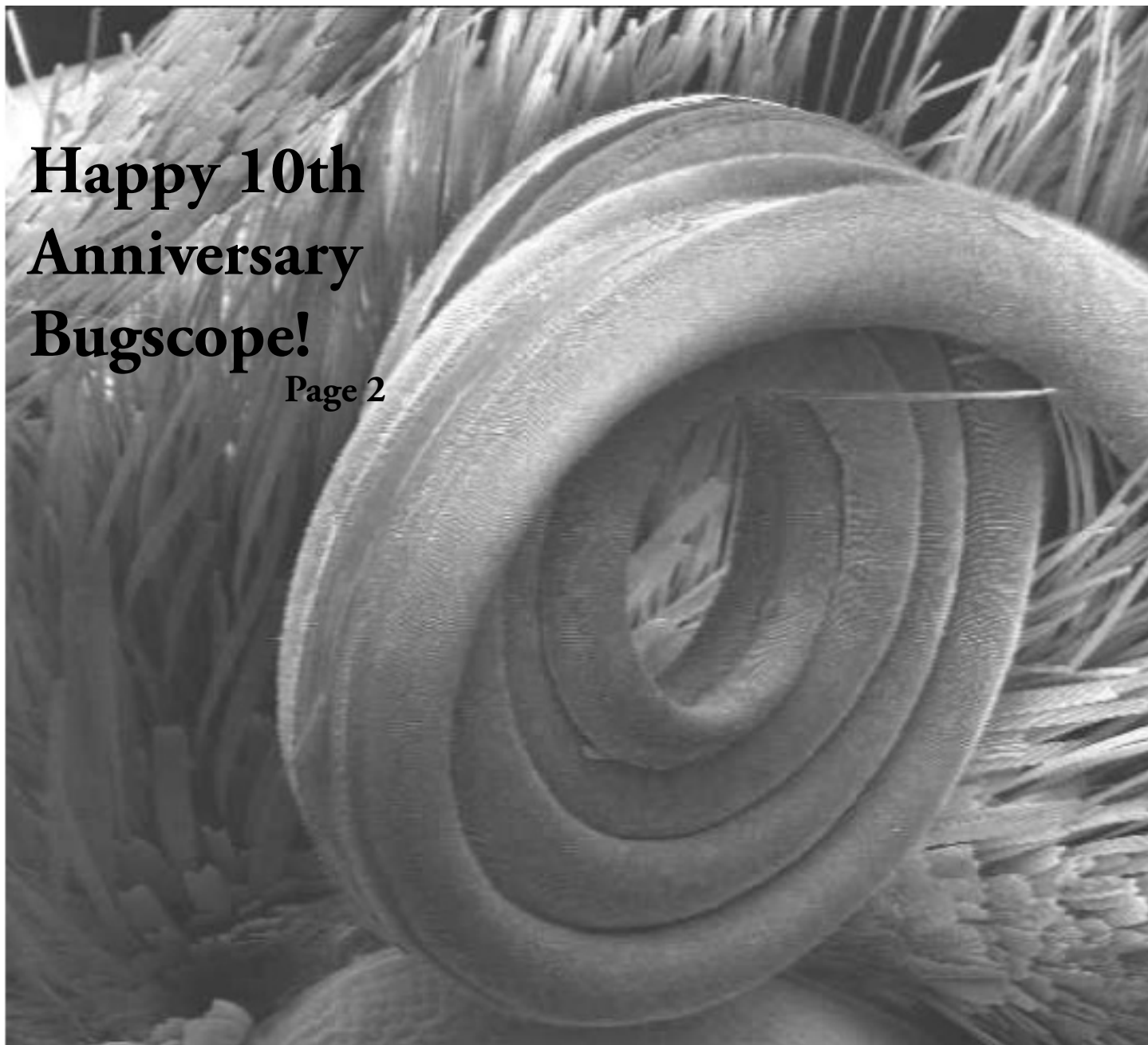


# SYNERGY

BECKMAN INSTITUTE FOR ADVANCED SCIENCE AND TECHNOLOGY

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## Happy 10th Anniversary Bugscope! Page 2



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Beckman researcher  
John Wang

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A screen capture from a live Bugscope session.

*Student 8: put 8 in control*

...

*Student: It is fun to control*

*Student : do you have fun lokking at bugs*

*alex: oh yeah, this is a blast, we love doing bugscope*

...

*Student 15: can 15 be in controll*

*Student 9: thanx i am now in controll!!*

Halfway through a recent session, the “driver” at the school who was in charge of guiding the SEM moved it out of range of the on-screen sample.

*Cate: Whoops, the end of the world. :(*

Robinson leapt out of his chair and sprinted from his office across the hall to the Beckman basement room housing the SEM, and manually reset the microscope. Soon the students and teachers were looking at an image of a wasp’s eye rendered with amazing clarity and detail. A question was asked about whether each of the little lens squares they were seeing that make up the eye are actually individual eyes.

*Scot: each is a separate ‘lens’*

*Scot: you can see that there are many hundreds to thousands of individual facets, individual ommatidia*

*Cate: there are still some mysteries as to what the compound eye sees, most think that each lens will see a part of the “picture” and relay each*

**“It’s very energizing. You’ll have three or four people responding and everyone is trying to answer these questions as soon as they come up,” Ray said. “It’s think on your feet, rapid-fire questioning. We have developed this thing of knowing who is going to answer what question.”**

**— Annie Ray**

*part back to the brain where it is put together*

Later in the session Ray, a Ph.D. candidate in entomology at Illinois, responds to a question from the third grade class asking if all insects have a thorax.

*Annie: All insects have head, thorax and abdomen. All insects have six legs and one pair of antennae. Those are the requirements for being an insect!*

A couple of minutes later time is up for this session of Bugscope and all parties say goodbye, thanks, and then sign off.

According to the Bugscope Web site, “Bugscope allows teachers everywhere to provide students with the opportunity to become microscopists themselves – the kids propose experiments, explore insect specimens at high-magnification, and discuss what they see with our scientists – all from a regular web browser over a standard broadband internet connection.”

Teachers make an application for their classes to take part in a Bugscope session, with some classes sending in samples of bugs and other items they have scavenged from their homes, yards, and elsewhere, or they may see samples provided by the BugOps and others.

Not all of the samples are of insects. A growth of coral was sent in from one classroom, while the BugOps like putting a sample of anti-caking salt from Wendy’s in the SEM because, Robinson said, “it looks like an Aztec carving instead of a boring cube.”

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Ray said she brings in “mosquitoes, abandoned specimens from my department, glowworms which are actually beetles, owl flies, lice, bed bugs, ticks,” and some bugs that, she added with a laugh, “I collect off of myself.”

Prior to each session the samples are prepared using a gold-palladium coating, the samples are placed in the SEM, images of some samples are pre-set for quick reference, and once the class logs in, the fun begins.

The teachers and/or students are in charge of navigating, focusing, magnifying, and other controls of the SEM, while they interact with the BugOps via a chat window that is just below whatever image the SEM is focusing on at the moment. A Bugscope session may have the teachers relaying the questions and doing all the driving or – and this, the BugOps say, is the most fun – it may feature the students doing the driving and asking the questions themselves.

Ray usually takes part in Bugscope sessions from her lab in Morrill Hall or at her apartment. Other BugOps like Robinson, Wallace, and Conway usually join in from their respective offices, while Lazarevich is usually handling things in the room housing the SEM and its operating computers. While the BugOps sit at their computers, students and their teachers in places like Illinois and Hawaii and Spain fire questions at them, while they race to respond as quickly and as accurately as possible.

Robinson said their approach to students is to let them learn by doing.

“We don’t go in and say now we are going to teach you about silkworms. That would be trying to frame the discussions for the students,” he said. “We don’t want to be talking down to the students. The idea of having chat lines and not dictating to the students is that it brings the students in where they are participating and it’s democratic; they can talk and we can talk.”

There is a rapport between the BugOps that has been ongoing since Robinson and former full-time ITG staff member Daniel Weber worked on the original Bugscope sessions.

“We had a friendly competition, joking around and trying to answer questions faster and more completely,” he said. “Daniel is good-natured and I just went along with Daniel. The kids could see that we were having fun.”

Robinson said being a good BugOp requires certain qualities. “You want to have good people skills and you have to be patient.”

Ray, who will get her Ph.D. in entomology in May, is the only long-term, trained entomologist Bugscope has ever had.

“I had heard that some mythical program existed over at Beckman from some members

charged sometimes.

“It’s very energizing. You’ll have three or four people responding and everyone is trying to answer these questions as soon as they come up,” Ray said. “It’s think on your feet, rapid-fire questioning. We have developed this thing of knowing who is going to answer what question.”

The chat is designed so the BugOps can highlight a question they want to answer in pink. Students are color-coded in blue and teachers in red in the chat window, while the Adminz, as the BugOps are called, are in green. Each session is archived with transcripts and images of the chat as it took place. Teachers may return to the Bugscope Web site to use their session over and over. The students and teachers’ names are kept anonymous.

Robinson said there have been more than 420 Bugscope sessions with more than 250 classrooms taking part since 1999. He said the most common question they get from the students is: “What do those hairs do? Annie Ray actually wrote a paper called ‘What do those hairs do?’”

So what *do* those bug hairs do?

“They are the means that the insects have for assessing their environment,” Robinson said. “They are purely sensory. They could be thermal receptors for hot or cold, or they could be detectors for pheromones, some multi-chemo sensor. All these things we see we don’t always realize what they are.”

The Bugscope project has undergone changes over the years as far as technology

development and growing to include classrooms from all over the world. But the basic mission has remained the same: show students that science can be exciting as well as educational, and that even scientists can have fun.

“We want them to have a great experience, we want them to see something that they have never seen before or had the ability to do before,” Robinson said. “We want them to understand that they are actually driving this \$600,000 microscope and that these

*more on page 5*



*The Bugscope staff. Left to right: Chas Conway, Cate Wallace, Alex Lazarevich, Umesh Thakkar, Scott Robinson, and Annie Ray.*

**“(ITG) wanted to do technology development but in 1998 when this was conceived and in 1999 when it started, this was something people didn’t know. There weren’t many examples of this — remote access scanning microscopy wasn’t done. In a lot of ways it’s unique and that’s what has kept it going.”**

**— Scott Robinson**

of my department,” Ray said. “So I came over to look at some of the insects I work on and then I got to know some of the people down in the Microscopy Suite. I just wanted to help out however I could because I thought it was a really great program and a great opportunity, and they needed an entomologist too.

“I said ‘do you need somebody to help out with Bugscope’ and they were like ‘yeah, sure, log in if you want.’ It just worked out. Our personalities meshed. The rapport that we have in a session is really good.”

The Bugscope sessions can get pretty

aren't just canned images. We want the kids to just have an awesome time.

"The reward for us is when they start asking 'well what did you have to study in school in order to be able to do this.' It gives us a lot of energy and is the most fun thing that we do during the week. We want that enthusiasm to carry over to the kids and we want the kids to see that being a scientist is a viable option and that we're not these stuffy people in white coats who don't talk to anybody."

*Student: how long have you been a scientist*

*Annie: I started graduate school in 2003, but I studied biology in college. And I started college in 1999. So about 10 years*

...

*Student: annie what is your major study?*

*Annie: I study chemical communication in longhorned beetles*

*Student: how long have you been a scientist*

*Annie: I started graduate school in 2003, but I majored in biology in college*

*Student: scot how long have you been a scientist*

*Scot: I have been doing this for a long time*

*Scot: I got hired to help set this up 10 years ago*

It was a little over 10 years ago that Robinson came to ITG and Beckman, and shortly thereafter that a powerful new electron microscope was added to the Microscopy Suite arsenal.

"Ten years ago today," Robinson said on Jan. 12 while pointing at the Bugscope room north of his office in the Microscopy Suite's Beckman basement digs), "within a few days of that, I was pulling the microscope in on a pallet into that room.

"We already decided what we were going to do with the microscope; we were going to start this thing called Bugscope. The microscope was funded by NSF specifically for Bugscope, to be able to run Bugscope. Of course we were going to use it for other things but we bought it to run Bugscope as a sustainable outreach program."

The microscope was funded by NSF specifically for Bugscope, to be able to run Bugscope. Of course we were going to use it for other things but we bought it to run Bugscope as a sustainable outreach program."

A decade after it debuted, Bugscope is fulfilling the mission that was first envisioned for it in 1999. The idea for an online scientific educational outreach program featuring remote access microscopy was hatched in the 1990s with Chickscope, a technology

**"We are always going to be surprised and pushed and challenged by the questions the kids have. You are so strongly motivated to make it better and better that you wish you had an encyclopedic knowledge of insects. We realize we might run into things that some people have never seen. Some of these aren't studied much. It's fascinating and it's never ending. We want to keep this level up as high as we can."**

**— Scott Robinson**

development program that used magnetic resonance imaging to view samples.

Robinson said the cost to maintain Chickscope was prohibitive, so a proposal was made to the National Science Foundation for an environmental scanning electron microscope (ESEM) that would be used in an innovative new educational outreach program that would allow students remote access to an electron microscope via an Internet connection.

"(ITG) wanted to do technology development but in 1998 when this was conceived and in 1999 when it started, this was something people didn't know," Robinson said. "There weren't many examples of this – remote access scanning microscopy wasn't done. In a lot of ways it's unique and that's what has kept it going."

Robinson said the grant proposal was for an environmental electron scanning microscope (ESEM) because they were promoted as not requiring specimen preparation, but he and others had to make some changes to the original concept.

"The conductive and non-conductive samples showed them that that wasn't going to work and there was limited time to use the microscope in wet mode, so we are using an ESEM as a scanning electron microscope," he said. "What's really cool about this thing now is this is first class. It's an ESEM but it is also a field emission electron microscope that has much, much better resolution than a normal electron microscope."

The ESEM is now part of ITG's Microscopy Suite array of high-powered

instruments for high resolution imaging of micro- and nanoscale samples. It is used for other projects but its main purpose is for Bugscope sessions. Robinson said the first session was March 19<sup>th</sup>, 1999, with Central Academy in Champaign.

Technology development has been an important part of Bugscope's growth over the years. Conway, who has been with Bugscope since his sophomore days at University High School, is credited with co-designing the Bugscope redevelopment effort in 2007. According to the Bugscope site, "At this point every piece of software code that powers the Bugscope project was written by Chas, and his sense of style is evident throughout."

Lazarevich has contributed in a big way to Bugscope, generalizing the program's tools for use with other, similar projects. As systems administrator, he is the sessions' technical expert and, as the Bugscope Web site, says "ensures that Bugscope has computers that work, disks with space, and a network that keeps the images and chat flying back and forth."

Robinson has been a guiding force behind Bugscope since he joined Beckman in late 1998. It's clear he is passionate about the program and wants the next Bugscope session to be better than the last one.

"It's sort of like you are only as good as your last session," he said. "You really want to have a great interaction with the kids and you want to have good, complete answers."

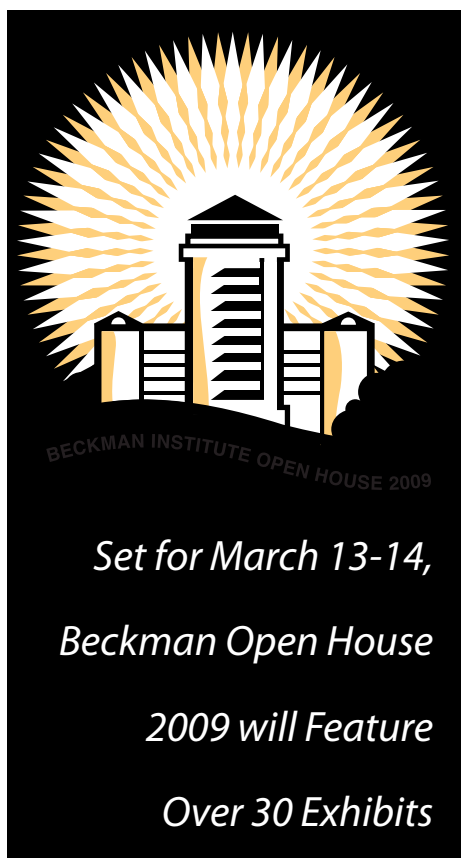
In addition to K-12 students taking part in Bugscope, it is also being used by education professor Michelle Korb at Marquette to acquaint pre-service teachers with the program. Also, researchers at the Scripps Research Institute are using remote access to look at SEM lines of cancer cells.

After a decade Bugscope is still going strong and plans are to keep it that way.

"We think that the basic idea of what we're doing is sound," Robinson said. "We don't want to reengineer something that works really well. What we want to do is refine it."

"We are always going to be surprised and pushed and challenged by the questions the kids have. You are so strongly motivated to make it better and better that you wish you had an encyclopedic knowledge of insects. We realize we might run into things that some people have never seen. Some of these aren't studied much. It's fascinating and it's never ending. We want to keep this level up as high as we can."





# Open House Serves to Communicate Beckman Institute Research

Joe Lyding enjoys the Beckman Institute Open House because it gives him a chance to demonstrate his group's research to the general public, test his students on their ability to explain that research for a lay audience, and, last but not least, because he too gets to be an Open House visitor.

"I love these things. I have a ten-year-old daughter and I like to bring her around and let her see all these things," Lyding said. "I think it's a real eye opener, especially for the kids to see something that goes beyond their traditional education where everything is defined and people grade you on what is known.

"Here we are pursuing what isn't known. The ability to work on open-ended problems is what research is all about. A place like Beckman has created the ability to work on open-ended problems and an important part of that is to be able to explain them to the people who are paying the bills."

Bringing Beckman research to the people who are paying the bills is part of the Institute's mission of public outreach. Every two years the public is welcomed into the building for the Beckman Institute Open House to learn more about the work that goes on at one of the country's top centers for interdisciplinary research.

Beckman faculty member Deana McDonagh shares Lyding's feelings about the usefulness of Open House.

"It's an opportunity to actually share with everybody the work we're doing that we're so enthusiastic about," she said.

That sharing can be a useful tool for understanding one's own research.

"Because we have to consider the general public, it makes you very sensitive to how you communicate and on what level," McDonagh said. "I'm a firm believer in keeping everything simple and straightforward, so the maximum number of people can understand what you're doing. It really makes you become more fluent communicating with people on all levels what it is you are doing and why."

"It's a good exercise for us," said Lyding, who leads the Nanoelectronics group at Beckman. "If we can't explain what we do in terms that everybody can understand, then

we probably don't understand it ourselves. So it's a very good exercise for me and the students to be able to do that."

And it serves as a test for Lyding's students.

"It's actually interesting for me watching my students trying to describe stuff," Lyding said. "It tells me a lot about how well they understand it. They're actually being tested by me in the process of trying to convey what we do to the public. I find it very intriguing."

The biennial Beckman Institute Open House will take place March 13-14 and will feature 31 exhibits, a larger number than in recent years. The thousands and thousands of visitors who have taken part in the Beckman Institute Open House over the years have seen little robots racing around, an up close view of an insect's world through the Bugscope microscope, and intriguing displays illuminating the science of the brain, among many other exhibits.

Open House 2009 will again feature those popular displays, but will also include some of the research being done by newer Beckman faculty members like McDonagh. She plans on using one of her research tools in the exhibit – one that should draw lots of interest from visitors. McDonagh, an associate Professor of Industrial Design at Illinois, has worked with collaborators at Beckman to fashion a kiosk for testing product design. A light will illuminate an unusual item inhabiting the kiosk and a TV monitor will capture visitors' unrehearsed reactions for those nearby to see. McDonagh hopes exhibits like hers will serve to fire people's imaginations when it comes to science, especially the imaginations of younger visitors.

"I remember as a child it only takes something to really grab your interest for it to shape your career path," she said. "We're all very aware of how science, technology, and engineering, needs to be repackaged for the younger generation. This is one way of showing the bridge between the sciences and the arts, which is design, and it's showing it in an applied way through the kiosk."

Potential future applications of the research are what drive many Beckman projects. Both

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**"If you can show people how research is applied, and how it's going to have an impact on everyday life, a relevancy emerges that the general public can understand."**

**— Deana McDonagh**

Lyding and McDonagh say possible real-world outcomes of research are an important part of the Open House mission.

"If you can show people how research is applied, and how it's going to have an impact on everyday life, a relevancy emerges that the general public can understand," McDonagh said. "When research is very abstract and distant, it's almost like it has nothing to do with them. But what Beckman is doing is showing people how relevant the work is here."

"We do a lot of fundamental research but there is always a technology undertone," Lyding said. "So if we're doing nanofabrication we do it on silicon because chip technology is based on silicon. The idea is, while we might be working on things that may be way over the horizon, we might find something along the way that is useful."

"I also find that the public is much more perceptive than people might ordinarily think. While they may not have a Ph.D. in this or that, if you explain stuff to them in a way that it's clear that you understand what you are saying, they get it. They don't need equations and they don't need to spend years of their life learning this stuff. If you explain it properly, the average person will understand it quite well."

Lyding has taken part in every Beckman Institute Open House. This year his lab will again be demonstrating the power of scanning tunneling microscopy, showing effects like atomic scale patterned surfaces. Lyding's group has actually performed nanoscale writing, forming letters and words out of atoms. He said some lucky visitor may even get to see their name written in atoms and receive a printout of it.

Other exhibits this year feature curiosity-inducing titles like Slips of the Tongue: Beyond Freud, Robot Learns Grammar and Talks,

Brain Computer Interface, Seeing Speech, The Curious Case of our Changing Brain, Voice-Typing Game, and Senior Odyssey.

There's plenty more, with 31 exhibits planned to introduce visitors to Beckman research in areas like computer simulations and scientific visualization, bioengineering, neuroscience, and nanoscale applications.

Visitors will be treated to a spectacular view of the computer process of photosynthesis through dynamic 3-D computer simulations, as well as computer-generated graphics that reveal the molecular world of proteins.

More amazing displays include demonstrations of how computer power can benefit our lives. There will be an interactive demonstration of a non-invasive imaging technique for medical applications, software that can estimate gender and age, and a demonstration of a voice-typing game.

Brain research is an important part of the research at Beckman and the Open House will feature many examples of this work. Intriguing new research into a brain-computer interface (BCI) will highlight the work of Artificial Intelligence group member Todd Coleman. Coleman has developed a BCI that enables users to spell out sentences in English using only their brainwaves. Justin Rhodes, a member of the NeuroTech group who researches motivational behaviors like alcoholism and drug abuse, will have an exhibit that has visitors shoot baskets while wearing goggles that simulate alcohol intoxication.

Language and speech production are also key areas of Beckman research, as will be evidenced by several exhibits. Cognitive Science group member Chilin Shih will be demonstrating a rare and highly advanced instrument for measuring speech production

called an articulograph that lets visitors see movements of the lips, tongue, and other parts involved in speech as it is being produced. The voice typing game is part of Mark Hasegawa-Johnson's exhibit that features an automatic speech recognizer his laboratory is developing. Called the Universal Access Project, the technology enables people, including those with speech disorders, to enter text into a personal computer.

As always, technology development is an important part of the Beckman Institute Open House experience and 2009 will be no different. Yi Lu of the 3-D Micro- and Nanosystems group will be demonstrating the work of his lab that has used functional DNA technology to develop applications like a simple dipstick sensors for testing chemicals and biological samples for medical diagnostics and the environment. EROS, an imaging technique developed by Beckman researchers Monica Fabiani and Gabriele Gratton, uses infrared light to measure brain activity.

A special display in 2009 will highlight the 10-year anniversary of Bugscope, the Imaging Technology Group's (ITG) popular educational outreach program. Visitors will see how this unique program has let thousands of students in grades K-12 from around the world operate ITG's scanning electron microscope. Launched in 1999, Bugscope has enabled students and teachers from four continents and Australia view extraordinary images of insects and other samples in ways usually reserved for trained scientists.

The Beckman event will once again be held in conjunction with Engineering Open House on campus. Hours for the Beckman Institute Open House are 9 a.m. to 4 p.m. Friday, March 13<sup>th</sup>, and 9 a.m. to 3 p.m. Saturday, March 14<sup>th</sup>. Admission is free.



# *Celebrating Two Decades of Research Success*

*Beckman Institute 20<sup>th</sup> Anniversary Celebration Unites Past and Present for April 16 Event*

The upcoming Beckman Institute 20<sup>th</sup> Anniversary Celebration is looking like an A list event – one that everyone is invited to. Former and current University of Illinois and Beckman Institute officials and faculty are on the speakers list for the 20-year celebration, while the researchers, students, and staff members who are continuing the Beckman mission of interdisciplinary research in 2009 are being asked to join the party.

Set for April 16<sup>th</sup>, the 20<sup>th</sup> Anniversary Celebration will serve to reunite those who have been a part of Beckman history, honor them and those currently working at the Institute, and salute the past two decades of Beckman Institute successes.

The importance of the Beckman Institute to people at the University of Illinois is made obvious by the list of speakers for April's 20<sup>th</sup> Anniversary Celebration. Founding director Ted Brown will be the keynote speaker, while the two directors who followed him, Jiri Jonas and Pierre Wiltzius, will also give remarks. They will be joined by former University of Illinois President Stanley Ikenberry, chancellors and other campus officials, as well as the many others who were instrumental in the creation of the Institute and help ensure its continued existence as a premier center for interdisciplinary research.

Since its official opening in April of 1989 to today, the Beckman Institute has been a leader in a wide range of research fields such as neuroscience, nanoscale technology, and bioengineering. Beckman researchers have produced discoveries in biomedical applications like hearing aids and imaging techniques, new materials such as self-healing polymers, and in the science of the brain. In 2008, grant funding for research at the Institute was at an all-time high, new faculty were added, and research lines were generated while others

continued to thrive and expand.

The 20<sup>th</sup> Anniversary Celebration will honor the research that has taken place at the Institute and the many people who have made it all possible. What began more than 20 years ago with informal discussions about some type of privately-funded multidisciplinary research facility at Illinois led – through the efforts of people like Brown and Ikenberry and the generosity of Arnold and Mabel Beckman – to today's interdisciplinary research-based Beckman Institute. And, thanks to current Institute officials, faculty, students, and staff, Beckman remains as vital and relevant in 2009 as when it first opened two decades ago.

To celebrate the people and research that made and continue to make the Beckman Institute a research leader, a program will be held in the auditorium, followed by a reception in the atrium. Interim Director Tamer Başar will begin the 20<sup>th</sup> anniversary celebration program in the auditorium with opening remarks at 3 p.m., followed by speakers like Chancellor Richard Herman, Biological

Intelligence Co-chair William Greenough, Wiltzius, Jonas, and Brown.

A reception will be held following the speeches with a timeline display of important events in the Institute's history and refreshments.

The last time such an event was held at Beckman was in 1999, when Arnold Beckman returned for a celebration of his 99<sup>th</sup> birthday and the Institute's 10<sup>th</sup> anniversary. Arnold, who used to play piano for a silent movie theater during his high school days, performed on a grand piano for celebrants in the atrium. Many people were present for that event, including NeuroTech research coordinator Kathy



**The 20th Anniversary Celebration  
will honor the research that has  
taken place at the Institute  
and the many people who  
have made it all possible.**

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# FACULTY PROFILE

**I have seen what pouring chilled saline onto a seizing brain will do. I say why can't we just implant something that drops the cortical temperature and helps seizure patients?**

**— Huan (John) Wang**

Huan (John) Wang has practically got the field to himself. A neurosurgeon at Carle Clinic, Wang is starting a research line at the Beckman Institute that will go where almost no one has gone before: exploring the thermal properties of the brain.

"I am probably one of less than five (researchers) specifically studying brain temperature as a parameter," Wang said. "I'm interested in developing the field and in understanding it for normal states and for pathological states."

"As a neurosurgeon, obviously that would extend into potential therapeutic alterations, so we could have implantable devices to alter regional brain temperature and achieve therapeutic effects."

Wang said that while body temperature has been studied extensively, much less is known about the important role that temperature plays on brain function for one solid reason. "We essentially know very little about brain temperature because it's a well-protected organ."

Wang plans to change that through a new facility – tentatively called the Thermal Neuroscience Laboratory (TNL). Wang, who earned his M.D. at the University of Kentucky and did his residency with the University of Illinois College of Medicine, will continue to work as a neurosurgeon at Carle and will soon join faculty at the U of I College of Medicine. The TNL will serve as his hub for research into brain temperature.

Wang, a faculty member in Beckman's Bioimaging Science and Technology (BST) group, knows the importance of collaboration at the Beckman Institute. He is currently working with Beckman colleagues Brad Sutton and John Georgiadis from the College of Engineering toward development of a non-invasive cerebral imaging modality to get his project started. For the preliminary

studies of brain temperature they will be using magnetic resonance imaging (MRI).

"The starting point is having a non-invasive MRI protocol to evaluate brain temperature," Wang said. "We want to get a measurement for understanding thermal mapping, how brain temperature distributes from different areas of the surface to the core of the brain. We want to understand spatial and temporal variations for this parameter of the brain, and then extend that into what alterations it has in various pathological states involving the brain."

**I am probably one of less than five (researchers) specifically studying brain temperature as a parameter. I'm interested in developing the field and in understanding it for normal states and for pathological states.**

**— Huan (John) Wang**

Wang said the project's first goal using MRI – chosen for its non-invasive and high resolution qualities – will be to understand thermal properties in normal states of the brain, then move on to pathological states. He envisions other studies involving populations like the elderly and, in concert with the research and technology development, perhaps someday creation of therapeutic interventions such as an implantable device for controlling brain temperature.

"If in 10 years we can have a good understanding of temperature distribution from a spatial and temporal standpoint and study various pathological populations, say dementia with the aging population, we can understand how the temperature is different in these populations and why," he said. "And then we can see if there is any therapeutic

modulation we can do."

According to Wang, therapies could be developed even as the experimental research matures.

"They are not mutually exclusive," he said. "The parallel project will be developing a potential implantable device to alter brain temperature in a rapid (way). The therapeutic implication is that, even if you don't understand brain temperature, you know in certain states that lowering brain temperature will arrest a pathological process such as seizures."

Wang's research is informed by the fact that he has had firsthand experience dealing with brain pathologies.

"I have seen what pouring chilled saline onto a seizing brain will do," he said. "I say why can't we just implant something that drops the cortical temperature and helps seizure patients?"

Wang said the research area of cerebral thermal medicine and related topics is an important one. For example, he said, people with mental disorders can have different temperature distributions in their brain because of their pathological state.

"Thermal properties are important, perfusion is important, how much heat is coming in and how much is leaving, circulation, are all important," he said. "The best thing (about this research) is we would start to get a glimpse of the importance of brain temperature."

"We all know it's important but we don't know its temporal variation. Body temperature, we know that in the morning it is lower and in the afternoon it is higher and what it does in disease states. But we don't know what the brain's normal physiological variations are. And that is an extended project of its own."

# RECENT BECKMAN INSTITUTE RESEARCH IN THE NEWS



## **SCIENTISTS PROVE GRAPHENE'S EDGE STRUCTURE AFFECTS ELECTRONIC PROPERTIES**

February 16 – A paper by Beckman Institute faculty member Joseph Lyding and graduate student Kyle Ritter that appears online in the Feb. 15 issue of *Nature Materials* reports on their experimental results that will help push research into using graphene as a material for electronic devices toward practical applications.

*U of I News Bureau*

## **MIXING MOBILE DEVICE USE AND DRIVING PUTS ELDERLY, YOUNG AT RISK**

February 16 – Elderly and younger drivers are most at risk of getting into an accident when they talk on a mobile device while driving, according to Art Kramer, a Beckman researcher and psychology professor at Illinois.

*CNN*

## **NANOTECHNOLOGY HEATERS AND THERMOMETERS FOR THERMAL PROCESSING OF NANOMATERIALS**

February 10 – Researchers have reported an approach to fabricate a 100-nanometer-sized heater/thermometer using contact photolithography and controlled anneal conditions, says Beckman researcher and U. of I. mechanical engineering professor William King.

*Nanowerk News*

## **CARBON NANOTUBE AVALANCHE PROCESS NEARLY DOUBLES CURRENT**

February 8 – By pushing carbon nanotubes close to their breaking point, researchers at the University of Illinois, including Beckman affiliate Eric Pop, have demonstrated a remarkable increase in the current-carrying capacity of the nanotubes, well beyond what was previously thought possible.

*U of I News Bureau*

## **RESEARCHERS FIND PHYSICAL ACTIVITY IMPROVES QUALITY OF LIFE**

January 27 – Researchers at Illinois, including Beckman's Edward McAuley, have found physical activity is associated with a small improvement in the quality of life for those with multiple sclerosis.

*London Free Press*

## **TWISTABLE, STRETCHABLE ELECTRONICS CREATED**

January 27 – John Rogers, a Beckman researcher and U. of I. professor of materials

science and engineering, is collaborating with a professor at the University of Miami and a professor at Northwestern University in the development of a design for stretchable electronics.

*UPI*

## **SUPERCOMPUTING HITS THE DESKTOP**

January 26 – John Stone, a senior research programmer at the U. of I.'s Beckman Institute, has long been a user of HPC clusters, and says a personal supercomputer brings a level of convenience not seen with traditional systems.

*Design News*

## **FABRICATING 3-D PHOTONIC CRYSTALS**

January 21 – John Rogers, a Beckman researcher and U. of I. professor of materials science and engineering, colleagues at Illinois, and a team from Sandia National Laboratories in Albuquerque, N.M., have developed a simple technique that allows for the fabrication of silicon photonic crystals in 3-D.

*PhysOrg.com*

## **LEBURTON REPORTS ON LACK OF THERMOELECTRIC EFFECT IN METALLIC CNTs**

January 13 – Jean-Pierre Leburton, head of the Computational Electronics group at Beckman, has reported on the absence of a thermoelectric effect in metallic carbon nanotubes, an important discovery for their potential use as conductors in future electronic devices.

*U of I News Bureau*

## **WORLD'S SMALLEST FUEL CELL PROMISES GREENER GADGETS**

January 8 – Mark Shannon, a Beckman researcher and U. of I. mechanical science and engineering professor, and Saeed Moghadam, a U. of I. chemical engineering researcher, have come up with a design for a tiny fuel cell that generates power without consuming it. Just 3 millimeters wide, it is the world's smallest working fuel cell.

*New Scientist*

## **INVISIBLE ELECTRONICS MADE WITH CARBON NANOTUBES**

January 6 – Researchers at Illinois, led by Beckman's John Rogers, have turned to single-walled carbon nanotubes in their search for materials that can offer higher mobility and better performance in flexible circuitry.

*Nanowerk News*

## **SCIENTISTS FOOL BACTERIA INTO KILLING THEMSELVES TO SURVIVE**

December 16 – Like a firefighter fighting fire with fire, researchers at the U. of I. and the University of Massachusetts at Amherst have found a way to fool a bacteria's evolutionary machinery into programming its own death. "The basic idea is for an antimicrobial to target something in a bacteria that, in order to gain immunity, would require the bacteria to kill itself through a suicide mutation," said Gerard Wong, a Beckman affiliate and professor of materials science and engineering, of physics, and of bioengineering at the U. of I.

*U of I News Bureau*

## **PAPER-THIN SPEAKERS MADE FROM CARBON NANOTUBES**

December 11 – Earlier this year, scientists at Illinois demonstrated the first radio receiver made from carbon nanotubes. Now Chinese researchers have built the speakers to go with it – out of the same material. "I think it's very cool," says John Rogers, a Beckman researcher and professor of materials science and engineering at the U. of I. who led the development of the nanotube radio.

*IEEE Spectrum*

## **BECKMAN RESEARCHERS REPORT COGNITIVE SKILL TRANSFER EFFECTS**

December 11 – A new study by the Beckman Institute's Art Kramer and Beckman Fellow Chandramallika Basak reports that that, for the first time, a training program produced cognitive skill effects that could be transferred to skills not related to the experiment. Using an interactive video game, the researchers found that multi-dimensional training can affect several individual components of cognitive function.

*U of I News Bureau*

## **BECKMAN RESEARCHERS DEVELOP NEW SELF-HEALING COATINGS**

December 9 – Beckman Institute researchers Scott White and Paul Braun have developed new self-healing coatings that automatically repair cracks and other failures for potential applications as additives in automotive paint or patio furniture finishes.

*U of I News Bureau*

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# 20th Anniversary Celebration

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Bates, who remembers with amazement the 99-year-old Arnold's virtuosity on the piano.

"They sat him in front of it and it was amazing," Bates said. "His fingers were just flying. You talk about a man who could use both sides of his brain – wow. He was great."



*Arnold Beckman playing piano in the Beckman Institute atrium in 1999.*

While many people remember Arnold's playing, not many know that he also played piano during that same trip for a Boys and Girls Club dinner he attended in his hometown of Cullom. Beckman attendant Chris Roberts chauffeured Arnold and his daughter Pat around during that visit from their home in California.

"It was going to be his last time here," Roberts said. "We were walking around in the building and they saw this small piano and his daughter said 'hey dad why don't you get on there and play a song?' and he went over there and started playing. It was kind of surprising with him getting a little up there in age."

While Arnold, who passed away in 2004 at the age of 104, won't be around for this celebration, his daughter Pat is tentatively scheduled to join the festivities.

Arnold and Mabel Beckman donated \$40M through the Beckman Foundation in late 1985 to build the Institute. The building wasn't completely finished until 1989 but personnel began moving into the facility in 1988 and faculty and more staff followed in the early months of 1989.

The official opening of the Beckman Institute took place April 7<sup>th</sup> 1980 with Arnold, Mabel, Brown, Ikenberry, Illinois governor James Thompson, and many others on hand. In one of the many speeches given that day, Arnold said that the Beckman Institute facility "exceeded all my expectations."

Many of those same people will be back for the 20<sup>th</sup> anniversary celebration because of what the Beckman Institute means to them.

## BECKMAN IN THE NEWS

**CONTINUED**

### A CURIOUS ANTIPATHY FOR WATER

December 5 – Beckman affiliate and U. of I. materials science professor Steve Granick and U. of I. materials science research scientist Sung Chul Bae write about the curious effect known as hydrophobicity.

*Science*

### WHEN DNA IS NOT DESTINY

November 24 – Scientists are finding that "social information alters gene expression in the brain to change the way an animal behaves," says neuroscientist David Clayton, a Beckman researcher and professor of cell and developmental biology at the U. of I.

*Newsweek*

### RESEARCHERS MAKE NEW ELECTRONICS - WITH A TWIST

November 24 – John Rogers, a Beckman researcher and U. of I. professor of materials science and engineering, and Yonggang Huang, a professor of civil engineering at Northwestern University, have improved their "pop-up" technology to create circuits that can be twisted.

*Cellular-News*

### GRANICK DEVELOPS METHOD TO ADVANCE USEFULNESS OF LIPIDS

November 10 – Beckman Institute researcher Steve Granick, a member of the 3-D Micro- and Nanosystems group, has developed a method for stimulating patchiness in phospholipid membranes, a process which could help in using the organic compounds in biomolecules and biosensors.

*U of I News Bureau*



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