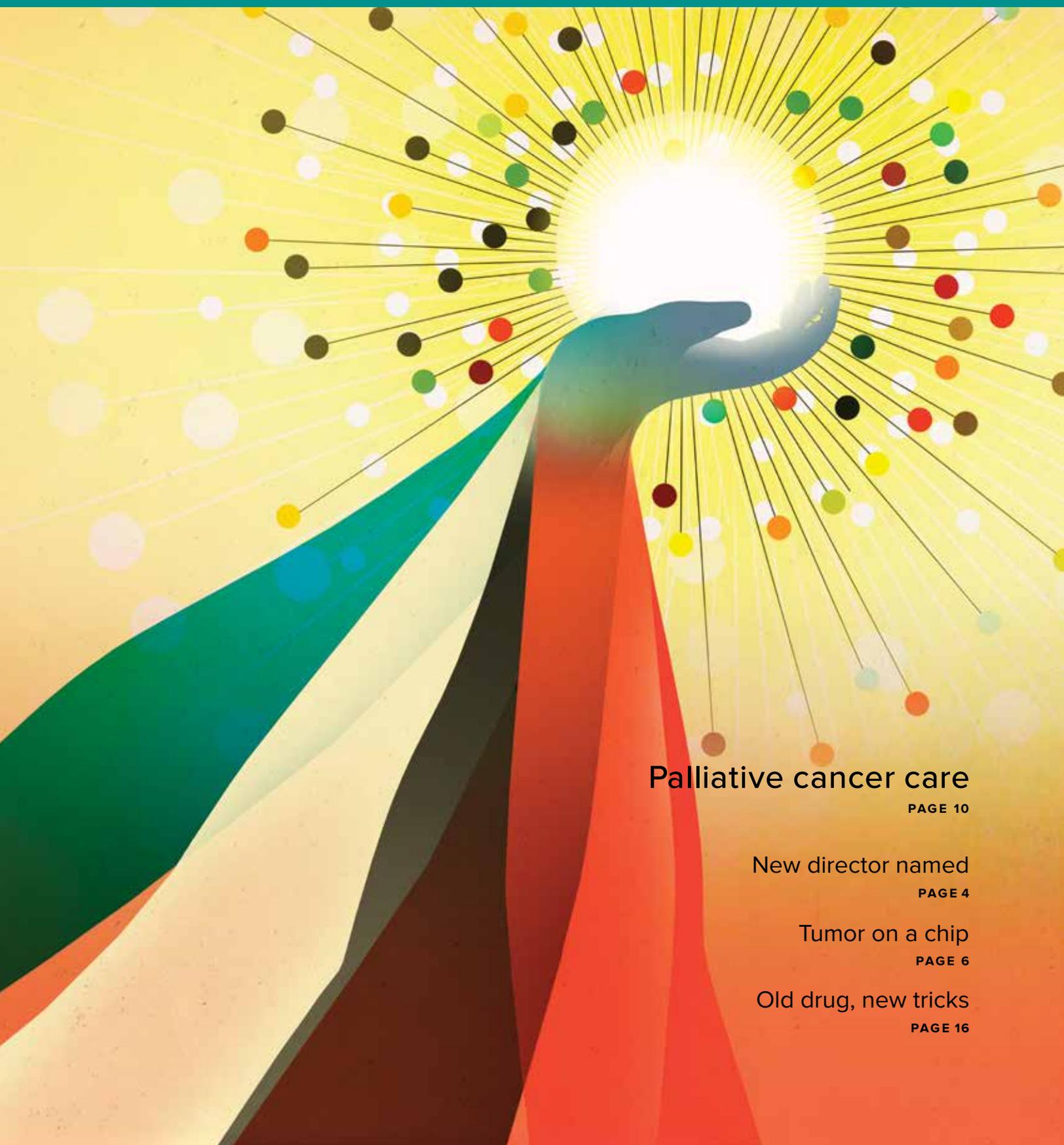


SYNTHESIS

THE MAGAZINE OF UC DAVIS COMPREHENSIVE CANCER CENTER

VOL 21 | NO 1 | SPRING 2018



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Dear Reader,

In this issue of *Synthesis*, we highlight remarkable achievements by our incredible team at the UC Davis Comprehensive Cancer Center to optimize care for people with cancer, train the next generation of cancer researchers and deploy high-tech, leading-edge research tools. Ultimately, we envision that these efforts will reduce the cancer burden in our community and beyond.

Our cover story spotlights the cancer center's Supportive Oncology Program, which promotes exceptional palliative care. The program offers patients professional support to manage pain, stress and other challenges at any point during the cancer journey. You will learn that palliative care is not just confined to the end of life but is a critical component of a patient's overall treatment plan, regardless of cancer stage.

Also in this issue of *Synthesis*, we'll tell you about Cancer Biology, a popular undergraduate science class at UC Davis, and its role in helping secure the pipeline for cancer researchers. This class builds a solid foundation in biology for our young researchers, allowing them to develop the skillset to methodologically study and solve the cancer problem.

We will introduce you to UC Davis biomedical engineer Steven George, whose laboratory at UC Davis is creating a novel platform for determining whether a certain drug against breast cancer will be effective for a specific patient's tumor. George explains this "tumor-on-a-chip" technology and how it may help personalize cancer treatment.

Taking innovative ideas from the laboratory to the clinic is an essential part of what we do at UC Davis. On the hunt for new agents against advanced prostate cancer, researcher Allen Gao found promise in an old tapeworm drug, niclosamide. Today, Gao is collaborating with oncologist Chong-xian Pan on the clinical trial of a drug that has proven to be effective not only in the laboratory but, remarkably, in the clinic.

We are happy to present these and other stories in this issue of *Synthesis*. If you have any suggestions for future editions, please contact our editor, Dorsey Griffith, at dgriffith@ucdavis.edu.



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

SYNTHESIS

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VOL 21 | NO 1 | SPRING 2018

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Review by UC Davis researchers contributes to new prostate cancer screening recommendations

An exhaustive review by UC Davis researchers of more than 60 studies is the basis for new national prostate cancer screening recommendations. The U.S. Preventive Services Task Force recommends that for men ages 55–69 the decision to undergo periodic prostate-specific antigen (PSA)-based screening for prostate cancer should be an individual one and should include a discussion between the patient and his clinician about the potential benefits and harms of screening.

The task force determined that while screening offers a “small

potential benefit of reducing the chance of death from prostate cancer in some men,” many men “will experience potential harms of screening.” Those include false-positive results that require additional testing and possible biopsy, over-diagnosis and overtreatment, and treatment complications such as incontinence and erectile dysfunction.

The new recommendation updates a prior one published in 2012, in which the task force concluded that screening benefits do not outweigh the expected harms enough to recommend routine screening.

The evidence was compiled and analyzed for the task force by a team at the UC Davis Center for Healthcare Policy and Research, and led by **Joshua Fenton**, a family medicine physician who has



conducted numerous studies on the effectiveness of various cancer screening methods and technologies.

A 17-year legacy: AANCART tackled Asian American cancer health disparities

In 2000, the National Cancer Institute funded the Asian American Network for Cancer Awareness, Research and Training (AANCART) to reduce health disparities among Asian Americans. Headquartered at UC Davis Comprehensive Cancer Center since 2002, the group’s researchers poured their energy into investigating the unique cancer burden affecting Asian Americans. The grant ended in December 2017.

Asian Americans are the first U.S. population to experience cancer as the leading cause of death, and their cancers are disproportionately due to infectious agents such as viruses that cause liver cancer. High rates of tobacco use and lower rates of cancer screenings are additional challenges facing these populations.

To focus on this burden, AANCART developed linguistically appropriate

materials in at least six Asian languages, cultivated culturally competent and trusting relationships with the community, trained bilingual/bicultural lay health educators, completed 12 randomized controlled studies and nurtured an impressive array of next-generation researchers.

Seventeen years and 218 published peer-reviewed papers later, AANCART achieved major milestones — some even unpredicted — in demonstrating that cancer risk behaviors can be significantly reduced for colorectal cancer and liver cancer among Asian Americans.

Other notable achievements included:

- **Mentorship of new and early-stage investigators**, many of whom pursued post-secondary degrees, published research as primary investigators and received awards,

including **Elisa Tong**, winner of the UC Davis Dean’s Team Science Award; **Shin-Ping Tu**, the new chair of the Division of General Internal Medicine; and **Julie Dang**, director of the Cancer Center’s Community Engagement and Outreach;

- **Creation of a bilingual (English/Spanish) video** about advantages for HIV-positive patients to participate in cancer clinical trials, now in use in Puerto Rico;
- **Collection and utilization of a record number of biospecimens** to characterize cancer risk in Asian Americans; and
- **Laying the foundation for a three-year Bristol-Myers Squibb Foundation grant** to increase cancer detection, care and prevention into primary care offered through Health And Life Organization (HALO), which runs community clinics in Sacramento.

NATIONAL CANCER INSTITUTE TYPES OF CANCER RESEARCH

CANCER RESEARCH INCLUDES FOUR BROAD CATEGORIES

Basic research seeks to understand the fundamental aspects of nature. It provides the foundation for advances against cancer.



Clinical research tests drugs, medical devices, or other interventions in human volunteers to improve all aspects of patient care.



Population-based research explores the causes of cancer, cancer trends, and factors that affect the delivery and outcomes of cancer care in specific populations.



Translational research moves basic research findings into the clinic and clinical research findings into everyday care. In turn, results from clinical and population-based studies can guide basic research.



SOURCE: NATIONAL CANCER INSTITUTE

Cancer Center and HALO collaborate to reduce cancer burden in Asian Americans

A collaboration spearheaded by UC Davis cancer specialists was launched June 1 to enhance cancer prevention and oncology care for up to 10,000 Asian Americans, Native Hawaiians and Pacific Islanders in Sacramento.

The UC Davis Division of Hematology and Oncology and Comprehensive Cancer Center are partnering with Health And Life Organization (HALO) and its community clinics to identify those at risk and get them the expert care they need.

The collaborative is led by **Moon Chen, Jr.**, associate director for cancer control and cancer health disparities at the Cancer Center, and funded with a \$750,000 grant from Bristol-Myers Squibb Foundation with additional support from the UC Davis Office of Research, Cancer Center and Clinical and Translational Science Center.

Cancer is the leading cause of death in Asian Americans, many of which are preventable. The collaborative will focus on interventions, including tobacco cessation and human papilloma virus vaccination, and screenings for cervical, liver, breast and colorectal cancers.

Screenings will take place at HALO clinics with support from bilingual health educators and UC Davis specialists who can help the clinics use the electronic medical record as a tool to alert providers about needed screenings and care.

PRIMO “LUCKY” LARA

Named UC Davis Comprehensive Cancer Center Director

Primo Nery Lara, Jr. is the new director of the UC Davis Comprehensive Cancer Center, leading a team of more than 300 scientists with an estimated \$90 million in annual research funding and a clinical enterprise that serves more than 10,000 adult and pediatric patients throughout the region every year.

Lara’s move into the director’s role comes with unprecedented commitment and support from the university and health system, with enhanced resources to meet the National Cancer Institute’s more rigorous requirements and the growing clinical needs for advanced cancer care in the region. A reimagined leadership and organizational structure will enable the cancer center to more nimbly embark on innovative basic, translational and clinical cancer research — the foundation for the nation’s leading NCI-designated cancer centers.

“Dr. Lara is well-respected among his peers and his advice is sought by many,” said UC Davis School of Medicine Interim Dean Lars Berglund. “He is a resourceful and experienced leader, and I know he will build upon the strong foundation already in place at the cancer center to bring it to new heights and continued national prominence. With instrumental

institutional support from both UC Davis Health and UC Davis, he is well-positioned to do so.”

Lara, 52, replaces Ralph de Vere White, who retired in 2016. As director, Lara holds the Codman-Radke Chair in Cancer Research and serves as executive associate dean for cancer programs. Lara was selected for the position after a national search; he served as acting director since July 2016.

UC Davis is the only NCI-designated comprehensive cancer center that cares for patients throughout the Central Valley of California, a diverse region of more than 5 million people. With a dual role as both an academic medical center for research and delivering excellent care for the community, UC Davis offers a citywide clinical trials program that enables every eligible cancer patient access to early-phase investigational therapies, regardless of their treating hospital affiliation.

Known to most as “Lucky” Lara, the new director began his career at UC Davis as a hematology-oncology fellow specializing in cancers of the lung, kidney, prostate and bladder. He was invited to join the faculty in 1999. A strong advocate for his patients,

One of my philosophies has always been that everything you do, whether in the lab, in a database or pathology department, **only matters if it eventually touches an individual.**

— PRIMO “LUCKY” LARA



Primo "Lucky" Lara

A strong advocate for his patients, Lara works **tirelessly to ensure that each is provided comprehensive care and access to leading-edge therapies.**

Lara works tirelessly to ensure that each is provided comprehensive care and access to leading-edge therapies.

"One of my philosophies has always been that everything you do, whether in the lab, in a database or pathology department, only matters if it eventually touches an individual," he said. "It can't be done in isolation. If it has very little chance of affecting a cancer patient, we won't prioritize it."

Lara is an accomplished scientist, with principal research interests in the field of developmental therapeutics and in cancer clinical trials development. He has served as the cancer center's associate director for translational research, which takes novel therapies from the laboratory into the clinic to benefit patients, since 2008. Lara has chaired or co-chaired many trials from phase I to III and has authored

or contributed to more than 200 peer-reviewed scholarly papers, most of which describe research into novel cancer therapies.

His leadership in clinical research at the cancer center extends to the broader cancer research community where he enjoys a national and international reputation. In March, Lara was named incoming deputy chair of SWOG, a leading international cancer research organization, where he will also oversee the National Clinical Trials Network portfolio of treatment trials. He serves as editor-in-chief of two journals, *Cancer Treatment and Research Communications* and *Kidney Cancer*.

Lara is active in medical education and training, serving as principal investigator of the NCI-funded K12 Paul Calabresi Clinical Oncology Training Grant, which trains junior faculty

scholars to be independent, patient-oriented cancer researchers. As cancer center director, Lara is responsible for ensuring the center meets its strategic planning goals and aligning those with the broader university goals. Among them is to grow the clinical program throughout the region and beyond.

"We have a tremendous opportunity to leverage the unique scientific expertise in the schools, laboratories and academic departments throughout UC Davis," Lara said. "Our job is to make sure that our collaborations result in transformative cancer research and care for each of our patients."

Lara completed his medical residency at Rush University Medical Center in Chicago and received his Doctor of Medicine degree at the University of the Philippines. The first Filipino-American to lead an NCI-designated cancer center, Lara emigrated to the U.S. in 1992 from Manila; he is now a naturalized U.S. citizen. He is one of eight children raised by a single mother, all of whom now live in Northern California. A resident of Davis, Lara is married to Elizabeth Lara; they have two sons, Joshua and Matthew, both undergraduates at Stanford University.

Tumor on a chip:

A NEW TOOL TO PERSONALIZE CANCER CARE

RESEARCHERS AND CLINICIANS are learning how to personalize cancer treatments by adopting next-generation sequencing (NGS), mathematical models and other approaches to ensure that each patient gets the ideal combination of therapies.

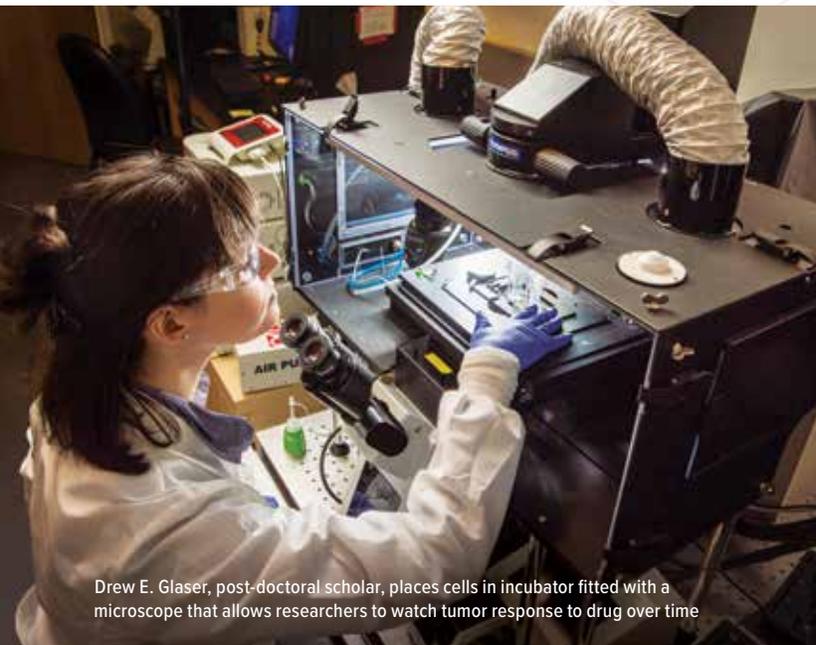
UC Davis biomedical engineer Steven George has a different strategy: create microtumors from patient samples and test drugs against them.

The device could help address a fundamental challenge in oncology: **Cancer is not one disease but many.**

“We can put primary human cancer from a

patient’s biopsy in a small, microfluidic device with perfused human capillaries and deliver drugs through the capillaries,” said George, professor in the Department of Biomedical Engineering. “It would give us an idea if the cancer is sensitive or resistant to a certain drug even before it is given to the patient.”

The device could help address a fundamental challenge in oncology: Cancer is not one disease but many. Consider the variations among breast cancers, such as ductal carcinoma in situ, invasive ductal carcinoma and triple-negative tumors. Each type might require a different therapeutic approach, and the complexity only increases. Cancers are chaotic, and even similar tumors often have different mutations, challenging physicians to find the most optimal therapies for each patient’s unique cancer.



Drew E. Glaser, post-doctoral scholar, places cells in incubator fitted with a microscope that allows researchers to watch tumor response to drug over time



Steven George with his microfluidic device

NGS has been enormously helpful. By identifying specific mutations in tumors, clinicians can assign treatments that target those variations. But NGS has its own shortcomings. Sometimes targeted therapies fail, even when the tumor sequence indicates they should work.

George believes his technology could augment NGS and other systems to provide real-time feedback on which agents work for a particular tumor.

Drugs vs. tumors

George and colleagues have spent more than a decade developing this tumor-on-a-chip technology. The device, made from a flexible polymer —

like a firm rubber — can fit into the palm of your hand. Microfluidic channels, about the width of a human hair, are connected to engineered human capillaries. Together, the channels deliver tumor material, the extracellular matrix and nutrients that support the tumor.

The capillaries are a key refinement, helping these 3D micro-tumors better replicate conditions inside the body. The tumor specimen itself is tiny, smaller than a cubic millimeter, making it incredibly helpful for clinicians, since acquiring large amounts of biopsied tumor tissue can be difficult. In addition, the platform's small size will help researchers test multiple agents on different samples simultaneously.

George and colleagues have spent **more than a decade developing this tumor-on-a-chip technology**. The device, made from a flexible polymer — like a firm rubber — can fit into the palm of your hand.

“We can put tissue into the device and test several different drugs,” says George. “We could potentially screen a panel of drugs or test the same one at different concentrations. There are a number of choices in the neoadjuvant (prior to surgery) setting for breast cancer. If the tumor is more sensitive to one agent over another, then you would choose that drug.”

Immunotherapy

In addition to testing chemo or targeted therapies, the device could also help determine whether immune therapies can help specific patients. The first generation of these drugs, called checkpoint inhibitors, has been both miraculous and disappointing.

In addition to **testing chemo or targeted therapies**, the device could also **help determine** whether **immune therapies** can help specific patients.

For the 20–25 percent of patients who respond to these treatments, tumors evaporate. The rest see

little to no effect, and the side effects can be significant.

Having the ability to test checkpoint inhibitors, or other immune system-targeting drugs, on live tumor tissue could help determine if a patient will respond.

This could be both a short- and long-term approach. George’s lab is currently modeling different ways to use stem cells to test immunotherapies, using cells from the patient to create induced pluripotent stem cells (iPSCs), which can then be coaxed in culture to form essentially any tissue. Because these cells come from the patient, and not a donor, they could provide more precise information on how that patient’s immune system will react to therapy.

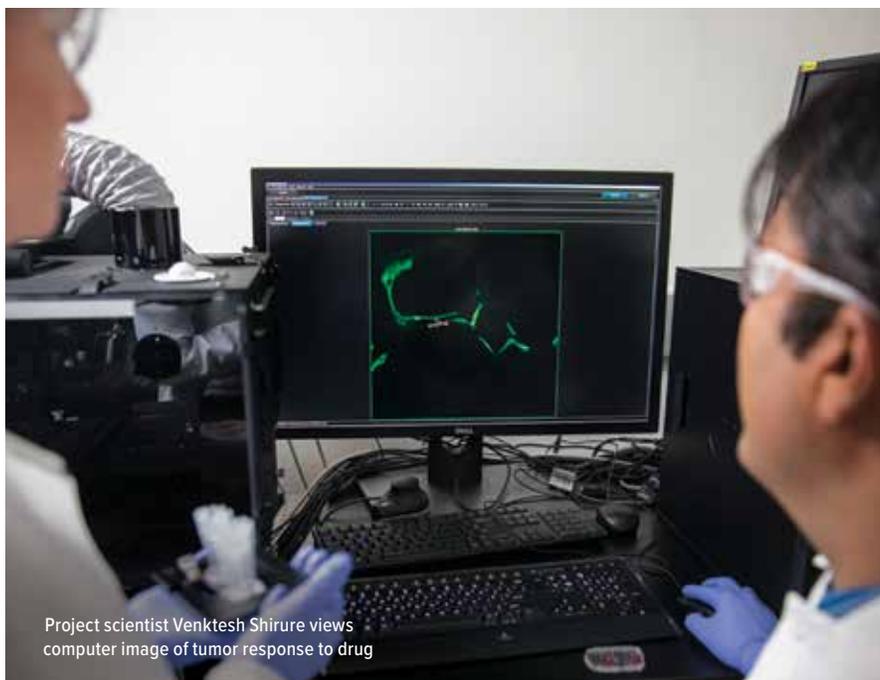
“You would have a genetically matched in vitro system to test immunotherapy or other agents,” says George.

This is not a fast process — it would take three to six months to transform a patient’s cells into the target tissue. However, this method could give physicians a head start should the patient’s cancer return, which it often does.

“If we can give the clinician useful information six months later, they can know what to do if the cancer comes back,” says George.

Drug discovery

Looking down the road, a tumor on a chip could be a great advantage for drug discovery. While animal models can be very useful, they don’t quite replicate humans. As a result, many drugs that work in animal models fail in human clinical trials.



Project scientist Venktesh Shirure views computer image of tumor response to drug



Drew Glaser and post-doctoral scholar Vasudha Murlidhar prep the cells for injection into the microfluidic device

“The success rate is low because predicting drug efficacy can be quite difficult,” says George. “With our platform, you could have better information to choose which drugs go into clinical trials. So far, pharmaceutical companies have been interested in using it to test lead compounds prior to clinical trials.”

George and colleagues are still refining the system in the lab, and he has co-founded a biotech company, Kino Biosciences, to help commercialize the technology. And while the device has obvious applications in cancer, there are other potential applications.

“Eventually, our technology could be useful to test drugs for other diseases that involve the immune system,” says George. “We are currently exploring rheumatologic diseases, organ transplantation, multiple sclerosis and type I diabetes.”

“Eventually, our technology could be **useful to test drugs for other diseases** that involve the immune system. We are currently exploring rheumatologic diseases, organ transplantation, multiple sclerosis and type I diabetes.”

— STEVEN GEORGE

PALLIATIVE CARE

Emotional, spiritual and other support

When Angelina Voyevoda was diagnosed with late-stage cancer last year, her world collapsed. Just 34, with three kids and a stay-at-home husband, Voyevoda was suddenly hospitalized and told the aggressive cancer, which began in her lung and spread to her bones, could kill her within weeks.

She long ago beat those tough odds, thanks to the expert cancer care she's received. And while the ensuing months have been challenging, Voyevoda says one key intervention — along with God — has helped her survive: palliative care.

"I've had help with so many problems — pain, insurance, depression, big decisions," says Voyevoda. "It has made such a difference in my life."

Long associated just with hospice, palliative care is rapidly gaining traction as a tool that enhances quality of life and may also improve survival. At UC Davis, palliative care is emerging as a centerpiece of the Supportive Oncology Program, reflecting evidence that its beneficial effects on symptom control and holistic well-being can help at any stage of a serious illness — not just the very end.

This spring, the UC Davis Comprehensive Cancer Center dramatically expanded its palliative care offerings with the launch of a specialized clinic that provides patients support services as a complement to standard oncologic treatment. Staffed by a doctor, nurse, social worker and chaplain, the clinic helps



Left to right: Julie Kim, chaplain; Mook-Lan Iglowitz, physician; Nathan Fairman, physician; Meghann Crane-Russ, social worker

patients manage pain, stress and other challenges associated with cancer, including questions raised by the wide variety of treatments available today.

“One of the persistent myths about palliative care is that it’s only available at the very end of life, but there’s a strong body of research supporting its use simultaneously with disease-directed treatment,” says Nathan Fairman, the cancer center’s director of Supportive Oncology and Survivorship. “Patients who receive palliative care early on feel more in control of their care,

At UC Davis, palliative care is emerging as a centerpiece of the Supportive Oncology Program, reflecting evidence that its **beneficial effects** on symptom control and **holistic well-being can help at any stage of a serious illness — not just the very end.**

less stressed and tend to have better outcomes.”

Palliative care is defined as specialized medical care for people with serious illnesses. Practitioners focus on reducing patients’ pain

and other symptoms through an interdisciplinary approach that typically includes providing emotional and spiritual support.

Over the past decade, the field has expanded rapidly as public interest

in palliative care has increased amid reports of its benefits. In 2000, less than one-quarter of U.S. hospitals had a palliative care program; by 2016, three out of four offered services, according to the Center to Advance Palliative Care.

Such growth reflects studies showing that patients who receive palliative care tend to fare better than those who don't. Benefits include significant reductions in pain, fatigue, insomnia, depression and anxiety, as well as considerable improvements in

Benefits include significant reductions in pain, fatigue, insomnia, depression and anxiety, as well as considerable improvements in overall quality of life and an enhanced ability to cope with a difficult prognosis.

overall quality of life and an enhanced ability to cope with a difficult prognosis.

Patients receiving palliative care

early also are less likely to have late-in-life hospitalizations — including time in an intensive care unit or emergency room — than those who receive palliative care later, a 2015 study showed. Fewer visits mean lower hospital costs, with one study estimating that inpatient palliative care consultations are associated with more than \$2,500 in net cost savings per patient admission.

Some research also has shown palliative care's potential to improve survivability. One 2010 study of patients with metastatic lung cancer found that those who received palliative care along with standard oncologic care lived significantly longer than patients who did not receive palliative care.

Reflecting such findings, the American Society of Clinical Oncology (ASCO) in 2016 updated its guidelines to recommend that “inpatients and outpatients with advanced cancer should receive dedicated palliative care services, early in the disease course, concurrent with active treatment.”

“That was huge,” Fairman recalls, “because we had the most well-respected clinical oncology organization acknowledging that it's best for the patient to have a specialist in palliative care working alongside the oncologist.”

Adoption of the ASCO guideline also shows how far palliative care has come. For years, its link with hospice gave it a bit of an identity problem, with many



Nathan Fairman

people misperceiving its value and assuming patients receiving such care had given up on life.

In addition, some oncologists viewed palliative care with distrust, assuming providers might dissuade patients from pursuing cancer treatments. Similar tensions surrounded the role of palliative care in a research institution with a mission to develop novel therapies to beat cancer.

“Patients sometimes reach a point where continued cancer therapy is no longer in line with their goals,” explains Fairman, an associate professor in the Department of Psychiatry and Behavioral Sciences. “When that happens, palliative care experts can help patients, their family members and their doctors come to a new decision about the focus on their medical care.”

At UC Davis, the investment in supportive oncology services has been growing steadily in recent years. Resources now include educational programs for patients and families, dedicated oncology social workers, psychiatric and spiritual support, a pain medicine clinic, and a home-based palliative care service for patients whose symptoms make traveling difficult.

Last year, the cancer center took another step forward by creating Fairman’s position. A psychiatrist with certification in hospice and palliative medicine, Fairman continues to see patients and teach courses while striving to expand and integrate support services across the cancer center’s continuum of care.



“I’ve had help with so many problems — pain, insurance, depression, big decisions. **It has made such a difference in my life.**”

— ANGELINA VOYEVODA

The full-service Palliative Care Clinic, which sees patients four days a week, might be called the *pièce de résistance*. In Fairman’s view, it dovetails perfectly with the “comprehensive” mission embedded in the cancer center’s name.

“I think our patients believe that when they come to UC Davis, they will be cared for comprehensively, as a whole person,” he says. “We need to honor that expectation, and our supportive oncology program aims to do just that.”

Fairman says the clinic also frees up oncologists to “focus like a laser on treating the cancer” while the support team helps patients with symptoms, side effects and the myriad non-medical issues triggered by serious disease.

“Someone with a serious cancer who maybe struggles with mental health problems or other complex medical issues can present a very challenging situation for oncologists,” says Fairman. “I think they appreciate being able to partner with another

team of experts, to support patients and their family members while they are dealing with cancer.”

Voyevoda certainly does. The West Sacramento resident has undergone surgery, chemotherapy, immunotherapy and radiation for her cancer, and has experienced a cascade of symptoms and side effects, including significant pain.

But visits and phone support from her home-based palliative care team have made a difference. Her nurse and social worker have helped with medication adjustments, arranged a home visit by a specialist to treat an eye infection, mediated an insurance coverage dispute and even helped with logistics so that Voyevoda’s father could visit from Russia.

“We can call them any time, for any problem,” says Voyevoda. “Let me tell you, some people gave up on me, but not these people. I will never forget them.”

MEET OUR BILE DUCT AND LIVER CANCER TEAM

CATHERINE VU is chief of Vascular and Interventional Radiology. She provides non-surgical options for primary tumors and for cancers that have spread to the liver. These include selective internal radiation therapy (SIRT), trans-arterial chemo-embolization (TACE) and percutaneous ablations. SIRT combines embolization and radiation therapy to directly target lesions in the liver, offering a high dose of radiation to the tumor while mostly sparing normal liver tissue.

“Interventional radiology treatments are relatively new to oncology, and some providers are unaware of the innovative treatments we offer,” Vu says. “When I meet patients in the clinic to discuss these therapies, they regain hope, and that alone makes my job worthwhile.”

STEVEN COLQUHOUN is director of the hepatobiliary program and a surgical oncologist who has more than 25 years of experience treating patients with hepatobiliary cancer. Colquhoun, who began his career at UC Davis in 1993, specializes in liver transplantation and most recently was director of the Liver Transplant and Pancreaticobiliary Surgery Program at Cedars-Sinai in Los Angeles.

“I am here to reinstate the liver transplant program at UC Davis and bring back the full complement of treatments available for patients with liver tumors, which includes liver transplantation,” he says.

MAY CHO is a medical oncologist who specializes in the medical treatment of gastrointestinal malignancies, including esophageal, gastric, pancreatic, hepatobiliary and colorectal cancers. She is a strong advocate for providing patients with comprehensive care that includes profiling for genetic mutations, regional therapies, clinical trials and supportive care.

“In the era of personalized genomic medicine and immunotherapy, the treatment paradigm

for cancer is changing,” she says. “Innovation and clinical trials are important — not only to aim for a cure, but also to reduce side effects of therapy and disease, and to enhance quality of life.”

Cho says she understands that a cancer diagnosis is frightening for patients and their family, and that trying to beat cancer can be exhausting and frustrating. “It is my pleasure and humble privilege to be part of these journeys and help patients and families make informed decisions to make their paths smoother.”



CANCERS OF THE BILE DUCT AND LIVER are tackled by a collaborative, multidisciplinary team of experts at UC Davis Comprehensive Cancer Center. Together they provide state-of-the-art treatments using a range of approaches that include medical oncology, interventional radiology, radiation therapy and surgery.

ARTA MONJAZEB is a radiation oncologist who specializes in therapy for and research on gastrointestinal cancers. Much of his work focuses on cancers of the hepatobiliary system. He helped design novel treatment strategies now being tested in clinical trials for primary liver cancers and liver metastases. He also has implemented stereotactic ablative radiotherapy for cancers of the liver and pancreas.

“Hepatobiliary cancers are very common in our patient population,” he says, “and I am proud to be part of a team of experts that provides world-class care to our patients.”



SEPIDEH GHOLAMI is board certified in hepatopancreatobiliary (cancers of the liver, pancreas and biliary tree) and surgical oncology, and recently completed her dual fellowship at Memorial Sloan Kettering Cancer Center. She is working to build a multidisciplinary liver surgery program with a focus on molecular genetics and immunopathology in liver malignancies. Gholami hopes to develop new systemic and targeted therapies, and she is part of the gastrointestinal immuno-oncology group studying the tumor microenvironment, pathways of therapeutic resistance and immune profiling to design early-phase neoadjuvant clinical trials.

“I am also establishing a new regional treatment program for colorectal cancer that has spread to the liver with the introduction of the hepatic artery infusion chemotherapy pump program,” she says. The pump program is designed to deliver chemotherapy through the hepatic artery to more directly target the tumor.



EDWARD KIM is a medical oncologist and scientist who specializes in the medical treatment of gastrointestinal malignancies, including pancreatic, hepatocellular, biliary, esophageal, gastric and colorectal cancers. An advocate for and expert in developing clinical trials, Kim currently conducts several hepatobiliary cancer trials that combine standard chemotherapies with immunotherapies and newer agents that target known genetic mutations.

“It’s a pivotal point for patients with hepatobiliary cancers,” he says. “In just the past couple of years, several new options have emerged with up to five different approved treatments for hepatocellular (liver) cancer. So it’s more important than ever for these patients to be managed by a multidisciplinary team to guide them through the complex options to tailor a sequence of therapy for each individual patient.

“Biliary cancers, including intrahepatic and extrahepatic cholangiocarcinoma and gallbladder cancers, remain very challenging with a single, FDA-approved line of therapy. Genomic profiling of these tumors has revealed that each of these three biliary cancers is distinct. My goal is to profile patients’ tumors early in the course of therapy to gain insight into unique genomic alterations that may allow for a precision-medicine approach to their care.”

TEACHING AN OLD DRUG NEW TRICKS

Tapeworm medication extending lives of advanced prostate cancer patients



Thomas Hogue and Rudy Cuellar have both made lasting contributions to the Sacramento area community.

Hogue is an evangelist and the father of seven grown children. “Don’t ask me to count the grandchildren,” jokes the 78-year-old Elk Grove resident. Since

moving to the area in 1980, Hogue has been organizing a team of more than 300 volunteers as part of Loaves and Fishes that feeds thousands of homeless people in downtown Sacramento twice a month.

Cuellar is a 67-year-old former art instructor living in Sacramento. He retired from California’s correctional system where he spent years bringing the healing power of art to inmates. He also spent years teaching art to students at Sacramento State University. But many local residents might know him best as a member of the Royal Chicano Air Force, a group of activist artists. “I was the youngest and I don’t drink, so I used drive all those old guys around,” Cuellar says.



Thomas Hogue and Tara Martinez, nurse practitioner

Hogue and Cuellar may also be making a lasting contribution to science and helping to reduce the number of deaths caused by advanced prostate cancer, which last year numbered more than 29,000. When they volunteered for a phase I clinical trial being conducted by researchers at the UC Davis Comprehensive Cancer Center, both men were suffering from advanced disease that was not responding to treatments. Now, thanks to a drug called niclosamide, discovered in 1958 to treat tapeworm infections and rediscovered by UC Davis researchers

When they volunteered for a **phase I clinical trial** being conducted by researchers at the UC Davis Comprehensive Cancer Center, **both men were suffering from advanced disease** that was not responding to treatments. Now, thanks to a drug called niclosamide ... **both have been cancer-free for more than a year.**

to be useful against prostate cancer, both have been cancer-free for more than a year.

“Initially, 95 percent of patients with metastatic disease will respond to current treatment, but eventually almost all of them will become resistant to the medications,” explains oncologist Chong-Xian Pan, a professor of medicine and urology. “That leaves men with advanced disease with few options. Niclosamide may help us change that.”

The phase I study of niclosamide included six men and was funded by the National Cancer Institute’s Small Business Innovation Research (SBIR) program. Now, Pan and his colleagues have been awarded a second SBIR grant for a phase II study that will allow them to offer the niclosamide treatment to more patients. Because niclosamide is already FDA-approved, the combination therapy could be available to men with advanced prostate cancer in as little as three to five years, Pan says.

That would be good news given that prostate cancer is the most common form of cancer diagnosed in men. One in nine will be diagnosed

with the disease in his lifetime. In recent years, prostate cancer has become one of the most treatable types of cancer — that is unless a man develops the advanced form of the disease. Niclosamide could change that.

For the current trial, researchers combined niclosamide with abiraterone, an androgen blocker and one of the medications currently used to treat prostate cancer. According to Pan, androgen deprivation therapy is the first line of treatment for prostate cancer that has spread to other parts of the body, or metastasized. When androgens are blocked, tumors shrink. Researchers believe that niclosamide inhibits resistance and allows

abiraterone to continue to do its job.

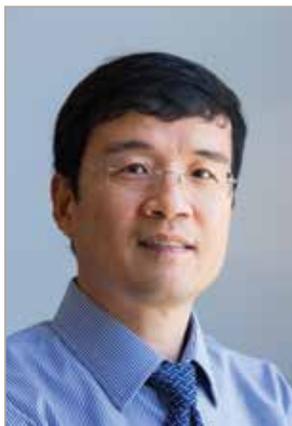
However, when patients have become resistant to androgen-deprivation therapy, they are diagnosed with castrate-resistant prostate cancer, or CRPC. Studies have shown that the tumor cells of men with CRPC have a receptor that is different from the one most men have. (A receptor is a cell-surface protein that binds to a specific molecule; testosterone, in this case.) The surface receptor these men carry is called androgen receptor variant-7, or AR-V7.

“If a patient has the AR-V7 receptor, current medications don’t work well and that leaves them with few treatment options,” says Allen Gao, Ralph de Vere White Professor of Urology, director of urologic research and the scientist who discovered the effectiveness of niclosamide.

Gao had been studying the mechanisms by which men develop resistance to androgen blockers and decided to screen molecules, including drugs currently used to treat other conditions.

“Out of more than a thousand molecules, we found several candidates that inhibit AR-V7. We chose niclosamide, an FDA-approved drug

Under Pan’s care, Cuellar has lost 27 pounds, is busy with his artwork, and continues to walk three to four miles daily around his neighborhood. “I have four grandchildren in Fresno. I get to watch them grow up,” he says.



“If a patient has the AR-V7 receptor, current medications don’t work well and that leaves them with few treatment options.”

— ALLEN GAO



Rudy Cuellar

to treat tapeworm infection, as the best one for the study,” Gao says.

Both Hogue and Cuellar have been on a regimen of niclosamide and abiraterone for over a year. When they began, both had PSA levels in the hundreds. (PSA stands for prostate-specific antigen, a protein produced exclusively by prostate cells. Blood levels of PSA are used to detect prostate cancer.) After just eight weeks, each man saw his PSA levels drop to undetectable levels — and stay there.

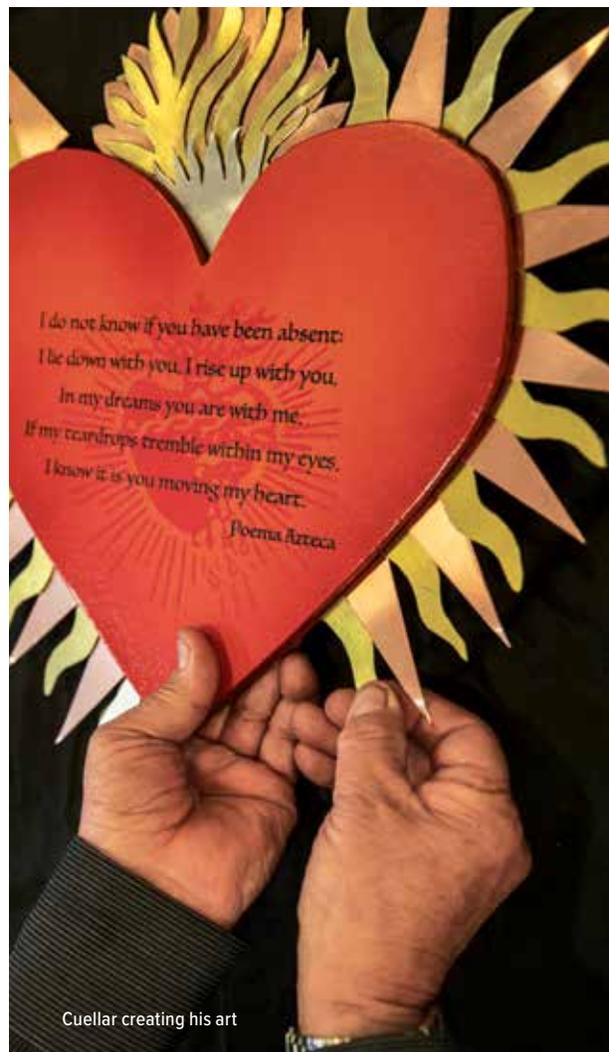
“We have never seen this with abiraterone alone,” Pan says.

Under Pan’s care, Cuellar has lost 27 pounds, is busy with his artwork, and continues to walk three to four miles daily around his neighborhood. “I have four grandchildren in Fresno. I get to watch them grow up,” he says.

Hogue, who also walks his neighborhood, is back to doing 25 to 30 push-ups every morning. “I feel like a 100 percent better from where I was. I exercise. I feel good. I am back to traveling,” he says.

The initial SBIR grant was awarded to the cancer center and Pandomedx, a UC Davis start-up company cofounded by Gao. In the future, the team plans to combine niclosamide with other current prostate cancer therapies to see if they get similar results. Pan says the time and money saved by finding an already FDA-approved drug that can successfully treat CPRC means more lives can be saved.

“If our trial is successful, this will offer CRPC patients the chance to receive effective treatment.”



Cuellar creating his art



{PATIENT EXPERIENCE}



KRISTIN MENSONIDES BRINGS MORE THAN A DECADE OF EXPERIENCE IN HEALTH CARE

ADMINISTRATION from Cleveland Clinic and Sutter Health to her role as director of oncology services. The Oklahoma native lives in Napa with her husband, an administrator at Crestwood Behavioral Health in San Francisco. We met with her to discuss this newly created position and why it's critical to supporting patient care and excellent customer service.



Why did you choose to join the UC Davis Comprehensive Cancer team?

A. In all the service lines I've worked, cancer has been my favorite. I've had the opportunity to work for academic and community hospitals, and I enjoy the academic environment the most. What inspires me are the leading-edge medicine, education and research components, clinical trials, and advocacy for patient care. It was a really exciting opportunity to join the UC Davis family and to shine a light on the incredible work being done — not just in Sacramento — but in our surrounding communities to give patients access to the services they deserve.



What are some of the challenges you face?

A. One of the challenges is access, which shows up in several ways. We are working to expedite our current processes through our new Patient Referral Center to ensure new patients can see a physician as quickly as possible. We are also working to help gain access for patients who would like to receive care at UC Davis but whose insurance providers are not contracted with the health system. We never want to delay care.



Can you share your short- and long-term goals for improving patient satisfaction?

A. Fortunately, we addressed a short-term goal shortly after I joined the team. We added employees to the call center to reduce call wait times. We are also reevaluating our processes and workflows, setting expectations and defining metrics to improve customer service. The call center is one of the gateways to the cancer center, and it's often a patient's first impression of us.

As far as long-term goals — we're analyzing our staffing models to see how we stack up against other University of California hospitals and other comprehensive cancer centers. We need to ensure we have aligned our staffing resources, such as nursing, medical assistants, physicians, nurse navigators, social workers, dietitians and genetic counselors, to truly wrap around our patients throughout their cancer journey. It is a team approach to care, and we need to ensure we are staffed to adequately meet the needs of our patients every step of the way.

We have such a wonderful team and foundation. I'm excited by the opportunity to elevate the cancer center and showcase the hard work the existing team demonstrates.

MARCIO MALOGOLOWKIN,
CHIEF OF THE DIVISION OF
PEDIATRIC HEMATOLOGY AND
ONCOLOGY, talks about fertility
planning for adolescent and
young adult cancer patients.



How can cancer and cancer treatment affect a patient's fertility?

A. Infertility can be the result of a tumor or surgery to remove a tumor, or of chemotherapy or radiation treatment, which can destroy a person's ability to produce sperm and affect the ability of eggs to mature. Cancer treatment also can have an impact on hormone production and endocrine function necessary for fertility.



How big of a problem is this for young cancer patients and survivors?

A. Depending on the therapy received, infertility can affect up to 80 percent of adolescent and young adult patients. For example, some chemotherapeutic agents can lead to a profound or even permanent loss of sperm production in men or egg maturation in women.



What is oncofertility?

A. Oncofertility is a new field of medicine that brings together oncology and reproductive medicine with the goal of improving and developing fertility preservation options for cancer patients, as well as mitigating the effects cancer treatment has on future fertility potential.



Why focus on this now?

A. As cancer doctors we have not paid enough attention to this need. We tend to focus on cancer treatment and survivorship, but may forget about the side effects of treatment that can affect a patient's ability to eventually have a family. Many of these patients haven't had a chance to think about having children, and it's our responsibility to make sure they have the information they need to explore their options before starting treatment.



What can be done to address fertility concerns?

A. For males, we can offer sperm banking prior to treatment. We work with the Northern California Fertility Medical Center and California IVF Fertility Center, where semen is collected and frozen for future use. For patients unable to ejaculate, the center offers sperm harvesting and other techniques for preservation. Female patients can undergo ovarian stimulation, egg harvesting and freezing for preservation. We want to offer these options for everybody who runs the risk of fertility problems and make other technologies, such as testicular and ovarian tissue preservation, available to patients.

At UC Davis Comprehensive Cancer Center we have a mission to preserve the right of our patients to have fertility options.

GATEWAY TO
CANCER RESEARCH

Popular undergraduate course
inspires future scientists

The general title belies the **depth and breadth** of this upper-division class, which is now **aimed at biological sciences majors** but also **offered to anyone (with permission) regardless of background.**

LAST SPRING, Petra Dahms' Facebook profile picture carried the banner

"I'M WITH SCIENCE." The UC Davis graduate's inspiration: "Cancer Biology," one of her courses.

"Cancer Biology was one of my favorite classes and contributed to my decision to pursue a career in cancer research," says Dahms, now working at Stanford University. "The class — and working with Dr. Barlow for the summer on a research project — were

truly life changing for me."

Dahms' sentiments were echoed by Wang Cao, an undergraduate biology major at Nanjing University in China, who also took Cancer Biology last year through UC Davis Extension.

Speaking via Skype from Nanjing, he says he was particularly surprised to learn how complex the biology underlying cancer is. The course fueled a fascination with immunotherapy.

Old idea updated

Offered by the UC Davis Department of Microbiology and Molecular Genetics, Cancer Biology is run this spring quarter



Martin Privalsky

by Martin Privalsky, distinguished professor, and Sean Collins, assistant professor. Jacqueline Barlow, assistant professor, instructed the class last spring quarter. Other faculty members have made important contributions as guest lecturers.

Privalsky remembers that a similar but less scientifically oriented course targeted to non-majors was offered about 30 years ago, which covered some basic science as well as social issues around cancer.

“The course was very well received by a diverse group of students,” recalls Privalsky, then a guest lecturer for the class.

The course fell by the wayside over the years, but Wolf-Dietrich Heyer, professor and department chair, approached Privalsky about reviving it with a more scientific focus. The

“Focusing on the normal state and then on how things go awry is a **good model to better understand any biological system**. The course really provides a **wonderful opportunity to integrate knowledge** from other classes.”

— MARTIN PRIVALSKY

general title belies the depth and breadth of this upper-division class, which is now aimed at biological sciences majors but also offered to anyone (with permission) regardless of background.

The updated Cancer Biology provides a firm grounding in cell biology and cancer genetics, and covers the basics of clinical treatments, including chemotherapy, radiation, surgery, personalized medicine and immunotherapy. The course uses the second

(2014) edition of the classic 900-page tome, “*The Biology of Cancer*,” by Robert Weinberg, which provides a comprehensive introduction to the subject, taking readers from the basics to a solid foundation of knowledge.

Lessons of cancer widely applicable

About 70 students took the popular class last year, and enrollment is expected to be even higher this year. While more than half the students

are pre-med or have an interest in pursuing another health science career, there are always some students in the class from other fields, such as zoology or plant sciences.

The instructors would like to see students with even more diverse backgrounds join the class.

“Focusing on the normal state and then on how things go awry is

a good model to better understand any biological system,” Privalsky says. “The course really provides a wonderful opportunity to integrate knowledge from other classes.”

Class instructors want students to come away understanding that scientific progress is incremental, so sudden news of a cure for cancer is unlikely. And yet the basic understanding of cancer biology is continuously advancing. This is the essence of scientific knowledge, they argue, and what leads to improved therapies, higher cure rates and better prognoses than were possible decades ago for many cancers.

After Cao finished the class, he embarked on two biomedical research projects at Melbourne University in Australia — one in colon cancer and the other in immunotherapy. Now back at Nanjing University, he will pursue a doctoral degree at Melbourne University after graduation, with plans to continue immunobiology research.

“I find that I love it!” he adds with evident delight.

Reaching beyond the science

What students do after graduation from UC Davis is not tracked, so it is not known how many pursue medicine or cancer research after taking the course. The instructors are thrilled to hear that some have been inspired to embark on such careers, but emphasized that this is not their only goal.

“Everyone has some personal experience with cancer, whether it is a friend, family member or even the student who has had to confront it,” says Privalsky. “We approach the course from multiple angles, with the aim that students will learn the science but will also connect on a more human level.”

The last few lectures of the quarter-long course are devoted to societal and psychological aspects of cancer, including personal and financial impacts. Some of the



Wang Cao

“The information I learned in **Cancer Biology has been invaluable** to my research experience,” she says. Dahms plans to continue to “be with science” and is applying to doctoral programs in cancer biology, genetics and molecular biology.



guest lecturers discuss their own experiences with the disease, further driving home the real-world relevance of what students have learned in class. The instructors hope that all students will be able to talk about cancer more comfortably and with a greater understanding as the matter inevitably arises during their lives.

Launching the next generation

Dahms and Cao have kept in touch with Barlow, who taught the course last year. Dahms is currently a research assistant in a Stanford laboratory, investigating transplant rejection in the lymphatic and cardiovascular systems.

“The information I learned in Cancer Biology has been invaluable to my research experience,” she says. Dahms plans to continue to “be with science” and is applying to doctoral

programs in cancer biology, genetics and molecular biology.

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— MARTIN PRIVALSKY

LOVE OF TEACHING THAT DIDN'T STOP IN THE CLASSROOM

Arbuckle woman's life and legacy supports clinical research

JEANNINE Struckmeyer taught kindergarten in Arbuckle, Calif. for 34 years. She knew everyone in town; generations of children began their academic careers in her classroom. Known for her magnetic personality, fabulous desserts and appetite for adventure, her death caused heartbreak in the community, who paid homage to their beloved friend by donating to the UC Davis Comprehensive Cancer Center in her memory.

“Everybody remembered ‘Mrs. Struckmeyer,’ ” says Mark,

Known for her **magnetic personality, fabulous desserts and appetite for adventure**, her death caused heartbreak in the community, who paid **homage to their beloved friend by donating** to the UC Davis Comprehensive Cancer Center in her memory.



Mrs. Struckmeyer and her family

her youngest son. “She really made a positive impact on a lot of people.”

Friends, former students and neighbors demonstrated their love by giving more than \$16,000 to the research of Tianhong Li, a UC Davis lung cancer specialist and Mrs. Struckmeyer’s primary oncologist. Li and the cancer center team made a lasting impression on the retired teacher — and, as it turns out, the reverse was also true.

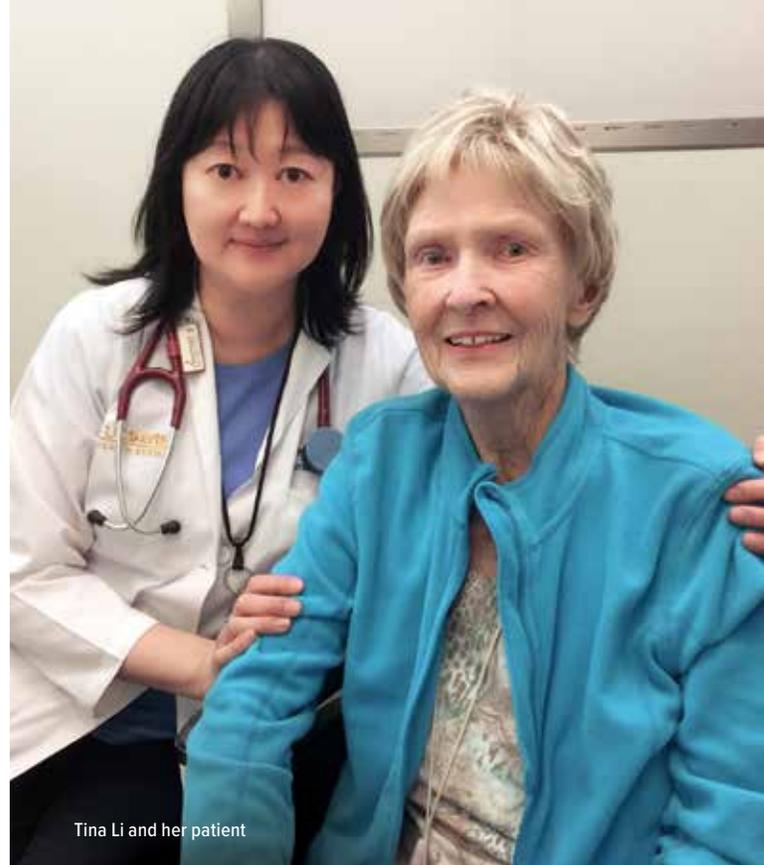
“My mother had complete faith in Dr. Li and the medical staff,” says Mrs. Struckmeyer’s oldest son, Tedd. “She did so well with treatment and was fast to tell everyone how great Dr. Li was. We felt a lot of support.”

Although she was retired, Mrs. Struckmeyer never stopped teaching; her willingness to participate in cancer clinical trials taught her doctors valuable lessons. When her tumor didn’t respond to the second clinical trial, doctors did another biopsy. Her care team discovered that her tumor had uncommon EGFR mutations, and she was prescribed a new drug, afatinib, for more than two years.

“We are constantly learning,” Li says. “She (Mrs. Struckmeyer) got EGFR-targeted therapy before we understood it. Medical advances can be made



Mrs. Struckmeyer celebrates a birthday.



Tina Li and her patient

because of clinical trials, but we still need better drugs for a cure.”

Throughout her journey, Mrs. Struckmeyer had six courses of treatment, including three as part of clinical trials, and kept a positive attitude — she surpassed the average life expectancy after diagnosis five-fold.

“Mrs. Struckmeyer was a firm believer in the value of clinical trials and research at UC Davis Health,” says Keeman Wong, the cancer center’s senior director of development. “She helped lead us to insights about new treatments that will undoubtedly help future patients, and the gifts made in memory of Mrs. Struckmeyer will advance our work.”

The Struckmeyer siblings each held important roles in their mother’s care. Tedd and his wife, Lynda, a retired nurse, accompanied her to appointments for support. Mark, a farmer, drove her to and from appointments every week. Her daughter, Lisa McClish, enjoyed one-on-one time with her on weekends.

Donations to the cancer center for Dr. Li’s research were icing on the cake for the family, who felt lucky to have the community support.

“She would always say, ‘If they didn’t tell me I was sick, I’d never know I had cancer,’” says Tedd. “We decided we needed to create a bucket list. Part of our plan was to have things for her to look forward to.”

The family went to Disneyworld in Florida, North and South Carolina, Georgia and the San Juan Islands. They drove to San Francisco during the holidays to view Christmas lights, rode in a hot air balloon in Napa Valley and visited the San Diego Zoo, where they dared one another to ride a zip-line.

Near the end of her life, Mrs. Struckmeyer’s cancer metastasized to her brain and the targeted therapies failed to suppress all the identified tumor mutations. It became clear treatment was no longer an option, and together with her family and care team, she achieved her end-of-life goals — she saw her “greatest treasure” and only grandchild, Colt, turn 12, and she made it to her 87th birthday.

Donations to the cancer center for Dr. Li’s research were icing on the cake for the family, who felt lucky to have the community support.

“In memoriam gifts are a wonderful way to honor the patient and recognize physicians, nurses and others for their amazing care,” Wong says.

Nov. 7, 2017 would have been Mrs. Struckmeyer’s 88th birthday. While the family couldn’t all be together to celebrate, they each agreed to honor her by enjoying dessert at the same time, then swapped photos afterward to seal the memory.

To learn how you can help support cancer research, education and patient care, contact Keeman Wong at kmwong@ucdavis.edu or 916-734-9322.



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Synthesis – the art of bringing together distinct elements

in a way that makes them whole— is a particularly

relevant name for the magazine of UC Davis Comprehensive Cancer Center, which is distinct in its commitment to team science.

Our research program unites clinical physicians, laboratory scientists, population specialists and public-health experts from

throughout UC Davis and Lawrence Livermore National Laboratory with the goals of making cancer discoveries and delivering

these advances to patients as quickly as possible. We are also dedicated to sharing our expertise throughout the region,

eliminating cancer disparities and ensuring all Californians have access to high-quality cancer care. *Synthesis* – linking the best in

cancer science toward the united goal of improving lives – is the name of our magazine, and our promise as your National Cancer

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