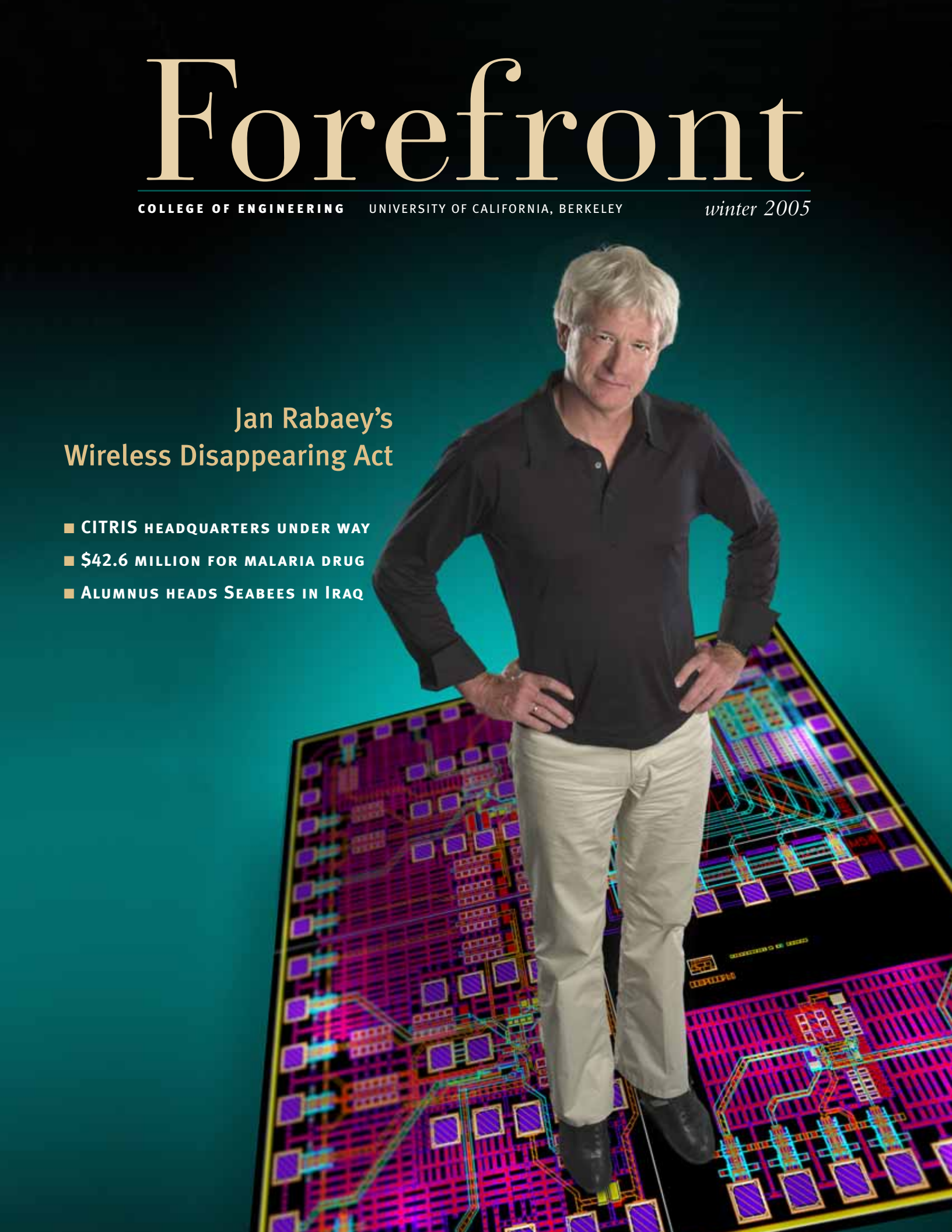
# Forefront

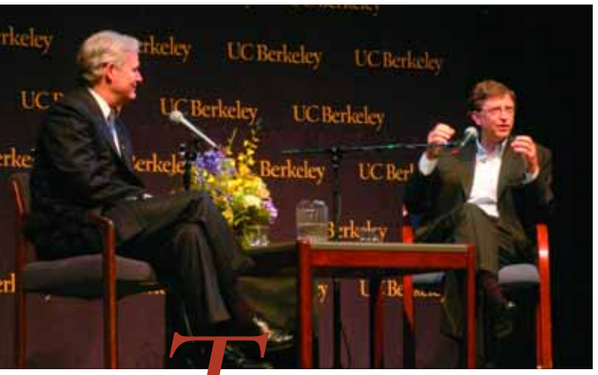
COLLEGE OF ENGINEERING UNIVERSITY OF CALIFORNIA, BERKELEY winter 2005



## Jan Rabaey's Wireless Disappearing Act

- CITRIS HEADQUARTERS UNDER WAY
- $42.6 MILLION FOR MALARIA DRUG
- ALUMNUS HEADS SEABEES IN IRAQ

## dean's message:
### THE NEW RESEARCH UNIVERSITY




PEG SKORPINSKI PHOTO

*Bill Gates in conversation with Dean Newton last fall at Zellerbach Hall*

This fall we heard a number of industry luminaries, including Microsoft chair Bill Gates, HP's Carly Fiorina, and Intel CEO Craig Barrett, echoing a similar warning: The U.S. will lose its place as world leader in technological innovation unless we ramp up funding and take a more serious approach to domestically based advanced research and development, the force that drives our long-term scientific and economic success.

The nation's top research universities and associated national laboratories—with their culture of collaboration and out-of-the-box thinking—have become increasingly involved in the advanced R&D "ecosystem." Their large-scale research facilities and stores of talented faculty and students make it possible for research to rise above boundaries between disciplines, between basic and applied science and engineering, and between academics and industry. Our basic research is use-inspired but freed from commercial pressures like fast-tracking to market and maximizing shareholder value.

The future of our domestic economy is becoming increasingly dependent on university-based advanced R&D. Corporate R&D investment—not just in technology but in a range of sectors—has declined steadily for the last three years. Federal research funding has made up some of the drop-off, but spending increases there have emphasized defense and homeland security. Now, 58 percent of companies with the highest R&D expenditures are based in Europe and Japan, with only 42 percent in North America, and many of those depend entirely on universities for their long-range R&D.

Exceptions to this trend include some of our own corporate partners in the Silicon Valley, like Intel and Microsoft, who are among the top 15 investors in R&D worldwide, according to MIT's *Technology Review*. Sun Microsystems is making headlines, even drawing criticism from industry analysts, for its heavy expenditures in R&D. But far from frivolous, these forward-thinking corporate investors are collaborating with Berkeley to help support faculty research, fund student scholarships, and host major initiatives like CITRIS, which would be impossible to undertake in a commercial environment and much less rewarding for our students without the connection to the corporate world.

Research universities are providing what I like to call a regional "demilitarized zone" for advanced research. This rich resource and its increasingly critical role in our economic future must be acknowledged, nurtured, and funded, not only to empower our long-term technological preeminence, but also to plant our students—the technology leaders of the future—firmly in the context of a real world. 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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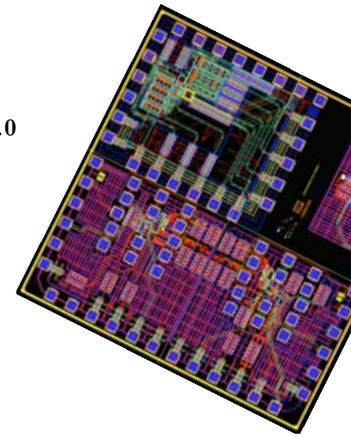
**On the cover**
The next generation of smart homes could have tiny wireless devices hidden in the couch or tucked into the fridge. Just a few millimeters square (shown here about 1,000 times its actual size), this is Berkeley electrical engineer Jan Rabaey's PicoRadio. Operating on just 100 microwatts of power, PicoRadios are outfitted with myriad sensors to detect light, motion, and temperature.
*Read the story on page 12.*

**COVER PHOTO BY BART NAGEL**

# Forefront


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

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# letters to the editor

### Social entrepreneurism

Thank you for sharing the visionary new class you are pioneering at Berkeley [fall 2004]. I am truly proud that my old school is able to define this vision and has already gotten results.

I received this issue of *Forefront* when I am thinking seriously about a career shift to "social entrepreneurism." I have been in the telecommunications field for over 25 years and believe passionately that appropriate technology has much to offer developing countries. There are technologies we have today—in particular, your article discussed wireless—that have the ability to offer vastly improved communication services at a modest cost, services that give many communities much better control over their lives. Congratulations for your progress in this area; it is in the true Berkeley spirit.

**—AVNISH AGGARWAL**
*Fremont (M.S.'76 EECS)*

### Rethinking engineering

I read the account of ICT4B [fall 2004]. . . . It is clear that bettering communications is effective in the development of poor countries. So also are access to safe drinking water, road construction, health care infrastructure, accessible primary education, development of local manufacturing and services for local markets, and the empowerment of women.

A challenging study is that of the proper interaction of folks such as ourselves and the local population of these countries. For neither those who believe that we need to provide the leadership in technical development, nor those who believe that all these countries need is financial help have a sound hold on reality.

Since 1987, I and Berkeley architecture professor Charlie Huizenga have carried out an experiment called Agua Para La Vida **(www.aplv.org)** in remote parts of rural Nicaragua, to develop drinking water systems. We have found that, even in a field as old fashioned as water delivery, the required engineering needed to be rethought afresh, occasionally invented, and imaginatively adapted to local conditions. We have also learned about the transmission of sound technical material to youngsters who had minimal previous schooling.

**—GILLES CORCOS**
*Professor Emeritus, Mechanical Engineering*
*UC Berkeley*

### Global nonsense

I could not disagree more with the ideas expressed in some of the letters in your last issue [fall 2004]. . . . Obviously, all engineers have to be able to read and write in order to understand their "technical" material. However, engineers are not trained to be Peace Corps volunteers.

After graduating from Cal, I happily sat at a drafting board (not a computer as they do today) and was delighted when I received more complicated assignments. Many of my fellow employees would compliment me and often questioned, "How the heck did you figure that out?!" My answer: Thanks to the outstanding education I received at Cal.

The requirement that all graduates must pass an examination on U.S. history is good and proper, but to burden all students with a global course of study is inappropriate and nonsense.

**—CHARLES FRANKLIN DE WOLF**
*Emeryville (B.S.'49 ME)*

### California's most valuable asset

The five years I spent at Berkeley, from 1961 to 1966, were the most valuable in my life. . . . The number of Nobel laureates exceeded 15, and Berkeley was rated number one, surpassing Harvard in most fields. It made me feel happy and fortunate that I could attend such a beautiful campus filled with outstanding scholars, while my own country was still in a politically and economically underdeveloped condition.

With deep sorrow I read that the governor of California seems not to see the true value of the higher educational system. I know his dilemma in facing huge financial deficits, but the last thing the state should be doing is ruining its most valuable asset, the UC system, particularly Berkeley. There are thousands of alumni like myself residing in foreign countries who would silently play the role of good diplomats for California because they feel very proud of their time there receiving an excellent higher education. We will be greatly disappointed if Berkeley's rating slides down to average.

**—CHOUNG MOOK LEE**
*(M.S.'63, Ph.D.'66 Naval Arch)*
*Professor of Mechanical Engineering*
*Pohang University of Science and Technology, Korea*

### Beyond the ivory tower

Your last issue's articles [fall 2004] capture the enthusiasm and commitment of Berkeley as a public institution to address some longstanding societal problems through technology. More importantly, the articles do a great job of educating the general public about cutting-edge research and how it can make potential and significant societal contributions as well as change perceptions of Ph.D.s and the ivory tower.

A friend of mine who read the stories online wrote back, "What you are doing seems very complex, but what impresses me is how practical your work is. I always thought Ph.D.s were very abstract. To see it at work—and in a region that desperately needs it—is enlightening."

**—MATTHEW KAM**
*ICT4B researcher, Department of EECS,*
*UC Berkeley*

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*

STEVE MCCONNELL PHOTOS, UC BERKELEY

*At a press event announcing the appointment of Berkeley chancellor Robert Birgeneau (above) to a state committee overseeing stem cell research, MSE and bioengineering professor Kevin Healy (left) demonstrates for Lt. Gov. Cruz Bustamante (right in both photos) the new hydrogel medium his lab is creating for generating stem cells.*

## Berkeley chancellor named to stem cell oversight committee

Berkeley Chancellor Robert Birgeneau has been named to a state committee charged with overseeing the implementation of California's new $3 billion stem cell research effort.

"I'm pleased and honored by this appointment," Birgeneau said, following the press announcement by Lt. Gov. Cruz Bustamante in Hearst Memorial Mining Building. "This is an important responsibility, and there is much work to be done."

California's stem cell research effort is the result of Proposition 71, a $3 billion bond measure approved by 59 percent of the voters in last November's election. The measure establishes the California Institute for Regenerative Medicine to coordinate stem cell research, which has applications in treating a wide range of human diseases, including cancers, neurological diseases such as Parkinson's and amyotrophic lateral sclerosis (ALS or Lou Gehrig's disease), spinal cord injuries, and diabetes.

The bond measure was put forward in the wake of the Bush administration's decision to limit federal funding for any research involving destruction of human embryos, the source of some stem cells. Proposition 71 backers argued that existing stem cell colonies used for research are unreliable, are contaminated by the mouse cells used as a growth medium, and cannot be propagated.

The 29-member Independent Citizens Oversight Committee will manage the institute and appoint another committee responsible for parceling out research grants beginning in March. In addition to Birgeneau, other appointees include several deans of top medical schools in the state, including David Kessler of UCSF, Claire Pomeroy of UC Davis, and Philip Pizzo of Stanford.

At the press event, Berkeley officials gave Bustamante and reporters a tour of the Hearst Mining lab where BioE and MSE professor Kevin Healy is developing a new synthetic medium for growing stem cells. The medium is hydrogel, a sticky substance similar to contact lens material, which would provide a safer and cleaner environment for growing stem cells than the current medium, which uses mouse cells and is vulnerable to contamination.

Healy currently uses a Bush administration–approved stem cell line stored at UCSF to do his research. He is a faculty affiliate with the California Institute for Quantitative Biomedical Research (QB3), one of the four California Institutes for Science and Innovation sponsoring multidisciplinary research in the sciences, engineering, and mathematics. ■

BY NOEL GALLAGHER, UC BERKELEY MEDIA RELATIONS

PEG SKORPINSKI PHOTO

*Participants at the CITRIS groundbreaking were (from left) Chancellor Robert Birgeneau, major CITRIS donor Dado Banatao, UC president Robert Dynes, Special Advisor to Governor Schwarzenegger on Jobs and Economic Growth David Crane, ME graduate student Elizabeth Reilly, and CITRIS director Ruzena Bajcsy.*

## CITRIS Headquarters: New building to foster innovation

With ceremonial tosses of dirt on a sunny October afternoon, College and University leaders kicked off construction of the new headquarters building for CITRIS, the Center for Information Technology Research in the Interest of Society.

About 300 faculty, students, and alumni, as well as campus, community, and state leaders attended the groundbreaking ceremonies to celebrate the complex that will provide students and faculty with state-of-the-art facilities for pioneering interdisciplinary education and research.

Launched in 2001, CITRIS is one of four California Institutes for Science and Innovation, formed as a public–private partnership. Drawing from strengths in engineering, the sciences, business, public policy, economics, and the humanities, CITRIS has grown rapidly to embrace dozens of faculty–student teams across the four UC partner campuses, including Berkeley, Davis, Merced, and Santa Cruz.

The new CITRIS building will be the hub of this wide-ranging network—a lively nexus for development of innovative, high-impact technology targeted to solve some of the most challenging problems in energy, health, security, the environment, and beyond.

"The goal of CITRIS is to maximize the impact of our education and research," said Engineering dean Richard Newton in an upbeat presentation emphasizing the CITRIS hallmarks of collaboration, corporate partnerships, and "use-inspired" research to serve society and improve people's lives. Key contributors, he said, are the corporate and private donors who have funded the building and the students working on CITRIS projects today, who will be the leaders of tomorrow.

"The words of the CITRIS acronym really spoke to me," said Elizabeth Reilly ('07 ME), a graduate student working in CITRIS on "energy-harvesting" wireless sensor networks that she hopes will help conserve our energy supply. "A center that's in the interest of society; there's an opportunity to do research here that really matters."

Dado Banatao, Silicon Valley entrepreneur and major CITRIS benefactor, also spoke. "The lifelong and distance learning aspects of the institute were what really brought CITRIS to the attention of my wife Maria and me," he said. "We believe strongly in bringing the strength and values of a Berkeley engineering education to students who would not otherwise have such an opportunity."

The 145,000 square-foot building, scheduled for completion in 2007, will include a nanofabrication laboratory, distance learning center, flexible educational and research facilities, and will link to the partnering UC campuses. Visit the CITRIS Web site at **www.citris-uc.org** for more details. ■

## U.S. Supercomputing Lead in Jeopardy, Panel Reports

The U.S. will be unable to retain its lead in supercomputing technology unless the federal government increases funding for advanced research in high-performance computing and ensures the viability of supercomputer vendors, said a report issued last November by an 18-member panel of computer experts.

"For the past decade, insufficient government funding, little long-term planning, and inadequate coordination have reduced opportunities to make the most of this technology to improve national security and promote scientific discovery," said Berkeley EECS professor Susan Graham, who cochaired the independent panel. EECS professor James Demmel also served.

The world's most powerful computers, supercomputers can quickly perform complex calculations for applications such as modeling climate change, simulating natural disasters, monitoring nuclear stockpiles, and mapping genes. The U.S. currently has 53 percent of the world's fastest supercomputers, but federal funding has dropped in the last 10 years, and both China and Japan are making inroads in supercomputer technology.

PEG SKORPINSKI PHOTO

*EECS professor Susan Graham co-chaired the supercomputing panel, sponsored by the National Research Council of the National Academies.*

The report, "Getting up to speed: The future of supercomputing," recommends increasing federal spending from $42 million to $140 million annually; developing an integrated plan for securing leadership in hardware, software, and related technologies; and research collaboration between agencies here and overseas.

See the National Academies Press Web site at **www.nap.edu** to order the full report. ■

## $42.6 million Gates Foundation grant to produce malaria drug

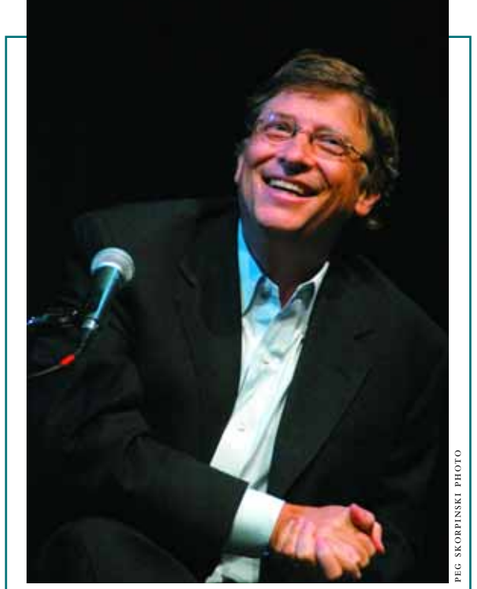
The Bill & Melinda Gates Foundation has made a $42.6 million five-year grant to OneWorld Health, a San Francisco pharmaceutical institute, to support nonprofit research and development of an affordable and accessible cure for malaria, which is responsible for 1.5 million deaths each year.

UC Berkeley researchers will partner with OneWorld Health, founded in 2000 as the first U.S. nonprofit pharmaceutical company, and Amyris Biotechnologies, an east bay biotech company, to engineer a synthetic equivalent of the compound artemisinin, currently the most effective treatment for malaria. The goal is to reduce manufacturing costs and create a stable and scalable supply of affordable antimalarials for the developing world.

The breakthrough technology behind the process—part of a pioneering field called synthetic biology—has been in development over the last 10 years by Berkeley chemical engineering and bioengineering professor Jay Keasling and his research team. Keasling is also director of synthetic biology at Lawrence Berkeley National Lab and a researcher at the California Institute for Quantitative Biomedical Research (QB3).

"This project will use some of the latest advances in molecular biology to engineer a microbial chemical factory and reduce the cost of a much-needed drug tenfold," Keasling said. "This is a dream project: interesting science, high technology, rapid transition from the bench to the bedside, and most important, critical need." The nonprofit nature of the partnership, he added, could be a model for attacking neglected diseases in the developing world.

Each year, between 300 and 500 million people, most of them poor, are infected with malaria, and at least 1.5 million die, primarily children in Africa and Asia. The disease has become increasingly resistant to front-line medications, but artemisinin combination drugs provide a nearly 100 percent effective treatment. At $2.40 per adult course, however, these therapies are beyond the reach of millions of the world's poorest people.



PEG SKORPINSKI PHOTO

*Microsoft chairman and chief software architect Bill Gates spoke with engineering dean Richard Newton from Zellerbach Hall stage last October for an audience of 1,500 engineering students. "The university system is the number one thing that has allowed the U.S. to be at the center of innovation," Gates said, adding that the U.S. must beef up funding in both industry and universities and take more risks in research and development if it is to remain at the forefront of technology. To see a video of the event, go to* ***www.coe.berkeley.edu/multimedia/billgates/.***

To reduce that cost to well under a dollar, Berkeley has issued a royalty-free license to both OneWorld Health and Amyris to develop technology for the malaria treatments. In exchange, Amyris will produce the drugs at cost, and OneWorld Health will perform regulatory work required to allow the low-cost, microbially based product to be substituted for plant-based product by manufacturers of combination drugs containing artemisinin. ■

## Engineers take leading role in student government

PEG SKORPINSKI PHOTO

*Outgoing Chancellor Robert Berdahl looks on as engineering senior and ASUC president Misha Leybovich encouraged new students to regard their time at Berkeley as both an "opportunity and challenge" to try new things.*

Student body president Misha Leybovich, an engineering physics senior, officially kicked off the 2004-05 school year by welcoming new students to campus last fall. The annual Welcome Week convocation, held at Memorial Glade, was attended by hundreds of the 8,218 new freshmen, transfer, and graduate students attending UC Berkeley this year.

Leybovich is one of four engineers, a record number, serving on the Associated Students of the University of California (ASUC). Highly visible in his role as president, he has been sighted shaking hands with Bill Gates, schmoozing with Steve Wozniak, and introducing Dean Richard Newton at the CITRIS groundbreaking. Also serving as ASUC senators are engineering undeclared junior Chris Abad, ME sophomore Igor Tregub, and MSE sophomore Peter Chung.

Welcome Week was one of the final duties hosted by outgoing Chancellor Robert Berdahl, who retired last September after seven years at Berkeley. ■

## NEES showcases pioneering approach to earthquake engineering

Berkeley researchers have a unique role in a bold new center funded by the National Science Foundation (NSF)—the George E. Brown Jr. Network for Earthquake Engineering Simulation (NEES)—that will revolutionize earthquake engineering research, improve seismic design and performance, and may extend its reach beyond national borders and seismic applications.

"Berkeley's key contribution to NEES is the geographical distributed hybrid simulation testing method," says NEES principal investigator Jack Moehle. "It will allow us to shift our research emphasis from conventional physical testing to integrated experimentation and computation, hybrid model development, and simulation," Moehle says. He is CEE professor and director of Berkeley's Pacific Earthquake Engineering Research Center.

Officially known as *nees@berkeley*, the Berkeley facility celebrated its grand opening at Richmond Field Station in November. Under construction for four years, the center was built in an existing lab with $5 million worth of state-of-the-art upgrades. The preexisting strong floor and other structural components were equipped with a reconfigurable reaction wall, new hydraulics, new control room, and new instrumentation, including a 128-channel high-speed data acquisition system and an array of 50 specialized digital cameras for measuring structural deformation.

"For the first time we can make hybrid models consisting of both physical and numerical components," says CEE professor Bozidar Stojadinovic, one of three principal investigators who teamed with Moehle to build the NEES facility. "This makes it possible to test physically the complicated parts of structures, while the simple ones are modeled in the computer, saving money and facilitating more tests." Other principal investigators are Stephen Mahin and Khalid Mosalam for construction, and Nicholas Sitar for operations management, all on Berkeley's CEE faculty.

NEES will function as a shared-use collaboratory for coordinated research, with special emphasis on six priority areas most likely to yield major breakthroughs in earthquake engineering. These include efforts to retrofit existing structures, mitigate soil-related failures, develop performance-based design standards and loss prediction models, and protect lifeline infrastructures.

The NEES labs will permit controlled simulation of complex problems in earthquake engineering, with Berkeley providing the hybrid testing infrastructure for the 15 sites nationwide. Such testing can be conducted at several labs simultaneously through Internet networking and teleobservation, facilitating sharing of resources and interdisciplinary collaboration.

"Conventional structural design protects against collapse, and we now do that quite well," says Stojadinovic. "What has been hurting us most is the economic damage after an earthquake." To minimize such losses, NEES researchers will develop performance-based seismic design standards to guide building for much finer grades of performance. Structures of the future might be designed, for example, specifically to house expensive equipment or to fully recover function within 24 hours of a disaster. ■

PEG SKORPINSKI PHOTOS

*The massive Universal Testing Machine subjected a concrete column specimen to 2 million pounds of load in an earthquake simulation at the NEES opening. Inspecting the damage are (from left) Berkeley's Bozidar Stojadinovic and Jack Moehle, and Mark Coles of the NSF.*

*In the NEES control room, engineer Don Clyde demonstrates how the latest information technology helps solve the space limitations of earthquake simulation on large and complex structures like a suspension bridge. One lab alone cannot adequately test such a structure, but several labs networked together can.*





## Berkeley's nanoscale research efforts get a boost from NSF

PEG SKORPINSKI PHOTO

*COINS Executive Committee members include coprincipal investigators (from left) Roya Maboudian of chemical engineering, Roger Howe of EECS and mechanical engineering, and COINS director Alex Zettl of physics.*

At Berkeley's new Center of Integrated Nanomechanical Systems (COINS), scientists and engineers are working together to create new nanoscale materials, such as microscopic components for use in ultra low-power computing devices and synthetic adhesives based on the tiny biological structures that enable geckos to climb walls.

With $11.9 million in funding over the next five years from the National Science Foundation (NSF), COINS is one of six new research centers for nanoscale research that will involve a multidisciplinary faculty of researchers from Berkeley, Caltech, Stanford, and UC Merced, as well as collaborators in industry and the national laboratories.

"The new centers support research that addresses societal needs," says Alex Zettl, professor of physics and COINS principal investigator. "Our specific goal here at Berkeley is to develop low-power, manufacturable, and multifunctional systems for information, medical, and security technologies."

A major thrust of the centers is to bridge disciplines and provide a coherent approach to nanotechnology research and education. At Berkeley, 22 faculty from engineering and chemistry, molecular and cell biology, physics, and economics will collaborate, focusing on applications in chemical and biological sensing and high-density, low-power, low-cost computation. CITRIS (the Center for Information Technology Research in the Interest of Society), Berkeley Nanosciences and Nanoengineering Institute, Lawrence Hall of Science, the Molecular Foundry, and a multitude of other programs will be involved, in an effort to bring Berkeley's many nanoscale research efforts under one umbrella.

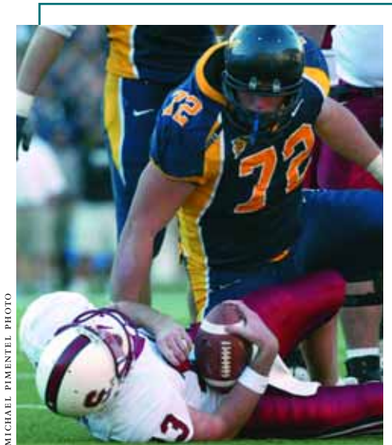
"From the engineering point of view, the focus of the work will be to exploit the unique properties of these new nanomaterials," says Roger Howe, EECS professor, COINS researcher, and member of the COINS executive committee. New faculty and postdoctoral fellows are being recruited, Howe explained, and an outreach component will target the general public, students, and legislators to educate them about potential applications of nanoscience—the study and synthesis of tiny materials that are mere nanometers (one billionth of a meter) in size.

Other engineering faculty involved include Paul Alivisatos of chemistry and MSE; Jeffrey Bokor, Ronald Fearing, and Tsu-Jae King of EECS; Luke Lee of BioE; Liwei Lin, Arunava Majumdar, and Lydia Sohn of ME; and Ramamoorthy Ramesh of MSE and physics. Tom Kalil, special assistant to the chancellor for science and technology, had a leading role in developing Berkeley's COINS proposal.

The NSF funded five other centers at Northeastern, Ohio State, University of Pennsylvania, Stanford, and University of Wisconsin, Madison, each of which focuses on a specific aspect of nanoscale research. The six new centers complement eight existing centers, bringing NSF 2004 funding for nanoscale research to $250 million. ■

PEG SKORPINSKI PHOTO

**JAMES O'BRIEN**, assistant professor of computer science in EECS, has been named to *Technology Review* magazine's 2004 TR100, a list of 100 top young innovators under age 35 whose work is having a profound impact on technology worldwide. O'Brien's work in computer animation—which generates realistic motions like smoke, fire, splashing water, and shattering glass using physically based simulation and motion-capture techniques—can be used to train surgeons, soldiers, and firefighters and to generate special effects for film and television. O'Brien, who also won a Sloan Research Fellowship last year, is faculty advisor for the Berkeley Computer Animation and Modeling Group.



MICHAEL PIMENTEL PHOTO

*Defensive tackle Tom Sverchek tangled with Stanford quarterback T.C. Ostrander as the Bears crushed the Cardinals 41-6 in the 107th Big Game. The Bears' "phenomenal" 10-1 season ended in a No. 4 ranking in the sportswriters' and coaches' polls, in the top six for both offensive and defensive scoring, and with a margin of victory averaging 24 points. At press time, the Bears were heading for the Holiday Bowl after the BCS poll eclipsed their chances of a Rose Bowl appearance.*

PEG SKORPINSKI PHOTO

*Professor Arun Majumdar (left), director of the new Berkeley-ITRI Research Center, celebrates the signing of the collaborative agreement with President Johnsee Lee of ITRI, Taiwan's largest research organization.*

## Berkeley research institute to collaborate with Taiwan industry

"Energy is the single biggest technological issue that will haunt us for the next 50 years," says Berkeley mechanical engineering professor Arun Majumdar. "The environmental impact of continuing to use fossil fuels means that we have to look for other ways of producing energy."

To extend the search, UC Berkeley has entered an historic collaboration with Taiwan's largest research organization, the Industrial Technology Research Institute (ITRI). The Berkeley-ITRI Research Center will spur development of powerful energy technologies based on the University's nanoscale innovations—from flexible solar cells fabricated onto plastic to a "bio battery" powered by the glucose in your body.

The collaboration provides ITRI with "immediate access to UC Berkeley's basic research and the Silicon Valley ecosystem," according to Majumdar, director of the center. "It will help Berkeley continue to bring in the best people from around the world."

The Berkeley-ITRI Research Center is affiliated with the Center for Information Technology Research in the Interest of Society (CITRIS). ITRI will provide $500,000 annually for five years to support ITRI fellows, graduate students, and postdoctoral researchers. Berkeley will also host ITRI researchers on campus.

Already, Majumdar adds, a Berkeley-ITRI collaboration is under way to develop a novel nanotech-enabled battery that converts salt water into electricity. ITRI researcher Ming-Chang Lu contributed expertise in the fabrication of nanofluidic arrays, the tiny "plumbing" system embedded in the device.

"All of the fundamental processes of energy conversion occur at the nanometer scale," Majumdar says. "So if you can manipulate things down at those scales, you might be able to increase the performance of existing devices and even create new methods of converting and storing energy." ■

BY DAVID PESCOVITZ

*Kara Nelson*

*Brian Wirth*

PEG SKORPINSKI PHOTO

## Young Berkeley Engineering researchers win PECASE award

Berkeley Professors Kara Nelson, Kimmen Sjölander, and Brian Wirth were among five Berkeley researchers and 57 nationwide to receive the nation's highest honor for scientists in early stages of their careers, the Presidential Early Career Award for Scientists and Engineers (PECASE), presented last fall.

CEE assistant professor Nelson is researching how sunlight and oxygen treat contaminated water via UV light and photo-oxidation, which can lead to cell damage in waterborne pathogens. Her work may facilitate improved methods for treating drinking water and wastewater as well as better water quality standards, particularly in developing countries.

BioE assistant professor Sjölander (not pictured above) works with experimental biologists investigating the evolution of proteins, the workhorses of all life. (*See story page 16.*) She is developing algorithms to determine how proteins evolve novel functions and structures, including how proteins confer disease resistance in plants and animals.

NE assistant professor Wirth uses computational modeling to study mechanisms that cause defects in metals—primarily those resulting from irradiation by neutrons and ions—for the purpose of monitoring safety in nuclear facilities. ■

# 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.***

## Sproul installation features state-of-the-art webcam

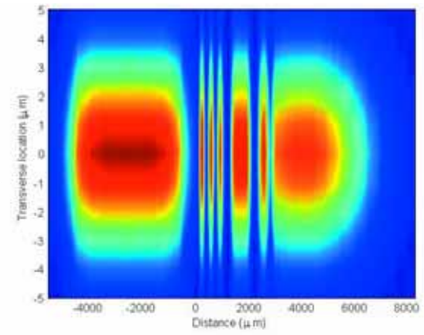
A robotic camera mounted atop UC Berkeley's student union for six weeks last fall exhibited the latest webcam technology and simultaneously got people thinking about privacy in public places, all in conjunction with campus events celebrating the 40th anniversary of the Free Speech Movement.

The brainchild of Professor Ken Goldberg and a multidisciplinary student team, Project "Demonstrate" was tested by more than 4,000 users who, through the camera's Web site, could get a live view of Sproul Plaza, remotely zoom in for close-ups, and snap still photos for posting on the archives. Up to 20 Web users at a time could share the camera, which would then calculate a group view.

"The system uses algorithms we developed for efficiently computing the optimal camera frame given many simultaneous user requests," says Goldberg, professor of IEOR and EECS. The project was exhibited at the Whitney Museum's Artport Web site and has generated dialogue on campus and beyond. Visit the Web site at **http://demonstrate.berkeley.edu** for a simulation of the live site and photo archives. ■

*The webcam was positioned to get a sweeping live view of the historic plaza from the steps of Sproul Hall to Sather Gate and Telegraph Avenue. A simulation can be viewed at* ***http://demonstrate.berkeley.edu.***

PHOTO COURTESY OF KEN GOLDBERG




*View a simulation of slow light entering and exiting semiconductor quantum wells at* ***http://photonics.eecs.berkeley.edu/slowlight/slowlight_field_big_fast.avi.***

## Setting limits on the speed of light

In an age where everything seems to be getting speedier, Berkeley researchers are slowing down that proverbial measure of speed—the speed of light—in an effort to improve network communications.

EECS professor Connie Chang-Hasnain, former EECS postdoc Pei-Cheng Ku, and others have shown for the first time that the group velocity of light, the speed at which a laser pulse travels along a light wave, can be slowed to about six miles per second (mps) in semiconductors. That's 31,000 times slower than the normal speed of light through a vacuum (186,000 mps).

"This achievement marks a major milestone on the road to ever faster optical networks and higher performance communications," says Chang-Hasnain, who is also director of Berkeley's Center for Optoelectronic Nanostructured Semiconductor Technologies. The technology could facilitate 3-D graphics transmission, high-resolution video conferencing as good as face-to-face encounters, and quantum memory chips that could boost the power of supercomputers, including those used for complex climate modeling. ■

## Secondhand smoke finds a room of its own

PHOTO COURTESY OF BRETT SINGER

*In addition to furnishings, carpet, and draperies, the smoking room at LBNL features a single-port puffer smoking system and sorbent tubes to collect air samples for analysis.*

Berkeley researchers are conducting studies in a new type of smoking room—where machines do the smoking—to investigate the dynamics of environmental tobacco smoke (ETS). CEE professor Bill Nazaroff and Lawrence Berkeley National Lab (LBNL) researcher Brett Singer (M.S.'94, Ph.D.'98 CEE) utilize a furnished room that more accurately simulates a home environment than the stainless steel chambers often used in ETS studies.

The researchers study the various components of ETS, like benzene, formaldehyde, and other known carcinogens and contaminants. They carry out detailed sampling and analysis to understand factors like sorption onto room surfaces, ventilation, and how indoor pollutant levels compare to those in outdoor environments. The goal is to develop guidelines that can help minimize health risks for nonsmokers whose housemates won't kick the habit.

"The irony is that the amounts of several of these pollutants breathed by individuals exposed to ETS far outweigh the total amount breathed by the rest of us from polluted urban air," Nazaroff says. The research is being conducted in collaboration with LBNL's Environmental Energy Technologies Division. ■

*Professor Jon Burgstone's IEOR 190, the College's new class in engineering entrepreneurship, was in such high demand when it was first offered spring semester 2004 that more than 100 students showed up for the 45 available slots.*

## Center confers new status on engineering entrepreneurship

One student presenting his business plan for an entrepreneurial venture was met with a classroom full of raised hands, a barrage of questions, and a challenge from the instructor: "Does everyone agree that this business can generate $60 million of revenue in its first two years?"

The setting was IEOR 190, the College's new class in engineering entrepreneurship and the foundation for Berkeley's new Center for Entrepreneurship and Technology (CET). Similar programs exist at Georgia Tech, University of Illinois at Urbana-Champaign, MIT, and Stanford, and the demand is growing among engineers who are increasingly working in management roles in U.S. companies.

"Students are thirsty for this kind of knowledge," says Jon Burgstone, IEOR professor and CET faculty chairman. "Exposing them to the mindset of an entrepreneur will make them better prepared and more competitive." A private investor, Burgstone was formerly co-founder and CEO of SupplierMarket, an online marketplace for locating new trading partners that was acquired by Ariba in 2000 for $1.1 billion.

The CET will allow the College to attract both students and professionals interested in better academic preparation for entrepreneurship, Burgstone says. He has assembled an academic board of engineering faculty and a high-powered advisory board that includes Michael Marks (Flextronics), Jim Davidson (Silverlake Partners), Allen Morgan (Mayfield), and Tom Byers (Stanford). The CET will coordinate closely with Berkeley's Management of Technology program run by Drew Isaacs and Haas Business School's Lester Center for Entrepreneurship and Innovation run by Jerry Engel, both Haas professors.

"The curriculum will take advantage of much that is already available in this area, buttressed by the appropriate use of some of the finest entrepreneurs in the world who live right here in the Bay Area," says Marks.

Long-term plans include offering engineering undergraduate majors a five-course certificate in entrepreneurship. Besides IEOR 190, current offerings include 190B/E198, Entrepreneurial Marketing and Finance; and 171, Organizational Leadership. With two classes under his belt, IEOR senior Andrew Laffoon has nothing but rave reviews.

"Burgstone's class [190] gave me the tools and knowledge I need to work in a startup," Laffoon says. "The CET and the programs it will offer are a huge need and a huge opportunity."

Go to **www.ieor.berkeley.edu/~cet/** for more details. ■

## California Triumph

*CE graduate student Hirokazu Hiraiwa (B.S.'04 CE) beat out 15 competitors in a contest to compose a new fight song for the Cal Marching Band, its first new song since 1978. Hiraiwa won $2,000 and got to conduct the band's performance of "California Triumph" at the opening football game of the season. Although he never wrote a song before, Hiraiwa played trombone in the band as an undergraduate. Go to* ***www.calband.berkeley.edu/calband/media/triumph.html*** *to hear "California Triumph."*

## Berkeley top ranked in world for engineering and IT

UC Berkeley is the No. 1 engineering and information technology university in the world, ahead of No. 2 MIT and No. 3 Stanford, according to rankings published last month by the *Times Higher Education Supplement (THES)*. The higher education weekly published by *The Times* of London also named Berkeley No. 4 on its list of the top 100 science universities. The ranking followed *THES's* announcement that Berkeley finished second in its first-ever list of the top 200 universities in the world, behind only Harvard, based on a survey of 1,300 international academic leaders.

Berkeley also held onto its spot as the top-ranking U.S. public university according to *U.S. News & World Report*. Among all 248 U.S. universities—both public (162) and private (86)—that offer undergraduate, master's and doctoral degrees, Berkeley was ranked 21st. In a separate specialty listing, Berkeley's engineering programs ranked third among undergraduate programs at schools whose highest degree is a doctorate, and eight of its engineering programs were ranked fifth or higher. ■





**RONALD YEUNG** (B.S.'68, M.S.'70, Ph.D.'73, NA) received the prestigious 2004 Davidson medal from the Society of Naval Architects and Marine Engineers (SNAME) for his "outstanding scientific accomplishment in ship research."

Yeung, distinguished professor and former chairman (1989–96) of naval architecture and offshore engineering, is recognized worldwide as a leader in ship hydrodynamics. An early pioneer in the field, he is the author of a widely quoted 1982 survey paper, "Numerical methods in free-surface flows," that remains a classic today. He took a faculty position at MIT in 1974, then returned to Berkeley in 1982, and was advanced to the rank of distinguished professor in 1994. In 1997, he spearheaded the formation of the Interdisciplinary Graduate Group of Ocean Engineering at Berkeley.

THE SACRAMENTO BEE/ANNE CHADWICK WILLIAMS PHOTO

*Berkeley computer science graduate student Vinod Prabhakaran (left) tutors Lamarr Mainor Sr. through San Quentin's College Program, where 42 inmates have earned AA degrees.*

## Tutoring gives CS students a view inside prison walls

Every Monday and Wednesday evening, computer science Ph.D. student Sean Rhea joins a carload of Berkeley students for the drive along I-580 from Berkeley and across the Richmond Bridge to San Quentin. The students are volunteer instructors, teaching assistants, and tutors in the San Quentin College Program, the only onsite degree-granting program in the California State prison system.

"I wanted to do something good for the world and see that I am actually making a difference," says Rhea, who tutors math. "In contrast to other forms of activism, teaching the inmates provides a very real and immediate reward," he adds.

The program was initiated in 1996, when Patten University, a small Christian college in Oakland, opened an associate of arts extension at the prison. The curriculum offers more than 20 transferrable courses in the humanities, math, and the physical and social sciences. About 200 inmates are enrolled, 42 have completed AA degrees, and some parolees have transferred into community colleges and universities.

According to program director and Cal alumna Jody Lewen (Ph.D.'02 Rhetoric), the classes provide an opportunity for people of very different social, economic, and cultural backgrounds to interact.

"These highly educated graduate students are coming in to teach the prisoners," Lewen says, "but what often happens is that the teachers learn more than the students, especially about the criminal justice system. It's a 'world-rocking' experience for a lot of them."

Vinod Prabhakaran, another computer science Ph.D. student at Berkeley, also taught math for the program, working with the inmates in the basement of San Quentin's former hospital building.

"I heard about the prison college program from another student volunteer," says Prabhakaran. "I felt like it was a concrete way of helping. I also like teaching, and teaching basic math to grown-ups is a very interesting challenge."

Volunteers are vital to the program's success, according to Lewen, who last year founded the Prison University Project, a nonprofit organization devoted to supporting the San Quentin program and expanding similar prison programs throughout the state. All depend heavily on volunteer teachers and tutors from UC Berkeley and other area colleges, since funding does not allow for the hiring of teaching staff.

"We look for people who are not only excellent teachers," says Lewen, "but who are also professional, mature, and responsible—people who can function in this kind of environment." Each volunteer must go through several hours of training before being cleared by the prison to work with the inmates. Most devote five or more hours each week to their teaching responsibilities at the prison.

"It's a rewarding experience, but it's not all roses," says Rhea. "Some of the students have a legitimately hard time learning, others are recovering alcohol or drug users, and many are distracted by concerns about their families outside the prison."

The program has generated some controversy because, critics say, it is unfair to provide a free college education for inmates when others have to pay. But, for now, the program continues, and a formal evaluation may be undertaken by the state to determine future funding levels.

"For many of these guys, learning is an entirely new experience," Rhea says. "But once they make the transition, they seem like completely different people. They stop looking at the class as something they need to pass and start seeing it as fun." ■

BY CAROL MENAKER

Carol Menaker of San Jose is a freelancer who writes for a number of university alumni magazines.

# HEADING INTO THE GOLDEN AGE OF WIRELESS 2.0

## Newly minted PicoRadios sport ambient intelligence and disappear into the environment

BY DAVID PESCOVITZ | PHOTOS BY BART NAGEL

*Rabaey and Otis (left) have recently found a way to shrink the PicoRadio's antenna to a mere trace wire, reducing cost as well as the radio's diminutive mass. "Now we hope to bring the power down, maybe even by a factor close to 10," says Otis.*

In Jan Rabaey's vision for the future of computing, the most powerful PCs are the ones you cannot see. These computers will be invisible but alert. Small and inexpensive, they will be woven into the tapestry of our lives—hidden in our pockets, clipped to our prized possessions, embedded in our home appliances. They will sense our behavior and sometimes act on our behalf.

Rabaey, Berkeley professor of electrical engineering and computer sciences (EECS), calls this paradigm "ambient intelligence." Science fiction enthusiasts know it as the smart home.

Inside Rabaey's imagined smart home, surround sound music follows him wherever he walks, shifting from speaker to speaker. The refrigerator knows when it's running low on milk and eggs, automatically e-mailing an order to a grocery delivery service. A smart power meter informs the thermostat when it's least expensive to run the air conditioner to maintain the desired temperature, reducing energy consumption and the monthly utility bill. If Rabaey misplaces his car keys, he pushes a tiny icon painted on his wall and a flat panel display comes alive with a video image of his living room. A bull's eye graphic appears superimposed on the sofa cushion where his key chain lies hidden. Authentication algorithms embedded in the system ensure that information flows in an unobtrusive and a-need-to-know basis, avoiding Big Brother scenarios and unauthorized snooping.

"Today's consumer electronics world consists of individual gadgets," says Rabaey, who is also a researcher at the Berkeley-based Center for Information Technology Research in the Interest of Society (CITRIS), as well as director of the Gigascale Systems Research Center (GSRC), a multi-university research center sponsored by the semiconductor industry. "But ambient intelligence means that the gadgets form networks so they can communicate with one another."

And that brings Rabaey to the PicoRadio, the tiny, inexpensive, low-power communications technology that he and his students—among them doctoral candidate Brian Otis—have developed over the last five years at the Berkeley Wireless Research Center (BWRC), where Rabaey serves as scientific codirector. The idea is that a PicoRadio costing less than $1 could be slapped on any object, from a washing machine to a key chain, enabling it to join ad hoc wireless networks and share information with its neighbors. Outfitted with myriad sensors to detect light, temperature, and motion, the PicoRadio creates a distributed network that understands its environment and reacts to it. The prefix *pico*, meaning one-trillionth, isn't to be taken literally, but rather serves as a reminder of the research group's mission: creating new generations of ever smaller, cheaper, lower-powered devices.

"The big questions we ask are how much simpler can our radios be than today's off-the-shelf technology?" says Rabaey. "How little energy do they need? How small can they be?"

The tiny device in Rabaey's hand holds the answers, at least for the moment. Just a few millimeters square, the most recent generation of PicoRadio chips has just returned from the chip fabrication facility. This one, called a "Quark" node in reference to the subatomic building blocks of matter, draws just 100 microwatts of power. That's 10 times less than the energy needed by the commercial radios on UC Berkeley's Smart Dust, small wireless sensor nodes that monitor everything from a building's seismic stability to the environmental conditions in a redwood forest canopy. Even devices based on Bluetooth—a popular technology for wireless communications between nearby devices—require a comparatively huge 70 milliwatts of power to provide short-range connectivity so you can wirelessly synch your computer and cell phone address books or even replace the wires on a hands-free headset for your cell phone.

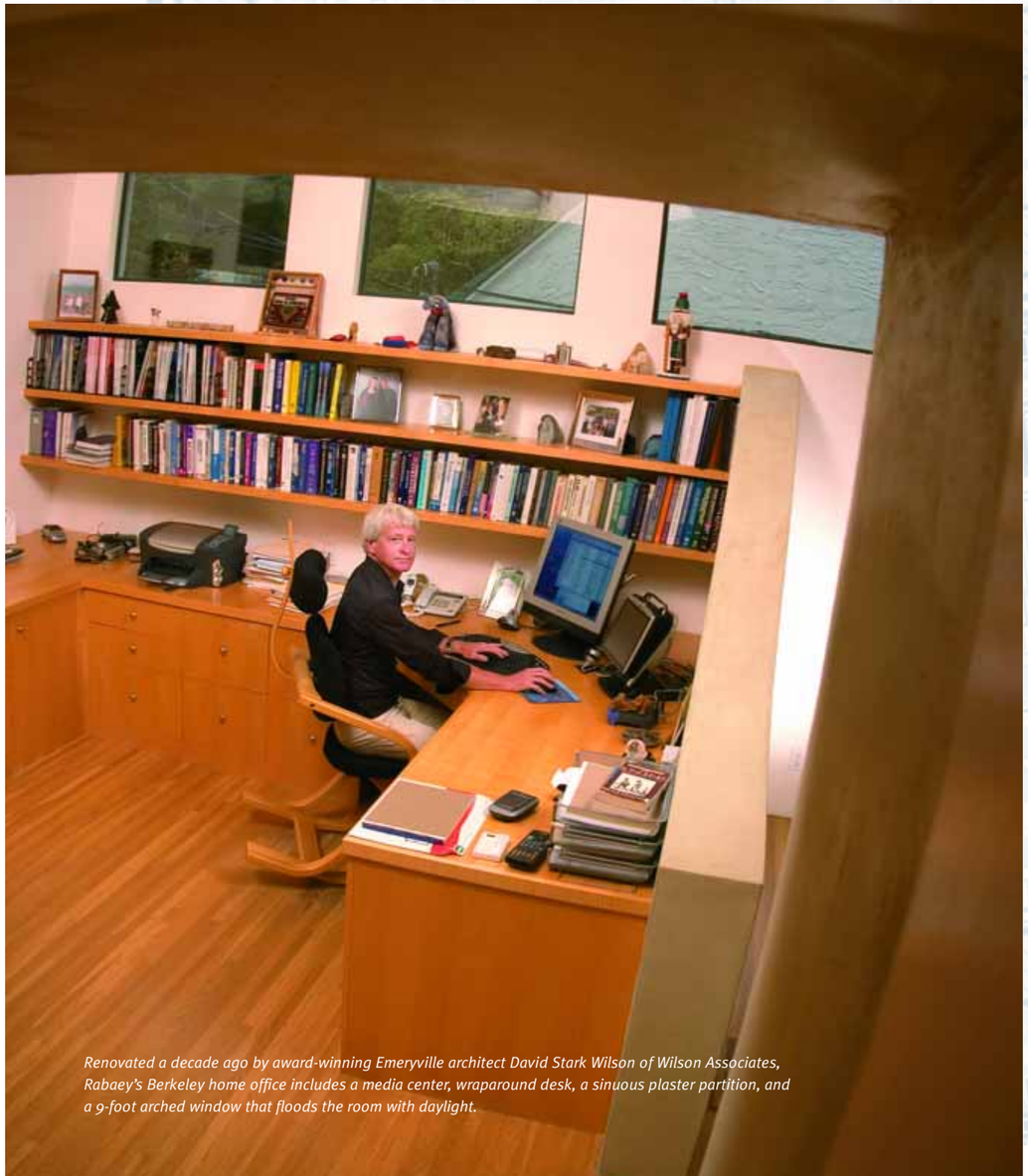
To hit such low power and small size with the PicoRadio, Rabaey and Otis adopted a mantra of "simplify, simplify, simplify!" They stripped the necessary radio frequency (RF) electronics down to its bare bones. The Quark node consists of two custom chips: a digital signal processor and a two-channel radio transceiver. The antenna is printed directly onto the circuit-board with the electronics that drive the microchip. In fact, Rabaey gets a kick out of linking every component in an electron micrograph of the PicoRadio RF chip to its counterpart in a photo of a vintage 1949 wireless set.

"In the 1920s and '30s, they only had a couple of vacuum tubes to play with so they used a lot of passive components," he says. "In the same way, rather than use hundreds or thousands of transistors, we really minimize the number of active components that require the most power. The underlying assumption of the ambient intelligence concept is that the complexity of the system lies not in the individual nodes, but in the collection of connected nodes."

Still, wireless communication is notoriously power hungry. That's why cell phones are limited to a few hours of talk time before you have to recharge their batteries. Of course, the smart home applications that Rabaey foresees require sensor nodes with a range of only a few meters. For longer transmissions, the nodes pass data across the network, bucket-brigade style. And in an innovative approach to power conservation, the radio only "wakes up" when it has to send and receive. Given those constraints, batteries would seem like the perfect approach to power the PicoRadios. And they are, Rabaey explains, until it comes time to charge them.

The diminutive size and low cost of the PicoRadio nodes means that they can be deployed by the thousands in every nook and cranny, from light switches to milk cartons to key chains. But the sheer number of nodes makes changing batteries or manually recharging the devices completely impractical. That's why the PicoRadio was built from the bottom up to be self-sufficient. "They scavenge energy from their environment," Rabaey says.

“PicoRadios scavenge energy from the environment.”



*Renovated a decade ago by award-winning Emeryville architect David Stark Wilson of Wilson Associates, Rabaey’s Berkeley home office includes a media center, wraparound desk, a sinuous plaster partition, and a 9-foot arched window that floods the room with daylight.*

The Quark PicoRadios are outfitted with small solar panels. With sufficient illumination, either from the sun or indoor light bulbs, the solar cells trickle power into two rechargeable coin batteries that keep the node alive when light is scant. For deployment in total darkness, the team hopes to outfit PicoRadios with the ability to convert natural vibrations—the hum of computer monitors, the continuous shudder of heating and cooling ducts—into electricity. In collaboration with mechanical engineering professor Paul Wright and his group, the team built devices that harness this kinetic energy. Fabricated with the same processes used to manufacture computer chips, the vibration-based generators could eventually be integrated into the PicoRadios.

Right now though, Rabaey, Otis, and the other students on the team are honing the PicoRadio design to further reduce power consumption. One way to conserve juice, Otis explains, is to integrate even more of the external circuitry into the custom chips—from the electronics that control the power flow to the onboard clocks that provide the “heartbeat,” synchronizing the execution of software instructions. To that end, they are collaborating with the Berkeley Sensor and Actuator Center on tiny micro-electromechanical systems (MEMS) devices that can be built directly on top of the Quark chips.

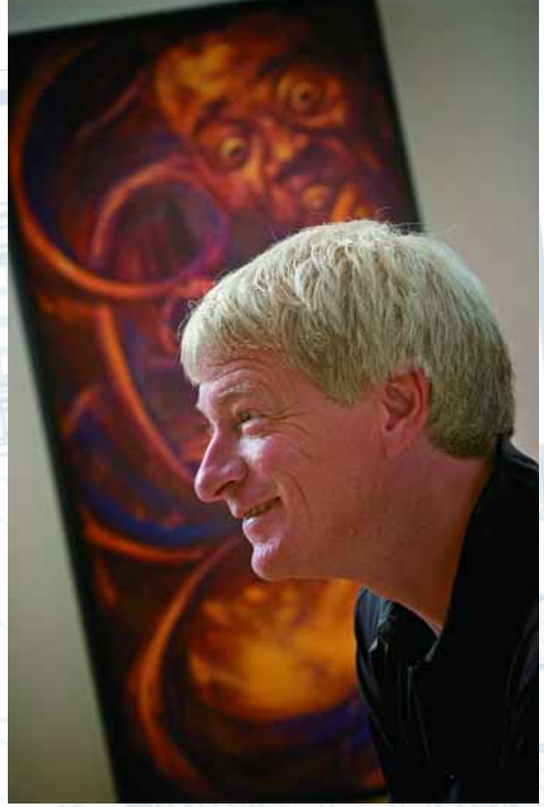
“The exciting part for me is doing work that contributes to my field of RF design while also pushing forward the capabilities of sensor networks,” Otis says.

Meanwhile, the first PicoRadio application is already in development within CITRIS. Supported by the California Energy Commission, Rabaey, Otis, and Wright are working with researchers at UC Berkeley’s Center for the Built Environment to cut utility bills by combining PicoRadios with “demand-response” energy pricing.

A demand-response cooling system involves PicoRadio sensors that monitor temperature in various parts of a house or apartment and relay data to a networked thermostat. Simultaneously, sensors coupled to electrical circuits in breaker boxes monitor the power consumption of other appliances. As energy prices shift hourly, those numbers are transmitted wirelessly from the utility company to a smart meter at the residence. Sophisticated computer algorithms running on the thermostat will keep the house cool without turning on the air conditioner at peak times.

“This kind of closed-loop control could save you 10 to 15 percent on your power bill,” Otis says. The user’s only responsibility would be to program temperature preferences into a familiar thermostat. The network would take care of the rest. The power behind the curtain, Rabaey says, is what ambient intelligence is all about.

“My vision is for all electronics to disappear into the environment,” Rabaey says. “This technology will help change the way we interact with the information flowing around us so that it’s much more natural.” ■



*Raised in a small town near the medieval Belgian city of Brugges, Rabaey discovered the silky sounds of American jazz when he moved to the U.S. The sophisticated pulse of Miles Davis, John Coltrane, Louis Armstrong, and Brazilian bossa nova create the ambience Rabaey works best in. “It’s so relaxing and inspirational,” he says, “like a voice speaking.”*

DAVID PESCOVITZ writes *Lab Notes*, the College of Engineering’s online research digest, and contributes to *Popular Science*, *TheFeature.com*, and *Business 2.0*. His writing on science and technology has been featured in *Wired*, *Scientific American*, *IEEE Spectrum*, and the *New York Times*.

# KIMMEN SJÖLANDER:
## COMPUTATIONAL ARTIST EXTRAORDINAIRE

BY GORDY SLACK | PHOTOS BY PEG SKORPINSKI

On the wall above Professor Kimmen Sjölander's desk hangs a photograph of the Beatles, taken at the release party for their Sgt. Pepper's Lonely Heart's Club Band album. They are beaming, soaring at the top of their game. Sjölander keeps that photo to remind herself and her students that creative play and hard work make beautiful music together.

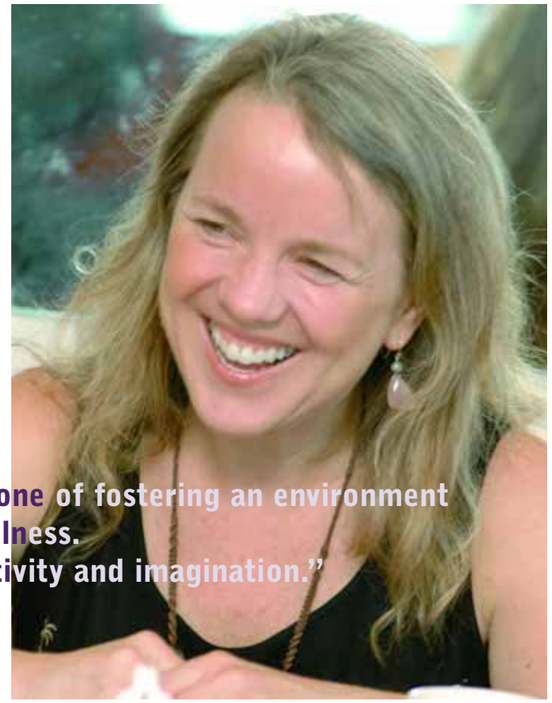
Sjölander made her mark early. Even as an undergraduate at UC Santa Cruz, she was developing innovative algorithms under the wing of bioinformatics innovator David Haussler. Today, a decade later, her digital code is all over the field of computational biology, particularly in the area of protein phylogenomics. In September she won a Presidential Early Career Award for Scientists and Engineers (PECASE), the nation's highest honor for scientists in the early stage of their careers.

In 1997, Sjölander went to work for a biotech startup that was soon bought by Celera Genomics, where she played a key role in the functional analysis of the proteins encoded in the human genome. As principal scientist for the Protein Informatics group at Celera, she coauthored the landmark publication of the human genome in the journal *Science*.

For the past three years, Sjölander has been on the College's bioengineering faculty heading up the Phylogenomics Group. Her lab develops computational methods that uncover evolutionary relationships among proteins, allowing scientists to infer the structure and function of newly discovered proteins on the basis of their relationships to known ones. Identifying the structures and functions of proteins—the workhorses of all life—helps biologists untangle the story of evolution and will be key to helping genetic researchers understand how proteins confer disease resistance in plants and animals, and perhaps in the development of new medicines.

A faculty scientist at Lawrence Berkeley National Laboratory, Sjölander is a member of the three-campus initiative, the California Institute for Quantitative Biomedical Research (QB3). She holds a joint appointment in the Department of Plant and Microbial Biology, where she works with biologists on plant disease resistance. Using a National Human Genome Research Institute grant, she is also developing a digital catalog of human brain proteins.





INSET BUTTERFLY PHOTO BY KIMMEN SJÖLANDER, AVID NATURE PHOTOGRAPHER

**Q:** Let's dive right in and talk about how you launched your career in computational biology.

**K.S:** My bachelor's degree and my Ph.D. at Santa Cruz were both in computer science. I focused on machine learning, which comes down to developing basic mathematical and algorithmic approaches to extracting information from data. I had the great luck to work with [UC Santa Cruz computer science professor] David Haussler, who was starting to apply machine learning to biological data. Based on a research project I did as a freshman, David invited me to be part of a team applying methods from speech recognition to the problem of multiple-sequence alignment of proteins. This ended up being the genesis of hidden Markov models for proteins, which had an enormous impact on computational biology. It took off from there.

It sounds like you walked right onto a rocket ship that was already smoking on the launch pad.

Totally. I had dreamed of doing research and being a scientist, and suddenly there I was. Those were amazing days, full of creativity. First thing I did in the morning was turn on the computer to see what happened to my experiments the night before, and I haven't stopped. I'm as excited and obsessive as I was back then. On the other hand, it wasn't easy. When I went back to school, I had three young kids. My twins were two and my oldest was five.

What was it like for your children to grow up when you were so heavily into your studies?

I chose to do my undergraduate work at Santa Cruz partly because it provided such a healthy framework for raising my children. Family student housing at Santa Cruz was very supportive. Being a single parent is really hard for most people, and it wasn't easy for me, but for the most part we had a tremendous time. There might have been times when my kids wished they had a mom who'd have cookies and milk on the table when they got home, but not many. We did a lot of hiking and exploring and gathering lichen in the redwoods. We still think about how great those times were.

You went back to school after a 15-year academic hiatus. You explored a lot of different worlds during that period. Tell us about your life between leaving school and returning to Santa Cruz as an undergraduate in 1990?

My twin sister and I started college at City College of New York when we were 15. After a year, I left home and got a job. I went through a bunch of different lives, something like Picasso's different periods. I studied Chinese literature and art and philosophy and worked as a waitress. I was sculpting and painting and writing poetry and hanging out in the cafés in Greenwich Village. My friends were ballet dancers and painters and musicians.

In 1975 I moved to the Bay Area from Manhattan to help my sister raise her daughter and entered a spiritual phase. I got into Zen Buddhism for a while, then tried Hinduism with Indian guru Sri Chinmoy. Then I got pulled into this bunch of born-again Christians and married my first husband, with whom I had my three kids. By now I think I've been successfully immunized against all religions.

**That's when you decided to go back to school?**

Yes. I wanted to get a Ph.D. in the sciences. At that point, I wanted to have something that was entirely mine, something not dependent on a man. And of course I wanted interesting and challenging work. I got that in spades!

**What was it like going back to college at age 32, and why Santa Cruz?**

Santa Cruz is a relaxed, funky little beach town and the first time I drove through I felt at home. I knew I wanted to study machine learning and artificial neural networks as ways of modeling the brain. Santa Cruz had David Haussler, the leading person working in these areas.

When I started school, I wanted to study human cognition. But it became evident that while computational neuroscience was interesting, the time for computational molecular biology had arrived, and that the machine learning methods we were developing were powerful tools in this field. It was thrilling to be a part of something so real and important and to be able to contribute my own research as an undergraduate. But to tell the truth, going into my senior year I still wasn't 100 percent sure that I wanted to stay in computational biology.

Then David showed my work to [UCSC molecular biologist] Harry Noller. At that time there was a big controversy over the branching order in the tree of life. I had come up with clustering algorithms that we applied to DNA sequences, and the phylogenetic tree I constructed supported one side of the debate. Noller got interested and suggested I take his course on the molecular biology of the gene.

That course was like the last battle in *The Chronicles of Narnia*, where these English children wander through the Kingdom of Narnia and find a little hut in a glade. They go into the hut and find an entire world there. When I took the class with Noller I felt like I was opening the door to this hut, and that hut was the cell. The world of the cell just opened up to me. These molecules, proteins, were doing things! There is a whole dynamic life going on within them, which is an absolute mystery. They were like living things, not just inert, passive objects. It was a tremendously exciting time. That feeling hasn't stopped.

**So you entered grad school at Santa Cruz knowing you wanted to combine the computer modeling tools you'd developed with the study of life and evolution?**

The methods I applied toward protein phylogenic tree construction can also be applied to species evolution. In fact, a chapter of my Ph.D. looked at the phylogenetic relationship between humans, chimps, gorillas, orangutans, and so on. But most of my work in phylogenetics has been identifying protein superfamilies, which has a distinct set of problems.

**You use phylogenetic inference to identify how protein superfamilies evolve novel functions and structures. Why is that so tricky?**

Phylogenetic or evolutionary inference has been traditionally applied for speciation—figuring out how species are related—and the biological processes underlying protein superfamily evolution add a level of complexity. Also, proteins have different forms at different times in their lifecycle, and there are post-translational modifications. They interact with partners and they have conformational changes. They form complexes, they engage in the complex, and then they disengage from the complex. There is a hubbub of activity in the cell. We're just beginning to understand how proteins do these things and under what circumstances. When you look at these protein families at the molecular level, it changes your view of life. You can line up related proteins from bacteria, fungi, mammals, and plants in a multiple-sequence alignment and see we all have a common ancestor.

**How did you come to have a joint appointment with the Department of Plant and Microbial Biology?**

I was here at Berkeley when I saw a program announcement from the National Science Foundation for plant genome research. When I give talks on how protein superfamilies evolve novel functions and structures, one of my favorite examples is a little protein superfamily that includes toxins made by scorpions as well as plant and insect defensins [proteins, that are part of the innate immune arsenal]. When you look at this superfamily, you immediately see that the common ancestor of plants, insects, and scorpions—some primitive eukaryote—had some gene like these, which has evolved to play different roles in the present day descendents. In plants and insects, they're part of the defense. In scorpions, they're part of the offense.

When I saw this announcement, I realized I could take the computational methods I developed for protein superfamily analysis and apply them to proteins involved in plant disease resistance. As it turns out, many of the proteins involved in the mammalian innate immune system are found in plants. And when we study the two systems side by side, we get some interesting insights. I wanted to find biologists to collaborate with, so I looked online and found a Berkeley faculty member working in this area, Barbara Baker, a plant and microbial biology professor. We met at a local cafe and in the course of that first cappuccino decided to work together. We've become great friends too. One thing led to another, and I was invited to join PMB as an affiliated faculty member.

**We're still in the midst of computational biology's big bang, but has the field said anything important yet about the big theories or patterns of evolution?**

One thing that has become very clear is that although evolution is described as largely tree-like, there is a lot of horizontal gene transfer going on, particularly among bacteria. Computational biology has really highlighted this.

**Speaking of horizontal transfers, when you are working across disciplines, you rely a lot on collaborations.**

Absolutely. My collaborations with experimental biologists are crucial. They help ensure that we're developing methods that will address problems important to the biologists and not just problems that are theoretically interesting. Working with experimental biologists also helps hone our methods. We apply a computational method to data that biologists are interested in and get some predictions. Then the biologists do wet-bench experiments and give us feedback. Then we look at the data together and find out what parts we might not have been paying enough attention to.

Dale Chihuly's Persian Pond, from *Chihuly Gardens & Glass*

PHOTO BY TERRY RISHEL, COURTESY OF CHIHULY STUDIO

**"Chihuly's work is an inspiration of what I want my science to be like," says Sjölander, whose other favorite artist is Picasso.**

**Do you use these tools to corroborate and cross-check the results that biologists are getting, or also to forge new territory?**

We sometimes find novel members of protein families that the biologists didn't know existed. They'll tell us that they're looking for a protein with such and such characteristics. We'll find the proteins and they do experiments on them and say whether we're right or wrong. Or we predict that a certain protein has a specific function based on our analysis. Then they go and test that.

**Where do you see your work going now?**

I'm now in a place where I can work on my first love scientifically, trying to understand human cognition. I hope to learn something about what we are as sentient animals and how the protein families that confer that functional specificity have evolved.

**You've said that David Haussler's creativity and playfulness, as well as his science, were inspiring and formative for you.**

Everyone in my lab knows how important it is to me to be creative and playful but also to work hard. We have very high standards of scientific excellence. You have to be rigorous or it stops being fun.

**Your work has so many different facets. Is there a central question in all of this diverse activity?**

The central question is, "How does life evolve?" Period. It's the evolution of life and the understanding of life. I address the question in a concrete way by studying how protein superfamilies evolve novel functions and structures.

**Are you ever nostalgic for your bohemian years as an artist?**

When I was young I wanted more than anything to be a great artist…and in a way that dream has come true. I'm not the kind of artist I thought about being then; I'm a computational artist. But I get to exercise my creativity, to use my mind and imagination to engage the world and to explore it and to reflect it. I just love that.

GORDY SLACK is an Oakland-based science writer specializing in evolution and the environment. His work appears in *California Wild*, *Wired*, *Mother Jones*, *Bay Nature*, and *Sierra*.




STEPHEN MILLER PHOTO, COURTESY OF NEMEA EXCAVATIONS ARCHIVE, UC BERKELEY

# TEMPLE OF ZEUS RISES AGAIN

## Column reconstruction reveals an obsession with engineering perfection that dates back to 4th century B.C. Greece

BY JENN SHREVE

At the site of Ancient Nemea in the Greek province of Corinthia, where mythology records Hercules' first labor with the ferocious Nemean lion, life goes on much as it has for the last two millennia. Here, in the seismically active eastern foothills of the Arcadian Mountains, the land is studded with olive trees and grape fields and is home to a small village of farmers. The Temple of Nemean Zeus, although mostly in ruins, still dominates the valley as it has for more than 2,300 years.

Last August, as the world's Olympians descended upon Athens, the New Nemean Games were wrapping up 80 miles to the west. Revived in 1996 by Berkeley classics emeritus professor Stephen Miller, the games attracted more than 700 runners from around the world. They competed B.C. style—barefoot and sporting tunics. Their course was a clay track, dug out millennia ago in the shadow of the Temple of Zeus. Among the runners was Berkeley civil engineering professor and Greek native Nicos Makris.

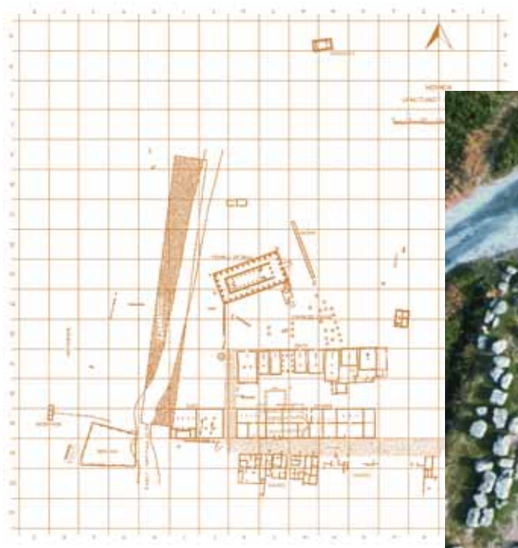
"The games were a shower of information from how things were done in the past," says Makris, a specialist in earthquake engineering who joined the Nemean Temple project in the fall of 2002, served with Miller as codirector for one year, then took over as director last January.

Miller, who retired in December, felt his work at Nemea would not be complete until attention turned to the Temple of Zeus. "It's this temple, which has been in ruins for centuries, which will provide links to the site's sacred and cultural origins as well as valuable insights into ancient Greece's innovative engineering techniques," says Miller.

While it is standard fare for archaeologists to preserve and analyze the monuments they excavate, Miller made the decision more than 20 years ago to go beyond that at the temple, taking on the ambitious task of trying to reconstruct the temple's columns.

"For me," he says, "the impetus for reconstruction is preservation. Yet when it came time to literally put the pieces back together again, I had to confess there were problems with the temple I wasn't prepared to handle because I'm not an engineer," says Miller, a classical archaeologist who began excavations in ancient Nemea 30 years ago, unearthing the town's athletic stadium, entrance tunnel (covered in ancient graffiti with the athletes' names), track, bathhouse, and what is likely the world's oldest locker room. "What it has meant is that we get an interesting discussion back and forth: archeology-engineering. There's a spirit of cooperation that Nicos and I have that's very productive."

Built in 330 B.C., the Temple of Nemean Zeus was an architectural and engineering triumph, combining elements of the Classic Doric temples with a creative twist of Hellenistic experimentation. Its presence had always dominated the Valley of Nemea. "The temple was the religious focal point of the Nemean Games and the one monument that every member of the crowd was sure to visit," says Miller.



STEPHEN MILLER PHOTO, COURTESY OF NEMEA EXCAVATIONS ARCHIVE, UC BERKELEY

**Right:** *Aerial view of the Temple of Zeus. The column drums, weighing a hefty 2.5 tons each on average, can be seen scattered around the temple.*

Fourth century B.C. visitors, who came by the tens of thousands every two years for the festival games—athletes, trainers, judges, lawyers, slaves, and priests—made their way through a bustling crowd of magicians, fortune-tellers, historians, poets, and peddlers to the temple's altar to offer sacrifices and prayers to Zeus.

They approached the 9,240-square-foot temple from the east, arriving at the temple's facade, which was elegantly formed by six 34-foot-high Doric columns. The outer colonnade of the temple consisted of 32 columns—six along the short east and west sides, and 12 along the long north and south sides. The building had an interior colonnade of 14 Corinthian-style columns and stone stairs at the back of the main chamber leading into a sunken crypt, where local oracles dealt out predictions throughout the festival games. It was in front of the stairs that the imposing statue of Zeus resided. Long gone, the cult statue was most likely taken to Argos when the games were moved there in 271 B.C., according to Miller.

The temple was meticulously oriented by its ancient architects so that at sunrise on the late July day the festival began, the sun's rays were precisely angled to pierce directly through the open temple doors, bathing the statue of Zeus in bright light.

Over the years, the temple weathered wars and the erosion of time, but it was the persistently recurring temblors in this seismically active region—some exceeding a 7.0 magnitude—that most experts believed brought the temple down. However, in the course of his analysis, Makris learned otherwise. "It was people who brought the columns down," he says. "They used the foundation and other square stones to build other structures, including a 5th century basilica to the south, built from the 'borrowed' stones." Early Christians of that era, say Makris and Miller, threw down the 34-foot columns surrounding the temple to gain access to the square blocks inside.

What this meant was that the three remaining columns possessed incredible seismic integrity, Makris says. "This was a crucial discovery. We proved that the Greeks had state-of-the-art knowledge in engineering. This temple was designed to withstand earthquake motions much stronger than those expected in the province of Corinthia. This is the most solid proof of the brilliance of the ancients' structural design."

Unlike the monolithic columns of earlier Greek temples, this temple's architects designed columns made of mounted stone cylinders, called drums. Each of the 32 outer columns and two inner columns on the entrance porch was constructed of 13 separate limestone cylinders. Measuring an average of 1.5 meters in diameter, three-quarters of a meter in height, and weighing some 2.5 tons each—massive enough, say the experts, to keep them from being looted—these huge cylinders were stacked with astonishing precision in a multidrum column typical of the era. The joints between the drums were carefully sealed and the porous limestone completely coated with a plaster made from the dust of Pentelic marble—fine white marble mined from quarries near Athens—giving the humble limestone structure the grand appearance of a marble monument.

So why then, did these ancient architects choose the awkward drums as building blocks instead of single monoliths as the Greeks had been so fond of using in earlier temples?

"I'd always been told that the Greeks in early days adopted column drums for economic reasons," says Miller. "It was cheaper." But as the team began replicating the precise fit of the ancient drums—26 hand-worked surfaces per column—it became clear that they were neither easier to use nor more affordable. Makris tested the stability of different column designs and found a more compelling reason for the switch to the multidrum design.

## "THE GREEKS HAD A STRONG BELIEF IN THE PERFECT FITTING OF STONES."

"It was seismic safety," he says. The Greeks had a strong belief in the perfect fitting of stones, Makris explains. "They often created surfaces that would fit together within 1/32 of an inch, which is tremendously difficult to do when working with a material as porous as limestone. Despite the fact that they were building with a poor material, they managed to create a monument with amazing acuity and craftsmanship."

It was their obsession with perfection that gave the temple superior stability, says Makris. "At the same time, the temple was built in such a way that, should a strong earthquake occur, the stone blocks were not tied together with rigid connections up the center, so there was the necessary mobility, and the temple could absorb the incoming energy from the earthquake."

This discovery, Miller realized, was supported by a key linguistic clue: The Greek word for column drum, *spondylos*, also means vertebra. "We've come to understand that the flexibility and shock-absorbing principles of the spinal column were what they were after."

The process of rebuilding is a painfully slow one, one column per year, Makris estimates. At a quarter of a million dollars per column, it's also tremendously costly. Rebuilding each column requires restoring the stones along the foundation, the column drums, as well as the large stone beams that once ran along the tops of the columns, many of which are badly damaged.

The Greek Ministry of Culture mandates that ancient materials be preserved wherever possible and that building techniques of the past be emulated. This means that when repairing damaged stone, workers preserve the look of the original piece by making a plaster cast of the broken surface, then replicating it using a complicated system to create a negative impression of the ancient surface on the new replacement block. A cement-based adhesive that combines the dust of the new stone is mixed in so that the original physical and chemical properties of the stone are replicated as nearly as possible, allowing moisture in the stone to pass through the joint instead of rotting the stone away at the joint, as would happen if an adhesive like epoxy were used.

"In a simple world we'd just pour concrete," says Miller. "But since our task is to put back into place all the ancient material that has survived and reproduce the same techniques used in antiquity to the best of our ability, there is a great deal that goes into this."

A growing archive of engineering discoveries has emerged from the site. The team discovered that wooden pegs placed in the center between two drums were used as rivets, so the ancient Greeks could rotate one drum atop another to achieve a perfect fit. In the summer of 2003, cement was discovered below the top of the foundation.

"I always believed the Greeks used cement more frequently than we gave them credit for," says Miller. "Porous limestone has lots of holes. In putting new blocks together [in modern construction], when we run into a block with a lot of holes, we fill it with cement. The ancient Greeks did the same thing, something we've recently learned."

By the end of summer 2002, Miller and his team had successfully reconstructed two new columns, bringing the number of standing columns to a total of five. Over the next two years, Makris hopes to complete the work already under way on the next four columns to fill out the northeast corner of the temple. But one of the main obstacles the team faces on the next four columns is the need to reconstruct nearly 80 blocks missing from the foundation. In compliance with the Ministry of Culture, new material is sourced from the same ridge that the temple's original builders mined. Several unused drums remain there to this day. Large boulders displaced from the construction of a nearby highway have also been cut into rough shape using a chainsaw fitted with a diamond piece, then hand finished to create the final surfaces.

"The ancient Greeks were not building these temples out of necessity. They built them because they wanted to express the greatness of their civilization," says Makris, who is on sabbatical in Greece. "This is a remarkable opportunity to preserve a valued part of my country's heritage. There's a lot we don't know yet. Every step in the process has yielded long-lost information about the ancient Greeks' remarkable abilities as engineers and architects." ■

JENN SHREVE is a writer who covers technology and culture. She lives in San Francisco and is earning her M.F.A. in fiction writing at San Francisco State University.

SARAH YANG, UC Berkeley Media Relations, contributed to this story.

PEG SKORPINSKI PHOTO

THEODORE PSYCHOGIOS PHOTO

**LEFT:** *"We share a fundamental creativity with the ancient Greeks that marks the human spirit at its best," says Miller, working at the Nemean Archives in Dwinelle Hall.*

**BELOW:** *"Because its interior had been robbed of so much building material, fully reconstructing the Temple of Zeus may not be possible," says Makris.*

THEODORE PSYCHOGIOS PHOTO

PHOTOS COURTESY OF JACK MARTIN

*At age 84, structural engineer Jack Martin is still looking for "fun projects" like this one, the 270,000-square-foot stainless steel Walt Disney Concert Hall, which he can see from the window of his 31st-story apartment in downtown Los Angeles.*

## Berkeley, not baseball, has been very good to him

When Jack Martin (B.S.'43 CEE) looks out the 31st floor window of his downtown Los Angeles apartment, he has a spectacular view of architect Frank Gehry's latest creation, the sweeping 270,000-square-foot Walt Disney Concert Hall. While observers might see this massive stainless steel structure of undulating panels as a thing of awe and beauty, Martin sees it as a creative solution to a complex structural engineering problem, or what he calls "a fun project."

The Walt Disney Concert Hall is one of hundreds of structural engineering projects in the Martin & Associates portfolio that began with the firm's first big commission in 1954, the Fremont Hotel and Casino in Las Vegas. Today, at 84, Martin continues to exhibit the extraordinary creativity and imagination that still attracts to his firm some of the most ambitious structural engineering projects in the world.

Martin easily reminisces about his life as a young boy in the 1930s. In 10 years he attended eight different schools. From age 14, he worked in lumber camps and wheat fields in Oregon and Washington. At 17, a talented ball player with American Legion–sponsored experience in both high school and junior college, Martin was headed for a career in baseball.

But in 1938, a chance meeting with Cal baseball coach Clint Evans opened the door to Martin's Berkeley education. Two days later, with a loan in hand and the promise of a job, Martin was enrolled in Berkeley's Department of Civil Engineering. Once in school, it was his innate perseverance and his gift for visualizing complex engineering problems that formed the foundation of his extraordinary career.

"The professors and staff at Berkeley were so good to me. They helped me with loans, looked out for me when I was sick, and made sure I had a job every summer," Martin says. "I'm so grateful for everything they did. That's why it's so important to me to give back."

Martin's firm has consistently ranked among the top 20 in *Building Design and Construction's* Top 300 list and in the top 160 of *Engineering News Record's* Top 500 Design Firms. Martin himself has been recognized many times for his generosity and support in helping others, including Berkeley Engineering, where he has established the John A. Martin Endowment to benefit the Department of Civil and Environmental Engineering. In 1994, the College recognized Martin with its Distinguished Engineering Alumni Award. ■

BY CAROL MENAKER

PEG SKORPINSKI PHOTO

*Barbara Newell of Piedmont had the chance to catch up with engineering graduate fellows at a recent fellowship reception in Wozniak Lounge. Newell endowed a fellowship fund, one of many available for engineering graduate students, in 2001 to honor her late husband, Professor Emeritus Gordon Newell, a pioneer in transportation engineering who died in an automobile accident. Pictured (from left) are Newell, Christos Katsaras, Ashutosh Agrawal, Mark Wan, and John-Michael Wong.*





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### 2000s

**MARC RAMIREZ** *(B.S.'04 ME)* started this past fall as a master's student in UC San Diego's mechanical engineering program.

**SHADRACH ROUNDY** *(M.S.'00, Ph.D.'03, ME)*, a lecturer at Australian National University, was cited in the TR100, *Technology Review's* list of 100 young innovators under the age of 35 whose technology research is having a worldwide impact. Roundy was recognized for his tiny generators that convert background vibrations into electricity to power wireless sensor networks.

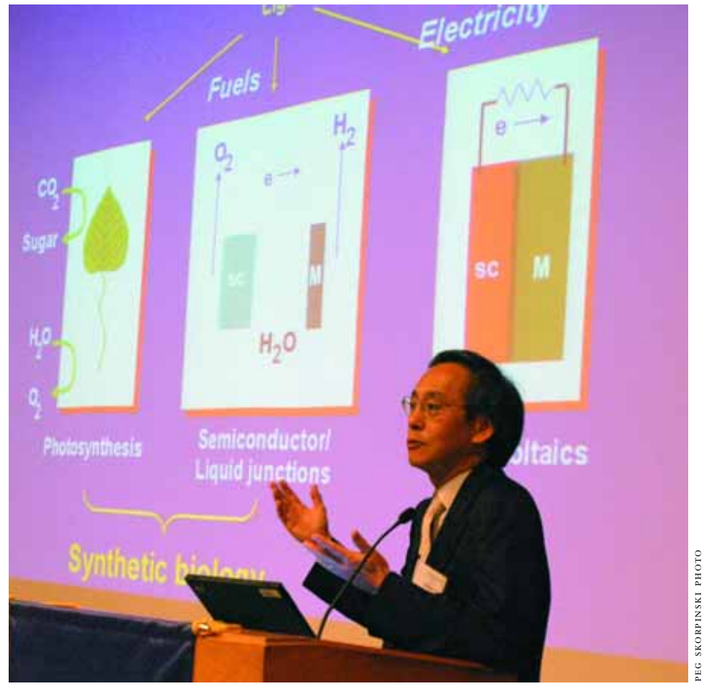
### 1990s

**EUGENE CHOW** *(B.S.'95 Eng Physics)*, formerly of Mountain View, writes: "Tina and I are finally leaving the Stanford farm (after nine years!) and moving to Fremont (closer to Cal!). We'll miss the Cal band trumpet raids by our apartment and blasting the big "C" during Big Game Week for the naïve Stanford frosh."

**ERIC DEVRIES** *(B.S.'90 ME)* of Union, Kentucky, is project leader for installation and startup of Toyota's V8 engine plant in Huntsville, Alabama. He's now starting a digital engineering project for application of 3-D data in Powertrain production preparation. **edevries@lycos.com**

**ROELOF DRENTH** *(B.S.'99, M.S.'00 ME)* is a mechanical engineer for Arcturus Marine Systems of Rohnert Park, California. **RoelofDrenth08@hotmail.com**

**KARA KOCKELMAN** *(B.S.'91, M.S.'96, Ph.D.'98 CE)* was promoted to associate professor of civil engineering at the University of Texas at Austin and gave birth to twins last year.




PEG SKORPINSKI PHOTO

*It was standing room only in Sibley Auditorium for a lecture by Nobel laureate and Lawrence Berkeley National Laboratory director Steven Chu (Ph.D.'76 Physics), one of the events celebrating Cal Homecoming weekend. The lecture, entitled "Life as Beautifully Engineered Systems," was an entertaining journey on the molecular scale through several biological systems—the workings of the ear, for example—to illustrate the exquisite design and functioning of life forms. Go to* ***www.coe.berkeley.edu/homecoming/*** *to see a video of Chu's talk.*

**KEVIN KORNEGAY** *(M.S.'90, Ph.D.'92 EECS)*, associate professor of electrical and computer engineering at Cornell University, received the 2004 Dr. Janice A. Lumpkin Educator of the Year Award from the National Society of Black Engineers. Founder and director of the Cornell Broadband Communications Research Laboratory, which conducts research on high-frequency integrated circuit design, Kornegay also received the Cornell Provost's 2004 Award for Distinguished Scholarship in recognition of his work in radio frequency and wireless system devices. He was selected by *Science Spectrum* magazine as one of the "50 Most Important Blacks in Research Science for 2004," and received a 2004 IBM Faculty Award of $40,000 in support of his research.

**MARK STEVENSON** *(M.S.'98 CE)* of Berkeley, previously an associate with Structural Design Engineers in San Francisco, is currently a project manager with Tipping-Mar & Associates in Berkeley. **mstevenson@pcmagic.net**

PHOTO COURTESY OF BENN KARNE

*Benn Karne, on location in Utah's starkly beautiful Bonneville Salt Flats, explores the quirky characters who participate in Speedweek every August in* Bonneville: Wide Open, *a documentary he made with longtime friend Steve Davy.*

## Gearhead turned filmmaker tells story of Speedweek

Benn Karne (B.S.'72 ME) loves fast cars. Before he was old enough to drive, he updated the brake system of his dad's 1930 Model A pickup from its original all-mechanical arrangement to "modern" hydraulics. He speaks nostalgically of his first car, a big old '62 Chevy, and the Corvette he road-raced before settling down with the responsibilities of home, family, and a real job.

"The reason I got into engineering in the first place was because I liked hot rods," Karne says. Self-employed for 15 years, he now specializes in vehicle accident reconstruction, that is, determining the events that occurred in a vehicle collision, usually to determine the pre-impact velocities and positions of those involved. Now he's trying his hand at filmmaking, and guess what the film's about?

Fast cars, of course.

Karne and friend Steve Davy, an award-winning videographer, have made a documentary about Speedweek, the event sponsored each August by the Southern California Timing Association that turns Utah's famed Bonneville Salt Flats into a miles-long track for everything from powered barstools to souped-up diesel trucks that can travel at speeds of 250 mph.

"Some of these people get their vehicles to go really fast," Karne says. "They may not have an engineering background, but they have lots of hands-on experience with land-speed vehicles."

The film, *Bonneville: Wide Open*, premiered last November at the California Independent Film Festival in Livermore, with guest appearances by both filmmakers and one of the drivers featured in the film, who showed off his cleverly engineered streamliner specially designed to nab a land speed record at Bonneville.

"We wanted the film to appeal to a general audience but also to gearhead types, and I think we achieved that." Karne says. "But we had to keep some of the speed secrets out. For example, if someone had a special motor detail or steering arrangement—and that was the stuff that really appealed to me as an engineer—the builders said it would put them years behind if we revealed those secrets to their competition."

Made on a "proverbial shoestring budget," the film has not yet been picked up for wider distribution. But the filmmakers are hoping to get it on the Discovery Channel or similar outlet and, in the meantime, plan to sell DVDs through their Web site, **www.bonnevillewideopen.com.**

Karne's son Matt, now a junior at Berkeley, drives a '62 Chevy hot rod. Among his own collection of five cars, Karne says, there's still an old Corvette. "But it doesn't get out too often these days." ■

## 1980s

**WUNJEI CHENG** *(B.S.'83 EE)* of New York City has invested his own funds over the past several years in helping hundreds of homeless get off the streets in the greater New York area through person-to-person contact, remotely through the Internet, and through his publications. **wjcheng@yahoo.com**

**ISHTIAQ CHISTI** *(M.S.'80 ME)* of Long Beach has an electrical energy business in the U.S. and works as an international consultant in the areas of energy efficiency, distributed generation, and solar energy. **ishtiac@aol.com**

**JAY CLARE** *(B.S.'86, M.S.'89 ME)* of Moraga is vice president and department manager at URS Corp. in Oakland. **jay-clare@urscorp.com**

**PAUL LING** *(B.A.'83 CS)* is living in Pleasanton with his wife **LORRAINE STURGIS LING** *(B.A.'84 CS)* and their three children, Kelly, Eric, and Sara. He is working in the software industry, creating mobile phone applications. **pling@extendinc.com**

**MARK OBERGFELL** *(M.S.'82 CE)* of Indianapolis is managing the civil/engineering department for Ter Horst, Lamson & Fisk Engineers, a 38-person civil and structural engineering firm.

**GEOFFREY SCHLADOW** *(M.Eng.'80 CE)*

has been named founding director of the UC Davis Tahoe Environmental Research Center, a new center for research and teaching. An Australian native, Schladow has been on the UC Davis faculty since 1993 and previously served as a marine researcher at Lawrence Berkeley Laboratory. He has conducted extensive research at Lake Tahoe and is an expert on the fluid mechanics of lakes and their interactions with fine-particle transport and algae growth, problems that have caused Lake Tahoe's legendary clarity to decline.

## 1970s

**RUDOLPH BONAPARTE** *(M.S.'78, Ph.D.'81 CE)* is president and CEO of GeoSyntec Consultants, a national engineering and environmental sciences firm. He is living in Atlanta with his wife Anna and their three children Sarah, Alex, and Maria. **rbonaparte@geosyntec.com**

**MARK CAPRON** *(B.S.'76, M.S.'81 CE)* of Oxnard, California, is a professional civil engineer with six patents who has served with the U.S. Navy Civil Engineer Corps, the Naval Civil Engineering Laboratory, and Ventura Regional Sanitation District. He is an activist on environmental issues such as air quality, methods of slowing global warming, and minimizing traffic congestion. The *Ventura County Star* recently published his editorial advocating a contest—based on the DARPA Grand Challenge—to stimulate development of smart cars that minimize such transportation-associated environmental problems. **capox@aol.com**

**JAMES FRENCH** *(B.S.'78, M.S.'82 CE)* is principal geotechnical engineer at MACTEC Engineering and Consulting in Oakland. **jbfrenchge@earthlink.net**

**ANTHONY MOROYAN** *(M.S.'77 EE)* of Los Altos Hills is chairman of Viasphere, International, Inc., which manages venture capital funds to help incubate high-tech startups.

**ROGER VAN BRUNT** *(M.S.'77 EE)* is principal engineer at RF Micro Devices in Scotts Valley, California. He is married with one 16-year-old child and enjoys running, gardening, and travel. **rvanbrunt@mac.com**

## 1960s

**RICHARD CHINN** *(B.S.'61 CE)* of Hillsborough, California, is an Engineering Alumni Society director and this year's designated director for the College of Engineering on the California Alumni Association Board. His wife Carrie ('65 Education) is completing her 39th year in elementary education as principal of Lomita Park School. Their daughter Jamie (2000, UC Davis) is a project manager for Gap Corporation. **rickbchinn@engineeralum.berkeley.edu**

**THOMAS DAVINROY** *(Ph.D.'66 CE)* of Alameda is retired and traveling the world. He writes, "I attended a meeting last July in Helsinki, Finland, for those of us who are deaf."

**ROGER FLYNN** *(B.S.'64 EE)* of Albuquerque writes, "I am retiring as EVP and COO of Public Service Company of New Mexico to become a full-time fly fisherman, beer brewer, cabinet maker, and tourist." **zinlover@osogrande.com**

## EECS alum teaching computers to speak K'iche'

Andy Lieberman (B.S.'88 EECS) has been recognized with a 2004 award from the San Jose Tech Museum of Innovation for his work with Enlace Quiché, a small nongovernment organization dedicated to preserving the language and culture of Guatemala's native Mayan population.

Founded in 2000 by the Academy for Educational Development and USAID, with Lieberman as its president, Enlace Quiché's goal is to incorporate technology into the training of bilingual (Spanish-Mayan) teachers. In just four years, the organization has established 28 technology centers, produced 14 interactive Mayan language CDs, launched an Internet portal, and opened a demonstration and training center.

Credit for these successes, Lieberman says, goes not to him, but to the thousands of Guatemalan teacher and student participants who are using computers and, at the same time, keeping their Mayan heritage alive.

"A lot of people in technology think that just getting access to a computer is what the developing world needs," Lieberman says. "But there's a whole other issue of making technology meaningful and responsive to people's needs. If you're going to bring technology to rural Guatemala, it has to be culturally relevant and in their language."

Lieberman grew up in San Francisco and helped Lowell High install its first computers before he graduated in 1983. According to his father, Andy has been gravitating toward this kind of work his whole life.

"My son has always been enterprising, and he's always been interested in other people," says Harry Lieberman. "He once talked about getting a bus, putting computers on it, and driving around rural areas so kids could use the computers. Now he's basically doing what he dreamed of."

As an EECS student at Berkeley, Andy entertained the idea of a high-tech career, but an unsatisfying internship with a large Boston-based semiconductor company changed all that.

"I was having a hard time finding meaning in the work," he says. "I kept asking myself, 'What am I really contributing to society?' I had so many opportunities growing up; teaching and sharing what I have and what I know are very strong values."

On a 1990 trip to Guatemala to learn Spanish, Lieberman fell in love, first with the country, then with a woman named Tomasa, who is now his wife. They live with their two children in the mountain town of Santa Cruz del Quiché, where he is known as "Teacher Andy."

Go to **www.enlacequiche.org.gt/getknow.htm** for more about Enlace Quiché. ■

PHOTOS COURTESY OF ANDY LIEBERMAN

*Andy Lieberman (above) was honored by the Tech Museum for his pioneering efforts to bring computers and the Internet into Guatemala's educational system. A key element is the use of K'iche' and more than 20 other indigenous languages that predate the Spanish Conquest.*

## A COMPUTER SCIENTIST WITH A BIRD'S-EYE VIEW


PHOTO COURTESY OF CECILIA ARAGON

*Once painfully shy, late to ride a bike, and nervous about driving a car with a stick shift, Aragon is quite at home in her custom-built Sabre 320, which climbs at 4,500 feet per minute and has a roll rate of 420 degrees per second.*

Shortly after completing her master's degree, Cecilia Aragon (M.S.'87 CS) earned her pilot's license, became an air show pilot, and was a two-time member of the U.S. Aerobatic Team. Now, she has returned to Berkeley after a 14-year hiatus from her studies to complete her doctoral degree in computer science, where her passions for flight and mathematics merge.

"It's so exciting being back in school," she says. "Berkeley is really at the forefront of this kind of work."

As a computer scientist in the computational sciences division at NASA Ames Research Center in Mountain View, Aragon's work involves the study of local wind shear and other airflow hazards in the search for ways to improve air travel safety. With more than 5,000 accident-free hours in flight, she may have a more personal investment in keeping the skies friendly.

"I have these two viewpoints that not many people have, and I want to use them to make a difference," Aragon says. "People involved in aviation tend to be very specialized. I've known 20-year veteran aircraft designers who have never been in the aircraft they were designing for."

Aragon has developed a cockpit display system that displays invisible air currents to warn pilots of impending disturbances in the air. The system was incorporated into a high-fidelity rotorcraft simulator and tested by 16 U.S. Coast Guard and Navy pilots, with dramatic results: For hazardous landing approaches in highly turbulent conditions, the hazard indicator reduced the crash rate from 19 percent to 6.3 percent.

Perhaps the most dramatic thing about Aragon, however, is that she used to be deathly afraid of heights, a fear she aggressively conquered after a flight in a private plane over the beautiful San Francisco coastline. ("I was in heaven," she recalls.) Now she fearlessly executes air tricks like multiple snap rolls and tailslides.

"Mastering my fear gave me a feeling of confidence that has carried over to other parts of my life," Aragon says. "Let's face it. Compared to pointing the nose of an airplane straight at the ground and flying vertically down at 200 miles an hour, everything else in life seems easy." ■

BY CAROL MENAKER

**RICHARD GOODMAN** *(Ph.D.'64 MSE)*

of Mendocino was awarded an honorary doctorate from Graz University of Technology in Austria for his significant and innovative contributions to engineering geology and rock mechanics and his biography of Austrian civil engineer Karl Terzaghi. Emeritus Professor of Geotechnical Engineering at Berkeley, he worked in both mineral technology and civil engineering. When he retired in 1994, he was awarded the Berkeley Citation. Also active in opera as a singer, producer, pianist, and stage director, he founded the Berkeley Opera and continues to perform roles there.

**JACK LINDLEY** *(B.S.'60 CE)* of Fremont retired from Alameda County Public Works Agency. **lindleyjack@comcast.net**

**STAN LUCAS** *(B.S.'62 ME)* of Long Beach is working full time at age 65. He writes, "The concept of retirement is truly frightening!"

**UKRIT SIRIPRUSANAN** *(B.S.'68, M.S.'72 CE)* of Barrigada, Guam, is president and principal engineer of Geo-engineering and Testing and Marianas Drilling of Guam and Geotesting of Saipan, serving the western Pacific for 30 years.

## 1950s

**GEORGE ANSOLABEHERE** *(B.S.'52 CE)* of Bakersfield retired as a construction engineer for Kern County. Married in 1959 to Marcelle Ariey, they have four children and seven grandchildren.

**WILLIAM BLYTHE** *(M.S.'57 CE)* of Palo Alto received his Ph.D. in applied mechanics from Stanford in 1962 and taught at San Jose State University for 42 years, serving 12 years as chair of the Department of Civil Engineering. He is now retired but consulting in vehicle dynamics and collision analysis. **wrbsr@sbcglobal.net**

**ROLAND DUQUETTE** *(B.S.'56 EECS)* of La Canada, California, is now retired from his career as an electrical engineer, currently serving as a financial officer for six trusts. A member of Eta Kappa Nu and Tau Beta Pi, he spent seven years in the U.S. Navy.

**DAVID EBERLY** *(B.S.'55, M.S.'56, ME)* of San Francisco writes, "I'm retired and goofing off with photo and computer projects after many tedious years in the unusual occupation of tending facilities maintenance and repairs in a popular local free lunch dining room." **eberlydk@aol.com**

**RONALD GERDES** *(B.S.'57 ME)* is working part-time at NASA Ames Research Center's Flight Simulation Lab as an engineering test pilot. **vstolguy@aol.com**

**RONALD GERSTEN** *(B.S.'56 ME)* of Creve Coeur, Missouri, has a dental practice and is writing two books, *Acts of Kindness* and *Balance in the Universe: Theory of Gravity and Time*. His grandson celebrated his Bar Mitzvah in Israel.

**JAMES INGRAM** *(B.S.'59 ME)* of Vacaville has been retired since 1995 but continues as a staff consultant to the cities of Vacaville and Dixon. He has been a licensed civil engineer since 1965. **jhivacaville@comcast.net**

**A.T. (TOM) LEWIS** *(B.S.'54 CE)* of Berkeley writes, "I just returned from Paris, France, where I had the privilege of






PHOTO COURTESY CLIFFORD MAURER

*Saad (above, left) was one of the students in Maurer's (right) ICAP training course to teach young Iraqi men construction skills. "I don't know how or where he got the Cal hat, but he wore it every day," Maurer says. "You can see why I took a special liking to him."*

## ALUMNUS MAURER HEADS SEABEES IN IRAQ CONFLICT

U.S. Navy Commander Cliff Maurer (M.S.'88 CE), a career military officer with a long list of naval assignments and decorations to show for his nearly 20-year career, recently returned home after leading Naval Mobile Construction Battalion 74 (NMCB-74) to Iraq in two tours of duty. The first was during the fall of Saddam Hussein in the early months of 2003; the second was one grim year later, when the Iraqi insurgency first peaked and the reality of war set in.

Maurer was reassigned last July to an administrative post in Washington, D.C., on the Chief Naval Operations staff for shore infrastructure management. A native of Allentown, Pennsylvania, and 1984 graduate of the U.S. Naval Academy, Maurer credits Professor Ben Gerwick at Berkeley with teaching him how to think thoroughly through and execute a project, skills he says he needed every day he was in Iraq.

"We had lots of tense moments in Fallujah," Maurer says, describing action in the Sunni Triangle, the 100-mile swath from Baghdad north to Tikrit where 80 percent of Iraqi guerrilla attacks occur.

"This conflict won't be resolved in a few months," Maurer says. "It'll take years, and it won't always be pretty. But what gives me hope is the Iraqi people themselves. They're a lot like us. Despite our cultural differences, they are good people who value education and want to make life better for their children. They were very appreciative of the work we did."

Maurer's NMCB-74 unit was first deployed to Al-Jaber Airbase in Kuwait in late 2002 to build the largest construction project in pre-hostilities Iraq: a 22-acre parking apron and taxiway for the Third Marine Air Wing's F/A-18 Hornet aircraft. When war was declared on March 21, 2003, the battalion moved to a critical role in supporting the First Marine Expeditionary Force as it moved into Iraq and successfully toppled Saddam's regime.

"The Marines had to move quickly over the miles from Kuwait to Baghdad," Maurer says. "We were two or three days behind them, making sure their MSR [main supply route] was intact so their supplies could keep up with them."

Maurer's Seabees worked in and around Nasiriyah, building and repairing bridges and completing an unfinished interstate. The tour of duty earned them several awards, including the Presidential Unit Citation and the Society of American Military Engineering's Peltier Award for outstanding performance in active duty. On May 30, 2003, they returned to home base in Gulfport, Mississippi, to a hero's welcome.

Construction battalions, also known as the Seabees, originated in 1941, when World War II created a need for skilled civil engineers who could do standard and specialized construction and battle-damage repair as well as fight battles. Immortalized in John Wayne's 1944 "The Fighting Seabees," these battalions have been much decorated in their 60-year history for both war and peacetime operations.

As attested by their motto, "We build, we fight," construction battalions are often deployed for civil/military operations (CMO), helping a wartime community rebuild its infrastructure and spirit. This was the top objective when NMCB-74 was redeployed in February 2004 to Fallujah, one of the war's hottest hot spots.

"CMO was our major reason for going back," Maurer says, "to help the Iraqis get their economy and community back together—schools, medical clinics, anything that had an immediate impact. But the insurgency was in full swing and, unfortunately, the local people and their families were under threat of being killed by the terrorists if they worked with us or collaborated in the work of Coalition Forces."

The battalion did succeed in initiating the Iraqi Construction Apprentice Program (ICAP), an 8–12-week course in basic construction and project management that also provided Iraqi men tools and incentives to start their own construction companies. Already disenfranchised by unemployment and a crumbling infrastructure, many Iraqi men are unable to save the traditional dowry—in Iraq the man's responsibility—required to prove to a woman's family that they can support a wife. Consequently, Maurer believes, they are easily tempted to join the insurgency as a way of life.

"Construction is a universal skill, and we believed the training would invigorate these men," Maurer says. "We were determined to help the Iraqis succeed in embracing their own freedom." ■

working on planning software for the French National Railways. One never knows where civil engineering will lead!"

**WILFRED LEWIS JR.** *(B.S.'52 EE)* of San Marino, California, retired in 1993 after more than 41 years at Northrop Grumman. He traveled with his wife of 33 years, Dorothy, to Alaska, Europe, the east coast, Sacramento, and Hawaii before she passed away in December 2001.

**WILLIAM SCHICK** *(B.S.'57, M.S.'58 ME)* of Los Altos, is happily retired after a very rewarding career designing a broad range of communications equipment and using many of the subjects he learned at Berkeley Engineering. **vbschick@earthlink.net**

**JAMES SPIRAKIS** *(B.S.'55 IE)* is retired and living in the Villages Golf and Country Club in San Jose. **jamesspirakis@msn.com**

## 1940s

**CHARLES FAULDERS** *(B.S.'48 ME)* of Camarillo, California, retired in 1990 from North American Aviation, Inc. He writes, "I'm enjoying retirement and am an avid reader of newspapers and books. During a recent trip to Oakland to see our son Thom, we drove by Hesse Hall. It's still there, by gosh! Brought back memories!"

**GUY FLUCK** *(B.S.'49 CE)* of Hemet, California, has advanced Alzheimer's. He worked as a design engineer on the space program at Boeing and is proud to be a Berkeley graduate.

**KONG GO** *(B.S.'47 CE)* of Albany is retired and active at Berkeley Chinese Baptist Church. He writes, "My dear wife Kit Fay Go passed on in 2002." **gokong@aol.com**

**RUSSELL GREEN** *(B.S.'47 EE)* of Walnut Creek is retired from his career as a control systems engineer.

**CARL GRONDORF** *(B.S.'43 EE)*, a Berkeley native, lives in Grand Junction, Colorado, with his wife of 54 years, Edith Katherine Drake. He served with the U.S. Army Signal Corps during World War II, where he received special training to maintain operation of long-distance telephone service to headquarters. In addition to professional positions with UC Berkeley, the U.S. Postal Service, and a manufacturing firm in Colorado, he has worked with Habitat for Humanity and served in various capacities for the Presbyterian Church throughout the U.S., most recently as pastoral advisor to the National Committee of Presbyterian Men.

**J. PUTNAM HENCK** *(B.S.'40 CE)* of Sky Forest, California, is now retired from a general engineering and building contracting career.

**CHARLES "CAP" KIERULFF** *(B.S.'41 EE)* of Los Angeles is retired from his own company, Kierulff Electronics. He writes, "Barbara and I have celebrated our 63-year anniversary. Over the past 25 years I have collected vitals on 11,000 Kierulff relatives. In addition to EE, I enjoyed rowing on the Cal Crew from 1937 to 1941 with Gregory Peck and Dave De Varona!" **capkierulff@msn.com**

**ROBERT KUSHNIR** *(B.S.'48 EE)* was assistant engineer on a B-24 at Iwo Jima during World War II. He retired in 1985 from Colorado Springs Iron & Metal and C.S. Auto Wrecking. He had a major stroke in 1988, quit playing tennis in 1998, and underwent cardiac surgery in 2002. His older son Steve and family live in Germany.

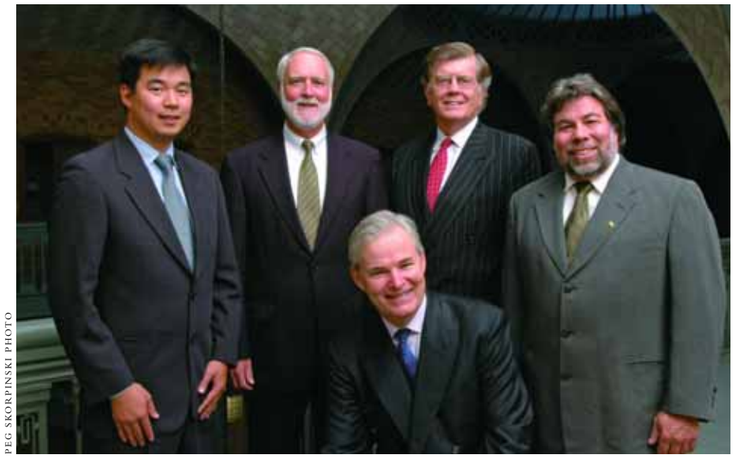
**LUDY LANGER** *(B.S.'47 ME; B.A.'48 Bus Ad)* is back to moving cars for Hertz at the Sacramento airport after 18 years of retirement.

**PHILIP SKARIN** *(B.S.'46 CE)* of Sherman Oaks, California, is serving his 11th year as publicity chair of the Retired Los Angeles City Employees Association. He has also retired after six years as a World Masters weightlifting champion. **philskar@aol.com**

**JOHN VIDMAR** *(B.S.'43 ME)* of Los Angeles is retired and as busy as ever, traveling, reading, collecting, and investing. **JohnVidmar@aol.com**

**ROBERT WEYAND** *(B.S.'41 Metallurgy)* of Prescott, Arizona, is retired and enjoying life, using his computer to keep in touch with friends. **rweyand@cableone.net**

## BERKELEY ENGINEERING CELEBRATES DISTINGUISHED ALUMNI



PEG SKORPINSKI PHOTO

*DEAA winners (from left) In Sik Rhee, Wayne Clough, Floyd Kvamme, and Steve Wozniak with Dean Newton (foreground). The DEAA recognizes exemplary professional and technical leaders, academic and research careers, or public service contributions in engineering. Rhee received the Outstanding Young Engineer Award, established in 2002 to recognize a rising leader under age 40.*

The four guests of honor included a charismatic Georgia-born educator, one of California's leading venture capitalists, a famous undergraduate who registered at Berkeley under a false name, and a Korean American who found his major by asking a friend which courses would be the most difficult.

This year's top alumni—Wayne Clough, Floyd Kvamme, Steve Wozniak, and In Sik Rhee—were celebrated by Berkeley Engineering at its 30th annual Distinguished Engineering Alumni Awards (DEAA) banquet, attended by 180 guests in the lobby of Hearst Memorial Mining Building last September.

Clough (Ph.D.'69 CE), a Georgia native and now president of Georgia Institute of Technology, is an internationally recognized leader in geotechnical engineering and one of the country's foremost engineering educators.

Kvamme (B.S.'59 EECS) is partner emeritus in the Menlo Park–based venture capital firm Kleiner, Perkins, Caufield, and Byers. One of five founding members of National Semiconductor in 1967, he helped transform the Syracuse-based transistor company into a billion-dollar microelectronics supplier.

Wozniak (B.S.'86 EECS) had already invented Apple computers when he became a student at Berkeley Engineering. To lower his profile, he enrolled as "Rocky Clark," a moniker constructed from his dog's name and his then-wife's surname. He founded Wheels of Zeus, Inc., in 2001, to further investigate solutions to everyday problems through education and technology.

Rhee (B.S.'93 EECS) enrolled at Berkeley in 1989. Not knowing which courses to attend he asked a friend which were the hardest. "EECS is hell," his friend replied, so Rhee promptly enrolled in EECS. After graduating, he founded Kiva, a software startup that was acquired first by Netscape and later by AOL. In 2002, he founded Loudcloud, now Opsware Inc., the leading provider of data center automation software.

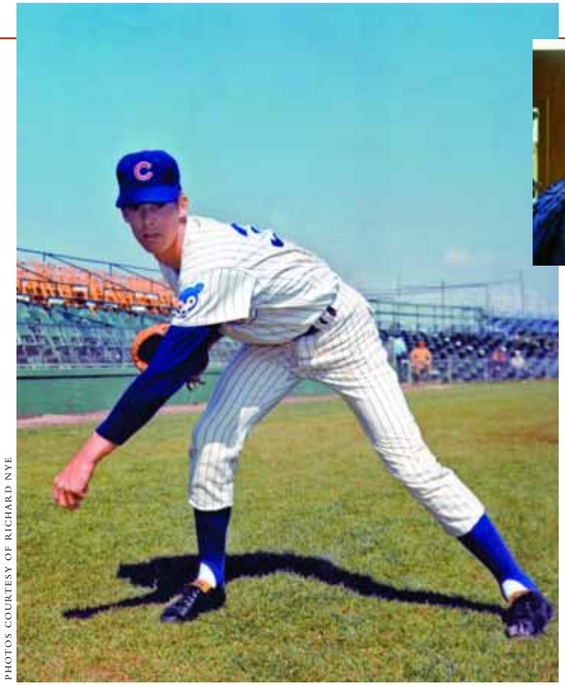
Visit **www.coe.berkeley.edu/alumni_friends/deaa/** for a video of the event. ■

### CALL FOR 2005 DEAA NOMINATIONS

Nominations are now being accepted for 2005 distinguished alumni who will be honored at next year's event on Saturday, September 24, 2005, at Hearst Memorial Mining Building. Nominations may be submitted online and must be received by March 15, 2005. Go to **www.coe.berkeley.edu/alumni_friends/deaa/index.html** to nominate your favorite alum.







PHOTOS COURTESY OF RICHARD NYE

*Richard Nye as a Cubs pitcher and (inset) with one of his patients, Harvey, a hyacinth macaw. Nye says his engineering degree was a big help in veterinary school because it sharpened his critical thinking.*

## CEE ALUMNUS HITS HOME RUN ON THIRD CAREER CHOICE

Richard Nye (B.S.'66 CEE) took the long route to his current profession. First there was the engineering degree; then there was the professional baseball career. Now he runs his own veterinary practice in the Chicago suburb of Westchester.

"I thought that baseball was a fluke, and I wanted something to fall back on," Nye says of his engineering degree. "Besides I didn't think I was drafted high enough to take the whole thing seriously."

Nye was working toward his degree on an academic and athletic scholarship when, as a junior, he was drafted in the first-ever baseball draft by the Houston Astros. Drafted again in 1966 by the Chicago Cubs, he finished that year pitching in the majors. After a taste of the big leagues, although he returned to school to complete his bachelor's and even considered graduate school, he soon had an epiphany: Engineering was no longer his passion.

"Engineering didn't inspire me, so I went off to spring training and played professional baseball for four years. I even got an opportunity to throw fast balls to Willie Mays and the rest of the Giants," Nye says. He played for the Cardinals and the Expos before a torn rotator cuff halted his five-summer career. He was 28 years old and had a young family to raise.

Unfortunately, there was no baseball nest egg to cushion the blow. Unlike the highly paid athletes of today, ball players in the '60s made a minimum starting salary of about $7,000 a year. He decided to go back to school, this time in veterinary science because of his deep-rooted love of animals.

In 1986—inspired by Susan Brown, a veterinarian colleague who later became his second wife—Nye opened the Midwest Bird and Exotic Animal Hospital. The first all-exotic animal hospital in the U.S., it caters specifically to birds and exotic pets like ferrets and iguanas. With a staff of 26, the hospital has about 15,000 client visits a year.

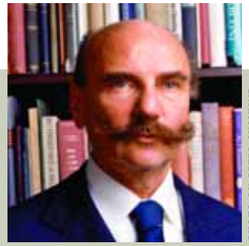
"I get a lot of pleasure from communicating with the pets' owners and connecting with the animals," he says. Although he rarely uses his engineering skills, he says his various career choices have steered his life in the right direction.

"If I had gotten involved in medicine right off the bat (no pun intended)," Nye says, "I would have ended up in human medicine, and I wouldn't have been happy. I prefer working with animals." ■

John Austin

Sam Ruvkun

Lawrence Stark



Charles Susskind

PHOTO BY PETER SUSSKIND

**JOHN H. AUSTIN** *(Ph.D.'63 CE)*, environmental engineer, died last August at his home in Arlington, Vermont. In more than 20 years with the U.S. Agency for International Development (USAID), he worked to improve water supplies and sanitation systems worldwide. A professor at four universities, he conducted training in sanitation and public health throughout the world. A bird-watcher and mountaineer, he once climbed the Matterhorn.

**WILLIAM C. CHENOWETH** *(M.S.'40 CE)*, a civil engineer who survived the Bataan Death March, two years in a Japanese prison camp, and the destruction of a Japanese transport ship during World War II, died last June in Seattle. He graduated at the top of his class from West Point and joined the Army Corps of Engineers, retiring as a lieutenant colonel in 1946.

**JAMES EATON** *(B.S.'58, M.S.'61, Ph.D.'63 EE)*, a Sacramento native who reached the rank of master inventor in 40 years of working for IBM, died last September in San Jose. His contributions included early generations of supermarket checkout scanning equipment, magnetic tape data storage products, and serving on the commission that recommended computer control of the power grid following the 1965 East Coast blackout.

**JOHN R. EDMUND** *(B.S.'47 ME)* of Berkeley died last April.

**JOHN JAY FISKE JR.** *(B.S.'41 EE)* of Coulterville, California, who worked for Westinghouse as electronic control specialist during World War II, died last March. He organized the electronic components professional group, which became the Institute of Electrical and Electronics Engineers.

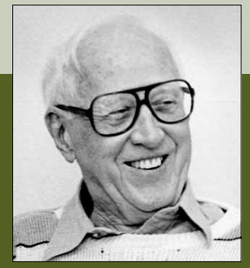
**GEORGE RICHARD HERRICK** *(B.S.'39 ME)* died in Reno last May. A test and trials engineer at Consolidated Steel Corporation, he enlisted in the U.S. Navy and served as an aviation ordnance officer in rocket training during World War II. He retired in 1983 after 27 years with H.C. Smith Oil Tool Company. He was also a gardener, specializing in orchids.

**SAM RUVKUN** *(B.S.'41 CE)* of Piedmont, a Kaiser Engineers vice president and founding president of the Engineering Alumni Society, died last June. His career at Kaiser coincided with the lifespan of the company. Ruvkun helped fund the building of Soda Hall and Bechtel Engineering Center.

**LAWRENCE W. STARK**, Berkeley professor emeritus of physiological optics and engineering, died last October of non-Hodgkin's lymphoma. Trained as a neurologist, he was a pioneer in using control and information theory to characterize neurological systems and applying engineering principles to biological systems. He joined the Berkeley faculty in 1968 with joint appointments in optometry, EECS, and ME.

**CHARLES SUSSKIND,** 82, professor emeritus of EE at Berkeley, died in June of Alzheimer's. His research focused on generation and transmission of microwaves and their interaction with biological tissues. His work formed the foundation for bioengineering at Berkeley, which became a department in 1999. A native of Prague, Susskind joined the U.S. Army as a radar specialist during World War II, then moved with his wife to the U.S. He joined the Berkeley faculty in 1955 and was assistant dean of engineering from 1964 to 1968. He loved classical music and played the cello.

**ROBERT S. SWANSON** *(B.S.'38 EE)*, a former research scientist with NASA's precursor, the National Advisory Committee for Aeronautics, died last September in Fairfax, Virginia, at age 89. Working with testing models in wind tunnels, he developed procedures for correcting test data for the constraining effects of wind tunnel walls and for evaluating the effects of propeller thrust on airplane stability. He worked for Lockheed and Northrop before founding Astro Consultants. He was an avid golfer, tennis player, and enjoyed square dancing.



**GEORGE MASLACH** *(B.S.'42 ME)*, dean of engineering from 1963 to 1972 and vice chancellor for research and academic affairs, died November 11 at age 84 following a stroke. A native of San Francisco, he began his career as an aeronautical engineer and joined the Berkeley faculty in 1952. As dean, he boosted engineering enrollment, and the school rose to No. 2 in the national rankings of engineering schools. In 2001, a campus building was named for him and his wife.

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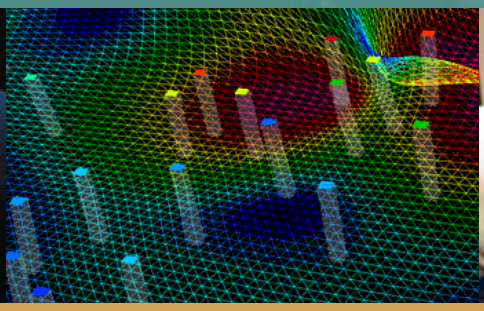

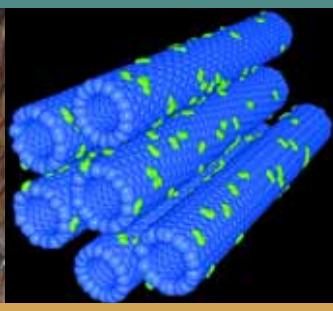

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