University of Illinois at Urbana-Champaign

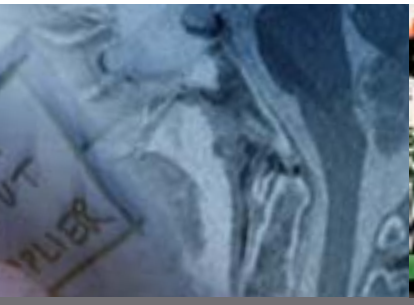
# Biomarker

INSTITUTE FOR GENOMIC BIOLOGY

Vol 6 No 1


THE MODERN SCIENTIFIC LANDSCAPE, EVOLVED

# FEATURES











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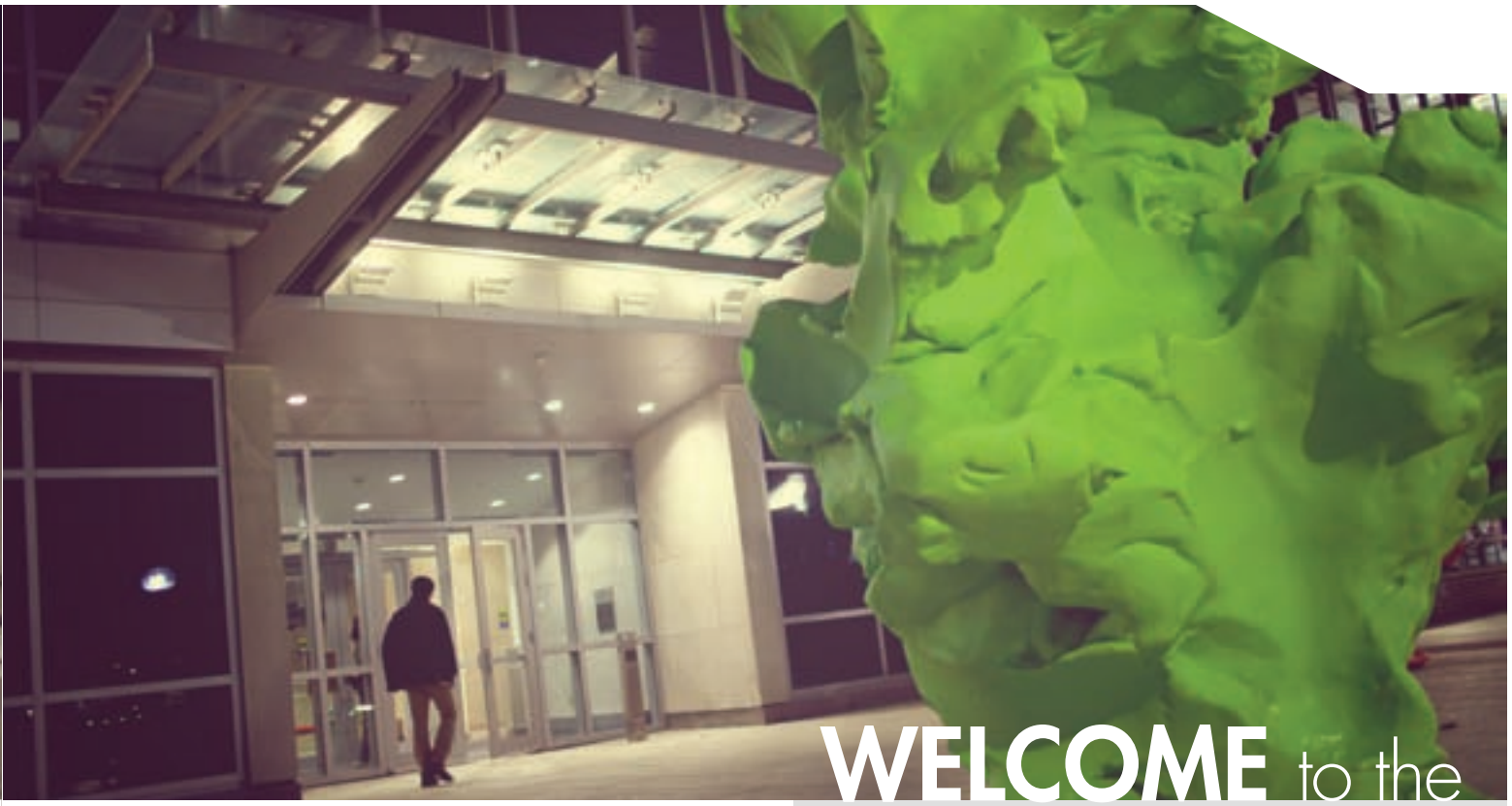
# REVOLUTIONARY UNDERSTANDING

**HAVING THE ABILITY TO SEQUENCE THE GENOMES OF MICROBES, PLANTS, AND ANIMALS HAS LED TO REMARKABLE ADVANCES IN BIOLOGY. YET THIS FIRST "GENOMIC REVOLUTION" HAS BEEN LIMITED TO A RELATIVELY SMALL NUMBER OF ORGANISMS.** Thanks to plummeting sequencing costs, within five or ten years we will have access to the genomic sequences of thousands of different species—microbes, plants, and animals—and also thousands of genomic sequences of individuals within some of these species. When we can sequence nearly any genome of any species of interest, we will enter what I call the "second genomic revolution." At that point, genomics will permeate and truly transform biology, and that is going to be a very exciting time for all of us. The IGB, as one of the pre-eminent genomics institutes in the world, is uniquely positioned to lead that revolution.

IGB's focus on collaborative and interdisciplinary research, fundamental to the very nature of the Institute, is one of our great strengths. The breadth of innovation and invention that takes place among the themes is unique to our facility and grants us multiple paths to discovery. It is imperative that we continue to nurture creativity and encourage the cross-disciplinary working environment that is IGB's hallmark.

That cross-disciplinary environment has resulted in incredible work, including the recent development of a new type of bandage, called a microvascular stamp, which can direct the growth of blood vessels across the surface of a



# WELCOME to the NEW DIRECTOR

wound. In addition, plant biologists have devised a new way to calculate the potential climate impacts of land use changes, to account for both the greenhouse gas value and the biophysical attributes of different ecosystems. And by altering the shape of proteins, we've realized more efficient ways to deliver DNA segments to cells, increasing the potential for clinical gene therapy.

Equally important is our involvement with the community, whether it's taking part in the Citizen Scientist program with the Osher Lifelong Learning Institute, creating a new Center for Nutrition, Learning, and Memory in conjunction with Abbott Nutrition and the Beckman Institute for Advanced Science and Technology, or hosting the first annual Summer Internship for Native Americans in Genomics Workshop. And to help prepare the next generation of researchers, we have established a new National Science Foundation training grant, Vertically Integrated Training with Genomics.

It is an exceptionally exciting time to be involved with the IGB, and I am honored to officially assume directorship of the Institute. To our faculty, affiliates, students, staff, and administration, and to all our supporters and stakeholders in the community, I thank you for this opportunity and look forward to embarking on the next genomic revolution, together.

- Gene E. Robinson

PROFESSOR GENE E. ROBINSON WAS OFFICIALLY NAMED DIRECTOR OF THE IGB IN JANUARY 2012, following a national search. Robinson brings an enormous wealth of experience to the position. He served as interim director since March 2011, and prior to that led the Genomics of Neural and Behavioral Plasticity research theme. The IGB community looks forward with great enthusiasm to a promising future under his direction.

Robert Easter, Interim Vice Chancellor for Research, praised the new appointment."I am confident that Gene will continue to conduct transformative research in neuroscience and genomics while he serves as IGB Director.

"I look forward to working with Gene and the IGB research community to support and expand IGB's extensive research program and its already excellent national and international visibility."

> "HE HAS SIGNIFICANTLY ADVANCED THE UNDERSTANDING OF THE ROLE OF GENES, HORMONES, AND NEUROCHEMICALS IN THE MECHANISMS AND EVOLUTION OF SOCIAL BEHAVIOR," SAID EASTER.

# BRAINFOOD: NEW CENTER FOR NUTRITION, LEARNING, AND MEMORY ESTABLISHED


## DARK CHOCOLATE, BLUEBERRIES, RED WINE, EVEN KALE: EVERY DAY A DIFFERENT FOOD

is proclaimed to have exciting health benefits. Little is known about how these foods improve well-being, but a new center established at the University of Illinois may soon change that, specifically those benefits related to cognition.

The Center for Nutrition, Learning, and Memory (CNLM) will support interdisciplinary exploration into whether any compounds in foods might improve learning and memory and, if so, how. This undertaking is significant because it is the first-ever joint project between the Institute for Genomic Biology and Beckman Institute. The Center is supported by a five-year commitment from Abbott.

"Society is more and more interested in health and wellness," says Neal Cohen, director of the CNLM. "We and Abbott saw the possibility of having our first trans-institute enterprise to get an even larger and more disparate group of people around the table to solve what we are all calling a grand challenge: can we find nutrients or compounds that can enhance cognition across the life span?"

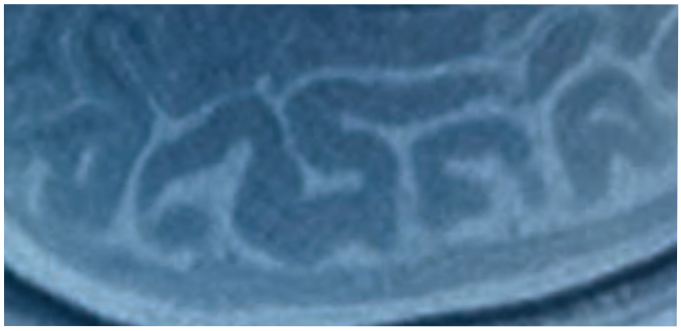
Grants awarded by the CNLM will leverage the university's strengths in interdisciplinary research—including the IGB's expertise in genomics and systems research, together with Beckman Institute, the neuroscience program, and the division of nutritional sciences—to understand how nutrition impacts the brain and learning.

It is an exciting undertaking because there is the potential for major discoveries with widespread benefits. While it is well-recognized that the brain is affected by what we eat, there is not a lot of evidence yet for what those effects are, says Gene Robinson, director of the IGB and a member of the CNLM's executive committee.

While the Center will certainly test selected nutritional compounds in assays of learning and memory, its scope will also be far broader and deeper.

"Abbott is respected in the market as a science-based company," Robinson says. "They ground their claims in science. That leads, then, to an interest in developing a very broad-based approach to research in this area."

This is not the first collaboration between the university and a commercial enterprise, but it is among the most ambitious.



> THE BEST WAY TO SUCCEED IN THIS GRAND CHALLENGE IS TO GET PEOPLE FROM MULTIPLE DEPARTMENTS AND MULTIPLE PROGRAMS AND MULTIPLE SCIENTIFIC APPROACHES WHO ARE EXPERIENCED AT WORKING TOGETHER AND WILLING TO EXTEND THEMSELVES FURTHER THAN THEY HAVE EVER EXTENDED THEMSELVES BEFORE.
>
> *- Neal Cohen*

"There is a general trend in industry to appreciate the prowess of major research universities in both basic and applied research and try to leverage both rather than recreate it in-house," said Robinson.

In Abbott's case, the company also has a history of strong ties with Illinois; there are more than 1,000 Illinois alumni working at Abbot. The company also was attracted to Illinois because of the four highly interdisciplinary groups (neuroscience program, nutritional sciences, Beckman, and IGB) that form the center, says Robinson.

"Those four together provide a really attractive basis for engaging with Illinois," he says.

By combining the expertise of all four campus units, researchers will be able to explore not just the "what," as in what compounds confer what benefits, but also the "how," as in by what pathway or pathways those benefits occur.

"If you do get a compound that improves learning and memory, you want to know the underlying mechanisms," says Robinson. "Those mechanisms are multilayered, so to develop a sound understanding of how a compound is improving learning and memory requires analyzing the effects of that compound at multiple levels, including brain activity, brain chemistry, and also at the molecular levels using tools of genomics and molecular biology."

IGB's expertise in genomics will be critical to the effort and will complement Beckman's capabilities in studying learning and memory and for brain imaging. IGB's expertise in model systems also will complement Beckman's work on humans.

"In addition to starting with compounds and asking what effect they might have, if we can get insight into how they work, then we can look for compounds that cause a change in this way. We then can take advantage of model systems research, one of IGB's strengths, as an engine to complement research on humans, which is more expensive and moves slower," says Robinson.

Cohen says that the university's great strength in interdisciplinary research is essential to this complex and multifaceted endeavor.

"The best way to succeed in this grand challenge is to get people from multiple departments and multiple programs and multiple scientific approaches who are experienced at working together and willing to extend themselves further than they have ever extended themselves before," he says.

By being a collaboration across institutes, the undertaking also sends the message that "this is the grandest thing we've ever done," Cohen says. "The scope and promise of the center is even larger than the two institutes. It's a higher order, more interdisciplinary than even one of the institutes."

"I think the campus is excited about the idea of doing something that is grand enough that it can involve a large portion of the university," he adds.

Some projects will receive up to $200,000, and others can receive up to $1 million. The total amount will depend on the number and quality of proposals, Cohen said. Funding will be determined by a joint committee from Illinois and Abbott.

ADDITIONAL INFORMATION ABOUT THE PROGRAM IS AVAILABLE AT *www.CNLM.illinois.edu.*

# A "DEAL OF DISTINCTION"
# THE ENERGY BIOSCIENCES INSTITUTE TAKES AIM AT **WORLD'S** ENERGY FUTURE

SINCE THE ENERGY BIOSCIENCES INSTITUTE'S INCEPTION IN LATE 2007, MORE THAN 750 RESEARCHERS HAVE CONTRIBUTED WORK TO THE ENTERPRISE, OVER 120 PAPERS HAVE BEEN PUBLISHED IN SCIENTIFIC JOURNALS, AND NEARLY 80 PROGRAMS AND PROJECTS HAVE BEEN LAUNCHED—SOME COMPLETED—IN THE SCIENTIFIC QUEST TO APPLY THE SYSTEMS AND MECHANISMS OF BIOLOGY TO THE WORLD'S ENERGY CHALLENGES.

Now, more than one-third of the way into its 10-year journey, the EBI is poised to uncover the truths, discover the unknowns, and decipher the complicated codes of nature that will allow the development of sustainable, environmentally responsible, and affordable sources of energy to offset the intractable hold that fossil fuels have had on modern society.

## BEGINNINGS

It all started with a commitment by the energy company BP to invest $500 million in a partnership with academic researchers who could bring their expertise to bear on issues involving the biotechnical aspects of transportation fuel development. Bioenergy was a concept great in promise but limited in practice, and BP wanted to know if future investments in its development would be worthwhile economically. Goals such as making carbon-neutral fuel out of plants were seen to require a multifaceted research environment that could best be implemented in a university setting. Solving the world's energy needs in the 21st century and beyond would take a broad interdisciplinary approach matching academia's superior research capacities with industry's mastery of markets and commercialization.

In 2007 the EBI was born with the University of California at Berkeley, the University of Illinois at Urbana-Champaign, and the U.S. Department of Energy's Lawrence Berkeley National Laboratory taking part in the creation. Berkeley researchers work from the historic Calvin Laboratory. while the EBI set up its headquarters at the Institute for Genomic Biology building. Illinois also oversaw the creation of the Energy Farm, a 320-acre outdoor laboratory for studying the agricultural issues surrounding biofuel production.

With 49 initial programs and projects and nearly 300 scientists and staff, the Energy Biosciences Institute set out on its 10-year crusade to change the transportation energy paradigm. A national organization of technology transfer professionals dubbed this new partnership a "deal of distinction" for its potential to "leverage complementary skills, expertise, and resources in a way that has the potential to result in the development of novel energy sources and solutions that could significantly benefit the global community."

## THE FIELDS OF DREAMS

As determined by a governing board of academic and BP leaders, work has proceeded in five different fields of research, each one possessing a biological component to the production of energy.

It all begins in the fields—finding sustainable, high-yielding plants as sources for biofuel production. A major component of the EBI's research portfolio is dedicated to the search for feedstocks that, unlike corn and sugarcane that are grown for ethanol production, are not food crops and may be grown on land unsuitable for food production. The ideal plant, which will differ by region, is one that yields the most biomass with the lowest use of land, water and energy. Harvest, storage, and transportation issues also are key to the success of a given feedstock.

Once the plants are harvested, they must be reduced to their component elements, in particular the sugars that reside in the cellulose and other components. It is the sugars that can be fermented into ethanol and other fuels. But the sugars are chemically locked up in long polymers

that must be broken down into constituent parts before the sugars can be used for fuel synthesis. This deconstruction process, called biomass depolymerization, is one of the keys to economical biofuel production. EBI researchers are looking at both chemical and biological means to break the chemical bonds that will release the sugars. Fermentation and processing of the resulting fuels is another challenge to overcome, because there are still numerous inefficiencies in the overall process that reduce the net energy yield and increase the cost of fuels.

The EBI is looking at the economics of biofuel production and land use; the impacts of biofuel on the energy markets; and effects of current and prospective fuel standards, legislation and regulatory policies that both incentivize and limit biofuel production.

## THE JOURNEY

More than 70 research efforts have received funding since 2007, totaling more than $107 million in support. Awards are divided into two categories: programs and projects. Programs are typically large integrated multi-investigator efforts with broad goals, funded from about $400,000 to about $1 million per year, and may continue for the 10-year life of the institute. Projects are smaller activities of two to three years that are narrower in scope; these average about $200,000 annually per project. As of 2011, 25 programs and 51 projects had been funded. The research is conducted mostly within EBI space so that postdoctoral, support, and graduate student researchers from different disciplines can work side-by-side.

But finding advanced fuels as alternatives to fossil-based fuels is a marathon, not a sprint. Much work still needs to be done before biofuels can be considered commercially competitive with petroleum products.

Today local farmers are working with industry leaders and research institutions to plant biomass crops that could someday fuel the world's energy needs and contribute to a sustainable energy future.

## GROWING BIOMASS FOR ENERGY: A FARMER DIGS IN

After visiting with University of Illinois researchers at the IGB and EBI, Illinois grain farmer Eric Rund decided to plant *Miscanthus* x *giganteus* (or *Mxg*) on his midwestern land. Miscanthus, a large perennial grass hybrid of *Miscanthus sinensis* and *Miscanthus sacchariflorus* is one of the biomass feedstocks that EBI scientists are researching for biofuels energy production.

"It became clear that Miscanthus was my best option for producing biomass," Rund said. "It produces high yields on few inputs and it's non-invasive. Miscanthus harvest runs from December through March, so it wouldn't interfere with my other farming operations."

Rund is just one of many farmers in Illinois and across the nation who are planting energy crops such as Miscanthus, switchgrass, and native prairie plants on land that is poorly suited for row crop production.

"All farmers have some land that's less desirable, particularly near streams or waterways," Rund notes. "If growers planted an energy crop on this type of land, they would not only produce biomass fuel and additional income, but they would also help the environment by creating grass strips that help keep excess fertilizer and herbicide out of the streams while providing a beneficial environment for wildlife."

To establish Miscanthus, Rund planted 15 acres in spring 2011. "From one acre planted with 16,000 plants, we can harvest enough rhizomes in two years to plant 50 to 60 acres," he says. "We only had to sacrifice a few corn acres initially, providing us with two more years to obtain a clearer picture of how the biomass industry was developing before we made a larger financial commitment."

Rund, who has farmed for nearly 40 years, grows seed corn, food-grade corn, and seed beans on 750 acres in central Illinois. He is growing *Miscanthus* x *giganteus* stock for New Energy Farms of Ontario, Canada.

Before deciding to plant Miscanthus on his Illinois farm, Rund and his son, Luis, traveled to Europe where growers are burning the crop and replacing coal to generate heat and power. "In Austria and Germany growers do not bale Miscanthus, but instead use silage choppers for harvest. Many stored this crop by simply dumping it on the ground at the end of the field. This made harvest and storage fast and inexpensive. The growers we visited used Miscanthus chips to heat their homes and livestock buildings, their schools, and even a district heating plant," Rund said.

Rund says he would like to see less emphasis placed on large advanced fuel power plants and more support provided to single-dwelling and school-sized biomass heating projects with local producers providing the biomass.

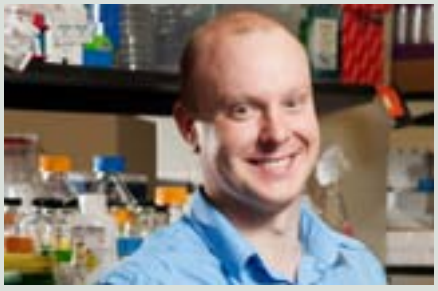
Rund said he believes the government should support and expand the Biomass Crop Assistance Program (BCAP) that provides incentives for producers to plant biomass crops. "Billions are being spent to develop the technology to convert biomass to advanced fuels, but a mere $112 million remains in the BCAP program this year," he said. "Biomass energy is being studied by many wise people. Billions of dollars have gone into research. This is definitely not a short-sighted venture."

# IGB RESEARCH **BRIEFS**

## GROUNDBREAKING HEALTH INFORMATICS BOOK SHOWS HEALTHCARE INFRASTRUCTURE SOLUTIONS

University of Illinois professor **Bruce Schatz** (Genomics of Neural & Behavioral Plasticity) has co-authored a groundbreaking book on Health Informatics, based on his popular computer science course. The text is the first book combining the solutions of modern computer science with the problems of modern medical science. The book is expected to be a key reference for professionals working in health management, from information to healthcare executive, health information technologist to computer scientist, and physician to patient.

*Healthcare Infrastructure: Health Systems for Individuals and Populations* describes a new healthcare infrastructure that will gather personal health records from every individual and correlate each longitudinal record across whole populations. The book explains the problems of personal medicine and public health, then the solutions possible with information technology.



## ILLINOIS PROFESSOR RECEIVES NIH DIRECTOR'S NEW INNOVATOR AWARD

**Douglas A. Mitchell** (Mining Microbial Genomes) is a professor of chemistry at the University of Illinois and a recipient of the 2011 National Institutes of Health Director's New Innovator Award. The $1.5 million award, given over a period of five years, recognizes bold ideas from some of the nation's most promising new scientists.

Mitchell uses chemical methods to study the mechanisms that contribute to bacterial virulence and antibiotic resistance. His current studies focus on the thiazole/oxazole-modified microcins, a class of microbial compounds with profound structural and functional diversity. While some of these compounds have antibiotic or anticancer activity, others are disease-promoting toxins.

Mitchell's lab is developing a strategy to disrupt toxin biosynthesis in a number of bacterial pathogens. He predicts that this approach will lead to drugs that combat pathogenic microbes without disturbing the symbiotic bacteria that are essential to proper human physiological function. This new class of antimicrobial compounds will be less likely to select for antibiotic resistance in the targeted pathogens than drugs now used, he said.

## TWO IGB FACULTY NAMED UNIVERSITY SCHOLARS

**Paul J. Kenis** and **James M. Slauch**, both IGB faculty, have been recognized as University Scholars at the University of Illinois. The program, which began in 1985, recognizes excellence while helping to identify and retain the university's most talented teachers, scholars, and researchers.

Kenis (Regenerative Biology & Tissue Engineering), a professor of chemical and biomolecular engineering, is an expert in the field of micro fluidics. His research program is focused on the development of novel microfluidic tools for applications in energy and health. During the past 10 years, he has built a highly productive and internationally well-known research program at Illinois.

Slauch (Host-Microbe Systems), a professor of microbiology, is internationally recognized for his work on Salmonella virulence, a major cause of food-borne illness. His research focuses on the interplay between the human host and bacterium in disease. His work demonstrated, for example, that an enzyme produced by Salmonella is key to enabling the bacterium to evade the immune system, and to actually live in phagocytes in the body. In a second area of impressive impact, Slauch identified the complex process through which bacteria sense that they are in the phagocyte and should start producing virulence proteins.

## INSTITUTE FOR GENOMIC BIOLOGY, SCHOOL OF INTEGRATIVE BIOLOGY RECEIVE MAJOR NSF TRAINING GRANT

The National Science Foundation has awarded the IGB and the School of Integrative Biology a $3.2 million training grant. NSF's Integrative Graduate Education and Research Traineeship (IGERT) is a highly regarded grant program that was founded in 1998 and has

provided interdisciplinary research training to approximately 5,000 graduate students.

The University of Illinois grant, Vertically Integrated Training with Genomics (VInTG), will provide support for as many as 30 graduate students during the next five years. Students will learn ways to both ask and answer the big research questions of the coming decades.

VInTG will address two "grand challenges" in biology: how do genomes interact with the environment to produce biological diversity and how are biological systems integrated from molecules to ecosystems? Answering these questions will help both science and society determine how to maintain food security under climate change; how to integrate genetics and ecology to study emerging infectious diseases; and how organisms' responses to climate change influence biodiversity and ecosystem function.

The Smithsonian Tropical Research Institute (STRI), one of the world's premier tropical research institutes, is a partner in the grant and will host students at their research facility in Panama. Students will have access to STRI's large, diverse, and long-term study sites and databanks for a variety of organisms and ecosystems in Panama.

## TEAM DESIGNS A BANDAGE THAT SPURS, GUIDES BLOOD VESSEL GROWTH

Two IGB research affiliates have developed a bandage that stimulates and directs blood vessel growth on the surface of a wound. The bandage, called a "microvascular stamp," contains living cells that deliver growth factors to damaged tissues in a defined pattern. After a week, the pattern of the stamp "is written in blood vessels," the researchers report.

"Any kind of tissue you want to rebuild, including bone, muscle, or skin, is highly vascularized," said University of Illinois chemical and biomolecular engineering professor **Hyunjoon Kong**, a co-principal investigator on the study with electrical and computer engineering professor **Rashid Bashir.** "But one of the big challenges in recreating vascular networks is how we can control the growth and spacing of new blood vessels."

The researchers see many potential applications for the new stamp, from directing the growth of blood vessels around a blocked artery, to increasing the vascularization of tissues with poor blood flow, to "normalizing" blood vessels that feed a tumor to improve the delivery of anticancer drugs. Enhancing the growth of new blood vessels in a coordinated pattern after surgery may also reduce recovery time and lessen the amount of scar tissue, the researchers said.

## IGB DIRECTOR OF OPERATIONS AND FACILITIES TIM KERESTES RETIRES

After decades of service to the University of Illinois, IGB Director of Operations and Facilities **Tim Kerestes** has retired.

A graduate of the University of Illinois at Urbana-Champaign architecture program, Kerestes spent a majority of his professional career contributing to the Urbana campus, working on projects such as the library for the College of Agriculture, Consumer, and Environmental Sciences, the Grainger Engineering Library, the Chemical and Life Sciences Laboratory, and the Beckman Institute for Advanced Science and Technology.

He provided exceptional project management for the construction of the IGB, bringing the final project cost several million dollars below budget because of his unwavering dedication and outstanding work ethic. The IGB community owes him a great debt of gratitude, and congratulates him on his successful retirement and well-deserved break.

## IGB INCREASES INTELLECTUAL PROPERTY OUTPUT

In the past three years, IGB researchers have continued to increase the number of disclosures, applications, patents, and licenses for intellectual property. Those have been assisted by the Office of Technology Management at the Urbana-Champaign campus.

For FY2009 and FY2010, eight U.S. patent applications were accepted, but FY2011 saw a notable increase to 12 U.S. patent applications. Disclosures from the IGB remained steady in 2009 and 2010 with 12 and nine, but that number increased to 15 in 2011. The past two years also have seen two licenses optioned with one patent issued in 2010 and two patents issued in 2009 and 2011.

# IGB HOSTS GENOMICS INTERNSHIP FOR NATIVE AMERICANS

## A WEEKLONG PROGRAM FOR NATIVE AMERICANS IN GENOMICS

INCLUDED EVERYTHING FROM LEARNING TO DO DNA EXTRACTION AND GENOTYPING TO A DISCUSSION ABOUT INTEGRATING INDIGENOUS AND SCIENTIFIC IDEAS AND VALUES. BUT BY FAR THE MOST POWERFUL OUTCOME WAS A LASTING BOND AMONG 12 PARTICIPANTS AND SEVEN FACULTY, ALL NATIVE AMERICANS FROM ACROSS THE UNITED STATES AND CANADA.

"To my knowledge nothing like this has ever been done before," says Kim TallBear, assistant professor of science, technology, and environmental policy at the University of California, Berkeley, and one of the Summer Internship for Native Americans in Genomics (SING) faculty. TallBear is a member of the Sisseton-Wahpeton Oyate Dakota tribes.

Other workshops for Native American scientists have been held, but none for a full week and specifically about genetics, and targeted to undergraduates, graduate students, and post docs. The benchwork component also was unique.

The IGB hosted this first-ever internship July 10-17, but the idea had been percolating in organizer Ripan Malhi's mind since his graduate-student days.

Malhi, associate professor and molecular anthropologist at the University of Illinois, uses genetic techniques to test the long-held assumption that movement of goods, such as pottery, and ideas, such as corn cultivation, represented the movement of people as well. He has worked to determine whether that is, in fact, the case, by using genetic techniques. He works most closely with several First Nations tribes of Canada.

The challenge, he found, was not so much the laboratory techniques (though handling ancient DNA can be tricky) as it was gaining the trust and cooperation of the Native American communities he approached for DNA samples.

"The difficult part was finding Native American communities with the interest in using their DNA to examine their history and especially those willing to take samples from their ancestors, though it varied from community to community," said Malhi, whose parents are from India and who grew up in a small town in South Dakota and in Yuba City, California. The general feeling was, "why should we trust you?" he says.

Anthropologists have been collecting data from and studying Native American populations for decades but rarely sharing data or knowledge with the study participants. The media often portray Native Americans as "anti-science" but they are not, says Malhi. However, they do not want to be taken advantage of.

Several disputes have been publicized by the media, such as the Havasupai study, in which researchers took DNA samples from a community for a study of diabetes, but then used the data to also study schizophrenia and other conditions. In addition, no data or findings ever were shared with the tribe that donated the samples. Native Americans feel betrayed.

"I've always been conscious that research is political," says TallBear. "It's about making some people subjects while others have the right to inquire."

Malhi envisioned a program that would expand on the education of indigenous people in the science of genetics, discuss the implications of that research, and enable them to collaborate more with other scientists, both Native and non-Native.

SING participants came from a range of disciplines including genome sciences, computer science, botany, ethnic studies, and resource management. In addition, two tribal leaders from the Metlakatla tribe in Canada attended the internship. Many had some genetics background, and those in the group who had hands-on experience with bench work, such as sequencing genomes, taught those who did not. IGB personnel also provided instruction. Even some of the SING faculty learned techniques they had not done before, TallBear said.

"The biggest impact I believe SING had was to unite budding Native scientists and provide them with a rich environment for career growth and identity development," says Jake Long, a graduate student in botany at Oklahoma State University and a member of the Miami tribe. "I believe that once there is a well-established community of Native scientists in genomics, they will be able to bridge the cultural gap between Western science and traditional ways of thought."

TallBear also noted that there was not the usual wrangling or tension be-

tween the social scientists and the biological scientists at the internship, which often occurs at other professional meetings she attends.

"The participants had really productive conversations because they were all Native people invested in doing science in ways that are more democratic and meet the needs of tribal and first nation communities," says TallBear. "While they had different languages and kinds of training and theoretical backgrounds that they came from, they really had an incentive to have a conversation because they also shared a social and cultural commitment to making science more productive for tribal communities."

In fact, the diversity helped in some ways, says Nanibaa' Garrison, a postdoctoral research fellow at Stanford University and a member of the Navajo tribe. The seminar "really opened up everyone's eyes because people without a strong genetic background were able to understand the science much better than before and people with a science background had never thought about or been exposed to the social implications of their work."

In addition to bonding about science, participants connected through intense and complex discussions and role-play on the ethical, legal, and social implications (ELSI) of research within Native American communities. Participants generally felt that this was the most compelling aspect of the workshop.

"The ELSI presentations were outstanding, and I learned a lot about the different stakeholders in genomic research," says Katrina Claw, a graduate student at the University of Washington and a member of the Navajo tribe. "I brought home the message that I should carefully scrutinize ELSI issues in any current and future research that I do."

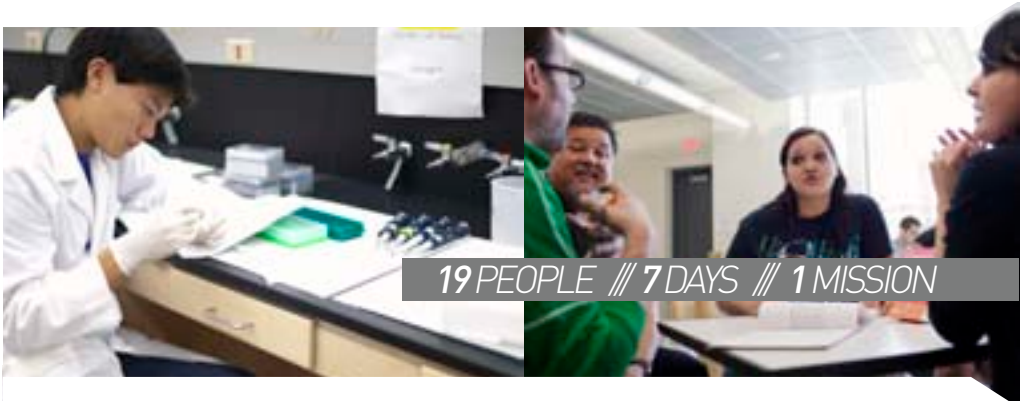
The ELSI sessions were very interactive, which made them very effective. "Often, I will feel at a loss about how to communicate an ethical concept, and I felt that the organizers were able to conceptualize what I was trying to say," adds Claw. "In addition, the social scientists were able to offer a completely different perspective on many of the topics discussed throughout the week. I felt like these were important issues and would have gone unnoticed or not addressed without their presence."

"The ELSI discussions were some of the most valuable for me," agrees Long. "I have only really paid attention to how ELSI topics relate to Native American maize landraces (varieties of corn developed by Native Americans), and the main source of conflict in the native community has been through human genetic/genomic studies. I realized even more how complex these issues are, and how easy it is for Western science to completely miss things that are culturally taboo or significant."

Malhi especially hoped that the internship would create a sense of community for Native Americans in academic settings. By all accounts this sense of community developed very strongly.

"My main incentive for attending the workshop was to meet more Native Americans in or interested in genomics," says Claw. Being a graduate student in genome sciences "is a lonely place because I'm often the only Native American person. Though I have found support from various non-Native people, it is very empowering to talk with other Native scientists about science."

There are tentative plans to hold another SING, perhaps in two years time, says Malhi. This one was very successful and he'd like to build on that.



# CITIZEN SCIENTIST

WORKING IN A LAB ENVIRONMENT PROVIDES GREAT OPPORTUNITY TO COLLABORATE AND LEARN FROM COLLEAGUES OF A DIFFERENT BACKGROUND, AND NOW AN EVEN BROADER EXPERIENCE IS TAKING PLACE.

Sharon Gray, a Ph.D. student with Dr. Andrew Leakey's group since 2008, and Jo Pride are taking part in a new program being offered by the Osher Lifelong Learning Institute (OLLI) at the University of Illinois at Urbana-Champaign.

OLLI is part of a national network that recognizes learning has no age limits and provides its members with exciting courses, a wellness program, and educational trips, as well as small-group discussion opportunities, a meeting place and special events.

Pride was one of a dozen older adults from the Illinois chapter of OLLI that took part in a pilot program called Citizen Scientist that placed them in campus research laboratories. Gray and Pride are working together on research that is looking into the effects of elevated levels of carbon dioxide and how they play a role in the growth of soybeans, leaves and roots.

Founding OLLI Director Kathleen Holden, Institute for Genomic Biology Director Gene Robinson, and Beckman Institute Director Art Kramer worked to jointly fund the program that matches graduate students with a Citizen Scientist. Robinson said they wondered what it would be like to have an OLLI member embedded in a laboratory as a Citizen Scientist.

Geena Skariah, an OLLI Fellow and coordinator of the Citizen Scientist program, said she was skeptical when they discussed placing older adults into a lab setting and having them conduct experiments. "But I am now a believer," she said. "It can be done. And, I have learned how to better explain my research to laypeople because of this program."

For Pride, learning about growing soybeans and studying the effects of carbon dioxide on them was a natural fit for this long-time gardener. As a young wife and mother, Pride says when she was raising her family she was an avid gardener but did not work outside the home and never studied science.

When Pride's husband passed away she moved to Illinois to be closer to her children. Her son told her about OLLI and she was ready to get involved. When not conducting experiments or recording data at the IGB, Pride volunteers

with the Champaign County Forest Preserve District at Lake of the Woods in Mahomet where she helps children plant vegetables and works with them in the discovery garden.

Pride, who works with Gray one time each week for two hours, says when she walked into the lab, part of the Genomic Ecology of Global Change theme at the IGB, she felt very welcome and not in the way. "It is fantastic what goes on in this lab," she says. "I am so impressed by what happens here. Sharon and I have been working side by side, and I'm just trying to learn."

Gray notes that Jo is a quick learner. "Jo questions why I am doing something, which then helps me explain the research and why we are doing an experiment," she says. "When I didn't know the answer or couldn't fully explain why we were doing something, then we would look it up together and find out together."

In the lab, Gray and Pride have been growing a legume, *Medicago truncatula*, to investigate the root structure of the plant and determine how the root growth changes with higher and lower levels of carbon dioxide.

"It's been great to see what goes on in this environment," Pride said. "This has been a learning process for me. I hope I'm offering something. Sharon has been a good teacher because she has taught me a lot."

Leakey looks forward to that process continuing with Pride and other participants in the OLLI program. "Jo has re-invigorated our lab group by reminding us of the fascination with nature that led many of us into scientific research originally," Leakey said. "In addition, Sharon has benefited from explaining to Jo about her research and its potential benefit to society—a key skill for scientists today."

Robinson said he was pleased with the progress of the first OLLI Citizen Scientist program and hopes they can expand the program in the future. "We are creating ambassadors for science and for the university," he said. "We're enriching the experience of the OLLI scientists, and we are enriching the laboratories, their functions, and their abilities."

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>
> — JO PRIDE

# ADVANCING DISCOVERY AND INNOVATION
*in the life sciences*

## GRANTS

**YONG-SU JIN**
*Isolation of Genetically Tractable Haploids from Industrial Polyploid Saccharomyces cerevisiae*
BP

**MATTHEW WHEELER**
*Engineered Scaffolds for Complex Craniomaxillofacial Reconstructions*
National Institutes of Health

**JONATHAN SWEEDLER**
*In Situ Correlated Molecular Imaging of Chemically Communicating Microbial Communities*
Department of Energy


# IGB AWARDS

**ANDREW LEAKEY** (*Genomic Ecology of Global Change*) was selected as a Beckman Fellow, Center for Advanced Study. Leakey's proposal, "Opening the Black Box of Plant Responses to Global Environmental Change with Genomic Tools," deals with global environmental change in this century and the impact on growing conditions in farmers' fields and crop yields.

**RASHID BASHIR** (*Regenerative Biology & Tissue Engineering*) and **WILFRED VAN DER DONK** (*Mining Microbial Genomes*) have been elected fellows in the American Association for the Advancement of Science. The Illinois researchers are among 539 new fellows chosen by their peers for their efforts toward advancing science applications that are deemed scientifically or socially distinguished.

**PAUL KENIS** (*Regenerative Biology & Tissue Engineering*) and **JAMES SLAUCH** (*Host-Microbe Systems*) have been named as University Scholars, a program created to recognize the university's most talented teachers, scholars, and researchers. See related story on page 8.

**DOUGLAS A. MITCHELL** (*Mining Microbial Genomes*) is a recipient of the 2011 National Institutes of Health Director's New Innovator Award. The award recognizes bold ideas from some of the nation's most promising new scientists. See related story on page 8.

**WILLIAM METCALF** (*Mining Microbial Genomes*) has been appointed as an editor of the *Journal of Bacteriology*, one of the primary research journals published by the American Society for Microbiology.

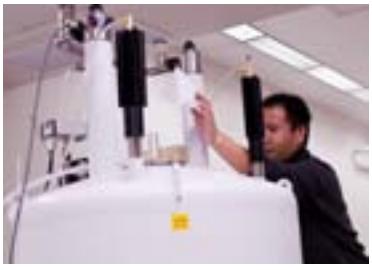
**HYUNJOON KONG** (*Regenerative Biology & Tissue Engineering*) was named a new Center for Advanced Study 2012-13 Fellow and **SHENG ZHONG** (*Cellular Decision Making in Cancer*) as a new Center for Advanced Study 2012-13 Associate.

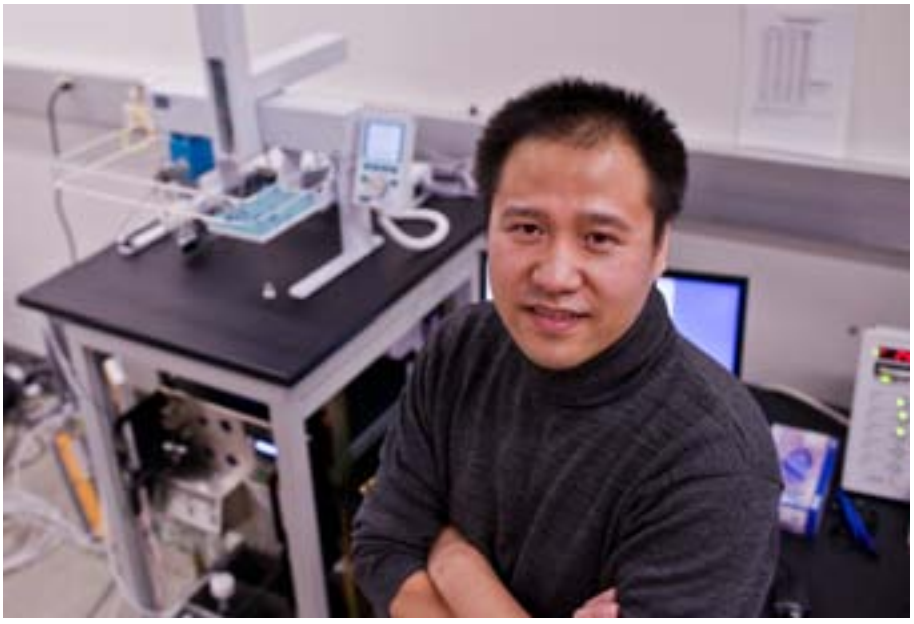
**JIAN MA** (*Cellular Decision Making in Cancer*) was named one of *Genome Technology* magazine's Young Investigators, as nominated by senior principal investigators in their field.

**K.C. TING** (*Energy Biosciences Institute*) is the first recipient of the James R. and Karen A. Gilley Academic Leadership Award. This award was established to recognize a member of the American Society of Agricultural and Biological Engineers (ASABE) who is providing outstanding academic leadership while serving as department head/chair of an ABET-accredited agricultural and biological engineering program in the United States.

**JONATHAN SWEEDLER** (*Mining Microbial Genomes*) was among 213 distinguished scientists elected as fellows of the American Chemical Society (ACS), in recognition for outstanding accomplishments in chemistry and for making important contributions to ACS.

# *The IGB's NEW* NUCLEAR MAGNETIC RESONANCE INSTRUMENT





**THE IGB RECENTLY PURCHASED A 600MHZ NUCLEAR MAGNETIC RESONANCE INSTRUMENT** from Agilent, adding a powerful new tool to the equipment in the Institute's Core Facilities. Wilfred van der Donk, a faculty member in the Mining Microbial Genomes theme, wrote and received a grant from the National Institutes of Health. The IGB made up the difference.

This $1 million instrument is one of the main techniques used to obtain physical, chemical, and structural information about molecules and probe the interactions between molecules. This instrument can provide detailed information on the topology, dynamics, and three-dimensional structure of molecules in solution state.

The 600 MHz magnet from Agilent and CapNMR probes from Protasis were installed in January at the IGB and have the following features:

## MAGNET

14.1 Tesla 54 mm bore Agilent Premium Compact Shield Superconducting Magnet.

## PROBES

OneNMR probe (1H-19F/15N-31P 5 mm PFG OneNMR Probe) Unique design provides high performance for both high frequency (1H-19F) and low frequency (15N-31P) to observe and decouple experiments.

HCN probe (1H{13C/15N} 5mm PFG Triple Res Probe) Designed for the study of biomolecules (protein and peptide).

CapNMR™ probe (flow probes) Combines recent scientific advances in capillary-scale fluidics and enhanced mass sensitivity to provide a highly sensitive, cost-effective, and robust platform for flow NMR analysis of microliter volumes and nanomole quantities.

Two types of CapNMR™ probes available are: ICG probe Direct proton/indirect carbon probes equipped with VT and z-axis pulse field gradients. Optimized for proton detect experiments: 1H, COSY, TOCSY, NOESY, 13C HSQC, and 13C HMBC.

Phosphorus probe Probe optimized for 31P detect experiment, which also can be used for proton NMR experiments.

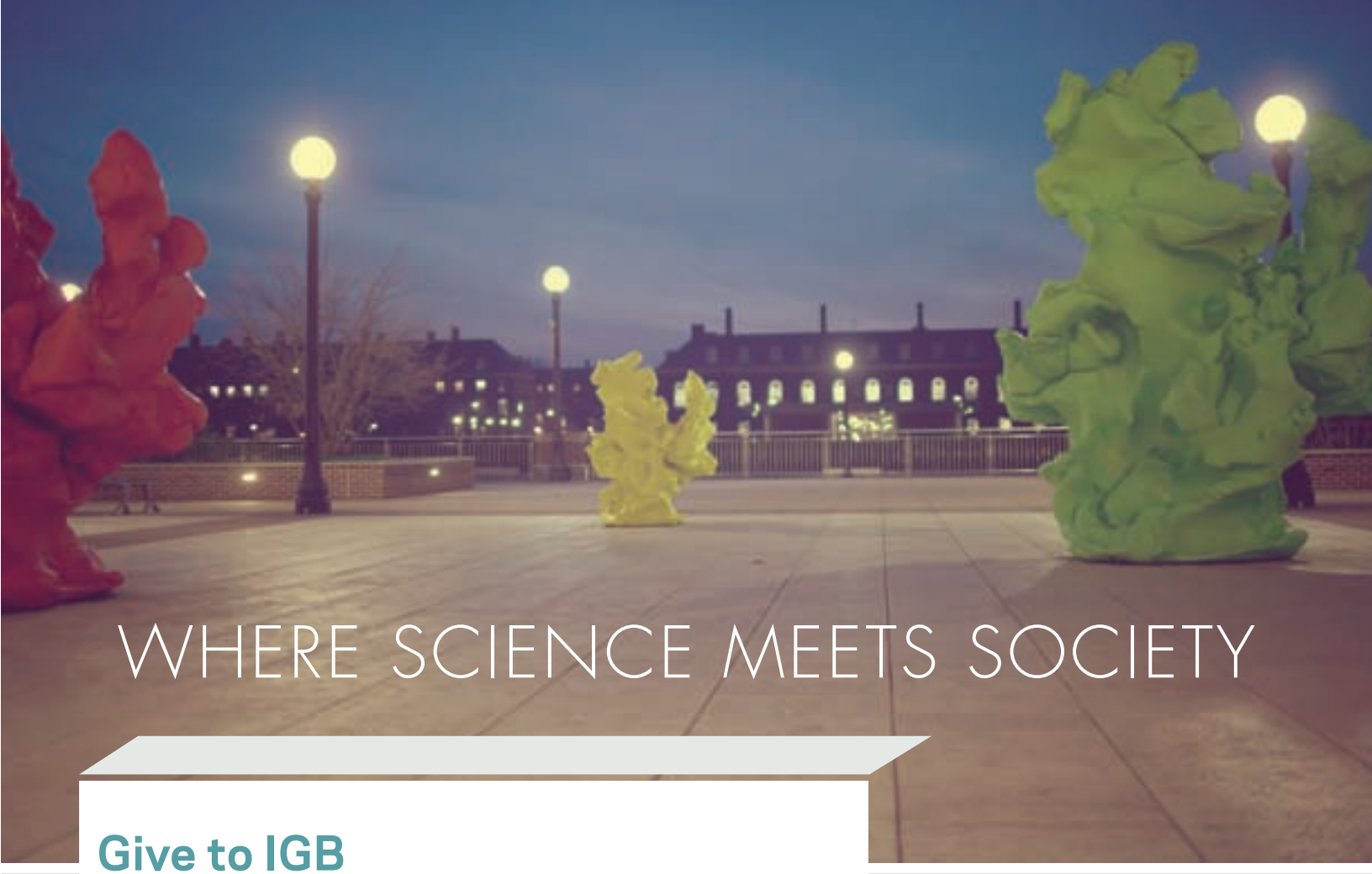
## ONEMINUTE-NMR™

One Minute-NMR™ is a fully automatic sample handling and data acquisition system. Load the samples, queue them in the One Minute-NMR™ software interface, and wait for an email indicating the data has been acquired.

Xudong Guan has been hired as the NMR Specialist to train people and provide assistance with the new NMR instrument. Guan comes to the IGB with 10 years experience with NMR equipment. He received his Ph.D. in Chemistry from the City University of New York and managed a NMR facility at Nankai University in China.

Guan said that by studying the peaks of nuclear magnetic resonance spectra, researchers can determine the structure of many compounds.

"It is important to have a Ph.D. level personnel to provide help for this instrumentation," said Core Facilities Director Glenn Fried. "Xudong can explain the output of the instrument to users and provide training."



# WHERE SCIENCE MEETS SOCIETY

## Give to IGB

Research at the Institute for Genomic Biology impacts society. Melding progressive scientific ideas and innovative state-of-the-art methods of conducting research has been a hallmark of the IGB since it was established in 2003. These ideas and methods are solidifying the University of Illinois at Urbana-Champaign as a world leader in the use of genomics to answer large-scale biological questions. In essence, this research aims to transform our world in health, the environment, and energy use and production.

Philanthropic support for IGB is crucial because the pace and scope of change in the field of genomic biology require large investments on an ongoing basis. The IGB must bring together world-class researchers and students, laboratory space, materials, and equipment. All research is funded by external sources. Your donation will help us continue shaping the future of science and society.

www.igb.illinois.edu/about/giving

**Melissa McKillip**
**IGB Development Director**
**(217) 333-4619**
**mmckilli@illinois.edu**

## STAY CONNECTED WITH THE IGB

Stay connected to news, events, and program information at the Institute for Genomic Biology. By joining our mailing list, you'll receive our e-newsletter and Biomarker with details about seminars, workshops, and symposia at the IGB.

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