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CLOSE-UP: Truckee-based educator Chauncey Parker examines a boulder for an outdoor class in the new California Naturalist Program, which integrates citizen science into conservation. Story on page 18.

BREAKTHROUGHS

UC BERKELEY COLLEGE OF NATURAL RESOURCES • FALL 2013

Reconstructing the Global



System

The New Naturalists

On the Ground with
the Master of
Development Practice



The featured news stories in this magazine usually focus on research findings generated by our faculty, researchers, students, and alumni, but this issue is different.

Both main articles concern new initiatives whose work is just getting started. There's good reason to pay attention: Both programs are about transforming the status quo — at UC Berkeley, in California, and across the world.

The Berkeley Food Institute is a new interdisciplinary research center bringing together experts from across the campus and from the outside world to study the entire food system — from scientific, social, legal, policy, and journalistic angles, and angles we may not yet know or understand. The team that has been working tirelessly behind the scenes to launch the new center recognizes that it is only by working together and across academic disciplines that we can seriously address the complex topic of food (page 10).

Officially moving from pilot to statewide launch this year, the California Naturalist Program provides certification to naturalists from all walks of life. This new UC program is building opportunities for environmental job training and volunteerism, and a new age for citizen science (page 18).

In another story on transformations, Energy and Resources Ph.D. candidate and California Public Utilities Commissioner Carla Peterman is focusing on developing the energy storage market, a project that could push California's alternative energy to the next level of efficiency and make it a model for other states (page 22).

Last fall, we launched the Berkeley Master of Development Practice. To see how much can be accomplished with vision, funds, and intellectual rigor behind a new program, you can fast-forward and see the amazing work that our first cohort of students has done all over the world (page 6).

Visions, funds, and rigor were also behind getting our new institute off the ground. We are pleased to tell you the story of Bob Epstein, the Berkeley Food Institute's earliest and most active donor (page 28).

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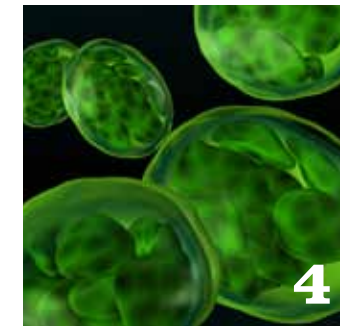
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Go to nature.berkeley.edu/breakthroughs.

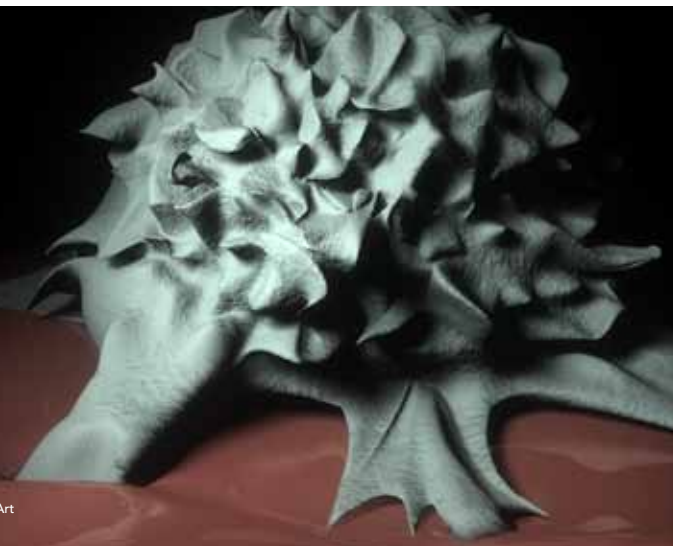
COVER AND NEAR LEFT: Photographer: Annabelle Breakey
Food Stylist: Heidi Gintner

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Disabling Enzyme Cripples Cancer Cells

Illustration of an aggressive cancer cell IMAGE: O'Reilly Science Art



Knocking out a single enzyme dramatically cripples the ability of aggressive cancer cells to spread and grow tumors, offering a promising new target in the development of cancer treatments, according to a UC Berkeley study published August 26 in the journal *Proceedings of the National Academy of Sciences*. The research sheds new light on the importance of lipids, a group of molecules that includes fatty acids and cholesterol, in the development of cancer.

Researchers have long known that cancer cells metabolize lipids differently than normal cells. Levels of ether lipids — a class of lipids that are harder to break down — are particularly elevated in highly malignant tumors, although the nature of that correlation has been unclear for decades.

“Cancer cells make and use a lot of fat and lipids, and that makes sense because cancer cells divide and proliferate at an accelerated rate, and to do that, they need lipids, which make up the membranes of the cell,” said the study principal investigator, **Daniel Nomura**, assistant professor of nutritional sciences and toxicology. “Lipids have a variety

of uses for cellular structure, but what we’re showing with our study is that lipids can also send signals that fuel cancer growth.”

In the study, Nomura and his team tested the effects of reducing ether lipids on human skin cancer cells and primary breast tumors. They targeted an enzyme, alkylglycerone phosphate synthase, or AGPS, known to be critical to the formation of ether lipids, and found that inactivating it substantially reduced the aggressiveness of the cancer cells. “The cancer cells were less able to move and invade,” said Nomura.

The researchers also found that in mice injected with cancer cells, disabling AGPS resulted in no tumor growth, whereas mice with the enzyme intact rapidly developed tumors.

Future steps include the development of AGPS inhibitors for use in cancer therapy, Nomura said. The study co-authors also include **Kunxin Luo**, professor of molecular and cell biology and faculty scientist at Lawrence Berkeley National Laboratory.

— ADAPTED FROM AN ARTICLE BY SARAH YANG

Repairing Acid Rain Damage Improves Forest Health

Acid rain from industrial pollution has damaged the health of forests for close to 50 years. Working in the American Northeast, researchers led by **John Battles**, professor of forest ecology, restored soil calcium that had been depleted by acid rain. As a result, the forests have increased their levels of carbon sequestration and improved their resiliency to major disturbances like ice storms, which are likely to increase with climate change. Researchers have also measured significant improvements to the health of the iconic sugar maple, a

tree species sensitive to acid rain effects. The findings were published in September in *Environmental Science and Technology Letters*.

— ADAPTED FROM AN ARTICLE BY SARAH YANG

VENERABLE: The Society of American Foresters awarded **Kevin O'Hara**, professor of silviculture, the 2013 Carl Alwin Schenck Award “in recognition of devotion and demonstrated outstanding performance in the field of forestry education.” O'Hara was honored at a ceremony held in October in Charleston, S.C.

NewsMakers

“[The project] does clearly pass a cost-benefit test to the tune of something like \$5 billion.”

David Sunding, Professor, Agricultural and Resource Economics



An August 6 *Los Angeles Times* article covered an economic analysis, led by Sunding, that determined that the benefits of building a new tunnel system for the Sacramento–San Joaquin River Delta would far outweigh the costs. The project would stabilize water supplies from the Delta, which serves roughly two out of every three Californians, as well as restore the estuary’s ecosystem.

Store Credit

Energy and resources doctoral candidate **Laura Schewel** was named the winner of the 2013 Young Researcher of the Year award at the International Transport Summit in Leipzig, Germany, on May 23. Her title-winning paper, “Shop 'Till We Drop: A History and Policy Analysis of Retail Goods Movement,” analyzed two large data sets to understand how much time both shoppers and merchandise delivery trucks spend motoring on the road to retail. Improving the data and understanding interactions between sectors could lower shopping-related greenhouse gas emissions and lead to more sustainability-oriented policies, Schewel says. (See NewsMakers, this page).

“We have no idea what’s happening on the roads. Just none. When you compare that to what we know about what people watch on TV, it’s absurd.”



Laura Schewel, M.S. '11, Ph.D. Candidate, Energy and Resources Group

Schewel was named one of *MIT Technology Review*'s annual “35 Innovators Under 35,” published in the September/October issue, for her company StreetLight Data. The startup developed software that uses cellphone and navigation data to generate the demographics of people who drive by or stop near any specified address. The results have applications not just for transportation but for marketing, business development, and urban planning.

Park It

Geographer **Carolyn Finney**, assistant professor of environmental science, policy, and management (ESPM), is one of 12 appointees to the distinguished leadership panel of the Parks Forward Commission, it was announced in August. Parks Forward, created following the passage of the California State Park Stewardship Act of 2012, is tasked with designing and adopting a blueprint for “a financially sustainable



PHOTO: Lymnly Labovitz

and functionally relevant State Park System that meets the needs of a changing population and provides an innovative park system model for the rest of the nation,” according to a press release from the California Resources Agency. **Caryl Hart** Ph.D. '09, ESPM, director of Sonoma County Regional Parks and a CNR Advisory Board member, is also serving on the new leadership panel.

“How long will it be until an idealistic and technically literate researcher deliberately releases genome and trait information ... in the name of open science?”

Steven E. Brenner, Professor, Plant and Microbial Biology



In a June 12 opinion piece in the journal *Nature*, Brenner says it's inevitable that a leak of genomic information will occur. “Individual scientists, institutions, and funders should consider now how they will react when this happens,” Brenner says. He stressed that discussions about the risks of a leak must also include the tremendous benefits to society of using that information to achieve medical progress.

PHOTO: Jim Block

Scientists Use Today's Cells to Date Origins of Photosynthesis, Biodiversity

Photosynthesizing cyanobacteria invaded the earliest one-celled plants about 900 million years ago, eventually becoming chloroplasts (pictured) that conferred on plants the ability to convert sunlight into energy.

PHOTO: istockphoto

Long before Earth became lush, when life consisted of single-celled organisms afloat in a planet-wide sea, bacteria invaded the ancient ancestors of plants and animals and took up permanent residence. One bacterium eventually became the mitochondria that today powers all plant and animal cells; another became the chloroplast that turns sunlight into energy in green plants.

A new analysis by two UC Berkeley graduate students more precisely pinpoints when these life-changing invasions occurred, placing the origin of photosynthesis in plants hundreds of millions of years earlier than once thought. The paper was published in June in the *Proceedings of the National Academy of Sciences*.

"When you are talking about these really ancient events, scientists have estimated numbers that are all over the board," said study co-author **Patrick Shih**, Ph.D. '13, Plant and Microbial Biology. Estimates of the age of eukaryotes — cells with a nucleus that evolved into all of today's plants and animals — range from 800 million years to 3 billion years ago.

"We came up with a novel way of decreasing the uncertainty and increasing our confidence in dating these events," he

said. Shih and colleague **Nicholas Matzke**, Ph.D. '13, Integrative Biology, believe that their approach can help answer similar questions about the origins of ancient microscopic fossils.

The two researchers employed fossil and genetic evidence to estimate the dates when bacteria set up shop as symbiotic organisms in the earliest one-celled eukaryotes. They concluded that a proteobacterium invaded eukaryotes about 1.2 billion years ago, in line with earlier estimates. They found that a cyanobacterium — a blue-green algae that had already developed photosynthesis — invaded eukaryotes 900 million years ago, much later than some estimates, which are as high as 2 billion years ago.

Shih and Matzke realized that they could get better precision than previous fossil-based estimates by studying today's mitochondria and chloroplasts, which from their free-living days still retain genes that are evolutionarily related to genes currently present in plant and animal DNA. "These genes ... were present in our single-celled ancestors and are present now and are really, really conserved," Matzke said. "These go back to the last common ancestor of all living things, so it helps us constrain the tree of life."

— ROBERT SANDERS

Bedbugs Won't Take the Bait

Detecting bedbugs is key to controlling them, and a new UC study shows that current methods for finding the blood-sucking pests aren't very reliable. Researchers tested three commercial monitors. At best, the monitors containing attractants captured only 10 percent of the bedbugs, scientists wrote in the July–September issue of *California Agriculture*. The researchers call for improving monitors as well as developing new methods to lure the insects more effectively.

"If we could put out bait and the bedbugs find it and die, wouldn't that be great?" said **Vernard Lewis**, UC Cooperative Extension specialist in the Department of Environmental Science, Policy, and Management and lead author of the article. Lewis is testing attractants for bedbugs and observing their behavior.

— ADAPTED FROM AN ARTICLE BY PAM KAN-RICE

PHOTO: Noel F. Snyder



Male and female (yellow forehead) green-rumped parrotlets in Venezuela.

New Ecological Twist on Climate Change

Yes, those spring wildflowers did arrive earlier this year. The timing of flowering, egg-laying, and migratory behavior — breeding behavior known as phenology — in many plants and animals has been altered by climate warming that affects their food supply and other environmental conditions. A new study, published in *Proceedings of the National Academy of Sciences* in September, provides the first evidence that phenological responses to climate change might be more complicated than previously thought.

The green-rumped parrotlet breeds multiple times from May to November in Venezuela, with variations driven by year-to-year differences in rainfall and population size, the study found. "It's advantageous for the birds to nest early in the breeding season to produce more offspring per year, but both the offspring and the breeding female survive better into the next year if nesting starts later," said **Steven Beissinger**, ESPM professor and the study's principal investigator. This pattern is called "opposing selection" and results from trade-offs between the timing of reproductive success and survival. Opposing selection could explain why many field studies of plants and animals report strong selection on heritable traits, such as bill length or body size in one direction — either larger or smaller — without accompanying changes in the trait over generations.

"Our results also highlight the importance of measuring the evolutionary basis for phenological shifts, not just documenting the shift, if we want to understand how species will cope with climate change," Beissinger said.

— ANN BRODY GUY

POWER PLANTS: The Energy Biosciences Institute was granted its first patent since the public-private research partnership was established in 2007 between UC Berkeley, University of Illinois at Urbana-Champaign, Lawrence Berkeley National Laboratory, and energy giant BP. U.S. Patent No. 8,431,360, titled "Methods and Compositions for Improving Sugar Transport, Mixed Sugar Fermentation, and Production of Biofuels," was granted on April 30. The discovery resulted from work that uses yeast to improve the conversion of plant cell wall sugar to produce biofuel.

SUBJECT: Why I Do Science



ENTRY BY:
Sarah Hake

ENTRY #:
010

My love of plant biology began in a taxonomy class as an undergraduate at Grinnell College, going outdoors, classifying, and collecting. I thought a career collecting flowers in the high Sierra Mountains would be just about right. However, I discovered in graduate school that I was more drawn to experimental approaches of lab work. I visited maize geneticists at the University of Missouri in Columbia and remember Ed Coe and Gerry Neuffer dashing through the cornfield in a blur, pointing out mutants and significant findings. I also went to my first maize genetics conference as a graduate student and remember writing a postcard to my parents telling them I had found my home in science. Raised in a nonreligious family, genetics felt like my bible.

The cornfield is a beautiful laboratory. Each row has a different family, containing siblings that segregate interesting morphological phenotypes. Both in our summer nursery here in Berkeley and a winter field in Mexico, my lab members and I plant the field together and share observations and stocks. We begin walking through the field when the plants are just a couple of leaves big, and then again and again until the critical time of pollination. At this point, the plants are human size and we are fairy queens, taking pollen from one plant to another. Being in the field — basically being in the experiment — is an incubator for our best ideas.

I also experience my love of field science at home, where my husband and son run a vegetable farm. Here the field work takes on a different tone, with decisions about what to plant when and where. Although the seeds are purchased and do not represent genetic families, there are the occasional morphological mutants that I love to ponder as I help harvest.

Sarah Hake is the director of the U.S. Department of Agriculture's Plant Gene Expression Center in Albany, Calif., and an adjunct professor in the Department of Plant and Microbial Biology. She is a fellow of the American Association for the Advancement of Science and a member of the National Academy of Sciences.

PHOTO: Jim Block

PHOTO: Dong-Hwan Cho, UC Riverside

**ON THE GROUND
WITH THE MASTER OF**

Development Practice

The first cohort of UC Berkeley's new Master of Development Practice (MDP) fanned out across the globe this summer to complete their required practicum, allowing students to apply the skills they learned in the classroom to real-world challenges.



Jian (Sam) Ju (China) worked with the Food and Agricultural Organization of the United Nations (FAO) at its headquarters in Rome, Italy. His project merges household data with climate data from Zambia, Malawi, and Vietnam to understand how climate-smart agricultural practices affect agricultural production and food security in these regions.



Kiva is a nonprofit organization that uses small-scale lending, the power of the Internet, and a worldwide network of microfinance institutions to help create opportunity and alleviate poverty around the world. As a Kiva fellow in Palestine and Israel, **Shereen Masoud** (USA) acted as Kiva's "eyes and ears on the ground," working with local partners to ensure that loan dollars go where they are needed most.

In Nablus, the 21-year-old tailor Osama used his Kiva loan to buy a new laptop so that he can research the latest styles.



John Grams (USA) conducted research for the FAO on rural supply chains for various animal products in Mongolia. The aim of the project is to improve the livelihoods of small herders.

Sadhika Kumar (India) worked on India's sustainable cities pilot, part of the larger Delhi-Mumbai Industrial Corridor Project undertaken by the Indian government in collaboration with the Japanese government and the private sector. The project aims to alleviate poverty by creating employment opportunities and increasing existing infrastructure, while also addressing climate change-related challenges.



Peter Myers (USA) and **Zhen Zhao** (China) worked with Sir Dorabji Tata Trust, an Indian philanthropic organization, to evaluate an education project in rural West Bengal, that integrates computers and other technology into school curricula. The two reported on how well the program met its goals of improving educational achievement, bridging the digital divide, and improving teaching and learning strategies.



Maximilian Zaenker (Germany) collaborated with SEKEM, a non-governmental organization (NGO) based in El Minya, Egypt, that promotes sustainable food production in arid conditions and fosters human-centered (community-focused) development throughout Egypt. Zaenker delivered workshops that promote sustainable water use, but his work was interrupted by the region's violent political clashes, which led to his evacuation from the region.



Tara Roach (USA) worked with Not For Sale, an organization that fights modern-day slavery around the world. She was part of a team that is conducting a comprehensive study on human trafficking in the San Francisco Bay Area, paving the way for a self-sustaining job-training program to support survivors and at-risk individuals.



Narissa Allibhai (Kenya) assisted the NGO Lem Ethiopia (the Environment and Development Society of Ethiopia), based in Addis Ababa. Her various projects included creating a presentation on human-centered design and helping to develop, implement, and analyze a baseline survey for the Population, Health, and Environment Integration project.

PHOTO: Narissa Allibhai



The Nairobi, Kenya-based Human Needs Project (HNP) is building a new cooperative town center that will provide services in sanitation, health, education, and finance in Kibera, Kenya's largest slum. **Celia Chessin-Yudin** (USA) designed a public health campaign, and **James Tinker** (USA) designed data collection and storage systems and prepared education programs to train HNP staff as enumerators and analysts. CNR Advisory Board member **David Warner '76** is cofounder of HNP, with Connie Nielson.



The Durban, South Africa-based company Wonderbag seeks to improve livelihoods across the globe and contribute to climate change mitigation through production and distribution of 100 million of its products around the world. Wonderbag's titular heat-retention gadget continues to cook food up to several hours after just a few minutes of boiling on the stove, allowing families to reduce their use of water and cooking fuel and reduce carbon dioxide emissions. The Berkeley MDP team of **Jessica Clayton** (USA), **MaaNaa Pierre** (Ghana), and **Kamila Demkova** (Slovakia) worked with agricultural and resource economics Ph.D. student **Vanessa Reed** to conduct household surveys and data analysis to evaluate the device's potential to meet the company's goals. (See The Big Picture, page 29.)

PHOTO: Courtesy of Wonderbag



Asa Feinstein (USA) was in Baja California, Mexico, to evaluate the social impact of Del Cabo, a progressive company that works with smallholder farmers to produce and export organic produce. His summer research aimed to fill a knowledge gap on the company's social impact.



PHOTO: Peg Skorpinski

Farewell to a Friend

Norma Gallins Kobzina: 1944–2013

On May 6, Dean J. Keith Gilless sadly announced the death of **Norma Kobzina**, the head of Information Services at the Marian Koshland Bioscience and Natural Resources Library. She was 69 years old. The cause was pancreatic cancer. We are sharing just a few excerpts from the outpouring of affection for Kobzina, who had a Ph.D. in Spanish from Cornell as well as her M.L.I.S. from UC Berkeley. “Norma loved her work and always felt a part of the College of Natural Resources,” John Kobzina, her husband of 45 years, told *Breakthroughs*. Norma, the feeling is mutual.

“Norma was considered by all who dealt with her to be the ultimate librarian and professional. However, she also

should be remembered for the practical and scholarly contributions that she made that went far beyond the needs of Berkeley faculty and students. She wrote articles questioning the value of impact factors in evaluating research, looking at which journals contributed most to specific fields, and which papers were most influential. However, to me, she’ll first be remembered as a great friend.” — *Vince Resh*

“Norma was a wonderful educator, and she helped this big institution seem like a community.” — *Lynn Huntsinger*

“Norma remembered everyone’s name, and her joy for helping people learn how to do research in her ever-changing library-scape only seemed to increase each year. She was a lovely and unique person.” — *Nancy Peluso*

“I met Norma 25 years ago as we commuted on BART when she spotted a soil science journal in my hands and asked why I was reading it. Her sparkling curiosity was one of the hallmarks of the working relationship we had since then, particularly when she was offered the challenge of teaching the library training sessions for the large freshman course I give on environmental studies with Professor Robert Hass of the English Department. Norma developed an extraordinary approach to combining environmental science and nature writing in these sessions, thereby ensuring that the broadest variety of library resources would be exposed to our students. Insofar as I am aware, this represented the first time humanities and natural sciences were integrated to give library instruction to Berkeley undergraduates. Through her remarkable efforts, the intrinsically interdisciplinary spirit of the course was made manifest in a way neither Bob Hass nor I had expected. She was truly one of the great treasures of the Berkeley Library.” — *Garrison Sposito*

To help support the work that Norma loved, send a check for the *Norma Kobzina Library Fund to: Development and External Relations, The University Library, 131 Doe Library, Berkeley, CA 94720-6000.*

WATCHDOGS: After getting to know each other at CNR’s 2012 homecoming picnic, **Pamela Behrsin** ’10 of MapLight, a nonprofit research organization that tracks money’s influence on politics, and **Hillary Lehr** ’07, director of Global Exchange’s Elect Democracy campaign, teamed up to create the hard-hitting report, *Meet the FIRE Sector: How Wall Street Is Burning Democracy*, which charted the \$4.2 billion spent by finance, insurance, and real estate industries (FIRE) on lobbying, campaign contributions, and other influence efforts in the past six years. The report’s accompanying scorecard assigned each sitting member of Congress a Wall Street Loyalty rating based on the percentage of the lawmaker’s votes that aligned with the FIRE lobby’s positions on legislation impacting economic security.

— ANN BRODY GUY



Bob Buchanan Retires

Plant and Microbial Biology Professor **Bob Buchanan** retired in June after serving on the UC Berkeley faculty for 50 years, with the last 5 as CNR’s executive associate dean. During his career, he made major discoveries in microbiology and biochemistry, published more than 200 research articles, taught an estimated 10,000 students, and co-edited the leading textbook on plant biochemistry and molecular biology. Buchanan and his many contributions to the University and his field will be feted at a private ceremony in November. His numerous honors include election to the National Academy of Sciences, being a fellow of the American Academy of Arts and Sciences, and receipt of an Alexander von Humboldt Research Award.

Read Q&A: nature.berkeley.edu/breakthroughs

STEVEN LINDOW, a professor of plant and microbial biology, has been appointed the new executive associate dean of the College. Lindow is a member of the National Academy of Sciences and a fellow of the American Academy of Microbiology, the American Phytopathological Society, and the American Association for the Advancement of Science.

MolTox Wins New Internship

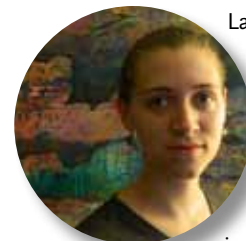


PHOTO: Dwight Ford

Last spring, local startup Elara Bioscience launched a paid internship created specifically for Berkeley’s molecular toxicology undergraduates. Working under the direction of **Dale Johnson**, the company’s president and CEO and an adjunct professor of nutritional sciences and toxicology, interns will pitch in toward the company’s goal of providing industry with online, secure access to chemical toxicity data and current safety regulations.

Breanna Morris, now a junior, won the inaugural spot and was joined by two more interns over the summer. “The most exciting thing about the internship is the chance to see the real-world effects of the work we’ve done,” she says. Getting lost in small, segmented tasks can sometimes result in losing sight of the bigger picture, but she says, “as an intern I can step back and see how all of the work we put in moves us closer to the company’s goals.”

Morris, who has worked for a decade at her own web design and e-marketing company and is married with three children, saw her two interests come together. “The internship gave me the opportunity to see how web technologies can be applied to the biotech and toxicology industries,” she says. “It’s great to have a chance to merge my love of information technology with my passion for toxicology.” — GUY

NEXT {BIG} THING

“Putting a value on sewage as a resource has a twofold benefit: creating a profitable platform for sanitation services while producing a renewable fuel source.”

Troy Hodges (far right) with John Palfreyman
PHOTO: Akua Nkrumah



TROY HODGES

Conservation and Resource Studies '13

Following graduation, I spent my summer in Ghana as a Cal Energy Corps intern with Waste Enterprisers, a startup waste-to-fuel company. In Accra, Ghana, sanitation is an elephant in the room — fecal sewage is dumped directly into the ocean without any treatment, polluting swathes of beaches and adversely affecting local health. Working as a process engineer, I conducted research on methods for drying fecal sludge to use as a biomass fuel to replace coal for energy needs. Putting a value on sewage as a resource has a twofold benefit: creating a profitable platform for sanitation services while producing a renewable fuel source.

My studies were crucial in giving me insights to work on this interface of health, environment, and energy in both technical and social avenues. Inspired by my experiences with the Fossil Free Cal campaign at Berkeley, I reached out to the Ghanaian Youth Environmental Movement and worked with them in organizing a rally protesting a coal-fired power plant proposal in Ghana that was rushed through without government transparency.

In October, I started interning with the International Renewable Energy Agency in Abu Dhabi as a climate analyst researching best policy practices for national green growth strategies. I am fascinated with the dynamic intersection of science and policy and am eager to sponge up whatever new experiences come my way.

Recent CNR Grads Make Their Marks

Reconstructing the Global



System

To a casual observer, the proceedings at the Clark Kerr Conference Center this past spring may have looked like the typical machinery of academic self-perpetuation: eager grad students, a jetlagged coterie of international experts, breakout sessions, guest panels, strategic use of PowerPoint. And yet closer inspection reveals more than a few peculiarities. To begin with, most people found themselves seated alongside someone who not only was a complete stranger, but somebody whose entire field of study was unfamiliar. In fact, many of the attendees weren't academics at all. A senior advisor to the mayor of Los Angeles rubbed shoulders with a soil scientist; a doctor chatted with an Internet tycoon, a cartographer, and a tomato farmer.

But the revolutionary nature of the day's events came into focus as the 165 attendees filed out to grab their catered lunch. Where were the soggy sandwiches with gray roast beef and too much mayo? Where was the tiny yellow bag of Lay's potato chips? Instead, attendees munched on baked ricotta with herbs and white bean and celery salad with asparagus. Delicious and healthy, to be sure, but even more important to the conference organizers, the produce was supplied mainly by a local farm that provides significant environmental benefits through emphasizing biodiversity, and the significant social benefit of year-round labor for its farm workers.

Fittingly, the symposium was laying the groundwork for the fall 2013 launch of the **Berkeley Food Institute** (BFI), an ambitious new research group that has as its goal nothing less than transforming the way the world grows, processes, distributes, and consumes food.

A few of the participants at the Berkeley Food Institute's inaugural symposium in May. Left to right: Sierra Orchards owner Craig McNamara and National Family Farm Coalition president Ben Burkett during a lively panel discussion; UC Berkeley agroecology professor Miguel Altieri, activist and academic Jun Borras, and author-activist Raj Patel look on; faculty co-director Claire Kremen during a discussion group.

PHOTOS: Lauralyn Curry-Leech

Unlike the more rarified air of, say, molecular biology or Russian literature, everyone on earth has a personal understanding of and connection to food. And yet the reality of what it takes to get a meal onto a table is unfamiliar to most people, and shockingly complex. According to **Alastair Iles**, associate professor of environmental science, policy, and management (ESPM) and one of two faculty co-directors of the BFI, the food system "spans the range from farms to processing firms to supermarkets, from farm workers to restaurant workers, from urban to rural farms, and from large companies to nimble community NGOs."

Arriving at a nuanced understanding of all those variables would be a lot to heap onto the plate

of any one person or even a single academic department. Fortunately, the BFI draws strength from five units: the College of Natural Resources, the Goldman School of Public Policy, the Graduate School of Journalism, the School of Public Health, and Berkeley Law. Its executive director, **L. Ann Thrupp**, has a multidimensional background in government, academia, and the nonprofit advocacy arena, and as a leader in sustainable and organic farming. The BFI's ability to attract talent from across campus and at every level, including 25–35 affiliated faculty, is perhaps its greatest strength.

"The university is known for excelling at multiple academic disciplines, but the Institute will truly be interdisciplinary," says **Claire Kremen**, an ESPM

professor and, with Iles, BFI's faculty co-director. It's not enough just to conduct high-level environmental science, she explains. "We need to get the results of that work into the policy process. To be really effective, we need to communicate broadly. An academic department isn't set up to do that, but an institute can take that process as its main way of acting."

Food 101

It's only natural that a cutting-edge food institute would be launched from the Berkeley campus — it's basically impossible to talk about the sustainable food movement without circling back to Berkeley. From **Francis Moore Lappe's** 1971 book, *Diet For A Small Planet*, to **Alice Waters's** seminal influence, to **Marion Nestle's** decades of scholarship and



The new research group's goal is nothing less than transforming the way the world grows, processes, distributes, and consumes food.



“There are pockets of people all across campus – in geography, in education, in ethnic studies – who study food and we wondered, why aren’t we talking to these people, why don’t we know them?”

Maywa Montenegro

advocacy, Cal alumni have played an integral role in shaping the national discussion surrounding food.

Author and Berkeley journalism professor **Michael Pollan**, a BFI executive committee member, has become something of a national food guru. His recent class, Edible Education 103, was open to 400 students, as well as 300 members of the public, who rushed to reserve spots online. The lectures, which featured guest speakers from across the food spectrum, even became a hit on YouTube. “Any class that’s even tangentially related to food is immediately oversubscribed,” says **Sally Smyth**, a recent Goldman School graduate who served as the director of operations before becoming a Presidential Fellow with the U.S. Department of Agriculture.

Berkeley students have been working on food reform for years. In 2011, for example, students in the Graduate School of Journalism published *The Ration*, an iPad magazine that touched on everything from nutrition to farming to the psychology of labeling. A year earlier, a group of undergraduates received a grant to open the Berkeley Student Food Collective to expand access to organic, sustainable foods. Others redesigned the food packaging in the dining halls and started a program to redistribute excess food from corporate events to low-income Oakland neighborhoods.

There has been a breadth of interest in the research arena as well. Since 2011, the **Berkeley Center for Diversified Farming Systems (DFS)** has been a key touch point for exploring agriculture techniques that rely on biodiversity for critical inputs like pollination, soil fertility, pest and disease control, and efficient water use. But researchers found that they needed to expand their focus beyond the production side to confront the myriad issues encompassed by the simple word “food.”

“There are pockets of people all across campus — in geography, in education, in ethnic studies — who study food and we wondered, why aren’t we talking to these people, why don’t we know them?” says **Maywa Montenegro**, an ESPM Ph.D. student and DFS’s communications coordinator. “We had a

pre-symposium mixer ... and it was pretty astonishing to see the overlap in interests. There were sparks flying as people realized, like ‘I could really get my hands into your data and love it.’”

Those sparks helped ignite something much bigger. With guidance and commitment from an executive committee and vision, perseverance, and financial support from some early backers (see College Support, page 28), the Berkeley Food Institute was born. By crafting a mission statement that calls for transforming the global food system into one that is “healthful, ecologically sustainable, socially just, and economically equitable,” the Institute has set its aims high.

Changing the Questions

Holding an inaugural symposium was a great start; the event gathered minds from across the entire food system to inform a research agenda. But there’s a long way to go before real results will materialize. How can already flourishing successes be scaled up into big wins with wide-reaching effects? Everyone involved with the BFI understands that “contributing to some dusty scientific paper that seven people will read is not enough,” says **Kathryn DeMaster**, an assistant professor of agriculture, society, and food security. “We need to ask questions that are relevant to the public. If we do that, then we have the chance to be particularly impactful.” Toward that end, the BFI will support faculty interested in conducting new research that connects their interests to the information needs of constituencies such as growers, eaters, and policymakers.

A few key areas of inquiry have already begun to emerge. “CNR is particularly well positioned to contribute to commodity chain analysis,” says DeMaster, and that process of following a product through every intricacy of its life cycle is a natural fit when it comes to food.

Other essential questions include how first-world appetites contribute to food insecurity in the developing world; how regulatory programs like labeling, nutritional requirements, and organic certification can change consumer behavior; and how large-scale producers can be incentivized to reduce their reliance on



PHOTO: Kara Brodgesell

DEFENDING THE RIGHT TO FOOD

Olivier De Schutter is not an easy man to catch. His summer itinerary alone included Thailand, Malawi, Belgium, and two trips to India. “We can always talk over Skype,” he offered in an email. As the United Nations Special Rapporteur on the Right to Food, De Schutter’s mandate is as overwhelming as the balance in his Frequent Flyer account. His job is to promote the “adoption of measures at the national, regional, and international levels for ... the fundamental right of everyone to be free from hunger.”

The son of diplomats, De Schutter attended grade school in India, Saudi Arabia, and Rwanda — his time spent earning law degrees from Harvard and the Université de Paris seems ho-hum in comparison. De Schutter has always used these rarified academic credentials to focus on human rights and poverty issues; food, of course, is an inseparable component. “The pressure on resources of the global south to feed our own needs in the north are becoming extremely difficult to bear for the poorest in the south,” he says.

To that point, De Schutter will be on campus this fall teaching the seminar *The Political Economy of Hunger* as one of the Berkeley Food Institute’s first visiting scholars. “We have all the technical solutions [to hunger],” he says, “but we have failed, because of ... the wrong policies, sometimes adopted in good faith, but which have not worked.”

“I’ve changed my mind many times,” he says of which policies work best, “and I hope to change it many times again in the future.” And while his multidisciplinary U.N. experience will be a great asset to the BFI, the biggest challenge may be getting him to sit still long enough to share it. Office hours in Bangkok anyone?

ACCOLADES: In July, De Schutter was awarded the Francqui Prize, Belgium’s most prestigious scientific honor, given in the social sciences and humanities only every three years.



pesticides, antibiotics, and agricultural techniques that deplete soils. None of these problems can be solved in isolation. “We can accomplish more together than we might in our individual departments,” DeMaster says.

Scope of Influence

The mechanics of achieving boots-on-the-ground change are complicated and often opaque to people who spend the bulk of their time in academia. But Goldman School Dean **Henry Brady** has been involved in the BFI since its inception, and he sees great opportunities for making concrete change. “We are more linked to government than most other faculties on campus,” he says. “What we bring is a real sense of the policy issues and an ability to link that with governmental agencies. The Institute provides us with an opportunity to connect Berkeley’s world-class research with government policymakers.”

The alliance with the J-School offers similar opportunities for broad-based impact; a steady drumbeat of media attention can be instrumental in challenging society’s orthodoxies. “We will generate stories on the ground by sniffing around, looking for new models and experiments,” says **Edwin Dobb**, BFI executive committee member and Carnegie lecturer in journalism. “We might drive research, and we might drive policy considerations.” The idea is that journalists can help scientists develop the storytelling skills they’ll need to move out of the academic arena and into the wider world. Indeed, it’s the teamwork and skill-sharing between the many participants that will determine the success of the Institute.

But how exactly will success be measured? Journal articles generated, conferences sponsored, students involved, graduate research funded: All of these traditional academic metrics are crucial, but none of them is enough to achieve the transformative influence that the group envisions. “We’re not going to be happy,” says Brady, “until people look to us as the go-to experts, so that when Washington is talking about these issues, people from our group are asked to come testify.”

Olivier De Schutter, who keynoted the May symposium, *(article continues on page 16)*

ANATOMY OF A TOMATO

Where does your food come from? We follow a single item from farms to schools, stores, restaurants, processing plants, and even bookstores.

MACHINERY After the mechanical tomato harvester was introduced in 1960 and California tomatoes were bred to meet its needs — with tough skins and simultaneous ripening — nearly all the state's tomato crop was converted to machine harvest. The result was a split in the tomato business that still persists: California growers process almost all the canned tomatoes and tomato paste consumed in the United States while 90 percent of the more strenuous, lower-paying salad-tomato picking jobs moved to Florida.

EXPOSÉ In his book *Tomatoland* (2011) and numerous articles and media appearances, Barry Estabrook documented the working and living conditions of Florida tomato workers, which range from extreme poverty to outright slavery.

SMALL VICTORY The Campaign for Fair Food, a partnership effort between Florida farmworkers and consumers urging corporations to engage in fair and safe labor practices, succeeded in getting major food buyers, including Taco Bell, Pizza Hut, McDonald's, Whole Foods, and Trader Joe's, to agree to a 1¢ raise and a pledge that no worker who picked their tomatoes was being exploited.

TOXIC CLOUD The official Florida guidebook for commercial tomato growers documents 110 different chemicals that growers can spray on tomato fields. In *Tomatoland's* "Chemical Warfare" chapter, Estabrook documents numerous birth defects and illnesses associated with tomato pickers routinely exposed to these chemicals.

LEGAL HURDLES Small and mid-size farmers worry that the Food and Drug Administration's well-intentioned Food Safety Modernization Act will conflict with their use of water and environmental conservation practices, including the use of hedgerows and diverse cropping strategies. Likewise, the new regulations could require capital investments that are out of the reach of some small and mid-size food processors.

CHECK, PLEASE That caprese salad on your plate might have been served by someone earning \$2.13 an hour, the federal minimum wage for tipped workers. Seven of the ten lowest paying jobs in America are restaurant jobs, resulting in food service workers having twice the food stamp usage and three times the poverty rate than the rest of the U.S. workforce.

GESUNDHEIT Two-thirds of all food workers report cooking or serving food when they are ill — most food service workers don't receive paid sick leave and can't afford to miss work. The public health implications are quantifiable: 90 percent of food-borne illnesses in the United States can be traced back to sick food workers.

RUBBISH Tomato waste is full of untapped nutritional goodness, yet every year around four million tons of tomato by-products are tossed out in Europe alone. Researchers have found that the skin and seeds could be a nutritious food additive. A new process for removing impurities from tomato sludge could also keep mountains of tomatoes out of the waste stream.

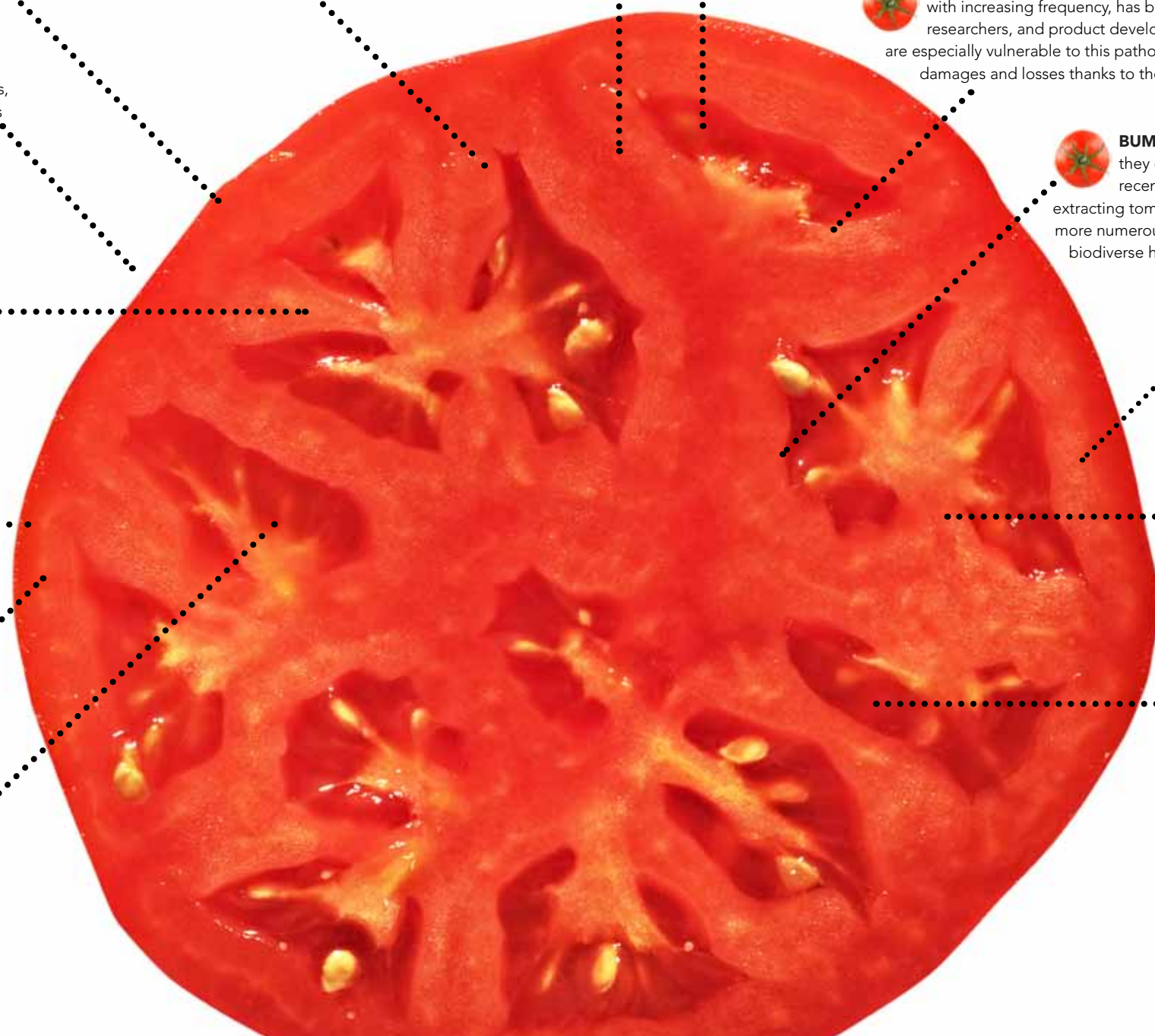
FIGHT THE BLIGHT Late blight, a disease that has been plaguing East Coast tomato plants with increasing frequency, has been monitored and managed with the help of plant breeders, researchers, and product developers. Organic growers, who do not use chemical fungicides, are especially vulnerable to this pathogen, and many have successfully avoided blight-caused damages and losses thanks to the creative work of plant pathologists and biologists.

BUMPER CROP Honeybees don't pollinate tomatoes because they can't get the pollen, and the flowers don't produce nectar. But recent studies show that many native bees know the trick to extracting tomato pollen, and the plants they pollinate produce larger and more numerous fruit. Growers can attract more native bees through biodiverse hedgerows and intercropped planting.

BLISSSED OUT Michael Moss's 2013 *New York Times Magazine* story about engineered food brought widespread attention to the "bliss point," a magic combination of salt, sweet, and flavor common in marinara sauce formulations and snack foods. The taste compels eaters to want more, even if they aren't hungry.

HEALTHY KIDS In 2010, the U.S. Congress passed the Healthy Hunger-Free Kids Act, which updated the rules regarding the nutritional standards of the National School Lunch Program (NSLP) and other child nutrition programs, resulting in increased access to fruits and vegetables for millions of children.

LUNCH LINE No, the USDA didn't literally declare pizza a vegetable in the final 2012 rule on the NSLP nutrition standards. Rather, the ruling over-valued the portion size of tomato paste that constitutes a vegetable serving, keeping it possible for pizza manufacturers to produce a product that schools can declare as containing one vegetable serving.



Compiled by Ann Brody Guy with Maywa Montenegro and Sally Smyth
TOMATO PHOTOS: iStockphoto

The goal of the BFI is, in part, to disrupt the normal pace and process of academia by putting researchers in contact with people outside of their comfort zone.

has a more ethereal but no less challenging measure of success. Recognizing that experts tend to be immersed in their own disciplines, De Schutter says that “success is to be measured by the opportunity for each faculty member involved to revise their assumptions as to the magic bullet they believe they hold in their hands.” (See *Defending the Right to Food*, page 13.)

Global and Social Approaches

Magic bullet is also a good way to describe the relationship that a lot of Americans have to their food. This fruit will make me live forever; that grain will make me skinny. Research-based food trends like pomegranates or the Paleolithic Diet occasionally net some value for people with the time, education, and money to ponder every morsel. But for the vast majority of the world’s eaters, such concerns are out of the question. And that’s why the issue of social justice is integral to food.

“There are two food systems in this country,” says **Maria Echaveste**, BFI executive committee member and the policy and program development director at Berkeley Law’s Institute on Law and Social Policy. “If you’re wealthy, you can afford to purchase food that’s organic, that has less pesticide residue, that’s



Alastair Iles

less processed. It just costs more. And then there’s the food that’s mass-produced and cheaper, but has deep implications for both health and society.” And the problem only broadens as you look outside the United States. “I fundamentally believe that the fights 100 years from now will be about food and water,” Echaveste continues. “Those places that figure out how to produce food in a sustainable, regionalized way are simply going to be more successful.”

Even when it comes to local issues, massive numbers of stakeholders present a dizzying array of interests and ideologies that are not always in alignment. UC Berkeley has not been immune to conflict. Over the past two years, in a well-publicized dispute, urban gardening activists repeatedly broke into the Gill Tract — a patch of land in Albany that CNR scientists use for agricultural research projects — to cultivate the soil and advocate for more community-oriented use of precious urban agricultural land. The University, which owns the plot and had worked closely with the Albany community on plans to develop land adjacent to the fields, repeatedly spoke in favor of urban agriculture but against the group’s tactics.

Despite these clashes, the BFI’s principals remain committed to involving grassroots voices like the Gill Tract activists in the dialogue, including inviting three members of the group to participate in the May symposium. The activists were constructive voices in the larger discussion, and the convergence struck a small, hopeful step in mending fences and identifying many points of agreement.

“We need a sandwich strategy, a little from above, a little from below,” Jun Borrás, associate professor at the International Institute of Social Studies at



A VOICE FOR FOOD WORKERS

When **Saru Jayaraman** walks into a restaurant, she doesn’t see the same things that most diners do. Sure, she appreciates a colorful salad or an artfully laid table, but her attention is usually drawn toward the man in the back cutting 500 onions a night or the waitress on her feet for 8 hours who, on a slow night, might not break even after her commute and childcare costs. “How great is it to eat an organic, locally sourced meal when the server is being paid \$2 an hour, when they’re being yelled at, or racially discriminated against?” she asks. “How ethical can your meal really be?”

Jayaraman, a labor researcher and activist, was contacted by restaurant workers who had been displaced from the World Trade Center after 9/11. She soon learned that “the largest and fastest growing industry in the country proliferates the lowest paying jobs.” Her interests range from increasing the minimum wage for tipped workers — it has remained at \$2.13 in most states since 1991 — to partnering with the Icahn School of Medicine at Mount Sinai to create ergonomic kitchen workstations. This fall, as one of the Berkeley Food Institute’s first visiting scholars, she’s wrapping it all together in the wide-ranging course *Food Systems Policy*.

But what she’s most excited about is changing consumer demand. Jayaraman, the director of Berkeley’s Food Labor Research Center, remembers when restaurants claimed going organic would ruin them. “Now Walmart [is providing] organic food because that’s what consumers are demanding,” she says. The same can happen with working conditions. Her smartphone app, ROC (Restaurant Opportunities Centers) National Diners Guide, helps people determine which restaurants provide a living wage and fair working conditions.

“I’ve had people tell me, ‘I always thought about the cows and the pigs, but I’ve never thought about the people touching my food.’” Jayaraman says. In the future, she hopes that people will look beyond the end of their forks and understand that you “can’t have good food without good working conditions.”



The Hague, said at the symposium. Academic investigation is often backward-looking, Borrás says, but with the scale and immediacy of the problems currently facing the food system, “we are not interested in post-mortem research.” The goal of the BFI is, in part, to disrupt the normal pace and process of academia by putting researchers in contact with people outside of their comfort zones. The best chance for success, Borrás thinks, is to “marry the sense of urgency of campaigners and advocates with the rigor of the academic community.”

It’s so easy to take what we eat for granted, and yet studying the food system in its entirety is truly a radical act. Thinking about the challenges that the BFI will face, Alastair Iles likes to look at the buildings that house much of CNR. The massive stone faces are engraved with pictures of food: cattle, beehives, bushels of wheat, grapes. And on Hilgard Hall, in stark relief, are words that hearken back to Berkeley’s heritage — and mission — as a land-grant institution: “To Rescue for Human Society the Native Values of Rural Life.”

Iles laments that it’s been a long time since UC Berkeley has been the national leader on issues of food and agriculture. But in the minds of everyone involved, there’s no doubt that the BFI is destined to not just circle back to that early mission but to amplify it and propel the field in new directions. From rooftop gardens to multi-ton fishing vessels, from village councils to the United Nations, from starvation to obesity, questions about the world’s food supply get more complicated by the day. In taking on what may be the signature issue of our era, the Berkeley Food Institute is as ambitious in its appetite as it is hungry for change. **311**

WASTE NOT: A new startup co-founded by two Berkeley alumni is doing its part to end food waste and hunger in the United States. The website and mobile app, *Feeding Forward* (www.feedingforward.org), connects people with excess food to human-service organizations in need, according to Zoë Wong-Weissman '13, the group’s communication specialist.



WHAT'S NEXT FOR THE FOOD MOVEMENT?

Join us for a conversation with former USDA Deputy Secretary **Kathleen Merrigan** and author and professor of journalism **Michael Pollan** with reporter **Linda Schacht**.



Thursday, November 14, Wheeler Auditorium, 7 p.m. Doors open at 6:30 p.m. Free; seating is on a first-come basis.

THE Horace Albright
LECTURE IN CONSERVATION

PHOTOS: Kathleen Merrigan, USDA; Michael Pollan, Fran Collin; Alastair Iles, Jim Black

The New Naturalists

UC's California Naturalist Program is integrating citizen science into conservation

By Ann Brody Guy

“**B**irds are mobile indicators of ecosystems,” wildlife biologist Walter Clevinger tells a group of California Naturalist students bundled against the early-morning cold. At 7:15 a.m., the group had just crunched across a frosty meadow at Sagehen Creek Research Station, 10 miles northeast of Truckee, to check netting for ensnared birds. “They need food, cover, and water just like us. They help us understand how these meadows are changing and what’s causing the changes.”

Back at the picnic table that serves as a temporary classroom, Clevinger pulls a tiny dusk flycatcher out of a cloth sack and leads students through a series of procedures. He measures the wing and beak and determines the sex by blowing the feathers up on the belly — a female’s breast, reddish from increased blood flow, will “unzip” to help warm the eggs. The bird looks peaceful as it submits to Clevinger’s steady grip, resigned to the intimate transaction between species. He attaches a tag to its leg and releases it.

Next to him, Jen Cubias grips a pencil and clipboard through thick gloves and records information. The self-declared “bird nerd” has been volunteering at Sagehen this past summer, helping Clevinger gather data that is part of a national study on bird

survivorship. She took the 10-week California Naturalist course herself the previous summer, earning one of the new statewide program’s first certifications, which are issued by the University of California Cooperative Extension (UCCE), a land-grant educational outreach organization that is best known for running the 4-H Club and Master Gardener programs.

Sagehen’s summer course is just one of ten being offered across nine California counties this year as the new program emerges from a yearlong pilot to scale up across the state. Other states, like Texas, Minnesota, and Virginia, have thriving naturalist trainings, but California’s is destined to be the biggest in the United States, and it’s an early adopter in a new trend to redefine naturalist work, merging conservation with public participation in scientific research, known as citizen science.

“Contributing to scientific research is a relatively new option for people wanting to volunteer for conservation,” says **Heidi Ballard**, Ph.D. ’04 Environmental Science, Policy, and Management (ESPM), a professor of education at UC Davis and principal investigator on a National Science Foundation (NSF) grant that supported the integration of citizen science into the program’s curriculum. Aspiring naturalists can choose

research participation — stewardship and education are the other options — for their service hours, which their local course providers may either suggest or require.

Keeping It Local

Before citizen science could be included in the naturalist curriculum, a structure had to be created for a state with an enormous diversity of people, institutions, and ecological systems. **Adina Merenlender**, the program’s co-founder and a Cooperative Extension specialist affiliated with ESPM, says she and co-founder Julie Fetherston, a former UCCE county advisor, addressed those challenges by using a “course in box” approach that allows partner organizations to tailor it for their own localities.

“We’re a big state — 38 million people. We also have more bioregions than any other state, a lot of environmental issues, and a lot of institutions — museums, gardens, outdoor education groups — so it took us a while to ground-truth the whole thing,” explains Merenlender. A year-long soft launch gave her and co-authors Deborah Edelman and Greg de Nevers valuable user input on an early draft of *The California Naturalist Handbook*, the official course textbook, published by UC Press this year, and helped them learn how best to implement a collaborative, trainer-to-trainer model.

Left: Retired geologist Gary Raines leads naturalist students on an all-day field trip. Right: Walter Clevinger blows on the belly of a dusk flycatcher to determine its sex.

PHOTOS: Courtesy of Paul Kirchner Studios, all rights reserved

Partner organizations adjust the training to their local ecosystem and, by doing their own instructor and student recruitment, tap local expertise and serve their respective communities. UC provides the curriculum materials and the handbook and qualifies each institution and teacher to ensure that UC’s high standards and science-education goals are met.

“We cover a lot of management of natural resources and environment issues,” Merenlender says. “What are natural resources? What are California’s major ecosystems? The curriculum could come right from ESPM — physical sciences, ecological and biologic science, and environmental issues in policy and management.”

Redefining the Naturalist

The mix of summer students at Sagehen reveals a lot about the program and its potential ripple effects across the state, for both scientific research and the burgeoning community of certified naturalists it is producing. Some had strong science or education backgrounds. Young people and soon-to-be-retirees were looking toward first or second careers. But they



Adina Merenleder

PHOTO: Lauralyn Curry-Leech

all shared a mission to align their lives with their passion for the outdoors.

The enthusiasm is palpable on an all-morning geology field trip that is a nonstop frenzy of looking, touching, sniffing, photo-snapping, notebook-scribbling, and attempting to identify every rock, tree, wildflower, and bug along the trail. Gary Raines, a retired geologist from United States Geological Survey who is leading the hike, approves. “What we’re doing here is wandering intelligently instead of wandering aimlessly,” he explains as he guides students through some detective work to discern the movement of an ancient glacier.

Not surprisingly, the course is a magnet for teachers, and its effects will be felt in the schools as the program grows. “We have this nature trail and basically people just go for walks on it, but no one really understands what’s there,” says Laura Griffin, a third-grade teacher from Grass Valley.

“What we’re doing here is wandering intelligently instead of wandering aimlessly.”

Gary Raines

She plans to use her training to create a teacher’s field guide for the trail. Lynn Hori, a retired high school teacher from Palo Alto, wants to help kids connect what they are learning in biology to the world outside the classroom. She’s focusing her capstone project, required for certification, on a stewardship program she plans to implement in her former school district.

Chauncey Parker emerges as the go-to person for the names of the various species. He should know — currently an outdoor educator for Gateway Mountain Center in Nevada County, he has been doing naturalist work since he was 15. He took the program to mingle with the experts and build a network of colleagues.

In college, **Janet Zipser Zipkin**, Haas ’74, M.B.A. Haas ’76, a UC Berkeley business alumna now retired from a marketing career at Stanford, used to play volleyball with classmates who were studying forestry and the environment. “I’d say, ‘hey, look at that butterfly that flew across the net, that’s a ... ,’ and they’d say, ‘what are you doing in business school?!’” Zipkin remembers. “Well, I had my career and raised my kids and now I get to do what I’m passionate about. Don’t you just *love* it? It’s like camp for grown-ups.” On the board of the Truckee-Donner Land Trust, she already has the passion and commitment, so the program’s basic science and naturalist skills are “exactly what I need. I’ll make a better board member because I understand the land better.”

Griffin says the course, and especially its citizen science component, has also given her the confidence to get more involved in volunteer research. “We have a lot of groups like that in Nevada County, but I wasn’t quite ready to jump in. Now I feel like I can do that.”

A Community of Doers

That’s just what Ballard and Merenleder, who also worked on the NSF grant, had in mind. The latest cool app may make the evening news, but, Ballard says, “public participation in scientific research has been going on for 20 years before the Web and app revolution.” For example, teams of people can adopt a stream to do water-quality monitoring. “The naturalist program is helping make all these different kinds of



projects available and training naturalists to participate.”

Ballard developed a database that makes finding a project as easy as deciding what you’re interested in. It’s searchable by keyword and organized by county to facilitate community-based activities.

In addition to locally based groups, a larger community of newly certified naturalists is growing, lively, and vocal. “What we’re learning from the early pilots is that the first thing they want to do is participate,” Merenleder says. “They get 10 weeks of training, they get certified, and they want to do more. They want to do service. They want to interact with each other. They want to get more information on nature. They’re real doers, and at Cooperative Extension, our work is about galvanizing that energy.”

Case in point: Kaitlin Backlund was so inspired when she finished her certification last summer that, at the suggestion of Sagehen’s directors, she developed a workshop on the online database iNaturalist, which she gives to local volunteers as well as naturalist students.

Working the Networks

Via the website or mobile app, people anywhere in the world can upload photos and the GPS locations of species to the iNaturalist database and confirm each other’s sightings. Developed as the master’s thesis of

Students gather in the outdoor classroom at Sagehen Creek Research Station, near Truckee, Calif.

PHOTO: Courtesy of Paul Kirchner Studios, all rights reserved

three UC Berkeley School of Information students, iNaturalist is now approaching 20,000 registered users and has been adopted by the California Naturalist Program as its official data repository and online journaling tool.

But iNaturalist is just a tool. “The reason people do citizen science is because it’s social, fun, and people can contribute to something they care about,” Ballard says. “It’s one thing to be social online, but even better when it’s social in person, outdoors.”

That social aspect makes citizen science and naturalists the perfect marriage. With this burgeoning new community — both live and virtual — California is only beginning to feel the new wave of activism as the program looks ahead to its third year. **311**

CONNECT WITH THE NEW NATURALISTS

Learn about the California Naturalist Program: ucanr.edu/sites/UCCNP

Find a citizen science project in your county: ucanr.edu/sites/UCCNP/California_PPSR

Sign up for iNaturalist: www.iNaturalist.org

TRANSFORMING RENEWABLE ENERGY

PH.D. CANDIDATE, ENERGY AND RESOURCES GROUP

CARLA PETERMAN

When Carla Peterman was in high school, her older brother gave her a copy of *A Sand County Almanac*, by Aldo Leopold. Published in 1949, a year after the famed ecologist died, the book became a cornerstone of the American environmental movement. By the time Peterman got to it, it had been out for nearly five decades, but its message lit a spark that still burns — even if numbers and policies weigh more on her day to day than the flora and fauna that concerned Leopold.



By Nate Seltenrich | Photographs by Jim Block

“It gave me an appreciation of the different human and biological systems and the impact we can have on the earth, and therefore the importance of responsible resource management,” explains Peterman, a Ph.D. candidate in energy and resources. “That’s how I developed my own environmental ethos.”

Peterman, who at 35 holds an M.S. in environmental change and management and an M.B.A. from Oxford, and has conducted research at Lawrence Berkeley National Laboratory and the University of California Energy Institute, draws a direct line from that revelation to her current position on the California Public Utilities Commission (CPUC), where she serves as the lead commissioner for storage and alternative transportation. It’s a role that has everything to do with responsible management of our state’s resources — including money.

“The broader picture is that as governments and states pursue clean-energy policy, they’re looking for the most effective policies to drive down the cost,” Peterman says. “The funds are finite, so it’s important to be deploying them in an effective manner.” That’s where she comes in.

Peterman was a commissioner at the California Energy Commission when Governor Jerry Brown appointed her to the five-member CPUC in January 2013, for a six-year term. This summer she served as the mastermind and public face of a high-profile proposal to stimulate the energy-storage market in California through procurement targets — much like those in the state’s renewable portfolio standard, which directs utilities to purchase 33 percent of their power from renewable sources by 2020. In this role, she proposed that by 2020 the state build 1.3 gigawatts of storage, or roughly 3 percent of average peak load.

For Peterman, the two goals work hand in hand and for more than the simple reason that they’re pinned to the same year. “There’s been a growing appreciation that as you introduce renewables, you have to introduce other technologies that can keep energy at a constant flow,” she says. Due to renewables’ intermittent production and their dependence on weather, wind, and solar, the plants lack some of the convenience of natural gas plants, which provide steady baseline power and can be fired up at will.

Fitting energy storage into the grid will help smooth renewables’ power curve and allow them to stand alone, rather than lean on backup gas generators. “Storing energy allows us to use it at higher-value times without creating the air emissions you would have from burning fossil fuels,” Peterman says. “The technologies are emerging, so they are high cost. But they are also high benefit.”

California is the first state to propose energy-storage targets, making Peterman’s work groundbreaking, not just at home but nationwide. The markets energized by California’s new policies could likewise spill over state lines.

California is the first state to propose energy-storage targets, making Peterman’s work groundbreaking, not just at home but nationwide.



Left: Peterman in her office across from San Francisco City Hall. Above: A contest-winning student poster about conservation.

Peterman’s proposal was under review over the summer and should be finalized this fall. Meanwhile, she’s also overseeing CPUC initiatives to integrate electric vehicles into the grid, electrify heavy- and medium-duty transportation, including at ports, and remove market barriers to biogas energy, in addition to other proceedings around telecommunications, railroads, water, and natural gas.

“I’m lucky to have the vantage point I have because I get to learn about all these different topics and see the connection,” Peterman says. Her Energy and Resources Group (ERG) studies — her dissertation addresses the impact of public policy on renewable energy costs — have reinforced the notion that there’s no single solution to the state’s air-quality and climate-change issues. A colleague once told her that being an ERGie means being the mortar that holds the bricks together in a building. “Having an interdisciplinary education allows me to play that mortar role.”

“It’s an exciting time to be in energy,” Peterman continues, revealing the passion that first set her on this path. “You can make a difference.”

Q&A Talks to the World Bank

A few of CNR's many alumni working at the World Bank tell *Breakthroughs* about their development efforts, international lifestyles, and contributions to the World Bank's goal of reducing poverty.



Tracy Hart

M.S. '93, Ph.D. '97 Agricultural and Resource Economics
Senior Environmental Specialist

Behind the title: I currently work in Jordan, Palestine, Yemen, and Iraq as the environmental team member on water supply and wastewater treatment projects. I work in that nexus between water and environment, addressing questions such as what environmental impacts does the desalination process have; how and where should we reuse treated wastewater; and how are increased water supply and wastewater flows affecting aquifers.

Addressing poverty: I tell my daughter and my friends that I work to get more water and cleaner water to poor people. In the Middle East, like the western United States, water

is scarce everywhere. Cleaner water has immediate health impacts, and more efficient uses of water effectively create more water. Often I am working with transboundary waters — resources shared by two or more countries — and countries benefit by negotiating how much water each will use, and how much water-based pollution each one intends to dump. This requires diplomatic skills as well as technical ones, and those diplomatic skills are the ones I am developing more fully later in life.

Memorable project: I worked on a 10-year project to increase the percentage of access to fresh drinking water for rural Ghanaians. Over that decade, the number of rural Ghanaians with access to clean water improved from 35 to 45 percent, and the project all but eliminated river blindness throughout most of Ghana. The Ghanaians working in the Community Water and Sanitation Agency were the heroes, and I remain proud to have worked alongside them. To this day, I consider Ghana to be my second home and my co-workers there as lifelong friends. The 10-year perspective provided the insight that forward progress is slow, and in the immediate, one must trust that hard work will eventually yield results.

Development priority: *Even though I work in water, I am convinced that the most pressing development need is to increase girls' participation in schools.* Higher education attainment for women leads to a stronger valuation of the role of education for both girls and boys in the household. It contributes to more informed health decisions, including contraceptive health, and leads to a more-fully informed workforce. The trickle-down impacts of this one intervention are so wide that it is a key, if not the key, to improving livelihoods.

CNR influence: I can honestly say that every week I use analytics learned in my second-year natural resource and environmental economics course sequence (261 and 262)



Tracy Hart on a visit to New York City



Left to right: Gero Carletto during a field visit in Zanzibar, with Othman Haji Mwalim, Fatma Abdalla Amour, and Salama Abeid, extension officers from the Ministry of Agriculture. The group is conducting research on the measurement of cassava yields.

PHOTO: Raka Banerjee

as well as **Michael Hanemann's** Water Resource Economics course, which was fundamental in narrowing my technical expertise to drinking water, irrigation water, water quality, and the management of transboundary waters.

Stand-out journey: I was working in Abidjan, Ivory Coast, during a failed coup attempt in 2002. Food and water were running out, domestic TV and radio were down, and the only news we were getting was from BBC radio. After waiting for the unrest to blow over (it didn't), I finally decamped and took a hotel bus to the airport. During that bus ride through Abidjan, I saw houses burning, stores looted, and mobs with machetes covered in blood and bandanas over their noses and mouths. At the airport, the goal was a one-way ticket to anywhere, paid in cash, plus some "extra donation." I witnessed a lot that day that I hope never to see again.



Gero Carletto

M.S. '91, Ph.D. '96 Agricultural and Resource Economics
Senior Economist, Development Research Group

Behind the title: When my daughters were little, I had the hardest time explaining to them what my job was. For a five- and seven-year-old, their dad was "traveling all the time in strange places, collecting information on stuff, and study-

ing things." They are teenagers now and describe my work in exactly the same way. I manage the Living Standards Measurement Study (LSMS), a program in the Development Research Group to support methodological improvement in household surveys and strengthen developing countries' capacity in collecting high-quality data to adequately inform policy-making. For that, I travel all the time in strange places, collect information on stuff, and study things.

Poverty reduction: Household surveys modeled on the LSMS are the backbone of much of the analysis carried out at the World Bank and beyond in support of developing countries' efforts to eradicate poverty. For more than 30 years, the LSMS team has worked toward advancing the poverty agenda by improving the measurement and our understanding of poverty. The Bank's president recently announced new goals of eradicating extreme poverty and promoting shared prosperity — goals that call for a renewed effort in improving both the availability and quality of poverty data. The LSMS will continue playing its role to ensure that anti-poverty policies and programs are informed by the right data.

Eye-opener: On my first visit to Somalia in the late 1980s, I was barely 25, working for the United Nations. The Somali government had carried out a population census a few years before, but some "glitches" kept the National Statistical Office from completing the data processing, which in those days was done on a computer mainframe. My mission: Find

out what abstruse technical problem was delaying the data release, and get the data processing finalized. Armed with the right academic background and lots of enthusiasm, I land in scorching-hot Mogadishu. After only a couple of days, the solution was clear: sweaters! The data entry room, which had to be kept cold for the computer mainframe to work properly, was too cold for the staff members who wore Somali weather-appropriate shorts and sandals. This caused high absenteeism and paralyzed data entry for months. In that project, and in many more after that, I ended up using my common sense and ingenuity as often as my academic preparation.

Jet-set life: I am on a plane right now. I was on a plane two weeks ago. I will be on another one next week, and in three weeks time. But after 25 years of traveling, I still love it. What I find particularly rewarding is being immersed in one culture at noon and in a completely different one at 9 p.m. The challenges? Being away from my family for long stretches of time and always missing Pearl Jam every time they come to town.

Standout journey: Probably the most interesting place I visited was Iraq in the mid-1990s, between the two wars. I visited twice and traveled to every little corner of the country, from Al Faw in the south to Sulaymaniyah and Dohuk in northern Kurdistan. Absolutely fascinating ... and awfully sad. The situation was so dire that in many markets across the country you would find people selling pieces of their homes: bricks, windows, and doors, even rebar removed from concrete. Most places in Africa are certainly poorer (no windows in their homes to sell), but in Africa you get a sense that people are used to hardship. Iraq's middle class and professionals clearly were not prepared.



George C. Ledec

Ph.D. '92 Wildland Resource Science
Lead Ecologist, Africa Region

Behind the title: My role is to promote environmentally sustainable development in general, and biodiversity conservation in particular, within Bank-supported development projects, studies, and policy advice to governments. Most of my work now focuses on the sub-Saharan region; during 1990–2009, I was based in the Latin America and Caribbean region. I work with specific infrastructure, such as water supply and electric power, and natural resource-management projects to help ensure that they comply with the Bank's environmental policies, including Natural Habitats Policy. I also lead and contribute to analytical studies, such as one now underway on biodiversity offsets.

Addressing poverty: Lasting poverty reduction requires sustaining key natural resources, especially biological ones. Millions of poor people depend on fish and other wild foods, timber, fuelwood, and medicinal plants harvested

from natural ecosystems. Millions more, especially in rapidly growing urban areas, depend on the ecosystem services generated by natural habitats, including maintaining water supplies, protecting infrastructure from sedimentation, and minimizing damage from floods and coastal storms. Natural ecosystems also mitigate climate change by storing massive amounts of carbon in vegetation and untilled soils, as well as helping people (rich and poor) adapt to climate change by buffering the effects of increased climate variability and rising ocean levels.

Eye-opener: While working on the World Bank publication, *Greening the Wind: Environmental and Social Considerations for Wind Power Development* (2011), I found eye-opening the amount of push back from some of the wind industry, and even from environmental organizations, to the idea that wind — like all large-scale power-generation technologies — has significant environmental impacts that need to be addressed in project planning, construction, and operation. This study enabled me to verify the impacts of land-based wind power on birds, bats, and natural habitats, along with key mitigation measures that have yet to be consistently applied in most countries, including the United States.

Global perspective: Being in a global organization facilitates knowledge-sharing across countries and regions. For example, I work with a project in Burundi that is applying lessons learned from Ethiopia, Colombia, and El Salvador about the benefits of shade-grown coffee (versus open-sun coffee) for biodiversity and erosion control, as well as improving coffee quality and farmers' incomes.

Development priority: The most pressing need for developing countries is to improve the quality of life of their citizens in ways that are environmentally and socially sustainable. Environmental sustainability means using fresh water, soil,



George C. Ledec



Jean-Jacques Dethier on a recent visit to Bremen, Germany

forests, and fisheries without losing or degrading them, maintaining viable populations of wild species, and keeping carbon emissions within reasonable limits. This is, of course, also a challenge for developed countries. **However, developing countries have yet to build much of their infrastructure, so they have opportunities to develop more sustainably and avoid repeating some of the environmental mistakes made by developed countries.**

Standout journey: One that especially stands out for me is Hong Kong. It is one of the world's most densely populated territories, yet close to 70 percent of its land area is green space, including Mai Po, a world-class coastal wetland reserve, and Tai Po Kau, a forest reserve with recovering native wildlife populations. The area still faces major environmental challenges, but it shows what can be achieved with adequate planning and management.



Jean-Jacques Dethier

Ph.D. '85 Agricultural and Resource Economics
Research Manager

Behind the title: I manage the Research Support Budget, which is like a mini National Science Foundation for the World Bank. Staff members from all over the Bank send me research proposals in all possible areas: health, education, infrastructure, finance, etc. I select external reviewers to evaluate them, and I also review them myself. If they are of good quality, I finance them. I am also in charge of publishing the policy research working papers series on our website, which is very popular worldwide. Also, about a third of my time is dedicated to doing my own research, which lately has been focused on urban sustainability.

Poverty reduction: The World Bank tries to influence development by financing projects and programs, but also by producing knowledge that can assist in reaching our goals, especially poverty reduction. By financing good research on

all the dimensions of poverty alleviation — social policy, health policy, education, empowerment, etc. — we contribute to that goal.

Memorable projects: When I worked in operational jobs in Africa, the Middle East, and Eastern Europe, I managed the first-ever project to Albania when it opened up during the transition to a parliamentary system in 1992. The country was in shambles; overloaded electricity transformers in the streets of Tirana were exploding in front of our eyes; there were 30 cars in the entire country when we first went there; there were no spare parts for anything. So we did an emergency loan to fix the most urgent issues in energy, agriculture, and transport. I worked closely with Ministry of Finance and Central Bank staff, who were excellent and very dedicated, and I traveled extensively in the country. I genuinely had the feeling that my work was useful and appreciated by the Albanians — and that's a great feeling! The most intellectually stimulating work I did was with Nick Stern, now Lord Stern, which resulted in a book that I co-authored with him, *Growth and Empowerment: Making Development Happen* (MIT Press).

Development priority: The most pressing need for poor countries is economic growth. Poverty rates have literally collapsed in the last 20 years or so — in large part because most of the poor were in China and India, two countries that have done well. Poverty rates collapsed largely because developing-country growth accelerated over the last 10 years. **But there is no point in having high growth rates if they are achieved at the price of destruction of the ecosystem — if CO₂ emissions increase and biodiversity is destroyed.** In my view, the most pressing need is to focus on “green growth” and the consequences of climate change.

CNR influence: Without a doubt, the biggest influence on my professional life has been Professor **Alain de Janvry**. Not only has he been a mentor and a friend throughout all these years, but he has also shaped my way of thinking. Alain is for me the model scientist: honest, hard working, dedicated, and incredibly sharp. He is also a wonderful human being. **31**



A Force Behind Berkeley's New Food Mission

PHOTO: Lauralyn Curry-Leach

Bob Epstein's kids are picky eaters. You wouldn't think he'd pay much attention though, since both of his boys are grown and out of the house. But it's not about turning up their noses at a specific dish. Instead, the Epstein family's preferences run more toward a massive overhaul of the whole world's food systems.

As a co-founder of five companies, including software giant Sybase, Epstein, B.S. '74, M.S. '76, and Ph.D. '80 Electrical Engineering and Computer Sciences, is not somebody who is afraid of big challenges. So when Bob, his wife Amy, and their children came to a consensus that they wanted their family foundation to focus on food, he immediately set to work. They gave themselves three goals: establishing an institute for the study of food, working on access to quality food for K-12 students, and eliminating antibiotics in healthy animals within 10 years. If that sounds like a lot to handle, Epstein seems unfazed. "I'm just determined," he says. "Not unreasonably optimistic. That's the essence of being an entrepreneur: If you can get the subject under your own control, you can solve it."

In addition to the family foundation's initial contribution to the **Berkeley Food Institute** (see "Reconstructing the Global Food System," page 10) of \$75,000 and ongoing funding of \$50,000 annually for four years, Epstein is taking a remarkably hands-on approach to getting the new institute off the ground. "Bob is a force of nature," says **Henry Brady**, dean of the Goldman School of Public Policy, where Epstein serves on the board of advisors. "I know few people who are better at defining what they want to do and then figuring out how to get there."

Epstein has been involved with the BFI from the very beginning, and he estimates that he works about one-quarter time

on the project. Not only has he been incredibly successful at soliciting new donors, but his entrepreneurial instincts and corporate know-how have been invaluable to an institute that seeks to stretch beyond the traditional boundaries of academia.

Despite his successes, which include helping secure additional seed funding from the 11th Hour Project of the Schmidt Family Foundation, Epstein calls food "the hardest thing I've ever worked on." And that means a lot coming from a man who shepherded two anti-global warming bills through California's legislature by way of Environmental Entrepreneurs (E2), a group he founded. Unlike with software, "You can't solve the problem just by changing the product," he says. "We need food to come from natural sources."

Difficulties aside, Epstein sees food as a potentially unifying issue in this age of political division. "Here's the opportunity to build something that has broad political strength rather than polarization," he says. "Nobody wants to eat poison." And that's something that even the fussiest eaters can agree on.

— ZAC UNGER

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Photo by Mark Lanning

A Soweto, South Africa, customer of Wonderbag, a heat-retention device that continues to cook food after it's removed from the stove, saving users water, fuel, and time. The company says that when scaled up globally, the product will reduce carbon emissions, deforestation, and indoor air pollution, and improve the lives of girls in developing countries, who are often pulled out of school to forage for wood. This summer, students from the Berkeley Master of Development Practice researched the company's potential. (See On the Ground, page 6.)

PHOTO: Courtesy of Wonderbag



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