TRAIN 2022 adventure completed



When one imagines what 6th-8th grade students might be interested in, these projects may not immediately come to mind: studying metabolism in the Minecraft universe, investigating whether toxic frogs know they are toxic, building a robot that can deliver snacks or plant seeds, and designing an anti-drone weapons device. Yet, these studies were successfully completed by students from Franklin STEAM Academy.

From September 2021 till May 2022, students met weekly and consulted with researchers from the IGB and a dozen students from University Laboratory High School to develop their ideas.

The STEAM (Science, Technology, Engineering, Arts, and Mathematics) TRAIN (Transdisciplinary Research Across Institutional Near-peers) project aims to inspire independent, curiosity-driven student research through interactions with near-peer mentors. Franklin students discover their love for science by exploring difficult issues that they're passionate about while the Uni High students serve as mentors.

“These students created some phenomenal projects, a few of them literally being of graduate school caliber. It's awe-inspiring to realize what such young kids are capable of when they are provided with the resources and mentorship to bring their ideas to life,” said [Daniel Urban](#).

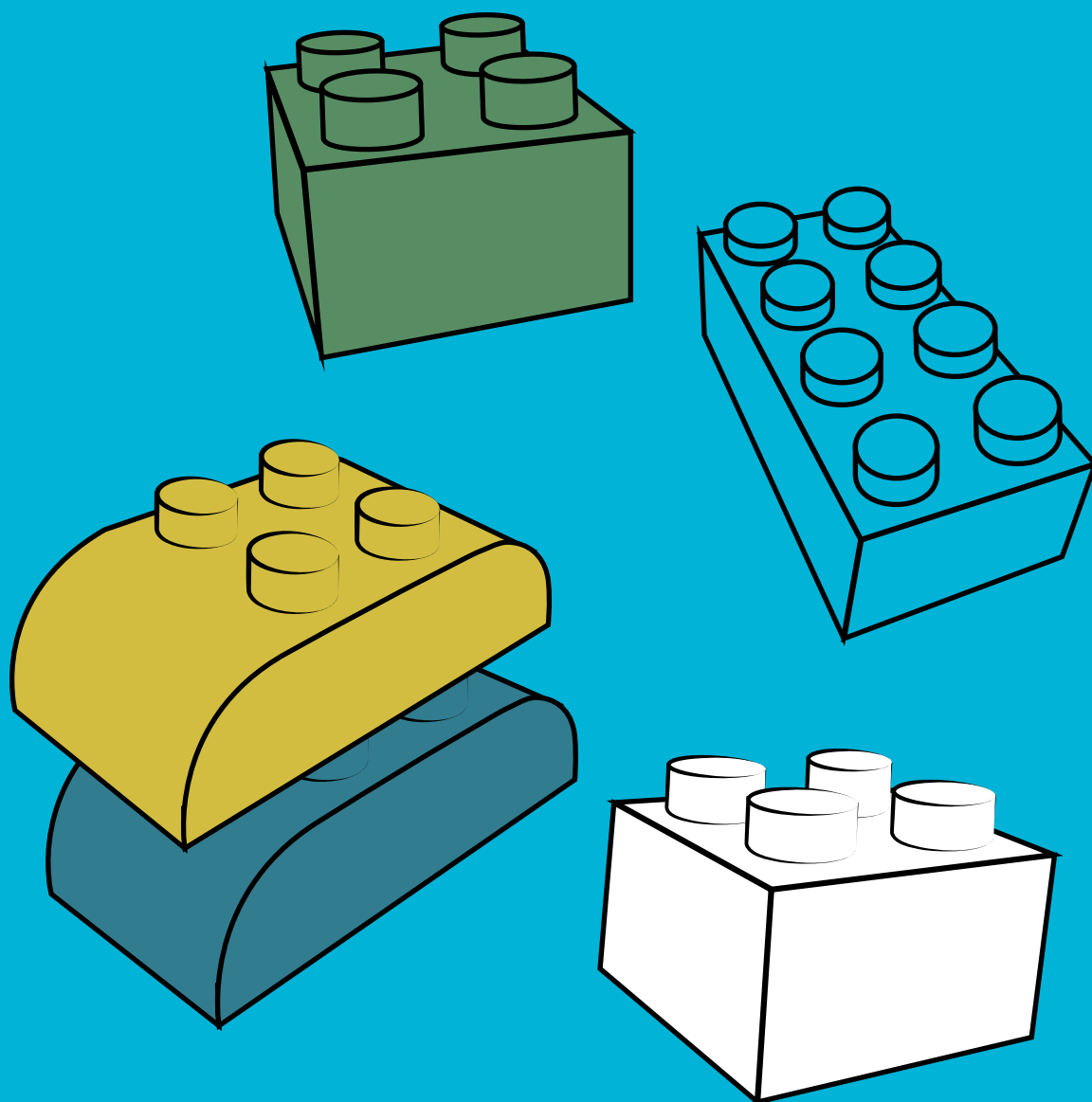
[#BuddingResearchers](#) [#CreativeKids](#) [#ChooChoo](#)

May 23

People Mentioned

Daniel Urban,
Senior Outreach
Activities
Coordinator

Ankit Veerendra,
Undergraduate
Student in the
Department
of Computer
Engineering
(pictured, center)



Automated synthesis allows for discovery of charge transport in organic molecules

A cross-disciplinary team has demonstrated a major breakthrough in using automated synthesis to discover new molecules for organic electronics applications, by rapidly scanning through a library of molecules with precisely defined structures. This could be used to uncover, via single-molecule characterization experiments, a new mechanism for high conductance.

#NatComms #BSD #MMG #DoD #Beckman
#CrossCampusCollaborations #MolecularLegos





Illinois general assembly recognizes IGB for 15 years of scientific contributions



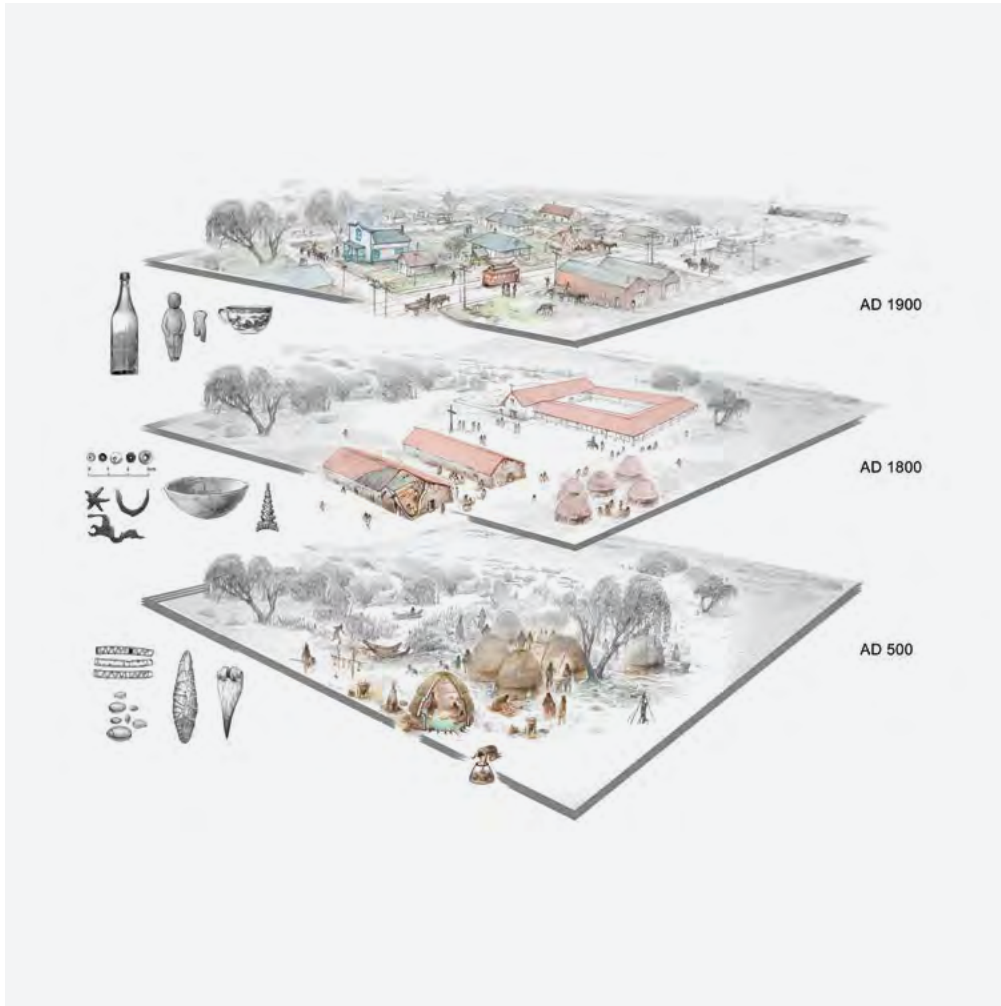
The Illinois General Assembly officially recognized the IGB for celebrating fifteen years of genomic research addressing major societal issues in the areas of agriculture, environmental conservation, health, wellness, technology, and society. The IGB houses a broad portfolio of interdisciplinary life sciences research on the University of Illinois Urbana-Champaign campus.

“Institutes devoted to advancing our understanding of critical topics such as food security, drug discovery, and technological innovation are essential for Illinois to remain a leader in the realm of scientific discovery,” said State Representative Carol Ammons, who represents the 103rd District. “We need exactly the sort of cutting-edge research in genomics, biology, and the life sciences that the IGB has been providing to the state over the last 15 years.”

The IGB was dedicated on March 29, 2007 with special funding from the Illinois Legislature, and operates under the mission of advancing life sciences research and stimulating bioeconomic development in the state of Illinois. Members of the IGB work collaboratively, utilizing a team-based framework that leverages expertise from many distinct disciplines in science and engineering and unites fundamental and applied research approaches to tackle grand scientific challenges.

[#CrossCampusCollaborations](#) [#ChangingTheWorld](#) [#IGBRules](#)
[#15YearsOfIGB](#)

March 29



Study ties present-day Native American tribe to ancestors in San Francisco Bay Area



A genomic study of Native peoples in the San Francisco Bay Area finds that eight present-day members of the Muwekma Ohlone Tribe share ancestry with 12 individuals who lived in the region several hundred to 2,000 years ago.

The study challenges the notion that the Ohlone migrated to the area between A.D. 500-1,000, said [Ripan Malhi](#), who led the research with Stanford University population genetics and society professor Noah Rosenberg in collaboration with a team of other scientists and members of the Muwekma Ohlone Tribe.

Previous studies of artifacts and language patterns suggested that the Ohlone were relative newcomers to the region. But the genomic research found a deep signal of continuity between the ancient population and the new one.

People Mentioned

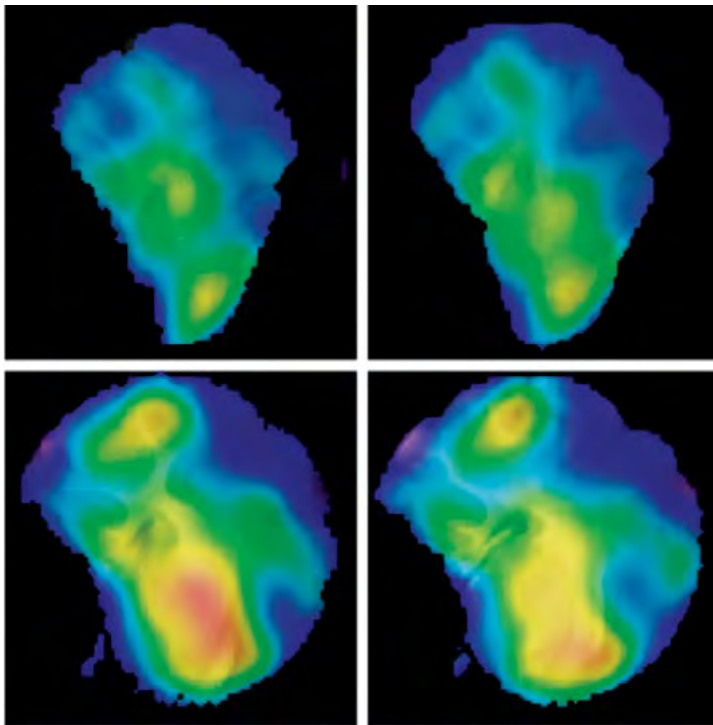
Ripan Malhi,
Professor of
Anthropology



“We were able to find one ancestral component from their genomic analysis that was shared with ancient people from the Bay Area,” Rosenberg said. “The Ohlone living today who participated in the study may not be direct descendants of the ancient people whose genomes we sequenced, but the analysis suggests they descended from the broader population to which those ancient people belonged.”

#GNDP #GSP #IGOH #NSF #SFPUC #FarWestern

March 21



Team uses MRI to image epigenetics in the brain



A multidisciplinary team has devised a new approach to 3D imaging that captures DNA methylation, a key epigenetic change associated with learning in the brain. Epigenetics is a key mechanism by which gene expression is regulated. The new approach—called epigenetic MRI—will open up avenues of research into how such changes mold the brain. The team includes [King Li](#), [Fan Lam](#), and IGB Director [Gene Robinson](#).

“Our DNA is the same from cell to cell and doesn’t change,” Li said. “But tiny molecules, like methyl groups, are attached to the DNA backbone to regulate which genes are actively being transcribed into RNAs and translated into proteins. DNA methylation is a very important part of controlling gene functions.”

People Mentioned

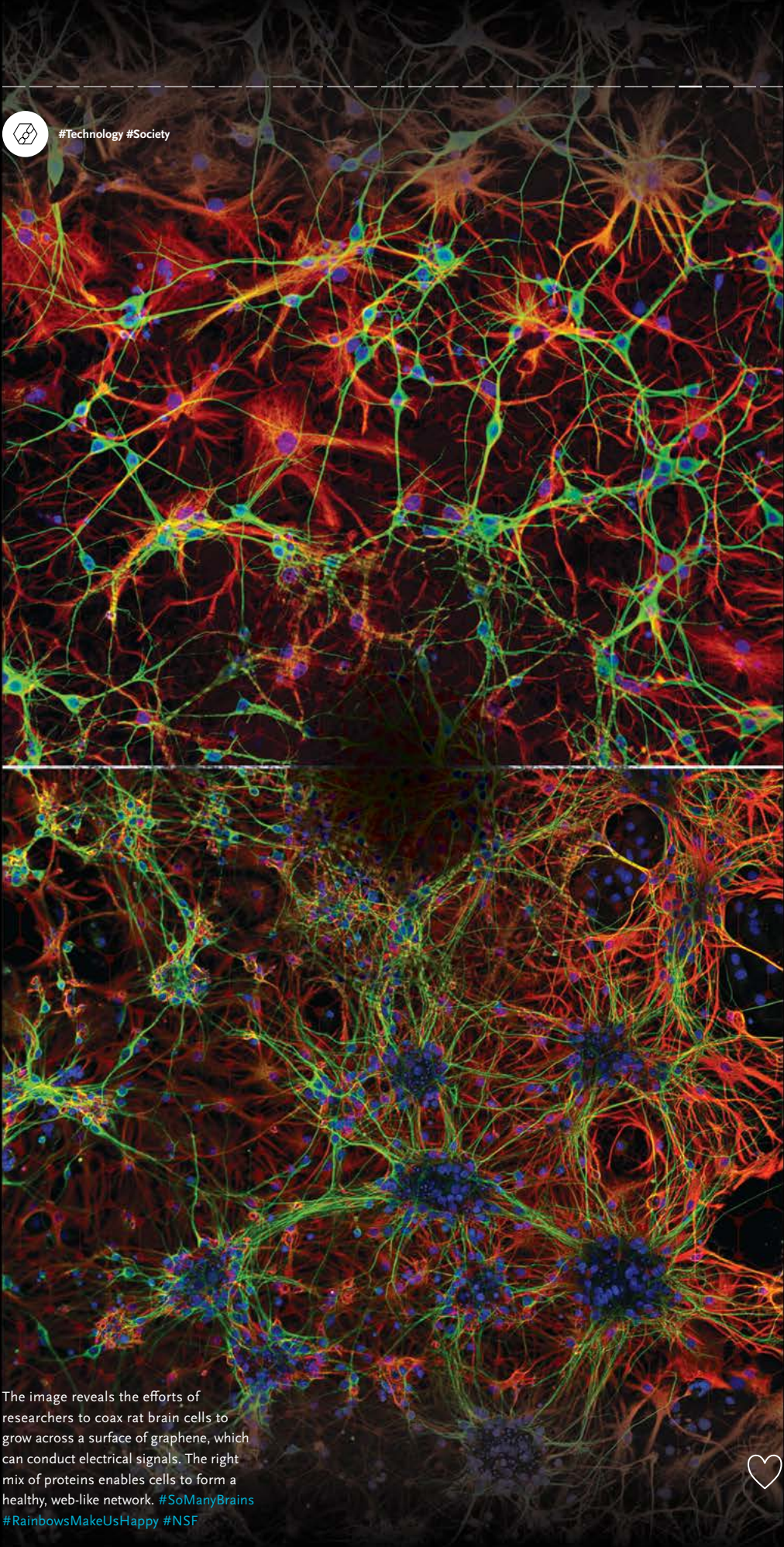
Fan Lam, Professor of Bioengineering

King Li, Professor Emeritus, Carle Illinois College of Medicine

Gene Robinson, IGB Director and Swanlund Chair



#Technology #Society



The image reveals the efforts of researchers to coax rat brain cells to grow across a surface of graphene, which can conduct electrical signals. The right mix of proteins enables cells to form a healthy, web-like network. [#SoManyBrains](#) [#RainbowsMakeUsHappy](#) [#NSF](#)

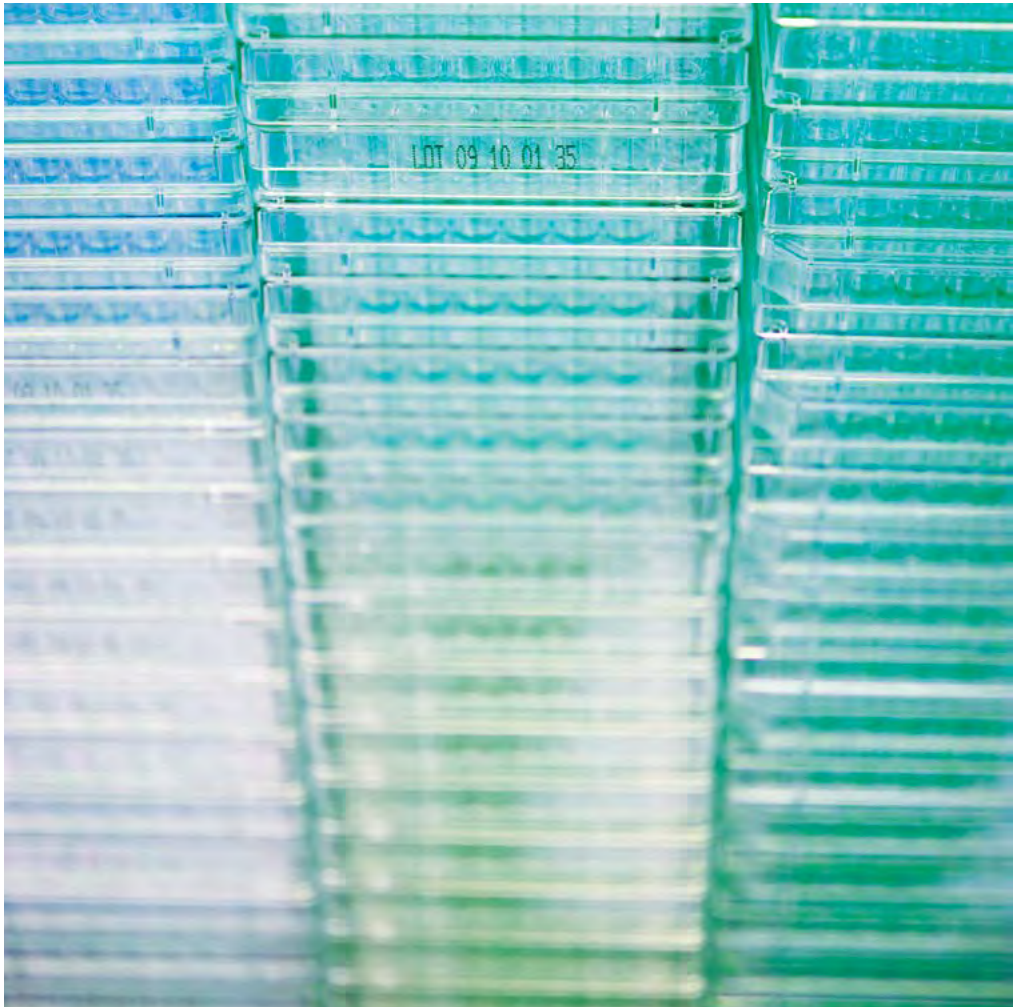




Neurons and other brain cells respond to environmental cues within seconds or milliseconds, while changes in gene expression take longer. Scientists have been unable to precisely capture the molecular changes that take place in the brain over time. Earlier epigenetic studies of honey bees and other organisms required the removal of brain tissue for analysis. With this new approach the Illinois team can use the MRI to directly image epigenetic changes in live subjects.

#PNAS #GNBP #Carle #Beckman #ISI #ThisIsYourBrainOnMRI

March 23



Reducing the carbon footprint through single-use plastics reuse



Each year 5.5 million tons of single-use plastics are generated by science labs, negating 83% of the world's recycled plastics. A team at Illinois was



#Technology #Society

awarded a \$81,865 grant to reduce dependency on single-use plastics by developing protocols for plastics reuse.

The project, Single-Use Plastics Elimination and Reuse Protocols for Labs (SUPERLabs), is being funded by the Student Sustainability Committee on campus, and led by [Jessica Brinkworth](#).

The waste elimination protocols will focus on polypropylene and polystyrene reuse and replacement, which includes culture dishes, pipette tips, and conical tubes. Brinkworth foresees an estimated 50-90% plastic waste reduction per lab that decides to adopt the protocols.

[#GNDP](#) [#GSP](#) [#IGOH](#) [#SSC](#) [#ReduceLabWaste](#)

February 25

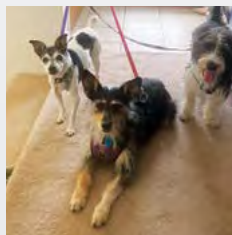
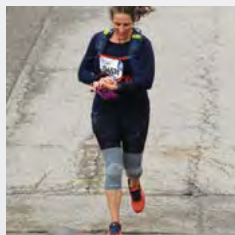
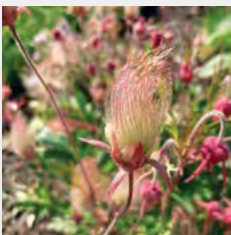
People Mentioned

Jessica Brinkworth,
Assistant Professor
of Anthropology



Jessica Brinkworth
Assistant Professor of Anthropology

[#PeopleToFollow](#) [#ADayInTheirLife](#)





New set of chemical building blocks makes complex 3D molecules in a snap



A new set of molecular building blocks aims to make complex chemistry as simple and accessible as a toy construction kit. Researchers at the University of Illinois Urbana-Champaign and collaborators at Revolution Medicines Inc. developed a new class of chemical building blocks that simply snap together to form 3D molecules, and an automated machine to assemble the blocks like a 3D printer.

This automation could allow chemists and nonchemists alike to develop new pharmaceuticals, materials, diagnostic probes, catalysts, perfumes, sweeteners and more, said [Dr. Martin Burke](#).

For more than 15 years, Burke's group has pioneered the development of simple chemical building blocks called MIDA boronates, which snap together sequentially using one simple reaction. The new set of building blocks, called TIDA boronates, unlock the missing third dimension, incorporating specific twists and 3D structures directly into the blocks.

"It makes very complex 3D molecules in a very simple way," Burke said. "This has been the secret chamber that only card-carrying chemists with decades of experience can enter. Now everyone can come in and play in the sandbox."

[#Nature](#) [#MMG](#) [#NIH](#) [#NSF](#) [#DamonRunyonFoundation](#)
[#HenryLuceFoundation](#) [#ACS](#) [#ASF](#)

February 9

People Mentioned

Martin Burke,
Professor of
Chemistry

“The opportunity to position
the Urbana campus
as a major center for
genomic biology turns
on the linchpin of the
Post Genomic Institute.”

Carl R. Woese, Ikenberry Professor of Microbiology

in a letter to UIUC President James Stukel, March 27, 2003

[Post Genomic Institute was subsequently renamed to Institute for Genomic Biology]

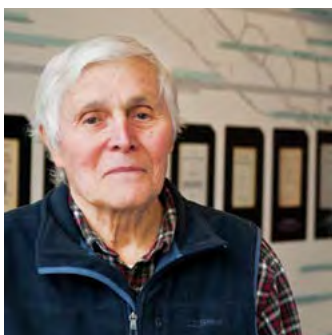
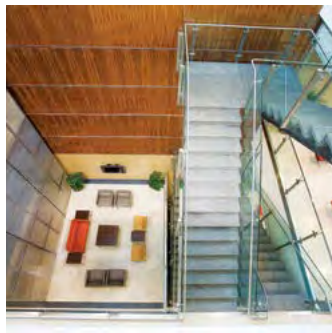
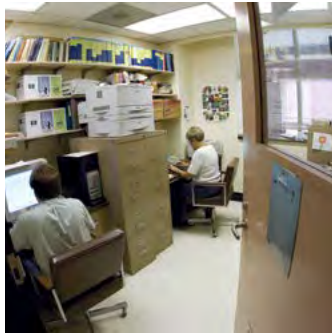


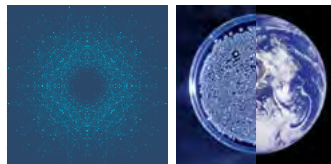
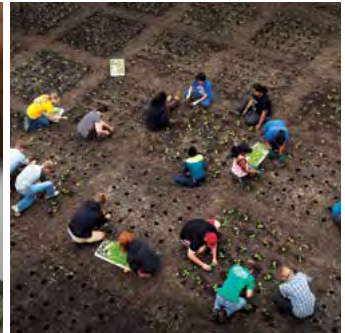
15

#15YearsOfIGB

A walk down memory lane to commemorate what we have accomplished so far. #ThrowBackThursdays
#NotAlwaysOnAThursday

| | |
|--------------------------------------|----|
| INSTITUTE FOR GENOMIC BIOLOGY | |
| IGB ADMINISTRATION | |
| HARRIS LEWIN DIRECTOR | 36 |
| JENNIFER QUIRK ASSOCIATE DIRECTOR | 30 |
| BUDGET & RESOURCE PLANNING | 24 |
| GARY ANDERSON DIRECTOR | 28 |





“We also exemplify the spirit of collaboration through the 50 full members and 50 affiliates who comprise the eight IGB Research Themes, drawn from 30 departments in six colleges and campus units.”





Numbers 2007 to 2022

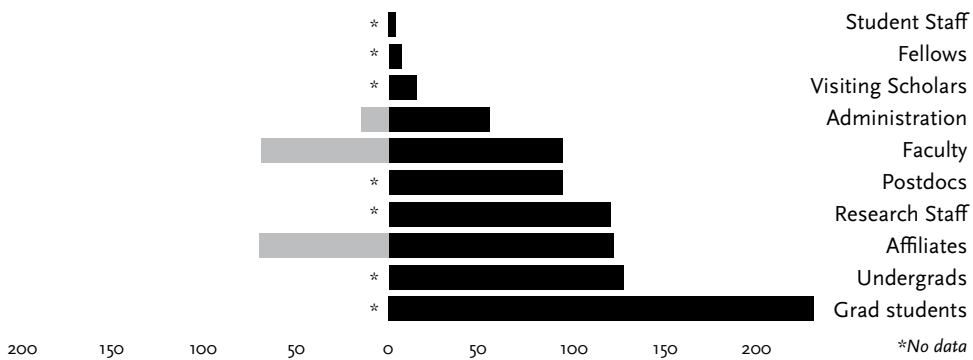
2007 2022



People

Total in 2022: 868

Since its inception, the IGB has been a community of faculty, students, and staff who all share the common goal of helping our institute reach its full potential.



Economic Development

Over the past 15 years our researchers have been at the forefront of innovation, creating new tools that can help our future generations.



Patents:

Bio-Engineered Hyper-Functional "Super" Helicases
Taekjip Ha, Sinan Arslan

Biosynthesis and Engineering of Lanthipeptides
Wilfred van der Donk, Ayse Okesli, Kenton J. Hetrick, Mark Walker, Xiao Yang



Publications

1011 papers published, 5 in *Science and Nature*

Automated iterative Csp3-C bond formation, Blair, D. J., Chitti, S., Trobe, M., Kostyra, D. M., Haley, H. M. S., Hansen, R. L., Ballmer, S. G., Woods, T. J., Wang, W., Mubayi, V., Schmidt, M. J., Pipal, R. W., Morehouse, G. F., Palazzolo Ray, A. M. E., Gray, D. L., Gill, A. L. & **Burke, M. D.** *Nature*. 604:7904

Ancient DNA and deep population structure in sub-Saharan African foragers, Lipson, M., Sawchuk, E. A., Thompson, J. C., Oppenheimer, J., Tryon, C. A., Ranhorn, K. L., de Luna, K. M., Sirak, K. A., Olalde, I., **Ambrose, S. H.**, Arthur, J. W., Arthur, K. J. W., Ayodo, G., Bertacchi, A., Cerezo-Román, J. I., Culleton, B. J., Curtis, M. C., Davis, J., Gidna, A. O., Hanson, A., et al., *Nature*. 603: 7900

Multiple rereads of single proteins at single-amino acid resolution using nanopores, Brinkerhoff, H., Kang, A. S. W., Liu, J., **Aksimentiev, A.** & Dekker, C. *Science*. 374: 6574

Masitinib is a broad coronavirus 3CL inhibitor that blocks replication of SARS-CoV-2. Drayman, N., DeMarco, J. K., Jones, K. A., Azizi, S-A., Froggatt, H. M., Tan, K., Maltseva, N. I., Chen, S., Nicolaescu, V., Dvorkin, S., Furlong, K., Kathayat, R. S., Firpo, M. R., Mastrodomenico, V., Bruce, E. A., Schmidt, M. M., Jedrzejczak, R., Muñoz-Alía, M. Á., Schuster, B., Nair, V., Han, K-Y., O'Brien, A., Tomatsidou, A., Meyer, B., Vignuzzi, M., Missiakas, D., Botten, J. W., **Brooke, C. B.**, Lee, H., Baker, S. C., Mounce, B. C., Heaton, N. S., Severson, W. E., Palmer, K. E., Dickinson, B. C., Joachimiak, A., Randall, G. & Tay, S. *Science*. 373: 6557

Flyby reaction trajectories: Chemical dynamics under extrinsic force. Liu, Y., Holm, S., Meisner, J., Jia, Y., Wu, Q., Woods, T. J., Martinez, T. J. & **Moore, J. S.** *Science*. 373:6551



Core Facilities

Since 2007, the Core Facilities at the IGB has been a state-of-the-art resource for biological microscopy and image analysis. Its core mission is to provide researchers across our campus with the tools and expertise to meet their imaging needs.

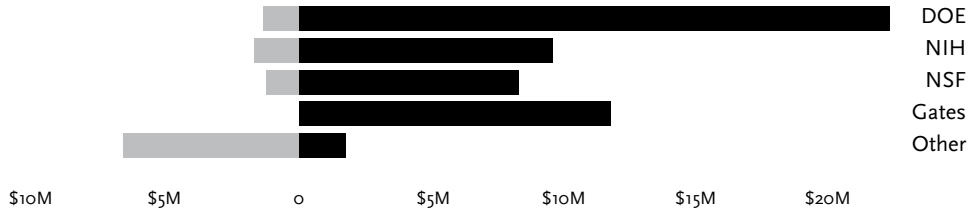


2007 2022

\$ Grant Awards

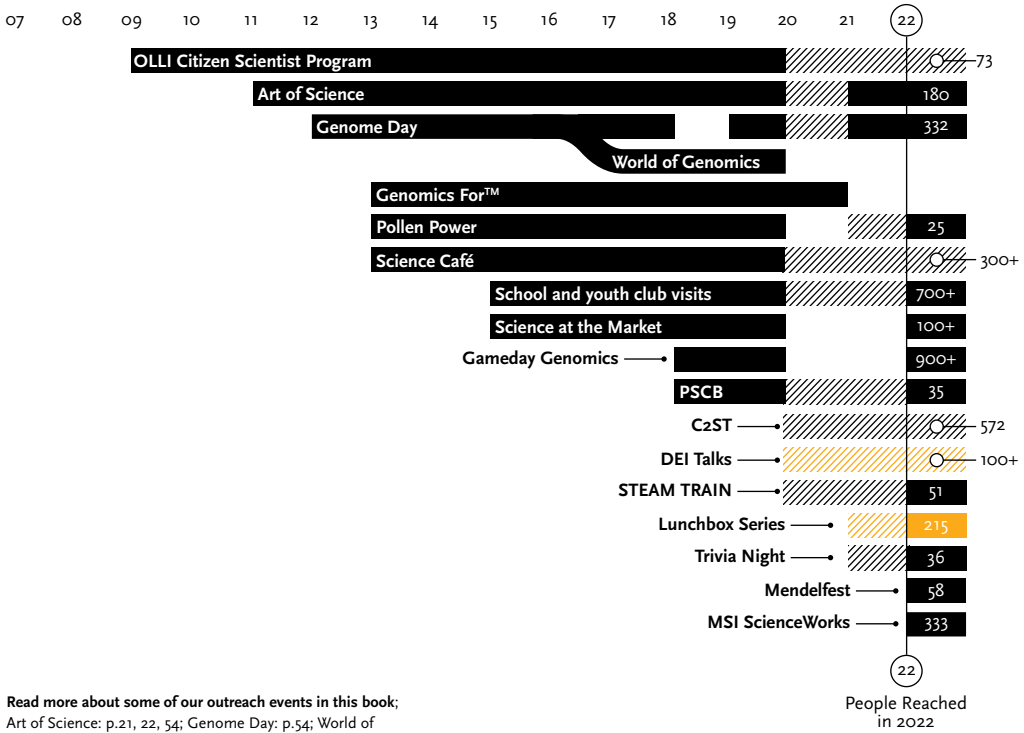
Total FY07: \$10,745,239 → Total FY22: \$53,655,522

Our work is made possible by several funding agencies. We are grateful for their support and look forward to our future endeavors.



↗ ↘ Outreach

The IGB embodies its motto: Where Science Meets Society. By engaging with the public through programs and events, publications, and citizen science efforts, we ensure that our work continues to be relevant and impactful, a force for positive change in the wider world. These interactions remind IGB faculty, students and staff what motivates their research, while helping the public understand the work that goes into modern, cutting-edge research and the results that come out of it.



Read more about some of our outreach events in this book;
 Art of Science: p.21, 22, 54; Genome Day: p.54; World of Genomics: p.54; Genomics For™: p.54, 60; Pollen Power: p.54, 67; STEAM TRAIN: p.54, 75; DEI Talks: p.74; Mendelfest: p.55;
 See the pictures from these programs on our social accounts @IGBillinois

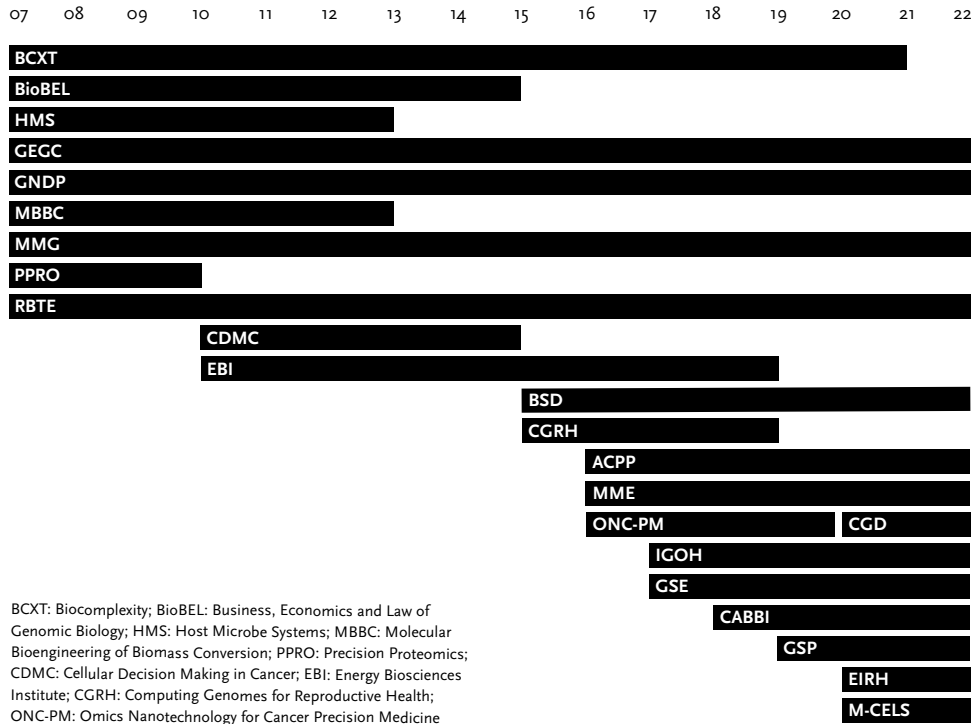
▨ Virtual/Hybrid/Outdoor
 ■ DEI Task Force Initiatives



Research Themes and Centers

8 (2007) → 15 (2022)

In each IGB research theme, the common goal of a particular grand challenge in research creates synergy among diverse groups of scientists across the Illinois campus. The IGB also hosts numerous research centers, fostering collaboration with external partners.



Awards

Alison Bell, Professor of Evolution, Ecology, and Behavior (GNDP leader), received the Quest Award, Animal Behavior Society.

May Berenbaum, Professor and Head of Entomology (GEGC/IGOH), named to the President's Committee on the National Medal of Science.

Rohit Bhargava, Founder Professor in Bioengineering (CGD), received the New York/New Jersey Society for Applied Spectroscopy Gold Medal Award.

Martin Burke, May and Ving Lee Professor for Chemical Innovation (MMG), elected to the National Academy of Medicine; elected to the Fellows of the American Association for the Advancement of Science.

Carla Cáceres, Professor of Evolution, Ecology and Behavior (IGOH), named the G. William Arends Professor.

Kathryn Clancy, Professor of Anthropology (EIRH), named the Dean's Distinguished Professorial Scholar, College of Liberal Arts & Sciences.

Peter Fox, Founder and Principal of Fox Ventures, LLC and IGB Leadership Council member, received the Distinguished Service Award, University of Illinois Alumni Association.

Kaiyu Guan, Blue Waters Associate Professor, Natural Resources and Environmental Sciences (CABBI), received the GroundBreaker Prize, FoodShot Global.



Awards Continued

Sara Pedron Haba, Research Assistant Professor, Chemical and Biomolecular Engineering (RBTE), named an awardee of the American Association for Cancer Research.

Hee-Sun Han, Mark A. Pytosh Scholar and Assistant Professor of Chemistry (GNBP/IGOH), received the Amy L. Devine Award, Illinois chapter of Alpha Omega Epsilon.

Mark Hauber, Harley Jones Van Cleave Professor of Host-Parasite Interactions, Evolution, Ecology, and Behavior (GNBP), received the Alexander von Humboldt Research Award, Alexander von Humboldt Foundation; elected to the Fellows of the American Association for the Advancement of Science.

Katy Heath, Associate Professor of Plant Biology (IGOH), named the Dean's Distinguished Professorial Scholar, College of Liberal Arts and Sciences; elected to the Fellows of the American Association for the Advancement of Science.

Joseph Irudayaraj, Professor of Bioengineering (CGD/EIRH/MME), elected to the Fellows of the American Association for the Advancement of Science.

Yong-Su Jin, Professor of Food Microbiology (BSD/CABBI/MME), named University Scholar.

Madhu Khanna, Professor of Agricultural and Consumer Economics and iSEE Director (CABBI), named the Alvin H. Baum Family Chair.

Cecilia Leal, Associate Professor and Racheff Faculty Scholar in Materials Science and Engineering (M-CELS), received the College Award for Sustained Excellence in Diversity, Equity and Inclusion, Grainger College of Engineering.

Xin Li, Assistant Professor of Cell & Developmental Biology (GNBP), named the Lincoln Excellence for Assistant Professors Scholar by the College of Liberal Arts & Sciences.

Ripan Malhi, Professor of anthropology (GNBP/GSP/IGOH) elected to the Fellows of the American Association for the Advancement of Science.

Elizabeth Murphy, iSEE Managing Director, received the SPARC Outstanding Service Award, Sponsored Programs Administration.

Donald Ort, Robert Emerson Professor in Plant Biology and Crop Sciences (GEGC Leader/BSG/CABBI), received the Jalal Aliyev Lecture Scholarship, International Society of Photosynthesis Research.

Jason Ridlon, Associate Professor of Animal Sciences (MME), appointed as the Center for Advanced Study (CAS) Associate.

Gene Robinson, IGB Director, Swanlund Chair, Professor of Entomology (GNBP), elected as the Councilor to the National Academy of Sciences.

Andrew Smith, Professor of Bioengineering (CGD), elected to the Fellows of the American Institute for Medical and Biological Engineering.

Rachel Smith-Bolton, Associate Professor of Cell & Developmental Biology (GNBP/RBTE), received the Teaching Excellence Award, School of Molecular & Cellular Biology; named the Norman P. Jones Professorial Scholar, College of Liberal Arts & Sciences.

Amy Wagoner Johnson, Professor and Andersen Faculty Scholar, Mechanical Science and Engineering (EIRH/RBTE), elected to the Fellows of the American Institute for Medical and Biological Engineering.

Tandy Warnow, Associate Head for Research and Faculty Development, Department of Computer Science (IGOH), received the College Award for Excellence in Faculty Mentoring, Grainger College of Engineering; elected to the Fellows of the American Association for the Advancement of Science.

Rachel Whitaker, Professor of Microbiology (IGOH leader), appointed the Harry E. Preble Professorship.

Nicholas Wu, Assistant Professor of Biochemistry (IGOH), named Searle Scholar.

Huimin Zhao, Steven L. Miller Chair in Chemical and Biomolecular Engineering (BSD/GSE lead/CABBI/CGD/MMG), appointed the editor-in-chief of ACS Synthetic Biology; received the Food, Pharmaceutical and Bioengineering Division Award in Chemical Engineering, American Institute of Chemical Engineers.

Managing Editor
Nicholas Vasi

Design
Mirhee Lee

Writing
Shelby Lawson
Ananya Sen

Printing
Premier Print Group

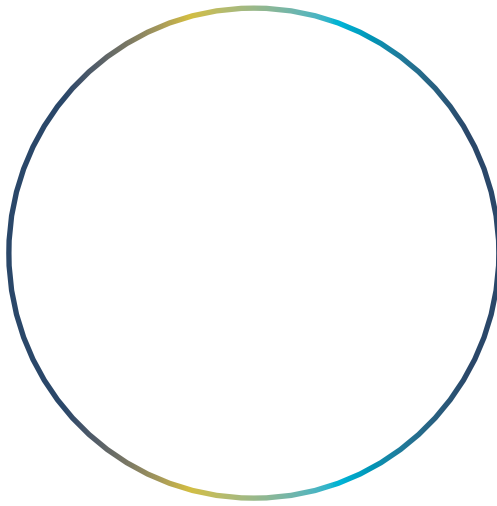
Writing Contributors

Jenny Applequist; Allie Arp; Claire Benjamin; CCIL Communications; Phil Ciciora; Tracy Crane; Heather Coit; Dave Evensen; Alisa King-Klemperer; Jenna Kurtzweil; Shelby Lawson; Susan McKenna; Amanda Nguyen; Lauren Quinn; Aaron Seidlitz; Ananya Sen; Kyle Shelton; Grainger College of Engineering; Ivan Sanchez; Huan Song; Marianne Stein; Liz Ahlberg Touchstone; April Wendling; Julie Wurth; Diana Yates; Lois Yoksoulian

Image Contributors

Allie Arp; Beckman Imaging Technology Group; Claire Benjamin; Jessica Brinkworth; Taylor Canady; Eric S. Carlton; Jee-Wei Emily Chen; Qian Chen; Chrejsa; Oana Danciu; Noah Dibert; Andrew Dou; Dyani; Eutrophication&hypoxia; Kathryn Faith; Flickr; Eleanor Grosch; Don Hamerman; Michelle Hassel; IGB Core Facilities; Illinois Natural History Survey; Vasiliki Kolliopoulos; Mirhee Lee; King C. Li ; Nantao Li; Anna Longworth; Vittoria Mariano; NASA; NIAID; Jillian Nickell; NIH; Ninjatacoshell; Julia Pollack; Ellen Qin; Leo Reynolds; Alex David Jerez Roman; Skip Russell; Erik Sacks; Coralie Saless-Smith; Mona Schreiber; Carl Shultz; L. Brian Stauffer; J.D. Talasek; Grace Tan; Christopher A. Taylor; Aleczandria Tiffany; U of I Bee Research Facility; James Vattano; Jennifer Walter; Jason Wang; Wikimedia Commons; Alex William; Fred Zwicky





**Carl R. Woese Institute
for Genomic Biology**
UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN



@IGBillinois | igb.illinois.edu