THE NUCLEUS OF AN EXPANDING SCIENCE
LETTER FROM THE DIRECTOR

It is a pleasure to welcome you again to another issue of the MCB magazine.

A central theme of this issue deals with how major research advances are realized in the biological sciences. It is well appreciated that many significant discoveries are now made by teams of collaborative researchers. An important part of the history of accomplishment at U of I is due to an open and synergistic environment that encourages cross-campus and cross-disciplinary interactions.

While several institutes on campus provide a structure for bringing multidisciplinary partners together, multiple bridges also exist between research groups, departments and colleges. This provides a feeling of openness and possibility that makes human creativity the only limit to discovery. As many who have moved to other institutions or outside of academia can attest: This degree of collaboration in the absence of formal relationships between individuals and units is not common at other institutions.

When you connect the links among highly productive bio-science research centers across campus, one often finds an MCB faculty member at the nucleus. In basketball, the center, also known as the post, is normally the tallest player on the team, and often has a great deal of strength. As is evidenced in the content of this issue of the our magazine, MCB faculty in the College of Liberal Arts and Sciences provide critical participation in the research enterprises being conducted in the Beckman Institute, the Institute for Genomic Biology, the Center for the Physics of the Living Cell, and numerous collaborative partnerships in the College of Engineering, the College of Veterinary Medicine, the College of Agriculture, Consumer and Environmental Sciences, the College of Applied Health Sciences and the College of Medicine.

It is a pleasure to introduce you to the seven new faculty joining MCB as well as a sampling of the important advances in education and research being conducted within the School and its four departments. Importantly, we also continue to stress the amazing accomplishments of our undergraduate and graduate alumni, particularly when one appreciates the breadth of career paths, from journalism through endowed professors in academy to senior corporate leaders, the educational experiences in MCB and its departments have clearly been most enabling.

As we enter into the holiday season and new year, we wish you a productive and fulfilling 2015!

Dr. Stephen G. Sligar
Aptamers, single-stranded RNA molecules, are being studied for their potential in detecting infectious particles.

From blood clotting to Alzheimer’s disease, MCB faculty members are involved in cross-campus, interdisciplinary efforts. These collaborations are driven by cutting-edge approaches and highly translational questions.

One example is the work of Yi Lu, professor of chemistry, who is trying to design an aptamer to recognize an entire virus particle. Aptamers are RNA molecules that can bind to specific targets.

Lu’s work involves understanding how adenoviruses, which cause serious diseases like respiratory infections and liver disease, interact with human cells.

To better understand these interactions, Lu is developing new techniques to detect infectious adenoviruses at a molecular level.

Through this work, Lu and his colleagues hope to develop new tools for diagnosing and treating adenovirus infections, which can be challenging to detect.

This project is one of three large cross-campus projects recently funded by the University’s Institute of Sustainability, Energy, and Environment. These projects aim to address pressing societal issues like clean water and global health.

As Lu explains, “The ultimate goal is to develop a diagnostic tool that can be used in the field, making it accessible to those in need.”

MCB faculty members are involved in a variety of cross-campus collaborations, and these efforts are leading to significant contributions and new solutions.
Membrane proteins are extremely difficult to study because if you remove them from the cell membrane, they become inactive, they aggregate like scrambled eggs, and they die,” says Sligar.

Meanwhile, Chad Rienstra, professor of chemistry, had developed a way to use solid-state nuclear magnetic resonance (SSNMR) to answer structural questions about larger molecules, including membrane proteins that standard NMR cannot. This technology also promised to advance the understanding of cell membranes and could be used to understand how the lipid portion of membranes, in particular, interacts with membrane proteins.

This is precisely the kind of interdisciplinary undertaking in which cell biologists are essential, says Martha Gillette, professor of cell and developmental biology.

“My main goal is to apply these computational techniques to exciting biomolecular problems and to advance our understanding of the microscopic world in and around us.”

At the time that Tajkhorshid heard about Morrissey’s work, Tajkhorshid’s group had been doing computer simulations on cell membranes that were about the size of the Nanodiscs. He realized that he could run simulations of the binding of blood clotting proteins to membranes.

More recently, this membrane team has expanded to include Ryan Bailey, professor of analytical chemistry. Bailey has developed a micro ring technology that can measure the binding affinity and rate of binding of the protein with the membrane.

Morrissey says when physical scientists, such as Bailey and Rienstra, collaborate with biologists, their expertise can be more effectively brought to bear on important problems.

“Chemists and engineers who collaborate with biophysicists enjoy bringing their expertise to bear, but blood clotting is a very mature field, it’s very hard to enter,” he says. “By working with us, we can tell them what very important questions there are and then they can bring their expertise to bear. Biology is their future. Although they are world class in their field, they also need biologists to identify the most important biomedical questions to focus on.”

These collaborations have been enormously fruitful. The team has joint lab meetings every other week and has published 18 papers together. They have also competed successfully for multiple NIH grants.

“Nobody else is really studying these protein-membrane interactions at the level we are, with so many complementary techniques,” adds Tajkhorshid.

This multidisciplinary approach is laying the groundwork for new therapies for blood clotting diseases and disorders, such as hemophilia and thrombosis. Using these approaches will help them understand why, for example, factor VII binds stronger or weaker compared to other coagulation factors and how they can change that behavior to improve current therapies.

Gillette is leading an equally ambitious collaborative project that will explore the dynamic brain — “how it remembers, enables us to move or be moved, to awake and sleep each day of our lives,” she says.

The team, which includes Jonathan Sweedler, professor of chemistry and director of the School of Chemical Sciences, Gabriel Popescu, professor of electrical and computer engineering, and John Rogers, professor of materials science and engineering, intends to examine how neurons in the brain are activated in response to experiences, in order to see how they cause behavioral changes and subsequent activities of the neurons, also known as brain plasticity. In order to do this, the team will develop and use newly created, complementary technologies that will non-invasively control, measure, and analyze brain network dynamics and change in real time.

“There’s no other group that’s really thinking about this problem in this way,” says Rogers.

One of the key initial steps in coagulation is the formation of complexes between different clotting factors, a reaction which is to a large degree controlled by binding of these proteins to specific regions of the cellular membrane. The image shows the structure of a complex between tissue factor (green) and factor VII (blue) on the surface of a membrane. Phospholipid molecules interactively interacting with the complex and anchoring it in the membrane are shown using a more thicker representation. Deeper penetration of factor VII and the close engagement of its bound Ca²⁺ ions (purple spheres with phosphatidyls are evident.

Image provided by Ernad Tajkhorshid

SCHOOL OF MOLECULAR AND CELLULAR BIOLOGY 7

MCB
Dan Llano
Molecular and Integrative Physiology
Taher Saif
Mechanical Science and Engineering
Anthony Fan
Mechanical Science and Engineering

Neuron stretching device

Gillette is very optimistic that these tools hold tremendous promise for identifying the signatures of neural activity that generate complex behaviors, insights not previously possible.

One technique, developed by Popescu, is a non-invasive, non-labeling imaging method that reveals differences in optical densities within the cell. For example, the nucleus is revealed as a crater because of spatial differences in optical density.

“These are novel imaging technologies that you can’t buy,” says Gillette.

Popescu’s technique will be further developed so that he can image, not single cells, but slices of brain where all the connectivity is laid down by developmental processes and see how they are functioning in real time, thanks to Popescu’s transparent, tattoo-like electrodes and sensors and Sweedler’s analytical techniques to measure peptides. Gillette, the neurophysiologist, brings the intellectual glue that will orchestrate the approaches and interpret the outcomes to advance brain science.

“I’m really proud of this project,” says Gillette. “It wouldn’t have happened except for two things. Everyone involved is very innovative and very collegial. You have to put your ego down and be willing to compromise. The EFI was able to get this to happen, and very few things happen except for two things. Everyone involved is very innovative and very collegial. You have to put your ego down and be willing to compromise.”

There are dozens of orthologs in the protein database that were identified by Patricia Babbitt and her colleagues at University of California, San Francisco, so we determined not only the function of one but also the functions of all the enzymes in the pathway that allows the microbe to consume tHypB, their work offers insight into the role of orthologous enzymes in similar pathways in other organisms.

Researchers with the EFI are working to develop strategies and tools that other researchers can use to accomplish similar feats of discovery.

“There was a time when a researcher devoted his or her entire career to a single enzyme,” Gerlt said. “That was a long time ago, although some people still practice that. Now, genome-sequencing technology has changed the way that biologists have to look at problems. We can’t keep looking at problems in isolation.”

For Further Reading
See the entire article in Nature: http://www.nature.com/nature/journal/v423/423041a

It Takes a(n Academic) Village to Determine an Enzyme’s Function
By Diana Yates

The new effort is part of the Enzyme Function Initiative (EFI) at the Institute for Genomic Biology at Illinois. This initiative, funded by the National Institute of General Medical Sciences and led by Gerlt as designed to address “ compression problems that are of central importance to biomedical science but are beyond the means of any one research group.” The EFI focuses on enzymes of bacterial origin.

Neil Popescu’s technique will be further developed so that he can image, not single cells, but slices of brain where all the connectivity is laid down by developmental processes and see how they are functioning in real time, thanks to Popescu’s transparent, tattoo-like electrodes and sensors and Sweedler’s analytical techniques to measure peptides. Gillette, the neurophysiologist, brings the intellectual glue that will orchestrate the approaches and interpret the outcomes to advance brain science.

Dan Llano’s interests in the brain have led, in his case, to the clinic, where he focuses out how aging and Alzheimer’s affect the auditory system, as well as how language and cognitive dysfunction arise from stroke.

“We are studying how brains process various kinds of sounds using a range of techniques including imaging, electrophysiology, and computational work,” says Llano, professor of medical and molecular integrative physiology and full-time faculty member with the Beckman Institute’s NeuroTech group.

Llano has a very successful collaboration with Taher Saif, professor of mechanical science and engineering, who has had a longstanding interest in the mechanical properties of neurons. For example, Saif determined that even tiny perturbations in the mechanical tension of neurons can substantially change neuronal activity.

Llano has preparations of brain slices in his lab that he puts on micro-devices built by Saif that exert tiny forces on the portions of brain tissue. He then uses optical imaging to measure how populations of brain cells respond to these forces.

“There are many clinical conditions where mechanical forces are extremely important. For example, brain tumors, traumatic brain injury, and hydrocephalus all stretch brain cells and nobody has any idea how that affects brain function,” says Llano.

The collaboration was initiated by one of Saif’s graduate students, Anthony Fan, who knew Llano’s group was using optical imaging. Fan thought that might be a good way to measure the impact of stretching across a population of neurons instead of a single neuron at a time.

Saif and Fan are experts at making micro-devices, such as the one that can stretch a single neuron. Llano is using that device for another project, for which they are submitting a collaborative grant.

This combination of experimental biology with new techniques in computation and imaging is where the future lies.

And, as biologically based research becomes more highly collaborative, MCB is a natural magnet—the nucleus even, of an expanding community.
Team Finds Mechanism Linking Key Inflammatory Marker to Cancer

By Diana Yates

Scientists call this Jekyll-and-Hyde molecule NF-kappa B. In healthy cells, it is a powerful “first responder,” a vital part of the body’s immune and inflammatory responses. It responds most of its life in the cell’s cytoplasm, quietly awaiting orders. But when extracellular signals—of a viral or bacterial invasion, for example—set off chemical alarms, the cell unchains this warhorse, allowing it to go into the nucleus where it spurs a flurry of defensive activity, including the transcription of genes that trigger inflammation, promote cell proliferation and undermine cell death.

Researchers have known for years that a hyperactive form of NF-kappa B that gets into the nucleus and stays there is associated with various cancers. But they didn’t know what was keeping it active in the nucleus.

“Normally in the cell NF-kappa B is in the cytosol, it’s not in the nucleus, and it’s not activated,” said University of Illinois medical biochemistry professor Lin-Feng Chen, who led the new study. “You have to stimulate normal cells to see NF-kappa B in the nucleus. But in cancer cells without any stimulation you can see this nuclear form of NF-kappa B. The cell just won’t die because of this. That is why NF-kappa B is so important in cancer.”

In the new study, Chen’s group found that another molecule known to help regulate gene expression, called BRD4, recognizes a specific amino acid on a subunit of the NF-kappa B protein complex after the amino acid has been marked with a specific tag, called an acetyl group. This “acetylation” allows the BRD4 to bind to NF-kappa B, activating it and preventing its degradation in cancer cells.

BRD4 belongs to a class of molecules that can recognize chemical markers on other proteins and interact with them to spur the marked proteins to perform new tasks. Chemical “readers” such as BRD4 are important players in the field of epigenetics, which focuses on how specific genes are regulated.

“In epigenetics, there are writers, there are readers and there are erasers,” Chen said. The writers make modifications to proteins after they are formed, without changing the underlying sequence of the gene that codes for them. These modifications (such as acetylation) signal other molecules (the readers) to engage with the marked proteins in various ways, allowing the proteins to fulfill new roles in the life of the cell. Epigenetic erasers remove the marks when they are no longer of use.

Such protein modifications “have been shown to be critically involved in transcription regulation and cancer development,” the researchers report.

“To test whether BRD4 was contributing to the sustained presence of NF-kappa B in the nucleus of cancer cells, Chen and his colleagues exposed lung cancer cells in cell culture and in immune-deficient mice to JQ1, a drug that interferes with BRD4 activity. Exposure to JQ1 blocked the interaction of BRD4 and NF-kappa B, blocked the expression of genes regulated by NF-kappa B, reduced proliferation of lung cancer cells and suppressed the ability of lung cancer cells to induce tumors in immune-deficient mice, the researchers found.

The researchers also discovered that depletion of BRD4 or the treatment of cells with JQ1 induced the degradation of the NF-kappa B subunit recognized by BRD4.

Chen said that BRD4 likely prevents other molecules from recognizing the hyperactive NF-kappa B in the nucleus and marking it for degradation.

“This is an example of how epigenetic regulators and NF-kappa B may one day be targeted for the treatment of cancer,” he said.

Researchers from Illinois biochemistry professor Satish Nair’s laboratory and from the laboratory of James Bradner at the Dana-Farber Cancer Institute contributed to this study.
What Won’t Kill You, Might Make You Stronger

New Research Seeks to Find out If Viruses Can Be Friends as Well as Foes

By Claire Sturgeon, Institute for Genomic Biology

Viruses are responsible for much more than sore throats and stuffy noses. Researchers now believe that some viruses may protect hosts from competitors and help them survive. Despite the fact that viruses are practically everywhere and affect every living thing, scientists know very little about their positive impact on their hosts.

The National Science Foundation awarded a five-year, $2-million grant to Rachel Whitaker, a microbiologist, and an interdisciplinary, multi-institutional team to explore the idea of viruses and their hosts coevolving together in the lab in the model system of hot springs at Yellowstone National Park.

“I hope to find that viruses are not just pathogens—that they are influencing dynamics in a bigger way,” said Whitaker, who is leading the Illinois team. “Sometimes they are good for their hosts, acting as symbionts or mutualists. I think it would be really neat if there were little infectious particles that could help the organisms they infect to survive and compete against their foes.”

Preliminary data has already shown that if an organism survives infection, it can use the virus to kill its competitors in the environment.

“I was once thought that viruses infect a microbe and kill it, or they don’t infect at all,” Whitaker said. “We have realized, given genomics and metagenomics, that it is a much more complex dynamic.”

Now we are asking, if hosts can use their viral infection as a weapon against their competitors, how does that affect these populations and their ecosystems? It’s a new way of looking at things,” says Whitaker.

Through laboratory experiments, Whitaker’s team will study host-viral interactions, including the costs and benefits of chronic (long-term) infections. Mark Young, a professor of virology at Montana State University, will study these interactions in a natural hot spring using a device developed by Sascha Hilgenfeldt, a professor in the Department of Mechanical Science and Engineering at Illinois.

Evolutionary ecologist Joshua Weitz from Georgia Tech University will use Whitaker and Young’s findings to develop a theoretical and computational eco-evolutionary model of how viruses and microbes interact.

“We are figuring out the parameters that will go into the model, then using the model to project what’s happening in nature, and finally going into nature to see if it works,” Whitaker said. “We will also learn things about natural populations that we didn’t know and that we can test in the lab then apply in our models. It will be an iterative process.”

To study the natural populations systematically, a method is needed to separate the host cells from the viruses. Hilgenfeldt has developed a device that currently separates particles by size that are between two to ten micrometers in diameter. In comparison, a human hair is about 75 micrometers wide. Archaerial cells, however, are just one micrometer wide and viruses are about 10 times smaller.

“Hilgenfeldt says he will have to use some “fluid-dynamical tricks” on his device to make it work for such small particles: the larger archaerial cells are captured in a tiny vortex caused by an oscillating bubble, while the smaller viruses are able to pass unhindered through the channel.

“It’s a tunable size filter because the strength of the transport flow and the bubble vibration strength decide what particle size gets through and what particle size is retained,” Hilgenfeldt said. “We are excited to apply this principle to the samples from hot springs to figure out how the population dynamics can change.”

Through this grant, Whitaker also plans to study microbial adaptive immunity, where a host is able to recognize infectious particles (like viruses) and degrade them if they are infected again.

“This work is pretty important because there is not a very good understanding of how adaptive immunity affects the evolution of pathogens,” Whitaker said. “We are hoping to apply some of the things we learn by looking at this simple adaptive immunity system and its diversity in order to understand the evolutionary impacts of diversified adaptive immunity in general.”

Through a SEED project funded by the Institute for Genomic Biology, Whitaker is also using a similar approach to examine how bacterial adaptive immunity and virus infection affects population dynamics of human pathogens. “Every organism on Earth gets infected by viruses. Understanding these dynamics will have a great impact on our understanding of the microbial world.”

This grant also supports various outreach and education efforts, including Project MICROBE that will develop age appropriate curriculum materials for K-12 classrooms based on current research in microbiology.

Left to right: Researchers Elizabeth Rowland, Samantha Dewerff, and María Bautista with associate professor of microbiology Rachel Whitaker.

Sascha Hilgenfeldt, a professor in the Department of Mechanical Science and Engineering, developed a device that separates particles by size.

Photo by Kathryn Coulter
What’s Going on in the Mind of a Mouse, and What Does It Mean for Humans?

By Doug Pearson

When an intruder mouse is placed into the territory of another mouse, sparks fly. The resident mouse will rush the intruder in a furious attack—although if you’re watching this happen in the lab of Lisa Stubbs, a screen separating the mice will prevent any harm from coming to the intruder.

For Stubbs, a professor of cell and developmental biology in MCB, the important part is not the external behavior of the mice. She says their goal is to understand “what’s going on under the hood”—what’s happening in the molecular machinery within the brain of the aggressor mouse. This, in turn, can shed light on what happens in the human brain.

Stubb’s and five other Illinois researchers recently received a $3 million grant from the Simons Foundation to study the genetic root of behaviors common among many different species, such as aggression, mate selection, and care for the young.

“The reaction to intruders is one of those fundamental behaviors,” Stubbs says. “It’s the same reaction that a honeybee has when a stranger comes into its hive, and it’s the same kind of reaction a person might have if somebody breaks into their home.”

The study concentrates on three species. Stubb’s specialty is mouse genetics, while Alivon Bell in animal biology is focusing on the stickleback fish. Meanwhile, Gene Robinson, on entomology, is focusing on the honeybee. According to Stubbs, they are looking at what genes are being turned on and off as a result of the intruder experience, and they have found a common genetic response in all three species. They found that about 100 genes showed similar changes in expression in response to the threat. What’s surprising, she says, is that many of these genes are best known for their roles in embryonic brain development.

“The animals are learning from this experience,” Stubbs says. “We do not know yet for certain, but this ‘developmental’ signal they might reflect new pathways being carved by neuronal processes, as a result of the experience.”

For instance, her lab studies mice with a regulatory mutation that affects the tissue-specific expression of a transcription factor gene, known as Dlx10. Her studies have shown that this gene plays an important role in the prostate development, and they suspect it may be required for adult prostate health as well. (Transcription factors encode certain proteins that, in turn, control the expression of genes.)

“The regulatory elements are far away from the genes they are regulating,” she says. “We’re interested in identifying those elements that are peculiar to mammals, as well as those that are similar among many species.”

As she explains, “If a gene is regulated similarly in mice, stickleback fish, and bees, it’s likely to be similar in just about every kind of creature you can imagine. Looking across diverse species gives us a special view into the most ancient and fundamental mechanisms.”

A Meeting of the Minds

Neurologist Connects Carle with Campus

By Doug Peterson

“The idea seemed harebrained at first,” says neurologist Dr. Graham Huesmann. On the face of it, his idea didn’t make sense: For new memories to grow, certain neurons had to die.

And yet, that counterintuitive idea arose when Huesmann noticed something very strange. Whenever songbirds heard a song for the first time, levels of the protein caspase-3 skyrocketed in the bird’s brain. But there wasn’t the same boost in caspase-3 when songbirds heard a familiar song.

This was Huesmann’s first clue that caspase-3 played an important role in the formation of new memories in birds—and in humans. What made this idea seem “harebrained” was that caspase-3 is primarily known for triggering the death of defective cells. How could something that kills cells have anything to do with the creation of memories?

In his research with the Neuroscience Program as an MD/PhD student, Huesmann found that caspase-3 destroyed neural connections, disrupting the unnecessary neural connections surrounding a particular memory, and this creative destruction strengthened memory formation. His finding has had important implications in the study of such memory disorders as dementia and Alzheimer’s.

Huesmann, a neurologist at Carle Hospital in Urbana, holds a research appointment in Molecular and Integrative Physiology (MIP) and is one of the driving forces behind Carle’s new Neuroscience Institute. The institute aims to form links with MIP and other University of Illinois departments as they uncover the unexpected through their research.

Huesmann was born in New Haven, Connecticut, but he grew up in Highland Park, Illinois. He says he toyed with the idea of following his father into psychology; however, being around med students in a study group at the University of Oregon inspired him to go into medicine instead.

Huesmann settled on neurology because he says he had always been fascinated by “the complex nature of the brain. Neurology encompasses all of all of medicine,” he says, noting that neural activity plays an important role in every field, from cancer biology and orthopedics to endocrinology.

After earning a master’s degree and a medical degree in biology from the University of Oregon in 1996, with minors in chemistry and dance, he was drawn to the medical school’s program in Urbana, where he worked in the laboratory of MCB professor David Clayton. It was in Clayton’s lab where he came up with the notion that caspase-3 might have something to do with the creation of memories. He credits Clayton for encouraging him to pursue this unique hypothesis.

“David said go for it,” Huesmann recalls. “He was an amazing mentor.”

Huesmann likens the formation of memories to the creation of a bas-relief sculpture. Just as an artist must chip away stone for the image to steadily appear, our brain must “chip away” at unnecessary neural connections for memories to become lasting.

For example, if you’re meeting someone for the first time and you want to remember the person’s face, you don’t need to remember the color of the person’s clothes or that a car went by outside the window, he says. Caspase-3 destroys those unnecessary connections, thereby strengthening the most important memory of the person’s face.
Dr. Catherine Christian
The Department of Molecular and Integrative Physiology welcomes Dr. Catherine Christian, who joined the department as an assistant professor in August of 2014. Dr. Christian received her PhD in neuroscience in 2007 from the University of Virginia, Charlottesville and completed her postdoctoral research at Stanford University. Dr. Christian is dedicated to join MPI and its ongoing work in understanding the interplay between genomics and neurodevelopment.

Many patients with temporal lobe epilepsy experience altered hormone levels, irregular meal patterns, and significant weight loss. This dysfunction may result from a number of complex factors, including genetic predispositions and environmental influences. The Christian lab is exploring the role of astrocytes, a specialized brain cell, in the regulation of hormone levels and appetite as they relate to temporal lobe epilepsy. Dr. Christian’s current research is focused on understanding the impact of temporal lobe epilepsy on the brain’s cellular and neurodevelopmental systems. Specifically, Christian’s laboratory is using a model of temporal lobe epilepsy to investigate the role of astrocytes in the regulation of appetite and food intake. The lab is currently exploring the role of astrocytes in the regulation of appetite and food intake, and the potential implications for the treatment of temporal lobe epilepsy.

Dr. Erin Nelson
Dr. Erin Nelson is a new assistant professor in the Department of Molecular and Integrative Physiology, joining the department at the start of the fall 2014 semester. Dr. Nelson received his PhD in immunology and molecular endocrinology from the University of California, San Francisco.

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Dr. Xin Li
Dr. Xin Li is an assistant professor in the Department of Cell and Developmental Biology. Dr. Li has dedicated her research to understanding the molecular mechanisms underlying the development of the nervous system.

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Dr. Procko’s current research is focused on understanding the molecular basis for neuronal recognition of environmental molecules, in particular sweet taste. How can different sweet substances activate the same sweet taste receptor? Procko’s current research is focused on understanding the molecular basis for neuronal recognition of environmental molecules, in particular sweet taste. How can different sweet substances activate the same sweet taste receptor? Procko is a leading expert in the field of neuroscience and has made significant contributions to our understanding of how the brain recognizes different flavors. His work has been published in numerous high-impact journals and has been widely cited.

Dr. Nien-Pei Tsai
Dr. Nien-Pei Tsai joined the faculty of the Department of Molecular and Integrative Physiology as an assistant professor at the start of the fall 2014 semester. Dr. Tsai received his PhD in pharmacology from the University of Michigan, Ann Arbor.

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Dr. Derek Wildman
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Dr. Wildman’s current research is focused on understanding the molecular basis for neuronal recognition of environmental molecules, in particular sweet taste. How can different sweet substances activate the same sweet taste receptor? Procko is a leading expert in the field of neuroscience and has made significant contributions to our understanding of how the brain recognizes different flavors. His work has been published in numerous high-impact journals and has been widely cited.
Students in the School of Molecular and Cellular Biology are anxious to gain experience in a research laboratory setting in order to prepare for graduate studies and future careers. Bench experience provides MCB undergraduates with an opportunity to learn and utilize the tools and techniques that will be encountered in academic and corporate research laboratories.

Some of the benefits for the students include:

- Developing hands-on skills with current tools and techniques
- Enhancing science-based verbal and written skills
- Building critical thinking and data analysis abilities
- Exploring and refining career directions
- Developing professional ties for future opportunities
- Working in a collaborative team environment

“Don’t underestimate the power of undergraduate research.”

I have been fortunate to work with an extremely talented group of undergraduates (I have had 35 undergrads in my lab since joining the faculty in 2001). These students typically bring a high level of enthusiasm and dedication to the lab, and I am amazed by what they are able to accomplish while juggling a very heavy course load. It is particularly gratifying when undergraduates earn co-authorship on manuscripts, because co-authorship is based on making significant intellectual contributions to the work, and not just serving as a pair of hands. I am really proud of these students and take real pride in seeing them move on to the next stage(s) of their careers. One of my favorite things about being a faculty member at Illinois is getting to work with such fantastic undergraduate students.

— Professor Phil Newmark, Professor of Cell and Developmental Biology
By Dale Annunziata

One reason the University of Illinois College of Medicine established a branch on the Urbana-Champaign campus is because of this institution’s extremely strong and deep bench in basic scientific research, most notably the School of Molecular and Cellular Biology. The College’s founders, several of whom were MCB faculty, believed that those strengths could benefit first-year medical students who needed to learn the most current basic science behind the practice of medicine.

Those very same strengths also inspired early administrators to establish the University’s MD/PhD program here in Urbana. Formal programs that offer both doctorates and medical degrees, known generally as MD/PhD programs, are not new, but the Illinois program, which was established almost 40 years ago, is among the oldest and largest in the country.

The University of Illinois program is known as the Medical Scholars Program (MSP). Unlike Medical Student Training Programs (MSTP), Illinois’ MSP program is not funded by an NIH training grant. The University of Illinois is the only school to offer doctorates in one of 35 disciplines, from history or philosophy to engineering or neuroscience.

Nevertheless, the most popular doctorates are in MCB departments — biochemistry, cell and developmental biology, microbiology, and molecular and integrative physiology. In fact, of the 120 Medical Scholars Program students currently enrolled, one-third are earning their PhDs in MCB. Recent figures show that half of the NIH NRSA fellowship awardees are in MCB.

The close relationship between MSP and MCB is both intellectual and physical. It means that on a given day, Daiva Mattis, who does research in David Kraus’s lab, might start an experiment in her lab, walk across to the medical sciences building by way of the third floor bridge, sit in class and hear a lecture on some disease that links to methods and techniques developed in the lab.

“U will wonder if they’d considered pulling out antibodies from these families, screening those and creating selective treatments based on that,” says Mattis. “Then I go back to the lab and while I’m thinking about the lecture I might wonder if we could use flow cytometry to screen for this. It’s a matter of collecting the right reagents, finding the funding. It’s that back and forth. When [classes and research] are so integrated in one day, doing that back and forth, you have a lot of these ideas.”

Mattis notes that going to seminars and brainstorming with her peers further fuels that synergy. In many, if not most, cases the campus medical school is on the fringes of the campus or in another part of the city entirely.

“We have more integration (compared to other programs), which is invaluable,” she adds. In addition, MSP students are exposed to the topics and fields their classmates are pursuing.

This relationship between MCB and the MSP program benefits both programs and creates a rich and valuable experience for students.

The program at Illinois is structured in such a way to take maximum advantage of the graduate school experience. In most programs students take the first two years of medical school, which encompasses classes in basic sciences, before doing their graduate research and earning a doctorate, and then returning to complete the last two years of medical school, preparing them primarily for clinical work.

At Illinois, students begin with the graduate program. They spend their first year entirely immersed in their graduate program. MSP students take their first year medical school courses throughout the years they are pursuing their PhD.

James Slauch, a professor of microbiology, has been the director of the Medical Scholars Program since 2002. “We consider this integrated pathway optimal in that the students approach the medical school curriculum with the critical thinking skills of a graduate student while also incorporating medical knowledge into their graduate research,” he says.

“I like the idea of portions of the MSP program being combined,” says Mattis. “While you’re working on your PhD you can take some medical school courses, giving you some exposure. While you are in medical school classes you are thinking about research and while you are doing research thinking about medical applications.”

David Cervantes’s research and medical school experiences dovetailed very nicely. After landing in Kevin Xiang’s lab (who has since moved on to UC Davis) he became quite interested in signaling pathways implicated in heart failure.

“It’s some of the most translational research we have here,” says Cervantes, who is currently in a thoracic surgery residency at the Emory University School of Medicine. “I could follow that research through my entire career.”

Cervantes studied the beta adrenergic signaling pathways that are implicated in heart failure. As hypertension forces the heart to work harder and harder, it gets bigger and bigger. In the end, that response kills the heart because as the heart remodels itself it develops so much tissue that blood can’t get to it, thus the heart can’t contract or get electricity.

If there are many pathways involved, what happens if you block a single protein from a specific pathway? This same pathway is implicated in diabetes.

Cervantes says he became known as the “heart guy” in his medical school classes and the “medical guy” in his PhD program.

“My PhD work has most certainly informed my medical school experience and vice versa,” he says. “Having the PhD allowed me to approach the work from a different angle than medical school. I’ve been able to critically evaluate the medical literature and ask questions like ‘why are we doing this? What would happen if we didn’t do this instead? Where are the controls? Is this the best treatment?’”

His lab mates often turned to him to determine whether there is clinical relevance to a given research direction.

“When I learned something on the wards I could come back and say, ‘can we look at this?’”

The main reason Cervantes’s research included looking at insulin receptors was because he observed diabetic cardiomyopathy on the wards. “I went back to the lab and asked Kevin, ‘Can we try this?’ And he asked, ‘Is it important?’ After what I’d seen on the wards I told him, YES!”

“The interplay between COM and MCB is unparalleled at other schools,” says Cervantes. “They are interwoven, the lines blur where medical school and graduate school begin and end.

“It’s not just cooperative, it’s synergistic,” he adds. “It’s not just the concepts, the materials, that are the same but they build on one another. It makes a stronger student. The time in the lab produces a better understanding of the material. Without COM, MCB wouldn’t be as strong and without MCB, COM wouldn’t be as strong. It’s like any good relationship.”

Neal D. Andruska Biochemistry David Shapiro

Wesley Arli Biochemistry Aneesh Kaladra

Adele K. Barry Biochemistry Deborah Leckband

Emily C. Celender Biochemistry Paul Fregly/author

Sharen M. Cho Biochemistry James Morrison

Kratna A. Drax Biochemistry Martin Burke

Daniel T. Farris Biochemistry David Krane

Jennifer H. Halvor Biochemistry Martin Burke

Rick Lawrence Biochemistry Rudy Refa

Robin M. Martin Biochemistry Carol Wight

David M. Martin Biochemistry David Krane

Richard J. Sava Biochemistry James Morrison

Eva R. Cook Cell & Dev Biology Fei Wang

Lisa Moore Cell & Dev Biology Jonathan Henry

Alex Thomas Cell & Dev Biology Jonathan Henry

Rachel J. Wielandt Cell & Dev Biology Je Chen

Luba A. Fretzin Microbiology James Slouch

Aza Flanagan Microbiology Jeff Gardner

Lauren T. Gates Microbiology Joanna Shkel

Charles P. Heidebrand Microbiology James Morrison

Sang Jung Microbiology Richard Tapping

Jennifer L. Lopriore Microbiology Jeff Gardner

D’Phoeva L. Liu Microbiology Steven Bloche

Kim Eun Naun Microbiology James Slouch

Michael L. Nama Microbiology Steven Bloche

Michael J. Sorensen Microbiology Richard Tapping

Tufliyn Molecular & Cellular Biology

Jennifer M. Arnold Molecular & Integrative Physics Martha Gillette

Matthew J. Beshi Molecular & Integrative Physics Lori Reinstein

Matthew M. Chuehn Molecular & Integrative Physics David Shapiro

Honnell, Eric Cancer Molecular & Integrative Physics Edward Roy

Saimadu J. Irving Molecular & Integrative Physics Martha Gillette

Harmeet Kaur Microbiology Molecular & Integrative Physics

Ilyy Pembahsa Molecular & Integrative Physics David Shapiro

Karan P. Narayanan Molecular & Integrative Physics William Butter

Harry J. Reesenberg Molecular & Integrative Physics Martha Gillette

Wix V. Molecular & Integrative Physics Martha Gillette
Scientists Discover a New Role for Estrogen in the Pathology of Breast Cancer

By Diana Lino

Scientists have discovered a previously unknown mechanism by which estrogen prepares cells to divide, grow and, in the case of estrogen-positive breast cancers, resist cancer drugs. The researchers say the work reveals new targets for breast cancer therapy and will help doctors predict which patients need the most aggressive treatment.

The University of Illinois team reports its findings in the journal Oncogene.

Estrogen pre-activates the unfolded-protein response (UPR), a pathway that normally protects cells from stress, the researchers report. The UPR spurs the production of molecular chaperones that prepare cells to divide and grow. Without chaperone proteins to do the work of folding and packaging other proteins, cells—including cancer cells—cannot divide. For this reason, chaperones are a popular target for new cancer therapies.

Activation of the UPR is known as a normal response to stress—when a cell lacks adequate oxygen or nutrients, for example, or is exposed to cancer-killing drugs. UPR activation prepares the cell for major changes associated with cell growth, division and survival under stress.

It wasn’t known before this study, however, that estrogen initiates this pathway before such stresses appear, said University of Illinois biochemistry professor David Shapiro, who led the new analysis with lead author, MD-PhD student Neal Andruska.

“This is a new role for estrogen in the pathology of cancer,” Shapiro said. "Others have shown that stress activates this pathway, helping to protect some tumors. What is new is our finding that estrogen can pre-activate this pathway to protect tumors.”

When estrogen binds to its receptor it sparks a cascade of molecular events in the cell. A key event occurs when a channel opens in the membrane of a compartment that stores calcium, and calcium floods into the cell.

That’s a signal to activate the UPR pathway, the stress pathway,” Shapiro said. “It’s also a signal that many researchers think has something to do with cell proliferation. The calcium itself may be a proliferation signal.”

The stress-response pathway induces the production of chaperone proteins.

“I like to think of this pathway as an assembly line,” Shapiro said. “In order for cells to divide, you’re going to have to produce a lot more proteins. The chaperones help you to package, fold up and ship all these proteins.”

The UPR also is a mediator of cell death. If a normal cell is exposed to too much stress, the stress response spurs apoptosis, a kind of cellular suicide. In cancer, however, mild activation of the UPR by estrogen blunts this cell-death pathway, allowing cancer cells to survive and even resist drugs, the researchers found.

The team also looked at the expression of UPR-related genes in publicly available data from samples of breast tumors obtained from women who had been diagnosed up to 15 years prior.

FOR FURTHER READING
See the entire article in Oncogene: http://www.nature.com/onc/journal/vaop/ncurrent/full/onc2014292a.html

Biochemistry professor David Shapiro (center), MD-PhD student Neal Andruska (left), graduate student Xiaobin Zheng and their colleagues discovered a new mechanism by which estrogen contributes to the pathology of breast cancer.

Photo by L. Brian Stauffer

“...Andruska, who spearheaded the research and carried out the computer analysis of the breast cancer data, found that UPR activation is a very powerful prognostic marker of the course of a woman’s disease,” Shapiro said.

The analysis revealed that among women with estrogen-receptor-positive breast cancer who underwent tamoxifen therapy, breast cancer was 3.7 times more likely to recur in those overexpressing the UPR. Ten years after a breast cancer diagnosis, only 15 percent of those with the highest level of UPR-gene expression were disease-free, compared with 80 percent of women with minimal UPR expression.

“Our marker helps identify breast cancers that are likely to be highly aggressive and therefore require intensive therapy,” Shapiro said.

U of I graduate student Xiaobin Zheng, postdoctoral researcher Xuinan Yang and food science and human nutrition professor William Hefflerich contributed to the research.

The National Institute of Diabetes and Digestive and Kidney Diseases at the National Institutes of Health funded the research.
The Meaning of Alma Mater

June Remboldt Aprille Establishes Molecular and Integrative Physiology Endowment

By Doug Peterson

In one of her speeches as provost of Washington and Lee University in Virginia, June R. Aprille pointed out that “alma mater” literally means “nurturing mother” in Latin.

“Alma mater is much more than a campus and buildings,” Aprille said in her speech. “Like a parent, it has the potential for profound developmental influence.”

Recognizing this “profound influence” in her own life, Aprille, an MCB alumna, has established a gift to thank her alma mater—the University of Illinois. She recently created the June Remboldt Endowment for Molecular and Integrative Physiology in honor of her family, her mentors, and the Illinois faculty who inspired her best efforts, with particular thanks to her PhD mentor, Dennis Baustow.

“UIUC admitted me to the graduate program at a time when women were not welcome at many other top-tier institutions,” said Aprille. “I will be forever grateful for that opportunity. The degrees I subsequently earned at UIUC were the foundation of my whole career, and any accomplishments I attained were not welcome at many other top-tier institutions,” said Aprille. “I will be forever grateful for that opportunity. The degrees I subsequently earned at UIUC were the foundation of my whole career, and any accomplishments I attained were based built on that. I am glad for the chance to ‘give back by giving forward’ and help the next generation of promising graduate students achieve their best potential as I was empowered to do as a result of the education I received at UIUC.”

Aprille received her MS in 1969 and her PhD in 1970 in physiology from the U of I and went on to become an internationally recognized researcher on energy metabolism and muscle function at the cellular and molecular level, especially in newborns. Her laboratory showed that some newborn infants have particular DNA mutations that compromise energy metabolism.

She joined the biology faculty at Tufts University in 1977 and was also assistant clinical professor of pediatrics at Tufts University School of Medicine and a lecturer in biochemistry at Harvard Medical School. In addition, she served as vice provost at Tufts University, and provost at both the University of Richmond and Washington and Lee University before retiring in 2011.

In honor of her outstanding career, the U of I Department of Molecular and Integrative Physiology awarded Aprille the Distinguished Alumni Award for Professional Achievement in 2003.

The June Remboldt Endowment will benefit graduate fellowships in MIP.

Second Chances

MCB Alum Helped Develop Drug That Gave New Hope to HIV Patients

By Doug Peterson

Michael Recny will never forget his encounter in the early 2000’s with several HIV-infected patients who had become resistant to all available antiretroviral medications. One patient told him how he had sold his life insurance policy and most of his possessions and was preparing for the final days of his life. He had run out of options.

However, the young man went on to explain that when he learned about a new experimental drug called Fuzone, he became part of the clinical trial. This antiretroviral drug turned the HIV-infected man’s life around.

Recny, who received his PhD in biochemistry from the University of Illinois in 1983, played a key role on the team at Trimeris, Inc., which developed and brought Fuzone to market. “What’s more, the Trimeris success was part of a dramatic turnaround in the whole political landscape of the field of recombinant DNA technology and racing to commercialize it with all of these first-generation recombinant proteins.” It was outrageous. “Recny worked as a staff scientist and laboratory head at Genetics Institute, and his lab was the first to publish the correct protein structure and biological activity of natural and recombinant human erythropoietin, which eventually became a multi-billion dollar drug.

Recny spoke at the 2014 MCB commencement ceremony, he told the story of how spending 10 years with successful biotechnology companies in Boston, he was recruited to join an ambitious start-up biotechnology company spun out of the University of California, San Francisco. One year later, the Bay Area company was bankrupt.

“For the first time in my professional career, I was unemployed,” he says. “Frustration, anger, apprehension, doubt—you name it, I felt it.”

But Recny bounced back, and after seven months of hard work he landed a job at another new start-up biotech company—Trimeris. Their experimental drug, Fuzone, was a ‘wildly revolutionary way to fight HIV,’ he says. It was the first in its class, “and as I look back now, I realize how incredibly rare that is. A first drug in a class happens only once.”

Recny grew up in Liverpool, New York, just north of Syracuse, where he spent his youth playing pickup hockey in their backyard ice rink. He says chemistry always came easy to him, so after receiving his undergraduate degree from the University of Rochester (where he played centerback on the football team), he came to U of I to get his PhD.

He worked in the lab of Lowell Hager, the biochemistry department head. Hager, who passed away this year, had a tremendous influence on his life. Recny says. However, Hager initially was not enthusiastic when Recny passed up an academic career after finishing his PhD and joined one of the first biotechnology companies born out of Harvard Medical School to help commercialize recombinant DNA technology. In 1984, Recny says he took a “leap of faith and jumped into” the biotech world, beginning with Genetics Institute in Boston.

Genetics Institute went head-to-head with legendary biotech companies such as Genentech, Biogen, and Amgen. As he puts it, “We were basically inventing the whole field of recombinant DNA technology and racing to commercialize it with all of these first-generation recombinant proteins.” It was outrageous.

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In 1989, he went to Procept, where he was director of protein biochemistry and helped structure three major research and development agreements with several international pharmaceutical companies over a five-year period. Then, after the failed start-up in San Francisco, he came back east to join Trimeris.

It was the early 1990s, and biotechnology was not the only thing exploding at the time. So was the AIDS epidemic.

“According to the World Health Organization, the HIV-1 epidemic in the early 1980s, played a key role on the team at Trimeris, Inc., which developed and brought Fuzone to market. ‘What’s more, the Trimeris success was part of a dramatic turnaround in the whole political landscape of the field of recombinant DNA technology and racing to commercialize it with all of these first-generation recombinant proteins.’ It was outrageous.”

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“All of the first-generation antivirals only worked for a short time, and people were searching for all kinds of ways to address HIV infection,” he says. Recny ran the research and development team at Trimeris, trying to identify which peptide would best fight HIV. He also led the team that devised a way to manufacture the first batch of the compound they took into clinical trials in 1997.

“Fuzone was a small company at the time, so Recny was instrumental in helping to raise millions of dollars to fund clinical studies with Fuzone, and in developing a partnership with one of the world’s largest pharmaceutical companies, Hoffman-La Roche. Together the two companies completed the clinical development and launched Fuzone in 2003.

Today, Recny lives in Chapel Hill, North Carolina, and is chief executive officer for Calvert Holdings, which works with small biotech and pharmaceutical companies that develop new experimental medicines, helping them with testing required by the FDA. For instance, they partnered with a company and also invested $1 million of their own money to help complete FDA testing so the company could begin human clinical trials with a new compound.

The compound is now in Phase II human clinical trials and could become a revolutionary approach to treating Type 2 diabetes.

When Recny spoke at the 2014 MCB commencement ceremony, he also had the unique honor of going through the hooding ceremony for his PhD. In 1984, exactly 30 years earlier, he had been unable to attend his graduation ceremony, so in 2014 he tied up that loose end. MCB Professor Susan Martinis, acting in Hager’s place, had the honor of hooding Recny.

“What sticks with me over my long career are the personal interactions with patients, he says. For instance, he remembers that when he was at Genetics Institute, a young man with hemophilia spoke to their team and said that Genetics Institute’s recombinant human factor VIII eliminated the risk for him and other hemophiliacs of getting HIV from tainted blood during transfusions.

As a young scientist, my head was always buried in the lab thinking about the next experiment,” he says. “But that experience helped me to rise above the laboratory bench and make the connection between the power of technology and the impact that it actually had on someone’s life. It became a guiding principle of my career.”
William T. Greenough (1944-2013)

William T. Greenough, professor emeritus of psychology at the University of Illinois and a pioneer in studies of brain plasticity and development, passed away on December 8, 2013 in Seattle, of complications associated with Lewy Body Dementia. Throughout his career, Greenough explored the neural basis of learning and memory and the effects of aging, exercise, injury and environmental enrichment on the brain.

Bill was one of the towering figures in neuroscience, not only on this campus but around the world,” said Neal J. Cohen, a professor of psychology at Illinois and the director of the Neuroscience Program once led by Greenough. Greenough employed all the tools and techniques available to him—from optical and electron microscopy to electrophysiological and molecular approaches—to understand how the brain responded to a variety of influences.

“His research revealed that environment, exercise and training continued to shape the brain throughout the lifespan,” Cohen said. “The work led to new insights into the signaling and regulatory mechanisms at work in the brain and how those functions can go awry in conditions such as Fragile X syndrome, the most common cause of inherited neural impairment.”

Greenough joined the U of I faculty in 1969 after earning a doctorate in psychology at the University of California, Los Angeles. By the time he retired in 2009, he held a endowed Endowed Chair at Illinois and was a Center for Advanced Study (CAS) professor of psychology, of psychiatry and of cell and developmental biology. He had served as the director of the Neuroscience Program and the director of the CAS. He played a critical leadership role in the establishment of the Beckman Institute for Advanced Science and Technology, the first multidisciplinary institute on the Urbana-Champaign campus.

He is survived by his mother, Maryon; sister, Mary, brother, Tom; daughter, Jennifer, son-in-law, Jorge, and two grandchildren, Alejandro and Matteo.

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He is survived by his mother, Maryon; sister, Mary, brother, Tom; daughter, Jennifer, son-in-law, Jorge, and two grandchildren, Alejandro and Matteo.
Abigail Salyers (1942-2013)

Abigail Salyers, former Arnold Professor of Microbiology and Immunology, passed away on November 6, 2013 at the age of 71. During her 40-year career, Salyers revolutionized how we think about the bacteria that live in the human intestinal tract, made major contributions to our understanding of antibiotics resistance, and led the way in the study of the role of the intestinal microbiome in health and disease. She was a pioneer in the emerging field of microbiology and a leader in the study of the interactions between bacteria and their host. Salyers earned a bachelor’s degree in mathematics in 1963 and a doctorate in physics in 1969 from George Washington University. After four years of teaching, research, and tenure at St. Mary’s College in Maryland, she switched fields by taking courses in biochemistry and microbiology and secured a second post-doctorate position in biochemistry and microbiology at Virginia Polytechnic Institute (VTI). She studied, taught, and performed research at VTI from 1973 to 1978. Salyers joined the University of Illinois at Urbana-Champaign in 1978 and became the first female tenured professor in microbiology at Illinois in 1983 and achieved the rank of full professor in 1988. While at Illinois, Salyers was named a University Scholar, Faculty Member of the Year in the College of Medicine, a member of the Center for Advanced Study and a faculty member in the Institute for Genomic Biology (IGB). Salyers received the Pasteur Award for Research and Teaching (Illinois Society for Microbiology), the All-Campus Award for Excellence in Teaching from the University of Illinois Medical School, the Golden Apple Award for Medical School/Teaching three times, and was named the G. William Arens Professor in Molecular and Cellular Biology from 2004 until her retirement in 2012. Throughout her microbiology career, Salyers studied the interaction of colonial bacteria with their host, antibiotic-resistance gene transfer, genetics of obligate anaerobes, and conjugal transposons of Bacteroides. Salyers was assisted in her research by numerous research associates and students, with over 200 peer-reviewed research articles, reviews and book chapters. Salyers authored a number of books in the fields of microbial pathogenesis and antibiotic resistance, most notably “Bacterial Pathogenesis: A Molecular Approach; Antibiotic Resistance Transfer in the Mammalian Intestinal Tract: Implications for Human Health, Food Safety and Biotechnology, Microbiology: Diversity, Disease and the Environment; and Bacterial Resistance.”

During the anthrax incidents in 2001, Dr. Salyers served as president of the 40,000-member American Society for Microbiology, the oldest and largest single life science membership organization in the world. She stressed the need for more research on the spread of antibiotic resistance, hospital-acquired bacterial infections, and other diseases that threaten thousands of lives each year. Salyers is survived by her life partner Jeffrey Gardner, daughter, Georgia (Betsy) Wiel, brother, Robert; and sister, Martha.

William Slator Jr. (1917-2013)

William Warner Slator Jr. passed away on December 23, 2013 at the age of 96, after a brief illness. Dr. Slator was a former professor and head of the Department of Molecular and Integrative Physiology. He was a distinguished biologist and excellent administrator who led the department at a pivotal time during the founding of the medical school in Urbana. Slator received an AB and MS degrees and a PhD degree in physics in 1946 from the University of Michigan. He became a Fellow of the John Simon Foundation for Medical Physics at the University of Pennsylvania, and later worked as physicist at the Ballistic Research Laboratory in Aberdeen, MD, during World War II. In 1946, Slator served as a research associate and instructor of physics at the University of Minnesota before accepting a professorship in Biophysics at Washington University in St. Louis in 1949. Slator joined the University of Illinois in 1969 as professor and head of the Department of Physiology and Biophysics (now Molecular and Integrative Physiology), a post he held until 1976. Slator retired in 1986 and was a professor emeritus at the time of his death.

A pioneer in the emerging field of biophysics, Slator steered the Department of Molecular and Integrative Physiology in a more mathematical, quantitative direction. He was a charter member of the Biophysical Society, formed in 1957, where he served as secretary and council member, and was instrumental in founding the School of Basic Medical Sciences (now College of Medicine) in Urbana in 1971.

Slator was an exceptional researcher, first as physicist and later as a muscle physiologist. During his tenure at Illinois, he studied the scattering of light in biological tissues, first by blood in the process of hemostasis, and then in muscle to examine changes in response to muscle contraction.

“He was one of the first to elucidate how drugs and hormones altered the electrical and mechanical properties of heart muscle, laying a sound foundation for later developments in cardiac pharmacology,” said his colleague Dr. Eric Jakobsson, professor emeritus of Pharmacology. “He was one of the first to show that bacterial reaction centers converted light energy into chemical energy with almost 98% efficiency, and that certain herbicides function by displacing a specific bound quinone molecule,” said Dr. Govindjee, professor emeritus of biophysics and plant biology and long-time friend and colleague of Slator.

Born in 1945 in London, UK, Slator studied at the University of Bradford, earning his BS in 1967 and his PhD in 1971. After postdoctoral research at the University of London and Cornell University, and a brief faculty position at the University of California at Santa Barbara, he joined the faculty at the University of Illinois at Urbana-Champaign in 1975 as an assistant professor in the Departments of Plant Biology, Physiology, and Biophysics. He held many positions during his years on the faculty of the University, including serving as Director of the Center for Biophysics and Computational Biology from 1995-1999. He joined the Biochemistry Department in 1999 and served as Head of Biochemistry from 2004-2009. He also held faculty positions in the Departments of Plant Biology and Molecular and Integrative Physiology.

In addition to his important research contributions, Professor Slator was a passionate teacher and mentor, and an outstanding colleague who gave unsparingly to others. He was known for the breadth and depth of his knowledge, quick wit, and the gracious and inspiring to all who knew him.

William Warner Slator Jr. is survived by his wife Mary and their children, Lydia, Tristan and Sebastian.

Colin A. Wraight (1945-2014)

Professor Colin A. Wraight passed away July 10, 2014 at the age of 68 after a long and heroic struggle with cancer. Professor Wraight employed biochemical and biophysical methods to understand how the structure of membrane proteins allowed them to catalyze the transfer of electrons and protons as biological energy conversion, processes fundamental to life on this planet.

“He was the first one to show that bacterial reaction centers converted light energy into chemical energy with almost 98% efficiency, and that certain herbicides function by displacing a specific bound quinone molecule,” said Dr. Govindjee, professor emeritus of biophysics and plant biology and long-time friend and colleague of Wraight.

Born in 1945 in London, UK, Wraight studied at the University of Bradford, earning his BS in 1967 and his PhD in 1971. After postdoctoral research at the University of London and Cornell University, and a brief faculty position at the University of California at Santa Barbara, he joined the faculty at the University of Illinois at Urbana-Champaign in 1975 as an assistant professor in the Departments of Plant Biology, Physiology, and Biophysics. He held many positions during his years on the faculty of the University, including serving as Director of the Center for Biophysics and Computational Biology from 1995-1999. He joined the Biochemistry Department in 1999 and served as Head of Biochemistry from 2004-2009. He also held faculty positions in the Departments of Plant Biology and Molecular and Integrative Physiology.

In addition to his important research contributions, Professor Wraight was a passionate teacher and mentor, and an outstanding colleague who gave unsparingly to others. He was known for the breadth and depth of his knowledge, quick wit, and the gracious and inspiring to all who knew him.

William Warner Slator Jr. is survived by his wife Mary and their children, Lydia, Tristan and Sebastian.
Doctor of Philosophy

Biology, Distinction

Biochemistry

Jianzhong Hu, Fall 2013
Hanhong Li, Fall 2013
Caojie Li, Fall 2013
Yueying Zhang, Fall 2013
Wenqi Qi, Fall 2013
Sijun Li, Fall 2013

Cell and Developmental Biology

Wenbo Xu, Summer 2013
Shihua Zhang, Summer 2013
Xiaoliang Nan, Summer 2013
Zhiyong Zou, Summer 2013
Yingfu Wang, Summer 2013

Molecular and Integrative Physiology

Lei Guan, Fall 2013
Jingye Peng, Fall 2013

Master of Science

Biology

Prashanth Shenoi

Aline Duarte

Michael Levitt, Summer 2013
Brooke Hoover, Summer 2013

Microbiology

Brooke Hooper, Fall 2013

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