

Summer 2011

Volume Sixteen

# UCLA COLLEGE

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**UCLA** COLLEGE OF LETTERS AND SCIENCE



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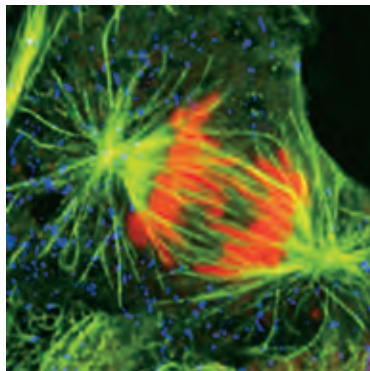
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Photo by Robin Weisz



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# UCLA COLLEGE

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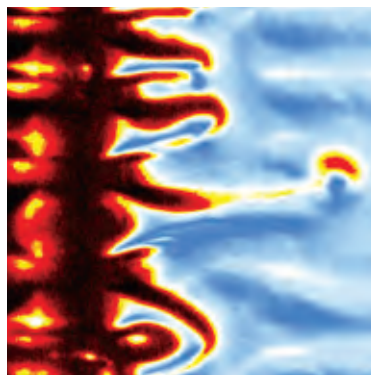
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### UCLA College of Letters and Science

**Alessandro Duranti**  
Dean of Social Sciences

**Joseph Rudnick**  
Dean of Physical Sciences

**Judith L. Smith**  
Dean and Vice Provost for Undergraduate Education

**Victoria Sork**  
Dean of Life Sciences

**Tim Stowell**  
Dean of Humanities

College Development  
**Stephen Jennings**  
Executive Director

College Marketing  
**Harlan Lebo**  
Director

Development Writer  
**Margaret MacDonald**

Media Relations  
**Meg Sullivan**  
**Stuart Wolpert**

Design  
**Robin Weisz/Graphic Design**

Please address comments to  
hlebo@support.ucla.edu

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## From the Deans of the College

# New Support for a High-Quality Undergraduate Education

Dear Friends:

UCLA is America's most popular university for college applicants, and this fall, we will enroll the largest freshmen class in the university's history. Most of those students will be studying in the College of Letters and Science, and we have been working with the university's leadership to ensure that we have the resources we need so our incoming freshmen and continuing students can graduate in a timely manner with the high-quality education they deserve.

Chancellor Gene Block and Executive Vice Chancellor and Provost Scott Waugh have provided temporary resources called Undergraduate Academic Incentive Funds to meet student enrollment needs in critical lower-division courses, including general education courses, courses on composition, foreign languages, quantitative reasoning, and preparation classes for our most popular majors. We also plan to increase offerings of upper-division courses for all undergraduates.

Temporary bridge funds were previously used to cushion the blow of steep cuts in state funding and preserve core academic programs. That funding helped us maintain our goal of ensuring that students can graduate on time. As a result, UCLA now has one of the highest four-year graduation rates of any public university in America; 70 percent of undergraduates get their degrees in four years.

While other college campuses have had to drastically cut back on course offerings, that hasn't been the case at UCLA. We have worked very hard to manage enrollment so our students' needs are met, and we will continue to do so.

Providing an outstanding undergraduate program is our highest priority, and Undergraduate Academic Incentive Funds will support that goal.

As always, we welcome your views.

Sincerely,



**Alessandro Duranti**  
dean of  
social sciences  
aduranti@college.ucla.edu



**Joseph Rudnick**  
dean of  
physical sciences  
jrudnick@college.ucla.edu



**Judith L. Smith**  
dean and vice provost for  
undergraduate education  
judis@college.ucla.edu



**Victoria Sork**  
dean of life sciences  
vsork@lsdean.ucla.edu



**Tim Stowell**  
dean of humanities  
tstowell@college.ucla.edu



# College News

An update of events and progress in the UCLA College of Letters and Science.

## UCLA and the Peace Corps: A Half-Century of Meeting the Global Challenge

**The College recognizes the university's service in the global community with a celebration of the 50th anniversary of the Peace Corps.**

On March 1, 1961, just weeks after President John F. Kennedy urged in his inaugural address, “Ask not what your country can do for you. Ask what you can do for your country,” he signed an executive order establishing the Peace Corps. Thousands of Americans—most of them college-age—rose to the challenge, ushering in a new era of national service and creating an army of volunteers committed to global improvement and cross-cultural exchange.

UCLA and the College of Letters and Science played a vital role in the Peace Corps effort from the beginning, training thousands of volunteers from around the country, advising Peace Corps leadership during its formative years, and sending scores of Bruin alumni to volunteer throughout the world. Starting that first summer with 48 trainees bound for Nigeria, more than 2,000 future Peace Corps volunteers came to Westwood for three months of rigorous training in the language, politics, and culture of their host countries, led by internationally-recognized scholars from the College in African and Latin American studies.

From 1961 until 1969, when training shifted overseas, more than one out of 10 Peace Corps volunteers received instruction at UCLA—probably more than at any other university.



*President John F. Kennedy with Peace Corps volunteers, including UCLA alumnus Haskell Ward (front left).*

UCLA is the alma mater to more than 1,800 Peace Corps volunteers, and 14 current faculty and staff have been volunteers. Ninety-two UCLA alumni are now serving in 46 countries, and 25 graduates from the Class of 2011 have applied to be part of the Bruin tradition of service in the Peace Corps.

To commemorate this shared commitment to educating service-minded Americans, this spring UCLA celebrated the 50th anniversary of the Peace Corps with campus events, exhibits, and a film screening. At the College's principal Commencement ceremony on June 10, Peace Corps director Aaron Williams delivered the keynote address, and graduating seniors presented the flags of the 139 countries in which the Peace Corps has served (*see page 16*).

[www.spotlight.ucla.edu/peace-corps-50th](http://www.spotlight.ucla.edu/peace-corps-50th)

*Aaron Williams, director of the Peace Corps, delivered the keynote address at the College's Commencement ceremony on June 10.*

## AAP Director Charles Alexander Receives Diversity Award

Charles Alexander, associate vice provost for student diversity in the College's Division of Undergraduate Education, was honored with a 2011 Champion of Health Professions Diversity Award by The California Wellness Foundation.

The foundation recognized Alexander for directing programs that keep low-income, first-generation students on track in health and science. A diverse workforce will provide the cultural competence required for high-quality health care for all Californians.

A pioneer of pipeline programs that increase diversity in health professions, Alexander directs the Academic Advancement Program, which supports students from educationally disadvantaged backgrounds, including first-generation college students and students from low-income families and underrepresented populations.



*Charles Alexander*



Many students in the College participate in research as undergraduates, taking major roles in important studies and publishing their findings even before they graduate.

# Creating Knowledge Through Research

## AS UNDERGRADUATES

**“Students who participate in undergraduate research take responsibility for innovative projects and become key members of the faculty mentor’s research group. There is no better way for our students to engage in the bold excitement of a research university and excel in their quest for knowledge.”**

By Dan Gordon

Matthew Pimentel admits that his decision to engage in research as a freshman at UCLA was practical.

“I was pre-med, and I figured it was something I needed to do to get into medical school,” he said. “It was only after I got involved that my attitude changed.”

For the last two years, the senior majoring in microbiology, immunology, and molecular genetics has been studying the effects of stress on breast cancer metastasis in the laboratory of Dr. Lily Wu in the Department of Molecular Medicine and Pharmacology. He has traveled to scientific meetings to present his work and, last September, was co-author of a paper published in the peer-reviewed journal *Cancer Research*.

Research is no longer something Pimentel has to do; it’s something he wants to do—well beyond graduation.

“You’re surrounded by brilliant people who have such interesting ideas, and you’re challenged to think about new ways to ask questions,” said Pimentel, who intends to pursue a Ph.D. in immunology as a result of the experience. “It’s really exciting.”

Pimentel was one of four UCLA seniors honored in April as part of the national celebration for Undergraduate Research Week. The students were selected, based on their outstanding independent laboratory contributions, by a committee of faculty and staff involved in administering programs in the Undergraduate Research Center/Center for Research and Academic Excellence (URC/CARE) in the Division of Undergraduate Education. The quartet is a representative sample of the multitudes of undergraduates engaged in research on the campus, according to Tama Hasson,

director of URC/CARE.

“One of the major successes of UCLA is that we have so many undergraduates who are contributing to the research enterprise,” said Hasson, who estimates that more than 2,000 undergraduates took part this year.

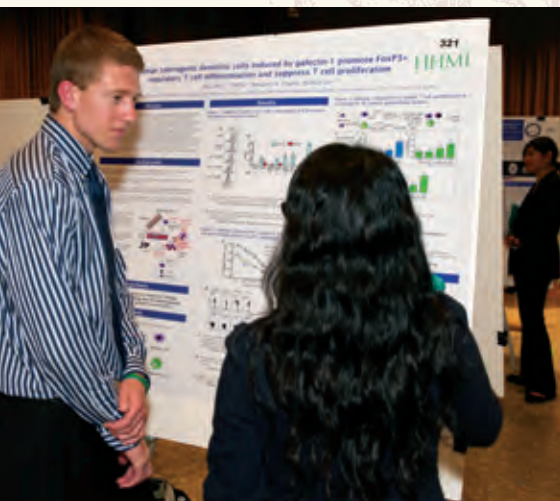
The U.S. House of Representatives designated the week of April 11 to recognize the value and contributions of undergraduate research. But at UCLA, such recognition is not new. Each year in May, the campus holds its own Undergraduate Research Week, including Science Poster Day, in which undergraduates present their work and are eligible for awards. As an indicator of the growth of undergraduate research at UCLA, this year there were 312 posters—more than double the number of participants just five years ago.

“Students who participate in undergraduate research take responsibility for innovative projects and become key members of the faculty mentor’s research group,” said Judith L. Smith, dean and vice provost for undergraduate education, who has been a strong proponent of undergraduate research since her appointment to the position in 1996.

“There is no better way for our students to engage in the bold excitement of a research university and excel in their quest for knowledge,” said Smith.

The opportunity to participate in one of the world’s leading research enterprises is what drew Kimberly Frutoz to UCLA. Frutoz was a junior-college student when she experienced research for the first time during a summer program at UC Irvine.

“I went into it without really knowing what it was going to be like, and I came out if it thinking it was amazing—this is how we generate new ideas, how we improve knowledge,” Frutoz said. “It opened



*William Temple (left) presents his findings at UCLA’s Undergraduate Science Poster Day in May.*





my eyes to the opportunities offered by the UC system.”

Since transferring to UCLA, Frutoz, a physiological sciences major and a biomedical research minor, has capitalized on those opportunities. Working in the lab of Dr. Bennett Novitch in the Department of Neurobiology, Frutoz is studying the development of progenitor cells in the spinal cord. In addition to her participation at Science Poster Day, she won an award for her presentation at the California Alliance for Minority Participation 2011 conference in Irvine and was selected to be a Howard Hughes Medical Institute EXROP (Exceptional Research Opportunities) student for the summer of 2011. Frutoz hopes to submit a publication in the next year as she continues her work in Novitch’s lab while applying to M.D./Ph.D. programs.

For Paula Wu, a senior neuroscience major and biomedical research minor and editor-in-chief of UCLA’s *Undergraduate Science Journal*, basic science represents the best of two worlds—an ideal intellectual challenge with humanitarian ends.

“A career where you have to be really creative and also think critically and scientifically is a unique combination,” Wu said, “and I find it really fulfilling to know that it’s not just esoteric—what we’re doing will one day contribute to helping people.”

Working in the lab of Dr. Ronald Harper in the Department of Neurobiology, Wu is using state-of-the-art imaging techniques to study the function of various sub-regions within the brain’s insular cortex that are related to cardiovascular control. The research may lead to better understanding of how the brain regulates basic physiological responses.

Wu has worked at the National Institutes of Health for several years, continuing the project she started in the NIH Summer Internship Program; like Frutoz, she plans to enroll in a joint M.D./Ph.D. program.

As a high school student, William Temple read with fascination about stem cell research and the potential for a new era of personalized medicine resulting



*Undergraduate research scholars (from left) Kimberly Frutoz, William Temple, Matthew Pimentel, and Paula Wu.*


from completion of the Human Genome Project. But Temple didn’t envision participating in the pursuit of discovery until a conversation with a resident assistant at his dormitory.

“She was a pre-med student involved in research, and she told me how to get involved,” Temple said. “I had no experience, but I was enthusiastic.”

That was enough for one investigator, who allowed Temple to get his feet wet as a freshman. The next year, Temple began work in the lab of Benur Lee in the Department of Microbiology, Immunology, and Molecular Genetics, where he has been working ever since.

Temple is studying the role of a carbohydrate-binding protein and how it modulates the behavior of dendritic cells and T cells of the immune system. His group found specific cells that appear to suppress the immune response, suggesting their potential for a therapeutic role in patients with autoimmune diseases. A paper with Temple as a co-author was recently submitted to the *Journal of Immunology*. He was selected to present his findings at the 2011 National Conference on Undergraduate Research.

“This is a new frontier,” said Temple, who plans to continue in Lee’s lab next year while applying to medical schools.

“I’m doing experiments that no one else in the world has done, and building on research conducted by world-renowned scientists who have contributed to what we know about the immune system,” said Temple. “Working with a pediatric oncologist, I see children with cancers related to immune system problems, which shows me how my research is relevant. It’s been amazing to experience this all as an undergraduate.” 



# Cautious HOPE

By Art Silverman

Rob Summers was in his junior year at Oregon State University when a hit-and-run accident in 2006 left him paralyzed below the chest. Summers' doctors told him that he shared the fate of millions of others with spinal cord injuries: he would never walk again.

They were wrong.

A team of scientists from UCLA, the University of Louisville, and the California Institute of Technology, working with Summers at the Frazier Rehab Institute in Louisville, has achieved a significant breakthrough in initial work on paralysis that holds promise for treating spinal cord injuries.

Doctors implanted an electrical stimulator, developed primarily by UCLA researcher V. Reggie Edgerton, onto the lining of his spinal cord to try to wake up his damaged nervous system. Within days, Summers stood without help. Months later, he wiggled his toes, moved his knees, ankles and hips, and was able to take a few steps on a treadmill.

"It was the most incredible feeling," said Summers. "After not being able to move for four years, I thought, 'things could finally change.'"

Today, Summers is able to reach a standing position by supplying the muscular push himself. He can remain standing and bearing weight for up to four minutes at a time (up to an hour with periodic assistance). And aided by a harness support and therapist assistance, he can make repeated stepping motions on a treadmill. He can also move his toes, ankles, knees and hips on command.

Summers' progress "remains unprecedented in spinal cord injury patients," said researchers from the University of Zurich who wrote commentary that accompanied publication of the research in the British journal *Lancet*. "We are entering a new era when the time has come for spinal-cord-injured patients to move."

These results were achieved through "epidural electrical stimulation" of the subject's lower spinal cord, mimicking signals the brain normally transmits to initiate movement. Once that signal is given, the spinal cord's own neural network, combined with the sensory input derived from the legs to the spinal cord, is able to direct the muscle and joint movements required to stand and step with assistance on a treadmill.

The device created in the laboratory of Edgerton—a distinguished professor of integrative biology and physiology, and neurobiology—is designed to activate a patient's spinal nerves enough to make them responsive to sensory signals coming from the legs. The approach, which Edgerton has been using in animal models for nearly three decades, is like using a hearing aid to amplify sound.

A device developed primarily by UCLA scientist V. Reggie Edgerton is helping a man paralyzed from the waist down make an "unprecedented" recovery, offering new potential for millions of people who live with some form of paralysis.



V. Reggie Edgerton: "The spinal cord is smart."



**“We are entering a new era when the time has come for spinal-cord-injured patients to move.”**

The other crucial component of the research was an extensive regimen of training while the spinal cord was being stimulated and with Summers suspended over the treadmill. Assisted by rehabilitation specialists, Summers’ spinal cord neural networks were retrained to produce the muscle movements necessary to stand and to take assisted steps.

The researchers envision a day when at least some individuals with complete spinal cord injuries will be able to use a portable stimulation unit and, with the assistance of a walker, stand independently, maintain balance and execute some effective stepping.

Relief from secondary complications of complete spinal cord injury—including impairment or loss of bladder control, sphincter control, and sexual response—could prove to be even more significant.

“The spinal cord is smart,” said Edgerton. “The neural networks in the lower spinal cord can initiate weight-bearing and relatively coordinated stepping without any input from the brain. This is possible, in part, due to information that is sent back from the legs directly to the spinal cord.”

This sensory feedback from the feet and legs to the spinal cord facilitates the individual’s potential to balance and step over a range of speeds, directions, and levels of weight-bearing. The spinal cord can independently interpret these data and send movement instructions back to the legs—all without cortical involvement.

Susan Harkema, a professor of neurological surgery at the University of Louisville, oversees the human research program there. Harkema began her career as a postgraduate student in Edgerton’s UCLA laboratory, where Edgerton pioneered the field of locomotion with extensive animal studies. The two have been close collaborators ever since.

“This is a breakthrough. It opens up a huge opportunity to improve the daily functioning of these individuals,” said Harkema, lead author of the research. “But we have a long road ahead.”

“While these results are obviously encouraging,” Edgerton concurred, “we need to be cautious. There is much work to be done.”

The research was funded by the Christopher and Dana Reeve Foundation and the National Institutes of Health. Edgerton is a member of the Reeve Foundation’s Science Advisory Council and its International Research Consortium on Spinal Cord Injury. Harkema is director of the Reeve Foundation’s NeuroRecovery Network, which translates scientific advances into activity-based rehabilitation treatments.

Other scientists who worked with Edgerton are researcher Roland Roy, who was a co-author of many of the animal studies, and Yury Gerasimenko from the Pavlov Institute of Physiology.

More than 5 million Americans live with some form of paralysis, defined as a central nervous system disorder resulting in difficulty or inability to move the upper or lower extremities. Roughly 1.3 million are spinal cord injured, and of those, many are completely paralyzed in the lower extremities.

“This procedure has completely changed my life,” said Summers. “For someone who for four years was unable to even move a toe, to have the freedom and ability to stand on my own is the most amazing feeling. To be able to pick up my foot and step down again was unbelievable, but beyond all of that, my sense of well-being has changed.

“My physique and muscle tone have improved greatly, so much that most people don’t even believe I am paralyzed,” Summers said. “I believe that epidural stimulation will get me out of this chair.” 🇺🇸

Photo: Rob Summers



*Patient Rob Summers in testing. “To everyone’s disbelief, I was able to stand independently the third day we turned it on.”*



# THE PAST IS PRESENT



Chris Johanson takes his studies of ancient Rome into the electronic realm.

By Mary Daily

As a freshman, Chris Johanson began college at Iowa State University, planning to be a computer scientist. The curriculum for his major required some humanities electives, so, along the way, he signed up for Latin.

Nothing was ever the same again.

Johanson was hooked on the classics, and that's the field he pursued all the way through a Ph.D. at UCLA, where, after graduation, he joined the faculty.

Still, Johanson's computer skills and interest have not been dormant. Today he teaches and conducts research in digital humanities, combining his two passions. Through the modern technology of digitization, he brings students into contact with a rich history of scholarly work that reaches back over the centuries.

"We have extraordinarily robust technology to study historical phenomena in space and time," Johanson said. "This gives us a whole new way to talk about things. Digitization enables us to address questions more effectively. We can do things today that 20 years ago were theorized or set aside because they were too expensive or the tools were unavailable."

The digital world in which Johanson spends much of his

time is the Roman Forum of the 2<sup>nd</sup> century BCE. He's there to study the stagecraft of the funerals of prominent Roman citizens and the gladiatorial games that followed.

Digitization adds a third dimension to the two-dimensional material that is conveyed through archaeological site reports and the paper and library tradition. The process often reveals new knowledge as incongruities arise—when something previously believed true doesn't actually fit the lay of the land. Elements from different research projects can be layered in the spatial laboratory and measured against geographical coordinates connected to each digital model.

"It's a 'Tinker Toy' model to test ideas before changing the surrounding models, similar to methods used by scientists," Johanson said. "The knowledge base is then modified to reflect the nuances that are discovered in the digital space."

Digital study is particularly important to the study of ancient places where the only information available comes from small bits of archaeological evidence and textual descriptions written much later by antiquarians digging up the past. The visualization helps explain what the texts are saying.

"We build new databases of knowledge inquiry for the



Left image: Chris Johanson and the Experiential Technologies Center.

Center image: Marie Saldaña, Chris Johanson, and the Experiential Technologies Center.

**“We have extraordinarily robust technology to study historical phenomena in space and time. This gives us a whole new way to talk about things. We can do things today that 20 years ago were theorized or set aside because they were too expensive or the tools were unavailable.”**



*Chris Johanson: “The goal of digitally re-creating an ancient site is not to show it exactly as it was, but to enable researchers to answer specific questions about the activities that took place there.”*

city of Rome by layering different types of information on the architecture and the archaeology, creating a new place for conducting research,” Johanson said.

“The goal of digitally re-creating an ancient site is not to show it exactly as it was, but to enable researchers to answer specific questions about the activities that took place there.

“This is more about visualizing information than about trying to reconstruct an archaeological site,” said Johanson, who experienced the Forum digitally before actually seeing it in person. “There are always multiple possibilities, and the visualization lets you look at different iterations of how it might have been. The research drives what we build.”


The visualization also adds rigor to scholarship by providing a shared baseline through which researchers can know that they’re all talking about the same thing.

Within the digital Forum, Johanson studies the visual messages that can be drawn from the layout of the funeral procession. For a deceased person of high status, the procession usually included actors who dressed in ceremonial garb of gold, purple and crimson, and wore waxen masks that depicted the ancestors of the deceased. There were also professional mourn-

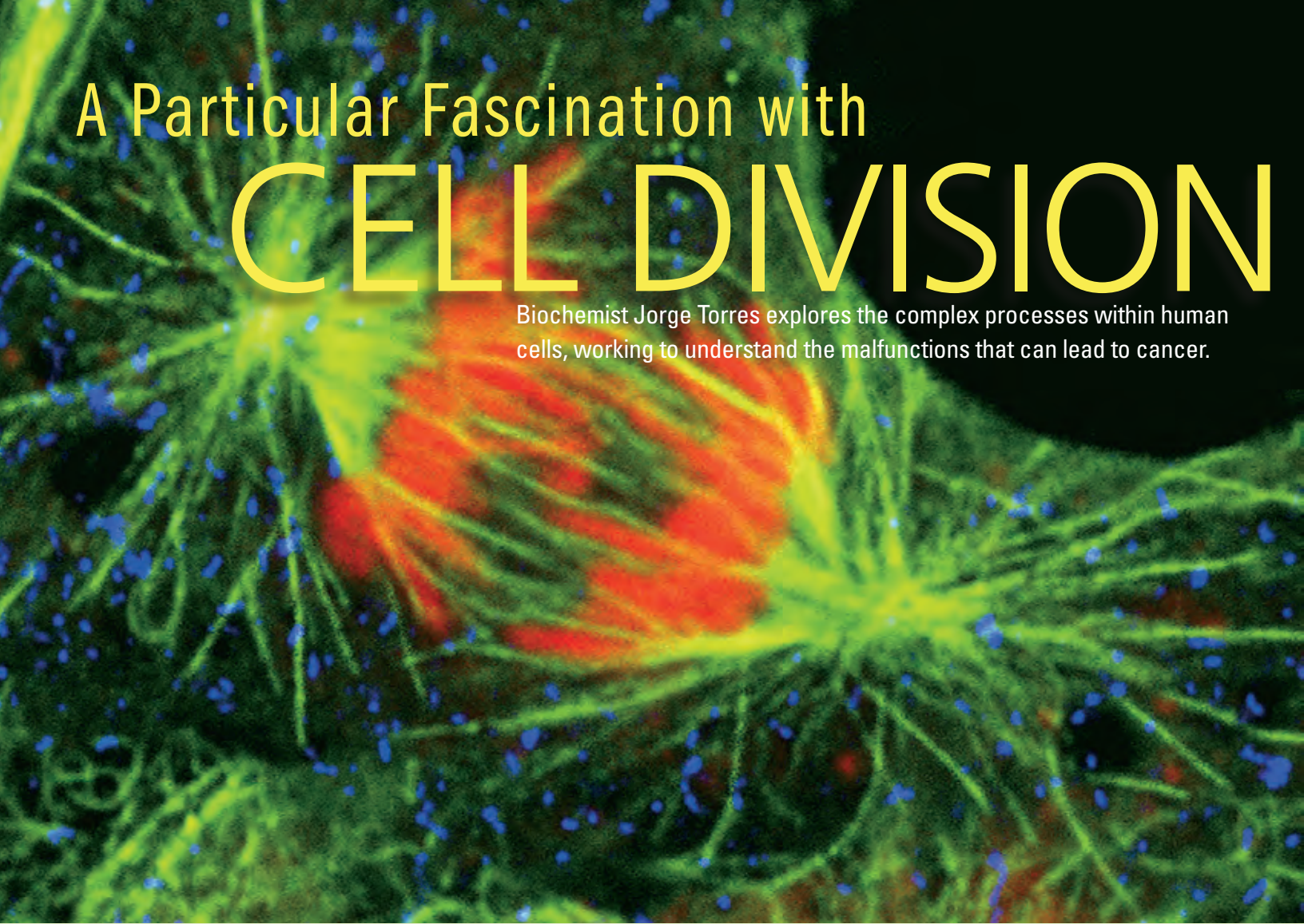
ers, hired to encourage others in attendance to audibly express their grief.

“The event was so important,” Johanson said, “that Romans were motivated to fight and die in combat so that their funerals would follow.”

The eulogy, of particular interest to Johanson, was usually delivered by a son of the deceased standing at the rostrum within the Forum. It included a recounting of the deeds of the deceased and his illustrious ancestors. The corpse on display served as a prop. Johanson examines the various locations within the forum where each part of the funeral took place and how that changed over time. He inserts people into the models in order to understand what they could see and hear. Gradually, the event starts to come to life.

Although ancient Rome is Johanson’s special interest, he also sees his work as kind of a case study or example of how space-based research and representation can enable a boundless array of study opportunities in almost any field. Loving the classics, though, he’s especially excited about the ability of virtual reality to span the centuries and make yesterday seem almost like today. 





# A Particular Fascination with CELL DIVISION

Biochemist Jorge Torres explores the complex processes within human cells, working to understand the malfunctions that can lead to cancer.

**“Mapping the key proteins involved in cell division could give us valuable therapeutic vantage points. Once you identify the critical components of cell division, it is then possible to develop therapies that target specific proteins to inhibit cells from dividing. Inhibition of these proteins can have an impact on cancer cells that are proliferating uncontrollably.”**

By Aaron Dalton

There are probably not too many biochemists who can trace the source of their professional inspiration back to a wrestling coach, but that is where the path began for UCLA assistant professor Jorge Torres. Born in Texas, Torres’ family moved to Indio, near Palm Springs; at Indio High School, his wrestling coach was also his biology teacher.

“I really looked up to him as both a mentor and a fantastic teacher,” recalls Torres. “He was smart in everything he did, and that is what got me thinking more about pursuing science as a career.”

After high school, Torres enrolled at UC Santa Barbara and almost immediately began work in biology labs, studying genomes, chromosomes, and enzymes. One enzyme called telomerase held particular fascination for Torres. When telomerase is activated, it increases the ability of cells to replicate, divide, and almost become immortal. It sounds wonderful on the surface, but the reality is that uncontrolled cell division is one of the defining characteristics of cancer cells. Cancer cells tend to proliferate uncontrollably and form a mass of cells that have the potential to metastasize, enter the bloodstream, and cause havoc throughout the body.

After graduating from UC Santa Barbara, Torres went to Princeton for graduate school, rotating through the labs of several professors and ultimately working to understand the role of certain chromosomal components in cancer prevention.

Torres focused his investigations on enzymes called DNA helicases that play vital roles in both DNA replication and DNA repair. When helicases malfunction, DNA replication stalls and the DNA itself can break into fragments, which leads in turn to chromosomal rearrangements that change the genetic makeup of a cell with potentially dire effects on human health.

By the time he finished his work at Princeton, Torres had decided he wanted to target his research even more specifically on understanding and preventing human diseases. He took a post-doctoral position at the Stanford School of Medicine where he investigated cell mitosis, the crucial step in cell division where chromosomes are separated into two identical sets.

Since joining UCLA in 2009, Torres has continued to investigate mitosis, especially the development of the mitotic spindle. Humans live an average of 80 years, but the lifespans of most of the trillions of cells in a human body are much shorter, measured in days or months. As old cells die out, new ones are born through a continuous process of cell replication and division. Each time a cell divides, it replicates and then must separate its chromosomes. The mitotic spindle is composed of microtubules only nanometers thick that segregate the duplicated chromosomes to opposite poles of the cell so that the cell can divide cleanly down the middle with equal and identical amounts of genetic material ending up in each new cell.

“The mitotic spindle is critical not only to align the chromosomes, but also to pull them apart,” said Torres. “The pulling apart has to be equal to both sides, otherwise one cell has too much genetic material and the other side has too little. That can lead to huge problems such as either cell death or uncontrolled cell proliferation.”

Torres and the five graduate students and one post-doctoral fellow who work in his lab are studying the enzymes and processes involved in the assembly of the mitotic spindle. Their research on protein interactions may seem abstract, but they hope their findings will be applicable down the road to the development of therapeutic interventions, particularly in the field of oncology.

“Mapping the key proteins involved in the process of cell division could give us valuable therapeutic vantage points,” explained Torres. “Once you identify the critical components of cell division, it is then possible to develop therapies that target specific proteins to inhibit cells from dividing. Inhibition of these proteins can have an impact on cancer cells that are proliferating uncontrollably.”

Despite having had a good experience working on the ‘industry’ side of biochemistry when his Stanford laboratory was acquired by biotech firm Genentech, Torres said he always felt drawn toward academia.

“I felt that the university setting offered me freedom to pursue my research interests,” he reflected. “Besides, I really enjoy interacting with students, mentoring and teaching them.”

Having had such valuable experiences himself as an undergraduate working in a lab, Torres tries to give UCLA undergraduates lots of opportunities to assist with research. He

currently has four undergraduates working in his lab.


In the classroom, Torres is teaching a course on post-translational modifications in human diseases, showing his students how incorrect protein modifications can lead to developmental defects or diseases.

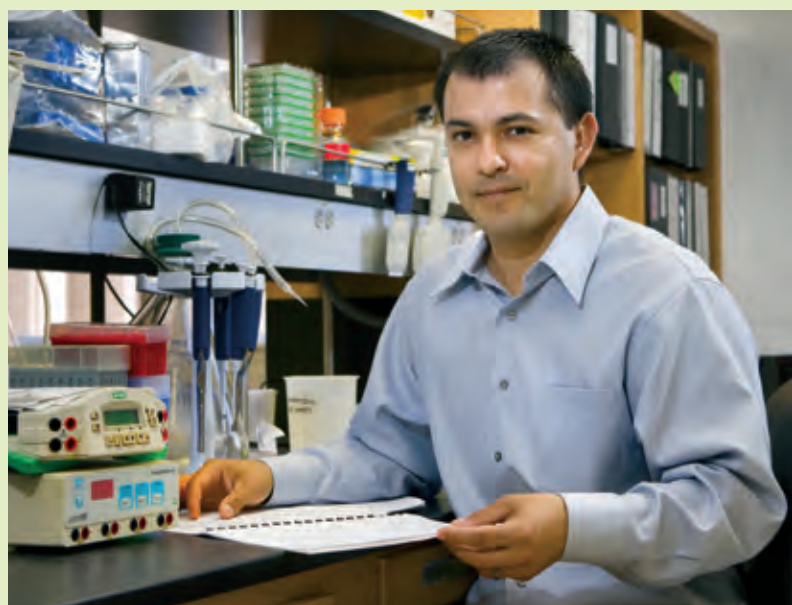
“The proteins that modify other proteins are important for practically all pathways within cells,” noted Torres. “From signaling and transcript to translation, everything relies on protein modifications.”

Beyond his teaching and research, Torres works to give back to the community in other ways. He gives guest lectures at high schools to motivate students to study science. He also gives presentations on campus at UCLA at the invitation of Hispanic student groups.

“There aren’t many Hispanic science professors in the United States right now, so to the extent that I can use my experiences to help motivate people to pursue careers in science and medicine, I am more than happy to do that,” said Torres.

Although he is still in the early stages of his career, Torres has already received several honors for his scholarship, including UCLA’s John McTague Career Development Chair given to promising new faculty and assistant faculty.

“I always knew that I wanted to do science in Southern California, so joining UCLA was definitely a type of homecoming for me,” says Torres. “I feel fortunate to have a chance to collaborate with so many great researchers, not just in my department, but also with faculty at the Jonsson Comprehensive Cancer Center, the David Geffen School of Medicine, and the California Nanosystems Institute. Coming here has been fantastic, especially given the extent to which people are willing and eager to collaborate and help each other advance their research.” 



*Jorge Torres: “I felt that the university setting offered me freedom to pursue my research interests. Besides, I really enjoy interacting with students, mentoring and teaching them.”*



# Opening the Door to Undergraduate Careers

By Robin Heffler

**S**hantel Daniels remembers feeling overwhelmed when she first set foot on campus in the summer of 2009—until she attended the UCLA New Student Orientation session for transfer students.

“The program eased a lot of my fears about the type of students I would encounter, how the class scheduling worked, and whether I could finish my degree in two years,” said Daniels. In June, she earned a bachelor’s degree in art history, and plans to be a curator with an educational focus at a modern art museum.

For the last two years, Daniels also has been helping others to successfully navigate the academic, social, and other challenges facing new students. She is among more than 75 students in New Student and Transition Programs who serve as advisors and coordinators at orientation for new students as well as families, working alongside full-time staff by providing guidance and a comprehensive introduction to life as a Bruin.

The programs—key elements of New Student and Transition Programs—explain to freshmen, transfer students, and their families how undergraduates can fulfill their academic goals and graduation requirements at UCLA, boosting their intellectual and personal development, and showing them where on campus they can turn for help.

“Our goal is to ensure that students are enthusiastic about coming to UCLA and have the tools to thrive here,” said Roxanne Neal, director of UCLA New Student and Transition Programs, which oversees orientation programs and follow-up. “Orientation is about providing a strong transition to the University.”

Academic achievement is “first and foremost,” she said. “Our mission to help students become strong academically is reflected in how we guide them in choosing their majors and course planning. Ancillary programs, such as research, volunteer work, and other extracurricular involvement, all go to support the academic experience.”

Almost 95 percent of first-year students and 85 percent of transfer students have attended New Student Orientation. First-year students participate in a three-day program; for transfer students, who are typically slightly older and already have some experience with college life at their previous institutions,



orientation is covered in one day.

New students are introduced to a liberal arts education, and how it provides a foundation for a well-rounded life after college. Then, they receive guidance about academic preparation for UCLA coursework, exploring fields and clarifying goals, and choosing their classes.

“We try to demonstrate that it’s not just about finding a major that will lead to a job, but using a passion you have to shape how you want your career to go,” said Neal. “A lot of students have undeclared majors, but have a general interest, such as life sciences or social sciences, that they’re considering. So, they can go to workshops about how to find majors and courses that spark their interests.”

Orientation participants also learn about student services, listen to presentations on sexual assault, substance abuse, and sexual health, and get a taste of life on campus and in Westwood village.

Students are also introduced to the world of community

New Student and Transition Programs gives incoming students a head start on their lives as Bruins—months before they enroll in their first class on campus.



“Our goal is to ensure that students are enthusiastic about coming to UCLA and have the tools to thrive here. Orientation is about providing a strong transition to the University.”



*Through New Student and Transition Programs, Bruins are introduced to university life at meetings with student advisors (left) and in civic engagement projects such as Operation Gratitude (above).*

quirements and curriculum alternatives, student services and advising, and the UCLA environment.

First-year students can also get a jump on meeting their required coursework by enrolling in the College Summer Institute (CSI). During the six-week session before the fall quarter, students live on campus, taking general education and composition courses. They also enroll in a civic engagement course, where they choose among themes—including the arts, fitness, ecology, social media, science and technology, and social justice—and develop a research project or other assignment that involves them in the community.

“We hope students will appreciate the value of civic engagement and want to continue their involvement during their undergraduate careers and beyond,” said Neal. “We see community involvement as another cornerstone of undergraduate education outside of the classroom.”

The global community, of course, also comes to UCLA. This year, students from other countries will have their own orientation session in the fall if they are unable to attend the summer sessions.

And there are post-orientation sessions and personal advising conducted throughout the academic year to make sure students are on the right path in planning their academic careers. For Daniels, the process of giving and coordinating support for other students is also personally beneficial.

“It’s been amazing to work with the fulltime staff and deal with responsibility in the workplace,” she said. “The advising I received, as well as my work as a coordinator, showed me the importance of having your own goals and implementing them as you see fit, while working as part of a collaborative effort.”

service; for the second year, students in the orientation sessions will get hands-on volunteer experience. In collaboration with the Volunteer Center on campus, they will participate in the work of “Operation Gratitude,” a nonprofit group that has sent more than 500,000 care packages to military personnel all over the world. Students will write supportive letters to the troops, put together care packages, and hear veterans speak in-person about their military experiences.

“Last year, I remember a former helicopter pilot talking about how great it was to get a note from someone back home when he was stationed somewhere remote—how meaningful that contact was,” said Neal. “It was powerful for the students to hear it firsthand.”

At Family Orientation, parents, spouses, grandparents, aunts and uncles, and siblings are all welcome. The session is presented, Neal said, because “the strength of your family support directly impacts your success here.” Topics include the factors leading to academic achievement, graduation re-



Charlene Villaseñor Black's background and love of the humanities led her to a career studying the religious art of 17th-century Spain and the Americas.

# Icons



# Ideals

*“I’m interested in how religious images, both male and female, are used as models of behavior—particularly how certain religious icons are meant to uphold gender ideals and how worshippers respond to that.”*

By Mary Daily

When Charlene Villaseñor Black was 15, she toured Mexico as part of a musical group, performing around the country. In Taxco, during an afternoon off, while the rest of the group went in search of the town’s famous silver, Black went into churches. In one spectacular Baroque structure, she was “just dazzled” by 18<sup>th</sup>-century altar pieces. That experience helped shape the course of Black’s life.

“That was the moment,” she said.

Today, Black is a scholar of 17<sup>th</sup>-century religious art in Spain and the Americas, and she traces her love of the field to that afternoon. When she teaches “Introduction to Renaissance and Baroque Art History,” she shows images of that church and tells the story to her students.

A Mexican American, Black grew up Catholic in Arizona, surrounded by religious images.

“My introduction to art history wasn’t in museums,” she said. “It was seeing religious art at home and in church.”

Yet, for a long time, music was Black’s first love. A musical performance major as an undergraduate, Black immersed herself in history, literature, and foreign languages. She knew she wanted to do graduate work in the humanities, but wasn’t sure what field to pursue. So she took a year of non-degree courses to explore different subjects—not a path she’d recommend to her students, by the way. But she found her answer: art history was what she loved, and everything came together—her Mexican American heritage, her religious background, and her love of the arts.

Today, Black’s work continues to meld all three in her position as associate professor in the Department of Art History. She is also affiliated with Chicana and Chicano studies and religious studies.

“I’m interested in how religious images, both male and female, are used as models of behavior,” she said, “particularly how certain religious icons are meant to uphold gender ideals and how worshippers respond to that.”

Black came to UCLA a decade ago on a Mellon Postdoctoral Fellowship, after taking leave from a teaching position at the University of New Mexico. While she was here, her current position became available, so she stayed.

Her first book, *Creating the Cult of St. Joseph: Art and Gender in the Spanish Empire*, looked at the gender politics of religious art in Spain and Mexico during the era of conquest and colonization. Specifically, it examined how Joseph is held up as a model father and husband and how his cult is used in Mexico to try to change indigenous family structures into something more European. The book won the College Art Association’s Millard Meiss Award.

Now Black is at work on a second book, *Transforming Saints: Women, Art and Conversion in Spain and Mexico, 1521–1800*, which focuses on the moment of conversion in Mexico after the Spanish defeated the Aztec Empire.

“I’m interested in how indigenous women received images of female saints,” she said.

The classes Black teaches range from a large general education course in Renaissance and Baroque Art, which covers Europe and the Americas for 300 students a quarter, to a recent seminar offered in conjunction with an art conservator at the Getty Center. That course looked at materials and techniques of art objects. Students spoke with scientists in the Getty’s conservation labs and worked on objects in the Getty Museum. They developed original research, and now some plan careers in art conservation.

Black, who attended public schools, beginning with Head Start and continuing through her Ph.D. at the University of Michigan, is a champion of public

*Charlene Villaseñor Black studies a broad range of religious imagery, from traditional 17th-century art such as “Holy Family with a Little Bird” by Murillo (left) to modern-day visions like Alma Lopez’s “Our Lady” (right).*



Detail of “Our Lady” digital print by Alma Lopez copyright 1999

universities and has turned down appointments at private colleges.

“As a professor, my goal is to offer access to faculty, thoughtful mentoring, and an emphasis on critical thinking at the public university,” she said. To be closer to the students, in fall 2010, Black and her 11-year-old son Joseph entered the Faculty in Residence program at UCLA. They live in Sproul Hall, where they share a floor with 94 undergraduates.

“We love it,” she said. “I do a lot of programming.”

Black has taken students on field trips to the Getty Center and spearheaded activities in recognition of Day of the Dead. She and her son attend dance competitions on the Hill and are regulars at karaoke night. But even more mundane routines such as eating in the dining hall are meaningful.

“The students see that we’re just normal, everyday people,” Black said. “If they like, they can talk to me about their academics there. It’s really rewarding.”

She also said life in the residence hall has made her a better professor. Instead of just seeing a student as someone who makes a particular grade in coursework, she sees the whole person. “I have a much more integrated view of their lives,” she said.

“My hope,” said Black, “is that I may help prepare our students to become truly thoughtful and critical individuals, full participants in democracy and politically aware persons who are not afraid to think on their own.”



*Charlene Villaseñor Black: “My introduction to art history wasn’t in museums—it was seeing religious art at home and in church.”*





*The procession of flags—at the June 10 Commencement ceremony for the College of Letters and Science, graduating seniors presented the flags of the 139 countries served by the Peace Corps since the organization was created in 1961. Commencement Weekend 2011 was a tribute to the spirit of public service in the global community.*



# Revealing the Truths of Nature

By Dan Gordon

Through nearly three decades of research and teaching at UCLA, Jeffrey H. Miller's enthusiasm for the process of discovery has continued to grow.

"It's the ultimate intellectual endeavor," said Miller, professor in the Department of Microbiology, Immunology and Molecular Genetics.

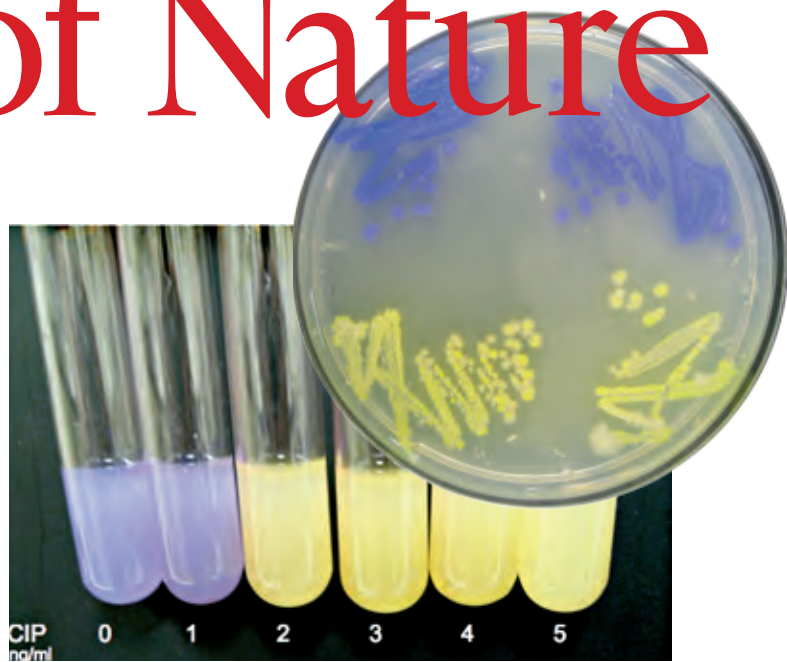
"The way I see it, you're playing chess with Mother Nature. Each time you capture a piece, she will reveal one of her truths. But Mother Nature is a very good chess player and tends to guard her truths closely. That's what makes it so challenging."

Miller has been up to the challenge, publishing key discoveries in the areas of DNA repair and—more recently—antibiotic resistance with the potential for a major public health impact. In April came a well-deserved achievement: membership to the American Academy of Arts and Sciences. Miller was one of three UCLA faculty members recognized this year for distinguished contributions to their field of study, joining the likes of George Washington, Ralph Waldo Emerson, and Albert Einstein as fellows who have been elected since the academy was founded in 1780.

Throughout his career, Miller has focused on the process of DNA repair—the ways that cells correct potentially damaging mutation-causing substances in DNA. The process is critical to human health. People who lack certain DNA repair systems are predisposed to early-onset cancers. Working with bacteria in the 1990s, Miller and colleagues discovered a system that repairs oxidative damage and found that a human gene known as *mutY* knocked out the oxidative repair system, leading to a high rate of mutations. They later showed in a mouse model that when the *mutY* gene was missing, there was a significantly higher rate of several types of cancers. Others have now found this to be true in humans.

"It's a great example of how studying a repair gene in bacteria has led to tests to detect cancer susceptibilities in people," Miller said. "That has continued to be our approach—to first define processes in bacteria or yeast, and then find the human counterparts, because you can learn things much more quickly in these simple systems."

While continuing to unravel the processes involved in DNA repair, in recent years Miller's group has also moved into a new area of research: bacterial resistance to antibiotics and how to overcome it. The rapid increase in drug-resistant infections is



*Chromogenic proteins expressed in E. coli that are studied in the lab of Jeffrey H. Miller can be used to design a test to detect trace levels of antibiotics—a valuable tool in studying bacterial resistance to antibiotics. Here (above), a mixture of yellow and purple stains turns yellow in the presence of only one nanogram per milliliter of the antibiotic ciprofloxacin.*

a major public health crisis in the United States. Antibiotics are both overused and misused, Miller explained—whether they're being prescribed for patients who don't really need them or used as growth promoters in the agricultural industry.

As a result of the overexposure and through the evolutionary process of natural selection, bacteria mutate to resistant forms; increasingly higher doses are then needed to be effective until, in some cases, the infections become resistant to the existing drug combinations.

The most vivid recent example of drug resistance is the evolution of Methicillin-resistant *Staphylococcus aureus* (MRSA)—the so-called "superbug" that killed approximately 25,000 people in the United States last year.

Meanwhile, Miller notes, the pipeline of new antibiotics has dried up, mainly because drug companies have concluded that the cost of developing them is prohibitive. So Miller's group has taken a different approach: adding a "co-drug"—a so-called potentiator that will render cells more sensitive to existing antibiotics. So far, Miller and colleagues have identified the targets: proteins that, when genetically knocked out, will "potentiate" the antibiotics. Now they are screening for drugs that will achieve that effect.

Ironically, the same week that Miller had delivered a lec-



Molecular biologist Jeffrey H. Miller, who has long sought insight into how cells correct mutation-causing substances in DNA, has also moved into new areas of research: the complex problems of drug-resistant bacteria and how to overcome them.



**“The way I see it, you’re playing chess with Mother Nature, and each time you capture a piece, she will reveal one of her truths. But Mother Nature is a very good chess player and tends to guard her truths closely. That’s what makes it so challenging.”**

ture on MRSA to two of his classes, what started as an ear infection took a turn for the worse, and soon he was hospitalized with MRSA, the very infection he had been discussing with his students. Fortunately, Miller missed only a week of classes, but he left the hospital with a renewed sense of purpose.

“It was a reminder that this isn’t just an intellectual exercise; it’s a deadly serious business,” Miller said.

Miller also takes seriously the business of attracting bright young minds to science. For the last three years he has taught a popular course on microbial genomics, based on a conference he has organized every two years in Lake Arrowhead since 1996, in which eight different UCLA researchers present their original research papers and engage students in discussions. Since 1997, Miller has taught an innovative course in the College Honors Collegium, “The Interaction of Science and Society,” in which both science and non-science majors discuss the implications of issues such as stem cell research, genetically modified foods, and epidemics.

Miller is a strong believer in the importance of involving undergraduates in research. Inspired by Court TV’s “I, Detective” program, which gives viewers the opportunity to play a role in solving a case, he developed a discovery-based laboratory manual, “I, Microbiologist,” for first-year students.

Colleague Erin R. Sanders developed the program into a course and the two professors authored a book of the same name that was published last year. In his own lab, Miller mentors an average of 8–10 undergraduates at any one time. Few UCLA labs have had as many undergraduate names on papers published in peer-reviewed journals.

“Young people have been switching out of science at an alarming rate because it’s not presented in an interesting enough way,” Miller said. “It’s a national concern.” He believes engaging undergraduates in research from the beginning is a vital step toward enhancing science’s appeal.

“Skiers talk about being hooked after their first great downhill run,” said Miller. “It’s the same thing in science. When you do your own experiment and find something, that thrill of discovery is indescribable.”

It’s a thrill that Miller still experiences, and for his achievements he will be inducted into the American Academy of Arts and Sciences in Cambridge, Massachusetts, in September as part of a class that includes other renowned scientists along with such luminaries as actress Helen Mirren, and musicians Paul Simon and Bob Dylan.

“I don’t know whether they’ll be there for the induction,” said Miller, laughing, “but I’m bringing my autograph book.”



# Themes of HUNGER, FOOD, AND SURVIVAL

An award-winning book by Judith Carney explores how food crops from Africa crossed the ocean with slaves and soon became a staple of American agriculture.



A Yam Festival in 19th-century Ghana. African people domesticated many important food crops that today are an important part of world food production.

By Wendy Soderburg

*“In its popular imagery, Africa has always been a hungry continent that has long failed to feed its own. But this was not always so.”*

When Judith Carney accepted the Frederick Douglass Book Prize for her work, *In the Shadow of Slavery: Africa’s Botanical Legacy in the Atlantic World*, she aptly quoted the American social reformer and former slave for whom the prize is named.

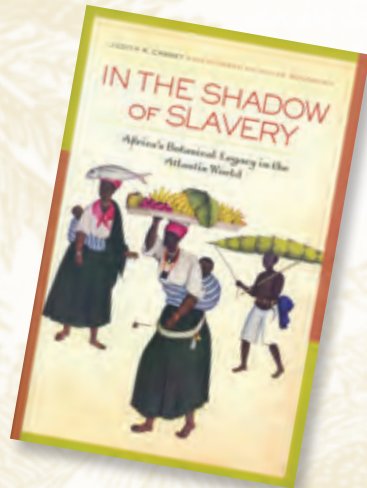
“I have often been so pinched with hunger as to dispute with old ‘Nep,’ the dog, for the crumbs which fell from the kitchen table,” Douglass had said about his years in bondage.

“Many times have I followed with eager step the waiting-girl when she shook the tablecloth, to get the crumbs and small bones flung out for the dogs and cats.”

Hunger was Douglass’ “constant companion, as it was for many people of African descent enslaved in the Americas,” said Carney, a UCLA professor of geography. “In its popular imagery, Africa has always been a hungry continent that has long failed to feed its own. But this was not always so.”

*In the Shadow of Slavery* describes in compelling detail how, in ancient times, Africa domesticated many important food crops that today grace tables all over the world: sorghum, millet, a species of rice, yams, black-eyed peas, tamarind, okra, coffee, and kola.





What was fascinating, Carney said, was how this all happened. During the 350 years of the transatlantic slave trade, some 35,000 voyages transported more than 12 million Africans to the Americas. The death rate during transit was horrendous, but those captives that survived the long Atlantic crossing survived by eating food purchased in Africa.

The book describes how Africa's domesticated plants and animals—loaded onto the ships for the voyages—proved remarkably well-suited to the New World's tropical environment. When some ships arrived with excess provisions, the first generations of New World Africans used these opportunities to plant familiar grains and root crops.

"These humble plots became, in effect, the botanical gardens of the Atlantic world's dispossessed," Carney said. "It was here that plantation owners and European naturalists discovered African crops with which they had no previous familiarity." Before long, Carney added, enslaved female cooks were introducing African foods to the planters' tables.

*In the Shadow of Slavery*, written by Carney and her husband, Richard Rosomoff, is a co-winner of the \$25,000 Douglass prize, along with a book written by Siddharth Kara, Harvard University's fellow on human trafficking. Presented by Yale's Gilder Lehrman Center for the Study of Slavery, Resistance and Abolition, and by the Gilder Lehrman Institute of American History, the Douglass award is the most generous history prize in the field and is given for the best book written in English on slavery or abolition.

It's somehow fitting that Carney—whose previous book was *Black Rice: The African Origins of Rice Cultivation in the Americas*—would win a prize for a book on food.

"I always had an interest in agronomy, or food systems," said Carney. "That was my original interest in graduate school, and it remains my principal interest—how people in very different environments and in different cultures across the world have met their subsistence needs for food. I also had a real interest in understanding the issue of hunger and why it is that some parts of the world are hungry."

Peek into Carney's background and you can easily understand her interest. Her father died of a heart attack at age 39, leaving her immigrant mother with five children under the age of 6. The family got by on welfare and Carney's father's social security checks, but there were times when they didn't have enough to eat.

As the oldest child, Carney recalled wanting to deliver her family from poverty. She studied hard at

school and was thrilled to receive a scholarship to Michigan State University. But just a month later, she received devastating news—her mother was diagnosed with cancer. Three months later, her mother died.


Carney, just 18 at the time, was ready to abandon her education to fight for custody of her brothers, who had been placed in an orphanage. (Her sister had already been placed with a family.) But the judge refused her request.

"I remember him saying to me, 'It's a wonderful thing you want to do, but this is an opportunity that very few people get—a scholarship to college. And I want you to take advantage of it,'" Carney said. "It seemed so mean at the time, and I thought society was so harsh, but now I wish I could write him and thank him. He did me a favor."

Carney graduated with a B.A. from Michigan State, and went on to receive master's and Ph.D. degrees in geography from UC Berkeley. In 1988, she joined UCLA's Department of Geography as an assistant professor, where she's remained ever since.

Carney is currently researching 17<sup>th</sup>- and 18<sup>th</sup>-century plants in Central Baja that were cultivated by Jesuit missionaries to produce the wine they used during the celebration of Mass.

"I started from a very naive perspective, but the quest and the questions took me in so many interesting directions and into so many different parts of the world," Carney said. "I've been privileged to have experienced so many poor, but dignified, people in my life, and that has just moved me profoundly, to the degree that I can tell a story that merits broader understanding.

"It's a story of peace and reconciliation and hope for us all that we can talk about things that have been so wrong and painful in the past." 



*Judith Carney: "I started from a very naive perspective, but the quest and the questions took me in so many interesting directions and into so many different parts of the world."*



# CityLab



UNDERGRADS EXCITE HIGH SCHOOLERS ABOUT SCIENCE

The College's undergraduate-operated program to make science fun and engaging for students from low-performing high schools celebrates its 10th anniversary.

By Alison Hewitt

*“Wake up in the mornin’ feelin’ like Watson and Crick,  
Grab my labcoat and goggles, I’m gonna hit this City(Lab).  
Before I leave, brush my teeth with some nucleotides,  
‘Cuz when I leave for my lab I’m going to transcribe.”*

Thus begins UCLA science students' DNA-focused video parody on YouTube of the Ke\$ha song, “Tik Tok,” a pop-culture reference that definitely catches the attention of sleepy high schoolers when they arrive for a day of lab work with UCLA's energetic CityLab program.

The Bruin students who run the CityLab program know how important it is to make science fun. Through CityLab, which is celebrating its 10<sup>th</sup> anniversary this year, undergraduates bring students from low-performing high schools to UCLA and have just five hours to make science both understandable and appealing.

The freedom to make topics like gel electrophoresis exciting is part of the attraction for the undergrad teachers, said Eric Chan, a CityLab co-director and senior majoring in computational and systems biology. He joined as a sophomore as a way to teach and volunteer at the same time.

“The ultimate goal is to excite the high schoolers about science, and since we have a lot of control over how we teach, we're able to make it fun and animated,” Chan said. “I love hearing their energy and excitement. It kind of reignites my own passion to remember how rare it is for most people to be able to do these kinds of lab experiments.”

It has huge benefits for both the high schoolers and the college students, said Dwayne D. Simmons, the CityLab faculty advisor and a professor in integrative biology and physiology.

“The high school students get an experience of what it's like to be in the UCLA environment and participate in a real lab,” Simmons said. “The undergrads are also inspired. They're giving to the community in a fun way, and they're learning. They know the lessons already, but it's very different to learn

the material well enough to teach it.”

Simmons meets a few times each quarter with the two co-directors. As their faculty adviser, Simmons signs off on purchases of new lab materials and helps maintain a long-term vision for the program as the students graduate and leave—a vision that includes more of their educational music-video parodies (he said, “They're so cool”). But overall, it's the students who run the program.

“They're incredibly self-sufficient,” Simmons said. A team of 13 students forms the CityLab staff, and they manage the program: they find and schedule the high schools for visits, charter the buses, develop the curriculum, apply for grants, administer the labs, recruit new members, and more.

Although the student-teachers can enroll in the program for UCLA credit for two quarters, many of the undergrads in CityLab return as volunteers. In fact, most of the staff includes these experienced CityLabbers, who earn neither money nor credits for their hours of work.

“Seeing the high schoolers ask questions and get into it, and change their minds about coming to college is really rewarding,” said Kevin Terashima, a fourth-year neuroscience major and co-director of CityLab, who got involved as a sophomore. “I loved it and kept on doing it.”

In fact, at least one current member came to UCLA because of his high school experience attending CityLab, Terashima said. The group is developing tracking tools to find out how many students CityLab inspires to attend college and major in science, said Angela Gee, CityLab's staff liaison and an academic administrator in the Undergraduate Research Center. CityLab is housed in the center, through which the Division





*UCLA science students host high school visitors for CityLab programs, coordinated by (below from left) co-directors Kevin Terashima and Eric Chan, with faculty advisor Dwayne Simmons.*

of Undergraduate Education under dean Judith Smith provides some of their funding.

“It’s been an amazing decade,” said Gee. “CityLab was very novel when the idea first came up.

“The program targets high schools without many resources and that have minorities who are so underrepresented in the sciences. The idea is to give these students the opportunity to realize they do have potential in science. A lot of them don’t realize they can do it.”

Terashima and Chan work with about 40 CityLab members, and four Saturdays each quarter the group hosts about 60 high school students on campus. The week before is given over to prep. Most of the CityLabbers are science majors, and even the handful of humanities majors have to take science prerequisites to join, but they all still have to learn how to teach. The students use outlines of the curriculum to develop their own presentations. After a dry-run in front of their peers, they incorporate feedback for the real thing. Friday before the big day, they set up three to five laboratories that UCLA faculty have volunteered to open up for the weekend program.

Saturday morning, a bus rolls into the Ackerman turnaround at about 9 a.m. After a tour of campus, they gather for a series of presentations about one of CityLab’s three specialties: DNA forensics, sickle cell anemia, or enzyme analysis. The high school teachers choose one, and the day starts with a skit or music-video parody, followed by in-depth presentations on the science and how to do the lab. For example, the DNA lesson starts with a video about a stolen sandwich and the scene of the crime before the group splits up to rotate through three 20-minute info sessions.

“Then there’s a presentation about replication, transcription, RNA, and DNA so they have a solid basis,” Chan said. “Then we talk about how our lab project, gel electrophoresis, is used in crime-scene analysis. And there’s a biotechnology presentation, a fun one about innovation and how DNA is used outside of crime-scene analysis.”

Then it’s time for the hands-on lab work: testing DNA samples to compare to the crime scene. With more than 40 undergrads to work with the 60 or so high schoolers, there’s lots of individual attention. The group breaks for lunch while waiting for the test results. Lunch gives both groups of students a chance to get to know each other and talk about college life, Chan said. CityLab volunteers hand out their email addresses and encourage the high schoolers to get in touch.

By 2:30, the high schoolers have checked their lab results, reunited for one more skit or musical by the undergrads to conclude the lesson, and boarded the bus. CityLab doesn’t know how many students will stick to science, but the high schoolers definitely remember the CityLab videos, Terashima said.

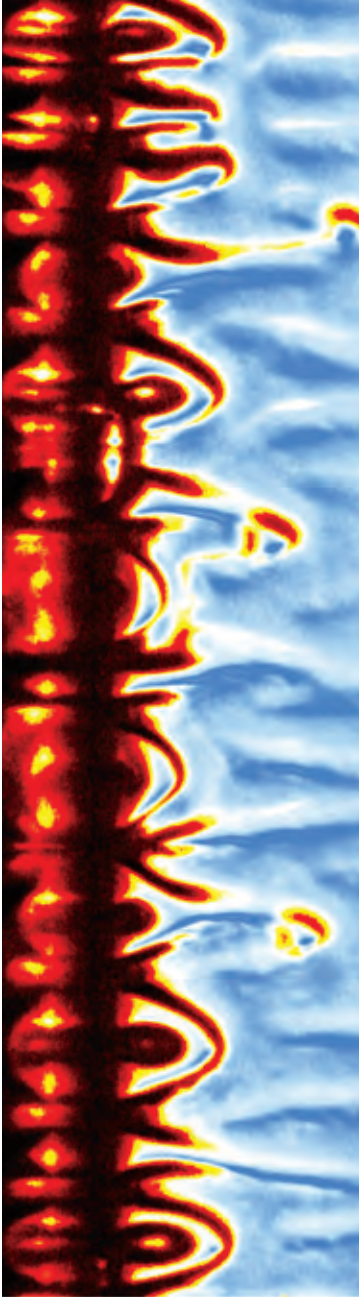
“We get really great emails,” he said. “The high schoolers say, ‘I showed this to all my friends, and we’re using this to study for the test because you made it easy to understand.’ That’s really rewarding.”



**“The idea is to give these students the opportunity to realize they do have potential in science. A lot of them don’t realize they can do it.”**

# *Fiat Lux* in a Flask

Physicist Seth Putterman studies a wide range of extraordinary physical phenomena, such as the production of light by bursting gas bubbles, and X-rays produced by peeling adhesive tape.



*Seth Putterman (right) delivering his Faculty Research Lecture. Above: a microscopic image of peeling adhesive tape, a process that can produce x-rays.*

By Wendy Soderburg

When physics professor Seth Putterman delivered the 109th UCLA Faculty Research Lecture last fall, audience members knew the exact moment he got into the groove: It was when the New York native slipped back into Brooklynese.

At the Faculty Research Lecture—the highest honor that UCLA faculty can award to one of their own—that auspicious moment occurred early in Putterman’s talk, titled “Fiat Lux: Light from Gas Bubbles, X-Rays from Peeling Tape, and Fusion from Crystals.” Putterman, whose research explores “spontaneous energy,” carried out an experiment on stage that demonstrated a phenomenon called sonoluminescence, in which a flash of light accompanies the bursting of a bubble in a liquid when sound waves are passed through it.

To demonstrate sonoluminescence, Putterman took a flask filled with phosphoric acid and shook it until the temperature inside reached roughly 18,000 degrees Fahrenheit. Bubbles inside the liquid expanded and collapsed,

releasing tiny flashes of light as they did so.

Putterman received a grant from the U.S. Department of Defense to study these bubbles of liquid, with the goal of increasing their energy density. Should his lab reach its goal, however, he will be careful about what he says—lofty claims in science are always challenged, as Putterman well knows. In fact, in 2005, Putterman was asked by the BBC to appear in a documentary while trying to reproduce results that scientists at another university claimed they had achieved.

“The documentary was called *An Experiment to Save the World*,” Putterman said.



**Putterman’s lab heated a crystal, causing an electric charge to build up on its surface and develop 100,000 volts. Appreciating the enormous potential of their invention, Putterman and his staff were actually able to use it to generate nuclear fusion.**

“The other researchers claimed that by making bubbles using deuterated acetone, when the bubble collapsed, they got deuterated acetone nuclear fusion. And that would be very interesting, because they were saying that instead of 10,000 degrees, they got to a temperature of millions of degrees. And at temperatures of millions of degrees, they reached thermonuclear fusion.”

In a form of “reality physics television,” a BBC camera crew filmed Putterman and his staff as they tried to reproduce the experiment in real time. They set up the experiment with deuterated acetone and used a neutron detector that was built at UCLA. After two weeks of filming and interviewing, however, Putterman’s lab was unable to reproduce the results.

“This is a very important point: No one has proven that it’s impossible to do this,” Putterman said. “The payoff is so great that although it’s risky, it’s worth doing if you have an idea. So this is what we could call ‘high-risk, high-gain’ research.”

Putterman created news himself back in 1990 when he and his graduate student, Brad Barber, published a paper in *Nature* magazine showing that in some situations, the flash of light in the sonoluminescence phenomenon was about 50 picoseconds—or 50 trillionths of a second—long. That was a much shorter period than scientists had thought, and it generated a lot of interest in the field.

More recently, Putterman’s lab was credited with inventing crystallic fusion. They took a crystal—just an inch in size—and heated it by about 40 degrees Celsius, causing an electric charge to build up on its surface and develop a voltage of 100,000 volts. Appreciating the enormous potential of their invention, Putterman and his staff were actually able to use it to generate nuclear fusion.

“And *here*, we succeeded,” Putterman said with a smile. “This has been reproduced. That’s essential. Other laboratories have reproduced this; they need neutron generators for various applications.”

In October 2008, Putterman and three colleagues in the UCLA Department of Physics and Astronomy—Carlos Camara, Juan Escobar and Jonathan Hird—published research that showed that peeling everyday adhesive tape can, incredibly, produce X-rays.

The cover of the journal *Nature*, in fact, showed an X-ray picture of Putterman’s finger that was produced by peeling regular Scotch tape.

In a May 2011 issue of *Nature*, Putterman and his colleagues again were the subject of an article about using adhe-

sive tape to produce X-rays. This time, however, the focus was on their development of a simple prototype that could serve as a low-cost X-ray source for commercial engineering.


The middle son of a U.S. Customs Service employee and a housewife-turned-interior-designer, Putterman attended the engineering school at Manhattan’s Cooper Union for the Advancement of Science and Art for two years before transferring to Caltech. At Rockefeller University in New York City, where he received his Ph.D., Putterman’s thesis adviser was famed physicist George Uhlenbeck, with whom he worked on various research papers in the field of quantum fluids.

Putterman recalled that it was the chance to work with physicist Isadore Rudnick that drew him to UCLA in 1970 as an assistant professor.

“I was a theorist, and Izzy Rudnick was an experimentalist. It looked as though there was room to combine and do interesting things,” Putterman said.

One of those ‘interesting things’ was the study of sonoluminescence. Putterman recalled how a friend teased him about his interest in fluid mechanics.

“He said if I knew so much about fluids, explain how they make light when vibrated,” the physicist said. “I thought it was impossible, but he said to study the old German literature.”

Putterman had UCLA graduate student Brad Barber set up an apparatus to create sonoluminescence based on the published papers; in the meantime, he visited other labs that had studied it. When he got to Lawrence Crum’s laboratory at the University of Mississippi, he was astonished to find that one of Crum’s graduate students, Felipe Gaitan, was exploring an unusual phenomenon: the creation of light from sound from just one bubble. Putterman was intrigued, and a lifetime fascination with sonoluminescence was born. 



# Exploring Democracy at Its Roots

By Mary Daily

Giulia Sissa shares appointments in political science and classics, bringing to her courses a unique view of how the ancient origins of democracy reflect on nations and politics today.

“It’s amazing when we realize,” said Giulia Sissa, professor of political science and classics, “how thoroughly the past continues to shape the present.”

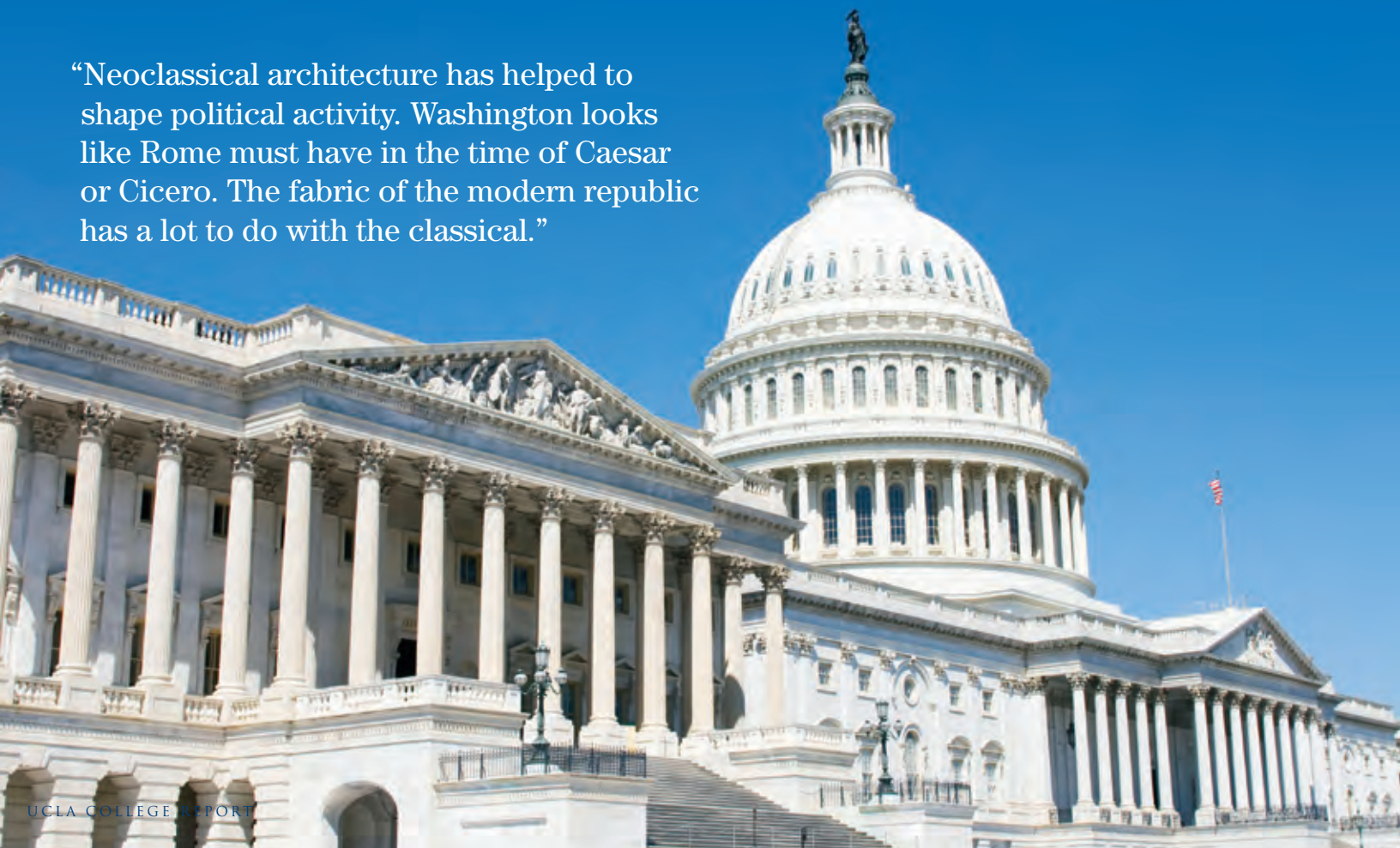
Sissa, who is Italian-born and trained in Italy and France, is steeped in the history, anthropology, and philosophy of the ancient world. Her interest in the past is always connected to major contemporary issues, such as democratic theory, addiction, feminism, sexuality, utopian thinking, and political emotions.

Sissa teaches and studies the scope of political thought from Plato to Machiavelli to Obama; for example, in one of her most popular courses, “The Invention of Democracy,” Sissa explores the origins of democratic theory in ancient Greece.

“The word ‘democracy’ literally means the ‘power of the people,’ which implies domination,” said Sissa. “In Greece, it meant that the people were in charge, actively governing themselves. There was no president, no king, just a small society of citizen soldiers, and the military component was crucial.”

The important feature in ancient democracy was the general assembly, where the people met together and stood up to speak to their fellow citizens. Decrees were voted upon, so the gathering was not for just consulting or giving opinions, but for making effective decisions.

“Neoclassical architecture has helped to shape political activity. Washington looks like Rome must have in the time of Caesar or Cicero. The fabric of the modern republic has a lot to do with the classical.”







*Giulia Sissa: “It has taken a long history of struggle and revolution to reach the point of equal rights within a society.”*



However, this assembly included free adult males only—no slaves, no minors, no women; those voices didn’t count.

“It has taken a long history of struggle and revolution,” Sissa said, “to reach the point of equal rights within a society.”

Philosophers criticized this power of the people because it was based not on competence and expertise but on opinion.

“The people could change their minds from one meeting to the next, and those who gave advice weren’t accountable for what they said,” Sissa pointed out. “The philosophers saw the activity of ruling as an intelligent strategy, and the people as ill-equipped to execute that vision.”

What most of us think of as “democracy” today, however, is not a form of government in the way that monarchies or republics are. In modern politics, the concept of democracy is not a noun but an adjective—“democratic”—a quality that can be attributed to different forms of government.

“The United States, for example, was designed as a modern state based on a very ambitious and powerful political theory,” said Sissa. “The intent was not to re-invent a Greek democracy, but to reconcile another ancient classical model of the state—the Roman republic—with the experience of independence and revolution.

“The founders of the U.S. made references to the Roman model, which was democratic but not a democracy. That is why the United States was created as a ‘democratic republic.’”

The Roman republic had three components: the monarchic, represented by consuls; the aristocratic, represented by the senate; and the popular, represented by the people. The three components were brought together to create a perfect balance of power—what today we call “checks and balances.”

“The Ancients favored the three-part system,” said Sissa, “because they saw pure democracy as too radical, too popular, too egalitarian, and too based on liberty as license.”

Sissa likes to begin her political science classes by showing images of official buildings that house state offices in contem-

porary cities as well as in ancient Athens and Rome, such as the Parthenon and the U.S. Capitol.

“These are classical temples,” she said. “In front of them you will often find a statue of the goddess Athena. Neoclassical architecture has helped to shape political activity. Washington looks like Rome must have in the time of Caesar.”

Sissa poses the question to her students: Can democracy be exported? Can people in non-democratic nations be persuaded to embrace it? It’s an age-old question and paradox.

“Modern Americans see democratic quality as a value,” Sissa said. “They trust the common sense of ordinary people. It’s something Americans would like to export. It’s democratic to think that freedom has to be the same for everyone.”

The paradox is that while democratic thinking means taking responsibility for one’s personal actions, opinions, and freedom, it includes the conviction that democracy is also good for everyone else. Sissa said the Athenians were “absolutely exemplary” in this regard. They believed they should impose democracy on other states, whether they wanted it or not because they, the Athenians, knew best. “That is exactly what the American doctrine has been—this sort of intrinsic aggressiveness.”

Sissa calls democracy a “soft form of interaction” because it involves listening to others, deliberating, and compromising. Yet eventually a vote must be taken.

“At that point, democracy is not so soft because the losers have to accept the outcome,” she pointed out. “That acceptance is critical, to avoid blood in the streets after an election.”

Sissa points out that in our complex world, the claims of human rights, cultural habits, and individual bodies sometimes clash and compete.

“We ought to determine which of these claims is most important, case by case, Sissa said. “This is the challenge of multicultural, truly democratic humanism.”



## 2011 COLLEGE AWARDS: CELEBRATING THE EXTRAORDINARY

The College's annual recognition of excellence included honors for an alumna who is the first woman to win a Nobel Prize for Economics, and recognition of Betty and S.L. Huang as the 2011 Honorary Fellows of the College.


More than 200 people gathered in March at the Beverly Hills Hotel to celebrate all that is extraordinary about the College of Letters and Science—from promising young graduate students and a Nobel prize-winning alumna, to two of the College's most loyal supporters.

At the annual College Awards Dinner, the deans of the College of Letters and Science began the program by presenting the Charles E. and Sue K. Young Student Awards, endowed by Louis and Evelyne Blau, to four exceptional UCLA graduate students: Natasha Abner (Linguistics), Joshua Bloom (Sociology), Cameron Neece (Psychology), and Diego Ubfal (Economics). These awards recognize outstanding research and teaching, exemplary university citizenship and dedicated community service.

The decision to focus on graduate students two years in a row underscores their vital role in UCLA's academic, teaching and service mission as well as the need to establish more graduate fel-

lowships in order to remain competitive with other top-tier public and private universities.

Chancellor Block then presented the UCLA Medal—the university's highest honor—to 2009 Nobel Prize winner and alumna, Elinor Ostrom. Ostrom earned her bachelor's, master's, and Ph.D. in political science at UCLA and is the first woman to receive the Nobel Prize in economics, awarded for her work on governance and common pool resources. Presenting the medal to Ostrom, the Chancellor spoke of "being proud to recognize and celebrate a lifetime of groundbreaking achievement that began at UCLA."

To cap off the evening's celebrations, the Chancellor awarded Betty and Shang-Li "S.L." Huang the titles of Honorary Fellows of the College "in recognition of their extraordinary service and philanthropy." 



Elinor Ostrom, UCLA alumna and winner of the 2009 Nobel Prize winner for Economics, addresses the audience at the College Awards Dinner after receiving the UCLA Medal.

## HONORARY FELLOWS OF THE COLLEGE:

### A Conversation about Higher Education with Betty and S.L. Huang

Betty and S.L. Huang have been enthusiastic and generous friends of UCLA and the College of Letters and Science for more than ten years, with each serving on boards of campus organizations: Betty for Women & Philanthropy and S.L. for the UCLA Foundation. S.L. is an entrepreneur and retired president of TPY Enterprises, a national real estate property firm.

The Huangs established the Huang Family Foundation in 2003 to support their twin passions of education and the arts, and their generosity extends to many other worthy causes throughout Southern California.

In 2005, they created the S.L. and Betty Huang Research Fund, followed in 2007 by the Huang Graduate Student Support Fund, both in the Division of Physical Sciences in the College. Their support of graduate students enables UCLA to attract and support graduate scholars of the highest distinction. Betty and S.L. are especially proud of their support of UCLA mathematics professor and Fields medalist Terence Tao.

The Huangs' remarkable commitment, in terms of both their time and financial support, has contributed immensely to UCLA's excellence.

#### CR: Can you tell us a bit about your background?

**SL:** I was born in China but my family moved to Hong Kong when I was four years old. My parents later sent me to high school in the United Kingdom, and I stayed on to do my undergraduate degree in engineering at Imperial College, London. But I'd always wanted to go to graduate school in America, so I attended Caltech where I earned my master's and Ph.D. in mechanical engineering.

**Betty:** I was born in Taiwan and raised in Hong Kong from the age of 5. For college, I started at a small university but later transferred to USC. Although my initial career was in banking, I've been involved



in charitable organizations for many years, mainly in the arts and culture.

**CR: Why did you decide to move permanently to the United States from Hong Kong?**

**Betty:** Both S.L. and I attended university here, so we decided we wanted our two children to experience an American education from the start. Hong Kong has a very good but structured education system—we felt an American education would be more innovative and creative.

**SL:** We also feel that the freedom we have here is of the utmost importance to our success in the world. Here we are free to pursue our dreams and if we work hard enough, we can achieve great things.

**CR: Why do you support higher education?**

**SL:** I truly believe that an excellent education leads to opportunities to be successful, and American universities and graduate schools are the very best in the world. And in the U.S. we have limitless opportunities to do research and study what interests us.

**Betty:** Education is the future. It is bringing up the next generation; therefore it is very important, but I also believe in supporting arts and culture, and that everyone should have supplementary skills in arts, music, and sports. All of this helps to mold a person's identity and experiences.

**CR: And the secret to your success?**

**SL:** I mentor several young people, and I always talk to them about the importance of hard work. Genius and intelligence can only take you so far. I explain to them the rule of 7/10: work seven days a week, 10 hours a day—at least for some periods of your life!

**Betty:** I always give 100 percent in everything I do. When I agree to work on a volunteer committee, I try to go to every meeting. Right now I'm on about seven committees—it's like a full-time job but I am enjoying every moment of it.

**CR: How did you first get involved with UCLA?**

**SL:** We were first introduced to the university almost ten years ago by a good



*Betty and S.L. Huang, on the Great Wall of China (right), and with Chancellor Gene Block as Honorary Fellows of the College (above).*

friend and former Caltech schoolmate of mine, Tony Chan, who at that time was dean of physical sciences. Our relationship with UCLA flourished when we sponsored the talented mathematics professor, Terence Tao, and has continued as we've established additional educational programs in the physical sciences. Along the way we've been impressed by everyone we've met on campus, by their drive for excellence. No doubt UCLA's success is due to the high quality of its people.

**Betty:** The fact is, my friends from USC joke about it and call me a traitor! But over time S.L. and I have built a close connection with UCLA. And the many wonderful students we've met at various events are incredibly bright and willing to learn—they inspire us.

**CR: What motivates your philanthropy?**

**SL:** Delivering quality education requires both money and talent. UCLA already has access to lots of talent, so our financial support helps UCLA be successful, and our graduate fellowships help attract the best graduate students. I consider this nothing less than an investment in our future. 🇺🇸



*“Delivering quality education requires both money and talent. UCLA already has access to lots of talent, so our financial support helps UCLA be successful, and our graduate fellowships help attract the best graduate students. I consider this nothing less than an investment in our future.”*



# A Model Concept to Encourage New Scholars

The new Lemelson Anthropological Scholars Program will link faculty and students in relationships that create opportunities for undergraduate and graduate students to conduct original field research.

Robert Lemelson's multifaceted career as a psychological anthropologist, educator, and documentary filmmaker is a tribute to both the importance of interdisciplinary research and the value of mentor relationships in scholarly endeavors. Lemelson received his undergraduate degree in biology and anthropology from Hampshire College, where he learned firsthand the importance of being mentored by senior faculty.

At UCLA, Lemelson's doctoral dissertation spanned the fields of medical and psychological anthropology, psychiatry, and Southeast Asian studies; he received his Ph.D. from UCLA in 1999. Currently adjunct professor of anthropology at UCLA and research anthropologist at the Semel Institute of Neuroscience and Human Behavior, Lemelson fueled his passion for synthesizing different scholarly fields by creating and funding several educational programs at UCLA.

Lemelson's latest initiative, beginning in the winter quarter 2012, is the Lemelson Anthropological Scholars Program at UCLA, which will bring together individual faculty, graduate students, and small groups of UCLA undergraduates to form collaborative mentor relationships. Through the new Scholars Program, undergraduates will develop opportunities to conduct original field research. Lemelson has high hopes for the Scholars Program, noting that "it will allow committed scholars to go much deeper into their research and give them opportunities to really explore their vocation as anthropologists."

Said dean of social sciences Alessandro Duranti, "I consider the



Robert Lemelson (second from right) at a field site in Bali.

Scholars Program to be a model of the high quality collaborative training we can provide in fieldwork-based research." And according to Carole Browner, chair and professor of anthropology, "This is a novel concept that develops vital research skills among both undergraduate and graduate students by fostering close mentor relationships. A portion of the gift funds four graduate fellowships, which will greatly strengthen our ability to attract and retain top graduate students."

The Scholars Program grew from Lemelson's belief that creative, problem-oriented research skills and close mentor relationships are of crucial importance in training active and engaged anthropologists.

"I know from my experience that regular, one-to-one contact was much more powerful than seeing a professor once or twice a semester during office hours," said Lemelson. "It helped build my identity and shaped me as a scholar."

Lemelson's belief in the value of interdisciplinary scholarship has resulted in the creation of innovative programs that have shaped the direction of academic inquiry, as well as the training and experience of graduate students and post-doctoral researchers. In 1999 Lemelson created the Foundation for Psychocultural Research (FPR), which supports research and training in neuroscience and the social sciences.

Since 2002, FPR has funded the FPR-UCLA Culture, Brain and

For information about supporting the UCLA College of Letters and Science, call Stephen Jennings, executive director of development, at (310)825-2558.



Development Program (CBD). This graduate training and research program brings together the disparate disciplines of neuroscience, anthropology, psychology, education, psychiatry, and applied linguistics to explore the complex relationships between the brain, individual behavior, and culture.

The work of CBD students and faculty has spanned a wide range of research—from laboratory-based experiments involving neural imaging to anthropological field research in areas as diverse as Greenland, Burma, and Mexico. Graduate students, through their mentor relationships with senior faculty, integrate and gain competence in these different areas, helping to forge new scientific ground. The emerging disciplines of cultural neuroscience and neuroanthropology were, for example, innovated first by the FPR-UCLA Program, the first of its kind in the nation.

Lemelson believes that scholarship should also be socially and politically engaged. Through his generosity, since 2008 the Indonesian Studies Program (under the auspices of the Center for Southeast Asian Studies) has been able to award graduate fellowships to support research on issues such as gender, environmental resource management, and political change. The program's recent conference, "Legacies of Violence," addressed issues of human rights abuse and mass violence in Indonesia and East Timor, and included a screening of Lemelson's film about the 1965 mass killings in Indonesia, entitled "Forty Years of Silence: An Indonesian Tragedy."

Lemelson has contributed much time in the last decade to teaching in the anthropology and psychology departments at UCLA. He is a popular professor, consistently landing in the top ten on Bruinwalk, a UCLA student-managed "rate-the-professors" website. He is also a committed mentor, inviting some

of his best students to work as interns for his film production company; two of his closely mentored student-interns are now pursuing doctorates in medical anthropology at UC Berkeley.

Lemelson has been conducting research in Indonesia since 1993, and has shot more than 1500 hours of film footage there, resulting in the completion of eight ethnographic films. His recent film series "Afflictions: Culture and Mental Illness in Indonesia" was nominated for the Best Limited Series award by the International Documentary Association in 2010. His written work, published in numerous journals and books, includes the 2007 volume *Understanding Trauma: Integrating Biological, Clinical*

*and Cultural Perspectives*, co-edited with McGill University psychiatrist Laurence Kirmayer and neuroscientist Mark Barad of the Semel Institute. This is the first scholarly volume to be edited jointly by a psychiatrist, a neuroscientist, and a cultural anthropologist.

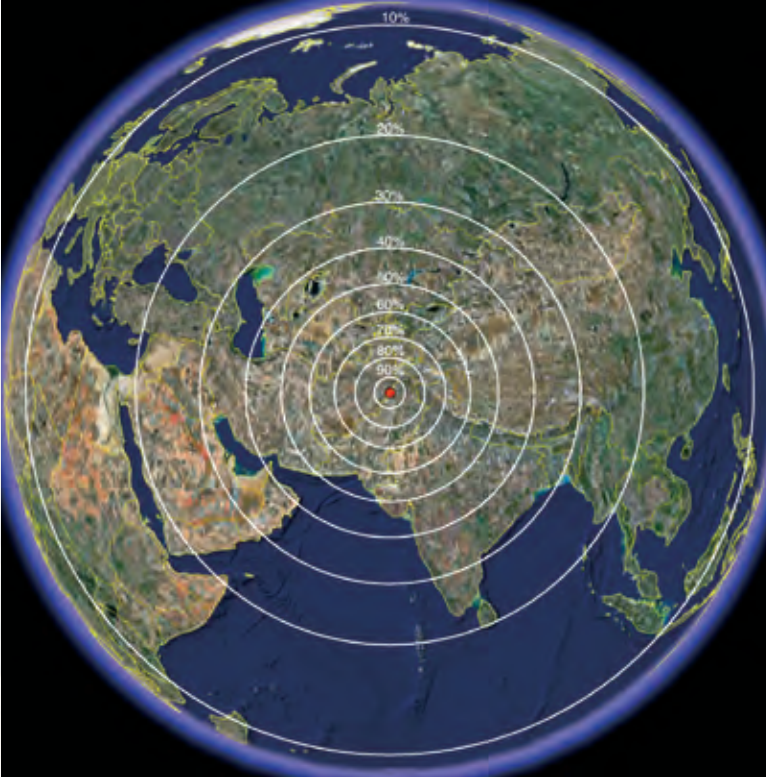
In addition to teaching at UCLA, Lemelson is president of the FPR and serves as a director of the Lemelson Foundation (a family foundation dedicated to improving lives through invention) and an ethnographic film director at Elemental Productions.

For more about the Lemelson Anthropological Scholars Program, visit [www.anthro.ucla.edu/lemelson\\_scholars](http://www.anthro.ucla.edu/lemelson_scholars)



"I know from my experience that regular, one-to-one contact was much more powerful than seeing a professor once or twice a semester during office hours. It helped build my identity and shaped me as a scholar."





*The probability model of the location of Osama bin Laden, developed in 2009 by undergraduate students and geographer Tom Gillespie. Abbottabad, where the terrorist was found May 2, is located in the area showing 88.6 percent probability.*

# Bin Laden in Their Sights

Two years before the American intelligence community tracked down Osama bin Laden, undergraduate geography students and their professor created a model that nearly pinpointed the location of his hideout.

They didn't get his address quite right, but five undergraduates and a geography professor zeroed in on the general whereabouts of the world's most wanted terrorist—and they did it more than two years before Osama bin Laden was actually found.

Now the world wants to know how they did it.

Cleverly, they employed theories typically used by biogeographers to determine the likely location of endangered birds or plants, high-resolution satellite imagery, remote sensing data, and an analysis of life history characteristics.

Put simply, if bin Laden were an endangered California condor, what would his habitat look like?

In a prescient paper that was published in February 2009, geography students taking the class "Remote Sensing in the Environment," taught by Professor Thomas Gillespie, developed a probability model that pointed to Parachinar, a city in northwest Pakistan, as bin Laden's most likely hideout.

Although the actual location turned out to be 230 miles away in Abbottabad, where bin Laden was found and killed May 2, the model created by the UCLA researchers turned out to be on track; it predicted an 88.6 percent chance that bin Laden would be found in the area where Abbottabad is located.


And based on the characteristics of bin Laden's life history, the researchers also hypothesized that the mastermind of 9-11 was living near or in a large town—not in a primitive cave in the rugged Tora Bora mountains where he was last located in 2001. They predicted correctly that he was living in a tall building to accommodate a man who stood 6 feet 4 inches tall, protected by walls over three meters high with access to electricity, based on a rumor of his dependence on a dialysis machine.

The building would need more than three rooms to accommodate bodyguards, they suggested, and there would likely be space between structures to allow bin

Laden personal privacy. Plus, the grounds would have trees to protect him from aerial surveillance.

Gillespie, who's more likely to be found in a rain forest in Hawaii searching for the best place to plant endangered trees than out hunting terrorists, said that the bin Laden exercise was challenging, but just one of many such class assignments that geography students master. His students have looked at agriculture in the California Central Valley, drone bombing in the Federally Administered Tribal Areas of Pakistan, and mining damage in Papua New Guinea.

While there's actually a lot of overlap between what geographers do and what the intelligence community does in terms of using geospatial technology to solve problems, Gillespie takes no credit for helping in the hunt for bin Laden.

"I would rather be remembered," said Gillespie, "for planting a whole bunch of trees in Hawaii to get them off the federal endangered species list." 



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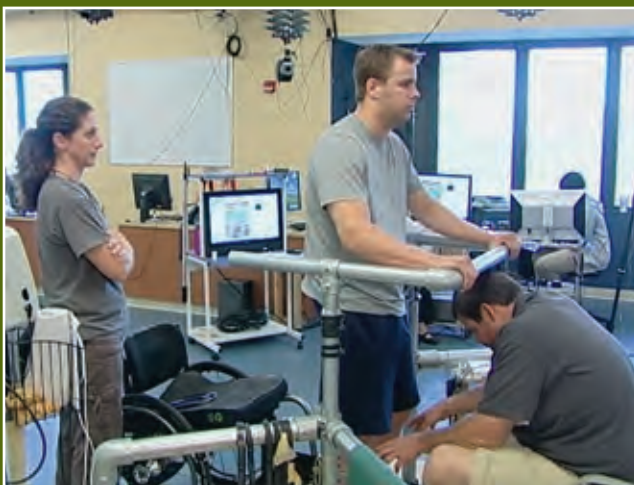
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*A hit-and-run accident left Rob Summers paralyzed from the waist down. Once doctors implanted on his spinal cord an electrical stimulator developed primarily by UCLA researcher V. Reggie Edgerton, within days Summers stood without help. Months later, he regained movement and was able to take a few steps, in what is being called “unprecedented” progress for spinal-cord-injured patients. See page 6.*