

IGB NEWS

Upcoming Events
Monthly Profiles
Happenings at IGB

Image Of The Month

IP @ IGB

Department Announcements

Volume 8, Number 6

UPCOMING EVENTS

IGB Seminar (MMG)

Culture Independent Approaches to Natural Product Discovery

October 20, 2015, 12:00 p.m.

612 Carl R. Woese Institute for Genomic Biology

Sean F. Brady, PhD

The Rockefeller University

David Rockefeller Graduate Program,
the Tri-Institutional MD-PhD Program
and the Tri-Institutional PhD Program
in Chemical Biology

Lunch with the Core

*The Invisible Mouse – Revealing the
Inner Workings of the Social Brain with
3D CLARITY Imaging*

October 21, 2015, 12:00 p.m.

612 Carl R. Woese Institute for Genomic Biology

Chris Seward

Stubbs Lab

University of Illinois

Harris A. Lewin Pioneer in Genomic Biology Distinguished Lecture

*Evolutionary Genomic Analyses of African
Populations: Implications for Human Evolution
and Disease*

October 27, 2015, 12:00 p.m.

612 Carl R. Woese Institute for Genomic Biology

Sarah A. Tishkoff, PhD

David and Lyn Silfen University Professor in
Genetics and Biology

University of Pennsylvania

2015 David Gottlieb Memorial Lecture

*Neglected Microbes, Cryptic Pathways, and their
Impact on Infectious Diseases*

October 27, 2015, 4:00 p.m.

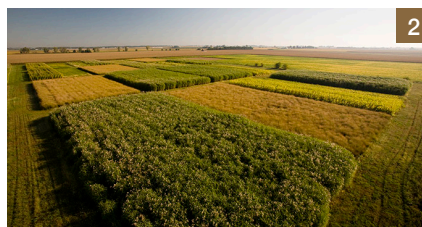
B102 Chemical & Life Sciences Lab

Prof. Dr. Christian Hertweck

Professor for Natural Product Chemistry,
Friedrich Schiller University, Jena

Head of Department Biomolecular Chemistry,
Leibniz Institute for Natural Product Research
and Infection Biology - Hans Knöll Institute (HKI)

FEATURED NEWS



It's Time To Stop Thinking in
Terms of Food Versus Fuel



Study Adds to Evidence
That Viruses Are Alive

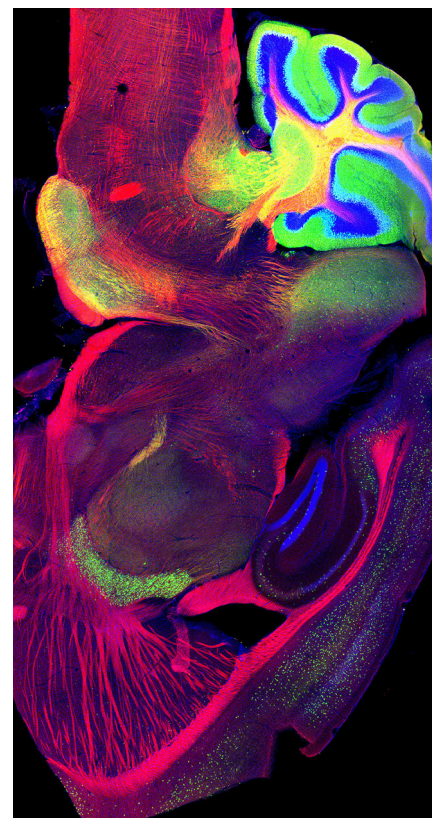


Profile: UIUC_Illinois
The Illinois iGEM Team



On the Grid:
Happenings at IGB

IMAGE OF THE MONTH



This month's image features a 100um thick mouse brain slice, cleared with optimized CLARITY techniques for imaging on the IGB LSM 710 confocal microscope. Novel imaging techniques are necessary for examining whole brain protein expression patterns. Animal brains are large, complex structures difficult to image comprehensively on thin sections by traditional immunohistochemistry (IHC) techniques.

This image is provided courtesy of
Chris Seward, of the Lisa Stubbs Lab.

IGB News

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



It's Time To Stop Thinking in Terms of Food Versus Fuel

Whether you have taken a side or a backseat in the discussion, the “food versus fuel” debate affects us all. Some say growing more biofuel crops today will decrease greenhouse gas emissions, but will make it harder to produce food tomorrow, which has prevented the U.S. from maximizing the potential of environmentally beneficial biofuels.

In a recent article, published by the National Academy of Engineering, University of Illinois’ Gutzwill Endowed Chair of Plant Biology and Crop Sciences Steve Long and University of California’s Philomathia Professor of Alternative Energy Chris Somerville predict farmers can sustainably, and affordably, meet humanity’s growing demand for food and fuel.

“It is not possible to control which fields are affected by climate change, but we can decide which fields could produce biofuels without impacting food production, and which crops will benefit the environment most,” said Long, who directs the Realizing Increased Photosynthetic Efficiency (RIPE) project at the Carl R. Woese Institute for Genomic Biology.

Biofuel crops capture and store carbon dioxide from the air, lowering greenhouse gases (GHG). This is especially true of the perennial biofuel crops, like *Miscanthus* and prairie cordgrass. As a clean-burning alternative to gasoline, biofuels also reduce GHG emissions from your car.

Not all biofuel is created equal

Today ten percent of your car’s fuel (or more if you use E85) comes from ethanol, a fuel often made from fermenting corn and sugarcane. An alternative—called cellulosic ethanol—is produced from

plants (called feedstocks) that are not grown for food.

Corn ethanol produces 34-44 percent less GHG emissions than gasoline. Sugarcane ethanol reduces GHG emissions by more than 50 percent; some estimate it reduces GHG by as much as 82 percent. Cellulosic ethanol, when combined with carbon capture and storage, may be a carbon neutral source of fuel with no net GHG emissions.

Cellulosic feedstocks have a lot of other benefits: They convert more sunlight energy into biomass energy per unit land area than food crops. Their deep, soil-binding root systems preserve precious topsoil and recycle nutrients, requiring little or no additional fertilizer. And because they don’t have to be replanted each year, perennial feedstocks have an even smaller carbon footprint than annual crops.

Turn idle acres into fuel sources

The article notes that the U.S. is in a very fortunate position. “The U.S. has many millions of acres of unused and marginal land that could support biofuel crop production, to the economic and environmental benefit of those regions,” Long said. “This cannot be done tomorrow, but with well-planned research and development, in 20 years these acres could provide a perpetual and sustainable source of fuels for the U.S.”

Over the past 25 years, six million hectares of land dropped out of crop production due to federal conservation reserve programs and farmers abandoning marginal land that is not profitable for food crops. Cellulosic feedstocks thrive on this marginal land, including infertile land in the South as well as

semi-desert and salty soils.

Miscanthus × giganteus, a promising cellulosic feedstock, showed no significant difference in yield when grown on high-quality or marginal land in Illinois. In England, it was grown for 14 years without fertilizer without any evidence of yield loss.

Great, but how much will this cost?

While biofuels made from food and feed crops (e.g. corn and sugarcane) will increase the price of food, you won’t notice a price hike at the grocery store; the price of grain is a very small portion of retail food prices in developed countries. This also provides an incentive to the farmer to invest and improve efficiency of production, Long said.

Biofuels will increase food prices in developing regions where large numbers of urban people live on a few dollars a day and depend on raw grains. However, rural small farmers in these areas will benefit from higher crop prices and could invest their profits into increasing production, which would eventually decrease prices.

“We cannot afford to ignore the effects of GHG emissions on our climate,” said Long. “Failing to allocate acreage to produce these sustainable fuels will cost us much more in the long run. But to fully realize the potential of bioenergy, we need support for continued technical improvements, together with effective and enabling policies. Planned in an informed way we can have both food and fuel from plants.” ■

Written by Claire Benjamin. Photo by L. Brian Stauffer.

RESEARCH



Crop sciences professor Gustavo Caetano-Anollés led a study that adds to the evidence that viruses are alive and share a long evolutionary history with other life forms.

Study Adds to Evidence That Viruses Are Alive

A new analysis supports the hypothesis that viruses are living entities that share a long evolutionary history with cells, researchers report. The study offers the first reliable method for tracing viral evolution back to a time when neither viruses nor cells existed in the forms recognized today, the researchers say.

The new findings appear in the journal *Science Advances*.

Until now, viruses have been difficult to classify, said University of Illinois crop sciences and IGB faculty Gustavo Caetano-Anollés, who led the new analysis with graduate student Arshan Nasir. In its latest report, the International Committee on the Taxonomy of Viruses recognized seven orders of viruses, based on their shapes and sizes, genetic structure and means of reproducing.

“Under this classification, viral families belonging to the same order have likely diverged from a common ancestral virus,” the authors wrote. “However, only 26 (of 104) viral families have been assigned to an order, and the evolutionary relationships of most of them remain unclear.”

Part of the confusion stems from the abundance and diversity of viruses. Less than 4,900 viruses have been identified and sequenced so far, even though scientists estimate there are more than a million viral species. Many viruses are tiny – significantly smaller than bacteria or other microbes – and contain only a handful of genes. Others, like the recently discovered mimiviruses, are huge, with genomes bigger than those of some bacteria.

The new study focused on the vast repertoire of protein structures, called “folds,” that are encoded in the genomes of all cells and viruses. Folds are the structural building blocks of proteins, giving them their complex, three-dimensional shapes. By comparing fold structures across different branches of

the tree of life, researchers can reconstruct the evolutionary histories of the folds and of the organisms whose genomes code for them.

The researchers chose to analyze protein folds because the sequences that encode viral genomes are subject to rapid change; their high mutation rates can obscure deep evolutionary signals, Caetano-Anollés said. Protein folds are better markers of ancient events because their three-dimensional structures can be maintained even as the sequences that code for them begin to change.

Today, many viruses—including those that cause disease—take over the protein-building machinery of host cells to make copies of themselves that can then spread to other cells. Viruses often insert their own genetic material into the DNA of their hosts. In fact, the remnants of ancient viral infiltrations are now permanent features of the genomes of most cellular organisms, including humans. This knack for moving genetic material around may be evidence of viruses’ primary role as “spreaders of diversity,” Caetano-Anollés said.

The researchers analyzed all of the known folds in 5,080 organisms representing every branch of the tree of life, including 3,460 viruses. Using advanced bioinformatics methods, they identified 442 protein folds that are shared between cells and viruses, and 66 that are unique to viruses.

“This tells you that you can build a tree of life, because you’ve found a multitude of features in viruses that have all the properties that cells have,” Caetano-Anollés said. “Viruses also have unique components besides the components that are shared with cells.”

In fact, the analysis revealed genetic sequences in viruses that are unlike anything seen in cells, Caetano-Anollés said. This contradicts one hypothesis

that viruses captured all of their genetic material from cells. This and other findings also support the idea that viruses are “creators of novelty,” he said.

Using the protein-fold data available in online databases, Nasir and Caetano-Anollés used computational methods to build trees of life that included viruses.

The data suggest “that viruses originated from multiple ancient cells ... and co-existed with the ancestors of modern cells,” the researchers wrote. These ancient cells likely contained segmented RNA genomes, Caetano-Anollés said.

The data also suggest that at some point in their evolutionary history, not long after modern cellular life emerged, most viruses gained the ability to encapsulate themselves in protein coats that protected their genetic payloads, enabling them to spend part of their lifecycle outside of host cells and spread, Caetano-Anollés said. The protein folds that are unique to viruses include those that form these viral “capsids.”

“These capsids became more and more sophisticated with time, allowing viruses to become infectious to cells that had previously resisted them,” Nasir said. “This is the hallmark of parasitism.”

“Many organisms require other organisms to live, including bacteria that live inside cells, and fungi that engage in obligate parasitic relationships – they rely on their hosts to complete their lifecycle,” he said. “And this is what viruses do.”

“Viruses now merit a place in the tree of life,” Caetano-Anollés said. “Obviously, there is much more to viruses than we once thought.” ■

Written by Diana Yates. Photo by L. Brian Stauffer.

PROFILE



UIUC_Illinois, the International Genetically Engineered Machine (iGEM) team at Illinois, earned a silver medal at the 2015 iGEM Giant Jamboree competition.

UIUC_Illinois: The International Genetically Engineered Machine (iGEM) team

Digital memory versus analog: it's a question that's plagued music lovers for years. In biology, however, the focus is overwhelmingly digital: 0 or 1, on or off, genes expressed or not expressed. But what would analog memory look like in a cell, and how might it be useful?

This past summer, the UIUC_Illinois International Genetically Engineered Machine (iGEM) team set out to create a novel genetic part that would allow bacteria to record their environment in analog. Their completed project, SCRIBE (Synthetic Cellular Recorders Integrating Biological Events), was presented over the weekend at the iGEM Giant Jamboree in Boston, where it received a silver medal.

The International Genetically Engineered Machine (iGEM) Foundation is a non-profit organization that promotes synthetic biology technologies and collaborative, open-sourced study in the context of high school and undergraduate education. Teams comprising 6-10 students compete in an annual competition and submit a genetic part, or "BioBrick," to be added to iGEM's Registry of Standard Biological Parts, which then becomes available to researchers around the world.

"If you want a truly fundamental and yet frontier-pressing extracurricular as an undergraduate, and are interested in molecular biology or genetic engineering," said team member Sameer Andani, "there's nothing else you can do that's more beneficial for your education than participating in iGEM."

iGEM teams design their own study and manage research tasks over the course of the spring and summer. The competition culminates in the annual Jamboree, where teams attend lectures and present their findings for a chance to win medals in various subjects, including their BioBrick, Wiki site, and outreach efforts. The 2015 Jamboree attracted more than 250 teams from 35 countries.

The University of Illinois iGEM team, hosted by the Carl R. Woese Institute for Genomic Biology, is now in its eighth year, and has won several medals at both the regional and international level. The 2015 team consists of ten undergraduate students from six departments, including three returning members. Their research was conducted in the Biosystems Design theme laboratory under faculty advisor Dr. Yong-Su Jin, with the mentorship and assistance of graduate advisors from a number of departments.

The team's work was built on research by Dr. Timothy Lu at the Massachusetts Institute of Technology, redesigned to function as a modular system inside a bacterium for recording the level of certain substances in their environment. Team member Caroline Blassick described SCRIBE's memory as "far more specific than other biosensors [...] it's able to hold the values [of the inducing substance], and doesn't 'turn off' or forget."

Whereas traditional biosensors only test in binary—often through bioluminescence, glowing to indicate presence, dark for absence—SCRIBE causes the cell to add a telling mutation to its chromosome, which is then passed to its daughter cells. By plating and sequencing cells from the trial sites, it would be possible to extrapolate the number of recombination events, and determine how much of the inducing substance was in their environment.

"In human history," said Andani, "the most energetically conserved form of data is DNA. And that's what we're manipulating—we're encoding DNA. We're keeping 'memories' inside a genetic tape recorder, inside the genome of the cell itself."

Blassick suggested one potential application for SCRIBE: testing for groundwater contaminants. The expense and expertise required to use testing kits are what made traditional biosensors popular in the first place, she explained, "but what if there's a remote water source people want to measure the

contaminants in—maybe it's periodically flooded but not consistently contaminated, or it drains completely during different seasons—that could slip by regular tests." SCRIBE, however, could survive in the groundwater for weeks, and "remember" having encountered contaminants that are no longer present.

"SCRIBE could become a cost-effective, long term, and durable solution for testing environmental contaminants," concluded Blassick.

Funding for the UIUC_Illinois iGEM team was provided in part by the IGB, the Departments of Bioengineering, Agricultural & Biological Engineering, Chemical and Biomolecular Engineering, and the Roy J. Carver Biotechnology Center. Applications for undergraduates to join the 2016 iGEM team will be released this winter. To find out more about SCRIBE and iGEM, visit the UIUC_Illinois iGEM page here.

Team members include: Sameer Andani, Molecular and Cellular Biology; Caroline Blassick, Bioengineering; James Blondin, Chemical Engineering; Joshua Cheng, Chemical and Biomolecular Engineering; Miranda Dawson, Bioengineering; Noah Flynn, Bioengineering; Pierce Hadley, Bioengineering; Linyang Ju, Molecular and Cellular Biology; Ashwin Pillai, Agricultural and Biological Engineering; and Arudhir Singh, Physics.

The IGB thanks the advisors who contributed their time and leadership: Yong-Su Jin, BSD and EBI; Steve Lane, Yong-Su Jin Lab; Todd Freestone, MMG; Michelle Goettge, MMG; Erik Andersen, BSD; Zach Costliow, Patrick Degnan Lab; Tim Turner, Yong-Su Jin Lab; and Jessica Beaudoin, BSD and ReBTE lab supervisor. ■

Written by Kathryn Metcalf. Photo by Kathryn Faith.

ON THE GRID HAPPENINGS AT THE IGB

AWARDS

JESSE BLACK

Jesse Black, (Microbiology, Whitaker Lab) has been selected as a 2015 award recipient of the American Society for Microbiology (ASM) Undergraduate Research Fellowship, aimed at highly competitive students who wish to pursue graduate careers in microbiology.



DONALD ORT

Donald Ort, Robert Emerson Professor of Plant Biology (Genomic Ecology of Global Change theme leader) has been named to the Agricultural Research Service Science Hall of Fame, for his major impact on agricultural research and for his outstanding accomplishments within the agricultural research community.



VIJAY SINGH

Vijay Singh, Professor of Agricultural and Biological Engineering (Genomic Ecology of Global Change) has been named a University Scholar, a program created to recognize the university's most talented teachers, scholars and researchers.

OUTREACH



GENOME DAY

The fourth annual Genome Day will be held on Saturday, November 14 from 1-5 pm at the Orpheum Children's Science Museum. As with previous years, the event will be an open house and the activities will be primarily for elementary aged children. These hands-on activities will teach children about DNA, genes, genomes, and evolution and will be free and open to the public. If you are interested in volunteering, we invite you to use the following volunteer signup form: <http://www.igb.illinois.edu/content/genome-day-volunteer-form>.

If you have any questions about volunteering or the activities, please contact your theme fellow or Courtney Cox, outreach fellow, at Cox22@illinois.edu.

BLOOD DRIVE & TYPING



IGB BLOOD DRIVE RETURNS

The next IGB blood drive will take place on Thursday, October 22, 2015. The blood drive will take place in the lower concourse area of IGB, near Array Cafe, from 8:00 am - 1:00 pm.

For more information contact Darci Edmonson or online at www.bloodcenterimpact.org. Sign up for your appointment online using Group Sponsor Code 70881.

Have you ever been curious about what your blood type is? Your blood type determines what types of blood you can both give and receive. More than 4.5 million people need blood transfusions each year. That means that 1 out of 4 people will need at least one blood transfusion in their lifetime. You can find out your blood type in under 5 minutes when a staff member from Community Blood Services of Illinois will be conducting a blood typing event on Monday, October 19 from 12-2:30 pm in the Conference Room.

GIVING



PAYROLL DEDUCTION

Payroll deduction is an easy way for University employees to make gifts directly and automatically from a paycheck. As with online giving and EFT, payroll deduction donations allow us to minimize administrative expenses. Further details can be found at www.uif.uillinois.edu.

More information on giving can be found at www.igb.illinois.edu/about/giving.

ON THE GRID HAPPENINGS AT THE IGB

ENTREPRENEURSHIP



ENTREPRENEURSHIP LECTURE SERIES

The entrepreneurship lecture series is an opportunity for students, academics and professionals in the life sciences, engineering and other disciplines to gain insight about entrepreneurship and innovation. The third lecture in the series, titled "A (Brief, Mostly Western) History of the Concept of Creativity" will be presented by Richard Foster, Ph.D., Venture Partner, Lux Capital, and Fellow of the American Academy of Arts and Sciences. It will be scheduled for Wednesday, November 11 at noon in IGB Conference Center Room 612. Pizza will be provided. For more information, please contact Courtney Cox, outreach fellow, at Cox22@illinois.edu.

SYMPOSIUM



LOOKING IN THE RIGHT DIRECTION: CARL WOESE AND THE NEW BIOLOGY

To mark the renaming of our institute, in late September the IGB held a special symposium highlighting the historical aspects of work on microbiology, evolution and molecular biology as researched by Carl Woese and colleagues, as well as some of the most exciting modern research directions that have been inspired or impacted by his work and ideas.

If you missed any of the content from our incredible lineup of speakers, please visit our YouTube page for a playlist of the publicly available talks: <http://bit.ly/1LgoBcz>.

EVENT



ANNUAL IGB HALLOWEEN PARTY

Thursday, October 29
4:00pm, Array Café

IGB members and your families: please join us for the Annual IGB Halloween Party! There will be games with prizes and face painting for kids, a contest for the best costume, a photo booth, and lots and lots of treats and candy!

EVENT



IGB POSTDOC ASSOCIATION CAREER DEVELOPMENT WORKSHOP

IGB postdocs are invited to attend a workshop in IGB 612 on November 6. Hosted by the IGB Postdoc Association, the goal of the event is to provide postdocs with the resources and expertise that are essential for preparing a Career Development Plan. The event will include a panel discussion with invited panelists from a variety of science-related professions. Following the panel, small workshops will be available in which participants can prepare and hone their Career Development Plans with direct guidance from accomplished researchers, teachers, and professionals.

For more information and to register, see <https://www.igb.illinois.edu/education/postdoctoral-association>.

LEWIN LECTURE



HARRIS A. LEWIN PIONEER IN GENOMIC BIOLOGY DISTINGUISHED LECTURE

Tuesday, October 27
12:00pm, 612 IGB

Join us for the next installment of the Lewin Lecture series, "Evolutionary Genomic Analyses of African Populations: Implications for Human Evolution and Disease" by Sarah A. Tishkoff, David and Lyn Silfen University Professor in Genetics and Biology, University of Pennsylvania.

GOTTLIEB LECTURE



2015 DAVID GOTTLIEB MEMORIAL LECTURE

Tuesday, October 27
4:00pm, B102 Chemical & Life Sciences Lab

The 2015 Gottlieb Lecture will be given by Prof. Dr. Christian Hertweck, Professor for Natural Product Chemistry, Friedrich Schiller University, Jena, Head of Department Biomolecular Chemistry, Leibniz Institute for Natural Product Research and Infection Biology - Hans Knöll Institute (HKI), entitled "Neglected Microbes, Cryptic Pathways, and their Impact on Infectious Diseases."

DEPARTMENT ANNOUNCEMENTS

BUSINESS

2015 CAMPUS CHARITABLE FUND DRIVE

The 2015 Campus Charitable Fund drive is underway September 21st –November 13th . Please consider contributing! Take a moment to read the brochure by visiting the website at www.ccfid.illinois.edu.

A few things you might want to remember:

We encourage everyone to give by on-line payroll deduction.

If you are giving by payroll deduction, please remember to type in the annual amount you wish to donate. There is no limit to the number of agencies that you may select, but the minimum ANNUAL donation is \$24.00 (\$2 per month).

When making a one-time donation, make your check(s) payable to the umbrella organization(s) listed on the Pledge Form, not to designations within the umbrella. If you have any questions throughout the campaign, please contact Jacinda King at 244-2276 / jking@igb.illinois.edu. The deadline is November 13, 2015. ■

COMMUNICATIONS

SPEAKING TO THE MEDIA

As many of you may be approached for interviews or news coverage regarding your work at the IGB, a short guide is available to assist you on interacting with the media. This guide can be found on the IGB website by using [this link](#).

Some basic points include:

- Be prepared with key points to relay during the interview
- If you're anticipating difficult or controversial questions, practice beforehand. Both the Illinois News Bureau and Public Affairs are able to provide mock interviews
- Answer questions using only the information that should appear in the final publication
- Clearly convey your name, home department, connection to the IGB, funding organization, associated universities, institutes, and/or key individuals involved. ■

UNIVERSITY LIBRARY

CITATION MANAGEMENT TOOLS

Managing citations can be a real challenge, as can keeping up with all of the citation management tools.

If you are a RefWorks user, you should have already received a notification that the University Library will cancel its RefWorks subscription at the end of the current contract (i.e., July 1, 2016). The citation management landscape has changed drastically since the Library first provided RefWorks to campus, and the Library felt it no longer makes sense to subsidize a single fee-based tool, when there are so many free and fee-based tools now available. If you wish to continue using RefWorks after July 1, 2016, you may be able to pay for an individual RefWorks subscription, but the vendor has made no final decisions at this time.

If you would like to switch tools or just get started using a tool, the Library offers a variety of citation management tool guides and training, which are included in the Citation Management Software Overview (<http://guides.library.illinois.edu/citationmgmtoverview/>). The Library has a Choosing a Citation Manager workshop (<http://illinois.edu/calendar/list/4068>) and a comparison chart (<http://www.library.illinois.edu/learn/research/citation/CitationManagers.pdf>). There are also workshops and guides specific to the major citation management tools – EndNote, Mendeley, RefWorks, and Zotero.

If you have questions about citation management tools, please contact Sarah Williams, the Life Sciences Data Services Librarian (scwillms@illinois.edu). ■

OPERATIONS & FACILITIES

COMPLIANCE & FIRE SAFETY

In order to meet the University Campus Code Compliance & Fire Safety requirements, Facilities & Services (F&S) will be testing the fire alarm system in the IGB building starting on Monday October, 19th through Friday, October 23rd.

On Wednesday, October 21st at 7:00 am F&S will test the alarm horns and flashers. There will be no need to evacuate the building during this test. Please post this notice in your areas for any employees that may not have access to this information. ■

RECENT PUBLICATIONS

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

Zhang G-, Liu J-, Kong II, Kwak S, Jin Y-. Combining C6 and C5 sugar metabolism for enhancing microbial bioconversion. *Curr Opin Chem Biol.* 2015;29:49-57.

Mazor T, Pankov A, Johnson BE, et al. DNA methylation and somatic mutations converge on the cell cycle and define similar evolutionary histories in brain tumors. *Cancer Cell.* 2015;28(3):307-317.

Tabatabaei Yazdi SMH, Yuan Y, Ma J, Zhao H, Milenkovic O. A rewritable, random-access DNA-based storage system. *Sci Rep.* 2015;5.

Traniello I. Bringing science to prisons is not enough. *Science.* 2015;349(6253):1176.

Kreig A, Calvert J, Sanoica J, Cullum E, Tipanna R, Myong S. G-quadruplex formation in double strand DNA probed by NMM and CV fluorescence. *Nucleic Acids Res.* 2015;43(16):7961-7970.

Abil Z, Zhao H. Engineering reprogrammable RNA-binding proteins for study and manipulation of the transcriptome. *Mol Biosyst.* 2015;11(10):2658-2665.

Luo Y, Zhang L, Barton KW, Zhao H. Systematic identification of a panel of strong constitutive promoters from *streptomyces albus*. *ACS Synth Biol.* 2015;4(9):1001-1010.

Blanchard AE, Lu T. Bacterial social interactions drive the emergence of differential spatial colony structures. *BMC Syst Biol.* 2015;9(1).

Zhu H, Peck SC, Bonnot F, Van Der Donk WA, Klinman JP. Oxygen-18 kinetic isotope effects of nonheme iron enzymes HEPD and MPnS support iron(III) superoxide as the hydrogen abstraction species. *J Am Chem Soc.* 2015;137(33):10448-10451.

Moisés SJ, Shike DW, Shoup L, Rodriguez-Zas SL, Looor JJ. Maternal plane of nutrition during late gestation and weaning age alter *angus* × *simmental* offspring longissimus muscle transcriptome and intramuscular fat. *PLoS ONE.* 2015;10(7).

Ju K, Gao J, Doroghazi JR, et al. Discovery of phosphonic acid natural products by mining the genomes of 10,000 actinomycetes. *Proceedings of the National Academy of Sciences.* 2015.

Gomez A, Rothman JM, Petrzalkova K, et al. Temporal variation selects for diet-microbe co-metabolic traits in the gut of gorilla spp. *ISME J.* 2015.

Yendrek CR, Koester RP, Ainsworth EA. A comparative analysis of transcriptomic, biochemical, and physiological responses to elevated ozone identifies species-specific mechanisms of resilience in legume crops. *J Exp Bot.* 2015.

Eerkens JW, Carlson T, Malhi RS, et al. Isotopic and genetic analyses of a mass grave in central california: Implications for precontact hunter-gatherer warfare. *Am J Phys Anthropol.* 2015.

Choi JS, Mahadik BP, Harley BAC. Engineering the hematopoietic stem cell niche: *Frontiers in biomaterial science. Biotechnol J.* 2015.

Wang X, Vukovic L, Koh HR, Schulten K, Myong S. Dynamic profiling of double-stranded RNA binding proteins. *Nucleic Acids Res.* 2015;43(15):7566-7576.

Freestone TS, Zhao H. Combinatorial pathway engineering for optimized production of the anti-malarial FR900098. *Biotechnol Bioeng.* 2015.

Wang M, Yu C, Zhao H. Directed evolution of xylose specific transporters to facilitate glucose-xylose co-utilization. *Biotechnol Bioeng.* 2015.

Hollister SJ, Flanagan CL, Zopf DA, et al. Design and quality control for translating 3D-printed scaffolds. *Essentials of 3D Biofabrication and Transl.* 2015:43-59.

Sears KE, Maier JA, Rivas-Astroza M, et al. The relationship between gene network structure and expression variation among individuals and species. *PLoS Genet.* 2015;11(8).

Smith CE, Ernenwein D, Shkumatov A, et al. Hydrophilic packaging of iron oxide nanoclusters for highly sensitive imaging. *Biomaterials.* 2015;69:184-190.

Si T, Hamedirad M, Zhao H. Regulatory RNA-assisted genome engineering in microorganisms. *Curr Opin Biotechnol.* 2015;36:85-90.

Raghavan M, Steinrücken M, Harris K, et al. Genomic evidence for the pleistocene and recent population history of native americans. *Science.* 2015;349(6250).

Caetano-Anollés D, Caetano-Anollés G. Ribosomal accretion, apriorism and the phylogenetic method: A response to petrov and williams. *Front Genet.* 2015;6(JUN).

Chen W, Long KD, Kurniawan J, et al. Planar photonic crystal biosensor for quantitative label-free cell attachment microscopy. *Adv Opt Mater.* 2015.

Baumann K, Venail J, Berbel A, et al. Changing the spatial pattern of TFL expression reveals its key role in the shoot meristem in controlling arabidopsis flowering architecture. *J Exp Bot.* 2015;66(15):4769-4780.

Rittschof CC, Grozinger CM, Robinson GE. The energetic basis of behavior: Bridging behavioral ecology and neuroscience. *Curr Opin Behav Sci.* 2015;6:19-27.

Logue MW, Amstadter AB, Baker DG, et al. The psychiatric genomics consortium posttraumatic stress disorder workgroup: Posttraumatic stress disorder enters the age of large-scale genomic collaboration. *Neuropsychopharmacology.* 2015;40(10):2287-2297. ■



IGB News is published by the IGB Communications Office.
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www.igb.illinois.edu 15.130