

**UCDAVIS**

**COLLEGE OF AGRICULTURAL  
AND ENVIRONMENTAL SCIENCES**

# OUTLOOK



**MAGAZINE**

FALL/WINTER 2019

## *Advancing* **HEALTH**

Exploring ways to keep communities strong



Dean Helene Dillard

## From the Dean

New leadership supports environment, healthy communities

### IT TAKES COLLABORATION

and teamwork to address the complex issues that face society and to make sure people have access to good nutrition, clean air and water, health services and other resources they need to live healthy, productive lives. Our college is dedicated to working with communities, fellow researchers and industry to solve real-world challenges so that, together, we can build a better world for us all.

Two new members of our college leadership team will help us provide the science, innovation and talented graduates that communities need to prosper. I am pleased that Professor Patsy Eubanks Owens, an expert in landscape architecture and environmental design, and Professor Marcel

Holyoak, an ecologist and instructor in environmental science and policy, have joined our team.

Professor Owens is our new associate dean for human and social sciences, and Professor Holyoak is our associate dean for environmental sciences.

Owens joined the UC Davis faculty in 1990 and has served as chair for both the Departments of Environmental Design and Human and Community Development, as well as the inaugural chair of the Department of Human Ecology. Owens' research focuses on the relationships between people and the outdoor environment. She examines the role of the physical environment in the development, health and well-being of youth and methods of community involvement in design decision-making.

Owens' leadership style is much like her approach to conducting community-based design. She believes in listening and respecting



Professor Marcel  
Holyoak



Professor Patsy  
Eubanks Owens

the views of those who have intimate knowledge and personal investment in the decisions under consideration. Her commitment to mentorship, diversity and scholarship will help our team meet the needs of communities across the globe.

Holyoak comes to us with a deep dedication to the role environmental science and policy can play in promoting sustainable environmental management, social equality and healthy communities. He became a faculty member in the Department of Environmental Science and Policy in 2000 and served as department chair from 2016 to 2019. Over the last several years, Holyoak has worked extensively to increase course offerings and programs in environmental and social justice.

Holyoak's research focuses on the effects of global change on animal populations and communities, and the maintenance of biodiversity in natural ecosystems. His work contributes to the conservation of imperiled species in California, and in understanding changes in biodiversity in response to global change. He has broad training in biostatistics, theoretical ecology and experimental design, and significant experience in interdisciplinary environmental and social science.

With Owen's and Holyoak's vision and leadership, our college will continue to provide the research, engagement and resources communities need to thrive.

HECTOR AMEZCUA/UC Davis

## OUTLOOK MAGAZINE FALL/WINTER 2019

Dean  
Helene R. Dillard

Director of Communications  
Caren Weintraub

Writers  
Diane Nelson  
John Stumbos

Photographer  
Hector Amezcuia

Designer  
Lisa Wells

Digital Editor  
Stephanie Perla

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To update your address or to subscribe:

email:  
[outlook@agdean.ucdavis.edu](mailto:outlook@agdean.ucdavis.edu)

phone:  
530-752-8673

mail:  
Outlook Magazine  
Dean's Office, CA&ES  
One Shields Ave.  
Davis, CA 95616-8571

### ON THE COVER

Farmer Richard Bennett peels a tangerine in an orchard across from his home in Exeter, California. CA&ES researchers are working with farmers like Bennett to save citrus from a devastating disease that has now reached California, where much of the world's fresh citrus is grown.

COVER PHOTO BY:  
JOE PROUDMAN/UC Davis

## Delivering health and well-being

Our college is committed to supporting vibrant communities. On virtually any day, you will find students delivering fresh produce to underserved communities, for example, and faculty working with diverse groups to explore ways to improve the air we breathe, the food we eat, the water we drink and the neighborhoods we call home. In this issue, we feature efforts to save citrus, promote food safety, protect air quality after wildfires, enhance child development and a host of other projects to foster health and well-being.

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Skyler Zapata, an undergraduate major in plant sciences, is one of many students who grow produce at the UC Davis Student Farm to support science and service to the Davis community.

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## GLICK

### TAKES HELM OF DEVELOPMENT, EXTERNAL RELATIONS

Christopher Glick is CA&ES' new assistant dean of development and external relations. Glick previously served as assistant dean of development and alumni relations for the UC Berkeley College of Environmental Design. In his new role, Glick will manage a multifaceted program that includes development, stewardship and external engagement. As a member of the Dean's Policy Council, Glick will provide leadership, strategic planning and implementation for all college development activities.

## Finding Solutions to Rural Poverty

UC Davis will lead a new global research program to build and test ways to overcome some of the biggest challenges for lifting and keeping rural families out of poverty in developing countries.

The Feed the Future Innovation Lab for Markets, Risk and Resilience received a five-year, \$30 million grant from USAID to study the root causes of poverty and food insecurity with emphasis on recurring risks from disasters like drought, flood and conflict.

"As global development efforts continue to improve, we still see humanitarian disasters that strip rural families and communities of hard-won gains," said Michael Carter, the innovation lab's director and a professor of agricultural and resource economics at UC Davis. "We will provide needed evidence on how to accelerate those gains and to ensure they stick."

You can read more at [caes.ucdavis.edu/MRR](http://caes.ucdavis.edu/MRR).

The 31st annual  
**COLLEGE CELEBRATION**

will be held Friday, Oct. 4, 2019,  
from 5:30 to 8:00 p.m.  
at the UC Davis ARC Pavilion.

For more information and  
to purchase tickets, visit  
[caes.ucdavis.edu/events/  
college-celebration](http://caes.ucdavis.edu/events/college-celebration)



GREG MCFAUL/National Oceanic and Atmospheric Administration



EDWARD CHARLES BRUMMER/UC Davis

## *The Science of* **CANNABIS**

Cannabis is available for medicinal and recreational use in a majority of states, but cannabis research has long struggled to keep pace with the law. To bring more scientific understanding of the plant and its products, UC Davis researchers have partnered with a federally compliant pharmaceutical company—Biopharmaceutical Research Company (BRC)—to analyze the chemical and biological profiles of cannabis.

The work will help health care providers, scientific professionals, law enforcement and regulators better understand potential benefits and risks.

Researchers will analyze legally obtained cannabis materials in BRC's labs. There will be no cannabis on campus or any UC Davis-owned or leased property as part of this research.

## New UC Berries

The UC Davis Public Strawberry Breeding Program has released five new varieties that will help farmers manage diseases, control costs and produce plenty of large, robust berries using less water, fertilizer and pesticides. Two of the new varieties could increase yields by almost 30 percent.

"These new varieties are intrinsically different from the ones they replace," said Professor Steve Knapp, director of the strawberry breeding program. "After three years of field tests, we're seeing higher yields, greater disease resistance and better postharvest quality."

The U.S. is the world's largest

producer of strawberries and almost 90 percent of them are grown in California. About 60 percent of the state's strawberry fields are planted with varieties developed at UC Davis.

Each of the new varieties will have its own farming niche—thriving better in certain environments under specific growing conditions. The team anticipates releasing one or two additional varieties in early 2020 that can be planted in the summer and harvested in time for the winter holidays.

For more on this story, see [caes.ucdavis.edu/strawberry](http://caes.ucdavis.edu/strawberry).



HECTOR AMEZCUA/UC Davis

# Decoding Fat to improve human health

By Diane Nelson

**THERE ARE GOOD AND BAD FATS**, nutritionists say. But not all polyunsaturated fats, the so-called good fats, are created equal. CA&ES food chemist Ameer Taha is exploring whether eating too much linoleic acid—a type of polyunsaturated fat found mainly in vegetable oils and processed foods—can cause chronic inflammation, migraine headaches and other health problems.

"Researchers have shown that too much linoleic acid could be bad for the heart," said Taha, an assistant professor with the Department of Food Science and Technology. "My research shows that it might also be bad for the adult brain."

Humans need some linoleic acid to stay healthy, but people in the United States are getting three to six times the amount they need, which can be linked to the nation's appetite for processed foods.

"You can trace the rise in linoleic consumption in North America to the rise in use of soybean and other vegetable oils in processed food," Taha said.

In collaboration with colleagues at the National Institutes of Health (NIH), Taha conducted dietary tests with people who suffer from drug-resistant, chronic migraine headaches. When migraine sufferers reduced linoleic acid

and increased consumption of long-chain omega-3 fatty acids—polyunsaturated fats found in foods like fish—their migraines decreased 40 percent.

Taha has also shown that in rats, too much dietary linoleic acid reduces the brain's capacity to cope with inflammation, which can cause migraines. Taha is now exploring whether excess linoleic acid can affect the developing brain.

## Good fat/bad fat

The dietary fat debate goes something like this: If we replace the saturated fats found in foods like beef and cheese with polyunsaturated fats—like those in vegetable oil—we will reduce our total cholesterol and improve our health.

That's not necessarily so. Christopher Ramsden, a clinical investigator at NIH, has shown that replacing saturated fat with linoleic acid does

not decrease the risk of heart attacks or death, despite lowering blood cholesterol. Taha was a postdoctoral fellow at NIH where he researched linoleic acid alongside Ramsden before joining the UC Davis faculty in 2014.

"Chris and his colleagues went back through data from the 1960s and found that study participants who ate a diet low in saturated fat

**"Replacing saturated fats with vegetable oils such as soybean and corn oil may not be the best strategy."**

and enriched with high-linoleic acid oils reduced their cholesterol by an average of 14 percent, but the low-saturated-fat diet did not reduce mortality," Taha said. "In fact, they found that the greater the drop in cholesterol, the higher the risk of death during the trial."

For healthy fats, Taha says it's better to choose ones that are relatively low in linoleic acid, like butter, olive oil, coconut oil and canola oil, and to consume foods that are high in omega-3 fatty acids, like salmon.

"Replacing saturated fats with vegetable oils, such as soybean and corn oil, may not be the best strategy because it may increase oxidized levels of LDL cholesterol, the so-called bad cholesterol, which can cause inflammation and many health concerns."

## How much is too much?

Researchers haven't yet established how dietary needs for linoleic acid change with age and disease. Taha and his team are developing innovative methods to measure linoleic-acid requirements, looking at how much linoleic acid is secreted by the liver, for example, and how much the heart and brain consume.

"When we measure how much the liver puts into the blood in relation to how much is consumed by organs, we can start to understand how much linoleic acid we should consume when



Food chemist Ameer Taha is studying the effect various lipids have on neurodevelopment.

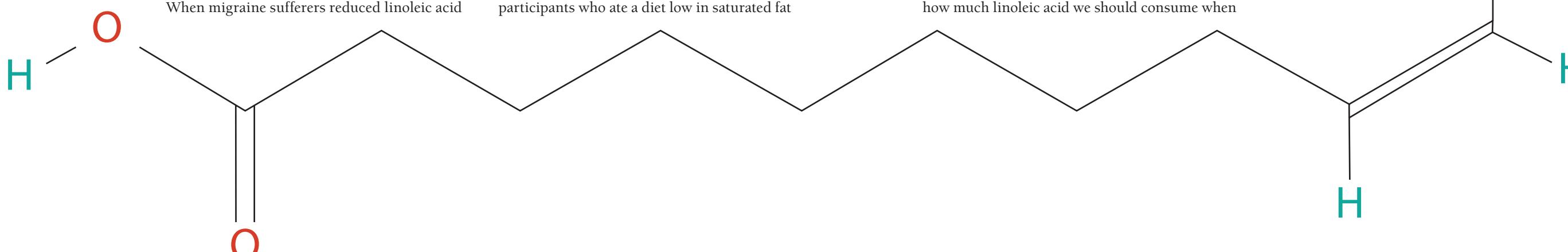
HECTOR AMEZCUA/UC Davis

we're 2 and 20 and 70," Taha said.

Taha is investigating a wide range of lipids like linoleic acid and lipid-like environmental toxins such as pesticides, flame retardants and antibiotics. He's especially interested in the impact these compounds have on neurodevelopment.

In addition to the link between linoleic acid and brain function, Taha is exploring whether a mother's exposure to pesticides can impact neurodevelopmental disorders like autism and whether certain levels of antibiotics in farmed seafood can affect human health.

"When we understand the mechanisms and risks associated with exposure to certain compounds, we can help devise strategies to establish dietary safety limits and improve health and well-being," Taha said. ●





BY JOHN STUMBOS

## What scientists are beginning to learn about emissions from wildland fires

ON NOVEMBER 8, 2018, the deadliest and most destructive wildfire in California history ignited near the Sierra Nevada foothill community of Paradise. The Camp Fire, as it became known, burned more than 153,000 acres, destroyed nearly 19,000 homes and buildings, and killed at least 85 people.

The wildfire's smoke was trapped by a strong atmospheric inversion layer, dispersing it throughout the Sacramento Valley and even into the Bay Area. Air quality became so bad—about 10 times worse than the safety standard for particulate matter in Davis—that the campus closed for an extended period through Thanksgiving.

Environmental toxicology professor Qi Zhang, an air quality expert, recognized a unique research opportunity and went into action.

"I'm interested in biomass burning," she said. "So when the Camp Fire

happened, I stuck tubing outside the window of my lab on the fourth floor of Meyer Hall to collect air samples. I ran those through an aerosol mass spectrometer to measure the airborne particles."

Zhang also conducted a metal analysis with a device called a "Particle into Liquid Sampler" because this wasn't an ordinary wildfire. Thousands of structures and their contents also went up in smoke. Based on initial indications, the smoke contained enhanced levels of heavy metals like copper and iron, but a thorough analysis has yet to be completed.

Meanwhile, Professor Tony Wexler, an engineer in the Department of Land, Air and Water Resources and director of the Air Quality Research Center, was at work with Keith Bein, a researcher at the Center for Health and the Environment, developing a

mobile monitoring system to collect air pollution from wildfires for chemical and toxicological analysis. They couldn't get their mobile unit as close to the Camp Fire as they wanted because officials were keeping people away, but they're geared up and ready to go at the next opportunity.

"People have done a lot of studies on the health effects of wood smoke," Wexler said. "But this is different. It's houses that are burning, too, and we have a lot of stuff in our houses that you wouldn't want to burn and breathe—plastics, pesticides, cleaning fluids and solvents, building materials."

Particulate matter in the atmosphere contains microscopic solids or liquid droplets that are so small they can be inhaled and cause serious health problems, according to the Environmental Protection Agency. Some particles less than 10 micrometers in diameter can get deep into the lungs and some may even get into the bloodstream. Of these, particles less than 2.5 micrometers in diameter, also known as fine particles or PM2.5,

pose the greatest health risks such as cardiac arrhythmias and heart attacks, and respiratory effects such as asthma attacks and bronchitis.

The daily standard for maximum exposure to PM2.5 levels is 35 micrograms per cubic meter of air. During the Camp Fire, levels exceeded 300 micrograms in parts of the region—some of the worst air quality in the world at the time. "That's really hazardous on its own," Zhang said. "When we look more closely at the composition of the particulate matter, it could be even more concerning."

So just how concerned should people be about breathing smoke from wildfires? The concentration of atmospheric pollutants is higher during wildfire events, but Wexler cautions against being alarmist: "The health effects of the anxiety about smoke may be worse than the health effects of the smoke itself. Nonetheless, individuals with asthma and other respiratory conditions are definitely at risk from wildfire smoke."

Susceptible populations, such as

the young, are most at risk. In 2008, a number of wildfires filled the valley with smoke. Lisa Miller, a veterinary medicine professor and researcher at the primate center on campus, studied monkeys born that year and compared them with monkeys born a year later when the air was clear. Her research showed that infant monkeys exposed to wildfire smoke had an immune system with a depressed ability to respond to infectious agents when they became adolescents.

There are other considerations brought by wildland fires burning in areas with homes and other urban development. After the Santa Rosa fires of 2017, local citizens were concerned about the impact of toxic air contaminants on locally grown produce. However, a study with the help of UC Cooperative Extension in Sonoma County found that produce safety was not significantly affected. An analysis of eggs from backyard chickens in the area by the School of Veterinary Medicine found a small percentage of properties affected by

This car and home on Panorama Point in Paradise was among the thousands to burn in November 2018 during the devastating Camp Fire, which produced thick smoke throughout the Sacramento Valley. Researchers collected air samples at UC Davis during the fire to study the contents of the smoke. [caes.ucdavis.edu/news/smoke](http://caes.ucdavis.edu/news/smoke)

HECTOR AMEZCUA/The Sacramento Bee

lead contamination but no obvious association with proximity to wildfire.

Scientists acknowledge there is much to learn about wildfires and the smoke they produce. "Wildfires have become such a common phenomenon," Zhang said. "There are a lot of unknowns when these particles are emitted, what the implications for human health are, and what the implication for the regional climate is. A lot of study needs to be performed." ●

### Plans in place to deal with wildfire impacts

If wildfire smoke descends again upon the campus as it did last November, UC Davis will be ready. Contingency plans have been developed to deal with smoke and other potential wildfire impacts. Learn more about precautions, preparations and policies:

- [bit.ly/Wildlife-Season-Impacts](http://bit.ly/Wildlife-Season-Impacts)
- [bit.ly/UCDavis-Power-Outage](http://bit.ly/UCDavis-Power-Outage)

# SAVING CITRUS



Researchers race to keep citrus in our diets and communities

BY DIANE NELSON

**MOST OF US DON'T THINK TWICE** when we put tasty tangerines in school lunches or make lemonade from the lemons on our backyard tree. CA&ES researchers are working with farmers and state agriculture officials to keep it that way.

"It's hard to beat the flavor and nutrition of citrus," says farmer Richard Bennett, reaching high to pull an orange from a tree near his home in Exeter, California. He peels it in two long ribbons and the fresh scent of zest fills the air. "Citrus is so important to our health and economy. I'm concerned that one day soon we will lose it all, not just here in California but around the world."

California produces 80 percent of the nation's fresh citrus, most of it in small California communities like Exeter. UC economists say citrus production provides \$7 billion to the state's economy, including \$500 million in wages. And oranges are a nutritional powerhouse, ripe with vitamin C, energy, fiber and a wide range of nutrients.

Workers harvest navel oranges in Exeter, California. Most of the world's fresh citrus is grown in small Central California communities like Exeter.

JOE PROUDMAN/U.C. DAVIS

Citrus is threatened by a disease called Huanglongbing or HLB—more commonly known as citrus greening—that has decimated groves in Asia, Brazil, the Dominican Republic and Florida. The disease is now spreading in California.

"If we don't act quickly, we could lose all fresh citrus within 10 to 15 years," says Carolyn Slupsky, CA&ES professor of nutrition and food science. "Losing citrus would be devastating to people's health and livelihoods and even change the way we cook and eat. No lime for our guacamole, no lemon on our fish."

Citrus greening can move with alarming speed. In Florida, the disease was first detected in 2005. Fourteen years later, orange production has fallen by more than 75 percent and grapefruit production is down 85 percent. Backyard citrus has virtually disappeared in some areas.

In California, state agriculture officials have detected HLB in more than 1,500 trees, a number that grows by about 60 each week as officials inspect and remove suspect trees. An infected tree can live for years without symptoms, so the number of dying citrus trees in California may be much higher.

So far, infected trees have been found mainly in backyards in Southern California. Officials say there is no guarantee the pathogen hasn't already spread to commercial groves or to the Central Valley, but they hold out hope.

"Some people believe that citrus in the Central Valley might be spared because of the climate—that the winters are too cold and summers too hot for the insects that transmit the disease," says Associate Professor Neil McRoberts, a plant disease epidemiologist and scientific advisor to the Citrus Research Board of California. "But it looks like the Central Valley temperatures are right at the threshold, so a few degrees warmer in the winter and cooler in the summer could change that. I think we're at the tipping point. If people work together and nature

helps us out, fresh citrus might be able to hold on."

## FIGHTING WHAT YOU CANNOT SEE

The bacterium that causes HLB is spread by the Asian citrus psyllid, a tiny insect that feeds on citrus leaves and stems. Infected trees can look healthy for years, all the while serving as reservoirs of disease. Symptoms emerge over time as a dying tree's fruit turns misshapen, bitter-tasting and green—which is how it got the name, "citrus greening."

There isn't a cure yet, so dozens of CA&ES researchers, including Professor Slupsky, are developing effective, affordable ways to spot it early in order to slow the spread while they explore long-term solutions like disease-resistant varieties. The work is complicated by the fact that the HLB bacterium, like some other microbes, is "unculturable," which means it can't be grown outside the host and studied in a petri dish.

"To understand how the infection works and find ways to fight it, we have to perform experiments within infected plants," says Gitta Coaker, a CA&ES professor in plant pathology. "That's harder and more time consuming because we have fewer tools available to test possible antimicrobials, and it is laborious to identify genes that influence disease resistance. And, trees take a long time to grow."

Coaker and her team are developing ways to test citrus plants for resistance at a very early stage, which could speed up the breeding process by identifying genes that influence important traits.

The state citrus industry is investing more than \$40 million annually to improve methods to detect HLB-infected trees and develop a cure.

Citrus grower Bennett finds hope in the science and collaboration.

"I'm afraid we may already be too late, but I do find optimism in the research," he says. "Science is our last hope." ●



**How can you recognize signs of the disease in your own backyard trees?**

The Citrus Pest and Disease Prevention Program website provides photos and tips on what to look for and who to call to help control the spread. [californiacitrusthreat.org](http://californiacitrusthreat.org)

JOE PROUDMAN/U.C. DAVIS



### The Gateway to Good Eating

UC Davis students and the Davis community benefit from an abundance of fresh organic fruits, vegetables and flowers grown at the Student Farm. Many students like recent graduate Katie Blackwood (pictured, SAFS '18) participate in the Community Supported Agriculture program that provides weekly baskets to subscribers. Throughout the year, students also glean tomatoes, peppers, squash, sweet corn and other produce items and make them available at no cost to students at a number of campus outlets, including the ASUCD Pantry and Fruit and Veggie Up! located in the Memorial Union. Other distribution sites include resource centers that support first generation students and UC Davis' diverse student body. UC Davis Dining Services also purchases Student Farm produce to ensure greater access to fresh, healthy food in the dining commons. To learn more about the Student Farm's food security efforts, please visit [caes.ucdavis.edu/news/food](http://caes.ucdavis.edu/news/food).

HECTOR AMEZCUA/UC Davis

# Improving human health from inside and out

BY DIANE NELSON

**EVEN WHEN HE WAS A BOY GROWING UP IN MARIN COUNTY,** Daniel Choe wondered why some kids were more prone to behavioral problems.

"Some of my peers got involved with drugs, fighting and crime," said Choe, who is now an assistant professor in the CA&ES Department of Human Ecology. "I felt bad seeing them damage their minds and bodies and futures. In retrospect, I see it gave me empathy for why people make certain choices. It made me wonder, 'How can we prevent and treat behavioral problems so people can lead more fulfilling lives?'"

That question drives Choe to this day as he builds an innovative child development program at UC Davis, where he was hired in 2014. Choe is exploring which experiences in early childhood can contribute to mental health problems later in life. He looks at family and neighborhood influences, such as poverty and violence, and a child's capacity to "self-regulate" or manage their emotions and behavior in stressful situations.

"We have a lot to learn about how self-control and social competence allow children to suppress problem behaviors and overcome environmental stressors," said Choe. "But interventions that only target self-regulation are not a panacea. Aside from individual differences in people's ability to cope, there are also systemic, institutional reasons why certain populations are at greater risks for breaking the law. We need to look at it as a whole. To build healthy communities, we have to first meet people's basic needs."

## Marshmallows and delayed gratification

In the early 1970s, Stanford psychologist Walter Mischel launched a long-term study on delayed gratification that still informs the study of self-regulation.

"It's called the marshmallow test, though we don't use marshmallows anymore," Choe said. "They're considered a choking hazard."

The experiment works like this: A child about 4 to 6 years old sits in a room with a small treat. The youngster is given the option of eating it now or getting two treats if he or she can wait maybe 15 minutes. Decades later, researchers discovered that the children who waited longer for the reward were significantly more likely to lead healthy and successful lives as measured by things like Body Mass Index, SAT scores,

lucrative jobs and stable relationships.

"The positive effects of early self-regulation were more powerful than children's IQ and family income in predicting success later in life," Choe said.

Choe recently received a UC Davis Hellman Fellowship Award, which supports early-career faculty, to investigate the development of self-regulation in children and families in Yolo County. Choe's lab uses a form of the marshmallow test along with other methods to assess impulse control and resilience to adversity. Choe also studies intergenerational family dynamics, because how we were raised influences our own parenting behavior. And he measures parental stress and maternal mood.

"A mother's depression is a risk factor for a whole host of problems, including difficulties self-regulating," Choe said. "That's why addressing institutional issues—like adopting reasonable family leave policies—is so important to child welfare. It's all connected."

## Trust matters

Trust plays a big role in self-regulation and the choices we make.

"Sometimes, what looks like a bad decision can be perfectly reasonable based on experience," Choe said.

Over the years, psychologists have conducted variations of the marshmallow test. In one permutation, some children worked with a trustworthy adult and others did not.

"The untrustworthy adult would promise to bring the child nice crayons, for example, and show up with a few broken



HECTOR AMEZCUA/UC Davis

Daniel Choe sometimes uses an observation lab to watch children and families play games and interact in order to assess self-regulation, or the ability to flexibly manage emotions, attention and behavior in different situations.

pencils," Choe said. "They would promise other things, too, that they never delivered."

When the untrustworthy adult gave children the option of a treat now or two treats later, many youngsters ate the treat that was in front of them, regardless of their ability to self-regulate.

"When a promise is likely to be broken, we choose what's immediately available," Choe said.

Context is everything when seeking to treat and prevent behavioral problems. Choe says parents can help children develop self-regulation by providing a safe, loving, predictable environment. Schools and workplaces can offer

meditation to help people manage stress.

"But for people dealing with basic survival, who are wondering where they might find their next meal, meditation isn't enough," Choe said. "To improve mental health, our society must also address larger issues like education and income inequality."

That's where working together can help.

"I love being at UC Davis and in this college," said Choe, who is also a faculty affiliate with the UC Davis Center for Poverty Research. "There is a commitment to collaboration and service to improve people's lives. Together, maybe we can make a difference." ●

**"Sometimes, what looks like a bad decision can be perfectly reasonable based on experience."**



## Student explores connection between exercise and mood

**CAN TRACKING YOUR STEPS WITH ELECTRONIC DEVICES** increase physical activity and improve your mood?

Not necessarily. In a new study, recent UC Davis graduate Jody Zhou and Human Ecology Associate Professor Siwei Liu found that after 100 days of wearing a Fitbit, participants tended to exercise less and feel more depressed than before they started monitoring their activity. The research may shed light on the link between exercise and mood.

"We found a significant decrease in activity throughout the 100 days and that corresponded with an increase in participants' depressive mood symptoms," said Zhou, who will begin graduate studies in the Department of Human Ecology this fall. Zhou received her B.S. in Cognitive Science from the College of Letters and Sciences in 2018. "Moods improved among those who exercised more and depressive symptoms increased for those who exercised less."

Zhou conducted the study in 2018 as part of a class project led by Professor Liu, who specializes in quantitative methodology to study human development. Liu uses new technologies like smartphones and wearable devices to develop innovative ways to measure physiological and emotional responses to social interactions. Zhou capitalized on Liu's methodology to explore the connection between exercise and depression.

"The scientific literature says that physical activity can reduce depression, but there's not a lot of research on the cognitive mechanism of why that is so," Zhou said. "We believe it has to do with self-efficacy, or the confidence in our ability to accomplish a task and succeed. When we achieve a goal, we feel good about ourselves, and that reduces stress."

In the study, Zhou and Liu asked 196 participants to wear a Fitbit for 100 days. Participants customized their daily goals. Researchers didn't monitor who completed their tasks.

"Our aim was to see how people behave in the real world, so we didn't intervene in their fitness routines," Liu said.

Before the experiment began, Zhou and Liu assessed each participant's baseline depression by asking questions like, "How often during the past two weeks did you feel hopeless or depressed? Tired or low energy? Have trouble staying asleep or sleeping too much?"

They asked the same questions during two follow-up interviews.

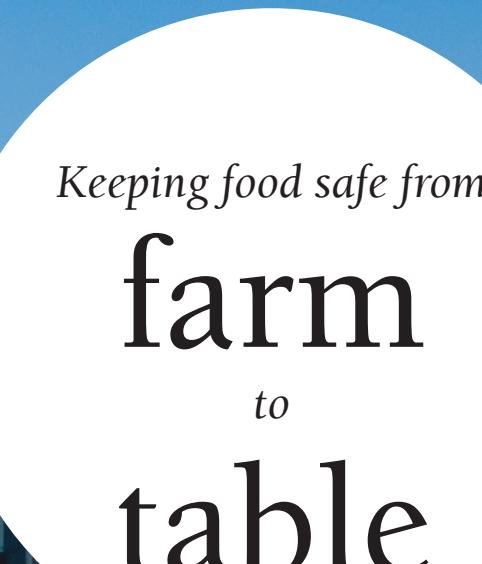
"Most people had more negative moods after the self-monitoring period," Liu said. "Many participants were excited to get started with the Fitbit. But once the novelty wore off, they reverted to old habits and their physical activity declined. That may help explain their negative feelings."

Zhou looks forward to furthering her studies in statistics and human behavior.

"I was so inspired by Dr. Liu's class," Zhou said from her home in China. "I learned that applied statistics can help social scientists develop innovative methods to explore important questions in human development."

—Diane Nelson

HECTOR AMEZCUA/UC Davis



## Keeping food safe from farm to table

by Diane Nelson

**OUR MOTHERS WERE RIGHT:** We should eat our greens—and golds, purples, oranges and reds. A growing body of research shows that eating a wide variety of produce and protein can promote health, prevent disease and even stave off the effects of aging.

In short, farm-fresh food is good for us. But it's confusing and concerning when products like lettuce, spinach, eggs, peanut butter—you name it—are recalled due to exposure to foodborne pathogens that have the potential to make us sick. How can we be sure our food is safe?

"There will always be some risk

of contamination from anything that's grown outdoors and handled by humans," said Linda Harris, Cooperative Extension specialist and chair of the CA&ES food science and technology department. "But our researchers work to promote food safety at each stage of the food production process to significantly minimize the risk."

Food recalls have seen an uptick in recent years, but Harris says that's because we're better at detecting potential problems.

"We can detect them faster and more accurately, which means—especially with perishable products—there's a greater

chance the product is still in the marketplace when we discover there's something to recall," Harris said. "When food is recalled before people get sick, by far the most common situation, it means the mechanisms are in place to keep us safe."

CA&ES faculty work with farmers, processors, packers, shippers, retailers and consumers to promote food safety with hundreds of agricultural commodities. As an example, let's look at leafy greens like lettuce and spinach as they make their way from farm to table.

Continue to the next page.

# Keeping food safe from farm to table



**On the farm**  
It's all about preventing contamination, which can come from water, soil, animals, equipment and humans. Researchers conduct studies that help identify food safety challenges and work with small- and large-scale farmers to find solutions.

## IS THE WATER CLEAN?

Water used for irrigation and other agricultural needs can increase the risk of foodborne illness if it's not clean. Any water that has the potential to come in contact with edible portions of the plant must comply with stringent food safety guidelines for leafy greens.



## Harvest

Head lettuce, like iceberg, is usually harvested by hand and machine-wrapped in plastic on conveyor systems set up in the field. Growers are required to clean and sanitize all machinery and provide workers the training, sanitized gloves and washing stations they need to promote food safety.

## MOWING THE GREENS

Leafy greens, such as spinach, are often harvested by machines that mow the crop and gather the leaves into large bins. The equipment is cleaned and sanitized between uses and handlers ensure leafy greens don't touch the soil after harvest.



COURTESY KEATING/STOCK

## MANAGING MANURE

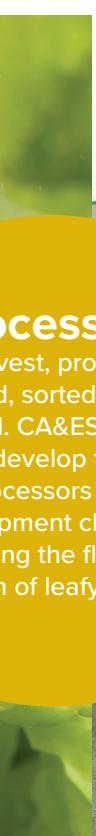
Manure can be an economical, practical source of the nutrients plants need to grow. But raw manure can harbor potential foodborne pathogens. Untreated manure cannot be used on lettuce or leafy greens. Instead, growers can use only properly composted soil amendments for these and many other crops.

## WHERE ANIMALS ROAM

Produce-related outbreaks are sometimes traced to plants and watersheds contaminated by domesticated animals like livestock, wild animals and birds. CA&ES faculty work with lettuce growers to identify sustainable approaches that minimize crop contamination and protect wildlife and the natural environment.

## IMPROVED PACKAGING

UC Davis researchers are also developing antimicrobial packaging that both repels bacteria and reduces the microbes that cause food to spoil. The new plastic material could be used to line produce bins and wrap produce to improve safety and freshness.



Courtesy Photo

## Processing

After harvest, produce may be washed, sorted, packaged and chilled. CA&ES faculty are working to develop technologies to help processors keep water and equipment clean while preserving the flavor and nutrition of leafy greens.



BRIAN NICHOLS

## FRESHNESS MATTERS

Buy leafy greens that are fresh and not bruised, whether in or out of a package. For packaged salads, check the best-if-consumed-by date.

## SEPARATE

Keep leafy greens away from household chemicals and raw meat, poultry and seafood in your shopping cart, check-out bag and refrigerator. Don't prepare leafy greens with the same knife or cutting board used with raw poultry, meat and seafood unless your tools have been washed with hot water and soap.

## Distribution

Lettuce and leafy greens sometimes have to travel long distances to reach consumers. To promote postharvest quality and safety, distributors keep transport vehicles clean and make sure produce stays chilled all the way to the grocery shelf.



## Consumers

By the time leafy greens reach your kitchen, producers, regulators and researchers have worked together to ensure safety. Here's what you can do at home.

## CHILL

Packaged salads should be refrigerated in the store and at home.

## CLEAN

Rinse head lettuce or fresh leafy greens under cool tap water. Packaged leafy greens labeled "ready to eat" or "triple washed" do not need to be rinsed. Never wash lettuce with bleach or detergent. Wash your hands with warm water and soap for at least 20 seconds before and after handling lettuce and leafy greens.

GRIGORY URQUJAGA/UCDavis



Bez Tabesh presents Dean Dillard with a gift to the college at the annual Scholarship Reception.

ACADEMIC TECHNOLOGY SERVICES/UC Davis

## Inspirational scholarship recipient believes in a culture of giving

**UC DAVIS STUDENT BEHZOD "BEZ" TABESH** has a story to tell. It's about finding opportunity in challenge and about showing gratitude for those helping his dreams come true.

"It feels like a miracle that I'm here studying clinical nutrition on a path toward a career in physical therapy," he said.

Growing up in the Bay Area, he was bullied for being the new, overweight Persian kid in middle school. In high school, he battled back from depression and loneliness when he discovered the transformative power of exercise. He became a personal trainer and, at one point, even set up a gym in his parents' garage.

Then tragedy struck. Tabesh was hit by a car while riding his bike and fractured his hip. "It felt like the worst thing in the world," he said. "But during my rehabilitation process, I fell in love with physical therapy. My path began to make sense."

He buckled down at the local community college and set his sights first on UC Davis to study clinical nutrition and eventually for physical therapy school at UC San Francisco. He transferred to Davis in 2017. His hard work paid off when he found support from two people he didn't even know.

Lisa Harris and her sister, Dina Bosby, created

the Joseph A. and Jean M. Teresi Memorial Scholarship at UC Davis to honor their parents. The scholarship is for a nutrition major one year and a student of any major intending to become a K-8 school teacher the next.

Tabesh is the first recipient of that scholarship, and it's made a huge difference in his life during a particularly difficult time for his family. His father had been diagnosed with a rare disease that claimed his life.

"My scholarship gave me the chance to take care of my family in ways that I couldn't before," Tabesh said. "My mom didn't need to worry about my tuition, housing or expenses at all. And it helped me find the mental therapy I needed in dealing with my dad's death."

At an event last spring to honor scholarship recipients and their donors, Tabesh delivered a moving speech. "You ignite a potential in us that enables us to persevere," he said. "You uplift our spirits through tough times and believe in us."

Then he surprised everyone with a check to the UC Davis Foundation. "Because of my experience, I want to give back, as well," he said. "I hope my gift helps a student who can benefit from the financial support the same way I have. I believe in a culture of giving."

—John Stumbos

*"I hope my gift helps a student who can benefit from the financial support the same way I have. I believe in a culture of giving."*

## Gift from alumnus John Boynton creates plant genetics fellowship

**DR. JOHN E. BOYNTON, A UC DAVIS ALUMNUS,** retired Duke University professor and renowned expert on photosynthesis, has bequeathed a generous gift from his estate to establish a fellowship in honor of his mentor, tomato geneticist Charles M. Rick, Jr.

Boynton passed away in summer 2018 at the age of 80 in Silver City, New Mexico, where he lived in retirement.

His gift establishes the Charles Rick Endowed Fellowship in Plant Genetics for Ph.D. students interested in plant molecular genetics or molecular plant breeding. Boynton wanted to make sure that at least one recipient each year receives an award sufficient to cover all the costs of their Ph.D. degree.

"I am very pleased to make this gift to further the excellence of UC Davis," he said in January 2018.

Helene Dillard, dean of the College of Agricultural and Environmental Sciences, acknowledged Boynton's accomplishments and expressed her deep gratitude for Boynton's selfless tribute to his alma mater.

"John made significant contributions to our understanding of how plants function through his research on the basics of photosynthesis," she said. "He shared with me how working at UC Davis helped set the stage for his successful career in academia. Thanks to John, some of our graduate students studying in the fields he found so fascinating will have the opportunity to carry on his legacy. We are extremely grateful for John's gift."

Boynton spent his formative years in Tucson, Arizona, where he graduated from high school in 1956. After studying horticulture and plant breeding as an undergraduate at the University of Arizona, he set his sights on UC Davis. With Rick's guidance, he focused his graduate work on chloroplasts in tomatoes. His Ph.D. in genetics was awarded in 1966. He served as an NIH Postdoctoral Fellow at UC Davis, and subsequently conducted postdoctoral work at the University of Copenhagen, Denmark, and at Stanford University.

In 1968, Boynton joined the faculty of Duke University in North Carolina, where he became a distinguished professor of botany and genetics and worked until his retirement in 2000. Throughout his career, much of his work focused on digging deeper into the function and expression of chloroplast genes. He was the first Duke botanist to conduct research at the sub-cellular level with his work on the genetics of organelles.

"Not only does his work have great significance for the understanding of basic biological processes, such as photosynthesis, which involve the chloroplast, but his research also has

practical applications," his botany colleagues wrote in a 1995 letter. "Dr. Boynton has made contributions of pivotal importance in the development of techniques that now permit the introduction of foreign genes into the chloroplast."

He also was instrumental in setting up the national Chlamydomonas Genetics Center at Duke in 1979, which helped ensure availability of this species for other researchers. Chlamydomonas is a genus of green algae used in research.

Boynton also was passionate about the West. In his teens, he spent summers working at cattle ranches in the eastern Sierra Nevada. He frequently visited Mono Lake while he was a graduate student in Davis and later joined in efforts to fight water diversions from the area. In retirement, he continued to spend his summers at Mono Lake and the rest of the year in New Mexico. Dr. John E. Boynton is thoughtfully remembered in an obituary in the Grant County Beat, the local paper in Silver City.

—John Stumbos





Jill Carmel Photography

The Khaira family (left to right): Meera, Ravinder, Naveen and Kamal. "Ravi" and Kamal are UC Davis alumni. Meera is a current UC Davis student and Naveen is attending Georgetown University.

**Giving back comes naturally to this family**  
Seva is the Sikh word for selfless service and is a central part of the Khaira family's beliefs. Kamal and her husband, Ravinder, both UC Davis alumni, have found many ways to be of service to their alma mater.

One way is through charitable gifts and pledges to support experiential learning funds in both the College of Agricultural and Environmental Sciences and in the College of Biological Sciences. The Khairas believe it's very important to give students the opportunity to expand their education beyond the classroom.

They also established the Ted Bradshaw Engaged Student Scholars Program in honor of Kamal's late mentor. This program connects students with community leaders to address real-world problems.

## Kamal Khaira returns to campus to lead UC's CalFresh Healthy Living

**KAMAL KHAIRA IS BACK ON CAMPUS**—as director of UC's CalFresh Healthy Living, a program that delivers nutrition education through county Cooperative Extension offices. She's a natural fit for the job.

Khaira first came to UC Davis in 1988 to pursue a career in sports medicine. Through an undergraduate internship she discovered that wasn't at all what she wanted to do. A counselor suggested she look into corporate wellness, so Khaira found a position with Pacific Bell's corporate offices in San Francisco.

"I was exposed to this model of prevention that I didn't know much about but loved it," she said.

Khaira next worked for Sacramento County as a health educator targeting at-risk youth in continuation high schools, group homes and juvenile hall. Kaiser Hospital recruited her to run its health education center in Roseville.

Then she met her future husband, Ravinder, a medical resident at Loma Linda University, and moved to Southern California. There she landed an executive-level job with the American Heart Association and led a campaign on heart disease and stroke prevention awareness.

After her twin daughters were born, she focused on family until the girls entered preschool. The public health muse came calling again and led her to Ted Bradshaw, a professor of human and community development at UC Davis in 2004.

"My whole career involved community-based health programs," she said. "And I wanted to learn more about the theory around it."

At the age of 34, Khaira was a student again, working toward a master's in community development. She set up an ambitious project at six pilot sites around the state focusing on middle and high school students.

"They learned about the benefits of healthy eating and physical activity," she said. "But they also had leadership and civic engagement opportunities to experience how their actions affect their communities."

In Del Norte County, for example, students got the school board to replace dysfunctional water fountains with new hydration stations. In West Oakland, they created Mandela Grocery, a worker-owned cooperative stocked with healthy food from local farmers.

"Hundreds of youth have been touched by these engagement projects," she said.

Khaira became director of CalFresh Healthy Living in June 2018. Her goal is to infuse the program with that same co-creation philosophy she honed as a graduate student.

"When communities are involved, they feel ownership and we see stronger impacts and outcomes," she said.

Learn more at [uccalfresh.ucdavis.edu](http://uccalfresh.ucdavis.edu).

—John Stumbos



HECTOR AMEZCUA/UC Davis

## Helping hands

Mauricio Guerrero-Villanueva, a clinical nutrition major, gets ready to volunteer at the Knights Landing One Health Center Medical Clinic. Twice each month, the clinic unites UC Davis undergraduates, graduate students and medical students with physicians and nurses to provide free healthcare to the medically underserved in Knights Landing, La Tijera, Robbins and nearby migrant camps. Many student volunteers are preparing for careers in healthcare. Undergraduate students act as interpreters, patient advocates, receptionists and lab workers. UC Davis operates similar clinics throughout the Sacramento region to improve access to healthcare for uninsured and low-income populations.

University of California, Davis  
One Shields Avenue  
Davis, CA 95616-8571  
#986H



Song Yang of Vue Family Farm in Elk Grove fills a box with eggplant for clinical nutrition major Alicia Marzolf (left) and Laura Roser, a recent graduate of the sustainable agriculture and food systems major, at the Davis Farmers Market this summer. The students collect food that is then distributed to families by the Yolo Food Bank.

Every human on the planet depends upon food production, yet a third of what we produce never reaches the table. At the College of Agricultural and Environmental Sciences, we are working to change this.

A gift to the **Food Loss and Waste Collaborative** will support innovative solutions to reduce food loss throughout the entire food life cycle.

Learn more and donate at  
**CAES.UCDAVIS.EDU/FOOD-LOSS**