IGBNEWS

Achievements, awards, and information about the IGB community

Volume 3, Number 7

Featured News

New IGB Website

The new IGB Website is now live. You'll find a lot more dynamic content, resources, and up-to-date news and events, now with more convenient organization. Check it out: **www.igb.illinois.edu** ■

{Upcoming Events}

Coffee Break with the Office of Technology Management

November 2, 2010

Stop by anytime between 2:00-3:30 p.m.

2nd floor break room, Main Lab Building

IGB Donut Day

Friday, November 5, 2010

8:30 a.m.

Array Café

Translational Biomedical Research Seminar

November 8, 2010

Noon

IGB Conference Center #612

Keith L. Knutson, Ph.D.
Mayo Clinic

"Immune-induced Generation of Breast Cancer Stem Cells"

Pioneers Seminar

Tuesday, December 7, 2010

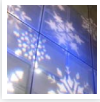
Noon

IGB Conference Center #612

Susan M. Rosenberg, Ph.D.
Baylor College of Medicine

"Title to be announced"

IGB Holiday Party



December 10, 2010

4 :00 – 6:00 p.m.

Atrium, Main Lab Building

Thanksgiving Break Hours

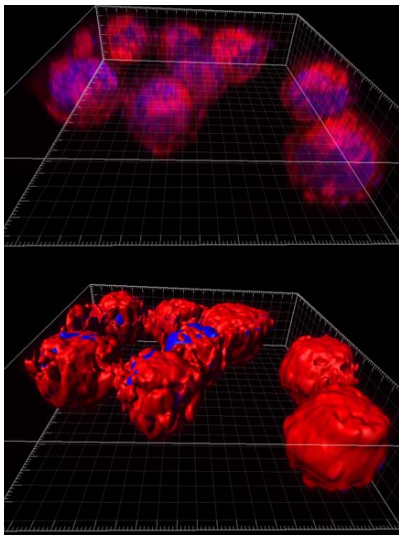
November 22-24, 2010

IGB Administrative Offices open regular hours, 8:30 a.m. - 5:00 p.m.

November 25 & 26, 2010

IGB Administrative Offices will be closed.

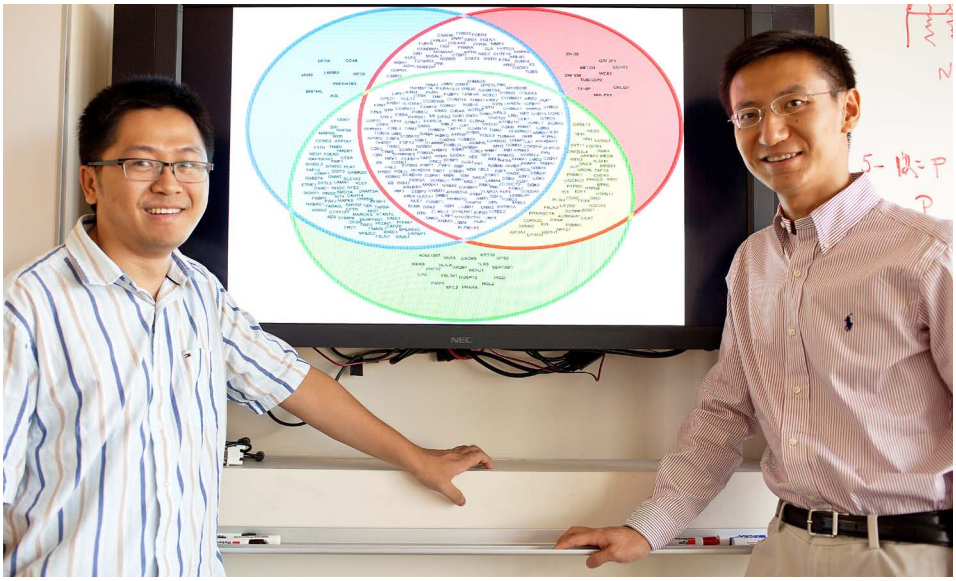
{Image of the Month}



This month's Core Facilities Image of the Month, "Mitochondria in Live Cancer Cells," was made by Quinn Peterson from the Hergenrother Lab, using the Zeiss 710 LSM Confocal Microscope and rendered with Imaris.

IGB News

Share your news with the IGB. Send your story ideas to **mme@illinois.edu**



Sheng Zhong: Comparing Gene Regulatory Networks Across Species

Sheng Zhong, assistant professor of bioengineering, has just received the 2010 NIH Director's New Innovator award, a prestigious recognition that is intended to "stimulate innovative research and support promising new investigators." The grant supports young investigators with funds up to $300,000 in direct costs per year for five years.

Zhong (above, at right) uses systems biology approaches to study cellular differentiation and evolution. One thing Zhong looks at is how gene regulatory networks (GRNs) orchestrate the level of expression of each gene by controlling whether, when and how vigorously that gene will produce RNAs and proteins. But to study GRNs, one needs not just DNA data, but RNAs, proteins, and biochemical modifications and a way to study them all together, hence systems biology.

> "We hope to use this empirical study together with theoretical developments to be able to understand evolution from a slightly more comprehensive matter and hopefully reach some principled understanding of how evolution is working."

Zhong's group pioneered looking at the GRNs of embryos before they are implanted in the uterine wall. Recently, Zhong and his group have observed that close to forty percent of the genes shared by humans, mice and cows are expressed differently pre-implantation. This is far more variation at such an early developmental stage than generally assumed. The group's findings were published as a cover article in Genome Research and featured in Nature.

"The traditional thought was that different mammals would develop in a similar way at least until implantation," says Zhong. "The shapes of the embryos under the microscope, the number of cells, and the morphology of cells, were extremely similar. So that guided the conventional understanding."

Zhong and his collaborators were also able to determine the mechanism for the GRN variation.

"That initial finding was a surprise," says Zhong. "And then from that observation we started to investigate what are the genomic reasons that could essentially give rise to such a large variety of gene activity. This turned out to be a pleasant surprise that we could work out a part of the mechanism."

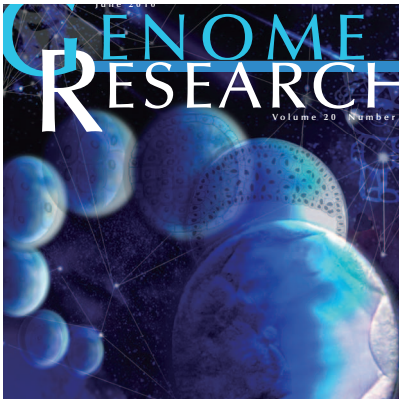
In short, Zhong's group, and collaborators from Massachusetts General Hospital and the Genome Institute of Singapore, demonstrated that transposable elements, aka "jumping genes," might be capable of re-wiring the gene regulatory network.

Altered gene regulation can also be introduced in some other cases by point mutations that affected the binding of regulatory proteins to DNA, notes Zhong.

These experiments suggest a method by which evolution could occur; Zhong's group did find "traces of evolutionary changes of GRN structures, also termed re-wiring of GRNs. "

He is particularly excited about these preliminary findings for their potential to help us understand how evolution shapes the human genome. In the near future, Zhong hopes to use the analysis of pluripotent stem cells and pre-implantation embryonic development as "testbed questions" to build and test quantitative evolutionary models for GRNs. Although an enormous amount of research into DNA as it relates to evolution has been undertaken, other substrates, such as RNA and proteins have been much less studied with regard to what elements are conserved or changed during evolution. This is something Zhong has focused on.

Continued on page 3



Dan Xie, (main photo, at left) first author of the *Genome Research* paper and a member of Zhong's lab, has been awarded the prestigious Mavis Future Faculty Fellows (MF3) award from the College of Engineering. The Mavis Fellowship allows doctoral students who are interested in academic careers to gain experience in research, teaching, and mentoring by providing them with $6,000 in stipend and travel funds.

A graduate of the University of Science in Technology of China, Xie joined Zhong's Computational Biology Lab in 2006. He served as a teaching assistant for a biomedical instrumentation course, and he has guest lectured in a statistics and genomics course. He plans to finish his doctorate by summer 2011 and begin his career in academia or at a research institute.

"We wanted to put proteins, RNAs and genomes and the interactions among them in one context to study evolution," says Zhong. "We hope to use this empirical study together with theoretical developments to be able to understand evolution from a slightly more comprehensive matter and hopefully reach some principled understanding of how evolution is working."

Zhong's ultimate goal is to systematically understand and appreciate the differences in a wide range of mammalian GRNs. He is in the process of adding pig and opossum, thanks to the expertise of campus experts. Ideally this work will help the scientific and medical communities understand how findings from other animals can be extrapolated to human biology and to what extent those findings may need to be adjusted.

His findings also suggest that multiple gene regulatory networks can guide early embryonic development, says Zhong, who hopes that information can be harnessed to make pluripotent cells from adults cells more quickly, efficiently and inexpensively. ■

{Research}

Microbiome Project to Impact Women's Health

A team of scientists from the Institute for Genomic Biology, Mayo Clinic, and the J. Craig Venter Institute are leveraging a long-standing research relationship to apply results from the Human Microbiome Project to help identify microbial risk predictors for preterm birth.

"Bacterial vaginosis affects between 10 and 15 percent of women of reproductive age and is associated with a host of genital tract infections and pregnancy complications," says lead researcher Bryan White, a professor of animal science at the U of I. "Our ultimate goal is to use the wealth of genomic information from the Human Microbiome Project to improve women's health." The Human Microbiome Project is an NIH program to identify and catalog the microbes within the human body and determine their impact on health.

"This is a collaborative effort to apply cutting-edge technology to one of the fundamental problems in maternal-fetal health," says Douglas Creedon, M.D., Ph.D., Mayo Clinic obstetrician and gynecologist. The project also represents the first major initiative of the newly formed Mayo-Illinois Strategic Alliance for Technology-Based Health Care.

White and Creedon, along with co-leader Brenda Wilson, an associate professor of microbiology at Illinois, and Karen Nelson and Derrick Fouts at the J. Craig Venter Institute, will use the emerging microbiome, metagenome, and reference genome datasets to characterize the microbiomes associated with urogenital infections. These include bacterial vaginosis, urinary tract infection and yeast vaginitis, which afflict over 1 billion women each year.

The project, entitled "The human vaginal microbiome and bacterial vaginosis," will explore the complex relationship between vaginal microbiota and humans. Scientists are particularly interested in the link between the vaginal infection and preterm birth, as microbiologic evidence suggests that infection may contribute to approximately 25 percent of preterm births.

"In most cases of preterm labor and delivery, intrauterine infection is not clinically apparent," White says. "But there seems to be a strong correlation between infection and premature birth. We see colonization rates as high as 79 percent for birth at 23 weeks of gestation, yet they decline to 11 percent at 31 to 34 weeks."

A $650,000 grant from the National Institutes of Health's National Institute of Allergy and Infectious Disease (NIAID) will help support the work. White and Wilson are both members of the Host-Microbe Systems Research Theme. ■

New Tool in the Fight Against Tuberculosis

Researchers at the Institute for Genomic Biology have developed a way to harness the prodigious quantities of both genomic and metabolic data being generated with high-throughput genomics and other techniques. They have developed an algorithm that automatically integrates both data sets. The model, called probabilistic regulation of metabolism (PROM), enables researchers to perturb a given regulatory gene or metabolic process and see how that affects the entire network.

"PROM provides a platform for studying the behavior of networks in a wide range of different conditions," says Nathan Price, principal investigator.

Using this model the researchers have created the first genome-scale, regulatory-metabolic network of *Mycobacterium tuberculosis*. Their results were published online by PNAS on September 27.

Using *E. Coli* as a benchmark, Price, professor of chemical and biomolecular engineering, and graduate student Sriram Chandrasekaran showed that PROM was more accurate and comprehensive than the previous model for *E. Coli*, which had been done by hand and published in 2004.

After using *E. Coli* as a proof of principle, they targeted tuberculosis, a bacterium that has not been as thoroughly studied as *E. Coli*. Price and Chandrasekaran had less than half the amount of data that they had for *E. Coli* and were still able to create a model that predicted knockout phenotypes 95 percent of the time, says Price.

Price and Chandrasekaran built the algorithm using microarray data, transcription-factor interactions that regulate metabolic reactions, and knock-out phenotypes. The method is both accurate and fast. PROM may prove particularly helpful to tuberculosis researchers because, although when tuberculosis is growing it can be killed, the real challenge is to target the bacterium during its dormant or quiescent stage. PROM may enable researchers to identify and target the pathways keeping the cells alive during dormancy.

PROM also represents a major advance because it successfully integrates the statistically derived transcriptional regulatory network with a biochemically derived metabolic network.

"That is the new part," says Price. "People have created regulatory models and metabolic models. But there has been nothing before that could combine them in this automated fashion. It is difficult to get these two to talk to each other in the right way."

Price and Chandrasekaran created an algorithm that makes use of probability. Earlier models used a Boolean or a binary approach, in which a gene is either on or off. PROM can account for a gene or enzyme that can also be part way on or part way off, so it acts more like a rheostat than a toggle switch.

"People were stuck here for a long time. That's why PROM is such a nice method. It's sort of Boolean but it's probabilistic Boolean. It does allow us to have a continuous variation," says Price.

"These models can guide genome-scale synthetic biology," he adds. "And understanding how the networks are put together lays the foundation for us to design genomes that encode for networks that behave in the way we want them to, such as engineering microbes to convert environmental toxins into biofuels, for example." ■

Awards

Carl R. Woese (Biocomplexity) was presented the Trustees' Distinguished Service Medallion at the Sept. 23 UI Board of Trustees meeting in Urbana. The award recognizes individuals whose contribution to the growth and development of the UI, through extraordinary service or benefaction, has been of unusual significance.

Sheng Zhong (Cellular Decision Making in Cancer) has received the National Institutes of Health Director's New Innovator Award for 2010. The award addresses two important goals: stimulating highly innovative research and supporting promising new investigators.

Bruce Fouke (Biocomplexity, EBI) has been awarded the 2011 Samuel von Pufendorf Visiting Research Fellowship in the Pufendorf Institute for Advanced Studies at Lund University in Sweden. Fouke, who will become the very first Pufendorf Fellow, will be conducting astrobiology research at the Pufendorf Institute for Advanced Studies in Lund. ■

Vote

Vote for the IGB

Love working for the IGB? Let the world know. Vote for the IGB in The Scientist's annual "Best Places to Work" survey.
www.the-scientist.com/jsp/bptw2011.html ■

New Arriavls

Three new researchers join the IGB

Deepak Somaya has joined the IGB as a faculty member in the Business, Economics and Law of Genomic Biology (BioBEL) Research Theme.

Jianjun Cheng has joined the IGB as an affiliate in the Regenerative Biology and Tissue Engineering Research Theme.

M. Andrea Martens has joined the IGB as a faculty member in the Business, Economics and Law of Genomic Biology (BioBEL) Research Theme. ■

Fund Drive

Campus Charitable Fund Drive

The 2010 Campus Charitable Fund drive is underway. Please consider contributing! You can read the brochure by visiting the website at **www.ccfd.illinois.edu**.

A few things to remember:

- We encourage everyone to give by online 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 either Jacinda King at 244-2276 / **jkking@illinois.edu** or Dale Johnston at 244-5595 / **dkjohnst@illinois.edu** ■

Dissertation Award

Catherine Connor Outstanding Dissertation in Biotechnology

The Roy J. Carver Biotechnology Center (CBC) will award two prizes of $1,000 and $500 to the winner and first runner up in a competition to recognize outstanding work in biotechnology.

Illinois Ph.D. candidates whose studies are within the area of molecular biology, genomics, proteomics, or other applications of biotechnology and who are within two years of completion of their dissertation are invited to participate. Qualified candidates are required to submit a poster presentation (no larger than 4' x 4') and one page typed abstract (with your name, and complete contact information) to the Biotechnology Administrative Office (2608 IGB, 217.333.1695) by 4:00 p.m. on December 15, 2010. Posters used in previous presentations qualify, as long as the candidate is the first author and the content is a portion of their dissertation. Presentations will be judged on originality of research, scientific merit, relevance to biotechnology, and appearance. Awards will be presented in January 2011. ■

Conference Rooms

Scheduling conference rooms

If you need to schedule a conference room in the IGB, here's who to contact:

Conference Center
Darci Wooden (facilities@igb.illinois.edu)

Computer Lab
Dan Davidson (help@igb.illinois.edu)

Gatehouse Conference Room (second floor)
Barbara Jauhola (bjauhola@illinois.edu)

Theme Conference Rooms
Individual theme secretaries ■

ADMINISTRATIVE NEWS

{Business}

USCIS Fee Change

On November 23, 2010, the United States Citizen and Immigration Services (USCIS) will once again change their fees. Although a few fees will actually decrease or be eliminated, most will increase. The following changes will affect cases at the University of Illinois:

- Form I-129 (used for H-1 and O-1 applications) will increase from $320 to $325.
- Form I-140 (immigration petition used for green card cases) will increase from $475 to $580.
- Form I-907 (premium processing, used optionally for the above forms) will increase from $1,000 to $1,225.

Changes in fees paid by international employees:

- Form I-485 (adjustment of status application) will increase from $1010 to $1070.
- Form I-765 (application for a work permit) will increase from $340 to $380.
- Form I-539 (certain extensions and changes of status) will decrease from $300 to $290.

For the complete list of USCIS fee increases, go to **www.uscis.gov** and look under "News" and "Fact Sheets." ■

{Computer and Network Resource Group}

Server Life Cycle

The majority of servers at the IGB are at or near the end of their three-year life-cycle. As a result, the CNRG will be sending out messages often with notifications of outages of specific systems with the goal of having everything updated by the end of summer 2011. If you have any projects that could be impacted by one of these outages, please contact **help@igb.illinois.edu**, and we will try to schedule appropriately. ■

{Biotechnology Information Center}

Faculty of 1000 Has Expanded

Hopefully you were a regular user of *Faculty of 1000 Biology* – a great way to find out which articles "experts" in various biology fields have evaluated as "exceptional," "must-reads," or "recommended." *Faculty of 1000* has recently changed its name (dropped "Biology") and expanded coverage to include the medical disciplines. If you already are receiving alerts from F1000, you may want to revisit it to select additional areas of interest.

Try F1000 out at: **www.library.illinois.edu/orr/get.php?instid=226365**

You'll find the main part of *F1000* under the Evaluations link:

- Browse by subject area to see newly evaluated papers and those that have high F1000 Article Factors.
- Use the Advanced Search to find articles of particular interest, those published at a particular institution, those rated by a faculty evaluator, or published in a particular journal.
- Be sure to register for a MyF1000 account so you can request regular email alerts based on broad subject areas or your specific searches.

Other sections of *F1000* include:

- Reports – peer-reviewed commentaries on emerging themes
- Posters – repository for posters from meetings – deposit yours or view others
- Magazine – *The Scientist*

If you bookmark *F1000* on campus, you can use **http://f1000.com**. Use the Library's URL for accessing F1000 from off-campus. ■

{Communications}

We're developing video content for the IGB website. If you would like to be featured, contact Melissa Edwards at **mme@illinois.edu** to arrange filming. ■

{Safety}

IGB Vacuum System

In last month's issue of IGB News, we covered some of the basics of working safely with the IGB vacuum system. This month, we'll delve a little deeper:

VACUUM TRAPPING

When using a vacuum source, it is important to place a trap between the experimental apparatus and the vacuum source. The vacuum trap protects the pump and the piping from the potentially damaging effects of the material, protects people who must work on the vacuum lines or system, and prevents vapors and related odors from being emitted back into the laboratory or system exhaust.

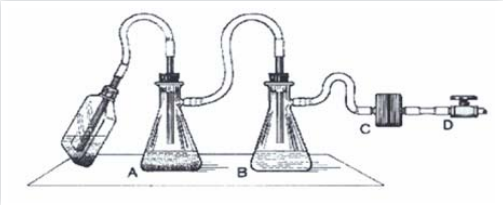
There have been incidents where improper trapping caused vapor to be emitted from the exhaust of the house vacuum system, resulting in either re-entry into the building or potential exposure to maintenance workers.

Unfortunately, this type of incident is not the worst that can happen. In 2001, at the University of California - Davis, two plumbers were injured when a house vacuum line burst after one of the plumbers attempted to solder a fitting on the copper line. Results of analysis found evidence of copper perchlorate (an oxidizer) and acetate, which created an explosive mixture upon heating by the torch.

PROPER TRAPPING TECHNIQUES

To prevent contamination, all lines leading from experimental apparatus to the vacuum source should be equipped with filtration or other trapping as appropriate.

For **particulates and bioaerosols**, use filtration capable of efficiently trapping the particles in the size range being generated



Vacuum Trap
The left suction flask (A) is used to collect the contaminated fluids into a suitable decontamination solution; the right flask (B) serves as a fluid overflow collection vessel. An in-line HEPA filter (C) is used to protect the vacuum system (D) from aerosolized microorganisms.

For most **aqueous or non-volatile liquids**, a filter flask at room temperature is adequate to prevent liquids from getting to the vacuum source.

For **highly reactive, corrosive, or toxic gases**, use a sorbent canister or scrubbing device capable of trapping the gas.

For **solvents and other volatile liquids**, use a cold trap of sufficient size and cold enough to condense vapors generated, followed by a filter flask capable of collecting fluid that could be aspirated out of the cold trap.

For most **volatile liquids**, a cold trap using a slush of dry ice and either isopropanol or ethanol is sufficient (to -78 deg. C). Avoid using acetone. Ethanol and isopropanol are cheaper and less likely to foam. ■

{Operations and Facilities}

Accidents

If you're in an accident while driving a University vehicle, you need to take two steps to ensure that you are in compliance with all University, State, and Insurance Reqirements:

First, report the accident to your campus transportation office and your immediate supervisor within 24 hours, even if you're still in travel status.

Then, be sure to complete and submit a SR-1 Illinois Motorist Report of Motor Vehicle Accident to your campus transportation office not later than three days following the accident (but preferably within 24 hours). This is the same form the state requires of any driver of any vehicle involved in an accident in Illinois—it's not a University-specific requirement.

Blank copies of this form are always in the glove compartment of every University vehicle. The state does not make it available online. ■

ILLINOIS

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