



2014 ANNUAL REPORT

**CARL R. WOESE** INSTITUTE FOR GENOMIC BIOLOGY

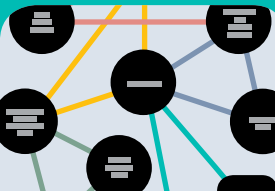
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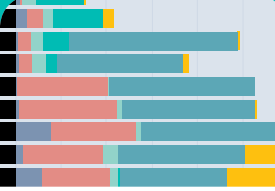
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DIRECTOR'S MESSAGE  
Gene E. Robinson

“Knowing this, society will come to see that biology is here to understand the world . . . Biology's primary job is to teach us. In that realization lies our hope of learning to live in harmony with our planet.” – Carl R. Woese, *“A New Biology for a New Century,”* *Microbiology and Molecular Biology Reviews*

These were the closing words of a review written by renowned Illinois microbiologist Carl R. Woese and published in 2004, eight years before his death. Around the same time that Woese wrote these words, he also wrote to university administration in support of an initiative to form a new institute, one that united scientists across campus in the dawning era of genomic research. In 2006, this initiative culminated in the Institute for Genomic Biology (IGB). This year, to recognize Woese's paradigm-altering achievements in biology, we have renamed our institute in his honor.

Since its foundation, the IGB has been committed to great science, and to addressing societal challenges—two aspects of a single comprehensive mission. The world of research and the world at large are inextricably linked, and they mirror each other in the changes they experience over time. In scientific research and in society, new technologies have allowed us to break down geographical barriers and increase connectedness; they have led to a shift toward Big Data and bigger goals.

This year, we have seen these trends reflected in the accomplishments of the IGB's academic partnerships. A partnership between researchers at the Mayo Clinic and at Illinois, including many IGB members, is poised for great achievements; a \$9.34M grant from the NIH to establish a Center of Excellence will support them as they create a

MORE

MORE

revolutionary computing analytical tool. Other joint undertakings in genomic Big Data came to full fruition, including the efforts of two international consortia that used datasets of an unprecedented scale to clarify the evolutionary origins of modern bird and flowering plant species.

The collaborations that make our work possible extend beyond the traditional boundaries of academia. Citizen scientists working in the labs of IGB members, as well as many others across campus, are making important contributions to research. Many of these individuals participate through the Osher Lifelong Learning Institute, a learning community for people over the age of 50. Involvement in science brings new passion and interest to the lives of those who volunteer in these roles, and their presence adds to the diverse skill sets and depth of knowledge being applied to important research challenges.

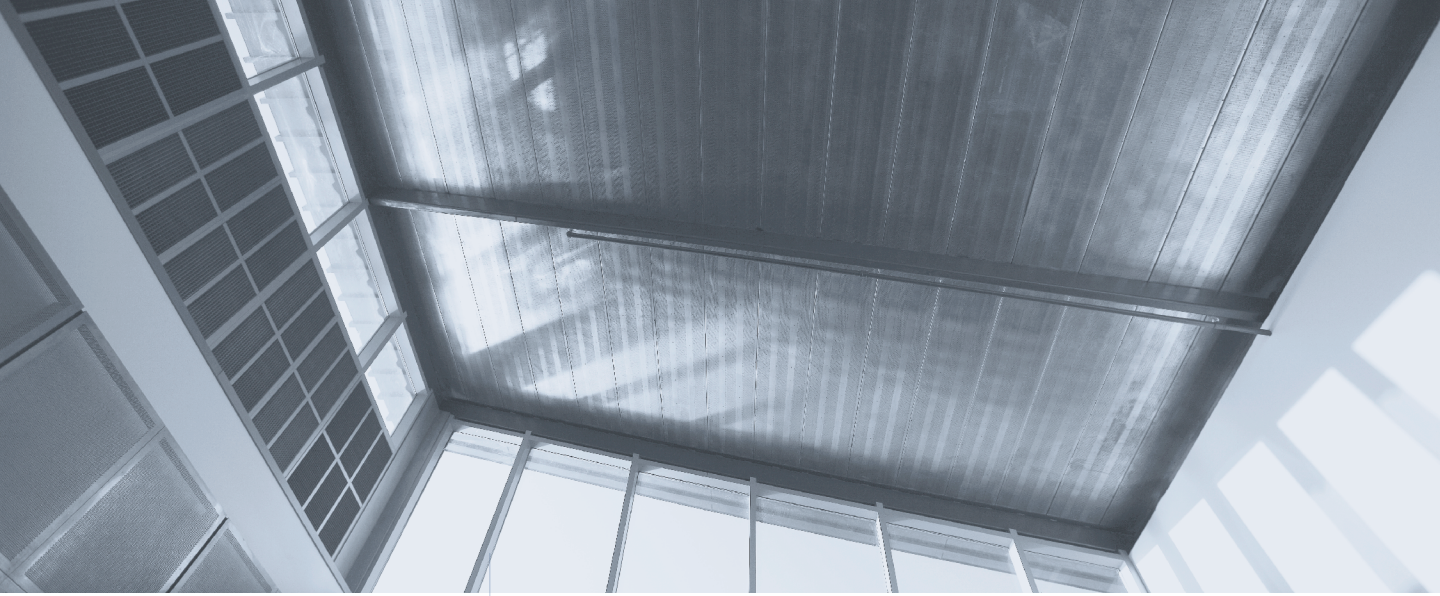
Established programs like this one help us maintain our strong ties to the community. As the ways in which our society shares and receives information continue to evolve, we also continue to explore new forms of public engagement. This summer, IGB members and their collaborators released a popular new massively open online course, or MOOC. Other IGB members shared their work and ideas via the blogs and websites of national-level organizations. They also engaged public interest through diverse media forms including videos, images, and music.

We are proud that our members bring energy, ingenuity, and dedication to every aspect of our institute's mission. Those qualities have resulted in findings and innovations that have great potential to positively impact our society's welfare. Our work this year included the development of new ways to discover antibiotics, and to understand their actions; new understanding of how the genome controls the incredible healing potential of stem cells; and new models to understand how the environment is impacted by human activities, and how we can protect it.

In the spirit of connectedness, of investigating novel ideas and forms of communication, we are also including an extra facet to this year's annual report. In the pages that follow, we have included some stories of events that brought our global society together—in sadness, in triumph, or in exploration. The connections between these stories and our own research help us reflect on what we have accomplished, and where we need to go from here. This year brought us a new name, new avenues of research, and a renewed sense of purpose.

*Gene E. Robinson*  
Gene E. Robinson  
DIRECTOR, CARL R. WOESE INSTITUTE FOR GENOMIC BIOLOGY





## ABOUT THE IGB

Seven years ago, the University of Illinois founded the Carl R. Woese Institute for Genomic Biology (IGB), a visionary facility that brought together the university's diverse expertise to address formidable challenges. Today, this experiment in transdisciplinary research forms collaborations that yield many discoveries and scientific advancements, continuing to support the hypothesis that the whole is greater than the sum of its parts.

### **Integrating Diverse Backgrounds**

IGB members are drawn from a broad range of disciplines, including life sciences, social sciences, engineering, law and business. IGB faculty and affiliate members remain an integral part of home departments while pursuing collaborative research projects at the IGB. Theme leaders help coalesce members into thematic research groups.

### **Problem-oriented Research**

The IGB research portfolio is diversified, but its goal is singular: advance life sciences research to benefit society. One theme is seeking the origin of life, another is solving the global energy crisis, while others are developing regenerative therapies, personalizing cancer treatments, and investigating how the brain influences behavior. These groups are housed in large shared laboratories, enabling the sharing of equipment and ideas.

### **Dynamic Research Focus**

IGB research themes are not permanent; they are expected to evolve. Every five years, an external advisory board reviews the relevance and progress of IGB themes. Anyone can propose new themes to explore developments in biological research and emerging problems in health, agriculture, and the environment.

[MORE](#)

**Where Science Meets Society**

Through innovative outreach and education programs, the IGB invites people of all ages to learn about and participate in transdisciplinary research. The IGB hosts accessible, hands-on educational activities for children and their families, as well as workshops and events designed to engage specific groups in meaningful and relevant genomic research.

The mission of the IGB is to advance life science research at the University of Illinois at Urbana-Champaign and to stimulate bio-economic development in the state of Illinois.

**IGB Research Themes**

- **Biocomplexity (BCXT)** — Explores the origin of life and the behavior of biological systems.
- **Biosystems Design (BSD)** — Uses engineering concepts to guide the study, design and construction of biological systems.
- **Business, Economics and Law of Genomic Biology (BIOBEL)** — Examines the financial and legal issues related to genomic technology.
- **Cellular Decision Making in Cancer (CDMC)** — Works to better understand how cancer alters the inner workings of cells.
- **Genomic Ecology of Global Change (GEGC)** — Studies the intersection of genomics and global climate change.
- **Gene Networks in Neural & Developmental Plasticity (GNDP)** — Investigates how biological diversity is affected by the structure and function of gene regulatory networks.
- **Mining Microbial Genomes (MMG)** — Discovers small molecules that might provide new medical solutions.
- **Regenerative Biology & Tissue Engineering (RBTE)** — Studies the replacement or regeneration of tissues and organs.

**IGB Strategic Partnerships**

- **Center for Nutrition, Learning, and Memory (CNLM)** — Determines the impacts of nutrition on learning and memory in the human brain. In addition to the IGB, the Center partners with Abbott Nutrition and the Beckman Institute for Advanced Science and Technology.
- **Energy Biosciences Institute (EBI)** — Addresses the global energy challenge through a unique public-private collaboration, originally funded by a 10-year, \$500 million grant from BP. The partnership includes the University of California, Berkeley; the University of Illinois at Urbana-Champaign; the Lawrence Berkeley National Laboratory; and BP.

CONCEPTUAL CONNECTIONS ACROSS IGB THEMES AND PARTNERSHIPS



TRANSLATIONAL MEDICINE COMPLEX NETWORKS ENGINEERING SOLUTIONS  
ENVIRONMENT AND ECOSYSTEMS NUTRITIONAL HEALTH AND FOOD SECURITY  
MENTAL AND EMOTIONAL HEALTH

This annual report is a chronicle of news and events in 2014. The IGB news stories feature the four pillars of the Institute's mission, denoted by the icons below. Interspersed with these stories are world news items that highlight connections between ongoing IGB research and current global issues. Combined, these stories illustrate that the IGB is the vertex where science meets society.



#### RESEARCH

With visionary researchers and state-of-the-art technology, the IGB has the potential to feed a growing population, treat terrible diseases, provide sustainable fuel, and address other societal challenges.



#### PARTNERSHIPS

IGB faculty are united by their determination to improve the status quo. Their collaborations with each other, as well as other researchers from across the world, drive innovation and discovery.



#### EDUCATION

The IGB believes that education is the most powerful tool to inspire progress. Providing and participating in educational opportunities is key to achieving the Institute's mission.



#### COMMUNITY

The IGB strives not only to benefit the community through research, but to engage it through outreach and education initiatives. These programs invite people to connect with the research that may one day impact their lives.



#### WORLD NEWS

The IGB is a part of the global community; work at the Institute affects, and is affected by, circumstances and events around the world.



A year is defined by the passing of days, the changing of seasons. But each year is punctuated by events that break our routines, inspiring us to consider our roles in society. The Carl R. Woese Institute for Genomic Biology is where science meets society, where we employ genomics to realize our vision of a healthier, more prosperous world in the coming years.



18 December 2014

Carl R. Woese:  
An indivisible  
part of our  
history

[go.illinois.edu/IGBrenamed](http://go.illinois.edu/IGBrenamed)



On December 18, 2014, the Institute for Genomic Biology was renamed in honor of Carl R. Woese, a microbiology professor who changed the course of science with his discovery of a third major branch of the tree of life.

“We are now the Carl R. Woese Institute for Genomic Biology,” said Swanlund Chair of Entomology and IGB Director Gene Robinson. “By changing our name, we honor an individual who has made legendary contributions to science, who served as an Illinois microbiology faculty member for nearly 50 years and who, as a founding member of the IGB, paved the way for us to emerge as a leader in advancing life sciences.”

In 1977, Woese and his colleagues overturned a universally held assumption about the basic structure of the tree of life. They discovered that there were three distinct branches, or “domains,” of life—not two, as had been previously thought. The new class of organisms they discovered looked superficially like bacteria, but their

Image: Jason Lindsey  
[go.illinois.edu/Lindsey](http://go.illinois.edu/Lindsey)

evolutionary history was completely different. These microbes are now known as archaea (are-KEY-uh), and are genetically and evolutionarily as distinct from bacteria as plants and animals are.

Woese made his discovery by comparing the molecular sequences associated with the cellular machinery that translates the genes of individual organisms into proteins. In doing so, he pioneered the practice of using molecular sequences to gain insights into biology, an approach that has now become standard in biology and is the precursor of today's genomics. Woese passed away in late 2012.

"Carl Woese's discoveries in evolutionary biology have had revolutionary implications for all branches of biology, and no more so than in the emerging science of genomics, which owes its foundation to Carl's work," said Nigel Goldenfeld (BCXT Theme Leader), a Swanlund Endowed Chair Professor of Physics and longtime colleague, collaborator and friend of Woese. "It is very fitting indeed that the IGB will forever be associated with his name, and it will be an inspiration to all who work here."

"Since our dedication in 2007, this Institute has carried on the spirit of discovery, dedication and determination so well-embodied by Carl," Robinson said. "His legacy is now an indivisible part of our history."

December 2014

Department of  
Bioengineering, College  
of Engineering



Congratulations to Rashid Bashir (RBTE), elected to be a Fellow of the International Academy of Medical and Biological Engineering. The honor goes to researchers from across the world who have made "outstanding contributions to the profession of medical and biological engineering."

17 December 2014



Nigel Goldenfeld  
@NigelGoldenfeld

#CuriosityRover finds methane on #Mars! Life or serpentinization? Or both?  
<http://nyti.ms/1A6D4Bu> <http://bit.ly/1zsp6Kg> #astrobiology

16 December 2014



Methane  
suggests that  
Mars may  
harbor life

[astrobiology.illinois.edu](http://astrobiology.illinois.edu)

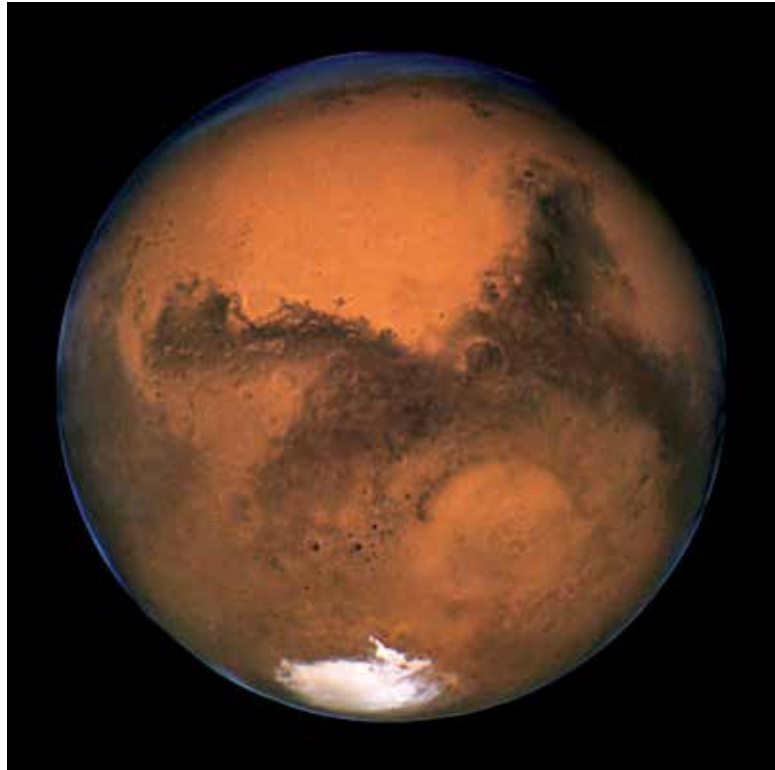


Image: NASA, ESA, and  
the Hubble Heritage Team  
(STScI/AURA)

NASA's Curiosity rover recorded a burst of methane lasting more than two months, an indication that the Red Planet may support life after all. The discovery of carbon-based organic molecules is more evidence that Mars may support life.

"There are two possible explanations for this methane," said Nigel Goldenfeld (BCXT Theme Leader) (see June 9), a Swanlund Endowed Chair Professor of Physics. "One is life itself. The other is a geological process known as serpentinization. In fact, they are connected."

The Institute for Universal Biology (IUB), a NASA Astrobiology Institute housed within the Biocomplexity (BCXT) research theme, is characterizing the fundamental principles governing the origin and evolution of life (see July 7). IUB member Elbert Branscomb, working closely with Michael Russell at the Jet Propulsion Laboratory in Pasadena, has shown how serpentinizing environments, such as Earth's alkali hydrothermal vents under the ocean, might be natural locations for life as we know it to emerge. The pH of these vents explains the strange way all known cells on Earth have evolved to produce and use energy.

This process, quite bizarrely, involves constantly filling up and depleting a kind of chemical reservoir that is created by pushing a lot more protons onto one side of a membrane than the other—just like pumping water uphill to fill a lake behind a dam. This reserve of protons can later be released to produce a form of energy called ATP. Every day our bodies produce and consume their weight in ATP. Within minutes, the human body's entire ATP energy reserve is consumed and regenerated.

"That's why you can't stand to be without oxygen for more than a few minutes," said physicist Elbert Branscomb (BCXT), an affiliate faculty member at the IGB. "We live on a thin, desperate edge to keep our metabolic motors running full blast. Yet in spite of this desperation, the process isn't carried out by using our energy sources directly, but by using the indirect, proton reservoir method. It's an arrestingly strange way of doing business that has made many scientists question why it is this way."

Curiosity's discovery is evidence of serpentinization and therefore evidence that life may be evolving on Mars right now, just as IUB scientists speculate it did on Earth four billion years ago. That is, if life hasn't evolved already. Scientists also speculate that the methane is a waste product of living microbes.

While the jury is still out, the IUB seeks to find out if early life forms are still being created on Earth by serpentinization, and if so, how to detect them. "We have a sample of only one planet known to harbor life," Goldenfeld said. "Thus it is critical that we be creative in extracting the most information from Earthly life as possible, if we are to ever understand the existence, likelihood, and nature of life elsewhere in the Universe."

Ongoing work to understand serpentinization is done in collaboration with Russell and postdoctoral researcher Tommaso Biancalani (BCXT).

15 December 2014



ElizabethWhittington  
@eyoste



Beautiful images from @IGBillinois in a display at Chicago's O'Hare. This one is of colorectal cancer cells.

December 2014



*Department of  
Kinesiology and  
Community Health,  
College of Applied  
Health Sciences*



Marni Boppart (RBTE) was elected a fellow in the American College of Sports Medicine. Among other things, the fellowship recognizes "professional achievement and competence in the related disciplines of sports medicine via education, published works, professional practice and a demonstrated interest in and/or contribution to the goals of sports medicine."

12 December 2014



Mayor Don Gerard  
@DonFerard

I just got my honey from Entomology!  
@Illinois\_Alma @IGBillinois @MayBerenbaum via @BuzzFeed <http://www.buzzfeed.com/igbillinois/13-things-only-igbillinois-understands-16hfl...>

12 December 2014



## Birds find their place in the avian tree of life

[go.illinois.edu/BirdFamilyTree](http://go.illinois.edu/BirdFamilyTree)



An international effort involving more than 100 researchers, nine supercomputers and about 400 years of CPU time has yielded the most reliable avian tree of life yet produced, researchers report in *Science*. The tree reflects the evolutionary relationships of 48 species of birds.

The computational effort, led by Founder Professor of Bioengineering and Computer Science Tandy Warnow (BCXT) and University of Texas at Austin graduate student Siavash Mirarab, took more than four years to complete. They were funded by the NSF, the Howard Hughes Medical Institute and the Guggenheim Foundation.

10 December 2014



Fake John Groce  
@IlliniJohnGroce

Hey @IGBillinois would you be the ones that I need to talk to to clone Malcolm Hill or is that someone else?



Genomic Biology  
@IGBillinois

.@IlliniJohnGroce Unfortunately, you can only clone cells. You can't clone things like dedication, talent, and commitment.

10 December 2014



Looks like something new is coming to the IGB Gatehouse ...



December 2014



Congratulations to the six Illinois faculty elected 2014 fellows of the American Association for the Advancement of Science, including IGB members Brendan A. Harley, professor of chemical and biomolecular engineering, and Phillip A. Newmark, professor of cell and developmental biology.

*Harley: Department of Chemical and Biomolecular Engineering, College of Engineering*

*Newmark: Department of Cell and Developmental Biology, College of Liberal Arts and Sciences*



4 December 2014



EBI:

Addressing one of the grand challenges of our time

[energybiosciencesinstitute.org](http://energybiosciencesinstitute.org)



On Dec 4, 2014, BP announced that the EBI will no longer continue with the development of the lignocellulosic (LC) biofuels technology and business. As the historic grant (to date the largest university-industry partnership known) winds down, EBI Deputy Director Isaac Cann (EBI/BCXT) reflects on past accomplishments and looks to the grant's future.

"The fact that the EBI is coming to an end doesn't mean that the production of cellulosic fuel has come to an end," said Cann, a professor of microbiology and animal sciences. "Two or three companies just started on a commercial scale, and the students whom we trained are going to work for them. We trained a lot of manpower for the field."

MORE

EBI: Addressing one of the grand challenges of our time

In 2007, BP hosted an international competition for universities looking to solve the global energy challenge. The resulting EBI partnership, originally funded by a \$500 million grant for 10 years, includes researchers from the University of California, Berkeley (also the EBI headquarters); the University of Illinois at Urbana-Champaign (where research is housed within the IGB); the Lawrence Berkeley National Laboratory; and BP.

The EBI should be very proud of all that it has accomplished to date, Cann said (see July 28 and September 2). Before this partnership, microbes would convert one type of sugar into biofuel, then convert a second type of sugar, an inefficient process that took a long time. EBI researchers engineered microbes that use the two sugars simultaneously, a landmark achievement that dramatically sped up the fermentation process. Researchers also developed an “ingenious” way to produce jet fuel and biodiesel that is compatible with current engines.

Over the last seven years, the EBI was issued 1 patent and released 2,488 public disclosures, including disclosure forms, abstracts, manuscripts, posters, presentations, etc. The extraordinary individuals who devoted their talent, time and energy to the EBI made these achievements possible. In 2014, the Institute included 91 principal investigators and faculty, 200 postdoctoral researchers/staff scientists, 202 graduate and undergraduate students, 73 specialists, technicians and assistants, as well as 30 people in administrative support.

To Cann, the students are one of the EBI’s most important investments and greatest achievements. As the EBI winds down, BP will continue to invest in the future of bioenergy research by supporting the partnership’s students and postdoctoral researchers.

“As a university professor, my main job is to train the next generation of scientists,” Cann said. “The EBI offered me the opportunity to give the best training that I can to these students. Every student who had a chance to work at this place, both here and at Berkeley, had the opportunity of a lifetime.”

For many, the EBI was an unparalleled opportunity to work together, with top-notch resources and support, toward a common goal. By opting not to delegate specific funds to the partner institutions, but instead grant funds to exceptional applications regardless of their affiliation, the EBI fueled academic competition that led to impactful discoveries. This partnership will no doubt serve as a model for future collaborations between industries and universities.

“It wasn’t that everybody who applied succeeded in getting a grant. If your grant was deemed excellent, then you got funded,” Cann said. “This approach to funding enforced trust that led to collaboration, ensuring a truly multidisciplinary approach to doing research to address one of the grand challenges of our time.”

3 December 2014



RIPE Research  
@RIPEresearch

@RIPEresearch Director, Steve Long, named one of the World’s Most Influential Scientific Minds: 2014 @TR\_ScienceWatch <http://bit.ly/1sx4uyM>

2 December 2014



US Rep Rodney Davis  
@RodneyDavis

Congratulations to Dr. Berenbaum, a world class @Illinois\_Alma entomologist, on receiving the National Medal of Science! [youtube.com/watch?v=yz5W05...](http://youtube.com/watch?v=yz5W05...)



1 December 2014



Study shows different species share a "genetic toolkit" for behavioral traits

[go.illinois.edu/GeneticToolkit](http://go.illinois.edu/GeneticToolkit)



The house mouse, stickleback fish and honey bee appear to have little in common, but at the genomic level these creatures respond in strikingly similar ways to danger, researchers report. A study led by Cell and Developmental Biology Professor Lisa Stubbs (GNDP Theme Leader) found that when these animals confront an intruder, many of the same genes and brain gene networks tune up or down in response.

Animal biologist Alison Bell (GNDP), Swanlund Chair Professor of Entomology and IGB Director Gene Robinson, and computer scientist Saurabh Sinha (BSD/GNDP) also made important contributions to the work, which was reported in the *Proceedings of the National Academy of Sciences*.

The team used comparative genomics to look at changes in brain gene expression in each species in response to intrusion by another member the same species. All three species exhibited changes in the expression of genes that regulate hormones and neurotransmitters known to influence behavior. Other shared responses were seen in the expression of genes that contribute to brain growth and plasticity; metabolic genes; and genes related to muscle function. The Simons Foundation supported this research.

*Image: Alexander Francis Lydon, 1879*

December 2014



Gene Robinson (Director) was conferred the degree of Doctor Philosophiae Honoris Causa of the Hebrew University of Jerusalem.



*Department of Entomology, College of Liberal Arts and Sciences*



21 November 2014



May Berenbaum  
@MayBerenbaum

Yesterday at White House, Obama said to me "I do care about the bees and we'll fix 'em!" Too bad about term limits!

20 November 2014



Entomology professor May Berenbaum awarded National Medal of Science

[go.illinois.edu/MedalofScience](http://go.illinois.edu/MedalofScience)

Swanlund Professor of Entomology May Berenbaum (GEGC) has been awarded the National Medal of Science, the nation's highest honor for achievement and leadership in advancing the fields of science and technology, according to an announcement from the White House Press Office.

Berenbaum, also the head of the Department of Entomology, has been a faculty member since 1980. Her research, which studies the chemical mechanisms underlying interactions between insects and their host plants, including the detoxification of natural and synthetic chemicals, has produced hundreds of peer-reviewed scientific publications and 35 book chapters.

*Image: National Science and Technology Medals Foundation*

"Professor Berenbaum's work has fundamentally changed what we know, how we study and how the public understands the role of insects in nearly every aspect of human life and development," said Chancellor Phyllis M. Wise.

Devoted to teaching and fostering scientific literacy through formal and informal education, Berenbaum has also authored numerous magazine articles and six books about insects for the general public. She created the Insect Fear Film Festival, a local fixture for over thirty years, to engage and entertain members of the public with feature-length films and shorts, commentary on the films, an insect petting zoo and an insect art contest.

November 2014



May Berenbaum (GEGC) received the National Medal of Science, the nation's highest honor for achievement and leadership in advancing the fields of science and technology, administered by the NSF and bestowed by the President of the United States.

*Department of Entomology, College of Liberal Arts and Sciences*

21-20 November 2014

## Genomics for everyone

[go.illinois.edu/GenomicsforJudges](http://go.illinois.edu/GenomicsforJudges)



Genomic research has an ever-growing impact on areas such as health and agriculture, yet members of the public have limited access to educational opportunities in genomics—resources that would help them relate new findings to everyday life.

The IGB created the Genomics for™ program, a series of workshops for the public and for professional groups, to address this need. Each workshop is tailored to a particular demographic, with content that relates advances in genomics to the needs and interests of that group.

Project NEURON, a curriculum development group at Illinois, partnered with the IGB in July to offer Genomics for™ Teachers. Attendees of the week-long Genomics for™

*Image: Project NEURON*

MORE

Genomics for everyone

Teachers workshop engaged in and critiqued hands-on curriculum activities related to genomics, heard presentations from Illinois faculty on the societal impacts of genomic biology, and received guidance and peer feedback on independent curriculum development projects.

In November 2014, the Illinois Office of the State's Attorney Appellate Prosecutor and the IGB held another workshop, Genomics for™ Prosecutors. The two-day event explored the relationship between genome activity and criminal behavior, and the accuracy and admissibility of DNA evidence.

18 November 2014



Team led by chemistry professor and IGB faculty Wilfred van der Donk discovers how microbes build a powerful antibiotic in a recent paper in *Nature*. <http://bit.ly/1EVMG1f>

6 November 2014



Team discovers  
how microbes  
build a  
powerful  
antibiotic

[go.illinois.edu/  
BuildingAntibiotics](http://go.illinois.edu/BuildingAntibiotics)



Researchers report in *Nature* that they have made a breakthrough in understanding how a powerful antibiotic agent is made by microbes. Their discovery solves a decades-old mystery and opens up new avenues of research into thousands of similar molecules, many of which are likely to be medically useful.

Richard E. Heckert Endowed Chair in Chemistry Wilfred van der Donk (MMG), Biochemistry Professor Satish Nair (MMG) and group focused on a class of compounds that includes dozens with antibiotic properties. The most famous of these is nisin, a natural product in milk that can be synthesized in the lab and is added to foods as a preservative. An enzyme involved in the creation of nisin removes water to help give the antibiotic its final, three-dimensional shape. This is the first step in converting the spaghetti-like peptide into a five-ringed structure.

The rings are essential to nisin's antibiotic function: two of them disrupt the construction of bacterial cell walls, while the other three punch holes in bacterial membranes. This dual action is especially effective, making it much more difficult for microbes to evolve resistance to the antibiotic. The NIH and the Ford Foundation supported this work.

4 November 2014



Rory Sacks  
@RorySacks

the @IGBillinois MOOC is one of the best and most engaging MOOCs out there right now. Setting the bar for sure #Illinoisemergenceoflife

1 November 2014



ssmirhee

First time going to #GenomeDay hosted by #IGBillinois. Idk if my 3yo understood much but she was ranting about #cells and #DNE (or DNA, lol). And she had a lot of fun!!



1 November 2014

Kids and parents explore a molecular world at Genome Day

[go.illinois.edu/GenomeDay](http://go.illinois.edu/GenomeDay)



More than 300 children, parents, and friends of the IGB gathered at the Orpheum Children's Science Museum in Champaign for an afternoon of fun with DNA, cells, and the tree of life. Genome Day, an open-house event for community members of all ages, was organized this year by Animal Biology Professor Karen Sears (GNBP/RBTE) and IGB Fellow Farhan Chowdhury (CDMC), and held on November 1.

MORE

Kids and parents explore a molecular world at Genome Day

Genome Day features hands-on, child-friendly activities related to genomics. This year, attendees used beads, tonic water, and a black light to model the spread of infection; built models of genes, cells and viruses; and reconstructed animal skeletons. For the second consecutive year, volunteers from SACNAS (Society for Advancement of Chicanos and Native Americans in Science) provided language assistance for Spanish-speaking attendees.

As part of the outreach mission of the IGB, events such as Genome Day make genomics research engaging and relatable. Participants this year commented on their enjoyment of the wide variety of scientific topics covered by the many activities. Next year's Genome Day is already on the calendar for November 14, 2015.

1 November 2014



Genomic Biology retweeted:



Stubbs Lab  
@stubbslab



@IGBillinois Genome Day was a great success! @stubbslab taught about alleles causing variations in taste and smell.

November 2014



Nicholas Vasi (ADMIN) received the 2014 Communicator

of the Year Award for Communications & Marketing Excellence from the office of Public Affairs. This award is presented to an individual who exemplifies the qualities of service, innovation, and advancement.

Communications Office,  
Carl R. Woese Institute for  
Genomic Biology

10

**29 October 2014**  
 New study  
 uses DNA  
 sequences to  
 look back in  
 time at plant  
 evolution

[go.illinois.edu/  
PlantEvolution](http://go.illinois.edu/PlantEvolution)

*Image: Susan Sprunt  
[go.illinois.edu/Sprunt](http://go.illinois.edu/Sprunt)*



Scientists from North America, Europe and China published a paper in the *Proceedings of the National Academy of Sciences* that provided strong evidence for a major revision of the evolutionary tree of plant life.

The research team used next-generation DNA sequencing technologies and analytical tools to gather and interpret an unprecedented amount of genomic data from a diverse set of plant species, resulting in an improved understanding of the evolutionary history of land plants.

As part of the 1000 Plants (1KP) initiative, the researchers generated millions of gene sequences from plant species sampled from across the tree of life. By resolving these relationships, the study illuminated the complex processes that allowed ancient algae to evolve into land plants, with adaptations to compete for light, water and soil nutrients.

Computer scientist Tandy Warnow (BCXT) and her student Siavash Mirarab developed new methods for analyzing the massive datasets used in the project, with support from the NSF. "The datasets we were analyzing in this study were too big and too challenging for existing statistical methods to handle, so we developed approaches with better accuracy," Warnow said.

15 October 2014



Genomic Biology  
@IGB Illinois



Join @IGB Illinois Director Gene Robinson and donate at our blood drive in 612 IGB; accepting donations until 1 pm.

9 October 2014



Illinois,  
Mayo Clinic  
collaborate to  
revolutionize  
genomic data  
analysis

[go.illinois.edu/KnowEnG](http://go.illinois.edu/KnowEnG)



Today's researchers, working with the advantages of new, sophisticated laboratory technology, have unleashed a river of valuable biomedical data—much more, in fact, than many of them have the tools to properly analyze, or the capacity to store. In 2012, the NIH created the Big Data to Knowledge (BD2K) initiative to enable efforts to harness the potential of this flood of information. In September 2014, as part of the first wave of BD2K funding, Mayo Clinic and Illinois received a \$9.34M, 4-year award to create one of several new Centers of Excellence for Big Data Computing.

The goals of the Illinois-Mayo Center, which is hosted by the IGB's Gene Networks of Neural and Developmental Plasticity (GNDP) research theme, are focused on the



analytical challenges posed by the rapidly growing body of genomic and transcriptomic data produced by genome-wide, high-throughput experimental technologies.

Abel Bliss Professor of Computer Science Jiawei Han (GNDP) is the Center's Program Director. Other Principal Investigators are Professor of Computer Science Saurabh Sinha (BSD/GNDP); Founder Professor of Bioengineering and Physics Jun Song (CDMC); and Richard Weinshilboum, M.D., Interim Director of the Mayo Clinic Center for Individualized Medicine and Director of the Center's Pharmacogenomics Translational Program. NCSA and IGB Director of Bioinformatics and Director of the HPCBio Group C. Victor Jongeneel (GNDP) is Executive Director of the new Center.

Together, the team is developing an analytical tool called KnowEnG, which will integrate many disparate sources of gene-related data into one enormous network, a comprehensive guide against which a researcher's specific results can be compared. KnowEnG will accommodate future growth in size and scope of the network, as the scientific community continues to learn about the relationships among genes. In addition, the Center is creating a training framework that empowers researchers to use the new tool and engage in bioinformatics research, regardless of their prior computational knowledge.

October 2014



Paul Hergenrother (CDMC) and Sandra Rodriguez-Zas (GNDP) were named University Scholars; this program was created to recognize the university's most talented teachers, scholars and researchers.

*Hergenrother: Department of Chemistry, College of Liberal Arts and Sciences*

*Rodriguez-Zas: Department of Animal Sciences, College of Agricultural, Consumer and Environmental Sciences*



7 October 2014

Microbes:  
The residents  
living on and  
inside you

[www.youtube.com/  
IGBillinois](http://www.youtube.com/IGBillinois)



Ever wonder about the trillions of microbes that live on your skin, in your muscles and organs, even inside your brain? Watch our helpful animation, produced by the IGB, to learn a little bit more about microbiota and your own microbiome.



**28 September 2014**

Novel roadmap through bacterial genomes leads to new drug discovery

[go.illinois.edu/NaturalProductGenomics](http://go.illinois.edu/NaturalProductGenomics)



For millennia, bacteria and other microbes have engaged each other in intense battles of chemical warfare. Doctors fight diseases with antibiotics co-opted from these microbial wars, but their efforts are frustrated by the development of drug resistance that outpaces drug discovery.

Microbiologist and molecular and cellular biologist Bill Metcalf (EBI/MMG Theme Leader), IGB Fellow James Doroghazi (MMG), and colleagues have now created an

algorithm to analyze microbial genomic data and speed discovery of new therapeutic drugs. Their work, supported by the NIH and the IGB, was published in *Nature Chemical Biology*.

Metcalf and Doroghazi combined multiple comparative metrics in an algorithm that sorted data from 830 bacterial genomes into an orderly, searchable reference. An experiment performed in collaboration with a group of chemists at Northwestern University, led by former Illinois faculty member Neil Kelleher, then used a high-precision analytical technique to infer the chemical composition of unknown compounds isolated from bacterial strains in the study. The researchers were able to match the presence of these compounds with specific groups of genes.

Image:  
Doroghazi, Albright et al.

**26 September 2014**  
New research  
may help  
doctors  
personalize  
cancer  
treatments

go.illinois.edu/  
CombatCancer



Most types of tumors, including cancer, require a supply of blood to grow larger than a few millimeters. Scientists have made great progress in combating cancer by finding effective ways to stop the formation of new blood vessels, called angiogenesis.

The NIH, Merck, American Cancer Society, Illinois Division Basic Research Grant, United Negro College Fund, and the Federation of American Societies for Experimental Biology support this work.

In a paper in *PLOS ONE*, Assistant Professor of Bioengineering Princess Imoukhuede (RBTE) and co-authors used optical approaches that can be further developed to trap cancer cells. In another paper, published in the *Journal of Materials Chemistry B*, Imoukhuede and other researchers began setting the calibration standards needed to quantitatively profile cancer cells. In two articles in *Cancer Medicine* and *PLOS ONE* on profiling and modeling, Imoukhuede and her colleagues reported that they have begun collecting data and creating computational models.

**23 September 2014**



Andrew Leakey  
@leakey77

@nytimes report on our efforts to develop crops tolerant of pollution and climate change [nyti.ms/1ri59ll](https://nyti.ms/1ri59ll) @IGBillinois @Illinois\_Alma



**The New York Times**

### Testing Future Conditions for the Food Chain

Researchers are trying to mimic the growing conditions expected to arise decades in the future as the air fills with heat-trapping gases and other pollutants from human activity, with some worrisome...



October 2014

*Department of Geology  
and Department of  
Microbiology, College of  
Liberal Arts and Sciences*



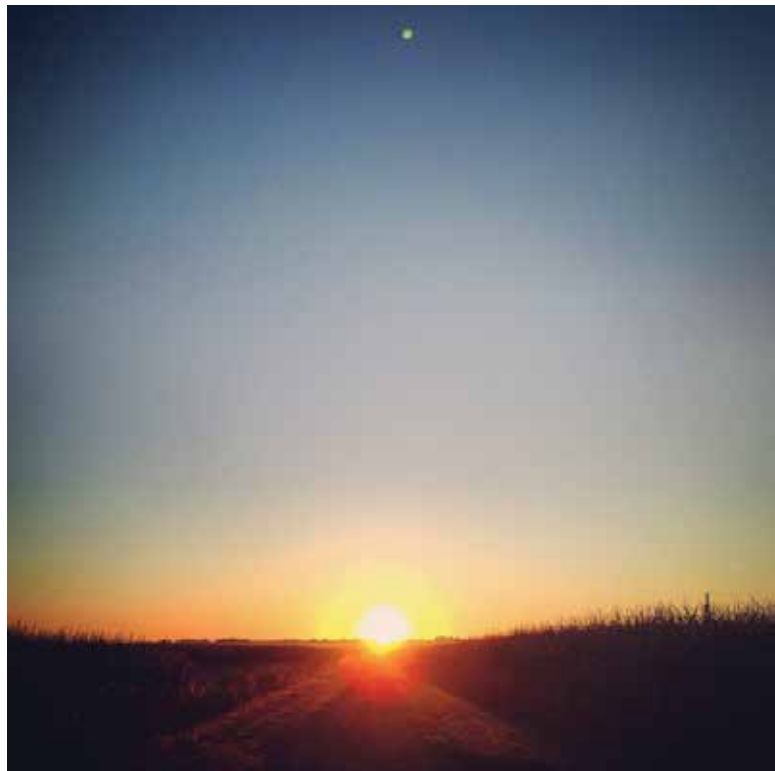
Bruce Fouke (BCXT/EBI) has been chosen to serve as the 2014-2015 American Association of Petroleum Geologists Roy Huffington Distinguished Lecturer in the Asia/Pacific Region. His formal AAPG lecture tour will include New Zealand, Australia, Thailand, Vietnam and Japan, and cover topics such as field geobiology, coral reef ecosystems, and his work with the Yellowstone Hot Springs.

23 September 2014



markwilliamholmes

Out at the farm this morning



Genomic Biology  
@IGBillinois

.@MarkWHolmes, is this a picture of South Farms at @Illinois\_Alma? Beautiful.



Mark Holmes  
@MarkWHolmes

@IGBillinois @Illinois\_Alma Yup. I was out at SoyFACE at dawn for some measurements.

23 September 2014

Koala study reveals clues about origins of the human genome

[go.illinois.edu/KoRV](http://go.illinois.edu/KoRV)



Eight percent of your genome derives from retroviruses that inserted themselves into human sex cells millions of years ago. Right now the koala retrovirus (KoRV) is invading koala genomes, a process that can help us understand our own viral lineage and make decisions about managing this vulnerable species.

"It may be a very long, slow, painful process for the host species, one which human ancestors have gone through and overcome many times in the distant past," said animal scientist Alfred Roca (GNBP).

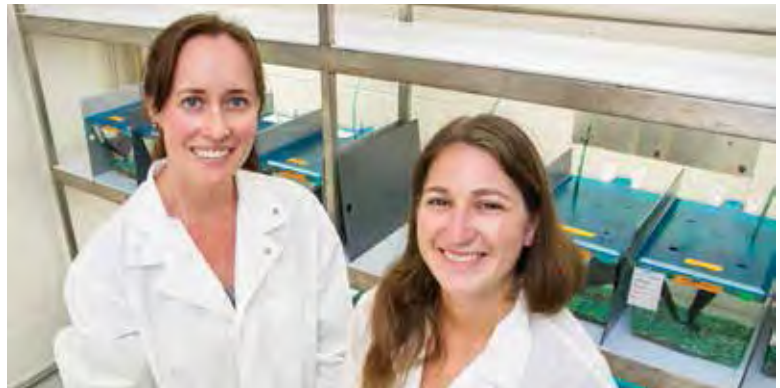
In a recent study, published in *Molecular Biology and Evolution*, Roca and co-authors discovered that 39 different KoRVs in one koala's genome were all endogenous, which means passed down to the koala from one parent or the other; one KoRV was found in both parents. The San Diego Zoo, Columbus Zoo, San Francisco Zoo, and Riverbanks Zoo provided koala samples for the study, which was supported by the NIH.

Image: Norbert Potensky and the Vienna Zoo

17 September 2014

Male stickleback fish influence offspring behavior, gene expression

[go.illinois.edu/SticklebackDads](http://go.illinois.edu/SticklebackDads)



Researchers reported that attentive stickleback fish fathers influence their offspring to behave in a way that makes them less susceptible to predators. The offspring of these fathers also show changes in brain gene expression.

MORE

Male stickleback fish influence offspring behavior, gene expression

Animal biologist Alison Bell (GNBP) and postdoctoral researcher Katie McGhee evaluated fatherly influence on fry behavior by separating half of the fry from their dads before they hatched. When a predator fish was near, the orphaned sticklebacks made frantic attempts to escape, making them easier targets for the predator. Their attentive father-reared sibling exhibited less of this frantic behavior. In contrast, there were no behavioral differences between orphaned or parented fry of less attentive fathers.

These findings suggest that fathers can help to compensate for inherent vulnerabilities by changing their behavior in ways that affect offspring behavior, Bell said. This work, supported by the NSF and NIH, was published in the *Proceedings of the Royal Society B: Biological Sciences*.

10 September 2014

Where will science take us in 20 years? Blog provides 2034 predictions

[go.illinois.edu/MentalHealth](http://go.illinois.edu/MentalHealth)



The Science Coalition, a nonprofit organization that promotes the importance of federal investment in research, unveiled a new blog featuring predictions of what science and innovation will yield for the future. The blog—*SCIENCE 2034*—is intended to call attention to the need for strong and sustained federal funding for basic scientific research by highlighting the exciting possibilities of the future.

"In the year 2034, we will have solved a fundamental mystery of the brain: how past experience affects future behavior," wrote Swanlund Chair of Entomology and IGB Director Gene Robinson in his contribution to the blog.

*This discovery could help reduce instances of mental illness and help more Americans live healthier, more productive lives. Why does this matter? Too many people struggle with debilitating conditions like depression, schizophrenia, and post-traumatic stress disorder. Once we better understand the connections between our past experiences and the changes in gene activity that cause these diseases, we will be better able to treat specific brain ailments.*

October 2014

*Department of Plant Biology, College of Liberal Arts and Sciences; Department of Crop Sciences, College of Agricultural, Consumer and Environmental Sciences*



REUTERS

Stephen Long (GEGC) was named a Thomson Reuters Highly Cited Researcher in recognition of ranking among the top one percent of researchers for most cited documents in their specific field. He was also named by Thomson Reuters as one of the World's Most Influential Scientific Minds for 2014.

8 September 2014



laurawennstrom

#Drawing class field trip to #IGB to draw #TonyTasset #DarwinsPlayground #uiuc #publicart



2 September 2014



Search for  
better biofuels  
microbes  
leads to the  
human gut

[go.illinois.edu/  
BetterBiofuels](http://go.illinois.edu/BetterBiofuels)



Scientists have scoured cow rumens and termite guts for microbes that can efficiently break down plant cell walls for the production of next-generation biofuels, but some of the best microbial candidates may actually reside in the human lower intestine.

Reported in the *Proceedings of the National Academy of Sciences*, these findings have significance for human health, but also for biofuels production, since the same sugars can be fed to yeast to generate ethanol and other liquid fuels. The human microbes appear to be endowed with enzymes that break down a complex plant fiber component more efficiently than the most efficient microbes found in the cow rumen, said animal scientist Isaac Cann (BCXT/EBI Deputy Director), whose work was funded by the EBI and USDA.



11 August 2014

Robin Williams' life and death inspire others to help those in need

[go.illinois.edu/MentalHealth](http://go.illinois.edu/MentalHealth)



In the collective memory of several generations, Robin Williams' acting persona is the archetypal mentor. His vivid portrayals of the unconventional English teacher John Keating in *Dead Poets Society* and the frank yet gentle therapist Sean Maguire in *Good Will Hunting* leave viewers with an impression of kind sincerity, an impression that is only reinforced by Williams' more light-hearted roles. Williams used his incredible comedic talent to positively impact the lives of his audiences through the parts he played and his philanthropic efforts.

Image: Peggy Sirota  
[go.illinois.edu/Sirota](http://go.illinois.edu/Sirota)



His legacy makes the manner of his death this August all the more poignant. Williams took his own life; his doctors reported that his recent depression and death were likely caused by Lewy body dementia, a Parkinson's-like neurological disease.

William's death shook the world because of his unique personality and talent. Tragically, the mental illnesses that led to his death are quite common. Millions of people suffer from debilitating disorders of mood and aging-related dementia each year, yet researchers are still struggling to understand the neurological and developmental origins of these diseases.

Recent and ongoing advances in research technology offer hope that a genomic approach to mental disorders may prove fruitful (see September 10). For example, work by researchers like Associate Professor of Psychology and IGB affiliate [Monica Uddin](#) explores how the genome integrates the influences of nature and nurture on mental health.

"We have not had as much success in identifying the genetic basis for stress-related mental disorders such as major depressive disorder (MDD) or post-traumatic stress—in part because the environment plays a larger role in the development of these disorders," said Uddin. "There has been a growing appreciation for the role of epigenetics—molecular factors such as DNA methylation and histone modifications that help to regulate gene function without changing the underlying DNA sequence—in shaping risk for mental disorders."

Uddin is currently engaged in a collaboration with Professor of Psychiatry and Psychology Susannah Tye, a clinical researcher at Mayo Clinic, to examine epigenetic predictors of antidepressant resistance in rats. The insights from this work may eventually enable better diagnostics and treatment for MDD. Other work at the IGB also examines the interplay between brain gene regulation, behavior, and well-being (see September 17).

Perhaps this can be part of the legacy of Williams and countless others who have lost their lives to neurological disorders: a renewed dedication to discover effective means of treatment, and ultimately to predict and prevent illnesses before they begin.

11 August 2014



Nicholas Rabchenuk  
@rabbitnutz

Memorial at good will hunting bench. @7News @NESN @fox25news @GregHillWAAF



rCS  
@guzmania

@rabbitnutz We have lost a favorite son, when will researchers solve mental illness puzzle? We know more about universe than the human mind

6 August 2014



# Cell mechanics may hold key to how cancer spreads and recurs

[go.illinois.edu/CancerCellMechanics](http://go.illinois.edu/CancerCellMechanics)



Cancer cells that break away from tumors to go looking for a new home may prefer to settle into a soft bed, according to work published in *Nature Communications*. In a process called metastasis, cancer cells can spread to other organs, evading treatment and causing relapse. Leonard C. and Mary Lou Hoeft Professor in Engineering Ning Wang (RBTE) and colleagues found that these so-called tumor-repopulating cells may lurk quietly in some environments, but thrive in others.

Cancer cells placed in very soft gels grew and multiplied, as expected. The cells placed on stiffer gels became dormant, but "woke up" and began to multiply and spread when later moved to softer environments.

Wang said these findings may explain why soft tissues, such as the brain or lungs, are most vulnerable to metastasis. This work was supported by the NIH.

Image: Jason Lindsey  
[go.illinois.edu/Lindsey](http://go.illinois.edu/Lindsey)

August 2014



Stephen Boppart (RBTE) and Martha Gillette (GNBP) were among 36 researchers to receive Early Concept Grants for Exploratory Research from the NSF. These grants enable the development of new technologies to better understand how complex behaviors emerge from the activity of brain circuits.

*Boppart: Department of Electrical and Computer Engineering, College of Engineering*

*Gillette: Department of Cell and Developmental Biology, College of Liberal Arts and Sciences*



August 2014

Department of Electrical  
and Computer Engineering,  
College of Engineering

Brian T. Cunningham (MMG) received a Technical Achievement Award from the Institute of Electrical and Electronics Engineers' Engineering in Medicine and Biology Society. Cunningham received the award "for development and commercialization of optics-based biosensors and detection instruments for applications in drug discovery, diagnostics, environmental monitoring and life science research."



August 2014

Department of Chemical  
and Biomolecular  
Engineering, College of  
Engineering



Deborah Leckband (RBTE) was elected a 2014 fellow of the Biomedical Engineering Society for her research, which includes the investigation of how mechanical and biochemical signals are transduced across cell membranes to regulate cell and tissue functions.

4 August 2014

Researchers  
boost insect  
aggression by  
altering brain  
metabolism

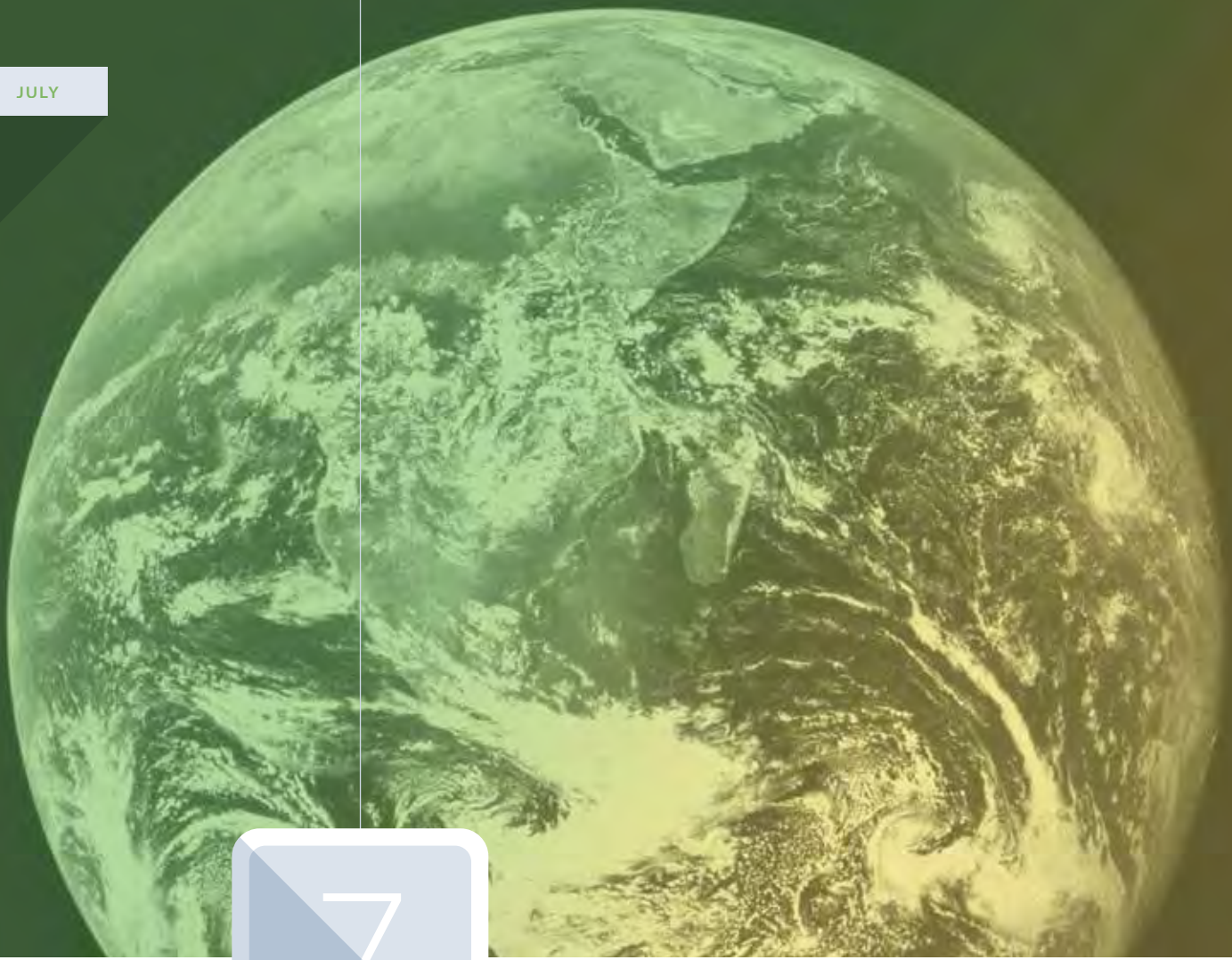
[go.illinois.edu/  
BrainMetabolism](http://go.illinois.edu/BrainMetabolism)



Illinois scientists have discovered that they can crank up insect aggression through a surprising method—interfering with a basic metabolic pathway in the insect brain. Their study of fruit flies and honey bees showed a direct, causal link between brain metabolism and aggression.

In a new study reported in the *Proceedings of the National Academy of Sciences*, postdoctoral researcher Clare Rittschof, Swanlund Chair Professor of Entomology and IGB Director Gene Robinson, and colleagues saw that increased aggression was dose-dependent in drugged bees. However, the drugs had no effect on chronically stressed bees.

The findings offer insight into the immediate and longer-term changes that occur in response to threats, Robinson said. The NSF supported this work.



**28 July 2014**

Earth can sustain more terrestrial plant growth than previously thought

[go.illinois.edu/PlantGrowth](http://go.illinois.edu/PlantGrowth)



A new analysis suggests the planet can produce much more land-plant biomass—the total material in leaves, stems, roots, fruits, grains and other terrestrial plant parts—than previously thought. The study, reported in *Environmental Science and Technology*, found current estimates do not consider human efforts to boost plant productivity through genetic engineering, plant breeding and land management, said Evan DeLucia (EBI/GEGC), the G. William Arends Professor of Biology.

To estimate a new theoretical limit, Delucia and his team used a model of light-use efficiency and the theoretical maximum efficiency with which plant canopies convert solar radiation to biomass. This limit is “roughly two orders of magnitude higher than the productivity of most current managed or natural ecosystems,” the authors wrote. The EBI funded this research.

*Image: NASA/Apollo 17 crew; taken by either Harrison Schmitt or Ron Evans*

19 July 2014



## Radio frequency ID tags on honey bees reveal hive dynamics

go.illinois.edu/  
HiveDynamics



A study that used radio-frequency identification (RFID) tags to track the flight activity of hundreds of individual honey bees has yielded two discoveries: some foraging bees are much busier than others; and if those busy bees disappear, others will take their place.

“We found that some bees are working very, very hard—as we would have expected,” said Swanlund Chair Professor of Entomology and IGB Director Gene Robinson, who led the research. Data from the tags revealed that about 20 percent of the foraging bees in a hive brought home more than half of the nectar and pollen supply. Surprisingly, when elite honey bees were removed from the colony, previously low-activity bees were able to dramatically increase their foraging rate to compensate.

Citizen scientist Paul Tenczar developed the technique to attach RFID tags to bees and to track their flight activity with monitors. He worked with Robinson’s laboratory group to measure the foraging behavior of bees. Swanlund Professor of Physics Nigel Goldenfeld (BCXT Theme Leader) and graduate student Vikyath Rao analyzed the data. The study was funded by NSF and the Christopher Family Foundation and reported in the journal *Animal Behaviour*.

17 July 2014



## To bees and humans, all sugar sources are not created equal

go.illinois.edu/SugarSources

Many beekeepers feed their honey bees sucrose or high-fructose corn syrup when times are lean inside the hive. This practice has come under scrutiny; some bee health experts suspect that inadequate nutrition plays a role in honey bee declines.

In a new study described in *Scientific Reports*, researchers examined the effect of bees’ diet on gene activity in a tissue called the fat body, which combines the functions of the liver and fat tissues in vertebrates. Hundreds of genes related to protein metabolism, brain signaling and immune defense showed differences in activity depending on whether bees were fed corn syrup or sucrose versus honey.

“It seems that in both bees and humans, sugar is not sugar—different carbohydrate sources can act differently in the body,” said Swanlund Chair Professor of Entomology and IGB Director Gene Robinson, who performed the new analysis together with entomology graduate student Marsha Wheeler. Funds for the study were provided by the North Central Region Integrated Pest Management Center.

17 July 2014



## Identifying barriers to stem cell production

go.illinois.edu/  
ReprogrammingCells



Pluripotent stem cells, naturally occurring stem cells that develop into any one of the many cell types, have enormous implications for regenerative medicine, but they are rare in adults and difficult to grow in the laboratory. The recent discovery that human somatic cells can be reprogrammed in the laboratory to generate pluripotent stem cells could lead to revolutionary treatments for many chronic diseases, including cancer.

These laboratory-modified cells, called induced pluripotent stem cells (iPSCs), appear to be equivalent in every way to naturally occurring stem cells.

Unfortunately, cells inherently resist the reprogramming of gene expression researchers use to create iPSCs. For the first time, Founder Professor of Physics and of Bioengineering Jun Song (CDMC) and other researchers have systematically catalogued the barriers to reprogramming somatic cells to generate iPSCs.

This work, reported in *Cell*, was supported by grants from the NIH; Netherlands Organization for Scientific Research; California Institute for Regenerative Medicine; University of California, San Francisco Program for Breakthrough Biomedical Research; and a Sontag Foundation Distinguished Scientist Award.

July 2014

*Department of Plant  
Biology, College of  
Liberal Arts and Sciences;  
Department of Crop  
Sciences, College of  
Agricultural, Consumer and  
Environmental Sciences*



Royal Society Fellow Stephen Long (GEGC) was invited to serve as a Sectional Committee Chair for the Royal Society. The Sectional Committees select a short list of candidates for election as Royal Society Fellows from the hundreds of nominations received each year.

16 July 2014



Associate professor of anthropology Ripan Malhi featured on the Day of Archaeology website with great new article "Molecular Archeology Puts Artifacts in Perspective." Read it at <http://bit.ly/1oOvrJQ>

15 July 2014



## Turning the tide for rare disease research

<http://mayoillinois.org>



*Image: Wilfred van der Donk ice bucket challenge UIUC. [go.illinois.edu/DonkALS](http://go.illinois.edu/DonkALS)*

This summer, a pop culture craze for internet charity swept the nation—carried along by a two million-bucket wave of ice water.

The “Ice Bucket Challenge” emerged as a way to raise awareness of amyotrophic lateral sclerosis (ALS), sometimes called Lou Gehrig’s Disease, and to raise funds for ALS research. ALS, a fatal disorder, is characterized by the progressive death of nerve cells that control muscle movement, resulting in decreasing motor control and the eventual loss of ability to move, swallow, or breathe. There is currently no cure.

Participants in the Ice Bucket Challenge created videos in which they doused themselves with freezing water, sometimes in elaborate or unexpected ways. They referenced ALS and nominated others to create their own videos, donate to research through a nonprofit organization, or both. Although initially not focused on a particular charity, the phenomenon went viral after several high-profile individuals related their participation to the need for ALS research funding. Eventually, the trend generated enthusiasm for charitable giving to support research for a variety of disorders, along with other philanthropic endeavors.

Part of the inspiration for the ALS Ice Bucket Challenge came from the difficult circumstances that surround ALS research. The disease is complex, rare, and deadly. For those who suffer from uncommon and intractable disorders, and for those close to them, the need for effective treatments and cures is overwhelming. However, each of these disorders presents a unique and daunting scientific challenge, while their rarity makes it difficult for research efforts to get enough attention and funding.

Research at academic institutions like Illinois is an important component of the solution to this societal problem. Partnerships with medical institutions, such as the Mayo-Illinois Alliance (see October 9 and March 17), facilitate the type of broad, interdisciplinary clinical research projects that are needed to tackle complex disorders.

14 July 2014



ALS Cycle of Hope  
[@CycleofHope4ALS](https://twitter.com/CycleofHope4ALS)

Have you heard about the ICE BUCKET CHALLENGE for ALS? Danny the Intern survived it this weekend... <http://fb.me/1jROiF8i8>

11 July 2014



Ripán Malhi  
featured on 'Day  
of Archaeology'  
website

go.illinois.edu/  
DayofArchaeology



Where archeologists exhume secrets, lost histories from the soil, "molecular archeologists" uncover secrets lying inside human remains. By piecing together ancient DNA, molecular archeologists can more definitively answer questions about our past.

For the "Day of Archaeology," a project that provides a window into the daily lives of archeologists from all over the world, anthropologist Ripán Malhi (BIOBEL/RBTE) described what it's like to be a molecular archeologist.

"Some people in my field consider themselves to be molecular archeologists as we tend to work with archeological remains and use an archeological context to help infer the genetic patterns we see," he said.

8 July 2014



Ritu Raman  
[@raman\\_ritu](#)

"The Emergence of Life" #MOOC by @IGBillinois & @coursera sounds truly fascinating. Can't wait to learn more! [https://www.coursera.org/course/emergenceoflife ...](https://www.coursera.org/course/emergenceoflife)



Coursera

**Emergence of Life - University of Illinois at Urbana-Champaign...**

Emergence of Life from University of Illinois at Urbana-Champaign. Take free online classes from 115+ top universities and educational organizations. We partner with schools like Stanford, Yale,...



July 2014



Department  
of Chemistry,  
College of Liberal  
Arts and Sciences



ACS  
Chemistry for Life®

Patricia Blair (MMG) was selected to receive an American Chemical Society Division of Medicinal Chemistry Predoctoral Fellowship, a prestigious award given annually since 1991. The award recognizes superior achievement as a graduate student.



7-11 July 2014

Another successful year for the IGB summer camp, Pollen Power!

[go.illinois.edu/PollenPower2014](http://go.illinois.edu/PollenPower2014)



For many people, the word “pollen” evokes only the idea of a springtime allergenic nuisance. For one group of middle school girls, though, pollen is now a symbol of summertime fun and learning. Twenty-six girls from around East Central Illinois came to participate in Pollen Power!, a week-long science day camp hosted July 7-11 by the IGB on the Urbana-Champaign campus.

Campers investigated the function and microscopic structure of pollen, and discovered connections between the biology of pollen and larger ideas: how plants grow and reproduce, the environmental impacts of climate change, and the importance of insect and vertebrate pollinators.

The camp was designed to give girls a kaleidoscopic picture of what it means to be a plant biologist. Activities included using the IGB Core Facilities' high-powered microscopes; learning to identify different types of pollen and pollinate corn; and hearing guest talks from IGB researchers on the science of pollen and the crucial role that women play in STEM fields. The camp, which will be offered again July 6-10, 2015, is supported in part by the NSF.

7 July 2014

Thousands united through a new online course to explore the origins of life

[go.illinois.edu/EmergenceofLife](http://go.illinois.edu/EmergenceofLife)

[www.youtube.com/IGBillinois](http://www.youtube.com/IGBillinois)



How did life emerge on Earth? How have life and Earth co-evolved through geological time? Is life elsewhere in the universe?

MORE

Thousands united through a new online course to explore the origins of life

The College of Liberal Arts and Sciences, the IUB, and the IGB have partnered to create an online course that explores these and other enticing questions. The course, called Emergence of Life, has attracted thousands of participants since it was offered on Coursera for the first time this summer. Course material covers the entire history of life on Earth within the context of the Tree of Life, from ancient primordial life before the first cell to the evolution of modern species.

The pioneering work of Carl R. Woese, Stanley O. Ikenberry Endowed Chair of Microbiology at the time of his death, has revolutionized our understanding of the fundamental structure and evolutionary relatedness of all living entities on Earth. Although concepts from Woese's work are central to transdisciplinary genomic research, the new course is among the first to include his work in its curricula.

The course, which was offered a second time this fall, was made possible with the contributions of scientific experts from around the world, including Karl Stetter at the University of Regensburg; Norm Pace at the University of Colorado Boulder; Jan Sapp at York University; and Mike Russell at the California Institute of Technology. Two Illinois faculty members, Professor of Geology and Carver Biotechnology Center Director Bruce Fouke (BCXT/EBI) and Swanlund Professor of Physics Nigel Goldenfeld (BCXT Theme Leader), also played major roles in the course.

1 July 2014

Climate relicts may help researchers understand climate change

go.illinois.edu/  
ClimateRelicts



While hiking through the Ozarks' characteristic oak and hickory forests as a teenager, ecologist and IGB Fellow Scott Woolbright (GEGC) discovered something decidedly uncharacteristic for the region: prickly pear cacti growing on an exposed, rocky ledge.

In a recent paper published in *Trends in Ecology and Evolution*, Woolbright describes how populations and communities like these, known as climate relicts, can help scientists understand how ecological communities are affected by climate change. The IGB supported this work.

Image: Victor Korniyenko  
© Victor Korniyenko, used under a CC BY-SA 3.0 license.  
go.illinois.edu/Korniyenko

1 July 2014



Genomic Biology  
@IGBillinois

Check out Francis Collins @NIHDirector perform our @NIH\_CommonFund song by @neurobeegirl! <http://bit.ly/1sUbVQY> #doublehelixguitar

6

**30 June 2014**

Ebola outbreak  
focuses global  
attention on  
African health  
needs

[hpcbio.illinois.edu](http://hpcbio.illinois.edu)



Throughout the spring of 2014, a deadly epidemic was gradually building momentum in West Africa. By midsummer, the humanitarian aid organization Médecins Sans Frontières (Doctors Without Borders) announced that the scale of the growing outbreak of Ebola virus disease had exceeded their ability to respond. Just a few days later, the number of reported cases totaled 779, and the number of reported deaths reached 481—more than any previous outbreak, yet only a small fraction of the 20,000 cases and 7,800 deaths confirmed by the end of 2014.

The outbreak had a dramatic global impact. International health organizations, as well as the aid organizations of individual nations, worked together to help Guinea, Sierra Leone and Liberia, the three countries most devastatingly affected by the disease.

*Image: ©Crown copyright 2012  
[go.illinois.edu/CrownCopyright](http://go.illinois.edu/CrownCopyright)*

MORE

Ebola outbreak focuses global attention on African health needs

The health crisis created by the Ebola outbreak brought attention to the challenges faced by medical workers in many regions of Africa: the need for better public health education; lack of personnel, infrastructure, and equipment; and many other serious, ongoing health issues.

A source of hope throughout the Ebola outbreak has been the dedicated efforts of many different groups and organizations to combat the disease. One such group is the Human Heredity and Health in Africa Consortium (H3Africa). H3Africa is a large-scale project funded by the NIH and Wellcome Trust to enable African researchers to apply the power of genomic research to health challenges that affect their geographical region. Computational and bioinformatics support for the consortium is supported by H3ABioNet, a multi-institutional project.

NCSA and IGB Director of Bioinformatics and Director of the HPCBio Group **C. Victor Jongeneel (GNDP)**, as well as other HPCBio group members (see October 9), are key participants in H3ABioNet. The training and consultation provided by H3ABioNet have already expanded the genomic research capabilities of H3Africa projects across the continent. These research efforts are addressing not only the acute challenge of Ebola, but also the chronic and severe health concerns that these areas face, including hemorrhagic fevers, malaria, tuberculosis, and HIV.

29-30 June 2014

Securing tomorrow's food supply by engaging today's students

[go.illinois.edu/PlantBioResearch](http://go.illinois.edu/PlantBioResearch)



Gutgsell Endowed Professor of Crop Sciences and Plant Biology Stephen Long (BSD/EBI/GEGC) was inspired by his participation this June in the Gatsby Plant Science Summer School for undergraduate students, held near York, England. The annual week-long intensive course addresses a growing need to promote student interest in plant sciences. Long delivered a plenary lecture, conducted a Q&A, and met with small groups. He also advised on the design and execution of laboratory activities for high schools.

"The success of this course in exciting that interest was palpable," Long said. He believes that plant biology is no longer emphasized in U.S. and U.K. high schools in part because plant sciences are seen as uninteresting and unimportant. In actuality, he said, "plants are fundamental to our existence, and we're running out of what they provide."

26 June 2014

Biosphere  
features IGB  
Fellow Melissa  
Cregger

[www.youtube.com/  
IGBillinois](http://www.youtube.com/IGBillinois)



Biosphere is an ongoing video series that showcases IGB research. In our debut video, IGB Fellow and microbe maven Melissa Cregger discusses about her adventures in microbiome research and starting a family.

25 June 2014

Illinois  
study may  
improve rice  
productivity

[go.illinois.edu/RicePaddy](http://go.illinois.edu/RicePaddy)



Illinois researchers established the university's first rice paddy to test rice performance in Illinois and at Kyoto University in Japan. The two plots, which were planted on the same date, should reveal clues about what factors help the plants more efficiently convert the sun's energy into food, a metric known as photosynthetic performance.

This experiment is part of the Realizing Increased Photosynthetic Efficiency (RIPE) project, a five-year effort led by Gutzsell Endowed Professor of Plant Biology and Crop Sciences Stephen Long (BSD/EBI/GEGC), which is funded by a \$25 million grant from the Bill & Melinda Gates Foundation to substantially improve the productivity of worldwide staple food crops.

June 2014



*Department of Chemistry,  
College of Liberal Arts  
and Sciences*



**hhmi** | Howard Hughes  
Medical Institute

Jeffrey Moore (BSD) was named an HHMI Professor. This distinction honors respected researchers who also are transforming education within their fields.

June 2014

Department of Sociology,  
College of Liberal Arts  
and Sciences

Image: Tiffany Jolley,  
WILL Illinois Public Media



Ruby Mendenhall (GNBP) was named a Richard and Margaret Romano Professorial Scholar. The three-year appointment is based upon recognition of outstanding achievements in research and leadership on campus.

23 June 2014



Claire Sturgeon  
@ClaireSturg



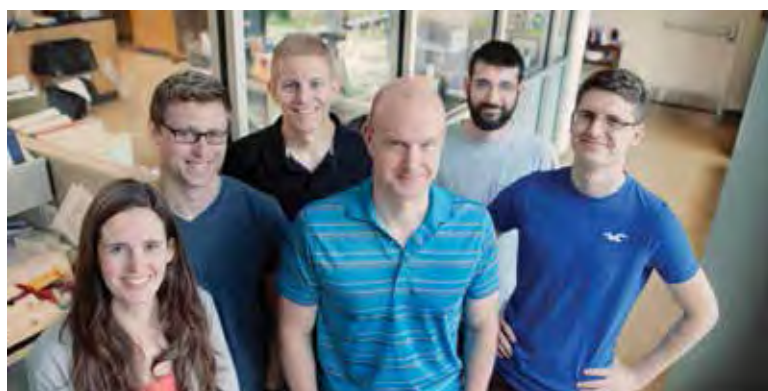
Had a behind the scenes look at @leakey77 on @WICD w/ @JHarrisWICD talking about #pollenpower. <http://Bit.ly/1m4UCCX>

17 June 2014



Innovative  
technique  
transforms  
hunt for  
antibiotics

[go.illinois.edu/  
NaturalProductDiscovery](http://go.illinois.edu/NaturalProductDiscovery)



Antibiotic resistance is depleting our arsenal against deadly pathogens, including those that cause tuberculosis and Staph infections. In an *ACS Chemical Biology* study, Assistant Professor of Chemistry Doug Mitchell (MMG) with his lab members developed a new technique to quickly uncover novel products (including potential antibiotics) produced by bacteria.

Using genomics, researchers are now able to screen soil bacteria that are likely to produce novel antibiotic products. During the screening process, a chemical tag is added to the compounds of interest. The addition of these tags adds mass to the product so researchers can easily detect the reactive products using mass spectrometry.

This study was supported by the David and Lucile Packard Fellowship for Science and Engineering, Robert C. and Carolyn J. Springborn Endowment, American Society for Biochemistry and Molecular Biology Undergraduate Research Award, National Center for Research Resources, NIH, and the IGB.

13 June 2014



Classic Lewis Carroll character inspires new ecological model

go.illinois.edu/  
EcologyModel



Inspired by the Red Queen in Lewis Carroll's *Through the Looking Glass*, plant biologist James O'Dwyer (BCXT) improved a 35-year-old ecology model to better understand how species evolve over decades to millions of years.

The new model, called a mean field model for competition, builds on the "Red Queen Effect," an evolutionary theory introduced by Leigh Van Valen in the 1970s, which suggests that organisms must constantly undergo evolutionary adaptation in response to changes in other ever-evolving organisms and an ever-changing environment.

The mean field model assumes that new species have competitive advantages that allow them to multiply, but over time new species with even better competitive advantages will evolve and outcompete current species, like a conveyor belt constantly moving backwards. Ecologists can use models to predict what happens next and diagnose sick ecosystems. The Templeton World Charity Foundation supported this work, which was published in *Ecology Letters*.

12 June 2014



NASA  
@NASA



In 1 hr: @Astrollini talks living & working in space at @NASAGoddard. Watch: <http://www.ustream.tv/channel/nasa-educational> ... & #askNASA Q's

June 2014



Department of  
Bioengineering, College of  
Engineering



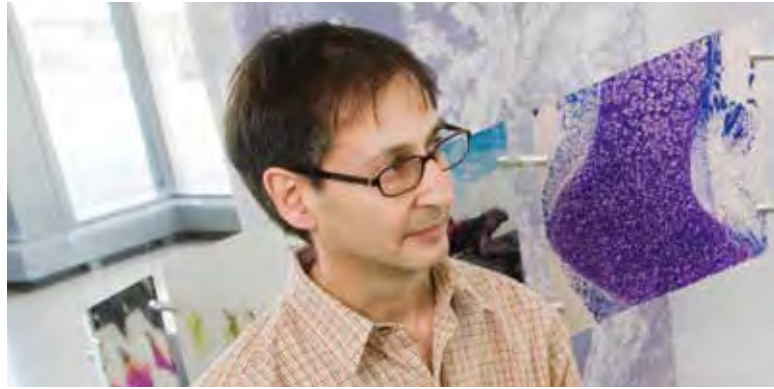
Rashid Bashir (RBTE) was selected as Chair of the Nanotechnology Study Section (NANO) in the Center for Scientific Review of the NIH. NANO reviews applications focused on research in bioengineering and technology development relating to the unique properties of nanomaterials.

9 June 2014



Nigel Goldenfeld interviewed in *Huffington Post*

go.illinois.edu/HuffingtonPost



The *Huffington Post's* Susan Mazur interviewed Swanlund Professor of Physics Nigel Goldenfeld (BCXT Theme Leader) about evolution, Carl R. Woese, and the need for a theory of life:

*As a condensed matter physicist, Goldenfeld's main interest is pattern formation and the processes involved in pattern formation. He researches everything from snowflakes to geological formations to the stock market. He and his team have captured gorgeous images of some of these formations in progress at Yellowstone National Park.*

In response to a question from Mazur about whether any common themes united his diverse research interests, Goldenfeld said during the interview:

*One thing is that systems that are out of equilibrium are much more interesting than systems that are in equilibrium. Systems in equilibrium lapse into perfect states like crystals, etc. Systems that are out of equilibrium are messy and produce turbulence and swirly clouds and human beings and galaxies and strange patterns in space and time. . . it's my main intellectual interest.*

5 June 2014



iBioFAB at University of Illinois

www.youtube.com/IGBillinois



The Illinois Biological Foundry for Advanced Biomanufacturing (iBioFAB) is a fully integrated computational and physical infrastructure that supports rapid design, fabrication, validation/quality control, and analysis of genetic constructs and organisms. As the first "living foundry" in the world, the iBioFAB provides a new manufacturing paradigm for chemicals, materials, and biologics.

3 June 2014



NCSAatIllinois @NCSAatIllinois

@IGBillinois recently hosted @NASA Astrobiology Institute Executive Council. Thx for taking time to tour #BlueWaters <http://t.co/gxTXiwzy9S>



3 June 2014



As carbon dioxide levels rise, crop nutritional value will decline

go.illinois.edu/CO2Effects



Researchers have some bad news for future farmers and consumers: as carbon dioxide levels rise this century, some grains and legumes will become significantly less nutritious than they are today.

Associate Professor of Plant Biology Andrew Leakey (EBI/GEGC) and colleagues from eight institutions in Australia, Israel, Japan and the United States simulated high carbon dioxide levels in open-air fields and reported in *Nature* that the nutritional quality of some of the world's most important crops dropped in response to elevated carbon dioxide. This research was supported by the USDA; Illinois Council for Food and Agricultural Research; and the National Institute for Climatic Change Research.

June 2014



Congratulations to Bioenergy Connection, the EBI magazine, which received a bronze award from the Council for the Advancement and Support of Education (CASE) for its latest issue "Forest Bioenergy: Is It Sustainable?"

Read the issue online at [www.bioenergyconnection.org/](http://www.bioenergyconnection.org/).

3 June 2014



Laura McLay  
[@lauramclay](https://twitter.com/lauramclay)

Neat [@illinois\\_alma](https://twitter.com/illinois_alma) exhibit at [@fly2ohare](https://twitter.com/fly2ohare) #yeahscience



Univ. of Illinois  
[@illinois\\_alma](https://twitter.com/illinois_alma)

[@lauramclay](https://twitter.com/lauramclay) [@fly2ohare](https://twitter.com/fly2ohare) Where science & art meet. Thanks for sharing your photo of the [@IGBillinois](https://twitter.com/IGBillinois) display.

5

30 May 2014

New technique  
first step to  
stem cell  
specialization

[go.illinois.edu/StemCells](http://go.illinois.edu/StemCells)



The gap between stem cell research and regenerative medicine just became a lot narrower. A new technique coaxes stem cells to begin differentiating into specific cell types, a process known as specialization. It is the first time this critical step has been demonstrated in a laboratory.

Mechanical Science and Engineering Professor Ning Wang (RBTE) demonstrated that not only is it possible to induce mouse embryonic stem cells to differentiate into developmental tissue categories in the lab, but also that this manipulation requires a careful combination of correct timing, chemical factors and physical environment. The team used genetically expressed fluorescent dyes to monitor the process in real time.

Illinois researchers, in collaboration with scientists at Notre Dame University and the Huazhong University of Science and Technology (HUST) in China, published their results in *Nature Communications*. This work was supported by the NIH and HUST.

Image: Poh, Y.-C. et al.  
[go.illinois.edu/Poh](http://go.illinois.edu/Poh)

May 2014

Department of  
Chemistry, College of  
Liberal Arts and Sciences

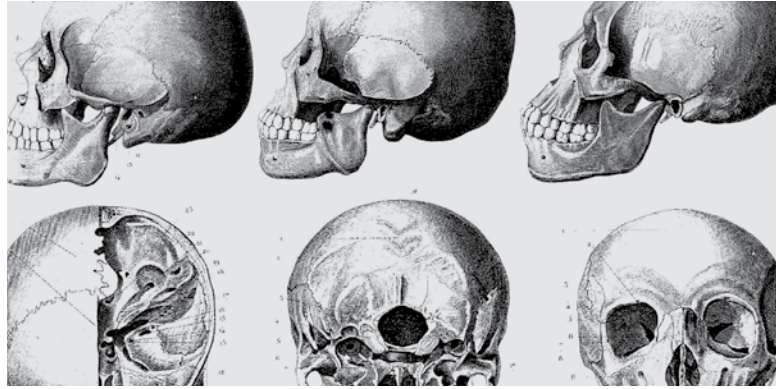


Wilfred A. van der Donk (MMG) was elected to the American Academy of Arts and Sciences, one of the longest-standing honorary societies in the nation. In addition, for his "creative work on the chemistry, biosynthesis and mechanistic enzymology of the cyclic peptide and phosphonate classes of antibiotics," he was awarded the Royal Society of Chemistry's Bioorganic Chemistry Award for 2014.

16 May 2014

# Genetic study resolves speculation about first people in Americas

go.illinois.edu/  
FirstInhabitants



Numerous genetic analyses support the widely accepted view that the original American immigrants crossed over a land bridge that once connected northeast Asia to present-day Alaska. However, ancient remains with narrower skulls and other features distinct from most Native Americans led to hypotheses that these individuals came to the Americas from as far away as Australia or Southeast Asia.

Associate Professor of Anthropology Ripan Malhi (BIOBEL/RBTE) and coauthors reported in *Science* that genetic information extracted from the tooth of an adolescent girl who fell into a sinkhole in the Yucatan 12,000 to 13,000 years ago is unique to Native Americans, despite her unusually shaped skull.

This research was an international effort involving scientists, divers and technicians from more than a dozen institutions. Funding was provided by the NSF, Expeditions Council of the National Geographic Society, Archaeological Institute of America, Waitt Institute, Pennsylvania State University, University of New Mexico, University of Texas at Austin, DirectAMS, and Instituto Nacional de Antropología e Historia.

Image: *The Iconographic Encyclopaedia of Science, Literature and Art, 1851*  
go.illinois.edu/  
IconographicEncyclopaedia

16 May 2014

# Collaborative learning: The OLLI Citizen Scientist Program

go.illinois.edu/  
OLLIScientists



Albert Himoe stands in front of a cluttered lab bench and holds a plastic tube up to the light, looking for the small mass of DNA

MORE

Collaborative learning:  
The OLLI Citizen  
Scientist Program

clinging to the side of the tube. It looks like a dry wad of mucus. Himoe has spent the last four days preparing this seemingly insignificant speck of genetic material.

It contains a special gene that will play an integral role in genetic research on Fragile X Syndrome (FXS), the most common cause of inherited cognitive impairment, with 20 to 30 percent being diagnosed with autism. Professor of Cell and Developmental Biology Stephanie Ceman (GNBP) has been studying this condition since 1997.

Himoe joined Ceman's lab in 2011 as a citizen scientist through the Osher Lifelong Learning Institute (OLLI), a member-driven learning community for people over the age of 50. OLLI citizen scientists are matched with scientists at Illinois based on their knowledge, skills, and interests. They volunteer in a lab for several hours every week, often being assigned their own task to manage for the lab.

The Citizen Scientist Program was conceived by Swanlund Chair and Professor of Psychology and Neuroscience and Beckman Institute Director Art Kramer, Swanlund Chair Professor of Entomology and IGB Director Gene Robinson, and former OLLI Director Kathleen Holden in 2009. Today the program has about 15 citizen scientists who are involved in a variety of disciplines and subject areas, from entomology to neuroscience. Past participants include retired school teachers, bankers, gardeners, scientists, and others.

16 May 2014



U of I News Bureau  
@NewsAtIllinois

Honey bees did better this winter, but it's not clear why. @IGBillinois prof Gene Robinson explains in @NatGeo: <http://ow.ly/wVFJ3>



**National Geographic**

**U.S. Honey bee Losses Not as Severe This Year | Nat Geo Food**

By **National Geographic** @NatGeo

Harvard study says pesticides play a role in the die-off of U.S. honey bees, essential plant pollinators.



May 2014



Jonathan Sweedler (MMG) received the Council for Chemical Research 2014 Malcolm E. Pruitt Award. The award recognizes outstanding individual contributions to the progress of chemistry and chemical engineering through promotion of mutually beneficial interactions among universities, the chemical industry, and government. Sweedler is the first Illinois faculty member to win the award.

Department of Chemistry,  
College of Liberal Arts  
and Sciences

2 May 2014

Yield limits  
in the corn  
belt topic of  
latest science  
perspective

[go.illinois.edu/YieldLimits](http://go.illinois.edu/YieldLimits)



Robert Emerson Professor of Plant Biology  
Don Ort (BSD/GEGC Theme Leader) and  
Gutgsell Endowed Professor of Crop  
Sciences and Plant Biology Stephen Long  
(BSD/EBI/GEGC), discuss corn belt yield limits  
in a recent perspective entitled "Limits on  
Yields in the Corn Belt" in *Science*:

*In total global production, corn (maize, Zea mays L.) is the most important food and feed crop. Of the 967 million metric tons produced in 2013, 36.5% were produced in the United States, mostly in the Midwest Corn Belt. The United States is by far the world's largest corn exporter, accounting for 50% of corn exports globally. Until recently, breeding and management have allowed farmers to increase the number of plants per acre without loss of yield per plant. On page 516 of this issue [of Science], Lobell et al. use a detailed data set for farms across the Corn Belt, to show that increasing yields have been accompanied by rising drought sensitivity, with important implications for future crop yields.*

*The data set contains yields, environmental variables, and management variables for Midwest corn fields in each year from 1995 to 2012. Lobell et al.'s analysis reveals that while corn yield has increased, drought sensitivity has also increased. This may be explained by the fact that with more plants per acre, less soil water is available to each plant. Yield was most sensitive to water vapor pressure deficit (VPD), a factor that has rarely been included in past analyses but that has major implications for yields as climate change progresses in the Corn Belt.*

May 2014



ACS  
Chemistry for Life®

Kyle Dunbar (MMG) was  
chosen for the 2014  
Knowles Award by the  
American Chemical  
Society Division of  
Biological Chemistry.

Department of Chemistry,  
College of Liberal Arts  
and Sciences

4

30 April 2014

A race against  
evolutionary  
time to  
discover new  
cures

[go.illinois.edu/MMG](http://go.illinois.edu/MMG)



Antibiotic resistance is now a "major global threat" to public health, according to a report by the World Health Organization (WHO), which said resistance is now "in every region of the world." The report, based on data from 114 countries, focused on seven bacteria that cause serious diseases, including pneumonia, diarrhea and blood infections.

"Without urgent, coordinated action by many stakeholders, the world is headed for a post-antibiotic era, in which common infections and minor injuries which have been treatable for decades can once again kill," said Keiji Fukuda, WHO's Assistant Director-General for Health Security, in a news release.

Practices such as over-prescribing, failing to finish courses of antibiotics, and reliance on too few products are depleting our cache. The pharmaceutical industry currently runs on less than 10 percent of the synthetic potential of the microbial world, says [Bill Metcalf \(EBI/MMG Theme Leader\)](#), the G. William Arends Professor in Molecular and Cellular Biology. That is, while the most prolific bacteria can produce 30 or 40 antibiotic compounds, scientists know of less than 10 percent of all natural products produced by bacteria.

However, there is hope, said [Doug Mitchell \(MMG\)](#), an assistant professor of chemistry. The Mining Microbial Genomes (MMG) research theme is interested in pathways and genes that can be mined to discover novel products that are medically useful. One goal is to generate a catalog of potential antibiotics and partner with industry to get them to patients.

*Image: Bernard Walker  
© Bernard Walker, used under  
a CC BY-NC 2.0 license.  
[go.illinois.edu/Walker](http://go.illinois.edu/Walker)*

"We use modern techniques to discover antibiotics and other naturally occurring products that might be anticancer agents or immunosuppressants, all of which are complex molecules from nature that have medicinal value," Mitchell said. "We can do this with technologies that weren't available to us even just a few years ago."

MMG is already unlocking the innate potential of bacteria. Mitchell's group developed a novel way to screen antibiotic-producing bacteria and identify natural products that are produced in extremely small quantities (see June 17). Metcalf created an algorithm to analyze microbial genomic data and speed discovery of new therapeutic drugs (see September 28). Richard E. Heckert Endowed Chair in Chemistry [Wilfred van der Donk](#) (MMG) and Biochemistry Professor [Satish Nair](#) (MMG) made a breakthrough in understanding how microbes build some of the powerful antibiotic agents in nature (see November 6).

"If you look at our ancestors, who did not benefit from modern antimicrobial chemotherapies, you can envision a future where our descendants are not going to live lives as full and healthy as ours," Mitchell said. "If resources aren't earmarked for this problem, if we stay on the present course, we are in big trouble."

22 April 2014



Genomic Biology  
[@IGBillinois](#)



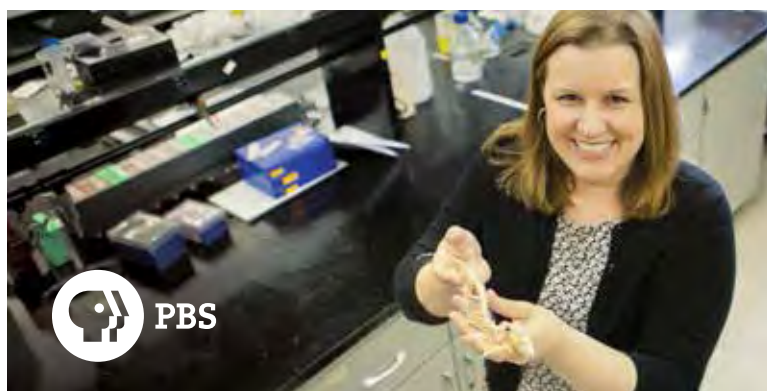
The IGB Art of Science wall installation is complete! Stop by [@IGBillinois](#) to see these breathtaking images.

16 April 2014



IGB researcher stars in national TV series

[go.illinois.edu/YourInnerReptile](http://go.illinois.edu/YourInnerReptile)



Animal biologist Karen Sears (GNDP/RBTE) held a gray short-tailed opossum in front of the camera. Special lighting had transformed this evolutionary researcher's everyday laboratory into a television set for *Your Inner Fish*, a three-part PBS series based on a book by Neil Shubin (also the show's host) that traces 350 million years of human evolution.

During the second episode called "Your Inner Reptile," which aired on April 16, Sears showed the television audience that some of the opossums' developmental processes resemble the evolution of mammals' middle ear bones from reptile jawbones. She described how, as embryonic opossums mature into adults, two tiny bones disconnect from their jawbone, shrink, and move up to become their middle ear bones.

16 April 2014



Don't miss Episode 2 of Your Inner Fish on PBS tonight at 9pm, featuring Karen Sears, assistant professor at the School of Integrative Biology. Tonight's episode is entitled "Your Inner Reptile," and will showcase among other things some of the major transitions in our ancestor's evolution. <http://www.pbs.org/your-inner-fish/about/episode-guide/>

9 April 2014



Genomic Biology  
@IGBillinois

Via @nprnews: What To Do Now That The Heartbleed Bug Exposed The Internet  
<http://n.pr/1qrJdn>

13 April 2014



May Berenbaum  
receives a  
namesake

[go.illinois.edu/Cockroach](http://go.illinois.edu/Cockroach)



Image: Kayla Kaplan and  
Dominic A. Evangelista  
[go.illinois.edu/  
KaplanEvangelista](http://go.illinois.edu/KaplanEvangelista)

“We’ve recently discovered a new species of cockroach in the genus *Xestoblatta*. It’s dirty, it’s ugly, it’s smelly, and it needs a name,” wrote Dominic Evangelista, a Ph.D. candidate at Rutgers University, in a blog post for *Entomology Today* on March 20.

In an effort to fund a research project about tropical landscapes driving evolution, Evangelista turned to Experiment.com, a crowdfunding site for scientific endeavors. He offered the privilege to name the new cockroach to the highest bidder.

Swanlund Professor of Entomology May Berenbaum (GEGC), also head of the Department of Entomology, read about the new insect’s biology and was sold. The species, now named *Xestoblatta berenbaumae*, represented a quarter of the cockroach specimens Evangelista collected in Guyana.

Evangelista presented Berenbaum with specimens of *Xestoblatta berenbaumae* at Entomology 2014, ESA’s annual meeting in Portland, Oregon. “There’s no greater honor, and no better form of immortality in science,” she said.

“What an incredibly good illustration of how little we know,” Berenbaum said. “A quarter of the specimens collected were undescribed species!”



10 April 2014



Art of Science 4.0 (22 photos)

The 'Art of Science: Images from the Institute for Genomic Biology, now in its fourth year, is a meeting place between the University and our community as a whole, and a celebration of common ground between science and art. — at [indi go Artist Co-Op](#)



April 2014



*Department of Crop Sciences, College of Agricultural, Consumer and Environmental Sciences*



Stephen Moose (EBI/BSG/GEGC) received a Faculty Award for Excellence from the College of Agricultural, Consumer and Environmental Sciences, recognizing outstanding professional achievement and demonstrated excellence in the areas of teaching, research, and extension.

April 2014



*Department of Animal Sciences, College of Agricultural, Consumer and Environmental Sciences; Department of Microbiology, College of Liberal Arts and Sciences*



Isaac Cann (BCXT/EBI) was awarded the Paul A. Funk Recognition Award by the College of Agricultural, Consumer and Environmental Sciences, presented to faculty and academic professionals for outstanding achievement and major contributions to the betterment of agriculture, natural resources, and human systems.

3-7 April 2014

Cells to societies:  
Images span  
scales of  
measurement,  
and the border  
of art and  
science

[go.illinois.edu/OHareAoS](http://go.illinois.edu/OHareAoS)



Artists and scientists have unique ways of discovering the mysteries of nature, yet they share a common language—the language of images—to communicate with the world. The IGB’s Art of Science series, now in its fourth year, is a celebration of common ground between science and art. This year’s exhibit, held April 3-7, included images of microchannels used to sort single cells, laser dissections of developing root tips, and honey bees identified with colorful paint marks.

As in the past, the exhibit was displayed at the indi go Artist Co-op in Champaign, Illinois. Art of Science images from previous years can also be seen at several locations throughout the state: Champaign Willard Airport, Chicago Midway International Airport, and, since February 2014, O’Hare International Airport in Chicago.

The Art of Science would not exist without the assistance of a Champaign businessman, Doug Nelson from BodyWork Associates, who envisioned the exhibit as a way to engage the public by showcasing the beauty of scientific research.

2 April 2014

[go.illinois.edu/SmilePolitely](http://go.illinois.edu/SmilePolitely)



Of course we know how great our Array Cafe is - but it's nice to see others discovering it as well! Check out a recent article from Smile Politely ...



**Array Cafe has good food down to a science**

The first time I visited Array Cafe was last year, when I was lured in by a sign outside of the Institute for Genomic Biology that read something along the lines of...

[SMILEPOLITELY.COM](http://SMILEPOLITELY.COM)

1 April 2014



Heartbleed  
leaves 17% of  
the Internet's  
web servers  
vulnerable to  
data theft

go.illinois.edu/CNRG



Many popular web servers use OpenSSL to encrypt usernames, passwords and other information so it cannot be accessed by a third party when these data are transferred from a personal computer to a website. The 1.0.1 version of OpenSSL, an open-source project, included a mistake that allowed hackers to retrieve information from the web server's memory without leaving any evidence.

Here's how it works: when a computer is connected to the Internet, it uses a call and response, called a heartbeat, to ensure that the website is actively waiting for its requests. The computer sends a set of data, and the website echoes back those same data. With Heartbleed, a hacker could request extra data from the server's memory, including requests made by other users such as login credentials, cookies and other exploitable information.

The Computer Network and Resource Group (CNRG) at the IGB ran a command to see which machines were vulnerable to Heartbleed and later installed a patch to secure them, said CNRG Director [Dan Davidson](#). To protect IGB users and their data, CNRG uses firewalls and automatically locks out users for five minutes after three incorrect attempts to log in. They also use a security monitoring systems to oversee attempts to hack the IGB, of which there are thousands each day.

These hackers want personal information, like user names, passwords and emails, that they can use for money-making scams. "Few are interested in stealing genomic data because they lack the expertise to understand and exploit it," Davidson said. "They are trying to find a way to break into systems, so that they can send out more spam, that gets out through more systems, so more people get duped into giving them important information."

MORE

MORE

Heartbleed leaves 17% of the Internet's web servers vulnerable to data theft

Medical data, including genomes, are often tied to personal information, said C. Victor Jongeneel (GNDDP), NCSA and IGB Director of Bioinformatics and Director of HPCBio. Healthcare providers, like Mayo Clinic, and researchers are interested in how to share medical information while also protecting it. "Clearly those are contradictory imperatives," Jongeneel said. "But you cannot do large scale human genetics and find genetic causes of diseases without sharing information."

With few human genome projects in the IGB research portfolio, the Institute is able to focus more of its efforts on data preservation. In the meantime, Jongeneel said, "We are trying to make sure that if we do get data that are private and sensitive, we don't do stupid stuff with it, and we comply with all regulatory requirements including HIPAA [Health Insurance Portability and Accountability Act]."

MARCH



19 March 2014

New research seeks beneficial qualities of viruses

[go.illinois.edu/VirusDynamics](http://go.illinois.edu/VirusDynamics)



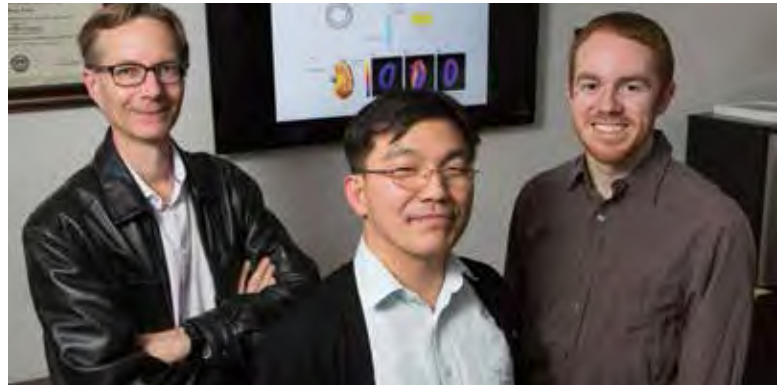
Viruses are responsible for much more than sore throats and stuffy noses. Researchers now believe that some viruses may protect hosts from competitors and help them survive. Despite the fact that viruses are practically everywhere and affect every living thing, scientists know very little about their positive impact on their hosts.

Image: Graham Beards  
© Graham Beards, used  
under a CC BY-SA 3.0 license.  
[go.illinois.edu/Beards](http://go.illinois.edu/Beards)

17 March 2014

## Combining weak chemical forces to strengthen a novel imaging technology

[go.illinois.edu/ContrastAgent](http://go.illinois.edu/ContrastAgent)



Chemical and biomolecular engineer Hyunjoon Kong (RBTE) and colleagues have improved MRI (a noninvasive test that allows doctors to see detailed pictures of tissues and organs). To do so, they turned current contrast agent technology on its head—or rather, they turned it inside out. The new compound they designed in collaboration with Roger Adams Professor of Chemistry Steven C. Zimmerman is not only more effective, but also self-assembling.

When doctors perform an MRI, they administer a contrast agent: a chemical that improves the clarity of the resulting image. In a recent *ACS Nano* article, the team reported their creation of a contrast agent in the form of a nanoparticle, whose components naturally join together in solution. The nanoparticle produced clear diagnostic images in comparison with other contrast agents. In a second study published in *Langmuir*, Kong and Smith developed a process for chemically cross-linking the components of the nanoparticle that made the nanoparticles more stable.

The work reported in *ACS Nano* was a collaboration among Kong, Zimmerman, and others at Illinois, as well as Dr. Sanjay Misra and researchers at the Mayo Clinic. Both studies were supported by funding from the NIH and Illinois Center for Advanced Study.

March 2014

Department of  
Bioengineering, College of  
Engineering



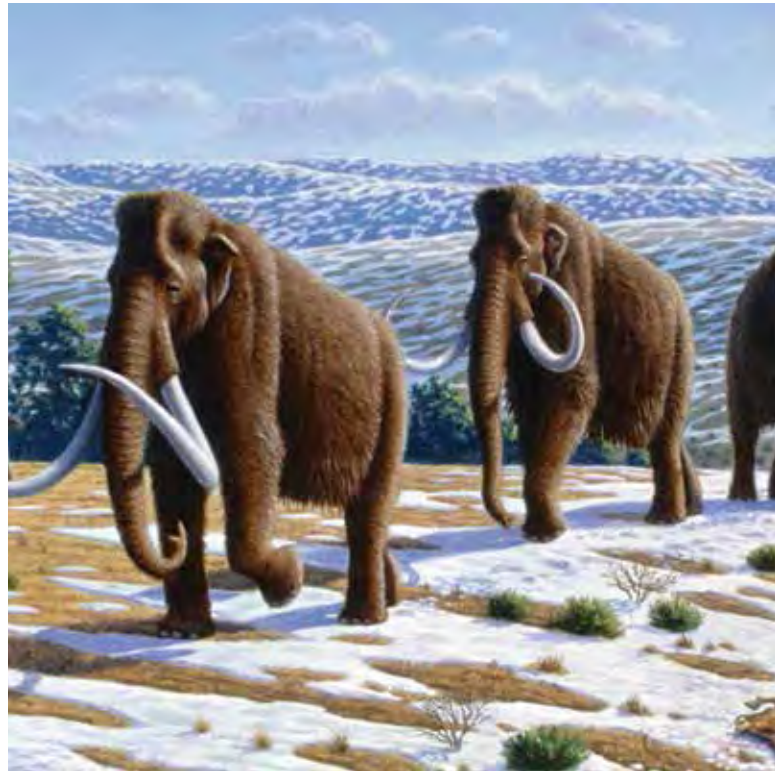
Sua Myong (CDMC) received the Rose Award for Teaching Excellence, created to foster and reward excellence in undergraduate teaching in the College of Engineering.

13 March 2014



## Mammoth discovery highlights ancient DNA

sib.illinois.edu/malhi



*Image: Mauricio Antón*  
© 2008 Public Library of Science,  
used under a CC BY 2.5 license.  
go.illinois.edu/Anton

Scientists recently unearthed one of the world's best-preserved woolly mammoth specimens. Scientists hope the 43,000-year-old specimen has intact DNA that can be used to recreate the extinct species' genome.

Some want to use this genetic code to clone the mammoth, nicknamed Buttercup, a goal that presents both scientific hurdles and ethical considerations. So far, the team has not found a complete copy of Buttercup's genome. However, they may be able to recreate it by piecing together long fragments of DNA.

Associate Professor of Anthropology [Ripan Malhi \(BioBEL/RBTE\)](#) said this type of ancient DNA research is accelerating right now, due to recent advances. "We can do things now that we haven't been able to do before," Malhi said. "I like to say that ancient DNA is in a golden era. When I was a graduate student working on ancient DNA, it probably would've taken me years to sequence one complete mitochondrial genome, and now we can do that in a week or so."

Malhi studies the ancient history of humans (some more than 10,000 years old) in North and South America (see July 11). While some specimens are found in arctic conditions, similar to Buttercup, others come from shell middens, ancient trash heaps that preserve DNA remarkably well. Malhi has found that while cultural artifacts (like pottery) diffused over thousands of years, DNA evidence suggests that Native American families generally remained in the same geographic region (see May 16).

"Many North American indigenous communities lost a strong connection with their past because of the effects of European contact and colonization," Malhi said. "Due to the large amount of death that happened at that time, the oral histories that may have been passed down were limited or nonexistent. In the way of revitalizing these communities and learning about their past, indigenous peoples can do it through archeology, oral histories, and the use of DNA as a way of understanding their ancestral influence."

5 March 2014



Mirhee Lee  
@Meeds80



A dessert fit for @IGBllinois Scared and excited to eat it! Hope it doesn't taste like a mouse!

3 March 2014



## Scientists 'resurrect' 30,000-year-old giant virus

[life.illinois.edu/whitaker/](http://life.illinois.edu/whitaker/)



Image:  
Brocken Inaglory  
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[go.illinois.edu/Inaglory](http://go.illinois.edu/Inaglory)

Scientists discovered the largest known virus, buried 100 feet within the Siberian permafrost, where it has been hidden for 30,000 years. In a laboratory, they reactivated the ancient virus and found that it infects single-celled amoebas.

This discovery has raised concerns that other viruses, including smallpox found in frozen corpses, may be released as the planet warms. "But think about what they did," said [Maria Bautista](#), a graduate student in the lab of Microbiology Professor [Rachel Whitaker \(BCXT\)](#). "They took the samples to a lab and put the viruses on a plate of cells that were just waiting to be infected. The chances are slim that this virus would just aerosolize where a live, active amoeba is hanging out on the frozen tundra."

Instead of the arctic tundra, Whitaker's lab is hunting for new viruses in acidic hot springs at Yellowstone National Park and Kamchatka, Russia (see March 19). "Obviously they are completely different environments, but the strategies we use are very similar," Bautista said. "We are both looking for novel, different viruses."

MORE

MORE

Scientists 'resurrect'  
30,000-year-old giant virus

Whitaker is a member of the Biocomplexity (BCXT) research theme, which uses genomics to explore the interplay between evolution and ecology, especially in extreme environments. Other IGB research explores how viruses integrate themselves into an organism's genome (see September 23). To date, scientists estimate that they have only explored one percent of existing viral diversity.

"We really don't understand how host-virus interactions are shaping the evolution of natural populations," Bautista said. "To do so, we need to go find these viruses, find out if they can confer any benefit to their hosts, or if they make them sick. If we don't find them, and we don't study these interactions, we are always going to be missing part of the equation."

FEBRUARY





25 February 2014

Team converts sugarcane to a cold-tolerant, oil-producing crop

go.illinois.edu/PETROSS



A multi-institutional team reports that it can increase sugarcane's geographic range, boost its photosynthetic rate by 30 percent and turn it into an oil-producing crop for biodiesel production.

Stephen Long (BSD/EBI/GEGC), Gutgsell Endowed Professor of Crop Sciences and Plant Biology, and his team have an ambitious goal: to enable growers to meet 69 percent of the U.S. mandate for renewable fuels by growing the modified sugarcane on abandoned land in the southeastern United States. The team presented its latest findings on February 25 at the DOE's Advanced Research Projects Agency-Energy (ARPA-E) Energy Innovation Summit in Washington, D.C. ARPA-E supported this research.

February 2014

Department of Chemical and Biomolecular Engineering, College of Engineering



Brendan Harley (RBTE) received the Everitt Award for Teaching Excellence from the College of Engineering for development of an innovative elective course on tissue engineering. The winner of this award is selected by students from the Engineering Council.

24 February 2014



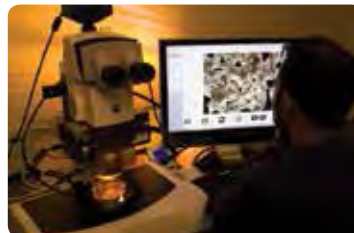
Genomic Biology @IGBillinois



@zeiss\_micro Key Account Manager Sam Byerly sent us an @ohare Art of Science exhibit #science selfie. #IGB #ILLINOIS



Genomic Biology @IGBillinois



@zeiss\_micro Love this #science selfie and your cutting-edge #microscopes that made this @Sci\_Art exhibit possible. pic. twitter.com/XVdGnQGVMZ



ZEISS Microscopy @zeiss\_micro

@IGBillinois and we love your #sciart exhibit! best wishes from the whole team ;)



Genomic Biology  
@IGBillinois

Still haven't found an outfit to debut on the @TheEllenShow? We've got the #science grad students covered. #Ellenois pic.twitter.com/iMSU23PmFC



Caroline  
@c\_cvetkovic

@IGBillinois or these outfits? :) #scienceselfie @TheEllenShow



Genomic Biology  
@IGBillinois

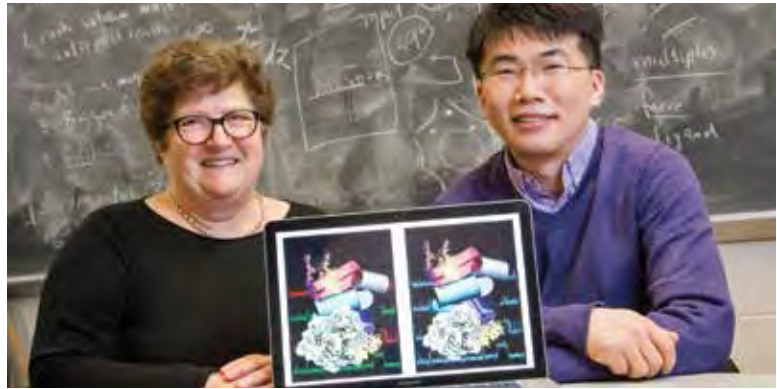
@c\_cvetkovic LOVE IT! Can't believe these didn't make the cut. Maybe there will be a next time, @TheEllenShow? #ILLINOISlove #SCIENCElove



Christopher Rao (BSD/ EBI) received the Excellence in Research Award from the College of Engineering for his research accomplishments in the area of biomolecular engineering, on topics such as infectious disease, bioenergy production, and synthetic biology.

12 February 2014  
Advanced techniques yield new insights into ribosome self-assembly

go.illinois.edu/  
RibosomeAssembly



Ribosomes, the cellular machines that build proteins, are themselves made up of dozens of proteins and a few looping strands of RNA. A study reported in *Nature* offered new clues about how the ribosome, the master assembler of proteins, also assembles itself. Better understanding of how the ribosome is put together may suggest new possible antibiotic targets. The NSF and HHMI funded this project.

“The ribosome has more than 50 different parts—it has the complexity of a sewing machine in terms of the number of parts,” said Gutsell Professor of Physics Taekjip Ha (CDMC Theme Leader). “A sewing machine assembles other things, but it cannot assemble itself if you have the parts lying around. The ribosome, however, can do that. It’s quite amazing.”

Ha, who led the research, worked with William and Janet Lycan Professor of Chemistry Zaida Luthey-Schulten (BCXT) and Johns Hopkins University Biophysics Professor Sarah Woodson. Together, they discovered that as a ribosome comes together, the first component protein to be added tends to bind to RNA when the RNA takes on an unusual conformation—one not seen in the fully assembled ribosome. Shape and flexibility of the RNA may help subsequent proteins to incorporate themselves into the ribosome as it forms.

10 February 2014



Don't miss our upcoming talk this Friday with geologist Bruce Fouke as he discusses the Art of Yellowstone Science - part of the NASA Astrobiology Institute Seminar Lecture Series.



**The Art of Yellowstone Science: Mammoth Hot Springs as a Window on Evolutionary Processes**

Friday, 14 February 2014 at 12:00

Carl R. Woese Institute for Genomic Biology in Urbana, Illinois

7 February 2014



Winter  
Olympics  
highlight  
sports'  
triumphs and  
pitfalls

go.illinois.edu/RBTEtheme



Image:

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go.illinois.edu/Tenetko

The sports of the Winter Olympics are filled with a sparkling, daredevil charm that distinguishes the Games from their summer counterpart. Several first-time American Olympians returned from the 2014 Winter Games, held February 7-23 in Sochi, Russia, with gold medals in snowboard and ski events. However, two stellar and popular skiers, Bode Miller and Lindsey Vonn, were forced to miss events by another ubiquitous aspect of these winter sports: serious and recurring injury.

Both Miller and Vonn have undergone knee surgeries in the past few years, followed by lengthy recovery processes. A recent study of elite winter athletes suggested that more severe injuries are more frequent than milder ones, in contrast to high-risk summer sports, in which injury frequency typically drops as severity increases. The majority of the severe injuries seen in many winter sports are knee ligament injuries. Connective tissue damage is difficult to heal; scar tissue forms readily, and current treatments rely on reconstructing or transplanting tissue, strategies that leave the joint less stable and more vulnerable to relapse.

What if injured tendons or ligaments could be coaxed to recover by using some of the same growth processes that formed them in the first place? Researchers, including many in the Regenerative Biology & Tissue Engineering (RBTE) research theme, are working to create medical technologies that would actively promote regrowth of damaged bone, muscle, and connective tissues. Brendan Harley (RBTE), an assistant professor in the Department of Chemical and Biomolecular Engineering, and his lab are engaged in a particularly complex challenge: how to regenerate the interfaces between multiple tissues, such as tendon and bone.

"The tissues in our body are not uniform. Instead they contain patterns and gradients essential to their function. What I'm most excited about is how you develop biomaterials that replicate these heterogeneities in order to promote regeneration," Harley said. One technology his lab is developing: a porous "collagen foam, like a kitchen sponge," that could be taken from storage in an operating room, loaded with a patient's own cells (see July 17 and May 30) , and implanted in the body to actively promote regeneration of the tendon-bone interface. This collagen scaffold contains structural, mechanical, and biochemical signals that aid and guide tissue growth.

Part of Harley's research is to consider how the collagen scaffold can be designed so that the rate of tissue formation is synchronized with the rate at which the scaffold naturally degrades inside the body. Another critical engineering challenge is to balance competing concerns between the porosity of the scaffold required to promote healing and the strength of the scaffold required for it to remain intact in the patient.

"You can make scaffolds stronger by making them less porous, but that impairs both the cells' ability to get in, and the ability for nutrients to diffuse in," Harley said. "In our group, we've been inspired by design principles you see in porcupine quills and sunflower stalks. In these bioinspired structures, we're integrating reinforcing elements such as high-density membrane shells or fiber reinforcement structures to create a composite scaffold that has the requisite strength and porosity." In a few more years, this technology and others like it may restore the physical fitness of orthopedic patients, whether their arena is an Olympic slope or their own backyard.

4 February 2014



We've partnered with the Department of Anthropology, and the Native American and Indigenous Studies Program at the University of Texas at Austin, to host the next Summer Internship for Native Americans in Genomics (SING) Workshop.



#### 2014 Summer Internship for Native Americans in Genomics

University of Illinois and University of Texas partner to host the Summer Internship for Native Americans in Genomics (SING) Workshop.

[IGB.ILLINOIS.EDU](http://IGB.ILLINOIS.EDU)

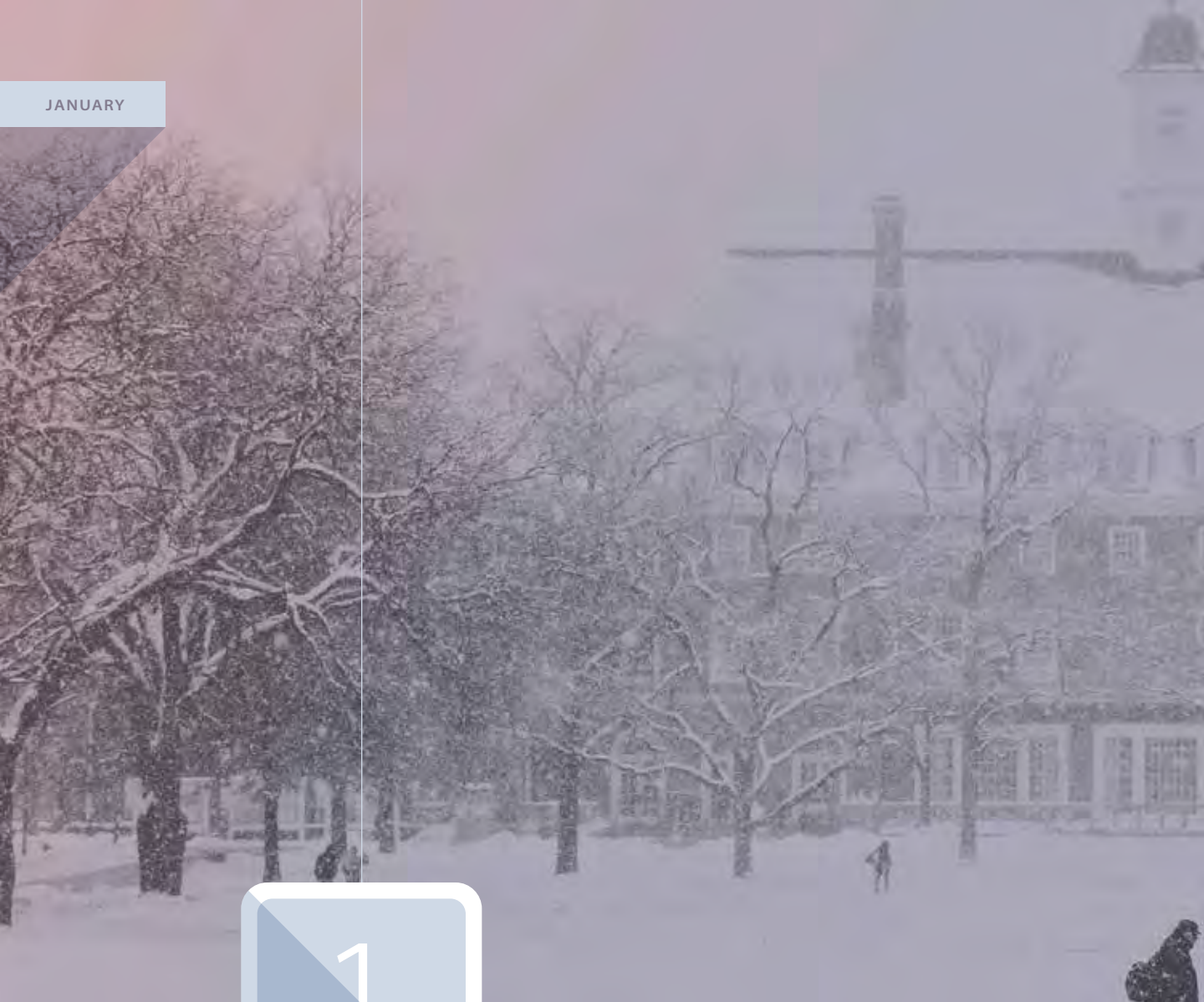
February 2014



*Department of  
Bioengineering, College of  
Engineering*



Jun S. Song (CDMC) was named the first Founder Professor of the Department of Bioengineering as part of the Grainger Engineering Breakthroughs Initiative established in 2013 to support big data and bioengineering by enhancing facilities, funding student scholarships, and bringing senior faculty to Illinois.



**January 2014**  
 2014 winter  
 defined by  
 polar vortex



The winter of 2014 was marked by heavy snowfall and record low temperatures. On January 6, 2014, Central Illinois was colder than Anchorage, Alaska. Non-essential Illinois employees were encouraged to stay home when temperatures plummeted to -6 degrees Fahrenheit, with a wind chill of -40.

Meteorologists partly credited this unusually cold weather to the polar vortex, a pocket of extremely cold air that usually circulates around the Earth's poles. A recent study established a link between the effects of climate change, i.e. warming oceans and melting ice, and the distorted polar vortex bringing arctic weather more frequently into the Midwest.

This isn't the first time that America's Heartland will experience the ill effects of climate change, nor will it be the last. The summer of 2012 was characterized by record heat



and widespread drought. This increasing variability is just as concerning as the warming trend, said Jim Angel, the Illinois State Climatologist. The Genomic Ecology of Global Change (GEGC) research theme predicts what these changes will mean for ecosystems and develops ways to overcome these challenges to meet humanity's needs.

Using novel technologies, researchers in the GEGC theme are able to simulate rising temperatures and levels of carbon dioxide and ozone to study how agronomic ecosystems will respond to climate change.

GEGC experts reported that as carbon dioxide levels rise, crops become less nutritious (see June 3). "When we take all of the FACE [Free Air Concentration Enrichment] experiments we've got around the world, we see that an awful lot of our key crops have lower concentrations of zinc and iron in them at high CO<sub>2</sub>," said Andrew Leakey (EBI/GEGC), associate professor of plant biology. "And zinc and iron deficiency is a big global health problem already for at least 2 billion people."

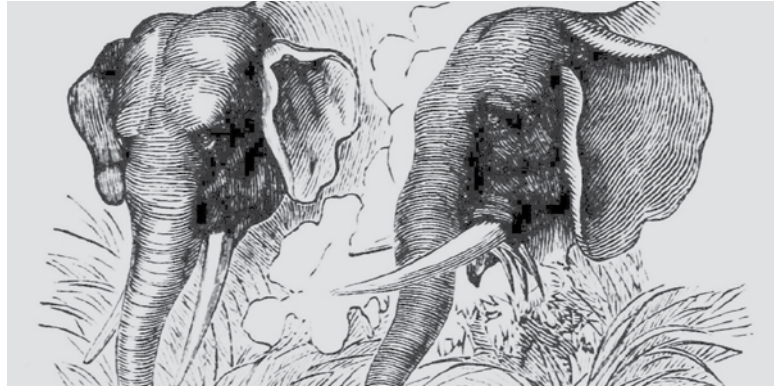
Fellow GEGC members Stephen Long (BSD/EBI/GEGC) and Don Ort (GEGC/BSD), both professors in plant biology and crop sciences, are engineering plants that photosynthesize more efficiently and therefore produce more. It's not a silver bullet, but this increase in yield can help meet growing demands and compensate for yield hits from climate change (see June 25).

9 January 2014



## War elephant myths debunked by DNA

go.illinois.edu/WarElephant



Through DNA analysis, Animal Sciences Professor Alfred Roca (GNBP) has disproved years of rumors and hearsay surrounding the ancient Battle of Raphia, the only known battle between Asian and African elephants. This work was supported by the United States Fish and Wildlife Service and published in the *Journal of Heredity*.

The battle took place in 217 B.C. between Ptolemy IV, the King of Egypt, and Antiochus III the Great, the King of the Seleucid kingdom that reached from modern-day Turkey to Pakistan. In 1948, Sir William Gowers reasoned that Ptolemy must have fought with forest elephants that fled from larger Asian elephants, as Greek historian Polybius described 100 years after the battle. Until now, the question remained: Did Ptolemy employ African savanna elephants (*Loxodonta africana*) or African forest elephants (*Loxodonta cyclotis*) in the Battle of Raphia?

"Using three different markers, we established that the Eritrean elephants are actually savanna elephants," said Adam Brandt, a doctoral candidate in Roca's lab. "Their DNA was very similar to neighboring populations of East African savanna elephants, but with very low genetic diversity, which was expected for such a small, isolated population."

7 January 2014



Lindsey Vonn

I am devastated to announce that I will not be able to compete in Sochi. I did everything I possibly could to somehow get strong enough to overcome having no ACL but the reality has sunk in that my knee is just too unstable to compete at this level. I'm having surgery soon so that I can be ready for the World Championships at home in Vail next February. On a positive note, this means there will be an additional spot so that one of my teammates can go for gold. Thank you all so much for all of the love and support. I will be cheering for all of the Olympians and especially team USA! XO Lindsey

January 2014



Amy Wagoner Johnson (RBTE) was awarded a Chair of Excellence by the NanoSciences Foundation. This award program attracts talented researchers to collaborate with laboratories on progressive research projects in Grenoble, France. (Department of Mechanical Science and Engineering, College of Engineering)



January 2014

*Department of Electrical  
and Computer Engineering,  
College of Engineering*



Brian T. Cunningham (MMG) was elected as a 2013 Charter Fellow of the National Academy of Inventors (NAI). According to the NAI, election is a "high professional distinction accorded to academic inventors who have demonstrated a highly prolific spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on quality of life, economic development, and the welfare of society."

1 January 2014



Kingman Arts PhotoBlog

Happy New Year!  
via the-science-llama



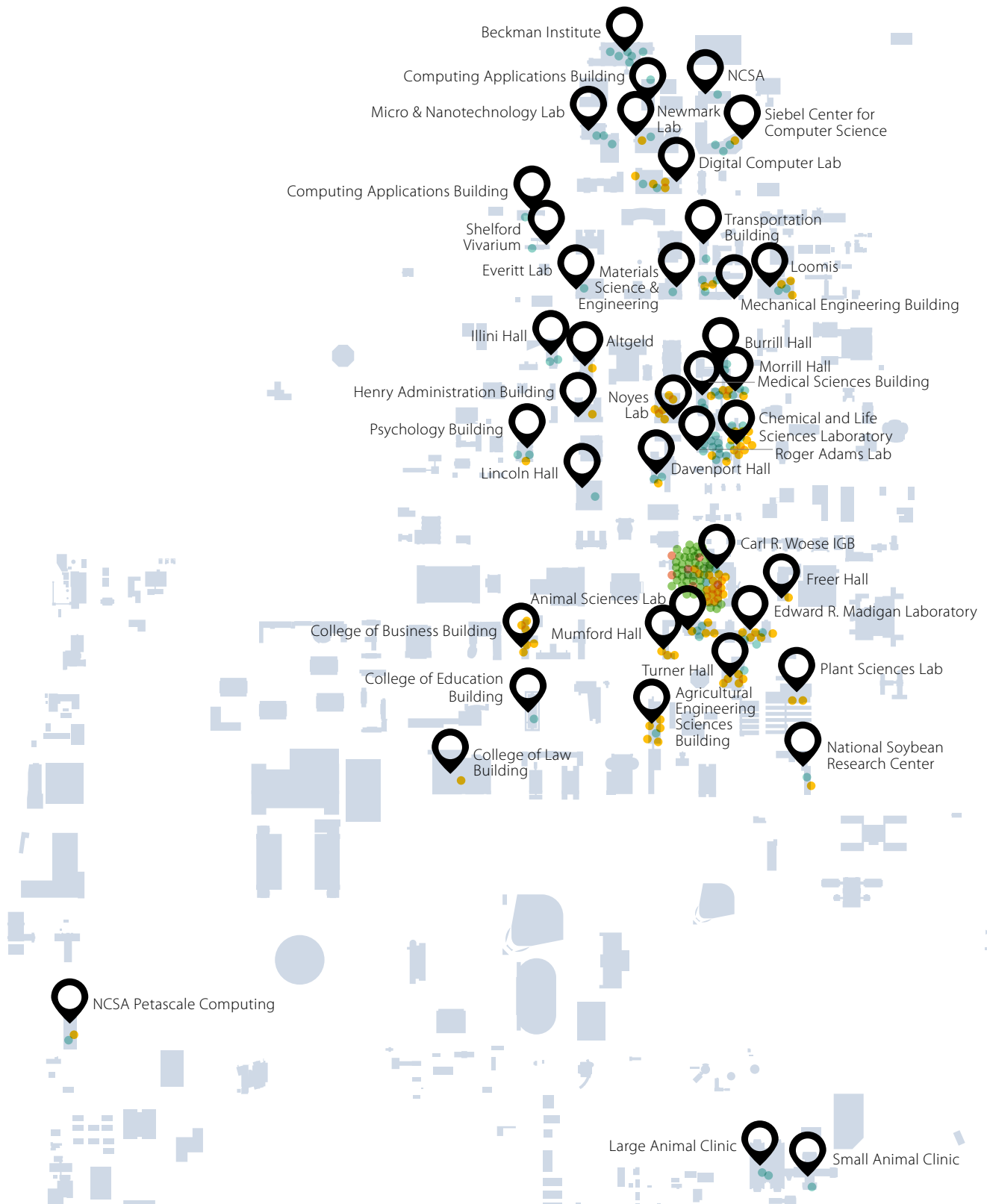
31 December 2013



Ed Yong  
@edyong209

If you had a [lousy] 2013, regression to the mean is your friend in 2014. If you had a good 2013, ignore this tweet, what do I know?

Just as a year is made of months, made of days, our Institute is made of transdisciplinary themes, made of faculty, who believe that collaboration is the linchpin of discovery. Their breakthroughs, detailed in publications that include *Science* and *Nature*, are made possible by the generous support of funding agencies and donors.



NCSA Petascale Computing



### PEOPLE

IGB faculty span 7 colleges and 32 departments

- Faculty: 69
- Affiliates: 69
- Administration: 43
- IGB Fellows: 6
- Visiting Researchers: 20

- Student Staff: 38
- Research Staff: 141
- Post Docs: 144
- Undergraduates: 245
- Graduate Students: 376

**TOTAL: 1151**



Highlighted authors are  
IGB members or affiliates.

## IGB FY14 PUBLICATIONS

268 papers published, 9 in *Science* or *Nature*

### SCIENCE

[Chemla, Y.R.](#), [Ha, T.](#) "Ultraslow relaxation of confined DNA." *Science*. 2014, 345:380-381.

Kennett DJ, Asmerom Y, Kemp BM, Polyak V, Bolnick DA, [Malhi RS](#), Culleton BJ. "Early Americans: misstated results." *Science*. 2014, 345:390.

Watanabe J, Hattori M, Berriman M, Lehane MJ, Hall N, Solano P, Aksoy S, Hide W, Touré Y, Attardo GM, Darby AC, Toyoda A, Hertz-Fowler C, Larkin DM, Cotton JA, Sanders MJ, Swain MT, Quail MA, Inoue N, Ravel S, Taylor TD, Srivastava TP, Sharma V, Warren W, Wilson RK, Suzuki Y, Lawson D, Hughes DST, Megy K, Masiga DK, Mireji PO, Hansen IA, Van Den Abbeele J, Benoit JB, Bourtzis K, Obiero GFO, [Robertson HM](#), Jones JW, Zhou J-J, Field LM, Friedrich M, Nyanjom SRG, Telleria EL, Caljon G, Ribeiro JMC, Acosta-Serrano A, Ooi C-P, Rose C, Price DP, Haines LR, Christoffels A, Sim C, Pham DQD, Denlinger DL, Geiser DL, Omedo IA, Winzerling JJ, Peyton JT, Marucha KK, Jonas M, Meuti ME, Rawlings ND, Zhang Q, Macharia RW, Michalkova V, Dashti ZJS, Baumann AA, Gäde G, Marco HG, Caers J, Schoofs L, Riehle MA, Hu W, Tu Z, Tarone AM, Malacrida AR, Kibet CK, Scolari F, Koekemoer JJO, Willis J, Gomulski LM, Falchetto M, Scott MJ, Fu S, Sze S-H, Luiz T, Weiss B, Walshe DP, Wang J, Wamalwa M, Mwangi S, Ramphul UN, Snyder AK, Brelsfoard CL, Thomas GH, Tsiamis G, Arensburger P, Rio RVM, Macdonald SJ, Panji S, Kruger A, Benkahla A, Balyeidhusa ASP, Msangi A, Okoro CK, Stephens D, Stanley EJ, Mpondo F, Wamwiri F, Mramba F, Siwo G, Githinji G, Harkins G, Murilla G, Lehväsliaho H, Malele I, Auma JE, Kinyua JK, Ouma J, Okedi L, Manga L, Aslett M, Koffi M, Gaunt MW, Makgamathe M, Mulder N, Manangwa O, Abila PP, Wincker P, Gregory R, Bateta R, Sakate R, Ommeh S, Lehane S, Imanishi T, Osamor VC, Kawahara Y. "Genome sequence of the tsetse fly (*Glossina morsitans*): vector of African trypanosomiasis." *Science*. 2014, 344:380-386.

Chatters JC, Kennett DJ, Asmerom Y, Kemp BM, Polyak V, Blank AN, Beddows PA, Reinhardt E, Arroyo-Cabrales J, Bolnick DA, [Malhi RS](#), Culleton BJ, Erreguerena PL, Rissolo D, Morell-Hart S, Stafford TW Jr. "Late Pleistocene human skeleton and mtDNA link Paleoamericans and modern Native Americans." *Science*. 2014, 344:750-754.

### NATURE

Cooper KL, [Sears KE](#), Uygur A, [Maier J](#), Baczkowski KS, Brosnahan M, Antczak D, Skidmore JA, Tabin CJ. "Patterning and post-patterning modes of evolutionary digit loss in mammals." *Nature*. 2014, 511:41-45.

Moroz LL, Kocot KM, Citarella MR, Dosung S, Norekian TP, Povolotskaya IS, Grigorenko AP, [Dailey C](#), Berezikov E, Buckley KM, Ptitsyn A, Reshetov D, Mukherjee K, Moroz TP, Bobkova Y, Yu F, Kapitonov VV, Jurka J, Bobkov YV, Swore JJ, Girardo DO, Fodor A, Gusev F, Sanford R, Bruders R, Kittler E, Mills CE, Rast JP, Derelle R, Solovyev VV, Kondrashov FA, Swalla BJ, [Sweedler JW](#), Rogaev EI, Halanych KM, Kohn AB. "The ctenophore genome and the evolutionary origins of neural systems." *Nature*. 2014, 510:109-114.

Myers SS, Zanolatti A, Kloog I, Huybers P, [Leakey AD](#), Bloom AJ, Carlisle E, Dietterich LH, Fitzgerald G, Hasegawa T, Holbrook NM, Nelson RL, Ottman MJ, Raboy V, Sakai H, Sartor KA, Schwartz J, Seneweera S, Tausz M, Usui Y. "Increasing CO2 threatens human nutrition." *Nature*. 2014, 510:139-142.

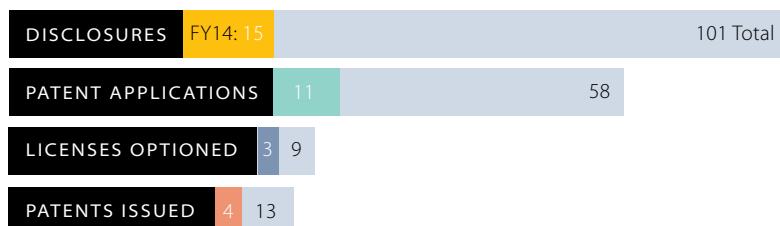
Rasmussen M, Anzick SL, Waters MR, Skoglund P, DeGiorgio M, Stafford TW, Jr., Rasmussen S, Moltke I, Albrechtsen A, Doyle SM, Poznik GD, Gudmundsdottir V, Yadav R, Malaspina AS, White SS 5th, Allentoft ME, Cornejo OE, Tambets K, Eriksson A, Heintzman PD, Karmin M, Korneliussen TS, Meltzer DJ, Pierre TL, Stenderup J, Saag L, Warmuth VM, Lopes MC, Malhi RS, Brunak S, Sicheritz-Ponten T, Barnes I, Collins M, Orlando L, Balloux F, Manica A, Gupta R, Metspalu M, Bustamante CD, Jakobsson M, Nielsen R, Willerslev E. "The genome of a Late Pleistocene human from a Clovis burial site in western Montana." *Nature*. 2014, 506:225-229.

Kim H, Abeyirigunawardena SC, Chen K, Mayerle M, Ragnathan K, Luthey-Schulten Z, Ha T, Woodson SA. "Protein-guided RNA dynamics during early ribosome assembly." *Nature*. 2014, 506:334-338.



#### ECONOMIC DEVELOPMENT

By the end of FY14 the IGB had 101 total disclosures, including 33 from the EBI, and 58 patent applications, of which 17 were from the EBI.



#### Patents Issued

##### ***"High Resolution Sensing and Control of Electrohydrodynamic Jet Printing"***

Andrew Alleyne, John Rogers, Kira Barton, Placid Ferreira, Sandipan Mishra

##### ***"Compositions and Methods Including Cell Death Inducers and Procaspace Activation"***

Karson Putt, Paul Hergenrother, Quinn Peterson, Valerie Fako

##### ***"Materials and Methods for Autonomous Restoration of Electrical Conductivity"***

Aaron Finke, Aaron Jackson, Benjamin Blaiszik, Jeffrey Moore, Joshua Ritchey, Khalil Amine, Marta Baginska, Mary Caruso, Nancy Sottos, Paul Braun, Scott White, Susan Odom

##### ***"Therapeutic Methods and Agents for Treating Myotonic Dystrophy"***

Chun-Ho Wong, Jessie Peh, Paul Hergenrother, Steven Zimmerman

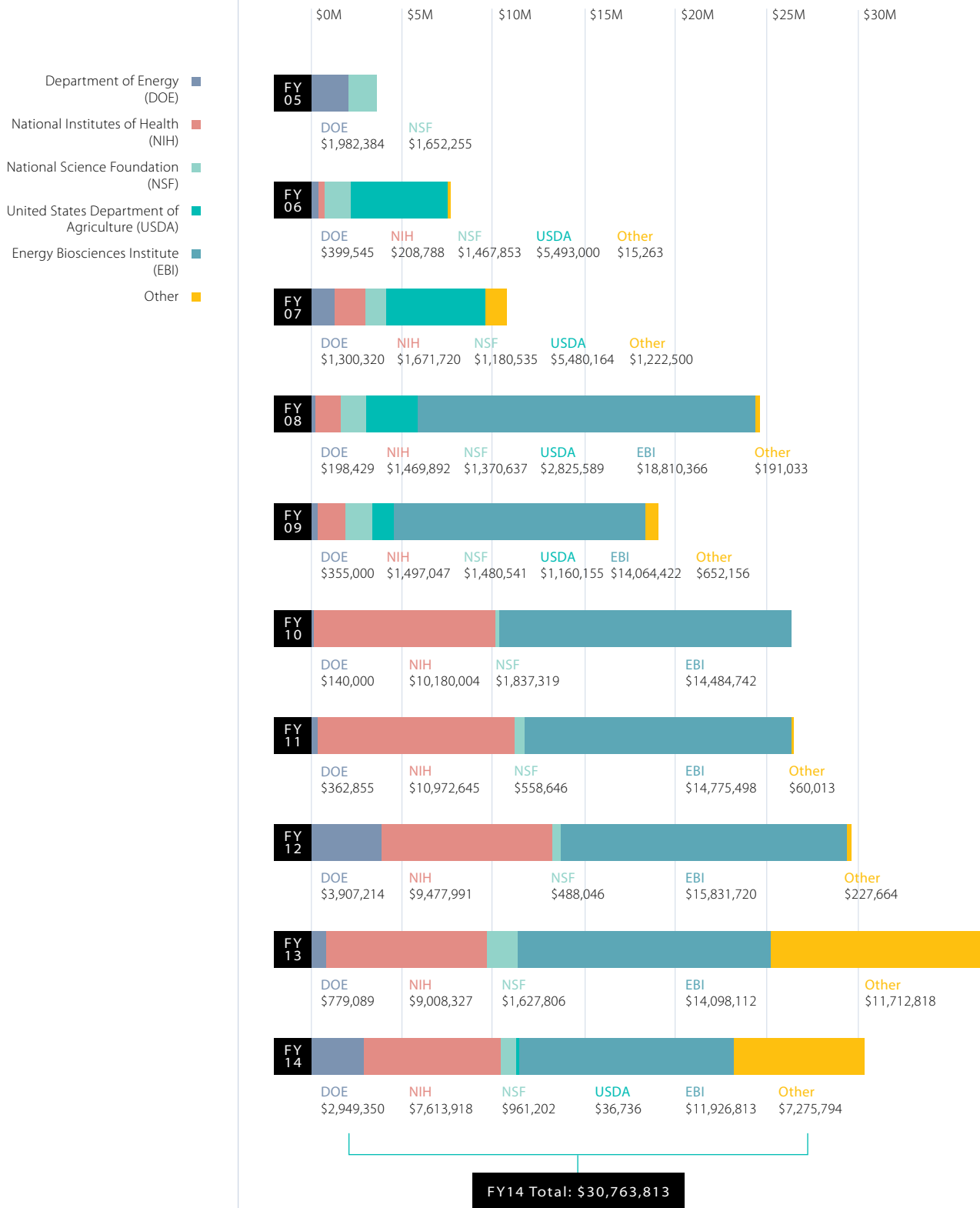
#### IGB CORE FACILITIES USAGE

FY14 Users – 109 Research Groups, 293 active users

MORE

Economic Development

IGB GRANT FUNDING





## GIVING AND DONOR ROLL

Thank you to all the individuals, foundations, corporations, and organizations that have supported the Carl R. Woese Institute for Genomic Biology. All gifts to the IGB from July 1, 2013 to June 30, 2014 are included in the Honor Roll. Gifts may include any of the following: cash, stock, matching gifts, grants, bequests, planned gifts, gifts-in-kind, real estate, and paid life insurance.

Great care was taken to ensure the accuracy of the Honor Roll listings. We would appreciate you alerting us to any errors or omissions. Please direct your inquiries to Melissa McKillip, IGB Development and Outreach Director, at [mmckilli@illinois.edu](mailto:mmckilli@illinois.edu) or (217) 333-4619.

- American Society of Plant Biologists
- Anonymus
- Bill & Melinda Gates Foundation
- BodyWork Associates
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Image: JD Maloney  
[go.illinois.edu/Maloney](http://go.illinois.edu/Maloney)



**Managing Editor** ● Nicholas Vasi

**Design** ● Mirhee Lee

**Writing** ● Claudia Lutz and Claire Sturgeon

*Contributing writers: Liz Ahlberg, Phil Ciciora, Dusty Rhodes, Siv Schwink, Diana Yates*

**Images** ● Kathryn Coulter

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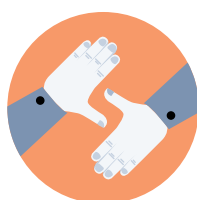
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## WHAT DO THESE ICONS MEAN?

This annual report is a chronicle of news and events in 2014. The IGB news stories feature the four pillars of the Institute's mission, denoted by the icons below. Interspersed with these stories are world news items that highlight connections between ongoing IGB research and current global issues. Combined, these stories illustrate that the IGB is the vertex where science meets society.



RESEARCH



PARTNERSHIPS



EDUCATION



COMMUNITY



WORLD NEWS

## ABBREVIATIONS AND ACRONYMS

### IGB RESEARCH THEMES

BCXT	Biocomplexity
BSD	Biosystems Design
BIOBEL	Business, Economics and Law of Genomic Biology
CDMC	Cellular Decision Making in Cancer
GEGC	Genomic Ecology of Global Change
GNDP	Gene Networks in Neural & Developmental Plasticity
MMG	Mining Microbial Genomes
RBTE	Regenerative Biology & Tissue Engineering

### IGB STRATEGIC INDUSTRY PARTNERSHIPS

EBI	Energy Biosciences Institute
CNLM	Center for Nutrition, Learning, and Memory

### OTHER ABBREVIATIONS AND ACRONYMS

AAAS	American Association for the Advancement of Science
ARS	Agricultural Research Service
IGB	Carl R. Woese Institute for Genomic Biology
DOE	Department of Energy
HHMI	Howard Hughes Medical Institute
IUB	NASA Astrobiology Institute for Universal Biology
NIH	National Institutes of Health
NSF	National Science Foundation
USDA	United States Department of Agriculture