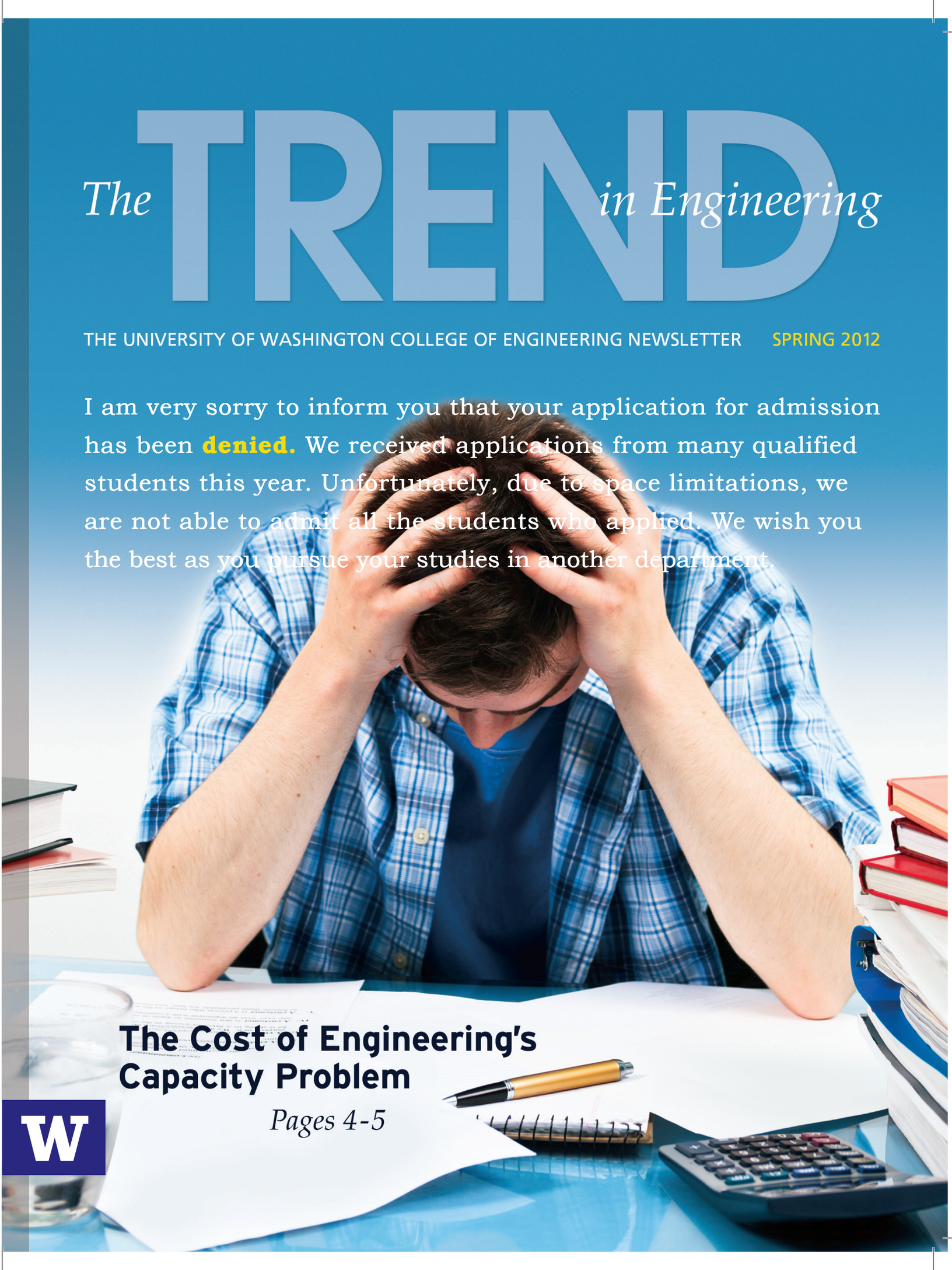
The TREND *in Engineering*

THE UNIVERSITY OF WASHINGTON COLLEGE OF ENGINEERING NEWSLETTER SPRING 2012

I am very sorry to inform you that your application for admission has been **denied.** We received applications from many qualified students this year. Unfortunately, due to space limitations, we are not able to admit all the students who applied. We wish you the best as you pursue your studies in another department.



The Cost of Engineering's Capacity Problem

Pages 4-5

Time to Grow UW Engineering

TODAY'S STUDENTS want to make a difference in our world and they think big. It's exciting to see what they accomplish every day through their course and lab work, and when they compete nationally. Here are some great examples: bioengineering senior Cameron Turtle was recently named a Rhodes Scholar; an interdisciplinary UW team claimed the world championship in synthetic biology at the International Genetically Engineered Machine competition; an enterprising team of mechanical engineering students were selected to compete in the EcoCAR Challenge; many more have won research awards and exciting job offers.

As proud as I am of these students, I am painfully aware of hundreds of other would-be engineers who weren't admitted in spite of very good qualifications, because we just don't have the available slots. We want to grow. Our local industry partners need more graduates, and there is a strong pipeline of bright high school kids preparing now for future careers as engineers. Over the past many months, we've begun to develop models for growth – not just growth at the margins, of a few students here and there, but the addition of a few hundred students – enough to have real impact.

What does it take to grow at this kind of level? At this time, funding is necessary, and at a future date, facilities will be needed. As state support has waned, we have become more efficient, yet the simple fact is that engineering education isn't cheap – and the resources we have aren't enough. One idea on the table, a program fee, would require a substantial increase in private funds – gifts from alumni, friends and industry – to provide new sources of financial aid and scholarships for engineering students.

My new mantra is "access to education has two A's – affordability and availability." We need to ensure all qualified students will have a chance to pursue an engineering education. How can you help? Read our cover story and let me know your thoughts. Together we must work with the State of Washington to create more slots, maintain high quality and ensure that a student from any economic background can become a Washington Engineer.

"Our local industry partners need more graduates, and there is a strong pipeline of bright high school kids preparing now for future careers as engineers."

Matt O'Donnell
Frank & Julie Jungers
Dean of Engineering

Research Symposium to Explore Molecular Engineering & Sciences

The finishing touches are being put on the new Molecular Engineering & Sciences (MolES) building near the west entrance to campus. The MolES Institute brings together interdisciplinary teams to catalyze translational research in the biotech and cleantech fields. The new building will provide cutting-edge research facilities for more than 15 research groups, three research centers, and a state-of-the-art molecular analysis facility.

Save the Date! Tuesday, September 18, 2012

Join us to celebrate the launch of the institute at a special one-day research symposium that draws together leaders from cleantech and biotech to contemplate the challenges and envision the future of this emerging field. Confirmed speakers include Dr. Jay Keasling and Dr. Peidong Yang from the University of California, Berkeley, and Dr. James Buntaine of Konarka Technologies. The symposium will include a tour of the new facility.

▶ **A complete schedule of activities will be posted this summer at: http://www.moles.washington.edu/**

Charged Bodies: Ferroelectricity discovered in mammalian tissue

By Hannah Hickey

THE HEART'S INNER WORKINGS are mysterious, perhaps even more so with a new finding. UW engineers have discovered an electrical property in arteries not seen before in mammalian tissues.

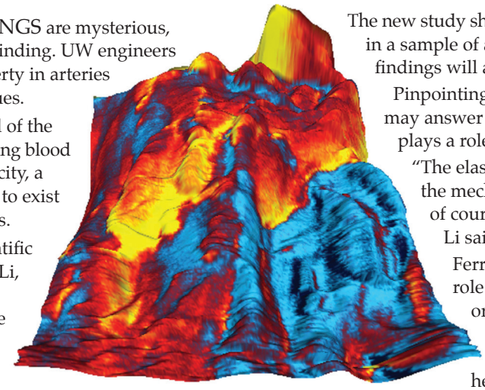
The researchers found the wall of the aorta, the largest blood vessel carrying blood from the heart, exhibits ferroelectricity, a response to an electric field known to exist in inorganic and synthetic materials.

"The result is exciting for scientific reasons," said lead author Jiangyu Li, associate professor of mechanical engineering. "But it could also have biomedical implications."

A ferroelectric material is an electrically polar molecule with one side positively charged and the other negatively charged, whose polarity can be reversed by applying an electrical field.

Ferroelectricity is common in synthetic materials and used for displays, memory storage, and sensors.

Li collaborated with co-author Katherine Zhang at Boston University to explore the phenomenon in biological tissues. The only previous evidence of ferroelectricity in living tissue was reported in seashells. Others had looked in mammal tissue, mainly in bones, but found no signs of the property.



The new study shows clear evidence of ferroelectricity in a sample of a pig aorta. Researchers believe the findings will also apply to human tissue.

Pinpointing the source of the ferroelectricity may answer questions about how or whether it plays a role in the body.

"The elastin network is what gives the artery the mechanical property of elasticity, which of course is a very important function," Li said.

Ferroelectricity may therefore play a role in how the body responds to sugar or fat. Diabetes is a risk factor for hardening of the arteries, or atherosclerosis, which can lead to heart attack or stroke. The team is investigating the interactions between ferroelectricity and charged glucose molecules, in hopes of better understanding sugar's effect on the mechanical properties of the aortic walls.

Another possible application is to treat a condition in which cholesterol molecules stick to the inside of the channel, eventually closing it off.

"We can imagine if we could manipulate the polarity of the artery wall, if we could switch it one way or the other, then we might, for example, better understand the deposition of cholesterol which leads to the thickening and hardening of the artery wall," Li said.

NAE Honors David Stahl

UW Engineering's newest member of the National Academy of Engineering (NAE) is David Stahl, professor of civil and environmental engineering.

The NAE honored Stahl for his application of molecular microbial ecology to environmental engineering. Stahl's research concerns microbes and the role they play in processing nutrients. He also studies evolution and competition among microbial communities, and how to harness microbes for the bioremediation of polluted sites. Election to the Academy is among the highest professional distinctions accorded an engineer.

Stahl is author of more than 220 academic papers and is co-author of a NASA and Jet Propulsion Laboratory report on handling samples from Mars; a National Research Council task group report on possible human contamination of Jupiter's moon Europa; and an American Academy of Microbiology report titled "Microbial ecology and genomics: A crossroads of opportunity."

Also elected this year are UW affiliate professor Henrique Malvar and UW alumnus Peter Farrell.

▶ **Read more at www.engr.uw.edu/news**

Junior Faculty Win Coveted NSF CAREER Awards

Three junior faculty have been awarded National Science Foundation CAREER Awards. The grants typically provide funding of $400,000 to $500,000 over four to five years. Two of this year's recipients, Marco Rolandi and Xiadong Xu, are assistant professors in materials science and engineering. James Pfaendtner, an assistant professor in chemical engineering, is the other recipient.

▶ **Read more at www.engr.uw.edu/facresearch/awards.html**

The Cost of Engineering's **Capacity Problem**

By Stuart Glascock

LIKE MANY OF HER POST-DOT-COM-BUBBLE PEERS, UW sophomore KeliAnne Hara focuses her career sights on a bigger picture, beyond mere economic self-interest. An aspiring bioengineer, she wants to make a difference, to impact the environment or basic infrastructure, or work in global health.

The 20-year-old forged a stellar academic achievement record. A well-rounded student, she entered the UW with an impressive Issaquah high school transcript packed with advanced placement credits and extra-curricular skills. She slam-dunked her UW engineering prerequisites.

Confident but cautious, she applied to the bioengineering program at the UW College of Engineering. Then, in what seems like a strange plot twist, a rejection email dropped in her inbox. As has happened to so many others, she slammed head-on into the capacity problem.

"It was incredibly competitive and I didn't get in," Hara said. "At the UW, you can be smart, but not smart enough."

Hers is not an isolated example. Good students collide into the capacity wall all the time. Sadly, the UW College of Engineering is unable to accommodate hundreds of highly qualified students every quarter – redirecting them to other UW majors, or dispatching them to other schools, often out of state.

"It was incredibly competitive and I didn't get in," Hara said. "At the UW, you can be smart, but not smart enough."

The capacity problem is not a soft rain, misting lightly on a select few; it's a downpour. Last year, in the Department of Computer Science & Engineering – the most over-subscribed department in the College – only 30 percent of qualified applicants could be accommodated. Last year, the College as a whole turned away more than 500 prospective engineering majors. Nearly half of upper-division applicants saw their goals blocked.

"It is heartbreaking," said Ed Lazowska, the Bill & Melinda Gates Chair in Computer Science & Engineering. "We are sending away outstanding students who would absolutely succeed in the program. It's depriving students of the preparation they need, and it's depriving employers of the employees they need."

Acutely aware of the conditions, administrators are exploring alternatives for growing enrollments, increasing student financial aid, and promoting engineering education.

The Governor and legislature recently approved a proposal to increase capacity in engineering programs and this will begin to address the backlog of students seeking an engineering education.

"Nobody likes the access predicament," says Matthew O'Donnell, dean of the UW College of Engineering. "We aren't talking about turning away kids who can't do algebra. We turn away UW students who have completed pre-reqs and have well above 3.0 averages, and we can't accommodate them."

Student demand far outstrips supply of classroom – and perhaps more importantly – laboratory seats. Paradoxically, at the same time, high-tech companies locally and nationally clamor for engineering talent. If the College doubled the number of engineers it graduated, local industry would absorb them all, O'Donnell insists.

At present, the two primary funding sources for undergraduate education – state funds and tuition – are increasingly inadequate. In fact, the UW's state funding has been cut 50 percent – over $200 million – in the past three years. In 1990, the state provided nearly 80 percent of funds to educate students; today the state funds only about 30 percent. Tuition has risen, but state funds and tuition do not cover the full costs for engineering programs.

At the UW, as well as on a national level, engineering education is more expensive to deliver than most other disciplines. It requires competitive faculty salaries, modern laboratories and up-to-date technology. Establishing a program fee for engineering students is one method that peer engineering schools nationally have employed, and is a method UW administrators are considering to ease the budget crunch. Such a fee would not be undertaken without a concurrent student aid plan to relieve the burden on students as much as possible.

"A program fee is on the table," O'Donnell said. "If we don't talk about it, we are shooting ourselves in the foot. The fundamental issue is that we can't charge tuition anywhere near what actually covers costs. With the right fee, we could accept more students, but access has two A's – affordability and availability. Affordability will require a substantial increase in financial aid to ensure that all qualified students can become Washington Engineers."

"With the right fee, we could accept more students, but access has two A's – affordability and availability."

Funding shortfalls are taking a toll. Undergraduate, UW in-state tuition and fees rose 20 percent last year, to $10,575. The costs have nearly doubled in five years. In 2006-07, in-state undergraduates paid $5,460 and about 10 percent more in fees. In engineering, direct impacts include a sharp decline in the number of teaching assistants and the elimination of electives.

"It is simple, just hard to accept," O'Donnell says. "It's not broken or inefficient systems. We are one of the most efficient major research institutions. It's not a pipeline issue. It's about capacity."

Remarkably, the number of UW engineering graduates has not grown during the astronomical rise of Seattle's high-tech marketplace. Some 30 years ago, Microsoft Corp. employed no one in Washington state; today, the global software titan's head count is 90,412.

The home-grown aerospace and computing industry broods over the same topic.

Jeremy Jaech, chairman of the Technology Alliance, a statewide industry organization, decries the shortage of qualified technical workers. Tech-focused companies – especially mid-size firms and start-ups – can't afford to hire nationally or internationally. A limited local talent pool holds them back.

"In the information science area, unemployment here is less than 3 percent. That's full employment. It's very competitive for hiring right now," says Jaech (MS, CS '80), who has led market-creating, job-generating software companies for three decades. He co-founded Aldus, creator of PageMaker layout software. He also started Visio, which was acquired by Microsoft. Jaech serves on the boards of a dozen software companies, one of which may flee to a state with more available engineers.

"If our own kids are not getting into the schools because of capacity issues, we are squeezing them out of a high-paying future," he said, urging College of Engineering alumni to get involved.

"Boeing is constantly looking for the best and brightest aerospace engineers and computer scientists," said Todd Zarfos, vice president of engineering for Boeing Commercial Aviation Services. "Boeing not only hires to expand business but also because of increasing retirements," said Zarfos (MS, EE '90). Boeing workers' average age is 48.

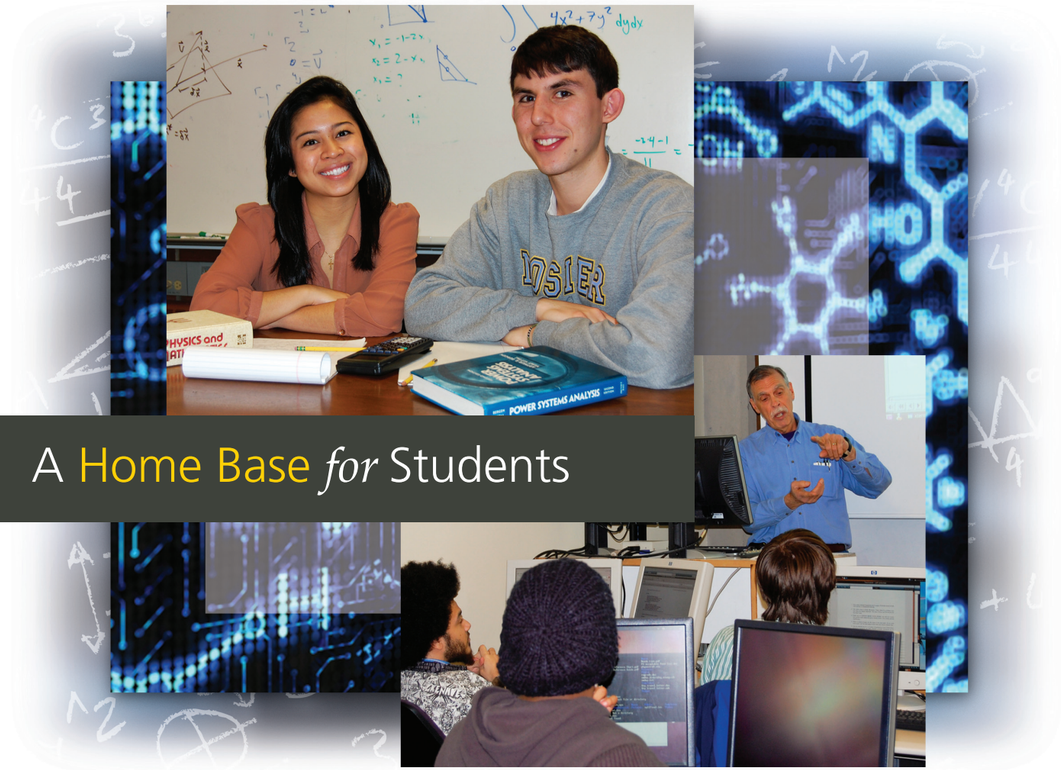
"Around 28 percent of our employees are retirement eligible," Zarfos said. "That will go up to 50 percent in five years. We are going to have a continuing demand for aerospace workers." Boeing pushes math and science education in K-12 schools and syncs up with all the state's institutions of higher education, Zarfos says.

"We absolutely want to see healthy, indigenous programs and where we see constraints, like the capacity issue, we will encourage the state to help address that," Zarfos said.

Meanwhile, as industry hunts for next-generation engineers, too many young Husky hopefuls face the stark capacity limits.

By the way, Ms. Hara insists her rejection email is not the final verdict.

"I'll keep my grades up," she said, her voice still upbeat and focused. With confidence and clarity, she added : "I'll apply again this summer."



A Home Base *for* Students

By Sandy Marvinney

IN THE COUNTDOWN TO AN EXAM or project deadline, you will find Tomas Martinez studying in the Engineering Academic Center (EAC) in Loew Hall, sometimes until 3 am. For the electrical engineering senior, it's a quiet, inviting refuge compared to the hubbub in Odegaard Library.

For Sirena Merfalen, a junior majoring in industrial and systems engineering, the center is a community that has made a huge university seem smaller. She stops in frequently to do homework, assist other students, or get problem-solving help.

As an entering freshman and the first member of his family to attend college, alumnus James Bland (BSEE '96) needed support cracking the UW codes — how to register, what's a blue book. He found that and more at the center, including a study partner and life partner. Sally Bland (BS chemistry, '97) remembers the center as "home base" — where she no longer felt lost. The center helped them solidify their knowledge, shine as students, and contributed to launching careers at Intel.

For more than 30 years, the Minority Scholars Engineering Program (MSEP) has sustained a learning community that has served more than 1,500 underrepresented minority and women students who enroll at the UW to major in science, technology, engineering and mathematics, the STEM disciplines. MSEP programs, open to all UW students, are a vital bridge to smooth the transition from high school to the rigors of university coursework. Beyond freshman year, the programs and support network help students stay on track in meeting pre-engineering requirements and graduating in STEM disciplines, critical goals for the UW and our nation's science and technology sectors. A key introduction to the university experience is STEM BRIDGE (sidebar).

Convergence in the EAC

In the MSEP network, all roads converge in the Engineering Academic Center, three spacious classrooms on the second floor of Loew Hall, open to students 24 hours a day. Here students attend twice-weekly MSEP collaborative workshops in math, chemistry, and physics. They form learning communities, meet informally for study sessions, and as juniors and seniors help tutor other students and maintain their "home base." Statistics show that underrepresented students engaged in the EAC graduate with STEM degrees at a 60% higher rate than their peers.

If the center is the heart of the MSEP program, its soul for nearly 25 years has been instructor David Prince, whose vision for encouraging students to achieve high levels of excellence has guided growth of the center and its programs. For his deep impact on student success, the UW in 2011 honored Prince with the James D. Clowes Award for Advancement of Learning Communities. He is the first staff member to receive this honor.

"First-year calculus was a weed-out class for about 300 students, so it was impossible to get sufficient help from the teaching assistants," Merfalen said. "EAC workshops and tutoring were critical to me. Before midterms Dave holds all-day Saturday 'Math Till You Drop' problem-solving sessions. They gave me the tools to do well in my courses and built the foundation for my future success in engineering."

James and Sally Bland with their children.

To James and Sally Bland, Prince's passion for teaching and commitment to students were constants. "He was always supportive and always ready to listen to our frustrations and offer guidance. He was like a father," James said. "Without Dave and the center, I would not have made it through the UW," Sally noted. "As a freshman I was withdrawn and timid. In my sophomore year Dave challenged me to let go of my insecurities and teach chemistry workshops. When I graduated I was a transformed person. His mentoring made a huge difference in my life and in learning the people skills to be successful in my career."

An Inspired Gift

After hearing of Prince's award and student testimonials, an engineering alumnus (who wishes anonymity) donated $500,000 to establish a fund so the EAC can sustain programs and support student excellence for generations to come. Funding also improved the study center environment with new white boards, comfortable study tables and chairs, and carpeting. The fund also allowed for the creation of an Engineering Leadership Scholarship program for students who have assumed leadership roles in tutoring and mentoring. Another key vision is a new part-time instructor who teaches the chemistry workshops.

The donor allocated $150,000 in 1:1 matching funds to encourage other alumni and friends to contribute to an endowment that will grow over time to meet expanding student needs. As admission to engineering programs becomes increasingly competitive, extra support for underrepresented students will ensure they continue to shine as the bar rises and the college maintains diversity in enrollment.

"For many first-generation college students, the university is a huge culture shock, and these students especially need extra support. As a kid who came from a low-income background myself, and failed at math in my early schooling, I have a deep feeling for students who don't get it," Prince said. "I know what stands in their way and what it takes to succeed, and I can't wait to get to work every day to help these students crack the code. I really care about their success, and most students know that in a sense they are my kids."

Excellence Perpetuated

Martinez and Merfalen are proof the center is succeeding in its mission. Martinez developed a passion for teaching through tutoring students in the EAC. This summer he will volunteer as an English teacher in a rural area of Vietnam. After graduating in 2013 he plans to teach math with the Teach for America program and then work in power engineering.

Merfalen hopes to divide her summer between a STEM study abroad program in Australia and an internship at Boeing's Auburn plant. She loves industrial and systems engineering and is considering graduate school or an industry position.

The Blands are sterling examples of success among past generations of MSEP students. James went on to earn a master's degree and a law degree and is based at Intel's Portland center where he manages an eBusiness group. Sally worked in Intel's research and development unit for 10 years and now devotes her time to raising their son and daughter. Their son is excelling at math, thanks to tips from Prince about teaching children "the language of math," even as toddlers.

With the new endowment and alumni support, such success stories will perpetuate generation after generation.

Bridging High School and the UW

STEM BRIDGE annually helps 40 students from underrepresented groups smoothly transition to university-level science, technology, engineering, and mathematics work. The four-week summer program for incoming freshmen includes:

- a 3-credit mathematics course
- introduction to scientific gateway courses and research
- exploration of STEM majors, careers, and opportunities
- community building and resource networks
- experience living in a residence hall

STEM BRIDGE is a partnership of the College of Engineering and the UW Louis Stokes Alliance for Minority Participation (LSAMP). **www.engr.uw.edu/stembridge**

COLLEGE OF ENGINEERING
UNIVERSITY of WASHINGTON

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

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

Judy Mahoney
Associate Dean of Advancement

Heather Hoeksema
Senior Director of Communications

Mary Levin
UW Photography

Email comments or corrections to:
trend@engr.washington.edu

Read more online @ www.engr.uw.edu/news/trend.html

"Like" us at www.facebook.com/UWEngineering

Follow us at twitter.com/uwengineering

Mobile Web Site – m.engr.uw.edu UW Engineering offers news, events, maps, video and more in a mobile-friendly format. Point your smartphone or other mobile device to m.engr.uw.edu.

Diamond Awards Seventh Annual Dinner

Friday, May 18, 2012, 6-9 PM The Mountaineers Club

Please join Dean Matt O'Donnell as we honor these five eminent engineers with 2012 Diamond Awards for their outstanding professional and community achievements.

Steven Rogel, *'65 BS Chemical Engineering*
Distinguished Achievement in Industry

A respected leader in the forest products industry, Rogel is the former CEO of Weyerhaeuser credited with driving innovative engineering and technical solutions at all levels of the company.

Richard "Dick" Sandaas, *'60 BS Mechanical Engineering*
Distinguished Achievement in Industry

A prominent leader in the public works construction industry, his achievements have benefited the nation's disabled, the regional environment and its transportation system.

Anne Condon, *'87 PhD Computer Science*
Distinguished Achievement in Academia

An expert in computational prediction of RNA and DNA structure, Condon has championed participation of women and underrepresented groups in computing research.

Bonnie J. Dunbar, *'71 BS, '76 MS Materials Science & Engineering*
Distinguished Service

A veteran of five space missions, Dunbar has advocated nationally for engineering as a career field and also for K-12 science education.

Greg Badros, *'98 MS, '00 PhD Computer Science & Engineering*
Early Career

At Google, Badros led the AdSense engineering team and several consumer apps including Gmail, Calendar, and Reader. Currently at Facebook, he oversees advertising, search, data science and data infrastructure.

Inquiries: 206.616.1231 claradp@uw.edu **Read more about the honorees at www.engr.uw.edu/da**