

SYNERGY



BECKMAN INSTITUTE
FOR ADVANCED SCIENCE AND TECHNOLOGY

Issue 28 • Spring 2015



From the New World: A Sugar Planet

This image, created by Sizhu You, a chemistry Ph.D. student in Beckman faculty member Kenneth Suslick's group, won the 2014 School of Chemical Sciences Science Image Challenge.

See page 13 for details.

Breaking Down Emotional Barriers through Design

Deana McDonagh, industrial design professor and Beckman part-time faculty member, merges empathic design with scientific and technological advances.

As you read this you may be sitting in a chair at your desk, which serves a functional purpose. But do you often consider how the shape of the chair affects your posture and your mood? Or how the space between your chair and your desk helps or hinders your work?

How we emotionally and physically interact with design—from objects to spaces to services—is the subject of Deana McDonagh's research. At the Beckman Institute, she encourages scientists to look at what they're creating and ask, "Who is going to use this, and how can I make it easier for them to use it? How can I make them feel good about using this?"

McDonagh, a professor of industrial design at the University of Illinois, has explored the relationship between products and users, a field known as empathic design, since 1996.

"Empathic design responds to the functional and emotional needs of the people that your device, your environment, your service, is aiming to serve," explains McDonagh. "Empathic design acknowledges its users and provides subtle but very secure ways for somebody to live independently for longer."

A device as seemingly simple and universal as a button provides an empathic design issue for McDonagh to think about.

"Buttons are okay for many people, but what about people with arthritis?" McDonagh said. "Buttons are hard to manage for someone with arthritis. If something like a button, zipper, or difficult food packaging continually interrupts your day because you can't manage it, it breaks your workflow, and that disruption can lead to frustration. It can chip away at your confidence over the long term."

"Then over time, your choices become reduced, and you can't access the food, clothes, or whatever else you once loved, and your quality of life diminishes. It's important to ensure the devices, tools, and products that we rely upon to help us complete tasks are doing just that—helping."

McDonagh examines these sorts of issues when assessing the usability of a new product or space at the Beckman Institute. One project she has worked on is the redesign of Beckman faculty member Stephen Boppart's lab. Boppart develops optical imaging technologies and tests them on participants in his lab. But his lab doesn't look like a typical scientific lab. McDonagh based the design of the space on a doctor's office, yet relied on warm colors and pleasant furnishings to make the room feel less clinical and more comforting.

"I looked at the emotional side of going to visit a doctor," said McDonagh. "It makes people nervous. But if patients are calmer, they're going to have a more productive conversation, and they're going to listen and hear more. So I opened a dialogue about how the texture and colors flow in the room to make it more inviting, and what type of furniture will be comfortable for all shapes and sizes to sit on."

"Good design means people should walk into the room and not have to think about where to go. They should feel at ease in their surroundings. Good design remains unnoticed as it supports our actions and makes us feel empowered."

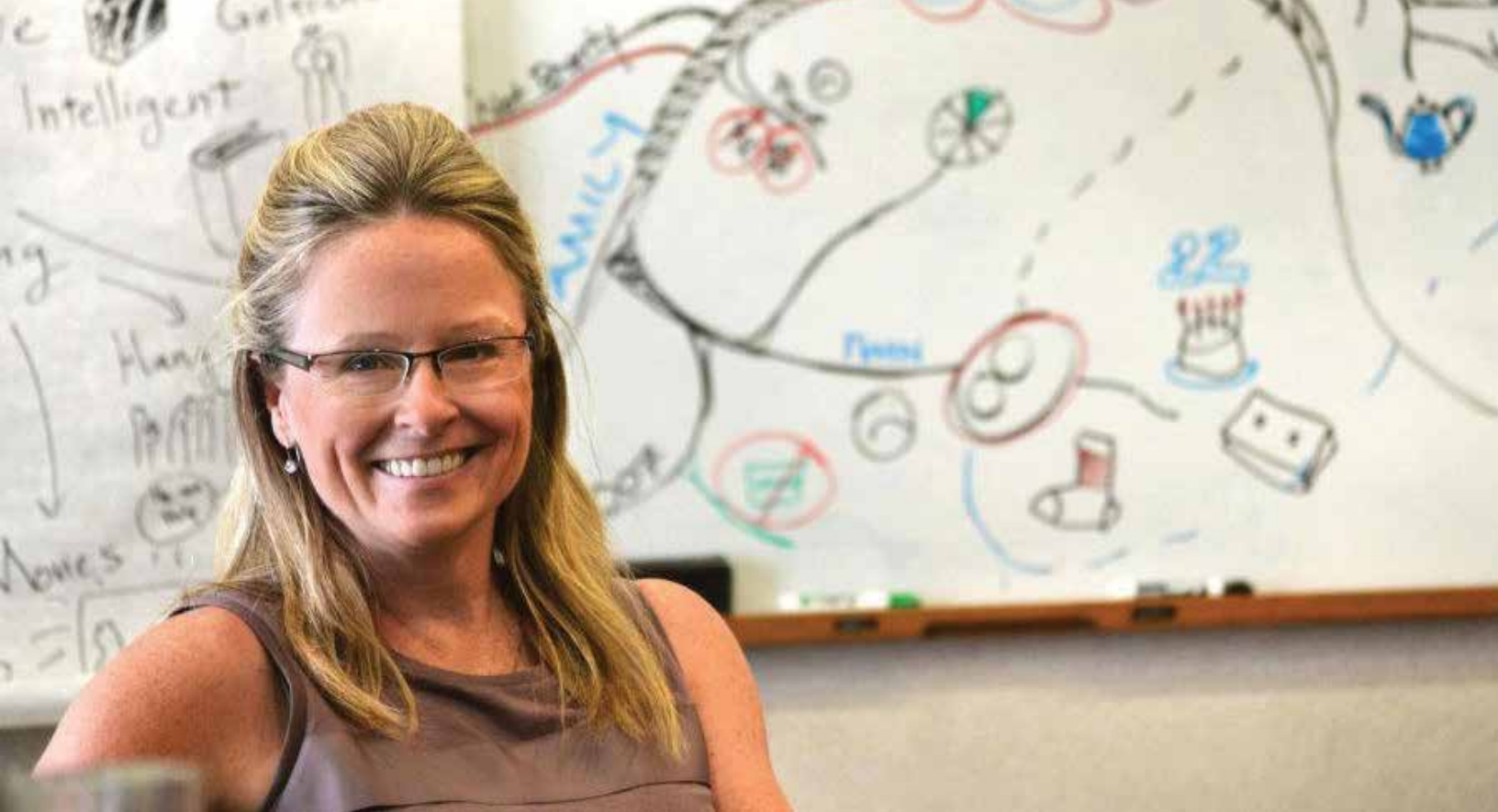
Boppart has sought McDonagh's guidance in not only his lab space, but also in the design of his imaging devices.

"Deana has elevated the importance of design and functionality in our technological development of medical devices and even in the environment in which these are used. Because medical devices and our healthcare environments have such a direct humanistic and personal influence, Deana's insights and contributions have helped to erode the boundaries that can sometimes exist between a personal patient-doctor encounter and the new technology that often confronts them," said Boppart. "Deana and her students have helped integrate empathic design from the start in our development of novel optical imaging instruments, as well as in the design and construction of a new 'clinical' laboratory space for investigating the delivery of healthcare with new technology."

Beckman faculty member John Rogers and his group have been leading research in sensors that adhere to the body like a temporary tattoo, and can detect various physiological markers. McDonagh is looking forward to providing guidance on the usability of his various wearable technologies by examining how users would interact with the product in a real-world environment.

"What designers bring is a different perspective, and they try to foresee the unforeseeable challenges, so technology is introduced without any psychological barriers," McDonagh said. "It's at the intersection of science and the lived experience. How can we bridge it so our products and technologies are applied in a way that people really want to have on their person, in their bodies, and in their homes?"

In addition to her work with faculty, McDonagh is also engaged with her students. She recently established the Disability + Relevant Design course (ARTD 299/499), which is the only one



of its type in the world. It brings students with physical disabilities, visible and nonvisible, together with designers, engineers, and computer scientists, to imagine products, spaces, and services that would make the world easier and better for all types of people.

“What designers bring is a different perspective, and they try to foresee the unforeseeable challenges, so technology is introduced without any psychological barriers. It’s at the intersection of science and the lived experience. How can we bridge it so our products and technologies are applied in a way that people really want to have on their person, in their bodies, and in their homes?”

—Deana McDonagh

She is the entrepreneurial designer in residence at the University of Illinois Research Park and at the start-up companies in the technology incubator at EnterpriseWorks. Her goal is to help entrepreneurs move designs from idea to product development that will make sense to consumers.

“This community is a remarkable oasis for entrepreneurship and start-up companies. The research results in brilliant technology, and then we say, ‘Hold on a minute, let’s just look at the context of who you’re designing for,’” McDonagh said. “So I’ve had

the pleasure of working with companies at the Research Park, helping student groups that are beginning to move into product development, helping them see their context from another perspective.”

It is through this involvement that McDonagh was recently nominated for an Advocacy Award for the Innovation Celebration, a collaboration among the University of Illinois, Parkland College, and the community, recognizing local innovation and entrepreneurial excellence.

McDonagh is also on the Edison Awards Nominations Review Committee, a position that enables her to see cutting-edge technology in a whole range of fields, and select winners for new or innovative technology awards.

“The joy of that is I’m an industrial designer, and being a part of the conversation about product design wouldn’t necessarily have happened 10 years ago,” McDonagh said. “People have become more aware of how product design impacts the usefulness of technology and its importance in satisfying needs beyond the functional.”

At the university, McDonagh hopes to continue collaborations with various groups at Beckman in order to create more intuitive and useful designs.

“I couldn’t do what I do without being here at Beckman. I tell people that when I’m here, I’m having a good day. It’s my happy place,” McDonagh said.



bit.ly/beckman-mcdonagh



A Little Training in the Microscopy Suite Can Go a Long Way

Beckman's Microscopy Suite, a facility open to researchers worldwide, hosts a wide range of tools for microscopic imaging. Hyunjung (Anna) Kim, a graduate student in integrative biology, found that electron microscopy was a key component of many projects in her lab, so she has become a vital resource in her lab's studies of host-pathogen interactions.

Anna Kim, a graduate student in integrative biology, spends a lot of her time in the basement of the Beckman Institute, performing electron microscopy (EM) in Beckman's Microscopy Suite, where some of the most advanced research in EM takes place every day.

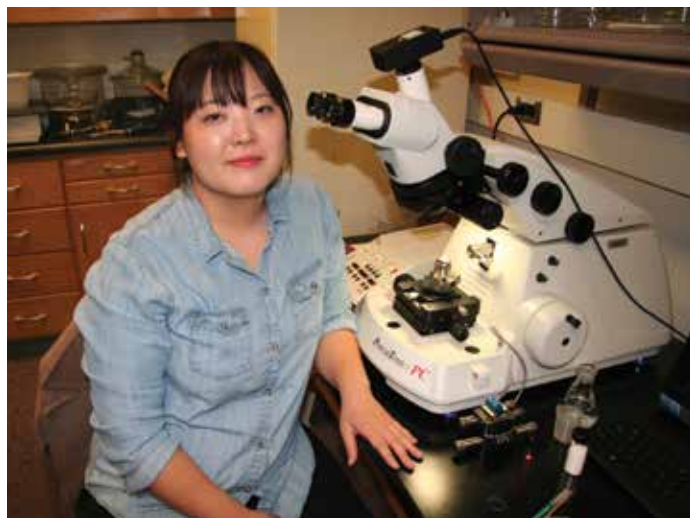
Many graduate students using tools in the suite, like Kim, are trained by the microscopy experts who manage the facility. Kim quickly mastered the two main modes of electron microscopy: scanning electron microscopy (SEM) and transmission electron microscopy (TEM). She became the go-to EM expert for her lab, directed by Steven Blanke, professor of microbiology. Kim is involved in several research projects with the lab's grad students, aiding in the visualization of their samples.

"The Microscopy Suite at Beckman makes it easy to learn new techniques, from knowing who to contact about each instrument, to getting trained and helped," said Kim. "With the help of [lab manager] Scott Robinson, I learned EM quickly, and thought it was so cool. With the magnification capabilities of EM—up to 2 nanometers for the SEM and 2 angstroms for the TEM—you can see subcellular details unmatched by conventional microscopy."

Blanke's lab looks at how common pathogens interact with host cells through their production of toxins and spores. The lab's ultimate goal is developing countermeasures against those pathogens. Blanke's group is involved in projects that focus on three different bacterial toxins/spores: vacuolating cytotoxin (VacA), a toxin secreted by *H.pylori*, which 50 percent of the

world population is infected with and is the only bacteria known to cause cancer; cytolethal distending toxin (CDT), a toxin capable of damaging DNA within cells; and spores formed by *B.anthraxis*, the bacteria that causes anthrax, an infectious and fatal disease of the lungs, gastrointestinal tract, and skin.

Kim's original project was to visualize the process of VacA binding to the surfaces of epithelial cells. She and Blanke realized that imaging with high-resolution microscopes and having access to the Microscopy Suite 24 hours a day/seven days a week could



Anna Kim with an ultramicrotome, which she uses to cut resin-embedded samples into thin 60-90 nanometer sections.

prove beneficial to many students in the lab, as they too were trying to visualize host–pathogen interactions at various levels. Kim started working with other students in the lab, helping them image their samples.

“It became really useful, and I started working with four or five grad students at a time, listening to what they wanted and helping them get the best image of whatever they’re looking for, whether it’s the cell-binding process, the effects of toxins on organelles such as mitochondria, or finding the exact location of toxins in a cell,” Kim said.

Kim uses SEM and TEM for different types of samples. For SEM, Kim prepares and then coats the samples with gold–palladium. The microscope beams high-energy primary electrons at a cell, for example, and the secondary electron signal ejected from its gold–palladium coating provides high-resolution images of that cell’s surface. In TEM, she slices the sample into 60- to 90-nanometer-thin sections and projects electrons through those sections, which interact with the heavy metal-stained specimen to form an image of what’s happening inside the cell.

“SEM is good to observe extracellular host–pathogen interactions, and TEM is good for intracellular host–pathogen interactions,” said Kim. “The best part of the job is when I can get a really good image for the grad students, or if I find something and show it to my advisor, and he just says, ‘Whoa!’ ”

Because she works with so many graduate students, Kim has her hands full, working between 10 and 20 hours a week in

the Microscopy Suite, along with her classes and a teaching assistantship in the College of Veterinary Medicine. Some recent samples she has worked on include *H.pylori*-infected rat stomach tissues, *B.anthraxis* spore-containing vesicles in macrophages, and immunogold labeling CDT in colorectal epithelial cells. All of these projects are aimed at developing a way to target and fight these pathogenic bacteria.

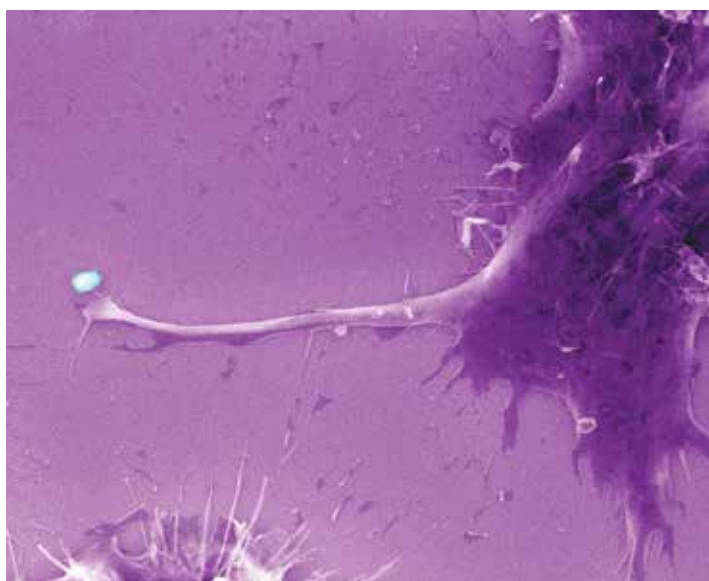
“The Microscopy Suite is one of my homes ...
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–Anna Kim

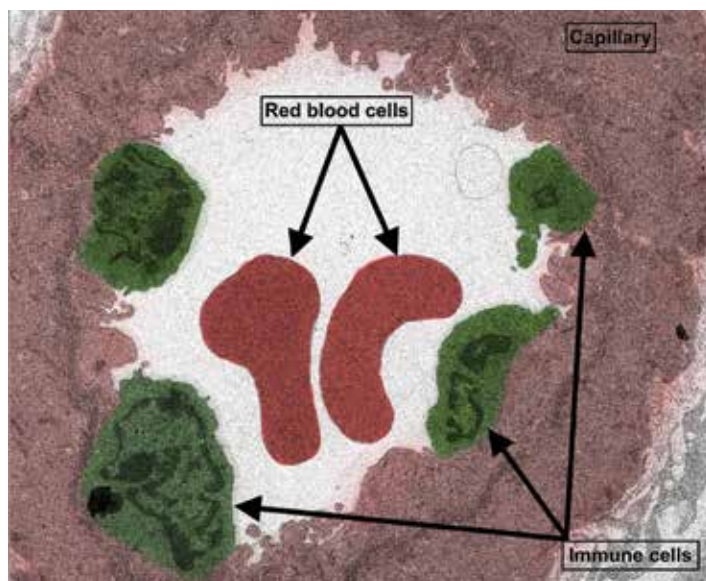
“I’m happy to be involved with all three of the groups examining these various samples. It allows me to expand the scope of my research,” Kim said.

Kim intends to continue as the lab’s EM expert, as she is planning on pursuing her doctorate in microbiology.

“The Microscopy Suite is one of my homes, and I even call some of the machines ‘my’ machines because I use them so much,” Kim said, with a laugh. “It’s an enormous advantage to have the Microscopy Suite as a resource for our lab.”



Anna Kim, a graduate student in integrative biology, captured this false-colored image with a scanning electron microscope (SEM), depicting macrophages that are infected with *B.anthraxis* (anthrax) spores. The macrophage is projecting out to grab the spore colored in blue.



Captured with the transmission electron microscope (TEM) in the Beckman Institute Microscopy Suite, this stomach tissue of a mouse is infected with *H.pylori*. With the TEM, Anna Kim found evidence of the immune response to the infection inside the cell’s tissues.

Molecules for the Masses: App Puts Chemistry at the Tips of Users' Fingers

The Theoretical and Computational Biophysics Group (TCBG) at the Beckman Institute worked with scientist Theo Gray to create an app that brings molecules to life in a handheld device.

Although molecules make up everything around us, most people encounter these groups of atoms held together by chemical bonds in the pages of a textbook. They read text and see a drawing of chemical symbols or colorful circles—a one-dimensional view of the microscopic structures.

Other representations have drawbacks as well: three-dimensional models are made of materials that can't replicate the rapid and continuous molecular movement. Molecules are wiggling and jiggling in a never-ending dance, but you can't see it, not even with the most powerful microscope.

"What is the best thing you could do to present (a molecule) to somebody?" asked Theo Gray, a scientist and author of *Molecules: The Elements and the Architecture of Everything*. "What's the closest that you can come to actually handing it to them, so they could pick it up and look at it themselves?"

How about an app? In collaboration with the Theoretical and Computational Biophysics Group (TCBG) at the Beckman Institute at the University of Illinois, Gray's company, Touchpress, has created an app for the Apple operating system (iOS) that brings molecules to life in a handheld device. Through the app, "Molecules by Theodore Gray," people can use up to 11 fingers to examine in great detail more than 350 molecules, which they can also twist, turn, and tie into knots.

"Every student who learns about typical molecules can do it now in a playful manner and realize that molecules are not dead and frozen, but that they move," said Klaus Schulten, head of TCBG, and professor of physics at Illinois.

The app also allows users to vary the temperature and time scale in order to make the molecules move more quickly or more slowly. If the temperature is warm, the molecules will move rapidly, while cold temperatures turn them sluggish, and absolute zero freezes them solid.

Getting molecules into everyone's hands has been a goal for Gray. Even though *Molecules* is a beautifully illustrated book, Gray knows that the most stunning color photos and detailed

descriptions can't show the actual nature of molecules as well as looking at moving images of the material and the atomic motions themselves.

"In the case of molecules, you really can't get a sense of what this stuff is like if you're just looking at a picture: how goopy is it? Is it very runny or is it very thick? Is it like molasses or more like oil or more like water?" explained Gray.

"There's also the fact that you can't see molecules: they're too small to see, and they're too fast to perceive, but by providing an interactive simulation, you can give people really quite a good intuitive feeling for what a molecule is like and how it moves and how it behaves, and translate that into human scale."

"Every student who learns about typical molecules can do it now in a playful manner and realize that molecules are not dead and frozen, but that they move."

—Klaus Schulten

A chance meeting at a 2013 New Year's Eve party between Gray and Barry Isralewitz, a TCBG research programmer, led to a discussion of molecular dynamic simulation. Isralewitz's work with the TCBG involves simulating biological structures down to the atomic level. The group has created the software packages VMD, which creates the visualizations, and NAMD, which simulates the movement of the structures. The software runs consecutively and in conjunction on powerful computing systems and is freely available to researchers around the world, who use it to model and simulate structures at detailed levels. Recently with the help of Blue Waters, a petascale supercomputer at the University of Illinois, TCBG unraveled one of the largest structures ever simulated—the HIV capsid, made up of 64 million atoms.



In conjunction with Beckman's Theoretical and Computational Biophysics Group, Theo Gray created "Molecules by Theodore Gray," available on iTunes.

For the app, Touchpress created the visualizations, and TCBG provided the NAMD software. Taking the software into iOS, which can be used on iPhones and iPads, was not an easy task. The TCBG staff, including Jim Phillips, John Stone, and Christopher Mayne, among others, consulted regularly with Richard Zito, the main programmer from Touchpress, who lives in London.

"When Theo Gray came to us, he was full of enthusiasm, and we were actually a little hesitant. We didn't know how well it would work out," said Schulten. "But it worked very well, and in the course of putting our program onto this device, some technical challenges had to be met and in the wave of enthusiasm of doing it, we actually met those challenges.

"We learned that our scientific software, which cost around \$20 million to develop for the world's best computers, can actually serve children and their parents in acquainting themselves with flexibility of molecules.

"Now between education and entertainment we can think of using it for teaching. VMD is actually already used at many colleges for teaching, but now with this approach and having just a tablet computer, not even a laptop or a desktop workstation, we can penetrate much further with utilizing our tools for teaching than we ever did before."

According to Gray, the app can make significant inroads into bringing molecules to the masses.

"It was particularly the combination of molecular dynamic simulation with a touch screen that makes it into sort of a magical experience that you don't have when you're doing it with

a mouse," said Gray. "Touch devices make things much more immediate and you have a personal connection to it. Combined with the fact that you can use multiple fingers to grab onto and move a molecule, like you would if you were actually holding it in your hands, it makes it quite a different experience and because it's an iPad app, it's available to anybody. I think it's a pretty significant step toward getting the general public to have a better intuitive grasp as to what molecules are like."

Schulten believes that the entertainment the app provides will help educate the next generation of scientists.

"Interacting with molecules makes them fun and natural, and that is a very powerful aspect of becoming familiar with the world of molecules," said Schulten. "This is a wonderful tool that fits the landscape of the computing world that anybody can become familiar with through a cell phone and with a tablet, and we can utilize this big science for teaching the next generation."

Molecules is the second volume in a proposed trilogy; *The Elements: A Visual Exploration of Every Known Atom in the Universe* was the first. Gray hopes that his next book *Reactions* and accompanying app can be as successful as *Molecules*.

"I think the most important thing, really," said Gray, "is the fact that this technology has existed for quite some time, a couple of decades, but it's really been locked up in labs, as it were—not because it wasn't possible to bring it out to a more wide accessibility, but just because no one had thought of a good context to do that in, and maybe have the idea that it was possible to port them to a touch screen device."

"Molecules by Theodore Gray" is available on iTunes for \$13.99.

Chipot Strengthens Ties to Computational Biophysics at Beckman

Chris Chipot, a Beckman Senior Fellow and adjunct physics faculty at Illinois, is visiting the Institute for six months to work closely with long-time collaborator Klaus Schulten, head of the Theoretical and Computational Biophysics Group and physics professor at Illinois.

Through a collaboration that began more than a decade ago, Chris Chipot has remained closely linked to the work and research of the Theoretical and Computational Biophysics Group (TCBG) at the Beckman Institute. Klaus Schulten, the head of TCBG, and Chipot started working together on algorithms to investigate the thermodynamics of complex biological systems, which were ported in one of the most widely used molecular dynamics programs in the world, NAMD.

NAMD is used by researchers and scientists for a variety of simulations, including the molecular mechanisms of influenza drug resistance and the structural elucidation of the rabbit hemorrhagic disease virus. Schulten's group distributes this program to scientists free of charge.

"This was a very fruitful endeavor, and one that set a long-standing collaboration in motion," Chipot said. "Over the years, we've used the algorithms built in NAMD to tackle many research efforts."

Chipot, the research director at the National Center for Scientific Research (CNRS) in France, and his lab focus their efforts in creating algorithms to model "rare" events.

"They're not rare events from the point of view of humans, but rare from a computational standpoint because they span timescales still inaccessible to routine computer simulations," Chipot said. "It takes specialized algorithms to be able to conquer the computational complexity of some of these events, like the modeling of proteins transporting material across membranes."

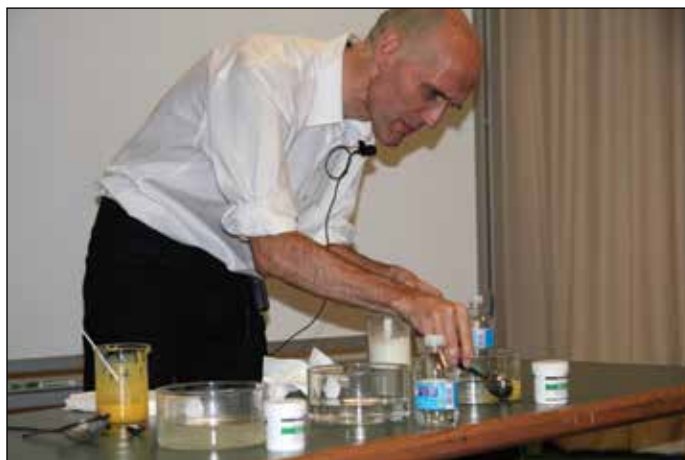
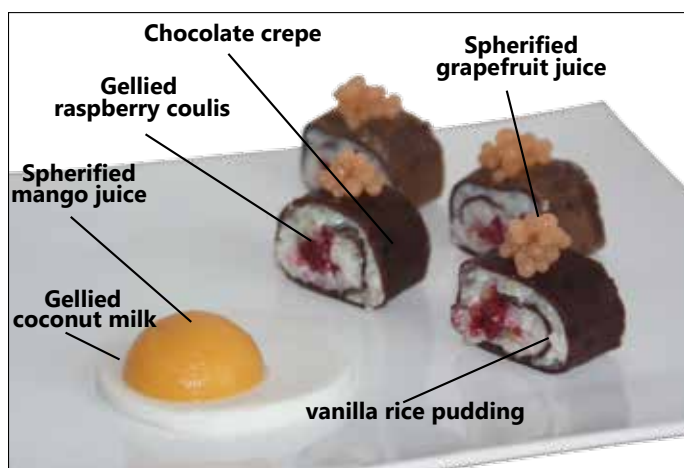
Schulten and Chipot have also recently developed another collaboration: an Associate International Laboratory (LIA), a group financially supported by both CNRS and Illinois to bring various researchers from around the world together to investigate problems in computational biophysics. One of the main components, Chipot said, is to capitalize on the synergistic expertise of dedicated scientists from many horizons.

They are working with a group of mathematicians from the École des Ponts ParisTech, outside Paris, to build on the algorithmic needs of rare-event simulations. They also collaborate with biologists, theoretical chemists, and physicists.

"We already have extremely talented scientists and developers who co-exist and produce incredible results in Klaus' lab," said Chipot. "Bringing other experts will hopefully inspire even bigger and more robust simulation advances."

Among other topics, the group will focus on understanding and simulating photosynthesis and chemotaxis more precisely. Both processes are highly complex, and as of yet, not fully understood at the atomic level.

Chemotaxis refers to the motion of biological objects in response to a chemical stimulus. Schulten's group investigates chemotactic behavior in bacteria, which can be viewed as paradigms for more complex processes such as cancer metastasis and immune



While at Beckman, Chipot gave a lecture "The Science of Spherification: A lecture on avant-garde cuisine" in which he shared his expertise in molecular gastronomy and spherification, which is the packaging of flavorful liquids in gel spheres, and how spherification has influenced his research in material science. "For the first time in my life, I managed to combine my two passions," Chipot said, "my job as a theoretician and cooking."

responses. Mapping out the process will hopefully illuminate why these phenomena occur.

“How these signals, both mechanical and chemical, are converted into movement remains largely unknown at the atomic level,” Chipot said. “Klaus’ group has endeavored to examine how the different units of the signal receptor self-assemble and operate. The specific tools developed in my group will help to address the underlying biologically slow events.”

Photosynthesis is a ubiquitous process used by plants and bacteria to convert light to energy, and of special interest to this group. One of Chipot’s goals is to understand the ATP synthase, a molecular motor, which is a key component of the photosynthetic machinery, responsible for the synthesis of ATP—the energy source of many metabolic processes.

“Dissecting at the atomic level how ATP synthase works is a tremendous challenge for theory. We are working to describe,

using high-performance computer simulations and specific algorithms that address rare or very slow events, the full cycle of ATP synthesis,” said Chipot.

Chipot is collaborating with Schulten’s students to help advance this research, in particular Abhi Singharoy, Beckman Postdoctoral Fellow, and Keith Cassidy, graduate student in physics, who are part of the TCBG.

“I really like the organization and structure of this group and the Beckman Institute. It’s an extremely productive environment, which keeps Klaus’ group at the bleeding-edge of its field,” Chipot said.

Chipot plans to stay at Beckman until at least the end of April and then return to France, while continuing to maintain the collaboration built through CNRS and Illinois.

Cancer Community at Illinois Collaboration for Cancer Research

The Cancer Community at Illinois welcomed faculty, physicians, external partners, staff, and students to a fall reception and poster session in November at the Beckman Institute. The event provided individuals, primarily young investigators, a chance to network with like-minded researchers in hopes of advancing their research, funding, and education goals.

Additionally, at its third annual meeting in October, Cancer Community at Illinois



Beckman faculty members Neal Cohen (top), Rohit Bhargava, and Princess Imoukhuede attended various Cancer Community functions in order to further collaborations to advance cancer prevention, detection, diagnosis, and treatment.

members gathered to give updates about ongoing cancer-related initiatives and programs, emerging areas of collaborative cancer research strength, and external funding applications.

Rohit Bhargava, Cancer Community faculty coordinator and Beckman faculty member, highlighted achievements and developments serving to advance the cancer research enterprise at Illinois.

Closer cooperation with clinical partners—specifically, a simpler IRB process and a student and physician cancer research program—has improved the research climate, Bhargava said. Working groups concerned with survivorship, nutrition, and physical activity have been added to the Cancer Community’s collaborative research portfolio.

Bhargava also cited an increase in campus support as integral to the growth of the Cancer Community. Faculty cluster hiring around cancer research expertise, a proposed College of Medicine at Urbana-Champaign that plays to the campus’ strengths, and the creation of the Interdisciplinary Health Sciences Initiative (IHSI) to support and promote health research have all played parts in increasing the Cancer Community’s momentum.

Bhargava noted that while cancer is a leading research topic at Illinois, strengths

are dispersed. He introduced a “bench to life” vision to focus and unite researchers.

“Rather than a ‘bench to bedside’ research approach to an acute disease, instead we focus on cancer across the lifespan and aim to make it a chronic, managed illness,” Bhargava said. “We use basic science and technology to improve cancer-affected lives. Cancer-free living inspires our research.”

Neal Cohen, IHSI director and Beckman faculty member, echoed Bhargava’s remarks and voiced his support of the Cancer Community’s vision.

“The Cancer Community is a poster child of faculty-driven research communities, of which IHSI will continue to encourage and support at Illinois,” Cohen said. “It’s incredibly important to keep building and promoting this community, so that campus and the world can use it as an example.”

The Cancer Community at Illinois is a program of the Interdisciplinary Health Sciences Initiative, with support from the Beckman Institute and the Department of Bioengineering.

Photos by Abby Bobrow,
Cancer Community at Illinois

Story by Ashley Lawrence,
Interdisciplinary Health Sciences Initiative

Get to know the... Grants & Contracts Team

Beckman is home to more than 80 staff who help facilitate the research and daily activities of the Beckman Institute. The Grants & Contracts team assists with pre- and post-award grant needs for the Institute, ensuring everything runs smoothly, from the proposal to the final reports.



KELLI WENDT

Grants and Contracts Specialist

When did you start working at Beckman, and where were you before?

I began working at Beckman in November 2012 after stops in the Department of Mechanical Science and Engineering and in Grants and Contracts–Post Award.

What are your job responsibilities?

I assist professors with submitting their research proposals and with post-award responsibilities including reporting to the sponsoring agency and reviewing expenditures on grants.

What do you like most about your job?

Providing support for professors who do incredible research.

What do you like to do in your spare time?

I enjoy music, watching college basketball, being outdoors, and spending time with family and friends.

How do you start your work day?

My day usually starts with checking email and prioritizing the day's schedule based on grant-driven deadlines. Since no two days are typically alike in Grants and Contracts, there usually is variety to my daily schedule.



ANDRE NNONG

Business Associate

When did you start working at Beckman, and where were you before?

January 2013.

I worked for the University of Illinois Extension and the International Food Policy Research Institute (IFPRI).

What are your job responsibilities?

I'm responsible for managing pre- and post-award research proposals and grants, preparing and reviewing documentation for TEM transactions for accuracy, generating monthly financial reports for grants and contracts funds for distribution to faculty, managing subaward contracts, and coordinating semi-annual certification for grant funds in collaboration with Beckman Institute-affiliated faculty.

What do you like most about your job?

Interacting with colleagues, faculty, and staff within the university.

What do you like to do in your spare time?

Reading and watching sports, especially football and basketball games.

How do you start your work day?

I start my day by reading emails, then I write down a to-do list for the day and tackle the shortest task for the day.



LORI BUTLER

Grants and Contracts Coordinator

When did you start working at Beckman, and where were you before?

I began in August 2000. I have held different positions within the business office on the finance and grant teams. Prior to the University of Illinois, I worked in industry, mainly for a local disk manufacturer for 16 years. Always in the area of finance. I am an accountant at heart.

What are your job responsibilities?

I moved into my current position in January 2009. I monitor and schedule the day-to-day activities for the Grants team. We maintain pre- and post-award grant functions for the Institute. I assist faculty with proposals, monitor and review account statements, and handle any items that faculty need help with. Customer service is our most important function.

What do you like most about your job?

I enjoy working with the faculty, and I am always excited to hear about the new research that they are engaged in. I enjoy developing budgets and analyzing spending plans. I try to anticipate how I can best serve my co-workers or faculty members. How can we accomplish the goal?

What do you like to do in your spare time?

I live on a farm and love reading, gardening, and spending time with my husband, children, and their families. This year I will officially become a grandmother. My oldest son and his wife are expecting a little girl. Can't wait.

How do you start your work day?

It is different every day. It depends how many fires need tending. I catch up on the emails and check the proposal log for the important deadlines! I have never lacked for something to do here.



JOHN PIRTLE

Grants and Contracts Specialist

When did you start working at Beckman, and where were you before?

I started working at the Beckman Institute last year in November 2013. Before Beckman I worked for Indiana Purdue University Indianapolis (IUPUI).

What are your job responsibilities?

My job responsibilities include assisting Beckman faculty in submitting grant proposals, preparing budgets, and reviewing information required for grant proposals while working with OSP to submit proposals to agencies. Job responsibilities also include managing grant awards, reviewing and approving expenditures charged to grant accounts, and also preparing monthly financial reports for Beckman faculty.

What do you like most about your job?

What I like most about my job is the people that I work with at the Beckman Institute. I enjoy the sincere appreciation that I receive from my co-workers, researchers, and managers.

What do you like to do in your spare time?

In my spare time I like heading over to Indianapolis with family to cheer on the Indiana Pacers and Indianapolis Colts.

How do you start your work day?

I start my work day by checking my calendar and to-do list, focusing on what needs to be accomplished for the day, making important calls, and responding to urgent emails.

JACKIE HARDEN

Grants and Contracts Specialist

When did you start working at Beckman, and where were you before?

I started at Beckman in November 2013. Before this position, I worked for the Department of Agricultural and Biological Engineering as an accountant. I've also worked in the Grants and Contracts Office.

What are your job responsibilities?

We do everything related to the financial aspects of Beckman grants and contracts funding—proposal budgets, post-award administration, sponsor reporting, project financial close out, etc. I work mostly with our private sponsored projects and Department of Defense awards.

What do you like most about your job?

I like the opportunity to work with world-class researchers on their grant proposals. Each proposal is unique and offers interesting challenges.

What do you like to do in your spare time?

I love to hike, bird watch, cook, read, travel, walk, and train my new dog, a mutt named Danny.

How do you start your work day?

First thing—check email for important messages. But after that, each day is different depending on what is going on.

Beckman Institute 25th Anniversary Symposium



Beckman celebrated its 25th anniversary with a symposium on October 10, 2014, with presentations from several special guests and many former Beckman Postdoctoral Fellows, commemorating the accomplishments of the past 25 years.



Upper left: Beckman Founding Director Theodore Brown shared stories of the origins of the Beckman Institute, his "home for many years," during the 25th Anniversary Symposium opening remarks.

Above: Special guests who attended the symposium include, from left, former Beckman Director Tamer Başar, former Beckman Director Pierre Wiltzius, Provost Ilesanmi Adesida, Chancellor Phyllis Wise, Vice Chancellor for Research Peter Schiffer, Beckman Director Art Kramer, former Beckman Director Jiri Jonas, and Beckman Founding Director Theodore Brown.

Left: Past and present Beckman Postdoctoral Fellows who presented at the 25th Anniversary Symposium: from left, Joel Voss, Timothy Nokes-Malach, Srinivas Akella, Dale Barr, Joe Toscano, Ilia Solov'yov, Slava Rotkin, Abhi Singharoy, Chandramallika Basak, Ilya Zharov, Gillian Hamilton, Preethi Jyothi, Ming Hsu, Mathews Jacob, and Chao Ma.

Language and Linguistics Initiative Added to Beckman Portfolio



ILLI co-founders Kara Federmeier and Jennifer Cole hosted an opening reception for the initiative, featuring a poster session that covered research in the fields of computer science, electrical and computer engineering, educational psychology, and speech and hearing science, among others.

Although newly formed, the Illinois Language and Literacy Initiative (ILLI), based at the Beckman Institute, builds on the legacy of the University of Illinois' extensive research into language. The initiative brings together researchers from across campus to study language—from how it is learned, comprehended, and spoken throughout the lifespan, to second language learning, to language processing by technological devices.

The Department of Linguistics at Illinois is one of the oldest modern linguistic departments in the United States.

"Illinois had this really, really wonderful linguistics department right from the get-go of the modern linguistics era," said Jennifer Cole, professor of linguistics and ILLI co-leader. "Some of the real pioneers in modern linguistics research got their Ph.D.s here in the 1960s and 1970s."

The program for teaching English as a second language at Illinois is considered one of the oldest in the United States. Charles Osgood, a psychologist at Illinois, was one of the leaders in the field of psycholinguistics, which studies the psychological and neurobiological factors that enable humans to acquire, use, comprehend, and produce language.

ILLI not only incorporates researchers from those fields typically associated with the study of language, but also from the fields of computer science, electrical and computer engineering, educational psychology, and speech and hearing science, among others.

Kara Federmeier, professor of psychology and full-time faculty member in the Cognitive Neuroscience Group, joins Cole, a full-time faculty member in the Cognitive Science Group, as the initiative's co-leader.

"The Beckman has always been a hub for research in this area," said Federmeier. "We want to more formally make that clear, and take better advantage of the fact that there is already this structure to press forward into new areas, leveraging the resources that Beckman offers."

Those resources include newer ways of investigating language, according to Federmeier. Beckman's cohort of faculty researchers who are interested in technology could prove beneficial to researchers who do not have access to certain technologies or the ability to build tools for improved research.

Such tools can include devices like eye-tracking, which was pioneered by researchers at Illinois. Other tools mark observational, behavioral, computational,

and corpus-based work and include human electrophysiological measures (EEG and ERPs); magnetic resonance imaging (structural and functional); ultrasound; optical signals; and stimulation techniques (TDCS and TMS).

Alternately, says Cole, bringing in the expertise of language researchers across campus to the technologists can provide new insights into research questions.

"At Illinois, we have this great language expertise—a lot of big universities have language expertise like we do here, but there are maybe a dozen universities where they've got the technology and the language people but no one's really figured out how to bring this together," said Cole. "That would be a very exciting development to pioneer in this initiative."

Cole also believes that researchers with a focus in signal processing and data analytics can find interesting research projects with the data sets provided by language researchers.

"We've got the data, we have the scientific questions, but we don't always have the skills, or the technological know-how to make the most of the data we have," said Cole. "Those are special skills and they are also represented at Beckman, but in different groups that language researchers don't traditionally interact with very well."

"We hope that this initiative will bring language research to light and spark interest in people who have something to contribute, but maybe they don't have a history of language-related research."

"It benefits everyone across campus to be more inclusive," said Cole. "We can strengthen the network of language researchers across campus, but still mark Beckman as a central point in that network. The idea of creating an initiative and bringing people together is hard to do without a central organizing place like the Beckman Institute. The culture of interdisciplinary interactions already in place here really facilitates this kind of thing, which then isn't bounded by Beckman."

Explore further: bit.ly/beckman-illi

Language and Linguistics as an Early Beckman Focus

In 1985, Jerry Morgan, professor emeritus of linguistics, was involved in early committees to create programs for the newly formed Beckman Institute. He served on the Program Committee for Biology, Behavior and Cognition Center of the Beckman Institute along with William Greenough, professor of psychology; Paul Lauterbur, professor of chemistry who developed the magnetic resonance machine (MRI), Carl Woese, professor of microbiology; and Gerry DeJong, professor of computer science; among others.

“Ideas about interdisciplinary research in cognitive science and artificial intelligence were being kicked around at the time the Beckman Institute was being organized,” said Jennifer Cole, co-chair of the new Illinois Language and Literacy Initiative. “These research areas became part of

Beckman. Jerry Morgan was a major player in that.”

Morgan went on to be associate director of Beckman, serving under both Theodore “Ted” Brown and Jiri Jonas.

Trained as Chomskian linguist, Morgan began looking at cognitive aspects of language. In the early 1990s, Morgan investigated how the various subsystems that make up human linguistic abilities interact through the new field of computational linguistics.

Morgan received funding from Motorola to do research on using speech in automobile navigation systems before they existed. “That was one of the very first large interdisciplinary studies funded at the Beckman Institute,” said Cole, who joined Beckman under Morgan’s invitation.

Today, said Cole, ILLI research builds on this early foundation.



Many researchers formed strong language and linguistics roots at the Beckman Institute, including, from left, Brian Ross, Georgia Green, Jerry Morgan, and Gary Dell.

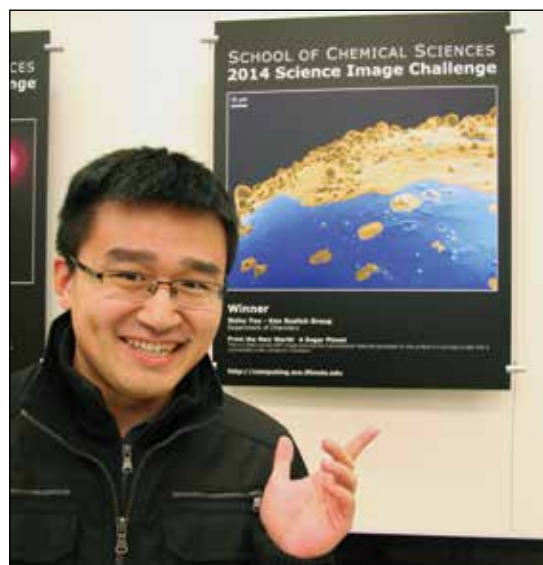
“Linguists and language researchers involved in the early days were visionary in forming interdisciplinary research linking language and technology, delivering new insights into the structure and processing of human language, as well as innovations in the design and implementation of speech and language technologies. This dual, synergistic approach continues to define Beckman research in language and literacy today,” said Cole.

2014 School of Chemical Sciences Science Image Challenge

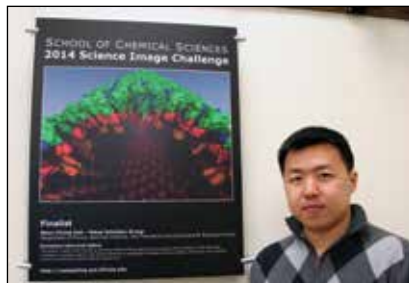
Congratulations to the winner and finalists of the 2014 School of Chemical Sciences Science Image Challenge. Sizhu You (right, and on cover), from Beckman faculty member Ken Suslick’s group, was awarded the top prize with “From the New World: A Sugar Planet.” Other finalists with advisors from Beckman included Tyler Earnest (bottom, left), from Zan Luthey-Schulten’s group; Boon Chong Goh (bottom, right), from Klaus Schulten’s group; and Melinda Sindoro (not pictured), from Steve Granick’s group.

This annual competition encourages students, postdocs, and staff in chemical and biomolecular engineering or chemistry to submit a scientific image designed to inform, educate, and inspire. Awardees are selected based on visual impact, effective communication, and originality.

The winning entries will be displayed for the year in the VizLab of the School of Chemical Sciences, 151 Noyes Lab.



ON THE COVER **From the New World: A Sugar Planet**
Sizhu You, a chemistry Ph.D. student in Beckman faculty member Kenneth Suslick’s group, and Ming-Wei Chen, a postdoctoral student in Illinois chemistry professor Dana Dlott’s group, study the concentration of ultrasonic energy in polymer composites. They discovered that intense thermal hot spots can be generated at delaminated polymer-particulate interfaces. This image is a false-colored scanning electron micrograph showing the morphology of a sucrose crystal that was flash heated and caramelized by such an ultrasonically generated hot spot, imitating the appearance of an extraterrestrial planet.



Tyler Earnest (left) and Boon Chong Goh and were finalists in the 2014 School of Chemical Sciences Science Image Challenge.

Honors & Awards



Lyding Wins AVS Achievement Award

Joseph W. Lyding, full-time faculty member in the Nanoelectronics and Nanomaterials Group, won the 2014 Award for Outstanding Research from the Prairie Chapter of the American Vacuum Society. Lyding, a professor of electrical and computer engineering, was awarded “for pioneering developments in scanning tunneling microscopy instrumentation and their applications to nanotechnology.”



Beckman Faculty Named AAAS Fellows

Joseph Lyding, full-time faculty member in the Nanoelectronics and Nanomaterials Group and professor of electrical and computer engineering, and Dan Roth (left), part-time faculty member in the Artificial Intelligence Group and professor of computer science, are among six faculty members from Illinois who have been elected 2014 fellows of the American Association for the Advancement of Science.



Monaikul Receives MRC-SOT Young Investigators Award

Supida Monaikul, a Beckman graduate student working in the NeuroTech Group, was recently awarded the Midwest Regional Chapter-Society of Toxicology Young Investigators Award. Her project plans to examine the adverse effects of PCB exposure on adolescents.



Pan Elected a Royal Society of Chemistry Fellow

Dipanjan Pan, Beckman part-time faculty member in Bioimaging Science and Technology and assistant professor in bioengineering, was named a Fellow of the Royal Society of Chemistry (RSC) for his professional contributions to the chemical sciences. The RSC, with offices in London and Cambridge, UK, was created in 1841 and currently has more than 50,000 members worldwide.



Johnson Receives Young Investigator Award

Curtis Johnson, assistant director for magnetic resonance operations in the Biomedical Imaging Center, received the Young Investigator Award at the BRAIN Grand Challenges conference hosted by IEEE EMBS in Washington, D.C. The goal of the conference is to discuss the challenges in addressing the national government’s BRAIN Initiative, and Johnson was honored for his research in elastography and its capabilities in predicting memory performance through the mechanical properties of the hippocampus.



Leckband Named Biomedical Engineering Society Fellow

Deborah Leckband, Beckman part-time faculty member in the 3D Micro- and Nanosystems Group and professor of chemical and biomolecular engineering, was honored as one of the newest Fellows of the Biomedical Engineering Society. She was recognized at the BMES annual meeting in October in San Antonio, Texas.



Bashir Elected a Fellow of IAMBE

Rashid Bashir, affiliate faculty member in 3D Micro- and Nanosystems and professor of bioengineering, has been elected a Fellow of the International Academy of Medical and Biological Engineering (IAMBE). The honor goes to researchers from across the world who have made “outstanding contributions to the profession of medical and biological engineering.”



White Receives ASC Outstanding Research Award

Scott White, part-time faculty member in the Autonomous Materials Systems Group, has been named the winner of the 2014 American Society for Composites (ASC) Outstanding Research Award. A Willett Professor in aerospace engineering, White has gained international recognition for pioneering several areas of composite materials research.



Marni Boppart Elected ACSM Fellow

Marni Boppart, full-time faculty member in the Bioimaging Science and Technology Group and associate professor in kinesiology and community health, has been elected a Fellow in the American College of Sports Medicine. Among other things, the fellowships recognize “professional achievement and competence in the related disciplines of sports medicine via education, published works, professional practice, and a demonstrated interest in and/or contribution to the goals of sports medicine.” Boppart will be inducted at the national meeting in May.



Beckman Faculty Named CAS Fellows

Jean-Pierre Leburton (top), full-time faculty member in the Nanoelectronics and Nanomaterials Group and professor of electrical and computer engineering, and Jian Ma, affiliate faculty member in the Bioimaging Science and Technology Group and assistant professor in bioengineering, have been named 2015 Fellows of the Center for Advanced Studies at Illinois.





Tajkhorshid Receives INCITE Award

Emad Tajkhorshid, a full-time faculty member of the Theoretical and Computational Biophysics Group and a professor of pharmacology, has received a 2015 Innovative and Novel Computational Impact on Theory and Experiment (INCITE) award.

The award provides 96 million hours of massive supercomputing at a Leadership Computing Facility that focuses only on the most ambitious research projects with the potential for major breakthroughs. Tajkhorshid's project, which has been developed and tested in his lab, will study the transition between structural intermediates of a number of transporters using a novel combination of several replica-based techniques coupling a massive array of all-atom molecular dynamics simulations.



Schulten Delivers National Lecture for Biophysical Society

Recently Klaus Schulten, of Beckman's Theoretical and Computational Biophysics Group and professor of physics, delivered the National Lecture at the 59th Annual Meeting of the Biophysical Society in Baltimore, the highest award given each year by the Biophysical Society. The topic of Schulten's talk was "Discoveries in Biophysics Through the Computational Microscope," in which he stressed that computation is now a tool for discovery, encompassing systems ranging from individual proteins, to larger complexes like the ribosome and the HIV virus capsid, all the way to a massive molecular machine—the photosynthetic chromatophore.



O'Brien Awarded Vision 20/20 Funding

Bill O'Brien, full-time faculty member in the Bioacoustics Research Laboratory, has received funding for his project "Noninvasive Early Detection and Dietary Treatment of Nonalcoholic Fatty Liver Disease," through the Division of Nutritional Sciences Vision 20/20 research program. This initiative, sponsored by DNS and the College of Agriculture, Consumer and Environmental Sciences Office of Research, is intended to catalyze unique interdisciplinary nutrition-related research.



Nahrstedt Receives SIGMM Award

Klara Nahrstedt, affiliate faculty member in the Image Formation and Processing Group, was named the 2014 winner of the Association for Computing Machinery Special Interest Group on Multimedia (SIGMM) award for Outstanding Technical Contributions to Multimedia Computing, Communications and Applications. Nahrstedt is a leading researcher in multimedia systems. She has made seminal contributions in the QoS management for distributed multimedia systems.



Insana Named Editor-in-Chief

Mike Insana, full-time faculty member in the Bioimaging Science and Technology Group, has been selected as editor-in-chief of the *IEEE Transactions on Medical Imaging*.

Beckman Institute Open House Cohen Wins T-Shirt Design Contest

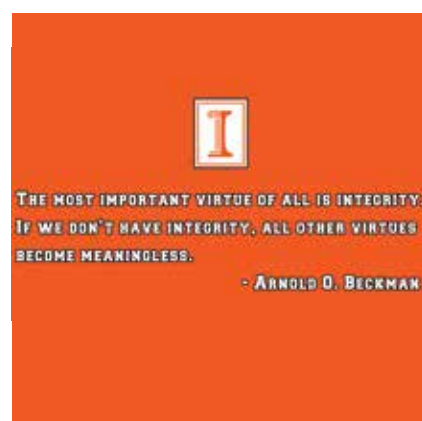
This year, the Beckman Institute hosted an Open House t-shirt design contest, and Aaron Cohen, a research facility attendant, was named the winner. His design featured the label of the Beckman Instruments IR-2 Infrared Spectrophotometer, which is on display on the first floor of the Beckman Institute.

"I'm a fan of old American signage, like '20s to '40s baseball, tobacco, gas station, and military signs," said Cohen, "so when moving some of the old Beckman Instruments equipment, the label for the spectrophotometer, made in the '40s, caught my eye, so I decided to use it in my design."

Cohen also added a quote from Arnold Beckman that "speaks volumes and should be adopted by all." In an interview in the 1980s, Beckman said, "The most important virtue of all is integrity. If we don't have integrity, all other virtues become meaningless."



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Friday, March 13 9 a.m. – 4 p.m.

Saturday, March 14 9 a.m. – 3 p.m.

#BIOH15

BECKMAN INSTITUTE 2015 OPEN HOUSE



Scientific and technological discoveries await at the biennial Beckman Open House, set for March 13–14.

Held in conjunction with the Engineering Open House, the Beckman Institute Open House features exhibits highlighting the work taking place at one of the nation's leading centers for interdisciplinary research.

The Beckman Café will be open for meals, snacks, and beverages.

Schools, clubs, and other large groups are welcome!

For more information, visit

beckman.illinois.edu/events/open-house

SYNERGY is a publication of the Communications Office of the Beckman Institute for Advanced Science and Technology at the University of Illinois at Urbana-Champaign. Each issue spotlights the people and science that make the Institute one of the premier facilities for interdisciplinary research in the world.

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