IGB NEWS

Volume 7, Number 2

UPCOMING EVENTS

IGB Seminar (CDMC)

Molecular Biomechanics of Cell Adhesion
March 18, 2014, 12:00 p.m.
612 Institute for Genomic Biology

Wendy Thomas, PhD
Associate Professor, Bioengineering,
University of Washington

IGB Seminar (BCXT)

E Unibus Plurum: Clonal Reinforcement Drives Evolution of a Simple Microbial Community
April 1, 2014, 12:00 p.m.
612 Institute for Genomic Biology

R. Frank Rosenzweig, PhD
Professor, Sciences Humanities,
University of Montana

Sixth Annual Energy Biosciences Institute Biofuels Law and Regulation Conference

Re-imagining Policy Incentives for Biofuels
May 2, 2014, 8:00 a.m.
I Hotel and Conference Center

The Conference will focus on exploring new ways that biofuel policies can be re-imagined in order to continue promoting growth in the developing biofuel industry. Register at http://www.biofuellawconference.org/

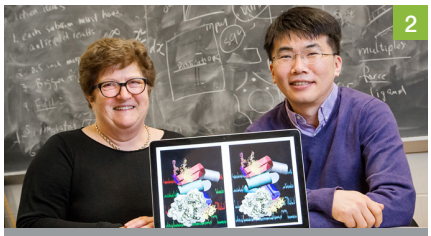
2014 IGB Fellows Symposium

The Success Strategies of Transposable Elements that Rapidly Diversify Genomes
May 8, 2014, 8:30 a.m.
612 Institute for Genomic Biology

Susan R. Wessler
University of California President's Chair
Distinguished Professor of Genetics
University of California, Riverside

Register for free at
http://conferences.igb.illinois.edu/fellows/

FEATURED NEWS



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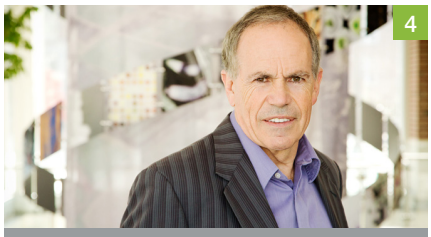
New Insights Into Ribosome Self-Assembly

3

Profile: Pat Brown



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Team Converts Sugarcane To Oil-Producing Crop

5

On the Grid: Happenings at IGB

IMAGE OF THE MONTH

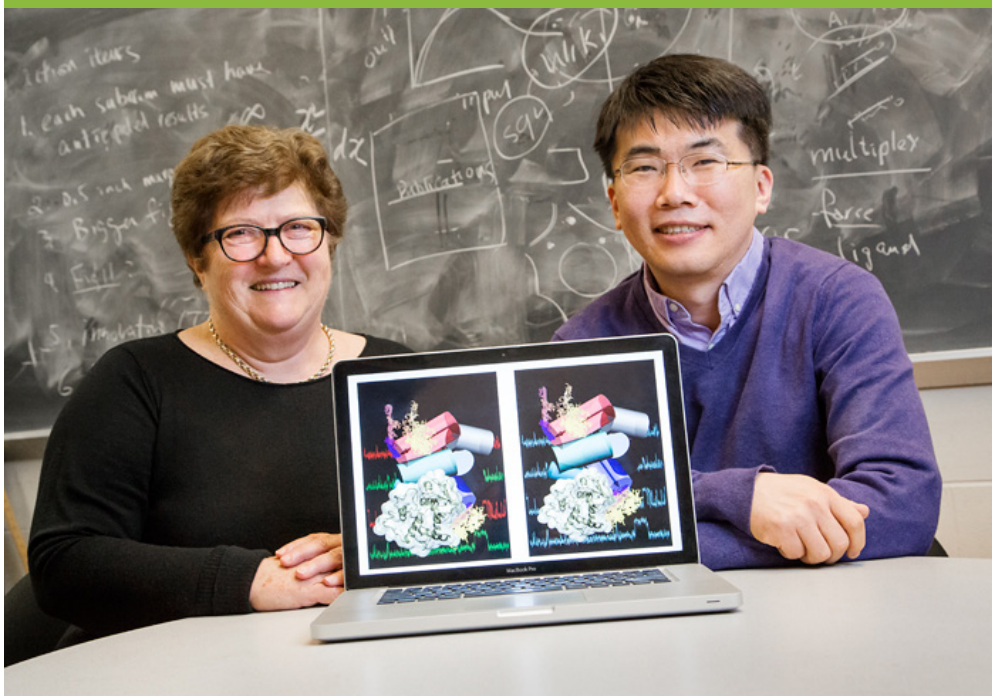
This month's image, "Super Resolution Structured Illumination Microscopy (SR-SIM) of Mouse Sperm," shows the 3-D localization of the protein syntaxin. Syntaxin plays a key role in the acrosome vesicle fusion necessary for penetration of the egg coat, and how syntaxin is re-localized to regulate function in vesicle fusion is being studied.

This image was captured with the Zeiss Elyra SR-SIM Structured Illumination Microscope, and is provided courtesy of Momal Sharif of the David Miller lab.

IGB News

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

FEATURE



Advanced Techniques Yield
New Insights Into Ribosome Self-Assembly

Ribosomes, the cellular machines that build proteins, are themselves made up of dozens of proteins and a few looping strands of RNA. A new study, reported in the journal *Nature*, offers new clues about how the ribosome, the master assembler of proteins, also assembles itself.

"The ribosome has more than 50 different parts – it has the complexity of a sewing machine in terms of the number of parts," said University of Illinois physics professor Taekjip Ha, who led the research with Illinois chemistry professor Zaida Luthey-Schulten and Johns Hopkins University biophysics professor Sarah Woodson. "A sewing machine assembles other things but it cannot assemble itself if you have the parts lying around," Ha said. "The ribosome, however, can do that. It's quite amazing."

In 2000, scientists published precise atomic structures of intact ribosomes (a feat that won them a 2009 Nobel Prize in chemistry) and for decades researchers have delved into the mechanics of ribosome function. But scientists have much to learn about how the ribosome itself is built from its component parts, Luthey-Schulten said.

Solving the atomic structure was a huge step forward "that tells us what the ribosome looks like once it's assembled," she said. "But it doesn't tell you anything about how it gets there, how all these parts come together."

All ribosomes consist of two subunits, each a cluster of precisely folded proteins and RNA. The team focused on the small ribosomal subunit of the *E. coli* bacterium. It is made up of about 20 proteins and a ribosomal RNA (known as 16S).

The researchers labeled one of those ribosomal proteins. Known as S4, it is thought to be the first to interact with the 16S RNA during assembly. They also labeled two sites on the 16S RNA. Each label fluoresced a different color, and was designed to glow more brightly when in close proximity to another label (a technology known as FRET). These signals offered clues about how the RNA and proteins were interacting.

(above) Chemistry professor Zaida Luthey-Schulten and Physics professor Taekjip Ha led a study of how the ribosome assembles itself.

The team was most interested in a central region of the 16S RNA because it contains signature sequences that differentiate the three cellular "domains," or superkingdoms, of life. Previous studies suggested that this region also was key to the RNA-protein interactions that occur in the earliest stages of ribosome assembly.

Using a "computational microscope," the team compared data from their FRET experiments with an all-atom simulation of the protein and RNA interaction. Their analysis revealed that the S4 protein and the 16S ribosomal RNA were a surprisingly "dynamic duo," Ha said. The protein constrained the RNA somewhat, but still allowed it to undulate and change its conformation.

The team found that the S4 protein tends to bind to the RNA when the RNA takes on an unusual conformation – one not seen in the fully assembled ribosome. This was a surprise, since scientists generally assume that ribosomal proteins lock RNA into its final, three-dimensional shape.

"We found that the S4 and RNA complex is not static," Ha said. "It actually is dynamic and that dynamism is likely to allow binding of the next protein" in the sequence of ribosome assembly.

"Once the S4 binds, it induces other conformational changes that allow the binding sites for other proteins to appear," he said. "So the binding site for the third protein doesn't appear until after the second protein is there."

This intricate dance of molecules leading to the assembly of ribosomes occurs very fast, Luthey-Schulten said.

"You can go from as few as 1,000 to 30,000 ribosomes in a bacterial cell during its cell cycle," she said. "More than 80 percent of the RNA that's in the cell is in the ribosomes."

Knowing how the ribosome is put together offers

new antibiotic targets, said Ha, who is a Howard Hughes Medical Institute investigator and a co-director of the Center for the Physics of Living Cells at Illinois.

"Instead of waiting until your enemy has fully assembled its army, you want to intervene early to prevent that from happening," he said. "We know that this protein/RNA region has unique signatures in bacteria, so maybe we can target this process while keeping the human ribosome intact."

Luthey-Schulten and Ha are affiliates of the Beckman Institute for Advanced Science and Technology and faculty members of the IGB.

The National Science Foundation and HHMI funded this project. ■

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

PROFILE

Pat Brown is an Assistant Professor in the Department of Crop Sciences, whose research includes the genetic improvement of sorghum as a bioenergy crop.

Pat Brown:
Shedding New Light on Sorghum

Sorghum thrives in dry, arid climates that are ill suited to corn and provides an alternative source of biomass for sustainable fuel production.

But first, scientists will have to exploit its capacity for growth.

"Sorghum is processed in the same ethanol facilities that use 40 percent of our corn crop," said Pat Brown, an assistant professor at the University of Illinois, a member of the Energy Biosciences Institute, and a member of the Genomic Ecology of Global Change research theme at the Institute for Genomic Biology. "It's just as good for making ethanol as corn is—there's no difference in conversion efficiency."

Having evolved on the edge of the Sahara Desert, sorghum thrives in sandy soils and hot temperatures. "For thousands of years, it's been progressively adapting to a more harsh and arid environment," Brown said. "It looks like that's going to be really important when you look at the predictions of how we are going to have to produce more food from the same amount of land, with more unpredictable rainfalls and rising temperatures."

Today, the Sorghum Belt stretches from South Dakota to Texas. But in as few as 50 years, the climate in Central Illinois may be like the climate today in Central Texas—which could make sorghum the crop of choice in more places.

"That's not that far down the road," Brown said. "Considering all of these factors, I think it's going to be really important to understand how sorghum does it."

So Brown is hunting for the genes inside sorghum that could be useful for bioenergy production, like plant height and flowering.

Flowering stops vegetative plant growth so the plant can divert nutrients to seed production. By impeding flowering, scientists can force the sorghum plant to continue to grow and produce more biomass.

"We are trying to understand the different signals that get integrated so that the plant knows when to flower," Brown said. "We want it to remain in a vegetative state, putting out leaves and getting taller and taller."

So far, Brown and his colleagues have identified promising regions of DNA through "genome-wide association" where researchers compare small changes in the DNA of different sorghum plants to see which genes cause which physical characteristics.

Through this process, they have found a change that is likely associated with sorghum's flowering time. Their hypothesis looks promising because the closest gene to this DNA variation is the same gene that controls rice plants' photoperiod response, the process by which plants can tell the time of year by sensing changes in the length of each night.

"We have not proved that it's doing the same thing in sorghum, yet," Brown said. "But it's a result that we are pretty excited about. It's an obvious candidate."

Brown received his bachelor's degree from Reed College. For his undergraduate thesis, he studied lichen, the result of a symbiotic relationship between fungi and either algae or cyanobacteria.

Back then, he was intrigued by organisms' physiology. But after working with a maize geneticist at the University of California, Berkeley, he realized that his physiological questions could be answered through genetics.

Brown went back to school to earn his doctorate in plant genetics from Cornell University. He began studying sorghum for his PhD and continues to study the crop today because, unlike corn and soybeans, there's a lot of basic knowledge still to learn.

"It's exciting because there's not as many people working on it," he said. "There is a lot of stuff to work out." ■

Written by Claire Sturgeon. Photo by Kathryn Coulter.

Stephen Long, professor of crop sciences and of plant biology, leads an initiative to turn sugarcane into a more productive, cold-tolerant, oil-rich crop.

Team Converts Sugarcane to a Cold-Tolerant, Oil-Producing Crop

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.

If the researchers achieve their goal, growers will be able to meet 147 percent of the U.S. mandate for renewable fuels by growing the modified sugarcane on abandoned land in the southeastern United States.

These are only the first steps in a bigger initiative that will turn sugarcane and sorghum – two of the most productive crop plants known – into even more productive, oil-generating plants.

The team presented its latest findings on February 25 at the U.S. Department of Energy's ARPA-E Energy Innovation Summit in Washington, D.C.

"Biodiesel is attractive because, for example, with soybean, once you've pressed the oil out it's fairly easy to convert it to diesel," said Stephen P. Long, a University of Illinois professor of plant biology, IGB faculty, and leader of the initiative. "You could do it in your kitchen."

But soybean isn't productive enough to meet the nation's need for renewable diesel fuels, Long said.

"Sugarcane and sorghum are exceptionally productive plants, and if you could make them accumulate oil in their stems instead of sugar, this would give you much more oil per acre," he said.

Working first with the laboratory-friendly plant Arabidopsis and later with sugarcane, the team introduced genes that boost natural oil production in the plant. They increased oil production in sugarcane stems to about 1.5 percent.

"That doesn't sound like a lot, but at 1.5 percent, a sugarcane field in Florida would produce about 50 percent more oil per acre than a soybean field," Long said. "There's enough oil to make it worth harvesting."

"Sugarcane and sorghum are exceptionally productive plants, and if you could make them accumulate oil in their stems instead of sugar, this would give you much more oil per acre."

The team hopes to increase the oil content of sugarcane stems to about 20 percent, he said.

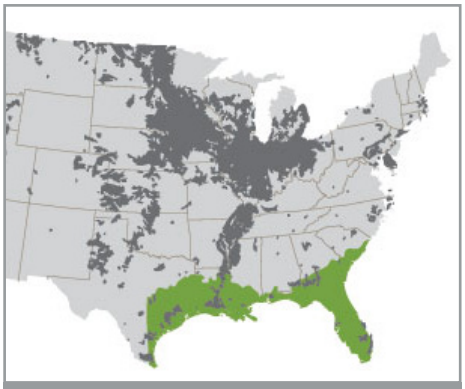
Using genetic engineering, the researchers increased photosynthetic efficiency in sugarcane and sorghum by 30 percent, Long said. And to boost cold tolerance, researchers are crossing sugarcane with Miscanthus, a related perennial grass that can grow as far north as Canada. The new hybrid is more cold-tolerant than sugarcane, but further crosses are needed to restore the other attributes of sugarcane while preserving its cold-tolerance, Long said.

Ultimately, the team hopes to integrate all of these new attributes into sugarcane, he said.

"Our goal is to make sugarcane produce more oil, be more productive with more photosynthesis and be more cold-tolerant," he said.

The research team, led by Illinois, includes scientists from Brookhaven National Laboratory, the University of Florida and the University of Nebraska. ■

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



If the researchers achieve their goal, growers will be able to meet 147 percent of the U.S. mandate for renewable fuels by growing the modified sugarcane on abandoned land in the southeastern United States (about 20 percent of the green zone on the map).

Graphic courtesy Stephen P. Long

ON THE GRID
HAPPENINGS AT THE IGB

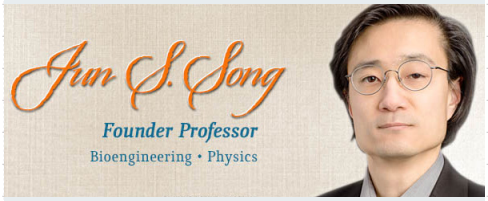
AWARDS

BRENDAN HARLEY

Brendan Harley, Assistant Professor of Chemical & Biomolecular Engineering, received the Everitt Award for Teaching Excellence from the College of Engineering for development of an innovative elective course on tissue engineering.

CHRISTOPHER RAO

Christopher Rao, Associate Professor of Chemical & Biomolecular Engineering, 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.



JUN SONG

Jun Song was named as the department of Bioengineering's first Founder Professor, part of the Grainger Engineering Breakthroughs Initiative established in 2013 to support big data and bioengineering through enhancing facilities, funding student scholarships, and bringing senior faculty to Illinois.

NEW ARRIVALS

CONNIE SCOTT

Connie Scott joins the IGB to support the Biocomplexity (BCXT) Research Theme. Before joining the IGB, Connie worked for the Institutional Review Board for 12 years. She has over 22 years combined managerial experience in the private sector and this campus.

JESSE SOUTHERN

Jesse Southern joins the IGB as Director of Operations and Facilities. He worked for the Division of Animal Resources for 10 years, most recently as a Coordinator of Laboratory Animal Facilities handling a variety of research, facility, and physical plant matters. Jesse's focus is to ensure that the building and operation systems support the cutting edge and dynamic research being conducted at the IGB.

ART EXHIBIT

ART OF SCIENCE 4.0

Save the date for the next show of the IGB's Art of Science exhibit! Opening Reception is Thursday, April 3, from 6:00 to 8:00pm at the indi go gallery. The exhibit will run April 4 through 7.

SYMPOSIUM

2014 IGB FELLOWS SYMPOSIUM

Registration is now open for the 8th Annual IGB Fellows Symposium.

Join us to hear the latest IGB research, connect with colleagues, and share your work during the poster session. This year will include talks from current Fellows as well as IGB faculty and theme leaders.

Our keynote speaker this year is Susan Wessler from the University of California, Riverside.

To register please visit
http://conferences.igb.illinois.edu/fellows

CAMP

POLLEN POWER! SUMMER CAMP RETURNS

Once again the IGB will be hosting Pollen Power!, a week-long day camp for talented girls who are interested in the biological sciences.

This year's camp will take place July 7-11, 2014. Save the date and register early!

For more information please visit
http://pollensummercamp.illinois.edu

IP @ IGB

UNIVERSITY OF ILLINOIS at URBANA-CHAMPAIGN
OFFICE OF TECHNOLOGY MANAGEMENT

INVENTOR INTERVIEW PROCESS

When an inventor discloses an invention to the OTM office, a commercialization analyst will review the technology and begin a patentability and marketability search. During this process, we find other publications, patents, and products that are related to the disclosure. The inventor interview is a way for us to clarify questions we have so that we can best proceed with analyzing the technology, and also to serve as a liaison for any questions inventors may have regarding the tech transfer process in general.

Here are some of the questions to typically ask in an inventor interview, with short explanations for why we ask them.

Did any other people contribute to this work? Are they affiliated with the University?
Often times, many contributors will be listed on a publication. For patents, however, the definition for what constitutes an inventor is much stricter, governed by patent law, and requires an "inventive step," Also, the nature of science is very collaborative, and usually an invention will have collaborators with other institutions. We work with those institutions to create inter-institutional agreements to make sure inventors are properly rewarded for their work.

Are there any documents (including theses or dissertations) being written on the invention, and if so, when would you anticipate completion? Has anything been publicly disclosed before (conference, poster, etc)?
As of March 2013 patent reform laws have brought the USA into a modified First to File system. Under the old system, a one-year grace period consisting of the time between a public disclosure and the filing of U.S. patent application covered all prior art, both your own and that of others. Under the new law, a one-year grace period is given to the inventor only for his/her own publications. Publications by others during the grace period are now *prior art* to the inventor's application if filed later, which can be used to defeat patentability. On balance, this can be mitigated by early disclosure to the OTM and prompt patent filing before publication, or as soon as possible after publication.

If you are about to submit a manuscript or go to a conference, just shoot us an email and we'll work with you to preserve the patentability of your IP.

For more information on patent reform:
http://otm.illinois.edu/AIA

What are your current plans for the technology? Do you plan to continue working on this technology? Do you plan to pursue a start-up?
We want to know what you would like to do with an invention and follow your desires. We are here to assist you in whatever avenue you would like to take your research. We also are a great resource to connect inventors with people on campus that can help to create a start-up, get SBIR funding, or meet other entrepreneurs.

What led you to the conception of the invention? Were the results you obtained unexpected? How many combinations of components were possible? Are you aware of any existing publications similar to this invention?
The US Patent Office frequently rejects patent applications based on very broad definitions of "obviousness" or "novelty". By better understanding your technology and how it compares with the landscape of other discoveries, either as a completely new idea or an improvement of current methods, we can craft a stronger patent application or license with an industry partner.

Hopefully, this gives you a better understanding of what to expect at an inventor interview, and we always look forward to learning about your work. For any questions, feel free to contact **mjscott2@illinois.edu** at any time!

BIOFUELS

SIXTH ANNUAL ENERGY BIOSCIENCES INSTITUTE BIOFUELS LAW AND REGULATION CONFERENCE

"Re-imagining Policy Incentives for Biofuels"

A one-day conference bringing together the field's leading experts to explore the challenges in creating a bioenergy-based future.

The Conference will focus on exploring new ways that biofuel policies can be re-imagined in order to continue promoting growth in the developing biofuel industry.

To register please visit
www.biofuellawconference.org

GIVING

WALK OF LIFE

Walk of Life pavers are the perfect way to commemorate a special event, like graduation. For installation by May 18, contact Melissa McKillip at **mmckilli@illinois.edu** no later than Friday, March 7.

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

ON THE GRID
HAPPENINGS AT THE IGB

SERVICE

2014 COMMUNITY & CAMPUS DAY OF SERVICE

Tuesday, March 11th, 2014
IGB Conference Room 612/614
5:00pm - 7:00pm

Join us for the 2014 Community & Campus Day of Service. Volunteers will package 147,000 meals on April 5 (Saturday) for Eastern Illinois Foodbank to benefit local needy families. Volunteers also are needed for a number of other projects around C-U through Austin's Day on April 12 (Saturday). A can drive is also planned for the week of April 6. Register as an individual or a group; families are welcome.

For more information and volunteer links visit **https://cuvolunteer.org/dayofservice**

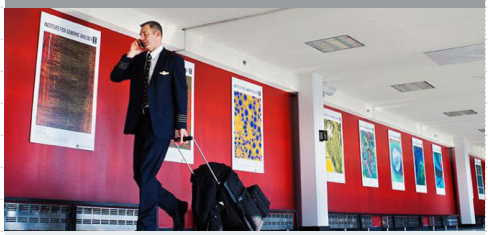
CEM

CERTIFICATE IN ENTREPRENEURSHIP AND MANAGEMENT

Please join the IGB Certificate in Entrepreneurship and Management (CEM) program Graduation, Pitch Presentations, and Reception on April 22, 2014 in Conference room 612 IGB.

For more information on the CEM program visit **http://www.igb.illinois.edu/cem**

EXHIBIT



ART OF SCIENCE AT O'HARE

Travelers passing through O'Hare International Airport can now enjoy beautiful imagery from the pioneering research taking place at the IGB.

Located in Terminal 3, 24 works showcase a variety of subjects from kidney stones to bee brains to plant cell walls.

O'Hare travelers who take a photo in front of the artwork and tweet it to @IGBillinois with the tags #scienceselfie #IGB #ILLINOIS have a chance to win free items from our cafe!

Read the full story at **http://bit.ly/1fo4gxz**

ADMINISTRATIVE NEWS

OPERATIONS & FACILITIES

ARRAY CAFE

New menu items have arrived at Array Cafe! Stop by to enjoy some new offerings such as the Cuban panini, loaded baked potato, or a gourmet mac & cheese with bacon! All of the Array favorites are still available, like the Italian Beef and Thursday sushi rolls. We've also lowered our coffee prices based on your feedback, so stop by today for lunch or a snack.

SURVEY

There's been a lot of changes at Array Cafe, that have resulted from the excellent suggestions of our customers. We want you to continue to give us feedback on what you like, what you don't like, and what we can improve.

Please fill out our survey at
http://www.igb.illinois.edu/content/array-cafe-survey

ADMINISTRATIVE NEWS

BUSINESS

TEM OPEN LAB SESSIONS

This is a great opportunity to get hands on experience and work out your problems with a UPay Expert.

SPACE IS LIMITED, PLEASE SIGN UP TODAY.
April 10, 2014 Thurs (1:30pm-3:30pm)
May 8, 2014 Thurs (9:30am-11:30am)
June 5, 2014 Thurs (1:30pm-3:30pm)

COURSE DESCRIPTION:
Are you live with the TEM System? Have you created Expense Reports or gone through the Review/Approve steps and need additional assistance with specific processes? If so, register and attend a TEM Open Lab and workout your problems with a UPay Expert.

The Open Lab is not a training session. This session is available to those currently live and working in TEM and is designed to help you with your specific issues with the System. If you are interested in attending a Open Lab, following are the requirements for admission:

- You must be active in the TEM system with an Enterprise ID and password for login.
- You must bring invoice documents or Expense Report numbers to process or discuss.
- You must be familiar with the TEM Resource Page materials and other related Payment webpages.
- You must register for the Payables Open Lab.

The Open Lab is not a training session and is only available to those who actively work with TEM and other Payables systems. If you are not currently enrolled, please wait until you are enrolled and experience the benefits of TEM and Payables systems before attending an Open Lab. There will be a minimum of 7 and a maximum of 14 attendees per session.

If necessary, cancellation notices will be sent 3 days prior to the session date. Please be sure your e-mail and phone contact information are correct.

LOCATION:
Green Street Building, 111 East Green Street, Champaign,
Lab #11 or Lab #16
The building hours are 8:30am - 5:00pm. Please check in with the receptionist near the back door before proceeding downstairs to the lab.

PARKING:
There is no visitor parking available in the Green Street Building Lots. There are metered spaces on Second Street as well as along the Boneyard Creek Path just north of Green Street. These spaces have a two (2) hour time limit, so meters must be fed accordingly. It is strongly recommended that you consider other transportation arrangements to the Green Street Building such as walking, car-pooling, or use of the bus. You may ride the MTD bus for free by showing your University ID. Maps and schedules are available on the MTD web site. ■

UNIVERSITY LIBRARY

TAIR INSTITUTIONAL LICENSE FROM THE UNIVERSITY LIBRARY

Beginning April 1, academic researchers will need a subscription to access The Arabidopsis Information Resource (TAIR), but our Biosciences Librarian, Kelli Trei, is using Library funds to pay for an institutional license for the University of Illinois at Urbana-Champaign. The subscription process was initiated in late 2013, so we hope that the paperwork will be processed by April 1 for seamless access to TAIR.

The National Science Foundation (NSF) funded TAIR from 1999 through 2013, but that grant funding has been phased-out. This new subscription-based business model is intended sustain TAIR as a resource for genetic and molecular biology data for the model plant *Arabidopsis thaliana.*

A related initiative to monitor is the development of the Arabidopsis Information Portal (AIP), which received NSF funding last year. AIP is expected to host TAIR's data, gene expression data, protein interaction data, and data from the 1001 Genomes Project.

If you have questions about access to TAIR, please contact the Biosciences Librarian, Kelli Trei (**ktrei2@illinois.edu**), or the Life Sciences Data Services Librarian, Sarah Williams (**scwillms@illinois.edu**). ■

COMMUNICATIONS

IGB WEEKLY UPDATE EMAIL

If you have content for the weekly email that is sent to all IGB members each Friday, please submit to **IGBsubmissions@igb.illinois.edu** for inclusion in the following week. The deadline for submissions is Thursday of each week by noon.

We are doing our best to keep the Update relevant to only those items that occur in the following week, but if you have an item you feel should be listed in multiple Updates, please indicate in your message in some way, such as "Post starts March 14, should run through March 28."

We will do our best to include every item received by the deadline, but may delay early items as needed until the week prior. ■

RECENT PUBLICATIONS

Liang J, Chao R, Abil Z, Bao Z, Zhao H. FairyTALE: A high-throughput TAL effector synthesis platform. *ACS Synth Biol*. 2014;3(2):67-73.

Rasmussen M, Anzick SL, Waters MR, et al. The genome of a late pleistocene human from a clovis burial site in western montana. *Nature*. 2014;506(7487):225-229.

Bouvier JT, Groninger-Poe FP, Vetting M, Almo SC, Gerlt JA. Galactaro d-lactone isomerase: Lactone isomerization by a member of the amidohydrolase superfamily. *Biochemistry*. 2014;53(4):614-616.

Gao J, Ju K-, Yu X, et al. Use of a phosphonate methyltransferase in the identification of the fosfazinomycin biosynthetic gene cluster. *Angew Chem Int Ed*. 2014;53(5):1334-1337.

Lian J, Chao R, Zhao H. Metabolic engineering of a *saccharomyces cerevisiae* strain capable of simultaneously utilizing glucose and galactose to produce enantiopure (2R,3R)-butanediol. *Metab Eng*. 2014.

Woodard SH, Bloch GM, Band MR, Robinson GE. Molecular heterochrony and the evolution of sociality in bumblebees (*bombus terrestris*). *Proc Biol Sci*. 2014;281(1780):20132419.

Sun N, Zhao H. A two-plasmid bacterial selection system for characterization and engineering of homing endonucleases. *Methods Mol Biol*. 2014;1123:87-96.

Mikel MA. Ancestry and characterization of US contemporary proprietary garden pea (*pisum sativum L. convar. medullare alef.*) germplasm. *Genet Resour Crop Evol*. 2013;60(8):2207-2217.

Lian J, Li Y, Rad MH, Zhao H. Directed evolution of a cellodextrin transporter for improved biofuel production under anaerobic conditions in *saccharomyces cerevisiae*. *Biotechnol Bioeng*. 2014.

Wetzel ME, Kim K-, Miller M, Olsen GJ, Farrand SK. Quorum-dependent mannopine-inducible conjugative transfer of an agrobacterium opine-catabolic plasmid. *J Bacteriol*. 2014;196(5):1031-1044.

Kim H, Abeysirigunawarden SC, Chen K, et al. Protein-guided RNA dynamics during early ribosome assembly. *Nature*. 2014.

Stumpf RM, Wilson BA, Rivera A, et al. The primate vaginal microbiome: Comparative context and implications for human health and disease. *Am J Phys Anthropol*. 2013;152:119-134.

Kellett WF, Brunk E, Desai B, et al. Computational evidence that vibrio vulnificus FrsA is not a cofactor-independent pyruvate decarboxylase. *Abstr Pap Am Chem Soc*. 2013;246.

Li K, Yang H, Schurig-Briccio LA, et al. Mechanism of action of SQ-109 analogs in a variety of organisms. *Abstr Pap Am Chem Soc*. 2013;246.

Pedron S, Becka E, Harley BA. Regulation of glioma cell phenotype in 3D matrices by hyaluronic acid. *Biomaterials*. 2013;34(30):7408-7417. ■

SAFETY

SAFE USE OF LABORATORY VACUUM PUMPS

When working in the laboratory researches can utilize several different types of vacuum besides using the house supplied vacuum. Normally the use of a small or portable vacuum pump is necessary for processes such as rotary evaporations, vacuum concentrators, gel dryers, vacuum filtration and desiccators. When using portable vacuum pumps some care and attention to safety is needed. Below are some common safety practices that should be implemented when using Laboratory Vacuum pumps.

- A cold trap should be used in the suction line of a vacuum pump to collect any volatile substances from the system and minimize the amount of material that enters the pump and dissolves in the pump oil.
- A cold trap should also be used with a water aspirator to minimize contamination to the discharge water.
- The output of a vacuum pump should be vented to an air exhaust system (chemical fume hood) anytime the pump is being used to evacuate a system containing volatile, corrosive or toxic substances.
- If the pump is being used to evacuate volatile, corrosive or toxic substances it is recommended to scrub or absorb the gases exiting the pump.
- Pumps should have a record of use to prevent cross contamination or reactive chemical interactions.
- The pump oil should be changed on regular intervals. The waste oil should be treated as contaminated waste and disposed of according to Division of Research Safety guidelines.
- Belt driven pumps should always have a guard in place to protect workers from being entangled in the belt and motor. ■

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