

IGB Outreach

Annual Report

20 18

**When you educate
one person you can
change a life, when
you educate many
you can change the
world.**

-Shai Reshef



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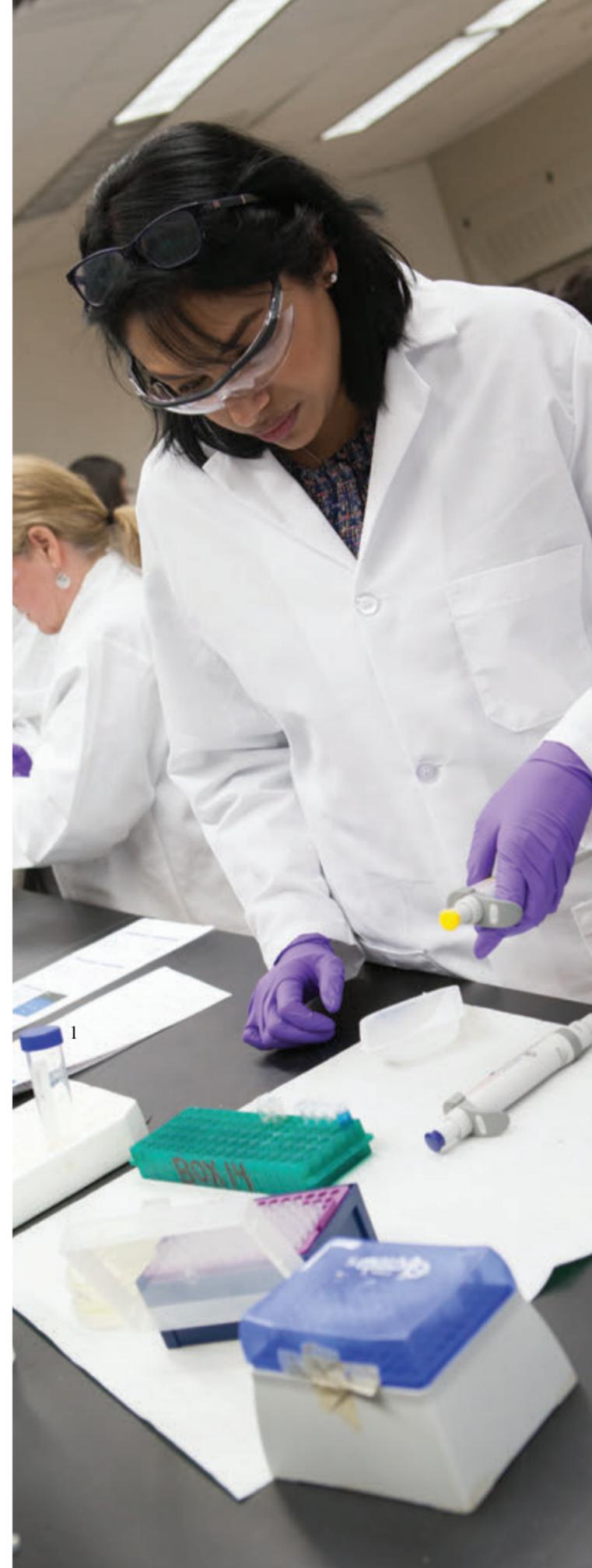
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IGB Outreach Annual Report 2018

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Letter from the Manager



Courtney Fenlon,
*Senior Outreach
Activities Manager*

Science is a cornerstone of modern society. Decontaminated drinking water, food from around the world in grocery stores, medicines to treat diseases, transportation around town, and wearable devices are just a handful of modern amenities made possible by science. These widespread applications of scientific research are improving our everyday lives, yet the communities using these technologies are often far removed from the scientists making discoveries. It's the curiosity and wonder that these scientific discoveries elicit that create the potential to connect different groups, bridge communities and span nations. We need to capitalize on these connections to propel science discovery into the future.

Connections and interactions between scientists and the public are critical. Scientists can more easily relate their work to real public needs and members of the public become better able to make informed decisions when it comes to the everyday impact of science and technology. This mutualistic relationship can then build opportunities to constructively engage and familiarize individuals with diverse beliefs and behaviors that inform our future decisions as a community, nation, and the world.

Nothing showcases the community engagement of the Carl R. Woese Institute for Genomic Biology (IGB) better than our flagship event, World of Genomics. This year, the three-day event was hosted at the St. Louis Science Center, where the

IGB had six learning stations and numerous hands-on activities for families and school children to learn about science and connect with researchers from the IGB. Over the three days, 45 science volunteers interacted with over 6,000 community members to discuss science research taking place at the IGB.

As part of the ongoing program, IGB hosted the Art of Science 8.0 opening reception at a new venue, Broadway Food Hall in Urbana. The IGB Art of Science shows feature images that originate from IGB research and are then artistically enhanced to emphasize principal features and draw in audiences to question and learn more about the underlying science concepts. IGB also connected with Franklin STEAM Academy to encourage students to create their own art from scientific images.

If there is anything that defines the Midwest community, it's college football on Saturdays. New this year, in collaboration with the Division of Intercollegiate Athletics, IGB outreach hosted Game Day Genomics, a science booth within Illinois' tailgate area at Grange Grove. IGB provided hands-on science activities to the families tailgating before Illinois home football games. Game Day Genomics was an excellent location to engage with a new group of diverse community members and connect over a shared interest of our Illini football team— Go Illini!

Other outreach stories from the IGB include hosting twenty judges for a Genomics For™ Workshop in November, our annual Pollen Power Summer camp for middle school girls, and the development of a new graduate student and postdoc training program, Professional Skills for Careers in Biosciences, which helps participants practice science communication, outreach and other careers skills.

These outreach events and the many others highlighted in this report are a direct reflection of the incredible research taking place at the IGB. None of these activities would be possible without the established collaborative research environment of the IGB and the connections amongst researchers from various backgrounds. IGB's strong connections have led to additional collaborations among departments, other universities and even communities around the world. The influence of IGB outreach and the researchers involved is truly astounding and fully encompasses the IGB's tagline of "Where Science Meets Society."



By the Numbers

Carl R. Woese Institute for Genomic Biology 2018 Outreach by the Numbers

9,000

People reached

1,793

Volunteer hours

360

Hours of outreach events

266

Volunteers

115

Days of outreach events

69

Outreach events

13

Community connections

16

Campus partnerships

22

Locations

9

Cities

4

States

3 - 92

Age of participants

Engaging The Community

IGB hosts a variety of outreach events that connect IGB research and researchers to society. These large-scale events are open to the public, intending to increase awareness and understanding of genomics in everyday life, and to empower communities to use this knowledge to shape their lives.

At a Glance

- ★ **World of Genomics:**
This exhibit brings the full scope of our research in health, technology, and the environment to the public with hands-on activities and stations for all ages.
 - ★ **Art of Science:**
A celebration of the common ground between science and art. The exhibit showcases artistically enhanced microscopic images from IGB research.
 - Game Day Genomics:**
A collaboration with the Division of Intercollegiate Athletics (DIA), this event brings science to the unexpected location of Illinois home football games.
 - Science at the Market:**
Genomics-related activities for family and children visiting the Urbana Farmer's Market.
 - Science Café:**
Public lectures and discussions with scientists from IGB and the Beckman Institute every month of the semester.
- ★ *feature story — for more detail turn the page*



★ World of Genomics

One of the IGB's most successful and comprehensive public engagement events, World of Genomics, was showcased for three days at the St. Louis Science Center from October 18-20, 2018. It featured six interactive learning stations spanning the breadth of our research in health, technology, and the environment.

The Tree of Life station highlighted the overarching metaphor used by Darwin to describe the evolutionary relationships among all organisms, both living and extinct. At this station, visitors learned about the third domain of life, discovered by Illinois researcher and IGB namesake Carl Woese.

At the Brains and Behavior station, guests examined concepts related to the human brain and behavior through the lens of bee researchers. Attendees viewed a live bee hive and used virtual reality goggles to explore 3D models of the brain.

The DNA to Drugs station showcased antibiotics in action and robotic devices helping researchers to identify new drugs. Participants learned how new treatments for cancer are successfully used to treat pets, as well as how these treatments are used to combat cancer in humans.

The Emergence of Life station explored how life began and what we can learn from fossils and skeletal evidence. The station also examined types of interactions that were present between microbes and the environment during the emergence of life on Earth, how these interactions play necessary roles in the human body, and how these relationships might be a shared feature of life on other planets.

Visitors at the Food and Fuel station observed how a combination of traditional breeding, genetic engineering, and genome editing can create plants with higher yields that withstand drought and disease. They saw our crop-rovng robot in action and considered how to design their own more efficient plants.

The Personalized Health station featured hands-on visualizations of the unique microbial communities that live inside every person and a 3D printer demonstrating how to create personalized implantable medical devices. Guests also saw technology that doctors can use for real-time early detection of cancer.



Tree of Life display



Brains and Behavior station
with a live bee hive

★ Art of Science

The Art of Science program is a celebration of the common ground between science and art. The art is created from images that emerge from IGB research via the IGB Core Facilities Microscopy Suite. The images are then enhanced to highlight and emphasize the beauty in research encountered daily by scientists. The Art of Science 8.0 opening reception was hosted at Broadway Food Hall in Urbana, a new location for 2018. The exhibit was visited by over 400 community members.

The exhibit emphasized the intricate relationship between art and science and highlighted the IGB's unique interdisciplinary research with images of plants, animals and microbes. This unique medley not only displayed the science beautifully, but also welcomed a conversation on science and its effects on society. Its goal was to help make the science at IGB accessible to the community and open discussions between the researchers and the public. The opening reception highlighted the work of IGB scientists and speakers Julia Fine, Jessica Saw, Shiv Sivaguru and Bruce Fouke.

Art of Science 8.0 images were also displayed at Willard Airport, the I Hotel and Grainger Library. Additional exhibits were installed at Abbott Laboratories in Chicago, with a collaborative piece created from scientific research at Abbott, and at the St. Louis Science Center as an addition to the World of Genomics.



Up close view of an art piece



Art of Science opening night

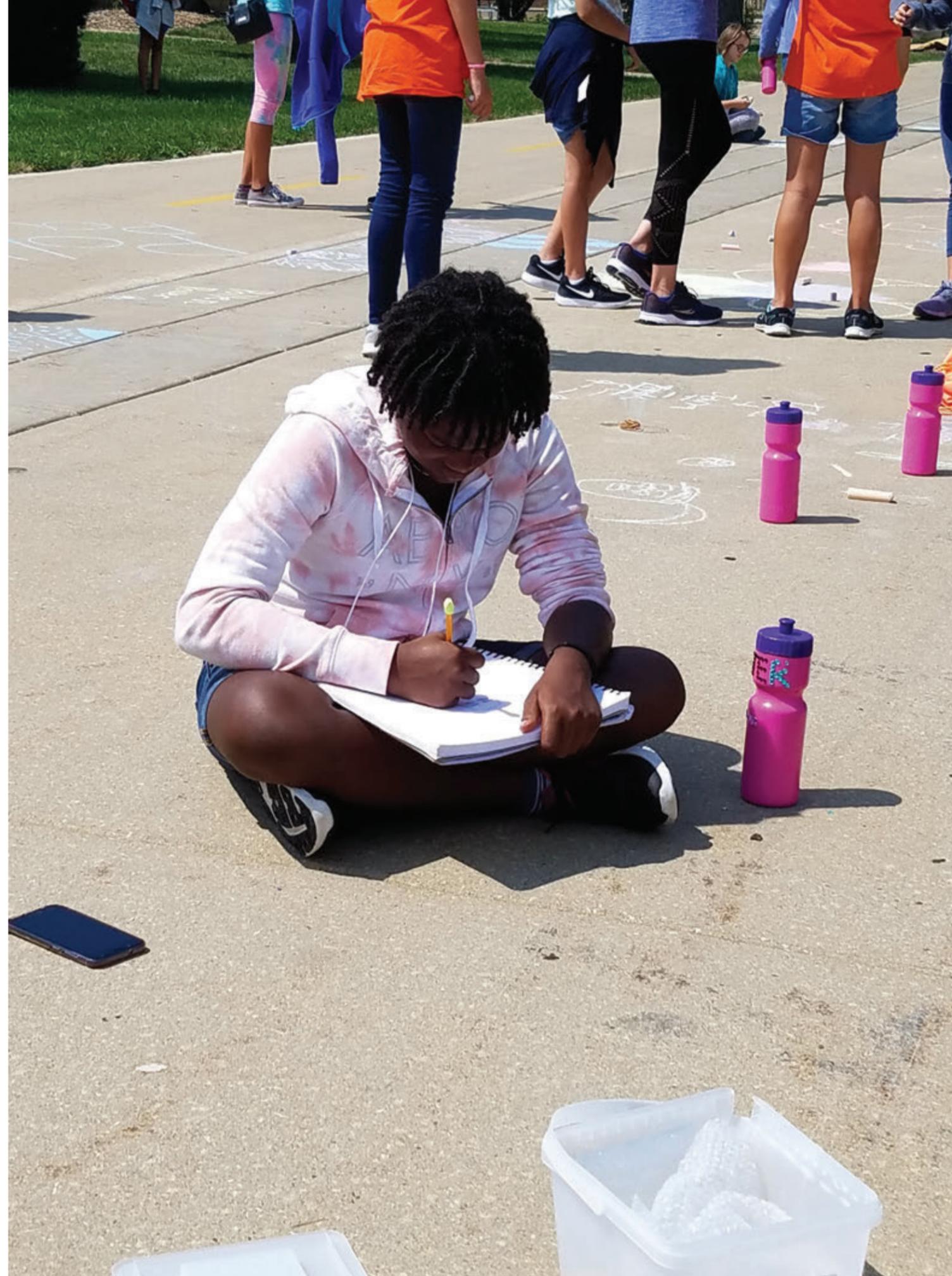
Cultivating the Future

The IGB is committed to outreach events for students. A variety of educational events for children in kindergarten through high school are hosted in order to introduce students to genomics, DNA, and evolution. These events also showcase roles in science and genomics research as achievable and potential careers.

At a Glance

- ★ **Pollen Power:**
This week long summer day camp at the IGB is offered to middle school girls interested in plant science.
- ★ **DREAAM Field Trip:**
A field trip and tour through IGB for a school-to-college pipeline program that works with at-risk boys and teens.
- Scholar Athlete Camp:**
Combines sports and science by offering science-themed visits and activities for students attending the DIA sports summer camps.
- Franklin STEAM Academy Art and Science Night:**
Science-based activities focused on creating art from science using bees and their behaviors for inspiration.
- Urbana Middle School Field Trip:**
A visit that allowed students to see growing archaea, view samples under a microscope, and learn about protein translation.
- Not On My Watch:**
DNA transcription and translation activities at the Not On My Watch morning session in Rantoul.

★ *feature story — for more detail turn the page*



★ Pollen Power

Most summer day camps rely on some standard activities to entertain their attendees—indoor and outdoor games, crafts, field trips, and snacks. The middle school girls who attended Pollen Power camp at the IGB in mid-July enjoyed all these traditional activities, but with some unique touches: plants and insects, fiber optics and lenses, microscopes and green screen recordings all played a significant role in the camp's agenda.

The camp, now in its sixth consecutive year, is funded in part by the National Science Foundation and the IGB. The camp is co-organized by plant biologists and IGB members Lisa Ainsworth (USDA ARS) and Andrew Leakey (CABBI/GEGC), as well as IGB Core Facilities, and Outreach staff. Female graduate students acted as counselors for the plant science-themed camp, providing examples for attendees of what a future career in science could look like.

In addition to the basics of plants and pollination, campers learned about the relationships among plant biology, animal pollinators, evolution, and global climate change through a series of projects and activities. The girls used high-powered microscopes and fabrication equipment to explore pollen grains and other plant structures up close. They wrote and produced their own short videos about Earth's present and future climate.

They also visited SoyFACE research fields to see IGB crop research in action and learned how to pollinate corn. They visited the Greenhouse to see how plants are grown in off seasons and the Pollinarium where they collected insect samples and saw a live bee hive.

Talks by female scientists and visits to laboratories around the Illinois campus helped provide a broad view of the many forms that scientific work can take and create a more concrete picture of its day-to-day realities. The ultimate goal of the camp is not just to educate, but to make a career in STEM—particularly plant science or engineering—more appealing and achievable to those who attend.



Pollen timeline activity



Pollinating corn in the field

★ DREAAM Field Trip

IGB offered field trips for students from schools in Champaign-Urbana and surrounding areas throughout the year that included a series of activities related to IGB research themes and tours of the research building. The ultimate goal of these field trips is to showcase IGB research and make the science relatable to the students.

During March 2018, we hosted students from the DREAAM House for a field trip to the IGB. DREAAM House, which stands for Driven to Reach Excellence and Academic Achievement for Males, is a school-to-college pipeline program that works with at-risk boys and teens to support them in their socio-emotional and academic development. The field trip included hands-on activities to help students understand the science behind some of the problems that researchers at the IGB are working to solve.

IGB hosted 12 students in grades two through five from schools across the Champaign-Urbana area for a day during their spring vacation. The students were taken on a tour of the IGB to see researchers at work in the labs and met the Core Facilities team who showed students some of the microscopes and the images they produce. The theme of the day was DNA: the outreach team worked together to lead the students in several DNA-related activities, such as building a DNA helix out of marshmallows and Twizzlers and learning about DNA transcription and translation by decoding a secret message using the amino acid codon chart. After lunch, the students donned their detective hats and modeled DNA techniques used in crime scene investigations to solve a fruit-themed murder mystery.



Extracting DNA from fruit



The DREAAM team

Educating Professionals

The IGB offers a variety of workshops and training programs for professionals to expand their genomics knowledge with a profession-specific curriculum so that they are armed with tools to interpret genomics research and data in their workplace. The rapid pace of progress in genomics means that the gap between current knowledge and the science that most adults learned in high school or college courses is continually increasing. Continuing education courses such as the IGB's Genomics For™ programs provide an opportunity to close that gap.

At a Glance

- ★ **Genomics for Judges:**
A three day workshop programmed with the National Courts and Sciences Institute for state and federal resource judges regarding genomics and the law.
- ★ **Genomics for GET:**
Students from King Abdullah University visited IGB through the Illinois International Global Education and Training Program to learn about genetic engineering research.
- Genomics for Teachers:**
Teachers attended a day long professional development program on genomic research and invasive species that was co-hosted by the Illinois-Indiana sea grant.
- Summer Internship for Indigenous Peoples in Genomics (SING):**
A workshop that brings together Indigenous peoples to learn about genomics as a tool for Indigenous peoples' communities.
- Osher Lifelong Learning Institute (OLLI) Citizen Scientist Program:**
OLLI citizen scientists paired up with graduate students and postdocs to experience laboratory research firsthand.
- Massive Open Online Course (MOOC):**
IGB working with CITL and the College of Law developed a Genomics and Law MOOC to explore the implications of genomics research in law.

★ *feature story — for more detail turn the page*



★ Genomics for Judges

The IGB had the unique opportunity to work with the National Courts in Sciences Institute (NCSI) to offer a Genetic Engineering Technical Workshop for Science and Technology Resource Judges. The workshop was designed to prepare the twenty justices and judges to grapple with legal questions involving DNA sequencing, genetic modification and engineering, and related technologies in the courts today and in the future.

The three day workshop capitalized on the IGB's depth and expertise on basic genomics research and the impact of genomic engineering on society. Judges were immersed in science lectures on the structure and function of DNA, the genetic engineering of bacteria, plants and animals, and discussed how these techniques can be applied to processes such as bioremediation and gene drives. Other sessions included two case studies, co-hosted by the University of Illinois College of Law, where judges were able to consider possible future scenarios as well as a laboratory session in which the judges manipulated bacterial DNA using CRISPR.

As DNA sequencing and other biotechnologies advance, the rate of new developments in genomic biology and their impact on society and in the courtroom will continue to grow. The success of the Genomics for Judges Workshop has already prompted plans to address the need to expand genomics education by offering additional workshops for judges in the future.



Modifying *E.coli* using CRISPR technologies



Heat shocking *E.coli*

★ Genomics for GET

IGB partnered with Illinois International to create Genomics for Global Education and Training (GET). GET is a unit within Illinois International that provides customized executive training programs and professional capacity building opportunities to prepare today's global workforce.

IGB hosted 12 students from King Abdullah University of Science and Technology (KAUST) in Saudi Arabia for a visit to the IGB to learn about the latest developments in genetic engineering research. The students were members of the KAUST Gifted Student Program, in which highly qualified high school graduates in STEM fields are provided with the guidance and support necessary to complete their bachelor's degrees at premier U.S. institutions, then return to KAUST with unique cultural experiences and newly acquired skills to complete their master's and PhD programs.

The students toured the IGB, learned about genetic engineering, and performed a series of serial dilutions for a practical example of working with genetically engineered bacteria. Students were then introduced to the Illinois Biological Foundry for Advanced Biomanufacturing (iBioFAB), a fully automated robotic system that automates tasks like serial dilutions and other computational and experimental techniques used in metabolic engineering. The students, most of whom will be pursuing engineering degrees, were not only able to learn more about the cutting-edge research in genetic engineering taking place at the IGB, but witnessed the collaborative nature of our facility, and observed several fields of study such as biochemistry, computer science, and engineering coming together under our Biosystems Design research theme to develop new technologies in the rapidly growing field of synthetic biology.



Watching iBioFAB in action



Working with genetically engineered *E.coli*

Developing Ourselves

Scientists can make a much larger impact with their science in society if they can constructively engage and communicate with the public. IGB outreach provides professional development courses, workshops, and events to prepare and equip scientists with the necessary skills for research and communications.

At a Glance

- ★ **Professional Skills for Careers in Biosciences (PSCB):**
A new program created to provide IGB graduate students and post-docs the opportunity to develop and enhance job skills.
- ★ **International Genetically Engineered Machine (iGEM):**
An international team competition made up predominantly of undergraduate students interested in the field of synthetic biology.
- IGB Postdoc Association:**
A collaboration to host events and workshops for postdocs' professional growth.
- Alan Alda Science Communications Training:**
A renowned science communications training event for volunteers and researchers at the IGB.
- National Society of Black Engineers (NSBE) Visit:**
High school students interested in studying science at Illinois visited IGB with NSBE to learn about the intersection of genomics and engineering.

★ *feature story—for more detail turn the page*



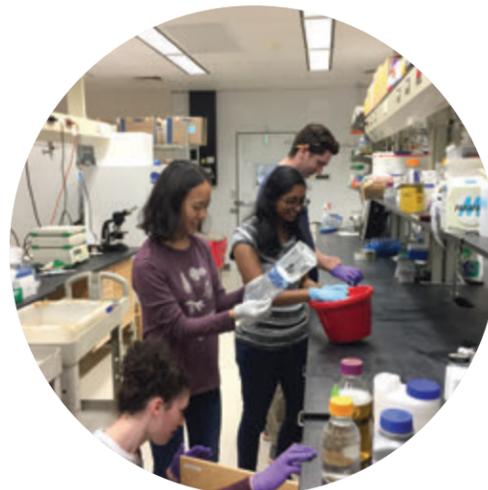
★ International Genetically Engineered Machine (iGEM)

The Illinois iGEM team won a bronze medal at the 2018 iGEM competition for their work on the relationship between lactic acid bacteria and baker's yeast. The iGEM competition brought together undergraduate students from across the world to present their research in synthetic biology and compete for prizes.

Five undergraduate students comprised the Illinois team: Prannathi Karumanchi, Ziyu Wang, Liam Healy, Amie Bott and Alexander Ruzicka. Their project was funded by the Center for Advanced Bioenergy and Bioproducts Innovation (CABBI) and the IGB. The team was mentored by graduate and postdoctoral researchers Carl Schultz, Shekhar Mishra, and Matthew Waugh, Research Coordinator Elizabeth Murphy, and Associate Professor of Bioengineering and (BCXI/BSD/CABBI/MME) Ting Lu.

The idea for the team's project came from the joint work of Lu and Yong-Su Jin(BSD/CABBI/MME), a Professor of Food Science and Human Nutrition. Lu is researching lactic acid bacteria, which are used in the production of cheese and yogurt, while Jin studies baker's yeast, which is used in baking bread. Lu and Jin wanted to see what a collaboration between these two organisms could achieve in the field of metabolic engineering. Lu wanted to investigate the ecosystem of lactic acid bacteria and baker's yeast and find a way to use them for producing valuable products.

The Illinois iGEM team continued this work by studying how lactic acid bacteria and baker's yeast work together, testing different environments and food sources. One of the biggest challenges the team faced was the lack of prior research in this area. Their project was one of inquiry and trial and error, but the team made quick progress. Lu said that the discoveries and progresses the team made are new to the field. Their work contributed to the goal of one day engineering these organisms, so that they could create a valuable product—a major goal of metabolic engineering.



iGEM students working on their research project in lab



iGEM poster competition

★ Professional Skills for Careers in Biosciences (PSCB)

PSCB was a new program created to provide IGB graduate students and postdocs the opportunity to develop and enhance their universal job skills.

PSCB is a workshop-based certificate program composed of seminars about communication, professionalism, marketing, budgeting, leadership, and more. The twelve workshops spanned the fall 2018 semester and will continue through Spring 2019 with lectures, interactive activities, writing and presentations.

The workshops covered topics such as the fundamentals of science communication, ethics in science and the workplace, building and leading a successful team, communicating with the media, solving problems as a leader, marketing yourself and your science, graphic design, and funding. Participants were encouraged to explore these topics through the lens of different career paths in the biosciences, such as academia, industry, entrepreneurship, policy, teaching and science writing.

Speakers included industry professionals, IGB graduates, and a variety of external industry experts as well as experts from a mixture of departments at the University of Illinois. Speakers highlighted skills necessary for all careers and showcased skills that PhD students can carry through from their scientific training to a variety of careers.

PSCB participants will receive a certificate after completing a capstone project in spring 2019 that will combine all the material covered throughout the program. At the capstone event, participants will present their projects to a panel of judges from the surrounding community. 2018-2019 was the pilot year for this new program, and it is expected to continue every year starting fall 2019.



Kate Ditewig-Morris presenting for PSCB



May Berenbaum presenting to the class



Getting Involved

Social Media



@IGBillinois



@IGBillinois



www.facebook.com/IGB.Illinois

Website

igb.illinois.edu

Volunteer

go.igb.illinois.edu/volunteer

Ideas?

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