Forefront

COLLEGE OF ENGINEERING UNIVERSITY OF CALIFORNIA, BERKELEY spring 2008

The tides are returning:

Mark Stacey and colleagues help turn back the clock for San Francisco Bay

- Blum Center boosts Berkeley outreach
- Tissue engineers build on nature itself
- Hewlett-Packard's Mr. Cool

dean's message

MISSION: POSSIBLE

BART NAGEL

My initial months as dean of Berkeley Engineering have been filled with an inspiring array of developments, projects and initiatives, punctuated last month by Intel and Microsoft's announcement that they will help fund Berkeley's Parallel Computing Lab, an effort with the potential to take parallel computing and multi-core processing to the next level. Our bioengineering department is settled in Stanley Hall; and the bustling CITRIS building project is on schedule for a year-end completion. Our exceptional faculty and students make the headlines every day, unleashing new successes to advance the art and science of technology innovation.

As I look forward to presiding over commencement 2008 on May 24, it is an opportune time to rise above the daily buzz for a bird's-eye view of our broad mission—*educating leaders, creating knowledge, serving society*—and our tripart role of teaching, research and outreach.

This issue of *Forefront* brings news of three initiatives that underscore the long-term vision behind our mission statement. It is no coincidence that, as we seek to expand the college's reach, all three programs are global in scope: Berkeley's new Blum Center for Developing Economies, focusing on our educational role, sets our students and their ingenuity loose to interact with local populations and solve real-world problems. Our research role is embodied in our new agreement with KAUST, to help develop their world-class multinational research institution in the Middle East. And our outreach role is illustrated by the ambitious CITRIS Global Research Alliance for Climate and Energy, a partnership with the Copenhagen Climate Council and others to host one of several meetings leading up to the 2009 U.N. Climate Change Conference, where world leaders will negotiate a replacement for the Kyoto Protocol.

We keep our mission in sharp focus as a reminder that what we do every day is not about the funding or the headlines. We don't just throw our projects and products over the wall and expect them to work their magic. We step into the trenches, roll up our sleeves and work with stakeholders to foster these technology transitions, so they can be absorbed into our systems and make the world a better place.

I welcome your thoughts at **dean.forefront@coe.berkeley.edu.**

—S. SHANKAR SASTRY
Dean, College of Engineering
NEC Distinguished Professor of Electrical Engineering & Computer Sciences
Roy W. Carlson Professor of Engineering

Forefront is published twice yearly to showcase the excellence of Berkeley Engineering faculty, alumni and students and bring their work to life for a broad engineering audience through news and research, profiles and current issues and events.

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BART NAGEL

On the cover
Read the story on page 11.

UC Berkeley environmental engineer Mark Stacey visits San Francisco Bay, where he and his colleagues are doing research designed to restore an ecosystem better suited to the flora and fauna that enjoyed coastal living long before we did.

COVER PHOTO BY BART NAGEL
BACK COVER PHOTO BY PEG SKORPINSKI

Letters to the editor

DIAMETRICALLY OPPOSED VIEWS?

Your Fall 2007 issue included an article about Professor Abolhassan Astaneh's investigation into the Minneapolis bridge collapse. He attributed its failure to "a perfect storm of accumulated problems" including corrosion, poor maintenance, crude pre-1970 welding technology and fatigue cracks exacerbated by brutal winters and de-icing agents.

According to the *San Francisco Chronicle* (January 16, 2008), the National Transportation Safety Board (NTSB) attributed the failure to gusset plates that were roughly half their required thickness. The NTSB apparently found no evidence that poor maintenance, cracking, corrosion or other wear "played any role" in the collapse of the bridge.

Readers are left with what appear to be two diametrically opposing views of why the bridge collapsed. Could this be clarified? Thank you.

—**GERALD CAUTHEN** (B.S.'53 CEE)
Senior Project Manager, Korve Engineering, Inc.
Oakland, California

Professor Astaneh replies:

My statement about the I-35W bridge was intended to convey the range of possible causes that led to its collapse. As the Forefront *story said, the NTSB will not complete its investigation and final report for several months. In fact, the remarks made in January by NTSB chair Mark Rosenker and widely reported in the press—that the gusset plates were the "critical factor" in the collapse—were, unfortunately, premature and misleading.*

These remarks were intended to provide an update on the investigation and alert the Federal Highway Administration that the gusset plates were indeed undersized, but the role they and other factors played in the collapse will not be known until the investigation is complete. We all look forward to the NTSB report to clarify what happened on August 1, 2007, and help prevent such tragedies in the future.

(Ed. note: As of March 21, 2008, Professor Astaneh has been retained by a law firm representing a group of victims of the I-35W bridge collapse.)

SHARING THE BCC DREAM

In response to your Fall 2007 stories on Project Genie and Charles Simonyi, I was married to Mel Pirtle (B.S.'61, M.S.'62, Ph.D.'67) until 1972 and worked at Berkeley Computer Corporation. I have very fond memories of those years and a few reminiscences worth sharing. . . .

DENNIS GALLOWAY

BCC was known as the "hippie company" because of the free spirits we attracted. One of our draftsmen (yes, they were all males) definitely looked the part: long hair, well-worn T-shirts and pants and bare feet. One day we got word that a very conservative investor was coming out for a meeting. Everyone was asked to dress up for the occasion, so that morning I made the rounds to make sure no one had forgotten. As I opened the door to our drafting area, sure enough, there was our little hippie wearing a coat and tie. How nice! Then, when I glanced down, I saw his bare feet sticking out. . . .

Everyone was driven and very focused, but one especially stands out in my mind: Charles Simonyi. Charles had gotten it in his head that he wanted a Jaguar XKE, so he taped a large picture of a primrose-colored XKE—primrose, not yellow, I was told—over his desk. He told me if you want something badly enough, you can make it happen. And he did. He asked for an advance on his salary and bought himself a brand-new, primrose-colored XKE. My [current] husband and I had the pleasure of visiting with him on his yacht in Copenhagen in 2006. Despite his enormous wealth, Charles is still the same gracious person he was during the BCC days.

—**ELEONORE JOHNSON** *(formerly Eleonore Pirtle)*
Portola Valley, California

EDUCATING SUPERB HUMAN BEINGS

In response to Dean Sastry's Fall 2007 *Forefront* message, welcome to your new position at the finest College of Engineering. I appreciate your introduction and hearing about your priorities. You say that Berkeley's approach is not only to educate engineers as superb technologists but also to instill in them an urgent sense of how technologies can make a difference in the real world.

It is wonderful that Berkeley educates "superb technologists," but I've always been concerned (ever since I attended the College in 1997) that overemphasis on that priority causes the College to overlook educating and producing "superb human beings." While I was in the COE, I felt that many of my colleagues were well-trained to do engineering tasks but ill-equipped to thrive in many other facets of human and social life. . . .

—**DUC BIEU PHAM** (B.S.'02 EECS)
Campbell, California

HOW TO DEFINE A NANOMETER

Thank you for a fine publication. I read *Forefront* almost cover to cover. I enjoyed the short-form pieces in your Fall 2007 story entitled "Green Future." The basic ideas are good—even better that you also list a couple of websites where one may dig deeper into the related topics.

I would like to point out what I think may be acceptable in *People* or even *Time*, but not in *Forefront*. On page 15, in defining nanometers, you say: ". . . that is, one-billionth of a meter or 100,000 times smaller than the diameter of a human hair." . . .

I suspect that most, if not all, readers are engineers or technologists who have a good sense of what a nanometer, or one-billionth of a meter, is. No need to obfuscate by the "100,000 times smaller." Most of us might even feel more nostalgic with a 1.0E-9! In any case, the measurement should be 1/100,000th of a human hair, if you really want to put it that way.

—**AZMAT MALIK** (M.S.'73 EECS, M.B.A.'78 Haas)
Director of Operations, Renesas Technology America
San Carlos, California

A NERD AND PROUD OF IT

In response to "Nerd or not?" in your Fall 2007 issue: As an alumna of Berkeley Engineering and former Berkeley High School Mathlete, I am definitely a nerd! Oddly enough, my gifted teenage son and all his friends are nerds too. This is not a bad thing to be. . . . I'd much rather be a nerd than not!

—**HEIDI STEWARD** (B.S.'83 EECS)
Research Engineer,
Pacific Northwest National Laboratory
Portland, Oregon

I don't remember being called a nerd, but everyone in my family calls me a "contraptioneer." This refers to my habit of modifying, if not building, my own version of almost anything. Some projects are simple, like a backpack frame; others are more complicated, like kayaks and iceboats. I've never owned a production whitewater kayak because they are difficult to get out of a turn and will initiate a turn if you don't actively keep them going straight. So I tank tested a bunch of foam blocks in the swimming pool until I figured out that a slight reverse vee at the back would improve the directional stability without using a skeg, which introduces yaw rate damping and reduces maneuverability. . . .

The iceboat started out as a cheap hollow door with runners and a sailboard rig but is now similar to many others, except that the sail is a NACA 0012 airfoil. I recently saw an article on the aerodynamics of wing masts that explains why mine needs more wind before it will move; the wing mast and sail they studied had a maximum lift of 2.0 compared with my maximum of 1.5. On the other hand, I have sailed in more wind than they could handle without ever lifting a runner off the ice. . . . So many gadgets, so little time!

Nerd is a word that lacks specificity. Is it synonymous with geek? Both have bad connotations, but which is worse? *Contraptioneer* applies specifically to engineers with an insatiable need to improve everything they use. . . . The English language can express any idea accurately, but too often an inexact word is used where an exact word is available. Sometimes, a new word is needed; and *contraptioneer* captures the essence of a true engineer's character.

—**JOHN PENNUCCI** (M.S.'80 ME)
Colchester, Vermont

Hell, yes, I'm a nerd, geek and probable dweeb. So what have I done since leaving Berkeley in 1951? A bunch of jobs in macho industry, like oil patch on a doodlebug crew for United Geophysical, underground hard rock mining engineer for Climax Molybdenum and adjunct professor of engineering at what is now the University of Nevada, Las Vegas (UNLV).

In 1961 I was asked by the dean to apply for a full-time position that he created to start the engineering program. For eight years I was the only engineer titled as such; talk about being the nerd with all those liberal-artsy types around. I was once on a three-person committee for an English master's student and asked her to compare Elizabethan sonnet with Troubadour form. "Oh!" said the English professor. "I didn't think you engineers knew anything about that!" . . .

Finally, I was allowed to hire two other engineers. Since then, UNLV engineering has split from the almost-good-enough-to-be-nerds in the science college, and we are now a college of about 60 professors with a doctoral program. . . . We call the other areas where they can't get a job with their degrees "Twinkies" and point out that their four-year degree emphasizes learning to say, "Would you like fries with that?"

Unlike Berkeley we don't have the top 7 percent, but we do darned well with the nerds we get. Typically our students take five years to graduate, and we have a strong Tau Beta Pi chapter. In civil we run about 30 percent women. Our economy here is great, so, among sophomores and higher, eight percent are interning. This slows down their progress to graduation because they take fewer classes, but it does help them pass the Fundamentals of Engineering exam, which we require of all graduates in all fields. It also means we have one of the lowest student debt ratios on campus.

So I come from a family of nerds: Dad, Grandpa, uncles, cousins, and I'm damn proud of it. My wife and older daughter are engineers, as are two of my sons, and another son is in architecture. Are they nerds?

—**HERBERT C. WELLS** (B.S.'49 Geology, M.S.'51 Mining)
Professor Emeritus, University of Nevada, Las Vegas
Las Vegas, Nevada

Write to us at **forefront@coe.berkeley.edu** or send your letters to *Forefront* letters, 312 McLaughlin Hall #1704, University of California, Berkeley, CA 94720-1704. Please include the writer's name. Note that we cannot include all letters received, and those published may be edited for length and clarity.

News from the Northside

What's new at Berkeley Engineering

CITRIS to co-host global climate change conference

AARON WALBURG

CITRIS—the Center for Information Technology Research in the Interest of Society—has a leading role in a global research summit this June, one of several meetings where world leaders will begin to negotiate a replacement for the Kyoto Protocol, which expires in 2012.

The conference, June 18–19 in Copenhagen, will bring together top international scientists, industry representatives and government leaders to explore research priorities in climate and energy that can achieve a low carbon future without compromising human prosperity or global growth. CITRIS is organizing the meeting, known as the CITRIS Global Research Alliance for Climate and Energy, in partnership with the Copenhagen Climate Council and other agencies.

"We are honored to be asked by the Copenhagen Climate Council to work with them," said CITRIS executive director Gary Baldwin, "to bring attention to the innovations required to reach global goals in curtailing greenhouse gas emissions." One important objective of the June meeting, Baldwin added, is to provide a "navigation tool" for the next United Nations Climate Change Conference, scheduled for December 2009, also in Copenhagen.

The Kyoto Protocol, adopted in 1997 by members of the United Nations Framework Convention on Climate Change, is considered the most ambitious agreement ever negotiated on environment and sustainable development.

For more, go to **www.c-grace.org.**

Berkeley Engineering courses shine online

YouTube isn't just a venue for fictional diaries (LonelyGirl) or odes of undying love for presidential hopefuls (Obama Girl). It's for learning, too. Last fall UC Berkeley became the first university to post full courses on the wildly popular, free video-sharing website. And Berkeley Engineering is a hit.

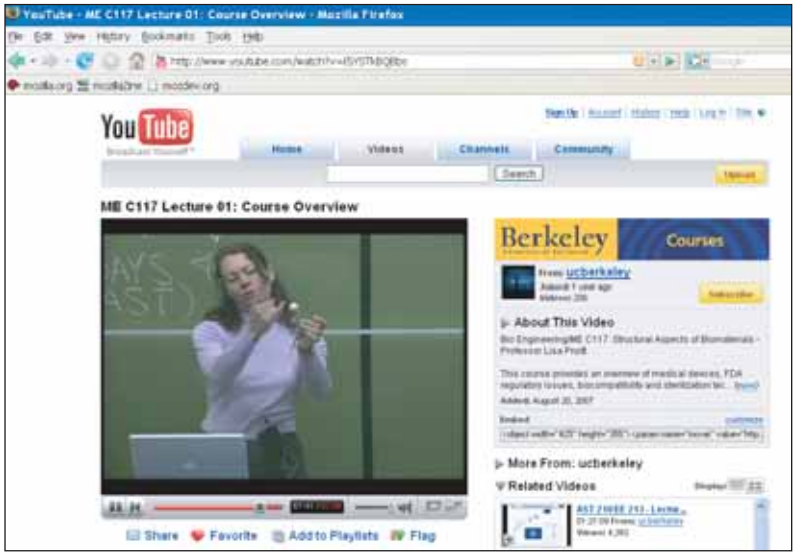
"Having the classes available has incredible advantages," says electrical engineering and computer sciences professor David Attwood, whose AST 210/EE 213 class, Soft X-Rays and Extreme Ultraviolet Radiation, is up. Some of his lectures have been viewed as many as 8,000 times since being posted. "You hear the students ask good questions," Attwood says. "With the dialogue that goes on, you know Berkeley is a high-quality place."

Berkeley's YouTube channel already offers more than 300 hours—and that's growing all the time—of video, from General Human Anatomy with Marian Diamond, to Physics for Future Presidents with Richard A. Muller. One of mechanical engineering professor Lisa Pruitt's lectures from ME C117, Structural Aspects of Biomaterials, an overview of medical devices, regulatory issues, biocompatibility and sterilization technology, has been viewed more than 6,800 times so far.

The viewers—who include students, professors and industry leaders around the world—seem to like what they see. *Handle wilwon33* comments, "Prof L Pruitt presents a delightful overview of considerations which must be taken to properly design a useful, long-lived prosthetic device." And *magna188* adds, "kool! I'm going to get a head start for college!"

While some UC Berkeley courses have been online since 2001 at **webcast.berkeley.edu**, YouTube reaches a broader audience. "The site is more than just an entertainment destination," says Jordan Hoffner, head of Premium Content Partnerships for YouTube. "We are pleased that higher education institutions are leveraging opportunities to promote and distribute their content to a worldwide audience."

Will online learning replace the classroom? Not according to Attwood, who recently had his EE 290f class in Synchrotron Radiation for Materials Science Applications added to YouTube's roster. "This is not high school,"



One lecture from mechanical engineering professor Lisa Pruitt's ME C117 class, Structural Aspects of Biomaterials, has been viewed more than 6,800 times so far on YouTube.

he says. "This is their career. The students wouldn't get the degree and they wouldn't get the peer interaction if they stayed home."

Attwood thinks the benefits of offering courses for free on YouTube far outweigh any negatives. "Opportunities appear for faculty who put the extra effort into getting classes online. We get research contracts from industry people watching. The NSF is interested in outreach. I'm asked to serve on advisory boards. There's nearly a contact made every day from this."

Go to **www.youtube.com/ucberkeley.** You just might learn something.

BY MEGAN MANSELL WILLIAMS

KAUST, now being built on the the Red Sea, plans to open in 2009.

UNIVERSITY IN THE MAKING

The mechanical engineering faculty and several campus governance bodies early this year approved an agreement to help develop Saudi Arabia's first graduate research university, the King Abdullah University of Science and Technology (KAUST). In exchange for a substantial gift, the department will help build KAUST's faculty and academic curriculum.

"The agreement will allow us to improve our facilities here in California, and fund a stream of graduate students, without taxing our existing infrastructure," said Professor Albert P. Pisano, department chair. "We're going to work on projects that are good for the Middle East and for California, like energy sources beyond petroleum, improved water desalination and solar energy in the desert."

While some faculty criticized the agreement, KAUST says there will be no discrimination or limits to academic freedom on its campus. Go to **www.berkeley.edu/news/media/releases/2008/03/04_kaust.shtml.**

COURTESY AUSTIN DAY

Bioengineering juniors Samantha Liang (fourth from right) and David Tulga (fifth from right) were participants on Berkeley's multidisciplinary iGEM team, which engineered a blood substitute from E. coli *bacteria.*

From bugs to blood

Despite its association with food poisoning, *Escherichia coli* can actually do good. A team of UC Berkeley undergraduates used the bacteria to demonstrate that a cheap, safe blood substitute can be made from humble beginnings.

Called "Bactoblood," the substance was designed in just three months as an entry for the annual International Genetically Engineered Machine (iGEM) competition, MIT's prestigious synthetic biology contest. Clutching bags of their red liquid, Berkeley's crew won a slot as one of six finalists in a field of 54 undergraduate teams from 19 countries. Peking University took the grand prize for constructing a self-differentiated bacterial assembly line.

"Bactoblood sounds crazier than it is," says project adviser John Dueber, a postdoc at UC Berkeley's California Institute for Quantitative Biosciences. The brainchild of chemical biology senior Austin Day, Bactoblood was concocted by a half-dozen talented undergraduates from bioengineering, biochemistry and anthropology, plus three high school students and graduate and faculty advisers. Berkeley's entry was different from the others, says team member and bioengineering junior David Tulga.

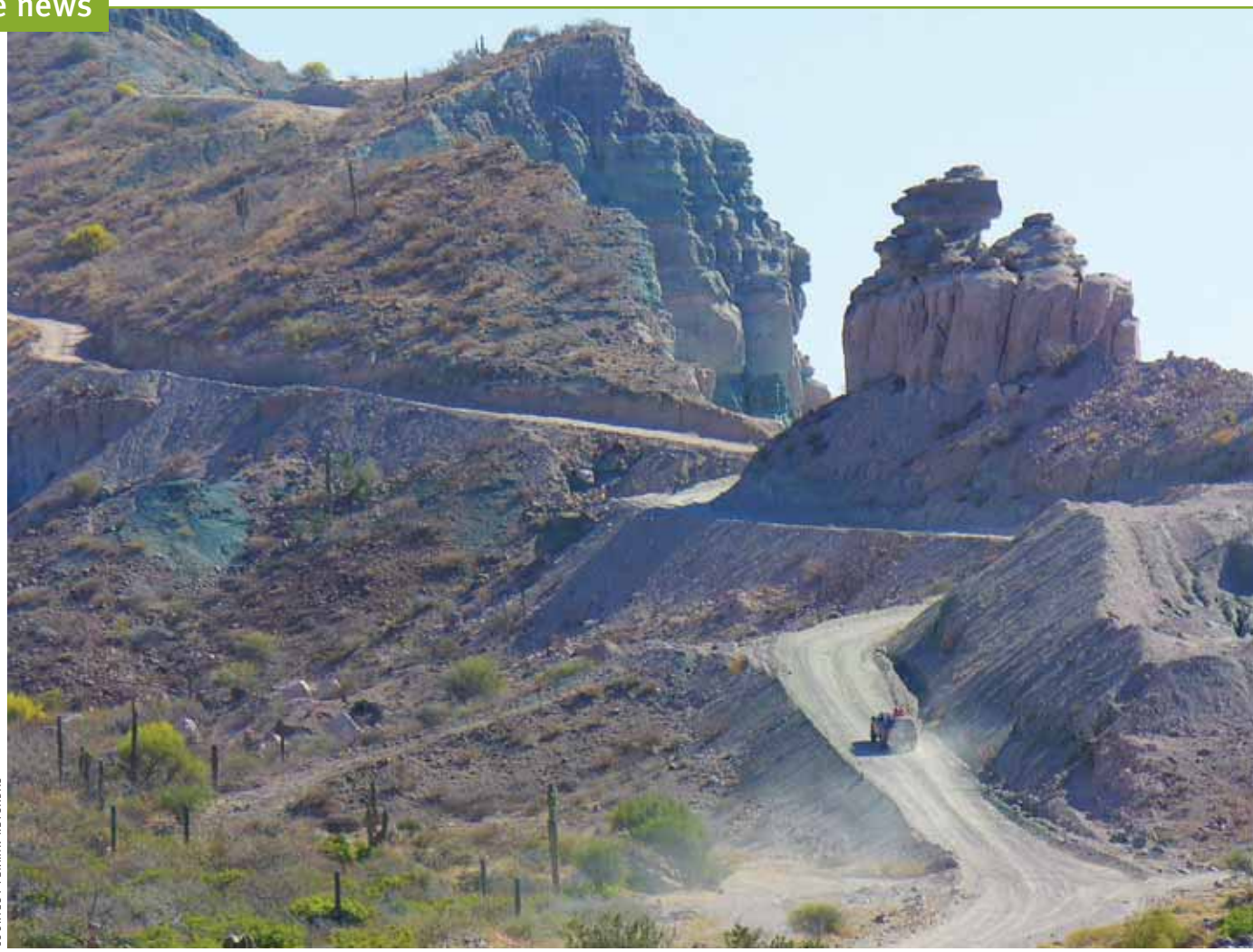
"Our project is really a complete system," Tulga says. "Think of it as a computer. A lot of people at iGEM are building components, like a keyboard or a hard drive. We were trying to build the whole computer."

The students genetically modified *E. coli* to detoxify it and help it live longer in the bloodstream. They engineered a genetic "self-kill" switch that destroyed the bacteria's DNA to ensure it wouldn't reproduce unchecked, then inserted the genes responsible for producing hemoglobin, the red blood cell protein that carries oxygen. They also modified the microbes to withstand freeze-drying, lengthening the product's shelf-life.

"Bactoblood is universally compatible, disease free and inexpensive, and you can reproduce it like crazy," says bioengineering junior and team member Samantha Liang. "I thought it was a really great idea."

Go to **http://parts.mit.edu/igem07/index.php/Berkeley_UC** for more.

BY ABBY COHN AND MEGAN MANSELL WILLIAMS



COURTESY FERMIN REYGADAS

A Blum Center team makes the four-hour drive from La Paz to Los Dolores, Baja California Sur, to check on water disinfection system installations and evaluate user satisfaction. Water and sanitation efforts often fail when they ignore the cultural and environmental realities of such remote locales.

Blum Center boosts Berkeley outreach to developing nations

Before Fermin Reygadas brought his water disinfection system to 150 families in Baja California Sur, Mexico, chronic intestinal illnesses and malnutrition from contaminated wells and springs were a debilitating but predictable fact of life. Today, residents say, the simple and affordable system has improved health in their pueblos, particularly among children and the elderly.

"Families are stopping us on the road, asking to have water systems installed in their communities," says Reygadas, a 28-year-old doctoral student in UC Berkeley's Energy and Resources Group.

The project is just one of 10 water and sanitation efforts supported by the Blum Center for Developing Economies, launched on campus in 2006 with a $15 million gift from San Francisco financier, philanthropist and UC Regent Richard C. Blum. The center is helping researchers like Reygadas turn innovative technologies and ideas into concrete solutions to the staggering problems of global poverty.

"I believe UC Berkeley can have a singular effect in the fight to alleviate human suffering," says Blum, who has worked for decades on global poverty. He founded the American Himalayan Foundation and the Global Economy and Development Center at the Brookings Institution and has funded projects in Africa with the Carter Center and, closer to home, in his own city of San Francisco.

The new Berkeley center's teaching, research and service ventures all point to the same goal—to understand and address issues facing the world's three billion people living in extreme poverty. Its action-oriented agenda focuses on three major initiatives: safe water and sanitation, improved health care, and efficient energy.

Though barely two years old, the center has hit the ground running. Already, multidisciplinary teams of students and faculty from such diverse areas as the College of Engineering,

the Energy and Resources Group, the School of Public Health and Haas School of Business have traveled to Mexico, India, Bangladesh, Uganda and elsewhere. They are working on such sustainable projects as low-cost water treatment devices, smart phones for health care workers and light-emitting diode (LED) lighting. A new effort will design fuel-efficient cooking stoves for refugee camps in Darfur.

"There are so many opportunities out there," says George Scharffenberger, Blum Center executive director. "We're just starting."

Nowhere was the excitement about the Blum Center program more evident than in Dwinelle Hall last fall, when a standing room crowd of 600 students turned out for an introductory global poverty class. A new undergraduate minor in Global Poverty and Practice, also introduced last fall, drew 55 students, twice the projected figure. Some prospective students have expressed interest in coming to Cal specifically for the new global poverty emphasis, says Ananya Roy, associate dean for international and area studies and the Blum Center's curriculum director.

One priority of the center, Roy says, is to focus on undergraduate education in an effort to mobilize the "next generation of global citizens and the next generation of Americans who could engage with the world in different ways."

The College of Engineering is one of the Blum Center's most enthusiastic participants. Dean Shankar Sastry serves as the center's faculty director, and the late Dean A. Richard Newton was an early proponent of engaging Berkeley students and faculty in adapting their technologies to help developing countries. Engineering faculty like Kara Nelson, an assistant professor of environmental engineering, are involved in the field projects.

"We have access to incredible resources," Nelson says. "It's our responsibility to use these resources to try to solve some of the world's most pressing problems." The goal is not simply to engineer clever new gadgets, she adds. Researchers also must understand the needs, cultures and economies of the communities being served. "We want to make sure we're designing technologies that people actually want to use," Nelson says.

Emily Kumpel, a 23-year-old civil and environmental engineering doctoral student, is part of a team from Berkeley and India studying a crowded Mumbai slum where fresh water is often fouled by sewage. The group is testing a prototype of an inexpensive water purifier built with 20-liter plastic jugs. On a recent visit, the students spotted immediate problems with their device.

"The water there is so dirty it clogs up the filter really quickly," Kumpel says. So, the students are back in the lab making modifications. Meanwhile, a Haas business student is exploring how the treatment system might eventually be sold and widely distributed.

"The Blum Center has catalyzed a lot of small individual efforts on campus," Nelson says. "Now there is an enormous amount of cross-learning going on between projects."

Twenty-year-old junior Greg Rulifson jumped at the chance to combine his civil engineering studies with the new global poverty minor. As part of a service learning requirement, he will join architecture students from the University of San Francisco this summer to build a community center in Nicaragua. A Blum Center fellowship is enabling him to make the trip.

Computer sciences professor Eric Brewer believes the time has come for engineers to take a more active role in the developing world. Through one Blum Center initiative, Brewer is designing cell phone software to improve health care services in Uganda.

"If you look at what's going to make a difference," Brewer says, "technology is one of the things that closes the gap."

For more on the Blum Center, go to **http://blumcenter.berkeley.edu.**

BY ABBY COHN

COURTESY FUNDACION CANTARO AZUL

COURTESY BLUM CENTER

ABOVE: *This Los Dolores family purifies a full day of drinking water in five minutes with their user-friendly water disinfection system, known as* la mesita azul *for the blue table it is mounted on.*

LEFT: *Fermin Reygadas, whose research is based partly in civil and environmental engineering, assembles a water disinfection system, which treats water with ultraviolet light and can be built for $60 to $90.*

CRAIGSLIST FUNDS NEW MEDIA CENTER ENDOWED CHAIR

BERKELEY CENTER FOR NEW MEDIA

The Berkeley Center for New Media (BCNM) in January received a whopping $1.6 million donation from online classifieds giant craigslist, the eighth largest Internet company in the world. The funds, along with a $1.5 million match from the William and Flora Hewlett Foundation, will be used to create the five-year-old center's first endowed faculty chair.

"The BCNM and craigslist share a fundamental respect for alternative thinking in the public interest," says Ken Goldberg, director of the interdisciplinary center, which encompasses more than 100 scholars from approximately 30 departments, including engineering, architecture, philosophy, film and journalism. "Our mission is to critically analyze and help shape developments in new media by facilitating research with unorthodox ideas, designs, artworks and experiments."

Establishing an endowed chair, Goldberg adds, gives added legitimacy to new media, defined on the BCNM website as anything from Wifi to Wii to Wikipedia.

Go to **http://bcnm.berkeley.edu.**

First things first

Turing Award winner Fran Allen visits Berkeley Engineering

Life is a series of firsts. First step, first word, first job. Fran Allen, IBM fellow emerita and a maverick in the field of computer science for nearly half a century, gives this idea new meaning.

In 1989, Allen became the first female IBM fellow. In 2000, she was the first recipient of the IBM Technology Mentoring Award, established and named in her honor (she's an avid mentor and advocate for women in computing). She was the first Anita Borg Award winner for Technical Leadership in 2004 and, in February 2007, the first woman ever to receive the A.M. Turing Award from the Association for Computing Machinery, her field's version of the Nobel Prize.

"Now I get invitations from around the world to come talk to women computer scientists—and that's what I've been doing," she says.

In January, the College's Department of Electrical Engineering and Computer Sciences hosted Allen for a series of appearances, including delivering a Regents' Lecture, sipping tea with undergraduates, visiting classrooms and departments and moderating a panel discussion on career advancement for women engineers.

A specialist in high-performance computing, Allen grew up on a farm in upstate New York and taught math at the local high school. While she was working toward her master's at the University of Michigan, IBM came knocking and hired Allen as a programmer. She figured she'd pay off her debts, then get back to teaching.

PEG SKORPINSKI

During her week at Berkeley, Allen (far left) rubbed shoulders with three other illustrious women in computing (from left, after Allen): Belle Wei (Ph.D.'87 EECS), dean of engineering at San Jose State University; Teresa Meng (M.S.'84, Ph.D.'88 EECS), professor of electrical engineering at Stanford; and Susan Graham, Berkeley professor of electrical engineering and computer sciences.

That was 50 years ago, when her first task was to instruct research scientists in IBM's new computer language, Fortran (IBM Mathematical Formula Translating System).

For more on Allen, go to **http://domino.watson.ibm.com/comm/pr.nsf/pages/news.20020806_fran_allen.html.**

BY MEGAN MANSELL WILLIAMS

STEVE MCCONNELL

BERKELEY'S EVER-GREENER PASTURES

UC Berkeley already has certified organic salad bars in its residence hall cafeterias and solar panels on its student union building rooftop, and Chancellor Robert Birgeneau wants to reduce campus greenhouse gas emissions to 1990 levels by 2014, six years ahead of the state's schedule.

But to better focus many decentralized efforts at reducing its long-term environmental impact, the campus has created an Office of Sustainability and hired Lisa McNeilly to direct it. McNeilly's credentials include stints with the Nature Conservancy and the White House Climate Change Task Force. Her first day on the job coincided with "Focus the Nation," a daylong teach-in held simultaneously at Berkeley and 1,500 universities and other institutions nationwide to raise awareness of climate change and stimulate action on solutions.

The UC system was recently recognized as a leader in sustainability, ranked number four of "10 That Get It" eco-friendly universities by the Sierra Club and given an overall grade of B for its green policies by the Sustainable Endowments Institute.

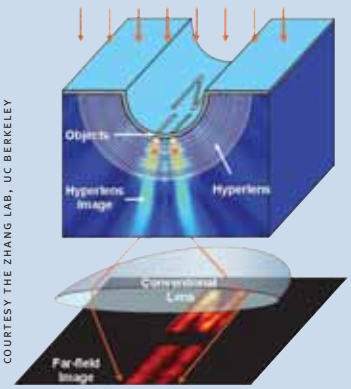
Go to **www.berkeley.edu/news/berkleyan/2008/01/30_mcneilly.shtml** for more.

BUSTING NUCLEAR SMUGGLERS

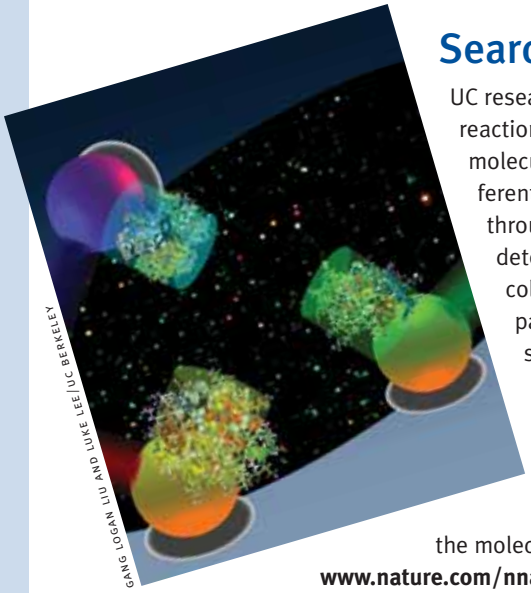
What do bananas and nuclear bombs have in common? They can look the same to a radiation detector. But a five-member group of UC Berkeley researchers led by nuclear engineering professor Edward Morse—the Domestic Nuclear Threat Security team, or DONUTS—received a $1.4 million grant from the National Science Foundation and the Department of Homeland Security to address the problem. Morse and company are pursuing more efficient ways to hunt for dangerous material using data mining, advanced image analysis and alternatives to germanium, which requires a strict temperature regime. Their work could one day lead to new detectors and improved domestic security. **www.berkeley.edu/news/media/releases/2007/09/14_NEgrants.shtml**

HYPERLENS IS TOPS

Discover magazine ranks mechanical engineering professor Xiang Zhang's hyperlens one of the top 100 science stories of 2007 in the January "Year in Science" issue. The lens jumps the so-called "diffraction limit" by compressing evanescent light waves, allowing images of nanoscale subjects to be projected in astonishing detail up to a meter away. The technology could allow biologists to study molecules in motion within living cells. **www.berkeley.edu/news/media/releases/2007/12/14_discover.shtml**



COURTESY THE ZHANG LAB, UC BERKELEY



GANG LOGAN LIU AND LUKE LEE/UC BERKELEY

Search for a cell's inner life

UC researchers found a noninvasive way to map biochemical reactions within living cells at a high resolution. Since all molecules have a unique fingerprint, absorbing light at different frequencies when reactions occur, passing light through a solution is a common method of spectroscopic detection. But bioengineering professor Luke Lee and colleagues created new local light sources using gold particles to capture molecular signatures. While the standard test requires vast reserves of molecules and often results in cell death, the tiny metallic particles make "seeing" biochemical reactions easier and less destructive. The researchers suggest their nanoplasmonic "stars" could usher in a new molecular imaging approach for studying life at the molecular level as well as new drug discovery techniques. **www.nature.com/nnano/reshigh/2007/1107/full/nnano.2007.413.html**

The air up there

That stuffed up, headachy feeling you associate with air travel isn't just the result of staying up late packing and waiting in long lines at the airport. Civil and environmental engineering professor William Nazaroff and colleagues say those symptoms may be caused by ozone inside the aircraft. The naturally occurring compound is found in high concentrations at altitude, where it protects the Earth from harmful UV rays. But as it seeps in through the ventilation system, it reacts with passengers' clothing and skin oils to produce volatile byproducts, including aldehydes that can irritate mucous membranes. The researchers studied four-hour "flights" aboard a simulated cabin and published their results last fall in *Environmental Science & Technology,* concluding that all planes should employ ozone control in their ventilation systems. **www.acer-coe.org**

Park it here

Circling endlessly for a parking space can be maddening, not to mention bad for the planet. But UC Berkeley's Institute of Transportation Studies (ITS) found that parking can be painless (and fast). They checked out Parking Carma, a wireless guidance system that tells drivers where to go—and how to get there—to find empty spaces using sensors underneath parking lots that feed information to a server. Drivers access the system by phone and Internet. Between 2004 and 2006, ITS tested Carma at the Rockridge BART station. Not only was it popular, but it also upped ridership, so drivers burned fewer fossil fuels searching for spaces and saved a road trip to boot. **www.parkingcarma.com**

Handy digital trainer

There's a new weight-training tool in town that fits like a glove. Really. Developed by EECS graduate student Kenghao Chang with professor John Canny, the system incorporates wireless sensors called accelerometers in a pair of gloves and a belt that track exercise type—bicep curl or bench press—and repetitions. Data loads by Bluetooth to a computer, which acts as a digital personal trainer to log progress and provide real-time tips. Chang hopes users will swap stories online and form a virtual workout community. **www.cs.berkeley.edu/~kenghao/**

MICROSOFT RESEARCH CAMBRIDGE


Boser


Brewer


Canny


Conboy


Majumdar


Muller


Patterson


Paxson


Rubinsky


Sawyer


Yelick

PEG SKORPINSKI PHOTOS

BERNHARD E. BOSER is now vice president of the Solid-State Circuits Society of the Institute of Electrical and Electronics Engineers. Boser, whose research emphasizes analog–digital interface circuits and micromechanical sensors and actuators, is also professor of electrical engineering and computer sciences and director of the Berkeley Sensor & Actuator Center.

The Association for Computing Machinery named professor of electrical engineering and computer sciences **ERIC BREWER** a fellow. His research focuses on Internet-based systems, scalable servers, search engines, network infrastructure, sensor networks, security and technology for developing regions.

JOHN F. CANNY, electrical engineering and computer sciences' Paul and Stacy Jacobs Distinguished Professor of Engineering, received $238,000 from the MacArthur Foundation for Digital Media and Learning for his Mobile and Immersive Learning for Literacy in Emerging Economies project, which uses cell phones to teach English to schoolchildren in rural India.

The California Institute for Regenerative Medicine granted assistant professor of bioengineering **IRINA M. CONBOY** $2.25 million to study the potential use of embryonic stem cells in rejuvenating aging muscles. She is a member of the Berkeley Stem Cell Center and an investigator with QB3, the California Institute for Quantitative Biosciences.

ARUN MAJUMDAR is now director of the Environmental Energy Technologies Division at Lawrence Berkeley National Laboratory, guiding research and development of sustainable energy technologies. Holder of the Almy C. Maynard & Agnes Offield Maynard Chair in Mechanical Engineering, he is also director of Berkeley's Nanosciences and Nanoengineering Institute and a member of the Nanotechnology Advisory Group to the President's Council of Advisors on Science and Technology.

RICHARD S. MULLER, professor in the graduate school and emeritus professor of electrical engineering and computer sciences, received the Institute of Electrical and Electronics Engineers (IEEE) Electron Devices Society 2007 Distinguished Service Award. Muller is editor-in-chief of IEEE's *Journal of Microelectromechanical Systems* and founding director of Berkeley Sensor & Actuator Center.

Professor of electrical engineering and computer sciences **DAVID A. PATTERSON** was named a fellow of the American Association for the Advancement of Science for his leadership and contributions to computer architecture.

The Association for Computing Machinery (ACM) recognized **VERN E. PAXSON**, associate professor of electrical engineering and computer sciences, with the 2007 Grace Murray Hopper Award, which carries $35,000 provided by Google, Inc. Paxson, whose research has yielded innovative techniques for measuring Internet behavior, is senior scientist with the International Computer Science Institute's Center for Internet Research and a staff scientist at the Lawrence Berkeley National Laboratory.

BORIS RUBINSKY received the International Society of Cryosurgery's Gold Award for developing minimally invasive cryosurgery—tissue destruction by freezing—using medical imaging. Rubinsky, the Arnold and Barbara Silverman Distinguished Professor of Bioengineering, pioneered the method, now used widely to treat prostate cancer.

Mechanical engineering professor **ROBERT F. SAWYER** was elected a member of the National Academy of Engineering, one of the highest honors for an American engineer. The Class of 1935 Professor of Energy Emeritus was recognized for his pioneering work in reducing energy consumption and promoting the understanding of air pollution.

KATHERINE A. YELICK is now director of the National Energy Research Scientific Computing Center, the Department of Energy's flagship computing center for unclassified research at Lawrence Berkeley National Laboratory. Yelick, professor of electrical engineering and computer sciences, focuses her research on programming systems and parallel programming techniques.

COURTESY SOUTH BAY SALT POND RESTORATION PROJECT

The tides are returning

Environmental engineers help turn back the clock 200 years for San Francisco Bay

BY DAVID PESCOVITZ

As you fly into San Francisco International Airport, the aerial view is a mosaic of color. The waters of south San Francisco Bay are a patchwork of shapes ranging in hue from deep navy to teal green to intense orange, the result of salt ponds. Areas of the bay cordoned off years ago for salt production, these ponds supply the stuff we use in everything from manufacturing glass and soap to flavoring our scrambled eggs. But the view from on high may soon change. UC Berkeley research is informing major efforts to restore San Francisco Bay—including more than 16,000 acres of salt ponds—to an ecosystem better suited to the flora and fauna that enjoyed coastal living long before we did.

San Francisco Bay's salt ponds derive their rich colors from a complex mix of algae, minerals, micro-organisms and brine shrimp, which change hues as the pond's salinity increases during the five years it takes to yield a bed of salt.

San Francisco Bay, circa 1800

San Francisco Bay, present day

COURTESY THE BAY INSTITUTE WWW.BAY.ORG

"More than a century ago, we decided that the San Francisco Delta was useful agricultural land and that the edge of the bay was good for development and salt ponds," says UC Berkeley professor of environmental engineering Mark Stacey. "Now there's momentum to reverse that trajectory and restore a lot of these habitats."

For the last four years, one of Stacey's laboratories has been the South Bay salt ponds. There, the South Bay Salt Pond Restoration Project (SBSPRP)—the umbrella organization that funds some of Stacey's research—is working on the second largest ecosystem restoration project in the country following the Florida Everglades.

"Many of the lands simply can't be restored to marsh habitats," Stacey says. For example, "Foster City was built on landfill in what was once baylands. It's not going anywhere. But there are many areas that are good candidates."

Restoration, he says, will take time, dedication and cross-disciplinary science and engineering. Stacey and his students embody all of that. Their efforts to understand the physical and mechanical processes that govern water flow could impact restoration projects throughout the bay for decades to come.

Why go to all this trouble to turn back the clock?

Restoration will not only recover lost tidal wetlands and native species; it will also replace a makeshift flood control infrastructure dating from the first half of the 20th century.

"The salt ponds were constructed by throwing up cheap earthen berms that weren't even engineered," says Steve Ritchie, SBSPRP project manager. "They have accomplished flood protection for the Silicon Valley, even though they weren't built for that purpose." Sixty percent of the restoration project's estimated cost—about $1 billion over the next 50 years, Ritchie says—will be spent on building new flood-control levees.

"We should be thankful to the salt makers," Ritchie adds. "If they hadn't built these salt ponds, we would have developed right up to the edge of the bay. Not only would those areas be under water, but we would have zero opportunity to achieve any restoration."

The San Francisco Bay, a 1,600-square-mile waterway between the Pacific Ocean and the Sacramento–San Joaquin Delta, is the largest estuarine habitat in the Western Hemisphere. Before the Gold Rush, it is estimated that the bay was 133 percent larger than it is today, with wetlands, salt marshes and tidal marsh surrounding much of its perimeter. But over the past two centuries, the bay has been filled in, drained, diked, bridged, dredged and dammed into agricultural fields, salt ponds, cities and other developments. Now, only 2 percent of the original marsh habitat is left.

LEFT: *Over the past 200 years, much of San Francisco Bay's 243,000 acres of aquatic ecosystem (green on map from 1800) has been converted to urban, industrial and agricultural uses (white on present-day map), resulting in an 82% reduction in tidal wetlands, a 42% reduction in tidal mudflats and a 7% reduction in open water.*

BELOW: *Mark Stacey grew up on the lakes of Minnesota and studied physics and political science at Stanford. His work on San Francisco Bay, he says, provides "the right mix of childhood associations with exciting physics and policy issues in the midst of a thriving metropolitan area."*

COURTESY MARK STACEY

The bay supports 750 native species of fish, birds, and other animals and plants. But the surrounding Bay Area is also home to 7.2 million people who depend on the estuary to meet their needs for salt as well as commerce, agriculture, fresh water, transport, building, recreational access and more. The delta of the Sacramento and San Joaquin rivers has been fashioned into a 1,100-mile system of water channels and subsided islands for agricultural production. It's also an important source of fresh drinking water and irrigation for more than two-thirds of the state. With its rich population of herring, bait shrimp and Dungeness crab, the bay supports the country's only urban commercial fisheries. It's also the largest harbor on the coast, a gateway to the Pacific for 67 million tons of cargo per year. That traffic in itself exposes the estuary to risks like last November's Cosco Busan oil spill. *(see sidebar, page 15).*

The pristine estuary that existed before the mid-1800s is long gone, Mark Stacey observes, but it can be restored to some degree. The trick, he says, will be balancing the human needs with those of the many wetlands ecosystems, some predating development and others that have emerged as a side effect of development.

The South Bay Salt Pond Restoration effort involves opening designated salt ponds to tidal flow and observing how the altered flow affects both sediment and salt movement throughout the entire bay. That's where Stacey brings his long history of research on tidal dynamics into play. Along with sediment, changes in tidal dynamics affect salt concentration in the restoration areas. Salinity, in turn, affects which plants will develop in the new marshlands and which animal species can thrive there.

"We're effecting change in an estuary in ways that have never been done before," Stacey says. "Fortunately, we have laws of physics that govern these processes and, with some predictive modeling, I think we can get a handle on how this restoration will affect tidal dynamics throughout the bay."

Since salt production began in San Francisco Bay in 1854, the ponds, owned mostly by Cargill Incorporated, have overtaken almost the entire area surrounding the bay south of the San Mateo Bridge, approximately 26,000 acres.

In October 2000, Cargill struck a deal, negotiated by Senator Dianne Feinstein, to consolidate its operations and sell more than 60 percent of its South Bay salt ponds to the state, in addition to 1,400 acres along the Napa River. The U.S. Fish and Wildlife Service and the Department of Fish and Game are now responsible for stewardship of the ponds. It's a complicated dynamic with numerous stakeholders.

In the South Bay, for example, of major concern are the migratory birds that use the area as a stopping-off point; one species may rely on marsh habitat, while others depend on the intertidal zones for feeding at low water. In the delta, endangered fish such as smelt take top priority. And throughout the bay, maintaining flood-control systems is a primary concern.

"The issue isn't whether restoration will occur but what the flavor of that restoration will be in each area," Stacey explains. "What are the trade-offs in each area? And what does the endpoint look like?"

> "We're effecting change in an estuary in ways that have never been done before."

Right now, the perimeter of the South Bay is largely a hardened rock-walled shoreline of levees. Historically, however, the transition from the bay was gradual, from channels to shallows to mudflats to marsh, high marsh, and then uplands. These habitats were all connected to each other and to the bay.

According to Stacey, restoration efforts are likely to soften the transition and once again link those habitats. The levees cannot be removed, since their flood-control function remains vital, especially in anticipation of rises in sea level from weather systems

RIGHT: *To conduct their research, Stacey and colleagues take small boats out on the bay to measure current, temperature, salinity, sediment and chlorophyll concentration, all factors that will be altered by restoring tidal flow to SF Bay's salt ponds.*

BART NAGEL

Environmental engineering graduate student Lissa MacVean

Only by exposing the subtle dynamics under the water's surface can we hope to re-engineer San Francisco Bay and turn back time 200 years.

and climate change. Instead, channels will be built through the rock walls to connect the habitats in specific places.

However, opening up the levees also leads to a cascade of new challenges. In the time since the shoreline was leveed, the land has subsided. In the South Bay, what was once marsh is now a couple meters below water, and, in the delta, that land is as much as 10 meters below sea level. Opening up the levees will create a tidal salt lake, where sedimentation can proceed until enough sediment builds up on the bottom for plants to grow and marsh to reemerge.

To conduct their research, Stacey, graduate student Lissa MacVean and colleagues frequently embark on bay cruises aboard a small boat outfitted with a variety of sensing instruments. They use an acoustic Doppler current profiler, which converts the echoes of audio waves into three-dimensional representations of the current. Sensors are immersed in the water to keep track of temperature and salinity and measure chlorophyll concentration, an indicator of what's living in the water.

Stacey's team recently received a National Science Foundation grant of $667,000 to study the physics of sediment movement around the bay and the role of wind and tides in that transport. The key to gathering useful data, he says, is measuring flows and currents on wide time scales, from "turbulent scales" lasting only a few seconds, to 12-hour tidal scales, to lunar and annual cycles.

The researchers have begun to analyze how the first holes in the levees, opened as part of the Salt Pond Restoration effort, have affected sediment transport. MacVean has spent months in the field monitoring the exchange between one of those ponds and Coyote Creek to track the movement of sediment. Her project is now being parlayed into a large-scale collaboration with Stanford to develop a hydrodynamic and sediment transport model for the entire San Francisco Bay with three years of funding from the Coastal Conservancy.

"I'm interested in the details of hydrodynamics because it's so firmly rooted in real physics," MacVean says. "But what motivates me is that this basic science has the potential to influence how restoration is performed."

Only by exposing those subtle dynamics hidden under the water's surface can we hope to re-engineer San Francisco Bay and turn back time 200 years.

"Some day, when you fly into the airport, you won't see the mosaic of reds, oranges and yellows anymore," Stacey sums up. "But the mix of habitats you'll be looking at will much more closely resemble a healthy San Francisco Bay as it once was."

David Pescovitz (david@pesco.net) is a research director at Institute for the Future, co-editor of *BoingBoing.net* and editor-at-large for *MAKE: magazine*.

Bay watch: Outsmarting future oil spills

BART NAGEL

UC Berkeley integrative biology professor Thomas "Zack" Powell

Last November 7, the 900-foot Cosco Busan container ship slammed into the San Francisco–Oakland Bay Bridge, spewing nearly 60,000 gallons of bunker fuel into the bay.

As spills go, it was comparatively small. (The Exxon-Valdez spill was 200 times larger.) But oil tarred the shoreline from Point Reyes to Half Moon Bay, closing the beaches, stalling the commercial crab fishing season and killing an estimated 20,000 marine birds. Toxins from the oil will remain suspended in the bay for some time, says oceanographer and integrative biology professor Thomas "Zack" Powell, one of Mark Stacey's colleagues on the South Bay Salt Pond Restoration Project. Plant and animal plankton absorb these toxins, which are in turn absorbed in even greater concentrations by the fish who feed on them. Birds have a higher risk of short-term death because, in preening, they ingest the oil.

"We have to attempt to clean them up, but I'm afraid it's more of a palliative for us than it is for the birds," Powell says. "And, where oil has washed up on shore, cleanup efforts are often worse than the oil because they use steam cleaning, which kills all the organisms."

There were widespread complaints that containment and cleanup efforts were slow and ineffectual. But Mark Stacey believes that emergency officials did the best they could given the limited information they had.

"All eyes were focused on the movement of the oil slick on the surface of the bay," he says. "There was no information about what was happening below the surface, but much of the oil had quickly moved down into the water, where it was subject to transport." Furthermore, the central bay has a complex geometry, Stacey says, broken up by bridges, islands, a sill and shallow shoals, not to mention ship traffic.

"If we want to do predictive modeling on a timescale of a few hours, such as in the event of an oil spill, we need to know the underlying physics of the bay and have real-time data," he adds. "It's more important to know where a spill is going than where it is."

To that end, Stacey is working with San Francisco State University geosciences professor Toby Garfield and UC Davis oceanographer John Largier to devise a system of breadbox-sized sensors that would sit at the bottom of the bay to monitor flow dynamics over the entire depth, then wirelessly transmit their data back to shore in real time.

The researchers are seeking funding and local partners to launch the project in earnest. With just a handful of such devices, Stacey says, engineers could uncover the mysteries of the bay's dynamics. If they succeed, the data streaming from their devices may someday give responders a head start in dealing with the next oil spill that threatens the region.

AP IMAGES/ERIC RISBERG

COURTESY MARK STACEY

Inspired by Nature Itself

Tissue engineers devise elegant tools to heal vessels, nerves and skin

BY KATHLEEN M. WONG | PHOTOS BY PEG SKORPINSKI
MEDICAL ILLUSTRATIONS BY CHRISTINE GRALAPP

Another day dawns in the emergency room, and patients are coming in at a rapid pace. An elderly man complains of chest pain and trouble breathing; his skin is ashen, his face sweaty. A woman who was in a car accident has sustained deep arm lacerations and cannot move or feel her fingers. Moments later, an ambulance delivers a little girl with severe burns on her face and body.

In the ER of today, options for these patients are limited. Tests reveal the man has blocked coronary arteries but no healthy vessels in his legs or chest that could be used as replacements. The woman can't use her hand because the nerves leading to her spinal cord have been severed. Without the protection of skin, the girl risks dehydration and infection and faces multiple surgeries to remove stiff and disfiguring scar tissue.

Song Li, UC Berkeley associate professor of bioengineering, is working to improve the options for such patients. A leader in the fast-growing field of tissue engineering—a fusion of cell biology, materials science and engineering—Li is working with his graduate students to develop replacement arteries, nerve grafts and wound healing technologies that work in concert with the body's own natural repair systems. Three of his students are now combining their bioengineering know-how with business savvy to form startup companies that will bring these technologies to the clinical setting in the next five to 10 years.

"We're trying to make biomimetic or bioinspired materials based on structures already in our tissues," Li says. Key to his lab's innovative products is the high-tech synthetic scaffolding they are built on. Using long fibers of polyesters (the bioabsorbable material surgical sutures are made of), the researchers can fashion membranes endowed with remarkable properties. To the naked eye, the membranes resemble shiny sheets of white tissue. But under the microscope, their surfaces reveal a nanoscale topography of grooves, divots and dimples that point cells in the direction they should grow and provide cargo space for stem cells, growth factors and other biomolecules that speed healing.

Li ascribes his lab's success to his talented, creative students, who build on one another's achievements by working as a team and identifying promising leads. The work comes not a moment too soon for patients in the ER of tomorrow.

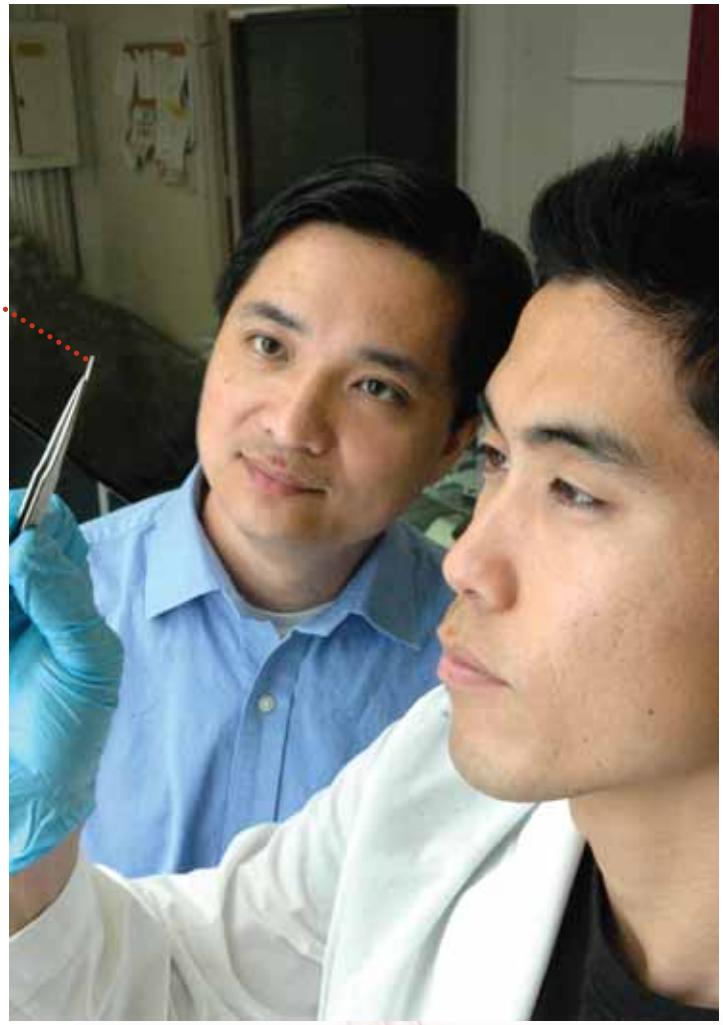
STEM CELLS IN TRAINING

Stem cells, the body's most versatile building materials, have the potential to mature into virtually any type of tissue. Li and his team—to ensure that their scaffolds would function seamlessly when implanted—planned to coat them with a living surface derived from a patient's own stem cells.

As a graduate student at UC San Diego, Li learned that the forces cells experience—the tug of gravity, an artery's expansion and contraction with each heartbeat—influence their fates. He suspected that mechanical stresses might also affect how stem cells develop.

"Our hypothesis is that specific microenvironmental factors, such as mechanical stresses and chemical factors, can promote cells to differentiate into specific types," he says.

In a groundbreaking experiment, Li's former graduate student Jennifer Park (Ph.D.'06 BioE) used mechanical force to coax stem cells to differentiate into smooth muscle. She seeded the cells on a stretchy silicone membrane, then used a device to stretch the cells and their rubbery matrix along one axis, like a child stretching Silly Putty, for several hours. The pace and direction of the stretching were designed to mimic the swelling action that vascular muscle cells experience in an artery. Within hours, gene activity indicated



Bioengineering associate professor Song Li (left) and his graduate student Craig Hashi (right) examine a prototype vascular graft, small enough to be implanted in cardiac tissue, that was engineered in the lab. Animal trials (inset) have proven successful, and Hashi expects to proceed to human trials in two to four years.

that the cells had partially transformed into the smooth muscle that surrounds arteries.

Building on Park's work, Li's Ph.D. student Kyle Kurpinski took the experiment one step further. He increased the duration of the stretching to once per second over a period of days and added nanoscale grooves to the membrane to recreate the arrangement of collagen fibers in blood vessels. When the grooves were oriented in the same direction as the stretching, as in nature, the cells aligned themselves the same way. This orientation enhanced the differentiation of stem cells into vascular cells, a process that could prove useful for generating a renewable supply of arterial muscle cells for the more than 500,000 Americans who undergo coronary bypass surgery every year.

REPAIRING A BROKEN HEART

Coronary bypass surgery replaces one or more of the arteries that normally supply blood and oxygen to the heart but have become clogged with plaque. The operation can be a lifesaver, staving off the imminent threat of heart attack. Surgeons prefer to use vessels harvested from a patient's own leg or chest, but in some patients these vessels are unusable, damaged by atherosclerosis or diabetes.

Current synthetic vessels don't fit the bill, says YiQuian Zhu, a neurosurgeon and student in the UCSF & UCB Joint Graduate Group in Bioengineering. When synthetic vessels are fashioned in a caliber narrow enough to replace coronary arteries, these soon become occluded by clots.

Li and graduate student Craig Hashi set out to design a better graft. They seeded a mat of nanofibers with the body's own universal replacement parts: stem cells harvested from bone marrow. The cells, they hoped, would smooth the surface of the graft and reduce the risk of aneurysms and clots. In time, the scaffolding would dissolve, to be replaced by the body's own cells. Zhu, an expert in microsurgery, implanted the tiny grafts into rats.

"In the very first animal we tested, the vessel came out clean," Hashi says. "And we just started rolling from there."

The researchers are now investigating the use of scaffolding without the stem cells. Patients often need surgery immediately, while harvesting and culturing the cells requires extra care, time and expense. "Ideally, you could take the vessel off the shelf and it would be ready to go right into the patient," says Hashi, who, with

Li, Zhu and several other graduate students, is now testing other molecules that might possibly lure stem cells to the site.

The concept won first place in two national invention competitions and at the 2007 Global Life Sciences Competition and caught the eye of outside investors interested in licensing the technology for commercial development. Hashi expects to be testing the grafts in humans within two to four years. When he graduates next month, he'll assume the post of chief scientific officer for NanoVasc, a biotechnology startup, and begin the process of developing the grafts for clinical use.

BETTER HEALING SKIN DEEP

Li and his team realized that micropatterned guidance of cells could solve another serious health problem: wound healing. In a deep cut, Kurpinski says, "the cells don't really know where to go. There's no structure left. That's one reason you get scar formation. If you have a big wound, the cells will randomly put down matrix and collagen, and it gets very disordered."

To prove his theory, Kurpinski laid down a nanofibrous scaffolding material between a gap and seeded both sides with cells. When the fibers weren't aligned, relatively few cells traveled into the space, but when the fibers led into the gap, cells followed like trains on a track, closing up the space. Laying such nanotextured sheets over the edges of a gaping wound could facilitate healing.

"We could guide new cells into the area of missing tissue and, we hope, improve soft tissue regeneration," Kurpinski says. "That way, we don't need a cell source. Instead, the body's cells will be able to feel this new patch and migrate in the right direction to form healthy tissue."

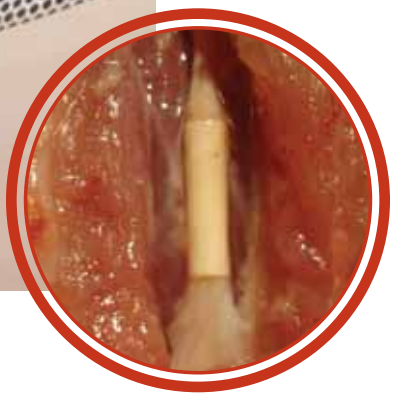
As they funnel cells into injured areas, the sheets could deliver molecules that encourage tissues to mend. Just as the nooks and crannies in an English muffin hold extra drops of butter, the scaffolding's nanotextured surface can hold surprisingly large quantities of biomolecules. "Skin is like a storage depot for growth factors and matrix proteins," Li says. "We can load up our scaffolding with chemical factors found in native tissue" to further accelerate healing.

Already, the technology has been licensed to a startup company, EscharaX, that will make products to promote wound healing. Kurpinski will spearhead the company's research and development when he graduates this year.

PAVING THE WAY FOR NEURONS

Nerves, like skin cells, are notoriously fickle about regenerating after injury. Each year in the United States, accidents and surgeries leave several hundred thousand people with trauma to the nerves that give feeling and movement to their arms or legs. Such peripheral neurons do have the capacity to heal themselves, sending new axons across an injured site and retracing their paths to muscles and sensory receptors, but only if the gap is no more than a few millimeters wide. Meanwhile, other tissues can fill the space, blocking the path to recovery. These patients face a lifetime of disability from irreversible paralysis.

Bioengineering graduate student Kyle Kurpinski holds the device he developed for "stretching" stem cells, training them to take on the characteristics of the smooth muscle cells found in vascular tissue. Fibers in cells stretched on grooved membranes (inset) were encouraged to differentiate even further.



Former graduate student Shyam Patel (Ph.D.'07 BioE) cultures nerve cells in Li's Stanley Hall lab. Now chief scientific officer at NanoNerve, he still returns to the lab regularly to collaborate on his nerve graft (inset) and related tissue engineering projects.

To repair these connections, Li says, nerves "just need guidance." Scaffolding with nanoscale patterns, he suspected, might show severed neurons the way to reestablish their connections.

Li's recent graduate student Shyam Patel (Ph.D.'07 BioE) set out to demonstrate the idea. He compared nerve tissue cultured on membranes with randomly directed versus aligned fibers. Neurons on the unaligned sheets sent out axons every which way, splitting their efforts so that no single axon traveled far. The neurons on the aligned fibers were a different story. "It was like a fast track; the axons just followed and grew very fast," Li says.

In neuron repair, time is of the essence; chances of surgically restoring nerve function diminish within months to a year. To hurry regeneration along, Patel doped the scaffolding with molecules that encourage neurons to extend. He found that neurons on coated, aligned nanofiber membranes grew five times longer than randomly oriented membranes without coatings. On the enhanced scaffolding, the neurons extended almost four millimeters in just five days—a growth rate comparable to the gold standard in neural repair, a section of nerve harvested from elsewhere in the body.

"We showed that you could use this topographical guidance and, combined with chemical guidance, make a new kind of scaffold. You could not only direct the extension of the axons but enhance their growth," Patel says. In order to translate the research to a clinically viable product, Patel has developed technology to fabricate tubular grafts composed of aligned nanofibers.

The nerve graft, named one of the top micro/nano technologies of 2007 by *R&D Magazine,* is now licensed by new startup company NanoNerve, which aims to shepherd the device to the clinic. Patel, the company's chief scientific officer, has just begun animal trials; he plans to begin human trials of aligned nanofiber grafts by year-end and trials of bioenhanced grafts by 2009.

"Since we've begun working on the technology, people come up to us at conferences and competitions, people who can't move their feet or arms anymore," Patel says. "We started this work from a purely scientific standpoint, but it's very compelling to witness people who suffer from these injuries and know that this technology could some day improve their quality of life."

KATHLEEN M. WONG is a science writer and editor based in Oakland. She writes *Science Matters @ Berkeley,* the online news journal of UC Berkeley's College of Letters & Sciences.

Gail Brager

A breath of fresh air

How alumna Gail Brager opened the workplace to a natural cool

BY RACHEL SHAFER

At the corner of Seventh and Mission streets, the thin tower of San Francisco's new Federal Building, home to 1,700 federal employees, reaches 18 stories into the sky. Despite its futuristic flourishes of steel mesh and glass fins and environmentally inspired features, like elevators that stop every three floors (to encourage climbing the extra flights), the building's most forward-thinking design element may be its simplest: windows that open.

Floors six and up have, in industry parlance, "operable windows." Employees needn't breathe conditioned air all day; they can simply reach over and open the window. The cool breezes blowing through these windows are a radical departure from the sealed air-conditioning systems common to most U.S. office buildings built after World War II. The main tower of the new building is designed to consume just 33 percent of the energy of a conventional office building, offering a refreshing trend in energy conservation as well as indoor comfort.

That the federal building has a natural ventilation system at all is partly the achievement of one woman, Berkeley Engineering alumna and architecture professor Gail Brager (M.S.'82, Ph.D.'84 ME). Brager is a researcher in the science of thermal comfort, the study of the environmental and psychological factors involved in an individual's perception of indoor comfort. Her research and that of her colleagues is accumulating a growing body of evidence that improving indoor environmental quality in various ways—including using operable windows—reduces not just energy consumption, but also employee sick leave and sick building syndrome, the ill health effects sometimes ascribed to sealed, inadequately ventilated buildings.

PEG SKORPINSKI

In the United States, buildings account for more than one third of greenhouse gas emissions, and cooling and mechanical ventilation in commercial buildings account for more than 30 percent of their energy use. So using operable windows to reduce energy consumption could have a potentially significant impact on reducing global climate change.

Brager has spent more than 20 years investigating thermal comfort in offices. In 2004, her research convinced the worldwide organization of air-conditioning engineers, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), that air conditioning isn't, well, cool, for every office building. By cracking the proverbial seal, she gave innovative architects and engineers a tool—ASHRAE's revised Standard 55—to install operable windows under industry-wide approval.

"Brager's work is essential to the future of green buildings, especially in the United States," says Kevin Hydes, former chair of the U.S. Green Building Council (USGBC) and now head of the World Green Building Council. With 15 million new U.S. buildings planned by 2015, the Intergovernmental Panel on Climate Change identifies the building sector as the most promising area for achieving deep cuts in CO_2 emissions. In fact, its 2007 Fourth Assessment Report cites Brager's work as one way to cut those emissions, by reducing our reliance on—what Brager would call our addiction to—air conditioning.

ESTO/TIM GRIFFITH

Brager's fascination with buildings began when, as a mechanical engineering grad student, she landed a job researching passive cooling and indoor air quality in the Environmental Energy Technologies Division at Lawrence Berkeley National Laboratory. After earning her doctorate, she joined the architecture faculty and is now also associate director of Berkeley's Center for the Built Environment, a 33-member industry-sponsored consortium researching the design and operation of commercial buildings.

"Architects don't fully understand me, and engineers don't fully understand me," Brager says. "I seem to be a research rebel no matter where I am." In fact, Brager's ability to maneuver smoothly between the physical and social sciences, between load calculations and psychological evaluations, between working professionals and academics, has given her a unique role.

"Architects have abdicated their historical knowledge of the engineering disciplines that Renaissance and other earlier architects had," says her colleague, architecture professor Edward Arens. "Architects are trained in the artistic and conceptual side and rely on engineers for the real nitty-gritty of what makes the building work." Consequently, Arens says, the Department of Architecture has recently begun working with engineering faculty like David Auslander, professor emeritus of mechanical engineering, on green building projects that will help students bridge the gap between the two disciplines.

"Gail is a mechanical engineer who is aware of these things and who is engaged in the ASHRAE process," Arens adds. "Her knowledge of both fields enables her to deal with problems of buildings and energy use in interesting ways."

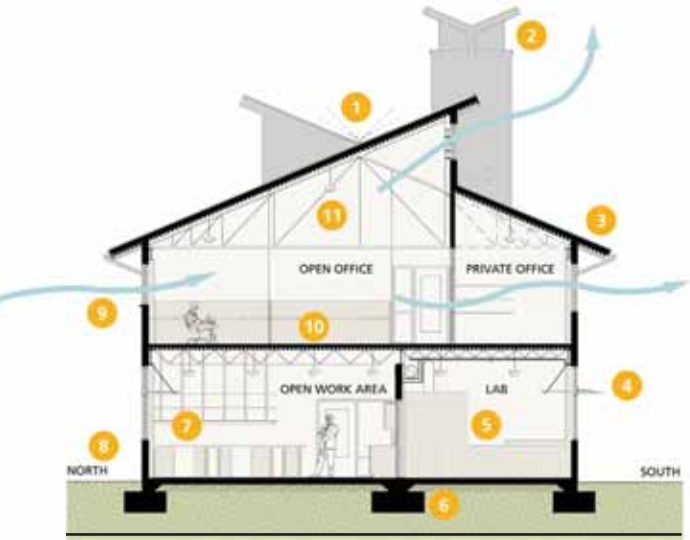
ASHRAE first issued its Standard 55 in 1966, setting a worldwide standard summer temperature range for office buildings of 73 to 79 degrees Fahrenheit. The standard, a range so narrow that only air conditioning could maintain it, was based on laboratory experiments conducted in carefully controlled environmental chambers by the late Danish researcher P. Ole Fanger. Good research? Yes. Good research in an actual office setting? No.

In the 1970s and '80s, as public awareness of energy consumption widened and architects and engineers who favored natural ventilation began to challenge Standard 55, ASHRAE decided to reexamine the research methodology behind it. Brager proposed a series of field studies using laboratory-grade instruments and rigorous survey methods to assess actual building occupants' responses to thermal environments in both air-conditioned and naturally ventilated buildings. ASHRAE funded Brager's team (which included Arens and architecture professor Cris Benton), working in the temperate Bay Area, followed by other teams applying her methods in different climates and cultures.

Brager teamed up with Richard de Dear, a thermal comfort researcher now at Australia's Macquarie University, to collect the raw data and

ESTO/TIM GRIFFITH

The San Francisco Federal Building features both manual windows at desk level and motorized windows at a greater height. From the building's southeast side, window panels flip up to a 90-degree angle to provide occupants a vista of San Francisco's SOMA district.



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10 RADIANT SLAB HEATING & COOLING
11 FULLY DAYLIT INTERIOR WITH LIGHTING CONTROLS

COURTESY EDHH ARCHITECTS

Brager is now focusing her research on mixed-mode buildings, which combine natural ventilation with mechanical systems that distribute air and cool interior spaces.

build a meta-database analyzing the behavioral, psychological and physiological responses to various indoor thermal conditions of approximately 20,000 workers in more than 160 buildings worldwide. The resulting paper, published in 2000 in the *ASHRAE Journal,* sent the thermal comfort research community into a tailspin.

"We discovered that people in air-conditioned environments became addicted to that narrow temperature range," Brager says. "They dressed the same year-round because they were dressing for the indoors. They had no control, so when conditions deviated from what they were used to, they screamed loudly." On the other hand, the data showed, workers in naturally ventilated buildings preferred a greater temperature range because they had control over their conditions. They could open or shut a window.

"Control matters," Brager says. "When people have control over a stimulus, they accept and, in fact, prefer a wider range of that stimulus compared with when somebody else is pushing the button." In fact, according to environmental construction website **greenbuildings.com,** giving employees control over their office air can reduce sick leave by as much as 30 percent.

Brager's research held up under peer scrutiny, becoming known as the "adaptive model of thermal comfort." But, knowing that true change in the building industry could come about only by modifying Standard 55, she began agitating for a revision, not an easy sell to air-conditioning professionals.

After all, operable windows have their drawbacks. They introduce noise, wind, odors, potentially poor air quality and additional cost as well as safety and security concerns. Operable windows don't automatically cool a building; they require careful placement and holistic design. And

human behavior is unpredictable; occupants leave windows open when they shouldn't and keep them closed when they should be open. Co-workers must agree on what's acceptable.

"Passive ventilation scares engineers who like a lot of control," Brager says. "As soon as you add pesky people who actually want to open the window and control the thermostat, it drives engineers crazy!"

Dan Int-Hout, chief engineer at the air distribution device company Krueger, chaired the Standard 55 committee. He recalls that Brager's campaign generated a great struggle within ASHRAE. "But she had so much data that we couldn't ignore it," he says. "In the end, design engineers, manufacturers and thermal researchers alike agreed that it was a reasonable approach." In 2004, ASHRAE revised Standard 55 to accommodate a more flexible definition of thermal comfort.

Europe, Australia and Japan are well ahead of the United States in implementing operable windows; code in some European countries actually requires them for ventilation. While no nationwide statistics are available on new U.S. buildings with operable windows, Int-Hout believes the number remains very small. Peter Alspach, Brager's former student and a mechanical engineer with Arup, the engineering firm for the SF Federal Building, thinks the trend is catching on.

"People are looking at operable windows for all sorts of reasons, such as occupant satisfaction, climate change, energy savings and financial savings," Alspach says. "In certain markets like San Francisco and Seattle, if you don't know how to build a natural ventilation system, someone else is going to get the job."

Brager is now investigating mixed-mode building, a hybrid strategy that combines operable windows with mechanical cooling systems. She's focusing on strategies—how and when to open windows versus when to power on the AC—to determine best practices. Her group developed an online database of mixed-mode buildings as a resource for engineers and architects in different climate zones (**www.cbe.berkeley.edu/mixedmode/index.html**).

Operable windows will never completely replace thermal controls, Brager concedes. Some buildings—like labs, museums, hospitals and prisons—will always require full control over indoor environments. Certain climates will always require air conditioning in summer; but, she says, using less of it in spring and fall can go a long way toward conserving energy resources.

"The true achievement of her work will be to convince the 330 million users of North American building space in this, the most consumptive place on Earth, that we can do more with less," says Kevin Hydes of the World Green Building Council.

Can we open a window and forgo air conditioning? We might have to dress differently but, as engineers know, the best solution is sometimes the simplest. Brager's real victory may be in opening our minds as well as our windows.

RACHEL SHAFER is managing editor of *Engineering News,* the College's semiweekly student newsletter, and associate editor of *Forefront.*

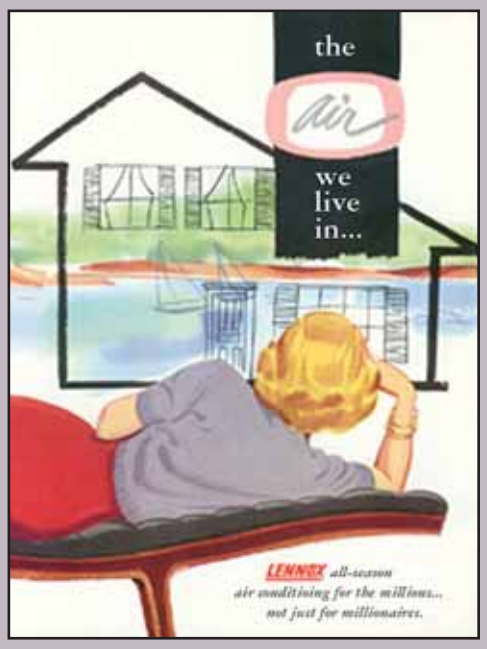
"Man-made weather" changes a landscape

Apparatus for treating air. That was the name of Willis Carrier's 1906 invention that launched the science and industry of air conditioning. By the 1930s, American moviegoers flocked to air-conditioned theaters as much for the cool environment as for that summer's hit feature.

After World War II, architects and engineers discovered how air conditioning could revolutionize building design. They could build anywhere without the need to site for optimal wind or shade. Sun Belt cities like Houston, Phoenix, Las Vegas and Miami grew exponentially. Since workspaces no longer needed to be near a window or designed for a cross breeze, architects could design floors 40 feet across and use floor-to-ceiling glass. Glass-walled high-rises like the United Nations headquarters, built in 1950, signaled modern architecture's embrace of the new technology.

"Air conditioning means success, wealth and civilization," says Alice LaPierre (B.A.'00 Arch), a former student of Gail Brager and now energy analyst for the City of Berkeley. "It means you're not subject to the weather anymore. You're not in poverty. You've arrived."

On the home front, the refrigerator served as a model for early residential air-conditioning units. The new technology—known as "man-made weather"—promised improved air quality, better sleeping and cleaner interiors, but it eliminated the need for architectural details like front porches, wide eaves and high ceilings, which were often sacrificed to finance the cost of central cooling systems.



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2000s

MICHAEL MONKANG CHU

(B.S.'97, M.S.'00 EECS) of San Jose is software product manager for the stream computing group at Advanced Micro Devices, Inc., a global provider of computing and graphics processing solutions. Previously he was manager of the application engineering group at DRC Computer Corporation and held key positions in software and hardware engineering at Stretch and Andes Networks. Chu has been flying since 2002 and also enjoys motorcycling, hiking, photography and spending time with his wife, Lucy. **mmchu@mmchu.com**

GREG DALTON *(B.S.'03 ME)* is an

aerospace engineer at UC Berkeley's Space Sciences Laboratory, where he works on satellite instruments for space exploration. He's now involved in NASA's THEMIS project, which sent five satellites into space in February 2007 to determine what triggers geomagnetic substorms, the phenomena responsible for the northern and southern lights. "The fun starts when the parts return from the machine shop and I begin to build," he writes. "Then I test the finished product in a vibration lab and thermal vacuum chambers that reproduce a space environment." He recently travelled to San Diego's Mt. Palomar to deliver an infrared telescope he helped build that will hunt for nearby small stars and detect any orbiting Earth-like planets.

LOUCYNDA P. ESCOBAR *(B.S.'05 ME)* is a quality engineer at Cisco Systems in San Jose. She's planning to pursue an MBA beginning in fall 2009.

MEHMET GUMUS *(M.S.'02, Ph.D.'07 IEOR)* became an assistant professor last September at McGill University's Desautels Faculty of Management in Montreal, Quebec, Canada. Gumus is married and has a young child.

CHRISTY S. HURLBURT *(B.S.'00 EECS)* is living in San Francisco. She recently got a job managing a service team at Medtronic and writes that she's "enjoying life as a Cal grad."

NICOLE E. HURLEY *(B.S.'02 BioE)* received her Ph.D. in bioengineering from the Georgia Institute of Technology in Atlanta last December.

EUGENE RYU KANEKO *(B.S.'01 ME)* of San Diego is a product engineer at OXO International, the consumer goods company. "I work closely with industrial designers developing innovative kitchenware products," he writes, including brands such as OXO Good Grips.

ANTHONY S. LEVANDOWSKI *(B.S.'02, M.S.'03 IEOR)* took his robotic motorcycle, Ghostrider, all the way to Washington, D.C., to the Smithsonian's National Air and Space Museum. The modified motorcycle, which balances, navigates and rights itself independently, was on display from early December through late January as part of the "Treasures of American History" exhibition presented by the Smithsonian's National Museum of American History (see photo). Levandowski designed and built the vehicle with the Cal Blue Team to compete in the DARPA Grand Challenge in 2004 and 2005. **www.ghostriderrobot.com**

RUI MA *(B.S.'04 EECS)* of Shanghai, China, completed three years of technology investment banking and is now a member of the real estate investing team at Morgan Stanley Shanghai.

ELIZABETH A. VARGIS *(B.S.'04 BioE)* is in a biomedical engineering

Ph.D. program at Vanderbilt University in Nashville, Tennessee. She is studying the use of optical spectroscopy to identify tissue changes due to brain and cervical cancers.

1990s

RANDY C. BEAUDREAULT *(B.S.'94 MSE)* of San Carlos, California, received his preliminary teaching credential in physics and chemistry last November. He's now looking for a teaching position in the Bay Area.

MING-LUN HO *(B.S.'95 Engineering Math)* receives tenure this June at Chabot College in Hayward, where he teaches math. He's a member of the Deer Creek Morris Men, who perform traditional English Morris dancing—incorporating bells, ribbons, sticks and shouts—around the Bay Area.

AUREN HOFFMAN *(B.S.'96 IEOR)* is the CEO of San Francisco–based Rapleaf **(www.rapleaf.com)**, a private startup whose software product lets users search name, age and social networking affiliations for anyone with a known email address.

PETER C. HSUEH *(B.S.'93 MSE, NE)* was promoted to special counsel at the Southern California intellectual property law firm Christie, Parker & Hale, where he specializes in prosecuting high-tech patent applications. Hsueh earned a master's degree in radiation health physics from Texas A&M University and graduated summa cum laude from Southwestern University School of Law. **peter.hsueh@cph.com**

KARA M. KOCKELMAN *(B.S.'91, M.S.'96 CEE)* is associate professor of transportation engineering at the University of Texas, Austin. She chairs the Transportation Research

Board's Travel Survey Methods Committee, sits on the National Academy of Sciences Energy and Transport Committee and is on the

editorial boards of five transportation and regional science journals. She writes that she "enjoys research, teaching and chasing around after my twin four-year-olds."

ZHEN H. LIU *(B.S.'92 EECS)* of San Mateo, California, has been a database system developer for 15 years and is a consulting member of the technical staff at Oracle, where he works on XQuery and XML data management.

STEVEN R. MCCANNE *(B.S.'90, Ph.D.'96 EECS)* cofounded San Francisco–based Riverbed Technology in 2002 and is the company's chief technology officer. Riverbed's devices coax wide area networks into behaving like local networks, allowing businesses to centralize servers and IT staff, reduce the amount of bandwidth they need and streamline work from remote offices. The company was the top IPO of 2006, according to the *Wall Street Journal,* and more than 20 of their employees are alumni of Berkeley Engineering.

ELIZABETH A. WEMPLE *(B.S.'87, M.S.'91 CEE)* is a shareholder at Kittelson & Associates, where she has worked for 14 years as an associate engineer and project manager. She is currently coprincipal investigator on development of the Highway Safety Manual, a national guide for improving highway safety.

1980s

BERNARD AMADEI *(Ph.D.'82 CEE)*, professor of civil engineering at the University of Colorado, Boulder, was elected to the National Academy of Engineering for 2008. A geomechanics researcher, he helped create Engineers Without Borders and is a leader in sustainable development education.

MICHAEL BRUNO *(M.S.'81 CEE)* was appointed dean of the Charles V. Schaefer Jr. School of Engineering & Science at Stevens Institute of Technology in Hoboken, New Jersey. An expert in ocean and coastal engineering, he holds a joint doctoral degree in ocean engineering from the Woods Hole Oceanographic Institute and Massachusetts Institute of Technology. He was a 1996 Fulbright Scholar and has been

director of the Center for Maritime Systems since 2003. Bruno was named to the National Research Council Marine Board, which advises government agencies with interests in the sea. A master scuba diver, he teaches students how to dive in a wave tank and then in the Hudson River.

BRIAN G. DEMCZYK *(M.S.'85 MSE)* of West Newton, Pennsylvania, is pursing investment and technical consulting opportunities. **www.webspawner.com/users/synmat/index.html**

MARK J. FREITAS *(B.S.'80 CEE)* is a principal engineer at Fugro, a geotechnical, survey and geoscience service company in Oakland.

SUSAN M. GALLARDO *(B.S.'80, M.S.'85 CEE)* is a principal engineer at Geomatrix Consultants in Oakland.

DORIEN C. GARMAN *(B.S.'82 ME)* is working at Aerospace Corporation in Chantilly, Virginia, as a systems director in satellite ground systems.

DIANE B. GREENE *(M.S.'88 EECS)* is president, CEO and

cofounder of VMware Inc., a Silicon Valley virtualization specialist company

ANN KIM

Yoky Matsuoka (left) and 8th-grader Olivia Pineda demonstrate Matsuoka's anatomically correct robotic hand, designed to integrate directly with the human body and brain.

LENDING A HELPING HAND

When she was on the Cal Tennis Club, Yoko "Yoky" Matsuoka (B.S.'93 EECS) dreamed of creating a robotic opponent that could return balls to her over the net. That bot never materialized, but her desire to build it launched a groundbreaking career that earned her a 2007 MacArthur "genius" award, a no-strings-attached, $500,000 honor from the John D. and Catherine T. MacArthur Foundation recognizing Matsuoka's bold research in neurobotics—neuroscience meets robotics—most notably her efforts in developing a brain-powered prosthetic hand.

A native of Japan, Matsuoka grew up in Santa Barbara, California. After graduating from Berkeley, she earned her master's and doctorate at MIT, then joined the faculty at Carnegie Mellon. In 2006, she joined the University of Washington, where she is now associate professor of computer science and engineering and on the research team at UW's Neurobotics Lab.

"Moving forward 25 to 30 years, we have to achieve very dexterous behavior," Matsuoka says. Current prosthetic options are stiff and provide only limited motion. But her approach could give amputees the ability to operate a replacement limb without, well, giving it a second thought.

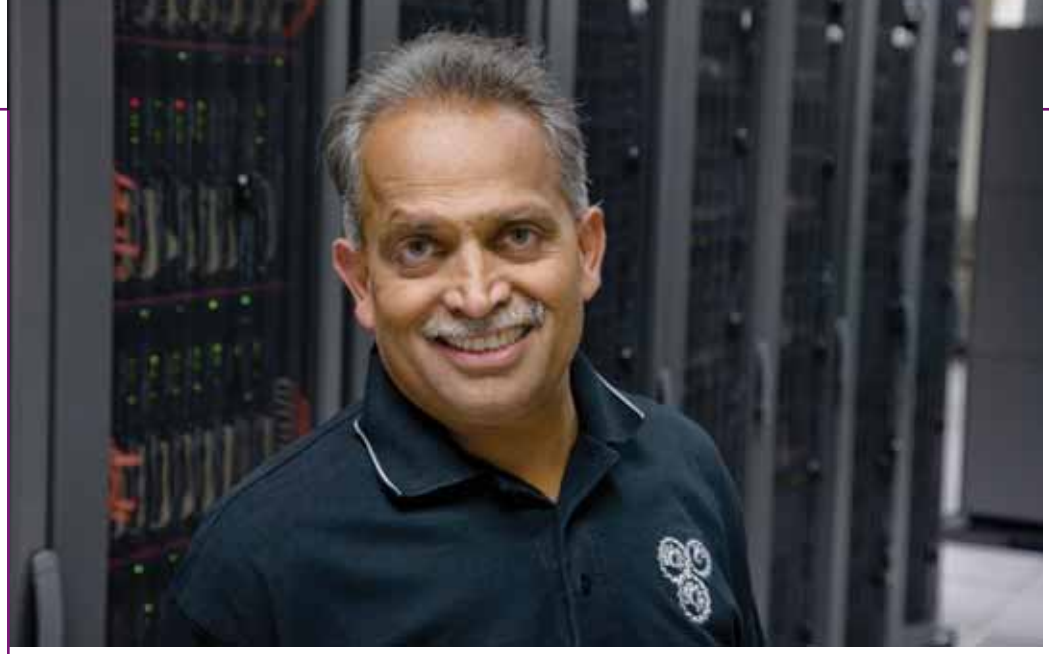
Matsuoka and team modeled a robotic prosthesis on an actual human appendage and wired it to function like the real thing. The device incorporates lifelike "bones" made from composite that articulate when mini-motors drive nylon polymer "tendons" to curl or flex a finger. In place of the brain signals that control movement in a normal hand, this creation uses neural data from real patients, transformed by algorithms into pulses that drive the motors. Matsuoka hopes that one day, an amputee will be able to attach the limb and operate it just as they would a biological one—with brain power.

"Assume you're missing your arm, and we give you a complex robotic prosthesis that has nothing to do with how your brain actually controls your arm," she says. "If we can provide a system that looks and functions like a real system, your brain doesn't have to work as hard to control it."

Matsuoka also built a robotic arm that safely guides individuals recovering from strokes and other neurological problems through their physical therapy regimes. With her newfound MacArthur funding, she has visions of starting a company, "writing a book or three" and working with K–12 institutions, all with the goal of speeding up the timetable for bringing neurobotic technology into our daily lives.

A robotic thumbs-up to that!

BY MEGAN MANSELL WILLIAMS



COURTESY HEWLETT-PACKARD

Chandrakant Patel (B.S.'83 ME), a native of Gujarat, India, is director of the "Cool Team" at Hewlett-Packard, researching ways to prevent chips, computers and data centers from overheating.

KING OF COOL

As a student, Chandrakant Patel (B.S.'83 ME) rode the bus every day from the low-income Graystone Hotel in San Francisco's Tenderloin, where he lived, to the verdant UC Berkeley campus, where he studied. Today, a lot has changed for Patel, now a fellow at HP Laboratories in Palo Alto, leading the charge to develop a new generation of energy-efficient data centers.

Patel left his home in India at age 18, bound for the United States and UC Berkeley. He couldn't be sure he'd get into Cal but, Patel says, he ran on instinct and youthful optimism.

"Berkeley was famous for world-renowned books by professors like Egor Popov," he says. "The fact that I could be in one of these classes gave me a sense of great anticipation."

To save money, he went first to Medford, Oregon, where his sister lived. He worked the lumber mills, even delivered paper towels and sold encyclopedias door-to-door. Then a family friend in San Francisco offered him a room at the Graystone in what, at the time, was one of the city's roughest neighborhoods. His room was about 12 feet by 10 feet, with a sink and a bookshelf. He lived there throughout his four-year college career and even worked as the hotel's weekend manager.

"I was more concerned with the big picture," he says. "I was in one of the most beautiful cities in the world: awesome climate, great school, stunning vistas. Where I stayed overnight was not meaningful."

He first enrolled at San Francisco's City College, a community college, and followed instructions in the course catalog detailing the path to Berkeley. "I still have that catalog and I still have the page marked," he says.

After two years, Patel was enrolled at Cal and had saved $1,000, enough to cover tuition and buy books. He even got a job as research aide in mechanical engineering professor George Johnson's lab for $300 a month. In 1983, Patel joined Memorex, where he worked in the Large Disc Division while attending San Jose State University part-time to earn his master's degree. In 1987, he landed a job at Hewlett-Packard, where he has been ever since.

Patel's work at HP initially involved mass storage design, but in the 1990s his interests went cold. Literally. He established a thermal technology research group and a virtual community he called the HP Cool Team to investigate issues surrounding heat, namely, how to prevent overheating in chips, computers and, now, data centers. Data centers are essentially big rooms filled with row upon row of racks, each one containing scores of computers that consume power and produce heat, which takes energy to remove.

"Imagine a room with 100 racks using 10 kilowatts each. That's one megawatt per room," Patel explains. "With a cooling system using a megawatt of its own, that's two megawatts per room. Say there are 3,000 data centers in the world, that's six gigawatts, or 20 million metric tons of coal per year to run all those centers. That gives you the magnitude of global resources required to run these rooms."

While most data centers are grossly over-provisioned—on full power all the time and kept bone-chillingly cold no matter what—Patel hopes his work on HP's recently launched dynamic "smart" cooling system for data centers can reduce energy needs by half. The system incorporates sensors on the racks, so air conditioning kicks in only when and where it's needed, say, the far right corner of the room, where dozens of computers are cranking. He is now also directing a new laboratory at HP, researching sustainable information technology ecosystems.

Patel has come a long way from the Tenderloin. But he hasn't forgotten the early days. In support of the community college system that served him so well, he taught on weekends at Chabot College in Hayward for more than 16 years. He also taught at UC Berkeley Extension and continues to teach at San Jose State University. And he still takes AC Transit to work every day.

"It's a great environment for reading," he says, "and with Wi-Fi on the bus, I can go through my email or keep an eye on a data center in India."

For more, go to **www.hpl.hp.com/about/bios/chandrakant_patel.html.**

BY MEGAN MANSELL WILLIAMS

based in Palo Alto. The company registered the largest technology IPO since Google and is the fourth largest publicly traded software firm in the world. Their product allows a server to handle multiple operating platforms at once for optimal performance. Greene is also an avid sailor and windsurfer.

RONALD B. HEGLI *(M.S.'86 ME)*

is chief technology officer and vice president of engineering for Awarepoint Corporation in San Diego. He was previously vice president and chief architect at Websence, Inc., and director of product programs for Neura Communications, Inc. Hegli started his career with General Electric Company as an Edison engineer.

KEITH D. HJELMSTAD *(M.S.'79, Ph.D.'83 CEE)* was named vice president and dean of the College of Technology and Innovation at Arizona State University's Polytechnic Campus. Hjelmstad was formerly professor of civil engineering at the University of Illinois,

Urbana-Champaign, where he also served as associate head of the department and associate dean for academic affairs in the College of Engineering.

JOHN F. LA FOND *(M.S.'81 ME)* is a partner and engineering manager for Jansen Combustion and Boiler Technologies in Kirkland, Washington. He writes, "I have two children at the University of Washington, both interested in attending UC Berkeley for graduate school."

OTTO LEE *(B.S.'89 NE)* is the former mayor of Sunnyvale, California. The Hong Kong native has a law degree from UC Hastings and is managing attorney for Intellectual Property Law Group LLP, specializing in patents, trademarks, copyrights and licensing of intellectual property.

DEBORAH L. MCGUINNESS *(M.S.'81 CS)* joined Rensselaer Polytechnic Institute in Troy, New York, as an endowed chair of the Tetherless World Research Constellation. She's a creator of the OWL Web Ontology Language, which allows computers to "talk" to one another. An expert in artificial intelligence, she formerly led the Knowledge Systems Artificial Intelligence Laboratory at Stanford University and is a member of the American Association for Artificial Intelligence and the Association for Computing Machinery.

JACKSON NICKERSON *(M.S.'86 ME)* received the Distinguished Faculty Award for 2007 from Washington University in St. Louis, Missouri, where he is the Frahm Family Professor of Organization and Strategy at the Olin Business School. He researches the effect of organizational structure—such developments as outsourcing and decentralization—on company performance. Nickerson also received the Olin School's Reid Teaching Award for the past seven consecutive years and, in 2003, the Missouri Governor's Award for Excellence in Teaching.

MICHAEL G. OLIVA *(M.S.'75, Ph.D.'80 CEE)* was named Distinguished Educator of the Year for 2007 by the Precast/Prestressed Concrete Institute of Chicago. He is associate professor of civil and environmental engineering at the University of Wisconsin–Madison.

PRABHAKAR RAGHAVAN *(Ph.D.'86 EECS)*, senior vice president and head of Yahoo! Research, in Santa Clara, California, was elected to the National Academy of Engineering for his significant contributions to algorithms and the structure of the World Wide Web.

RICHARD RUBY *(B.S.'77 Eng. Physics; M.S.'77, Ph.D.'84 EECS)* of Menlo Park, California, holds more than 50 patents for major inventions, including the thin film bulk acoustic wave resonator (FBAR) technology used in cell phones. He's married with three children, one at UC Santa Cruz and one at UC Berkeley. He still plays the violin.

JOSEPH F. SIFER *(M.S.'88 EECS)* is a vice president and partner at the consulting firm Booz Allen Hamilton. He is based in London and focuses on the telecommunications and technology sectors.

1970s

JESSE A. ANTE *(B.S.'68, M.S.'70 ME)* of Fremont, California (far left in photo), retired from Pacific Gas & Electric in 2000 and now works for the California Public Utilities Commission. His job, he writes, is to "encourage utilities to build transmission lines to access renewable, 'green' energy by 2011." He skipped last year's homecoming to attend his daughter Jennifer's wedding.

JEFFREY W. BUCKHOLZ *(M.S.'77 CEE)* of Jacksonville, Florida, recently received his Ph.D. in civil engineering from the University of Florida and celebrated 19 years as president of his company, J.W. Buckholz Traffic Engineering. He's also an adjunct professor at the University of North Florida.

LARRY BURNS *(Ph.D.'78 CEE)* is chief scientist and president of research and development and strategic planning for General Motors, where he's worked since 1969. Last year, Burns received the ASM International 2007 Medal Award for the Advancement of Research, which honors an executive active in the use of metals and other materials. He is an expert on GM's next-generation cars, including their experimental hydrogen-powered vehicle, their Hybrid 2Mode and the new E-Flex Fuel Cell variant, which uses fuel cell propulsion technology and a lithium-ion battery to provide up to 300 miles of petroleum- and emissions-free electric driving.

THOMAS W. BUTLER *(B.S.'73 ME)* of Issaquah, Washington, got his master's degree in mechanical engineering from the University of Washington, then went to work at Boeing, where he was elected a technical fellow after working there for 30 years. **twbutler@comcast.net**

ROBERT C. CLIFF *(B.S.'66, Ph.D.'71 IEOR)* spent four years as an assistant professor at UC Berkeley before launching Oakland-based Cliff Consulting Inc. (**www.cliffconsulting.net**), now in its 35th year. The small firm teaches finance professionals skills in project management and process streamlining and caters to several large clients, including Wells Fargo Bank, Bank of America and Kaiser Permanente. In his spare time, Cliff and his wife, Cathy, enjoy sailing, biking and snow skiing.

ALBERT S. GLENN *(B.S.'74, M.S.'76 ME)* is an assistant U.S. attorney doing criminal prosecution in Philadelphia.

BARBARA J. GROSZ *(M.S.'71, Ph.D.'77 EECS)* has been elected to the National Academy of Engineering for 2008 for her pioneering research in human–computer communication. She is interim dean at the Radcliffe Institute for Advanced Study and the Higgins Professor of Natural Sciences, School of Engineering and Applied Sciences, at Harvard.

RICHARD C. JARED *(B.S.'70 EECS)* of Martinez, California, retired in 2002 from Lawrence Berkeley National Laboratory, where he was a project engineer and head of the Electronics Engineering Department.

SUNG-MO "STEVE" KANG *(Ph.D.'75 EECS, at podium in photo)* was appointed the second chancellor of UC Merced, the first Korean American to lead a major research university, according to the newest UC campus's news office. Previously, Kang served as dean of the Baskin School of Engineering at UC Santa Cruz for six years and as professor of electrical engineering and computer engineering at the University of Illinois at Urbana-Champaign.

MIKE KARIBIAN

CHOK-KAU B. LEE *(M.S.'74 NE)* writes, "I am working in Mountain View and living in Cupertino. Anyone in my class want to get together?" **blee@ca.wai.com**

MICHAEL S. LEONARD *(M.S.'79 CEE)* is owner and principal of MLA Engineering, PLLC, a structural engineering consulting firm specializing in seismic improvements to existing buildings. He lives on Bainbridge Island in Washington state.

THOMAS M. MCGAUGHEY *(M.S.'73 CEE)* is currently project engineer for design of the terminal expansion at John Wayne Airport in Orange County, California.

HOWARD S. PINES *(M.S.'77 ME)* of El Cerrito, California, has been the data signal processing firmware engineer at three different Bay Area startups for the last 25 years. Previously, he was a staff scientist at Lawrence Berkeley National Laboratory doing alternative energy research.

MARINAS SCHEFFER *(M.S.'72 CEE)* is president of Scheffer Andrew LTD, a 70-employee consulting firm of planners and engineers based in western Canada.

SYLVIA D. SUMMERS *(M.S.'77 EECS)* was appointed CEO and member of the board of directors of Trident Microsystems, a digital TV technology provider headquartered in Santa Clara, California. Trident designs, develops and markets digital media for high-definition and LCD televisions.

GERALD F. WIECZOREK *(B.S.'71, M.S.'72, Ph.D.'78 CEE)* of Herndon, Virginia, works on landslide hazards for the U.S. Geological Survey. He has published about 120 articles on the subject, many of them available online.

GAIL WINTON *(B.S.'71 CEE)* retired in 2005 after more than 30 years as a civil engineer in both public and private practice. She writes, "I am now enjoying my retirement with my husband, Frank, also a retired civil engineer. I spend my time golfing, doing home improvement projects, traveling and taking care of my new granddaughter. Our daughter is a landscape architect, and our son is a deputy sheriff. I am ever hopeful that someday Cal will get to the Rose Bowl again! GO BEARS!!!"

ROBERT M. YAMAMOTO *(B.S.'77 ME)* of Sacramento is manager for the High Average Power Laser Program at Lawrence Livermore National Laboratory.

1960s

JAMES E. ALVERSON *(B.S.'54, M.S.'61 CEE)* of Redmond, Washington, writes, "I am now a retired civil engineer but am active in the ASCE History and Heritage Program and support Engineers Without Borders."

BRUCE R. BUCKELEW *(B.S.'66 IEOR)* of Piedmont, California, is the founder of Oakland Technology Exchange (OTX) West, a computer refurbishing company that helps the underprivileged gain technological skills and saves high-tech waste from polluting landfills. Buckelew worked as an engineer for IBM for 25 years and retired in 1991. His company repairs castoff computers, installs them in Oakland's schools and nonprofits and provides free machines and training to low-income families. **www.otxwest.org**

DOUGLAS A. HEWETT *(B.S.'68 EECS)* of Redondo Beach, California, is an embedded firmware engineer at AeroVironment.

CHARLES F. JENNINGS *(B.S.'62 CEE)* is a principal with San Francisco's Polytech Associates, Inc., which provides architectural services for both public and private clients.

ANTHONY JOHNSON *(B.S.'60 IEOR)* of Carmel, California, is a retired U.S. Army Colonel. He was commissioned out of Army ROTC and served 28 years in infantry, artillery, maintenance, missile and nuclear weapons units. He managed installation and depot logistics as well as training assignments. Since retirement, he's worked in manufacturing, security and nonprofit jobs. He writes, "I'm teaching business and organizational leadership at two local colleges and serving on boards of the Salvation Army and Kiwanis Club of Monterey. I'm tolerated by my wife, Judy, four daughters and nine grandchildren . . . and loving every minute."

SHINGO L. NISHIKAWA *(Ph.D.'69 EECS)* retired from AT&T/Lucent Technologies in 1979 and then spent five years in China. He writes, "Today, I teach business and technology management courses in English at Akita International University in northern Japan."

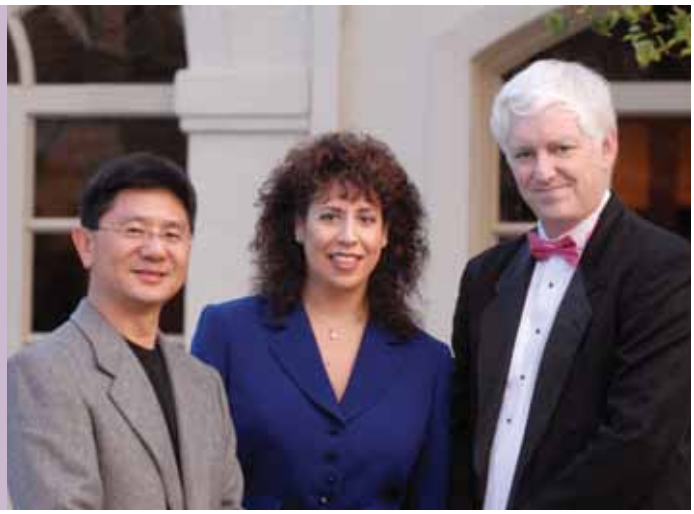
RONALD M. NOBLE *(M.S.'69 CEE)* is president and CEO of Noble Consultants, Inc., and Coastal Engineering Foundations. He's also president and owner of Willowbrook Stables in Petaluma, California.

KENNETH R. OBERT *(B.S.'65 EECS)* of Torrance, California, writes, "I hiked the Muir Trail last summer. I'm still studying cosmology and am pleased that Cal picks up Nobels in such things."

RANGAIYA A. RAO *(M.S.'61, Ph.D.'66 EECS)* of Los Altos Hills, California, was a member of the technical staff at Fairchild Semiconductor and a professor of electrical engineering at San Jose State University from 1965 to 2003. "I am a Cal football fan, and so is my grandson," he writes. "Lately, I am spending some time with my baby granddaughter and enjoy playing golf."

INNOVATORS UNITE!

Berkeley Engineering Innovation Award (BEIA) winners celebrated in February at the BEIA reception at Menlo Circus Club in Atherton. Honorees were (from left) James K. Lau (B.A.'81 Applied Math, CS), cofounder, executive vice president and chief strategy officer for Network Appliance, Inc.; Rula A. Deeb (M.S.'94, Ph.D.'99 CEE), senior associate at Malcolm Pirnie, Inc.; and Peter Norvig (Ph.D.'86 CS), director of research for Google. Lau and Norvig were recognized for lifetime achievement and Deeb as outstanding young leader. The awards, previously known as the Distinguished Engineering Alumni Awards, or DEAA, recognize outstanding achievements by alumni in engineering and technology. For more, go to **www.coe.berkeley.edu/awards.**



PEG SKORPINSKI

LET THERE BE LIGHT

In remote villages along Nicaragua's Caribbean coast, the seemingly simple act of switching on a light is anything but simple. It's usually impossible.

Mathias Craig (B.S.'01 CEE) wants to change that. Craig, 29, is cofounder of blueEnergy, a nonprofit organization that is harnessing the power of the wind to illuminate homes, schools and rural clinics in an impoverished region where nearly 80 percent of the residents have no electricity.

Since 2004, blueEnergy has brought wind turbines to six Nicaraguan communities, providing electricity to some 1,500 people. Rather than giving residents a handout, the nonprofit relies on community members to help install and maintain the hybrid wind and solar systems. "We take more of a holistic approach," Craig says.

While still in its infancy, blueEnergy is generating plenty of attention. Last July Craig won a CNN Heroes award, and his organization routinely fields a steady stream of requests to expand its operations.

"The plan is to take it global," says Craig, who at the same time wants to take a methodical approach to make sure they "get things right." Working from San Francisco, Craig travels to Nicaragua about four times a year and joins a team of 11 local employees, 10 international volunteers and his brother Guillaume at the organization's operations and manufacturing base in the town of Bluefields.

Because there are no roads leading to most communities they serve, simply reaching these villages involves an often tortuous, six-hour trip by small fiberglass boat or native dugout canoe. Further complicating the commute, Craig says: "It's hurricane country."

A wind turbine, which typically has six-foot-long blades and is posted on a 60- to 80-foot tower, can power 10 modest homes or a clinic. Each system costs about $12,000 to $15,000, with funding coming from foundations and private donations.

"Their dynamics are very complex," says Craig, who trains three residents in each community how to operate the systems. UC Berkeley's Renewable and Appropriate Energy Laboratory (RAEL) will soon conduct performance tests on blueEnergy's wind turbines. Craig plans to share the results with the Nicaraguan government, which has expressed interest in installing the turbines on a widespread basis.

Craig, who grew up in Eugene, Oregon, has long been intrigued by renewable energy. That interest blossomed at Berkeley, in the interdisciplinary Energy and Resources Group. Craig developed the idea for blueEnergy in a class on entrepreneurship in the developing world, which he took while earning his master's at MIT. Nicaragua was a natural base of operations, since the Craig brothers frequently traveled there as boys while their mother, a linguist, studied Amerindian languages of the region.

Sustainable energy is having a powerful impact on these communities, providing a low-cost alternative to dirty diesel generators. Already, Craig has seen the fruits of his labors: youngsters conducting evening study halls, lights going on in a tiny health clinic, even villagers switching on a TV to watch Spanish-language soap operas.

"We're not there to dictate the uses," he says. "We really see our role as providing opportunities."

BY ABBY COHN

PHOTOS COURTESY MATHIAS CRAIG

Mathias Craig (B.S.'01 CEE) with a young friend in Nicaragua, where he cofounded his company blueEnergy, which has brought wind turbines to six communities and provided electric power to 1,500 people.

PONISSERIL SOMASUNDARAN *(M.S.'62, Ph.D.'64 MSE, at right in photo)*, professor of surface and colloid chemistry at Columbia University, received the Engineer of the Year Award from the Malayalee Engineers Association of North America in 2007. He joined Columbia's faculty in 1970, has served as chair of the Henry Krumb School of Mines and of the Department of Chemical Engineering, Materials Science and Mining, and is now the La von Duddleson Krumb Professor. He is also director of the National Science Foundation Industry/University Cooperative Research Center for Advanced Studies in Novel Surfactants and Langmuir Center for Colloids and Interfaces.

JAMES L. UNMACK *(B.S.'64 EECS)* of Rancho Palos Verdes, California, is president of Unmack Everett Environmental, Inc., and has been appointed to the Health Experts Advisory Committee of Cal/OSHA, the California Division of Occupational Safety and Health.

ERNST S. VALFER *(B.S.'50, M.S.'52, Ph.D.'65 IEOR)* of Berkeley was the director of management sciences at the U.S. Department of Agriculture. He's also a licensed psychologist and has directed two psychiatric clinics since 1994. He's currently a senior research fellow at UCLA and a senior lecturer at UC Berkeley.

DON L. WARNER *(Ph.D.'64 MSE)* of Rolla, Missouri, is dean emeritus and professor emeritus at Missouri University of Science and Technology, formerly the University of Missouri–Rolla. He received the

Distinguished Achievement Award from the Colorado School of Mines last May.

WILLIAM K. WARNOCK JR. *(B.S.'66 CEE)* of San Rafael, California, is chief engineer of Jacobs Engineers in Northern California.

JAMES L. WEEKS *(B.S.'65 IEOR)* was appointed by the U.S. Congress to the Technical Study Panel on the use of belt air for underground coal mine ventilation.

EDWARD J. WORTMAN *(M.S.'61 CEE)* is a senior engineer for Oregon's Multnomah County Bridge Section. He's been involved with bridge rehabilitation and evaluation projects over the years, including the Golden Gate Bridge in San Francisco. He is now working on installation of Oregon's new Sauvie Island Bridge, being built off-site and floated in by barge. Wortman wrote *The Portland Bridge Book* with his wife, Sharon, and was named Civil Engineer of the Year in 2004 by the Oregon section of the American Society of Civil Engineers.

1950s

JAMES H. BASSETT *(B.S.'50 ME)* of Anaheim, California, retired in 1988 and moved to a retirement home in 2006. He has three children and five grandchildren. His kids are graduates of UC Berkeley, Riverside and San Diego.

JOHN M. BOZAJIAN *(B.S.'50 ME)* retired from Haghen Aircraft Co. in 1987 and moved to Arcadia, California, in 2002.

COURTESY BRET STROGEN

Bret Strogen (M.S.'04 CEE), far left, joined 13 former Udall scholars aboard the Udall Legacy Bus, a biodiesel-powered bus that toured the nation last summer.

GREEN MACHINE BLAZES ECO TRAIL

Fifty-four days, 26 cities, six national parks, six Native American communities, 8,606 miles and one carbon-neutral, biodiesel-powered bus. That's how Bret Strogen (M.S.'04 CEE) of Berwyn, Pennsylvania, spent his summer last year, along with 13 others who crisscrossed the nation aboard the Udall Legacy Bus, promoting environmental solutions and Native American rights.

The participants were former Udall scholars, recipients of Udall Foundation scholarships for exceptional students. The trip commemorated 10 years of service by the foundation, named after 30-year U.S. House of Representatives member Morris K. Udall, who championed environmental causes and enacted policies like the Alaska Lands Act of 1980, which doubled the size of the national park system.

"My grandfather used to say, 'What you have is only worth as much as what you can share,'" Strogen says. "I think that applies to knowledge as well. There's no point in learning something unless you can do something with it." Strogen used his engineering know-how to serve as biofuels and alternative energies coordinator for the tour, tracking mileage, fuel consumption and emissions using the engine's computer and a GPS log.

The Udall bus—one of the 39,000 U.S. motor coaches in operation that consume some 431 million gallons of diesel fuel annually—used about 160 gallons of fuel per passenger during the three-month tour. It cut its carbon emissions, however, by using a custom engine; burning blended biodiesel, which reduces emissions by 15 percent; and purchasing carbon credits from NativeEnergy, a private energy firm that invests revenues in sustainable businesses and projects.

The travelers made stops along their way to clear trails in Maine's Acadia National Park, rebuild bicycles for the needy in Chicago and teach kids healthy pizza-making at a Boys & Girls Club in Portland, Oregon. Strogen arranged for the group to tour the Fryodiesel plant in Philadelphia, where stinky, used fryer grease from restaurants is converted into fuel. They also stopped in New Orleans to check out new pump stations being installed by Pennsylvania-based construction and redevelopment firm Weston Solutions, which are designed to increase the pumping capacity of the city's canals.

Strogen was a project engineer at Weston until last November. He returned to Berkeley in January to pursue graduate work with civil and environmental engineering professor Arpad Horvath, comparing biofuels and fossil fuels.

For more about the tour, visit **http://udall.gov** and click on the bus.

BY MEGAN MANSELL WILLIAMS

NOEL EBERZ *(B.S.'59 EECS)* of Naalehu, Hawaii, got his master's in geology at San Jose State University in 1984 and spent 15 years as a Colorado River guide. He's now a docent at Hawaii Volcanoes National Park. **www.cosmic-concerns.net**

HARRY J. KRUEPER *(B.S.'51, M.S.'53 CEE)* is still working and writes that Cal was "a true inspiration."

CHARLES K. MILLER *(B.S.'58 Engineering Physics)* of Laurel, Montana, retired in 1987 from the National Bureau of Standards, where he was chief of the electromagnetic division. His wife, Bonnie, wrote in to say that, while physically healthy, her husband is suffering from Alzheimer's. "This terrible disease needs to be our next national concern," she writes. They recently celebrated their 56th wedding anniversary.

LOWELL K. PATT *(B.S.'56 CEE)* of Murrieta, California, wrote in to tell us about the great trout fishing in New Zealand and the two-week Hawaiian vacation he took with his entire family. He's also recently traveled to Australia and Florida.

JOHN R. PERROTT *(B.S.'56 CEE)* of San Antonio, Texas, has published two books, *Save Mozambique's Elephant Coast*, about his effort to develop a wildlife refuge for 5,000 elephants slated for mercy killing, and *Bush for the Bushman,* about the native people of the Kalahari Desert in southern Africa.

LEONARD A. REA *(B.S.'56 ME)* has been retired since 1996 and is enjoying golfing, travel and his grandchildren.

JAMES R. WARD *(B.S.'56 EECS)* moved from San Diego to Grass Valley in 2006 to be close to one of his sons. "We are enjoying the Sierra foothills," he writes.

1940s

ROBERT D. ANDREWS *(B.S.'47 ME)* of Lincoln, California, retired 14 years ago from Bechtel after spending 27 years on worldwide assignments.

LEONARD C. BEANLAND *(B.S.'49 ME)* of Castro Valley, California, writes, "I'm enjoying life and family. I will reach 85 this year and I'm still going strong." He retired in 1984.

ALVIN P. BEISER *(B.S.'49 CEE)* of San Mateo, California, is retired after working in large buildings and heavy construction.

CHARLES D. CARROLL *(B.S.'45 ME)* is retired and living in San Jose.

ROBERT A. DAL PORTO *(B.S.'49 IEOR)* partially retired in 2000. He's a lifelong cattle rancher in east Contra Costa County and spent 19 years, between 1981 and 2000, as a consultant for Chevron Shale Oil Co. in Grand Junction, Colorado. He's also a former land leveler and earth-moving contractor, as well as a farmer and land manager.

JAMSHED K. FOZDAR *(B.S.'48 EECS)* was involved in work on radio astronomy and electron microscopy at the U.S. National Bureau of Standards in Washington, D.C. At age 22, he received a letter from Albert Einstein commending his paper on the fourth dimension. He is now a telecommunications consultant and a member of the Professional Engineers Board of Singapore. He was honorary secretary of the Inter-Religious Organization of Singapore from 1996 to 1999 and has written three books on comparative religion, including *The God of Buddha.*

JOHANN B. FREYMODSSON *(B.S.'44 EECS)* of Santa Barbara, California, is the former president of Freymodsson Associates. He writes, "I'm retired and pursuing interests in physics and mathematics."

MYRON H. JACOBS *(B.S.'44 EECS)* of Sacramento switched to civil engineering after discharge from the U.S. Navy and spent the next 41 years as a bridge construction engineer. He retired in 1988.

JAMES W. NEIGHBOURS *(B.S.'40 ME)* is a 90-year-old retiree who works full time as a caregiver for his wife who has late-stage Alzheimer's. "As we live in New Jersey, I miss being able to attend Cal functions," he writes, "but I enjoy reading about them."

DONALD R. NUSS *(B.S.'41 ME)* is a World War II veteran and lieutenant commander who has traveled the world and written three books. He's at work now on his fourth, *The Last Stop*, loosely based on his life in a retirement home in Aliso Viejo.

COURTESY DONNA CARNES-GRAY

MAY 31 EVENT CELEBRATES JIM GRAY His visionary work in transaction processing made possible high-tech conveniences like ATMs, online ticketing and e-commerce. His database research paved the way for deep databases like Google. Through his eight years at Berkeley Engineering and his longtime research and design career at Bell Labs, IBM, Tandem Computers, Digital Equipment Corporation and Microsoft, he made a lasting contribution to both the academics and industry of computing.

He is Jim Gray (B.S.'66 Eng Math, Ph.D.'69 CS), who earned the university's first doctorate in computer science and went on in 1998 to earn the A.M. Turing Award, known as the Nobel Prize of computing. A seasoned seaman, Gray disappeared without a trace on a solo sailing trip to the Farallon Islands on January 28, 2007.

Friends and colleagues will celebrate Gray and his career contributions on May 31 at 9:00 a.m. in Zellerbach Hall, followed by technical sessions in Wheeler Auditorium. The event is cosponsored by UC Berkeley, the Association for Computing Machinery and the Institute of Electrical and Electronics Engineers Computer Society.

To register, go to **www.eecs.berkeley.edu/ipro/jimgraytribute.** Please check the website before the event, as hall assignments are subject to change.

1930s

WOLFGANG GABOR *(B.S.'39 ME)* writes that he celebrated his 90th birthday last year in May. He is still a registered mechanical engineer in the State of California, doing consulting work for "anyone who will hire an old guy like me. I have a wonderful wife, married 67 years!"

OTTO P. MORGENSEN JR. *(B.S.'33 ME)* of Kettering, Ohio, writes, "I am an 'old man,' 103 years old in April."

PAUL F. OFFERMANN *(B.S.'39 EECS)* writes that his granddaughter, Elizabeth Rose Mayeda, graduates from Cal this May with a double major in integrative biology (in which she received a Franklin M. Henry Award) and public health. She also received the Oscar Geballe Scholarship for graduate school.

EDWARD C. SAUNDERS *(B.S.'48 ME)* of Newport Beach, California, writes, "I'm living at the beach and happily retired after many years of owning and running my own company, which manufactured items for telephone companies."

ROBERT L. SISLER *(B.S.'40 ME)* of San Anselmo, California, writes, "I just reached the age of 90!" He's retired from Pacific Gas & Electric.

WILLIAM H. CHAPMAN *(B.S.'50 CEE)* died last October at age 80. He earned his master's in geodetic science from Ohio State University

and worked for the U.S. Geological Survey, mapping the western United States and Antarctica. He traveled to the icy continent multiple times, even in winter, and two of its physical features—Mount Chapman and the Chapman Ice Field—are named after him. He also enjoyed woodworking, photography and gardening.

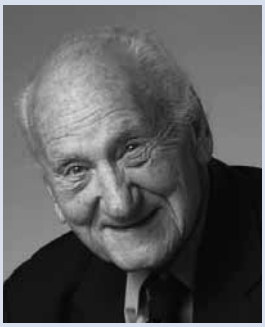
RALPH E. CLARK *(M.S.'68 EECS)* died suddenly of a heart attack at his home in Walnut Grove, California. He was 63 years old.

JULIUS J. JELINEK *(B.S.'38, M.S.'43 ME)* died in August in San Francisco at age 90. He worked as a postdoc on aircraft materials during World War II and taught engineering at Oakland Polytechnic College for several years before taking a full-time post at San Francisco City College. He retired in 1981. Jelinek was an avid traveler, woodworker, reader and music lover.

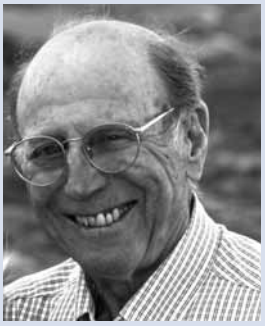
DAVID N. KENNEDY *(B.S.'59, M.S.'62 CEE)* died in Sacramento in December at age 71. Known as California's "water czar," he was director of the State Department of Water Resources, overseeing water resources for more than 30 million people.

Director from 1983 to 1998, Kennedy led the department through a five-year drought and three major floods. He served as a lieutenant in the U.S. Army Corps of Engineers from 1959 to 1962 and had a keen interest in the military and political history of World War II. He received UC Berkeley's Distinguished Engineering Alumni Award in 1997 and was elected to the National Academy of Engineering in 1998. After Hurricane Katrina, Kennedy served on an American Society of Civil Engineers panel to review a government study of levee failures in New Orleans.

ANTONI K. OPPENHEIM, professor emeritus of mechanical engineering and world expert on combustion and heat transfer, died in January at age 92. Born in Poland, Oppenheim attended the Warsaw Institute of Technology for aeronautical engineering until his studies were cut short by the 1939 Nazi invasion. He fled, eventually earning a Ph.D. in mechanical engineering from University of London, where he also worked with British scientists to improve the nation's fighter plane engines. He joined the Berkeley faculty in 1950. Oppenheim developed methods for studying the mechanics of detonations using high-speed photography and for quantifying radiation heat transfer by treating the system as a network, a concept still taught today. Most recently, he was working on a pulsed-jet combustion system to reduce pollution and double the gas mileage of auto engines.

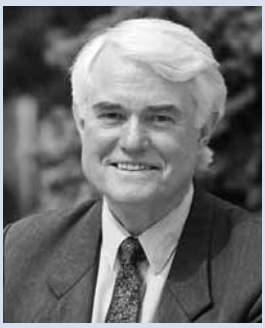


Professor emeritus of nuclear engineering **VIRGIL E. SCHROCK** *(M.S.'52 ME)* died at his home in Santa Rosa, California, last October at age 81. An expert in thermal hydraulics, Schrock studied boiling phenomena and heat transfer. He helped improve the safety of nuclear reactors by researching ways to remove heat passively using gravity rather than pumps and other equipment. Schrock earned two degrees from the University of Wisconsin–Madison and joined the UC Berkeley faculty in 1948. He served as an engineering officer in the U.S. Navy and remained active in the Naval Reserve, eventually becoming a commander. A fellow of the American Society of Mechanical Engineers (ASME) and the American Nuclear Society, he received the ASME Heat Transfer Memorial Award and the ASME Heat Transfer Division 50th Anniversary Award, among other honors. He was a great traveler, hiker, gardener, carpenter, tennis player and runner.



KATIE JERVIS PHOTOGRAPHY

GARY L. THOMAS *(B.S.'60, Ph.D.'67 EECS)* of West Orange, New Jersey, died in January at age 70. Thomas held several academic and administrative posts at the State University of New York at Stony Brook and the New Jersey Institute of Technology, where he was also professor of electrical and computer engineering. During his tenure (2000–2005) as chancellor of Missouri University of Science and Technology (formerly the University of Missouri–Rolla), enrollment increased nearly 18 percent, externally funded research expenditures doubled and major construction projects were initiated, all during a time of unprecedented higher education budget cuts. Thomas's research interests included green technology and brownfield remediation. He traveled in China, Russia and Brazil and once lived in Ghana.



KENNETH A. WRIGHT *(M.S.'68 IEOR)* of Ridgefield, Connecticut, died at his home in April at age 74. According to his widow, Dorothy, attending UC Berkeley was the high point of his academic career and enabled his subsequent work for Bell Laboratories. Wright attended Ohio State University while in the U.S. Air Force. Following his service in the Korean War, he earned a degree from Penn State, followed by a master's in experimental psychology from the University of Denver. He was an active sportsman who enjoyed skiing, flying, sailing and scuba diving. For more than a decade, he worked with Literacy Volunteers, tutoring students in reading skills.

PEG SKORPINSKI

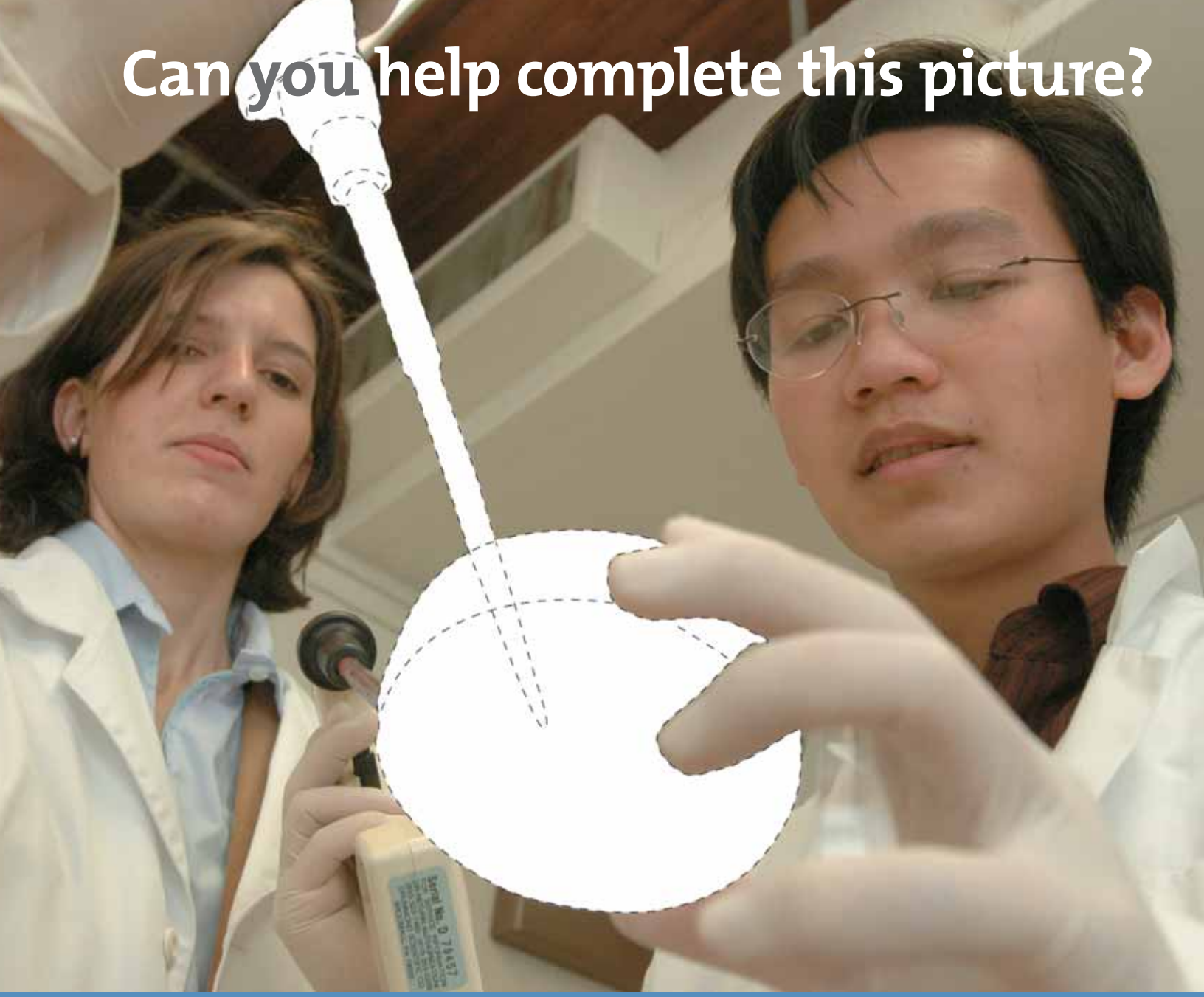
Berkeley Engineer R. J. Matthews (B.S.'49 ME) and his wife, Betty (B.A.'44 English), have made a planned gift establishing the Robert J. Matthews Undergraduate Scholarship Fund. This endowment will provide scholarships for financially needy undergraduates in the College of Engineering.

"I got a terrific engineering education from Cal. It was made possible by the generosity of others, and I'd like to return that to society."

—R.J. Matthews (B.S.'49 ME)

To learn how you can make Berkeley Engineering part of your estate planning, contact Jeff Rhode at 510.643.0908 or go to **www.coe.berkeley.edu/support-the-college/gift-planning.html.**

BART NAGEL



Your gift to **Berkeley Engineering's Annual Fund** will help provide these students with critical laboratory equipment.

Help make today's students tomorrow's leaders! *Go to* **www.coe.berkeley.edu/giving.**

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