

SYNTHESIS

THE MAGAZINE OF UC DAVIS COMPREHENSIVE CANCER CENTER

VOL 20 | NO 1 | SPRING/SUMMER 2017

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Dear Reader,

At the UC Davis Comprehensive Cancer Center we like to say we're breaking barriers to beat cancer. This is more than a slogan. It's a reflection of our mission to address the scientific, clinical and social roadblocks to achieving the best possible outcomes for each patient we serve. In this issue of *Synthesis* we will share a variety of ways in which we are taking on these obstacles.

Our cover story about Gracie Smith describes clinical trials designed by UC Davis oncologists that aim to improve the effectiveness of exciting new immunotherapies for patients with advanced lung cancer. In another story about immunotherapy, you will learn about an innovative use of an older drug that is stopping the progression of melanoma.

And don't overlook the photographic illustration of the collaboration between the Departments of Biomedical Engineering and Radiation Oncology in which patients with tumors close to the surface of their skin are fitted with custom-made shields that add a protective layer, reduce unnecessary radiation exposure and better target the treatment dose.

In other features that highlight the cancer center's supportive and specialized clinical care, you will meet David Copenhaver, a pain medicine specialist who works to bring individualized pain treatment to patients, and Angie Usher, a social worker who describes the role of new patient distress screening that helps ensure patients get the support they need through the duration of their care. You will also learn about our expanded Hereditary Cancer Program, which provides genetic counseling to patients at risk for inherited cancers.

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



Primo “Lucky” Lara | ACTING DIRECTOR, UC DAVIS COMPREHENSIVE CANCER CENTER

SYNTHESIS

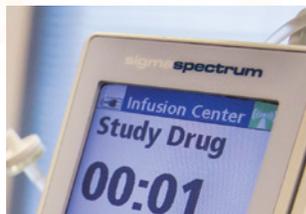
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cancer.ucdavis.edu



UC DAVIS
COMPREHENSIVE
CANCER CENTER

A NATIONAL CANCER INSTITUTE-DESIGNATED
COMPREHENSIVE CANCER CENTER

High-intensity ultrasound + immunotherapy = tumor control in mice

In a study published in *JCI Insight*, UC Davis researchers showed that combining high-intensity focused ultrasound with two immunotherapies (a PD-1 checkpoint inhibitor and TLR9 agonist) can produce excellent response rates in mouse models of epithelial cancer. **They also found that, for the combination to be effective, immunotherapies must come first.**

“These combination protocols can achieve a complete response in a large fraction of solid tumors,” said **Katherine Ferrara**, professor in the UC Davis Department of Biomedical Engineering

and senior author on the paper. “We found that we could achieve responses in distant lesions, but the specific protocol is really important.” High-intensity focused ultrasound is **a relatively new approach to eliminating or reducing malignant tumors.**



An ultrasound beam heats up tumor tissue, killing cancer cells in minutes. However, the effect is purely localized. The UC Davis team hoped that by combining it with immunotherapies they could gain more systemic tumor control.

When given in the correct order, the therapies had a profound impact on tumors, controlling systemic lesions, as well as those being targeted with ultrasound. In addition, treating multiple tumor sites sequentially with ultrasound following immunotherapy was more effective than immunotherapy alone.

Cancer Care Network welcomes two new sites

The UC Davis Health Cancer Care Network of community oncology programs has expanded to include **Barton Health** in Lake Tahoe and **Ridgecrest Regional Hospital** in the southeastern Sierra. **The affiliations enhance access to oncology services for patients in less urban areas who otherwise might have to travel hours to receive leading-edge cancer care.**

The Cancer Care Network, launched in 2008, also includes Rideout Cancer Center in Marysville, Mercy Cancer Center in Merced, Gene Upshaw Memorial Tahoe Forest Cancer Center in Truckee and AIS Cancer Center in Bakersfield.

As part of the affiliation, Barton Health is launching Barton Oncology. Barton Health patients, who until now



have received cancer care at Tahoe Forest Cancer Center, will have access to diagnostic and follow-up oncology visits at Barton.

Ridgecrest Regional Hospital will provide oncology services in the hospital’s outpatient pavilion. Ultimately they hope to build a cancer center and radiation oncology services.

HPV AND VACCINATION RATES



5 OF 10

BOYS NATIONWIDE

have started the HPV vaccine series



6 OF 10

GIRLS NATIONWIDE

have started the HPV vaccine series

65%

GIRLS IN CALIFORNIA

aged 13–17 years received at least one dose of the HPV vaccine

29%

BOYS IN CALIFORNIA

aged 13–17 years received at least one dose of the HPV vaccine

SOURCES: NATIONAL CANCER INSTITUTE, CALIFORNIA CANCER REGISTRY

Research linking obesity to immune function and disease funded

Researchers at UC Davis have received \$3.2 million in federal funds to further investigate how obesity and inflammation affect the body's immune system in fighting cancer.

The collaborative project brings together researchers from four UC Davis departments to better understand the mechanisms underlying the susceptibility of obese animal models to the toxicities associated with immunotherapy and to graft-versus-host disease, a complication of stem cell transplantation. The investigators also will examine the role of the microbiome in obesity and whether the diversity of gut bacteria plays a role in immune system function.



The research is being led by **William J. Murphy**, professor in the UC Davis Departments of Dermatology and Internal Medicine. The other researchers are **Mehrdad Abedi**, a hematologist-oncologist with the UC Davis Comprehensive Cancer Center, **Alice Tarantal**, professor in the Departments of Pediatrics and Cell Biology and Human Anatomy and the UC Davis Primate Center, and **Dennis Hartigan-O'Connor**, assistant professor in the Department of Medical Microbiology and Immunology and the Primate Center.

ABOUT COLORECTAL CANCER

What protects against colorectal cancer:

- Regular physical activity
- Aspirin use
- Removal of polyps larger than 1 centimeter



What might lower colorectal cancer risk:

- Use of nonsteroidal anti-inflammatory drugs (NSAIDs)
- Calcium supplementation
- Diet low in fat and meat and high in fiber, fruits and vegetables



What increases colorectal cancer risk:

- Being over age 50
- Family or personal history of colorectal cancer
- Inherited risk; certain gene changes linked to familial adenomatous polyposis (FAP) or hereditary nonpolyposis colon cancer
- Alcohol; drinking three or more alcoholic beverages per day
- Cigarette smoking
- Obesity
- Diets high in fat, protein, calories and meat



SOURCE: NATIONAL CANCER INSTITUTE

Second cancers deadlier in young patients

Second cancers in children and adolescents and young adults (AYA) are far deadlier than they are in older adults and may partially account for the relatively poor outcomes of AYA cancer patients overall, a new study by UC Davis researchers has found.

Published in *JAMA Oncology*, the study by **Theresa Keegan** also found that survival rates for many types of cancers are much higher when they occur as a

primary cancer than if they are a second cancer, especially among children and the adolescent and young adult population.

The study, based on an analysis of more than 1 million cancer patients of all ages from throughout the U.S., is the first to compare survival after a second cancer to survival of the same cancer that occurs as the first primary malignancy, by age. Researchers hope the findings help guide clinicians in providing age-specific



recommendations on cancer prevention, screening, treatment and survivorship, especially among the AYA population for whom survival rates have either worsened or not improved as they have for children and older adults.

Taking the brakes off

IMMUNOTHERAPIES

GRACIE SMITH hadn't had a cigarette since 1999, so when her bad cough started she figured it was hay fever.

When it lingered, doctors guessed bronchitis or pneumonia. Months later, the devastating news: lung cancer, with a suspicious lesion on her brain.

That was in 2015. Today, the 65-year-old Elk Grove resident is feeling great, and her tumors are under control, thanks to a novel trial developed at UC Davis Comprehensive Cancer Center that combines radiation treatment with immunotherapy.

Smith is benefiting from a quiet revolution going on in cancer care.

Today, the 65-year-old Elk Grove resident is feeling great, and her tumors are under control, thanks to a novel trial developed at UC Davis Comprehensive Cancer Center that combines radiation treatment with immunotherapy.

New immunotherapy drugs called check-point inhibitors are helping many people with cancer who might otherwise have no chance. Unfortunately, these therapies, also called PD-1 or PD-L1

inhibitors, only work for about 20 to 25 percent of patients.

UC Davis physician-scientists are working to understand how immunotherapies work and how to make them work so they can help more people. Medical



oncologist Karen Kelly and radiation oncologist Arta Monjazeb are collaborating on a series of clinical trials for patients with non-small cell lung cancer to do just that.

The promise of immunotherapy

One of cancer's many tricks is fooling the immune system into thinking the tumor is actually healthy tissue so the immune system leaves the cancer alone. By inhibiting PD-1 or PD-L1 proteins, checkpoint inhibitors help the body's disease-fighting T-cells recognize tumors and attack them.

But these therapies are frustrating — either they work like gangbusters or not at all. In rare cases they can even make cancer worse.

"It's been known for many years that radiation therapy has an immunomodulatory effect," says Kelly, a lung cancer specialist and associate

director for clinical research. "If you have a tumor in your lung and a tumor in your liver, when the lung tumor is irradiated, the liver tumor goes away."

By killing cancer cells, radiation releases neoantigens, molecules the immune system learns to recognize, leading to an increase in T-cells. The hope is that by increasing the number of cytotoxic T-cells through radiation, and taking their brakes off with PD-L1 inhibitors, the immune system will be better able to hunt down and kill cancer cells.

Smith, now retired, says she is grateful for the clinical trial that has enabled her to enjoy life and plan the next phase: a move with her husband to North Carolina.

"The overall idea is to use combinatorial strategies to improve on the already promising results of checkpoint inhibitors and extend that benefit to a wider population," says Monjazeb.

Clinical trials

The only way to improve care is to test new ideas. Kelly and Monjazeb are conducting clinical trials to optimize this combination approach for patients. The first one is using a PD-L1 inhibitor and radiation in patients with stage IV, metastatic lung cancer.

“We’re examining two things,” says Monjaze. “Is the combination safe and effective, and does the timing of the radiation make a difference?”

The timing issue is critical, as it could dictate whether the combination works at all. The team is testing a number of therapeutic variations to find the right approach.

A second trial is studying immunotherapies and radiation for patients with early-stage lung cancer, who might normally receive only radiation or surgery and radiation. Unfortunately, the cancer often comes back in another part of the body.

“The idea is that the combination will be better than either therapy alone,” says Monjaze.

Two other studies are geared to help patients who don’t respond

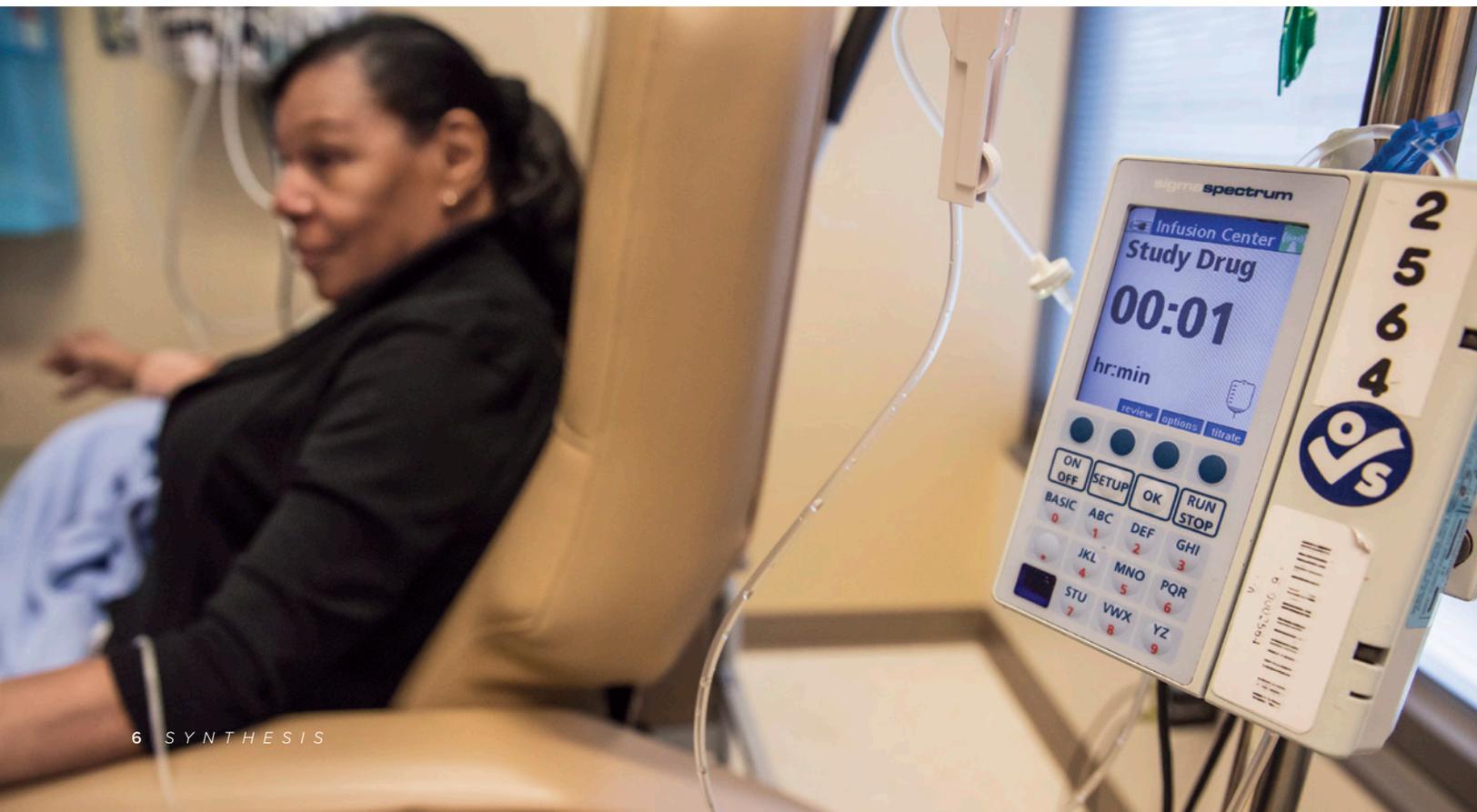
These trials are in their earliest stages, but preliminary findings have been encouraging. The team hopes they can replicate the results for Smith, who had stage IV lung cancer but could not tolerate chemotherapy.

to checkpoint inhibitors at all. One combines the PD-L1 therapy with a vaccine. Hopefully, the vaccine will shine a light on lung tumors so the unchecked T-cells will know where to go. The other combines radiation with interleukin 2 (IL-2) injected directly into tumors. Like the vaccine, IL-2 may increase T-cell activity.

Helping patients

These trials are in their earliest stages, but preliminary findings have been encouraging. The team hopes they can replicate the results for Smith, who had stage IV lung cancer but could not tolerate chemotherapy.

At the time, Smith was still working in the Sacramento County accounting department, and the effects of chemotherapy became too much to bear.





Karen Kelly



Arta Monjzeb

UC Davis physician-scientists are working to understand how immunotherapies work and how to make them work so they can help more people. Medical oncologist **Karen Kelly** and radiation oncologist **Arta Monjzeb** are collaborating on a series of clinical trials for patients with non-small cell lung cancer to do just that.

“It didn’t work, and it made me sick, so I was lucky enough to get into this clinical trial,” says Smith. “Since I’ve been on it, my scans have been coming back much cleaner; it’s not spreading at all. When I get the treatment, I’m not sick like I was with the chemo. I had a treatment today, and I’m back home and getting ready to fix dinner.”

The team will continue with their clinical trials, but there’s another important layer: collecting tumor, blood and other samples from patients for further

study. By investigating genes, proteins and other molecules, they hope to better understand why some patients respond to treatment and others do not.

“These samples contain some very important biology, and that will be of tremendous value,” says Kelly. “The successes that we’ve seen in cancer have all come from understanding the biology.”

Smith, now retired, says she is grateful for the clinical trial that has enabled her to enjoy life and plan

the next phase: a move with her husband to North Carolina.

“I’m just getting used to sitting around and doing nothing,” she says, laughing. “It’s a blessing. I was there at the right time.”

TEACHING AN OLD THERAPY new tricks

Melanoma, the most aggressive skin cancer, is also one of the most difficult to treat.

But Emanuel Maverakis, associate professor in the UC Davis Department of Medical Microbiology and Immunology, has helped develop a new approach with an old therapy: interleukin-2 (IL-2). Instead of giving IL-2 systemically, where it can cause widespread side effects, Maverakis and colleagues are injecting it directly into surface lesions. The team hopes they

can popularize this approach and help patients with metastatic melanoma around the world.

One of those patients is 75-year-old Larry Moberg, a retiree and avid tennis player from Sonora. Diagnosed with melanoma in April 2016, Moberg had surgery to remove the lesion and an affected lymph node. For several months, the cancer appeared to be gone, but late that summer it reappeared in the form of more than 20 small nodules on his arm. The surgeon sent him to see Maverakis.

But the side effects

IL-2 is a signaling molecule that can boost a patient's immune response. When it worked, systemic IL-2 essentially painted a target on tumors so T-cells could attack. But it didn't work often, and the side effects were horrific: fever, vomiting, diarrhea, rashes, liver issues, accelerated heart rate. Because melanoma typically does not respond well to chemotherapy, IL-2 became a fallback therapy.

"Systemic IL-2 works in around 9 percent of patients," says Maverakis, "but a few years ago, we didn't have any other treatment options. If you had 200 patients, maybe five of them could tolerate the full cycle with all the side effects. Even if they got the top-of-the-line therapy, the outcomes were dismal."



Dr. Maverakis with Larry Moberg at the end of his melanoma treatment.



Emanuel Maverakis

But studies were coming from Europe that showed IL-2 could be injected directly into skin lesions rather than infusing it throughout the body. Maverakis was intrigued: intralesional injections could bring the medicine directly to the problem and significantly reduce side effects.

“I had patients with metastatic melanoma, and we decided to treat them using this European protocol,” says Maverakis. “I could see the tumors there, I thought we could just target the medication right to the melanoma, so it made a lot of sense to use it intralesionally.”

A hard sell

Despite the promising results in Europe and the fact that he was using lower doses of IL-2 in a more targeted fashion, not everyone was excited about the idea. With all the side effects, IL-2 had a nasty reputation. But the need was great, and

Not only did the 11 patients in the trial have a 100 percent response rate, but the side effects were minimal.

could never tolerate systemic IL-2,” says Maverakis. “IL-2 was already approved for melanoma. We were just administering it in a way that was less toxic.”

Maverakis and colleagues moved forward, and the therapy showed dramatic results. Not only did the 11 patients in the trial have a 100 percent response rate, but the side effects were minimal. Armed with these positive findings, Maverakis has incorporated intralesional IL-2 into his regular practice.

Moberg was an excellent candidate for the therapy and came in for six appointments, receiving four to six injections each time. As with the research trial, the regimen included an immune booster called imiquimod

cancer surgeon Steve Martinez, formerly with UC Davis, strongly encouraged Maverakis to move forward.

“The patients we were treating

and topical retinoids, a form of vitamin A.

“The lesions are all gone,” says Moberg, “and as of this date, everything is fine. It did exactly what he said it would do.” As for side effects, Moberg experienced a mild chill a few hours after the injections, but that was it. And he’s back to his full tennis schedule.

Maverakis is obviously pleased with these results, but IL-2 still has a stigma, making many physicians reluctant to use it. However, the National Comprehensive Cancer Network recently incorporated the treatment into its guidelines, a move based, in part, on Maverakis’ published findings on the approach. Maverakis is reaching out to other cancer centers to help them replicate his results, and wants them to know that intralesional IL-2 and systemic IL-2 are two different animals.

“There are very few side effects,” says Maverakis. “We routinely treat patients in their 80s and 90s. We can treat cancers we couldn’t touch before.”

PAIN

harnessing mind, body and medicine



CANCER — AND SOMETIMES CANCER TREATMENT — CAN CAUSE PHYSICAL PAIN. The UC Davis Comprehensive Cancer Center offers a variety of medical treatments and non-drug alternatives to address pain associated with a cancer diagnosis. Pain specialist David Copenhaver provides insight into short- and long-term pain treatment and research at UC Davis.



What is the Center for Advancing Pain Relief and how will it affect patients with cancer?

A. The Center for Advancing Pain Relief is a multi-disciplinary consortium of experts from across UC Davis who study pain from different perspectives. As it relates to cancer, the center looks at unique and strategic approaches to finding novel medications, as well as for applying bio-psycho-social models of pain treatment. We do this by connecting groups of individuals in different disciplines who have not collaborated until now.



What kinds of collaborations do you envision?

A. Laboratory researchers interested in drug discovery can work with cancer center oncologists to bring early-phase, novel therapeutics to patients suffering from cancer-related pain being seen in the clinic, for example. Or, we might work with cancer surgeons ahead of an operation to educate patients about potential short- or long-term post-operative pain solutions. The goal is to provide a continuum of care so we are not judged solely on whether the entire tumor was removed or otherwise treated successfully, but on the success of the patient's overall outcome.





Opioid drugs are often prescribed for pain associated with a cancer diagnosis, but the drugs can be very addictive.

How can that be prevented?

A. For patients with the disease of addiction in addition to a cancer diagnosis we offer non-opioid strategies first — both pharmacological and interventional. Nerve pain, for example, can be blocked by ablating the small nerves in the lumbar spine. One class of antidepressant medications, serotonin norepinephrine reuptake inhibitors, as well as anti-convulsant therapy, also can afford substantial pain relief. And one opioid, buprenorphine, combined with naloxone, can treat both opioid addiction and cancer-related pain. All patients, regardless of a prior or existing addiction issue, need to be carefully monitored throughout their opioid pain therapy.



Besides pain control devices and drugs, are there other options for patients with cancer pain?

A. We are studying how pain affects the physics of the body and the psyche. Through the Center for Pain Medicine, we offer a cognitive behavioral program for patients to help them harness the mind to alleviate pain. Additionally, many of our patients participate in Art RX at Crocker Art Museum in Sacramento. This is a special program in which museum docents lead patients through the exhibits at their own pace, allowing the patients what I call “healthy escapism” and reducing their sense of isolation. The center also works to get patients moving again with Tai Chi or yoga, as well as offering nutrition, sleep, mood and bowel-care support.



DAVID COPENHAVER | UC DAVIS PAIN SPECIALIST



FROM CANCER
TO HEALTH

offers patients hope, support

When Cynthia Meier found out she had stage 3 ovarian cancer in November 2013 she felt frustrated and alone, like no one understood what she was going through.

“I had surgery and started chemotherapy,” Meier says. “But the doctors at the hospital didn’t offer anything else to help me deal with the disease.”

After doing some research, Meier moved her care to UC Davis Health.

“I got an appointment with a gynecological oncologist, and it’s been like night and day with the treatments offered — and the supportive care,” she says. “UC Davis educated me about cancer using counseling



“Everyone gets to know each other really well and trusts each other. This is important because it lets group members talk about more personal concerns, like sexual health and body image.”

— JENA COOREMAN



Cynthia Meier with daughter, Ashley

Through 12 weekly group sessions, women learn skills to cope with common problems faced by people with cancer, ways to alleviate cancer's physical symptoms and stress-management strategies.

the program wouldn't help me because my cancer was diagnosed too late, so it won't go into remission. I'll never really be completely healthy."

Meier now says the program had a tremendous impact, "amazing, valuable and life-changing," she says.

C2H focuses on a specific topic each week, such as nutrition, exercise and maintaining good relationships. At the beginning of the program, patients get a manual with course materials so they know what topics will be covered. They also have an opportunity to share their experiences and challenges during group discussions at each session.

"Everyone gets to know each other really well and trusts each other," Cooreman says. "This is important because it lets group members talk about more personal concerns, like sexual health and body image."

A registered nurse also attends the meetings and is available to address patients' questions. During

and other programs. That's helped me deal with my disease and given me hope."

From Cancer to Health (C2H) is one of these programs. Offered by the UC Davis Comprehensive Cancer Center, C2H teaches women how to better manage cancer-related stress. Through 12 weekly group sessions, women learn skills to cope with common problems faced by people with cancer, ways to alleviate cancer's physical symptoms and stress-management strategies.

"This is not a traditional support group," says Jena Cooreman, an oncology social worker who leads the program. "Our program is unique because we meet weekly and reserve the sessions exclusively for women who are part of the group."

Meier admits she was at first skeptical.

"I didn't want to go to the first session, but my daughter Ashley pushed me to," she explains. "I thought

OUTREACH

Meier's session, the nurse was Jessie Westlake.

"It was much easier to open up about certain health issues with her," Meier says. "She made us all feel very comfortable and safe."

Meier says the most valuable thing she learned through the program was how to deal with relationship conflicts, which in her case were exacerbated by her demanding schedule.

"Before I got cancer, I worked 50 hours a week and made lots of

money, but I didn't spend much time with my daughter," she says. "Cancer has actually made our relationship better. I learned how to communicate

better, and how to speak to my daughter in a non-offensive way. And now I have more time to spend with her, and I feel like I really know

"Just give it a try — it's completely life-changing. It's easier to live with cancer after going through the program. Now I have hope."

— CYNTHIA MEIER

QUESTIONS & ANSWERS

SUPPORTIVE CARE screening



EVERY PATIENT AT UC DAVIS is now screened for signs of distress. Cancer center social worker **Angie Usher** answers some questions about the distress screening program and how it's helping patients get the support they need.

ANGIE USHER | UC DAVIS COMPREHENSIVE CANCER CENTER SOCIAL WORKER



What is supportive care screening?

A: Screening for distress helps us identify patients with emotional, social and/or quality-of-life concerns. This process can quickly identify cancer patients at risk for psycho-social issues that can hamper successful cancer treatment. Screening begins with the Supportive Care Screening Questionnaire, which was modeled on the National Comprehensive Cancer Network screen. The guiding principle is to get to know what is most important to our patients, and provide support, information and resources to help them adjust and cope.

Has distress screening always been used in the cancer setting?

A: No. Although many cancer centers offer some psycho-social support to patients, distress screening was not required until 2015. Prior to that, the vast majority of cancer patients experiencing significant stress were not identified during routine oncology visits.

What have you learned since implementing the screening process?

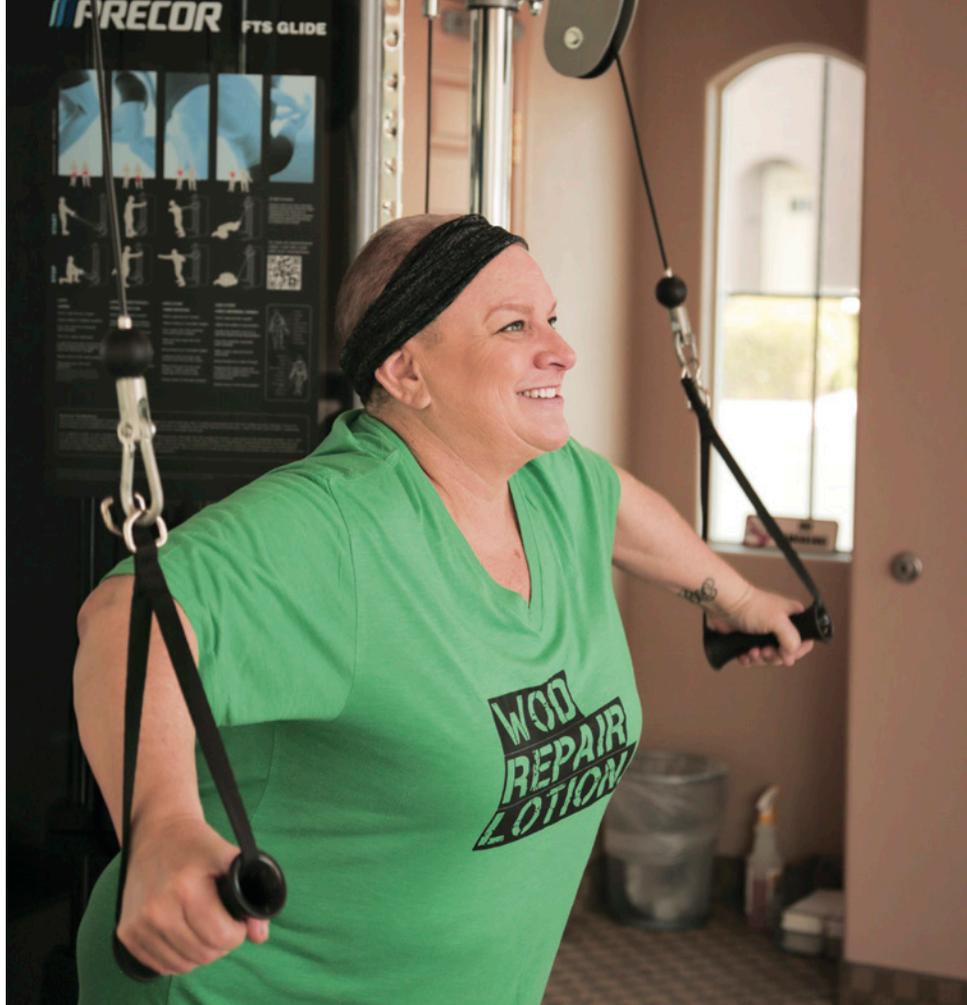
A: We are learning that both patients and psycho-social care providers benefit the most with a simple screen done frequently throughout treatment. As new research emerges, we will refine our screening tools.

her. I also have more time to do things I really enjoy, like paddle boarding and kayaking.”

Meier credits C2H with giving her the skills needed to deal with cancer, and she encourages other women with a cancer diagnosis to join the program.

“Just give it a try — it’s completely life-changing,” Meier says. “It’s easier to live with cancer after going through the program. Now I have hope. I know I’m going to beat the five-year life average I’ve been given. Cancer is my new career, and I’m ready for it.”

To learn more about From Cancer to Health, contact Jena Cooreman at jlcooreman@ucdavis.edu or 916-734-5198.



Nationally, distress screening has led to getting patients psycho-social support more quickly. Prior to 2015, it took about two weeks before a patient could see a social worker. With distress screening, that time has been cut almost in half. Some patients still express frustration that the screen may not address their specific concerns, or that it asks questions about problems for which there is no solution.

At UC Davis we want to be sensitive and responsive to patients’ screening concerns, and we will continue to follow national research to stay current on the best possible approaches to screening to meet patient needs.

What do you do with the information you get from screening?

A: We note patients whose screens indicate significant distress. Those with a score of five or above in the emotional, social or practical need categories are flagged and a social worker quickly contacts the patient.

Typically, the most stressful times in coping with cancer are at initial diagnosis, the start of any new treatment (surgery, chemotherapy, radiation, etc.) and at the end of treatment. It is important that we have supportive programs that

effectively help patients and their families through all of the phases of cancer treatment. We also track trends using data collected from all of our patients to better guide overall program development.

Any feedback from patients that you can share?

A: Many patients appreciate being contacted and educated about the supportive programs available to help them and their loved ones adjust to and cope with cancer and treatment.

We offer short-term individual cancer-coping counseling provided by a licensed clinical social worker. We also have disease-specific counseling groups and hope to grow these programs over the next year. Our peer navigators can also help patients through the initial shock of diagnosis and with adjusting to treatment.

To find out more about supportive care screening or counseling, please call 916-734-5959 and ask to speak to a social worker.

Patient-protecting shields HELP TARGET RADIATION DOSE

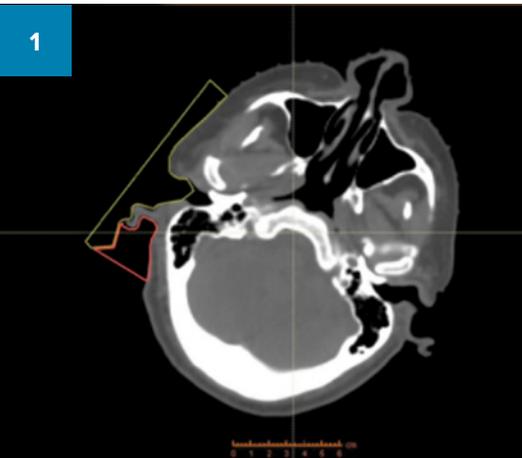
Not all cancers reside deep inside the body.

So when patients have cancers close to the surface, such as tumors of the head and neck or anal cancers, radiation oncologists have to use synthetic materials that add thickness to the treatment areas to increase accuracy of the dose and reduce the

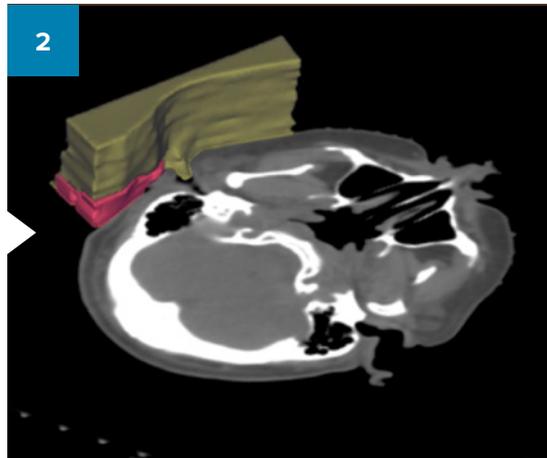
dose to tissues beyond the depth of the tumor. But commercial products, sheets of thin, plastic “skin” used for this purpose, are not conformal to the patient’s actual anatomy. Gaps between the patient and the material can reduce treatment accuracy.

To solve the problem, UC Davis Department of Biomedical Engineering scientists, working with oncologists and physicists in the UC Davis Department of

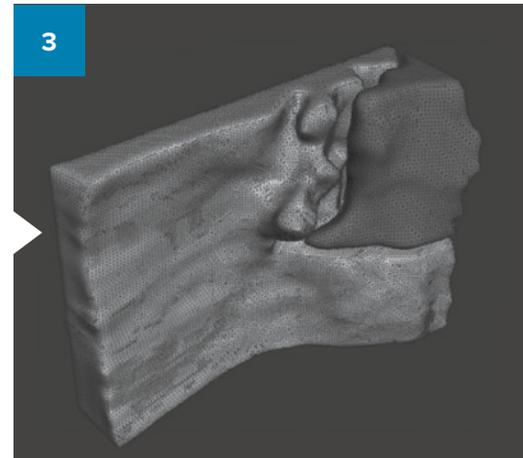
CT scan of the patient’s head, overlaid with outlines of the boluses to be created



CT scan with 3D depiction of the boluses



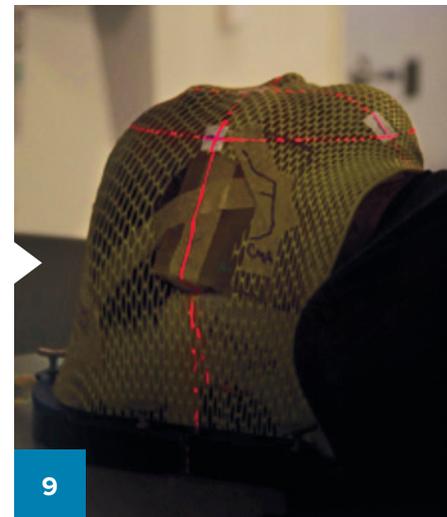
3D rendering of the bolus to be created using the 3D printer



The bolus pieces are secured with tape



Custom thermoplastic mask steadies the head



The patient is aligned with the center of the treatment beam with lasers

Radiation Oncology, developed a way to use 3D software and printing technology to create what are called boluses that conform precisely to the patient's treatment area.

The process begins with a CT or MRI scan of the patient's head, neck or other area to be treated. The image is used to trace out the shape of the treatment area and plan the shape of the bolus.

That information is sent to a development engineer in Biomedical Engineering, who feeds it into a computer program that converts the traced shape into a 3D rendering. A 3D printer reconstructs the information in physical space, and over the course of 7–10 hours creates the rubbery polymer bolus that can conform to the body.

SOURCES: Julian Perks, associate professor in the UC Davis Department of Radiation Oncology and Steven Lucero, TEAM laboratory manager in the UC Davis Department of Biomedical Engineering

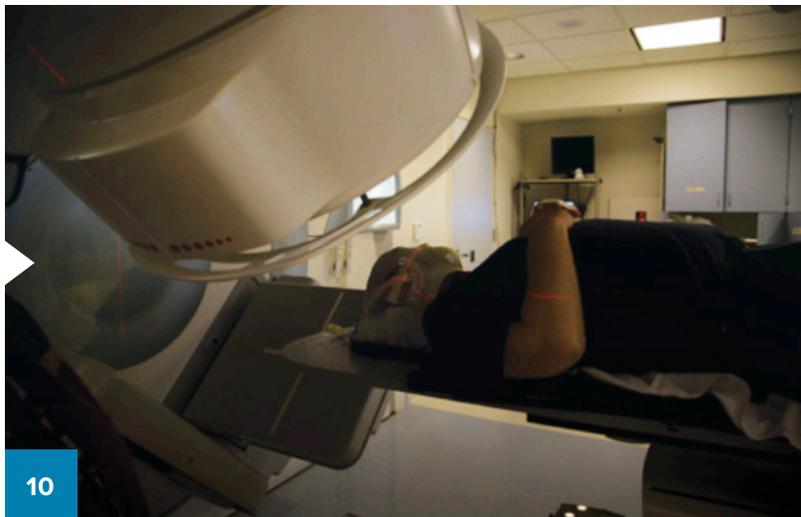
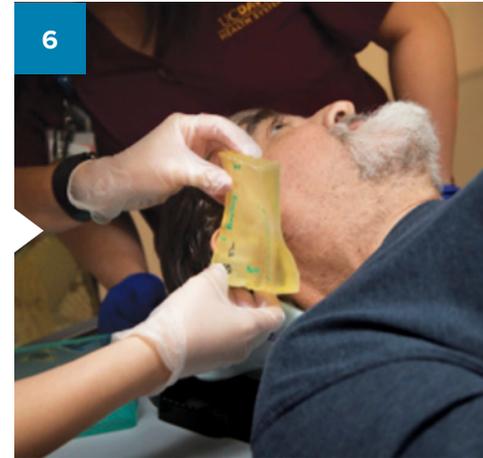
Patient Jess Harling Jr., who has cancer in his ear, is prepped for radiation treatment



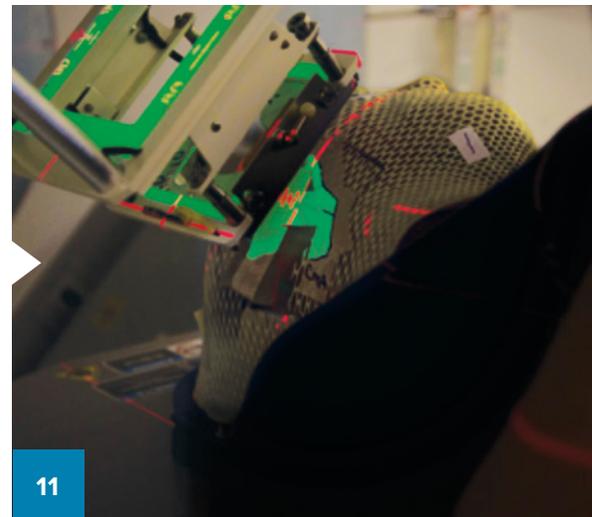
First 3D bolus fits behind the ear lobe



Second bolus fits over the ear and surrounding tissue; a small portion fits into the ear canal



The linear accelerator is angled to deliver treatment



The green light projects from inside the linear accelerator to define the treatment area

BRINGING NEEDED LIGHT

to pancreatic cancer's dark horizon

Ken and Cindy Blumenthal understand how devastating pancreatic cancer can be. Cindy's father died from pancreatic cancer, and she was diagnosed with the disease in July 2016.

"I had minor gastrointestinal symptoms, not something that I'd usually go to the doctor about," Cindy says. "But my family doctor ordered a CT scan and ultrasound, and they detected a tumor."

Cindy was referred to oncologist Edward Kim at the UC Davis Comprehensive Cancer Center.

"Dr. Kim had great insight into treatments and explained that we could get

excellent care here," Cindy says. "He really focuses on helping his patients, and on doing

pancreatic cancer research."

It was this combination of personalized care and a commitment to the science to help find a cure that led the Blumenthals to give to the UC Davis Comprehensive Cancer Center. The couple established the Ken and Cindy Blumenthal Fund for Pancreatic Cancer Research, which will provide \$50,000 over five years.

It was this combination of personalized care and a commitment to the science to help find a cure that led the Blumenthals to give to the UC Davis Comprehensive Cancer Center.



"We've had a wonderful experience — all of the doctors and nurses have treated us with so much kindness and respect — like family, not just a number," Ken says. "That's the best medicine they can give us, and that's why we decided to make these donations."

The Blumenthals also have planned an estate gift of \$2 million that will be used to create an endowed professorship for pancreatic cancer research. The Blumenthals' gift will be invested in a permanent fund, and annual income from the fund will support the research, teaching and service activities of the holder of the professorship. The professorship will go to a UC Davis faculty member who is a leader in pancreatic cancer research.

"These gifts are especially meaningful since pancreatic cancer research

is significantly under-funded, compared to other types of cancer,” Kim says. “The Blumenthals are deeply thoughtful, kind and devoted members of the community. I believe their generosity is based in part on their recognition of this need, and their goal to promote meaningful change and progress in pancreatic cancer research — starting right here at UC Davis.”

The Blumenthals, who are retired and live in Cameron Park, Calif., say that the cancer center faculty and staff have become their extended family.

“We don’t have many close friends or

family, so for us it was more meaningful to give our money to research,” says Cindy, who previously worked as a microbiologist. “This might help our friends and relatives in the future, and that will make it worthwhile.”

Ken says that although the future is uncertain, he and Cindy take comfort in

being together and knowing that they’re helping others.

“Cindy is still going through treatment,” he says. “She finished chemotherapy, and is getting ready to start radiation. The odds are against us, but we have other goals besides finding a

cure right away. We’re not trying to do something wonderful or generous — we’re making this donation because it’s the right thing to do.”

Kim says he’s overwhelmed by the magnitude of the gifts, and knows they’ll make a difference to others with pancreatic cancer.

“Contrasted against the dark horizon in the current landscape of pancreatic cancer are the rays of hope that come with gifts like the ones from the Blumenthals,” he says. “Their proactive generosity in the face of personal challenges and struggles speaks to why their gifts will have a lasting legacy in advancing the fight against pancreatic cancer.”

We’re not trying to do something wonderful or generous — we’re making this donation because it’s the right thing to do.

— KEN BLUMENTHAL



Edward Kim with Cindy and Ken Blumenthal

STILES bringing drive for success to life in retirement

JEANINE STILES has been in the saddle as the UC Davis Comprehensive Cancer Center’s chief administrative officer for 18 years, playing an instrumental role in leading the cancer center to designation by the National Cancer Institute (NCI) and building what has become a cancer care and research powerhouse. On June 29, Stiles retires, departing the cancer center for other

In her role as chief administrative officer, Stiles also was fully engaged in the cancer center’s clinical operations, and never hesitated to deal directly with patients’ concerns, whether parking, getting an appointment or an issue specific to their treatment.

saddles — the ones she puts on Max Chulo and Eagle Dance, her geldings at her ranch in Placerville. Stiles joined the cancer center in 1999 to work alongside now-

retired director Ralph de Vere White, dazzled by the director’s infectious energy, enthusiasm and ambition.

“We were two peas in a pod,” she says. “What attracted me was his goal to get NCI designation. Ralph was engaged, and his wanting to achieve this was really intoxicating.”

With Stiles’ breadth of experience putting large grant proposals together at UCLA, she became the perfect partner for de Vere White, who was adept at corralling disparate groups of researchers to build a scientific program that would impress the NCI. Equally animated and passionate about everything *cancer*, the two are close friends and mutual fans.

“The contribution of the cancer center to the benefit of UC Davis, the health system and our community was unimaginable when Jeanine arrived,” de Vere White says. “What has been achieved owes much to her years of work. We owe her a great debt of gratitude. On a personal level, she has been a delight to work with, dedicated, loyal and all wrapped up in a marvelous sense of humor.”

Richard Bold, professor and chief of surgical oncology, calls Stiles a stalwart supporter of the cancer center.

“There couldn’t have been a better leadership team with her working side-by-side with Ralph de Vere White,” he says. “As the duo that has led the cancer center through NCI designation and then comprehensive status, she was the



“There couldn’t have been a better leadership team with her working side-by-side with Ralph de Vere White.”

— RICHARD BOLD



perfect person to complement Ralph's vision and work tirelessly to do the hard work to make our success happen."

Earning the NCI's prestigious comprehensive designation in 2012, the cancer center today comprises more than 300 scientific members from across UC Davis and the Lawrence Livermore National Laboratory. The center boasts more than 300 cancer research projects and \$60 million in external research funding.

In her role as chief administrative officer, Stiles also was fully engaged in the cancer center's clinical operations, and never hesitated to deal directly with patients' concerns, whether parking, getting an appointment or an issue specific to their treatment.

"It's terrible getting a cancer diagnosis," she says. "They want to know that the people in charge care about them. I wanted to help them in any way I could."

"What has been achieved owes much to her years of work. We owe her a great debt of gratitude. On a personal level, she has been a delight to work with, dedicated, loyal and all wrapped up in a marvelous sense of humor."

— RALPH DEVERE WHITE

Stiles came to UC Davis from UCLA, where she held administrative leadership posts at the School of Theater, Film and Television, Department of Microbiology and Immunology and the AIDS Center, for which she helped win a \$38 million clinical trials grant from the National Institutes of Health. She also worked at the university's Office of Research as the director of R-NET, a software development project for research administration.

knew what she was doing," she says.

With her husband, Dan, Stiles looks forward to travel, yoga and getting herself and her beloved horses back into endurance riding condition.

"I'd like to get first place in the western region for limited distance — 25–30 miles — on a horse," she says.

With Stiles in the saddle, Max Chulo and Eagle Dance will surely be champing at their bits.

Leaving the cancer center with a strong administrative infrastructure for the next director has been her goal.

"I want my successor to come in and say, 'Wow, this person

HEREDITARY CANCER PROGRAM

empowers patients and families

Knowledge is power.

That's the overarching philosophy behind the Hereditary Cancer

Program at the UC Davis Comprehensive Cancer Center. And the power conferred by knowledge — in this case knowledge of possible genetic markers for cancer — belongs in the hands of cancer patients and their families.

"We are here to provide the most up-to-date information so people can make informed decisions. Whatever they choose to do — or not — we support them," explains Donna Walgenbach, a genetic counselor who has been with the program since its launch in 1998.

The primary mission of the genetic counselors and physicians who work in the program is to offer patients and their families comprehensive cancer genetics services, which include cancer-risk assessment, genetic testing with pre- and post-test counseling, and personalized recommendations for

cancer screening and risk reduction.

Recommendations is the operative word here, because the program is designed not to be prescriptive, but informative. The counselors seek to explain the genetic background of specific cancers, up-to-date treatments and possible options, then let patients choose their course of action.

Many people who seek genetic counseling want to pass on any potentially vital health information about increased risk to other family members.

That was the case with Debra Massaro, 65, who has had three types of cancer and is currently receiving care at the cancer center. Massaro chose to undergo genetic testing in part because she wanted her two adult daughters to know if they were at increased risk of cancer. Massaro also wanted to know if she carried a mutation in the BRCA1 or BRCA2 gene because if she did, her doctors would treat her breast cancer more aggressively, possibly with a mastectomy.

"I was nervous to find out what kind of genes I had," says Massaro, "but at least it gives you a plan for moving forward. That's their goal."

In addition to having two types of breast cancer, Massaro was treated



Genetic counselor Nicole Mans



Debra Massaro and family



several years ago for thyroid cancer.

Doctors may recommend genetic counseling if a patient has or has had cancer before age 50, more than one primary cancer, a diagnosis of a rare cancer, a known relative who carries a mutation for hereditary cancer, or a strong family history of cancer. During the initial meeting with a counselor, patients go through their family history of cancer, telling counselors of relatives who have had the disease, especially before age 50.

In Massaro's case, her father had cancer of the appendix at about age 40. Her father's mother was diagnosed with breast cancer at 72. Doctors wanted to know if Massaro carried a specific mutation that resulted in her thyroid cancer, and whether she carried the genetic breast cancer mutations. If she did,

Massaro chose to undergo genetic testing through the Hereditary Cancer Program in part because she wanted her two adult daughters to know if they were at increased risk of cancer.

she had no BRCA1 or BRCA2 mutation.

"I was happy, and my daughters were very happy," says Massaro.

Walgenbach says counselors work diligently to educate patients about the pros and cons of genetic testing, as well as its limitations. Some patients fear medical or genetic discrimination as a result of positive tests, and counselors inform them that such discrimination is against the law. Other patients simply do not want to know whether they carry a genetic marker for cancer.

doctors would recommend mastectomy along with chemotherapy. If she did not carry the marker, they would recommend a lumpectomy and chemotherapy.

Massaro's counselor Nicole Mans told her

Walgenbach stresses, however, that knowledge is power and can save lives. For instance, if a patient knows she carries a genetic mutation for colon cancer, she may have colonoscopies more frequently. If she knows she is at high risk for ovarian cancer and is past child-bearing years she may choose to have her ovaries and fallopian tubes removed.

Walgenbach and Mans say they discuss all of these options in depth with patients before and after genetic testing. Ultimately, however, the patient makes the decision.

"We are involved with supporting any decision of the individual," says Walgenbach.

Mans says the program is expanding. "We are a growing program, and we are putting a lot of energy into looking for all kinds of ways to improve care for our patients," she says.

Massaro believes the program already is phenomenal. "I feel at UC Davis they really care about their patients."

SURVIVORS DAY 2017



Dozens of cancer survivors, patients, friends and family enjoyed a morning of inspirational talks and networking Sat. May 20 for the annual **SURVIVORS DAY** CELEBRATION AND PICNIC at UC Davis Health.



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Copelynn Ojan gets some love from a visiting therapy dog before her chemotherapy appointment. KVIE Channel 6 spent several hours at the cancer center for the production of their documentary, "Healing Beyond Medicine," which featured UC Davis research on the role dogs have in reducing pediatric patient stress. The program first aired in March.

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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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