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Berkeley and Braving the New Flat World

Citizens, businesses and governments all over the world have to work harder than ever before to build upon and extend their regional lead as the most important cradle of discovery and innovation in the world by assembling a critical mass of talent right here in the Bay Area. Ultimately, I believe we at Berkeley must simply double-down on our efforts to identify and bring the best and brightest here to Berkeley, as undergraduates, graduates, postdocs, visiting scholars and faculty, in a strategy I call “intellectual insourcing.”

We must work harder than we ever have before to build upon and extend our regional lead as the most important cradle of discovery and innovation in the world by assembling a critical mass of talent right here in the Bay Area. Ultimately, I believe such a strategy is the most important way Berkeley Engineering can help create a sizeable “bump”—ideally a mountain—on this new flat world.

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

— A. RICHARD NEWTON
Dean, College of Engineering
Ray W. Carlson Professor of Engineering

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In memoriam
Four CEE undergraduates got more than they bargained for when they signed up for a class in civil engineered systems last spring. Their experience ushered them into a much larger realm involving architecture, economics and public policy, not to mention Art Deco styling and the psychology of suicide.

For their team project in Professor Robert Bea’s CEE 180 class, the students developed three conceptual design alternatives for a suicide barrier for San Francisco’s Golden Gate Bridge. Their concepts earned them first place in the class competition and got their paper accepted for publication in a major professional journal. Team member Doug Wahl (B.S. ’05 CEE), who graduated last December, says the experience transformed his career goals.

“I’m more interested in risk assessment now and think about projects in terms of whole systems,” Wahl says. “It’s so important to not just do calculations but engineer within political, economic, social and cultural systems.”

The Golden Gate Bridge Highway and Transportation District voted last year to proceed with a two-year, $2 million study of a suicide barrier using non-district funds, with $1.6 million already committed by the Metropolitan Transportation Commission. Supporters, including the City and County of San Francisco, Marin County and the Psychiatric Foundation of Northern California, have already committed funds toward the remaining $400,000, which must come from local sources. At press time, private fund-raising efforts were ongoing to raise a remaining balance of $256,400.

Although their models are not under formal consideration for the barrier, the students used the district’s stringent criteria for aesthetics, cost, security and emergency response in developing their designs. Most important, the barrier would have to effectively prevent a person from jumping but not add undue stress, weight or maintenance requirements to the 4,200-foot-long span.

The district has considered a barrier eight times since the 1950s in an effort to prevent some of the 1,300 fatalities, about 20 per year, that have occurred since the bridge opened in 1937. Opponents say that a barrier would be unsightly and prohibitively expensive (between $15 million and $25 million) and that public funds would be better spent on mental health programs. But psychiatrists as well as individuals who have survived suicide attempts believe that a simple barrier can deter jumpers. In fact, similar structures have effectively put a stop to suicide jumps off the Eiffel Tower and the Empire State Building.

Other members of the student team include Danielle Hutchings (B.S. ’05 CEE), Ryan Stauffer (B.S. ’05 CEE), and CEE exchange student Robert Simpson of Durham University in Scotland. Their paper, “Aesthetics, Death, and Landmark Structures,” will be published in an upcoming issue of the American Society of Civil Engineers’ Journal of Architectural Engineering.
Bringing a comet down to Earth

The prized cargo weighs less than a grain of salt and would fill no more than a thimble. But the cosmic dust captured by Stardust—NASA's first mission dedicated to cometary exploration—could shed light on the formation of our solar system, the origins of the Earth and its oceans, even the emergence of life.

For more details on CITRIS, go to www.citris-uc.org.

EECS professor reflects on his “FUZZY LOGIC” LEGACY

The Soda Hall office of EECS professor Lotfi Zadeh has so many books and papers stacked floor to ceiling that only a small footpath remains. The documents represent a lifetime of work that began before the age of computers and continues to define new theories about them today.

At the center of it all is fuzzy logic, a theory that challenges classical logic’s belief in absolute true or false. Although initially met with disdain, fuzzy logic is widely accepted today, with applications for everything from consumer products, industrial systems and operations research to medicine, geology and physics.

Zadeh and his pioneering theory were the center of attention last November when the EECS department dedicated its 2005 BISC (Berkeley Initiative in Soft Computing) conference to fuzzy logic’s 40th anniversary.

A native of Soviet Azerbaijan, Zadeh studied electrical engineering, took advanced degrees at MIT and Columbia and, prior to publishing his first paper on fuzzy sets in 1965, had already made seminal contributions to systems analysis and information systems.

“I’ve always been an admirer of mathematics, but I began to see a gap between the precision of math and the imprecision of the real world,” Zadeh said. “In fuzzy logic, everything is—or is allowed to be—a matter of degree,” he explains. “This is the way human thinking is organized. In the real world, almost nothing is black and white.” He wanted computers, too, to run on gradations rather than on binary absolutes.

Zadeh came to Berkeley in 1959, recruited from a full professorship at Columbia. He was chair of electrical engineering from 1963 to 1968, at which time a pivotal moment in the department’s history. When, in 1965, the director of the campus computer science center made a power grab for some electrical engineering faculty, Zadeh went to war. He initiated the department’s name change to EECS, not only preserving electrical engineering but also elevating the role of computer science. It set a trend that universities worldwide would soon follow.

“In general, you gain strength when you unite and lose strength when you disunite,” Zadeh said. “The Soviet Union and Europe are good examples of that.”

Now 84, Zadeh is also Professor in the Graduate School and BISC director. He spends much of his time lecturing and coming up with new theories, like his fuzzy logic–based approach to computation with information described in natural language. Among many honors, he was last November’s proceedings honoring him and his pioneering theory. The three-day conference included an exhaustive scientific program presented by the international elite of fuzzy logic and a full calendar of sold-out social events.

BERKELEY GETS THE KEYS TO HYDROGEN-FUELED CAR

Berkeley transportation researchers are test driving a new hydrogen fuel cell vehicle (FCV) on two-year loan from DaimlerChrysler Corporation, part of its Fuel Cell Project for the U.S. Department of Energy (DOE).

The car is in the commercial fleet of California Partners for Advanced Transit and Highways (PATH)—a research center of Berkeley’s Institute of Transportation Studies (ITS)—where researchers will drive the vehicle and assess its real-world performance.

The emerging technology provides an environmentally friendly alternative to conventional cars. In place of a battery, the FCV engine creates its own electricity using hydrogen as fuel and oxygen from the atmosphere. The byproduct is water, making FCV exhaust much cleaner than gasoline or diesel engines. But the vehicles take up to 10 minutes to refuel and have a limited driving range. With only 16 hydrogen fueling stations in the state, the technology also lacks a cost-efficient infrastructure.

Gov. Arnold Schwarzenegger in 2004 created a public and private partnership to support development of FCVs, including a plan to create 30 to 100 new hydrogen fueling stations in California by 2010. The DOE has several teams working on the Fuel Cell CP, with the goal of helping U.S. car manufacturers decide by 2015 whether FCVs are commercially viable.

Wright named chief scientist at Berkeley CITRIS

MI professor Paul Wright was appointed new chief scientist at Berkeley’s Center for Information Technology Research in the Interest of Society (CITRIS) on January 1. He succeeds EECS professor James Demmel.

The A. Martin Berlin Professor in Mechanical Engineering, Wright is codirector of the Berkeley Manufacturing Institute and the Berkeley Wireless Research Center. An expert on high-tech product design and rapid manufacturing, he joined the Berkeley faculty in 1991.

“There is a bubbling sense of excitement within CITRIS about the new headquarters at Berkeley and its ability to bring together multidisciplinary teams to impact vitally important issues,” Wright says.

Scheduled for completion in 2008, the building will provide a centralized focus for CITRIS research now ongoing in multiple locations by 100 Berkeley faculty in engineering, science, social science, law, information management, health care and other disciplines. Four UC campuses and more than 60 supporting companies are also involved.

For more details on CITRIS, go to www.citris-uc.org.

Stardust captures particles of the solar system

The Stardust spacecraft, sponsored by NASA, returned to Earth on January 15, 2004, laden with a specially formulated silicon medium called aerogel, to capture particles that could be as old as 4.5 billion years. The mission of the aerogel wedge cut from the sample collector (seen arrow) is to shave a mote of cometary dust at the end of its trail (see arrow). The dust speck is about 10 micrometers, one tenth the diameter of a human hair. The dust particles from beyond our solar system, more difficult to visualize than the cometary particles because they are fewer in number and smaller in size, NASA created a website (http://stardustathome.ssl.berkeley.edu) for volunteers to help analyze 1.5 million images of particle tracks. Weeks before the images were uploaded, some 100,000 people had already signed up to participate.

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Daily bidding for top billing on the Internet

Every day, the hammer goes down on millions of online auctions. And we’re not just talking about eBay. Search engines like Google and Yahoo! have created an advertising revolution and become billion-dollar businesses by auctioning off popular keywords to businesses that want their ad to rise to the top of the page. Berkeley EECS professor Umesh Vazirani and colleagues (one of whom is his brother and Georgia Tech computer science professor Vijay [Ph.D.’84 CS]) have developed a novel computer algorithm that could further refine the advertising auction model, making the process more competitive, optimizing income for the search engines, even allowing small businesses to get in on the action.

If you search the word refinement on Google, for example, you’ll see a list of mortgage brokers on the right side of the page. The top spot usually goes to those willing to pay the most each time someone clicks their ad. The clickthrough rate—how often an ad is clicked when linked to a specific keyword—is also factored into ranking the ads. Each day, advertisers specify their budget allotment for the automated auctions; once that budget is drained, the ad drops off the page.

Under the current system, an advertiser with a small budget who bids on an expensive keyword could run out of money early in the day, dropping out of the auction and reducing competition for that keyword. Indeed, a savvy opponent with a large budget could purposefully bid high early in the day, raising the price of the keyword and forcing the low-budget advertiser to make an early exit.

Such antics are not good for Google’s bottom line, however, because Google earns more when there are many advertisers competing for slots. The researchers’ new mechanism addresses this problem by lowering the ranking of advertisers who are short on cash, forcing them to spend more slowly and stay in the auction a little longer. “Our mechanism is more resilient than traditional methods for addressing this kind of gaming,” Vazirani says.

The researchers devised new mathematical tools that determine the optimal tradeoff between bid and daily budget for determining the ranking of advertisers. They have filed for a patent but hope the research will remain in the public domain for others to build upon.

For more on the story, go to the College’s online research digest, Lab Notes, at www.eee.berkeley.edu/labnotes/0505/vazirani.html.

Reliving San Francisco’s 1906 earthquake and fire

One hundred years ago April 18th, the 7.9 earthquake centered off the coast of San Francisco left all the way from Los Angeles to Oregon and Nevada. Only one minute long, it killed 3,000 people and ignited fires that burned for three days, forever changing the face of the Bay Area.

UC Berkeley and hundreds of organizations throughout northern California are marking the centennial of San Francisco’s great 1906 earthquake and fire—still ranked one of the greatest natural disasters in U.S. history— with conferences, memorials, exhibits, tours and other events. With preparedness as a major theme, the Governor’s Office of Emergency Services, the Earthquake Engineering Research Institute and the Seismological Society of America sponsored a five-day professional conference at Moscone Center April 18-22. The California Academy of Sciences held an exhibit entitled “Don’t Be Fooled, Be Prepared,” and the Neighborhood Emergency Response Team of San Francisco held a citywide drill.

College activities included a CEE-sponsored demonstration, “Bracing for the Next Earthquake,” at Cal Day on April 22. IEOR professor Ken Goldberg’s “Ballet Mori,” performed April 4 at the Opera House, featured ballerina Muril Maffe improving to music inspired by the Earth’s movements as transmitted in real time from UC Berkeley’s Strawberry Canyon seismograph on the Hayward Fault. Don’t miss Bancroft Library’s digital exhibit, five years in the making and live throughout the year, which showcases images, artifacts and audio clips from the quake, including a searchable gallery of images by neighborhood. Go to http://bancroft.berkeley.edu/collections/earthquakeandfire.

ME Chair Pisano serves up serious fun with his passion for gadgets

You may already know that Rube Goldberg (B.S.1904 Metallurgy)—the engineer, cartoonist and 1948 Pulitzer Prize winner who drew elaborate machines designed to sharpen pencils or perform other simple tasks—was a graduate of the College of Engineering. But did you know that the inventor of the computer mouse was also a Berkeley alum? In 1968 Douglas Engelbart (M.S.S.E., Ph.D.EE) developed the prototype for the indispensable device handled every day by hundreds of millions of computer users worldwide.

ME professor and chair Al Pisano revealed these and other entertaining tidbits from Berkeley Engineering lore in his Homecoming talk, “The Future of Gadgets,” about the history of apparatuses from vacuum cleaners to Swiss army knives to micro-electromechanical systems, or MEMS. He enumerated some of the College’s most famous inventions, including prestressed concrete; Berkeley UNIX, electronic design automation and the cutting-edge wireless sensors known as “smart dust” that detect motion and other ambient conditions.

Proceeding through his presentation, Pisano flashed an image of the first integrated micro-fabricated crash sensor, a tiny chip now manufactured in the billions and used to power motor vehicle airbag systems worldwide. These chips are exemplary of the diminutive gadgets of the future, he said, pointing to the screen.

“That chip right there has a job. Its job is to determine, from the way your car shakes and decel-erates, whether you have hit a pothole or had an accident, and to launch an airbag to save your life.”

Since Isaac Singer’s first portable sewing machine was patented in 1853, gadgets have gotten smaller and more sophisticated. The fun micromachines and nanoscale devices of the future will measure about 50 micrometers, Pisano said, close to the width of a single hair on his Southern Italian head. So small that ants could smile down at them (and he had a slide to prove it).

But these little machines have big responsibilities, Pisano added.

“The future is going to be determined by looking at the world from the very small and stretching all the way up to the societal scale,” he explained, “depending on whether we’re talking about those little micromotors, putting those sensors together in networks or assembling all that data together to see global trends. That, I think, is a big technological success.”

Go to www.eee.berkeley.edu/multimedia/index.html to see a video of Pisano’s talk.

EECS professors Franklin, Vazirani named ACM fellows

The Association for Computing Machinery (ACM) named Berkeley EECS professors Michael Franklin and Umesh Vazirani to its fellows program, established in 1991 to dis-tinguish the computing industry’s leaders among the association’s 80,000 members.

Franklin, who joined the faculty in 1999, was recognized for his contributions to dis-tributed information management. Vazirani (Ph.D.’84 CS) was named for his work in theoretical computer science and quantum computation. He joined the faculty in 1987.

The two are among 34 fellows recognized in 2005, bringing to 552 the total number named since the program’s inception. ACM fellows represent the world’s leading industries, research labs and universities for their contrib-utions to both the practical and theoretical aspects of computing, says the association. They will be formally inducted on May 20, 2006, in San Francisco.

“These individuals demonstrate the aston-ishing potential for innovation in the comput-ing discipline and the broad-based, profound and enduring impacts of their achievements for the way we live and work in the 21st cen-tury,” said ACM president David Patterson, the E.H. and M.E. Parker Chair of Computer Science in Berkeley’s EECS Department.

The world’s first computing society, the ACM was founded in 1947 to advance the skills of information technology professionals and students worldwide.
New CEE Professor goes with the atmospheric flow

CEE professor Tina Chow (below left) created simulations of flow in the atmospheric boundary layer of Switzerland’s River Valley (top). Color contours show simulated wind speed along the valley axis in meters per second (bottom). Red areas indicate flow moving up the valley away from the observer, and blue indicates flow moving down.

As anyone who has lived in the Bay Area knows, techniques used to forecast the weather are less than perfect. But researchers like Berkeley CEE professor Tina Chow are working to fill the gaps.

Chow joined the Berkeley faculty last July, following a year of postdoctoral research in the atmospheric science division at Lawrence Livermore National Laboratory. Her research in environmental fluid mechanics uses the same kind of forecasting models the weather channel uses. These are computer simulations that predict meteorological properties like atmospheric pressure, temperature and wind speed. Chow’s goal is to reach a deeper understanding of, and better prediction methods for, atmospheric flow over both natural and manmade terrain.

“I work on improving the algorithms that go into those models so that the forecasts can be more accurate,” says Chow, who has a bachelor’s from Harvard and M.S. and Ph.D. degrees from Stanford in environmental fluid mechanics and hydrology.

Chow’s focus is the atmospheric boundary layer, the region extending about a mile above the ground that most affects life on Earth.

She has studied a range of environments, from California’s Owens Valley in the Sierra Nevada to the Rivera Valley in the Swiss Alps, as well as urban settings like Oklahoma City. Faster computers are yielding higher-resolution forecasts, Chow says, but this sometimes makes it more difficult to predict the detailed air flow because the resolution reveals variations in the terrain, whether mountains or skyscrapers, that affect the movement of air over the Earth’s surface.

“Solutions for the equations that govern fluid dynamics are developed in idealized worlds,” she says. “But when you do environmental flow, you have rough terrain. Buildings, trees, fields and roads have to be accounted for.”

The research has the potential to yield new information about what causes bad air days in basins and valleys, for example, or to improve the accuracy of weather forecasts in complex urban areas, especially in cities with microclimates like San Francisco. It could provide valuable insight about how materials are transported in the atmosphere, like plumes of environmental contaminants, and help predict the effects of emissions from vehicle traffic.

“[W]e’d like to be able to predict in real time the dispersion of contaminants, either accidental or intentional releases, so that the effects might be controlled,” Chow says. “If we can get the flow model correct, the list of applications beyond weather forecasting becomes huge.”

Go to www.ce.berkeley.edu/~chow for more information on Chow and her research.

Air quality expert Sawyer appointed to top state slot

Gov. Arnold Schwarzenegger has appointed ME professor Robert Sawyer to chair the California Air Resources Board (CARB), a powerful statewide agency with a staff of more than 1,000 that regulates air pollution from industry, motor vehicles, consumer products and other sources.

The board’s mission is to promote California’s public health and ecological resources by reducing air pollutants while still taking economic effects into consideration. Recent actions include a ruling, now being legally challenged by the auto industry, that requires automakers to reduce tailpipe emissions of greenhouse gases almost 30 percent by 2016. Sawyer is the Class of 1935 Professor of Energy Emeritus at Berkeley, where he conducted extensive research and taught classes in such areas as air pollution, energy conversion, combustion and fire safety since 1966. He chaired Berkeley’s Energy and Resources Group, an interdisciplinary academic unit that conducts graduate teaching and research in environmental issues. He is also visiting professor of energy and environment at University College London, partner of an air pollution consulting company and former advisor to the World Bank on Mexico City air pollution.

Sawyer, a Democrat from Oakland, previously served on the 11-member CARB board in 1973–76.

Paul Gray to return to EECS faculty

Paul Gray steps down as Berkeley’s executive vice chancellor and provost on June 30 to return to the College, where he holds the Andrew S. Grove Chair in Electrical Engineering. He will be succeeded by political science professor and Russia scholar George Breslauer. Gray joined the EECS faculty in 1971 and has served as an administrator for 16 years, first as EECS chair (1990–93) and engineering dean (1996–2000), then becoming vice chancellor, the second highest administrative post on campus, in 2000. He answered a few questions for Forefront as he looked back on those 16 years.

Q. What first inspired you to become an engineer?
A. I loved tinkering with cars and model airplanes. In college, EE had a reputation of being hard and, being a competitive type, I decided to do that. I developed enthusiasm for electronics and integrated circuit design, so after graduate school the natural place to go was the Silicon Valley. Back in the ’60s, the total combined annual sales of the semiconductor industry was about $500 million yearly. Today it is approaching $300 billion worldwide and provides a steady stream of challenging research problems to work on.

Q. What do you like most about Berkeley?
A. The richness of the campus community is its strength. The alumni, faculty, staff, students and local community form a mosaic that is always stimulating and interesting.

Q. What accomplishment are you especially proud of?
A. These jobs are all about people. Most of the important things that happen here are done by faculty, faculty leaders, their staff and the students they work with. The most important task is to recruit, empower and support campus leaders and do everything possible to help them succeed.

Q. What are you most looking forward to about returning to the faculty?
A. I really miss working with graduate students and the satisfaction that comes when a student gets intuitive new insights. Often, through that process, the teacher gains new insights too.

Q. How have your skills as an engineer suited you for administration?
A. Engineers don’t have a monopoly on problem-solving, but the habit of taking big problems, breaking them into smaller problems, and solving each of those individually, often with teams working in parallel, was a help.

Q. Who has been your most important role model?
A. The most significant would be the late Don Pederson, who was a senior faculty colleague during my early years here. Don was a person of inspirational energy, integrity and intellect who had tremendous influence on me and many colleagues.
**BIO- AND ELECTRICAL ENGINEERS TAKE TOP PRIZES IN BUSINESS TECHNOLOGY CONTEST**

Two engineering teams outshone the competition at the second annual Technology Breakthrough Competition last November, held at the Berkeley Art Museum, to rise above a field of 41 entries seeking recognition and support in commercializing their products.

Both the grand prize and Science Breakthrough Award ($10,000) went to James Kirby, post-doctoral scholar with the Keck Graduate Group, and Eric Paradise, ChemE graduate student, whose work on the metabolic engineering of yeast could reduce by 90 percent the cost of manufacturing therapies for malaria, cancer and AIDS.

The top information technology prize ($5,000) went to EECS graduate students Josephine Chang, Brian Mattis and Steve Melisa, winners in the 2005 Technology Breakthrough Competition for their gas sensors project.

**KARL PISTER NAMED ALUMNUS OF THE YEAR**

Karl Pister (B.S.45, M.S./Ph.CE), dean emeritus of Berkeley Engineering and chancellor emeritus of UC Santa Cruz, was honored as California Alumni Association (CAA) Alumnus of the Year for 2005 at last month’s Charter Gala Event in San Francisco. The award, CAA’s highest honor, is given to a Berkeley alumnus who has achieved distinction through exceptional contributions to international, national, state or community welfare. “It is hard to find an individual whose life’s work better mirrors the very mission of our University,” said Chancellor Robert Birgeneau. Pister, who has held more than 20 academic and administrative positions at the University of California, has also received the Berkeley Medal and the College’s Distinguished Alumnus Award, as well as the University of California Presidential Medal.

Pister’s career and life are the subject of a 600-plus-page oral history published in 2003 by the Regional Oral History Office. The history chronicles Pister’s early years in Stockton, his civil engineering studies at Berkeley and the University of Illinois, his naval service and his 56-year academic career, and is rich in detail about his personal history. Pister is also featured in a recent issue of California, the bimonthly magazine of the California Alumni Association, available at www.alumni/ucalgm/200601/alumni.asp.

An engineer was last named CAA alumnus of the year in 1994, when the late T.Y. Lin (M.S.33 CE) took the honor.

**FROM A SIMPLE AUDIO RECORDING, BERKELEY RESEARCHERS WERE ABLE TO DECIPHER UP TO 96 PERCENT OF THE CHARACTERS ENTERED ON A COMPUTER KEYPAD**

Since each key makes a unique sound, says EECS professor Doug Tygar, this is a form of “acoustical spying” that could pose a computer security and privacy threat. See more at www.berkeley.edu/news/media/releases/2005/07/20-opto.html.

**A NEW CLASS OF SOLAR CELLS MADE OF INORGANIC NANORODS HAS BEEN DEVELOPED BY MSE graduate student Ilan Gur, who reported his research last October in Science. The cells combine the low cost of ultrathin organic materials with the absorption and durability of conventional inorganic photovoltaics, which could make solar cells cheaper and easier to produce in bulk. Go to www.berkeley.edu/labnotes/0106/gur.html.**

**AN “OPTOELECTRONIC TWEEZER” DEVELOPED BY EECS professor Ming Wu and colleagues can easily manipulate large numbers of single cells and particles on a microscopic slide. The device, reported last year in Nature, traps particles in optical traps aligned waveguides and individual microlens units on a spherical surface.** See more at www.lbl.gov/Science-Articles/Archive/sabl/2005/June/05-digital-heart.html.

**Seeing the human heartbeat in action**

New software developed at Berkeley enables computers to simulate blood flow through a human heart. The software, a JAVA programming language dialect known as Titanium, is the first step in creating 3-D digital models of an individual’s cardiovascular system and other internal organs. In developing the software, EECS professor Katherine Yeck and colleagues hope to solve problems in not only fluid mechanics but also elasticity to simulate blood flow dynamics around the flexible muscle fibers and irregular-shaped chambers of the heart. The biological models could be used to diagnose disease or observe the effects of simulated treatments on human organ systems. For more, go to www.berkeley.edu/news/media/releases/2005/s1_05_ims.shtml.

**Cars and buses just keep getting smarter**

Berkeley transportation researchers showed off their latest work at the Innovative Mobility Showcase case of Intelligent Transport Systems (ITS), held in conjunction with the 19th World Congress on ITS last November in San Francisco. Demonstrations included a transit bus outfitted with a collision warning system and a “smart” intersection equipped with radar, sensors and other tools that track approaching vehicles and activate warning signals when conditions are unsafe. For more, go to www.berkeley.edu/news/media/releases/2005/s1_05_ims.shtml.

**MINI-SEISMOMETERS**

Combining seismological technology with micro-electromechanical systems, CEE professor Steven Glaser has developed a device that could give engineers detailed information about the behavior of earth’s crust at specific faults. TerraScope®, a miniaturized vertical seismic array placed deep in the Earth near known fault lines, could be used to guide retrofits of existing buildings, trigger shutdowns of trains before a quake or compile predictive data from microquakes. The devices will be field tested this June at the Mascada World Heritage Site near Israel’s Dead Sea. Go to www.citris-uc.org/publications/newsletter/austral05/features.html.

**Mini-seismographs in the works**

Through an insect’s eye

Taking inspiration from nature, BioE professor Luke Lee is reconstructing biopolymer models of insect eyes to create advanced photonic systems. First, he and his team created artificial ommatidia, the conical structures that make up an insect’s compound eye. Then they constructed a 3-D compound eye with self-aligned waveguides and individual microlens units on a spherical surface. Lee’s research, published last fall in Science, has potential for applications in biomedical imaging, video technology, human vision aids, surveillance and remote navigation. Go to www.sciencemag.org/cgi/content/full/305/5693/1144.

**Karl Pister**

CET director Ilhakat Sidhu (far left) presents an award check to EECS graduate students (from left) Josephine Chang, Brian Mattis and Steve Melisa, winners in the 2005 Technology Breakthrough Competition for their gas sensors project.

**Cutting-edge research from Berkeley Engineering**

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Taking inspiration from nature, BioE professor Luke Lee is reconstructing biopolymer models of insect eyes to create advanced photonic systems. First, he and his team created artificial ommatidia, the conical structures that make up an insect’s compound eye. Then they constructed a 3-D compound eye with self-aligned waveguides and individual microlens units on a spherical surface. Lee’s research, published last fall in Science, has potential for applications in biomedical imaging, video technology, human vision aids, surveillance and remote navigation. Go to www.sciencemag.org/cgi/content/full/305/5693/1144.

**Seeing the human heartbeat in action**

New software developed at Berkeley enables computers to simulate blood flow through a human heart. The software, a JAVA programming language dialect known as Titanium, is the first step in creating 3-D digital models of an individual’s cardiovascular system and other internal organs. In developing the software, EECS professor Katherine Yeck and colleagues hope to solve problems in not only fluid mechanics but also elasticity to simulate blood flow dynamics around the flexible muscle fibers and irregular-shaped chambers of the heart. The biological models could be used to diagnose disease or observe the effects of simulated treatments on human organ systems. For more, go to www.berkeley.edu/news/media/releases/2005/s1_05_ims.shtml.

**Cars and buses just keep getting smarter**

Berkeley transportation researchers showed off their latest work at the Innovative Mobility Showcase case of Intelligent Transport Systems (ITS), held in conjunction with the 19th World Congress on ITS last November in San Francisco. Demonstrations included a transit bus outfitted with a collision warning system and a “smart” intersection equipped with radar, sensors and other tools that track approaching vehicles and activate warning signals when conditions are unsafe. For more, go to www.berkeley.edu/news/media/releases/2005/s1_05_ims.shtml.

**Mini-seismographs in the works**

Combining seismological technology with micro-electromechanical systems, CEE professor Steven Glaser has developed a device that could give engineers detailed information about the behavior of earth’s crust at specific faults. TerraScope®, a miniaturized vertical seismic array placed deep in the Earth near known fault lines, could be used to guide retrofits of existing buildings, trigger shutdowns of trains before a quake or compile predictive data from microquakes. The devices will be field tested this June at the Mascada World Heritage Site near Israel’s Dead Sea. Go to www.citris-uc.org/publications/newsletter/austral05/features.html.
Sharing the Sky

An Engineer’s Quiet Search for Extraterrestrial Intelligent Life

Not far from Mount Lassen in a field near the mountain hamlet of Hat Creek, California, an array of antenna dishes is pointed toward the starry night. The array—a radically new kind of radio telescope—and the scientists who mind it are waiting for a signal that will, literally, change the world.

BY DAVID PESCOVITZ
Whatever form that signal takes, it will mean one thing: We are not alone in the universe. The antenna array—only a portion of which is now online and ready to receive signals—will form a giant ear listening for intelligent beings up space, key to the extraordinary effort known worldwide as SETI, the Search for Extraterrestrial Intelligence.

One of the driving forces behind SETI, Berkeley Professor in the Graduate School William “Jack” Welch of electrical engineering and astronomy, can often be spotted flying high over the Cascade foothills in his Cessna 210, zipping between the campus and Hat Creek. For Welch, a key designer of the antenna array, it’s a matter of when, not if, that signal will be detected.

“We know there are hundreds of billions of stars in our own galaxy and a hundred billion other galaxies, each with hundreds of billions of stars,” says Welch. “With such staggering numbers and evidence that so many stars host planets that could be candidates for life, it’s inevitable that somewhere out there, there is intelligent life.”

Once an extraterrestrial transmission is detected, there’s an established, though informal, protocol for whom to inform, says Welch with a grin. It’s no longer the President of the United States or even the Secretary General of the United Nations who gets the first call. It is investor and philanthropist Paul G. Allen, co-founder of Microsoft. A major underwriter of the SETI project, he will be the first to know when the array named Allen Telescope Array, or ATA, has breaking news to report.

“I am very excited to be supporting one of the world’s most visionary efforts to seek basic answers to some of the fundamental questions about our universe,” says Allen. “The developments taking place with this new instrument will change the landscape of how telescopes will be built in the future.”

A joint effort between Berkeley and the SETI Institute in Mountain View, California, the ATA will be fully operational within the next few years, when funding has been secured to complete the 350-antenna array. With unprecedented sensitivity over a wide range of wavelengths centered in the centimeter radio band, it will take its place as one of the world’s most powerful telescopes, according to Welch, who has worked on this current SETI project since its inception in 1997.

When most people think of astronomy, they envision gazing at the stars through an optical telescope, a system of mirrors and lenses that collects light. The ATA, however, was designed for radio astronomy, a different branch of the science. Rather than gathering visible light, a radio telescope collects photons in the radio spectrum. The telescope then focuses those waves onto an electronic receiver, similar in many ways to an everyday transistor radio, but capable of tuning in much higher frequencies and detecting much fainter signals.

The ATA’s unique capabilities will allow it to span the equivalent of about four-and-a-half octaves, while most radio telescopes span less than half an octave, and optical telescopes span perhaps one or two. The ATA will survey billions of radio channels for narrowband signals, indicative of intelligent origin. These kinds of signals, less than one hertz wide, can be generated only by transmitters built for that specific purpose. According to the SETI Institute’s researchers, “If ET and friends are decent or at least competent engineers, they’l use narrowband signals as beacons to get our attention.” It’s like listening for a station as you twist your radio’s knob throughout all the static.

Until now, SETI has had to borrow time from other radio telescopes around the world, whenever those observatories could spare it from their own projects. Even so, some 800 stars identified as likely candidates for hosting Earth-like planets, and possibly life, have been scanned. Although observations begin in earnest this spring, once the ATA is fully built and operational, the tools will finally begin to be commensurate with the vastness of the task.

“At that time, it will vastly expand our capabilities, speeding up our search and exploration by a factor of at least 100,” says Welch.

The telescope will cover frequencies between 1,000 and 10,000 MHz in the centimeter radio band, a range five times greater than Project Phoenix, the SETI Institute’s previous search. Precisely situated and distributed across more than a hundred acres of dry, lava-strewn landscape in the Hat Creek Valley, the 350 combined dishes will have more collecting area and far greater flexibility than the much more expensive 100-meter class radio telescopes, situated in only a few sites around the world. The ability to monitor a huge range of wavelengths at once is key to the design, as it will enable astronomers to observe other cosmic phenomena simultaneously with the SETI search.

For example, Welch and his colleagues will use the array to make a cosmological map of the atomic hydrogen all around us. The visible universe may be composed of up to 90 percent hydrogen, the most abundant element known. Determining its spatial distribution in nearby galaxies could provide insight into the evolution of the cosmos and the mysteries of dark matter. “Looking out into space is looking back in time,” Welch says. “The information we tease out of the dark matter as we look out at other galaxies will tell us a lot about the beginning of the universe.”

The team will also seek out “transient sources,” radio emissions that “go bump in the night,” Welch says, and then vanish. Some transient sources such as supernovae and gamma ray bursts are well known, but Welch believes that other phenomena are waiting to be identified. The ATA will be the most sensitive instrument ever used to detect these transient events, one of which could be the signal the world has long been waiting to hear.

“With the ATA’s ability to view such a huge field, which is an extraordinary advance, I’ll be surprised if we don’t find some very interesting new transient sources,” he says.

Welch, who served as director at the Hat Creek Radio Observatory for two decades until 1996, and his Berkeley and SETI Institute colleagues first conceived of the APA in 1997. Allen contributed $11.5 million to design and develop technology, with an additional $1 million from former Microsoft chief technology officer Nathan Myhrvold. In the spring of 2004, pleased with the progress, Allen committed an additional $13.5 million, contingent on Berkeley and the SETI Institute raising $16 million on their own, an endeavor they are working on right now.

“Looking out into space is looking back in time.”

Each of the antennas in the array costs roughly $100,000. While that’s certainly not chump change, the ATA is an instrument that’s all about doing more with less. According to ATA project manager Dave DeBoer, every engineer on the team, consciously or not, kept a detailed mental tally of cost as they worked.

“We can make high-quality receivers, but the challenge was whether we could do it cheaply,” says DeBoer, who also teaches microwave engineering in the Department of Electrical Engineering and Computer Sciences. “It got down to the point of asking ourselves whether we really needed a particular connector or not. They may be just $15 each, but that adds up when you’re talking about 4,000 of them.”

The dishes themselves are fabricated by Andersen Manufacturing, an Idaho-based company best known these days for making trailer hitches. Years ago, the proprietor developed a novel method to cast backward satellite television dishes in a one-shot process that results in exceptionally smooth parabolic antennas. Now Andersen is SETI’s dish supplier.

To achieve the telescope’s wideband sensitivity, Welch and his colleagues devised a bit of ingenious antenna feed technology. In traditional pyramid-shaped log-periodic feeds, like those used in the ATA, the signal is picked up at the tip of the structure and runs down wires to the receiver.

“You can get antennas based on that principle at Radio Shack, but the design has always had a profoundly bad feature,” Welch says. “When the cable runs down the spine from the tip to the base of the long feed, much of the signal gets lost along the way.” The Berkeley researchers’ solution was to shooosh the receiver components inside the feed itself. The amplifier and cooling system are then attached just behind the tip of the feed terminals. Placing the cryocooler this close to the terminals reduces the destructive thermal noise present in every receiver. After all, DeBoer explains, electromagnetic waves carrying signals transmitted by an alien civilization may have been traveling in space for thousands of
Bob Sanders and the Scientific American, IEEE Spectrum, Wired, Science and College of Chemistry, and his work has been featured in an online publication of the College of Letters and ScienceMatters@Berkeley. He also writes Boing Boing.net for example, are neither diminished nor worn out. “They seem to be in a privileged position, ” she says. “They don’t work until they’re told to. They just sit around quietly, waiting to be called up. ”

“The regenerative properties of organs are tied to the behavior assigned to adult stem cells. Biologically to question how well it applied to organ and tissue repair jobs relatively well understood. It was the latter work that led her to question the old, straightforward entropy model of aging, specifically to understand that question, to scientists why do we get old and die? While philosophers and theologists have long pondered that question, to scientists “The idea that we’re the only form of life is just not tenable,” Welch says. “We know of more than 100 organic molecules that have already been detected in interstellar space. It’s just a matter of whether or not the deliberate signal will have taken so long to arrive that the senders might have already vanished. ”

When young muscle is injured, stem cells are mobilized to get to the site of the injury, to multiply, then to convert from fairly “primal” cells because of their ability to transform into a range of more specialized cells with dedicated functions. Embryonic stem cells, which are collected from immature embryonic tissue, can be made to differentiate in the lab into any type of human cell, from liver or heart cells to brain or skin cells. Stem cells are undifferentiated cells, sometimes described as “primal” cells because of their ability to transform into a range of more specialized cells with dedicated functions. Embryonic stem cells, which are collected from immature embryonic tissue, can be made to differentiate in the lab into any type of human cell, from liver or heart cells to brain or skin cells. Only in the last few years have new experimental methods enabled scientists to study the promising therapeutic possibilities of embryonic stem cells but, because harvesting them requires the destruction of several-day-old embryos, they are in the bull’s eye of a heated legal, political and ethical controversy. On the other hand, adult stem cells, which Conboy and scientists worldwide have long studied and used in their research, reside in adult organs and are not a subject of controversy. Adult stem cells can generate only a limited subset of cell types. Muscle stem cells are a key research focus for Conboy. They can generate new muscle tissue in a matter of days, but only in young organisms. They appear to lack this repair ability when they age. And in case he happens to forget, he only needs to close his eyes and listen. The drive motors on the dishes squeak at different frequencies when they’re activated. Occasionally, the software team playfully programs the motors to whir out different melodies. A particular favorite is the theme from the film Close Encounters of the Third Kind.

“Mostly, I’m too busy trying to get this thing to work to think about anything other than the engineering,” Delho says. “But there are those beautiful nights when I’m alone working on the telescope and I think about the broader implications of what we’re doing here.”

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“When we discovered that water is everywhere, I realized it meant life is probably everywhere too,” Welch says. “We know of more than 100 organic molecules that have already been detected in interstellar space. It’s just a matter of whether or not the deliberate signal will have taken so long to arrive that the senders might have already vanished. ”

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STEM CELLS, IF SWITCHED BACK TO THE “ON” POSITION IN OLDER BODIES, COULD CREATE NEW LIVER, HEART, BRAIN AND SKIN TISSUE.

don’t make on their own. But there’s more, she adds. It’s really cocktails, plural. You need to inhibit the age-specific molecules that accumulate in old organisms and prevent stem cells from working; and you also need a different composition of factors to first expand stem cells and then differentiate them to promote fusion with the already existing muscle tissue, which accomplishes the repair.

Conboy adds the new kinds of proteins when she wants the cells to stop dividing and begin turning into muscle tissue, says Mike Hoang, a bioengineering senior on Conboy’s team. The team goes on to measure the impact of those protein-infused environments on the muscle cell fate. Fluorescent red stain marks cells that are proliferating, green stain reveals the cells that are differentiating, and blue stain labels the DNA of all the cells. Hoang, the designated cell counter for the team, has manually counted some 30,000 cells this past year.

Studies in three-dimensional cellular environments in mice (in contrast to two-dimensional studies in a Petri dish, where stem cells grow on top of thin layers of gel substrates) are just now under way in Conboy’s lab. Her team has developed a model that will permit the injection of stem cells in a protective environment of protein factors to act as a time-release capsule of sorts. At the center of the capsule are the muscle stem cells, taken and cultured from the mouse into which they are being re-injected. They are bathed in a youthful growth factor cocktail, all suspended in an extracellular matrix, a kind of goopy stuff made out of adhesion molecules secreted by cells.

The inner section of the capsule gives way to an outer layer that contains the protein mixture, optimized to keep the stem cells from multiplying, to differentiate, and to fuse with damaged tissue. Both layers are biodegradable, and cells will migrate from the inner to the outer layer and, thus, will expand and then differentiate into new tissue. The little packets, more like droplets actually, are then injected into an old mouse, but the stem cells, responding to the youthful niche, will multiply, differentiate and repair as if they were youngster cells.

The mice trials should be completed this year. Then Conboy’s team will look at other mouse organs and tissues that they believe will respond to similar stem cell niche manipulations. “The same process could address many degenerative disorders,” Conboy says. “Although every tissue type and organ might have its own recipe and balance of biological regulators of stem cell activity, the same principles probably apply throughout the body, she says. Stem cells, if switched back to the “on” position in older bodies, could create new liver, heart, brain and skin tissue.

“Then people will still be different when they are 80 years old compared with when they were 20, but they will be much healthier at 80. If you can preserve your ability to repair your organs, and I think we can do it for every organ, you could be in a kind of aging plateau state until you are 120 years old or so,” Conboy speculates.

Before re-allocating your retirement benefits, though, remember that the ups and downs of some aspects of stem cell research are legion. In contrast to Conboy’s research with adult stem cells, the field of embryonic stem cells has been shaken by recent upsets, such as that surrounding the work of Hwang Woo Suk—a South Korean scientist who admitted to fabricating much of his research—and the efforts of some religious groups to halt certain kinds of stem cell research.

Consider, too, the legal and political roadblocks thrown before the new California Institute for Regenerative Medicine. The Institute, launched with money from the $3 billion stem cell referendum—California Proposition 71 passed by voters in November 2004—has been unable to fund any research to date because of lawsuits brought against it.

Although adult stem cell research like Conboy’s shouldn’t be affected by the controversy over embryonic stem cells, there has been a blend-over effect, Conboy says. Even her uncontroversial work has been surprisingly hard to fund.

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AMERICA’S RENAISSANCE IN NUCLEAR POWER

Next-generation nuclear reactors strive for radical simplicity

BY MARK WILLIAMS | PHOTOS BY BART NAGEL

In coming decades, the Earth’s reserve of fossil fuels will be declining just as billions of people in China and India arrive at the First World banquet table, adding new demands to a global energy infrastructure already stressed near its breaking point. All this, as climate change caused by hydrocarbon emissions becomes increasingly evident.

To date, just one energy technology—nuclear energy—has a proven record of coming within shouting distance of solving these problems. France already generates almost 80 percent of its electrical power from nuclear plants. Belgium nearly 60 percent, Sweden 45 percent. The United States generates 20 percent of its electricity from nuclear power plants.

We have more reactors than any other country, according to nuclear engineering professor Per Peterson, but we are a very large country, so the need is that much greater. “France closed its last coal mine in 2004. In the United States, 54 percent of our electricity still comes from coal,” says Peterson, an ardent and long-time advocate of nuclear energy.

After the debacle of Three Mile Island’s partial meltdown in 1979, nuclear utilities retrenched and focused solely on improving their ability to reliably run existing plants. During those fallow years, Peterson and a small group of Berkeley-trained engineers, all of whom are passionate environmentalists, played leading roles developing a third-generation reactor design, known as the Economic Simplified Boiling Water Reactor, or ESBWR. When Peterson joined the Berkeley faculty in 1990, U.S. nuclear plants operated at a 66 percent capacity factor. That number, since then significantly improved, now tops 90 percent.

It would seem that nuclear power’s time has come around again. The ESBWR has been recently chosen for three U.S. sites, while its AP1000 competitor, also designed with simplified safety systems, has been picked for five. While resurgent industry interest in nuclear energy has caught many by surprise, the roots were cultivated over the last 15 years.

“Many of the fundamental modeling and supporting experiments now being used in the licensing process for these new plants were done right here at Berkeley,” says Peterson. “This new generation of plants takes a completely different approach to safety function, incorporating passive safety systems and operating simply by gravity-driven processes. This involves opening just a few valves and eliminates the tangle of safety equipment that needs surveillance, maintenance and protection by security forces.”

Last year, when the ESBWR’s design—owned by General Electric—was selected for development at Grand Gulf in Mississippi, North Anna in Virginia, and River Bend in Louisiana, it was a validation of the work Peterson and his colleagues had accomplished. “It’s very exciting to see how many of the early ideas that we had are bearing fruit today,” says Peterson, who anticipates construction of the new reactors will begin in 2010, once licenses are issued by the Nuclear Regulatory Commission.

Fifty-five years have passed since the debut of the earliest Generation-I nuclear reactors, and now a new generation has arrived. These passive Gen-III+ plants, including the ESBWR, resemble their 1970s-era Gen-II predecessors about as much as a Toyota Prius hybrid resembles a vintage 1972 Pontiac. The arc of technological progress embodied in the Gen-III+ reactors has been a steady move toward radical simplification.

The ESBWR replaces previous reactors’ complex system for residual heat removal with a design that uses no pumps or emergency generators. In fact, this reactor possesses no moving parts at all, except the neutron-absorbing control rods that are pulled partway out from the reactor core to let a controlled fusion reaction proceed. That fission reaction generates heat that boils the water in the reactor core. That, in turn, becomes...
The first step to achieving that goal, suggests Peterson, is for the U.S. to do what most other nuclear nations do: move toward recycling its spent nuclear fuel. “Yucca Mountain would possess the physical capacity to accept spent fuel from all existing reactors and an equal number of new reactors,” Peterson says. “But the development of advanced methods to recycle spent fuel would defer any need to search for a second repository for past the end of this century.” To achieve this long-term goal, Peterson notes, the generation of reactor designs following the ESBWR must be capable of transmuting the heavy elements that accumulate in spent fuel.

“Nuclear power is environmentally the least malign of any of the energy production options.”

Thesteamburning plants release enough pollutants to cause 15,000 premature deaths annually in the U.S. alone. They also contribute substantially to global warming. On the other hand, the ESBWR would release negligible pollutants, except the spent fuel it produces.

So what about that nuclear waste? Peterson believes that the ESBWR is the pinnacle of what can be done with a water-cooled reactor. “It uses completely different construction methods, different design and different safety systems from previous reactors. What’s exactly the same are the materials, the coolant and the fuel cycle.” Changes in those areas, Peterson predicts, are where future improvement lies. The public, he says, will rightly reject a second repository site beyond the one selected at Yucca Mountain in Nevada. The nuclear industry must work within that limitation, something Peterson considers eminently doable. If nuclear fuel is used more efficiently, he maintains, residual waste could be reduced sufficiently that “the total capacity of a Yucca Mountain could be increased by 40 to 100 percent.”

Meanwhile, the seeds for the ESBWR design were planted in 1990, and the resulting Gen-III+ plants should be built and operating by 2015. Peterson and others around the world who work on advanced reactors have already begun developing models of possible fourth-generation reactors slated for commercial deployment by 2030. “At some point, we’ll abandon water as a coolant for reactors,” Peterson predicts. Multiple options are now being researched by a small community of experts across the world. Some fifth-generation fusion reactors—the future of nuclear technology, due to arrive around 2050—where one possible goal is replicating the energy source that powers the sun. That’s no small goal.

“Fusion has the potential to be the cleanest of any of the major power sources,” says Peterson. “In my generation, nobody entered the field of nuclear energy because they thought they’d be sitting on a goldmine. We all did it because this is a technology with enormous potential to solve our environmental problems and, moreover, one that we must competently manage because the security implications are so immense.”

Although many other magazines, including The Economist, Technology Review, Red Herring and Technology, have featured in-depth coverage of the ESBWR, Peterson is an Oakland-based science writer whose work has appeared in various publications, including The New York Times, The Washington Post, and The Guardian.

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From the XCF to Silicon Valley and back to Berkeley again

In his undergraduate days, Augie Kuo (B.S./M.EECS) burned the midnight oil working in the Experimental Computing Facility (XCF). The student club is famous in techie circles for dashing wires, championing open source, and creating the first Web browser. The club began as a programming outlet for the most daring, freewheeling and competitive EECS undergrads, where nothing less than brilliant code would do. Kuo was good enough to join the inner circle and, in those early years, he and other XCFers lost themselves in the passion and ambition of working on their own projects.

"Working in the XCF made you take responsibility for your own project," Kuo says. "There was no one managing you. And those long hours in the computer lab ... hours in the work environment. I remember walking around Cory Hall at 2 a.m., and there were still lots of people there."

Working in the XCF made you take responsibility for your own project. "When the company was purchased by Broadcom in 2000, he took a position in the broadband communications semiconductor company, where he is now a senior chip designer.

Computers always fascinated Kuo. As a child, he played video and computer games, which got him interested in how computers work. In high school he took advanced classes at Cal. As an EECS student, Kuo even set up and maintained his own web page, avant-garde in those days.

Today Kuo and his wife, Lisa Lejeune, rarely sit at their computers in their spare time. They'd rather travel, or you might see them sea kayaking, scuba diving or riding a tandem bike together. They maintain a strong connection to the campus and often return for concerts at Zellerbach Hall or football games at Memorial Stadium. They are also dedicated supporters and, in 2005, made a gift on behalf of Kuo's late mother, who was a Cal employee.

Kuo is a veteran of the Silicon Valley's semiconductor companies and their late-night work style. That was particularly the case in August 1997, when he cofounded the chip design company Alima Communications. He put in long hours handling every aspect of the startup operation, where the initial five employees went out to Costco to buy desks and build their own offices.

"It was a busy time," Kuo says, "but you had control of your own destiny." When the company was purchased by Broadcom in 2000, he took a position in the broadband communications semiconductor company, where he is now a senior chip designer.

"I'm still in grad school at Cal. Who loves it?" Kuo says. "When the company was purchased by Broadcom in 2000, he took a position in the broadband communications semiconductor company, where he is now a senior chip designer.

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The book only a daughter could write

It is a story that spans two continents and two generations, the tribute of an American-born daughter to her Bengali father, Felix Khan, whose move to Chicago in the 1950s would forever change the field of structural design. Yosmina Sabina (Khan) Byran (M.S. ’93 CE) in the 1990s with her father, structural engineer Fazlur Khan, whose life, work and genius are the subject of her recent book. The Journal of Architecture Education says the book is "an eloquent and "much needed" work that reveals Khan to be "a human being of extraordinary spiritual depth. He appears as a model of what many would like to be." The book’s cover (right) shows one of Khan’s final designs, the Taj Terminal in Saudi Arabia, and the background shows one of his best-known, the John Hancock Center in Chicago.

Yosmina Sabina (Khan) Byran (M.S. ’93 CE) in the 1990s with her father, structural engineer Fazlur Khan, whose move to Chicago in the 1950s would forever change the field of structural design. Yosmina Sabina (Khan) Byran (M.S. ’93 CE) in the 1990s with her father, structural engineer Fazlur Khan, whose move to Chicago in the 1950s would forever change the field of structural design. Yosmina Sabina (Khan) Byran (M.S. ’93 CE) in the 1990s with her father, structural engineer Fazlur Khan, whose move to Chicago in the 1950s would forever change the field of structural design. Yosmina Sabina (Khan) Byran (M.S. ’93 CE) in the 1990s with her father, structural engineer Fazlur Khan, whose move to Chicago in the 1950s would forever change the field of structural design.

Although by nature very gentle and philosophical, he was a driven man," Byran says, "and at the same time the spirit of the pilgrimage..." Khan received his B.S. in civil engineering at the University of Dhaka. Khan received his B.S. in civil engineering at the University of Dhaka. Khan received his B.S. in civil engineering at the University of Dhaka. Khan received his B.S. in civil engineering at the University of Dhaka. Khan received his B.S. in civil engineering at the University of Dhaka. Khan received his B.S. in civil engineering at the University of Dhaka.
Wacky website is hot stuff

Jim Young (B.S.'94, M.S.'97, Ph.D.'04 EECS) rides to work every day on his Ducati motorcycle. He tries to get there about noon, his office, located in a corporate building in downtown Berkeley, looks more like a college pad. The overhead lights are off, but Christmas tree lights and computer screens give. There’s a cushion here, a desktop propped on boxes there and a mess of empty bottles and magazines lying about.

LOUIS DE WAAI (M.S.'72 CE) is located in every major city in Africa. He writes, “I have retired from a consulting engineering firm but am still active as chairman of Table Mountain Cablesaw, director of the Automobile Association of South Africa, and chairman of a non-government organization called the Bicycling Empowerment Network (BEN), which brings mobility to lower-income folks by supplying affordable second-hand bicycles and new bikes. I am also conference director of the Mandela Summit.”

DAVID FRIEDMAN (B.S.'79 CE) of San Francisco received a Truman’s Citation from UC Berkeley Foundation at an awards dinner last February.

ANGELA KASPRZYK (B.S.'72 CE) is a consulting civil engineer in San Mateo.

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Going beyond the call to help students succeed

DeCoteau is director of the Charles Tunstall Multicultural Engineering Program (MEP), designed to recruit underrepresented minority students to the College and to make sure that they thrive academically, complete their degrees and make a successful transition to graduate school and careers. Since the program’s inception in 1998, more than 1,200 underrepresented students have graduated and, in many cases, have gone on to earn graduate degrees, start their own businesses and hold leadership positions in industry and academia.

“Many students are the best of the best,” deCoteau says. “They make me laugh, they make me proud, they make me cry, they drive me nuts. I never have a dull moment because they are so smart, challenging, inspiring, moti- vated, idealistic and creative. Their skill at inspiring students comes not only from her love of the job, deCoteau says, but also from her own Berkeley Engineering experience.

“I can relate to the students because I still remember what it was like to be an undergrad here,” she says. “I understand what they go through and help validate their experience. I told them, ‘When you graduate as a Berkeley engineer, you can face anything the world throws at you.’”

When she was a student in MSE, deCoteau participated in the program she now directs, one of several offered through the Center for Under-represented Engineering Students (CUES). The MEP director at the time, Charles Tunstall, had a significant role in motivating her. “He was my biggest cheerleader,” she says, “and that makes a difference in a place like Berkeley.” In 1988, she became the first Berkeley student in 25 years and the first American woman from Berkeley ever to win a Rhodes scholarship. She received her D.Phil. at Oxford, then returned to the Bay Area and taught MSE at Laney College before leading the MEP job. DeCoteau was one of 200 staff and faculty named by students respond- ing to the undergraduate survey, conducted annually by the Office of Student Research, as someone who “went beyond the call to help students succeed.”

Students tap into seminar series for survival skills

Two Tang Center psychologists and six engineers teamed up last February to give students a real check on navigating the stressful ups and downs of life at Berkeley Engineering.

“The Learn the Bear Necessities: How to Be a Successful Engineer” was the first in what will be a regular series of survival guide seminars involving faculty, alumni and students. Panelists included MSE professor John Gronsky (M.S. ’54, Ph.D. ’57 M.E.); ME graduate student Jenni Buckley, alumnus Bill McLean (B.S. ’63), M.S. ’66, Ph.D. ’72 M.E.); Engineering Physics sophomore Ipsita Furtula, alumnus Dolly Yu Chen (B.S. ’08 CEE), ME/MS senior Joan Grace Hsu, and graduates Rick Low and Claytay Davis, both counselors at University Health Services Tang Center.

“Don’t be afraid to ask questions in your work,” advised Chen, who works for HDR, Inc., an architectural, engineering and consulting firm with offices in the Bay Area. “There’s no real such thing as a dumb question. I’ll much rather have someone ask now, when they’re not sure, than wait until we’re all the way through the design process and it’s a problem. You also need to be adaptable. In order to be successful in my career, you need to be able to do everything.”

Gronsky told the audience that his day begins at 4:30 a.m. and usually doesn’t end before midnight. “For every hour of class, I put in 10 hours of prep time,” he said. “Be kind to your advisors and professors. We have stress, too.”

The students were given pizza and stress squeeze balls in the shape of little yellow construction hats, supplied by HDR, Inc.

“I’m trying to figure out how to be happy and academically successful at the same time,” said one student, “and this helps.” For more informa- tion on upcoming seminars, go to www.cee.berkeley.edu/alumni.

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LOWELL PATT (B.S. ’56 CEE) of Murrieta, California, is currently teaching his grandson to play golf. He’s also planning a month of touring Europe this spring.

JACK REET (B.S. ’56 M.E.; M.B.A. ’59 Res. Adm.) writes, “We retired to the Kennebec area of Maine in 2002 to be near our seven grandchildren. After a long career with Honeywell and a shorter one with Varian, I’m now enjoying tennis, golf and the grandchildren.”

RICHARD SCHELIN (B.S. ’56 CEE; B.S. ’59 in Physics) of Pasco, Washington, is president of Schelin International, which has done consulting civil engineering and architectural work in California, the Western United States and the Pacific. Far East areas for the last 46 years. The company received a national award from the American Institute of Architects for planning and designing California’s Columbia College. He writes, “We have begun preparation for our upcoming 50th anniversary in February 2010. I thank my lucky stars (as well as faculty and col- leagues) that I was smart enough to enroll at Cal for my first semester in 1947 and to graduate in 1956. It took me nine years, due to time in the Air Force, raising a family and working!”

JAMES SPARKES (B.S. ’53 IEOR) of San Jose retired from General Electric after 32 years as a line officer in the company in the Nuclear Power Department. During these years he worked in Holland and India.

NEIL TAYLOR (B.S. ’52 CEE; B.S. ’54 EECS) of Moraga, a former civil engineer for Pacific Gas & Electric, writes, “I have been retired for the past 17 years and am having more fun than a human being is supposed to have!”

ROGER BROXELL (B.S. ’51; M.S. ’53 CEE) of Lafayette recently celebrated his 80th wedding anniversary. He is enjoying his active retirement after many years of engineering and project man- agement at Kaiser Engineering.

WILLIAM BACH (B.S. ’51 CEE) of Santa Monica, California, is now retired and enjoys it. “I can relate to the students because I still remember what it was like to be an undergrad here,” she says. “I understand what they go through and help validate their experience. I told them, ‘When you graduate as a Berkeley engineer, you can face anything the world throws at you.’”

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in memoriam

HAL ANGER (B.S. ’43 EECS) of Berkeley died last October of heart failure at age 85. An electrical engineer in nuclear medicine, he was known for his invention in 1950 of the gamma, or scintillation, camera, later known as the Anger camera, which produced images of internal metabolic processes by tracking radiotracers. He was a major advance in the diagnosis of brain tumors and bone marrow disease. During World War II, Anger developed radar-jamming technology and later worked at Berkeley’s Donner Laboratory until his retirement in 1982.

ATEF GHOBRIAL (M.S. ’79, Ph.D. ’83 Bus. Ad.) of Roswell, Georgia, died last November. He was a professor of public administration and urban studies at the Andrew Young School of Policy Studies at Georgia State University in Atlanta. His research involved policy implications and finance of air transportation and other transit infrastructure, including public involvement in transportation planning and transit strategies for developing countries.

Larry Kulchin

LARRY KULCHIN (B.S. ’58 CE), a geotechnical engineer and founder of Kulchin & Associates, died in January. His company engineered shoring, underpinning and tieback technologies for more than 40 years. During that time, he developed several innovations that remain standards in geotechnical construction today, including “soil nailing,” introduced in 1973, a method of reinforcing existing ground by installing closely spaced steel bars. He and his wife Ann founded the B.O.R. Ranch in Bieber, California, a nonprofit organization offering horse-oriented therapeutic assistance to disabled people. An avid skier, he could be found on the Tahoe slopes more than 100 days a year.

TOM LAPSLEY JR. (B.S. ’62, M.S. ’65 ME) of Walnut Creek died last September at age 86. He joined the Berkeley faculty as ME professor in 1944, then transferred to OR, where he spent most of his career. He also served as associate dean of the College of Engineering for the last decade of his career and retired in 1985. An engineer to the core, his personal motto was succinct: “Never use a 2x4 if a 4x6 can fit.”

JERRE NOE (B.S. ’43 EECS) of Seattle died last November at age 92 after a brief battle with mesothelioma. He was the first chair of Computer Science and Engineering at the University of Washington, where he introduced a bachelor’s program in 1975. He also directed the Eden Project, key to establishing the department as a top computer science program nationally and internationally. He conducted radar research and development in Europe during World War II and led Stanford Research Institute’s ERMA project, which first computerized banking for the Bank of America in the 1950s.

EUGENE PETESEN of Lafayette, retired professor emeritus of chemical engineering at Berkeley, died last November of cancer at age 81. He was a leader in the field of reaction engineering, devoting his career to understanding chemical reactors, specifically catalyst failure. He joined the faculty in 1953 and retired in 1991.

FRANK PUMERVILLE (B.S. ’33 ME) of Richmond, Indiana, died last year at age 95. He had worked as a superintendent for Alcoa Aluminum Company in Pennsylvania.

William Oswald

JOHN WEHANSEN died last October at age 92 of congestive heart failure. He was professor emeritus of engineering science at Berkeley, where in 1938 he helped create the Department of Naval Architecture, which became a model for programs worldwide. (The field is now a major area of study within mechanical engineering.) Wehausen contributed original research in the areas of wave resistance, floating system motions, ship maneuverability and ship-generated solitary waves. He taught at Brown, Columbia and the University of Missouri, did service in the U.S. Navy during World War II, and worked at the David Taylor Model Basin, a Navy research lab, before coming to Berkeley in 1956. He retired in 1984. He played chamber music with his family and had an affinity for languages, including German, French, Russian and Turkish.

WILLIAM OSWALD (B.S. ’50, M.S. ’51, Ph.D. ’57 CE) of Concord died last December of pancreatic cancer at age 86. He was professor emeritus of environmental engineering and public health and senior scientist at Lawrence Berkeley National Lab. An innovator in algae biotechnology and wastewater treatment, Oswald was a pioneer in the field of ecological engineering. He was among the first engineers to study the symbiotic interactions between algae and bacteria in wastewater treatment ponds. Starting in the 1950s, he began research in natural treatment systems powered by solar energy, making wastewater treatment more affordable and sustainable. He was motivated by his U.S. Army experience during World War II, where he treated patients suffering from the effects of contaminated water and other sanitary conditions. In his 60-year career, he is estimated to have designed well over 100 wastewater treatment facilities around the world and was working on a proposal to study the use of his technology to treat sewage in the Ganges River and in the city of Varanasi, India.

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berkeley engineering

consider these facts:

• Only 10 percent of today’s engineers are women.
• Girls make up just 8 percent of 12th grade students who say they want to major in engineering.
• Role models can help girls discover how a career in engineering can make a difference in the world.

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