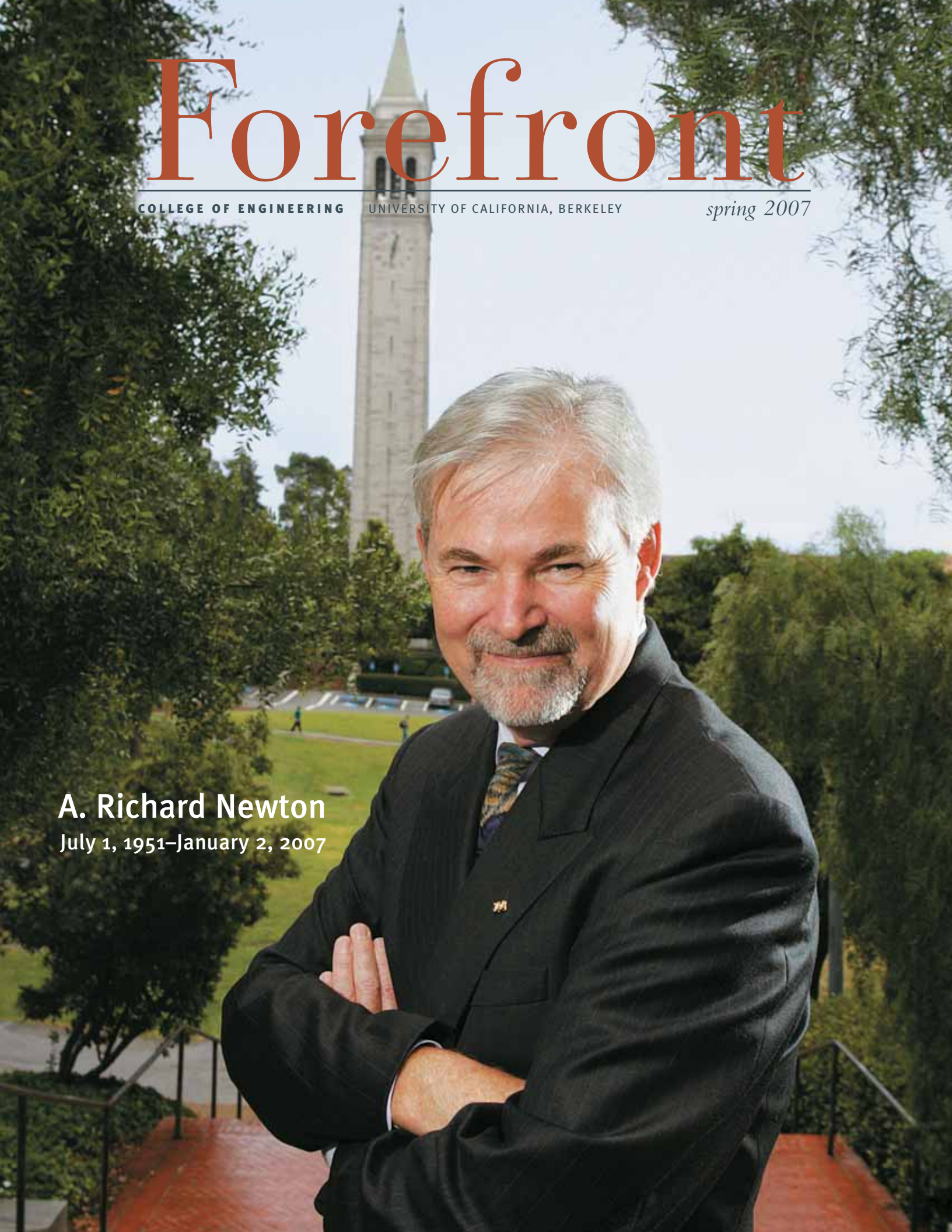
Forefront

COLLEGE OF ENGINEERING UNIVERSITY OF CALIFORNIA, BERKELEY spring 2007



A. Richard Newton

July 1, 1951–January 2, 2007

dean's message

The legacy of Richard Newton

PEG SKORPINSKI PHOTO

By the time you read these pages, nearly five months will have passed since the death of Richard Newton, our dean and visionary leader for the last seven years. His absence still leaves a tremendous void.

As our Berkeley Engineering family continues to mourn Rich's loss, we naturally turn to *Forefront* as the appropriate place to document his incredible legacy. We considered everything from a brief article to an entire issue devoted to him. We settled on something in between, which we hope will convey the story of an extraordinary man whose contributions touched engineering and academic communities throughout the world. We have also tried to capture the spirit of warmth and humanity that has encircled the College these last few months: the memorial events, the presence and words of Rich's family and friends, the outpouring of heartfelt messages and letters of condolence, for which I thank you all sincerely on behalf of everyone in the College.

An internal search is under way for a full-term dean with the goal of making an appointment by July 1, 2007. In the meantime, I will serve as acting dean. Paul Gray, who preceded Rich as engineering dean and recently returned to our faculty after serving the campus as executive vice chancellor and provost, has agreed to act as special assistant for space planning and development. I am delighted to welcome Paul back to the Dean's Office and grateful for his expertise and support during this difficult transition.

Rich always said that we should leave the world a better place than we found it. He could not have left a better example than the work he did at Berkeley and the truly vibrant College he has left behind. Our department chairs and faculty are dedicated to continuing his tradition of research, teaching and service on behalf of California, the nation and the world. Every day, our gifted young students provide us an immediate source of comfort, a reminder of our mission of educating engineers for leadership positions throughout the world, and a vision of the better and brighter future that lies ahead.

Please send us your thoughts at **dean.forefront@coe.berkeley.edu.**

— **FIONA M. DOYLE**
Acting Dean, College of Engineering
Donald H. McLaughlin Professor of Mineral Engineering

Forefront takes you into the labs, classrooms and lives of professors, students and alumni for an intimate look at the innovative research, teaching and campus life that define Berkeley Engineering.

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On the cover
Read the story on page 12.
A. Richard Newton, EECS professor and dean of Berkeley's College of Engineering, died suddenly in January. Known best as a pioneering technologist, Newton was also a brilliant entrepreneur, a tireless educator and a loving husband and father. Included are photos from his professional and personal life and tributes from those whose lives he touched.

COVER PHOTO BY NICK LAMMERS
BACK COVER PHOTO BY PEG SKORPINSKI

JEFF SHAW PHOTO

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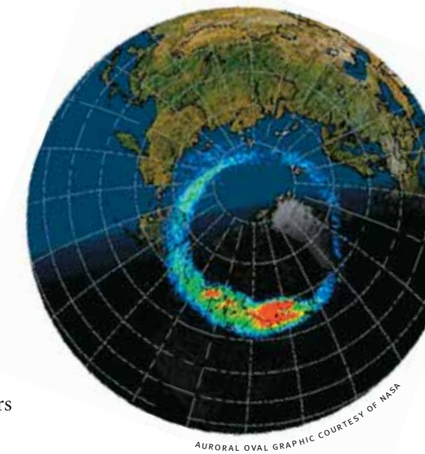
COLLEGE OF ENGINEERING UNIVERSITY OF CALIFORNIA, BERKELEY *spring 2007*



AURORAL OVAL GRAPHIC COURTESY OF NASA

CONTENTS

The biofuels conundrum

Unfortunately, Professor Patzek is quite correct regarding the use of ethanol as a means of reducing environmental damage. (See Fall 2006 *Forefront,* "Can biofuels help break our addiction to oil?") A mass balance addressing ethanol production demonstrates the fallacy of assuming that there is some "energy saving potential" resulting from ethanol use. There is also a significant economic disadvantage to ethanol (except for the major producer, Archer Daniels Midland) when one factors in all of the subsidies involved.

In order to both conserve energy and reduce carbon dioxide emissions, one should look more directly to available technologies that, although they may not have the "news appeal" of switchgrass (an apparent favorite of President Bush's), may reduce energy consumption and thereby reduce carbon dioxide emissions. One such commercially available technology is Pneu-Logic, which optimizes the operation of air compressors. Considering that 70 to 80 percent of industry worldwide employs air compressors, energy savings ranging from 15 to 60 percent could have a considerable impact on both reducing energy demand and reducing carbon dioxide emissions, and without the need for subsidies.

—**Franklin J. Agardy**
President, Forensic Management Associates
Hillsborough (M.S.'58, Ph.D.'63 Civil Engineering)

In memory of Ben Gerwick

I was saddened to learn of the death of Professor Emeritus Ben C. Gerwick Jr. in the January issue of *ASCE News.* (See brief obituary, page 32.) I had the opportunity to be a graduate student under Professor Gerwick. He was a man of many talents and a rare professional among engineers. He could relate to both the broad scope and the details and was very good at leading people. He made many contributions to society, his students, the profession of engineering and UC Berkeley. His contributions will be remembered for a long time.

—**Merlin Kirschenman**
Professor Emeritus, NDSU Moorhead, Minnesota
(M.S.'76 Civil Engineering)

(Editor's Note: We received dozens of notes and letters in response to the death of A. Richard Newton, dean of the College of Engineering, on January 2, 2007. See pages 14–16 for excerpts.)

Write to us at **forefront@coe.berkeley.edu** or send your letters to *Forefront* letters, 1925 Walnut St., #1704, University of California, Berkeley, CA 94720-1704. Please include your 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

STEVE MCCONNELL PHOTO

Dignitaries announcing Berkeley's new Energy Biosciences Institute included (from left) California Senate Minority Leader Dick Ackerman, Senate President Pro Tem Don Perata, BP America Chairman Robert Malone, Illinois Gov. Rod Blagojevich, California Gov. Arnold Schwarzenegger, Berkeley Chancellor Robert Birgeneau, UC President Robert Dynes, UIUC Vice Chancellor for Research Charles Zukoski, LBNL Director Steven Chu and BP Chief Scientist Steven Koonin.

Berkeley to lead $500 million push for new biofuels research

UC Berkeley has been selected to lead the new Energy Biosciences Institute (EBI), the largest public-private partnership at any U.S. university, to explore the next generation of clean transportation fuels produced through biotechnology. Funded by $500 million over 10 years from global energy giant BP, the effort was announced February 1 and heralded as an "unprecedented" collaboration that will support "radical research" in alternative fuels, potentially reducing the environmental impact of energy consumption worldwide.

Controversy arose in the weeks following the announcement, as some faculty and students voiced concerns about the scope of the partnership and its potential for industry influence on Berkeley's academic autonomy and integrity. In response, the Academic Senate held two special faculty meetings on the subject. Most recently, four Academic Senate committee chairs were invited by Beth Burnside, vice chancellor for research, to participate in negotiations with BP to develop draft contract language. A signed agreement is expected by mid-summer 2007.

The EBI will harness what BP called "some of the world's best science and engineering talent" at UC Berkeley, Lawrence Berkeley National Laboratory (LBNL) and the University of Illinois at Urbana-Champaign (UIUC), which was invited to join because of its agricultural expertise. Last October, BP invited five institutions to submit proposals for a research institute that could employ the tools of biotechnology in a search for cleaner fuels, initially focused on fuels for road transport. Berkeley's funding proposal—spearheaded by the California Institute for Quantitative Biomedical Research—trumped proposals from UC San Diego, MIT, Cambridge University and Imperial College London to get the grant.

The College of Engineering will have a role in the work, as will the departments of plant and microbial biology, molecular and cell biology, chemistry, chemical engineering and Berkeley's research programs in genetic engineering, synthetic biology and plant engineering. The "team-science" approach will facilitate "bold approaches that are well beyond the reach of a single investigator or discipline," said Steven Chu, LBNL director.

Initial research efforts will focus on developing "cellulosic" feedstocks—plants that can be broken down into their sugar building blocks—and methods for fermenting them into ethanol. Work is expected to begin this summer in temporary quarters in Calvin Lab and Hildebrand Hall. A new permanent headquarters is planned, for which California Gov. Arnold Schwarzenegger and the state legislature have already pledged $70 million.

At a faculty forum in March, Berkeley Chancellor Robert Birgeneau said the overwhelming campus response to the EBI has been positive. Shankar Sastry, EECS professor and director of the Center for Information Technology Research in the Interest of Society, said the agreement was in the fine tradition of Berkeley industrial collaborations that have had significant real-world impact. "That's what we're good at here at Berkeley," Sastry said. "There are few other places that have this magic sauce to be able to put such coalitions together."

Go to **www.berkeley.edu/news/berkeleyan/2007/04/12_ebi.shtml** for more on the EBI.

UC BERKELEY MEDIA RELATIONS STAFF CONTRIBUTED TO THIS REPORT.

PEG SKORPINSKI PHOTO

Richard Newton's daughters Neris, 13 (left), and Amrita, 11, sang the 1944 song "Sentimental Journey" at the January 6 memorial, demonstrating that singing was very much a part of life with their father.

Tributes reveal many sides of Richard Newton

In two campus events following his death in January, friends, colleagues and family members of Richard Newton painted a warm and richly detailed portrait of the charismatic native of Australia who came to Berkeley as a doctoral student in 1975 and left a lasting mark in his 31 years here as student, professor, department chair and dean of engineering.

The brilliant technologist, the intense thinker going a million miles a minute, the generous teacher, the quintessential optimist who believed that nothing was impossible: These were the common themes running through tributes from campus and engineering colleagues. Newton was known campus-wide as an unabashed champion for everything he believed in, most recently the emerging field of synthetic biology.

Newton's lesser-known qualities—the prankster, the accomplished vegetarian cook, the singer of lullabies and the man of introspection and spiritual calm—were also revealed in intimate eulogies from his family and closest friends. His daughters, Neris, 13, and Amrita, 11, sang; his wife, Petra Michel, read a love letter she had written to him; and Robert Newton told a story about his own recent efforts to persuade his brother to return to Australia, to which Rich replied, "Robert, I'm a Berkeley lifer!"

The first event, held January 6, preceded the start of the spring semester but was scheduled to allow Robert and Newton's sister, Jennifer Hayes, to participate and return quickly to Melbourne to care for their ailing mother, Bette Newton. The second event, held February 11, was widely publicized to include the entire campus and Bay Area community. Both events filled Zellerbach Auditorium's first floor, which seats about 1,000. Videos of both events can be viewed at **www.coe.berkeley.edu/multimedia/index.html.**

See our cover story on Rich Newton beginning on page 12.

Landmarks named for CITRIS benefactors

CITRIS, the Center for Information Technology Research in the Interest of Society, will carry the names of key benefactors who have been instrumental in launching the program and its Berkeley headquarters building, it was announced last December.

The CITRIS program at Berkeley has been named the Dado and Maria Banatao Institute @ CITRIS Berkeley in recognition of the Banataos' generous support. The College's new program focusing on international exchange, Global Learning and Outreach from Berkeley Engineering (GLOBE), also carries the Banatao name. The Banataos are the parents of three Berkeley graduates, and Dado is managing partner of Tallwood Venture Capital in Palo Alto.

The CITRIS headquarters building will be named Sutardja-Dai Hall, acknowledging the support of Sehat Sutardja and Weili Dai and Pantas Sutardja and Ting Chuk, all graduates of Berkeley Engineering. The Sutardja brothers and Dai are also cofounders of Marvell Semiconductor. The CITRIS nanofabrication laboratory, which will advance the program's capacity to build novel micro- and nanotechnologies, will be named the Marvell Nanofabrication Laboratory.

RACHEL SHAFER PHOTO

At a March 2 "topping-out" ceremony, the highest beam was prepared for Sutardja-Dai Hall, the new CITRIS headquarters, now under construction and slated for completion by January 2009. The "topping-out" ritual, which celebrates placement of a building's highest structural element, is traditionally accompanied by an evergreen tree, in this case a citrus tree, for good luck. CITRIS VIPs in attendance signed the beam, and a brass plaque bearing the signature of the late dean, A. Richard Newton, was affixed before the beam was hoisted and swung into place.

Other leadership benefactors who will be recognized in the CITRIS headquarters building include Stephen D. Bechtel Jr., Helen and Jeffrey Chan, Paul and Judy Gray, Kenneth Keller in honor of Richard Newton, Jean and E. Floyd Kvamme, James and Katherine Lau, David and Joanne Lee in honor of David Hodges, John Neerhout Jr. and Cheryl A. Valentine in memory of Barbara Neerhout, QUALCOMM Incorporated, Taiwan Semiconductor Manufacturing Company and Eugene and Joan Wong.

Teaching engineers to do the right thing

Do we have a right to die the way we want to die? What are the risks and benefits of transplanting genetic material from one organism into another? Is an engineer violating his or her professional code by working for a company that builds weapons of war?

These are some of the questions 160 Berkeley students are asking themselves this semester in Bioengineering 100, Ethics in Science and Engineering. One of several classes that satisfy the ethics requirement for bioengineering majors, the course is designed to get students thinking about the consequences, both good and bad, of the scientific technologies that are the tools of their trade.

"All these students can put themselves in a situation where they've had conflicting obligations," says Tom Budinger, M.D., Ph.D., professor of BioE and EECS and inaugural chair in 1998 of Berkeley's bioengineering department. "Dr. B.," as he is known, started the class in 2001. He gives students plenty of practice in independent thinking by assigning debates on hot-button topics and narrative problem sets to be turned in at each class meeting. "Students here will be using their intuition, not looking at equations," he says.

Budinger and his wife Miriam coauthored a textbook that serves as a companion for the course. Published last year, *Ethics of Emerging Technologies* builds on both their 40-plus-year careers as physicians and medical researchers. The 500-page book covers basic mechanisms of technologies like regenerative medicine and cloning, alternative energies and information technology. It also introduces concepts like utilitarianism and includes a section on business ethics.

"The prevalent books on ethics emphasize moral code rather than the root initiators for doing the right thing," Budinger says. "But in technology, you can't understand the ethics unless you understand the technical aspects." Through case studies—the 1986 Challenger explosion, for example, or the atomic bomb—the book and course together help students understand real-life conflicts before introducing theories and tools for resolving them.

"The class is not about teaching unethical people how to be ethical," says Robert Blazej, a Ph.D. candidate in the joint bioengineering group and one of the first to take the class. "It's about teaching ethical people how to make good decisions under pressure."

Budinger, a pioneer in the early days of magnetic resonance imaging and liver transplantation, knows firsthand the importance of exploring the risks and benefits of new medical technologies. He got the idea for the ethics text when he realized that bioengineering was evolving into edgy territories that might invite increased oversight and regulation. Indeed, regulatory control became a reality in 2001, when the Bush administration restricted federal funding of human embryonic stem cell research to existing cell lines.

"Tissue engineering, what we now call regenerative medicine, basically evolved from wheelchairs and canes to manipulating tissues, and it involves everything from hair replacement to issues around embryos," Budinger explains. "We can't just go naively ahead exploring a frontier without investigating the possible consequences."

Go to **http://bioeng.berkeley.edu/budinger/book.html** for more on Budinger and his work.

By the numbers

Undergraduates enrolled in BioE 100

69 in 2001

160 in 2007

PEG SKORPINSKI PHOTOS

In his provocative but friendly classroom style, BioE professor and author Tom Budinger asks an unsuspecting student in his ethics class what might be an appropriate punishment for plagiarism. He evokes giggles, sometimes silence, all in the name of stimulating critical thinking and sound judgment among budding engineers.

UC tops in biotech licensing income, patents

The UC system averaged the highest level of licensing income annually among universities worldwide from its biotechnology research, according to "Mind to Market," a study published last fall by the Milken Institute.

From 1997 to 2003, the UC system averaged about $100 million yearly in licensing income, followed by Stanford ($50 million) and MIT ($33 million). UC ranked first for the number of U.S. biotechnology patents issued, 723 between 2000 and 2004.

UC produces the second-highest number of startup businesses, about 20 a year, and one of every five nanotech patents comes from the UC system. Among U.S. and Canadian institutions, UC ranks second behind MIT in converting knowledge into commercially viable products and startup companies. See more on the report at **www.milkeninstitute.org.**

THEMIS PROJECT WILL SHED NEW LIGHT ON AURORAS

Five satellites launched into space February 17 from Cape Canaveral are now coasting in their orbits and being readied for a two-year journey to determine precisely what triggers geomagnetic substorms, the phenomena responsible for the spectacular light shows visible from the Earth's surface as the northern and southern lights.

The THEMIS mission (rhymes with "premise"), 10 years in the planning and four years in the making, marks the largest number of scientific satellites ever launched by NASA aboard a single rocket. As many as 65 staff at Berkeley's Space Sciences Laboratory (SSL), including several Berkeley Engineering alumni, have been responsible for outfitting the satellites with electric field instruments, magnetometers, electrostatic analyzers and solid-state telescopes, the tools that will gather and relay the data needed to solve the mystery of where the auroras begin.

"This project has been a real-life engineering feat," says SSL aerospace engineer Greg Dalton (B.S.'03 ME). "It has challenged us every step of the way in all mechanical engineering disciplines." Dalton is one of five Berkeley mechanical engineers working on THEMIS, a joint project of NASA and the German, French, Austrian and Canadian Space Agencies under the direction of Berkeley physicist Vassilis Angelopoulos. Other Berkeley alums working on the project are Robert Duck (M.S.'99 ME), Jeremy McCauley (B.S.'96 ME), Michael Sholl (M.S.'92, Ph.D.'95 ME) and Paul Turin (B.S.'80 ME).

NASA/JACK PFALLER PHOTO

Berkeley Space Sciences Lab aerospace engineer Greg Dalton (B.S.'03 ME) performed preflight testing on one of the THEMIS probes prior to the February 17 launch from Cape Canaveral. Few, if any, of these engineers have ever seen the phenomenon that has occupied so much of their effort over the past three years. "I've never seen the northern lights," Dalton says, "but some day I hope I will."

Scientists know that the auroras are caused by solar wind, an invisible stream of ions and electrons that blows off the sun at speeds of 400 kilometers per second, expanding through space and flowing around the Earth. This energy interacts with Earth's magnetic field, or magnetosphere, which can become overloaded, flinging electrically charged particles over the polar regions. When these electrons hit Earth's upper atmosphere, they cause the night sky to light up with the scintillating bands known in the north as the aurora borealis and in the south as the aurora australis.

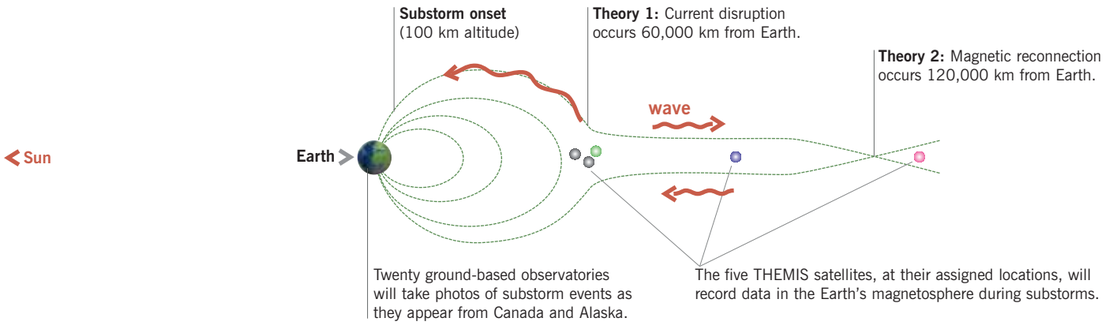
The THEMIS probes will collect their prime science data this winter, when they are directed to their assigned positions along the sun–Earth line and Earth is tipped back, putting North America in winter's darkness. The satellites' instrument systems will collect information on an estimated 30 substorms over the period of the mission and coordinate this in-space data with that from 20 ground-based observatories in Canada and Alaska, which will take about 45 million photos, one every three seconds, of events as they appear in the night sky.

"Imagine a flowing stream of particles," says THEMIS project manager Peter Harvey (B.A.'79 CS), explaining how the satellites will monitor substorm events in the magnetosphere. "The solid-state telescopes count the particles and measure how fast they're going; the electrostatic analyzer will detect what direction they're coming from, their flux and how much energy they have. The most important thing will be exactly when the storm hits the spacecraft."

THEMIS, an acronym for the official mission title, Time History of Events and Macroscale Interactions during Substorms, is also the name of the Greek goddess of order and justice. Her namesake project will end a 30-year debate over which of two theories explains the physical occurrence that triggers a substorm. The controversy has been impossible to resolve with previous single-satellite missions due to the huge size of the magnetosphere (see graphic).

Scientists hope THEMIS will also explain how substorms interrupt terrestrial power grids and communications systems, clarify how Earth's atmosphere shields us from the solar wind, and provide information that could help protect future commercial satellites and humans in space from the adverse effects of particle radiation.

Other Berkeley Engineering participants include lecturer David Pankow; ME professor emeritus David Auslander and several of his graduate students, including Jonghak Kim; and ME professor Hari Dharan's graduate students Tien Tan, Jevan Furmansky and William Tyler. For more details, go to **www.nasa.gov/themis.**



NASA's graphic shows the THEMIS satellites in the magnetosphere. Their data will indicate whether the substorms generated by solar wind are triggered by current disruption, which occurs approximately 60,000 kilometers from Earth, or by magnetic reconnection, which occurs at about 120,000 kilometers. Until now, the mystery has been impossible to resolve because of the sheer size of the magnetosphere. GRAPHIC COURTESY OF NASA

JAN CURTIS PHOTO

The bright green streaks of light are characteristic of the aurora borealis in the night sky over Fairbanks, Alaska. During a given substorm, while the THEMIS satellites are collecting physical data from the Earth's magnetosphere, the ground-based observatories in Alaska and Canada will be recording photographic data of the same substorm from the Earth's surface. One winter of coordinated data should provide the answer to the researchers' question of what precisely triggers the phenomenon.

Mind the gender gap, study group says

PHOTO COURTESY OF SHEILA HUMPHREYS

Eighteen Berkeley Engineering women attended last fall's Grace Murray Hopper Celebration of Women in Computing, the type of networking event ME professor Alice Agogino (front center, in red) says gives women the confidence and skills needed to compete in male-dominated academic science and engineering. "It's really helpful to be around so many successful women," says Juliet Holwill (third from right, back row), copresident of Berkeley's Women in Computer Science and Engineering. "It boosts your confidence."

First-generation airbags, installed in motor vehicles until 1998, decreased the risk of death for "average" front-seat occupants in 10 percent of collisions; but they actually caused injury in others, primarily women and children, in 40 percent of cases by some estimates. This, says Berkeley ME professor Alice Agogino, is because women were not involved in early research, in which airbags were tested exclusively on the average 5'10", 170-pound American male.

"Discrimination is bad science," Agogino says. "It affects how we do our research and practice." Agogino was one of 18 members of a National Academy of Sciences study panel that found that pervasive discrimination against women in the academic sciences and engineering is chasing them out of these fields. Berkeley Chancellor Robert Birgeneau was also on the panel, which published its findings last fall in the report "Beyond Bias and Barriers."

Women are poorly represented in academic science and engineering, the report said, due to a chilly atmosphere and inherent hiring and promotion policies that favor men. The report cites research from multiple sources and urges universities to score themselves on their recruiting and retention policies. Maximizing the potential of women in academia, the report says, will require aggressively altering personnel procedures, extending timetables for career advances like tenure, providing support for working parents and instituting oversight to ensure that academic searches are unbiased. Agogino, a mother of two, says support groups, mentoring and professional societies are "critical" to help underrepresented groups find peer support and develop coping strategies.

"Both men and women discriminate equally, and they don't know they're doing it," Agogino says. "It's not the gross discrimination of the past, but cumulative micro-discrimination, very subtle behaviors that begin to bother women as they happen time after time."

Among the report's findings: While they earn half the bachelor's degrees and 38 percent of science and engineering Ph.D.s, women constitute just one quarter of the U.S. workforce in those fields. Representation is even lower in research universities, where the percentage of women who are full professors barely reaches double digits except in the social, behavioral and life sciences. Senior academic women report that they are less satisfied than their junior counterparts, saying that they feel constantly scrutinized, undervalued by peers and passed over for collaborative projects.

The late Dean Richard Newton was a strong advocate for women engineers and nearly doubled the number of women on the engineering faculty, from 15 in 2000 to 27 today. While the specialties of environmental engineering and bioengineering in particular are improving, Agogino says, engineering generally has made less progress than other disciplines in recruiting women students and hiring women faculty. The percentage of women students and faculty in her department (mechanical engineering), for example, is less than 10 percent.

The study was motivated by remarks made in 2005 by Lawrence Summers, then president of Harvard, suggesting that research should be conducted on a possible biological explanation for why women don't pursue math and science. The National Academy of Sciences study discounts any significant biological differences but does report that women generally receive lower pay, slower promotions, fewer honors and fewer leadership positions than men in these academic fields.

Go to **http://newton.nap.edu/catalog/11741.html#toc** to see the report.

By the numbers

Women faculty in the College of Engineering

15 in 2000

27 in 2007

PEG SKORPINSKI PHOTOS

Brewer *Morris* *Wright* *Jordan* *Keasling* *Tomlin*

Three Berkeley Engineering faculty have been elected to the National Academy of Engineering, one of the highest professional distinctions for an American engineer. **ERIC A. BREWER,** professor of EECS, was recognized for the design of highly scalable Internet services; **JOHN W. (BILL) MORRIS JR.,** professor of metallurgy, materials science and mineral engineering, was recognized for advancing our understanding of the strength and toughness of materials through microstructural manipulation; and **PAUL K. WRIGHT,** the A. Martin Berlin Chair in Mechanical Engineering, was recognized for the invention of the first open-architecture control of manufacturing systems and development of Internet-based CAD/CAM systems.

MICHAEL JORDAN was named a fellow of the American Association for the Advancement of Science in February for his "distinguished contributions in the field of statistical machine learning, especially in the area of probabilistic graphical models." Jordan is the Pehong Chen Distinguished Professor in EECS and a professor in the Department of Statistics.

JAY D. KEASLING was named 2006 "Scientist of the Year" by *Discover* magazine for what it called his ambitious efforts to "rebuild life itself" through the nascent field of synthetic biology. He is professor of chemical engineering and bioengineering and director of Berkeley's SynBERC, the Synthetic Biology Engineering Research Center.

CLAIRE TOMLIN, associate professor of EECS, was one of 25 individuals nationwide to receive a 2006 MacArthur Foundation "Genius" Fellowship, a $500,000 "no strings attached" grant over the next five years. Recipients are selected for their creativity, originality and potential to make significant contributions in their future careers. Tomlin, who is also on the faculty at Stanford's Department of Aeronautics and Astronautics, is studying aeronautical applications of hybrid systems research, particularly aircraft flight control and air traffic conflict resolution.

New metal shear walls safer in quakes

Tests run at UC Berkeley confirm that a new metal shear wall design improves seismic safety and simplifies design for low-rise metal-frame buildings in California and other earthquake-prone regions.

Made of lightweight corrugated metal and screwed to metal frames, the wall was conceived by Berkeley structural engineering firm Tipping Mar + Associates and designed and tested in collaboration with CEE professor Bozidar Stojadinovic and a team of graduate student researchers. The design, which could be adapted to retrofit existing buildings, will be accessible to engineers and contractors at no charge.

"Everyone involved wants this technology to be accessible to anyone interested," Stojadinovic said. "That is why we're excited to make the final design tables freely available to the public."

Research concluded that the new panels are three times stronger than plywood and twice as strong as existing metal framing material. They are resistant to fire and mold, recyclable and, since they are built from off-the-shelf materials, the panels can be prefabricated before delivery to the construction jobsite, lowering costs.

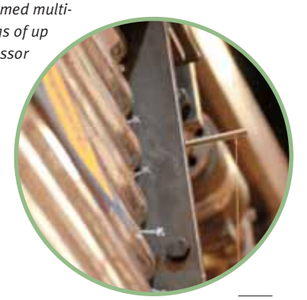
In a public demonstration last November, models of the new wall were subjected to 25,000 pounds of force and cyclic displacement, characteristic of a major Bay Area quake, before they started to crumble, rippling and popping screws onto the floor. Unlike plywood, which would snap and collapse under comparable forces, the metal wall slows the deformation process, which would prevent buildings from pancaking.

"Even during the most intense part of the test, the panel survived without collapsing," Stojadinovic said. "In a real building, people would be able to walk away." He is now preparing national building code language, approval of which could take up to three years, but engineers may be able to get permits to use the design on a case-by-case basis.

The research was funded by the Charles Pankow Foundation. For more details, go to **www.berkeley.edu/news/media/releases/2006/11/22_shear.shtml.**

PEG SKORPINSKI PHOTOS

The metal shear wall design, demonstrated last November by UC Berkeley civil engineers, is appropriate for new metal-framed multi-unit residential buildings of up to six stories. CEE professor Bozidar Stojadinovic explained to reporters how the corrugated metal shear wall transfers forces to the screws (inset), slowing building deformation in a major quake.



Student housing goes green

Showers are timed to the minute. The thermostat is set at 65 degrees by day, 58 at night. Lights are switched off until dark, and you might get scolded if you let the water run while brushing your teeth. You are in the Green Apartment, located in Berkeley's southside Channing-Bowditch student housing complex.

Tim Edgar, an ME/EECS junior, is one of the apartment's four undergraduate residents, three of whom are longtime friends with a shared interest in the environment. They were chosen from dozens of applicants because of their demonstrated commitment to conservation and their willingness to open their home routinely for tours to promote environmentally conscious living to the campus community.

"It's not hard for people to make a difference in small ways," Edgar says. "Radical lifestyle change is not the point. If you make incremental change, it will probably stick with you for the rest of your life." It quickly becomes second nature, he says, to power down the computer, find new uses for glass jars and take the bus rather than drive to the market.

The Green Apartment is the latest in a series of demonstration projects inspired by a 2002 Regents policy to promote eco-friendly practices on UC campuses. Other Berkeley projects include the Green Room, an eco-friendly residence hall room, and the Global Environment Theme House, which provides housing and credit-bearing educational activities for 20 ecologically minded students.

RACHEL SHAFER PHOTO

ME/EECS major Tim Edgar demonstrates a worm composting bin donated by Alameda County Waste Management Authority, the latest addition to the Green Apartment he and three other undergraduates are showcasing to help raise Berkeley's environmental consciousness.

The apartment is sponsored by Berkeley's Green Room Committee, which advises Edgar and his roommates on the hottest new green products, many of which are supplied through grants or donations. During tours, each item is labeled to explain why it is good for the planet. Featured are some familiar items, like power-saving Energy Star appliances and biodegradable, phosphate-free Seventh Generation household cleansers. Less familiar, perhaps, are the bed linens made of beechwood, which requires fewer pesticides than cotton to grow, and the compost bin, complete with live earthworms, for recycling organic garbage.

Edgar's own environmental awareness was raised when, as a high school student, he visited his sister at UCLA. A notebook he was carrying got soaked in the rain, and as the pages dried, they exhibited an unsavory yellow stain, the result, his sister said, of the infamous Los Angeles smog.

"From that moment, I realized that we're destroying the environment for future generations," Edgar says. The first step for those who want to go green, he suggests, is becoming more conscious of little things, like how much time you spend in the shower and creative ways to reuse household items. Don't be afraid to try something new, he adds.

"Organic might be 50 cents more," he says, "but it might be something you really love." For more, go to **www.berkeley.edu/news/media/releases/ 2006/11/09_green.shtml.**

By the numbers

3 Berkeley Engineering's 2008 ranking among U.S. graduate engineering programs, according to *U.S. News & World Report.*

AARON WALBURG PHOTO

Wide-open spaces: *Chancellor Robert Birgeneau officially opened Berkeley's new RAD Lab (Reliable, Adaptive and Distributed Systems Laboratory) in ribbon-cutting ceremonies late last year. The center, located on the fourth floor of Soda Hall, has no dedicated office space but is full of cubicles for docking laptops, and the walls are covered with whiteboards. EECS professor and founding director David Patterson (left, in camel jacket) is leading six faculty and 10 graduate students in research he says will create an online "Fortune One Million" of smaller companies that will provide the next wave of Internet services, well beyond what Google, eBay and Amazon offer today. Their work, which will be open-sourced rather than held as intellectual property, is expected to increase the speed and cut the cost of developing new Internet applications for everything from e-mail to online calendars. RAD Lab launched in 2005 with $7.5 million in funding from Google, Microsoft and Sun Microsystems and has since received support from Hewlett-Packard, IBM, NTT Multimedia, Nortel and Oracle.*

Exploiting low-quality petroleum sources like tar sands and coal, although tempting as the world transitions from oil to alternative energy sources, puts the environment at risk, warn Berkeley researchers Alex Farrell and Adam Brandt of the Energy and Resources Group. Their paper, published in *Environmental Research Letters,* studies the environmental, economic and security costs of projects like the Fort McMurray mine in Alberta, Canada, where tar sands are being dug up for oil excavation. **www.berkeley.edu/news/media/releases/2006/12/11_oil.shtml**

Wireless collision warning systems, under investigation for more than 10 years, have so far proven too expensive for wide application. But a more affordable approach using a global positioning system (GPS) receiver and a WiFi radio has been developed by CEE professor Raja Sengupta. The new system uses a display that tracks the driver's location in relation to other vehicles around it and gives visual warnings like car icons that increase in size or turn red to indicate imminent danger. **www.coe.berkeley.edu/labnotes/0306/sengupta.html**

An elegant lab on a chip, designed to sequence large genomes quickly and at low cost, could facilitate preventive care and therapy customized to each individual's genome. A photograph of the chip, developed by BioE graduate student Robert Blazej and colleagues, was featured in *Nature* magazine as an example of beautiful images produced by scientists in 2006. **www.berkeley.edu/news/media/releases/2007/01/02_nanoimage.shtml**

Geckos inspire stick that's not sticky

©CORBIS/MEDIABAKERY

The millions of tiny hairs found on gecko feet have inspired a microfiber array that supports loads on smooth surfaces and steep inclines. EECS professor Ron Fearing and his team created a polypropylene fiber array containing 42 million fibers per square centimeter—each only 0.6 micrometers in diameter, 100 times thinner than a human hair—that holds a quarter to a glass slide at an 80-degree angle. The material is not sticky and, unlike the gecko, it has low adhesion, meaning it does not resist being pulled off a surface. Possible applications include shoe soles, car tires and athletic equipment.
www.berkeley.edu/news/media/releases/2006/08/22_microfiber.shtml

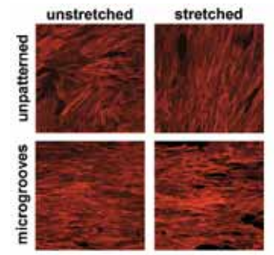
Phaking out phishers

Phishing schemes—in which scammers trick Internet users into providing their social security numbers and passwords—increased 81 percent in early 2006, affecting 1.2 million Americans and costing $1 billion. EECS professor Doug Tygar's work on the *dynamic security skin* could thwart phishers who create fake versions of an individual's trusted websites. The "skin" provides users with explicit visual clues, like address and status bars, to confirm the legitimacy of a website. **http://people.deas.harvard.edu/~rachna/papers/why_phishing_works.pdf.**

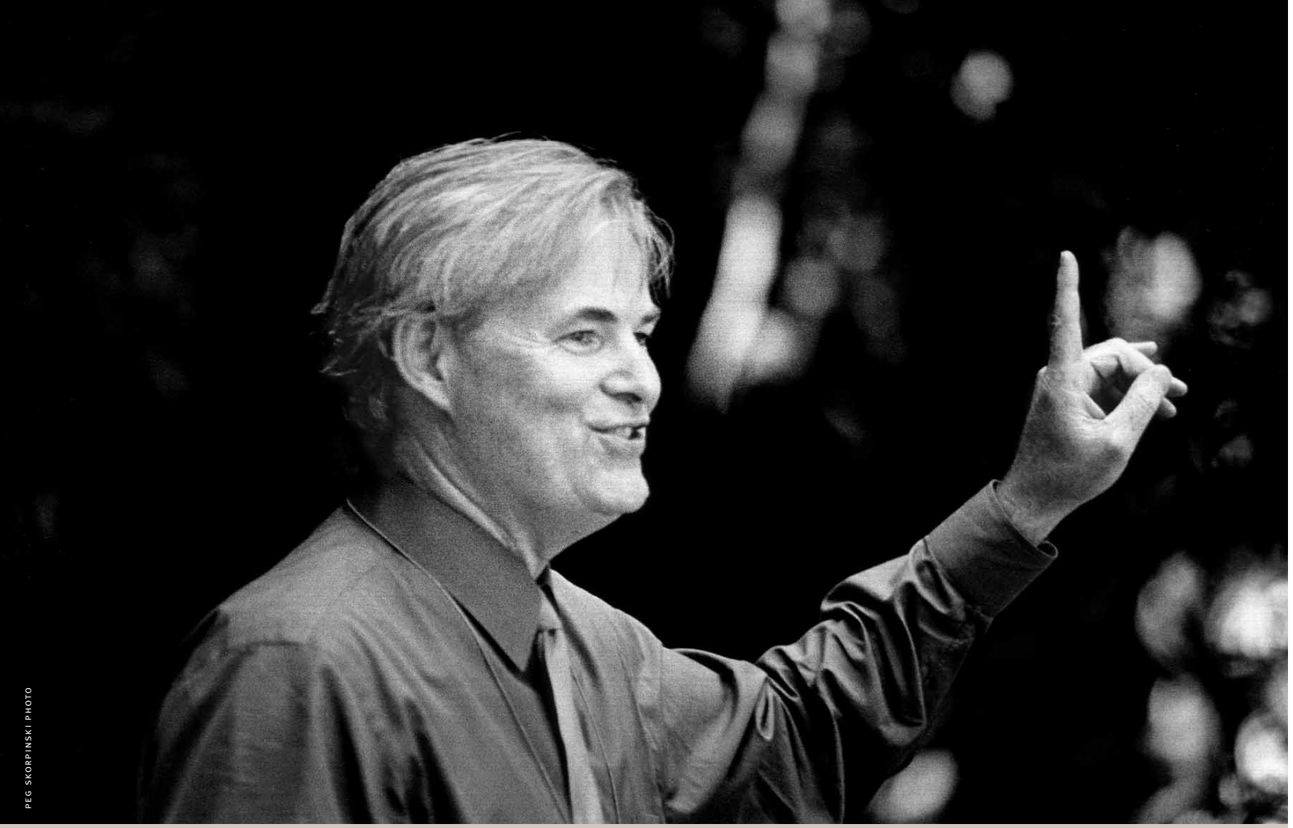
PETER SIU/GETTY IMAGES

Stem cells in training

Adult mesenchymal stem cells from bone marrow can be mechanically trained to differentiate toward the type of cell found in smooth vascular wall muscle, reports BioE researcher Kyle Kurpinski. His team placed cells on a grooved silicone membrane and "stretched" them longitudinally once every second, simulating the physical forces blood vessel cells encounter. Mesenchymal stem cells have the potential to become bone, cartilage and muscle tissue, but previous experiments have used chemical signals to stimulate differentiation. The cells could be used to treat diseased or damaged tissues. **www.berkeley.edu/news/media/releases/2006/10/23_stretch.shtml**



A minuscule microscanner could lead to improvements in conventional laser-based eye surgery, heads-up displays for advanced 3-D medical imaging and microprojectors for mobile devices. The scanner, fabricated by Berkeley EECS graduate students Hyuck Choo and David Garmire, is outfitted with parts much smaller than the period at the end of this sentence. Yet, its mirror vibrates back and forth 35,000 times per second with great precision and stability, and the device can be mass produced at low cost. **www.coe.berkeley.edu/labnotes/0906/choo.html.**



PEG SKORPINSKI PHOTO

Dean A. Richard Newton

Teacher, Leader, Innovator, Friend

The College lost one of its luminaries when A. Richard Newton, professor and dean of the College of Engineering, died of pancreatic cancer in January. He was 55. A pioneer in electronic design automation and integrated circuit design and a visionary in the technology industry, Newton's personal eloquence and magnetism drew widespread attention to his ideas for the role engineering could play in tackling some of society's most difficult challenges, particularly those of developing nations.

"Rich Newton was a man of incomparable vision," said Chancellor Robert Birgeneau. "Dynamic and entrepreneurial, he understood the power of engineering and technology in entirely new ways and he connected them to addressing society's toughest problems."

As a teenager in Melbourne, Australia, Newton's interest in engineering was ignited by long hours tinkering in the family garage, where he learned to repair TVs and radios. He earned his bachelor's and master's degrees from the University of Melbourne in 1973 and 1975. A fortuitous meeting in the early 1970s with Professor Donald Pederson of Berkeley's EECS department jump-started Newton's lifelong interest in electronic design automation. While still a student in Australia, he collaborated with Pederson on an early version of SPICE (Simulation Program with Integrated Circuit Emphasis) and went on to become a major force behind the project when he came to Berkeley in 1975.

"Dynamic and entrepreneurial, Newton understood the power of engineering and technology in entirely new ways."

"The semiconductor industry wouldn't exist today if it weren't for these simulation tools," said Paul Gray, EECS professor, former Berkeley executive vice chancellor and provost, and Newton's immediate predecessor as engineering dean.

Newton earned his doctorate at Berkeley in electrical engineering and computer sciences in 1978 and later that year was appointed to the engineering faculty. He quickly scaled the academic ladder, rising from assistant professor in 1978 to associate professor in 1982, full professor in 1985, and chair of the EECS department in 1999. He was named dean of the College and the Roy W. Carlson Professor of Engineering in 2000.

From 1998 to 2002, Newton served as founding director of the MARCO/DARPA Gigascale Silicon Research Center (GSRC), a collaborative research partnership with the U.S. government and the semiconductor industry to address the challenges of future chip design. Known for his work with the Mayfield Fund and Tallwood Venture Capital, two leading Silicon Valley venture capital firms focused on high tech, Newton contributed to the evaluation and early-stage development of more than two dozen new companies. He possessed an unmatched ability to marry technical insights with industry needs, helping to found a number of design technology companies including SDA Systems (now Cadence Design Systems), Synopsys, PIE Design Systems (now part of Cadence), Simplex Solutions and Crossbow, among others.

The driving force behind the UC Berkeley–led Center for Information Technology Research in the Interest of Society (CITRIS), established in 2001, Newton envisioned the four-campus center as a revolutionary new collaborative framework for universities to fulfill their missions of education, research and public service by developing the next generation of technologies to meet society's most pressing needs.

A champion of synthetic biology, Newton saw the emerging field as a means of applying engineering principles to the life sciences. He assumed a major role in making Berkeley a hub for pioneering synthetic biology research by garnering support for the Berkeley Center for Synthetic Biology and the NSF-funded Synthetic Biology Engineering Research Center (SynBERC), launched last year.

Throughout his deanship, Newton vigorously promoted women in engineering, nearly doubling the number of women on the College faculty. He served on the Board of Trustees for the Anita Borg Institute for Women and Technology, which helps industry, academia and government recruit and retain women leaders in high-tech careers.

Among the numerous awards he received was the prestigious 2003 Phil Kaufman award, the highest recognition for research and entrepreneurial contributions to the electronic design automation industry. In 2004, he was named to the National Academy of Engineering and in 2006 to the American Academy of Arts and Sciences. He was an active member of the Association for Computing Machinery and a fellow of the Institute of Electrical and Electronics Engineers.

In his personal life, Newton cherished his role as husband and father. His wife, Petra Michel, was an executive at Siemens in Germany when the two met at a conference in Japan, where she had invited Newton to be the keynote speaker. "I dealt with engineers at work but avoided them during my private time," she says. "I spent those hours with writers, artists and the like, who were able to stretch my mind. This changed after I met Richard. He showed me that there are engineers out there who can truly stretch your mind in many ways."

It was he who convinced her to have children, Michel says, and he made huge sacrifices, both professional and personal, to be fully involved in parenting daughters Neris, 13, and Amrita, 11.

For more go to **www.coe.berkeley.edu/newsroom/newton.**

A native of Australia, Newton began his 31-year career with the College of Engineering when he came to Berkeley as a doctoral student in 1975.

Richard Newton,
in our own words

Since Dean Newton's death in January, the College has received letters from all over the world expressing shock and sadness and sharing memories. They are posted on the College website at ***www.coe.berkeley.edu/newsroom/newton/memories.html.*** *Here is a sampling of the letters, some of which have been edited for length and clarity to include as many as possible.*

Rich was more than just an advisor; he was also a great mentor and friend. Despite having one of the most demanding jobs as dean of engineering, he always made students his priority. Very few people changed my life the way Rich did. He will be greatly missed, but his impact will continue to be felt for many generations to come.

—**OMAR BAKR,** *UC Berkeley, EECS Ph.D. student*

Richard Newton's death is a blow. His enthusiasms were many, and *Nature*'s pages were enlivened because of the contacts I had with him, especially our discussions about synthetic biology and the potential impact of information and communication technologies on the developing world. His presence at international events such as the World Economic Forum in Davos and the Science, Technology and Society Forum in Kyoto helped ensure that the discussions were well grounded and purposeful. He was a wonderful ambassador for Berkeley.

—**PHILIP CAMPBELL,** *Editor-in-Chief,* Nature

I came to know Richard over the last three years as part of my involvement with the College's Center for Underrepresented Engineering Students. He was a passionate believer in providing engineering opportunities for all qualified students and helping those students make a difference in the world. He instinctively knew that all great endeavors begin with people having a vision and working together to achieve it. I will deeply miss my interactions with this very caring and creative individual.

—**LUIS FIGUEROA,** *Director, Advanced Systems, Boeing, Integrated Defense Systems*

Richard was an easy man to like. His warmth, charm and easygoing nature affected everybody. Not only was he a man with a large vision, but he had an incredible sense of kindness. He taught his girls lovingly, watched his wife caringly. Once when I was staying at their house for a long weekend, I found a hot water bottle in my bed. In the morning Petra told me that Richard did this during the cold winter nights for all his girls, and that weekend, I was one of his girls.

—**SABRINA FOX,** *writer and family friend*

Rich Newton was my first virtual friend. We never met, but he reached out to me via e-mail. Normally, I don't respond to such overtures because I get too many. But there was something about his—the provocative challenges to conventional wisdom, the energy, the passion and the intelligence—that drew me in. He was so proud of his school of engineering. If someone's depth of character and insight can come through so powerfully in an e-mail, I can only imagine how much fun Rich and I would have had in person! May his memory be a blessing.

—**THOMAS L. FRIEDMAN,** *Columnist,* New York Times, *and author,* The World Is Flat

Richard Newton defined what it meant to be a successful academic, entrepreneur and administrator. He left a vibrant community, a vibrant profession and the seeds for significant societal changes to come. We have lost a quintessential leader and a good human being.

—**RAJESH GUPTA,** *M.S.'86 EECS; Professor of Computer Science and Engineering, UC San Diego*

Richard Newton enthralled his audience; you felt like you had been taken through a whirlwind. He inspired you to pursue ideas. And you did. Our role as Berkeley spokespeople became clear through Richard: Berkeley grooms communicators and engineering leaders.

Richard was proud of me. I could feel it. This helped propel me. I feel proud of him and his legacy and I am humbled and proud to have known him.

—**DEIRDRE HANFORD,** *M.S.'85 EECS; Senior Vice President, Global Technical Services, Synopsys, Inc.*

I grew up in Texas in a different and more conservative world than Berkeley. My love for Berkeley is in large part due to the mind-opening experience of working with Richard and understanding that success can be achieved in many different ways. Indeed, Richard's biggest gift to me is the strengthening of my inner person and the opening of my mind to a world that is much bigger and brighter than I had realized on my own.

—**MIKE HORTON,** *B.S.'94, M.S.'95 EECS; President/CEO, Crossbow Technology, cofounded with Richard Newton*

Rich was someone who had a transformational impact on so many people and organizations. Rich, you have been an incredible role model to me, so human and so real, so visionary and courageous. Your way of living life and your many ideas that have become reality will not be lost.

—**MARIA KLAWE,** *President, Harvey Mudd College; former engineering dean, Princeton University*

BART NAGEL PHOTO

AARON WALBURG PHOTO

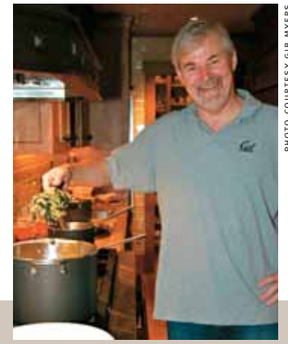
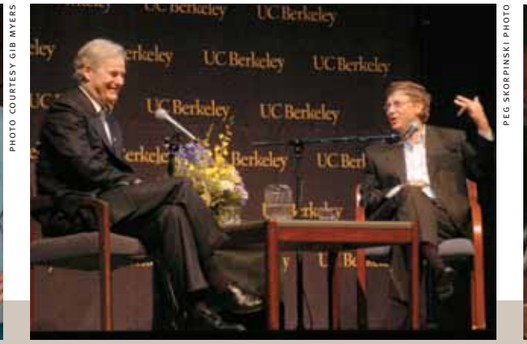


PHOTO COURTESY GIB MYERS



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BART NAGEL PHOTO

FROM LEFT: *Newton with eldest daughter Neris (left) and wife Petra Michel at the College's Distinguished Engineering Alumni Awards banquet, November 2006; with alumnus and Google CEO Eric Schmidt (M.S.'79 Ph.D.'82 EECS) at Commencement, May 2005; preparing mushroom risotto at a 2006 dinner party; in conversation with Microsoft's Bill Gates at Zellerbach auditorium, October 2004; with EECS Ph.D. student Omar Bakr in an ICT4B class meeting.*

The "Newton Effect"
a legacy of contributions

1972: Simulation Program with Integrated Circuit Emphasis (SPICE)

Newton was a major force behind the computer simulation program SPICE. The prototype of open-source software, SPICE or one of its myriad derivatives has been wielded in the design of nearly every integrated circuit developed during the last 25 years, from the processor in your PC to the custom chip in your mobile phone.

1998: MARCO/DARPA Gigascale Silicon Research Center (GSRC)

Cofounded by Newton, GSRC is a 19-campus research consortium funded by universities, industry and government. The GSRC is pioneering the future of design automation for semiconductors to increase chip capacity for use in cars, airplanes, cell phones and future devices we have yet to imagine.

2001: CITRIS

Newton was a tireless champion for the Berkeley-based Center for Information Technology Research in the Interest of Society, which involves four UC campuses. He envisioned CITRIS as a hub for engineers, social scientists and policy experts to collaborate on the world's most urgent problems in energy, health care, education and disaster preparedness.

2004: Information and Communication Technology for Billions (ICT4B)

Conceived by Newton and his colleagues, ICT4B is an interdisciplinary project that brings together faculty and students from Berkeley Engineering, Haas School of Business, the School of Public Health and the School of Information Management and Systems to provide information technology to people in developing nations. Newton's idea inspired research projects, classes and fellowships for students to travel abroad to explore how information technology, from wireless networks to alternative energy systems, could be used to help people everywhere from China to Uganda and spark economic change at the village level and beyond.

2005–06: Synthetic Biology

Newton advocated the establishment of two major centers at Berkeley for research in synthetic biology, the Berkeley Center for Synthetic Biology and the Synthetic Biology Engineering Research Center (SynBERC). He appreciated the emerging field's vast potential to revolutionize pharmaceutical production, yield new forms of clean energy and remediate environmental damage.

Wise guidance, uncommon inspiration and genuine warmth are qualities that people yearn for in a leader, and they are sadly in short supply. Rich had them in spades. He was a man of vision in the way he led our College into the 21st century. He was a man you wanted to, and did, believe in when he passionately described his vision. He was a man of honor and a man comfortable enough in himself to be able to connect closely with others. And no one else told a better or more charmingly biting (and true!) "Stanfurd" joke. God bless Rich, and for him, let's all say: Go Bears!

—**MISHA LEYBOVICH,** *B.S.'05 Eng. Physics*

We all know of Newton's laws, laws that explain the behavior of objects. In Rich Newton we had a force that exerted an extraordinary gravitational effect on people—profound, permanent and incredibly positive. My own encounters with the "Newton effect" came when I was running companies as an entrepreneur and investor. Rich was always there to provide ideas, energy, help and support. He got me excited about renewable energy, which led me to invest in a remarkable new technology for rural India and involve UC students and faculty. The life of a man like Rich will be measured through his effect on others, on what we do and will continue to do.

—**MIHIR PARIKH,** *B.S.'69 Eng. Physics, M.S.'71, Ph.D.'74 EECS; President & CEO, Aquest Systems*

When Rich died, for so many of us on the Berkeley campus, it was as if some grand and reassuring tree, whose shading canopy we had long assumed to be an indestructible refuge, had suddenly blown over, leaving an immense empty space against the sky. Rich was one of those rare men who was as kind and collegial as he was intelligent, energetic and competitive. His death leaves an emptiness of indescribable proportions.

—**ORVILLE SCHELL,** *Dean, UC Berkeley Graduate School of Journalism*

I remember Rich as more than a great engineer. Rich was perhaps the most remarkable person I have had the privilege to know. It was impossible to walk away from Rich without feeling better about yourself, better about the world, and most likely with a simple solution to an issue once thought to be complicated or difficult. Rich cared deeply, shared deeply and loved deeply. Since his untimely death so many people have commented on how much he will be missed. He was important to everyone who knew him, and everyone could easily consider him a special friend, for that is how he made people feel. Yes, he was a person of incredible intellect, a visionary, a strong leader and a great engineer. He was also a loving and proud father, a loving husband and an exceptional friend.

—**MEL SLATER,** *friend*

Rich is broadly recognized for his pioneering work in the EDA industry, his extraordinary contributions at the University and his tireless efforts to apply technology to solutions for societal problems. However, few people understood his seminal role as an unwavering advocate for women in technology. He mentored countless women, from students to CEOs, encouraging them to become agents of change. He shared a big, broad vision of a different world, in which technology helps the world's women—and men—enjoy better lives.

—**TELLE WHITNEY,** *President & CEO, Anita Borg Institute for Women and Technology*

Richard's gifts of being able to see through to solutions and to keep pursuing them diligently are representative of engineering. I would call him a true engineer. He was a true source of inspiration, and many of us will miss him for the rest of our lives. I love my alma mater so much and realize what a treasure we had. He was a Berkeley loyalist to the very end. May the Berkeley spirit live on.

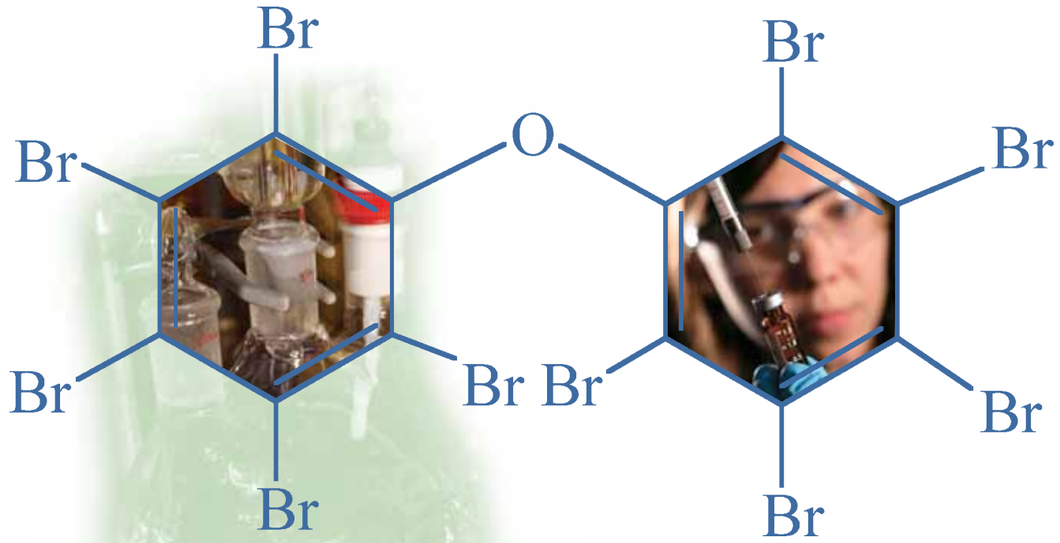
—**STEVE WOZNIAK,** *B.S.'86 EECS*

BART NAGEL PHOTO

Four areas of giving will honor Dean Newton's memory:

- The Dean A. Richard Newton Memorial Fund, to benefit the Berkeley Center for Synthetic Biology
- The Dean A. Richard Newton Memorial Professorship, for an engineering faculty member working in the area of synthetic biology
- The Dean A. Richard Newton Memorial Fellowship, to support graduate students in synthetic biology
- A gift in the Dean's memory, to name a room in the new CITRIS headquarters building, currently under construction and scheduled to open in early 2009

Gifts can be made in support of any of these areas. Please send checks, payable to the Berkeley Engineering Fund and with the gift area noted on the memo line, to College Relations, 208 McLaughlin Hall, Berkeley, CA 94720-1722. For more information, call 510-642-2487.



Bacteria's bad rap revisited

Nature's army of microorganisms tapped for toxic cleanup

BY DAVID PESCOVITZ | PHOTOS BY JEFF SHAW

Polybrominated diphenyl ether (PBDE)—it's a mouthful that most of us have never tried to pronounce or even heard of. But these chemicals are all around us, from household dust and creek sludge to our toddlers' Halloween decorations and the foods we eat. And in the future, they could make us very sick.

For 30 years, PBDEs, the chemical additives that are blended into plastics and foams during the manufacturing process to serve as flame retardants, have kept our televisions from burning up, our carpets from catching fire and our laptops from exploding. On the one hand, PBDEs are a lifesaving chemical family of 209 different variations; on the other, they are contaminating the environment and could be jeopardizing our health.

"Sadly, PBDEs are our generation's newly emerging contaminants," says Berkeley civil and environmental engineering professor Lisa Alvarez-Cohen, who has focused her research on bioremediation and toxic contaminants for nearly two decades. "PBDEs are *everywhere.* They are more or less omnipresent in our soil, food, air, blood and sewage. We once thought they were inert but now believe that they are not."

Many PBDEs are toxic endocrine disruptors linked to growth and development problems, yet it wasn't until 1999 that scientists first discovered PBDEs had made their way into human breast milk. Worse, PBDE levels in humans seem to have been rising exponentially since the 1970s. So, while PBDEs leach their way into our air, soil, water and bodies faster and in greater quantities with each passing day, scientists scramble to learn more about them in the hopes of saving us from this invisible poison.

Alvarez-Cohen and CEE graduate student Kristin Robrock hope to uncover what makes PBDEs tick like a biological time bomb. The team's multidisciplinary research, which bridges chemistry, biology, ecology and genetics, could lead to effective bioremediation processes or, in the nearer term, at least raise awareness about their danger. After all, Alvarez-Cohen's laboratory specializes in studying nasty chemicals and identifying ways to clean them up using nature's own antipollutant army, microorganisms.

"Our job is to ferret out the environmental fate of interesting compounds," she says. "Sometimes we find pathways that can help eliminate the compounds as environmental threats. In that regard, bacteria are our friends. Capable of converting the toxins into more benign molecules, bacteria can breathe in contaminants like chlorinated solvents and breathe out chloride salt, which is much safer. Our job is to bend them to our will to optimize bioremediation activity."

Alvarez-Cohen is referring to *in situ* bioremediation, the use of microorganisms to clean up environmental pollutants. *In situ* bioremediation occurs naturally, for example, when indigenous microbes degrade chemicals seeping out of leaky underground tanks at gas stations before they reach water supplies. Sometimes,

With U.S. levels of PBDEs on the rise, Professor Lisa Alvarez-Cohen (right) and CEE graduate student Kristin Robrock hope to learn whether PBDEs biodegrade, and if so, what the degradation process involves. By studying bacterial samples, either pure species or well-defined mixtures of samples, they can begin to understand how bacteria might transform PBDEs in the environment.

though, the natural process needs a nudge. Nutrients and substrates can be added, or the supply of microbes boosted, a technique called bioaugmentation. For example, cultured organisms in a stew of nutrients may be gravity fed or injected under pressure into the subsurface. But with its high cost, sometimes reaching $1,000 per liter of cultured bacteria, bioaugmentation is often the very last resort and, thanks to this Berkeley research, may become less necessary.

In recent years, Alvarez-Cohen and her students have studied a variety of environmental contaminants—from chlorine-based dry cleaning solvents and intense degreasers used in manufacturing to gasoline additives and PBDEs—along with the microorganisms that might biodegrade them. In the case of chlorine pollutants perchloroethene (PCE) and trichloroethene (TCE), commonly found at designated hazardous waste sites, the team is studying the genome of *Dehalococcoides,* bacteria that completely detoxify the solvents.

"*Dehalococcoides* actually breathes in chlorinated solvents and breathes out ethene," a safe chemical, she says. The microbe sets off a chemical reaction that removes, one by one, the chlorine atoms for energy, producing the nontoxic byproducts ethene and chloride.

With a better understanding of the bacteria, the researchers are able to help optimize bioremediation efforts by determining whether bioaugmentation is even necessary and how it should be carried out. For example, their science can help determine the ideal bacteria to introduce for the most efficient bioremediation. In researching chlorinated solvents, they validated their lab results through field studies at Seal Beach Naval Weapons Station in Orange County, California.

"Improving the bioremediation strategies saves resources, both environmentally and financially, by costing less and cleaning up more groundwater," Alvarez-Cohen says.

While the dangers of chlorinated compounds in our groundwater are well established, most of the compounds that Alvarez-Cohen and her team study are known as "emerging contaminants." That is, only recently have analytical technologies been sensitive enough to reveal the prevalence of some contaminants—pharmaceuticals and herbicides, for example—not previously known to be toxic. One emerging contaminant is *N*-nitrosodimethylamine (NDMA), a potent carcinogen that is, ironically, a disinfection byproduct of wastewater treatment. First, other researchers in Berkeley's environmental engineering program revealed that NDMA is produced from the chlorination of wastewater. Next, the Alvarez-Cohen group not only identified the microorganisms that most effectively biodegrade the compound, they also confirmed that the expression of a specific gene that codes for a certain enzyme is key to the process. Based on that knowledge, the bacterium could potentially be genetically evolved to boost its efficacy at degrading the contaminant.

Their most recent work, specifically on PBDEs, was spurred by a brief article that Alvarez-Cohen stumbled upon in a local newspaper. The story reported on flame retardants now being found in human breast milk. Troubled by the report, she suggested that Robrock dig into the scientific literature. Some toxicology data was available linking high levels of PBDE with cancer, thyroid problems, lowered immunity and other health problems in laboratory animals. Worse, the levels of PBDEs in humans are apparently doubling every five years. Surprisingly, though, very little was known about how PBDEs make their way through our world. And even less was known about how they may be biodegraded, if at all.

With the many unanswered questions and the high threat level, PBDEs were a natural target for the Berkeley researchers. The group of compounds, Robrock explains, is similar in some ways to polychlorinated biphenyls (PCBs), hazardous compounds used in some electronics products, and other nasty chemicals the group had previously studied.

Other forms, including the popular deca-BDEs, were deemed safe enough to sell and are still used in many TV cabinets, computer enclosures, wire insulations and other electronic components.

"The thought was that they're so big that they're inert, and your body can't absorb them," Robrock says. That's true, she explains, until they're in the presence of certain microorganisms. The researchers discovered that microbes slowly remove the bromines, or debrominate, even the deca-BDEs, transforming them into their ugly toxic cousins, including penta-BDEs.

"We can ban the lower congeners, but we have to be aware that the higher congeners will turn into those lower ones eventually," Alvarez-Cohen says. "So the first thing we hope our research will accomplish is to make people recognize that this is an issue."

Right now, Robrock is conducting experiments to understand how the compounds degrade. She begins with a bottle containing a particular congener, adds the bacterium and monitors the reaction for as long as three months. Using a state-of-the-art two-dimensional gas chromatograph, she's sussing out the biochemical pathways behind the debromination. Only by understanding the process in detail might a bioremediation process emerge that would take the compounds past the toxic congeners into benign forms.

"We were hoping that they would go from soup to nuts, from PBDEs all the way to nontoxic end products," Alvarez-Cohen says. "But so far we're just finding more and more toxic intermediates." Worse than that, the two recently discovered that PBDEs are toxic not only to people but to microbes as well.

"You could imagine that if this chemical is slowing down microbial reactions globally, there could be a profound ecological effect," Alvarez-Cohen says. "And there are alternatives," Robrock adds. "There are many chemicals that can act as flame retardants. We could switch to one that doesn't happen to look like a thyroid hormone."

> **Alvarez-Cohen's laboratory specializes in nasty chemicals, identifying ways to clean them up using nature's own antipollutant army, microorganisms.**

PBDEs consist of two rings, groups of atoms linked by bonds in a circular form, with bromines all around and oxygen between the rings. The fewer bromines in the "congener," the configuration of the compound, the higher the toxicity. That's because the smaller molecule is more easily picked up by our bodies and accumulated in fat. The chemical's similarity to thyroxin, the major thyroid hormone in our blood, leads to its dangerous impact on hormone levels.

"We originally went into this thinking that perhaps we could find naturally occurring microorganisms that biodegrade PBDEs," adds Alvarez-Cohen. "That would have been good news." A year after she and Robrock launched their PBDE project, the toxicity concerns led to U.S. manufacturers taking penta-BDEs and octa-BDEs, those with five and eight bromines, respectively, off the market.

While that would be an ideal solution, it won't happen immediately. And even post-ban, the question arises how much damage has already been done. So Robrock and Alvarez-Cohen continue to study these invisible hazards and how nature might help us clean up the potentially deadly messes we unwittingly make.

"I'm always astonished by the natural capabilities of organisms to help remediate contaminants," Alvarez-Cohen says. "Bacteria have gotten a bad rap, and I'm here to change that."

David Pescovitz (david@pesco.net) is coeditor of *BoingBoing.net*, a research affiliate with the Institute for the Future, and editor-at-large of *MAKE: Magazine*. He is a frequent contributor to *Forefront*.

Professor Boris Rubinsky, Arnold and Barbara Silverman Distinguished Professor of Bioengineering.

BREAKTHROUGH CANCER THERAPY

BioE's Rubinsky pioneers technique

LEAPS TO CLINICAL TRIALS

for eliminating tumors with unprecedented precision

BY PETER JARET | PHOTOS BY BART NAGEL

Late in the day at the end of a long week of experiments this past December, Boris Rubinsky, Berkeley professor of bioengineering and mechanical engineering, and a team of colleagues straggled back to his lab in Etcheverry Hall, their faces reflecting exhaustion and exhilaration in equal measure. The week's experiments marked the end of one phase of a remarkable scientific odyssey and the beginning of what could be a genuine revolution in cancer treatment. "We started out with high hopes," said Rubinsky, a compactly built man whose eyes sparkle with restless energy. "The results have been even better than expected."

Rubinsky's bold idea of killing cancer cells in a wholly new way, using microsecond electrical pulses, first occurred to him a few years ago. Since then, he has taken his idea through research and development to the first phase of human trials in a period of time considered by most an extraordinarily quick leap from theoretical notion to promising investigational therapy. If all goes well, a powerful new way to treat cancer may soon be in the hands of surgeons around the world.

The technique itself, called electroporation—applying electric current to cell membranes in order to open pores—isn't new. In the mid-1960s, scientists discovered that a millisecond-long high-voltage electrical pulse could disrupt the membranes of living cells, making them more permeable. Subsequent research suggested that the precisely modulated pulses create nanoscale pores in the cell walls, hence the term electroporation.

During the last decade, the concept caught on in modern biotechnology, where it is widely used to insert DNA sequences into cells. Cancer researchers are also investigating what is called "reversible" electroporation to make tumor cell membranes inside the body more permeable to cancer-killing drugs.

Since its discovery, electroporation has been used primarily in this reversible mode, which temporarily increases cell membranes' permeability until the holes close up naturally following treatment, allowing cells to survive.

Rubinsky and his former graduate student Rafael Davalos (M.S.'95 ME, Ph.D.'02 ME/BioE) had a different notion. Researchers already knew that a strong enough electrical pulse would induce irreversible electroporation (IRE), damaging the cell membrane so that cells leaked their contents and died. One research group suggested using IRE as a way to kill bacteria in contaminated water. Rubinsky and Davalos wondered if the same technique could be used to blast tiny lethal holes in the malignant cells that make up tumors in the body. "Nobody had thought of it for cancer," Rubinsky said. "Most people tried to avoid killing cells with irreversible electroporation in their applications. We decided to put it to use."

Oncologists already possess a variety of ways to ablate, or destroy, solid tumors. Radio-frequency ablation and high-intensity ultrasound, for example, kill with heat. Cryoablation, a technique Rubinsky has explored extensively, destroys cancer cells by freezing them. In prostate cancer, oncologists implant tiny radioactive seeds that destroy the runaway malignant cells. But these techniques all have serious drawbacks that limit their effectiveness. They can damage healthy tissue surrounding a tumor, for example, or leave malignant cells behind, allowing tumors to grow back.

"From the beginning we thought irreversible electroporation might offer important advantages," said Rubinsky. But before he could explore the potential benefits, he had to settle a surprisingly basic question: did the phenomenon of irreversible electroporation ablation actually exist? Clearly, a strong electrical pulse could kill cells. What no one knew for certain was whether the pulse destroyed cells by making their cell walls irreversibly permeable, or whether it simply heated them enough to kill them. The answer was crucial. If the killing mechanism was simply heat, then IRE would be no different from ablation methods like radio frequency or ultrasound and would not be likely to offer any advantages.

Results from preliminary studies were encouraging. Using mathematical analyses, Rubinsky's first research team—which included Davalos, then at Sandia National Laboratories in Livermore, and L.M. Mir, at Institute Gustave-Roussy in Villejuif Cedex, France—demonstrated that cells could be destroyed with a dose of electricity strong enough to make their membranes fatally porous but not strong enough to raise the temperature significantly. In a follow-up experiment, Rubinsky and two scientists at Tel Aviv University—graduate student Liron Miller and physician Jonathan Leor—successfully used IRE *in vitro* to destroy human liver cancer cells. "We knew then that irreversible electroporation existed as a phenomenon and that it could be used to kill tumor cells," Rubinsky explained.

The procedure had to do more than kill the odd cancer cell, however. It had to be able to destroy all the cells in a tumor reliably and with a high degree of precision. With cancer, the goal is to destroy 100 percent of the cells. If malignant cells are left behind, they will multiply to form another tumor.

In the next series of experiments, the researchers confirmed that, by adjusting the amplitude and length of the electrical waves, they could reliably kill all the target cells using irreversible electroporation. With those findings, they knew they had a completely new way of ablating tumor cells, one that was likely to perform very differently from existing ablation methods.

The time had come to put IRE to the test in animal studies. It is at this point that experimental cancer therapies frequently run afoul. What works in the lab often encounters unexpected complications in a living body. Not so here. In fact, Rubinsky's team discovered that the electrical pulses could be controlled with unprecedented precision. By positioning electrode needles strategically, Rubinsky's team was able to destroy the targeted tissue with the resolution of a single cell.

"That's extraordinary," said physician Gary Onik, an expert in cancer ablation and a pioneer in the emerging field of imaging-monitored cryosurgery. Onik, who directs the prostate cancer research program at Florida Hospital Celebration Health in northeastern Florida and has collaborated with Rubinsky for more than two decades, will supervise the first clinical trials of the technique in men with prostate cancer.

"It's possible to use this technique to destroy tumor cells that are right next to healthy tissue without harming the healthy cells. In cancer treatment, that kind of precision can mean the difference between life and death." One stubborn problem oncologists face is that tumors often grow next to blood vessels. Malignant cells, after all, need a great deal of nourishment for their runaway growth. Unable to risk destroying blood vessels, surgeons are sometimes forced to leave some malignant cells behind.

"Using irreversible electroporation, we've been able to destroy cells in tissue all around the margin of blood vessels without damaging them, something we haven't been able to do with other ablation methods," said Onik, who has developed other important advances in prostate cancer treatment. "What's more, because the pulse affects only cell membranes, it leaves other structures intact, including connective tissue and bile ducts. That means there's good reason to think we may be able to completely cure some forms of cancer that, until now, we've only been able to contain."

The team's experiments also demonstrated other key advantages associated with IRE. First, only very short electrical pulses are needed to kill cells, so the treatment can be performed with astonishing speed. "With irreversible electroporation ablation, the procedure lasts only as long as it takes to position the needles," noted Rubinsky. "We can actually ablate the malignant tissue in a fraction of a second." Other currently used ablation methods, such as radio-frequency ablation and cryoablation, sometimes take hours to perform.

Because the electroporation pulse is so short, the new technique also turns out to be more effective than other methods. With more traditional heating and cooling ablation techniques, blood flow around the tumor dissipates the extremes of temperature, diminishing the killing power of the treatment. With IRE, the pulse is so brief—like the flash of a flashbulb—that blood flow is essentially stationary during the treatment. Since the pulse damages only the cell membrane, collateral damage to other tissue components is nonexistent, reducing recovery to a few weeks, significantly shorter than with other existing ablation therapies.

Joining the group for the final experiments before human trials were to begin was research scientist William Hamilton of biotechnology firm AngioDynamics, based in Queensbury, New York, which has licensed the new technology.

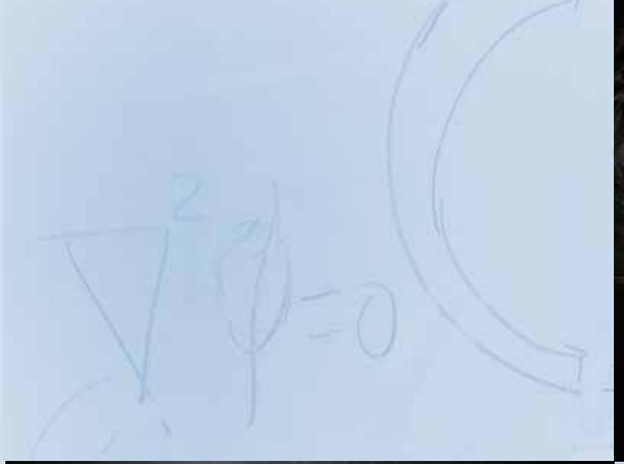
"It's been an amazing ride," Hamilton said. "I don't think any of us expected it to go so well, or so quickly." Asked why the research and development proceeded with such speed, he answered without hesitation. "It's the quality of the research, absolutely. At the beginning, everything was on paper. Using mathematical modeling, Boris and his graduate students were able to predict almost exactly what the effect on cells would be."

One potential drawback did threaten to complicate the new therapy. Because the pulse is so short and the nanoscale damage to the cell wall so subtle, treated tissue doesn't look visibly changed compared with untreated tissue. "In the earliest experiments we sometimes wondered if we were doing anything at all," Rubinsky said. "The perforations in the cell membranes are so small—on a nanoscale—that no one has ever actually observed them with the naked eye. All we were able to do is observe the effect over time as the cells die."

That could have spelled trouble for surgeons, who need to monitor their work in real time in order to make sure all the malignant tissue has been ablated while healthy tissue is left untouched. "You can't perform surgery to remove a tumor if you can't see what you're doing," Onik pointed out. But Onik and Rubinsky discovered that ultrasound imaging, already widely used in hospitals, clearly reveals the difference between treated and untreated tissue.

"Something about irreversible electroporation changes the reflectivity of the treated tissues," said Onik. "Why, is still something of a mystery to us." The fact that it does means that surgical oncologists will be able to use ultrasound to guide IRE, at least in

"WE THINK THIS TECHNOLOGY MAY BE EFFECTIVE FOR A WIDE RANGE OF SOLID TUMORS, INCLUDING LIVER, LUNG AND PANCREATIC CANCERS."



Rubinsky (above, right) currently divides his time between Berkeley and Israel's Center for Bioengineering in the Service of Humanity and Society, which he founded at the Hebrew University of Jerusalem in Israel. Rubinsky with Gary Onik (above, center), a pioneer in the emerging field of imaging-monitored cryosurgery who has collaborated with Rubinsky for more than two decades. Rubinsky's team (immediately above) includes (from left) Berkeley graduate student Yair Granot, post-doc student Antoni Ivorra, Berkeley licensing officer Curt Thiessen, electrical engineer Paul Mikus, Onik, Rubinsky, and William Hamilton of AngioDynamics. Berkeley Engineering alum Rafael Davalos, coinventor of IRE who is now teaching at Virginia Tech University, is not pictured here.

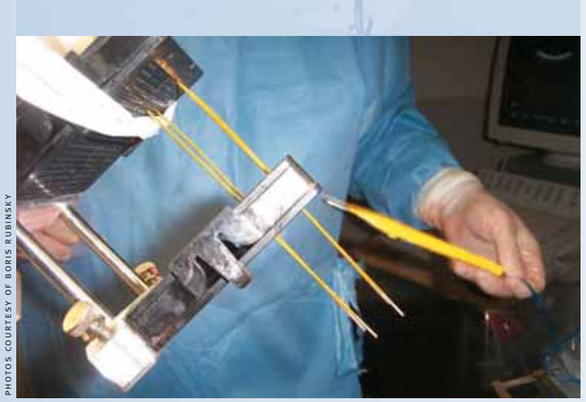
Extending IRE's Global Reach

Professor Boris Rubinsky, who pioneered the emerging technique of irreversible electroporation to destroy tumors, currently divides his time between Berkeley's Biomedical Engineering Laboratory and Israel's Center for Bioengineering in the Service of Humanity and Society, which he founded at the Hebrew University of Jerusalem in Israel. "Bioengineering is so focused on solving problems that we almost forget the people we're trying to help," says Rubinsky. "There is not enough attention paid to making these lifesaving technologies available to everyone around the world. That's the goal of the center."

Irreversible electroporation offers just such a technology, since the required equipment is relatively simple, and treatment can be completed in a matter of minutes. Faster recovery time also makes it feasible in those parts of the world where hospital facilities are limited.

To make the new treatment even more widely available, several members of Rubinsky's Berkeley team are developing a new imaging technique for irreversible electroporation that would be cheaper and more accessible than ultrasound imaging, now most commonly used. Known as electrical impedance tomography, the new technique measures the increased conductivity of tissues that have been electroporated. "When you open up nanopores in a cell membrane, ions inside or outside the cell can move freely across the membrane," explains biophysics graduate student Yair Granot, a member of Rubinsky's Berkeley team. "In this way, they conduct electricity, which we can measure using electrodes."

Electrical impedance tomography promises to be easier to use, requiring far less expensive equipment than ultrasound. A prototype device is expected to be ready within a few months.



PHOTOS COURTESY OF BORIS RUBINSKY

Cancer ablation specialist Gary Onik (above), who directs the prostate cancer research program at Florida Hospital Celebration Health in northeastern Florida, will supervise the first clinical trials of irreversible electroporation in men with prostate cancer. The four-probe electroporation system (below) is a commercial prototype produced by Oncobionic, Inc., the San Francisco company Rubinsky founded to market his soft tissue ablation technology. Oncobionic was recently acquired by AngioDynamics, Inc., a medical device manufacturer in upstate New York, for $25 million.

the early stages of its application. Several members of Rubinsky's team are currently working on an innovative imaging technique that would require far less expensive equipment than ultrasound. If their work succeeds, advanced minimally invasive surgical treatment with IRE could be made much more widely available, not only in the developed world but elsewhere, to urban as well as rural hospitals and clinics, which are often last in line when it comes to acquiring medicine's newest and most expensive technologies. (See sidebar, page 23.)

Meanwhile, the latest experiments conducted at UC Berkeley reveal that irreversible electroporation appears to mobilize the immune system, activating legions of immune cells to target and destroy tumor cells left behind by the treatment. "We still have a lot of research to do," Onik said. "But if it pans out, it would mean that, after treatment, any tumor cells left in the body would be tracked down and destroyed by the immune system."

Following Food and Drug Administration approval last December, clinical trials on individuals with prostate cancer began in February. The procedure promises surgeons an unmatched degree of control, according to Onik, and patients a faster recovery time, so it may also be less likely to cause the unwanted side effects that bedevil other ablation techniques, including incontinence and sexual dysfunction. Given its substantial advantages over other therapies, Onik expects that IRE will be quickly adopted by cancer surgeons. Although the method for destroying the cells is new, the practical technique of inserting electrodes is very similar to commonly used ablation therapies like radio-frequency ablation. "It should be very easy for surgeons to master its use," said Onik.

"We think IRE may be effective for a wide range of solid tumors, including liver, lung and pancreatic cancers," he continued. "At the moment, there's almost nothing we can do for these patients."

Beyond cancer, the technique has potential in other disorders that respond to ablation. Surgeons now treat dangerous heart arrhythmias, for example, with cryosurgery to destroy clusters of cells responsible for aberrant heart beats, a technique that can take an hour or more during open heart surgery. IRE could accomplish the same result in seconds. Irreversible electroporation might, one day, also be capable of removing the scar tissue that forms around surgically implanted stents, used to widen and prevent clotting in narrowed blood vessels.

Go to **www.berkeley.edu/news/media/releases/2007/02/12_IRE.shtml** for more on the IRE technique.

PETER JARET is coauthor of *Impact: From the Frontlines of Global Health* and *In Self-Defense: The Human Immune System*. His stories have appeared in *Health, Hippocrates, National Geographic, The New York Times* and *Newsweek*.

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2000s

YU (KEVIN) CAO *(Ph.D.'02 EECS)*

of Tempe, Arizona, received a 2006 National Science Foundation Faculty Early Career Development Award, given to the most promising young researchers in science and engineering. The award, worth $400,000 over five years, will support his work in developing infrastructure and tools to help bridge the knowledge gap between nanometer silicon technology and system integration. The award will also fund his research in nanoscale silicon transistors and components from other emerging technologies, such as the carbon nanotube, to devise more reliable nanoelectronics systems. An assistant professor of electrical engineering at Arizona State University, Cao also received a 2006 IBM Faculty Award.

RAFAEL DAVALOS *(M.S.'95 ME, Ph.D.'02 ME/BioE)*

received the Hispanic Engineer National Achievement Award for Most Promising Engineer, Advanced Degree, for his innovative work in bioengineering at Sandia National Laboratories and his recruiting and mentoring activities. He is now assistant professor of biomedical engineering at Virginia Tech University. (See story, page 20.)

DUANE KUBISCHTA *(B.S.'99, M.S.'02 ME)* of San Francisco has taken the last two winters off from

sequencing DNA at the Joint Genome Institute to pursue a second career making skiing action movies. His second full-length film was accepted for screening at the 2006 Banff Mountain Film Festival. For more, go to **www.adventurefilmworks.com.**

MARY W.C. LOUIE *(B.S.'05 ChemE/MSE)* of Pasadena is a graduate student in chemical engineering at the California Institute of Technology, doing research on solid acid fuel cells.

DAVID LI-WEI WANG *(B.S.'01 EECS)* of Saratoga, California, recently married **MARILEE CHAN** *(B.S.'01 Bus. Ad.)* and is now attending law school with a focus on intellectual property.

WENXIA YANG *(B.S.'05 IEOR)* lives in San Jose and works as a manufacturing engineer.

KRISTIN YAREMA *(Ph.D.'00 ChemE)* married **MICHAEL NOHAILE** *(Ph.D.'96 Molecular & Cell Biology)* last fall on the Caribbean island of Nevis. Both work in Morristown, New Jersey, for management consulting firm McKinsey & Company.

1990s

THOMAS BOWER *(M.S.'95 CE)* of El Granada works as a civil engineer for the City and County of San Francisco.

KARIM ELKATCHA *(B.A.'94 Architecture, M.S.'97 CEE)* of Sunnyvale is product manager for Digital Persona, Inc., a privately held biometric company. He was previously mechanical engineer and engineering team lead for a startup rotary laser company.

BARTON FORMAN *(M.S.'99 CEE)* of Los Angeles is pursuing his doctorate in water resources engineering at UCLA and leading an international water project in Guatemala for Engineers Without Borders, a group of nongovernmental organizations involved with international development work.

ALEKS GÖLLÜ *(M.S.'89, Ph.D.'95 EECS)*

of El Cerrito cofounded Pinc Solutions, where he is developing a complex tracking system that

uses radio-frequency identification to track product shipments. A native of Turkey, Göllü arrived in the United States in 1983 and earned his bachelor's degree at MIT. He worked at Oracle and Teknekron before founding OtelNet, then Pinc.

YOUNG HOON KWAK *(M.S.'92, Ph.D.'97 CE)* of Washington, D.C., received tenure as associate professor of project management at George Washington University School of Business.

JADINE LOUIE *(B.S.'92 ME)* of

South San Francisco took her final bow as artistic director and conductor of the San Francisco Lesbian/Gay Freedom Band last fall. S.F. Mayor Gavin Newsom named September 16, 2006, the day of her farewell concert, "Jadine Louie Day" in her honor. For more than 10 years she conducted the band, which was named the city's official band, in community concerts, parades and civic events. Louie earned her Berkeley Engineering degree after majoring in French horn at San Francisco State University.

GARY MAY *(M.S.'88, Ph.D.'91 EECS)* of

Atlanta was awarded the 2006 Mentor Award of the American Association for the Advancement of Science at its 173rd annual meeting in San Francisco last February. The award recognized his outstanding contributions in recruiting, mentoring and educating underrepresented students in science and engineering careers. May is professor and Steve W. Chaddick Chair in the School of Electrical and Computer Engineering at Georgia Tech.

MANISH MODI *(M.S.'91 ME)* of Fremont is a vice president at Oracle Corp., responsible for one segment of its Business Applications Development organization.

KEN SUSILO *(B.S.'90, M.S.'91 CE)* of Culver City, California, was recently awarded the 2006 Outstanding Civil Engineer in the Private Sector by the Los Angeles section of the American Society of

Civil Engineers (ASCE). An associate at GeoSyntec and manager of its Los Angeles branch, Susilo was recognized for his pioneering and environmentally sensitive engineering designs and planning solutions in the areas of storm water management, hydraulics and hydrology.

JENNIFER WU *(B.A.'93 CS)* of Lynnwood, Washington, is working as a regional sales manager for Microsoft.

DAVID YANG *(B.S.'99 EECS)* of Los Angeles writes, "I received a law degree from Boalt Hall in 2006 and am now an associate with Munger, Tolles & Olson LLP in Los Angeles. My engineering degree comes in handy when dealing with complex technological issues in litigation."

MICHAEL YOUNG *(B.S.'92 EECS)*

of Bellevue, Washington, has been appointed chief technology officer of Redfin, a real estate online brokerage firm based in Seattle. Previously, he was a lead program manager for Microsoft BizTalk Server, chief architect and engineering director at Plumtree Software and an architect at ViewStar, an enterprise software company.

1980s

HAMID BAHADORI *(M.S.'80, Ph.D.'88 EECS)*

of Redwood City has been appointed vice president of product development and hosted operations for WebTrends Inc. Bahadori's 19-year career includes engineering and leadership positions at high-tech and software companies Oracle, Sun Microsystems and NASA Jet Propulsion Laboratory. WebTrends, based in Portland, Oregon, is a market leader for web analytics and marketing performance management solutions.

BRIAN DEMCZYK *(M.S.'85 Eng. Sci./MSE)* is now "semi-retired" and living in western Pennsylvania.

WAYNE ERICKSON *(B.S.'80 ME)* of Los Gatos has spent more than 25 years in the data storage industry and is now executive vice president of a production test equipment company.

AARON FISHER *(M.S.'81 EECS)*

of Allentown, Pennsylvania, has joined SMSC as senior vice president of products and technology, bringing with him an extensive background in strategic engineering and marketing initiatives. He will direct all marketing, sales and engineering functions for the company, which specializes in semiconductor solutions for domestic and corporate markets.

BRIAN FUKUMOTO *(B.S.'89 ME)* and his wife, Becky, of Morgan Hill celebrate the adoption of their first child, Emma Luna, who was brought home from Chongqing, China, last fall. Fukumoto was director and treasurer of the Cal Engineering Alumni Society from 1998 to 2001.

COLEMAN FUNG *(B.S.'87 IEOR)*

of East Williston, New York, has established the Coleman Fung Risk Management Research Center at UC Berkeley to help develop new risk management–based business practices and tools. The Center will be housed in the Institute of Business and Economic Research. Go to **www.berkeley.edu/news/media/releases/2006/10/19_funggift.shtml** for more details.

OTTO LEE *(B.S.'89 NE/ChE)* was selected the 57th mayor of Sunnyvale last November, following several years of service on the city council and the planning commission and one year as vice mayor. A patent attorney, he

is founder and managing attorney of Intellectual Property Law Group LLP. He also holds the rank of commander in the Naval Reserve.

PAUL MEISSNER *(B.S.'85 MSE)* of

San Jose has been appointed CEO of Santur Corporation, the Fremont-based manufacturer of reliable tunable laser products for global telecommunications. His 18-year career in optics and semiconductors includes executive leadership positions with Coherent, KLA-Tencor and Applied Materials. Meissner also advises entrepreneurs through the Global Social Benefit Incubator at Santa Clara University and the Digital Visions Program at Stanford.

JAMES ROBERTS *(B.S.'79, M.S.'80 CE)* of Carmel Valley, California, is a senior vice president at Granite Construction Company, an infrastructure-related building company based in Watsonville.

FRIEDER SEIBLE *(Ph.D.'82 CE)* is the recipient of a 2006 Humboldt Research Award, one of Germany's most prestigious scientific honors, given to eminent foreign scholars in recognition of lifetime academic achievements. Award winners are invited to carry out research projects with a host university in Germany. Seible, dean of UCSD's Jacobs School of Engineering, plans to investigate fundamental design concepts that could improve the performance of structures under extreme loads caused by natural and man-made disasters. He will be hosted by the civil engineering faculty at the Bauhaus-University in Weimar and will visit and collaborate with structural research institutes across Germany.

GREG SPIRAKIS *(B.S.'82 EECS/MSE)* of Saratoga, California, joined the ArchPro board of directors. Spirakis had a 20-year career at Intel Corporation, where he served as vice president in the technology and manufacturing group, director of design technology and chair of the design technology council. He left Intel in 2005 to pursue investment and technology consulting opportunities.

LAURENS VANEVELD *(B.S.'79, M.S.'81 ME)* of Hayward is designing and promoting energy efficient and sustainable systems and concepts for building heating, ventilation and air conditioning systems.

SIMON WONG *(M.S.'78 EE, Ph.D.'83 EECS)* of Palo Alto was elected to Pericom Semiconductor Corporation's board of directors last fall. A professor of electrical engineering at Stanford, Wong is an expert in complementary metal-oxide-semiconductor (CMOS) devices and integrated components for radio-frequency operations. Previously, he served as CEO of the Hong Kong Applied Science and Technology Research Institute and helped cofound Atheros Communications.

1970s

THOMAS BUTLER *(B.S.'73 ME)* of Issaquah, Washington, is associate technical fellow at Boeing Commercial Airplanes in Seattle.

SHERMAN CHAO *(B.S.'72, M.S.'73 ME)* of San Francisco writes, "I am a Department of Energy [DOE] engineer, overseeing safety at Lawrence Livermore National

The man who made e-mail go

It was 1980. Personal computers hadn't been invented yet, and Soda Hall hadn't been built. The Internet was barely 10 years old and still in its nascent form known as Arpanet, the networking system developed by the U.S. Department of Defense. Access to this powerful tool was exclusive in those days, limited to academic researchers working on defense projects.

Eric Allman (B.S.'77 EECS, M.S.'80 CS) was pursuing his master's degree and working on Berkeley's INGRES project, one of the world's first and most influential relational database management systems. On their Cory Hall computer, INGRES staff like Allman had access to the powerful Arpanet network, a rare luxury coveted by the computer scientists in Evans Hall.

"There were sometimes fights," Allman says. "A lot of faculty and graduate students wanted accounts on our machine, but that was impossible." He was the only one in his group who knew anything about e-mail.

"At one point I figured, OK, I can write some software that glues this one software to this other software, forwards mail from Arpanet to their primary machine so they don't have to switch to this machine, and then forwards it back out again. It was a quick hack, but it worked."

From that simple problem-solving exercise evolved one of the first implementations of SMTP (Simple Mail Transfer Protocol), the Internet protocol used to deliver mail. Allman perfected his quick hack, working on his own time and distributing the program to Berkeley's Computer Systems Research Group (CSRG), which had a contract with the Department of Defense for developing an operating system that would facilitate collaboration among researchers.

The product, better known as sendmail, celebrated its 25th anniversary last fall. Sendmail became an important element of the Berkeley Software Distribution—the open-source operating system developed by the CSRG in the early 1970s—and now delivers more than 70 percent of the world's e-mail. But if he had known then what he knows now about spam, Allman says, he might never have tackled e-mail.

"It bugs me that people are using this system without realizing that they could destroy it," he explains. "I'd like to think better of the human race." The spam filters that are indispensable today could not have been built into early versions, Allman says, because the emphasis back then was on sharing, not security.

Now chief science officer of Sendmail, Inc., Allman focuses on developing authentication and encryption tools like DKIM (DomainKeys Identified Mail) and milter (mail filter) to better protect our electronic mail from interlopers. Sendmail's primary commercial product, Mailstream Manager, provides security and a host of other mail management functions to a majority of Fortune 1000 companies in 33 countries. Allman founded the Emeryville company in 1998, after e-mail became wildly popular and too "mission critical" for him to handle alone; until then, he had been distributing and supporting the software for free.

Eric Allman (B.S.'77 EECS, M.S.'80 CS) was a student at Berkeley Engineering when he developed sendmail, the invisible program that moves your e-mail to someone else's inbox when you hit "send." The product, still marketed and supported by Allman's Emeryville-based Sendmail, Inc., is now responsible for delivering 70 percent of e-mail traffic worldwide.

What Allman likes best about e-mail, he says, is its archival value, but he thinks both ordinary people and experts overuse it. When a decision needs to be made, for example, and e-mails go back and forth for days, he explains, "I want to say, 'Guys, get up and walk into that person's office and deal with it!'"

Allman, an El Cerrito native, was 14 years old when he first got his hands on a computer, an IBM 1401, and one of the first things he did was to recode the operating system. A self-described "social outcast" who was gay but still in the closet, Allman says computers allowed him to escape from the world.

"When I came to Berkeley in 1973, it was a truly exceptional time," he remembers. "I learned from Ken Thompson [B.S.'65, M.S.'66 EECS], one of the original authors of UNIX, who took a sabbatical from Bell Labs." He also rubbed shoulders with some of the most famous names in the business, including fellow alums Bill Joy (M.S.'79 EECS) and Eric Schmidt (M.S.'79, Ph.D.'82 EECS) and retired Berkeley professor Robert Fabry. While Allman's name may not be as famous as these, he prefers it that way.

"It requires a different ego to write this kind of software," he says. "A lot of people want to code video games; they want you to know it's their software. But with a mail transfer agent, you want it to be invisible. The only time people even know it exists is when it's broken. And you never want it to be broken."

Go to **www.sendmail.com/webprograms/25** for more on Allman and sendmail's 25th anniversary.

PHOTOS COURTESY MARK MELTZER

Mark Meltzer (B.S.'72 EECS), a skydiver since 1968, says every jump is equally exciting. "Once you accelerate to terminal velocity, you feel like you're floating on air; you have no inertial clues that you're falling at 120 mph. It's a very soulful experience."

Freefalling engineer

Mark Meltzer (B.S.'72 EECS) started skydiving in 1968 as a freshman at Berkeley. A love of classic planes, not adolescent thrills, lured him into what has become a lifelong passion.

"I've always been fascinated by aviation," Meltzer says. "I wanted to fly, but the cost of flight lessons was beyond my means. One day I was at Oakland Airport looking at derelict DC-6s and Stratocruisers when a sign on an old shack caught my attention." For $50 he could learn to skydive.

"I was definitely nervous that first time," he says. "It was grueling. The instructors would scream at you, like a military operation. The purpose, I think, was to get you used to stressful situations so you didn't panic."

After his first jump—even though a fellow student had to be pried off the wing strut, screaming, by her instructor—Meltzer couldn't wait to go again. In nearly 40 years he has completed hundreds of jumps without a single injury. He has had close calls, like the two times his main canopy malfunctioned and he had only about seven seconds to cut away from the fouled main chute and deploy his reserve canopy.

Following his EECS degree, Meltzer studied law at UC Hastings, earning his degree in 1975. Now vice president and general counsel at FoxHollow Technologies, he handles intellectual property, litigation and contracts for the Silicon Valley medical device firm. The company's primary product is a plaque excision system that he says has saved hundreds of limbs that would otherwise have been amputated due to clogged arteries.

"I love working with really bright, innovative people who are literally saving lives and limbs," he says. Like many engineers, his interests abound, including not just skydiving and aviation, but also electronics (he has several patents for heart defibrillator circuits) and commercial salmon fishing. He earned his way through school skippering fishing boats and still has the boat used by his late father, who taught him the fishing trade but steered him toward an engineering career.

"Law school was easy compared with engineering," Meltzer says. "Engineering has provided me with a great background for learning how to think logically." His knowledge of statics, dynamics and vectors, he says, also makes him a safer skydiver. He loves the adrenaline rush but is super cautious and carries two visual altimeters, two audible altimeters, a miniature "black box" digital flight recorder and an automatic device that deploys his reserve chute if he falls below 700 feet at freefall velocity.

"As an engineer, I know there is no perfect system," Meltzer says. "You can't wear two helmets, but I would if I could."

RACHEL SHAFER CONTRIBUTED TO THIS STORY.

Laboratory. I'm also recruiting new or recent engineering graduates, with an emphasis on diversity, for DOE internship positions. See our intern recruiting website at **www.nnsa.doe.gov/futureleaders.**"

TOM TAMIO HORIYE *(B.S.'78 EE)* of San Jose is a product engineer director at Sipex Corporation and previously worked at Advanced Micro Devices and National Semiconductor. He writes, "My wife Theresa and I have been married for more than 23 years and have two sons, Anthony and Ryan. I enjoy traveling to Disneyland every year with my family."

STEVE KANG *(Ph.D.'75 EE)* of San Mateo took office as the new chancellor of UC Merced in March. Dean of the Baskin School of Engineering at UC Santa Cruz since 2001, Kang is recognized as a leader in the development of the world's first 32-bit CMOS microprocessor chips and peripheral chips. He was selected following a nationwide search. While at UCSC, he initiated several interdisciplinary programs and collaborated with partner campuses at both the California Institute for Quantitative Biomedical Research and the Center for Information Technology Research in the Interest of Society. He was also a chaired visiting professor of EECS at the Korea Advanced Institute of Science and Technology.

HIRO KAWAMOTO *(M.S.'66, Ph.D.'70 EE)* of Nara City, Japan, writes from Japan's Nara Institute of Science and Technology, "I am now working on crop-enhancement and fermentation technologies and promoting them to U.S. ethanol companies and the Department of Energy. I feel as if I am now a plant biologist rather than the electrical engineer I used to be."

ROBERT KLUBER JR. *(B.S.'78 ME)* has been employed by Henkel Corporation at the same location since 1978. He and his wife Linda have been married 33 years and now live in Martinez on one and a half acres of land.

CHRISTIAN MEYER *(M.S.'66, Ph.D.'70 CE)* of Demarest, New Jersey, has been named chairman of the Department of Civil Engineering and Engineering Mechanics at Columbia University.

ED MITCHELL *(B.S.'76 EECS)* of Belmont, California, retired in 2003, after 28 years in the semiconductor industry, the last 13 in various vice president positions. He writes, "Loved the engineering work, didn't love the executive management work. Now, love the golf. And Go Bears!" **emitch2720@comcast.net**

JOHN MORAN JR. *(B.A.'70 CS)* is currently pursuing his doctorate in educational psychology at the University of Nevada, Reno.

JAMES RAY *(M.S.'74 EE)* of Bellevue, Washington, works in flight controls for Boeing Commercial Airplanes in Seattle. He also serves as secretary/treasurer for the Eastside Lyric Theater.

DIMITRY STRUVE *(B.S.'77 ME)* of Los Altos is approaching his 20th year at Sun Microsystems, where he is an engineering director developing x64 systems, high-end servers that handle computing, server consolidation and web infrastructure. He and his wife have two teenage children.

KENNETH TURKOWSKI *(M.S.'78 EECS)* of Menlo Park, after three years of consulting, is now developing graphics processing unit (GPU) code for Adobe.

KEVIN WALSH *(B.S.'76 EE)* of Lafayette, California, has been appointed vice president of marketing and business development at Arasan Chip Systems of San Jose, a supplier of reusable intellectual property cores, semiconductors and design services. In his 15-year career in software marketing and management, Walsh has successfully launched and managed many products. He previously held positions at Synopsys, inSilicon, Sapphire Design and Simplex Solutions.

RICHARD WISEHART *(M.S.'76 CE)* spent 30 years with the U.S. Forest Service before joining the City and County of San Francisco at their Hetch Hetchy Water and Power operations in Moccasin, California. He lives with his wife Mary and daughter Sue in Sonora.

ROBERT YAMAMOTO *(B.S.'77 ME)* of Sacramento is program manager for the solid-state diode-pumped laser at Lawrence Livermore National Laboratory, the most powerful laser of its kind in the world.

1960s

ALBERT GREEN *(B.S.'67 ME, M.S.'69 Naval Architecture)* of Benicia, California, is still busy volunteering with Friends of Benicia Library and helping at monthly book sales.

RALPH IWENS *(M.S.'64, Ph.D.'67 EE)* has been retired from TRW for several years. His last big project was the NASA Chandra X-ray Orbiting Observatory. He and his wife spent the summer of 2006 in Germany.

ANTHONY JOHNSON *(B.S.'60 IEOR)* of Carmel, California, is enjoying retirement in the Monterey Peninsula after more than 28 years in the U.S. Army, where he worked on missiles and nuclear weapons. He is teaching business and organizational leadership courses part-time for Chapman University and Hartnell College and serves on the board of five nonprofit organizations. He writes, "I also entertain eight grandchildren, fortunately not all at the same time."

STEPHEN KLINGER *(B.S.'63 ME)* of Manhattan Beach, California, retired in 2004 after working 42 years in the aerospace industry.

TERRENCE LANDEN *(B.S.'64 EE)* of Mission Viejo, California, retired from McDonnell Douglas Corporation, completing his tenure there in 1994 by working on the space station project.

DAVID LANG *(B.S.'66, M.S.'67 CE, M.B.A.'78 Bus. Ad.)* of Pleasant Hill writes, "I retired in 2003 and now split my time between the San Francisco Bay Area and North Lake Tahoe, where I enjoy skiing, bicycling and golf. Go Bears!" **VetteMan94523@aol.com**

ARMAND LANGMO *(B.S.'60 ME)* of Mount Hermon, California, retired in 2002 after 37 years with Bechtel Corporation. He now volunteers at Mount Hermon Conference Center, using his engineering and management experience. He is also on the Santa Cruz County Grand Jury for 2006–2007.

JACK LINDLEY *(B.S.'60 CE)* of Fremont is retired from the Alameda County Public Works Agency. He writes, "I'm always on the lookout for other civil engineers from the class of 1960." **lindleyjack@comcast.net**

STEPHEN MEISENHOLDER *(B.S.'61 ME)* of Manhattan Beach, California, retired in 2002 from the aerospace industry after 41 years, eight of which he spent at Aerojet General and 33 at TRW. He now keeps busy with world travel and serving as president of the local historical society.

CARLOS MORALES *(B.S.'69 IEOR)* of Jackson, New Jersey, writes, "Last October, I and two other Berkeley Engineering grads—**WINSTON WALLACE** *(B.S.'67 CE)* of Clintwood, Virginia, and **JOSÉ CHANGKUON** *(B.S.'68 EECS)* of Guayaquil, Ecuador—and our wives had the pleasure of visiting Machu Picchu, in the Andes Mountains of southeastern Peru. Apart from marveling at the wonder of this ancient engineering achievement, we had the opportunity to visit Cusco, seat of the Inca empire, and Lima, Peru's capital, with its colonial architecture and great museums. We are all members of the Berkeley Big Bang Club and look forward to our next meeting in the fall."

Visiting Machu Picchu last October are (from left) Changkuon, Wallace and Morales.

BART NAGEL PHOTO

Distinguished engineers, one and all: *Honorees (from left) Andy Grove (Ph.D.'63 ChemE) and Tejal Desai (Ph.D.'98 BioE) celebrated with Dean Richard Newton at the College of Engineering's 32nd annual Distinguished Engineering Alumni Award (DEAA) banquet, held last November 18 in the Betty and Gordon Moore Lobby of Hearst Memorial Mining Building. Grove, cofounder of Intel Corporation, received the Lifetime Achievement Award, and Desai, professor of physiology at UCSF, received the Outstanding Young Leader Award. The DEAA was Newton's last official event as dean before his death from pancreatic cancer early this year.*

1950s

BAL RAG SEHGAL *(M.S.'57, Ph.D.'61 NE)* retired in 2004 as professor of nuclear power safety at the Royal Institute of Technology in Stockholm. He is writing a textbook on accident safety for light water reactors.

PAUL S. L. WU *(B.S.'63, M.S.'64 ME)* of Encinitas, California, works for Hewlett-Packard in San Diego as a hardware design engineer.

RENDOW YEE *(B.S.'65 CE)* is the author of *Architectural Drawing: A Visual Compendium of Types and Methods,* published by John Wiley & Sons, Inc., the third edition of which will be published in June 2007. Now retired, Yee was chair of the architecture department at San Francisco City College. He and his wife Hedy just completed a children's book entitled *Wings of the World: An Alphabet Activity Book on Butterflies,* published by Trafford Publishing. **rend825@yahoo.com**

ERNEST BLEE *(B.S.'51 CE)*, a former transportation engineer, is now retired and living in Alamo, California.

JASPER COLEBANK *(B.S.'58 EE)* of Templeton, California, has been retired since 1996. After getting his Cal degree, he pursued his master's in EE at the University of Southern California with the support of a Howard Hughes Fellowship. His 35-year career in intercontinental ballistic missile research, design and testing included positions at Autonetics, Lockheed and Hughes Aircraft/General Motors/Raytheon.

JOHN COONEY *(B.S.'51, M.S.'53 CE)* of Boise, Idaho, retired in 1999 after 47 years with Morrison-Knudsen, Inc. (now Washington Group International). He served as project engineer for the Portage Mountain Underground Power Plant, assistant general manager for mining construction and senior project director for the Weldon Spring Site Remedial Action Project.

Six alumni named to NAE

Asad Ali Abidi

Rudolph Bonaparte

Teresa H. Meng

Silvio Micali

Six Berkeley Engineering alumni were elected to the National Academy of Engineering (NAE), one of the highest professional distinctions for an American engineer. Among academic institutions, UC Berkeley faculty and alumni have one of the highest representations in the NAE, which has 2,217 U.S. members and 188 foreign associates.

ASAD ALI ABIDI *(M.S.'78, Ph.D.'81 EECS)*, UCLA professor of electrical engineering, was cited for contributions to developing integrated circuits for MOS RF (metal-oxide-semiconductor radio-frequency) communications.

RUDOLPH BONAPARTE *(M.S.'78, Ph.D.'82 CE)*, president and CEO of GeoSyntec Consultants in Atlanta, was recognized for accomplishments in geoengineering with geosynthetics, design of landfill waste-containment systems and leadership in geotechnical engineering practice.

ROBIN K. MCGUIRE *(M.S.'69 CE)*, president and principal of Risk Engineering Inc. in Boulder, Colorado, was recognized for advances in engineering applications of probabilistic risk assessment in earthquakes and other natural hazards.

TERESA H. MENG *(M.S.'84, Ph.D.'88 EECS)*, Reid Weaver Dennis Professor of Electrical Engineering at Stanford, was cited for pioneering the development of distributed wireless network technology.

SILVIO MICALI *(Ph.D.'83 CS)*, professor of electrical engineering and computer science at MIT, was recognized for contributions to modern cryptography through the development of zero-knowledge protocols and pseudo-randomness theory.

ROBERT E. NICKELL *(B.S.'63, M.S.'64, Ph.D.'67 CE)*, president of Applied Science & Technology in San Diego, was cited for contributions to the finite element method and power plant safety.

BURTON CORSEN *(B.S.'50 ME)* is happily retired in San Jose.

TOM HARAMIS *(B.S.'51 CE)* of Laguna Woods, California, is retired after 40 years in the engineering department at Lockheed.

ROBERT KENNERKNECHT *(B.S.'59 EE)* is now living in Amity, Oregon. He received his master's in electrical engineering from the University of Southern California in electronic and control system design and analysis and worked in missile system design and analysis. He retired from industry in 1992 and joined the faculty at Cal State Poly in Pomona, where we worked until 1997.

LEUNG KU STEPHEN LAU

(B.S.'53, M.S.'55, Ph.D.'59 CE) of Honolulu is the author of *Hydrology of the Hawaiian Islands,* the first book on the subject, published last year by University of Hawaii Press. In 1959 he joined the faculty of the University of Hawaii at Manoa, where he was director of the Water Resources Research Center from 1971–1990 and is now professor emeritus of civil engineering. Last year Lau and his wife, Virginia (Lew), took an Alaskan cruise with their entire family of 13, including daughter **MELINA** *(B.A.'89, M.Arch.'92 Architecture)* and son-in-law **SHANE DOONG** *(B.S.'90 CE)*. Lau was a visiting professor at UC Berkeley in the 1960s.

JAMES LEPPER *(B.S.'59 EE)* writes from his new home of Ñuñoa, Chile, "I would like to contact any students and engineers from Chile and assist with or mentor their projects here. I have more than 20 technology patents to introduce in my new home. My objectives are to establish many connections with these people and create a pueblo government and an economy that uses earth recycling, not mining, to make a living." **jim_lepper@msn.com**

JOHN MUNRO *(B.S.'51 ME)* is currently retired and living in Walnut Creek.

CHARLES SCHEFFEY *(M.S.'51 CE)* of Arlington, Virginia, writes, "My first wife, Ella, passed away in 2004. I remarried on December 10, 2005, to Marguerite (Shay) Scheffey. We met and still live in Sunrise Independent Living."

VIRENDER KUMAR SONDHI *(M.S.'58 CE)* of San Ramon retired in January 2002 from the Federal Energy Regulatory Commission's San Francisco Regional Office, where his last position was deputy regional engineer. He writes, "I first came to UC Berkeley in February 1957 on a recommendation from Roy W. Carlson, whom I had met in India in October 1956, working on the 742-foot-high concrete gravity-arch Bhakra Dam in Punjab."

JAMES WARD *(B.S.'56 EE)* writes, "I moved to Grass Valley in 2006 to be near my son and met classmate **BILL BRIDGES** *(B.S.'56, M.S.'57, Ph.D.'62 EE)* quite by accident."

1940s

JOHN ALRICH *(B.S.'48 EE)* of Santa Barbara retired in 1987 from Xerox, El Segundo, where he worked in the Printer Systems Division.

ANDREW ARIEY *(B.S.'44 EE)* of Lafayette last year attended his 66th high school class reunion. He served briefly as a U.S. Navy lieutenant in carrier-based electronics on a torpedo bomber fleet before beginning a 40-year career at PG&E, where he became construction leader for a dozen large post-war steam power plants. He writes, "On retirement as chief mechanical and nuclear engineer, I look back on a very satisfying career leading a large crew of designers, engineers, draftsmen, clerks and secretaries creating from paper drawings those plants that are now our great system of electricity supply."

CHARLES CARROLL *(B.S.'45 ME)* applied for one job with General Electric when he got out of the U.S. Navy. He ended up working there for 38 years in various cities, including San Jose and Zurich, Switzerland. He retired in 1984 and is now living in San Jose.

BILL CHAMBERLIN *(B.S.'43 ME)* of San Jose writes, "One doesn't often take the train these days, but my wife Kay and I had a memorable journey to Grand Junction, Colorado, through the Feather River and Rio Grande Canyons. Spectacular scenery, and no need to glue your eyes to the white line!"

JOHN GOERL *(B.S.'48 IE)* of Alamo, California, retired from active construction and development work and is currently keeping active with veterans groups, service clubs and property management.

MYRON JACOBS *(B.S.'44 EE)* of Sacramento is retired after 41 years of working at Caltrans, building bridges in northern California.

JOHN KOSHEAR JR. *(B.S.'42 ME)* of San Diego spent four years in active duty with the U.S. Navy as a carrier aircraft maintenance officer. He later worked with Peerless Pumps, North American Aviation Space Technology Labs, Litton and Hughes Aircraft Co.

IRVAN MENDENHALL *(B.S.'41 CE)* of Los Angeles attended the 2006 meeting of past presidents of the American Society of Civil Engineers in Washington, D.C., last spring. He splits his time between southern California and Naples, Florida.

JAMES NEIGHBOURS *(B.S.'40 ME)* is caring for his wife, who has late-stage Alzheimer's. He writes, "We are living in a lovely life care community near our daughter in West Caldwell, New Jersey."

1930s

EUGENE SERR *(B.S.'47 CE)* of Red Bluff, California, is a regional vice president at the Conference of California Historical Societies. He writes, "In retirement I have become a local historian, using my engineering background to write about the former lumber flumes, logging railroads and other old roads in the area."

RICHARD WARD *(B.S.'49 CE)* retired as public works director of San Leandro. He now lives with his wife Jewell in Walnut Creek's Rossmoor Community and enjoys spending time at the engineers' club. **rhajward@comcast.net**

JOHN LORD *(B.S.'36 Mining and Metallurgy)* of Toms River, New Jersey, had a 40-year career that included two stints as a gold mining engineer in Colombia, South America, five years as a lieutenant in the U.S. Navy during World War II and nearly 30 years as a mining engineer for ASARCO in Placer, New York. After retiring in 1977, he worked as a consulting mining and civil engineer in New Jersey.

PAUL SHERIDAN *(B.S.'30 CE)* of Sacramento writes, "I am still directing a duplicate bridge game for seniors, bowling (had a 190 game recently, not bad for a 97-year-old), playing bridge and keeping busy with church activities."

When saving energy means safer lives

PHOTO COURTESY CHRISTINA GALITSKY

Researcher Christina Galitsky (M.S.'99 ChemE) worked with refugee families in Darfur to adapt the high-efficiency sheet-metal stove shown here to their cooking needs, just one of the projects she is involved in worldwide to help improve energy efficiency.

In Otash Camp outside Nyala, where some of Darfur's 2.2 million refugees live in makeshift tents, Christina Galitsky (M.S.'99 ChemE) spent November 2005 in an extended reciprocal cooking class. While local women taught her basic Sudanese recipes, she demonstrated how a high-efficiency wood-burning stove could cut their firewood consumption and, at the same time, safeguard their lives.

Galitsky is a researcher with the International Energy Group at Lawrence Berkeley National Lab (LBNL). Her work diagnosing and remedying energy-inefficient practices takes her from the Napa Valley, where she is refining computer software for California's wineries, to Bangladesh, where she is testing a cheap method for filtering arsenic from drinking water. *Technology Review* magazine named Galitsky its 2006 Humanitarian of the Year and one of the year's top 35 young innovators.

"I was surprised," she says about the honor. "We work in teams here, so I didn't feel I should be singled out." The Darfur project, initiated by fellow LBNL researcher Ashok Gadgil and implemented with aid organization CHF International, was designed to find cooking alternatives for Darfur refugees. The women, who use traditional three-stone fires for cooking, must scavenge wood from neighboring areas, which have already been stripped nearly bare of wood. The farther they wander from camp seeking firewood, the greater their risk of being attacked and raped by marauding Janjaweed militia.

Closer to home, Galitsky is occupied with another project, the Benchmarking and Energy and Water Savings Tool (BEST), developed in collaboration with Fetzer Wineries. The program measures a given winery's energy efficiency against a comparable hypothetical winery and suggests up to 100 energy- and water-saving technologies and cost-benefit analyses for each one. The tool, Galitsky says, has potential for application across entire industries and entire nations.

Whether her research takes her into an industrial setting or overseas, Galitsky's first step is exhaustive fact finding. For the BEST project, her team had to investigate every step of the winemaking process—from the number of grapes crushed to refrigeration tank sizes—and survey wineries worldwide for the most energy-efficient methods. In Darfur, she painstakingly interviewed families about what and how they cook so that a stove originally designed for use in India could be customized for conditions in the Sudan camps. Since Sudanese cooking pots are round, a rack originally designed for flat pots had to be reshaped; because of the gusty winds that blow through the Sudan, a windscreen had to be added to protect the flames; and since Sudanese women vigorously stir their pots when making *assida*, the flour-water paste that is one of the main staples of their diet, stabilizing stakes had to be added to keep the pots from tipping over.

"Many aid projects fail because no one researched the conditions to tailor the technology specifically for the people who will use it," Galitsky says. The new stove is now in testing; plans include establishing local manufacture and micro-financing in Darfur, then deployment to about 2,000 families. The decreased fuel demand could save each household $160 per year and cut firewood foraging trips in half.

While designing stoves was something she never anticipated doing, Galitsky finds satisfaction helping to conserve our limited store of natural resources. "Anything I can do anywhere on the planet to save energy is a help," she says. For more, go to **www.technologyreview.com/TR35/Profile.aspx?TRID=469.**

TODD BROOKS *(M.S.'88 ChemE)*

died on February 15, 2007. He parlayed his early jobs in the semiconductor field into a career as a venture capitalist with such firms as Mayfield Fund and JAFCO America Ventures and more recently attempted to raise his own fund. Brooks served on many boards, including components company Inphi and Berkeley's Haas School of Business.

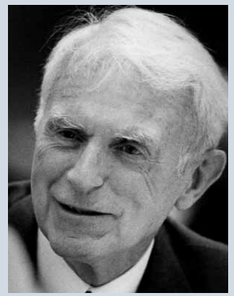
CHARLES CARNIGLIA *(B.S.'66 Eng. Math)*

of Santa Rosa died on December 21, 2006, after an extended illness. His achievements ranged from awards for excellence in teaching, to theoretical studies of the Goos-Haenchen effect, to key contributions in practical coatings for many U.S. projects such as the Department of Energy's NOVA Laser. His teaching career included faculty positions at the University of Maine-Orono, Sonoma State University and the University of Rochester Contemporary Optics summer program. He was the founder in 1987 of Thin Film Designer Software, a company that marketed a thin-film optimization and analysis program still in use today.

LLOYD FOWLER *(B.S.'49, M.S.'53 CE)*

of Scotts Valley, California, died last September at age 81 of complications from pneumonia. As chief engineer for Santa Clara Valley Water District, Fowler contributed to a period of tremendous change in water resources management and flood control. He worked on eight dam and reservoir projects and managed construction of Santa Clara Valley's first water treatment plant. He also oversaw a state water project that replenished water supplies and repaired levees, wells, storm and sewer drainage systems, roads and railroads, all damaged during a 55-year period of overpumping of groundwater.

BEN GERWICK JR. *(B.S.'40 CE)* of Oakland, Berkeley professor emeritus and a civil engineer

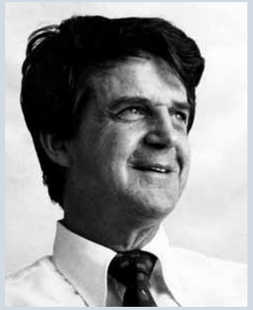


known for developing deep foundation construction, died in December of complications from a lung infection. He was 87. Best known for developing innovative methods of construction in extreme environments, his concrete foundation work included offshore oil platforms, high-rise buildings and long suspension bridges, notably the San Francisco–Oakland Bay Bridge and the San Mateo–Hayward Bridge. He started his 60-year career working at his father's marine and construction company in San Francisco and served on the Berkeley faculty from 1971 to 1989. Among his many awards were the Berkeley Citation (1989) and the College's Distinguished Engineering Alumni Award (1990). He also served in the U.S. Navy from 1940 to 1946, finishing his military duty as commander of the USS Scania. For more detail, go to **www.berkeley.edu/news/media/releases/2007/01/09_gerwick.shtml.**

FAYE (ZHANG) MARRON *(M.S.'90 EECS)* of Durham, North Carolina, died last November of lung cancer. A native of Beijing, Marron came to California to study at UCLA in the 1970s, then moved to Berkeley in the 1980s to continue with her graduate studies. A mother of two and an avid ballroom dancer, she continued dancing even after her cancer diagnosis.

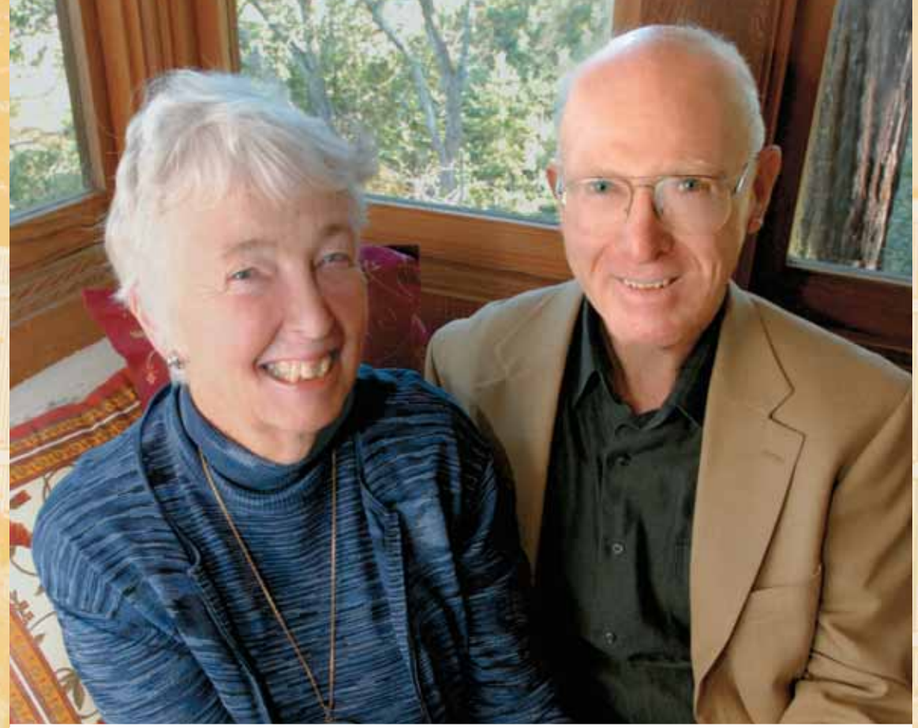
LES MILLER *(B.S.'68, M.S.'69 EE)* of San Jose died at age 59 of Parkinson's disease last March. During his 40-year electrical engineering career, he worked for several firms, primarily Spectra-Physics Inc. of Mountain View. He patented six devices, including a dual-piston pump and an apparatus for degassing a liquid. Before transferring to UC Berkeley, Miller got his engineering start at Sierra College in 1964. He bequeathed his estate of $1 million to the Sierra College Foundation, which will use the funds to support a new technology building on the Rocklin campus.

NORMAN MURDOCH *(B.S.'46 CE, M.S.'51 City and Regional Planning)* of Los Angeles died last



October at age 80 from myelodysplasia, a rare form of chronic anemia. He worked for the San Francisco Redevelopment Agency and the cities of Berkeley and St. Louis before relocating to Los Angeles, where he was director of the Los Angeles County Regional Planning Commission from 1974 to 1988. In his effort to create a more inclusive plan that balanced the interests of private developers with environmental and public interests, he conducted public polls and citizen review meetings. He was a founding member of the nonprofit Economic Development Corporation in 1981.

ERLANDO SAN MIGUEL JR. *(B.S.'04 EECS)* of Huntington Beach died last September. He earned his master's degree from UCLA in 2005.



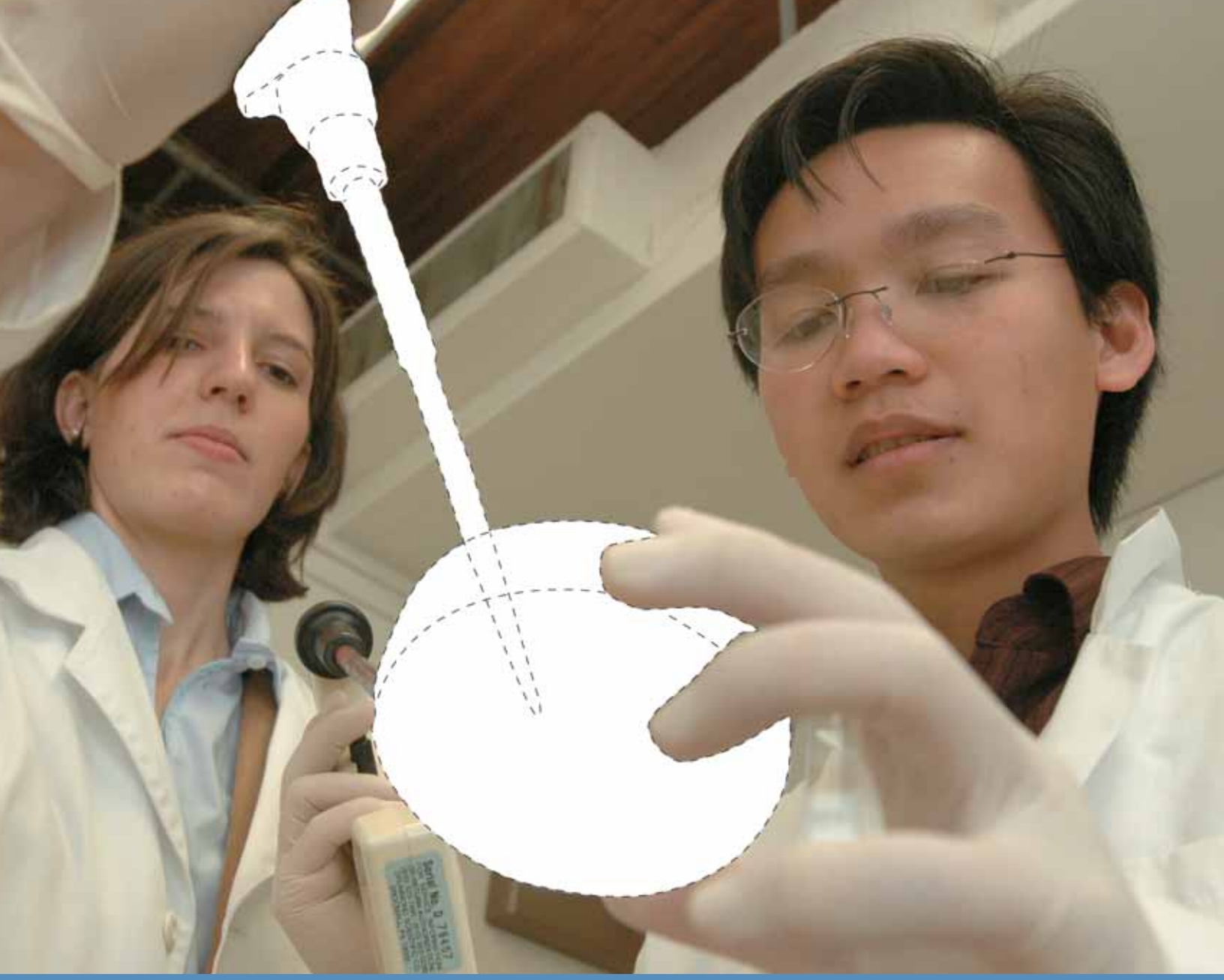
PEG SKORPINSKI PHOTO

Candy Penther and Howard Friesen met at UC Berkeley in 1948 and married three years later. Devoted to helping Cal students, the Friesens have funded more than 125 scholarships. They're thinking ahead, too; their estate plans include provisions for endowed faculty chairs. Thanks to smart financial planning and expert advice from Cal's gift planning specialists, they have already started funding one chair, the Howard Friesen Chair in Engineering, recently awarded to Professor David Culler, an eminent computer scientist.

"We recognize that the excellence of Berkeley's faculty needs to be supported. We're glad to know we can count on the University to carry out our intentions."

—Howard (EE B.S. '50) and Candy (Humanities B.A. '50) Friesen

To learn how you can make Berkeley Engineering part of your estate planning, contact Karen Rhodes in College Relations at 510.643.8064 or go to **www.coe.berkeley.edu/giving/planned_giving.html.**



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