SYNERGY

BECKMAN INSTITUTE
FOR ADVANCED SCIENCE AND TECHNOLOGY

Issue 25 • Winter 2014

A NEW ERA IN HCII

Researchers in Human-Computer Intelligent Interaction (HCII) are constantly working to make all kinds of technology more helpful and powerful for people to use. Mark Hasegawa-Johnson has recently been named HCII co-chair, and he has big plans for the future.

See story page 2

BLAZING A NEW TRAIL

HASEGAWA-JOHNSON STEPS FORWARD AS NEW HCII CHAIR

Mark Hasegawa-Johnson has recently accepted the offer to serve as Human-Computer Intelligent Interaction (HCII) co-chair. In this new role, he hopes to improve the international visibility of HCII research at the University of Illinois by building better bridges between HCII faculty members at Beckman to faculty with related research elsewhere on campus.

"The people normally involved in human-computer intelligent interaction research are social scientists, psychologists, ethnographers—people who study the way people think and interact with their environments. And then computer scientists and engineers and people in art and design create the methods by which the interaction between the human and computers can happen," Hasegawa-Johnson said.

By increasing campus interdisciplinarity, Hasegawa-Johnson believes that research projects will be enhanced, and Beckman will improve its international reputation in HCII. To help facilitate this, he is putting together a web site to improve communication between interested faculty members at Beckman and the university at large.

"What I love about being at Beckman is when I have ideas of things I want to work on that I have no prior knowledge of, I know there is someone in the building who is an expert in it," he said. "Everyone is very helpful—if I approach them about a subject, at the very least will they will say, 'This is what state-of-the-art is now, and here are a couple of things to read.' And sometimes these conversations turn into year-long collaborations."

Hasegawa-Johnson's plan as co-chair of HCII is to expand those collaborations across campus.

"Beckman has a strong research history in social and computer science, but there are other avenues on campus we can tap into, like a partnership with art and design. I think we can improve the international prominence of our research by making it easier for people across campus to talk to one another about these subjects and, hopefully, encourage more grant proposals, papers, research, and educational programs."

Dan Morrow serves as the other co-chair of HCII and is looking forward to increased collaboration across campus.

"It is exciting to have Mark join me as a co-chair of the HCII theme," said Morrow. "Mark has a long history of working across disciplinary boundaries within Beckman and across campus. He brings a lot of energy to the position and has already made progress in helping further integrate human-computer intelligent interaction research at Beckman with other faculty on campus who have similar interests."

Hasegawa-Johnson replaces Thomas Huang, professor of electrical and computer engineering. Huang was the longest-serving co-chair at the Beckman Institute. (See sidebar, on right.)

As Hasegawa-Johnson steps into his new role as co-chair, he credits Huang for helping him find success at Beckman.

"Tom has been a great mentor to me," Hasegawa-Johnson said. "He has helped me create the research program that I have. I owe a lot of my formative years here to the advice and support Tom gave me."

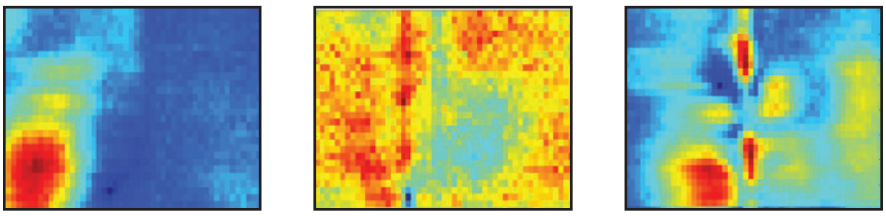
After nearly 15 years of research at Beckman, Hasegawa-Johnson has built up an extensive program that embodies multidisciplinary research—he has research lines in a variety of subject areas and with faculty members in diverse disciplines.

He focuses on speech, audio, and language processing, with particular interest in technologies that can automatically extract information from speech, audio, or text data. He is also turning his future research toward interactive technologies, or systems that can respond to and learn from humans to make their lives easier.

> **I think we can improve the international prominence of our HCII research by making it easier for people across campus to talk to one another about [related research] and, hopefully, encourage more grant proposals, papers, research, and educational programs.**
>
> Mark Hasegawa-Johnson

"Many of the computer systems that interact with humans, like automated voice systems when you call a company for example, are too regulated and precise and are not replicated by anything you want to accomplish in the real world. I think we can make our human-computer interaction systems more robust by building systems that interact and learn from humans in real time," said Hasegawa-Johnson. "This is a critical step in advancing speech technology. If these systems can learn in real time from human sources, then they will be much more effective and rapid in helping humans with whatever it is we want to do."

One of the ways Hasegawa-Johnson is using interactive technologies is creating a system called Robo-Buddies, which



Mark Hasegawa-Johnson conducts research in speech recognition systems. The infograms pictured here detail certain vocal patterns as the result of particular speech sounds. He uses this information to build better speech recognition programs for computers so they can more robustly communicate with humans.

employs pseudo-intelligent mediators that intend to improve communication between students with and students without physical disabilities. This project highlights the role technology can have in addressing the critical needs of diverse communicators in our societies, especially those with diagnosed communication disorders, by exploring ways to enhance people's communicative competence and social participation both through modern communication and computerized technologies.

"We're looking at ways a computer could help those with a communication disorder interact with their surroundings in a more productive and efficient manner," Hasegawa-Johnson said. "My role is developing an interactive dialogue system through a variety of algorithms and human interactions that will then be transferred to an interface like a tablet so students can easily use it to communicate with others."

This project, funded by a Focal Point grant from the University of Illinois, involves faculty from speech and hearing science, electrical and computer engineering, educational psychology, computer science, English, and special education—a truly multidisciplinary effort.

Hasegawa-Johnson is also building alliances with social scientists by providing speech technology support. He is working with Dorothy Espelage, professor of educational psychology, and M. Scott Poole, senior research scientist at the National Center for Supercomputing Applications (NCSA) and director of the Institute for Computing in the Humanities, Arts, and Social Sciences (I-CHASS), to study bullying in grade school playgrounds in order to develop a system that will automatically detect behaviors in groups.

"We have recordings of 40 children who put on microphones and played on a playground. Social scientists are going through the recordings and coding for aggressive actions, and then we're creating a system that will automatically detect aggressive actions," Hasegawa-Johnson said.

This is one scenario used to create a system called GroupScope, which will enable research into social interaction in large, dynamic groups to be conducted much more quickly and with much higher reliability than was previously possible. The system is created by automating many functions, including managing huge volumes of video, audio, and sensor data.

Many types of groups are being analyzed in this project, funded by the National Science Foundation (NSF), in hopes that GroupScope will shed light on the workings of critical functions performed by real world groups such as emergency response units, health care teams, stock exchanges, and military units. GroupScope will also have applications in the training of those working in multi-team systems, such as first responders to disasters. It can be used to record and "grade" training sessions, giving participants feedback on both strengths and weaknesses of their approaches.

Multidisciplinary projects like Robo-Buddies and GroupScope are the types of collaborative efforts Hasegawa-Johnson intends to help facilitate as HCII co-chair. Already, several faculty members from diverse areas such as industrial and enterprise systems engineering, advertising, and curriculum and instruction, have joined the Beckman Institute as affiliates in the HCII group, with intentions of starting collaborative projects.

"I'm excited about the great research we can all do together," Hasegawa-Johnson said. "Increasing our collaborations across campus will strengthen our research and project outcomes, and this will, in turn, strengthen our international HCII presence."

The Thomas and Margaret Huang Fund

The Thomas and Margaret Huang Fund for Graduate Research supports graduate students in Human-Computer Intelligent Interaction (HCII) at the Beckman Institute. The fund was established in honor of Professor and Mrs. Huang's many contributions to science, engineering, and society at large.

Huang is one of the leading figures in computer vision, pattern recognition, and human computer interaction in the world. He has advised more than 100 students during his career that has spanned five decades and three major research universities: MIT, Purdue, and U of I.

His accomplishments include winning the 2010 "Most Cited Paper of the Decade Award" from the *Journal of Visual Communication and Image Representation*. He also received the HP Innovation Research Award in 2009 and was named a Swanlund Chair at U of I in 2012.

With the help of an anonymous donor who offered a challenge gift to match two-for-one all new gifts to the fund for up to $50,000, more than $223,000 has been raised in support of this fund. A call for applications for the award will take place in January. The first (annual) awards will be provided to two graduate students in HCII in April 2014 for $3,500 each.

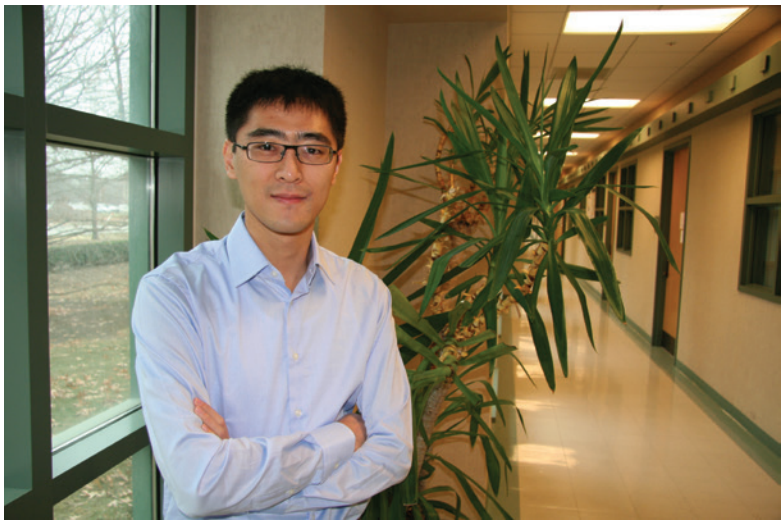
For more information, visit go.illinois.edu/huang_fund.

2013 Beckman Postdoctoral Fellows

Improving Health Care & Speech Recognition Systems

CHAO MA: METABOLIC IMAGING

Looking at metabolites is extremely valuable in characterizing the physiological state of tissues and can enable detection of a disease, like cancer or Alzheimer's, at very early stages. Magnetic resonance spectroscopy imaging (MRSI) incorporates magnetic resonance imaging (MRI) to noninvasively map concentrations of metabolites in the human body.



Chao Ma, a 2013 Beckman Postdoctoral Fellow, plans to create and develop advanced MRSI techniques that can better identify the metabolic functioning of tissues, particularly in the brain. Though the concept of using MRI for metabolic imaging has been around since the MRI was developed more than three decades ago, Ma is looking to improve it so it can be more widely used in clinical settings.

"MRSI measures the concentration of critical chemicals (metabolites) that maintain healthy cells and tissues," Ma said. "This information helps us understand how energy is consumed and how healthy the tissues really are. If the concentration of one or several metabolites is lower or higher than normal, this indicates something is wrong with that tissue."

Ma collaborates with Brad Sutton and Zhi-Pei Liang from the Bioimaging Science and Technology Group, and Yoram Bresler from the Image Formation and Processing Group. These professors have a variety of expertise in advancing MRI techniques, and Ma hopes that the collaboration between the three can push the limits of metabolic imaging so that seeing metabolic maps of tissues can be as clear and fast as possible.

Ma works with scientists in the Biomedical Imaging Center (BIC) to improve the metabolic imaging process by looking at the scan's resolution, signal-to-noise ratio, and imaging speed. Right now, the capabilities of MRSI can only scan at a resolution of one centimeter, which is too large to see the metabolic functions of tissues. Ma is developing techniques for higher resolution images, measuring at the millimeter level.

Developing high-resolution metabolic imaging is not easy though. In traditional MRI, the scanner detects signals from water, which composes a significant portion of the body. In MRSI, however, signals from metabolites are of interest, which are about a thousand times lower in concentration than water. Therefore, conventional MRSI is limited by very low signals.

One way to improve the images of metabolites is to average the results of many scans, but that would require the patient to be in the scanner for hours at a time. Ma hopes to develop new methods to gather data from a scan and better techniques to reconstruct the images to improve the signal-to-noise ratio without sacrificing imaging speeds.

Ma would like to use metabolic imaging techniques to complement Beckman's already strong foundation in neuroscience.

"Beckman is the ideal place for my research. First, I'm able to work with Sutton, Bresler, and Liang on the technical part of enhancing metabolic imaging," Ma said. "And then, because of the interdisciplinary atmosphere here at Beckman, I can apply my metabolic imaging process to aid other projects, like research in Art Kramer's and Neal Cohen's labs about healthy aging. Metabolic imaging adds another layer of information to traditional MRI scans that can offer insights into how brains age and why Alzheimer's occurs, as well as identify biomarkers of precancerous cells."

Metabolic imaging adds another layer of information to traditional MRI scans that can offer insights into how brains age and why Alzheimer's occurs, as well as identify biomarkers of precancerous cells.

Chao Ma

After successful implementation in research, Ma believes that a new scanning technique such as MRSI could be a powerful tool in the push for early detection of many diseases or as a tool for personalized medicine. In routine check-ups, metabolically abnormal tissues could be identified and quickly treated, and then a subsequent scan could test whether the treatment has affected the metabolic functions in a positive or negative way.

"Though the idea of metabolic imaging has been around for a while, it is finally becoming a reality so people can take advantage of it," Ma said.

PREETHI JYOTHI: AUTOMATIC SPEECH RECOGNITION

Speech, one of the most common forms of human communication, is an ideal medium for human-machine interaction. Automatic speech recognition (ASR), designing machines with the ability to automatically translate spoken words into text, is a compelling task for researchers in the field of Human-Computer Intelligent Interaction (HCII), one of Beckman's main research themes. Preethi Jyothi, a 2013 Beckman Postdoctoral Fellow, will be focusing her research in the next three years on building better ASR systems.

Conversational speech presents a major challenge for speech recognition software because of how different pronunciations can arise in casual speech.

"During conversation, words are more fluid, allowing for sounds to smoothly transition into one another, giving rise to a large variety in pronunciations," Jyothi said. "The large extent of pronunciation variability makes using ASR tremendously challenging. Most ASR systems use phonemes to represent speech as a single stream of discrete sub-word units. For example, the word "five" would be broken up into three phonemes: "f"–"ay"–"v." Most languages have 20 to 60 phonemes.

In a dictionary, each word is associated with a small number of canonical pronunciations. But one of the problems with using this representation for ASR is that there is more than one way in which a word is pronounced during conversation. For instance, the word "everybody" could be pronounced as "eh"–"v"–"r"–"iy"–"b"–"ah"–"d"–"iy"; "eh"–"v"–"er"–"b"–"ah"–"d"–"iy"; "eh"–"u"–"b"–"a"–"iy"; or "eh"–"b"–"ah"–"iy."

It is no easy task to enumerate all possible pronunciations of a word. One way Jyothi is working to combat these speech differences is by modeling how variations in pronunciations arise during speech production. Her models are inspired by linguistic theories that study how the various articulators of our vocal tract, for example, lips, tongue, vocal cords, etc., move together to create sounds.

"The challenge here," Jyothi said, "is to find the right way to incorporate these linguistic insights into computational models that are built from large amounts of speech data. In my doctoral research, I was able to build models that improved on earlier works along this line, but I believe we can go much further."

Jyothi also wants to use articulation-based models for ASR in a variety of languages.

> **Only a small fraction of the world's 7,000 languages have supporting speech recognition systems. I am keen on exploring how to bring speech recognition technologies to languages with low resources.**
>
> Preethi Jyothi

"Conventional recognition systems require large amounts of annotated data for training," Jyothi said. "As a consequence, only a small fraction of the world's 7,000 languages have supporting speech recognition systems. I am keen on exploring how to bring speech recognition technologies to languages with low resources, possibly using data from languages like English."

According to Jyothi, articulation-based models are language-independent properties, so they could be transferred between many different languages.

Speech recognition requires the combination of a variety of expertise, so Jyothi feels fortunate to have numerous resources available to her at the Beckman Institute.

"Speech recognition is an interdisciplinary area that lies at the intersection of several larger fields like signal processing, statistical modeling, machine learning, and linguistics," Jyothi said. "I decided to come to Beckman for research because it provides an ideal environment to work on such an interdisciplinary field with access to experts in all these areas. The Beckman fellowship is unique in that it allows us to choose any project of our liking and gives us all the freedom and flexibility to fulfill our goals. This is probably rare unless you are a faculty member. I feel very privileged to be given this opportunity."

Jyothi is working with several faculty members at Beckman, including Mark Hasegawa-Johnson and Jennifer Cole.

"Hasegawa-Johnson is an expert in developing coherent, mathematical models inspired by linguistic theories to aid automatic speech recognition," said Jyothi. "Cole is a well-known authority in both experimental and computational phonology. They also have experience with working on a variety of languages. Collaborating with both of them is extremely beneficial to me in my main goal of developing coherent models of speech recognition for low-resource languages, along with developing a solid understanding of the linguistic underpinnings of these models. I also look forward to collaborating with Paris Smaragdis, who looks beyond just speech and broadly works on machine learning approaches for computational audition and signal processing."

Jyothi hopes to leverage Beckman's supportive interdisciplinary environment and gain a more well-rounded, big picture view of the science surrounding her research interests.

"It's easy in speech recognition research to focus on specific parts of a research area. Because of the resources and expertise here, I can the broaden ways in which I look at a problem," Jyothi said.

When it rains, it pours

April Colette studies a city deeply affected by flooding

As a social scientist, most of April Colette's research isn't done in a lab, examining tiny atoms or MRI scans. Instead, her lab "is the world." She meets people and listens to their stories, talks with policy makers, and studies the geographical features of a land, with the hope of offering solutions to better the lives of people who live there.

As one of Beckman's Graduate Fellows, Colette is working with Jesse Ribot in Beckman's strategic initiative, Social Dimensions of Environmental Policy (SDEP). In the five years she's been working on her doctorate studies in geography, she's spent half of her time in Santa Fe, Argentina.

Santa Fe, the capital city of the Argentine province of the same name, is known for its long history of flooding. Most recently, it suffered two major floods: one in 2003 and another in 2007. Colette focuses her research on the causes and effects of these floods.

During the floods, Santa Fe was devastated, with many inhabitants losing their homes and some even losing their lives. After living there, Colette began to understand how much the flooding—both from river water and rain water—has not only affected the geography and use of land in Santa Fe, but the attitudes and lifestyles of its people.

"Even today, when it starts to rain, there are people who begin to panic. They worry, 'Is it going to flood again? What will I do? Where will I go?'" said Colette. "After a while interviewing people, spending time with them, and listening to story after story of flooding, I started feeling these same fears when it rained because of how panicked everyone else would be. I would hear the rain and wonder if the people who have shared so much with me were okay."

When in Argentina, she spends her days meeting with flood victims and residents to collect data on their experiences, and she also meets with various policy makers and government employees to discuss what happened during the floods, current and ongoing structural and non-structural projects to manage flood risk, and the institutional changes that have taken place within the government since the 2003 flood.

"In Santa Fe, I met with national, provincial, and municipal government officials and reviewed government documents from those levels first," Colette said. "Then using GIS data and government flood maps, I identified four neighborhoods having different experiences of flooding. I focused on residents of those neighborhoods and interviewed them along with politicians, state legislators, private sector engineers, and members of civil society associations, all of which helped to bring the bigger picture of the floods together."

In her research, it is clear that natural factors only partly contributed to Santa Fe's problems with flooding.

"It's not just the rain or rivers that are causing the floods," Colette said. "Floods happen in Santa Fe because the infrastructure does not operate as it should, or certain precautions aren't taken. The city is described as a pan or bowl because rivers run on the both the east and west sides, and when the rain falls, it collects in the middle. So there are some geographical challenges, but drainage is not the only problem. There is a fundamental human element. In 2003, the government left a gap in the embankment, never finishing the project. Four years later, some pumping stations were still inoperative and for those that did work, the rain exceeded their capacity to remove the water," Colette said.

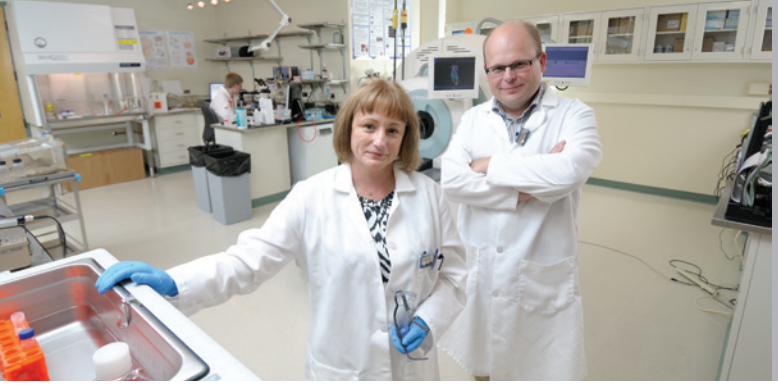
She intends to use this data and research to build proposals for policy changes in Santa Fe, though she hopes these policy changes will affect other cities worldwide. In essence, she is examining how all people understand climate-related vulnerability and risk, the factors that influence their understandings, and how their understandings influence the context in which citizens and the state respond to risk.

> **Even today, when it starts to rain, there are people who begin to panic. They worry, "Is it going to flood again? What will I do? Where will I go?"**
>
> April Colette

"If people's understandings of risk and vulnerability are different than the government's, there will always be a gap between state intervention and the effects on the ground. It demonstrates that people may not understand the logic of such an intervention and that government may not fully understand people's needs. There needs to be equal understanding and expectations on both sides, with effective distribution of information, so that both parties understand how the city is better preparing for floods," Colette said.

Colette has traveled back and forth between Argentina and the United States many times, and she loves the opportunity she has to travel as a geographer and ethnographer.

"Social science research is very unusual for researchers at Beckman," Colette said. "Being in the field is everything. Your lab is wherever you're studying, so it's very important that I go to that place. One of my methods is ethnography, so living there, experiencing the culture, talking with the people—that's what is most important. It makes for very rich, interesting research … I wouldn't have it any other way."



A CHANGE IN COMMAND

Iwona Dobrucka has taken over as director of the MIL, and former director Wawrzyniec Dobrucki has received a tenure-track position in bioengineering.

Wawrzyniec Dobrucki and Iwona Dobrucka, a husband-and-wife team at the Beckman Institute, are changing roles in the Molecular Imaging Laboratory (MIL), a state-of-the-art imaging lab within the Biomedical Imaging Center (BIC) at Beckman.

The lab was established in August 2010, and Dobrucki was asked to come aboard as director for his expertise in nuclear imaging with radioactive isotopes. Shortly after, Dobrucka joined the lab as a research scientist, and in just a few years, they made the MIL a place for leading-edge research, state-of-the-art imaging services, and student mentorship. Now, Dobrucki has been hired as a tenure-track professor of bioengineering and will use the lab as a researcher. Dobrucka has been promoted to director.

For the past few years, the two have worked together to build the lab from the ground up after a National Science Foundation (NSF) major instrumentation grant and Beckman Foundation funds assisted with the construction and equipment purchases. The lab features a multimodal microPET/SPECT/CT scanner, and it, like other facilities at Beckman, offers its services to any academic or industrial researcher. They have developed collaborations reaching from the Urbana-Champaign campus to international groups in Poland, Greece, and Germany.

"The MIL functions to serve our collaborators," Dobrucka said. "We continually expand our services and update our capabilities in order to meet the researchers' needs. In the beginning of our collaboration, they come to us with a problem, discuss their needs and availability of funding, and from that point we build the best imaging strategy for them, teach them how to use the equipment, and provide technical guidance along the way."

Transitioning from a research scientist to director, Dobrucka says her duties changed quite a bit.

"Before, I was more focused on daily routine aspects of the lab and my research only. Now I work on global strategy of how to run the lab. I run various projects, contact the PIs, perform calibration tests, while continuing to look for new collaborations and develop new possibilities for grant writing," Dobrucka said.

Both Dobrucki and Dobrucka also run their own groups through the MIL. Dobrucki, in conjunction with teaching, leads the Experimental Molecular Imaging Laboratory (EMIL), which is currently focused on developing novel targeted imaging probes to be used in the MIL.

"In our experimental lab, we're developing new probes that address important human health problems," Dobrucki said. "One of the probes images the process of angiogenesis, which is the formation of new blood vessels, and is a process implicated in the development of cancerous tumors and other cardiovascular pathologies.

MIL by the numbers

Users: >18 research groups

Scans: >1500 scans

Imaging data generated: >10TB (terabytes)

Beckman researchers using MIL: Stephen Boppart, Marni Boppart, Jianjun Cheng, Ling Meng, William O'Brien, Yi Lu

"Another nanoparticle-based imaging probe will allow for multimodal imaging of novel biological targets in atherosclerosis and prostate cancer. This new strategy will allow for sequential *in vivo* imaging of atherosclerotic plaques with PET scanner and fluorescence microscopy of biopsied tissue samples. Currently, we're using the MIL to evaluate these probes in animal models of human diseases."

The opportunity to conduct their own research while still providing advanced imaging services is one of the benefits to running the lab.

"The MIL is unique in that sense—it provides a service for other researchers, but is also a place where we can run our own research groups," said Dobrucki. "It fits nicely into the idea of an interdisciplinary laboratory at Beckman."

Between the two, they have students representing many different disciplines, including bioengineering, molecular and cellular biology, and electrical and computer engineering, with whom they've had a great deal of success.

"We've had some wonderful experiences, especially with undergraduate research. One of our first undergraduate students was Matthew Schuelke, and we worked with him to create images of an angiogenesis response to a heart attack in diabetic rats that won the 2012 Siemens Translational Image of the Year award," Dobrucka said.

Their tight-knit group has had success through collaboration and working toward common goals. Dobrucki and Dobrucka want their students to learn from one another, while also bringing a specific discipline into mix to introduce new insights, in order to develop the multidisciplinary atmosphere that Beckman was built upon.

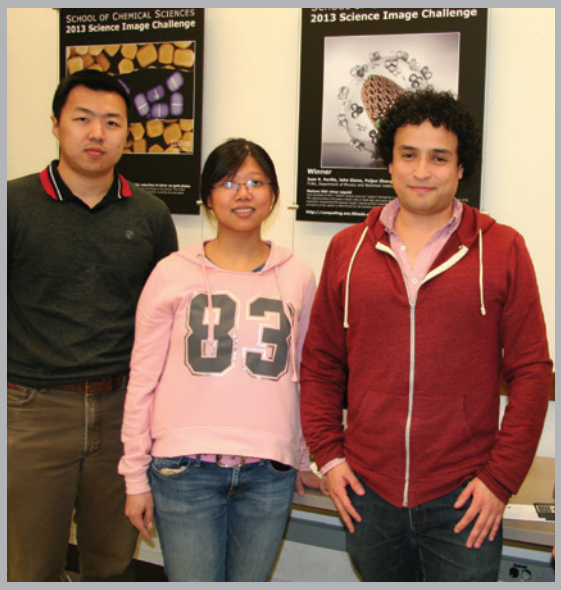
"Molecular imaging is a combination of biology, physiology, chemistry, and engineering—it's hard to find a person who has expertise in all those areas, so we want to bring students in to learn from one another," Dobrucki said.

School of Chemical Sciences
Science Image Challenge

The image "Mature HIV virus capsid," by Juan R. Perilla, John Stone, Peijun Zhang, and Klaus Schulten of the Theoretical and Computational Biophysics Group (pictured far right), won the School of Chemical Sciences Science Image Challenge.

The image shows viral particles of HIV-1 containing conical cores (or "cones") formed by a protein shell composed of the viral capsid protein (CA). The capsid protein (CA) plays critical roles in both late and early stages of the infection process and is widely viewed as an important unexploited therapeutic target. Capsid protein assembles into hexamers (gold) and pentamers (green); the curvature of the capsid is determined by the location of the pentamers.

Images by Li Huey Tan, graduate student in the 3D Micro- and Nanosystems Group, and Boon Chong Goh, graduate research assistant in the Theoretical and Computational Biophysics Group, were finalists.



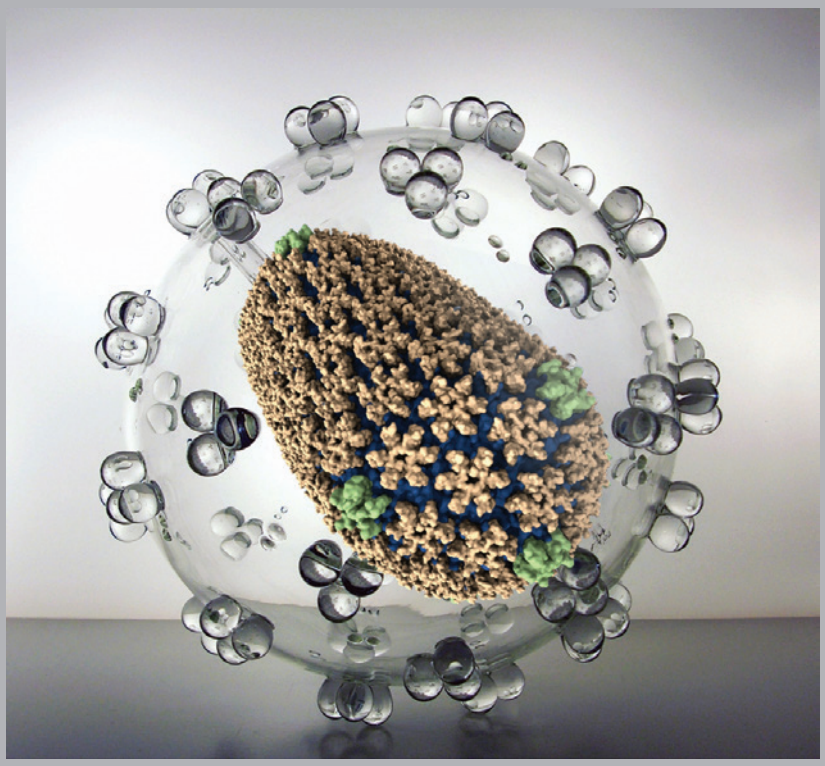
From left: Boon Chong Goh, Li Huey Tan, and Juan Perilla created research images that were among the top five in the School of Chemical Sciences Science Image Challenge.

Cancer Community at Illinois
Coming together for a cause

In October, the Cancer Community at Illinois hosted a grant planning symposium to bring together clinicians, physicians, faculty, postdocs, staff, and students from across campus and area health care facilities to discuss opportunities for collaborative research.

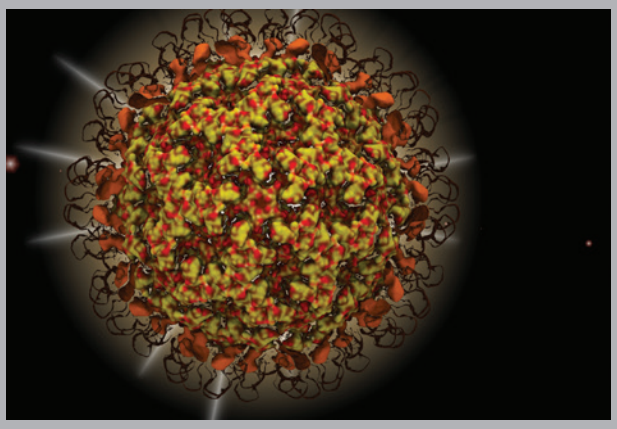
Rohit Bhargava, Beckman faculty member in Bioimaging Science and Technology and coordinator of the Cancer Community at Illinois, led off the event with a discussion of the opportunities for interdisciplinary research projects, as well as ways to provide students with experience in cancer research in order to guide their careers. The symposium included presentations about partnering with the Carle Foundation Hospital, the College of Veterinary Medicine, as well as discussions centered around particular areas of collaboration.

Attendees at the Cancer Community event included (from bottom left) Rex Gaskins, animal sciences professor; Ann Benefiel-Kunkel, life science research specialist; Rashid Bashir, Beckman affiliate; Marina Marjanovic, associate director of Imaging at Illinois; and Kendrith Rowland, physician at Carle Foundation Hospital. Rohit Bhargava, Cancer Community coordinator (top right), chats with Antonios Michalos, deputy director of Strategic Healthcare IT Advanced Research Project on Security (SHARPS). Mallory Schroeder, a Beckman undergraduate researcher, and Gretchen Clifton, program manager (middle right), helped organize the grant planning symposium.

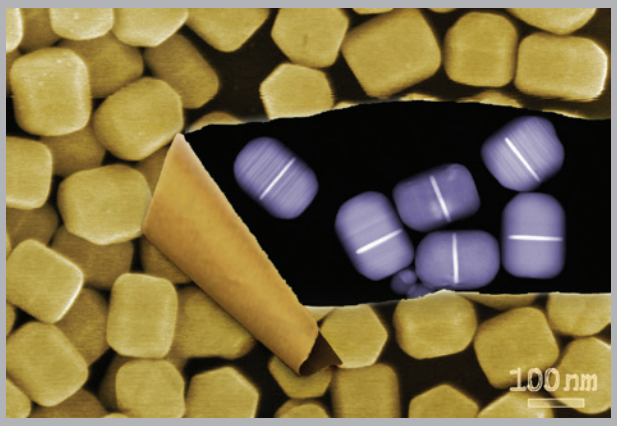


Winner

Juan R. Perilla, John Stone, and Peijun Zhang
Klaus Schulten Group
Theoretical and Computational Biophysics Group
Glasswork by Luke Jerram
Mature HIV virus capsid



FINALIST: Boon Chong Goh
Klaus Schulten Group
Theoretical and Computational Biophysics Group
Nudaurelia capensis ω virus



FINALIST: Li Huey Tan
Lu Group
3D Micro- and Nanosystems Group
Hexagonal rods formed from DNA-directed colloidal reduction of silver on gold plates

Medical Humanities Lecture

Ron Schleifer

Ron Schleifer, the first speaker in the Medical Humanities lecture series, presented a lecture on campus Thursday, November 14. Jointly sponsored by the Beckman Institute and the Illinois Program for Research in the Humanities (IPRH), the lecture examined the concept of "schema-based medicine" that Schleifer developed in his book, *The Chief Concern of Medicine*.

Schleifer is George Lynn Cross Research Professor in the Department of English at the University of Oklahoma, where he is also adjunct professor in medicine. On November 15, he conducted a workshop titled "Medicine and Literature" at the Beckman Institute. More than 20 undergrad and graduate students interested in the field of medicine participated in a discussion of the nature of vicarious experience, its role in the narratives people tell, and the importance of both for medical doctors.

On March 13, 2014, the next lecture in the series will be presented by David Yaeger, dean of the Arts Division at U.C. Santa Cruz.

Ron Schleifer, professor of English and medicine at the University of Oklahoma, examined the concept of "schema-based medicine" as part of the Medical Humanities lecture series.

Greenough Remembered as Instrumental in Beckman Development

William, "Bill," Greenough, faculty member in the Neurotech Group and professor emeritus in the Department of Psychology, died Dec. 18 at 69 in Seattle, of complications with Lewy Body Dementia. Greenough was instrumental in crafting the proposal that led to the creation of the Beckman Institute.

Greenough first joined the university as an instructor in 1968, finishing his Ph.D. in psychology from UCLA and becoming an assistant professor here in 1969, later becoming a full professor in 1978. He was Swanlund Professor in the University of Illinois Departments of Psychology, Psychiatry, and Cell and Developmental Biology, and served as director of the Center for Advanced Study at Illinois. He served as co-chair of the Biological Intelligence research theme at Beckman, which served as home to the William Greenough Laboratory since the Institute first opened its doors.

"Bill was a Beckman original," said Art Kramer, director of the Beckman Institute. "Bill, Karl Hess, and a few others were instrumental in crafting the proposal that led to the gift from Arnold and Mabel Beckman for the construction and development of the Beckman Institute."

As a researcher, Greenough had been a leader in changing scientific thinking when it comes to nervous system development and the brain. He helped take the concept of brain plasticity from theory to experimental proof to accepted science.

"Bill was one of the towering figures in neuroscience, not only on this campus but around the world," said Neal Cohen, faculty member of the Cognitive Neuroscience Group. "His work led the way in illuminating experience-related plasticity in the mammalian brain, overcoming early views that sensory and motor systems of the brain were largely fixed very early in life, showing instead that the development of new synapses occurred in response to environmental enrichment and learning."

Book Review

Dan Morrow, part-time faculty member of the Human Perception and Performance Group, edited and wrote the introduction for the recently published book *Reviews of Human Factors and Ergonomics, Volume 8* (SAGE Publications, 2013).

Volume 8 is the first thematic volume in the series and focuses on human factors research in health care. Collectively, the chapters highlight progress in this area of research and focus on processes related to quality of care and clinician and patient outcomes, from perceptual and cognitive processes underlying clinicians' ability to interpret and act on patient data, to processes underlying effective teamwork, to more macro-levels such as work processes in health organizations. The volume covers a range of theoretical approaches, including macroergonomic perspectives and more micro-levels of analysis of teamwork, patient-provider collaboration, and clinician interaction with information technology.

"The topic is very timely because the volume gives a snapshot of recent work related to the safety and efficiency of health care," Morrow said. "Patient safety has been a national concern at least since the publication of the Institute of Medicine report 'To Err is Human' in 1999, while efficiency and cost of health care is an underlying issue of the Affordable Care Act.

"In my introduction to the volume I highlight some of the strengths of the research described in the book, which make a strong case that health care safety must be addressed by system-based approaches that take seriously the idea that threats to patient safety arise less from discrete events than from interacting processes vulnerable to error and other pressures. These approaches analyze and address processes related to quality of care and clinician and patient outcomes at multiple levels, from perceptual and cognitive factors underlying clinicians' interaction with medical technology, to effective teamwork among clinicians, to more macro-levels such as how work processes link organizational practices and patient outcomes."

The book can be found, along with many other publications featuring Beckman faculty, on the book display located next to the Beckman Institute Café.

HONORS & AWARDS

Nahrstedt to be Inducted in German National Academy of Sciences Leopoldina

Klara Nahrstedt, affiliate faculty member in the Image Formation and Processing Group, will be inducted in the German National Academy of Sciences Leopoldina, Germany's foremost academic society, in March 2014. Nahrstedt's selection to Leopoldina's membership is in recognition of her scientific achievements and impact on science.

Cunningham Elected OSA Fellow; Named Interim Director of MNTL

Brian Cunningham, faculty member in the Nanoelectronics and Nanomaterials Group, was recently elected a Fellow of the Optical Society of America "for the invention, development, and commercialization of biosensors and detection instrumentation based upon nanostructured surfaces, and the development of biological applications."

Additionally, Cunningham has been named interim director of the Micro and Nanotechnology Laboratory (MNTL) at the University of Illinois.

Sweedler Receives American Chemical Society Award

Jonathan Sweedler has won the American Chemical Society (ACS) Award in Analytical Chemistry, recognizing "outstanding contributions to the science of analytical chemistry" for his pioneering development of methods to detect extraordinarily small quantities of neurotransmitters. Sweedler is a part-time faculty member in the Neurotech Group.

Insana Invested as Willett Professor

Michael Insana, faculty member in the Bioimaging Science and Technology Group within the Integrative Imaging research theme, was recently invested as Donald Biggar Willett Professor in the College of Engineering in bioengineering.

Rhodes Named Advisor of the Year for Medical Scholars Program

Justin Rhodes, faculty member in the Neurotech Group, was announced a recipient of the University of Illinois' Medical Scholars Program 2013 Outstanding Advisor of the Year Award.

Montrul Named University Scholar

Beckman affiliate Silvina Montrul is one of 14 faculty members from the three University of Illinois campuses chosen to receive the 2013 University Scholar Award. Montrul, a member of the Artificial Intelligence Group, focuses her research on the nature of the linguistic knowledge of certain bilingual speakers and investigates the mental representation of grammar in the mind. Her work in the field of heritage language linguistics—and bilingualism in general—is foundational.

Beckman Video Producer Drake Wins His Third Emmy

Beckman video producer Steve Drake won his third Mid-America Emmy for "Why Men are Better Navigators than Women," which features the research of Beckman faculty member Justin Rhodes. To watch the video, visit go.illinois.edu/emmyvideo.

Kenis Invested as Lycan Professor

Paul J. A. Kenis, part-time faculty member in the 3D Micro- and Nanosystems Group, was invested as the William G. and Janet H. Lycan Professor in the School of Chemical Sciences during an investiture ceremony on September 25, 2013, at the Spurlock Museum.

Leckband Elected to Biomedical Engineering Society's Board of Directors

Deborah Leckband, part-time faculty member in the 3D Micro- and Nanosystems Group, has been elected to the Biomedical Engineering Society's Board of Directors.

Lyding Receives Award for Research Excellence

Joseph Lyding, full-time faculty member in the Nanoelectronics and Nanomaterials Group, was honored with the Award for Research Excellence in Nanotechnology, given by the Bio/Nano Interface Center at the University of Pennsylvania.

Rogers, Schulten, and Sweedler Elected CAS Professors

Beckman faculty members John Rogers, Klaus Schulten (left), and Jonathan Sweedler were elected Center for Advanced Study (CAS) professors, one of the highest forms of recognition on the University of Illinois campus. CAS professors are permanent members of the center, appointed after a rigorous nomination and election process.

Rogers Wins American Ingenuity Award from Smithsonian

Beckman full-time faculty member John Rogers has been given a 2013 American Ingenuity Award by Smithsonian Magazine. Rogers is the 2013 honoree in the physical sciences, thanks to the invention of ultra-thin silicon electronics that dissolve in the body or the environment, ushering in a new era of biodegradable medical implants and environmentally friendly electronic devices.

Başar Receives IEEE Control Systems Award

Tamer Başar, former director of the Beckman Institute, has been awarded the 2014 IEEE Control Systems Award for his prolific and innovative career.

Did you see Beckman's holiday video featuring the iCub robot Bert? Check out his festive song, and other Beckman Institute videos at beckman.illinois.edu/video.

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.

Editor: Maeve Reilly
mjreilly@illinois.edu
Writer: August Cassens
acassens@illinois.edu

If you'd like to receive updates on the Beckman Institute, including Synergy and our annual report, you can subscribe to our mailing list at illinois.edu/gm/subscribe/15692.

Changing seasons at the Beckman Institute

FOLLOW US!

facebook.com/BeckmanInstitute

@BeckmanInst

youtube.com/BeckmanInstitute

Beckman Institute

Support the Beckman Institute

Make a secure online gift today:
beckman.illinois.edu/about/giving

Beckman Scholarship Fund
Supporting students and postdocs at the Beckman Institute

Beckman Support Fund
General support for research, operations, travel, equipment, and facilities

Erik Haferkamp Memorial Fund
Supporting undergraduate research in neuroscience

Nadine Barrie Smith Memorial Fund
Supporting women engineers in medical imaging

Thomas & Margaret Huang Fund for Graduate Research
Supporting graduate research in human-computer intelligent interaction

For more information, please contact the Beckman Institute at:
217-244-1176 or
giving@beckman.illinois.edu