Expanding the **DATA HIGHWAY**

TO STREAMLINE FUTURE NETWORK ACTIVITY
IF YOU’VE CONTRIBUTED TO AN IRA and now don’t need it to fund your own retirement, it would seem to make sense to give all or part of it to your children or a family member. And you can.

However, the taxes that you’ll pay will depend on the type of IRA that you have. The tax rules for traditional IRAs and Roth IRAs are very different.

With a Roth, contributions are made with after-tax dollars and the IRS takes its share upfront. Withdrawals from Roths, including making a gift, are tax-free.

However, contributions to a traditional IRA are made with pre-tax dollars within certain limits. Despite your generous intentions, the IRS will deduct income taxes from your withdrawal from a traditional IRA.

If you make a personal gift to a child or family member from your traditional IRA, you can’t avoid paying both income and estate taxes on the withdrawal. Your gift could be reduced by 50% or more by the time your family member receives it.

For this reason, traditional IRAs are the worst gift you can give your children.

That doesn’t mean you can’t be generous. It just means that you have to consider any gifts that you make within the context of your overall tax position.

Gifting traditional IRAs to UC Davis and other non-profits can be a wise choice. Designating a non-profit to receive your IRA fund often can be done with a simple online form.

A $2.5 million gift of IRAs was recently made to UC Davis Engineering by an anonymous alumni donor. The donor simply filled out the online forms from his investment firm and sent us a copy of his IRA designations.

By designating UC Davis or any charity, you maintain control of your IRA until you pass. Then, any remaining amount is transferred to the university as a tax-free gift.

If you would like more information on ways to avoid paying taxes while supporting UC Davis, please contact me at:

Oliver Ramsey, CFRE
Assistant Dean, Development and External Relations
direct: 530-752-7412
owramsey@ucdavis.edu
PLASTICS HAVE BECOME an environmental challenge, with ubiquitous empty water bottles blighting neighborhood streets and plastic-laden debris patches such as the Pacific trash vortex.

Thanks to undergraduates Akshay Sethi and Victor Awad, and their UC Davis-based start-up AmberCycle, we soon may see tangible progress regarding the world’s “plastics problem.” Weaning consumers of their dependence on plastic products is likely impossible; the more reasonable goal is to develop a faster, better and economically superior means of recycling it.

“Plastic recycling, as practiced today, isn’t very efficient,” Awad explains. “Basically, you melt down a bottle, mix it with new plastic, and make more bottles. The process is expensive; more to the point, it delivers a product that incorporates only 10 to 20 percent recycled material.”

Sethi had a better idea shortly after he arrived at UC Davis in 2011, as a freshman majoring in biochemistry and molecular biology (soon to be biotechnology). That “better idea” resulted in a biologically based lab project that degraded specific plastics: proprietary bacteria (“special bugs”) cultured to devour and transform feedstock plastic. He co-founded AmberCycle slightly more than a year later, in August 2012, in part as a means to enter that year’s International Genetically Engineered Machines (iGEM) competition. The UC Davis team took a gold medal at that year’s iGEM Regional Jamboree, held Oct. 12-14 in Palo Alto.

Sethi and AmberCycle were on their way.

“Making virgin plastic currently is a very convoluted process that primarily involves purified terephthalic acid (PTA) mixed with ethylene glycol, which produces polyethylene terephthalate (PET),” Awad continues. “AmberCycle uses a biological process to break down plastic at the chemical level, back to those source components: terephthalic acid and ethylene glycol. The ethylene glycol can be fed back into the reaction as fuel, and the terephthalic acid can be sold off.

“Our numbers and lab projections show that we already can break down plastic, producing terephthalic acid and ethylene glycol, at a rate that is economically competitive, given current market prices. Once we achieve our current goal of increased efficiency, and we secure a steady stream of feedstock plastic, we’ll be able to produce terephthalic acid at a price that’s competitive, or even cheaper, that what is charged by the oil companies that currently produce it.”

Awad, a chemical engineering major, joined the company in the summer of 2013. Sethi remains AmberCycle’s CEO of technology development, while Awad has been named COO of process development.

In fall 2013, AmberCycle became one of the first clients of the new Engineering Student Startup Center (ESSC), which assists entrepreneurial students with ideation, prototyping and technology startups.

“We hope to have a stable pilot plant running soon, either on campus or someplace externally, with steady production of terephthalic acid,” Awad outlines. “Our first-gen product will be vials of terephthalic acid, produced by degrading a couple dozen bottles at a time. By the end of 2015, we hope to expand into a larger facility, so that instead of producing grams or kilograms of terephthalic acid, we’ll be producing tons. We’re projected to be profitable within five to seven years, at which point we’ll purchase new equipment and upgrade further.”
ON FEB. 5, UC DAVIS ENGINEERING STUDENTS had the rare and exciting chance to chat with members of the International Space Station (ISS). This opportunity, known as an “In-Flight Education Downlink,” came through the courtesy of the Johnson Space Center’s (JSC) Office of Education, in conjunction with JSC’s Public Affairs Office.

The UC Davis downlink was supervised by MAE Professor Stephen K. Robinson, a former astronaut whose 36-year career with NASA included four shuttle missions and three spacewalks. He gave a 45-minute warm-up talk to bring students up to speed on the ISS mission and this particular crew, and a lottery determined which students were able to ask their questions live. The questions themselves were pre-screened in advance by JSC personnel, who requested a list of 20 topics, in priority order; Robinson ensured a lively mix of technical, scientific and even “lifestyle” questions.

Three ISS crewmembers participated: Terry Virts, who in early 2010 piloted the shuttle Endeavor when it brought the ISS its final permanent modules, Tranquility and Cupola; Samantha Cristoforetti, an Italian-born European Space Agency astronaut working and living on the station as part of her long-duration Futura mission; and Barry “Butch” Wilmore, who became the current ISS commander in November 2014.

The event was broadcast live on NASA TV, and streamed live on NASA’s website.
EXTRA-VIRGIN OLIVE OIL IS FLAVORFUL AND HEALTHY, which likely explains why sales of high-quality olive oil have tripled in America during the past two decades. But when purchasing a bottle of extra-virgin olive oil, can consumers be certain that the oil inside is, in fact, “extra virgin”?

Too often, the answer is no. As much as two-thirds of the extra-virgin olive oil sold in the United States actually is a lower-grade product, lacking the antioxidants, omega-3 fatty acids and flavor found in true extra-virgin olive oil.

What’s a consumer to do?

A team of seven undergraduate UC Davis engineering students successfully addressed this challenge, and in the process won the grand prize in the annual International Genetically Engineered Machines (iGEM) competition, which took place Oct. 30 through Nov. 3 at the Hynes Convention Center, in Boston, Mass.

This victory has directed all eyes toward the team’s breakthrough gadget: the OliView, a palm-sized biosensor designed to quickly evaluate the quality of olive oil.

The OliView’s obvious value undoubtedly helped the UC Davis engineers — Aaron Cohen, James Lucas, Lucas Murray, Sarah Ritz, Yeonju (Julie) Song, Simon Staley and Brain Tamsut — triumph amid a field of 245 teams from Asia, Europe, Latin American and North America.

Work began last summer, when the Aggie team met with some of the largest U.S. olive oil producers, and attended a hearing at the California State Capitol, to better understand the precise nature of the problem. The undergrad engineers soon realized that the challenge was quite complex, since it required the development of a gadget that could “read” and translate the elusive hint of rancidity — often a personal preference, from one consumer to the next, depending on the senses of smell and taste — into its chemical components. Existing tests were time-consuming, crude and dependent upon expensive instruments, yielding results that often didn’t correlate with sensory traits.

“Our research led us to aldehydes, and we ultimately realized that we would need to detect the relative levels of this chemical class in
olive oil,” Cohen explains. “We had to develop a protocol from scratch, which would allow us to measure the chemicals in olive oil, without denaturing our protein.”

The team eventually produced a working prototype that resembled an oversized thermometer, and — with attendant computer hardware and software — could read rancidity levels in a single drop of olive oil.

“It’s important to note that the OliView isn’t yet suited to enforce quality standards,” clarifies team advisor Marc Facciotti, an assistant professor in the Department of Chemical Engineering. “More work must be put into the chemistry and hardware. The concept’s core strength is that it can provide a common and readily accessible metric of quality; that can be widely distributed.”

At that point, the OliView could become a game-changer in a slippery conflict that has been percolating for years in the rapidly expanding U.S. olive oil market. Americans consumed 293,000 metric tons of olive oil in 2013, most of which was imported from European countries such as Spain and Italy. California growers, convinced they can make a better product, are looking to take a luscious bite of that $5.4 billion industry; they also believe it’s high time American consumers woke up to the fact that — for example — most so-called Italian extra-virgin olive oil is neither extra-virgin, nor made in Italy.

More to the point, European olive oils have flunked taste and content tests often enough, in recent years, to be considered a culinary scandal.

“This UC Davis project has great potential,” said David Garcia-Aguirre, production manager of the Lodi-based Corto Olive Co. “A biosensor that provides an easy, affordable way to help ensure the quality of our olive oil could prove incredibly useful; an innovation that would help get good oils into the hands of those who are trying to buy good oils.”

“It’s especially rewarding,” Tamsut concludes, “knowing that our project is practical, and will solve a real, tangible problem.”
COLLEGE OF ENGINEERING

Honors 2015 Innovators

THE UC DAVIS COLLEGE OF ENGINEERING kicked off its third annual Innovators Exhibit with a reception that took place March 3 in Kemper Hall’s Bruce and Marie West Lobby. The reception was highlighted by a presentation from Richard Chuang, who spoke about “Media and Technology: 35 Years of Changes.” Chuang (EE ’79), a longtime pioneer in the field of computer animation, spent several years with the DreamWorks film studio, along the way winning a shared Technical Achievement Academy Award. Today, he is the founder and CEO of Cloudpic Global. He is one of the five individuals honored in this year’s Innovators Exhibit, alongside Bill Colston (BME ’97), Laura Liptai (BME ’96), Niels Nielsen (MAE ’79) and Allen Northrup (BME ’90). After Chuang’s presentation, attendees spent time at each of the five Innovator Exhibit Stations, learning more about the innovative work of these accomplished UC Davis College of Engineering graduates. The exhibits will remain on display through February 2016.
UC DAVIS COLLEGE OF ENGINEERING

JOIN S EDUCATION INITIATIVE

THE UC DAVIS COLLEGE OF ENGINEERING has partnered with 121 other U.S. engineering schools, in an effort to spearhead a transformative movement in engineering education.

In a joint Letter of Commitment presented to President Obama on March 23, the UC Davis College of Engineering and its peer institutions have promised to establish and enhance special education programs designed to better prepare undergraduates for solving the world’s so-called “Grand Challenges”: the complex, yet achievable goals necessary to improve health, security, sustainability and quality-of-life issues in the 21st century.

Each of the 122 signatory schools has pledged to graduate a minimum of 20 students per year, who have been specially prepared to lead the way in solving such large-scale problems, with the goal of training more than 20,000 formally recognized “grand challenge engineers” during the upcoming decade.

Pilot UC Davis programs include a freshman-level course that introduces students to the engineering design process, while improving their oral communication skills; project-based learning (PBL) design studio experiences paired with existing engineering courses; and a new course titled “Starting and Prototyping a Technology Venture,” which grants engineering undergrads an opportunity to develop an entrepreneurial mindset.

On a national level, this innovative commitment already is bearing fruit. Twenty GCSPs already are active at institutions throughout the United States, and more than 160 NAE-designated Grand Challenge Scholars have graduated to date.

Half of these graduates are women — compared with just 19 percent of U.S. undergrad engineering students — which demonstrates the program’s appeal to groups typically under-represented within engineering disciplines.

“Our Grand Challenges for Engineering already have inspired more and more of our brightest young people to pursue careers that will have direct impacts on improving the quality of life for people across the globe,” said NAE President C.D. Mote Jr. “Imagine the impact of tens of thousands of additional creative minds, all focused on tackling society’s most vexing challenges.

“Changing the world’ is not hyperbole, in this case. They’ll do it ... and they’ll inspire others, as well!”

UC DAVIS ENGINEERING RANKS AMONG AMERICA’S BEST

Graduate Schools

THE LATEST EDITION OF AMERICA’S BEST GRADUATE SCHOOL RANKINGS, released by U.S. News & World Report in March, continues to rank the UC Davis College of Engineering among the best engineering schools in the nation. For the second consecutive year, UC Davis is ranked the 18th best public university for graduate education in engineering, from a field that assesses 193 engineering schools that grant doctoral degrees.

Most of the UC Davis College of Engineering’s graduate programs continue to rank among the best engineering programs in public universities. Agricultural Engineering again ranked 6th, while Environmental Engineering ranked 7th, Civil Engineering ranked 8th (tied with UC San Diego), and Biomedical Engineering ranked 9th. Programs that moved up included Aerospace Engineering, up two places to 18th (tied with the University of Florida); and Computer Engineering, up two spots to 19th (tied with Florida and the University of Massachusetts Amherst).

Other UC Davis Engineering programs that continue to show strength include Materials Science, at 17th; Chemical Engineering, Computer Science and Mechanical Engineering, all at 19th; and Electrical Engineering, at 23rd.

Environmental Engineering ranked 7th in the nation by U.S. News & World Report
“WE NOW HAVE THE COUNTRY’S LARGEST CENTRIFUGE... OUR MODELS WEIGH ABOUT 2.5 TONS, WHICH INCLUDES 1.5 TONS OF SOIL: THREE TO FOUR TIMES LARGER THAN WHAT ANYBODY ELSE CAN TEST.”

– DAN WILSON

CIVIL ENGINEERS AND EARTHQUAKE ANALYSTS wanting to minimize infrastructural damage, the next time a massive tremor strikes, know where to conduct their research: UC Davis’ world-renowned Center for Geotechnical Modeling (CGM). The facility’s modest set of offices sits adjacent to the Center’s star attraction: a concrete bunker that houses the enormous, 9-meter-radius centrifuge, capable of spinning a five-ton payload at 90 rotations per minute, thereby generating 75Gs of centrifugal force.

The massive device spins scale models — say, of a building or a foundation — that are constructed atop beds of soil placed in a “shaker” at the end of the centrifuge. At operational speed, a foot of soil in the model replicates the pressure forces bearing down on 80 feet of soil in our real world. Hundreds of wired and wireless sensors are buried in the model to collect data; when the speed is optimal, researchers hit the model with a split-second jolt that simulates the ground motion experienced during an earthquake. The goal is to determine not just how the buildings react, but the stability of the soil itself: whether it will retain some level of consistency or — worst case — completely liquefy.

“Geotechnical mechanics are extremely difficult to predict,” explains CGM Associate Director Dan Wilson. “These are non-linear and very complex behaviors. On top of which, we make it more complicated by testing all the way to failure. If you don’t understand how and when a structure or foundation will fail, you don’t understand how safe you are.”

Wilson is intimately acquainted with the Center and its work; he has been present since the massive centrifuge arrived at UC Davis, under somewhat unexpected circumstances.
Back in the late 1970s, Civil and Environmental Engineering emeritus professor James A. Cheney and a team of College of Engineering faculty collaborators joined with NASA to submit a successful $2.5 million National Science Foundation (NSF) proposal to develop a geotechnical centrifuge. The resulting facility was built at NASA’s Ames Research Center at Moffett Field, near San Jose; it became operational in 1984. When NASA abandoned its participation shortly thereafter, Cheney and his colleagues had the centrifuge moved to UC Davis in 1987, where it was installed in an open-air pit. The massive centrifuge became operational at its new site in 1988, with a peak acceleration of a modest 19Gs, because of wind drag.

Wilson arrived at UC Davis as a civil engineering student the same year the centrifuge was moved to campus, and he began working at the embryonic facility in 1990, doing experiments as an undergraduate student assistant. That same year, fresh NSF funding came through, allowing the construction of a concrete enclosure for the centrifuge; with wind drag no longer an issue, the centrifuge was able to accelerate to 53Gs. Cheney became the Center’s founding director; Wilson graduated in 1992, then continued working at the Center while earning his master’s degree (94) and doctorate (98). By then, the CGM had established its earthquake simulation capabilities with additional funding from the National Science Foundation, Caltrans, UC Davis and Japan’s Obayashi Corporation. Bruce L. Kutter, also a CEE professor, became the Center’s director in 1996.

In 2000, UC Davis and the CGM were selected as an NSF Network for Earthquake Engineering Simulation (NEES) host site, and an additional $5.1 million was used to upgrade the centrifuge facilities. Thanks to repairs, enhancements and various aerodynamic improvements, the centrifuge was able to accelerate to 75Gs.

“We now have the country’s largest centrifuge,” Wilson notes, “and we’re also equipped to build larger models. Our models weigh about 2.5 tons, which includes 1.5 tons of soil: three to four times larger than what anybody else can test. In that regard, our models are unique. We can do much more detailed testing than any other facility.”

Wilson has seen many changes during his quarter-century at the Center, the most rewarding in terms of academic and industry credibility. “Twenty-five years ago, we were a novel concept: a ‘lab test.’ That has changed dramatically; we’re now seen as a unique and powerful tool for the greater understanding of geotechnical mechanics. Our results correspond to what’s seen in the field, and some of our projects have led to changes in design code.

“Additionally, our tests have become much more robust. Twenty-five years ago, we had 30 sensors on an average model; now we have 200. In the beginning, we might have constructed a model of a single building; now we re-create an entire city block. Now we study not merely the reaction of a single building in the soil, but also — for example — the effect of a tall building on an adjacent short building. How would the presence of a skyscraper affect an adjacent tunnel? Or if an earthquake were to strike while you’re excavating next to a building, what would happen?”

Despite all the excellent work being done at the Center, Wilson often wishes he could enhance the “recognition curve” within his own UC Davis community.

“Campus colleagues still visit us all the time,” he laughs, “and they say, Wow, I had no idea you guys were out here!”

Doctoral student Kate Darby and her colleagues conduct research on new methods to characterize intermediate soils, which are not coarse enough to behave like sand or fine enough to behave like clay. The work has the potential to transform the technical training provided in graduate schools and professional courses, and to reduce costly engineering uncertainty in practice.
OMEED MOMENI WAS A CHILDHOOD TINKERER, forever soldering transistors, resistors and capacitors onto circuit boards. He still remembers the moment of elation, after building an FM radio transmitter and receiver that actually worked.

By the time he entered high school, Momeni’s interest had migrated to computers, particularly after his father, a civil engineer, bought one for the family.

“I was fascinated,” laughs Momeni, an assistant professor in the UC Davis Department of Electrical and Computer Engineering. “I wanted to know what was going on inside that box; how did it make graphics and do all those other things, with transistors and a circuit board?

“If you look at a car engine, you can see things move, and you can get an idea of how it works. But there’s nothing to ‘see’ inside a computer.”

Momeni’s mounting interest soon became a lifetime career; he completed his undergraduate work in electrical engineering at Iran’s Isfahan University of Technology, and then set his sights on the United States. (Although he grew up in Iran, Momeni was born in the U.S., where he and his family remained until he was 5, while his father completed his PhD work at Kansas State University.)

“I always wanted to return to the United States, because everybody knows that it’s the best place for higher education and top research,” Momeni insists. “The world’s best research, in many fields, takes place right here.”

He spent a few months at Arizona State University, then switched to USC to finish his master’s degree. “The move to USC came about because I also got a job as an engineer at NASA’s Jet Propulsion Lab in Pasadena. I designed L-band transceivers for synthetic aperture radars, and high-power amplifiers for mass spectrometer applications.

“But that work didn’t relate much to my desired research field, so after I completed my master’s, I accepted an offer to join Professor Ehsan Afshari, at Cornell’s School of Electrical and Computer Engineering. I was his first PhD student, and I helped start his research lab.”

Momeni has very fond memories of his PhD work, which he completed in 2011.

“Those four years were the happiest time that I’ve ever spent during my career. When you’re a student, you’re responsible solely for doing your research; you don’t have to worry about anything else ... and that’s a working environment that you’ll never get back again!

“A PhD is a time of your life when you can fully apply yourself to something you want to do, because you like it, and because it’s truly significant: something that you’ll later be able to look back on and say, I did the best I could, something I’m proud of.”

Momeni clearly embraced that level of dedication; he won 2011’s Best PhD Thesis Award from Cornell’s Department of Electrical and Computer Engineering.
Several offers arrived after he finished his doctorate, but Momeni knew where he wanted to be. He joined the faculty at UC Davis in 2012.

"UC Davis was at the top of my list, because its ECE department is famous and well-respected in the circuits field. Lots of faculty members work on different branches of circuits, which is ideal, if you wish to start your research in the same field.

"And we have a high-frequency lab — the Davis Millimeter-Wave Research Center — that's unique in the country. It has equipment that most universities can't even dream of!

"Consider smart phones: We download and upload, and there's a certain speed related to such activities, perhaps 50 megabits per second. Individual phones communicate with neighboring towers at different frequencies between 800 MHz and 2.5 gigahertz (GHz). The data communication speed is related to that frequency range and the bandwidth they can occupy. All smart phones operate at that frequency range, so it's extremely congested.

"With the upcoming arrival of 5G and even 6G networks, the necessary goal is to increase the data rate, which means we need to increase the frequency. But the transistors used on these small chips cannot handle higher frequencies as well, so our challenge is figuring out how to incorporate the transistors in a circuit so that the system can handle higher frequencies. Right now, we're looking at frequencies of 30, 60 and 90 GHz, and even 200-700 GHz.

"And we want to put all these capabilities onto small silicon chips, in order to produce hand-held devices for communication, imaging, sensing and spectroscopy. This also opens all sorts of other possibilities, such as disease detection via devices that would analyze a person's exhaled breath."

The inherent problem is that the physical characteristics of the transistors themselves have hit a wall. Today's transistors are so small that their dimensions are comparable to the size of silicon atoms; fundamentally, then, the transistors can't get any smaller.

"That's the challenge," Momeni agrees. "We're trying to come up with new ways of using the same silicon transistors: new systems, at new frequencies, that nobody has thought possible."

Momeni's efforts already have attracted the attention of the National Science Foundation's Division of Electrical, Communications and Cyber Systems, which in January awarded him a five-year CAREER grant of $500,000.

"For the grant, we're tackling the problem of integrating systems on a single chip, because as the frequency goes higher, the signal loss increases. Transmitters need antenna arrays to boost radiated signal power, which in turn require phase shifters, to 'tune' the direction of the beam ... but phase shifters at higher frequencies are extremely lossy.

"We've proposed a system that will bypass phase-shifters, and will exploit other signal properties — specifically, traveling- and standing-wave properties — to do the same thing as a phase-shifter, but with significantly lower loss. That'll make it possible for higher and higher frequencies to radiate with much better efficiency and superior performance."

Although devoted both to his research and teaching, Momeni also believes strongly in outreach. He's deeply involved with the UC LEADS (Leadership Excellence through Advanced Degrees) Program and the MacNair Scholars Program, both of which encourage under-represented students to enroll in post-graduate research.

"Such students could perhaps become the first people in their families to earn a PhD," Momeni explains, "which makes them excellent role models for their extended relations and friends. I had an undergraduate from UC Santa Cruz here last summer, and we worked together, and it went really well. When he graduates later this year, I know he'll continue on toward a master's degree."

Aside from his one-on-one interactions with students, Momeni has served on panels for both UC LEADS and MacNair, and also worked as an event judge and in other capacities.

"It's essential work. You don't get paid for it — nor would I expect to — but it's food for the soul. "It makes you feel like you've given back, and done something important for the surrounding community."

"WE'RE TRYING TO COME UP WITH NEW WAYS OF USING THE SAME SILICON TRANSISTORS: NEW SYSTEMS, AT NEW FREQUENCIES, THAT NOBODY HAS THOUGHT POSSIBLE."

– OMEED MOMENI
BEGINNING IN FEBRUARY, new and continuing materials science students have gained access to a free Massive Open Online Course (MOOC) titled “Ten Things Every Engineer Should Know About Materials Science.” The course is designed and hosted by James Shackelford, a distinguished professor emeritus in the UC Davis Department of Chemical Engineering and Materials Science.

The course can be accessed at https://www.canvas.net/browse/canvasnet/ucdavis/courses/ten-things-about-materials-science

Since joining the UC Davis College of Engineering in 1973, Shackelford has deftly divided his time between research, academic responsibilities, departmental service and an extensive passion for the world of fine art. In 1985, he published the first edition of Introduction to Materials Science for Engineers, a seminal textbook that has gone through multiple subsequent editions, and has been translated into Chinese, German, Spanish, Portuguese, Italian and Korean. In 2012, he received the UC Davis College of Engineering’s Outstanding Teaching Award.

With subtle nods to both David Letterman and Dr. Seuss, Shackelford has divided his new online course into 10 topics, ranging from “Thing One: The Menu of Materials,” to “Thing Ten: A Brief History of Semiconductors.” Stops along the way include creep deformation, stress vs. strain, fracture toughness and solid state diffusion.

“My ‘Ten Things’ concept derived, in part, from a desire to present a concise version of Engineering 45 — Properties of Materials — that was produced for UC Davis Extension in the summer of 2012,” Shackelford explains. “But the origins go deeper. I’ve occasionally done special offerings of E45 in a compressed time frame, notably in December 2013, as a visiting professor at our collaborative sister institution in Vietnam, the Hanoi University of Mining and Geology.”

Recognizing the need to hold the attention of potential students, Shackelford knew that he wanted to expand upon a traditional classroom scenario, by incorporating “field work.” He offers high praise for the production team that catered to such plans.

“Producing the course went smoothly, thanks to the professionalism of the Extension staff,” he notes. “They have extensive experience in doing online courses, but this was their first effort at a PBS-style show, wherein ‘location shots’ were used to introduce selected segments of the online lectures. Joe Najera and John Loring were a terrific video crew, and Kristen Hoard organized the effort from the Extension Office of Online Learning.”

Although early efforts to employ MOOCs as alternatives to traditional classroom instruction yielded results far short of expectations — as evidenced, for example, by the failure of Stanford-produced MOOCs at San Jose State University — Shackelford believes strongly that the model itself has great potential.

“The best use of MOOCs in a university setting would be via the ‘flipped classroom’ model, which was pioneered by Nobel Prize-winning physics professor Carl Wieman,” Shackelford explains. “There’s convincing evidence that having students embrace an online course lecture first, and then use classroom time for interactive and challenging discussions, provides a vastly superior mastery of the subject matter.”

Even so, technology has certain limitations.

“Ultimately, there’s no substitute for human contact,” Shackelford admits. “That will always be a tradeoff, against the economic gains and/or flexibility provided by online teaching.”
UC DAVIS BIOENGINEERS AWARDED NEARLY $4 MILLION FOR REGENERATIVE MEDICAL RESEARCH

THE CALIFORNIA INSTITUTE FOR REGENERATIVE MEDICINE (CIRM) has awarded a pair of $1.8 million grants to two UC Davis scientists, who are developing superior tools that will enable physicians to better assess the safety and efficacy of the bioengineered tissues used to treat cardiovascular disease and bone and cartilage repair.

Laura Marcu, a professor of biomedical engineering and neurological surgery, is leading a team that aims to combine label-free optical and ultrasonic imaging technologies, so that newly developed vascular replacement materials — typically used in surgical grafts to restore blood flow — can be better assessed and monitored directly in patients, thus preventing a graft’s potential failure.

Kent Leach, an associate professor of biomedical engineering and orthopedic surgery, will lead a team working to develop advanced light and sound technologies that will detect changes in engineered bone and cartilage. This project hopes to provide clinicians with improved abilities to identify if — and how — implanted cells are maturing and functioning in patients.

Possessing such next-gen diagnostic imaging capabilities could accelerate the development and clinical applications of everything from engineered vascular grafts, which currently can pose significant complications for patients, to stem cell therapies for regenerating bone and cartilage in diseased or damaged areas of the human body.

“The broad range of biophotonic and ultrasound technologies developed in our laboratory could improve our ability to produce safer, more functional engineered tissues, with large animal models to speed their use in clinical settings,” said Marcu, whose project is being done in collaboration with Leigh Griffiths, at the UC Davis School of Veterinary Medicine, and Claus Søndergaard, at the UC Davis School of Medicine. She also is co-principal investigator on Leach’s research project. “This work should improve real-time, non-invasive, label-free imaging capabilities, giving us a more thorough assessment of site-specific cellular growth and functional properties when engineered tissues are used.”

The two CIRM grants are part of the state stem cell agency’s newest Tools and Technologies Initiative, which is designed to support research that addresses unique translational challenges in regenerative medicine. Such three-year research grants focus on the creation, design and testing of novel or existing tools and technologies, to address translational bottlenecks to stem cell therapies.

“Currently, using stem cells to generate individualized implantable grafts suffers from patient-to-patient variability, which is unpredictable and immeasurable without destructive techniques,” said Leach, whose project also includes Kyriacos Athanasiou, chair of UC Davis’ Department of Biomedical Engineering. “California’s aging population, 20 percent of whom will be over the age of 65 in the next decade, will require functional replacement tissues to maintain their quality of life. We simply cannot assess the success or failure of a cellular therapy in living individuals, and it represents a major bottleneck in translating stem cell technologies to the clinic and delivering quality products for patients. We need nondestructive, minimally invasive methods to measure dynamic changes in tissue development.”

UC Davis’ stem cell program director, Jan Nolta, also sees great benefits for regenerative medicine research from the tools that Marcu and Leach are developing.

“One of the great barriers in regenerative medicine is our ability to understand and monitor what happens after stem cells are given to a patient,” said Nolta, who also directs the UC Davis Institute for Regenerative Cures in Sacramento. “We need to be able to tell whether the blood vessels truly are improving, and whether the bone and cartilage are getting stronger.

“This type of novel biomedical imaging research will advance our clinical assessment capabilities, and add to our efforts to safely turn stem cells into cures.”
UC Davis Launches Crowdsourcing ENERGY TOOL

THANKS TO JOSHUA MOREJOHN (BS, mechanical engineering, 2002) and a new interactive website developed by his Facilities Management Energy Conservation Office, UC Davis students, staff and faculty can provide real-time, crowd-sourced feedback about building environments that are (for example) too hot or too cold. The site, the Campus Energy Education Dashboard (CEED), debuted Nov. 3, following a “soft launch” a month earlier.

Visitors to the site — eco.ucdavis.edu — will find a campus map with “energy use intensity” figures given for (thus far) eight buildings. This site map is purely informational; students, faculty, staff and visitors wishing to add their feedback can access a new Thermal Feedback Tile available for their customized my.ucdavis.edu desktop. The new tile allows users to identify building and room number, and then select from a five-point range that indicates current comfort level: cold, chilly, perfect, warm or hot. The submitted feedback becomes part of CEED’s ever-expanding database.

“Our initial goal is the feedback system itself, to let us know how buildings are doing,” Morejohn explains. “We can’t be on site monitoring the 10 million square feet of campus at all times; we don’t have enough bodies. But all the buildings are occupied by thousands of students, staff and faculty; now they can supply us with the desired information.”

Obtaining that data is just the initial goal; Morejohn and energy analyst/project developer Kiernan March Salmon already are eager to exploit it, while eventually bringing all campus buildings online.

“The next goal is to turn this feedback into actual projects, in order to save the campus money,” Morejohn continues. “Maybe a thermostat needs to be moved. Maybe somebody put a refrigerator in front of a sensor, which would make it think the room was too warm. Maybe a server room needs to be put on its own system, separated from the host building. Maybe a broken window, thus far unnoticed, is letting in cold air and making one room abnormally chilly, compared to the rest of the building.”

The Thermal Feedback tile was released to students in mid-September, for the start of the fall quarter, and shortly thereafter for staff and faculty. The feedback from the tile will augment CEED and help Facilities find future energy projects.

“Eventually, we envision posting this information on a campus map, where everybody can see the feedback, building by building,” Salmon explains. “We also hope to enhance the data presented in the Thermal Feedback Tile, so by clicking on it a user could see overall stats for a given building: what feedback has been given, and what we’re doing about it, and on what sort of timeline.

“We anticipate user involvement beyond simple notification. We don’t just want students to let us know if, say, they’re too cold in a particular building; we’d like them to start thinking about why they might be too cold. Once they’re able to view the data that we’ll post, they’ll see what we see, in terms of daily or weekend trends. We hope they’ll start asking the right questions, perhaps even offering helpful suggestions.”
CONTROLLING WEEDS soon could become more effective, affordable and sustainable for vegetable growers in California and beyond, thanks to a system under development at UC Davis that will help plants “communicate” with a robotic cultivator.

The project, led by Professor David Slaughter of the UC Davis Department of Biological and Agricultural Engineering, received a $2.7 million grant in January from the U.S. Department of Agriculture's Specialty Crop Research Initiative.

The project, expected to take shape during the next five years, addresses a problem that has vexed precision weed management for years: How can a robotic cultivator be programmed to quickly distinguish friend from foe?

“Machines can recognize a weed, and they can recognize a crop plant, but they have trouble distinguishing one pattern from another when both are co-mingled, as often is the case with weeds and young crops in the field, particularly when traveling at a typical tractor speed of 3 feet-per-second or more,” Slaughter said.

Slaughter’s team is designing a robotic cultivator that can remove weeds in commercial fields as carefully as gardeners pull weeds in their own backyard, without the time-consuming labor and cost. This “smart” cultivator will be equipped with small knives that reach out to uproot weeds, and retract to keep crops intact.

It will weed the beds of any row crop, and will be especially useful in wide beds of densely seeded crops such as spinach and baby lettuce, which can turn green almost overnight with weeds and leafy crops.

“Current vision-sensing mechanical cultivators sometimes can recognize weeds along the edges of wide beds — or seed lines, as we call them — but they get lost in the middle,” said Steve Fennimore, a Cooperative Extension weed specialist with the UC Davis Department of Plant Sciences, and a member of the new robotic cultivator team.

“Workers often have to go back and hand-weed such beds.”

Thanks to a safe, simple seed coating, the plants will signal the cultivator by emitting a faint, fluorescent glow that will appear when seedlings emerge and are most vulnerable; this glow will vanish as the plants grow and become able to out-compete weeds for sun, water and nutrients.

“It won’t involve biotechnology or any genetic engineering,” Slaughter clarified. “The seeds will be coated with a safe, inert, fluorescent material.”

Slaughter’s team will develop the seed coating in collaboration with UC Davis Seed Biotechnology Center researchers, along with colleagues at Aginnovation, a Walnut Grove-based company that specializes in seed technology. The new cultivator should move more quickly through a field than current vision-sensor models, because it won’t take as long for the machine to distinguish invasive weeds from the valuable seedlings.

That’s good news for vegetable growers such as Alain Pincot, managing partner of Bonipak Farms in Santa Maria.

“As the cost of labor rises in California, mechanical cultivators become more important to both organic and conventional ag production,” Pincot said. “We’ve been fairly happy with our existing automatic weeder, but we would be interested in a new type of cultivator if it moved more quickly and could accommodate beds of various widths.

“A robotic weeder with a higher speed and good accuracy along the row would be a winning machine.”
The UC Davis College of Engineering honored several of its notable graduates with the 2014 Distinguished Engineering Alumni Medals (DEAM), which were presented during a ceremony that took place Feb. 28 at San Francisco’s St. Francis Yacht Club.

DEAM recipients are UC Davis engineering graduates with 15 or more years of professional experience, who have a record of outstanding professional or technical achievement; have rendered distinguished service to the College of Engineering, the engineering profession or the community; and have contributed in a significant way to the campus as a whole. DEAM Awards are granted in three categories, to honor excellence in business, academia and public service.

During a reception that was emceed by College of Engineering Dean Enrique J. Lavernia, DEAM Awards were presented to John Wasson, president and COO of ICF International; and April Fallon, chief of staff/product for LinkedIn (both for Business Achievement); Elaine Scott, dean of the School of Science, Technology, Engineering and Math, at the University of Washington, Bothell (Education Achievement); and Scott Johnson, founder, president and CEO of the Myelin Repair Foundation; and William Milliken, senior reservoir engineer, Chevron (both for Public Service).

Additional information about the annual DEAM Awards can be found at http://engineering.ucdavis.edu/alumni/distinguished-engineering-alumni-medal/
1. Sushma and Subhash Mahajan and Douglas Wright
2. Student speaker Earnest “Tre” Sayles (’15), an electrical engineering major and a safety on the UC Davis football team
3. Humberto Rincon (right), recipient of the 2014 DEAM for Achievement in Public Service, presents the 2015 award to Scott Johnson, founder, president and CEO of the Myelin Repair Foundation
4. Humberto Rincon (left), recipient of the 2014 DEAM for Achievement in Public Service, presents the 2015 award to William Milliken, senior reservoir engineer at Chevron
RICHARD AND JOY DORF have seen the future, and persuasive communication will be crucial.

In an era when dialogue too frequently deteriorates to 140-characters, the UC Davis College of Engineering is taking a progressive lead on reinforcing the need for students to develop superior interaction skills.

The first phase was a freshman pilot course that debuted fall quarter: ENG 098, Introduction to Engineering Design, which emphasized the primary goals of design, teamwork and technical communication. Students were grouped into teams that developed a product in response to a design challenge, and then pitched their work during oral, slide and poster presentations.

“The goal was to learn not only how to present, effectively and efficiently,” said instructor Spyros Tseregounis, a professor in the Department of Chemical Engineering and Materials Science, “but also how to evaluate a good presentation.”

Pleased by the success of this pilot course, The College of Engineering is proceeding with the master plan’s second phase: the creation of a space specifically designed to accommodate ENG 098. By the upcoming fall quarter, following a summer of construction, 1065 Kemper will have transformed into a sleek Design and Communications Space named for Richard and Joy Dorf, whose $250,000 gift is making it happen.
"The idea is fantastic," said Richard Dorf, an emeritus professor with dual appointments in the UC Davis School of Management, and the Department of Electrical and Computer Engineering. "I can’t think of anything else that we’d rather stand behind. Joy and I see this as proof that the College of Engineering values communication as much as design."

Both Richard and Joy Dorf place a high value on effective communication skills. Joy is well known for her long service as a Presbyterian minister, and recognized locally as the former associate pastor at Davis Community Church: a career that required focus, a command of language, and comfortable presentation skills.

"Effective communication today requires a greater bank of sensitivities than most people have learned," she notes. "In our multi-cultural era, presentation and word choice have become more challenging, and more crucial."

This philosophy was instrumental to the design of ENG 098, as originally envisioned by Tseregounis and Jim Schaaf, a lecturer in the Department of Mechanical and Aerospace Engineering (MAE), and assistant dean of undergraduate programs and advising; Jean-Pierre Delplanque, also a professor in MAE, and associate dean for undergraduate studies; and Jean VanderGheynst, a professor in the Department of Biological and Agricultural Engineering, and associate dean for research and graduate studies.

"The earlier we help engineering students appreciate the need for developing a crisp, polished presentational attitude, the better," Tseregounis said, at the time.

The reconfigured Kemper classroom will encourage precisely that mindset.

"We needed a highly flexible space, akin to what you’d see in a lot of start-up companies," Schaaf explains. "A space where students could brainstorm and sketch out their ideas, and then prepare and deliver presentations."

The room will contain six “zones,” one for each team of four to five students; each zone will include a table surrounded by mobile whiteboards, for quick ideation. Each zone also will have a projector, so students can connect their laptops and practice presentations that would require the use of audio/visuals. The instructor will have a central “master control station” that can, if desired, share the activities taking place within a given student group, with everybody else in the room.

The tables, whiteboards and projectors will be mobile, so the room can be converted into a standard lecture hall or seminar-style space, if the instructor so desires.

"This is a unique opportunity for us to showcase modern teaching styles that will allow students to participate in the design of their own projects, while also sharing their ideas with the entire class," Schaaf continues. "We also wanted to encourage students to work across disciplines: not just (for example) mechanical engineers working with other mechanical engineers.

"This is a vision of the future: of what we can do throughout the core curriculum. Once we get this first course solidly established, we’ll prototype another one at the sophomore level, with the goal of getting more hands-on activity throughout the curriculum."

"It’s exciting that every engineering student will take this freshman class," Joy Dorf said. "This is what our lives call for: people who can communicate effectively. It’s a very important skill, and making it part of the engineering curriculum delivers a message: You can know your formulas every which way, but they’re not much good if you can’t successfully share the results."

Looking forward," Schaaf notes, “we envision many such facilities throughout the College of Engineering, similar to what we’re creating in 1065 Kemper. This is something that each building should have: go-to places for students or teams desiring a creative space.”

“That’s how it works,” Joy Dorf agrees. “With our gift, we’re building on somebody else’s shoulders; eventually, somebody else will build on ours. We’re part of an ongoing stream of people who have committed a large part of their resources to this campus.”
JOHN OWENS RECEIVES INAUGURAL ADOBE AWARD

Adobe, a global leader in digital marketing and digital media solutions, has presented one of its inaugural Digital Marketing Research Awards to JOHN OWENS, the Child Family Professor of Engineering and Entrepreneurship in the UC Davis Department of Electrical and Computer Engineering. Owens and co-PI Stephen Boyd, a professor of electrical engineering at Stanford University’s Information Systems Laboratory, will share the $50,000 grant for their collaborative project, Scaling Convex Optimization with GPUs.

Owens and Boyd will explore the potential benefits of using a more sophisticated optimization technique to enhance the complex decisions required within Adobe’s Marketing Cloud. By focusing on GPUs and clusters of GPUs, Owens and Boyd expect to improve upon convex optimization techniques already employed widely in advertising, e-business, email spam filters, fraud detection, finance and numerous other fields.

MEDICAL JOURNALS HIGHLIGHT WORK BY BIOENGINEERING LAB

INNOVATIVE RESEARCH work by the UC Davis Musculoskeletal Bioengineering Laboratory was published last fall in two medical journals.


The work focused on the Musculoskeletal Bioengineering Lab’s efforts to develop new ways to treat osteoarthritis, with the goal of minimizing total joint destruction in the patient. The article discussed the short- and long-term clinical outcomes of current, widely used clinical repair techniques for resurfacing articular cartilage defects. Additionally, the team reviewed a developmental pipeline of acellular and cellular regenerative products and techniques that could revolutionize joint care during the next decade, by promoting the development of functional articular cartilage.


That report addressed an ongoing challenge regarding the limitations of lab-engineered artificial cartilage intended for use in the treatment of injuries and damage to joints and ligaments. The present study demonstrates, both in vitro and in vivo, that improvements in the mechanical properties of native and engineered tissues can be attained using the endogenous (hypoxia-mediated) and exogenous application of lysyl oxidase: the enzyme responsible for collagen cross-linking.

BROADER DISTRIBUTION FOR DOLPHIN RESEARCH

“Metabolite Content Profiling of Bottlenose Dolphin Exhaled Breath,” an innovative study led by CRISTINA DAVIS, a professor in the UC Davis Department of Mechanical and Aerospace Engineering, was distributed Oct. 15, 2014, as part of the American Chemical Society (ACS) Office of Public Affairs’ weekly PressPac, which is sent to thousands of journalists around the world.

Working with both dolphins in the wild and those under human care — and collaborating with San Diego’s National Marine Mammal Foundation, and Florida’s Mote Marine Laboratory — Davis’ team designed an insulated tube customized to trap the breath exhaled from the blowhole of a bottlenose dolphin. The resulting methodology allowed the team to document baseline compounds in the exhaled breath of healthy animals, and then to study the changes in the metabolic content of dolphin breath with regard to a variety of factors.

This breakthrough method of breath analysis is likely to provide an extremely valuable tool in future wildlife conservation efforts, while also deepening our understanding of marine mammal biology and physiology.
ATUL N. PARIKH PLACES RESEARCH STUDY IN PRESTIGIOUS ONLINE JOURNAL

ATUL N. PARIKH, a professor in the UC Davis Departments of Biomedical Engineering, and Chemical Engineering & Materials Science, collaborated on a study published October 15, 2014, in the prestigious online journal eLife. The article, “Oscillatory Phase Separation in Giant Lipid Vesicles Induced by Transmembrane Osmotic Differentials,” is derived from research conducted by Parikh, Kamila Oglecka, Padmini Rangamani, Bo Liedberg and Rachel Kraut.

The work was supported by a grant from the U.S. Department of Energy’s Basic Energy Sciences (BES) program at UC Davis, and executed via an international collaboration with Singapore’s Nanyang Technological University.

Parikh and his colleagues studied the free-living cells found within contemporary organisms: cells that employ a variety of highly sophisticated molecular mechanisms to deal with sudden changes in their surroundings. The team wished to determine how primitive cells existing near the dawn of life on Earth — cells that lacked advanced protein machines — might have responded to environmental assaults.

Ricardo Castro Honored by American Ceramic Society

RICARDO CASTRO, an associate professor in the UC Davis Department of Chemical Engineering and Materials Science, has received the 2015 Global Young Investigator (GYI) Award, presented by the Engineering Ceramics Division of the American Ceramic Society (ACerS). The award recognizes an outstanding young ceramic engineer and scientist whose achievements have been significant to the field, including an expansion of the knowledge base and commercial use.

Castro joined the UC Davis College of Engineering faculty in March 2009, where his research has focused on the phase transitions of nanocrystalline aluminum. Last spring, he received the ACerS’ 2014 Robert L. Coble Award for Young Scholars, an honor named for the ceramics pioneer who also devoted his professional career to enhancing the achievement and advancement of young ceramic scientists.

Andrew Canning Named APS Fellow

ANDREW CANNING, an adjunct professor in the UC Davis Department of Chemical Engineering and Materials Science, has been elected a Fellow of the American Physical Society (APS), in their Division of Computational Physics. Canning has been honored for “important contributions to the development of parallel and computational algorithms for a diverse range of electronic structure methods, and their application to systems ranging from nanostructures and complex magnetic systems, to nuclear detection materials.”

Canning also has worked at the Lawrence Berkeley National Laboratory (LBNL) since 1998, where today he is a staff scientist in the Scientific Computing Group. His research has focused on the development of new computational and mathematical methods for first-principles calculations, particularly parallel algorithms for large-scale parallel computers.
MUKHERJEE LAB WINS IEEE BEST PAPER AWARD

The Institute of Electrical and Electronics Engineers (IEEE) International Conference on Advanced Networks and Telecommunication Systems, which took place Dec. 14-17, 2014, in New Delhi, India, presented a Best Paper Award to research conducted at the lab run by UC Davis distinguished professor BISWANATH MUKHERJEE.

The paper, “Cost-Efficient Live VM Migration Based on Varying Electricity Cost in Optical Cloud Networks,” is authored by Abhishek Gupta, Uttam Mandal, Pulak Chowdhury, Massimo Tornatore and Mukherjee.

Mukherjee’s research focuses on lightwave networks; telecom networks, including solutions for broadband access networks that exploit optical and wireless technologies; energy-efficient network architectures for sustainability; future Internet design, including hybrid circuit-packet networks, dynamic circuit-switching, and Ethernet Everywhere; and survivable network architectures designed to combat large-scale failures and attacks.

NSF PRESENTS CAREER AWARD TO ERKIN ŞEKER

The National Science Foundation’s Division of Chemical, Bioengineering, Environmental and Transport Systems has awarded a five-year CAREER grant of $504,813 to ERKIN ŞEKER, a professor in the UC Davis Department of Electrical and Computer Engineering. Şeker will be PI on the research project, titled “Multifunctional Nanostructured Electrodes for Closed-Loop Control of Neural Activity.”

This project builds on an expanding regimen of medical devices — commonly known as neural interfaces — that can be implanted into the brain, in order to treat neurological disorders while providing a greater understanding for the complex network underlying the brain’s operation. Şeker intends to engineer multifunctional devices that can monitor the electrical signals that precede an epileptic seizure, and in response deliver anti-epileptic drugs in order to prevent full-blown seizures. This work also promises to benefit a wide range of other fields, including vascular stent and orthopedic implant coatings, catalytic fuel cells, and biosensors for pathogens.

ECE RESEARCH GROUP PLACES ARTICLE IN SCIENTIFIC JOURNAL

On Feb. 16, the journal Nature Materials granted online publication to an article emanating from the research group led by JOSHUA HIHATH, an assistant professor in the UC Davis Department of Electrical and Computer Engineering. The paper, “Binding Configurations and Intramolecular Strain in Single-Molecule Devices,” is authored by Habid Rascon-Ramos, Juan Manuel Artés Vivancos, Yuanhui Li and Hihath.

Their work focused on the contact geometry and binding configuration of single-molecule junctions in molecular-scale electronic devices such as transistors, diodes and wires. The goal was to develop a technique that could be used to better calculate how molecule-scale circuits behave, thereby addressing a traditional disconnect between theoretical predictions and experimental results.
DEBBIE NIEMEIER HONORED AS AAAS FELLOW

DEBBIE NIEMEIER, a professor in the UC Davis Department of Civil and Environmental Engineering, has been named a Fellow of the American Association for the Advancement of Science (AAAS). She has been honored for “distinguished contributions to energy and environmental science study and policy development.”

Niemeier’s research interests span transportation, vehicle emissions and air quality monitoring; energy consumption and land use interactions; and public sector infrastructure programming and budgeting. She served for two years as vice-chair of the UC Davis Department of Civil and Environmental Engineering, and then became department chair from 2001-04. She also directed the UC Davis-Caltrans Air Quality Project for more than a decade, and is founding director of the UC Davis Sustainable Design Academy.

CALIFORNIA FUNDS UC DAVIS/SOLANO STEM PROGRAM

The California Department of Education’s Math and Science Partnership Program has announced funding for “Programming and Robotics Integrated into Science and Mathematics (PRISM),” a joint proposal by the UC Davis Center for Integrated Computing and STEM Education (C-STEM) and the Solano County Office of Education (SCOE). The $1.8 million grant is designed to fund the project for three years.

PRISM will work with both middle-grade (5-8) and high school (9-12) students in six Solano County school districts — Fairfield-Suisun, Vacaville, Travis, Dixon, Benicia and San Ramon Valley — along with St. Catherine of Siene, and the Mare Island Technology Academy. The project will recruit more than 60 math, physical science or math-based Career Technical Education instructors, who will be trained during an intensive 10-day Summer Computing and Math Institute, where they’ll learn how to integrate computer programming and robotics into inter-disciplinary math and science instruction.

This new collaborative project with the Solano County Office of Education closely follows 2014’s $1.5 million three-year funding grant, also from the California Department of Education, to bring the UC Davis C-STEM curriculum to schools in Yolo County, Sacramento County — the Sacramento City Unified School District, and the Elk Grove Unified School District — and Placer County.

JIN YONG OH RECEIVES 2015 MUNIR AWARD

The UC Davis College of Engineering Awards Committee has presented the 2015 Zuhair A. Munir Best Dissertation Award to JIN YONG “JACKIE” OH, who completed his doctorate in electrical engineering in June 2014. Oh’s dissertation is titled High Throughput Manufacturing of Silicon Nanobridges for the Fabrication of 3D Gate-All-Around Field Effect Transistors.

The committee also selected Shaxun Chen, who earned his doctorate in computer science in September 2014, for an honorable mention; his dissertation is titled Enhancing Wireless Security Through Cross-Layer Approaches.

As a member of M. Saif Islam’s Integrated Nanodevices and Nanosystems Research Group, Oh’s work focused on nanomaterial synthesis and nanofabrication; nanowire-based FETS (field-effect transistors), detectors, sensors and photovoltaics; and devices based on ionic transport.

MIGUEL MARIÑO RECEIVES LIFETIME ACHIEVEMENT AWARD

The American Society of Civil Engineers (ASCE) has honored MIGUEL A MARIÑO, a distinguished professor emeritus of hydrologic sciences in the UC Davis Departments of Civil and Environmental Engineering, and Biological and Agricultural Engineering, with its Environmental and Water Resources Institute’s (EWRI) 2015 Lifetime Achievement Award.

Mariño’s research areas include environmental hydrology; fluid transport processes and biogeochemical transformations in soils, aquifers and rivers; and the planning, design and management of subsurface and surface reservoirs and irrigation systems.
OMEED MOMENI RECEIVES
NSF CAREER AWARD

The National Science Foundation’s Division of Electrical, Communications and Cyber Systems has awarded a five-year CAREER grant of $500,000 to OMEED MOMENI, an assistant professor in the UC Davis Department of Electrical and Computer Engineering. Momeni will be PI on the research project titled “Scalable Traveling and Standing Wave Structures for High-Power and High-Efficiency Terahertz and mm-Wave Radiator and Phased Array Systems.”

High-speed electronics rely increasingly on millimeter-wave (mm-wave) and terahertz (THz) systems for a wide variety of applications in health, security and industry. Remote sensing, active/passive imaging and short-range communication are evolving rapidly toward the superior resolution and higher data rate promised by mm-wave and THz frequencies, but thus far such systems are achieved solely by expensive and unwieldy devices such as gas lasers and discrete bulky components. Momeni hopes to make solid-state electronics the default platform for high-performance, on-chip THz systems, which would allow the many related applications to flourish, resulting in new opportunities in both the high-tech marketplace, and research and teaching institutions.

WILLIAM RISTENPART NAMED CHANCELLOR’S FELLOW

WILLIAM D. RISTENPART, an associate professor in the Department of Chemical Engineering and Materials Science, is among this year’s faculty members who have been named Chancellor’s Fellows. This annual designation, initiated in 2000, is one of the campus’ highest and most prestigious faculty honors. The program recognizes rising stars who shine as teachers and campus citizens, and whose scholarly work already puts them at the top of their fields, garnering attention far and wide.

Ristenpart has held the Joe and Essie Smith Endowed Chair of Chemical Engineering since 2012. His research focuses on complex transport phenomena, with an emphasis on using advanced experimental techniques to extract quantitative measurements from complicated phenomena. He has two active grants from the National Science Foundation, and is co-principal investigator on a National Institute of Justice grant to study the forensic-evidence properties of cut vs. torn duct tape.

For the second consecutive year, he and colleague Tonya Kuhl are co-teaching two introductory courses — one for chemical engineering majors, the other a general elective course — that use the roasting and brewing of coffee as the basis for teaching the principles of chemical engineering.

NATURE ARTICLE EXPANDS ON BRUCE WHITE’S EARLY RESEARCH

The scientific journal Nature began the new year by devoting the cover story of its Jan. 1, issue to a breakthrough study co-authored by BRUCE WHITE, a professor emeritus in the UC Davis Department of Mechanical and Aerospace Engineering. The paper, “Higher-Than-Predicted Saltation Threshold Wind Speeds on Titan,” is authored by Devon M. Burr, Nathan T. Bridges, John R. Marshall, James K. Smith, White and Joshua P. Emery.

The research represents the culmination of more than five years’ worth of work that was spearheaded, in great part, by data gathered from NASA’s Cassini-Huygens spacecraft, launched in 1997 and in orbit around Saturn since 2004.

This work has taken White back decades: Part of his 1975 PhD dissertation was devoted to a discussion of the winds on Mars. He subsequently helped build the “Mars Tunnel” and “Venusian Tunnel,” huge pressure-chamber facilities, at NASA Ames in the late 1970s and early ‘80s. When interest in those two planets soon waned, and the facility lay dormant for more than a decade, until being revived by the Titan project.
CHMS RESEARCH BREAKTHROUGH
PUBLISHED IN SCIENCE MAGAZINE

SABYASACHI SEN, a professor in the UC Davis Department of Chemical Engineering and Materials Science (CHMS), is senior author on a paper — “Observation of the Transition State for Pressure-Induced BO3 → BO4 Conversion in Glass” — published Aug. 29, 2014, in the journal Science. The report charts groundbreaking work conducted by his Amorphous Materials Research Group.

Borosilicate glass, which is less subject to thermal stress, is commonly used in reagent bottles manufactured under trade names such as Simax, Refmex, Pyrex and others. Although it has long been known that the structure around the boron atoms in borosilicate glass changes with pressure and temperature, until now materials scientists have been able to study these structures only in one state or the other: never in transition. Sabyasachi’s research team developed a probe that allowed them, for the first time, to use NMR imaging to capture data about atoms in borosilicate glass, as they “flipped” from one structure to another, while placed under pressures of up to 2.5 gigapascal (GPa).

CHEN-NEE CHUAH NAMED IEEE FELLOW

CHEN-NEE CHUAH, a professor in the UC Davis Department of Electrical and Computer Engineering, has been named a Fellow of the Institute of Electrical and Electronics Engineers (IEEE). Chuah has been recognized for her contributions to MIMO (multiple-input/multiple-output) communications and network management.

Chuah joined the UC Davis faculty in July 2002, and today is a Chancellor’s Fellow and currently leads the Robust and Ubiquitous Networking (RUBINET) Research Group. Her research interests include communications, computer networks and wireless/mobile computing, with an emphasis on Internet measurement and analysis, anomaly detection, routing and traffic engineering, social networks and intelligent transportation systems.

GEORGE TCHOBANOGLOUS PROFILED IN AAEES MAGAZINE

GEORGE TCHOBANOGLOUS, a Professor Emeritus in the UC Davis Department of Civil and Environmental Engineering, was profiled in an extensive, 10-page cover story in the winter 2015 issue of the American Academy of Environmental Engineers and Scientists’ (AAEES) Environmental Engineer & Scientist periodical.

The article profiles Tchobanoglous from his childhood days in a Greek-speaking family, growing up on a fruit and vegetable farm in Patterson, Calif., and the pivotal moment when he earned a full-tuition civil engineering scholarship to Stockton’s College of the Pacific (now the University of the Pacific). He was drawn to water-related subjects; in 1970, after completing his master’s and PhD work, he accepted an offer from previous mentor Ray Krone, who had just started the environmental engineering program at UC Davis.

Tchobanoglous soon became an international authority on wastewater treatment, management and reuse, and is widely recognized for promoting new technologies in wastewater filtration, UV disinfection, aquatic treatment systems, decentralized wastewater management systems, and solid waste management.
UC DAVIS RECEIVES SHARE OF MRPI PROJECT FUNDING

The University of California Research Grants Program Office has awarded funding for a Multicampus Research Program and Initiative (MRPI) that will include the participation of the UC Davis College of Engineering. The project, “Tunable Quantum Materials,” will be led by UC San Diego’s Ivan Schuller and Oleg Shpyrko; the co-PIs are UC Davis’ YAYOI TAKAMURA and UC Santa Barbara’s Jonathan Schuller.

The four-year project received a funding award of $1,289,411.

The project anticipates breakthroughs in tunable sub-wavelength optical devices, intelligent sensors that change functionality depending on stimuli, and artificial brains that rival biological systems. Schuller and his colleagues hope to provide a solution via new materials that will exhibit quantum correlations unavailable in the existing resources “toolkit.”

UC DAVIS GRADUATE EARN ‘BEST PAPER’ HONOR

NICHOLAS SHRAKE, who earned his master’s degree in electrical engineering at UC Davis in 2014, is first author on a paper that has been selected as the best enology paper published that year in the American Journal of Enology and Viticulture.

His co-authors on the paper, titled “In-Line Measurement of Color and Total Phenolics During Red Wine Fermentations Using a Light-Emitting Diode Sensor,” are RAJeEVAN AMIRTHARAJAH and ANDRÉ KNOESEn, both in the UC Davis Department of Electrical and Computer Engineering; CHARLES BRENNEMAN, of the UC Davis Department of Viticulture and Enology; and ROGER BOULTON, a professor in the Department of Chemical Engineering and Materials Science, and the Stephen Sinclair Scott Endowed Chair in Enology.

The paper details the development of a reduced-cost colorimeter for the tracking of total phenolics and color during fermentation.
KARL LEVITT RECEIVES LAPRI AWARD FOR SEMINAL PAPER

KARL LEVITT, a professor in the UC Davis Department of Computer Science, has received the 2014 Jean-Claude Laprie Award in Dependable Computing. The honor is particularly noteworthy, because it reaches back to recognize outstanding papers that have significantly influenced the theory and/or practice of “dependable computing.”


Their project’s SIFT (Scale-Invariant Feature Transform) system made breakthroughs in fundamental theory and algorithms for achieving reliable distributed system operation in the presence of Byzantine failure modes (arbitrary faults), specifically focusing on the key problems of clock synchronization and consensus. Using these algorithms, the team developed and demonstrated the first software-based implementation of a fault-tolerant computer, and were among the first to create extensive analytical proofs of correctness of their algorithms.

CALIFORNIA FUNDS UC DAVIS WIND POWER PROJECT

One of the first-round projects funded by the California Energy Commission’s (CEC) Energy Research and Development Program will take place at UC Davis. The project is headed by C.P. “CASE” VAN DAM, chair of the UC Davis Department of Mechanical and Aerospace Engineering; and Shu-Hua Chen, an assistant professor in the UC Davis Department of Land, Air and Water Resources. The $1 million CEC award will fund their research to improve the accuracy of short-term forecasting of wind power production in the Tehachapi Wind Resources Area.

Van Dam, the MAE Warren and Leta Giedt Endowed Professor, also is director of the UC Davis-based California Wind Energy Collaborative. His research interests include wind energy engineering, aerodynamic drag prediction and reduction, high-lift aerodynamics and the active control of aerodynamic loads. Chen’s research interests include regional climate, air pollution, model development, severe weather, cumulus parameterization, data assimilation and numerical schemes.

UC DAVIS HEADS USDA FOOD SAFETY PROJECT

A collaborative food-safety project headed by UC Davis has been selected for funding by the U.S. Department of Agriculture (USDA). The proposal, “An Integrated Approach to Eliminate Cross-Contamination During Washing, Conveying, Handling and Packaging of Fresh Produce,” will receive $4.752 million over the course of five years. The grant comes from the Food Safety Challenge Area of the USDA’s Agriculture and Food Research Initiative (AFRI).

UC Davis, as lead institution, has partnered with Rutgers University and Drexel University. The UC Davis team will be headed by Nitin Nitin, an assistant professor in the departments of Biological and Agricultural Engineering, and Food Science and Technology; Glenn M. Young, also in the Department of Food Science and Technology; Ian M. Kennedy, a professor in the Department of Mechanical and Aerospace Engineering; and Gang Sun, a professor in the Department of Chemical Engineering and Materials Science.

ETTC ‘GRADUATE’ RECEIVES U.S. DEPARTMENT OF ENERGY FUNDING

Ennetix, a software start-up founded by UC Davis computer science professor BISWANATH MUKHERJEE and colleague PULAK CHOWDHURY, has received Phase One funding from the Advanced Scientific Computing Research branch of the U.S. Department of Energy’s Small Business Innovation Research (SBIR) program. The funding, in the amount of $150,000, has been awarded to a project titled “Cloud-Based Network Performance Modeling for Contingency and Long-Term Planning.”

Ennetix, initially know as PutahGreen Systems Inc., became the UC Davis Engineering Translational Technology Center’s (ETTC) first tenant in the autumn of 2010. In January 2013, Ennetix became the Center’s second successful “graduate.”
Dan Sperling to Chair
U.S. TRANSPORTATION RESEARCH BOARD

DAN SPERLING, director of the UC Davis Institute of Transportation Studies, has been appointed the 2015 chair of the United States Transportation Research Board’s Executive Committee, which provides the nation with independent scientific advice on transportation issues.

The appointment was announced in January in Washington, D.C., at the Transportation Research Board’s 94th annual meeting, which was attended by 12,000 transportation professionals from across the United States and abroad. The Transportation Research Board is a major division of the U.S. National Research Council, the private, nonprofit institution that serves as the operating arm of the National Academy of Sciences and the National Academy of Engineering, and as an independent adviser to the U.S. government.

“The Institute of Transportation Studies is a global leader in sustainable transportation, and this appointment is a testament to Dan’s standing as a researcher and innovator in his field,” said UC Davis Chancellor Linda P.B. Katehi. “I’m sure that Dan’s leadership of the Transportation Research Board’s Executive Committee will serve as a tremendous boon for innovation in transportation across the country.”

Sperling will chair an executive committee that oversees the board’s programs and activities, engaging more than 7,000 engineers, scientists and transportation researchers and practitioners from academia, private and public sectors, including state departments of transportation and the U.S. Department of Transportation. The board’s mission is to promote innovation and progress in transportation through objective research.

“The Transportation Research Board is hugely influential as the focal point of transportation research activities in the United States and the world,” said Sperling. “I’m honored to lead it, and I look forward to helping broaden its engagement with environmental and other sustainability issues.”

Sperling, a UC Davis professor of civil engineering, and environmental science and policy, is a leading international expert on transportation policy and technology assessment, and energy and the environmental aspects of transportation. He founded the UC Davis Institute of Transportation Studies in 1991, and has led it to international prominence: building strong partnerships with industry, government and the environmental community, and connecting research with public policy and outreach.

In 2013, ITS-Davis was selected in a national competition to lead the U.S. Department of Transportation’s National Center for Sustainable Transportation, a two-year, $11.2 million research, education and outreach consortium of six universities.

During the course of a distinguished career, Sperling has testified numerous times before the U.S. Congress and multiple state legislatures. He has authored or co-authored more than 200 technical papers and 12 books, including Two Billion Cars (Oxford University Press, 2009), which earned him an appearance with Jon Stewart on The Daily Show. In 2013, Sperling received the Asahi Glass Foundation’s Blue Planet Prize, regarded as the Nobel Prize for environmental sciences. He has served as a board member of the California Air Resources Board since 2007, where his chief responsibilities are implementation oversight of the state’s climate change, alternative fuels, vehicle travel and land use, and zero emission vehicle programs.
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A student team from the University of California, Davis, took the grand prize in the finals of the global iGEM (International Genetically Engineered Machines) competition in Boston in November. The UC Davis students, all undergraduates, placed tops in what is known as the “overgraduate division.” See page 6.