

# SYNTHESIS

THE MAGAZINE OF UC DAVIS COMPREHENSIVE CANCER CENTER

VOL 21 | NO 2 | FALL 2018

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Dear Reader,

The UC Davis Comprehensive Cancer Center embodies all of the elements that make a world-class cancer program. It's ground zero for the basic research that fuels innovation in diagnosis and treatment. It's the training ground for bright, aspiring scientists. It's the hub for advanced clinical research, bringing novel and leading-edge diagnostics and therapies to patients. And it's the safety net guiding patients with meaningful support through their cancer journeys.



This issue of *Synthesis* illustrates each of these missions. In it you will read about groundbreaking genomics research that is pinpointing why Latinos suffer disproportionately from gastric cancer. And we take a long look at exciting projects and novel research to improve outcomes for patients with the most common — and most aggressive — brain cancer, glioblastoma.

Our cover story will introduce you to CURE, a program that brings underrepresented undergraduate students into our laboratories for mentorship and learning. CURE's hands-on approach has ignited science careers, many of them in the area of cancer research. Our story introduces you to two aspiring cancer researchers — both the first in their families to attend college.

Because cancer diagnoses and treatment regimens can be significantly arduous and complex, particularly those for acute blood cancers, our cancer center has specially trained nurse navigators who ensure that patients and their families have what they need throughout their journey, everything from education to transportation, appointment coordination and communication with referring physicians and hospitals. You will meet our navigators and one of their grateful patients in this issue.

We hope you enjoy these and other stories in this edition of *Synthesis*. If you have suggestions for future editions, please contact our editor, Dorsey Griffith, at [dgriffith@ucdavis.edu](mailto:dgriffith@ucdavis.edu).

**Primo "Lucky" Lara** | DIRECTOR, UC DAVIS COMPREHENSIVE CANCER CENTER

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*Breaking Barriers to Beat Cancer<sup>SM</sup>*

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COVER Pictured is CURE participant Yasmin Esparza.

[cancer.ucdavis.edu](http://cancer.ucdavis.edu)

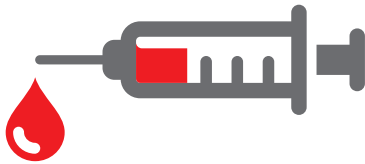


**UC DAVIS**  
**COMPREHENSIVE**  
**CANCER CENTER**

A NATIONAL CANCER INSTITUTE-DESIGNATED  
COMPREHENSIVE CANCER CENTER

## Liquid biopsy could ease the way to immunotherapy for lung cancer

A collaboration of researchers at UC Davis, Genentech and Foundation Medicine are the first to show that a blood-based test to assess tumor mutational burden (TMB) accurately identifies non-small cell lung cancer patients who could benefit from immunotherapies called checkpoint inhibitors. The blood test offers a much less invasive and more repeatable alternative to tissue testing. The study was published in August in *Nature Medicine*.



“We wanted to know if we could transfer this TMB assay from tissue to blood,” said **David Gandara**, who directs the cancer center’s Thoracic Oncology Program and is first author

on the paper. “We succeeded, establishing a TMB level in blood that correlates well with similar levels in tissue and was associated with favorable patient outcomes.”

Patients with higher TMB are often better candidates for checkpoint inhibitors.

“There are patients for whom the biopsy is inadequate from the start, or the tissue is used for routine pathology and we don’t have enough tissue left to do either genomic testing or tissue TMB,” Gandara said. “If we can do it in blood in one test, that offers many advantages for patients who have had an inadequate biopsy.”

Gandara said the test has already received Breakthrough Designation, the first step towards full FDA approval.

## Saturday adult infusions

On Oct. 6, the North Building of the Cancer Center opened to adult oncology and non-oncology

infusion patients. This new option provides an additional resource and more flexibility to patients who prefer Saturday appointments. To start, 12 chairs will be available from 8 a.m. to 6 p.m., and the number will grow as demand increases.

“Opening for six days a week allows us to meet the needs of our patients who can now avoid unnecessary hospital admissions or trips to emergency rooms for chemotherapy, blood transfusions or hydration on the weekend,” said **Kristin Mensonides**, director of oncology services. “We look forward to welcoming patients with open arms!”



## Specialty clinic for sarcoma patients opens

The UC Davis Comprehensive Cancer Center has opened a multidisciplinary clinic specializing in pediatric, adolescent and young adult sarcoma.

The sarcoma clinic, located in the Pediatric Oncology Clinic at the Cancer Center, is the only one of its kind in the Sacramento region. The treatment team sees patients the first and third Thursday of each month. Patients have access to a full range of experts, including specialists in pediatric and medical oncology, sarcoma surgery, nursing case management and others under one roof.

The clinic allows for seamless care across specialties to assure the best possible outcomes for patients

with bone and soft tissue sarcoma. Patients also have onsite access to specially trained physical therapists, social workers, nutritionists and other supportive care professionals to facilitate healing and survivorship.

“Advances in cancer have been the result of a multidisciplinary approach,” said **Marcio Malogolowkin**, chief of pediatric oncology at the cancer center. “Bringing experts together in the same room with the same patient increases our ability to communicate, improve our understanding of patients’ needs and deliver better care.”

Bone and soft tissue sarcomas are a very rare group of connective tissue malignancies, and successful

treatment outcomes require a collaborative, multidisciplinary approach, which may include surgery, chemotherapy or radiation therapy. The clinic also offers various clinical trials of new treatment approaches.

The lead treatment team includes medical oncologists **Elysia Alvarez** and **Marcio Malogolowkin**, orthopedic surgical oncologists **Steven Thorpe** and **Lor Randall**, surgery nurse practitioner **Abigail Inkster**, social worker **Robyn Peace**, nurse care coordinators **Yvonne Roach** and **Kristine Ahlberg** and physical therapist **Jennifer Beane**. The team also includes additional experts in surgery, radiation oncology, radiology and pathology.

## Necessity breeds invention for four-time cancer survivor

Cinde Dolphin had nine surgeries in 10 years for lung and breast cancer, but the four-time cancer survivor turned pain and frustration into an opportunity. The device she created to make patients like her more comfortable after surgery has since been embraced and endorsed by medical professionals at UC Davis and beyond.

“It’s been part of her healing process,” said **Scott Christensen**, a medical oncologist at the cancer center. “Doing something positive for others is very empowering.”

Like many post-surgery patients, Dolphin required a drain implanted near the incision site to prevent fluid build-up in her body. About a foot of thin plastic tubing carried the fluid to a plastic bulb that had to be emptied when full.

The drain can be cumbersome, uncomfortable, and get in the way of daily life. Dolphin wore them for weeks at a time.

Dolphin’s plastic surgeon recommended she use an apron from Home Depot to carry the drains, which hang awkwardly from the body. She thought there must be a better way.

“The apron pockets effectively kept the drain suspended, but the canvas construction prevented me from showering with it,” Dolphin said.

Dolphin took matters into her own hands. She went to a Dollar Store, loaded her cart with mesh laundry bags and, with help from family members, created a prototype.

“My brilliant nephew was willing to serve as the company’s seamstress,” she said. “I re-engineered the bags by sewing ¾-inch white bias tape to the top portion above the zipper. The design was ideal for 24/7 use, even when bathing. I knew I was on to something.”

Christensen gave Dolphin feedback on the product and connected her to



Cinde Dolphin

other medical staff for their opinions.

“I thought it was a great idea,” recalled **Gary Kurtz**, manager of the Post-Anesthesia Care Unit (PACU). “A patient saw a problem and wanted to help others.”

Kurtz placed an order for the UC Davis PACU and gave the carriers to his post-surgery patients. Nurses and patients alike responded positively. Today, each patient who needs a drain gets Dolphin’s Kili Medical Drain Carrier. The discrete, inexpensive pouch is lightweight, can be worn in the shower and allows patients more mobility.

The name “Kili” comes from Dolphin’s volunteer trip as a business advisor to women in a micro-loan cooperative near Mt. Kilimanjaro in Tanzania. She visited the village after she recovered from her final cancer surgery and paid homage to the families she met by naming the device for them.

“The experience had a profound impact on my life,” Dolphin said. “Locals



Kili Medical Drain Carrier demonstrated

call Kilimanjaro ‘Kili,’ and it seemed a fitting way to honor the ‘mamas’ I met.”

With a clean bill of health and a new business venture, Dolphin sells the Kili Medical Drain Carrier for \$14.99 in her retail shop online and directly to several Sacramento-area hospitals. She hopes to one day offer a similar solution for patients who wear colostomy bags.

“Thanks to everyone—including the UC Davis medical team and my network of friends and business associates—I am reminded that everything can be used for good, even after multiple cancer diagnoses.”

## Addressing vast cancer disparities among Latinos, Asians and Blacks: UC Davis leads precision medicine study to improve outcomes

UC Davis Comprehensive Cancer Center in September received a \$6.3 million grant from the National Cancer Institute's (NCI) Center to Reduce Cancer Health Disparities for a 5-year study to tease out why some ethnic and racial minority groups fare worse than whites when they get cancer and to find more precise treatments to improve their chances of survival.

The collaborative study engages four of the University of California's NCI-designated comprehensive cancer centers: UC Davis Comprehensive Cancer Center, Jonsson Comprehensive Cancer Center at UCLA, UCSF Helen Diller Family Comprehensive Cancer Center and the Chao Family Comprehensive Cancer Center at UC Irvine.

Under the grant, entitled "University of California Minority Patient-Derived Xenograft (PDX) Development and Trial Center" or UCAMP, tumor samples from patients will be delivered to UC Davis for the research, most of them from minority patients and the rest from non-Hispanic whites for use as controls. The samples will be used to grow tumors (or xenografts) in mice. They are then replicated so that each can be used to test a different drug. The goal is to generate at least 200 PDXs for use in two research projects.

The study will focus on four types of cancer that disproportionately affect minorities: lung, liver, gastric (stomach) and bladder. The first project in the study will focus on gastric and liver cancer among Latinos and Asian Americans, Pacific Islanders and Native Hawaiians, and the second will examine lung and bladder cancers among



African Americans. Researchers will use PDXs to discern their genetic characteristics and test potential targeted drugs to treat them.

When compared with non-Hispanic whites, African Americans have lower survival from lung and bladder cancer, even when diagnosed at the same stage of the disease.

"We are trying to address why this happens," said **Chong-xian Pan**, a medical oncologist and study principal investigator who leads that project. "Socio-economics could be a factor, but we also want to see if there are biological factors contributing to this disparity. PDXs are a great model, not only to study the biological differences of cancers from non-Hispanic whites and African Americans, but also to facilitate cancer drug development and precision medicine."

**Luís Carvajal-Carmona**, a UC Davis cancer genomicist, expert in the genetics of Latinos and a principal investigator, will lead the stomach and liver cancer project. He said the

study is an effort to correct a major discrepancy in existing cancer genomics research to date — the lack of minority patient representation, which is essential for the development of targeted, or personalized, treatments.

"Minority patients have the worst cancer outcomes for multiple reasons," he said. "One of them is that they come in with more advanced tumors because many don't have proper access to health care. But also because there are not enough data and models for the scientific community to develop precision medicine studies in them. So we want this NCI-funded research to be a magnet for minority-focused clinical trials."

**Moon Chen**, a UC Davis population scientist, expert in Asian cancer health disparities and a principal investigator, said PDXs have advantages over other research tools.

"They contribute to a better understanding of the underlying mechanisms of resistance and elucidate potential biological determinants of treatment responses and cancer health disparities for these tumor sites," he said.

## UC Davis research informs new national cervical cancer screening recommendation

Joy Melnikow, director of the UC Davis Center for Healthcare Policy and Research, led a comprehensive analysis of eight clinical trials and four cohort studies on cervical cancer screening. The study results show that while Pap smears are still highly effective for detecting pre-cancerous cells and cancer, testing for the virus that causes these cancers also is an excellent screening tool.

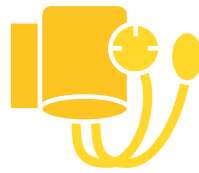


The findings, published in the *Journal of the American Medical Association (JAMA)* in August, were used to inform the U.S. Preventive Services Task Force, which published its updated recommendations on cervical cancer screening in the same issue of the journal.

The task force now recommends screening for cervical cancer every three years with Pap smear alone in women aged 21 to 29 years. For women aged 30 to 65 years the task force recommends screening every three years with a Pap smear alone, every five years with human papilloma virus (HPV) testing alone, or every five years with HPV testing in combination with a Pap smear.

# It's never too late to stop

HEALING AND HEALTH BENEFITS START AS SOON AS 20 MINUTES AFTER YOU QUIT SMOKING



## 20 MINUTES

BLOOD PRESSURE and PULSE return to normal



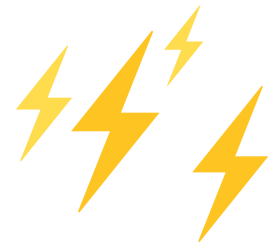
## 8-12 HOURS

BLOOD OXYGEN and CARBON MONOXIDE levels return to normal



## 48 HOURS

ability to TASTE and SMELL is greatly improved



## 72 HOURS

BREATHING becomes easier and ENERGY LEVELS increase



## 2-12 WEEKS

CIRCULATION improves and LUNG FUNCTION increases



## 12 MONTHS

excess RISK OF CORONARY HEART DISEASE IS REDUCED by about half and declines gradually thereafter

Program tackles nicotine addiction

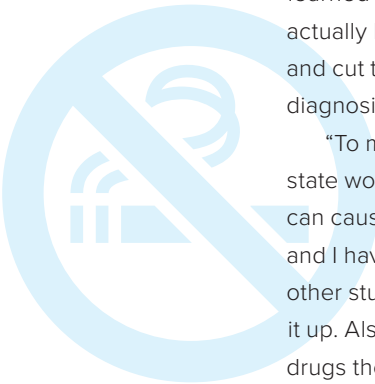
PATIENTS TARGETED FOR SUPPORT

**STEVEN BERKSTRESSER** has chewed tobacco for most of the past 40 years, and he’s always wanted to kick the habit. But it was a cancer diagnosis that prompted him to join a UC Davis program to help him quit.

Through the Stop Tobacco classes at UC Davis Health, Berkstresser learned that quitting tobacco can actually boost his chances of survival and cut the risk of a second cancer diagnosis.

“To me, it’s obvious,” the 57-year-old state worker says. “Chewing tobacco can cause tooth loss and mouth cancer, and I have high blood pressure and other stuff that would subside if I gave it up. Also, (tobacco use) makes the drugs they give you to fight the cancer less effective.”

Berkstresser is just the kind of person the UC Davis Comprehensive Cancer Center hopes to reach in a new effort that aims to support tobacco cessation among people diagnosed with cancer. The initiative is funded with a Moonshot grant from the National Cancer Institute.



“Research has shown that **it’s never too late to quit using tobacco**, especially among people battling cancer. In addition to **making the cancer treatment more effective, quitting can reduce the side effects** of chemotherapy, radiation and surgery, and improve patients’ overall **quality of life.**”

— TERRI WOLF

“Research has shown that it’s never too late to quit using tobacco, especially among people battling cancer,” says Terri Wolf, nurse program manager for the Cancer Center Cessation Initiative. “In addition to making the cancer treatment more effective, quitting can reduce the side effects of chemotherapy, radiation and surgery, and improve patients’ overall quality of life.”





Terri Wolf, Elisa Tong, Moreen Sharma

When 62-year-old Lawrence Glaser found out he had late-stage lung cancer in 2014, he not only kept smoking, but started drinking again after years of sobriety. It wasn't until he took stock of the fact that his doctors were doing everything they could to save his life that he took action and joined a smoking cessation class.

"I finally realized that the doctors were working 100 percent for me, and I was just being a bump on a log," he says.

Even after 42 years, Glaser was able to quit after three attempts. "It was the hardest thing I've ever done," he says. "It was like getting rid of an old friend."

Now, he tracks his savings—about \$4,300 per year, and notes how his sleep apnea, raspy voice and wheezing are gone.

Cancer center patients who want to quit are given a number of options that include free classes, support groups, medications and counseling.

Cari Shulkin, a tobacco treatment specialist who facilitates the tobacco cessation programs, emphasized that quitting tobacco is extremely difficult and that many patients, especially those dealing with a cancer diagnosis, may need several attempts before they are successful.

"Nicotine addiction is very isolating," she says. "Guilt and shame are a big part of the struggle when someone has repeatedly tried to quit and failed. This failure chips away at a person's confidence and the addiction becomes overwhelming and utterly compulsive. Our program can support patients on this journey, guiding them through the challenges of this addiction."

For more information visit <http://www.ucdmc.ucdavis.edu/cancer/support/support-services/tobacco-cessation.html>.

## Beating a deadly cancer in Hispanics

## LUÍS CARVAJAL-CARMONA FINDS NEW GENE TARGETS FOR TREATMENT

In August, Carvajal-Carmona and his cancer center colleagues were awarded a 5-year, \$2.65 million grant from the National Cancer Institute to study gastric cancer genetics in Hispanic populations around the world.

ONE MILLION people worldwide will be newly diagnosed with gastric cancer this year and 720,000 people will die

from the disease, making it the third leading cause of cancer deaths globally. Most people who receive this diagnosis will already be in the advanced stages

of the disease, facing a dismal 5-year survival rate of 5 percent.

A team led by cancer center researcher Luís Carvajal-Carmona is working to change those statistics by studying the tumors of Hispanic patients with a family history of gastric cancer.

“Hispanics carry among the highest burden of gastric cancer worldwide,” says Carvajal-Carmona, an associate professor of biochemistry and molecular medicine and a member of the Genome Center. “In the U.S. they are twice as likely to be diagnosed and twice as

likely to die once they are diagnosed, when compared to whites.”

In August, Carvajal-Carmona and his cancer center colleagues were awarded a 5-year, \$2.65 million grant from the National Cancer Institute to study gastric cancer genetics in Hispanic populations around the world. Up to 15 percent of individuals with gastric cancer have a family history of the disease. If scientists can identify the genes whose mutations lead to it, there is hope of both disease prevention and better treatments.

“Right now, there are only two FDA-approved drugs for the treatment of gastric cancer. Genetic studies of Hispanics are one of the world’s best hopes for both identifying at-risk individuals and new drug targets,” says Carvajal-Carmona, who also co-leads the cancer center’s Population Sciences and Health Disparities Research Program.

“It is my vision that our research group and our great cancer center become leaders in gastric cancer genetics and genomics,” he says. “Our goal is to generate a body of data that can be used in clinical trials of



Ana Patricia Estrada and Luis Carvajal-Carmona

**“Hispanics carry among the highest burden of gastric cancer worldwide. In the U.S. they are twice as likely to be diagnosed and twice as likely to die once they are diagnosed, when compared to whites.”**

— LUÍS CARVAJAL-CARMONA

drugs, as in genetic screening, early detection and disease prevention.”

Last year, Carvajal-Carmona and his colleagues made an important contribution to the field when they helped to firmly establish that PALB2, a gene involved in DNA repair, is a gastric cancer gene. In the 20 years prior to that, only one gene, CDH1, had been identified as being associated with gastric cancer.

“This body of data makes a good case for offering PALB2 testing to families with gastric cancer,” he says.

In a 2017 paper published in *Gastroenterology*, Carvajal-Carmona

and his team reported the findings of a study in which they sequenced all of the protein-coding genes in the genomes of 22 families with hereditary gastric cancer who had previously tested negative for harmful variants of CDH1. In addition to PALB2, the team found that mutations in BRCA1, a gene known to be involved in breast and pancreatic cancer, and RAD51C increase the risk for the disease. All three genes are involved in what is called homologous recombination (HR) DNA repair, a mechanism cells use to repair potentially harmful breaks that involve both strands of DNA.

As part of the planned studies funded by the new grant, the team will study HR pathway genes in DNA from hundreds of Hispanics with familial and early-onset gastric cancer diagnosed before age 50. The team also will sequence genes from tumors taken from Hispanic patients and compare the results to their own normal DNA. Finally, the team will carry out molecular characterization of HR-deficient gastric cancer tumors from Hispanics. They will be looking for associations among the kinds of tumors, clinical manifestations and risk factors.

The results from this part of the newly funded research program have the potential to impact both the prevention and treatment of gastric cancer, Carvajal-Carmona says. The team’s preliminary studies suggest that one in five Hispanic tumors are HR-deficient. Characterizing the HR pathway mutations in these tumors will likely suggest drug targets, as well as offer new gene mutations to help identify at-risk individuals.

Carvajal-Carmona says this kind of research is important for reducing health disparities worldwide—and closer to home. Most of what researchers know about gastric cancer genetics is based on studying tumors from Asian and non-Hispanic white patients. Carvajal-Carmona points out that it won’t be long before there are more Hispanics than whites in California.

“We have to start filling these knowledge gaps and allow all populations to benefit from the science we are doing,” he says. “While the data will be obtained from Hispanic patients, the findings of our study will advance research and treatment in both Hispanic and non-Hispanic patients.”

## Meet Huggie

### FIRST “FACILITY DOG” JOINS CANCER CENTER

**WHO has four legs,** wears a black coat and works alongside medical staff? Huggie — the first-ever facility dog at UC Davis Health. The 2-year-old Labrador retriever supports children receiving treatments in the cancer center’s Pediatric Infusion Center.

Huggie works with his foster mom and child life specialist, Jenny Belke, Monday through Friday to normalize and motivate pediatric patients and reduce any fear, stress, anxiety or pain they may be feeling.

“Patients and families deserve tailored care,” says pediatric oncologist Marcio Malogolowkin. “Each child has a different need, and I think Huggie is one more sign of our commitment to caring for patients’ individual needs.”

For 18 months before he could report for duty, Huggie lived with a volunteer “puppy raiser” for obedience training, socialization and basic care needs. He returned to Canine Companions for Independence for six months of intense professional training, and mastered more than 40 commands before attending the organization’s “Team Training.” He was then matched with Belke and received his doggy diploma. Only one in four puppies will meet the criteria to become a facility dog, according to Canine Companions.

Though he’s cute and cuddly, Huggie serves a therapeutic purpose for cancer patients and their families.

Cindy Bey watched her 12-year-old son Alex light up upon seeing Huggie

during a weekly treatment. Alex was diagnosed with a brain stem tumor that temporarily paralyzed the right side of his body, and made speaking and walking difficult. Adding to the trauma is the family’s two-and-a-half hour commute from Red Bluff each week for care.

“When we got here Alex didn’t want to be here. He was depressed and started crying,” Bey says. “When Jenny asked if he wanted her to bring Huggie over, he stopped crying and had a big smile on his face.”

Huggie’s presence at the cancer center required thoughtful planning. With Jean Wiedeman, a pediatric infectious disease specialist, Diana Sundberg, child life and creative arts therapy manager, developed a detailed protocol to ensure patient safety. Huggie requires supervision by a UC Davis Health representative at all times, weekly baths, a regularly laundered bed, leash and vest, and veterinary visits.

Sundberg, who manages the child life and creative arts therapy team, says she hopes to have three or four dogs placed at the health system.

“When you’re not feeling well, caring for something else can help take the focus off of your pain,” she says. “Children have the ability to build relationships with the dogs, which can provide a sense of familiarity and comfort when they’re in the hospital.”

Though he’s cute and cuddly, Huggie serves a therapeutic purpose for cancer patients and their families.





Huggie with cancer patient Bill Aubuchon

## FROM POTATO EXPERIMENTS TO GENE ANALYSIS

### CURE students thrive in research labs

When Sienna Rocha left San Diego to pursue a degree in neurobiology, physiology and behavior at UC Davis, she brought more than her belongings with her. The first-generation college student also carried encouragement from her family and a passion for science, although little more experience than conducting experiments on potatoes.

Today, thanks to her tenacity and the UC Davis Continuing Umbrella of Research Experiences (CURE) program, she is contributing to the research of a renowned UC Davis cancer geneticist.

Rocha is from a big Mexican family, with limited resources at home and school. Both of her parents had immigrated to the U.S. when they were children, and her great-grandmother still lives in a tiny town in Mexico. Rocha wanted to learn more about biology and pursue a career in scientific research, but had nowhere to turn.

“For me, going into science was super difficult because I never had anyone to ask for help,” the 19-year-old Rocha says. “Since the fifth grade I did everything on my own.”

CURE is a program funded by the National Institutes of Health to provide long-term mentorship and cancer research opportunities to disadvantaged students during their undergraduate years. The program at UC Davis is managed by Connie Champagne, director of educational enrichment and outreach programs (EEOP), and has served 28 students to date—several of whom went to medical school, graduate school, or are employed



Connie Champagne talks with Sienna Rocha and Yasmin Esparza

as researchers. Students come from African American, Hispanic, Hmong and Korean backgrounds, most are socioeconomically disadvantaged, and half of the participants are women.

For Rocha, the decision to pursue cancer research was personal.

"I've been interested in cancer since I was younger. A friend died from leukemia when I was little, and right now my niece has thyroid cancer," Rocha says. "I want to help cure this disease that hurts families and lives."

Rocha completed her first and second years in the Biology Undergraduate Scholars Program (BUSP) at UC Davis before she

connected with her mentor, Luís Carvajal-Carmona, assistant professor in the Department of Biochemistry and Molecular Medicine, whose lab is in the Genome Center.

Rocha was intimidated at first because of limited lab experience, but her peers and other CURE members

made her feel at home. She recalls conducting only one scientific experiment in high school where she measured the volume of potatoes immersed in different substances.

"The first time I stepped into a lab was when I came to UC Davis," Rocha says. "I felt super out of place, and like

**"These are my kids.** One of the most exciting parts of my job is to encounter students like Yasmin and Sienna, who are a little shy and nervous at first. **It's an absolute joy** to watch them grow and develop."

— CONNIE CHAMPAGNE

## FIRST STEPS

I didn't belong here. Having them (my peers) give me little tips helped me grow and feel more comfortable."

In the Carvajal-Carmona lab, Rocha is studying models called patient-derived xenografts in which researchers implant a human gastric tumor into an immune-deficient mouse. Once the tumor grows, it is analyzed to see which genes were passed on and is compared to other gastric cancer driver genes in a databank.

Yasmin Esparza, a 21-year-old CURE participant and fourth-year biochemistry major, has a similar background. Her parents had minimal

education, so it was important to them that their children had more academic opportunities. Esparza's curiosity about how the body works inspired her to study science—something no one in her family had done.

"It was different for me to go on this path," Esparza says. "Until I got to UC Davis, I had no one to advise

"It was different for me to go on this path. Until I got to UC Davis I had no one to advise me or tell me what the next steps were."

— YASMIN ESPARZA

me or tell me what the next steps were. When Dr. Champagne told me there was a primary investigator looking for undergraduate researchers, she pointed me in that

direction and led me to my mentor."

CURE participants spend 30–40 hours during the summer in the lab and up to 10 hours doing research in the fall, winter and spring quarters. Their mentors encourage a healthy school-life balance and check in with students to make sure they can balance lab time with academic demands.

Esparza caught the research bug as a high school junior after a trip to Johns Hopkins Hospital in Maryland where she had the chance to hold a human liver in the cadaver lab.

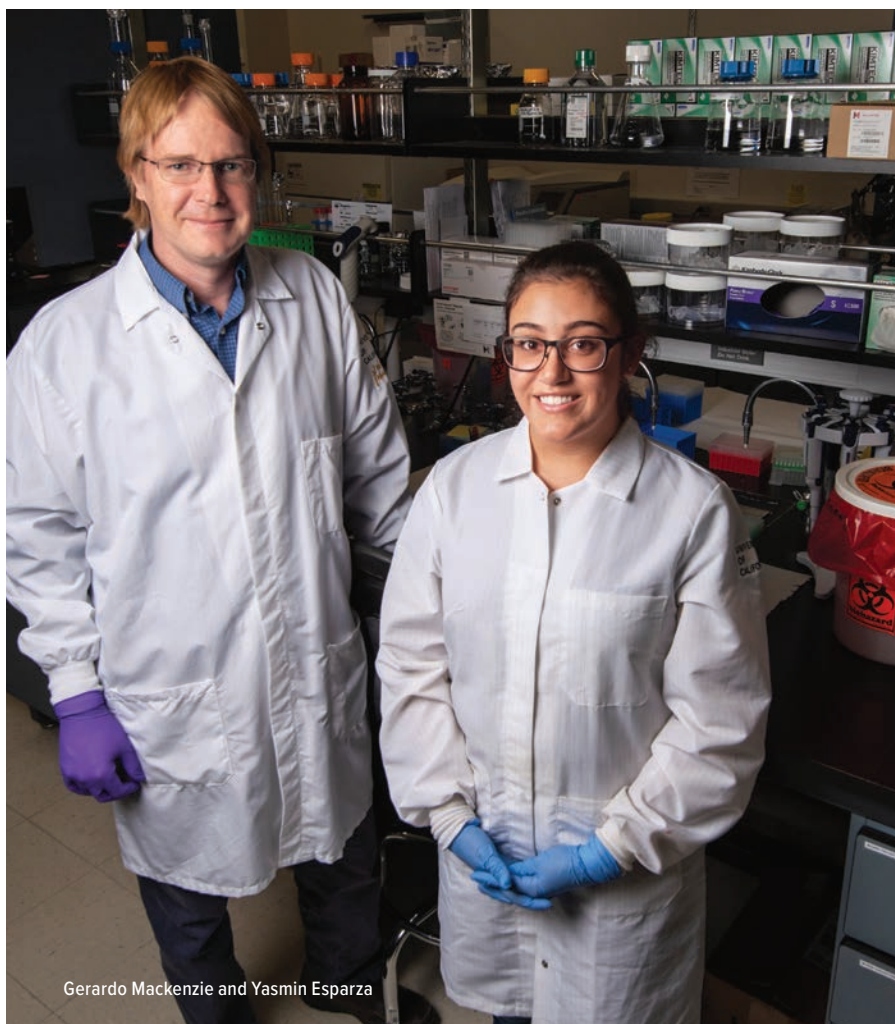
"In that moment I was so interested in how the body works," Esparza says about the experience. "I thought it was so cool to see what was going on inside of us, and I wanted to know the interactions within systems of the body."

Esparza works with Gerardo Mackenzie, assistant professor in the Department of Nutrition.

"Dr. Mackenzie makes sure I'm getting good grades," Esparza says. "He cares about me, my education and my future and wants me to succeed in all aspects of my life."

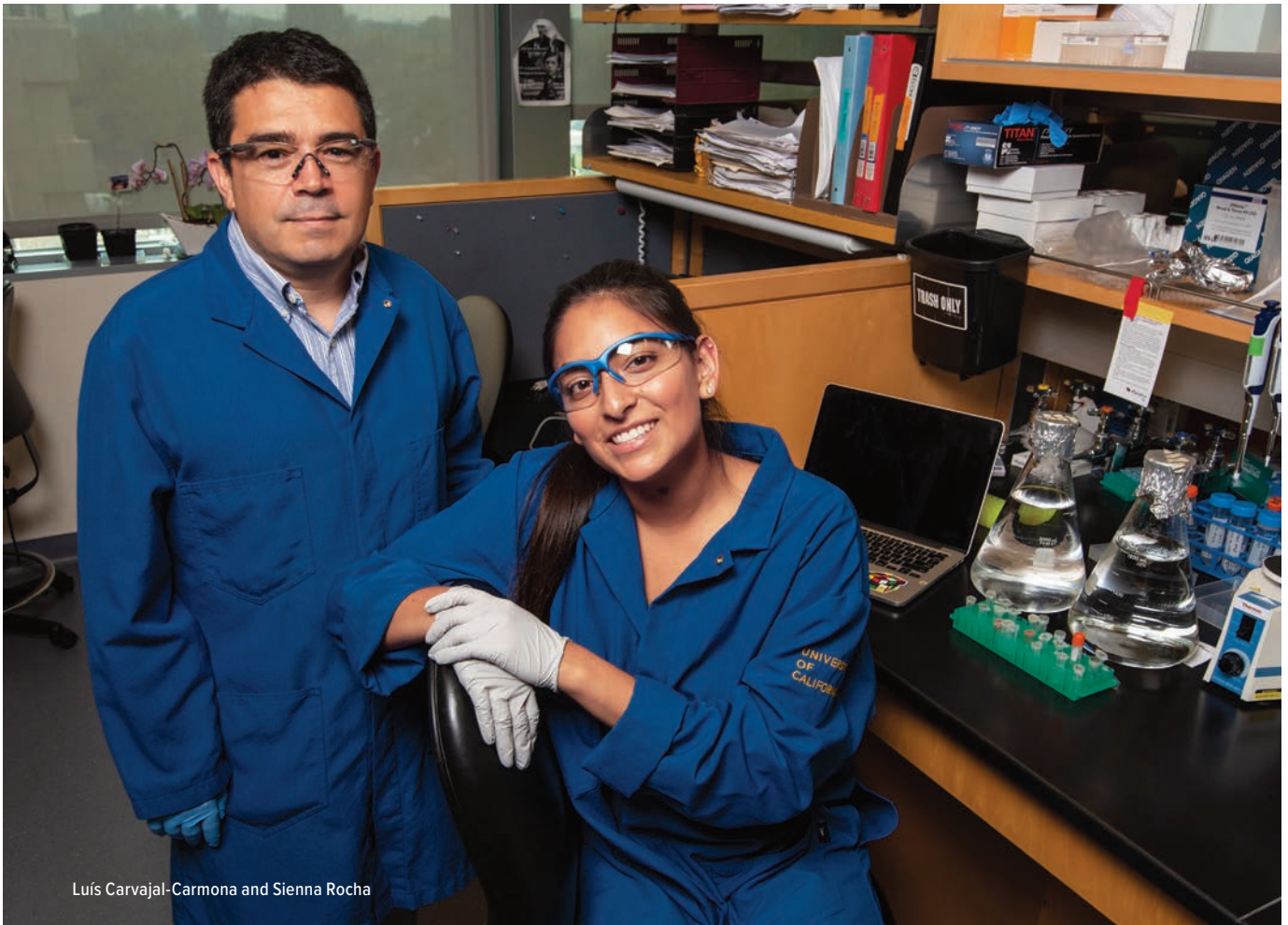
Esparza is currently helping to research whether a turmeric derivative, used in combination with a standard-of-care drug, can improve the pancreatic cancer treatment.

CURE participants also benefit from peer support. They gather



Gerardo Mackenzie and Yasmin Esparza





Luís Carvajal-Carmona and Sienna Rocha

once a week to read a scientific publication and analyze the research findings. A faculty moderator listens while students discuss the paper.

Champagne, who also directs BUSP, feels a kinship with the students.

“As a first-generation college student and immigrant, I had to jump through many of the same hoops,” she says.

When Champagne was asked to lead the program three years ago, she was excited by the offer. Her husband, now deceased after a battle with cancer, encouraged her to accept her role in EEOP because of her special connection to undergraduate students.

“These are my kids,” Champagne says. “One of the most exciting parts of my job is to encounter students

“The first time I stepped into a lab was when I came to UC Davis. I felt super out of place, and like I didn’t belong here. Having them (my peers) give me little tips helped me grow and feel more comfortable.”

— SIENNA ROCHA

like Yasmin and Sienna, who are a little shy and nervous at first. It’s an absolute joy to watch them grow and develop.”

The supplemental grant that funds CURE will not be renewed; however, Champagne plans to apply for a Youth Enjoy Science (YES) grant and to collaborate with UC Davis Comprehensive Cancer Center leadership to maintain the program for future generations.

While Esparza and Rocha don’t know exactly what their futures hold, they both plan to continue to pursue cancer research, thanks to Champagne, Mackenzie and Carvajal-Carmona.

“CURE really helps because it’s aimed toward underrepresented minorities,” Rocha says. “People like us don’t have that chance before coming to college. It’s given us direction and more opportunities than we thought we had.”

## CHALLENGING GLIOBLASTOMA

### New tools, models and targets against brain tumors

**Medicine has made incredible progress against many cancers — but not glioblastoma multiforme (GBM).**

The most common brain tumor, GBM is also the most aggressive. Patients rarely survive more than 18 months.

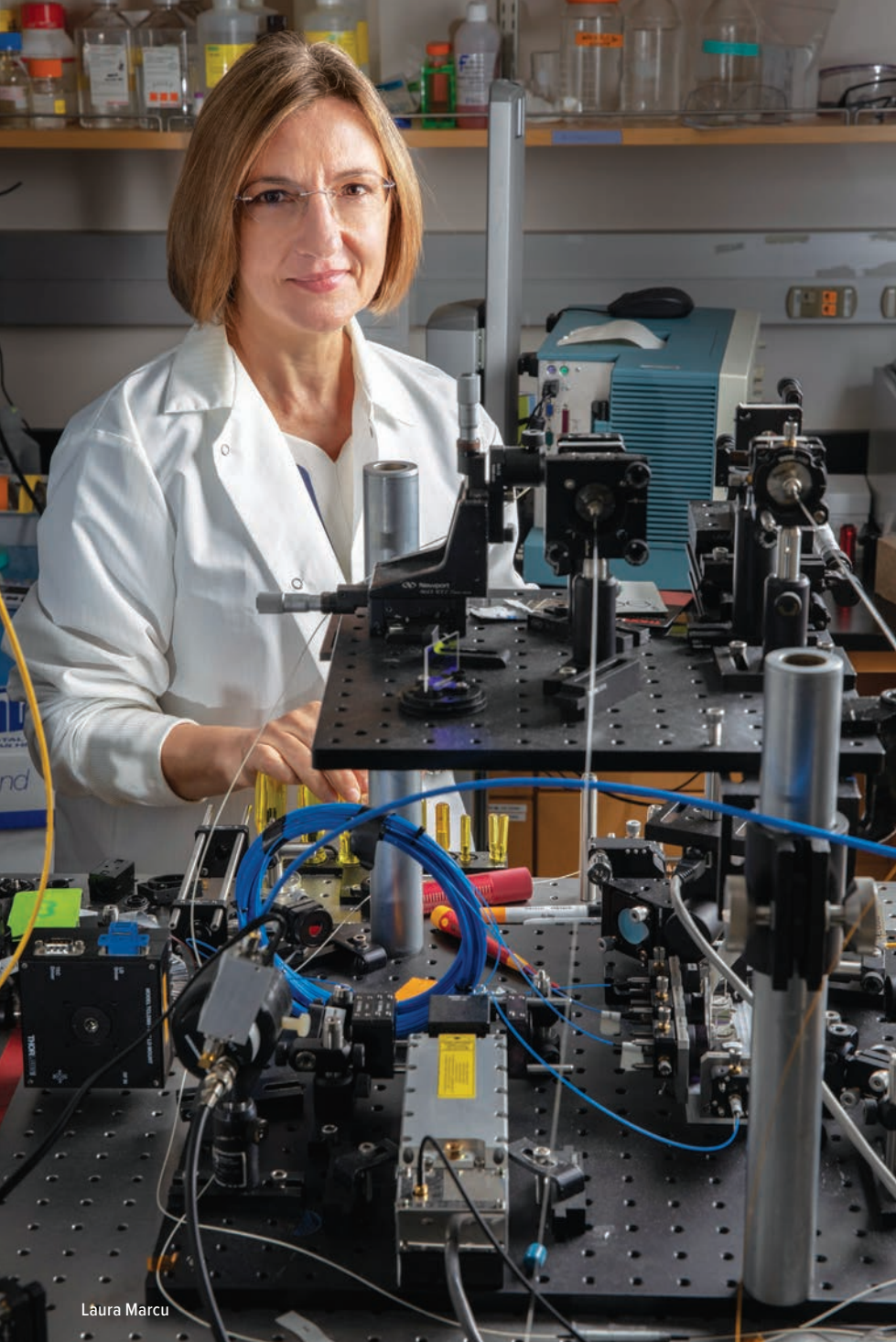
GBMs are difficult to treat for many reasons. Because these tumors often develop in sensitive brain regions, surgical and radiation oncologists must tread carefully. In addition, the blood-brain barrier, which protects us from pathogens and other invaders, blocks most chemotherapies.

Beyond that, GBMs are difficult to dislodge. Tumor tendrils penetrate the brain. Removing them has been likened to taking a wet spiderweb off a bush—microscopic remnants often remain.

These challenges have stumped the medical community for decades, but new approaches have potential to make great headway. Researchers and surgeons at UC Davis Comprehensive Cancer Center are studying new ways to control GBM. By hitting the disease from multiple angles, they hope to extend patient survival.

#### **Better surgical margins**

Surgical oncologists always want to remove as much cancer as possible, regardless of where the tumor is located, but working in the brain is especially challenging. Remove too little and the



Laura Marcu

“We’re taking advantage of the optical properties of different tissue types. **Light carries information about the molecular makeup of tissue**, and each molecule has a different signature. By measuring how long molecules emit light after they are excited by a low-energy laser beam, we can identify the type of tissue.”

— LAURA MARCU

## Griff Harsh joins brain tumor team

Griff Harsh, a prominent brain tumor specialist, has joined UC Davis as chair of the Department of Neurological Surgery and a scientific member of the cancer center.

Harsh, previously with Stanford University, is well known for his clinical practice and research into innovative treatments of tumors of the brain, pituitary gland and skull base. He has had a particular focus on glioblastoma, having discovered a gene deletion and a potential therapeutic target for the disease. He also has tested use of a fluorescent antibody that helps distinguish cancerous from normal brain tissue in patients with glioblastoma, enhancing the safety and precision of surgical treatment.



“There is tremendous potential at the cancer center to expand our brain tumor program,” says Harsh. “We have a multidisciplinary group providing coordinated care for patients with either a primary or a metastatic brain tumor. For the individual patient, we precisely tailor our recommendations for combined surgery, radiation, chemotherapy and immune therapy to the individual’s clinical needs and preferences.”

Harsh notes that the cancer center has a very active multidisciplinary brain tumor innovation group, which meets monthly to discuss new scientific laboratory findings and opportunities for new translational clinical trials at UC Davis.

“The focus is on identifying promising and potentially therapeutic interventions,” he says. “We have at least 10 labs with an interest in brain tumors; this provides fertile ground for increased understanding and therapeutic targeting of these malignant tumors. These include genetic studies to understand the mutations underlying the tumors and how best to interrupt their contributions to tumor development and progression. I’m very excited about it.”

# IN TRANSLATION

cancer comes roaring back. Remove too much and the patient can suffer cognitive damage.

Laura Marcu, professor of biomedical engineering and neurological surgery, is developing technology that could help surgeons precisely remove GBMs without harming healthy tissue.

“It’s very hard to visually differentiate between cancer and normal brain tissue,” says Marcu. “The idea is to be able to distinguish, in real time, the

“My vision for this is a device that is **permanently implanted**. We could put electrodes in and around the brain to **create an electrical cage** around the tumor.”

— KIARASH SHAHLAIE



From left: Katelynn Ondek, Gene Gurkoff, Kia Shahlai, Ali Izadi, Amir Goodarzi

brain regions where tumor cells are present from healthy brain tissue.”

Marcu’s team is solving this problem with light, or more specifically, the ways different tissues respond to light. She has spent several years developing a technology called fluorescence lifetime imaging (FLIM), which uses light to identify molecules in tissues.

“We’re taking advantage of the optical properties of different tissue types,” says Marcu. “Light carries information about the molecular makeup of tissue, and each molecule has a different signature. By measuring how long molecules emit light after they are excited by a low-energy laser beam, we can identify the type of tissue.”

In practice, a neurosurgeon deploys a handheld fiber optic probe to manually scan the surface of the brain or the cavity after a tumor has been removed. A viewer would instantly display information about each tissue’s fluorescence, helping the surgeon quickly separate cancer cells from normal ones.

This approach can augment presurgical MRI scans. Because the brain, and thus the tumor, often shifts during surgery, initial MRI scans become less useful. Real-time FLIM could eliminate that downside, allowing surgeons to reorient themselves during the procedure. In addition, the device requires no contrast agents or other markers; it simply sends light to the tissue and interprets the results.

This technology is being tested on patients but is still being developed. Eventually, a device company will have to step in to commercialize it. However, early results have been quite promising.

“We’re optimistic that we can distinguish the margins of the tumor using this label-free real-time approach,” says Marcu.

### **Pediatric glioma research gets funding boost**

Adding to the growing body of research dedicated to malignant brain tumors at UC Davis, Paul Knoepfler, professor in the Department of Cell Biology and Anatomy and cancer center member, recently was awarded a \$2 million grant to advance his research on childhood brain tumors called gliomas with the goal of catalyzing development of effective novel therapies. While both children and adults can get gliomas, the tumors have different mutations in the kids and likely require different therapies. Supported by the Alex’s Lemonade Stand Foundation, over the past three years Knoepfler and his team have worked to target these unique mutations using a cutting-edge technology called CRISPR gene editing. Through this method the team has developed new models of childhood gliomas and identified novel potential therapeutic approaches they plan to study. The funding also will enable his team to get an even clearer picture of how glioma mutations work to cause the cancer, which they predict will point to additional new therapies to test.

### **Cage the tumor**

There are three main therapies associated with cancer treatment—surgery, chemotherapy and radiation. But now, a fourth technique is being used on GBM—electric fields.

“By generating an electrical field in and around a tumor, and by rapidly alternating that field, we can disrupt the normal process cells undergo for replication,” says Associate Professor and neurosurgeon Kiarash Shahlaie. “The therapy is not a cure, but it does buy more time.”

These alternating electric fields, called TFields, can prevent cell division and even drive programmed cell death (apoptosis). TFields are particularly well-suited for the brain, since neurons do not divide, and could eliminate cancer cells that remain after surgery.

The FDA has approved a TFields instrument that uses electrodes on the scalp to generate the field. Clinical studies have shown the device increases survival, but there are drawbacks. Scalp electrodes can generate heat and other issues. In addition, because the field

must penetrate both scalp and skull, it requires more power, which is supplied by a large external battery pack.

Patients had best results when they wore the device for 18 hours or more, but the discomfort, inconvenience and poor aesthetic sometimes discouraged compliance. People didn't necessarily want to wear their electrical cap every day for the rest of their lives, regardless of the survival benefit.

Shahlaie and colleagues want to overcome these pitfalls with a miniaturized TFields device. They are retasking technology used to

implant electrodes inside the skull, similar to devices that treat epilepsy, Parkinson's disease and other conditions. Wires would lead to a power source implanted in the chest, much like a pacemaker. Because the electrodes would be in the brain, they would require less juice to achieve the desired effect.

"My vision for this is a device that is permanently implanted," says Shahlaie. "We could put electrodes in and around the brain to create an electrical cage around the tumor."

Shahlaie's colleague Gene Gurkoff, a research scientist in the Department

of Neurosurgery, said that will mean a real sense of freedom for patients.

"Having a fully implanted device means you could go to the hills and go camping, hiking or swimming and never have to worry about it," he says. "You just turn it on and let it do its job."

## A nice target

Researchers are constantly looking for selective therapeutic targets—proteins and other molecules that play key roles in cancer but are not vital for healthy cells. One of these is a protein called ATF5, which is overexpressed in GBM and other cancers.

ATF5 is a transcription factor, a protein that helps turn on multiple genes. Targeting transcription factors can be difficult, because they interact directly with DNA and are often well-protected inside the nucleus. For many years, researchers felt most transcription factors were "undruggable."

Shahlaie and colleagues want to overcome these pitfalls with a **miniaturized TFields device**. They are **retasking technology used to implant electrodes inside the skull**, similar to devices that treat epilepsy, Parkinson's disease and other conditions.



Amir Goodarzi tracks rat brain activity through implanted electrodes.

He created an **ATF5 derivative** — an engineered version of the protein that inhibits the original molecule’s function.

“I wanted to see if it caused cancer cells to differentiate. Instead, I found that it killed **cancer** but not normal cells.”

— JAMES ANGELASTRO

When James Angelastro was at Columbia University, he began investigating what would happen if he blocked ATF5. He created an ATF5 derivative — an engineered version of the protein that inhibits the original molecule’s function.

“I wanted to see if it caused cancer cells to differentiate,” said Angelastro, who is now associate professor in the Department of Molecular Biosciences at UC Davis. “Instead, I found that it killed cancer but not normal cells.”

Taking out ATF5 may destroy tumors because this protein regulates genes associated with cell survival. This is a big deal for cancer cells, which are often so damaged they need to turn up pro-survival mechanisms to simply exist. These survival genes also help tumors resist chemotherapy and radiation, but without them, cancer cells basically commit suicide.



James Angelastro

The team has continued to tinker with their ATF5 molecule, adding a cell-penetrating peptide (a piece of a peptide) that helps it penetrate cancer cells. Angelastro’s ATF5 derivative penetrates the blood-brain barrier, a big hurdle for many treatments. The lab has tested the molecule in cell lines and animal models, and each time it destroyed GBM tumors. The molecule could also be effective in ovarian, breast, pancreatic, prostate, lung and other cancers with high ATF5 levels.

The technology has been licensed to Sapience Therapeutics, which is continuing the preclinical studies. UC Davis has an inter-institutional agreement with Columbia University, which holds the Sapience Therapeutics license.

“This is a great proof of concept that we can indeed target transcription factors,” says Angelastro. “This opens the door to new approaches to modulate ATF5 and perhaps similar molecules to eradicate cancer.”

“JUST LIKE  
HAVING AN ANGEL”

Nurse navigators clear  
paths for patients

Oncology nurse navigators help patients  
and their caregivers through what can be  
a complicated and grueling journey.

**MICHAEL AND DONNA** Long spent Easter

Sunday in a Marysville emergency room. Blood tests and a PET scan revealed Mr. Long had non-Hodgkin lymphoma—a diagnosis that left the couple in a hopeless daze. With

support from oncology nurse navigators at the UC Davis Comprehensive Cancer Center, the Longs learned to manage what once felt like an impossible situation.

“I was in bad shape,” the retired police officer says. “It felt like I was in a car accident or some other terrible tragedy.”

Oncology nurse navigators help patients and their caregivers through what can be a complicated and grueling journey. Cancer care is complex and involves multiple transitions that require fine-tuned, interdisciplinary collaboration. Some patients are homeless, without financial support or a caregiver, or don’t speak English, which makes a challenging diagnosis more worrisome. Nurse navigators work to remove barriers to care with insurance providers, coordinate their tests or treatments with outside clinics or hospitals and personalize cancer care.

“A sick person can’t take care of themselves,” Mr. Long says. “Then there’s the bureaucracy to deal with. All the words—they weren’t in my vocabulary.”





Carol Leija with Michael Long

Rideout Health, where Mr. Long was diagnosed, transferred him to UC Davis Medical Center for six rounds of inpatient chemotherapy. The 21-day cycle is intense. He spends five days a month connected to an IV bag filled with clear, cancer-killing liquid, and gets a white blood cell booster shot to reduce his risk for infection 48–72 hours after he leaves the hospital. Today, the Longs feel far less bewildered.

“It’s not a world anyone can navigate alone,” says Mrs. Long. “I can’t tell you how wonderful it is to have someone guide you through the most horrible experience.”

It’s the first day of Mr. Long’s fifth cycle and his oncology nurse navigator, Teri Lown, greets him in

his hospital bed. He shows her a photo of the newest addition to his family while she asks how he’s feeling. A smile washes over Lown’s face as she looks at the tiny newborn with a full head of hair on Mr. Long’s phone.

“I don’t know how she (Lown) remembers everybody,” Mr. Long says. “She gives me a hug, it makes me feel

good. She understands what I’m going through.”

This is routine for Lown and counterpart Carol Leija. Each morning, they walk from their office at the Cancer Center to the Medical Center, where they “huddle” with nurses and physicians. In a crowded room on the eighth floor, they listen to status

“A sick person can’t take care of themselves.  
Then there’s the bureaucracy to deal with.  
**All the words** — they weren’t in my vocabulary.”

— MICHAEL LONG

# OUTREACH

updates on patients, including Mr. Long, and take notes. When the group disperses, Lown and Leija divide and conquer one case at a time.

“We function in a place where we listen, seek to understand and find how we can best connect the patient with what they need,” Leija says. “We have months of relationships with our

patients—emotional support, getting them into palliative care, or just being there.”

Mr. Long doesn't remember much of the first six weeks after his diagnosis, and he's grateful the nurse navigators helped him and his wife through the tough period.

“It's so overwhelming and confusing dealing with different

hospitals and different doctors, and it takes a while to get things set up,” Mr. Long says. “It just doesn't happen. Teri made it (the process) so much easier.”

Every patient need is different. For the Longs, who are grandparents of three, the 90-mile roundtrip drive from Yuba City several times per week was challenging. Lown contacted the clinic at Rideout to ensure Mr. Long could get blood tests and his booster shot closer to home.

“Twenty-five percent of cancer patients need an outside connection,” Lown says. “We want them to stay at UC Davis, but that doesn't always happen. When they go back home, they need help setting up care.”

Lown and Leija manage 240 cases annually and meet 10–12 newly diagnosed cancer patients every month through the Oncology Nurse Navigator Program. Every person

“We function in a place where we listen, seek to understand and find how we can best connect the patient with what they need. We have months of relationships with our patients—emotional support, getting them into palliative care, or just being there.”

— CAROL LEIJA



Carol Leija consults with Emily Becker.



Carol Leija, Neha Damle and Michael Long

“I feel like things are under control now, and **I can see some daylight,**” Mr. Long says.

Adds his wife, “It’s just like having an angel.”

they work with adheres to their personal treatment plan.

More than half of people in the program come into the hospital with leukemia. They require immediate attention because they are in “blast” crisis, or their bone marrow is full of cancer cells. In urgent cases like these, patients spend about a month in the hospital for chemotherapy.

“Acute leukemia and lymphoma patients can’t go two days without a blood check,” Leija says. “It’s easy to fall through the cracks.”

The team also supports physicians. UC Davis hematologist-oncologist Brian Jonas considers the program vital, and credits the navigators’ work for excellent patient care and satisfaction.

“Teri and Carol are caring, dedicated and passionate. They spend a lot of time with patients, families and caregivers when they are scared, overwhelmed and in shock,” Jonas says. “They do an amazing job of navigating patients by comforting and educating them, and giving them hope for the future.”

The program is likely to expand. The team hopes to upgrade existing nurse navigation software that reflects new metrics published by

the Academy of Oncology Nurse Navigators to better track patient and hospital needs and expectations. They also want to grow the program to reach patients with solid tumors.

For their part, the Longs are

grateful the program was there when he was in crisis.

“I feel like things are under control now, and I can see some daylight,” Mr. Long says.

Adds his wife, “It’s just like having an angel.”



Teri Lown

“I don’t know how she (Lown) remembers everybody,” Mr. Long says. “She gives me a hug, it makes me feel good. **She understands what I’m going through.**”

## HONORING NEIL ANDREWS

### with fund for endowed research chair

**AS CARLA Andrews** approached the end of high school in the 1950s, she saw two possible paths stretching before her: teaching and nursing. There may have been other career options for young women in Lima, Ohio, back then, but the guidance counselors hadn't mentioned them.

Teaching held little appeal for Mrs. Andrews, the daughter of a railroad conductor. So nursing it was, and what a fortuitous life choice that turned out to be.

After graduating with her degree from the University of Cincinnati,

The experience also **kindled in Andrews a lifelong interest in cancer research**—and connected her with the man who later became her husband.

Mrs. Andrews—then Carla Foster—joined the nursing staff at The Ohio State University. She worked for a time in orthopedics but switched gears and landed a job with Dr. Neil Andrews, chief of surgery at the affiliated Ohio Tuberculosis Hospital.

Her new boss was famous for developing a surgical procedure—later named the Andrews Technique—to treat tuberculous infections of the lungs. He also participated with the Central Oncology Group, a coalition that included several universities conducting clinical trials of early chemotherapy drugs. “I thoroughly loved that job, because we would see the patients in these early clinical trials every week and track them very carefully,” says Mrs. Andrews. “We had a very close-knit group, and it was very meaningful work.”

The experience also kindled in Mrs. Andrews a lifelong interest in cancer research—and connected her with the man who later became her husband. In 1969, she left Ohio for Los Angeles and worked for an oncology group there. When Neil Andrews moved west a year later to join the faculty of the new UC Davis School of Medicine, the two reconnected and married.

The marriage spanned 44 years, until Neil Andrews passed away in 2015, and for a long stretch the couple



From left: Dr. Neil in 1987, as UC Davis Chair of the Division of Community and Post-Graduate Medicine; Dr. Neil and Carla Andrews



Carla Andrews

Given their **interest in oncology and big-hearted approach to life**, it seemed natural that the couple **might be inclined to contribute** financial support to cancer research.

worked side by side. At UC Davis, the clinical trials in pursuit of effective cancer treatments continued. Neil Andrews served as chairman of the Division of Community and Post-graduate Medicine, as well.

The couple's dedication to community health extended far beyond their day jobs. Gov. Ronald Reagan appointed Neil Andrews to chair the Governor's Cancer Advisory Council, and he was also active in leadership of the American Cancer Society and California Medical Association throughout his life.

His wife's immersion in philanthropy was just as intense, highlighted by leadership positions with the Yolo County Medical Society Auxiliary (three terms as president) and the California Medical Association Alliance. As president of the latter group in 1990, Mrs. Andrews focused on raising funds to support community health projects. In 1991, she was recognized with an award from the UC Davis School of Medicine for raising money to support scholarships for medical school students.

Given their interest in oncology and big-hearted approach to life, it seemed

natural that the couple might be inclined to contribute financial support to cancer research. The Andrews have done just that, and then some.

The Andrews have been longstanding supporters of a variety of programs at UC Davis. In 1995, they began to set up a number of planned gifts that will result in the establishment of the Neil C. Andrews, M.D., and Carla F. Andrews Endowed Chair in Cancer Research at the UC Davis Comprehensive Cancer Center.

"We believed it would be most helpful if the gift wasn't restricted, because what's important today might not be important in the future," says Mrs. Andrews. "When I think of how things have changed in cancer treatment from the 1950s to today, it's astonishing, so we did not want to place limits on the fund's use."

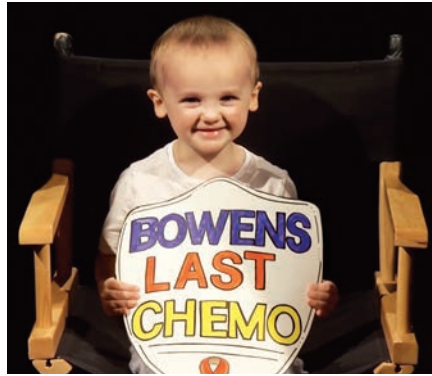
Keeman Wong, the cancer center's executive director of development, commends their generosity and foresightedness to create an endowed chair that reaffirms the cancer center's commitment to innovation and impact in cancer research.

"Dr. Andrews was truly a pioneer and stayed on the forefront of developing new cancer treatments with his work in clinical trials," Wong says. "The gift that Dr. and Mrs. Andrews are providing the cancer center will pay tribute to their commitment to helping advance the most important priorities in cancer research."

Mrs. Andrews is retired now, but she continues her volunteer work, loves to play golf and keeps close track of the latest research underway at the UC Davis Comprehensive Cancer Center.

Asked about her philosophy with regard to philanthropy, Andrews says she has always been guided by a straightforward principle: "Every gift makes a difference, no matter how large or small."

To learn how you can support cancer research, education and patient care, contact Keeman Wong at [kmwong@ucdavis.edu](mailto:kmwong@ucdavis.edu) or 916-734-9322.



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Medical oncologist **Jonathan Riess** and radiation oncologist **Megan Daly** co-chaired the third annual Bonnie J. Addario Lung Cancer Foundation “Your Next Step is the Cure” walk/run on June 23. The event raises funds for lung cancer education and research, some of which has been received by UC Davis Comprehensive Cancer Center investigators.

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**Synthesis** – the art of bringing together distinct elements

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