

DEPARTMENT OF CELL & DEVELOPMENTAL BIOLOGY



SCHOOL OF MOLECULAR & CELLULAR BIOLOGY

Letter from the Department Head

Welcome to the 2021 edition of the CDB newsletter. First, a big thank you to the Department of Cell & Developmental Biology faculty, staff, and students for their commitment, passion, and drive to excel. Your strength, resilience, and unflinching support has let us progress through these exceedingly uncertain times brought about by the pandemic. Though the past 20 months have been very challenging, collectively as a team, we have made significant strides that I am very proud of. This newsletter is a celebration of these achievements. As you read through the newsletter, you will notice that the scope of CDB's research and instructional commitment is commendable.

We have been fortunate as 2021 has been a great year for our department. We have been thrilled to welcome a new faculty member, Dr. Kevin Van Bortle, who joined the department as an assistant professor. In August, Prof. William Brieher was promoted to full professor. I am delighted to share that Dr. Martha Gillette won the 2021 Beckman Institute Vision and Spirit Award, an honor created by the institute's founder to recognize faculty who fostered collaboration in their research.

We have also been at the leading edge of research, thanks to the exemplary work of our faculty and alumni. In this newsletter, we have a special feature on Prof. Jie Chen who has published several recent influential articles on phospholipid-protein interactions and how these play essential roles in the regulation of many key cellular processes. In addition, Prof. Chen was also the recipient of the campus award for excellence in graduate student mentoring. We also feature two of our alumni, Dr. In-Hyun Park, associate professor at Yale, and Dr. Yejing Ge, assistant professor at MD Anderson. They both are former graduate students of Prof. Chen. We also highlight Dr. Belmont's research on how changes in gene association with nuclear speckles correlate with changes in gene expression. Further, Dr. K. Prasanth's research on noncoding RNAs and their role in cell proliferation and Dr. Smith-Bolton's research on the identification of mechanisms controlling regeneration are highlighted.

Finally, I would like to extend my sincere thanks and appreciation for the hard and inspiring work of all our students, postdoctoral associates, and technicians. They have continued to excel with their 'never give up' attitude even during these demanding times. As always, the students planned the 2021 retreat, but the pandemic forced us to move it to 2022. In this newsletter, we spotlight PhD student Janhavi Kolhe, who was the recipient of the Tom and Cynthia Cycyota Research Fellowship. We also call attention to two stellar former graduate students, Dr. Xiaohe John Li and Dr. Yo-Chuen Lin, recipients of the Tunji Toogun award.

Thanks to the steadfastness and exceptional contributions of all CDB members, we continue to function efficiently, with liveliness and fervor, even under the duress of the pandemic. We remain committed to continue our efforts on providing top notch education to our undergraduate and graduate students. We hope that our alumni stay actively engaged with the department to support our research, teaching, and service endeavors. **This year we created a Twitter account, @CDB_Illinois, and I invite you to follow us!**

Looking forward to a happy, healthy, prosperous, and a pandemic-free 2022.

Supriya Prasanth



2021

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Meet Kevin Van Bortle



The School of Molecular & Cellular Biology and Department of Cell & Developmental Biology are thrilled to welcome new faculty member Kevin Van Bortle! He joins us from the Stanford University School of Medicine, where he conducted his postdoctoral research. We recently spoke with him about his research and teaching interests, what drew him to the University of Illinois, and how he spends his free time.

Tell us about your lab and your research focus, including how you came to choose or specialize in this area.

My lab investigates RNA polymerase III (Pol III) transcription and the mechanisms that contribute to Pol III dysregulation in cancer. Pol III plays a central role in supporting protein accumulation and growth by transcribing genes encoding tRNA and 5S ribosomal RNA, in addition to many other important small RNA species.

Our current research focuses on the role of Pol III subunit composition as a modulatory mechanism that facilitates expanded Pol III activity in proliferating cells and cancer

contexts. We are also interested in better understanding the full extent of Pol III transcription and the nature and function of specific small RNA species generated by Pol III that remain poorly understood today. These directions stem from previous work exploring the 3D genome organization of Pol III-transcribed genes and a growing appreciation for how much we have yet to learn about Pol III.

What is especially exciting about this area of research at this time?

My group takes advantage of recently developed genomic and functional genomic approaches to generate improved, comprehensive maps of Pol III activity in human cells while deconstructing the role of specific factors in Pol III transcription. Using this approach, we are beginning to better understand mechanisms of gene regulation that contribute to proliferation and growth and aim to exploit these findings as potential cancer drug targets.

What interested you the most about becoming a faculty member in the School of MCB and the U of I?

Pol III transcription sits at the intersection of many fields, from gene regulation and noncoding RNA biology, to signal transduction, cell growth, and metabolism, to developmental and cancer biology. UIUC's School of Molecular and Cellular Biology is home to many leading research programs in these fields, as well as a top-rated graduate program with exceptional students. I am excited about the collaborative environment in MCB as well as the growing basic science focus of the Cancer Center at Illinois.

What are your teaching interests?

I believe that introducing undergraduate and graduate

students to programming and bioinformatics at an early stage is more important than ever. Molecular genomic approaches and large sequencing datasets are becoming increasingly ubiquitous, and these skills improve science accessibility, transcend individual subfields, and are ultimately transferrable to many diverse career pathways.

If any students (undergrad or grad) are interested in working in your lab, what's your advice or how can they get in touch with you?

I encourage any graduate or undergraduate students interested in joining our group to e-mail me with a brief description of their research interests: kvbortle@illinois.edu

Tell us about someone who made a difference in your life, such as someone who sparked your interest in biology, who encouraged you to pursue a career in academia or challenged your thinking about a topic.

I credit my undergraduate molecular biology professor, Cheeptip Benyajati, for sparking my interest in gene regulation and an appreciation of the experimental methods used to advance the field. I've been supported and encouraged by incredible undergraduate, graduate, and postdoc mentors (Jeffrey Hayes, Victor Corces, Mike Snyder) who have given me significant freedom to pursue novel directions that have led to my interest in studying Pol III transcription.

What do you like to do in your free time?

I enjoy staying active in my free time, including running, biking, or hiking with my dog, Scully. I'm also looking forward to dusting off my saxophone in Champaign-Urbana.

Catching up with Jie Chen



Jie Chen, professor and former head of the Department of Cell & Developmental Biology, is a respected researcher who has built a career exploring signal transduction in mammalian cells. She also is admired for her dedication to students throughout the years she's been at the University of Illinois. Most recently she received the Campus Award for Excellence in Graduate Student Mentoring.

Professor Chen spoke with Bianca Savant, a senior majoring in the MCB Honors Concentration, about her path to Illinois, her research program, and approach to mentoring students.

How did you become interested in biology and biochemistry?

Throughout high school, Jie Chen always showed an interest in the sciences. She deeply enjoyed physics and math. "Anything that was abstract and logical just spoke to me," Chen said.

In college, she chose to study biochemistry within the biology department at Peking University. At the time, biology was a rapidly-growing and exciting field, which is what initially drew Chen to the field. During her studies, she excelled in her courses, however; she was not as interested in biology as she had initially imagined.

This changed during her junior year of college. She was recruited by one of her biology professors to perform biochemistry experiments in his laboratory. The primary goal of her work was to purify an enzyme from cow intestines. Chen quickly became captivated by the process of scientific discovery.

"Proteins are so small that you cannot see them with the naked eye, but through experimental techniques, you can visualize them," she said.

This formative research experience piqued Chen's interest in biology and research. Since then, she has continued her research in protein biochemistry. She remains excited by uncovering extraordinary processes that occur in nature.

When did your experience with mentorship first begin? How has that had an impact on your own approach to mentoring?

Chen pursued her PhD at Rice University. One of the most impactful relationships she developed there was with her mentor, Kathleen Matthews, the Stewart Memorial Professor Emeritus whose research is in the structure and function of genetic regulatory proteins. Matthews

put in great effort and time working with her. Not only did she teach Chen everything she knows, but she also empowered Chen and allowed her to believe in herself. "The way that you were mentored is carried over to how you mentor your students," she said.

Now, Jie Chen has mentored about 20 of her own students. Her main challenge as a mentor is finding her students' strengths and empowering them.

"If you raise the bar, they will reach it. This has been proven true time and time again," she said. Chen strongly believes that mentorship goes both ways. She loves to mentor her students and learns a great deal from them. "My students are my heroes. They are smart, tenacious, and creative."

Being a mentor has been an enriching experience for Chen. She was recently awarded the Campus Award for Excellence in Graduate Student Mentoring. She continues to keep in touch with her former students today. Even with her countless accolades, Chen affirms that her students and their successes remain her proudest accomplishment.

Tell us about the research you and your students are engaged in at Illinois.

The Chen lab currently studies signal transduction mechanisms that regulate fundamental cellular and developmental processes in mammals. Exploring "what are the signaling pathways that control or modulate different biological processes" has been the focus of her lab since day one. Signaling pathways have always been of great interest to Chen; figuring out signaling pathways is the ultimate form of puzzle solving, she said.

CHEN, continued

Specifically, she studies cell growth and differentiation. These processes have many applications to human health. Understanding the mechanisms of cell growth is critical for cancer biology. Additionally, muscle differentiation, an important process in muscle regeneration after injury, also has clinical relevance.

For over 20 years, the mTOR signaling pathway was a primary focus of the Chen group. Their research and others in the field uncovered that mTOR signaling is not merely a pathway, but rather a network. In the last few years, Chen's lab has moved away from mTOR and expanded into other signaling pathways including lipid and cytokine signaling. Her group continues to make exciting discoveries of novel signaling mechanisms.

Her lab has been doing novel work in muscle regeneration. Within the immune system, typically cytokines receive credit for the creation of cytokines, however, muscle cells also make their own cytokine cells. Muscle cell-generated cytokines have been heavily overlooked in the past, however, the Chen lab has recently developed a mouse model to study them with in vivo significance. Her lab is at the forefront of this research.

What is it about the University of Illinois and MCB that makes it a fulfilling place to teach and do research?

Throughout her career, Chen said she has “really benefited from [this] collaborative and supporting environment” at the University of Illinois. Chen said she appreciates how everyone is very open to sharing, whether that be ideas or reagents. As a junior faculty member, she developed two parallel research programs in cell growth regulation and muscle differentiation. She did not have any prior experience with muscle differentiation but was encouraged to pursue this endeavor by a senior colleague, Professor Stephen Kaufman. He was incredibly supportive and believed that muscle differentiation would fit very nicely into her research pursuits.

How do you like to spend your free time?

Professor Chen has a love for good food and movies. She enjoys going to film festivals with her husband and spending time with her two children. During the pandemic, her lab group compiled their favorite recipes and created a lab cookbook.

The Chen lab has published several significant papers in the last year.

> In “**Redefining the specificity of phosphoinositide-binding by human PH domain-containing proteins**,” published in *Nature Communications*, Chen, recent PhD graduate Nilmani Singh, research specialist Adriana Reyes-Ordoñez, and colleagues discovered widespread, specific lipid binding by a large family of human proteins.

Phospholipid-protein interactions play an essential role in the regulation of many important cellular processes. The largest family of putative lipid-binding proteins contain the pleckstrin homology (PH) domain. Previous studies in the field estimate that approximately 10 percent of the PH protein family binds to phosphatidylinositol phosphate (PIP) with high specificity and affinity. However, research from the Chen lab contradicts that current view. In their article, the researchers suggest that about 50 percent of PH domain-containing proteins interact with specific PIPs.

> In the *Cell Reports* article, “**ARHGEF3 Regulates Skeletal Muscle Regeneration and Strength through Autophagy**,” Chen and collaborators uncovered novel molecular mechanisms of regulation in skeletal muscle regeneration. Humans possess over 70 guanine exchange factor (GEF) proteins that are important in intracellular cell signaling. Rho-dependent ARHGEF3 is an activator for a small family of G proteins that act as a molecular switch and are involved in signal transduction.

Despite their abundance and fundamental role in signaling, GEF proteins are not often studied in physiological settings. The Chen lab is the first to explore the effect of ARHGEF3 depletion in mice. Chen and postdoctoral fellow Jae-Sung You, the lead and co-corresponding author, link the deletion of ARHGEF3 with skeletal muscle regeneration in the article.

Researchers uncover role of a noncoding RNA in cell proliferation

By Bianca Savant

Kannanganattu V. Prasanth, professor of cell and developmental biology, and members of his lab investigate the regulation of gene expression and RNA biology with a focus on cancer. In an article published this year in eLife, “The S-phase-induced lncRNA SUNO1 promotes cell proliferation by controlling YAP1/Hippo signaling pathway,” Prasanth and fellow researchers detailed the role of long noncoding RNAs in cell cycle progression.

The cell cycle is a tightly regulated process. Deviations from the cycle lead to aberrant cell growth, which is linked to cancer. Because mutations in the cell cycle have such harmful effects, proteins responsible for cell cycle regulation are heavily researched. However, the role of long noncoding RNAs (lncRNAs) in cell cycle progression has not been studied as thoroughly.

While the human genome encodes lncRNA genes, not much is known about their functions. In a collaborative effort, the researchers identified lncRNAs that exhibited differential expression, similar to protein-coding genes, during cell cycle. The lab isolated cells at different stages of the cell cycle and performed RNA sequencing analyses to identify lncRNAs that were differentially expressed during specific cell cycle stages.

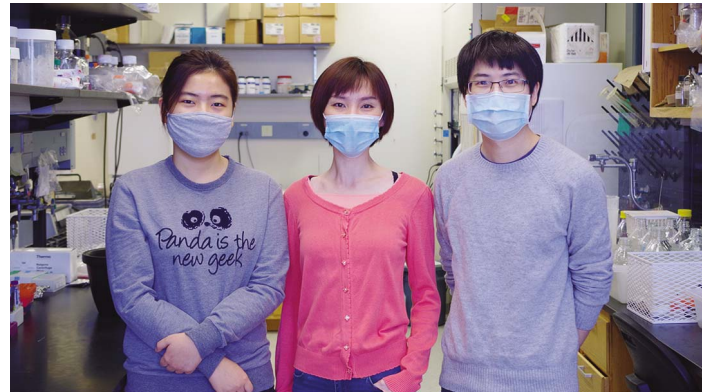


KV Prasanth

cell-cycle regulated lncRNAs and will be critical for understanding signaling steps in cancer progression as well

They identified nearly 2,000 lncRNA genes that showed differential expression at various stages of the cell cycle; they focused on characterizing the role of one of the S-phase up-regulated lncRNA, which is linked with cell growth and when deregulated, associated with cancer.

This particular study is a stepping stone for the characterization of



The graduate students who performed many of the experiments for this eLife paper during the COVID-19 pandemic included (left to right) You Jin Song (KV Prasanth lab), Qinyu Hao (KV Prasanth lab), and Yo-Chuen Lin (Supriya Prasanth lab).

as normal cellular development, according to Prasanth.

By modulating the expression of genes that control cell proliferation through gene knockdown experiments, investigators searched for genes that played a role in cell cycle progression.

After performing phenotypic screens upon knock down of several cell cycle-regulated lncRNAs, they identified SUNO1, a low copy lncRNA that only produces 5-10 transcripts per cell, to be upregulated in S-phase. The gene plays a critical role in facilitating cell cycle progression. Given its low copy number, this was quite surprising for the research group.

Their studies revealed that SUNO1 facilitates cell proliferation by promoting the oncogenic YAP1 (Yes-Associated protein 1) transcription co-activator-mediated gene expression.

In addition to S-phase, SUNO1 was also upregulated during DNA damage. Aberrant DNA damage, as well as uncontrolled growth during S-phase, may cause cancer. The research group found that elevated levels of SUNO1 are associated with poor cancer prognosis and tumorigenesis, making it a potential marker for diagnosis.

Looking beyond SUNO1, Prof. Prasanth said the major focus of his lab is to investigate the roles of novel lncRNAs in the cell cycle and cancer progression.

RESEARCH

Researchers identify mechanisms of controlling regeneration for two chromatin-remodeling complexes of *Drosophila*

By Maddie Blaauw



Rachel Smith-Bolton, a professor of cell and developmental biology at the University of Illinois, leads an exciting research program on tissue regeneration. Her work uses *Drosophila* as a model to explore the effects of different chromatin modifiers on initiating, spatially controlling, and ending regeneration in coordination with development.



Prof. Rachel Smith-Bolton (top) and postdoctoral researcher Yuan Tian (bottom).

In a recent publication in *Genetics*, she and postdoctoral researcher Yuan Tian uncover more mechanisms of regeneration control by showing the roles of two chromatin-remodeling complexes on regeneration in *Drosophila* through damaging the imaginal disc, the juvenile tissues that build the adult wing

during metamorphosis. In particular, they demonstrate the effects of the SWI/SNF BAP and PBAP complexes on *Drosophila* wing imaginal disc regeneration.

Figuring out how to control regeneration holds immense potential in medicine and beyond, but the tangles of cellular signaling and regulation make this a difficult task. Researchers have been able to identify signals that initiate regeneration in response to tissue damage, but little is understood about how these signals work or why they fail.

Regulation of gene expression during this time is also a topic that has eluded researchers. It is also unknown if regeneration genes are all regulated in a similar manner, or if different modification complexes are responsible for chromatin modification at different regeneration genes.

Smith-Bolton and Tian, who received her PhD in cell and developmental biology from Illinois in 2020, have made headway in this area by identifying the mechanisms of

controlling regeneration for two chromatin-remodeling complexes: the switch/sucrose non-fermentable (SWI/SNF) complexes Brahma-associated proteins (BAP) and Polybromo-associated proteins (PBAP). While it is known that these complexes play roles in regeneration in a variety of animal models (including *Drosophila* midgut and mouse skin, liver, and ear), little was previously known about the mechanisms through which the complexes achieve the necessary effects.

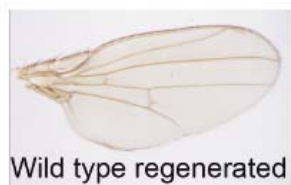
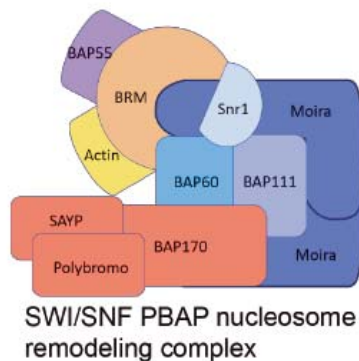
Their findings are outlined in the article, “Regulation of growth and cell fate during tissue regeneration by the two SWI/SNF chromatin-remodeling complexes of *Drosophila*.”

“We know when the tissue gets damaged, there has to be a big change in gene expression. It has to go from what it’s normally doing into damage response and regeneration,” Smith-Bolton said. “One of the big questions that Yuan was tackling was how it makes that switch. Chromatin regulators are a good candidate for how that switch is going to happen.”

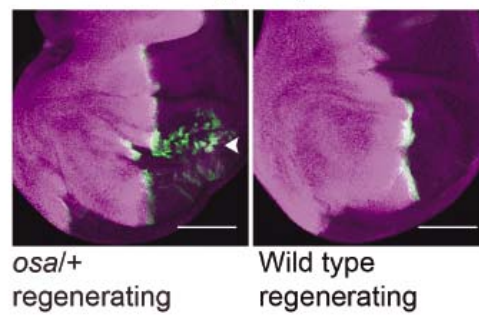
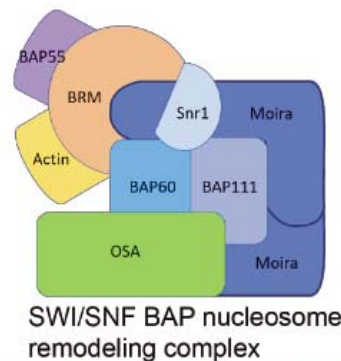
In their work, Smith-Bolton and Tian created tightly controllable tissue damage in the *Drosophila* wing discs using pro-apoptosis genes that can be activated at specific times and in specific tissues. Then, they observed how wing disc regeneration occurred without proper functioning of the BAP and PBAP complexes using mutants and RNAi lines targeting these components.

They found that while both complexes act during regeneration, they have very different roles. *Drosophila* without properly functioning BAP complexes had wing patterning defects after disc damage, with half of the wing pattern appearing as a mirror image of the other half, indicating that this complex plays a role in cell fate and organization of the wing tissue during regeneration.

In *Drosophila* without a properly functioning PBAP complex, the wing size was much smaller after disc regeneration, demonstrating that this complex plays a role in regenerative growth regulation and



Worse regeneration



Patterning defects

The fly *Drosophila* has two SWI/SNF nucleosome remodeling complexes, which control different aspects of tissue regeneration--growth and cell fate--as revealed by mutant phenotypes.

synchronization with development. Additionally, the team's work showed that BAP complex mutants are mispatterned after damage because BAP is needed to protect gene expression against mistakes caused by regeneration signaling.

Smith-Bolton believes that this work has potential for future applications in human regeneration research.

"While it may not be the exact same genes that are going to be important in pushing regeneration in our bodies, the idea that pushing regeneration can cause problems and mistakes is important to think about," she said.

"What do we have to use to stop those mistakes from happening, like the chromatin remodeling complexes that Yuan was working on, to make sure that gene

expression doesn't go haywire when we start pushing regeneration? That's, I think, one of the really important outcomes," Smith-Bolton said.

"Our study of regeneration contributes to the understanding of how tissue regeneration is precisely regulated after tissue damage," added Tian. "This can lead us to achieve proper regeneration through promoting regenerative growth, ensuring correct patterning, and regulating proper ending time instead of scarring or diseases," she said.

The lab has also identified additional mutations causing abnormal regeneration phenotypes and plans to investigate these mutations in future work.

RESEARCH

Belmont Lab offers new insights on nuclear speckles, improved mapping method

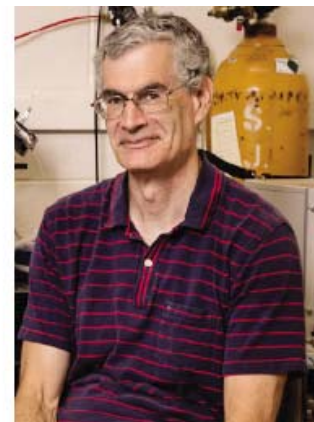
University of Illinois PhD graduate Liguo Zhang of the Andrew Belmont laboratory and collaborators have introduced an improved version of TSA-seq and used it to demonstrate how changes in gene association with nuclear speckles correlate with changes in gene expression.

The article, “TSA-seq reveals a largely conserved genome organization relative to nuclear speckles with small position changes tightly correlated with gene expression changes,” was published in *Genome Research*. Zhang, who received his PhD in cell and developmental biology in 2020, and colleagues were joined in this work by collaborators in the laboratory of Jian Ma at Carnegie Mellon University.

Cell line comparisons showed that small shifts in relative position towards or away from nuclear speckles strikingly correlate with increased or decreased gene expression, respectively, even comparing human embryonal stem cells with normal fibroblasts or two different cancer cell lines. At the same time, distances to nuclear speckles were remarkably conserved for about 90 percent of the genome.

Nuclear speckles were first discovered over 100 years ago, rediscovered in the 1960s, and then discovered again in the 1990s. Despite being the second largest nuclear body, there remains no clear consensus about their actual function. Two theories have prevailed since the 1990s. The first proposed that nuclear speckles serve primarily as storage sites for factors involved in RNA processing. The second theory proposed that they serve as a hub for active gene expression for a subset of active genes.

In support of the second model, the Belmont laboratory has demonstrated amplified expression from Hsp70 heat-shock genes at the HSPA1A/HSPA1B/HSPA1L chromosome locus occurring within several minutes after initial contact with nuclear speckles. Also, the



PhD graduate Liguo Zhang (left) and Professor Andrew Belmont (right).

Belmont laboratory has developed a new genomic method, TSA-seq, to measure relative distance to nuclear speckles genome-wide. As applied to the erythroleukemia K562 cell line, TSA-seq revealed a near 100 percent association of certain chromosome regions with nuclear speckles; these Speckle Associated Domains (SPADs) were highly enriched in the most highly expressed genes.

An obvious next question was how chromosomal distances to nuclear speckles varied in different cell types and how these differences correlated with differential gene expression. However, a major limitation of the original TSA-seq method was its requirement for several hundred million cells per measurement. TSA-seq uses the Tyramide Signal Amplification staining method to generate biotin-tyramide free radicals, generated by peroxidases coupled to antibodies.

The exponential decay in concentration of these free radicals, spreading radially from the antibody staining target, establishes a “cytological ruler,” allowing estimation of distance of chromosome loci from the staining target by measuring the variation in biotin labeling across the genome. TSA-seq measures the biotin labeling of DNA, rather than chromatin, to avoid a bias by varying protein composition—and labeling—across the genome.

Zhang and colleagues realized that the tyramide labeling efficiency of DNA was much lower than the protein labeling. This led them to deliberately saturate the protein labeling by pushing the peroxidase labeling much further, such that the TSA staining appeared nonspecific in the microscope. However, they realized this allowed them to obtain 10-20-fold higher labeling of the DNA, which remained specific (under-saturated), reducing the number of cells required to 15-30 million per experiment.

Comparison of cell types also suggests that much of the

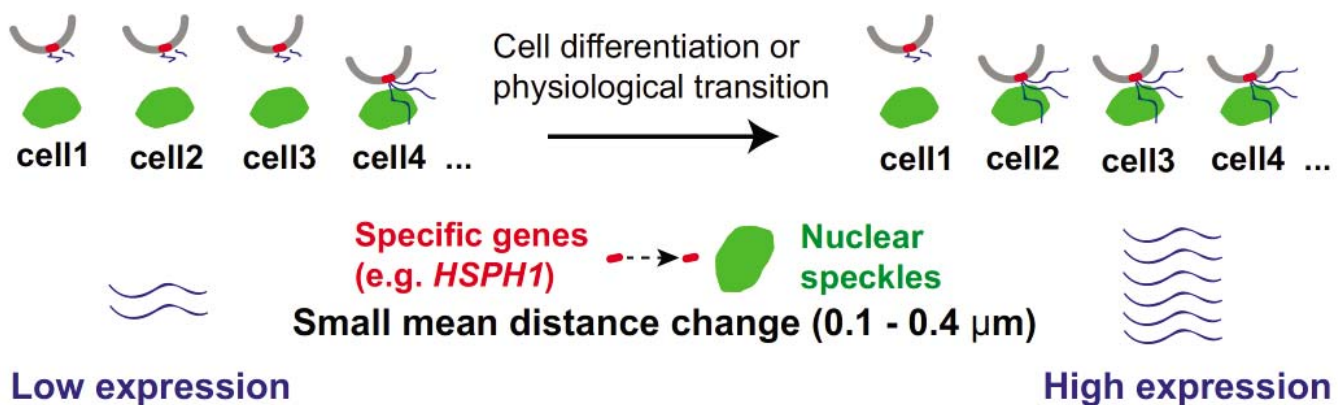
genome may be “hard-wired” in terms of positioning genes near nuclear speckles to facilitate their later gene activation by certain stimuli. For example, previous live-cell imaging of Hsp70 transgenes by the Belmont laboratory had demonstrated that whereas Hsp70 gene induction occurred 2-4 minutes after heat shock when the transgenes already were adjacent to nuclear speckles, induction was slowed by the several or even tens of minutes required for the transgene to move and touch nuclear speckles in cases where the transgenes were located away from nuclear speckles.

Zhang and colleagues discovered that the endogenous Hsp70 locus is among the top 1-2 percent of the genome in speckle proximity, already pre-positioned in multiple cell types very close to nuclear speckles. Moreover, they found this was true for roughly half of all other heat-shock induced genes, while the remaining heat-shock

gene loci were positioned with intermediate distance to nuclear speckles prior to heat shock and moved closer after heat-shock. Zhang and colleagues now suggest that this prepositioning of many other genes close to nuclear speckles might facilitate their activation under varying cellular conditions.

Future work will be aimed at better understanding the “logic” of this genomic “hard-wiring” relative to nuclear speckles, using this new TSA-seq 2.0 method to map chromosomal positioning relative to nuclear speckles genome-wide in multiple cell types under varying physiological conditions and developmental stages.

Moreover, extension of TSA-seq 2.0 to other nuclear compartments, such as nuclear lamina or nucleoli, will further elucidate nuclear organization and function. compartments, such as nuclear lamina or nucleoli, will further elucidate nuclear organization and function.



STUDENT FEATURE | Meet Janhavi Kolhe

PhD student Janhavi Kolhe is a recipient of the Tom and Cynthia Cycyota Research Scholarship.



Tell us where you grew up and about any people or events that had an influence on your education.

I grew up in India. Nobody in my family, immediate as well as extended family, has ever pursued life sciences at the PhD level. I was really interested in biology because of my high school biology teacher. It was my favorite class in school and that's how I ended up pursuing biology at the Indian Institute of Science.

Tell us about the lab you joined and your research pursuits.

I joined Dr. Brian Freeman's lab as I

was really excited about the research opportunities in his lab, and I really appreciate his method of mentoring. He has an open-door policy, and I can stop by his office at any time to troubleshoot my experiments. He is always looking out for his students' professional and personal well-being.

My PhD thesis involves using the novel technique of Benzoyl Phenylalanine crosslinking at a high throughput level to identify in vivo physical interactors of the molecular chaperone Hsp90. An essential chaperone in eukaryote, Hsp90 plays a role in cancer, infectious diseases and aging and is the target of many therapeutic drugs. Understanding its role in various cellular process could help with the design of better drugs or therapeutic approaches for different disease conditions.

I have worked on other projects in the lab including studying the players involved in chromosome motion, understanding transcription factor DNA binding dynamics, and have also used the interactome I have generated to pursue new pathways Hsp90 might be involved in such as translation and splicing.

Proudest moment so far while a PhD student?

My proudest moment so far while a PhD student at UIUC would be presenting two different talks at the Gordon Research Seminar and Conference on Stress Proteins in Growth, Development and Disease.

What are your plans after graduating?

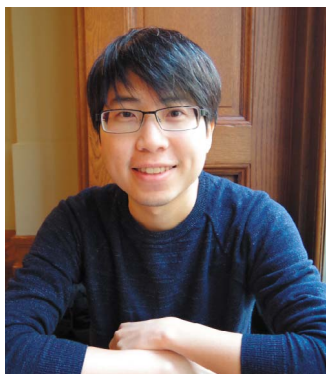
I am hoping to further my research experience after graduating by carrying out postdoctoral work in a lab working on developmental immunology or cancer. From there I would like to transition to industry as a consultant or scientist.

How do you find fulfillment outside the lab?

I love to cook and bake and try to find something interesting to bake as often as I can. I also enjoy acting, dancing, and singing and have been in a few (local theater) shows. During the lockdown last year, I even did some carpentry and designed a little kitchen table for my lab mate from scratch, which was a lot of fun!

STUDENT FEATURE | Yo-Chuen Lin, PhD '20

Recent PhD graduate Yo-Chuen Lin was a recipient of the Tunji Toogun Memorial Award.



Tell us where you grew up and about any people who had an influence on your life or education.

I grew up in Taiwan. My parents always supported me and gave me a lot of freedom to explore what I wanted to pursue.

What made you come to the U of I and pursue a PhD in cell and developmental biology?

I chose UIUC because of its opportunity. I had several other

offers when applied for PhD programs. But at the University of Illinois School of Molecular & Cellular Biology there are many labs in four different departments, which provided me with the greatest opportunity to experience different topics and search for what I really wanted.

Tell us about the lab you joined and your research pursuits while here.

I joined Dr. Supriya Prasanth lab, working on understanding the

STUDENT FEATURE | Xiaohe John Li, PhD '20

Recent PhD graduate Xiaohe Li was a recipient of the Tunji Toogun Memorial Award.



Tell us where you grew up and about any people or events that had an influence on your life or education.

I grew up in Nanjing, a historic city in east China. I had the luck to go to one of its top high schools where alumni who became National Academy of Sciences members are revered more than business magnates. We had a wall of fame just for the academy members including the late Yuan Longping, “Father of Hybrid Rice.”

Instead of focusing on test scores, the school promoted a wholesome education of personality and character. We were encouraged to

regulation of DNA replication and genome integrity. We know DNA replication has to be precise, and when there are damages to the DNA, they need to be repaired so that genetic information can be preserved during cell division.

The alteration in these processes can lead to cancer, among other diseases. I study protein factors involved in these processes and how they function to maintain genome integrity.

Proudest moment while a PhD student at UIUC?

challenge the dogma, which turned out to be very important in science.

Tell us about the lab you joined and your research pursuits while here.

I came to UIUC to study germ cells, once as a nihilist fascinated by the “disposable soma theory.” In the end I did not study germ cells. I had the luck of running into Professor Bill Brieher and his wife Vivian Tang.

My first project (in the Brieher group) was on an esoteric family of proteins. I had my fourth-year crisis and then the awakening. In the last three years of PhD, I pulled off a cell biology/imaging project on how the cytoskeleton maintains adhesion between cells. But I also learned quite a bit about biochemistry from Bill, a two-for-one education.

Proudest moment while a PhD student at UIUC?

The moment I realized I developed a unique taste of science, thanks to Bill Brieher. After soaking in the daily anecdotes of how Marc Kirschner and Tim Mitchison would think, I emulate. What I have developed is a

Definitely the moment I passed my thesis defense after several years of hard work.

What are your career plans?

I love research and learning new knowledge. I plan to continue with biomedical research and hopefully contribute to human health.

How do you find fulfillment outside the lab?

I enjoy music and watching sports. Also spending time with family and friends.

penchant for questions and papers that are old, weird and small but may grow into something as big as a new field.

How did you find fulfillment outside the lab while a student?

The piano practice room on the fifth floor of Smith Memorial Hall. I played the accordion first with local musicians at Dr. Patch Adams’ house and then in “Balkanalia,” the university’s Balkan music ensemble, where I made friends with many interesting non-scientist humans. Also, I enjoyed hiking despite the plainness of East Central Illinois.

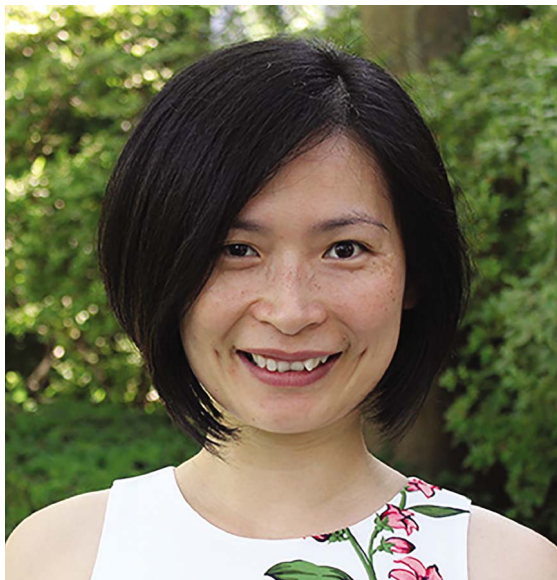
What are you doing now? What are your career plans?

I am doing a postdoc with Prof. Anming Meng at Tsinghua University on mammalian early embryo development. With the boldness of a high schooler claiming about future in the yearbook, I say I will work on the chemistry in early embryo development with an emphasis on sugar, if I have my own lab.

Favorite place on campus or in Champaign-Urbana?

I like all the green fields in Champaign-Urbana, such as the University of Illinois Arboretum. Walking in the park watching all the squirrels playing around is very relaxing.

ALUMNI FEATURE | **Yejing Ge, PhD '12**



Yejing Ge, PhD '12, is now a professor at MD Anderson Cancer Center in Texas.

What led you to the U of I and specifically the Department of Cell & Developmental Biology?

I was deeply drawn to the beauty of cell and development biology when I was an undergrad at Tsinghua University, China. During my undergrad thesis research, I learned from both my mentors and senior students in my department about U of I, and specifically the exciting and strong research in CDB. Hence here I was. I still recall the immerse joy and sleepless nights after receiving an offer to pursue my PhD at cell and developmental biology at the School of MCB.

Tell us about the lab and research you conducted while here at Illinois.

I studied this protein kinase known as mTOR, mammalian (mechanistic) target of rapamycin, and how it regulates skeletal myogenesis. mTOR is known as a master regulator of cell growth and metabolism, yet its role in skeletal muscle development and differentiation remained unclear.

During my graduate work, we found surprisingly, mTOR governs skeletal myogenesis both in a kinase-dependent and kinase-independent fashion. mTOR does so by orchestrating a network of signaling transduction events including the post-transcriptional gene regulations via microRNAs.

How did your advisor or time in the department have an impact on your life and career? What was one of your favorite memories of your time at UIUC?

My PhD advisor was Dr. Jie Chen. Jie is a role model for me in both personal life and academic career – her kindness, creativity, and fearlessness. Since then, even my hair cut is a copy of hers. The Chen lab and CDB has provided me with an extremely supportive and stimulating environment and has over the years taught me many tools to pursue my passion.

One of my favorite memories at UIUC is Green Street, with the fabulous restaurants, shops, and the vibrant community.

What's your advice for new graduate students or graduating PhD students?

Be persistent with your passion. Enjoy being a student and be inquisitive, bold, and rigorous.

Tell us about your current position and what research questions are you and your students investigating.

I am an assistant professor at MD Anderson Cancer Center. We study the molecular mechanisms underlying stem cell plasticity in skin wound repair, cancer, and aging. In mammals, adult stem cells are essential units to orchestrate postnatal remodeling and repair damage. In contrast to steady state, stem cells in coping with stress often expand their fates and embark on behaviors distinct from their homeostatic patterns, known as plasticity.

While plasticity is essential for organismal survival, its derailed regulation poses disease vulnerability to individuals. In the Ge lab, we apply development biology principles, mouse genetics and functional genomic approaches to dissect stem cell plasticity, in the goal of bridging human skin diseases with gene functions and advancing disease treatments.

What do you like to do for fun outside of work and the lab?

Travel, swim, happy hour with students, colleagues, family, and friends.

ALUMNI FEATURE | In-Hyun Park, PhD '05

In-Hyun Park, PhD '05, is now a faculty member at Yale University.

What led you to the U of I and specifically the Department of Cell & Developmental Biology?

In my master's program at Seoul National University, we had a couple of professors who were alumni of UIUC. They strongly recommended the university for my PhD training. I was very interested in cell biology and CDB was the perfect program for me.

Tell us about the lab and the research you conducted here.

I joined Jie Chen's lab, where one of the least known mTOR cell signaling pathways at that time (early 2000's) was being actively investigated. We had four senior graduate students and I had five more junior students during my training. I loved the vibrant environment.

My research was to study how the mTOR and its downstream signaling pathways regulate cell growth. When I joined the lab, our lab made one of the most exciting findings in the mTOR field: that mTOR shuttles between cytoplasm and nucleus. My first project was to determine how the nuclear mTOR regulate the activity of nuclear target S6K2. The lab also started to study the function of mTOR in regulating the stem cell differentiation using the myogenic differentiation system.

My second project was to study how mTOR regulates the later steps of myogenic differentiation, muscle growth or hypertrophy by IGF signaling. It was fortunate for me to be exposed to stem cell research, which led me to postdoc training and independent research in stem cell biology.

How did your advisor and your time in the department have an impact on your life and career?

My advisor, Dr. Chen, was one of most important mentors for me. She developed me as a scientist and researcher. When I studied genetics and cell biology with a few friends of mine, I found that I could not formulate and express my ideas. Dr. Chen had a great training program for the student to think and express their opinions during lab meetings. I am highly indebted for the training. Dr. Chen also allowed me to pursue multiple experiments that were new to the lab, such as fruit fly system to study muscle development.

I have two favorite memories from UIUC. One is the time when I spent playing board games and watching movies at Dr. Chen's house. All the players were competitive in winning the game, especially Dr. Chen's late father. It was



so fun, and a warming and relaxing experience. Attending UIUC football games and watching basketball were also so memorable. Even now, my favorite pastime is watching UIUC games.

What advice do you have for new graduate students or graduating PhD students?

For new graduate students, my advice is to get the fundamentals of experiments and projects. Please think about what are the principles of the experiments you're performing, and what are the controls to compare. What do you expect to see from the experiments? For graduating PhD students, please think big. Find a big question in the field of your interest, and ambitiously work to answer that.

What is your current position and what research questions are you currently investigating?

I am an associate professor of genetics at Yale University. My big research question is to construct the functional human brain in dish. Currently, we are developing methods to generate specific brain regions from human pluripotent stem cells, and to communicate with them.

What do you like to do for fun outside of work and your lab?

I love playing sports. I used to play a basketball at UIUC and even during post-doc. But basketball is too demanding now, and I play a soccer. My team won the Yale intramural tournament two years ago. The tournament last year was cancelled, but this year we won second place.



Martha Gillette wins Beckman Institute's Vision and Spirit Award

Congratulations to Martha Gillette, who was named the Beckman Institute's 2021 winner of the Vision and Spirit Award. Gillette is Alumni Professor of Cell and Developmental Biology, a professor in the Department of Molecular & Integrative Physiology, and director of the Neuroscience PhD Program.

The annual award, which includes \$150,000 in research funding, was created to honor the institute's founder, Arnold Beckman, by recognizing a faculty member who has fostered collaboration in their research and exemplifies Beckman's vision.

Gillette said she's "extremely thrilled," and that the award also recognizes the members of her research group and her interdisciplinary collaborators at Beckman. She works closely with a long list of faculty collaborators from chemistry; bioengineering; electrical and computer engineering; chemical and biomolecular engineering; evolution, ecology, and behavior; and molecular and integrative physiology.

Beckman Institute Director Jeff Moore recognized her enthusiasm for learning and growing, despite the challenges that come with interdisciplinary research.

"This attitude has propelled her research to the cutting edge of understanding the cellular and systems-level mechanisms of sleep, as well as the behavior of connected cellular systems," Moore said.

"By valuing a team-oriented approach, Martha pursues big research questions that draw upon the interdisciplinary skills of experts who share common research goals. The results are consistently spectacular. Martha is the common denominator of many collaborative projects — she is the driver of convergence," Moore added.

With the award's funding, Gillette said she will gather pilot data, in collaboration with researchers from all over campus, to learn more about the dynamic changes in fluid systems of the sleeping brain compared to the awake brain.



"This includes time-of-day changes in flow and composition of the fluid that perfuses brain tissue, washing out metabolites and toxins. Our focus is on how this makes sleep restorative," she said. "Also, the National Institutes of Health has encouraged us to think about day-night dynamics in cerebrovascular blood flow and how it leads to microbleeds in brain tissue, which is damaging to neurons."

Gillette said interdisciplinary collaborations have "emerged as the zeitgeist, the sign of our times in the funding landscape." Large, multi-investigator grants are at the forefront of major funding opportunities at NIH, the National Science Foundation, and the Department of Defense, as well as private foundations. "They are part of most researchers' future, if they are not already engaged in such collaborations," Gillette said.

"Interdisciplinary collaborations require curiosity and trust. You need to come together as equals, as team members, to the extent possible and invest part of your analytical brain in a common problem outside of your comfort zone. The possibilities are truly rewarding. Arnold Beckman was a visionary, indeed!"

Department launches Early Career Inclusive Excellence Seminar Series

We are pleased to announce that the Cell and Developmental Biology Early Career Inclusive Excellence Seminar Series, launched in Fall 2021, will continue in Spring 2022. The goal of this seminar series is to provide talented postdocs from diverse backgrounds the opportunity to present their research and engage with our scientific community. The department is committed to promoting an inclusive community that is open, just, and welcoming for all.

Postdoctoral fellows studying any aspect of cell and developmental biology are welcome to apply; applications from members of historically underrepresented groups are particularly encouraged. Selected applicants will be contacted to schedule a visit to the University of Illinois Urbana-Champaign (in person or virtually). During the

visit, the speakers will have the opportunity to present their research during the department's seminar series and to meet with faculty, postdocs, and students. The Department of Cell & Developmental Biology will cover travel expenses and lodging for in-person visits and provide an honorarium to the speaker.

Apply to be a speaker:

<https://go.illinois.edu/CDBEarlyCareerSeries>

> For additional questions, please contact:

Laura Martin, departmental office administrator, at Immartin@illinois.edu, or Xin Li, CDB seminar committee chair and assistant professor, at lixin@illinois.edu.

Congratulations to our 2021 award recipients and graduates

Graduate student awards

CDB Outstanding Teaching Assistant Award

Surabhi Sonam (Dr. Jonathan Henry)

Tom and Cynthia Cycyota Research Scholarship

Janhavi Kolhe (Dr. Brian Freeman)

Tunji Toogun Research Excellence Award

Xiaohe John Li (Dr. William Brieher)

Yo-Chuen Lin (Dr. Supriya Prasanth)

Graduate Student Platform Presentation Award

Omid Gholamalamdari
(Dr. Andrew Belmont)

Undergraduate student awards

Undergraduate Outstanding Research Achievement Award

Wiktoria Kowalczyk
(Dr. Andrew Belmont) and
Toma Tchernodrinski (Dr. Mary Schuler)

Tom and Cynthia Cycyota Research Scholarship

Darya Asoudegi (Dr. Supriya Prasanth)

Roderick MacLeod Award for Academic Excellence

Toma Tchernodrinski (Dr. Mary Schuler)

Recent graduates

December 2020

Xiaohe Li (Dr. William Brieher)
Yo-Chuen Lin (Dr. Supriya Prasanth)
Nilmani Singh (Dr. Jie Chen)
Yuan Tian (Dr. Rachel Smith-Bolton)

May 2021

Tayyab Adil (Dr. Jonathan Henry)
Qinyu Hao (Dr. KV Prasanth)

August 2021

Omid Gholamalamdari (Dr. Andrew Belmont)

December 2021

Dongwook Kim (Dr. Jie Chen)
Monica Lannom (Dr. Stephanie Ceman)
Surabhi Sonam (Dr. Jonathan Henry)

Alumni News and Recognition

- Yijie Geng, postdoc at University of Utah, 2020 NIH K99 award
- Harini Iyer, postdoc at Stanford University: 2021 postdoctoral fellowship from NIH/NIA/Stanford Alzheimer's Disease Research Center; postdoctoral fellowship from the BrightFocus Foundation
- In-Hyun Park at Yale School of Medicine: 2020 promotion to associate professor with tenure



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Giving to Cell & Developmental Biology

The Department of Cell & Developmental Biology appreciates the support of our alumni and friends. If you would like to make a donation, please use the form below or *visit mcb.illinois.edu/giving*

I would like to make the following contribution to CDB:

\$ _____ Cell and Developmental Biology Annual Fund (11331199)

\$ _____ Tunji Toogun Memorial Graduate Fellowship Fund in Cell and Developmental Biology (11341354)

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