mcb

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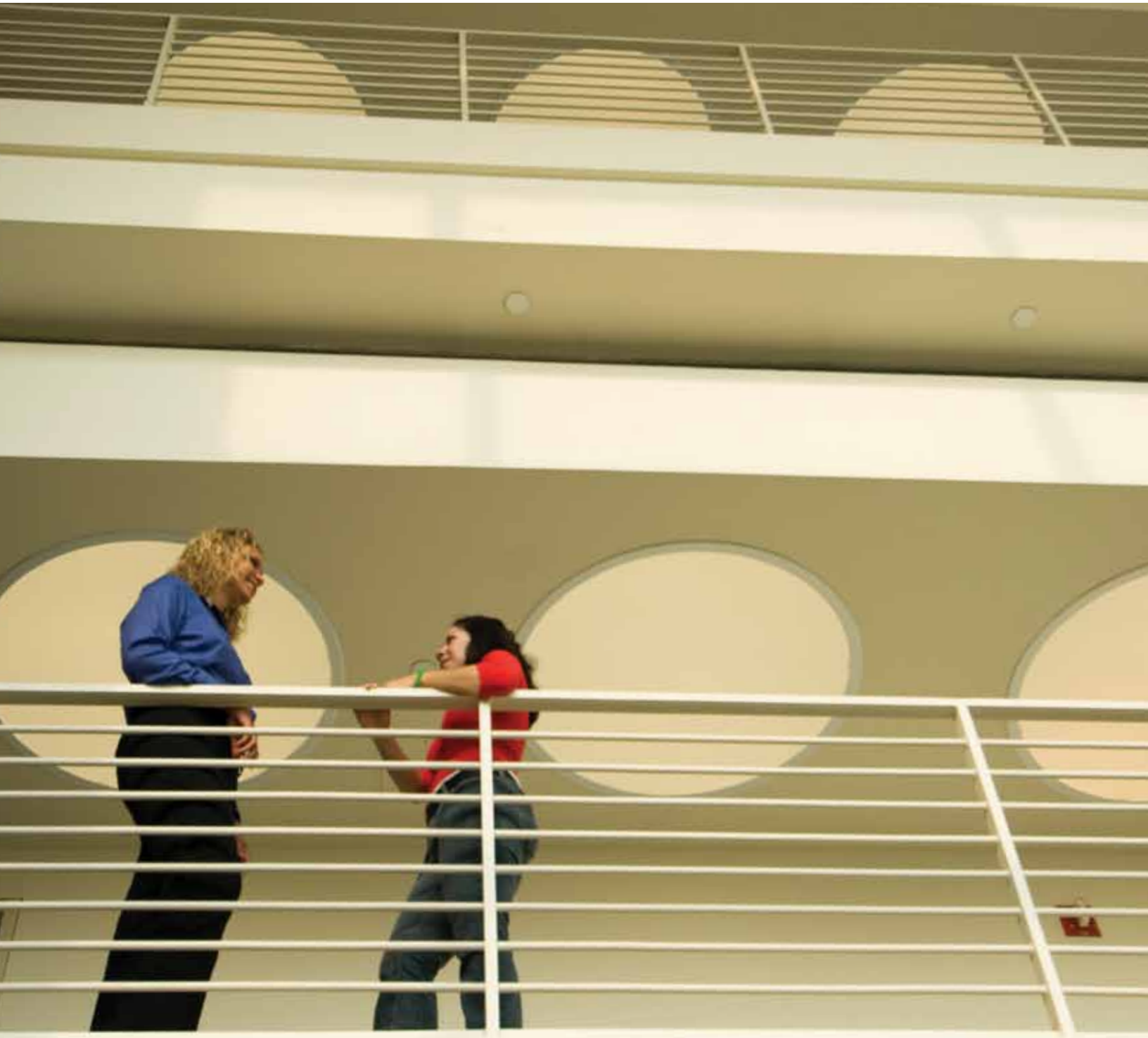

COLLABORATION IN THE LIFE SCIENCES

Letter
FROM THE DIRECTOR

Dr. Stephen G. Sligar

I trust the annual magazine from the School of Molecular and Cellular Biology (MCB) finds you well. We focus content this year on inter-disciplinarity and collaboration as the modus operandi in research and instructional delivery.

A bit of history is warranted. The University of Illinois has long been recognized as a leader in interdisciplinary science. Collaboration and openness have always been hallmarks of this institution, from the college level to the individual faculty member.

One pioneering venture at Illinois was the "Bridge Across Green Street." Beginning in the late 1960s and reaching a peak in the early 1980s, there existed a superhighway between the Department of Physics in the College of Engineering and the Department of Biochemistry in the College of Liberal Arts and Sciences. Providing facile exchange of students and post-doctoral fellows in exciting cross-disciplinary research, this relationship established a foundation for the development of biological physics and biophysics as a scientific discipline. This tradition continues with the Center for the Physics of the Living Cell funded by the National Science Foundation, the formation of a BioNanotechnology initiative between representatives of MCB and the Micro and Nanotechnology Laboratory in the College of Engineering, and the initiatives supported by Interdisciplinary Graduate Education Training Grants.

Interdisciplinarity is evident in MCB. We have four departments within the school, each with an outstanding reputation, as evidenced by the recent assessment of U.S. graduate programs by the National Research Council. Although each department grants a degree in its discipline, all new MCB graduate students are recruited at the level of the School, which provides support for the first semester of graduate studies. This allows a "rotation" program where the students spend time in the laboratories of three different MCB faculty, allowing a dramatic broadening of perspective and the initiation of multiple collaborative efforts. The incoming student modifies his or her research preferences after learning of alternate opportunities. Such a program is not inexpensive—it is the largest use of the School's indirect cost recovery from faculty research grants.

Similar cross-unit efforts are also reshaping the landscape of undergraduate education. The Stewarding Excellence Program (http://oc.illinois.edu/budget/) was founded by the Chancellor's Office to provide recommendations as to how the institution can improve its research and educational missions. I urge you to read these reports and provide feedback as to the concepts and the posted implementation plans. Although synergy across campus provides new opportunities to expand at the interface, we in MCB are diligent to ensure that the overall excellence of the MCB undergraduate educational missions is not diluted through egalitarian efforts or a regression to the mean.

We have just completed the 2011 Commencement ceremonies with an additional 405 MCB graduates pursuing further studies in graduate or professional schools, or joining the workforce in a variety of industrial positions. In all cases, our graduates can draw upon the excellent training received through majoring in Molecular and Cellular Biology. We encourage all of you to keep abreast of developments in MCB through our web site (http://mcb.illinois.edu). We especially want to hear from you: How we can improve the educational and research experiences of our graduates, and how can we better communicate our successes to our critical alumni base? One easy mechanism for you to get in touch with us is through the alumni web form (http://mcb.illinois.edu/people/alumni).

Sincerely,
Stephen G. Sligar
Director

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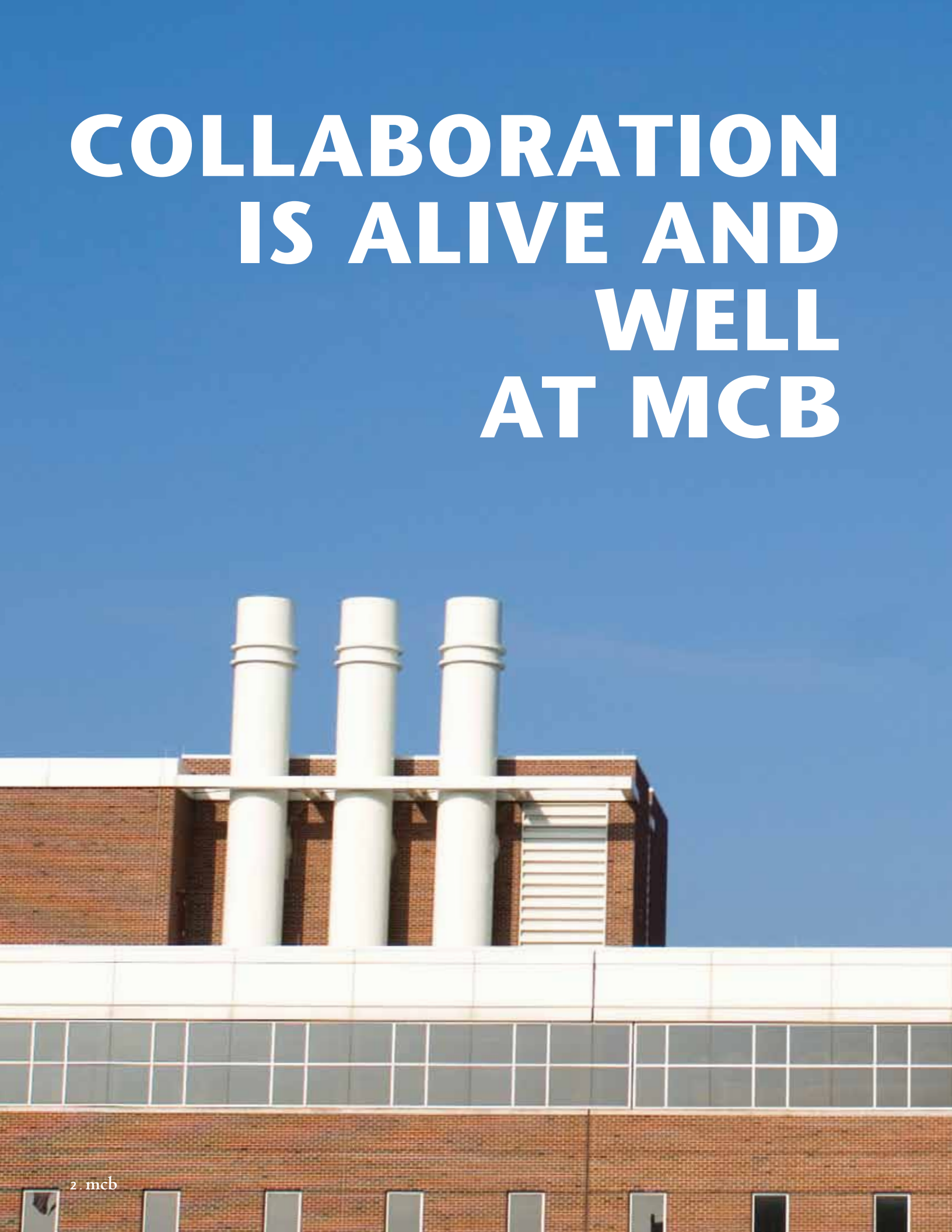
COLLABORATION IS ALIVE AND WELL AT MCB



Despite a challenging economic climate, The School of Molecular and Cellular Biology is receiving support for many industrious collaborative research projects, building bridges between departments, schools, and universities in the U.S. and abroad.

An inherently collaborative, interdisciplinary enterprise, MCB remains an established hub of scientific research in the life sciences with its four departments—Biochemistry, Cell and Developmental Biology (CDB), Microbiology, and Molecular and Integrative Physiology (MIP)—and affiliations with the Center for Biophysics and Computational Biology, the Program in Neuroscience, the Medical Scholars Program, and the Institute for Genomic Biology.

As shown in this issue, much of the scientific research done in MCB has medical applications. There is a strong synergy between MCB and the College of Medicine—fifteen MCB faculty have appointments in the College of Medicine. Two faculty members profiled in this issue—Brenda Wilson and Dan Llano—also work closely with hospitals and medical centers.

Our faculty often divide affiliations, creating cross-pollination between MCB and other units on campus—the School of Chemical Sciences, the School of Integrative Biology, and the Department of Comparative Biosciences.

Moreover, our faculty routinely log discoveries and publish papers in cooperation with researchers at other U.S. universities, and internationally.

This issue of MCB magazine is dedicated to providing a cross-section of these projects, and profiles of scientists whose work crosses intellectual, organizational, and geographic boundaries.

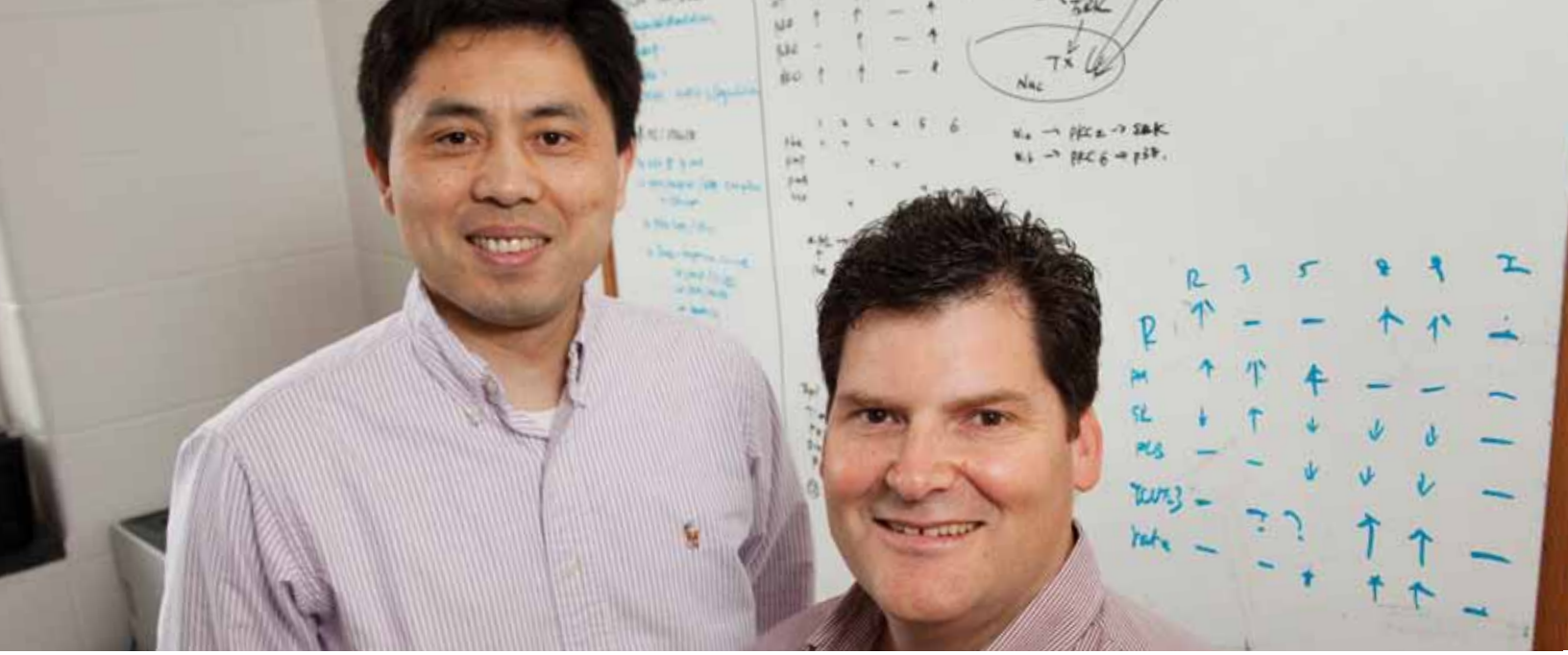


Photo by L. Brian Stauffer.

AMYLOID diseases

Since its original description in 1906 by Dr. Alois Alzheimer, Alzheimer's disease (AD) has achieved worldwide recognition. Approximately 5.3 million U.S. residents are known to have AD. The global cost of dementia this year will likely exceed 1% of the world's gross domestic product. Over the next 18 years 3–4 million members of the baby boomer generation will turn 65 annually. This demographic tsunami of aging individuals, in combination with the advent of early detection diagnostic techniques (e.g., MRI and spinal tap analysis), has led to predictions that the number of known AD cases may very soon double or even triple.

by Jeanne Bullock Goldberg

Researchers are working at a feverish pace to understand the pathophysiology of AD at the molecular level in order to develop targeted therapies for this heartbreaking, disabling, and costly disease. Our world-class scientists in MCB are involved in groundbreaking research, studying AD from many angles.

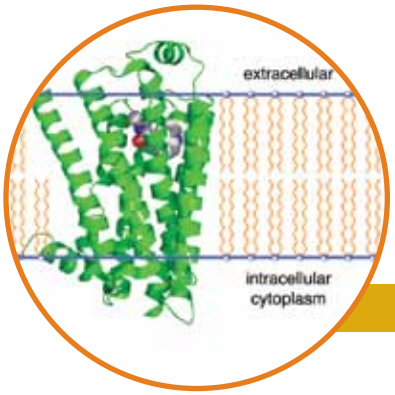


Figure: The β2 adrenergic receptor (green) spans the cell membrane (orange and blue). In this visualization, a binding pocket in the receptor interacts with a beta-blocker (red, gray and blue molecule near the center). The new study found that amyloid-β, a protein fragment linked to the detrimental effects of Alzheimer's disease, binds to a different region on the β2 adrenergic receptor.—Diana Yates.

charles COX & kevin XIANG

Assistant Professor of Molecular and Integrative Physiology Yang (Kevin) Xiang; Associate Professor of Molecular and Integrative Physiology, Biophysics and Computational Biology, and Neuroscience Charles Cox; and colleagues have received top-level recognition for work that has been performed in their laboratories, including publication in the *FASEB Journal*, *Science Daily*, and in local Illinois publications. Their research focuses on the role of a protein fragment, amyloid-β (Aβ), in the decline of cerebral function which is characteristic of AD. Using transgenic mice, Drs. Xiang and Cox have elucidated a cellular mechanism whereby Aβ binds to and activates β2 adrenergic receptors (β2ARs), which are specialized, cell membrane-based protein receptors responsible for converting signals created by hormones and neurotransmitters into downstream intracellular events such as electrical activity (ion-gating) or production of specific chemical products (see figure). Normally the

β2ARs are targets for endogenous neurotransmitters like norepinephrine rather than for a peptide like Aβ, so the binding of Aβ to the β2ARs is definitely a pathologic process with significant downstream implications. Binding of Aβ to β2ARs stimulates protein-based receptors known as AMPA receptors, which function as critical gate-keepers, allowing calcium and sodium ions to enter cells. A chronic state of excitatory neurotoxicity, subsequent synaptic dysfunction, and neuronal death results from this binding of Aβ to the β2ARs. Of great interest is the fact that this sequence of events seems to be common to other pathologic neurodegenerative diseases such as stroke, epilepsy, Down's syndrome (DS), and Parkinson's disease.

Three key findings in the Xiang and Cox laboratories are the following:

(1) Blocking Aβ binding to the β2AR should block the potentially pathologic stimulation of the AMPA receptors.

(2) Aβ binds to a different part of the β2AR than physiological binding agents such as neurotransmitters and hormones.

(3) If binding of Aβ could be selectively blocked by existing or new pharmaceuticals, potentially breakthrough progress could be made in the control of AD.

Xiang and Cox state that there are likely other important players in AD in addition to the β2ARs, but they believe that their research findings offer some key areas to explore in the ongoing effort to understand and hopefully control this disease. Currently they are seeking funding to access and utilize vast libraries of chemicals to find at least one which can serve as an Aβ targeted treatment for AD.

paul GOLD

Paul Gold and his staff are studying the neurobiological mechanisms of learning and memory formation. Recently the role of impaired glucose availability and utilization in AD and DS has been of interest. They are studying the regulation of brain potassium-ATP (K-ATP) channels, which play a crucial role in glucose metabolism and hence in memory formation. The focus of this work is a protein, α-endosulfine, which is a key regulator of the K-ATP channels, and is absent in the brains of most patients with AD or DS. Dr. Gold's AD-related research is in its early stages, but a potential outcome is the development of drugs which target the functions of the K-ATP channels in the brain to improve severe cognitive deficits that are associated with AD.

tom ANASTASIO

Associate Professor of Molecular and Integrative Physiology, Biophysics, and Neuroscience Thomas Anastasio is approaching Alzheimer's disease from a totally different angle. His expertise in computational biology is being applied to understanding AD. Many of the individual factors involved in the etiology of AD are known, but constructing a coherent picture of its pathogenesis remains an open challenge. In Dr. Anastasio's study, facts related to AD are collected through literature review and represented as declarations in a programming metalanguage known as Maude which, in his words, "allows us to know what we know." This approach facilitates the evaluation of the effects of simultaneous interventions at multiple sites in the pathways that are involved in AD—this is critical since AD is a multifactorial disease and will likely require a multi-pronged treatment strategy.

hee jung CHUNG

Assistant Professor of Molecular and Integrative Physiology Hee Jung Chung is studying the basic physiological mechanisms by which the brain acquires, processes, and stores information. Her work focuses on inhibitory potassium (ion) channels and their role in changing neuronal excitability, which directly influences learning, memory, and forgetting. Although not specifically focused on AD, this research undoubtedly has direct relevance regarding what goes wrong in the brain in AD.

The projects described above are excellent examples of applying basic scientific research findings to solve real-world problems that improve the quality of life—the essence of translational research. •

Scientists have known for decades that a protein fragment, amyloid-beta, is a key to the riddle of Alzheimer's disease. The German psychiatrist and neuropathologist Alois Alzheimer (1864-1914) himself first found aggregates of this "peculiar substance" in the brain of a dementia patient after her death. These bundles of protein, or plaques, are composed almost entirely of amyloid-beta, and still are used to diagnose Alzheimer's disease after death.—Diana Yates

brenda WILSON

Brenda Wilson builds bridges. She has established a far-reaching network of like-minded researchers in collaborations—campus-wide, locally, nationally, and internationally—crossing boundaries between pure science, translational research, clinical work, and government work.

At the University of Illinois, in addition to her position with MCB as Associate Professor of Microbiology, Wilson has co-authored a new textbook (see page 15), and is Host Microbe Systems Theme Leader at the Institute for Genomic Biology (IGB), among other responsibilities.

"It involves a lot of collaboration," she laughs. Wilson's Host Microbe Systems (HMS) Theme is geared toward understanding our host relationship with the system of microbes—helpful and harmful—that dwell in the human body. The HMS Theme includes collaborations across campus with the Departments of Microbiology, Animal Sciences, Anthropology, Computer Science, and Pathobiology, and the College of Medicine. One facet of the work is comparing the human microbial community to that of our nearest evolutionary relatives, primates, to learn how these microbe systems may have evolved.

This aspect of her research came about as an unexpected turn. Her team had become one of the first groups on campus to work with Carle Foundation Hospital in Urbana and Christie Clinic in Champaign. With these local hospitals' departments of obstetrics and gynecology, the scientists set up joint human study protocols, and were able to collect samples of vaginal bacteria from female volunteers.

While looking for an animal model with which to study women's health, her team discovered significant differences between baboon and human vaginal microgenomes. Their interest grew. The expanding team regrouped, and, to pursue the problem further, obtained NSF funding, including one of the most prestigious NSF grants, the HOMINID Award.

As they continued to study these problems, NIH funding allowed them to look at the impact of bacterial vaginosis on pre-term birth. The collaboration expanded to include work with the renowned Mayo Clinic, which had access to a large number of pregnant women considered at risk for pre-term birth. One of the results of this work is an ongoing project at The W.M. Keck Center for Comparative and Functional Genomics and the J. Craig Venter Institute to sequence the genomes of microbes taken from human volunteers.

Wilson's network also includes her role as the University of Illinois representative and executive board member of the Great Lakes Regional Center of Excellence (GLRCE) for Biodefense and Emerging Infectious Diseases Research. Professor of Microbiology Steven Blanke is also a member of GLRCE. Wilson's focus is botulism, Blanke's anthrax. Wilson and Blanke had worked together as post-docs at Harvard, and she is happy that they can continue as colleagues here at Illinois. She says, "it's great having two toxin people here on campus.... We work on different toxins, but a lot of the same questions are asked."

About her work, Wilson says, "I was taking on a new hat when I became HMS theme leader...a very new hat. But it's been a lot of fun. I can tell you that. I feel like I'm constantly learning new things. I never have to give up being a student." •

Photo by Chris Kemp.

Photo by L. Brian Stauffer.

"I am a very simple man," Associate Professor of Molecular and Integrative Physiology Claudio Grosman says, but "a sophisticated man when it comes to science."

claudio GROSMAN

Grosman's accomplishments in the areas of ion channels, including his recent invitation to join the Membrane Protein Structural Dynamics Consortium, are balanced by an affection for family, and a desire that these two poles of his life remain strong.

He came to the United States from the University of Buenos Aires in his native Argentina. He was attracted to the Department of MIP by the magnetic warmth of Sandy Helman and then-head Phil Best (both now retired), and settled here in 2002.

Another attraction held by Champaign-Urbana was the promise of simplicity. The uncluttered landscape and ease of living allowed Grosman to focus his attention on both his research and his family. He wanted to be monastic, he admits.

This focused life has yielded results. Grosman was recently invited to participate in a large-scale international collaboration to study membrane proteins. The Membrane Protein Structural Dynamics Consortium unites nearly 30 scientists from four countries in an effort to study membrane proteins. The 5-year, $22.5 million grant is known as a "glue grant," because it is meant to bind disparate scientists together.

It is Grosman's expertise in ion channels at the single molecule level that is of special value to the team. As a subject for single-molecule study, the ion channel is a brilliant candidate. Depending on their conformation, these membrane proteins allow or block the passage of rapid streams of ions through the cell membrane. When the ion channel membrane proteins become ion-permeable, they allow electricity to pass into and out of the cell. The diagnostic tools used to measure electric current—single channel patch clamp electrophysiology—are able to work at a very fine degree of precision (see figure). The ion channel's behavior can be can be observed with a resolution of 10–20 microseconds: events that last for that duration or longer can be detected. Although other macromolecules can also be studied one molecule at a time, ion channels remain the system that offers the highest temporal resolution, hence, the highest degree of detail.

As Grosman has a special interest in ion channels involved in fast synaptic transmission, he says he is "walking with one foot in biophysics and the other in neuroscience." He explains, "I have been working on the electrophysiological aspects of ion channels since my graduate-student years. I sometimes feel that I joined this field as a reaction against my undergraduate biochemistry experience. I was tired of chromatography columns, electrophoresis gels, graph bars, and blots of all kinds, and wanted to learn about cables, oscilloscopes, currents, voltages, complex curve fitting, and single molecules. The learning curve has been steep, but it has been a most satisfying journey." •

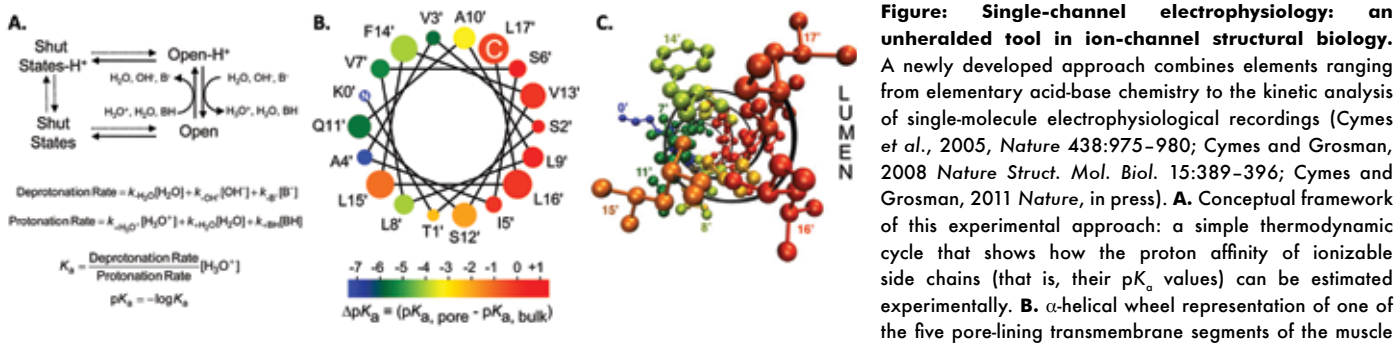


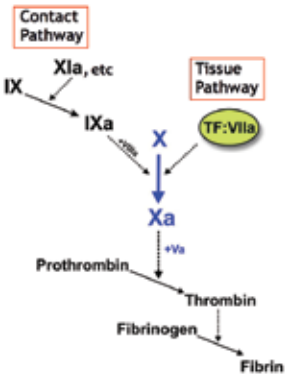
Figure: Single-channel electrophysiology: an unheralded tool in ion-channel structural biology. A newly developed approach combines elements ranging from elementary acid-base chemistry to the kinetic analysis of single-molecule electrophysiological recordings (Cymes *et al.*, 2005, *Nature* 438:975–980; Cymes and Grosman, 2008 *Nature Struct. Mol. Biol.* 15:389–396; Cymes and Grosman, 2011 *Nature*, in press). **A.** Conceptual framework of this experimental approach: a simple thermodynamic cycle that shows how the proton affinity of ionizable side chains (that is, their pK_a values) can be estimated experimentally. **B.** α-helical wheel representation of one of the five pore-lining transmembrane segments of the muscle nicotinic acetylcholine receptor. Basic side chains were engineered (one position at a time) along this α-helix, and the deviation of their pK_as from those expected in bulk water is color-coded. **C.** ΔpK_a values mapped onto a ball-and-stick representation of the pore-lining α-helix shown in B. The color code is the same as in B. For more details, see references cited above.

FROM GOOD CHOLESTEROL to blood clotting

by colin WRAIGHT

jim MORRISSEY

Professor of Biochemistry and Medical Biochemistry James Morrissey, as a post-doctoral fellow at the Scripps Research Institute, began studying components of the protease cascade that controls blood coagulation, initiating a life-long interest in understanding how cells regulate blood clotting in health and disease.



Simplified blood clotting cascade.

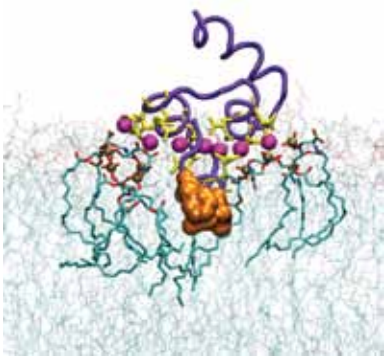
Morrissey and colleagues are revealing structure-based mechanisms of the major cascade "factors," and the essential role that the cell membrane surface plays in activating key members of the cascade. This work is leading to the development of therapeutic interventions for thrombosis and to novel hemostatic agents to stem traumatic and surgical bleeding.

In 2006, Morrissey, working with post-doctoral associate Stephanie Smith, discovered that polyphosphate (polyP, a polymer of inorganic phosphate) is a potent modulator of blood coagulation, and is present in the dense granules of platelets in the blood. Subsequent work by Morrissey's group showed that polyP triggers the so-called contact pathway of blood clotting.

Schematic of TF, fVIIa, and fX assembled on a nanodisc surface.

A parallel line of research in the Morrissey lab has been understanding the biochemical details of another important process of blood clotting, the tissue factor pathway. Here, the initiation event takes place when tissue damage exposes the soluble plasma protein, factor VII (fVII, a latent protease), to the integral membrane protein, tissue factor (TF), on the surface of extravascular cells. Once bound to TF, fVII is rapidly converted to its active form, fVIIa, which is maintained in an active TF-fVIIa complex. The membrane surface and its specific composition are crucial for the functional association of TF with fVIIa and for the activity of the TF-fVIIa complex in converting factor X (fX) to its active form fXa. FXa is the common element between the tissue factor pathway and contact pathway of coagulation, and initiates the final steps of the proteolytic cascade that forms blood clots.

The critical role of the membrane surface makes the coagulation cascade especially difficult to investigate, but key developments in other labs in the Department of Biochemistry provided the ideal approach to study it at a molecular level.



Gla-domain interacting with a phospholipid bilayer (detail from a full molecular dynamics simulation of fVII by Emad Tajkhorshid).

LATERAL THINKING

A lifetime of interest in lipids and lipoproteins led Professor Emerita of Biochemistry Ana Jonas to a structural model of high density lipoproteins (HDL). These so-called "good cholesterol" particles, which carry lipids and cholesterol in the blood for recycling in the liver, consist of two molecules of the protein component, apoA, wrapped around a bilayer of phospholipids and cholesterol, forming a roughly 10 nm diameter disc. In addition to the belt-forming region, apoA also has a globular component, which serves as a handle for binding to its cellular targets, such as in the liver.

stephen SLIGAR

emad TAJKHORSHID

I. C. Gunsalus Professor of Biochemistry and Chemistry and Director of the School of Molecular and Cellular Biology Stephen Sligar recognized that removing the globular part of apoA would create proteins that can act as generic scaffolds for discs of lipid bilayer, into which might be incorporated membrane proteins. These "nanodiscs," bounded by two membrane scaffold proteins (MSPs), would provide an unprecedented molecular tool for studying membrane proteins and their interactions with soluble partners, as well as the influence of the lipid composition.

Studies using nanodiscs by the Sligar lab, often in wide-ranging collaborations, have successfully incorporated many membrane proteins and complexes, including various enzymes, the full-size trimer of bacteriorhodopsin, visual rhodopsin, the β_2-adrenergic receptor, a complete chemotactic signaling complex, and the protein secretion channel from yeast, amongst others.

PUTTING IT ALL TOGETHER

For Jim Morrissey the nanodisc technology on his doorstep was the perfect answer for studying the interactions between tissue factor—which has a transmembrane anchor, and its immediate substrate, fVII—and between the activated TF-fVIIa complex and its targets in the protease cascade. Not only could TF be readily incorporated into nanodiscs, but the lipid composition of the membrane bilayer could be easily controlled, allowing a highly quantitative analysis of the influence of specific lipids on the protease activity. Initially, very high levels of the negatively charged lipid, phosphatidylserine (PS), seemed to be required for maximum activity, much higher than are present in cell membranes. However, it became apparent that the rest of the lipid composition is also critical and, with the right combination, PS was found to have its maximum effect at lower, natural concentrations.

The reason the membrane composition is so important is thought to be that the active sites of the clotting factors, such as fVIIa, and target sites of the substrates, e.g. fX, must be held in line, at just the right height above the membrane surface. This geometric constraint is achieved partly by binding fVIIa to TF and partly by interactions between the proteins and the lipid headgroups, mediated by calcium ions.

Factors VII and X, among others, have a highly specific modification of a cluster of glutamic acids, which have an extra acidic group added, forming γ-carboxyglutamic acid (Gla). The cluster of modified residues forms the Gla-domain, which is located at one end of the protein and binds calcium ions avidly. This facilitates binding to a membrane surface that has negatively charged lipids like PS. Morrissey believes that the orientation and depth of the binding interaction is very sensitive to the lipid composition, but the details are difficult to define and test. Again, however, departmental collaborations are coming to the rescue with novel methods.

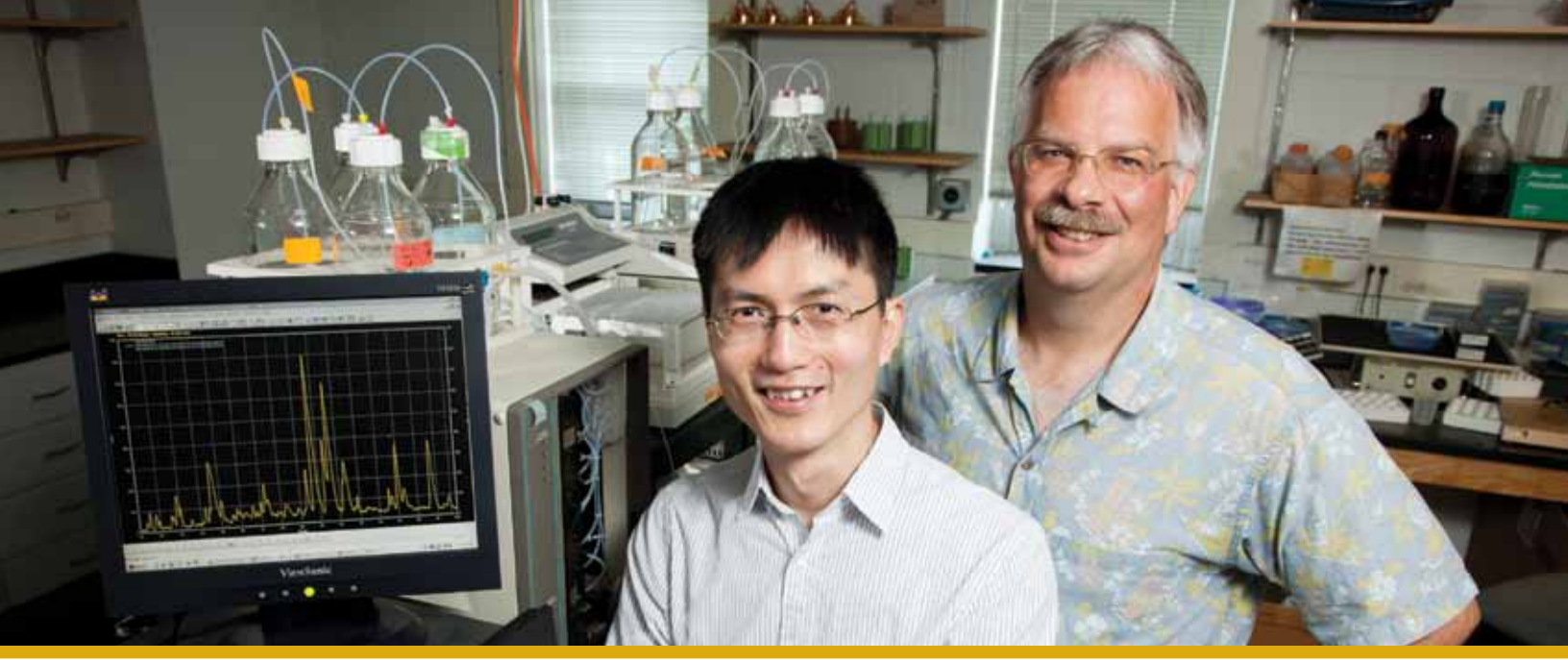
Morrissey's colleague in the College of Medicine, Professor of Biochemistry, Biophysics, and Pharmacology Emad Tajkhorshid is a computational biologist who has specialized in large scale molecular dynamics simulations of membrane proteins. Tajkhorshid's methods have previously provided exquisite insight to the mechanisms of action of important channel and transporter proteins.

Tajkhorshid, together with post-doc Zenmei Ohkubo, constructed the first model of the membrane-bound TF-fVIIa complex and ran extended simulations to investigate the dynamics of the complex on the surface of anionic membranes. As reported in *Journal of Thrombosis and Haemostasis*, they found that TF restricts the motion of fVIIa and stabilizes the catalytic site of fVIIa in space, thereby ensuring optimal interaction with the substrate, fX, much as Morrissey had surmised. In addition, these lengthy simulations showed the progressive insinuation of the Gla domain into the bilayer, with some of the negatively charged lipid headgroups accessing the calcium ions and pulling the Gla-domain into the membrane. The situation becomes crowded and some types of lipid headgroup can get in the way, which is why the rest of the lipid composition is important.

TRANSLATION

Translation of basic understanding into applied science is an increasingly important criterion for scientific research. The control of bleeding (hemostasis) is essential to survival, and coagulation is a major component of this. However, it must be finely balanced against excess, as unwanted clotting, or thrombosis, is a life-threatening event. The development of therapeutics for abnormal hemostasis therefore depends on a deep understanding of the processes involved. The collaborations of Morrissey, Sligar, and Tajkhorshid are revealing unsuspected mechanisms in the control of clotting that can lead to novel therapeutic approaches.

At the far end of the hemostatic spectrum, uncontrollable bleeding caused by major trauma, including battlefield injuries, can lead to death before patients can be transported to a hospital for surgery. Therefore, there is an urgent need to develop treatments that first responders can use to control bleeding in patients with severe internal injuries. In a new project with collaborators at the University of Illinois at Chicago, the University of Chicago, and the University of California, Santa Barbara, Morrissey is developing "threshold-switchable particles"—injectable compounds that can travel through the bloodstream and accumulate at sites of bleeding, reaching a sufficient level of concentration to initiate clotting locally. If successful, this will open a new paradigm for treating trauma injuries on site, by slowing or stopping internal bleeding rapidly at its source, and providing critical time for the injured to reach a treatment facility, thereby saving lives. •



Photos by L. Brian Stauffer.

craig MIZZEN

Histone H1, a protein that helps pack DNA into the cell nucleus, has an important role in regulating gene activity. Associate Professor of Cell and Developmental Biology Craig Mizzen and colleagues also found that histone H1 takes part in the formation of ribosomes, the cellular workbenches on which all proteins are made.

A human cell's genetic material is so vast that it must be condensed into tightly wound structures resembling beads on a string. The DNA winds around four core histone proteins to form one of the "beads," while H1 or "linker" histones clamp the DNA into place where it enters and exits the beads (see figure oppposite). One bead and its associated DNA make up a nucleosome. There are over ten million nucleosomes in the nucleus of a cell.

The new study found that when H1 histones are modified by the addition of a phosphate group, a process called phosphorylation, that modification is associated with changes in gene activity.

"Most studies of histone phosphorylation have focused on cell division, when phosphorylation is at its peak," said Mizzen. During cell division "much less of the genome is transcribed than at other points in the cell cycle.... Everything is geared toward separating the replicated genome copies equally between the new daughter cells."

Suspecting that H1 phosphorylation was important for processes besides cell division, Mizzen and his colleagues identified the exact sites in H1 that are phosphorylated during various portions of the cell cycle.

Then-doctoral student Yupeng Zheng developed antibodies that recognize phosphorylation at the H1 sites cells use when they are not dividing. This enabled Zheng to discover that such "interphase" H1 phosphorylation is preferentially associated with genes when they are actually being transcribed.

"Histones are normally found all over the genome," Mizzen said, "and elucidating what is different about the nucleosomes on active genes versus those on repressed genes versus the rest of the genome, most of which is not protein-coding, is a central goal of current research in molecular biology."

Several core histone modifications are known to localize preferentially to active genes, Mizzen said. "But our work provides the first evidence that this is also true for H1 that is phosphorylated at specific sites."

Zheng also made a second surprising discovery. Using fluorescence microscopy to analyze cells, he noticed that the fluorescently labeled antibodies targeting phosphorylated H1 in non-dividing cells were lighting up the nucleolus, the region of the nucleus that is dedicated to transcribing ribosomal RNA, the special RNA upon which ribosomes are assembled.

"The ribosomal RNA genes are kept in the nucleolus and they're transcribed by a different enzyme system than the messenger RNAs that are transcribed from protein-coding genes," Mizzen said. "The involvement of H1 phosphorylation in controlling ribosomal RNA gene transcription had not been suspected at all previously. That was a totally novel finding of our work."

The new findings could lead to a better understanding of alterations to the cell cycle associated with cancer and other diseases.

The study was a collaborative effort involving researchers from several departments on the U. of I. campus and the National Cancer Institute at the National Institutes of Health. Key collaborators included former Professor of Chemistry Neil Kelleher, Professor of Molecular and Integrative Physiology Ann Nardulli, and Gordon Hager at the National Cancer Institute. •

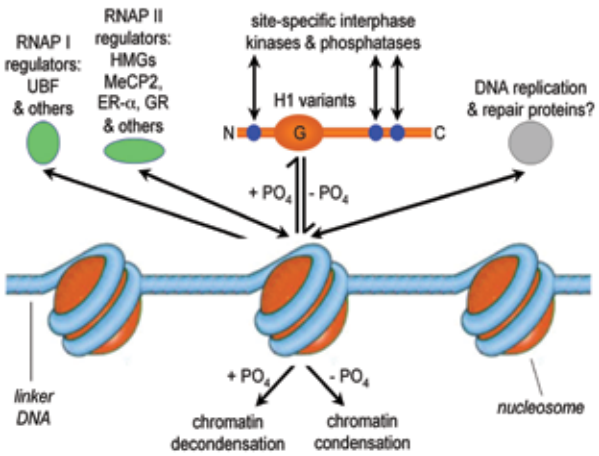


Figure: Site-specific phosphorylation of histone H1 enhances DNA accessibility in chromatin. The globular domain (G) of histone H1 binds DNA where it enters and exits nucleosomes and stabilizes their structure. The C-terminal domain (C) of H1 binds the linker DNA extending between nucleosomes and promotes chromatin condensation—the folding of chromatin fibers upon themselves to form more densely packed structures. The Mizzen laboratory has discovered that phosphorylation (+ PO_4) of H1 at specific sites (blue circles) during interphase of the cell cycle facilitates gene transcription. These interphase phosphorylations are thought to promote H1 dissociation from chromatin, facilitating transcription by promoting chromatin decondensation and enabling regulatory proteins to bind sites previously occupied by nonphosphorylated H1.

john GERLT

A team of researchers led by Professor of Biochemistry John A. Gerlt has received a five-year, $33.9 million grant from the National Institutes of General Medical Sciences (NIGMS) to study the functions of unknown enzymes.

This "glue grant" was awarded to provide resources to tackle the "complex problems that are of central importance to biomedical science but are beyond the means of any one research group," according to the NIGMS. Gerlt's team will develop a strategy for discovering the functions of unknown, or uncharacterized, enzymes discovered in genome-sequencing projects.

"Genome projects have taught us that many of nature's enzymes have unknown functions that need to be discovered," said Gerlt, an expert on the enolase superfamily of enzymes. Enzymes are proteins that catalyze the chemical reactions required for life, and enable organisms to live in complex environments and adapt to a variety of conditions.

"We have sequences for more than 10 million proteins and we might know the specific functions of half of those," Gerlt said. "But what do the other half do? If we knew their functions, imagine how we might use them to identify new drug targets or provide catalysts used in industry."

Gerlt and co-researcher Patricia Babbitt, of the University of California, San Francisco, have led the way in developing a novel method to determine an uncharacterized protein's function. Their approach uses computational methods to narrow the range of possible substrates for the enzyme. Gerlt says this project is a potentially powerful way to exploit the sequence data that have not yet been deciphered; it also could provide a way to learn more about metabolic pathways crucial to all organisms.

For the glue grant, officially known as the Enzyme Function Initiative, Gerlt and Babbitt have assembled a team of researchers from several disciplines to determine the structure of an unknown enzyme and then, computationally, determine a "hit list" of possible substrates, numbering in the tens, rather than the thousands.

The team of researchers comprises scientists from the Albert Einstein College of Medicine, Boston University, Texas A&M University, the University of New Mexico, the University of Utah, the Vanderbilt University School of Medicine, and the University of Virginia. The team also includes a microbiology group led by Professor of Microbiology John Cronan.

"This program gathers together an outstanding group of researchers who will use their expertise in enzymology, structural biology, computational modeling and bioinformatics to develop an approach to associate enzymatic functions with genes in thousands of organisms," said Warren Jones, the chief of the Biochemistry and Biorelated Chemistry Branch in the Division of Pharmacology, Physiology and Biological Chemistry at the NIGMS. •

dan LLANO

Photos by Chris Kemp.

After accumulating a wealth of experiences in the pharmaceutical industry, as a clinician, and a post-doc, Assistant Professor in Molecular and Integrative Physiology and the College of Medicine Dan Llano, a U. of I. alumnus, has returned to his alma mater to share what he's learned.

During what he jokingly refers to as a "miniature life sentence" at the U. of I., where he recalls many days in Burrill Hall eating meals from Derald's catering truck, Llano recieved a B.S., an M.D., and a Ph.D. In 2002, he left for a four-year residency at the Harvard Medical School / Massachusetts General Hospital in Boston, where he spent one year on general medicine and three years focused on neurology.

He then moved to the University of Chicago for a post-doc fellowship, where he helped to develop the Comprehensive Aphasia Center, followed by two years at Abbott Labs. At Abbott Labs, Llano worked on Alzheimer's drug development. He designed clinical trials and translational strategies. Most of his responsibilites entailed working with the researchers involved in basic science and designing translational trials to "bridge the gap between the basic science work and the human work."

After the stint at Abbott, Llano returned to the U. of I. to assume leadership of the lab of the newly retired, esteemed Professor of Molecular and Integrative Physiology Al Feng.

Although industry wasn't the path he ultimately chose, Llano considers his time at Abbott Labs a valuable experience. "At Abbott I sat on the interface between the basic sciences and the clinical sciences. And here in many ways I hope to do some of the same."

Thus he has been hired under the auspices of the Division of Biomedical Sciences to make connections in Champaign-Urbana between basic science at MCB and clinical neuroscience at Carle Hospital. Llano now has a rare split appointment: 80% as Assistant Professor of MIP and the College of Medicine, and Beckman Institute researcher; and 20% at Carle Hospital.

In his lab at the Beckman Institute, Llano's team studies top-down sensory projection systems in mice. During sensory perception, nerve signals travel back and forth up to the cortex and down to the sense organs. The signals travelling from the senses up to the brain have been studied extensively, but descending transmissions from the brain to the sensory periphery are not as well understood. Llano says, "There's a pretty rich body of theory as to what these descending projections might be important for. People haven't been too shy about speculating what these projections are doing. But what we don't have are data."

At Carle Hospital, he says, "I see patients who have cognitive disorders. I see some patients who have stroke and cognitive disorders due to stroke. I have a particular interest in language-related cognitive disorders, not unrelated to the work I am doing here in the lab on the auditory system. The bulk of what I see over at Carle are patients who have an age-related cognitive problem—commonly Alzheimer's disease or some variant."

"There's been a big desire to bridge the gap between what we've got over here at the U. of I. and what's happening at Carle. At the U. of I., obviously you've got researchers who are interested in developing therapeutics that are going to be useful... At Carle, we have a tremendous population of patients, and very good caregivers. High-class medical care across the street—literally."

Although basic science is his calling, Llano retains the desire to connect research and medicine. •

rachel SMITH-BOLTON

A new arrival to MCB, Assistant Professor of Cell and Developmental Biology Rachel Smith-Bolton is busy setting up her lab, which she describes as "the fly room." Smith-Bolton studies fruit flies: *Drosophila melanogaster,* to be precise.

After completing her undergraduate studies at Harvard, Smith-Bolton's graduate work at Stanford was focused on signal transduction in *Drosophila*. This was her introduction to the insect and its utility as a model system. For her post-doctoral research, she wanted to take what she had learned about how cells communicate and expand it to a tissue-wide level. At the University of California Berkeley, she worked in a lab that studied growth and growth control, and there she began a project that looked at the regulation of growth after tissue damage: regeneration as opposed to development. "The project worked," she smiles.

With that research she went on the job market and "looked for a good home."

Smith-Bolton says, "I think I found it here at the University of Illinois, because there are a number of other faculty whose interests lie in that same broad area of wound healing and regeneration after tissue damage, using a variety of organisms: including Phil Newmark, who studies regeneration in Planaria; Fei Wang, who studies embryonic stem cells that may one day be used as a tool for regenerative medicine; John Henry, who looks at the regeneration and development of amphibian lenses; and Jie Chen, who, through her studies of signaling and signal transduction, has looked at tissue repair and regeneration in mouse skeletal muscle."

She continues, "There's a whole community here within CDB that looks at tissue damage, repair, and regeneration in model organisms. In the broader university, with the Engineering and Chemical Sciences schools as well as the Institute for Genomic Biology, there are people who are interested in more applied aspects of regeneration, including building scaffolds for engineering regenerative tissues. There are tools available for potentially taking what I do at a very fundamental basic biology level to a more applied place."

Asked about the potential for medical implications of her research, Smith-Bolton explains that it is unknown why some tissues regrow and others just form scars. The field of regenerative medicine is interested in manipulating that process, to help all damaged tissues rebuild themselves to optimal function. One key target would be heart tissue after a cardiac arrest. Other important organs whose tissue can be permanently damaged through trauma or chronic illness include the lungs, pancreas, and kidneys.

"My hope is that by studying damaged tissue and the way it undergoes wound closure and regenerative growth in a very simple tissue, at a very basic level, we can learn some of the fundamentals of how a tissue senses that there's been damage, how it makes the choice to proliferate and replace what's been lost, and how it regains function that was there before the damage. My hope is that by studying that in a very simple tissue at a very fundamental level, what we learn can be applied to more complex tissues in more complex situations."

Drosophila may help answer some of these important questions. It's a lucky bug, and MCB and CDB are likewise fortunate to welcome Rachel-Smith Bolton to their team. •

FACULTY NEWS

NEW FACULTY

Dan Llano joined the faculty as Assistant Professor of Molecular and Integrative Physiology. For more about Dr. Llano, see page 12.

Rachel Smith-Bolton has joined the faculty as Assistant Professor of Cell and Developmental Biology. For more about Dr. Smith-Bolton, see page 13.

Dan Llano

Rachel Smith-Bolton

RETIREMENTS

Esmail (Essie) Meisami came to the University of Illinois in 1986, and was appointed associate professor in MIP in 1988.

Phil Best was appointed assistant professor in MIP and the College of Medicine in 1979. Phil served as Head of MIP for 10 years and as Interim Dean and Associate Dean of LAS.

Al Feng was appointed assistant professor in MIP in 1977 and served as head for 5 years. He was the Richard and Margaret Romano Professorial Scholar. He also served as Chair of the Neuroscience Program and Associate Director of the Beckman Institute.

Orrin David Sherwood was appointed assistant professor in MIP and the College of Medicine in 1973. He served for many years as Director of the Reproductive Biology Program.

IN MEMORIAM

Alice Helm (1938-2010)

Professor Alice C. Helm, 72, of Champaign passed away at 5:05 p.m. Thursday (Dec. 23, 2010) at Heartland Health Care Center, Champaign.

Ms. Helm was born on June 19, 1938, in Decatur, a daughter of Professor M. Stanley Helm and Maxine Bon Helm. She was preceded in death by her parents and her brother, Nathan.

Ms. Helm graduated from Champaign High School in Champaign and attended the University of Illinois, where she earned her undergraduate and postgraduate degrees.

She worked for the University of Illinois at Urbana-Champaign for 42 years. The majority of Professor Helm's years of service to the university was spent in the classroom and lab teaching microbiology, where she was a popular instructor for hundreds of students over the years.

She enjoyed traveling and was an avid University of Illinois athletics fan.

Memorial contributions may be made to the Helm Fund for Excellence in Power, Harker Hall, 1305 W. Green St., Urbana, IL 61801.

(from the *Champaign-Urbana News-Gazette*)

SELECT RECENT PUBLICATIONS

Alumni Professor of Cell and Developmental Biology Affiliate and Professor of Molecular and Integrative Physiology **Martha Gillette** is corresponding author on "Direct Cellular Peptidomics of Hypothalamic Neurons," in the February 18, 2011 issue of *Frontiers in Neuroendocrinology.*

The journal *Molecular and Cellular Biology* published "Arginine methylation by PRMT5 at a naturally-occurring mutation site is critical for liver metabolic regulation by Small Heterodimer Partner," by corresponding author Associate Professor of Molecular and Integrative Physiology **Jongsook Kim Kemper** and colleagues. The article appeared in print in a special "Spotlight" section.

Associate Professor of Biochemistry **Satish Nair** and Biochemistry Affiliate **Wilfred van der Donk** are corresponding authors on "Characterization and structure of DhpI, a phosphonate O-methyltransferase involved in dehydrophos biosynthesis," appearing in the *Proceedings of the National Academy of Sciences (PNAS)*.

Assistant Professor of Cell and Developmental Biology **Fei Wang** is corresponding author on "Integrated biochemical and mechanical signals regulate multifaceted human embryonic stem cell functions," appearing in the *Journal of Cell Biology*. The article is featured in the "In Focus" section.

Assistant Professor of Cell and Developmental Biology **Supriya Prasanth** is corresponding author of "A WD-Repeat Protein Stabilizes ORC Binding to Chromatin" in *Molecular Cell*.

Director of the School of Molecular and Cellular Biology, I.C. Gunsalus Professor of Biochemistry, and Professor of Biophysics and Computational Biology **Stephen Sligar** is corresponding author on "Nanomechanical detection of cholera toxin using microcantilevers functionalized with ganglioside nanodiscs," appearing in *Nanotechnology*.

Assistant Professor of Cell and Developmental Biology **Kannanganattu Prasanth** is corresponding author of "The Nuclear-Retained Noncoding RNA MALAT1 Regulates Alternative Splicing by Modulating SR Splicing Factor Phosphorylation," published in *Molecular Cell*, and recommended by Faculty of 1000.

Assistant Professor of Cell and Developmental Biology **Fei Wang** and colleagues have authored a paper appearing in *Stem Cells*: "High-Efficiency Induction of Neural Conversion in hESCs and hiPSCs with a Single Chemical Inhibitor of TGF-β Superfamily Receptors."

Assistant Professor of Biochemistry **Lin-Feng Chen** and colleagues have published "Helicobacter pylori CagA targets gastric tumor suppressor RUNX3 for proteasome-mediated degradation," in the journal *Oncogene*.

Professor of Molecular and Integrative Physiology and Neuroscience **Rhanor Gillette** and colleagues have published a paper in the *Journal of Neurophysiology*: "Nitric oxide potentiates cAMP-gated cation current by intracellular acidification in feeding neurons of *Pleurobranchaea*."

BOOK ANNOUNCEMENT

Associate Professor of Microbiology Brenda Wilson (see page 6) is lead author of the newly-published textbook, *Bacterial Pathogenesis: a Molecular Approach, 3rd Edition*. The book is collaboratively composed by Wilson with Professor of Microbiology and G. William Arends Professor of Molecular and Cell Biology Abigail Salyers (the original author of the first two editions), along with Dixie Whitt and Malcolm Winkler, who brought to the project experience in industry, among other strengths. The collaboration made the best use of all contributors, with all authors pitching in according to their expertise.

Wilson reconceptualized Salyers's original approach: to complement courses MCB 426 and 526 (taught by Wilson and originally developed by Salyers), Wilson arranged the chapters by concept, instead of by pathogen. She also added her exam questions from the course, making the book a "true textbook." "It's deceptively easy to read," Wilson says. "You don't realize that you're learning a lot." The intensity of the lessons is offset by humorous touches throughout. As another incentive, the authors deliberately kept the cost under $100.

HONORS, AWARDS

Associate Professor of Cell and Developmental Biology **Brian Freeman** has been awarded the Friedrich Wilhelm Bessel Research Award from the Alexander von Humboldt Foundation. This award is given to "scientists and scholars, internationally renowned in their field, who completed their doctorates less than 18 years ago and who in future are expected to continue producing cutting-edge achievements which will have a seminal influence on their discipline beyond their immediate field of work."

As part of the celebration for the 50th Anniversary of the journal *Biochemistry*, sponsored by the American Chemical Society, ACS has compiled a prestigious list of the journal's 50 most prolific writers. Three MCB professors have made the list: Professor of Biochemistry, and Biophysics and Computational Biology **Bob Gennis**; Professor of Biochemistry, and Biophysics and Computational Biology **John Gerlt**; Director of the School of Molecular and Cellular Biology and I.C. Gunsalus Professor of Biochemistry, and Professor of Biophysics and Computational Biology **Stephen Sligar**.

Of the approximately 100 cases that the Campus Committee on Promotion and Tenure reviewed this year, Associate Professor of Biochemistry **Emad Tajkhorshid**'s dossier was one of just four recognized as exceptional in terms of quality of work and overall achievement. There are two of these awards given to those who have just received tenure and been promoted to the rank of associate professor. This impressive acknowledgment carries a $3000 award to support scholarly activities.

Swanlund Professor of Molecular and Integrative Physiology and Cell and Developmental Biology **Benita Katzenellenbogen** is among three University of Illinois faculty involved in the Botanical Research Center, funded by a new $8 million NIH grant. Katzenellenbogen will lead a study on effects of botanical estrogens on gene activation and their interaction with estrogen receptors and regulatory proteins.

Professor of Microbiology and Director of the Medical Scholars Program **James Slauch** has been elected to the American Academy of Microbiology, among 78 microbiologists chosen by peers for significant contributions to their field. The American Academy of Microbiology now has more than 2,500 fellows "representing all subspecialties of microbiology, including basic and applied research, teaching, public health, industry and government service," according to a news release from the organization.

Linda Birnbaum and **Keith Westcott** are two of the four winners of the top alumni awards from the University of Illinois College of Liberal Arts and Sciences in 2010. According to *LAS News*: "Linda Birnbaum, a Microbiology alum, is the first woman and first toxicologist to lead the National Institute of Environmental Health Sciences (NIEHS). Since the 1970s, she has tackled the most serious toxicology issues of our time, from dioxins and PCBs to asbestos. Birnbaum split much of her career between the NIEHS and EPA and is currently leading an effort to assess the health risks posed by the 2010 Gulf oil spill.... Keith Westcott, a Biochemistry alumnus, was at Amgen when it burst onto the scene in the 1980s, sparking the biotechnology revolution. He has brought this industrial know-how back to U. of I., creating fellowships for graduate students in biochemistry. He also comes back to campus regularly to give talks, help with U. of I. Foundation activities, and teach a six-week course about pharmaceutical biotechnology from an industrial perspective." •

MCB GRADUATES

GRADUATE DEGREES

BIOCHEMISTRY

David Aggen, Ph.D.
Shweta Bhatt, Ph.D.
Kevin Clark, Ph.D.
Brad Evans, Ph.D.
Daniel Frank, Ph.D.
Bachar el haj Hassan, Ph.D.
James Heeres, Ph.D.
Deepthi Kanamaluru, Ph.D.
Snehal Patel, Ph.D.
Bryant McKay Wood, Ph.D.
Michael Burt, M.S.
Chad Gonzales, M.S.
Katherine McTavish, M.S.
Aaron Wells, M.S.

CELL AND DEVELOPMENTAL BIOLOGY

Yuan He, Ph.D.
Qian Liu, Ph.D.
Steven Long, Ph.D.
Zeynep Madak-Erdogan, Ph.D.
Jonathan Rhine, Ph.D.
Myung Eun Shin, Ph.D.
Chia-Yun Sun, Ph.D.
David Zimmerman, Ph.D.

MICROBIOLOGY

Quin Christensen, Ph.D.
Benjamin Circello, Ph.D.
Barbara Maureen Craig, Ph.D.
Yekaterina Golubeva, Ph.D.
Yue Guan, Ph.D.
Ian Gut, Ph.D.
Olivia Hinthong, Ph.D.
Byoungkwan Kim, Ph.D.
Seyeun Kim, Ph.D.
Prisca Massengo-Tiasse, Ph.D.
Elizabeth Moritz, Ph.D.
Angel Rivera, Ph.D.
Kristen Willis, Ph.D.
Lisa Boucek, M.S.

MOLECULAR AND INTEGRATIVE PHYSIOLOGY

Kyuri Kim, Ph.D.
Jiyoung Lee, Ph.D.
Ruijie Liu, Ph.D.
Pamela Monahan, Ph.D.
Tyler Moran, Ph.D.
SungHee Park, Ph.D.

BIOPHYSICS AND COMPUTATIONAL BIOLOGY

Qian Bian, Ph.D.
Fu-Yang Lin, Ph.D.
Erik Martin, Ph.D.
Damien Mathew, Ph.D.
Michael McLachlan, Ph.D.
Leonid Zamdborg, Ph.D.
Ruobing Zhang, Ph.D.
Swati Gupta, M.S.
Cancan Huang, M.S.

NEUROSCIENCE

Seth Ament, Ph.D.
Samit Shah, Ph.D.
Diana L. Thomas, Ph.D.
Jonathan Zombeck, Ph.D.

TEACHING OF BIOLOGICAL SCIENCES

Trisha McNew, M.S.

UNDERGRADUATE DEGREES

B.S. BIOCHEMISTRY

Jason Bugno
Seoin Choi
Amanda Etheridge
Kevin Houlihan
Bramwell Lambrus
Jeff Nian
Bincy Philip
Anna Karissa Reyes
Geeta Verma
Grant Zimmerman

B.S. MOLECULAR AND CELLULAR BIOLOGY HONORS CONCENTRATION

William Christensen
Kevin Chuang
Amy Fink
Minying Gu
Nina Hosmane
Michelle Hwang
Julia Kammel
John Kwok
Joy Lee
Aye Lwin
Daniel Miller
Lucas Miller
Michael Nolte
Alina Nuth
Megan Parilla
Avani Patel
Nisha Patel
John Pizarek
Shannon Powers
Revanth Reddy
Zachary Richardson
Benjamin Rodrigues
Adam Sadik
Chad Stevens
Katherine Tribble
Janani Vigneswaran
Jingwei Xiong
Linda Yala
Stephanie Yen
Jessie Zhang

B.S. MOLECULAR AND CELLULAR BIOLOGY

Finny Abraham
Arslan Ahmed
Hyungsik Ahn
Adil Ali
Lior Aljadeff
Emily Allen
James Allen
Margaret Allison
Amjad Alomari
Virginia Alvarado
Jurgis Alvikas
Seth Ament
Kimberly Antonelli
Kyle Arloff
Dinanath Attele
Aaron Baessler
Neda Bahrani
Di Bai
Fadi Bakhos
Katherine Barkus
Adam Barnas
Kevin Beltran
Tiffani Berkel
Christopher Berlinghof
Mark Bernson
Sheila Bhat
Azra Bhimani
Angela Bizzarri
Jordan Bloom
Erin Borchardt
Nathan Bowers
Jennifer Boysen
Emily Bozek
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Duat Bui
Heather Bukiri
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Kathryn Byrne
Jamison Carr
Jun Yong Cha
Christine Ching-Yeung Chan
Jennifer Chang
Kevin Chang
David Chavez
Yu Chen
Katherine Chenoweth
Alicia Cheversia
Kathleen Chmiel
Jeff Chorath
Yuen Chow
Katelyn Christopher
Brian Coffey
Craig Conrad
Maxx Craggs
Claire Creed
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Stephanie Czeschin
Mansi Dave
William Davis
Daniel Deligio
Mark Dell'Aringa
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Colleen Druffel
Yifei Du
Sarah Duchaj
Megan Dunning
Anthony Duong
Alexa Duque
Stephanie Dwyer
Melody Engelbrecht
Kristin Ericson
Charles Esquibel
Anton Evans
Emily Evans
Brett Flanagan
Alexis Flores
Martina Gabra
Christopher Galligan
Matt Gayed
Michael Genin
Benjamin Getz
David Goese
Jason Gordon
Nicole Green
Jessica Gries
Claire Gripp
Jake Groch
Riley Guillet
Samyuktha Gumidyala
Matthew Gust
Natalia Gut
Michael Hagstrom
Sara Hanahan
Grant Hansen
Graham Haworth
Casey Hegger
Lyndsey Heise
Finnbar Higgins
Jeffrey Hinchman
Steven Hizon
Derek Ho
Anna Hoban
Margaret Holly
Tyler Holsapple
Thomas Hsiao
Nicole Hybl
Samuel Hyde
Nikki Im
Nicole Inniss
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Mi Rim Jang
Faranace Janvier
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Vinesh Jeevanandam
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Avery Kechter
Seth Keller
Jessica Kelliher
Allison Kerr
Kamran Khatri
Shabbir Kheraluwala
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Jacob Kibrit
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Nirav Nagarsheth
Ramakrishna Nalluri
Hong Nan
Kenneth Naylor
Alyssa Noak
Sin Yeon Noh
Edmund Norris
Luke Novak
Timothy O'Connor
Hannah Okamoto
Yusuke Okuno
Semee Pak
Allison Palmer
Pratik Pandya
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Joon Young Park
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Nirav Patel
Tajal Patel
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Rowena Peralta
Danny Perez
Stephanie Pesenko
Torey Peterson
Eric Piacenza
Jamie Pitts
Renee Pospisil
Jillian Proffitt
Adrianna Quan
Benjamin Rabin
Robert Radtke
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Alexander Rusthoven
Alexandra Rutz
Jeffrey Sarcu
Sara Sarmast
Susan Schaedel
Christopher Schmehil
Danielle Schmidt
Caitlin Schneider
Heather Schneider
Lauren Schreiner
Eric Schultz
Eric Sedivy
Aravind Seetharaman
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Michael Strope
Elena Stuewe
Stanley Swat
Patrick Sylvester
Krupa Tailor
Nikita Talati
Fanny Tan
Sonam Tanna
Colin Therriault
Diana Thomas
Melvin Thomas
Shawn Thomas
Suravi Thomas
Austin Tom
Trang Tran
Logan Traylor
Barbara Tylka
Rikhav Vasanwala
Kristen Veldman
Shaun Wachter
Steven Waltersdorf
Krishnan Warrior
Forrest Waters
Nicolette Weeke
Teresa Weik
Robert Weisshappel
Maria Wemple
Monicka Wielgos
Jonathan Wiese
Kaitlyn Wilson
Lauran Wirfs
Kate Wlodarczyk
Patrick Woida
Wan Wu
Richard Yemm
Joanne Yoo
Jeong Ran Yoon
Ji Hee Yoon
Hana Yu
Laurie Zeilner
Ruobing Zhang
Xixi Zhao
Stephanie Zimmermann
Jonathan Zombeck

This list is an unofficial list of degree recipients from summer 2010 through spring 2011. Due to printing deadlines, the list may contain inaccuracies.

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