

# *The* TREND *in Engineering*

THE UNIVERSITY OF WASHINGTON COLLEGE OF ENGINEERING NEWSLETTER AUTUMN 2010

## **Awakening the Inner Scientist**

Foldit game engages the public in research

*Pages 4-5*



The academic year begins with good news about the year just ended, and bad news from Olympia about continuing declines in state revenues and further across-the-board budget cuts.

The good news reveals the growing strength of our program and ability to maintain our most vital academic and research activities through these difficult times.

Last year for the first time, research funding surpassed \$100 million. Actually, we blasted past to \$112 million in awards. While the total includes some federal stimulus money, growth in research funding has been phenomenal, much of it due to young faculty who are winning big grants.

In each of the past four years we have brought in 12 to 15 new faculty members and are recruiting exceptionally well at the highest level. Only occasionally do we lose a candidate to MIT, Stanford, or Berkeley, and none to the next tier of Illinois, Michigan, UCLA, and UC San Diego. A story on page 7 introduces you to three new faculty we lured away from other

institutions, all outstanding researchers and teachers with growing reputations in their fields.

In June, we graduated the largest number of students ever — 770 with bachelors degrees, 400 masters, and 105 doctorates. Enrollments are up, but now we are at capacity, with no more resources to expand at the undergraduate level. We admit only 50 percent of UW students who apply to our programs for junior-year entry, and many fine students leave the state for engineering schools elsewhere.

Engineering slots at Washington universities increased only modestly over the past 30 years while the state's population roughly doubled, and the high-tech economic sector boomed. It's the perfect tsunami — a huge surge of interest in engineering careers, a flood of undergraduate applications, and no capacity to absorb them. The one benefit is the steadily rising quality of applicants; we could expand enrollment by 25–30 percent and still hold firm on quality.

This is not a national trend. Applications to most engineering schools are holding fairly steady, while students are pounding on our doors wanting to get into UW Engineering.

Maintaining the status quo in engineering enrollment fails to service the state. If Washington wants to expand its high-tech sector, it needs to make investments required to train more engineering students who will help fuel that expansion and build a stronger economy.

**"Students are pounding on our doors wanting to get into UW Engineering."**

*Matt O'Donnell, Dean of the UW College of Engineering*

### *Rising Higher* **Lidstrom Now #2 at UW**



Mary Lidstrom recently became interim provost, filling the role Phyllis Wise left when the Board of Regents tapped her to serve as interim president following the departure of Mark Emmert.

A professor of chemical engineering and microbiology, Lidstrom holds the Frank Jungers Endowed Chair in Engineering and has been the vice provost for research since 2005.

Previously she was Engineering's associate dean for new initiatives. As the university's chief academic and budgetary officer, she will provide leadership in educational and curriculum development, long-range strategic planning, and management of research programs.



*Jim Hermanson*



*Per Reinhall*

### **New Chairs for AA & ME**

Two UW Engineering alums from the class of 1977 who earned their doctorates at California Institute of Technology now share yet another bond in recent promotion to chair a department.

Professor Jim Hermanson, associate chair of Aeronautics & Astronautics since January 2009, succeeds Adam Bruckner. His research interests are fluid dynamics, including compressible flow, combustion, and multi-phase flow.

Professor Per Reinhall succeeds Mark Tuttle in Mechanical Engineering. His research interests include studying vibrations in diverse structures and devices, plus a new focus on fuel cells.



## Are Graduating Students Ready for Professional Practice?

Enabling Engineering Student Success, a new publication by the NSF-funded Center for the Advancement of Engineering Education (CAEE), identifies key opportunities for improving how engineering undergraduates are prepared for professional practice.

“With the increasingly global need for engineers who are both technically and interpersonally competent, today’s engineering students may be under-prepared,” said Cindy Atman, CAEE director, lead author, and UW professor of human-centered design and engineering. “They may not recognize that getting engineering work done requires sound technical ideas that respond to real needs, and the ability to collaborate with a wide range of individuals.”

The report describes findings from CAEE’s Academic Pathways Study, a multi-year research effort involving more than 5,400 students at more than 20 institutions, and over 100 newly hired graduates. The report also offers questions to consider for faculty and others who support engineering education.

The CAEE report is available for download from the center’s website: <http://www.engr.uw.edu/caee/>

## Molecular Engineering Building

See slide show updates and a web cam at: <http://www.engr.uw.edu/about/bldgs/mole.html>



TOP: Members of the panel on Engineering Better Medicines (L to R) – Bruce Montgomery, senior vice president for respiratory therapeutics, Gilead Sciences, Inc.; Suzie Pun, Robert F. Rushmer Associate Professor in Bioengineering, University of Washington; Nicholas A. Peppas, chair of biomedical engineering and Fletcher Stuckey Pratt Chair, The University of Texas at Austin; and Lonnie Edelheit, retired senior vice president for research and development, General Electric Co.

LEFT: Alon Halevy, head of structured data management research at Google, discusses barriers to data analysis during the panel on Engineering the Tools of Scientific Discovery.

## NAE Grand Challenges Summit a Stimulating Forum

How can genetic therapies become a reality? Can we continue to send humans into space, or should we send only robots? How will we store and make sense of the flood of data generated by science? More than 500 engineers, scientists, policy makers, students, and others converged on Seattle May 2–3 for robust presentations and discussions on these questions and others. They focused on the themes “engineer better medicines” and “engineer the tools of scientific discovery.” The event was one of six regional forums held this year to consider how the National Academy of Engineering Grand Challenges will affect our lives and how best to address them.

Students, a key component of the summit, explored how these challenges will shape their careers and how their work will focus on finding solutions. The top three winners of the student poster competition will attend the national NAE Grand Challenges Summit this fall in Los Angeles.

Watch sessions on UWTV or online at [www.uwtv.org](http://www.uwtv.org)

## More UW Engineering News Online!

[www.engr.uw.edu/news/news.html](http://www.engr.uw.edu/news/news.html)

### • Deaf, Hard-of-hearing Students Do First Test of Sign Language by Cell Phone

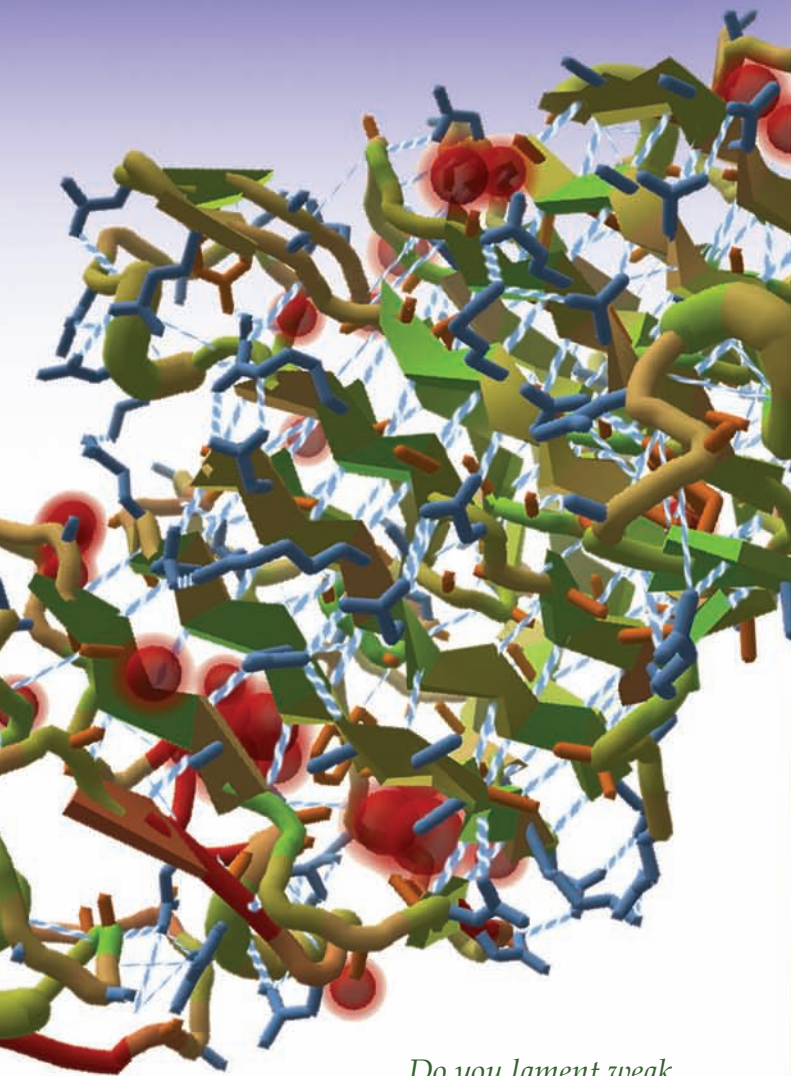
UW engineers are developing the first device able to transmit American Sign Language over U.S. cellular networks.

### • A Strategy to Fix Broken Hearts

Collaborating UW engineers and physicians have built a scaffold that supports the growth and integration of stem cell-derived cardiac muscle cells and promotes blood vessel growth.

# Awakening the Inner Scientist

*Foldit game engages the  
public in research*



*Do you lament weak  
public interest in science?  
Worry that relentless advances in  
computer power are supplanting brain  
power? Take heart. Legions of people  
who may not know a peptide from a  
quark are discovering their inner  
scientist and are proving that  
the brain can still beat a computer.*

**An intriguing computer game** conceived on the slopes of Mount Rainier and launched into global cyberspace at the University of Washington is proving that science is cool. Now close to 200,000 registered players around the world are playing Foldit and tackling thorny problems in protein folding that stump even a super-computer. Foldit is barely a ripple in the tsunami of 11 million people addicted to the “World of Warcraft” game, but Foldit’s ardent players are not whiling away the hours simply pursuing an adrenaline rush. They are helping advance knowledge in biochemistry that could lead to new treatments for disease.

Serious scientists are paying attention. Foldit’s creators recently published a paper in *Nature* (Aug. 5), reporting that game players are at least equal to and sometimes better than a computer in folding long chains of amino acids into compact three-dimensional shapes.

Proteins function properly in the body only when they are in the correct shape to allow the amino acid components to participate in biochemical reactions. Folding mistakes seem to be associated with a variety of health problems ranging from allergies to neurodegenerative disorders. Knowing how a specific protein folds into the right shape is important to understanding disease causes and developing new therapeutic drugs. The problem is that a newly formed amino acid chain could theoretically twist and fold into millions of possible shapes. Figuring out how they fold correctly and predicting the proper shape for a specific protein is one of the most difficult challenges in molecular biology, and trillions of calculations are needed to model even a small protein.

## **A New Path**

During a hike at Mount Rainier in 2006, computer science and engineering professor David Salesin and biochemistry professor David Baker mulled over a problem with Baker’s software program to predict the shapes of folding proteins. Called Rosetta@home, it performs trillions of calculations during downtime on the computers of about 200,000 volunteers. Some wrote to Baker saying they noticed the computer doing silly things while testing every possible pathway to find the best fold. They wanted to help guide the analysis.

Baker asked Salesin for advice on how to make the network more interactive. By the time they returned to the trailhead, they had settled on a multiplayer online game, and Salesin referred Baker to Zoran Popović, CSE associate professor and a computer graphics and animation expert. Popović enlisted the skills of two of his doctoral students, Seth Cooper and Adrian Treuille (CSE PhD ’08), the latter now an assistant professor at Carnegie Mellon.

To make Foldit fun and accessible for players with no scientific training, the team ditched technical terms and developed a game with colorful graphics, upbeat music, and tools named “wiggle,” “shake,” and “freeze.” Just as in other multiplayer games, rewards, feedback, and



community networking are central to maintaining engagement. Players compete individually or in teams to achieve high scores based on the stability of their folded structures, and they can share strategies in chat rooms and blogs.

## Citizen Scientists

People of all ages and backgrounds are playing Foldit, launched in 2008. Good visualization skills are an asset, but players learn all they need to know simply by playing, and biochemists tend to perform no better than laypersons. People especially excel over computers when a folding problem requires an intuitive leap or strategy shift.

The game continues to evolve through interchange among players, developers, and scientists. Obtaining valid scientific folding results is a key goal; another is to incorporate the best player strategies into Rosetta@Home to enhance the computer's capabilities. The team has brought a few top-scoring players to the UW to observe their folding strategies.

## Power of the Collective Brain

Foldit enlarges the scientific team. The *Nature* article credited the role of more than 57,000 players. Recent media coverage spurred a huge influx of new players, nearly quadrupling the registered number and still growing. In the 24 hours after NPR interviewed Popović, more than 4,300 signed on.

"It's great that Foldit has received wide recognition, due in no small part to the dedication of the players," Cooper said.

Other broad-based public scientific networks are searching for signs of intelligent life in the universe, looking for stardust, and classifying galaxies by shape. Any vestiges of the "lone scientist" myth are doomed.

"It's a new kind of collective intelligence, as opposed to individual intelligence, that we want to study," Popović said. "We're opening eyes in terms of how people think about human intelligence, and the possibilities when you get huge



Associate Professor Zoran Popović leads CSE's Foldit team.

"They were better players than anyone in our lab, and some used techniques that had never occurred to any of us," said Firas Khatib, a postdoctoral researcher in Baker's lab.

"People in the scientific community think Foldit is a great idea, but ask 'What can it produce in terms of results?' People are good at building things, so I'm expecting that people will be very good at building proteins," said Popović.

Seth Cooper says the next direction for Foldit is to design totally new proteins that don't exist in nature, but may help cure diseases. Baker is challenging players to design one that might cure HIV. Medical researchers would use the new proteins to develop therapies. Other new proteins might help address environmental or energy problems.

"Some player designs have looked so good that they have been tested in the wet lab, and we're working on making more of those," Cooper said.

"I am involved in something that has real relevance in the scientific world. It makes you very proud of what you do." *Charlie, player in England*

numbers of people together to solve a very hard problem. We hope the *Nature* paper will convince people who were sitting on the sidelines that the whole genre of scientific discovery games will really take off. Foldit will become part of a new Center of Game Science we have established in CSE."

The research was funded by the National Science Foundation, the U.S. Defense Advanced Research Projects Agency, the Howard Hughes Medical Institute, Microsoft Corp. and Nvidia Corp.

Try your hand at playing the game: <http://fold.it>

Foldit videos are on YouTube at:  
<http://www.youtube.com/user/uwfoldit>.

On the YouTube site, search "Biology for Gamers" to watch an excellent NatureChannel Video:

Nature paper: <http://dx.doi.org/10.1038/nature09304>

COVER IMAGE: In a 2010 experiment, the Protein Prediction Center challenged experts in 111 labs and groups worldwide to determine the natural folded state of this unsolved protein and others. The results will be announced in December.

Foldit's designers create protein models in a cartoon style with distinctive shapes so players can easily identify components and manipulate them with the click of a mouse. Prior to folding, predominant colors are red, orange, and yellow, indicating areas that need work. The colors turn mostly green when a protein folds close to its natural state, as in the image on page 4. The red balls indicate cavities that a player should try to eliminate.

## Yaw Anokwa Honored with Pizzigati Prize for Software

CSE doctoral student Yaw Anokwa was honored with the 2010 Antonio Pizzigati Prize for Software in the Public Interest for his work to make cell phones a more powerful resource for social change. He led a team of doctoral students who created Open Data Kit, a modular set of tools that helps nonprofit organizations around the world collect data on everything from deforestation to human rights violations.

Released last spring, the software turns cell phones into tools for collecting data in the field and moving it, with just a few finger swipes, to central Web-based servers or local computers. Users can capture and export text, photos, video, audio, and barcodes. The software was incubated at Google Seattle and uses the Android platform. More than 4,400 users have downloaded the free software and people from 178 countries have visited the website. The team will use the \$10,000 prize to deepen ODK's interaction with users.



## CSE Alumnus Recognized as a Top Young Innovator

T. Scott Saponas (CSE PhD, '10) is the latest UW Engineering alum cited in the Technology Review TR-35 list of the 35 most promising innovators under the age of 35. Each year the editors of MIT's *Technology Review* honor young technologists and scientists whose inventions and research are changing our world. Two alumni made the list in 2009 and two in 2007.

"Fingers flicking through the air, T. Scott Saponas is rocking a solo in the video game Guitar Hero — without a guitar. A soft band around his forearm monitors the muscles moving his fingers and hand. The band hides a ring of six electrodes that pick up the weak electrical signals produced by active muscle tissue. The signals are relayed to a computer, which controls the game ..." (<http://www.technologyreview.com/tr35>).

While a CSE grad student, Saponas developed software to process the jumble of signals from the muscle mass in the arm. A jogger using the armband system could tense hand muscles to switch tracks on an MP3 player without breaking stride, or a mechanic repairing an engine could use it to control a heads-up display. Now at Microsoft Research, Saponas continues to improve his system by combining the muscle interface with other sensors, including accelerometers and gyroscopes, to provide additional precision.



Julie Medero and Gabe Cohn

## Three EE Grad Students Win NSF Fellowships

Electrical Engineering has scored big on the NSF fellowship front this year. Three EE doctoral students have received three-year awards from the National Science Foundation's Graduate Research Fellowship Program (GRFP).

Julie Medero is working under Professor Mari Ostendorf to conduct research on natural language processing applications for automatic text simplification for ESL students.

Gabe Cohn works with Assistant Professor Shwetak Patel in the Ubiquitous Computing Lab. His interests include circuit design, embedded systems, VSLI, and other areas.

Linda Bai is researching network tomography in the Fundamentals of Networking Laboratory with Professor Sumit Roy.

## AA Student Heads Abroad on Bonderman Travel Fellowship

AA junior Luke Jensen is an honors student and a leader, but he is on his own for eight months of solo travel in South America, China, and other Asian countries. Each year, coveted Bonderman Fellowships grant 14 students \$20,000 to travel, learn, explore, and grow. Jensen says he will travel "with an open mind and a willing heart, turning my engineering education into a well-rounded understanding of what comes next for me and my neighbors all around the world."

## CEE Student Awarded Udall Scholarship

Geoffrey Morgan, a senior honors student and double major in civil/environmental engineering and international studies, has won a prestigious Morris K. Udall Scholarship. Morgan is fluent in Chinese and spent a year in China conducting independent research under the UW-Sichuan University program. He also has studied at the UW Rome Center. Morgan plans a career focused on sustainable development.

## Mari Ostendorf Will Receive National Education Award

Mari Ostendorf, associate dean for research and graduate studies and professor of electrical engineering, is being honored for encouraging and supporting increased participation of women in electrical/computer engineering. She receives the 2009 Harriett B. Rigas Award October 28 at the Frontiers in Education (FIE) Conference in Washington, D.C. This award from the IEEE Education Society is sponsored by Hewlett-Packard. FIE is an international conference of professional organizations focused on education innovations for computer science, electrical engineering, and technology.

## Buddy Ratner to Deliver University Faculty Lecture

Buddy Ratner, professor of bioengineering and chemical engineering, will deliver the 2010 University Faculty Lecture this fall. The distinction honors faculty whose achievements have had a substantial impact on their profession, their research field, or society. Ratner's research focuses on tissue engineering and specially designed biomaterials used in medical devices and implants. He holds the Michael L. & Myrna Darland Endowed Chair in Technology Commercialization and directs the UW Engineered Biomaterials Center. Check the UW calendar for the date of this free public lecture.

## Yoky Matsuoka is UW Medicine's 2010 Emerging Inventor of the Year

Yoky Matsuoka, the Torode Family Endowed Career Development Professor in Computer Science & Engineering, has been recognized by UW Medicine as the 2010 Emerging Inventor of the Year. She will be honored at a reception on October 26. Matsuoka is developing an anatomically correct robotic hand to investigate the neural control of human hand movements. The goal of this work is a prosthetic hand capable of executing detailed hand movements autonomously or with natural neural signals.

**NEW FACULTY** *Ten exceptional new faculty members join the College this academic year. We highlight three here. Meet all ten at: <http://www.engr.uw.edu/facresearch/newfaculty2010.html>*



### Cecilia Aragon

**Human Centered Design & Engineering  
Adjunct: Computer Science & Engineering  
and Information School**

Cecilia Aragon has been a staff scientist in the Computational Research Division at Lawrence Berkeley National Laboratory since 2005. Her research focuses on scientist-computer interaction, particularly how social media and computer-mediated communication are changing scientific practice. Other interests include computer-supported cooperative work, visualization, visual analytics, image processing, machine learning, cyberinfrastructure, and astrophysics. Aragon received the 2008 Presidential Early Career Award for Scientists and Engineers. She is a founding member of Latinas in Computing. She earned her doctorate at UC-Berkeley.



### Hugh Hillhouse

**Chemical Engineering**

Hugh Hillhouse joins the faculty as the Rehnberg Chair of Chemical Engineering, the department's first endowed chair. He comes from the National Renewable Energy Laboratory and the School of Chemical Engineering at Purdue. He works on molecular and nanoscale science and engineering for renewable energy technologies. He studies the fundamentals of molecular self-assembly of nanostructured films, and the development of new tools for x-ray scattering analysis of nanomaterials and of highly ordered arrays of semi-conductor quantum wires for high-efficiency solar cells. Among his honors are a National Science Foundation Career Award. He earned his MS in chemical engineering at UW ('96) and PhD at the University of Massachusetts, Amherst.



### Joshua Smith

**Computer Science & Engineering  
and Electrical Engineering**

Joshua Smith joins the faculty in winter 2011 from Intel Research Seattle, where he was a principal investigator. He recently was an affiliate assistant professor in CSE and EE. Smith's research interests include inventing new sensor systems, devising new ways to power them, and developing algorithms for using them. The research has application for ubiquitous computing, robotics (including novel sensors for robotic manipulation), and human computer interaction. Smith earned his doctorate in media arts and sciences at MIT and an MA in physics and theoretical physics at University of Cambridge.



371 Loew Hall, Box 352180  
Seattle, Washington 98195-2180

Matthew O'Donnell, PhD  
*Frank & Julie Jungers Dean of Engineering*

Judy Mahoney  
*Assistant Dean for Advancement*

Heather Hoeksema  
*Director of Communications*

Sandy Marvinney  
*Editor*

Hannah Hickey  
*Contributing Writer*

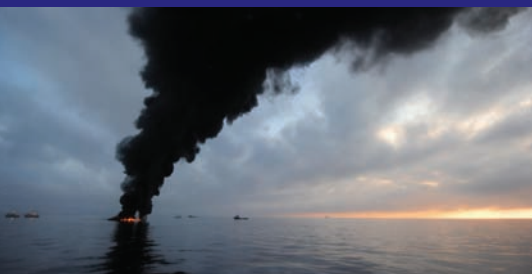
Mary Levin  
*UW Photography*

Send address comments or corrections to:  
Editor, The Trend [trend@engr.washington.edu](mailto:trend@engr.washington.edu)

# The TREND in Engineering

## 2010 ENGINEERING LECTURE SERIES

## Engineering in the Headlines



### High-Pressure Crisis in the Gulf **Wednesday, October 13**

James Riley, PACCAR Professor, Mechanical Engineering  
Alberto Aliseda, Assistant Professor, Mechanical Engineering

Desperate for an accurate assessment of how many barrels of oil a day were spewing into the Gulf of Mexico, the U.S. government pulled together a national task force of scientific experts that included two UW Engineering faculty members. Hear the story of this high-pressure, intensely challenging assignment.



### Going for the Green: London 2012 **Thursday, October 21**

Robert G. Card (BSCE '75), President, Facilities and Infrastructure Division, CH2M Hill

Colorado-based engineering firm CH2M Hill and two British partners are racing to the finish line as they complete multibillion-dollar facilities for the 2012 Olympics. Their legacy will be an all-new sustainable city on the outskirts of London. Bob Card describes the challenges of this Herculean effort and London's quest for both the gold and green.



### Driven to Distraction **Wednesday, November 3**

Linda Ng Boyle, Associate Professor, Industrial & Systems Engineering and  
Civil & Environmental Engineering

Mobile phones, PDAs, GPS devices, and glowing digital dashboards are drawing our gaze away from the road. Crashes occur and states pass laws, but will our habits change? Such devices are not only here to stay, they are multiplying. Professor Boyle is developing systems to help distracted drivers and keep our roadways safe.

**All lectures are at: 7 pm, Kane Hall 120, UW Campus — FREE! Registration required, online to [UWalum.com](http://UWalum.com) or call 206-543-0450**