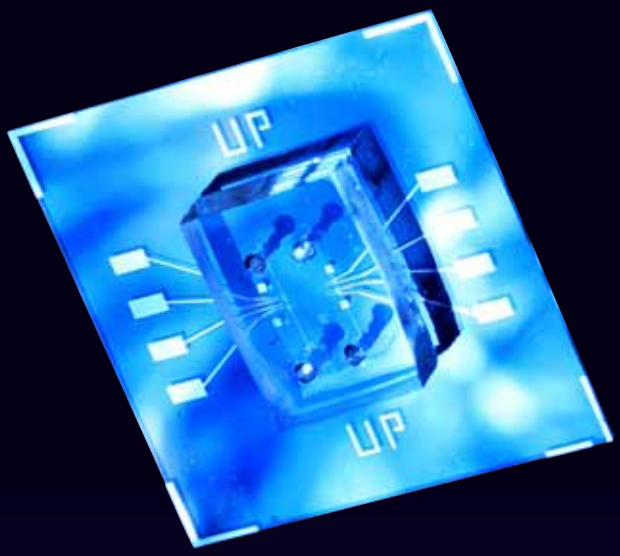
Forefront

COLLEGE OF ENGINEERING UNIVERSITY OF CALIFORNIA, BERKELEY fall 2005



A Nano-Star is Born

Tiny device targets hidden cancer cells

- Berkeley responds to Hurricane Katrina
- Students help housing project go solar
- A conversation with Steve Wozniak

dean's message

Food for thought

PEG SKORPINSKI PHOTO

Food is on everyone's mind this time of year, including about 950 schoolchildren at Martin Luther King Junior Middle School in Berkeley. And they're not just eating the food. They're growing it, harvesting it, cooking it, and studying it.

These sixth-, seventh-, and eighth-graders are participants in the Edible Schoolyard **(www.edibleschoolyard.org)**, a project founded by local restaurateur Alice Waters (B.A. '67 Humanities). The idea is to expose children to food production, ecology, and nutrition, and instill in their young minds and bodies an appreciation for meaningful work and nutritious food. As Alice says so well, "If they grow it, they *will* eat it!" These young people are literally eating their program up.

When I think of these young students, I can't help but feel optimistic. I'm sure this important brush with "learning-by-doing" will help them pursue whatever career they choose with enthusiasm and commitment, and I wonder how we can inspire minds like theirs to connect with science and engineering the way they have connected with the Edible Schoolyard. What can we do to inspire our most fertile minds—the ones with the potential to confront the 9/11s and the Hurricane Katrinas of tomorrow—to pursue science and engineering as a course of study and a consequent constructive application of their learning in our society as a way of life?

This summer our TEAMS Academy, the Teaching Engineering Applying Math Science program, put middle schoolers to work designing and building solar-powered robotic vehicles to boost their math and science skills. The six-week National Science Foundation (NSF)–sponsored enrichment program targets underserved minority students, hoping to steer them toward a career in engineering. Whether that long-term goal will be met remains to be seen, but, like those students working in the Edible Schoolyard, these young people simply can't resist the "hands-on, minds-on" approach of learning-by-doing.

Curricular experiments by the NSF show that engineering undergraduates do best when they are introduced early to working in teams and to tackling real-world problems that reinforce the personal and social relevance of science and engineering. We see this every day in our students working on projects in CITRIS, our Center for Information Technology Research in the Interest of Society. These young people are not only focused on finding a good job or earning money; they really want to make a difference in people's lives.

We must continue to look for compelling ways to catch the attention of our most talented potential engineers and scientists. I believe one secret is *connection:* connecting the next generation to something meaningful they can care about, whether it's as simple as a red ripe tomato or as lofty as alleviating poverty for their own community or for the entire globe. From this first spark of connection grows the engineer's fascination with our complex world—one full of challenges and opportunities—and the confidence needed to roll up one's sleeves and get to work.

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

— A. RICHARD NEWTON
Dean, College of Engineering
Roy W. Carlson Professor of 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 the College of Engineering at the University of California, Berkeley.

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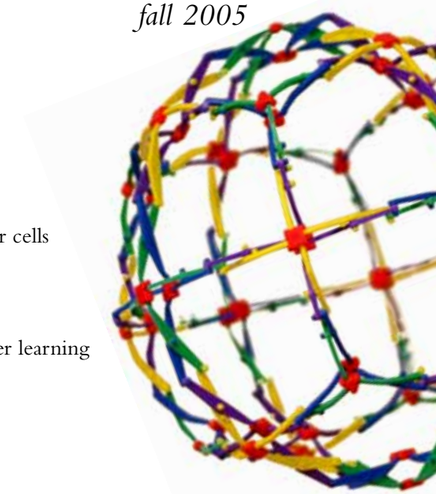
On the cover
Read the story on page 12.
The combined knowledge and imagination of mechanical engineers teamed with biologists, physicians, and entrepreneurs has led to a promising new nano-device for early cancer detection—a pore-on-a-chip—now in fabrication in Berkeley mechanical engineering professor Lydia Sohn's Nano-Biology Lab.

COVER PHOTO BY NICK LAMMERS
BACK COVER PHOTO BY PEG SKORPINSKI

Forefront

COLLEGE OF ENGINEERING UNIVERSITY OF CALIFORNIA, BERKELEY *fall 2005*



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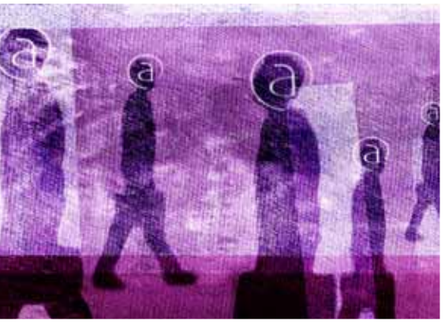
Discerning truth in the age of the Internet

In response to Dean Newton's message [spring 2005], rather than looking for an "algorithm," I think we need to be looking for a miracle.

No algorithm can overcome the limitations of the human animal. As the Vincent Cerf quote illuminates, "There are no electronic filters that separate truth from fiction." Dr. Cerf's comment is likely based on the understanding that, for humans, truth and fiction are personal interpretations of what is perceived by their senses. Historically, some truths were that the Earth was flat and the sun revolved around it. These "truths" were based upon narrow perceptions of reality



coupled with biases to maintain those perceptions. Since then, nothing about humans has changed to improve our perceptions and interpretations.

As with all technology, the Internet is a double-edged sword. You state that "it increases productivity and improves communications." That is one edge. You also state, "But the sheer volume of conflicting information, further degraded by valueless and outdated data, now threatens to become just so much white noise." That is the other edge, the one that decreases productivity and obscures communications. While the functionality and quality of technology has improved, its use or misuse still depends on the user.

Before an electronic filter could be built, some means of testing the accuracy of the filter would first have to be devised. But upon what existing process of data verification would such a test system be based?

I have never been involved with any aspect of publishing in an academic environment. However, it is my understanding that the process of peer review is used to substantiate the originality and usefulness of scholarly work. If the work does not pass the rigorous review process, it is not published. Yet I have read many articles of published work that have later been discovered to be plagiarized. Somehow the work was published in spite of the talents of the reviewers.

While there are limitations to the peer review process, would not being able to stamp some Internet information as "reviewed," with a review date and the names of the reviewers, "help users gauge the reliability of data found on the Web"?

An electronic filter, to detect derivative information, would first need to have all data digitized in order to make comparisons. That has yet to be accomplished. It would take massive central processing unit and input/output capabilities to make the comparisons. Another problem would be identifying the true source. As we know with patents, inventions are sometimes stolen and patented by the thief long before the inventor ever acknowledges his or her invention. If the filter cannot be certain about the source, we still have some risk, which leaves us back at your first step, as even the least amount of risk still leaves a gap in trust.

Not being an engineer, I cannot take this any further; but your challenge captured my attention. Thanks for the opportunity to ponder ideas other than my own.

—BOB SPETH
Yuba City, California (B.A.'70 CS)

Words of Wisdom

In response to Dean Newton's message that appeared in the last issue, you have written a few well-chosen and much needed words. Congratulations.

—DICK SHUEY
Schenectady, NY (M.S.'47, Ph.D.'50 EECS)

Water, Water Everywhere

I would like to compliment you on the spring 2005 issue of *Forefront*. It contained a lot of news about water, which I found extremely interesting. I would like to pass on some information that might be of interest to your audience pertaining to Berkeley's Water Resources Center Archives (WRCA).

The WRCA hosts the California Colloquium on Water four times each semester. This is an interdisciplinary lecture series, usually held once a month while school is in session, designed to educate people about water from many different perspectives: natural resources, humanities, law, physical sciences, engineering, etc. The fall series is sponsored by the College of Engineering, Vice Chancellor and Provost Paul Gray, and several other UCB deans. Lectures are free and open to the public.

The WRCA itself is a unique collection of materials pertaining to the state's water resources. For example, we just completed a grant to digitize over 800 photographs of the construction of the Los Angeles Aqueduct, and we have extensive documentation about prominent former faculty, including Joe Johnson, M.P. O'Brien, Etcheverry, Hans Albert Einstein, Professor Robert L. Wiegel, and Charles Derleth, to name a few.

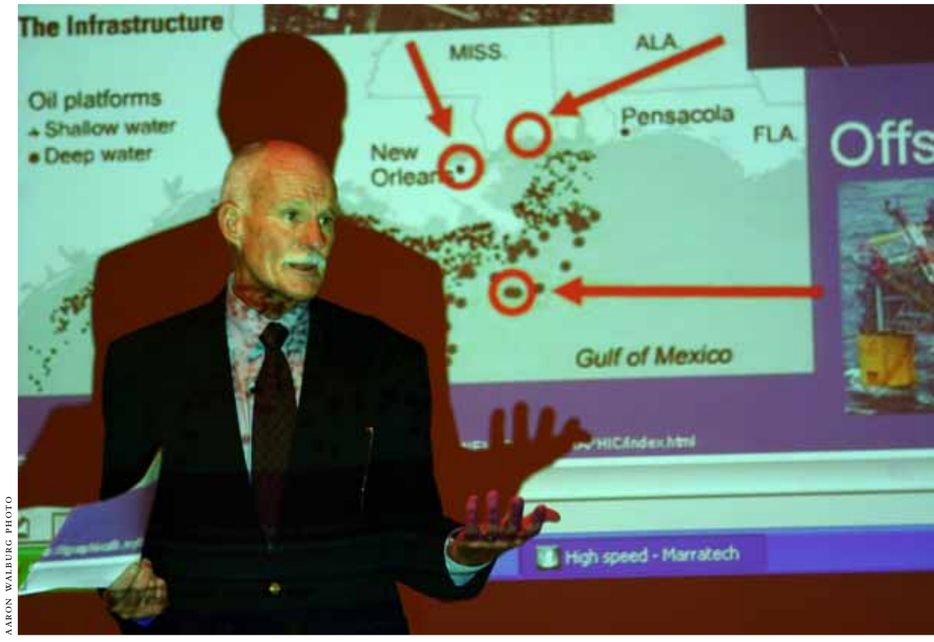
Go to **www.lib.berkeley.edu/WRCA/** for more details on our collection and location.

—LINDA VIDA
Director, Water Resources Center Archives
Berkeley (B.A.'82 Art History,
M.L.S.'83 Library Sciences)

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 the writer's name. Note that we cannot include all letters received, and those published may be edited for length and clarity.

News from the Northside

What's New at Berkeley Engineering



AARON WALBURG PHOTO

At a town hall meeting held in Sibley Auditorium the week after Hurricane Katrina struck the Gulf Coast, CEE professor Robert Bea described his own experience with Hurricane Betsy when it hit New Orleans 40 years ago. "Don't criticize or politicize," he advised. "These are the times to pull together. When the water drains, learn everything you can. Think ahead to the future."

Berkeley engineers mobilize in response to Hurricane Katrina

Berkeley Engineering faculty, staff, and students assembled at a town hall meeting in Sibley Auditorium the week following Hurricane Katrina's August 29 landfall to mobilize forces in the form of research efforts and outreach to those displaced by one of the greatest natural disasters in U.S. history.

In a particularly personal presentation, CEE professor Robert Bea told of his own experience in September 1965 when he, his wife, and their four-month-old son tried to flee New Orleans with Hurricane Betsy at their backs.

"The levees broke," Bea said. "I could just see the top of our house under 12 feet of water. There was no FEMA, no flood insurance. Everything was lost."

Bea has been instrumental in organizing research initiatives arising from that initial town hall meeting through the Katrina Recovery Task Force (KRTF), an inter-related team of civil engineers and other Berkeley researchers who are studying the hurricane's effects, serving as advisors in the recovery, and documenting important lessons learned.

The KRTF research projects include Bea's study of damaged coastal and offshore facilities; an investigation led by Haas professor Karlene Roberts into evacuation, health care, and other human social dynamics in response to the hurricane; and Berkeley geotechnical engineering professor Ray Seed's research on the New Orleans flood protection system.

Seed led a week-long field trip to New Orleans October 2 to investigate the failure of the city's levee infrastructure. His team's initial findings revealed that the three downtown levees failed not because they were overtopped by floodwater, as previously believed, but because their supporting pilings had not been driven deep enough into stable soil.

"It's important to get our report out as soon as possible," Seed said, "before [the Army Corps of Engineers] makes final decisions on how to rebuild the levee system." The team will submit a formal report to the National Science Foundation (NSF) and the Corps next spring. The KRTF research is sponsored by the NSF and CITRIS, the Center for Information Technology Research in the Interest of Society.

Berkeley is also hosting a number of university students and researchers displaced by the hurricane. The Katrina Emergency Fund and a University Health Services website have been established to provide financial support and traumatic stress counseling for visitors from the storm-ravaged area. ■

PEG SKORPINSKI PHOTO

SAMER MADANAT, CEE professor and director of the California Partners for Advanced Transit and Highways (PATH), is the new director of Berkeley's Institute of Transportation Studies (ITS). Madanat succeeds CEE professor Martin Wachs, who served in that capacity for six years and stepped down in July.

A specialist in maintenance and rehabilitation of transportation facilities, the 42-year-old Madanat joined the Berkeley faculty in 1996. He received his undergraduate degree at the University of Jordan, followed by master's and Ph.D. degrees from MIT.

Founded in 1948, ITS is home to approximately 50 faculty, 50 staff researchers, and more than 100 graduate students. Its programs receive average funding of more than $25 million annually, one of the largest award totals for an organized research unit or academic department at Berkeley. This institute is also headquarters for the UC-wide ITS, with affiliates at UC campuses in Davis, Irvine, and Los Angeles.

CITRIS joins Indian university in e-learning initiative

UC Berkeley and the Center for Information Technology Research in the Interest of Society (CITRIS) are two of several partners in a collaboration between India and the U.S. that will use a government-sponsored satellite to transmit educational programming throughout India.

India's Amrita University will lead the initiative to host faculty from top U.S. engineering centers, designed to enhance learning in India's fastest-growing universities, many of which are located in remote rural areas. Faculty will teach graduate and undergraduate courses via Edusat, a new satellite e-learning network launched last year by the Indian Space Research Organization.

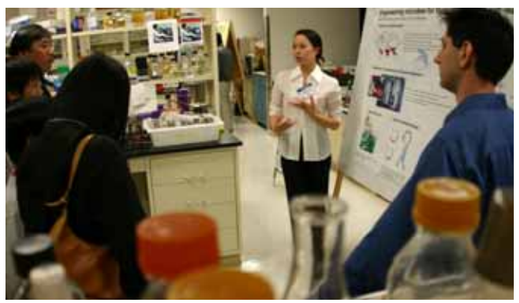
CITRIS director Shankar Sastry joined representatives of other participating institutions at a Washington, D.C., event in July, where a three-year agreement initiating the program was signed. Also in attendance were Indian Prime Minister Manmohan Singh and Venkata Rangan (Ph.D.'89 CS), vice chancellor of Amrita, a Berkeley alumnus, and professor of computer science and engineering at UC San Diego, who spearheaded the project.

UCSD JACOBS SCHOOL OF ENGINEERING PHOTO

CITRIS director Shankar Sastry spoke at the July event in Washington, D.C., announcing the Amrita initiative. A native of Bangalore, considered India's information technology capital, Sastry is also NEC Distinguished Professor of Engineering and professor in the departments of EECS and Bioengineering at Berkeley.

"This is an incredible opportunity for us to experiment in distance learning," Sastry says. "The satellite access available to Amrita is of an order that would be unthinkable in the U.S., difficult to access and prohibitively expensive." The collaborative aspect of the program, he added, will be mutually beneficial to both nations. Other participants include UC San Diego, Carnegie Mellon, Cornell, SUNY Buffalo, and Case Western Reserve.

Sastry this spring was also appointed principal investigator and director of another collaborative project, a UC Berkeley–led center to improve reliability of the nation's computer infrastructure and protect it from cyberattacks. The Team for Research in Ubiquitous Secure Technology (TRUST) will receive nearly $19 million from the National Science Foundation over five years and unite researchers from eight U.S. universities and industries nationwide. It was established following a presidential committee report recommending increased funding for cybersecurity research on the country's increasingly vulnerable information infrastructure. ■



AARON WALBURG PHOTO

ChemE postdoc Michelle Chang describes her research to attendees at an Engineering Dean's Society event last month celebrating the opening of the new Berkeley Center for Synthetic Biology. The research labs of BioE/ChemE professor Jay Keasling and BioE professors Adam Arkin and Dan Fletcher are now located at the off-campus state-of-the-art laboratory facility, where they are pioneering advances in synthetic biology. The promising new discipline builds living systems from genes, proteins, and other basic biological components. Chang's project, with Keasling and ChemE graduate student Eric Paradise (right), uses bacteria to synthesize anti-malaria treatments faster and more economically than they can be manufactured from botanicals. (For more, see Forefront's *spring 2005 cover story.)*

U.S. public works need an extreme makeover, ASCE says

The reality of Hurricane Katrina lends added weight to a report issued earlier this year by the American Society of Civil Engineers (ASCE), whose 2005 Report Card for America's Infrastructure granted an overall grade of D for the nation's roads, bridges, schools, energy grid, and other public works. The mark was down a notch from the D+ issued in 2001, the last time the report was published.

"These are serious problems, and the ASCE does a good job of raising public awareness about them," says UC Berkeley's Gregory Fenves, professor and chair of civil and environmental engineering. "The whole situation in New Orleans is a good example. It shows how interconnected and vulnerable our systems are and emphasizes the need for creative research and rational long-term investments."

Civil and environmental engineering research at Berkeley and elsewhere, Fenves adds, is examining methods, materials, and technologies to rebuild the nation's infrastructure in an attempt to avoid the problems of outdated and crumbling systems.

ASCE's report card assessed 15 categories, including three new areas—parks, rail, and security—not evaluated in 2001. Of the remaining 12, grades remained the same for three (bridges, dams, and solid waste); worsened for seven (roads, drinking water, transit, wastewater, hazardous waste, navigable waterways, and energy); and improved for two (aviation and schools). No area received an individual grade above C+, and security received an incomplete.

ALAN DOOLEY/U.S. ARMY CORPS OF ENGINEERS PHOTO

The levees keeping Lake Pontchartrain out of New Orleans, an example of the inadequate infrastructure described in ASCE's report, were particularly vulnerable to Hurricane Katrina. Here, a breach in the 17th Street Canal is visible in the upper right-hand corner. The New Orleans skyline lies in the distance.

According to the report, it would take five years and $1.6 trillion from all levels of government and the private sector to put America's crumbling infrastructure back together again, not including costs for security. Only $900 billion has been allocated to the effort. ■

Caltrans to fund Berkeley-based research on seismic safety of transportation

PEG SKORPINSKI PHOTO

CEE professor and PEER director Jack Moehle, here examining the results of a seismic test on a concrete column, is principal investigator of the Caltrans-funded push to upgrade the seismic safety of California's transportation infrastructure.

In an effort to improve the seismic safety of the state's highway system, the California Department of Transportation (Caltrans) has awarded $2.25 million to UC Berkeley's Pacific Earthquake Engineering Research Center (PEER).

The five-year grant will support multidisciplinary studies that bring together geologists, seismologists, and geotechnical and structural engineers from academia, private industry, and government agencies. Their research will focus on ground motion, soil response during severe ground shaking, and reliability of bridges and highway systems during an earthquake.

"Modern bridge seismic design relies on computer analyses of how the bridge will move during future earthquakes," says CEE professor Jack Moehle, director of PEER and principal investigator of the grant. "A major aim of our study will be to incorporate data and knowledge from recent strong earthquakes to develop improved procedures for selecting ground motion for design studies. The procedures will be applicable to new bridge designs as well as retrofits of existing hazardous construction."

Moehle pointed out that increasingly sophisticated technology is enabling researchers to better predict how structures will perform in earthquakes. Their studies on transportation systems, the researchers say, will be relevant to designing safer buildings, waterlines, and electrical systems.

The PEER Center is a National Science Foundation earthquake engineering research center supported by federal, state, and private industry funds. In addition to Berkeley, participating universities include Caltech, Stanford, UC Davis, UC Irvine, UCLA, UC San Diego, the University of Southern California, and the University of Washington. ■

PEG SKORPINSKI PHOTO

Surveying progress on Coliseum Gardens construction are (left to right) MSE graduate student Ilan Gur, former Haas student Angela McGuire, Sun Light & Power's Eric Nyman, MSE professor Eicke Weber, Sun Light & Power president Gary Gerber, and ME graduate student William Watts.

Berkeley students help Oakland housing project go solar

Hook up a community-minded building developer with a team of seriously solar students, and the result is a fortuitous mix of environmental consciousness and technical savvy, not to mention a break on taxes and the PG&E bill.

That's what's happening at Coliseum Gardens, a 16-acre affordable housing development now under construction in Oakland. For a class project last fall, four Berkeley students helped the builders do their homework on a solar power system for the new complex. Their comprehensive analysis of the solar industry, completed in 14 short weeks, helped project developers locate the vendor now designing rooftop panels for installation at Coliseum Gardens this spring.

"It was a great experience," says team leader Angela McGuire, formerly a student at Haas School of Business and so inspired that she is now steering her own career toward solar. "I learned so much about renewable energy." The project developers, New York–based Related Companies, also got a crash course in photovoltaics, the rapidly emerging field of rooftop solar cells that convert sunlight into usable energy.

Part of a massive revitalization effort started in 1995 near Oakland Coliseum, the $124-million project is a 350-unit affordable housing complex funded partially by the U.S. Department of Housing and Urban Development (HUD) HOPE VI program. Designed to revitalize blighted urban areas and failed public housing, HOPE VI emphasizes mixed-income housing, combined residential and commercial use, and access to public transportation.

"It's not that we were looking for free work, but we really didn't know enough about solar to do it ourselves," says Related architect Steve Wraight. The company stumbled on the idea of contacting Berkeley after seeing an article about NE professor Daniel Kammen's Renewable and Appropriate Energy Laboratory. Serendipitously, Kammen was working on a new class, the first specialty course in solar to be offered at Berkeley, with MSE professor Eicke Weber.

The class was the brainchild of graduate student instructors Tonio Buonassisi of Applied Science and Technology and Ilan Gur (B.S.'02, M.S.'03 MSE), now a materials science Ph.D. candidate. Looking for a way to get students outside the classroom and involved in real-world projects, they sold Kammen and Weber on the idea of opening up the solar class to more than just a handful of grad students. The class, "Photovoltaic materials: modern technologies in the context of a growing renewable energy market," was offered through the Management of Technology program and combined solar science content with market and policy considerations.

McGuire was one of 55 students from engineering and several other departments across campus who enrolled. She teamed up with William Watts (B.A.'05 Physics), now a graduate student in mechanical engineering, physics undergrad Damien Boesch, and visiting nanosciences student Mirjam Mueller to tackle the Coliseum Gardens project.

"These students wanted to sink their teeth into a real project," says Wraight. At first, he admits, he thought it would be just an "educational exercise" but was impressed by the real impact the students had. And the students were impressed by Related's commitment to standardize solar roof paneling systems for future affordable housing projects.

"This is a major real estate company that could replicate this system a thousand times," says Watts. "We thought if we could show that solar is easy and saves money, we could help bring down the market price and eventually make solar affordable in every home."

Photovoltaics (PV), from *photo* for light and *voltaic* for voltage, is one of several renewable energy sources—including biofuels, geothermal, wind, and hydropower—that, unlike coal and petroleum, are infinite in their supply and don't add carbon to the atmosphere.

PHOTO COURTESY OF SUN LIGHT & POWER

This spring, Berkeley-based solar supplier Sun Light & Power will install photovoltaic panels like these to supply electrical power to parking lots, laundry facilities, and other common areas of the affordable housing complex near Oakland Coliseum.

Researchers say PV's potential is tremendous because the sun shines everywhere.

With growth worldwide of 25 percent annually for the last 10-plus years and over 50 percent in 2004 alone, the solar industry is hot. Proponents say it could solve energy problems in the U.S. by reducing dependence on imported fossil fuels and the environmental damage caused by burning them, as well as stimulating innovation and the economy. Research, like the work being done by Weber, Buonassisi, and others on a technique that would facilitate using lower-grade silicon in manufacturing solar cells (see *Innovations*, page 9), promises to reduce the cost of materials and boost industry growth even more rapidly.

Although the U.S. lags behind Japan and Europe in use of solar, California is the third largest market worldwide and has far more sunshine. Here, PV panels are cost-efficient even without the government subsidies and utility rebates that have been used as incentives since the 1980s, when the industry first got started.

"Every megawatt of solar capacity installed avoids more than 300 pounds of smog-forming pollution and more than 870,000 pounds of global warming pollution each year," says Kammen, who retrofitted his 1937 Oakland home two years ago with a 2400-watt photovoltaic system. But costs are lower and efficiency greatly increased when solar is incorporated into new construction so that roof orientation, panel angle, shading, and other factors can be engineered to optimize sun exposure.

In addition to the Coliseum Gardens team, 10 other student groups inspired by the class worked on projects ranging from creating a solar wireless phone–powering device for use in developing countries to teaching solar concepts in the San Leandro School District.

Even the faculty was inspired.

"This class was one of the most gratifying teaching experiences I have had at Berkeley," says Weber, a member of the faculty since 1983. "Bringing in different disciplines is enormously helpful in teaching students how to network and work with people from different fields. Just like in industry, each team represented an interdisciplinary group in itself."

The class was such a success that it will be offered again in fall 2006. By then, Coliseum Gardens will be fully occupied, and a fresh crop of solar-psyched students will be scouting the Bay Area for new places to make their mark. ■

Two young engineering faculty recognized

PEG SKORPINSKI PHOTOS

Irina Conboy

Oscar Dubon Jr.

Two Berkeley Engineering faculty members were recognized with prestigious awards specifically designed to honor scientists in the early stages of their careers.

Oscar Dubon Jr. (M.S.'92, Ph.D.'96 MSE), MSE assistant professor and a researcher in the Materials Science Division at the Lawrence Berkeley National Laboratory, received the 2004 Presidential Early Career Award for Scientists and Engineers (PECASE), the nation's highest honor for young scientists. On faculty since 2000, Dubon focuses on thin-film growth methods for semiconductor materials that address challenges in nanoscale electronics and spintronics.

BioE professor Irina Conboy is one of only 12 young scholars nationally to be named an Ellison Medical Foundation New Scholar in Aging. The highly competitive recognition will support four years of basic biomedical research in age-related diseases and disabilities. A researcher in stem cell aging, Conboy received her Ph.D. in molecular and cellular immunology from Stanford and joined the Berkeley faculty in 2004.

PEG SKORPINSKI PHOTO

JASMINA VUJIC was the first woman to join Berkeley's Department of Nuclear Engineering in 1992 and is now one of the first women to be appointed to a nuclear engineering chairmanship in the U.S. Vujic was appointed NE chair in July, succeeding Per Peterson.

A native of Yugoslavia, Vujic began her studies at the University of Belgrade, now the capital of Serbia and Montenegro. She received her advanced degrees at the University of Michigan.

Vujic's research interests include development of advanced numerical methods for the neutronic analysis of nuclear reactors, radiation shielding, medical applications of radiation, and reactor core design and analysis, among others. She is also director of Berkeley's Advanced Nuclear Engineering Computing Laboratory and Davis Etcheverry Computing Facility.

To read more about Vujic and her research exploring techniques to optimize fuel cycling in nuclear reactors and improve waste management at nuclear power plants, go to **www.coe.berkeley.edu/labnotes/0605/vujic.html.**

GAMMA USA/FRÉDÉRIC NEEMA PHOTO

Anthony Levandowski (B.S.'02, M.S.'03 IEOR) demonstrates the equipment that makes his Ghostrider go at the DARPA Grand Challenge preliminaries last month. He plans to return to his IEOR doctoral work in January and continue working on autonomous systems.

Life goes on for Levandowski's Ghostrider

After a full-time two-year push to win the much-publicized DARPA Grand Challenge autonomous vehicle race, Berkeley's Blue Team and its unmanned motorcycle, Ghostrider, failed to qualify for the October 8 finals. But team leader and alumnus Anthony Levandowski (B.S.'02, M.S.'03 IEOR) is taking it in stride.

"Winning was not our first objective," Levandowski says. "Our real goal was to deliver innovation. And if you measure success by the amount of innovation per dollar, I think we're pretty far ahead."

Working with corporate sponsors like Agilent, Advanced Micro Devices, and Raytheon, Levandowski spent less than $150,000 outfitting the 90-cc dirt bike with an onboard computer, sensors, and gyros for steering and stability and two video cameras for eyes. It was the only two-wheeled vehicle in the field, which Levandowski says gives it more maneuverability and disposability than the converted Hummers, Jeeps, and trucks he competed against.

"Ghostrider wasn't as reliable as the 23 entrants that qualified," he says, "but it's the next generation for future practical applications because of its small size." Companies like Honda, he says, are inquiring about the vehicle's stabilizing hardware for possible safety and training applications. He hopes to keep Ghostrider alive by continuing to refine its subsystems, like the obstacle avoidance software, for potential use in unmanned scouting and surveillance operations.

The DARPA race, sponsored last year by the Defense Advanced Research Projects Administration, offered a $2 million prize to the first team to build a vehicle that could navigate unmanned through the Mojave Desert. None of last year's teams finished, creating even greater anticipation for this year's face-off as institutions like Carnegie Mellon and Caltech refined their vehicles. Stanford Racing Team's entry Stanley, the first of five vehicles to complete this year's 132-mile course with a time of 6:53:08, captured the prize. ■

Ruzena Bajcsy (far right), inaugural director of the Center for Information Technology Research in the Interest of Society (CITRIS), was joined by (from left) Berkeley Chancellor Robert Birgeneau and Dean Richard Newton at a gala farewell to mark her departure from the directorship after more than three years. UC President Robert Dynes and more than 100 well-wishers attended the festivities last June in Hearst Memorial Mining Building. Bajcsy's leadership, speakers said, established the institute as an important UC platform for researchers in overlapping disciplines working on innovative technologies to address large-scale challenges in areas such as energy, security, and health care. Bajcsy, an expert in machine perception, robotics, and artificial intelligence, will return to Berkeley's EECS faculty.

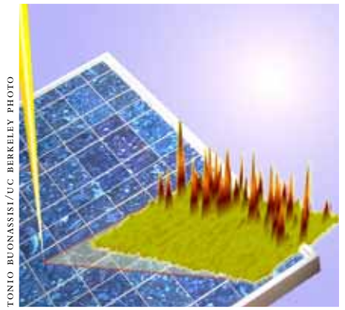
AARON WALBURG PHOTO

INNOVATIONS

Cutting-edge research from Berkeley Engineering

Innovations features brief updates on the pioneering research done by Berkeley Engineering faculty and students. See more at ***www.coe.berkeley.edu/newsroom.***

"Dirty" silicon could reduce cost of making solar cells



TONIO BUONASSISI/UC BERKELEY PHOTO

Artist's impression of a beam of intense radiation (from upper left) striking a solar cell and imaging a cluster of iron impurities in the silicon.

An inexpensive new technique that rearranges rather than eliminates metal defects in low-grade silicon could reduce the cost of manufacturing solar cells, says a Berkeley-led team of engineers in the August 14 issue of *Nature Materials.*

Most solar, or photovoltaic, cells use a highly refined form of silicon, the same expensive material used to make integrated circuits. A cheaper form of silicon is available, but it is laden with metal impurities and performs poorly in photovoltaic cells. Techniques to remove the impurities are prohibitively expensive.

The researchers first analyzed how the impurities responded to alterations in processing techniques. They found that slowing down the cooling rate during manufacturing caused the impurities to group in clusters rather than in a scattered distribution, improving performance by a factor of four.

The researchers, including principal investigator and MSE professor Eicke Weber and Applied Science and Technology graduate student Tonio Buonassisi, believe that other simple alterations in manufacturing could enhance the efficiency of dirty silicon and drive down the cost of making solar cells. ■

When is a needle not a needle?

Three Berkeley bioengineering undergrads are developing a new MicroJet injector to facilitate needleless drug delivery and reduce the pain, the potential for contamination, and the disposal problems associated with hypodermic needles.

The device uses a tiny piezoelectric actuator, which expands or contracts in response to an applied voltage, to propel liquids at speeds of 140 meters per second, about 315 miles per hour, through a patient's skin. Unlike similar devices now in use that operate with compressed air or mechanical springs, the MicroJet's electrical power source gives it greater control over delivery volume and speed, useful in tailoring injections to children and adults as well as to different areas of the body.

"The diameter of the nozzle is only 70 micrometers, nearly three times smaller than the thinnest conventional hypodermic needles," says Marcio von Muhlen, one of the students doing research under the guidance of BioE assistant professor Dan Fletcher. The other students include Laleh Jalilian and Menzies Chen (B.S.'04 BioE). ■

MARCIO VON MUHLEN PHOTO, UC BERKELEY

The MicroJet won't entirely replace the hypodermic needle (foreground), but its comparative precision could facilitate its use in microsurgery and in delivering arthritis drugs into joint areas too shallow for a needle to penetrate.

IMAGE COURTESY OF UC BERKELEY

The word NANO, recorded onto an organic polymer, appears sharper in the image created with the silver superlens (top) than that created with a conventional lens (bottom). The scale bar in both images represents 2 micrometers.

Superlens first to achieve nanoscale optical imaging

Berkeley engineers have developed a silver "superlens" used in conjunction with ultraviolet light to capture images at a higher resolution than ever before possible.

The research could lead to such advances as optical microscopes capable of capturing never-before-seen biomedical details in real time, like individual protein movements within a living cell, which could help in the development of new drugs.

"The field of optics is involved in much of today's technology, including imaging and photolithography, which is used to make semiconductors and integrated circuits," says ME professor Xiang Zhang, principal investigator of the study.

Beyond imaging, the work has longer-term implications for higher density electronic circuitry and faster fiber optic communications, such as a computer processor that could quickly search through the entire Library of Congress or other huge volume of data.

For more details, go to **www.berkeley.edu/news/media/releases/2005/04/21_superlens.shtml.** ■

Berkeley part of new e-voting research center

PEG SKORPINSKI PHOTO

EECS professor David Wagner is co-principal investigator of the new NSF-funded e-voting research center.

UC Berkeley will work with five institutions nationwide in the first large research effort to improve the reliability of electronic voting technology.

A new interdisciplinary center at Johns Hopkins University—A Center for Correct, Usable, Reliable, Auditable, and Transparent Elections (ACCURATE)—will bring together experts in computer science, law, and usability to address existing problems, such as lack of voter-verified paper trails, and explore new advances for computerized voting systems.

The announcement comes as growing numbers of election officials eye e-voting as an alternative to hanging chads and other outdated balloting methods. The percentage of U.S. voters using electronic voting equipment jumped from 13 percent in 2000 to 29 percent in 2004, according to Election Data Services.

"Many of today's e-voting systems were rushed into production in response to the pressure to replace punched-card balloting after the controversial 2000 presidential election," says Berkeley EECS professor David Wagner, co-principal investigator of the new center. "It was done before the research community was able to lay the groundwork to ensure that these electronic systems wouldn't replace old problems with new ones."

Funding of $7.5 million over five years will come from the National Science Foundation; Berkeley is expected to receive about $1.3 million. Other participants include Rice University, Stanford, the University of Iowa, and SRI International. ■

New program gives Taiwanese students a taste of Berkeley

PEG SKORPINSKI PHOTO

Taiwanese undergraduates visiting Berkeley from National Chiao-Tung University were all ears at an orientation conducted by Lisa Pruitt (right), ME professor and associate dean of virtual learning and outreach education.

This fall 14 undergraduates from one of Taiwan's top science and technology universities will spend the semester soaking up Berkeley's special ambience and some of its EECS course offerings through a fledgling program intended to boost education through global cooperation.

The visitors—all honors students in the equivalent of their junior year—hail from National Chiao-Tung University (NCTU) in Hsinchu and are visiting as "out-of-state" University Extension students through concurrent enrollment. When they return to NCTU at the end of the semester, they will have some solid Berkeley Engineering education and a positive cultural experience under their belts.

The arrangement is the first step in what is envisioned as a comprehensive program with a handful of world-class technical engineering and computer science universities in the Pacific Rim and India.

"This exchange will benefit Berkeley by further strengthening our reputation globally and by attracting the attention of top graduate students," says Engineering Dean Richard Newton. "If the program is as successful as we believe it will be, future options include working together with universities at the graduate level and expanding our research relationships with international corporations."

The program is funded by corporate and private supporters of NCTU, whose leaders hope it will have the long-term effect of advancing higher education efforts and institutions in their country. ■

PEG SKORPINSKI PHOTO

EECS professor **LEON CHUA**, known as the father of nonlinear circuit theory and cellular neural networks (CNN), is the first recipient of the Gustav Robert Kirchhoff Award of the Institute of Electrical and Electronics Engineers (IEEE). Chua was recognized for his outstanding contributions in the field of electronic circuits and systems, especially the CNN, a new architectural framework for nanoscale electronics and bio-inspired electronic and photonic systems. He is ranked by the Institute of Scientific Information as one of the top 15 cited authors in all branches of engineering from 1991 to 2001. A graduate of MIT and the University of Illinois at Urbana-Champaign, Chua joined Berkeley's faculty in 1970.

Berkeley and College of Engineering shine in rankings

Berkeley continues to rank in the upper echelon of universities by both national and international standards, according to the latest round of annual university rankings, with engineering programs on undergraduate and graduate levels taking high honors.

The "America's Best Colleges" issue of *U.S. News & World Report* again ranks Berkeley the top U.S. public university and number 20 among all universities nationally. Shanghai Jiao Tong University puts Berkeley overall in fourth place in the world again this year, behind Harvard, Cambridge, and Stanford, in its annual list of the world's top 500 universities.

In the *U.S. News* rankings, the College of Engineering's undergraduate programs moved up one notch to number two, tying with Stanford, from third place last year. All of Berkeley Engineering's individual programs were ranked fourth or better nationally except for its newest department, bioengineering, which was established in 1998 and was ranked 13th, up from 16th last year. Graduate engineering programs were ranked third overall in a separate list published last spring.

Princeton Review, which selects its list of the best 361 American colleges based on student surveys, cites Berkeley as one of the "best in the west" for its library and its blending of academics with community service. Princeton's ranking system avoids a single ranked list, emphasizing that "no school is best for all students." ■

Fall ushers in a new crop of engineers

RACHEL JACKSON PHOTO

New arrivals turned out in force at the College of Engineering's new student orientation August 24.

On August 22, Berkeley Engineering welcomed to campus its largest class since 1988, with 588 entering freshman and 186 junior transfers, 20 percent of them women. These budding engineers, representing more than six countries and 14 states, are the cream of the crop. Here are a few of their vital statistics:

Freshman admit rate	24%
Junior transfer admit rate	22%
Average freshman SAT I score	1400
Average freshman Math II score	745
Average weighted freshman GPA	4.35
Average junior transfer GPA	3.73

PEG SKORPINSKI PHOTO

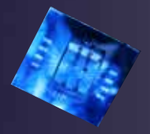
Hearst Memorial Mining Building's Betty & Gordon Moore Lobby was transformed into a little galaxy by J. Ignacio Diaz de Rabago, UC Berkeley Arts Research Center's 2005–06 artist in residence. The Spanish-born sculptor and painter, whose award-winning work has been exhibited extensively in Europe, is known for his large-scale installations in public spaces. For the Hearst exhibit, entitled "Round Room," he used white foam balls and transparent line to create the floating effect. It was one of two installations he did at Berkeley, his first projects in the U.S.

UC tops universities in developing patents

The University of California leads the nation's universities in developing new patents for the 11th consecutive year, the U.S. Patent and Trademark Office reports. UC recorded a total of 424 patents in 2004, followed by Caltech with 139 and MIT with 127. Of patents awarded at Berkeley, 46 percent originated with engineering faculty.

Education and research activity throughout the UC system has been crucial to California's economic growth and global competitiveness, especially in the key industries of biotechnology, telecommunications, information technology, and electronics manufacturing. More than 300 R&D-intensive firms in California were founded by UC engineers and scientists, including one in three of the state's biotech firms and one in six of its information technology firms.

UC's invention portfolio consists of more than 6,600 active inventions. In 2003–04, total licensing revenue (income received from UC agreements with industry) was $93.2 million, a portion of which is reinvested in research and education on UC campuses. ■



Nanocytometer's Star Is Rising

LYDIA SOHN'S ELEGANTLY SIMPLE PORE-ON-A-CHIP SEEKS OUT HIDDEN CANCER CELLS

BY JOHN ALDERMAN | PHOTOS BY NICK LAMMERS

Cancer patients, more often than not, learn to tolerate an overdose of challenges and indignities, not to mention fear and heartache, as they manage their long treatment regimens. High on the challenge list are the necessary but endless lab tests, then the interminably long, tense days waiting for results. Has the cancer metastasized, and if it has, where has it migrated, and can those cells be isolated and destroyed? Locating rare, circulating cancer cells hiding in sites distant from a tumor is still a medical impossibility.

But in mechanical engineering professor Lydia Sohn's Nano-Biology Lab, where she says, "biology meets solid-state electronics," an interdisciplinary team is fabricating a remarkably accurate, next-generation analytical device that could enable early detection of rare, isolated cancer cells where a relapse has occurred. This thumb-sized pore-on-a-chip, called a nanocytometer, could boost a patient's chances of surviving leukemia, prostate, or breast cancer—particularly where the cancer has recurred—by locating and separating isolated metastasized cancer cells. And it could bolt into the marketplace within five years.

"The nanocytometer lets us work at the intersection of a number of disciplines from biology and mechanical engineering to solid-state physics and chemical engineering," says Sohn, who taught physics at Princeton before joining Berkeley's faculty two years ago. Sohn relishes creative leaps between fields. "I'm drawn to interdisciplinary sciences because it keeps everything fresh and pushes breakthroughs in surprising ways," she says. "Mechanical engineering, in the form of micro- or nano-electro-mechanical systems, or MEMS/NEMS, allows us to design and fabricate the nanocytometer, while physics and chemical engineering provide the tools to solve and resolve problems and nuances in design and implementation. But biology is the umbrella under which they all fall. It's inherently nano, and a model for all things nano, because of numerous biological interactions that happen at the very most minimal levels inside the cell."

It was at Princeton that Sohn and her former physics graduate student Omar Saleh began developing tools for the relatively new and emerging field of biosensing—a fertile area to explore, particularly with the increased demand for biosensitive detection in medicine as well as bioterrorism. Biosensing inspired Sohn to make a transition from solid-state electronic devices to biology.

Delving deeper into the new field, Sohn became interested in nanopores—artificial pores that mimic nature's very own pores. The latter are tiny filters in the cell that play protective judge

and jury, monitoring which substances get the green light to pass through them. Made of silicone rubber, the artificial nanopores are also tiny filters that can be used for the identification of single molecules. Because of that, says Sohn, they need to be only slightly larger than those molecules themselves. "We became interested in pores because they have exquisite single-molecule sensitivity and specificity, leading us to ask what we could learn or copy from nature," says Sohn. "There were no artificial sensors out there that could do the same job."

Andrea Carbonaro, a 27-year-old Italian graduate student and key member of Sohn's team, has spent the last two years in Sohn's lab designing and fabricating the nanocytometer. "Andrea took the idea of using chips with pores and ran with it," says Sohn. "He advanced the earlier designs that were based on previous designs Omar and I had worked on."

Sohn and Carbonaro soon realized, however, that although these tiny pores were worthy of the "gee whiz" level of admiration scientists long for, there were significant results that could be achieved with slightly larger pores, and these would be much easier to produce. Combining their nanopores with the power of nanoelectronics—the very same electronics used to measure the electrical properties of quantum dots and carbon nanotubes—they created a "pore-on-a-chip" to filter and analyze proteins at the cellular level.

The device Carbonaro has been working on for the past two years relies on a fabrication process similar to the one used to make an integrated circuit. The nanocytometer is made of a single, tiny artificial pore whose dimensions are commensurate with a biological cell. The pore is connected to two reservoirs, and an electrolyte solution flows through the pore.

Next to the pore are platinum electrodes that measure the current across the pore. Whenever a particle of nonconductive material goes through, there is a change in the current related to the size of that particle. Knowing the dimension of the pore, you also know the dimension of the particle.

The device also takes advantage of the natural attraction that some cells have to specific antibodies and separates cells based on this attraction. Carbonaro modified the device so that these specific antibodies are incorporated into the pore, and those cells passing through that have the matching proteins slow down in the pore. The device can detect these slow cells and separate them from the rest of the cells being interrogated.

While the nanocytometer's uses are multiple, its form is singularly consistent. "What's striking is its elegant simplicity," says Sohn, who with Carbonaro is particularly eager to push engineering across discipline boundaries to accelerate therapeutic and research technologies in biology and medicine. For this, Sohn turned to close friend and physician-scientist Dr. Lucy Godley, whom Sohn has known for 21 years. The two met at breakfast on their first day at Harvard and, as Sohn says, never missed a breakfast together in their four years as undergraduates.

It was Godley, a hematologist-oncologist specializing in blood-borne cancers at the University of Chicago Medical School, who first mentioned to Sohn the need for something like the nanocytometer in medical research and practice. Over the course of their careers, the two had often talked of collaborating, but nothing had ever materialized. Then, at Berkeley's Chez Panisse restaurant last year, spontaneously celebrating the 20th anniversary of their friendship over "fish, pasta, and lots of chocolate," the two friends talked in detail about Sohn's device.

"PORES LED US TO ASK OURSELVES WHAT WE COULD LEARN OR COPY FROM NATURE."

Godley saw the breakthroughs that the small device could offer her field of cancer detection and treatment. "If we could isolate these cancer cells, we could study them and potentially learn what makes them spread, and it's that which often kills people," she remembered thinking. "Right now, we can only detect large groups of cancer cells that have grown in a site away from the primary cancer—metastases— which are groups of thousands of cells. But isolating individual cells that have the capacity to lodge elsewhere would be a real advance, because it might tell us who is at risk for developing a life-threatening metastasis."

As the friends lingered over lunch, it became obvious that Sohn's pore-on-a-chip could replace the machine now used in most major hospitals to sort and isolate cancer cells. That sophisticated diagnostic tool is a Flow-Activated Cell Sorter, better known as a FACS machine. It's as big as a hefty desk and incredibly pricey, and while the FACS has provided remarkable breakthroughs in cancer diagnoses and is considered state-of-the-art machinery, its drawbacks are significant.

Among the drawbacks, explains Godley, is that it requires a large volume of cells (i.e., lots of blood), and those cells must be tagged with a dye to identify specific antibodies or proteins. The procedure is costly and damages the cells it identifies. "Lydia's new device involves only a small volume of blood and unlabeled cells," she says. "The small volume of blood needed, as well as the unit's size, could have tangible results when it comes to life-threatening diseases. Ultimately we could prick a patient's finger in the clinic or at home and decide if the patient is in remission or not, much the way a diabetic has blood sugar tested," Godley continues. "Right now, patients have to undergo painful bone marrow biopsies, and this technology could limit the frequency of those tests."

Sohn and Carbonaro form the core of a multidisciplinary team that is aligning the already converging worlds of biology and nanoscale mechanical engineering. "The data look really great now," says the effervescent Sohn, who holds a joint staff appointment in the Physical Biosciences Division at LBNL.

The immediate advantage of replacement would be cost and size. When mass-produced using lithography, like transistors on silicon chips, a nanocytometer costs less than a nickel to make, and fits lightly between two fingers. "Our system is a very cheap one, and also very simple," says Sohn. "Physicians will be able to use it once at the patient's bedside, and then toss it."

Beyond the price and ease are crucial scientific implications: By identifying and collecting cells without changing or damaging them, researchers could easily harvest and use the collected rare cells for growth and research. Godley also believes Sohn's nanocytometer could be useful in isolating rare stem cells.

Sohn's device is very impressive, says Godley, who actually gave the device its name, godmother style. "When it comes to patients with solid tumors," says Godley, "those circulating cancer cells are extremely rare. There may only be five or ten cells in the entire body." This is where the FACS fails, she continues, because its statistical error rate is too high. Yet finding those cells is key, for early detection as well as monitoring patients, to see if their cancer is responding to treatment. "Because the FACS is one of the most widely used machines in my field, the applications

Mechanical engineering student Carbonaro immersed himself in biology for this project. His goal: to master the intricacies of the FACS to understand the machine well enough to replicate or improve upon each of its functions in his newly minted nanocytometer.

for Lydia's device were obvious," Godley recalls. From that lunch onward, Godley became an integral member of Sohn's team.

Godley's presence on the team and her medical specialty in blood-borne cancers made it easy to target leukemia cell detection as the first function implemented. But the team has also been working closely with Professor Marc Shuman, who presides over UCSF's prostate cancer research center. In the long-term lineup of targeted diseases, prostate and breast cancer come next for the nanocytometer and the team.

Linking up with Shuman was the result of discussions between Berkeley and UCSF seeking ways that the two institutions could collaborate in the future. In particular, both Berkeley and UCSF were interested in nano-applications in cancer research. Sohn leads the project on cell separation and propagation and is part of the full group's bid for a million-dollar National Cancer Institute grant for nanotechnology in cancer research.

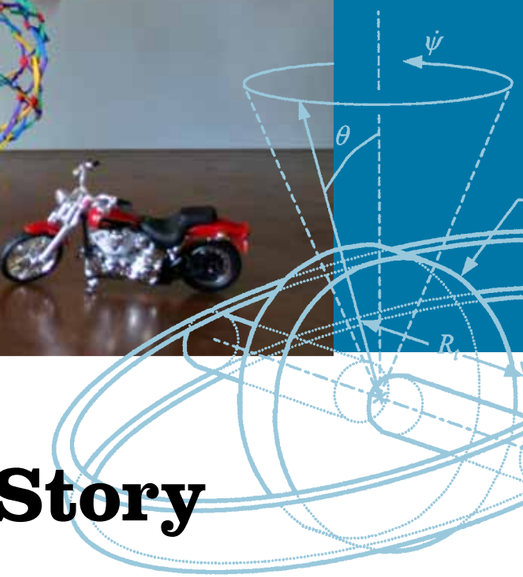
For patients, researchers, and Sohn's team, the stakes are high. Sohn has responded with a smart orchestration of resources and outside help. She's drawing input from other scientists as well as making use of several key consortiums and the new Berkeley Center for Entrepreneurship and Technology (CET), whose director Ikhlaq Sidhu and a group of entrepreneurial advisors heard Sohn's research presentation last spring.

With a patent already filed, the question for Sohn became whether to license the nanocytometer to an established company or form her own startup, the direction she now seems to be headed. "We would like to start something ourselves," she says. "There's something unique about the Berkeley culture." "People are passionate about what they do, so they will set aside the usual reluctance, whether social or departmental, to get their research done and open up new avenues of exploration."

Slated for December is a working prototype for isolating and sorting leukemia cells. The hope is that within three years, Sohn will be able to do the same with breast and prostate cancer cells.

By actively cultivating collaboration with friends, medical researchers, and other scientists, Sohn has taken her research in unexpected directions. "With a great biologist like Lucy Godley at your side to lead you, you can approach these problems unafraid," she says. In this particular case, one of the unique dividends of friendship and shared expertise could be saving lives. ■

JOHN ALDERMAN is a San Francisco–based writer whose work has appeared in *The Guardian, Japan Inc.,* and *Wired,* among others. His book *Sonic Boom* was a *New York Times* Notable Book in 2002. He is currently writing a photo book of computer history.



O'Reilly's Toy Story

Mechanical engineer turns playthings into instruments of higher learning

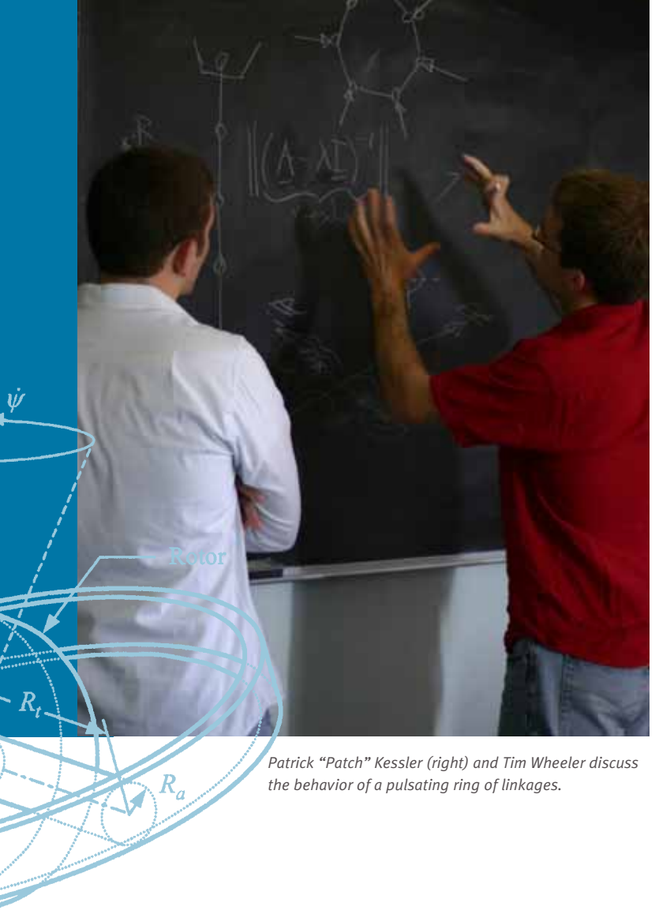
BY MARK FRAUENFELDER | PHOTOS BY AARON WALBURG

What is it about colorful spinning tops, kinetic sculptures, model motorcycles, even a penny rolling across a tabletop that makes a professor's heart thump and deepens his students' grasp of core engineering principles? Why toys, of course.

"Toys may seem simple, but looking at the principles of physics that govern how they behave can lead to deep insights and the unraveling of scientifically intriguing historical threads," says mechanical engineering professor Oliver O'Reilly. "I see toys as a pathway to understanding science. They're a way to develop an appreciation for mathematical methods and mathematical models. The fact that these toys have such a variety of interesting mechanics is extraordinary."

The table opposite O'Reilly's desk is loaded with what appears to be booty from a shopping spree at Toys "Я" Us. O'Reilly reaches for a clear plastic sphere about the size of a tennis ball, called a Dynabee. It has a smaller, green-colored ball inside that can freely spin inside its plastic enclosure, like a globe in a stand. He takes a length of string, winds it around a groove in the green ball, and gives it a yank, just as you would power up a lawn mower. Holding the sphere in one hand, O'Reilly slowly rotates his wrist. The smaller green ball starts spinning faster. In a matter of seconds, the green ball is a humming blur.

O'Reilly's students become intimately familiar with this sound, because their assignment is to develop a mathematical model to explain how the energy from their wrist movement is translated to the green ball. O'Reilly says most of them have no



Patrick "Patch" Kessler (right) and Tim Wheeler discuss the behavior of a pulsating ring of linkages.

idea how to begin to attack the problem. "It's almost a quantum leap beyond their understanding of dynamics," he says.

O'Reilly hands over the Dynabee, sold as a wrist exerciser for about $20, so others can feel what's happening. It exerts a force on your hand that you counteract by moving your wrist in the opposite direction. "They are feeding energy into the system," says O'Reilly. What's intriguing, he says, is that the green sphere is rotating much faster than their wrists are.

"The faster it spins, the easier it is to keep rolling—it's more stable," says O'Reilly. This phenomenon, in which speed is proportional to stability, can be found in satellites orbiting the earth. "Certain satellites are 'spin-stabilized,'" he says. "You get what's called resonance capture."

With a pleasing brogue, an easy smile, and a love for mechanics that borders on the infectious, Irish-born O'Reilly discovered the value of toys as teaching tools while a graduate student at Cornell University in the late 1980s. It was there that he met Frank Moon, a mechanical engineering professor. "He was very much into demonstration experiments," says O'Reilly. "He had an enthusiasm for toys and helped foster a culture of looking at toys and developing mathematical models for toys."

O'Reilly swivels round in his chair to grab a shiny disk sitting on top of a round mirror the size of a dinner plate. He picks up the disk, which resembles a chrome-plated hockey puck, and gives it a gentle spin on the mirror. For the next 60 seconds, the disk "spolls" (spins and rolls) on the slightly concave surface of the mirror, whirring as it goes. It looks like it'll never stop, until suddenly it begins tilting downward and spinning faster. The frequency of the whir increases rapidly and then—clink! It comes to a dead stop.

The physics describing the motion of the disk—which is sold as a science toy called Euler's Disk—turns out to be very complex. O'Reilly and one of his graduate students, Patrick "Patch" Kessler, wrote a lengthy paper describing their analysis of the toy. They believe, but are not certain, that the "clink" sound at the very end occurs because the disk loses all contact with the mirror the instant before it stops spinning and drops flat on the mirror.

The amount of work O'Reilly and his students have put into analyzing Euler's Disk is beginning to pay off. O'Reilly recently looked into the problem of squeaking brakes. He found similarities between the way Euler's Disk makes noise as it spolls and the way brakes squeak when the calipers pinch the rotating disk. "Sound doesn't cost that much energy," explains O'Reilly. Just as a tiny fraction of the energy in a spolling disk is lost via sound, a minuscule amount of the energy in a braking car is converted into a squeal. Despite O'Reilly's knowledge of the subject, he says his own car's brakes produce a nasty sound.

O'Reilly and Kessler's interest in vehicles extends beyond brakes. They have developed a clever motorcycle navigation system for BMW using a whirling pendulum to supplement a gyro sensor. And recently, one of O'Reilly's students told him about an impressive one-wheeled vehicle invented by a relative's father, the late Charles F. Taylor, a self-taught engineer from Colorado.

Taylor designed his all-terrain mono-wheel vehicles in the pre-microprocessor 1950s and 1960s, so the feedback systems were all mechanically based, a feat O'Reilly marvels at. "The number of mechanisms he came up with to get this thing to work in harmony—it's just mind boggling!" he says. A team of students, including Tim Wheeler and Bernice Yen, are studying Taylor's ingenious use of gyroscopes for steering and stability.

Taylor's work comes to life when O'Reilly pops a DVD into his laptop computer and a scratchy black-and-white 8-mm film starts playing. It's Taylor and his vehicle in action. "It truly is a remarkable sight to see this bizarre looking one-wheeled contraption zipping down a deserted prairie highway, tilting and slaloming in response to turns of the steering wheel. You might suspect trick photography was involved had you not been told otherwise," says O'Reilly.

When the film ends, O'Reilly picks up a multicolored plastic globe that looks vaguely like a geodesic Buckminster Fuller Sphere. But this toy, called a Hoberman Sphere, is collapsible, and has become a source of fascination for O'Reilly, who studies theories of deformable bodies. O'Reilly's wife gave him a Hoberman Sphere for Christmas. "It was on the mantelpiece in our house when one of my former students, Tom Nordenholz, walked in and said, 'That's an example of a pseudo-rigid body.' I thought about it, and said, 'Oh my God, you're right! It's an expandable sphere—a homogeneous deforming body.'"

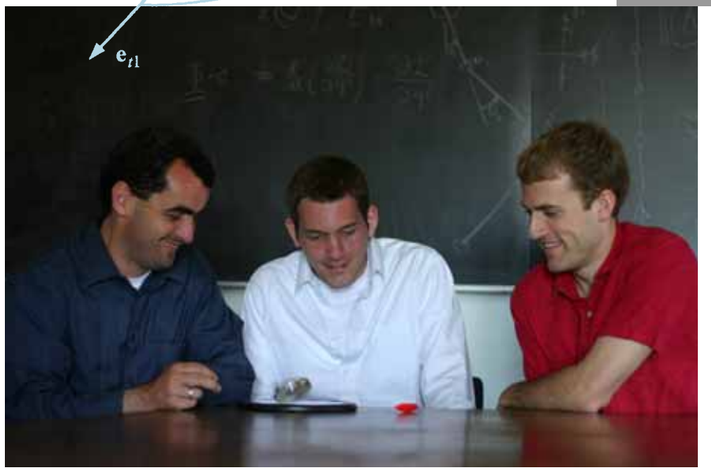
It also turned out to be an excellent instructional aid. O'Reilly wanted to teach his students how to calculate three-dimensional rotation using quaternion multiplication. (As the name implies, a quaternion consists of four numbers: w, x, y, and z.) Quaternion multiplication is commonly used in navigation schemes for satellites and in computer graphics applications, but O'Reilly couldn't think of a good way to introduce the method. He saw the Hoberman Sphere on his desk and thought, "That's it! The four numbers determine the orientation and expansion of the Hoberman Sphere!" Much to his surprise, O'Reilly later found that the sphere's motion was discussed in an 1820s paper by the famous mathematician Gauss. Now O'Reilly's students are as much fans of the sphere as their instructor.

Always on the lookout for toys that possess some quality that makes them special to a mechanical engineer, O'Reilly finds the search a great excuse to take his three-year-old daughter to toy stores. "A really good toy doesn't come up that often," he says. "It's pretty rare. At first, you're totally stumped by it, and then you slowly start to figure it out. You discover the essence of the toy. You unravel the puzzle. And that's really a great feeling." ■

Mark Frauenfelder is a writer and illustrator in Los Angeles. Founder of *Boing Boing.net*, and editor-in-chief of *MAKE* magazine, he also wrote *Mad Professor: Concoct Extremely Weird Science Experiments; The World's Worst: A Guide to the Most Disgusting, Hideous, Inept and Dangerous, People, Places and Things on Earth;* and *The Computer, a Visual History.*

PHOTO COURTESY OF TAYLOR'S DAUGHTER MARY ANNE URRY

The one-wheeled vehicle, patented by Charles F. Taylor in 1964, used gyroscopes for steering and stability—all before computers were there to assist. Taylor is seen here in 1965, driving the prototype of his vehicle near Golden, Colorado. Go to ***www.me.berkeley.edu/one_wheel_vehicle/*** *to download the movie of Taylor and his vehicle.*



"Toys seem to make things more interesting for students," says O'Reilly (left), with graduate students Tim Wheeler (center) and Patch Kessler and their "spolling" Euler's Disk. O'Reilly teaches a graduate seminar on rotation and occasionally a freshman seminar on special effects in the movies.

The Wizard Who's Woz

BY DAVID PESCOVITZ

Buck's of Woodside is an unassuming diner in the Silicon Valley known for its kitschy decor and first-rate flapjacks. For computer industry insiders, it's also legendary as schmooze central for the Valley's venture capital community. Buck's is the place where Netscape was hatched, PayPal got funded, and countless other dot-coms were seeded. Twenty years ago in a Los Altos garage not far from Buck's, Steve Wozniak, now a Silicon Valley icon, and Steve Jobs, who today is CEO of Apple and Pixar, were burning the midnight solder, building the Apple I.

Woz, as his friends call him, was born in 1950, the son of a Lockheed engineer. Growing up in San Jose, he was a talented tinkerer, earning his Ham Radio license in sixth grade and designing his first computer at age 13. It played Tic-Tac-Toe.

He spent his college years at the University of Colorado, De Anza College, and finally, Berkeley's Department of Electrical Engineering and Computer Sciences. To afford his electronics habit on a student budget, Wozniak and his friend Steve Jobs sold "blue boxes," illegal devices that enabled anyone to make free long-distance calls. In 1976, Woz dropped out of Berkeley to return to the South Bay, landing a job designing calculator chips for Hewlett-Packard. On the side he wrote arcade game software for Atari, where Jobs worked.

In his off hours, Wozniak hung out with the Homebrew Computer Club, a legendary geek gathering founded in 1975 by hacker hobbyists in Palo Alto. They mainly exchanged tips and tricks for the first personal computer kit, the Altair 8000. Woz and Jobs couldn't afford an Altair, so in 1976 they built their own personal computer. Because Jobs once worked in an orchard, they dubbed their machine the Apple I. It made a big splash at the Homebrew Computer Club, and Jobs was able to score a bonanza $50,000 order from a Mountain View computer store called The Byte Shop. Wozniak's father kindly removed his car restoration tools from the family garage, and production began on the Apple I. The next year, Woz introduced the faster Apple II, complete with color graphics, and quit his job at HP. Then in 1980, Apple Computer hit Wall Street, garnering the largest IPO since Ford Motor Company went public.

After recovering from a private plane crash in 1981, Wozniak took a hiatus from Apple. During that time, he orchestrated the US Festivals, celebrations of rock music, culture, and technology. By 1985, he and Apple had parted ways entirely, and Woz returned to Berkeley to finish his senior undergraduate year, graduating in May 1986.

He spent much of the 1980s and 1990s as a full-time philanthropist, aiding the renewal of downtown San Jose through donations to the city's ballet and Children's Discovery Museum, even teaching in the school district of Los Gatos where he currently lives. These days, his mind is incubating another new digital technology that could, yet again, cut a swath of change in our daily lives.

Q: Legend has it that the name on your 1986 Berkeley diploma is not Steve Wozniak.

SW: I asked that the name on the diploma be Rocky Raccoon Clark. Clark was my wife's maiden name and she went to Berkeley. When I went back to finish my degree, Apple was already well known. I was going to take computer classes and get A-minuses and B-pluses and I didn't want people thinking, "Why didn't Woz get all A-pluses?"

You're quite the prankster.

After my initial year at Berkeley I started the first dial-a-joke in the Bay Area. Back then you couldn't really get an answering machine unless you were a movie theater. Even then, you'd have to lease it from the phone company. So that's what I did. I met my first wife when she called the dial-a-joke line. Usually I'd just turn the machine on, but I happened to answer that time.

social group but I fit in with the people interested in computers. I listened, I talked a bit, I designed stuff, and I showed it off. This was for social reasons, not money. I wanted to share my knowledge and educate others about computers and point out some clever design techniques of my own. So when we did achieve some major success, I had a lot of wealth that I had not pursued.

Initially, your charity was in the form of the technology you invented.

Because I was associated with computers, I responded to requests for donations by sending a lot of computers to people. Sometimes it was to a school that was strapped for resources but that really wanted this new technology. Sometimes it was a person who was in the ruts, and I thought a computer might bring them out of it. I also had a desire to always be good to my schools, so I contributed a lot that way.

That do-it-yourself computer hacker mindset seemed to have faded a bit during the 1980s and 1990s, but it seems to be reemerging.

Before 1975 or 1976, it took huge teams to build computers. Then, there was a short period where one person could design and build things like the Apple. After that though, what you could accomplish was dwarfed by whatever the big companies did with their dollars. When we were growing up, we built little electronic parts and systems like house-to-house intercoms. Then we could tell the other kids at school about it and we stood out as a little special. If you're shy, that kind of thing gives you something to talk about.

In light of the Internet, the proliferation of wireless mobile devices, and the pervasive computing that Wheels of Zeus—a company you founded in 2001 to engineer breakthrough location technologies—is helping introduce, how do you envision the computer landscape of 2020?

When we were in Apple, I could accurately predict what would happen a year out because we were working on it. But if I tried to predict two years out I was usually wrong. Unexpected things would appear and there would be a better way of doing things.

As we move forward, we are developing standards where things work reliably, as expected. But we are also introducing newer, better modes of communication, both wired and wireless. We have so many types of media and modes of computer communication today. That often means that, when you are pushing the state of the art and pushing the future, things don't always work well together. We can demonstrate things working in ways that simplify our lives, but change one parameter or device and it's a frustrating effort to get things working. I don't see that changing, ever.

Will the number of media types and communication methods settle down to a few accepted ones by 2020? In my opinion, like the end of Moore's law, someday this is likely. Remember that we grew up with about four types of media—33 RPM, 78 RPM, 35-mm film, and 120-mm film. And they always worked. Since then we've had a real proliferation: CDs, laserdiscs, a host of magneto-optical media, floppies and HDs of various sizes, flash RAMs, SmartMedia, Compact Flash, memory sticks, and on and on; not to mention various tape media. There's no end and no single standard that people use.

The best thing for 2020 would be if all this settles out, but that would almost require us to not have many extremely good things to create. See the problem? You can't even hope for it, really, and you certainly can't predict it.

Apple has an amazingly dedicated and vocal community of users. Some even refer to the "Cult of Macintosh," and they're only half joking. Beyond the technology, what is it about Apple that fuels such passion?

The main reason is that Steve and I started from nothing but had good motivations about how we could change the world positively. That still comes out today. Some people are so endeared to it that it's almost as gripping as a religion. I honestly believe that it's about "thinking differently." People who don't want to go along with the masses have a place in the world with Apple. ■

David Pescovitz writes *Lab Notes*, the College's award-winning online research digest, and is coeditor of the popular blog *Boing Boing.net*. He also writes *ScienceMatters@Berkeley*, an online publication of the College of Letters and Sciences and College of Chemistry, and has been featured in *Wired, Scientific American, IEEE Spectrum,* and the *New York Times.*

"Pranks are just a creative form of logic."


1975


1986


1993


1993


2005

1975 Steve Wozniak (right) and Steve Jobs test their home-built Apple I. *1986* At a reception following his Berkeley graduation, Woz, who graduated as "Rocky Raccoon Clark" at the age of 35, caught a cream pie in his face. Already well known as Apple Computer's cofounder, he delivered his class's commencement speech. *1993* President George Bush presents Wozniak with the prestigious National Science and Technology Medal. *1993* With son Jesse and Poland's President Lech Walesa.
1975 PHOTO BY MARGARET WOZNIAK; OTHER PHOTOS COURTESY DAN SOKOL.

2005 Like the Pied Piper with his dogs (from left, Zeus, Z, and Bennie) and Segway scooter, Wozniak routinely transports two or three of the $5,000 scooters in the back of his car for teammates to use at his weekly Segway Polo match.
BART NAGEL PHOTO

I said, "I bet I can hang up faster than you," and hung up. But she called back and we talked. I've always been extremely involved in pranking. Some of my pranks are so complicated that they take days, even months, to work out. I think humor is a creative act. Pranks are just a creative form of logic. My iPod is filled with comedy as well as songs.

In 1982 and 1983, you orchestrated the US Festivals. Do you still go to live music concerts?

Absolutely. I was one of the founders of the Shoreline Amphitheatre with Bill Graham and I have been to almost every concert since it opened in 1986.

I know that philanthropy is also a big part of your life. What drove you to give away so much of your personal wealth?

I had always envisioned a life with a reasonable engineer's income, a lifestyle similar to that in which I grew up. I had never developed lofty goals of wealth or possessions. I didn't think I'd have enough money to take a vacation in Hawaii or to even own a home. I had grown up shy and didn't have a

In the 1990s, you became even more involved in schools by actually teaching on a regular basis.

I taught computers for eight years—young kids, elementary school, middle school, high school, and even teachers. I taught up to seven days a week. I wrote all my own material. I enjoyed it very much. I basically sponsored the full cost of everything, but it was so much fun and really worthwhile.

In many ways, you're a role model to hackers everywhere. And of course, I mean "hacker" in the original sense, as someone who pushes the capabilities of a technology. Do you miss wielding the soldering iron?

I do. A couple of years ago, I built a Segway [electric scooter used in pedestrian areas, invented by Dean Kamen] key programmer. The speeds you can go are stored in a key, so I made the device so I could program in my own speed. It's just one microprocessor that's basically equivalent to the processor in the Apple II. I still enjoy doing that kind of thing more than anything in the world.

When you and Steve Jobs were creating the first Apple, did you have any idea that you would be helping launch a revolution?

We did talk "big" talk of revolutionizing the world. I never thought that so many people would consider us the source of this change. It was due to technology advances, and various people were going to approach it in many ways. We were just one of those many pursuing the future of computers in every home. The revolution very quickly surpassed what I ever imagined.

Are you pleased with the evolution of the personal computer?

When we started, the focus was on doing as much as possible with as little as possible. Our first products, the Apple I and Apple II, were tools that you could learn to use and write programs to solve your challenges to become more of a master in your life and work. But as the revenues of this new market grew, lots of other people wrote the programs for you. So our users learned to use those programs rather than write their own. Many advances in computers, the GUI [graphical user interfaces] first implemented well by Apple with the Macintosh, were so much more important in giving us the things we appreciate about a computer today.

PEG SKORPINSKI PHOTO

John and Kathleen Dracup's Nob Hill home in San Francisco is full of oil paintings created by Kathleen's maternal grandmother. Hanging behind them is one, a portrait of Kathleen's mother Lucy that dates from the early 1920s.

John and Kathleen Dracup: Supporting the future of UC

For more than four decades, John and Kathleen Dracup have been a part of the University of California, first as graduate students, then as faculty. John (Ph.D.'66 CE) is professor of the graduate school in the Department of Civil and Environmental Engineering at Berkeley, and Kathleen is dean of the School of Nursing at UCSF. Last February, they made a commitment to create an estate plan that will enable them to continue their support of both campuses for years to come.

"We feel very fortunate to be able to make this financial commitment to UC and help future generations benefit, as we have, from this outstanding institution," says John. "Berkeley is just a magical place. The graduate students I work with are the best in the nation."

The son of Scottish immigrants, John grew up in Seattle and got his bachelor's degree at the University of Washington. He earned his master's at MIT before coming to Berkeley in 1962 for his doctorate. Kathleen, who was raised in Santa Monica, earned her B.S. at St. Xavier's University in Chicago and went on to earn a master's at UCLA and a doctorate at UCSF.

During the mid-'60s, John was teaching at UCLA. While visiting one of his students in the hospital, he met the student's nurse, Kathleen, and the two were married 18 months later. That was 33 years ago. They now have five children living in southern California and nine grandchildren.

"We're just delighted with UC," Kathleen says. "We believe in public education, the system's faculty governance model, and its tradition of excellence. All these factors make us want to support future generations."

John and Kathleen may owe their careers to the UC system, but they say it was their savvy investments in California real estate that enabled them to designate $500,000 from their estate to each of their schools. Their gift to UC Berkeley will provide fellowships to graduate students in environmental engineering, while the UCSF gift will establish an endowed chair in the School of Nursing.

"Being a dean," Kathleen says, "I've discovered that, if schools are going to prosper and grow, they must have the support of alumni and faculty." She emphasizes that UC is state *assisted,* not state supported, and that drastic decreases in state funding have made private support even more essential.

"Both John and I were the beneficiaries of scholarships," she adds. "We couldn't have obtained our degrees without them, so we have a tremendous appreciation for the importance of scholarships." ■

BY JENN SHREVE

Planning ahead for giving

Anyone planning retirement may find that making a charitable gift of accumulated assets, real estate, or other property to Berkeley Engineering may not only lighten the income tax load but also generate an attractive rate of income and diversification of assets. Such arrangements can facilitate making a larger gift than would otherwise be possible.

Many alumni in their 70s or older are surprised to discover that they have accumulated estates and retirement plans in excess of what they anticipated. If left outright to heirs, tax burdens as high as 70 percent can eat away at these assets. Designating Berkeley Engineering as a charitable recipient of retirement plan assets can be a tax-wise strategy.

The process—known as planned giving—involves creating a will, trust, annuity, or other fund that will be managed by the Foundation of the University. These arrangements qualify an individual or the estate for a significant tax deduction; in some cases, capital gains taxes may be reduced or even eliminated. The Foundation invests the funds and makes payouts for a specified time period, usually one's lifespan; when these payments end, assets in the trust pass on to the College to be used as specified by the donors.

Appropriate vehicles for planned giving include wills, living trusts, charitable remainder trusts, gift annuities, and pooled income funds. To learn more about any of these planned gift options, contact Jake DeMoe at 510-643-0908 or **demoe@berkeley.edu.** ■

GO TO **WWW.COE.BERKELEY.EDU/ALUMNI** FOR THE LATEST NEWS AND EVENTS OF INTEREST TO BERKELEY ENGINEERING ALUMNI.

CLASS NOTES

Keep in touch by mailing your news and photos to us at Class Notes, College of Engineering Office of Marketing and Communications, 1925 Walnut St. #1704, Berkeley, CA 94720-1704. Or go to **www.coe.berkeley.edu/classnotes** and click on *Submit Your Class Note.*

2000s

ZHONGNING CHEN *(B.S.'03 EECS)* writes, "I am exploring life as a graduate student here in Champaign, Illinois. Among other things, I completed my first marathon last year in Berlin, Germany."
cznworld@hotmail.com

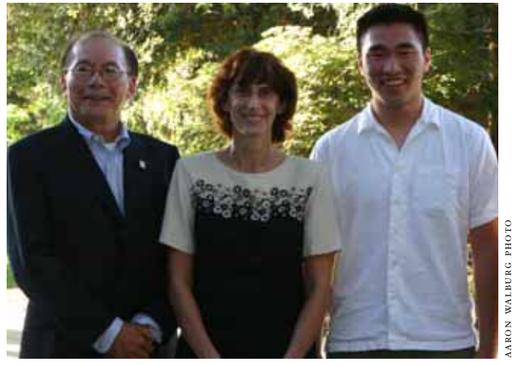
TOBIN FRICKE *(B.S.'03 EECS)* is a graduate student in physics at the University of Rochester in upstate New York. He writes, "Outside school I have started a cooperative housing system **(http://rochester-coop.org/)** modeled after Berkeley's University Students' Cooperative Association."
tobin@pas.rochester.edu

MONIKA (HALIM) JAMIESON *(M.S.'00 ChemE/MSE)* of San Jose is working for Applied Materials in their high-density plasma chemical vapor deposition product group doing product management. She writes, "My fiance Andrew and I got married on July 2 here in San Jose. It was a very lovely ceremony and intimate reception."
hmonika@yahoo.com

JESSICA SATO *(B.S.'04 ME)* of Providence, Rhode Island, is getting a master's degree in industrial design at the Rhode Island School of Design. **jsato@risd.edu**

ALEX SMOLEN *(B.S.'04 EECS)* of Fullerton has just been promoted to security solutions manager at Parasoft, a Southern California software developer. He recently participated in a panel discussion on application security at the Enterprise Architect Summit.

MICHAEL VESTEL *(Ph.D.'02 MSE)* of San Francisco was recently hired as staff scientist at SRI International's Microsensors Program and is helping to build the micro-electro-mechanical systems sensor group through collaborative efforts such as proposal writing and microfabrication research. The Microsensors Program is part of the Micro-Systems Innovation Center in SRI's Physical



AARON WALBERG PHOTO

Zorigt Bazarragchaa (right), inaugural recipient of the Sam Ruvkun EAS Achievement Award, was welcomed to Berkeley his first week of classes by (from left) Richard Chinn (B.S.'61 CE) of the EAS Board of Directors and Associate Dean of Academic Affairs Fiona Doyle.

Alumni Society honors EECS junior with first Ruvkun Award

His name is Zorigt Bazarragchaa (pronounced Zor-EET Ba-za-ROTT-cha). His father, a mechanical engineer and college teacher in Ulaanbaatar, Mongolia, sought political asylum in the U.S. four years ago. So, at age 16, Zorigt moved with his parents to Massachusetts, where he completed his senior year of high school and began studying English. He now speaks the language so well you hardly notice his accent.

"At first it was really hard," he says. "It took me about three or four months to understand what was going on. Now I'm very comfortable with the language."

This fall Bazarragchaa landed at Berkeley Engineering as the inaugural recipient of the Sam Ruvkun Engineering Alumni Society (EAS) Achievement Award. Sponsored by the EAS and named in honor of the late founding EAS president Sam Ruvkun (B.S.'41 CE), the award is administered through The Achievement Award Program (TAAP) of the California Alumni Association. Criteria include extreme financial hardship and demonstrated potential for academic excellence through a history of overcoming challenges and community involvement.

The award will provide two years of support to the Laney College transfer, an EECS junior working toward a research career. One of three children, Zorigt is the last of his siblings to leave the family nest. While settling into his classes, labs, and student housing, he is mindful of his parents, who have limited language skills and are still adjusting to life in the Bay Area.

He is considering specializing in microfabrication but is still investigating all the possibilities Berkeley has to offer. On top of his studies, he likes to wrestle and swim and has been tutoring community college students in math, chemistry, and physics through the Laney College Tutoring Center, an activity he hopes to continue. He will also participate in the EAS mentorship program this year.

"I'm starting to forget my Russian, which I was studying at school in addition to my native Mongolian," he says. "So I'm thinking of joining a Russian club here too."

To make a gift to the Sam Ruvkun Award fund, contact Mark Gladden at 510-643-8361 or **mgladden@berkeley.edu.** ■

Leitmann's Berkeley career nears half-century mark

JOSEF LEITMANN PHOTO

Professor Emeritus George Leitmann (left) receives congratulations from General Louis-Alain Roche after accepting the Croix de Guerre avec Palmes, France's highest military honor, in Paris last June.

Most people would consider their 80th birthday a fine time to relax and stay at home with the grandchildren. But not College icon George Leitmann (Ph.D.'56 Eng Sci). He marked the occasion by traveling to Europe with his wife Nancy to accept another round of accolades for his lifetime of accomplishments.

Now professor emeritus of engineering science and associate dean for international relations, Leitmann celebrated his 80th birthday on May 24. His 48-year Berkeley career has included everything from research and teaching to serving as the first ombudsman in the UC system. His campus awards include a 1991 Berkeley Citation, one of the University's highest honors, and a 2002 Distinguished Engineering Alumni Award.

But he made his mark well before that, on a reconnaissance mission with the U.S. 286th Engineer Combat Battalion during World War II. For his 1945 role in capturing Colmar, in Alsace-Lorraine, he was awarded France's highest military honor, the Croix de Guerre avec Palmes.

"I was barely 19," Leitmann recalls. "I was sent into Colmar to find a way to get in and, after three days of hiding, I guided my unit into the city. They didn't have any medals at the time, so they just gave me a ribbon." On June 1, 2005, the French Ministry of Defense invited Leitmann to Paris to celebrate the 60-year anniversary of the battle and to receive the Croix de Guerre again, this time in the form of a medal.

The Leitmanns also visited Stuttgart, where the 13th Annual International Workshop of Dynamics and Control was dedicated to George. Proceedings included papers on topics related to his research, a banquet in his honor, and presentation of the Werner Heisenberg medal for his "outstanding contributions to international scientific collaboration."

Leitmann claims he's slowing down, that his memory is losing its sharpness, and that his back gives him problems. So he exercises four times every day—with stretching morning and night, cycling mornings, and swimming at midday—to keep fit.

"Everybody's different," he says. "There are people who can lie down on the couch all day and be fine, but I'm a person who needs something definite to do every day. I need structure." ■

Sciences Division. Vestel's areas of interest include gas sensors; microneedle drug delivery systems; acoustic (ultrasonic) wave mass loading sensors for ocean and atmospheric applications; micro-mechanical actuators; microfabrication techniques from nano-, micro-, and meso-scale disciplines; and correlation of materials behavior with microstructure using advanced characterization techniques, including TEM and SEM, optical techniques, X-ray, and electron spectroscopy. **vestel@sri.com**

1990s

JUAN BARROSO *(B.S.'99 CE)* of San Jose writes, "After graduation I relocated to the South Bay and started working as a field engineer for Blach Construction. I was recently promoted to chief estimator, responsible for a yearly estimating volume of more than $200 million. I also oversee our college recruiting program and have attracted several talented Cal civil and environmental engineers to help us grow our company. Go Bears!" **juan.barroso@blach.com**

DYLAN CHIVIAN *(B.S.'94 BioE)* of San Francisco writes, "After a hiatus in the dot-com world, I returned to school and received a Ph.D. in biochemistry in spring 2005 from the University of Washington, where I was working on protein structure prediction. Now I'm back at Berkeley doing a post-doc with Adam Arkin, studying microbial systems." **dylan@lazy8.com**

PETER HSUEH *(B.S.'93 MSE/NE)* of Los Angeles writes, "I'm still working as an attorney in intellectual property, now at Christie, Parker, and Hale. My son was born last December. We're now a family of four!"

RISHI JAIN *(B.S.'96 EECS)* recently received his M.B.A. from Wharton Business School and returned to San Francisco to do turnaround consulting. **rjain@nightingale.biz**

AVINASH KANT *(Ph.D.'97 MSE)* is head of a new research franchise of investment bank Adams Harkness focusing on advanced research and production of cutting-edge materials in such areas as semiconductors, ceramics, chemicals, coatings, and nanomaterials.

DAVID LEVINSON *(Ph.D.'98 CE)* of Minneapolis was promoted and awarded tenure and is now associate professor of civil engineering in urban and regional planning at the University of Minnesota. In January, he was awarded the New Faculty Award of the Council of University Transportation Centers and American Road and Transportation Buildings. He was also granted a National Science Foundation CAREER award. His wife Trinh gave birth to their son Benjamin on October 26, 2004.

EDWARD "BOLIVIA" MONCADA *(B.S.'97 CE)* of Tulsa won first place and $298,070 in the pot-limit hold 'em event #11 of the World Series of Poker international finale at Harrah's Casino in Las Vegas last June. He became a professional poker player after working a few years as a civil engineering project manager.

PETER MULL *(M.Eng.'97 Naval Architecture)* of San Francisco is project manager for the U.S. Army Corps of Engineers, doing ecosystem restoration in San Francisco Bay and coastal areas. **petermull@sbcglobal.net**

GINGER OGLE *(M.S.'95 CS)* of Berkeley maintains the Berkeley Parents Network **(http://parents.berkeley.edu)**, one of the most popular parenting websites in the nation. It started as a mailing list of parents in her department when she was a graduate student and now has 12,000 national subscribers to its weekly email newsletter and other informational and networking services. Now a mother of three, Ogle is a full-time database programmer for Berkeley's Electronics Research Laboratory.

1980s

HAMISH CALDWELL *(M.S.'84 CE)* of Decatur, Georgia, is working as executive director in Cingular Wireless Data Services Business Markets Group.

WEN-RUEY CHANG *(M.S.'83, Ph.D.'86 ME)* of Acton, Massachusetts, was recognized as a fellow by the American Society of Mechanical Engineers for his engineering contributions in the area of slips, trips, and falls research. A research scientist with Liberty Mutual Research Institute for Safety, Chang investigates the causes of occupational accidents in an effort to improve on-the-job safety.

SALLY COSTELLO *(B.S.'81 ChemE)* of Escondido was named executive director of the Escondido Humane Society in August. She is a former health and safety manager for Air Products and Chemicals, Inc.

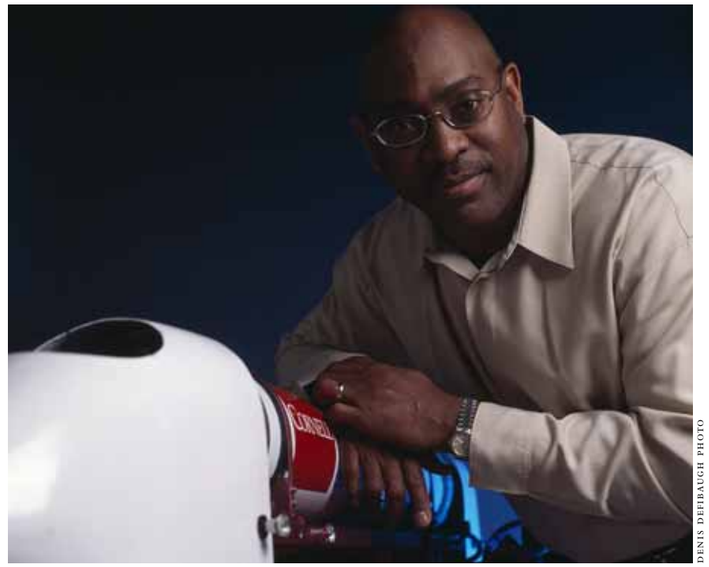
GRAYDON HANSEN *(B.S.'88 EECS)* of Auburn, Alabama, writes, "I am president of a company that provides batteries to our military for long run-time applications. It is satisfying to know that my Berkeley education is being put to work to help make our troops safer in an inherently hazardous situation."

BARBARA HILLIARD *(B.S.'81 ChemE)* of Green Bay, Wisconsin, works for Northern Environmental Technologies Inc., where she oversees work and business development in industrial environmental health and safety and Department of Transportation compliance. She has 13 years of experience in the chemical, paper, converting/printing, and petroleum industries.

ROY MARTINEZ *(B.S.'84 CE)* of Fair Oaks, California, recently joined American River Ventures, a venture capital firm that invests in early-stage information technology firms in Northern California, primarily outside Silicon Valley.

ERIC MILLER *(B.S.'86 ME)* writes, "After graduating I moved to Phoenix and cut my teeth doing analysis, software, and design for turbine engines. For the past 11 years I've been one of the owners of PADT, a company that provides mechanical engineering services to almost every industry. I'm enjoying doing design, analysis, and running a company. (The HR part isn't so fun.) Family life is even better: My wife and I have two boys, ages 7 and 2, and two dogs, one female age 13, and one male age 10." **eric.miller@padtinc.com**

JAIME MOYA *(M.S.'83 ME)*, a senior manager for Environmental Safety and Health Planning and Assurance at Sandia National Laboratories, won the 2005 Award for Professional Achievement from the



DENIS DEFIBAUGH PHOTO

Kevin Kornegay (M.S.'90, Ph.D.'92 EECS) with a vehicle built by students on his Autonomous Underwater Vehicle Team, will move in January to Georgia Institute of Technology, where he will be the Motorola Professor in the School of Electrical and Computer Engineering.

Inspiring engineers, one student at a time

Growing up in Queens, New York, Kevin Kornegay was "a nerd and proud of it," he says. "I was always building radios or oscilloscopes and tearing apart electric motors." His natural tendency to tinker was fueled not only by the electronic gadgets his mother bought him, but also by techno-wizard Barney Collier, the character played by black actor Greg Morris on CBS television's 1966–73 hit spy show, *Mission Impossible*.

"Collier was a technologist, and that had a significant impact on me," Kornegay says. "When African Americans are portrayed positively in the media, kids looking for examples to emulate can find important role models."

Kornegay (M.S.'90, Ph.D.'92 EECS) began his professional career as a researcher at IBM's T.J. Watson Research Center in Yorktown Heights, New York. In 1998 he joined Cornell, where he is now associate professor of electrical and computer engineering, focusing on mixed-signal integrated circuit design for broadband communications. Best known for founding Cornell's Broadband Communications Research Lab and his work on high-performance circuit design, he has recently mentored a number of award-winning student teams building autonomous, or unmanned, submarines.

"Autonomous systems require integration of sensors, computation, mechanical and electrical systems, and artificial intelligence," Kornegay says. "This is systems engineering at its highest level."

Watching his students put it all together, he adds, is his favorite part of the job.

"These projects culminate in designs that bring theory and practice together," he says. "It's thrilling to watch the students solve challenging real-world problems in real time."

Kornegay's honors are too numerous to list in their entirety. They include the 2005 Janice Lumpkin Educator of the Year award from the National Society of Black Engineers; recognition as one of *Science Spectrum* magazine's 2005 "Trailblazers," a list of the nation's top minority scientists; and a National Science Foundation CAREER Award.

"When I graduated from Berkeley," he says, "there were only two African American electrical engineering Ph.D. graduates in the country, and I was one of them. For the most part, those numbers haven't changed." Recent figures from the National Science Foundation confirm that blacks, Latinos, and Native Americans account for 23 percent of the U.S. population, but only 6 percent of its science and engineering labor force.

Today, Kornegay is doing his part to inspire more women and underrepresented minorities to excel in science and engineering. In his seven years at Cornell, he has mentored 14 Ph.D. graduates, three of them African Americans, one Latino, and one woman.

"Through my professional accomplishments, I try to be an example," Kornegay says. "If I can do it, they can do it." ■

Hispanic Engineer National Achievement Awards Corporation (HENAAC), presented at its 2005 conference in Anaheim last month. Moya personally recruits and encourages Sandia staff to participate in community projects such as MANOS, a public school program that introduces middle school students to science and engineering.

BRYON MOYER *(B.S.'82 EECS)* of Cupertino has joined Teja Technologies Inc. as vice president of product marketing, responsible for driving the development of Teja's next-generation products for embedded networking and communications software for multi-core processor architectures. Previously he worked at Actel, Altera, Cypress Semiconductor, Advanced Micro Devices, and Monolithic Memories.

DARRYLL PINES *(B.S.'86 ME)* is assistant professor in the Department of Aerospace Engineering at the University of Maryland and a program manager at DARPA. His research focuses on unmanned aerial vehicles, multi-expressive and evolving structural systems, and navigation of aerospace systems.

PRABHAKAR RAGHAVAN (*Ph.D.'86 EECS)* of Saratoga, California, has been appointed head of Yahoo! Research, leading research efforts in search and information navigation, social media, community, personalization, and mobility. He is also editor-in-chief of the *Journal of the ACM*, published by the Association for Computing Machinery, and consulting professor of computer science at Stanford.

WILLIAM TANG *(B.S.'80, M.S.'82, Ph.D.'90 EECS)* of Irvine holds joint appointments in bioengineering and electrical engineering and at the Integrated Nanosystems Research Facility at UC Irvine. He is now building a micro- and nanobioengineering program. Previously his career included six years in the automotive industry, three years with NASA, and three years as a program manager at DARPA.

1970s

REZA ABBASCHIAN *(Ph.D.'71 MSE)* of Riverside was appointed dean of UC Riverside's Bourns College of Engineering in September. Since 1981, he had been professor and chair of MSE at the University of Florida in Gainesville, one of the largest materials departments in the nation. Previously he was on the faculty at Pahlavi University in Iran.

STEVE BECK *(B.S.'71 EECS)* of Berkeley had his work exhibited this year at the Los Angeles Museum of Contemporary Art and the Smithsonian Hirshhorn Museum. The multimedia exhibit "Visual Music" showcased painting, film, video, light sculptures, and media features, including Beck's "Illuminated Music 2" **(www.stevebeck.tv)**, a Direct Video Synthesis performance. **sbeck123@aol.com**

RICHARD BENSON *(Ph.D.'77 ME)* was named dean of Virginia Tech's College of Engineering last spring. He most recently served as head of mechanical engineering at Penn State and associate dean for graduate studies at the University of Rochester.

CHARLES BERGSON *(B.S.'77 CE)* of Los Angeles has recently been appointed public works director and city engineer for the city of Compton, California.

GILLES EBERHARD *(B.S.'79 ME)* of Orinda writes, "I have migrated from mechanical engineering to IT and am now CIO for ChevronTexaco's Global Lubricants Company."
gilles.eberhard@chevrontexaco.com

PERSHING LUM *(B.A.'71 CS; M.S.'74 EECS)* of Rancho Cucamonga, California, retired from Kaiser Permanente in August 2004 after 28 years working to define requirements and select and implement systems in support of National Facilities Services. He writes, "I have since begun a new career in the academic world as associate director of customer services for the Information and Media Technology Department at Azusa Pacific University. I am thoroughly enjoying working with faculty and staff and mentoring students. It gives me the opportunity to pass on what I have learned working in industry and better prepare these students to succeed and have a positive influence on society when they leave the university." **plum@apu.edu**

HIROMI MATSUMOTO *(M.S.'76 MSE)* is professor in the faculty of environmental engineering in the Department of Mechanical Systems and Environmental Engineering at the University of Kitakyushu in Japan.

ARTHUR WATKINS *(B.S.'72, M.S.'74 CE)* of Fair Oaks, California, started Watkins Consulting in 2001, specializing in construction management and resident engineering of water and wastewater treatment and conveyance facilities. **aewatkins@yahoo.com**

1960s

ANTHONY D'ANGELO *(M.S.'68 CE)* of Matthews, North Carolina, is project coordinator for Charlotte Mecklenburg Utilities and is also working in Luxury Suites NFL Carolina Panthers Bank of American Stadium for fun.

PATRICIA DANIELS *(B.S.'68, Ph.D.'74 EECS)* of Seattle won the 2005 Meritorious Service Award of the American Society for Engineering Education (ASEE) for her academic leadership in advancing the electrical and computer engineering profession through scholarship and national accreditation service. Now associate dean and professor at Seattle University's College of Science and Engineering, Daniels has worked for the Aerospace Corporation, Westinghouse Aerospace, and the Boeing Company.

STEPHEN DIRECTOR *(M.S.'67, Ph.D.'68 EECS)* of Philadelphia has been named provost of Drexel University in Philadelphia. Considered a pioneer in computer-aided design, Director was previously dean of engineering at the University of Michigan and Carnegie Mellon.

CURT DYER *(B.S.'69 ME)* of Santa Ana has built and driven various models of his "Roller Safest Car in the World Sports Car" more than 230,000 miles since 1978. He holds a U.S. patent for the hundreds of features that give the car its superior handling and make it less likely to roll over in an emergency maneuver. He writes, "I'm trying to save the human race from extinction due to global warming by building hydrogen-powered fuel cell Rollers."

SADEQ FARIS *(B.S.'69, M.S.'71, Ph.D.'76 EECS)* of Pleasantville, New York, is founder, chairman, and CEO of two research and training laboratories: Reveo, which has facilities in New York, California, and Taiwan; and Inventqjaya, based in Malaysia. His research focuses on inventions related to energy, power, housing, and aquaculture, including an award-winning metal-fueled electric hybrid vehicle. A native of Libya, Faris holds 200 patents and has more than 200 pending in superconducting electronics, electrochemistry, MEMS, and terabyte optical communication.

GERRY FLINN *(B.S.'64 ME)* of Akron, Ohio, is owner and president of Vachon Industries, manufacturer of abrasive products.

KOMKEE LEUNG *(M.S.'63 ME)* of Moraga writes, "I retired last year. I spend my time playing table tennis and hope to be the over-70 California champion. I have two sons: Gordon, a UCSF-trained cardiologist, and **OMAR LEUNG** *(B.S.'94 MSE)* who, after a bachelor's at Cal got his Ph.D. at the farm in material science." **kkleung@comcast.net**

ALAN DOOLEY/U.S. ARMY CORPS OF ENGINEERS PHOTO

MAJ. HUGH DARVILLE/U.S. ARMY CORPS OF ENGINEERS PHOTO

A Texas Army National Guard Blackhawk drops a 6,000-pound bag of sand and gravel in the breach in the 17th Street Canal. Left: USACE Director of Civil Works Maj. Gen. Don Riley (M.S.'80 CEE) briefs Diane Sawyer, co-host of ABC's Good Morning America, *on air and land operations involved in the Hurricane Katrina cleanup.*

CEE alumnus directs Army Corps effort to "unwater" New Orleans

The hot and humid southern shores of Lake Pontchartrain bustle with engineers and contractors. Helicopters drop sandbags into breaches in the canal floodwalls, and a line of dump trucks loaded with aggregate stretches as far as the eye can see. One contractor shores up the road leading to the worksite, while another builds a temporary bridge for a crane to access a breach in the levee. Crammed between the lake on one side and floodwaters on the other, the worksite is about one-tenth the size required for an operation of this magnitude.

That is the scene described by Major General Don Riley (M.S.'80 CEE), stationed in Baton Rouge since August 28, the day before Hurricane Katrina hit. Riley is director of Civil Works for the U.S. Army Corps of Engineers (USACE), the nation's primary agency for planning and building public works. In that capacity, he also commands the USACE's Emergency Operations Task Force. When *Forefront* spoke with Riley in mid-September, he expected to be there through the month, living and sleeping on a barge in the Mississippi River.

Well, trying to sleep, that is.

"When you're working 20-hour days, even when you lie down to get some sleep, your mind is still running, your pulse is still racing," he says. A Hayward native and graduate of the U.S. Military Academy at West Point, Riley joined the Corps in 1973. He was appointed commander last July, just in time for the four hurricanes that hit Florida. But nothing he saw there compared with this one. The 2,000 Corps employees working under Riley in just two weeks following Hurricane Katrina already exceeded the number deployed in all four Florida hurricanes combined.

"Flying over the area I was just absolutely stunned by the extent of wind and water damage," he says. "In communities like Waveland and Bay St. Louis, Mississippi, all that was left were concrete slabs where there used to be homes."

Riley's job entails clearing out debris, restoring power, repairing roofs, and locating housing for displaced persons. It will take years for the area to recover from the ravages of the storm, he says. Funding of $3 billion has already been authorized and, Riley says, more will be needed.

"This is such a massive effort that it will stretch our engineering leadership to its full capacity," Riley says. "I'm using every bit of engineering knowledge I learned at Berkeley."

What is he learning today from one of the most powerful storms ever to hit the U.S. landmass? Hurricane Katrina, he says, is reminding us that development must not only be compatible with the environment, but also sustain and enhance it to increase protection. But, Riley adds, areas at risk for disasters—whether they be hurricanes or earthquakes—must be aware of that risk.

"Communities will always be faced with difficult choices and trade some level of protection for cost," he says. "They will never have enough money to protect for all contingencies."

Just as important as restoring infrastructure, livelihoods, and homes, Riley says, is rebuilding people's spirit and confidence. He has taken a lead role in working with state leaders to provide accurate and timely information to the media and public and to inform local government of what resources are needed

"The more senior you get in the profession, the more you find that engineering is not just the science of solving problems," Riley says. "Engineering today is as much about the art of striking the right balance as it is about getting the science of design and construction right."

Riley tells the story of one night when eight newborns needed to be evacuated from a New Orleans hospital in order to survive. Working together, late at night and without lighting, the Emergency Operations Center, Texas Forest Service, and Women's Hospital in Baton Rouge coordinated a baby brigade involving helicopters, boats, and cars on partially submerged highways that safely transported the little patients. Last he heard, all eight were doing fine.

"That was only one of a hundred similar things happening that day," Riley says. "Everyone involved feels a great sense of urgency about helping a community in need put their lives back together." ■

Engineering humor: The making of an atomic comic

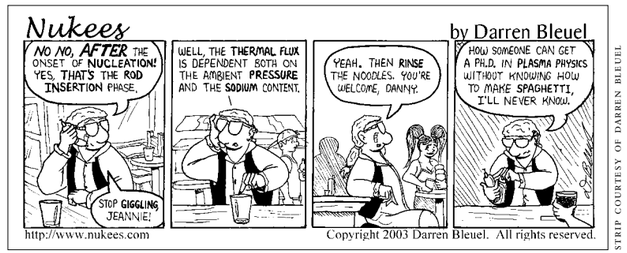
RACHEL JACKSON PHOTO

One day in 1996, then graduate student Darren Bleuel (B.S.'93, M.S.'97, Ph.D.'03 NE) was hanging out with his nuclear engineering buddies reading the *Daily Cal.* Someone started complaining about how terrible the comics were; then he turned to Bleuel and said, "You should do a strip."

"About what?" Bleuel asked.

"About us," came the reply. "About us nukees."

Bleuel knew the material was just waiting to be mined: comedy born from engineering students slaving away in the industrial environs of Etcheverry Hall, bent double under the demands of professors, pondering the nature of science over beers, and oh, the characters, the gloriously weird characters! Bleuel didn't hesitate. A comic strip named "Nukees." Now that *would* be funny.



STRIP COURTESY OF DARREN BLEUEL

He overcame one critical problem—that he didn't know how to draw—by copying other strips until he felt comfortable creating his own characters. In January 1997, Bleuel published his first strip in the *Daily Cal,* and the "atomic comic" was born.

"On the outside, it's about engineers and engineering," Bleuel says, "but it's really about people's feelings and whatever's in my head." Some of the situations are culled from his own experience, like living in Etcheverry for a month, harboring crushes on bartenders, and showing up at the wrong time for a midterm.

Now a health physicist at Lawrence Berkeley National Laboratory, Bleuel spends about 10 hours a week writing and drawing the strip, published three times weekly on his website Keenspot **(www.keenspot.com)**, which is devoted to publishing web comics.

Nukees is often set in Etcheverry or Blakes, the famous southside bar, called "Flakes" in the strip. The main character, Gav, is "an exasperated cynic-turned-mad-scientist" loosely based on the strip's creator. He is joined by a whole cast of characters, vaguely derived from Bleuel's NE student friends, and a "giant, nuclear-powered robot ant."

With an eight-year run, the comic strip has hit its stride, and Bleuel is happy to keep creating it. "It's therapeutic," he says. "It's nice to get all your feelings down." ■

BY RACHEL JACKSON

First published in the Daily Cal *on January 21, 1997, "Nukees" is inspired by Darren Bleuel's experiences as a nuclear engineering student. Both the artist and the strip's main character Gav can frequently be found at Blakes on Telegraph.*

DAVID SELWAY *(B.S.'61, M.S.'63 ME)* of Danville is retired from Lawrence Livermore National Laboratory.

NICKOLAS VRIONIS *(B.S.'65 EE)* of Los Altos writes, "I worked extraordinarily hard for 35 years and am now taking it a little easy, doing some consulting."
nvrionis@earthlink.net

1950s

DAVID BERG *(B.S.'53 ME)* of Oakland and his wife of 50 years spend weekends at their vacation home in Discovery Bay and are immensely enjoying their four grandchildren. They celebrated their 50th wedding anniversary on September 25.

WILLIAM BRIDGES *(B.S.'56, M.S.'57, Ph.D.'62 EECS)* writes, "I'm now retired from Caltech. We've completed our 'dream retirement home' in Nevada City, California, but still use our southern California home in Sierra Madre. Just like the old days . . . up and down Highway 99."

ROBERT COLLINS *(B.S.'55 CE)* of Bradenton, Florida, writes, "I'm enjoying life as a Florida 'snowbird.'" **midas23@aol.com**

EPHRAIM HIRSCH *(B.S.'53, M.S.'55 CE)* was appointed president of the San Francisco Building Inspection Commission.

WILLIAM KING *(B.S.'57 ME)* of Los Angeles writes, "I have retired from a career that included staff scientist positions at the Aerospace Corporation, RAND, and JPL. My wife **VELMA MCGOWAN** *(B.A.'57 Social Welfare)* is also retired."
wskingkarec@hotmail.com

DANIEL MOHN *(B.S.'58 CE)* of Twain Harte, California, retired as chief engineer of the Golden Gate Bridge in December 1994.

JOHN MORAN *(B.S.'50 EE)* of Palo Alto is retired and volunteering, doing restorations at the antique aircraft museum.

JAMES PALMER *(B.S.'55, M.S.'57 EECS)* of Fremont retired in 1995 from his professorship at George Mason University in Virginia. He also served as president of Metropolitan State College in Denver (1972–78) and administrator for the Research and Special Programs Administration of the U.S. Department of Transportation (1978–79).

NORMAN SCHNEIDEWIND *(B.S.'51 EE)* of Washington, D.C., is professor of information sciences in the Department of Information Sciences and the Software Engineering Group at the Naval Postgraduate School. He served as 2004 chair of the Faculty Council and was selected for a 2005 IEEE U.S. Congressional Fellowship. He is now working with the Democratic Subcommittee staff director on the Subcommittee on Financial Management, the Budget and International Security; and on the Governmental Affairs Committee of the U.S. Senate, focusing on homeland security.
nschneid@nps.navy.mil

HERBERT WELLS *(M.S.'51 Metallurgy)* of Las Vegas started the engineering program in 1961 at the University of Nevada, Las Vegas, where he was the only faculty member until 1969. Now the college is ABET accredited and has four departments and 70 faculty. Wells retired in 1997 as professor emeritus but still works part time.

GUY WINTON JR. *(B.S.'50 CE)* of San Diego played trombone in the Cal Band and is now singing at his rotary club.

1940s

WILLIAM ROSS AIKEN *(B.S.'47 EECS)* of Paradise published *Dossier Von Tauchendorf,* an historical tale set between the two world wars that reveals little-known history of Europe, America, and Africa. A former UC nuclear researcher and former director of research for Kaiser Aerospace and Electronics Company, Aiken has also served as mayor and city councilman of Los Altos Hills.

RAY BASS *(B.S.'43 ME)* of Union City celebrated his 60th wedding anniversary in June with his wife Eileen. An ordained minister, Bass worked at Douglas Aircraft during World War II, then as an engineering consultant designing air conditioning units. They have two daughters.

ALVIN PHILLIP BEISER *(B.S.'49 CE)* of San Mateo retired from a career in construction, building institutional private and public buildings and working on power plants, water, sewage, and other engineering projects.

ROBERT BRUCE *(B.S.'49 ME)* of Sun City Center, Florida, retired from Ford Motor Company in 1980. He and his wife Jene left California in 1962 and lived in Louisville, Kentucky, for 24 years, then moved to Florida in 1987. They have two children, four grandchildren, and three great-grandchildren. Their hobbies are golf, cooking, and traveling through the Midwest and eastern states.

LESLIE BURGESS *(B.S.'43 ME)* of Wilmington, Delaware, writes, "Since graduating from Harvard Business School in 1961, I have been professor of business administration at the University of Ghana, on the staff at the Harvard Group in Pakistan, a vice president of the Floor Corporation in Washington, D.C., and the CEO of a small business in Delaware until my retirement in 1992."

IVAN GENNIS *(B.S.'49 CE)* of Sacramento writes, "I'm still working as a civil engineering consultant, not having sense enough to quit. When you don't have to work, it's fun."

FRANK KREITH *(B.S.'45 ME)* of Boulder has been elected an honorary member of the American Society of Mechanical Engineers.

ROBERT MOELLER *(B.S.'42 EE)* of Los Angeles will celebrate his 89th birthday in December. He and his wife **PHYLLIS (CHILDS) MOELLER, M.D.** *(B.A.'47 Physiology),* celebrated their 60th wedding anniversary in July. She writes, "Robert enjoys feeding wild birds (and chasing squirrels from the feeder!), watering the lawn, and sawing up old lumber to make logs for the fireplace. Do any other Class of 1942 grads remember Robert? He has had diabetic/atherosclerotic aphasia for about a year and can't tell family about his Cal days."
prmoeller@sbcglobal.net

EDWARD SAUNDERS *(B.S.'48 ME)* of Newport Beach, California, is happily retired after a career in engineering and design work with his own company in Santa Fe Springs, California.

1930s

DAVID DOBBINS *(B.S.'39 ME)* of Palm Desert, California, writes, "I designed and hand-built the "Simcopter," a convertible auto/flying helicopter powered by a 300-hp Lycoming engine, which now resides at the Antique Aircraft Museum in San Martin, California. **dtdobbins@earthlink.net**

JOHN PEARSON *(B.S.'38 CE)* of San Leandro retired in 1978 as principal transportation engineer for the California Public Utilities Commission.

Engineering stars come out to Berkeley's DEAA

There's nothing typical about these engineers, five pioneers representing the Internet, sanitary and environmental engineering, computer policy, and China's tech industry. But they do typify the exemplary professionals who hone their skills and shape their careers at Berkeley Engineering.

Franklin Agardy, Bill Joy, Barbara Simons, John Deng, and Tom Zhang are the recipients of the 2005 Distinguished Engineering Alumni Awards (DEAA). The five were honored at the 31st annual DEAA banquet, attended by 150 friends and colleagues in Hearst Memorial Mining Building September 24.

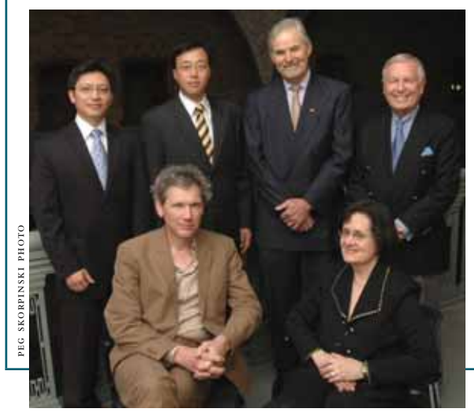
Franklin Agardy (M.S.'58, Ph.D.'63 CE), president of Forensic Management Associates and an expert in water pollution control, has extensive experience in hazardous waste management, environmental planning, and forensic investigation of explosions, fires, and toxins. As a civil engineering professor, he developed San Jose State's graduate program in sanitary engineering, then joined URS Corporation as a sanitary engineer, becoming president and CEO in 1987. He has written, coauthored, and coedited seven textbooks.

Bill Joy (M.S.'79 EECS) designed and wrote Berkeley UNIX as a graduate student. The first open-source operating system with built-in communications protocols, Berkeley UNIX became the backbone of the Internet. As chief scientist for Sun Microsystems, Joy was a key designer of such technologies as Solaris, SPARC, and Java. Holder of more than 40 patents, Joy is now a partner at venture capital firm Kleiner Perkins Caufield & Byers.

Barbara Simons (M.S., Ph.D.'81 EECS) is a former researcher staff member at IBM and an expert on computing technology policy and electronic voting. She was president of the Association for Computing Machinery (ACM) and founder of ACM's Public Policy Committee. A fellow of ACM and the American Association for the Advancement of Science, she has received multiple awards, including the Alumnus of the Year Award from Berkeley's Computer Science department. She is writing a book on electronic voting.

John Deng (M.A.'94 Physics, M.A.'97 Economics, Ph.D.'97 EECS) and Tom Zhang (Ph.D.'04 EECS) received this year's Outstanding Young Leaders Award. They are the founders of China's Vimicro Corporation, which commands 60 percent of the global market for PC camera chips and a large percentage of the Chinese cell phone multimedia chip market. They were recently honored with first prize in the China National Science and Technology Advancement Awards, the highest honor ever awarded to China's domestic integrated circuits design industry.

Visit **www.coe.berkeley.edu/alumni_friends/deaa/** to see a video of the event. ■



PEG SKORPINSKI PHOTO

Winners of the Distinguished Engineering Alumni and Outstanding Young Leaders Awards celebrated with Dean Richard Newton at a banquet in Hearst Memorial Mining Building September 24. Clockwise from left are Tom Zhang, John Deng, Newton, Franklin Agardy, Barbara Simons, and Bill Joy.

IN MEMORIAM


BEN AILES PHOTO

BRUCE BOLT, Berkeley professor emeritus of earth and planetary science and one of the state's most visible experts on earthquakes and seismic hazards, died in July at age 75. As director of UC's Seismographic Stations for 28 years, he traveled worldwide to investigate major earthquake sites, lecture on earthquakes, and serve on commissions throughout the country. A native of Australia, Bolt served on the California Seismic Safety Commission for 15 years and was its chairman in 1986. He joined Berkeley's CEE department in 1988. "He was an indefatigable advocate for communication between seismologists and engineers," says Berkeley CEE professor and chair Gregory Fenves. "He could speak to broad audiences, right at their level, including legislators and governors."


PEG SKORPINSKI PHOTO

New alumni representatives (from left) Dawn Kramer, Karin Mack, and Katharine Greenbaum confer on an agenda item at the all-day Engineering Alumni Society retreat this summer. These are your new conduits to Berkeley Engineering. Call or write them today!

ALUMNI SOCIETY BOARD PRESIDENT AND NEW STAFF KICK-START THE YEAR

Alumni relations activities at Berkeley Engineering have a new face. Three new faces to be exact. They are new Alumni Relations Director Karin Mack, incoming Engineering Alumni Society (EAS) Board President Katharine Greenbaum, and Alumni Relations Assistant Director Dawn Kramer.

Mack joined the Berkeley staff in August as alumni relations director, managing planning, implementation, outreach, and evaluation of all alumni activities. She has a 20-year career in higher education, most recently at UC Davis, where she founded and directed two academic enrichment and retention programs for engineers, Women in Engineering and the Center for Engineering Professionalism. Mack holds bachelor's and master's degrees in applied behavioral sciences from UC Davis.

Katharine Greenbaum (B.S.'95 IEOR, M.P.P.'05 Public Policy) will serve as EAS president for one year, representing the College's nearly 52,000 alumni and directing the board's program of educational and networking events designed to keep alumni and students active in the College. She has held positions at IBM and business consulting firm Fair Isaac Corporation, but now, with her public policy master's degree completed, she is moving her career into the nonprofit/public benefit sector.

"Involvement in the Society of Women Engineers provided connections and leadership opportunities for me as an undergraduate," Greenbaum says, "and that motivated me to get involved with the EAS after graduation." Her goals for the year include invigorating alumni programs, beefing up member participation, cultivating relations with student societies, and tapping into other alumni societies for support.

On staff since March, Dawn Kramer manages alumni and student events as well as print and online communications. She came to Berkeley from the National Multiple Sclerosis Society, where she worked since 1999 as director of special events and manager of programs and communications. Kramer holds a bachelor's from UC Davis in political science and public service.

All Berkeley Engineering graduates are automatically members of the EAS, and all are encouraged to participate in events, alumni programs, and board activities. Look for alumni news, distributed monthly by email and biannually through *Forefront*. For more details, go to **www.coe.berkeley.edu/alumni_friends/eas.html** or call 510-643-7828. ■

JACK CRAWFORD *(B.S.'49 EECS)* of Mill Valley died in June.

WILFRED LEWIS JR. *(B.S.'52 EECS)* of Pasadena died in June.

NICHOLAS PRESECAN *(M.S.'67 CE)* of Claremont, California, died in July at age 64. He earned an engineering bachelor's degree from Purdue, then served in Vietnam as a captain in the Marine Corps. He was chief engineer for Parsons Corporation and active in Claremont city government, serving as mayor from 1989 to 1992. A strong advocate for acquisition of parklands, he also wrote poetry.

BOB SINGLETON *(B.S.'52 EECS)* of Oberlin, Ohio, died in February at age 87. During World War II, he worked as a welder in the shipyards of San Francisco, then moved to Ohio and became general manager at Nelson Stud Welding. He retired in 1981 and became a community activist, serving with United Way, the local historical council, and founding the retirement community where he lived.

DANIEL TALT JR. *(B.S.'48 CE)* of Fremont died in August. He served in the U.S. Army during World War II and collected stamps.


UC SANTA CRUZ/MONICA LEE PHOTO

JANE WILHELMS *(M.S.'82, Ph.D.'85 CS)*, professor of computer science at UC Santa Cruz (UCSC) and an expert in computer graphics and animation, died in March at age 56. She began her career teaching anatomy and physiology in junior college and based much of her computer graphics work in animal modeling and animation on her biology background. She joined UCSC in 1985, where she was project director of the Scientific Visualization Laboratory, used by biology and engineering faculty to visualize their scientific data through computer graphics.

MAYNARD YOUNG *(B.S.'50 CE)* of Montebello, California, died in April. He retired in 1988 from a civil engineering consulting career and is survived by his wife Marion, five children, and eight grandchildren.

Bring a smile to a Berkeley Engineering student.

Your gift helps make today's students tomorrow's leaders.

When you support Berkeley Engineering through the Annual Fund, you help:

- Bring new faculty to the College to ensure students learn from the best.
- Support student leadership projects like the solar car, the concrete canoe, and more than 20 engineering societies.
- Enhance critical resources like our library and computer systems.
- Provide undergraduate students with real-world research opportunities.

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