

SYNTHESIS

A PUBLICATION OF
UC DAVIS CANCER CENTER

VOL 9 • NO 2

FALL/WINTER 2006



***Firing protons at
eye tumors***

***Brain injury research
helps fight brain cancer***

***Hot nanoprobes kill
cancer cells***

To our readers

Dear Reader,

Many of you may have seen the headlines this summer when the National Cancer Institute, the North American Association of Central Cancer Registries, the U.S. Centers for Disease Control and Prevention and the American Cancer Society issued their joint “Report to the Nation on the Status of Cancer.”

Overall, the news is encouraging: Americans’ risk of dying from cancer continues to drop, maintaining a trend that began in the early 1990s. At the same time, the rate of new cancers remains stable.

In California, the news is encouraging as well. A 2006 “California Report Card” issued by the California Cancer Registry shows that cancer incidence rates statewide dropped 12 percent – and cancer mortality fell 19 percent – from 1988 to 2002. The four major racial/ethnic groups in California each experienced declines in their death rate from cancer during this period.

Other findings from the California report card: Breast cancer incidence in our state has not increased since 1988, while the death rate from the disease has decreased 29 percent. Although prostate cancer incidence climbed 70 percent from 1988 to 1992, it has since returned to 1990 levels – and mortality from the disease has dropped 30 percent since 1988.

It is gratifying to see that our nation’s investment in cancer prevention, early detection, treatment and research is paying off. However, the fact remains that nearly one out of every two Californians born today will develop cancer at some point in their lives, and one in five will die of the disease.

This fact drives us to pursue the research you read about in every issue of *Synthesis*. In this issue, we bring you reports of three tremendously exciting advances now in development at UC Davis Cancer Center. You will learn how we harness protons to treat ocular melanoma, and about our efforts with Lawrence Livermore National Laboratory to make proton-beam radiation treatment systems compact and affordable enough to fit in any cancer center in the country, and powerful enough to treat cancer anywhere in the body. We introduce you to the collaborative work of our neuro-oncology researchers, whose efforts are bringing us closer to new therapies for brain cancer patients. And we report on our joint research with Triton BioSystems, in which we are perfecting a method that uses nanotechnology to destroy tumors with heat.

We also introduce you to Robyn and Kyle Raphael, who have turned the tragedy of their son’s death from cancer at age 5 into new hope for other children and families who face the disease.

Cancer remains a formidable adversary, but with continued research advances like those we report in this issue, continued support from friends like the Raphaels and continued investments in prevention, early detection and treatment, its defeat is only a matter of time.

Sincerely,



Ralph W. deVere White, M.D.
Director, UC Davis Cancer Center



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About the cover:
Featured is a brass collimator used in proton therapy for ocular melanoma. The hole in the device is custom-tooled to the size and shape of the patient's tumor. This collimator was made for Michael J. Bone, whose story begins on page 2.

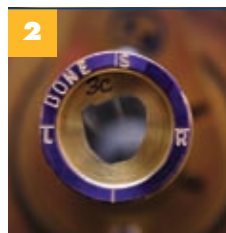
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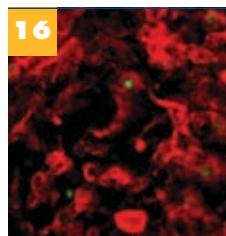


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Proton power

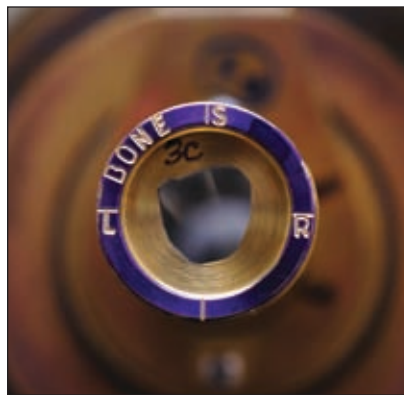
UC Davis ophthalmologists fight ocular melanoma with charged protons

On Sunday, April 2, 2006, Michael J. Bone, an athletic Sacramento-area veterinarian, noticed flashes of light in his right eye as he went about his weekend activities. Reading the newspaper Monday morning, he spotted a crescent-shaped shadow in the central vision of the same eye. On Tuesday evening, the shadow was still there. Bone's wife called the doctor the following morning.

By Thursday afternoon, following a battery of tests, Bone had a diagnosis. The avid skier, fly fisherman and father of three had choroidal melanoma, a cancer of the pigmented layer of the eye that lies behind the retina. The tumor was about one-third of an inch in diameter and just under a quarter-inch deep.

Tough choices

For decades, surgical removal of the eye, known as enucleation, was the only treatment for ocular melanoma. Enucleation remains a standard treatment for the disease today, but Bone also had two other choices: UC Davis is the only center in Sacramento that offers brachytherapy for melanoma of the eye, and one



Cold War-era cyclotron arrests tumors and saves eyes.

of six centers nationwide that can treat the lesions with proton-beam therapy.

After a weekend to research his options, Bone chose proton therapy. "It seemed the most advanced, with the best success rate and lowest risk of vision loss," he said.

Protons vs. gamma rays

Conventional radiation therapy kills cancer cells using gamma radiation. However, it has limitations as a treatment for tumors near delicate structures like the optic nerve or retina.

Gamma rays deliver energy to all the tissues they travel through, from the point they enter the body until they leave it.

Proton beams, in contrast, drop almost all of their energy on their target. Dosing is so exact that tissue just one-tenth of an inch from the target receives almost no radiation. Because damage to healthy tissue is minimized, doctors can treat cancers with higher and more effective radiation doses.

Since 1994, the cyclotron housed in the Crocker Nuclear Laboratory on the UC Davis campus has generated protons



Ophthalmologist Susanna Park examines Michael Bone's eye five weeks after his final proton-beam treatment.

used in the treatment of about 800 eye tumors in patients from as far away as New Zealand. Tumors have diminished or disappeared in more than 95 percent of cases, with better long-term survival rates than those seen in patients who have their eyes removed. In addition, most proton patients retain useful vision in the treated eye.

The second eye-sparing treatment for ocular melanoma offered at UC Davis, episcleral plaque brachytherapy, involves attaching radioactive seeds to the underside of a gold-capped plaque that is stitched onto

the tumor; the gold helps to shield surrounding healthy tissues from radiation leakage. The plaque is removed about a week later in a second surgery. Brachytherapy also has an excellent track record, with survival rates matching or exceeding those for enucleation. But for Bone, the choice was clear.

"Number one, proton-beam therapy has a higher success rate," he said. "Number two, I keep my eye. Three, I have one surgery instead of two. Four, because the radiation is so controlled, I don't have to

worry about collateral damage to healthy eye tissue – so there's very little risk of vision loss."

Collaboration with UCSF

The first step in Bone's treatment was a 75-minute operation at UC Davis Medical Center, in which Susanna Park, an associate professor of ophthalmology and vision sciences, stitched four tantalum rings to the back of his sclera, the tough white outer coating of the eye, along the perimeter of the tumor. The rings, which don't require removal and remain in place, show up in

HISTORY OF PROTON-BEAM THERAPY

1929



Cyclotron invented by Ernest O. Lawrence as a way to accelerate nuclear particles to very high speeds.

1930s

60-inch cyclotron built at Berkeley Radiation Laboratory with financing from the late William H. Crocker, a University of California regent. Machine is used in creation of seven new elements.

1939



Lawrence wins Nobel Prize in physics for invention of cyclotron.

1946

Lawrence protégée Robert R. Wilson, a professor of physics at Harvard and designer of Harvard's cyclotron, first proposes using protons for the treatment of cancer.

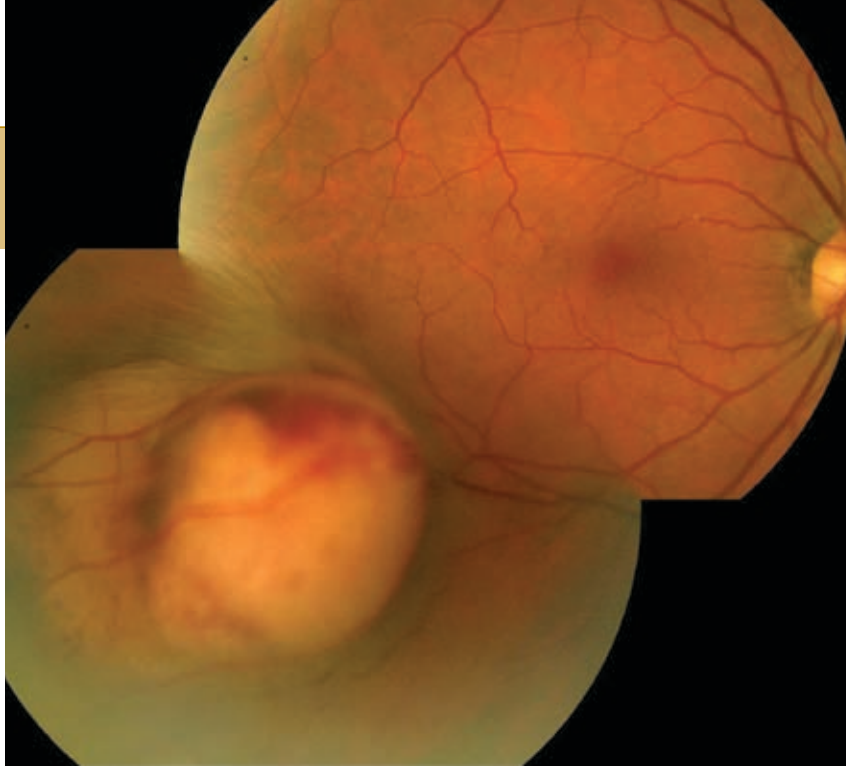
1948

Berkeley Radiation Laboratory conducts extensive studies on protons and confirms predictions made by Wilson.

1954



First patient treated with protons at Berkeley Radiation Laboratory.



Michael Bone's choroidal melanoma can be seen in these photos of his retina. The tumor is the lighter-colored lesion in the lower left image.

bright relief on X-rays, serving as clear guideposts for the proton-beam procedure.

Step two, a few weeks later, was a trip to UC San Francisco, where experienced technicians fitted Bone with the custom components he would need during the treatment: a bite block and partial face mask, to help immobilize his head, and a propeller with graduated blades to modulate the proton beam to the precise depth of his tumor.

Additional advance work took place at the UC Davis cyclotron, where machinists fashioned a hole the shape of

Bone's tumor in a brass fitting known as a collimator (*pictured on cover*); the collimator molds the beam to hit just the tumor and a small safety margin of tissue bordering it.

Treatment near home

UCSF physicians have offered proton-beam therapy for ocular melanoma at the UC Davis cyclotron since 1994. When radiation oncologists, physicists and technicians at UC Davis Cancer Center take over the jobs now being done in San Francisco, proton-beam patients will get

all of their care in Sacramento and Davis.

"We're trying to make proton-beam therapy more accessible to patients throughout the Central Valley and inland Northern California," said Park, who trained in proton-beam therapy as a resident and retina fellow at Harvard University/Massachusetts Eye & Ear Infirmary.

At the same time, researchers at UC Davis Cancer Center and Lawrence Livermore National Laboratory are at work on a new-generation proton-beam machine that promises to

1957

Treatment successfully duplicated on patients in Uppsala, Sweden.

1950s

Lawrence offers 60-inch cyclotron to John Jungerman, who would become the founding director of the Crocker Nuclear Laboratory at UC Davis.

In collaboration with Oak Ridge National Laboratory and the Naval Research Laboratory in Washington, D.C., the Berkeley machine is modified to a 76-inch cyclotron.

1961



Harvard treats first patient in its cyclotron.

1964



Magnets built at Berkeley Radiation Laboratory (renamed the Lawrence Berkeley Laboratory) move to Davis. The Crocker Nuclear Laboratory at UC Davis is dedicated in 1966.

make the therapy more available worldwide. The machine, powerful enough to treat cancer anywhere in the body, will be tested at UC Davis Cancer Center. (See story, page 8).

Just days after his final proton-beam treatment, Michael Bone was back to fly fishing.



Instructed to stare

Bone's first proton-beam treatment took place on Tuesday, June 6. That afternoon, he drove himself to the UC Davis cyclotron from his Fair Oaks veterinary practice.

He took a seat in the straight-backed metal chair in the lab's 8-by-12-foot treatment room, tilted his head back for an anesthetic eye drop, then leaned into the rigid face mask and bit down on the bite block. A belt securing his forehead to the back of the chair was cinched tight; clips were attached to his eyelids to prevent blinking. Bone was instructed to stare fixedly at a small red light on the proton therapy apparatus. A camera, focused on his eye, stared back. Any movement of Bone's head would be relayed immediately to a monitor on the other side of the door.

After assuring themselves that Bone was in proper position, the medical team – a radiation oncologist, physicist and two technicians – cleared the room and took up positions at a control center around the corner.

Medical physicist Inder Daftari activated the beam. Exactly two minutes later, Daftari turned it off.


Talking about the procedure immediately afterward, Bone said it wasn't as bad as he thought it would be.

"I just thank God I have these great doctors, great machines, great people to take care of me," he said.

Over the next three days, he returned to the lab for three

more two-minute treatments. Five weeks later, Bone was back at the UC Davis Ophthalmology Clinic for a follow-up appointment with Park. He had no vision loss. The tumor's growth had been arrested. And he had better than a 90-percent chance for a full cure.

His family and friends are as relieved as he is. Bone's best friend and fishing buddy, on first hearing about the melanoma, had quipped: "Well ... just so I don't have to tie on your flies for you."

A few days after his final proton-beam treatment, Bone was waist-deep in the American River, casting flies. He tied them on just fine. He didn't even need to squint. 

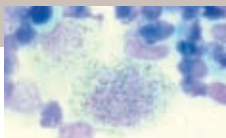
HISTORY OF PROTON-BEAM THERAPY

1970s



Atomic Energy Commission cuts off funding for nuclear facilities at universities. UC Davis cyclotron survives by finding new applications for cyclotron science in areas such as air quality, testing historical documents, food safety and cancer treatment.

1972

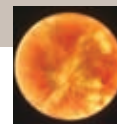


UC Davis cyclotron develops the first method for making pure iodine-123, employed in thyroid imaging and to detect tumors.

1974

Los Alamos National Laboratory cyclotron treats first patient with pi-meson beam.

1975



Use of ionized particle beams to treat eye cancers pioneered by team of scientists using the Harvard cyclotron.

OCULAR ONCOLOGY SERVICE

SCOPE

UC Davis Health System cares for more children and adults with eye cancer than any other center in inland Northern California, offering the latest and most advanced medical and surgical treatments available for ocular melanoma, retinoblastoma, ocular metastasis and choroidal hemangioma.

RESEARCH

Eye cancer specialists participate in key national clinical studies with leading research institutions around the country, offering patients the latest treatment methods, often months or years before they become widely available.

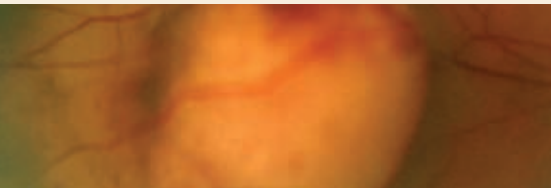
SPECIALISTS

The following specialists and subspecialists in the UC Davis Department of Ophthalmology and Vision Sciences and at UC Davis Cancer Center diagnose and treat eye cancers:

- vitreo-retinal surgeons
- corneal disease specialists
- neuro-ophthalmologists
- neurosurgeons
- ocular pathologists
- oculoplastic surgeons
- pediatric ophthalmologists
- pediatric oncologists
- radiation oncologists
- stereotactic radiosurgeons
- medical oncologists
- radiation physicists

SERVICES

- Proton-beam therapy for intra-ocular melanoma, available at only six institutions nationwide
- Brachytherapy for intraocular melanoma, in which radioactive seeds are stitched onto the tumor to destroy cancer cells
- Laser and photodynamic therapy for vascular tumors
- Laser therapy, systemic chemotherapy and radiation therapy for retinoblastoma
- State-of-the art technology for diagnosing disease and monitoring therapy, including digital fluorescein angiography, fundus photography, ICG angiography, optical coherence tomography, A- and B-scan ultrasonography, 3-D ultrasound tomography and ultrabiomicroscopy



For more information about eye cancer treatment and research at UC Davis Cancer Center, please call (916) 734-6603 or visit www.ucdmc.ucdavis.edu/cancer.

1978

UCSF and Lawrence Berkeley Laboratory team begins clinical trials of choroidal melanoma treatment with ionized helium beam.

1980s



UC Davis cyclotron used by historians and archaeologists to analyze chemistry of ink and paper without damaging documents, dates a copy of Gutenberg Bible to within three days.

1988



Proton therapy approved by FDA as radiation treatment option for certain tumors.

1990



Loma Linda University opens first hospital-based proton-beam clinic. The 250 MeV machine is designed and built by Fermilab, where Wilson was the founding director, with \$19.6 million in federal funding.

TIMELINE CONTINUED ON PAGE 10



Physicist George Caporaso, standing, and engineer Mark Rhodes, both of Lawrence Livermore National Laboratory, work with a component of the compact proton-beam accelerator they are developing in partnership with UC Davis Cancer Center.

Coming to a clinic near you

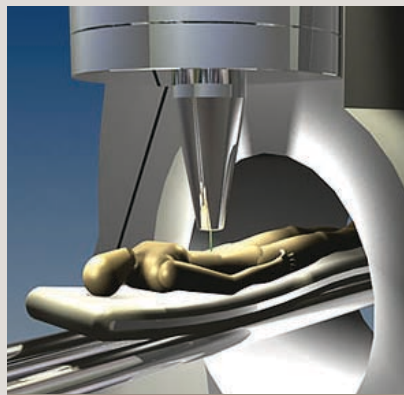
UC Davis Cancer Center and Lawrence Livermore National Laboratory join forces to make proton-beam therapy available to every major cancer center

The era of proton-beam therapy dates to 1954 in Berkeley, when a Cold War invention known as the cyclotron was first used to irradiate a cancer patient's pituitary gland. Since then the treatment has proved effective against malignancies of the prostate, lung and other organs.

Yet five decades after its first successful use, just six centers nationwide offer the treatment, leading the *Wall Street Journal*, in a consumer column last year, to refer to proton-beam radiation as "a well-kept secret in the war on cancer."

Size and cost have been the obstacles. A 90,000-square-foot building – bigger than many hospitals – is needed to house a state-of-the-art proton-beam accelerator. And the machines carry price tags of up to \$150 million.

But these barriers may be about to topple. Researchers from Lawrence Livermore National Laboratory and UC Davis Cancer Center are working on a subscale prototype of a "miniaturized" proton-beam accelerator. Led by George Caporaso of Livermore's Physics and Advanced Technologies Directorate, the research team aims to deliver



**"This will
impact
on cancer
worldwide."**

a final machine that will be small enough to fit in a typical radiation oncology suite, powerful enough to treat cancer anywhere in the body and priced at about \$10 to \$15 million. The lab is currently seeking commercial partners to help construct a full-scale model.

"Proton-beam therapy is more targeted, more effective and does less harm to healthy tissues than the radiation we now use in cancer treatment. If we can make it possible for every major cancer center to offer proton therapy, we will impact on cancer worldwide," said Ralph deVere White, associate dean for cancer programs and director of UC Davis Cancer Center.

These centers now offer proton-beam therapy: Loma Linda University Medical Center in Loma Linda, Calif.; Massachusetts General Hospital in Boston; the Midwest Proton Therapy Center in Bloomington, Ind.; MD Anderson Cancer Center in Houston; and Shands Jacksonville Medical Center in Jacksonville, Fla. The UC Davis cyclotron provides proton-beam treatment for eyes only.

While the UC Davis system has the most distinguished



Ralph deVere White, director of the UC Davis Cancer Center, and Dennis Matthews, director of the Lawrence Livermore National Laboratory's Center for Biotechnology, Biophysical Sciences and Bioengineering, forged the partnership between the two research institutions that led to the compact proton-beam project.

pedigree among the proton centers, it is also the smallest. The 70-million-electron-volt protons generated using its 268-pound magnets cannot penetrate more than an inch or two inside the body, making it perfect for treating ocular tumors but too small for most other cancers.

Caporaso expects his compact proton-beam accelerator, although it will be many times smaller than the existing Davis cyclotron, to deliver protons that carry 250 million electron volts of energy apiece, making the machine as

powerful as the largest machines now in operation.

Proton-beam therapy is now approved to treat a variety of cancers, but it has been studied most thoroughly as a treatment for prostate cancer. For example, a recent study of more than 1,200 men with localized prostate cancer found that survival rates for those treated with proton-beam therapy matched or exceeded those of men who had conventional treatment – but the proton-beam patients had lower rates of impotence, incontinence and other adverse side effects.

Long history in eyes

The therapy has been used to treat ocular malignancies for more than 30 years; the first eye treatment took place at Harvard's cyclotron in 1975. Three years later, a team of physicians from UC San Francisco and the former Berkeley Radiation Laboratory – renamed the Lawrence Berkeley Laboratory in the late 1950s – began clinical trials of protons and an alternate charged particle, ionized helium, to treat choroidal melanomas. Treatments took place at the Berkeley laboratory using

HISTORY OF PROTON-BEAM THERAPY

1992

Lawrence Berkeley Laboratory's clinical treatment program ends with closure of its Bevatron cyclotron. More than 2,500 patients had been treated at the lab since 1954.

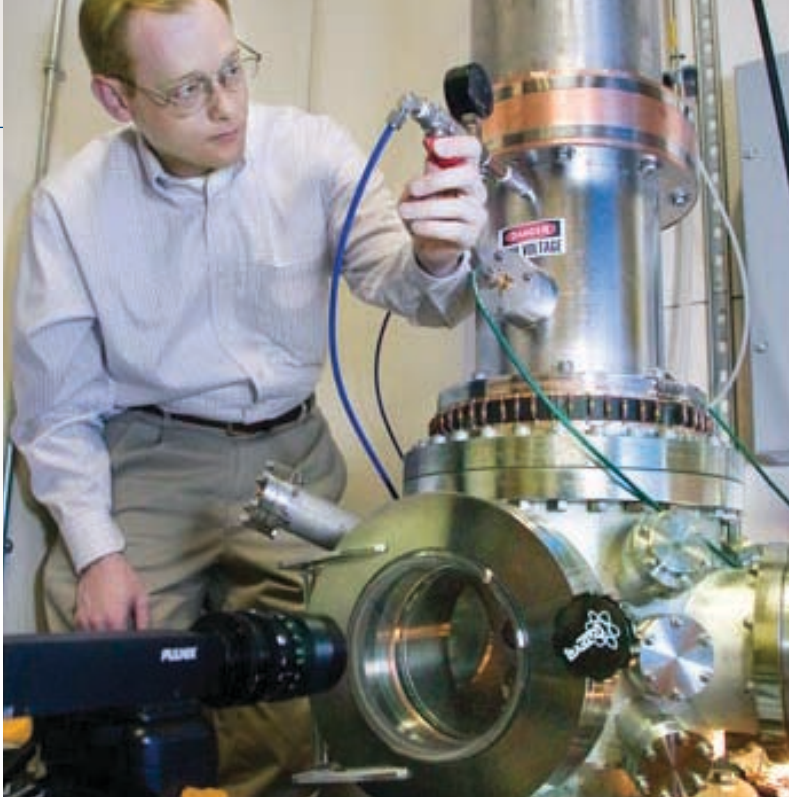
1994

Timothy R. Renner Ph.D. Proton Eye Treatment Facility established at Crocker Nuclear Laboratory at UC Davis.

1999



UC Davis Cancer Center and Lawrence Livermore National Laboratory establish formal research partnership to apply defense technology to cancer research, the first such agreement between a major cancer center and a national laboratory.



Lawrence Livermore engineer John Harris prepares a vacuum test chamber used in development of the compact proton-beam accelerator.

a cyclotron known as the Bevatron.

By the time the Bevatron went offline in 1992, UCSF ophthalmologists had treated more than 2,500 patients and, with Berkeley scientists, had helped to establish the optimal number of treatments and most effective dose per treatment for charged-particle therapy.


That long experience was transferred to UC Davis in 1994, when the UC Davis Proton Eye Treatment Facility was established through the joint efforts of Lawrence

Berkeley Laboratory, the UCSF Radiation Oncology Department, the Crocker Nuclear Laboratory at UC Davis and UC Davis Cancer Center. The National Cancer Institute provided additional support.

The UC Davis facility uses a 76-inch cyclotron housed in the Crocker Nuclear Laboratory. The Davis cyclotron has a proud lineage: It was created in the 1960s using components from a 60-inch machine originally built by the Nobel prizewinner who invented the cyclotron, Ernest O. Lawrence.

Sacramento system

Caporaso and his collaborators hope to construct their first full-scale compact proton-beam accelerator at UC Davis Cancer Center, where it would be used to treat not just ocular malignancies but other cancers as well. That would free the Davis cyclotron for full-time use in air quality, food safety and space satellite testing.

“There are a lot of technical challenges remaining. There are no guarantees,” Caporaso said. “But progress has been good so far – and we’re optimistic.” 

2000

UC Davis Cancer Center and Lawrence Livermore National Laboratory begin work on compact proton-beam therapy system. The two institutions eventually contribute \$3 million in funding to support George Caporaso’s work.

2001




Northeast Proton Therapy Center at Massachusetts General Hospital treats first patient.

2006

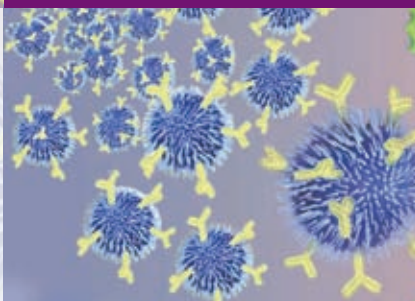
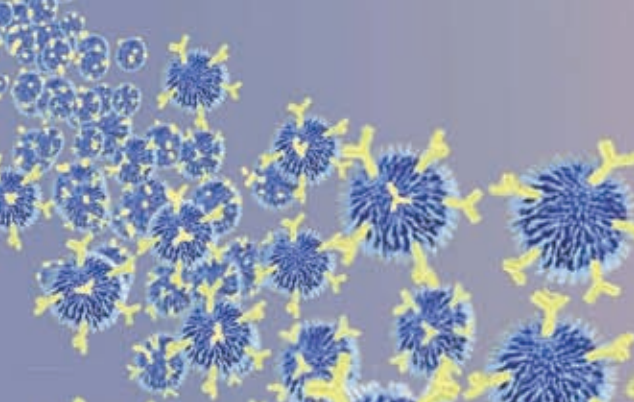


June: \$125 million, 94,000-square-foot Proton Therapy Center at MD Anderson in Houston opens to patients.

August: Caporaso reports on compact proton-beam therapy system at the 19th International Conference on the Application of Accelerators in Research and Industry in Fort Worth. 

TURNING UP THE HEAT ON CANCER

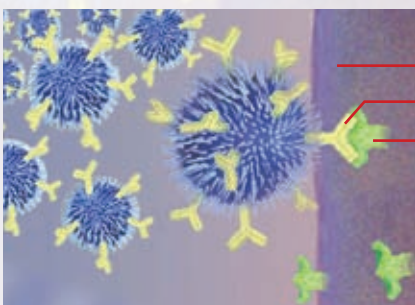
UC Davis researchers, working with scientists at Triton BioSystems in Boston, have developed a way to attach nanoscale bioprobes to cancer cells, heat the probes and kill the malignant cells. The system has worked in laboratory mice. It will be tested next in cancer patients.



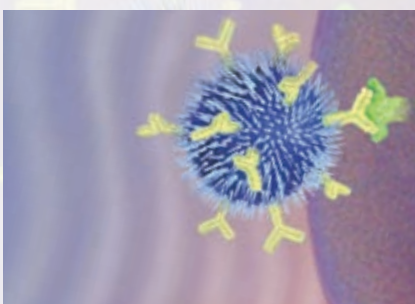
Trillions of magnetic iron bioprobes are injected into the bloodstream of a laboratory mouse that bears a human tumor.

BIOPROBE

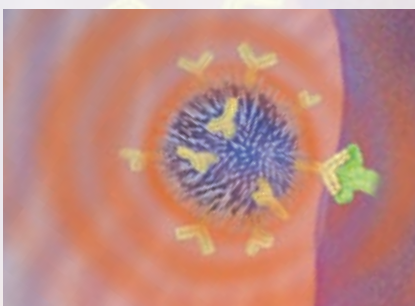
Each magnetic iron nanoprobe is cloaked in polymers and sugars that render it invisible to the immune system, and equipped with monoclonal antibodies designed to search out and lock onto a cancer cell. More than 10,000 of the bioprobes can fit in the period at the end of this sentence.



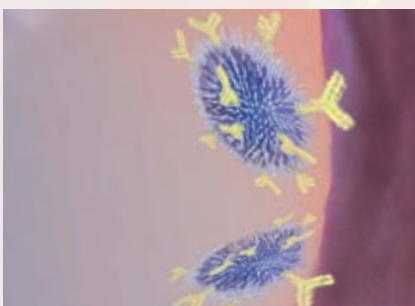
Antibodies on the probes search out and lock onto receptors on the surface of a tumor cell. Thousands of bioprobes can attach to a single cell.



Scientists apply an alternating magnetic field to the tumor region.



The alternating field forces the magnetic spheres to change polarity thousands of times per second, creating heat. Heat from the probes destroys the cancer cells.



Bioprobes cool off as soon as the alternating magnetic field is turned off. The probes degrade and are passed out of the body.

NANO ATTACK PROBES

Sally DeNardo turns up
the heat on cancer

A decade ago in Chelmsford, Mass., a military technology development company known as Triton Systems invented a new method for battlefield repairs of body armor and other composite materials. The method uses a resin imbued with nanoparticles designed to heat up when exposed to a magnetic field.

Triton scientists wondered: Could such particles also be used to heat and destroy cancer cells?

The question led to a spin-off company, Triton BioSystems, formed in January 2002, and a collaboration with Sally DeNardo and other scientists in the Radiodiagnosis and Therapy Program at UC Davis Cancer Center. DeNardo, a professor of internal medicine and radiology, is among the world's top experts in radioimmunotherapy, in which radiation is delivered directly to cancer cells.

For the last four years, she has explored the potential of Triton's Targeted Nano-Therapeutics (TNT) system in her laboratory at UC Davis Medical Center, using a mouse model of human breast cancer.

"This technique allows us



to use what we already know about attaching radioactive molecules directly to cancer cells," DeNardo said. "But this avoids the marrow suppression that can result from using high therapeutic levels of radioactivity."

In the UC Davis experiments, DeNardo creates bioprobes by equipping magnetized, iron-oxide nanospheres with radiolabeled monoclonal antibodies that she has previously studied in breast cancer patients. The antibodies are engineered to lock onto specific targets on the surface of breast cancer cells. Trillions of the bioprobes are then infused into the bloodstreams of laboratory mice that bear human breast cancer cells. Once the probes have searched out and locked onto the malignant cells, an alternating magnetic field is applied to the tumor region, forcing the magnetic nanospheres to change polarity thousands of times per second, instantaneously generating heat within the probes.

In two papers published last fall, DeNardo and her collaborators – including

**Experimental
approach
uses heated
nanospheres
to destroy
cancer cells.**

her husband, professor emeritus Gerald DeNardo, also a luminary in the field of radioimmunotherapy – showed that the trademarked TNT system effectively locks onto human breast cancer cells grafted onto lab mice. The group also showed that the treatment system can generate enough heat to shrink the tumors without harming the mice.

DeNardo and her colleagues have now completed a larger animal trial that confirms these results. The new study, due to be published later this year, also shows that researchers can measure bioprobe concentration by imaging the tumors, and can use the information to accurately predict how much of a tumor will be destroyed. This will be critical for calculating the right dose of bioprobes to give a patient.

Pioneer in radioimmunotherapy

Sally DeNardo was the subject of a lengthy profile in the *International Journal of Oncology* earlier this year. The profile cites her “unique leadership” and “seminal studies” in the field of radioimmunotherapy, noting that she was the first investigator to use monoclonal antibodies in the delivery of radioimmunotherapy when she generated monoclonal antibodies against mouse melanoma in 1979.

In 1985, she successfully treated patients with non-Hodgkin’s B-cell lymphoma and chronic lymphocytic leukemia using radiolabeled monoclonal antibodies, showing for the first time that radioimmunotherapy could be effective in these malignancies.

In 1990, she described the treatment of the first patients with breast cancer using radioimmunotherapy with a biologically active antibody, and provided the first evidence of a vascular target strategy for enhancing tumor uptake of a drug.

DeNardo is on the editorial boards of five international journals, has published more than 300 scientific articles, chapters and reviews, and has been recognized by multiple awards, including the Benedict Cassen Prize from the Society of Nuclear Medicine in 2000, in which she and Gerald DeNardo were acclaimed for their groundbreaking work in the radioimmunotherapy of lymphoma.

Molecular payloads

Samuel Straface, president and chief executive officer of Triton BioSystems, said the company approached the DeNardos because of their experience in radioimmunotherapy and their track record in conducting the research that sets the stage for U.S. Food and Drug Administration approval of new drugs. UC Davis’ reputation for

Research associate Cheng-Yi Xiong tests the stability and tumor-cell binding properties of nanoprobes armed with monoclonal antibodies.



Gerald and Sally DeNardo are acclaimed for their groundbreaking work in radioimmunotherapy.




multidisciplinary collaborations was also a draw.

“We were looking for a partner who had prior experience in delivering molecular payloads to cancer cells,” Straface said. “Biological targeting is what the DeNardos are famous for.”

According to Straface, the iron-oxide bioprobes used in the TNT system should be eliminated through the body’s normal iron metabolism, passing harmlessly from the body after a couple of weeks.

Because the bioprobes are inactive when infused into the body, he believes the approach will prove safer than chemotherapy or radioimmunotherapies that rely on the delivery of radioisotopes or chemotoxins via antibodies.

Clinical trials in human patients will be needed to settle these and other questions. The careful groundwork laid by DeNardo and her colleagues sets that stage. 

DeNardo lab delivers reliable new approach to cancer drug delivery


In a separate research effort with scientists at Lawrence Livermore National Laboratory, Sally and Gerald DeNardo have helped to develop a promising new method of delivering targeted radiotherapy drugs to cancer patients.

“Based on knowledge gained from antibody drugs currently in clinical use, we have engineered new cancer-targeting molecules that, when injected into the blood, not only bind to tumor cells but also efficiently ‘catch’ a subsequently given, small radioactive molecule, resulting in greatly enhanced tumor-targeted radiotherapy,” Sally DeNardo said.

The development opens significant new opportunities

for researchers in areas ranging from drug design to biophysics.

The UC Davis-Livermore team used atomic force microscopy to measure the binding forces between several single-chain antibody fragments and Mucin1. Mucin1 is commonly found in large quantities in a variety of epithelial cells in the human body; one of its specific forms is a marker for prostate, breast, colon, lung, gastric and pancreatic cancers. Binding between Mucin1 and antibodies recognizing the marker is critical to the DeNardos’ new approach.

A report of this work was published in the November 2005 issue of the *Proceedings of the National Academy of Sciences*. 



Headway against brain cancer

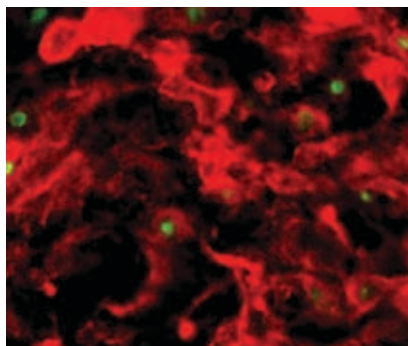
A serendipitous discovery may yield new treatments for glioblastoma

Fredric Gorin, a professor of neurology at UC Davis, was looking for a way to control the devastating brain swelling that frequently accompanies a head injury or stroke. Instead, he found a clue to designing new drugs against brain tumors.

The discovery changed the course of Gorin's research and sparked new hope for treating a neurologic cancer, glioblastoma, that kills 95 percent of sufferers within two years.

From published research, Gorin knew that a certain adult brain cancer cell – a malignant glioma cell – has the ability to swell. By determining how these malignant cells take on fluid, he suspected he might gain insights that could be applied to protecting injured cells.

Gorin guessed that the glioma cells relied on surface molecules known as sodium-proton exchangers to regulate their fluid levels. To test his hunch, he performed experiments with Peter Cala, professor and chair of physiology and membrane biology, in which glioma cells were exposed to a commonly used diuretic, amiloride,



**UC Davis
faculty hope
to change the
way brain
cancers are
treated.**

known to inhibit sodium-proton exchange.

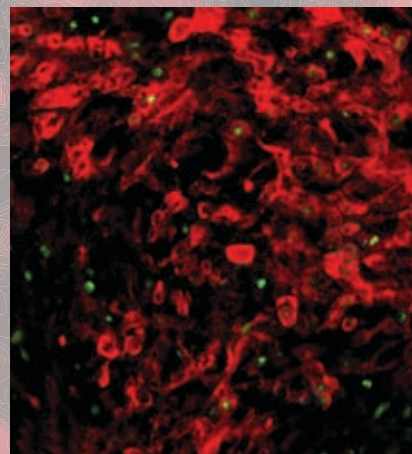
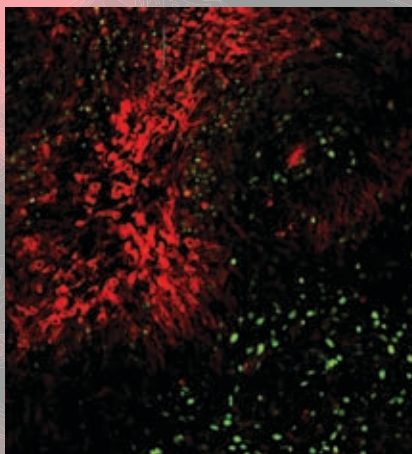
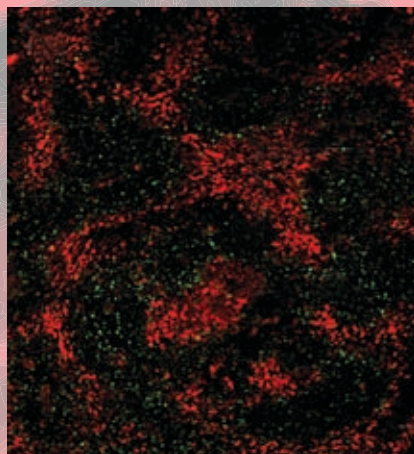
“We accidentally discovered that amiloride, when infused directly into the brains of rats implanted with intracranial human glioblastomas, would kill glioma cells, but not normal brain cells,” said Gorin, who works out of the UC Davis Center for Neuroscience.

Toward a new drug

Over the past 10 years, Gorin has labored to turn that serendipitous finding into a safe and effective drug for glioblastoma. Amiloride itself wouldn't work. The diuretic doesn't cross the blood-brain barrier, and can't be administered safely into the human brain at the doses needed to be effective.

So Gorin undertook the systematic study of the cellular mechanisms by which the drug kills brain tumors and slows their growth. Now he and his colleagues are using the information to engineer and test candidate compounds for new “prodrugs” against glioblastoma.

Prodrugs are harmless, inactive compounds that become active drugs only when exposed to an activating substance. Gorin



Progressively magnified fluorescent microscopy images show red and green glioma cells growing in and around black areas of dead tumor tissue. Experimental drugs under development at UC Davis are designed to kill and prevent the recurrence of these cancer cells even within tumor regions with poor blood supply.

and his colleagues have designed prodrugs that become drugs with amiloride-like properties when they encounter certain enzymes produced by malignant cells. In animal experiments, these prodrugs appear to be much less toxic than amiloride – and more effective at killing specific parts of a brain tumor.

Clinical testing

“With continued laboratory funding, we hope to test our compounds in humans within the next four to five years,” Gorin said.

The drug will need to be safe enough for patients to take for many years both to treat glioblastoma and prevent recurrence.

Gorin’s work to date has been supported by more than \$2 million in grants, including a prestigious multi-year Research Project Grant (ROI) from the National Institute of Neurological Disorders and Stroke and a Specialized Program of Research Excellence (SPORE) grant for the study of brain tumors. The spore grant is based at UC San Francisco. Gorin also has received support from the

California Cancer Research Coordinating Committee.

Stalking a killer

Patients and their physicians are desperate for a treatment for glioblastoma. The ideal drug would cross the blood-brain barrier and kill cancerous cells without causing debilitating side effects.

“There are not many brain cancer drugs that meet these requirements, which is why this work is so important,” said Robert O’Donnell, an associate professor of medicine who collaborates with Gorin.

Brain cancer is the leading cause of cancer-related death for those under age 35. Half of all brain tumors are primary ones, like glioblastoma, that originate in the brain, as opposed to spreading from other parts of the body. Every year, 17,000 Americans are diagnosed with primary brain cancer and 13,000 die of the disease.

Glioblastoma, thought to be caused by a genetic mutation, claimed the lives of composer George Gershwin at age 39 in 1937 and singer Bob Marley at age 36 in 1981.

Gorin credits the collaborative atmosphere at UC Davis with the growing success of his research program. From professors to graduate students and chemists to surgeons, the list of Gorin's collaborators is lengthy and varied. Michael Nantz, for one, was eager to join forces with Gorin.

"His whole concept of targeting these proton exchangers is a very exciting, new approach," said Nantz, a professor of chemistry.

Nantz and his graduate students are busy making the prodrugs that, when activated, mimic amiloride's destructive effect on glioma cells.

Stem cell theory

Rudolph Schrot, an assistant professor of neurosurgery, is another of Gorin's collaborators. According to Schrot, one of the newest theories of cancer biology holds that cancerous cells may arise directly from stem cells.

So Schrot and Gorin have teamed up with James Angelastro, an assistant professor of molecular biosciences in the School of Veterinary Medicine, in an effort to find and isolate brain tumor stem cells in patients who have died from particularly aggressive, fast-growing tumors.

Chemistry professor Michael Nantz, right, and graduate student Hasan Palandoken synthesize prodrugs that kill glioma cells but not healthy brain cells.


Their goal is to find these stem cells and use them as targets for more novel drugs.

"Brain tumors are not able to be cured by removing them," Schrot said. "The reason may be that stem cells remain after the bulk of these cells has been destroyed."

Gorin and his colleagues have built a comprehensive network of basic and clinical researchers that also includes neurosurgeons James Boggan, Candace Floyd and Bruce Lyeth, pathologist Robert Cardiff, entomologist Bruce Hammock and biochemist Thomas Jue. The UC Davis faculty who make up

this network hope to change the way brain cancers are treated, and have established a solid base for a growing neuro-oncology research program at UC Davis.

Gorin said he hopes to extend the collaboration to more members of the UC Davis Cancer Center research program, and to see new researchers recruited to the campus and medical center who are focused on neuro-oncology.

"There are a considerable number of people in our area with brain tumors," Gorin said. "We want to see more focused research and treatment for these people. There is such a great need." 



For the children

To honor their late son, a Roseville couple turn tragedy into hope for other children facing cancer

Following the death of their son from cancer at age 5, Robyn and Kyle Raphael resolved to channel their grief into helping other children and families battle the disease.

Eight years later, the nonprofit organization the Roseville couple established in their son's name stands as a testimony to the difference dedicated individuals can make and as a tribute to a brown-eyed boy who loved to make swords out of sticks, dress in superhero costumes and wear cowboy boots – even on the hottest summer days.

Since 1998, the Keaton Raphael Memorial has raised more than \$800,000 for pediatric cancer research and programs in Northern California, including more than \$300,000 for UC Davis Cancer Center and UC Davis Children's Hospital. The organization has also provided direct assistance – in the form of gasoline cards, phone cards, restaurant certificates, homemade blankets, information packets and cash – to more than 100 Northern California families whose children have undergone cancer treatment in Sacramento.

“After Keaton died, in



“I realized I’d better get busy and do something.”

the early days of grieving, my husband and I didn’t leave the house,” Robyn said. “It was second by second, minute by minute, hour by hour. Then I realized I’d better get busy and do something.”

A former municipal government staffer, Robyn had no professional background in either fundraising or advocacy. But she proved a quick study. Starting small, she talked to parents at her younger son’s preschool, addressed the Roseville Chamber of Commerce and shared the story of Keaton’s nine-month battle with neuroblastoma with countless individuals.

Friends stepped forward, offering legal, Web and graphic design assistance for the new nonprofit. Family members rallied. A golf tournament in Southern California organized by Robyn’s brother-in-law provided early seed money for the Keaton Raphael Memorial. Robyn’s dad single-handedly sold all the tickets for the memorial’s first golf fundraiser in Roseville. And as Robyn took her early steps into national advocacy – a 1998 march on Washington in support of childhood cancer research – her sister was at her side.

Alexis Von Aesch, 13, unwraps a blanket made by a Keaton Raphael Memorial volunteer. Robyn Raphael delivered the gift, one of many to the Von Aesch family, during one of Alexis' visits to the UC Davis Cancer Center's Pediatric Infusion Clinic.



“This organization created itself, is all I can say. It was built by a lot of people with sincere compassion for children and families,” Robyn said.

A family heals

As the Keaton Raphael Memorial grew, the Raphaels healed. On Jan. 1, 2000, the couple had a daughter, Kiana, now 6; her brother, Kyle, is 12. The elder Kyle continued in his career as a superintendent for the City of Sacramento Parks & Recreation Department. Robyn devoted herself full-time to daughter Kiana, son Kyle and the Keaton Raphael Memorial.

Still working out of a home office, Robyn today puts in 50-hour weeks as the paid executive director of an organization with chapters and volunteer boards in two cities, Roseville and Reno. The memorial now has two employees: a full-time family navigator based in Reno and a part-time assistant in Roseville.

These days, the Keaton Raphael Memorial sponsors its yearly trademarked “Chipping Away at Childhood Cancer” golf tournaments in both cities, acts as a local organizer for the

national St. Baldrick’s fundraising campaign for childhood cancer research, serves on the UC Davis Cancer Center’s Capital and Endowment Initiative steering committee and helps to host an annual holiday party for pediatric cancer patients at UC Davis. The organization’s latest project is ChildCancerJourney.org, a traveling awareness campaign.

“Some people refuse to accept tragedy ... and simply will not be defeated by it.”

Robyn also serves as one of 42 team leaders nationwide for the CureSearch National Childhood Cancer Foundation, which supports childhood cancer research. As team leader for California, she coordinates the organization’s advocacy efforts in this state. In addition, she leads the California delegation on its annual trip to Washington to

take part in CureSearch’s Gold Ribbon Days lobbying effort.

Ted Zwerdling, associate professor and chief of pediatric hematology and oncology, works closely with Robyn to identify unmet needs among pediatric cancer patients and their families at UC Davis Cancer Center and UC Davis Children’s Hospital.

“Some people refuse to accept tragedy,” the pediatric cancer specialist said. “Instead, they see it as a challenge, as a calling, and simply will not be defeated by it. They even seem to gain strength by what has happened to them, and put that strength to work so that maybe the future will be better.

“I once heard Robyn say that she cannot stop children from getting cancer, but that she doesn’t have to sit around and just let it happen. She can do something about it. To be sure, she has and she is. Her importance as an advocate, in caring for families, and in planning and developing programs for children and adolescents, cannot be understated,” Zwerdling said.

Robyn Raphael presents UC Davis Cancer Center director Ralph deVere White with a check to name a pediatric playroom after her late son. "Keaton's Corner" will be located on the ground floor of the Cancer Center's planned clinic expansion.



"Keaton's Corner"

Money raised by the Keaton Raphael Memorial has purchased toys, books and family resource materials for children and their parents, provided pediatric pain management training for physicians and nurses at UC Davis Children's Hospital and funded a \$50,000 pediatric playroom for the Cancer Center's planned expansion. The playroom will be named Keaton's Corner.

The organization's latest gift to UC Davis – \$92,000 generated from the 2006 St. Baldrick's celebrations – will be used to support research into the psychological and socioeconomic impacts of childhood cancer on patients and families. Last year's St. Baldrick's events coordinated by the Keaton Raphael Memorial raised \$40,000 for UC Davis. That money will provide first-year funding for a Pediatric Hematology and Oncology Fellowship Program within the

Department of Pediatrics, to begin in 2007.

The Keaton Raphael Memorial also continues to make direct grants to families facing childhood cancer, a service that sets it apart from other cancer organizations. The grants help families with the nonmedical expenses that accompany a diagnosis of pediatric cancer. Referrals are made by hospital social workers.


Building memories

"It's research that will give us a cure, but we have to take care of families along the way," Robyn said. "There are no requirements about how our family grants are spent. It can be new clothes for a child who no longer fits in anything because of swelling from steroid therapy. Or it can be a good time for the family; to me, that's an important use. Sometimes memories are what you're left with."

Richille and Brandon Von Aesch received a grant last year, after their then-12-year-old daughter, Alexis, was diagnosed with Ewing's sarcoma, a type of bone cancer. The Keaton Raphael Memorial provided the Von Aesches, who live about 40 miles east of UC Davis Medical Center in the town of Cool, with a packet of information resources, a \$250 cash grant, a phone card and a gas card. During one of Alexis' chemotherapy appointments, Robyn hand-delivered a blanket made by Keaton Raphael Memorial volunteers.

For the Von Aesches, the gifts were a comfort.

"Robyn's importance is that she knows what's going to be necessary. As a newly diagnosed family, you don't know what's ahead," said Richille, who quit her job at Home Depot so she could be at Alexis' bedside during the eighth-grader's monthly three- to five-day hospital stays.

"It was such a relief to get her start-up information packet, and such a comfort to know there's someone like her out there." 

For more information about the Keaton Raphael Memorial, call (916) 784-6786 or visit www.childcancer.org

First cancer research endowment established

UC Davis Cancer Center's first research endowment was established this summer with a \$1.5-million gift from the Auburn Community Cancer Endowment Fund.

The endowment is expected to generate about \$60,000 to \$70,000 annually to support basic science research at UC Davis Cancer Center.

"This endowment comes at a critical moment in cancer research, with federal support for basic science research flattening even as we get closer than ever before to understanding cancer at the molecular level," said Hsing-Jien Kung, professor of biological chemistry and director of basic science research at UC Davis Cancer Center.

The Auburn campaign got under way in the spring of 2001 when Dick Azevedo, a former mayor, decided to raise money for cancer research. He asked two of his friends, businessman Merv Hall and veterinarian Virgil Traynor, to discuss the idea over a cup of coffee. Each of the three pledged \$10,000. The effort expanded from there, eventually touching the entire community.

Inspired by Auburn, several other communities have pledged endowments. The South Placer Breast Cancer Endowment formed last summer. A Butte County group formed this year to fund an endowment for clinical cancer research. And a third group is gearing up in Amador County.

"The Auburn Community Cancer Endowment will reap important scientific, medical and economic dividends for everyone in our region for generations to come," said Ralph deVere White, director of



It took a village: Members of the Auburn Community Cancer Endowment Fund raised \$1.5 million in five years.

UC Davis Cancer Center and associate dean for cancer programs. "It is a tremendous legacy for the people of Auburn and Placer County, and a model for other cancer centers nationwide."

Toward a test for ovarian cancer

A team of UC Davis Cancer Center researchers has identified biomarkers for ovarian cancer, an advance that may lead to an early detection test for the disease.

The biomarkers were present in blood samples from ovarian cancer patients but not in samples from healthy patients, the researchers reported in the July 7 issue of the *Journal of Proteome Research*.

The investigators used an emerging science known as glycomics to identify changes in bloodstream sugars that appear to be characteristic of ovarian cancer. Some of these markers had never been detected before.

The researchers are now studying blood samples from a larger number of patients and healthy controls to isolate those biomarkers that will best detect early ovarian cancer.

An estimated 20,180 women will be diagnosed with ovarian cancer in the United States this year and only about 45 percent will survive five years.

"We are hopeful this approach will lead to a test that will allow doctors to detect ovarian cancer early, when it is most curable," said Gary Leiserowitz, professor and chief of gynecologic oncology and a study author.



Research biochemist Suzanne Miyamoto works on a potential screening test for ovarian cancer.

New drug extends lung cancer survival 22 percent

Adding the new molecularly targeted agent bortezomib to a standard chemotherapy regimen prolonged survival in patients with advanced non-small cell lung cancer, according to results of a national phase II trial led by UC Davis researchers.

Results of the study were reported at the 2006 annual meeting of the American Society of Clinical Oncology in Atlanta in June.

In the study, patients taking bortezomib plus gemcitabine and carboplatin survived a median of 11 months. In comparison, the longest median survival seen in past trials of platinum-based chemotherapy treatments for advanced non-small cell lung cancer was nine months.

“These survival results are among the best ever reported in patients with non-small cell lung cancer,” said Angela Davies, assistant professor of hematology and oncology and lead author of the study. The study was conducted under the auspices of the Southwest Oncology Group.

Lung cancer is the nation’s leading cause of cancer death. An estimated 174,470 people will be diagnosed with the disease this year, and 162,460 will die from it. Non-small cell lung cancer accounts for about 80 percent of lung cancer cases.

Portal to health

An estimated four million Asian Americans have limited English proficiency, a potential barrier to effective communication with health-care providers about cancer prevention, early detection and treatment. Now there is a Web tool to ease that barrier.

Developed by the UC Davis Cancer Center-based AANCART project (for Asian American Network for Cancer Awareness, Research and Training), together with the American Cancer Society, the new Web resource permits easy retrieval of cancer information materials that have been translated into more than a dozen Asian and Pacific Islander languages and reviewed for scientific accuracy.

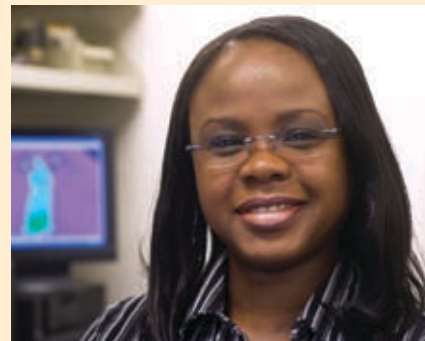
Intended for use by health-care professionals, the Asian and Pacific Islander Cancer Education Materials site is at www.aancart.org/apicem or www.cancer.org/apicem.

Hundreds of cancer education materials in Asian languages can now be accessed from a single Web portal.



Nigerian-born veterinarian wins award to support cancer research

After earning her veterinary degree from Nigeria’s University of Ibadan, Olulanu Aina moved to California in 1994 to work at the Army



Olulanu Aina

Veterinary Treatment Facility in Camp Pendleton. She went on to earn her master’s and doctoral degrees in comparative pathology at UC Davis. Today the naturalized United States citizen is an assistant professor of hematology and oncology. Aina works as a research biologist in the laboratory of Kit Lam, professor and chief of hematology and oncology, helping to develop early diagnostic tests for cancer.

Aina’s unique training and outstanding work recently earned her two years of salary and benefits support through a National Institutes of Health “Research Supplement to Promote Diversity in Health-Related Research” award.

“This grant is a wonderful opportunity,” said Aina, whose career goal is to combine her veterinary and comparative pathology training to answer important cancer-related questions for the benefit of human and animal medicine.

Novel compound targets leukemia and lymphoma cells

UC Davis Cancer Center researchers have developed a novel peptide that binds to the surface of leukemia and lymphoma cells with extremely high affinity, specificity and stability, and demonstrates remarkable promise as a tool to help image tumors and deliver anti-cancer drugs. The research was reported in the July issue of *Nature Chemical Biology*.

“We believe this peptide has great potential for becoming a new, effective imaging and therapeutic agent for patients with lymphoid cancers,” said

Kit Lam, professor and chief of hematology and oncology and senior author of the paper.

The peptide – named LLP2A – binds to a receptor found on the surface of lymphocytes. Lam’s next step will be to evaluate the binding of LLP2A in a larger number of human lymphoma biopsy samples. If those results are positive, Lam plans to test the peptide as a lymphoma imaging agent in patients.

Experiments are already under way at the School of Veterinary Medicine to evaluate LLP2A in dogs with naturally occurring non-Hodgkin’s lymphoma.

Snacks and kids’ health

School lunches and vending machines aren’t the only places to look for ways to improve students’ nutrition. Modest changes in the kinds of snacks offered at after-school programs can also have a significant positive impact on children’s diets, UC Davis researchers reported in the September issue of the *American Journal of Public Health*.

The researchers showed that a healthy snack menu in an after-school program can help low-income children – those at highest risk of obesity – consume more fruit and less saturated fat. Obesity is a risk factor for many chronic illnesses, including some cancers.

The study focused on an after-school program called Students Today Achieving Results for Tomorrow,

which serves 8,000 low-income kids from 44 public elementary schools in Sacramento, Elk Grove and Rio Linda. The program made such snack substitutions as animal crackers for brownies and fresh apples for canned peaches.



Study author Diana Cassidy

October 3, 2006

“Making the Most of Being a Caregiver”

A Learn at Lunch workshop

UC Davis Cancer Center auditorium, noon to 1 p.m.

Information: (916) 734-5935 or www.ucdmc.ucdavis.edu

October 6, 2006

Swinging Away at Lung Cancer Million Dollar Golf Challenge

Proceeds benefit lung cancer research

Teal Bend Golf Course, Sacramento, noon registration

Information: www.ramosfoundation.org

October 7, 2006

Festival of the Cure – Bike Ride

Proceeds shared with the South Placer UC Davis

Breast Cancer Endowment

1209 Pleasant Grove Blvd., Roseville, 7 a.m. check-in

Information: TruFitness (916) 782-8111

October 12, 2006

Thunder Valley Austin’s Fundraiser

Proceeds benefit the South Placer UC Davis

Breast Cancer Endowment

Austin’s Steak House, 1200 Athens Ave., Lincoln, 6 p.m.

Information: Aldo Pineschi, (916) 782-8079 or

www.wethinkpink.org

October 20, 2006

Pink and White Ball

Proceeds benefit the South Placer UC Davis

Breast Cancer Endowment

Granite Bay Country Club, 9600 Golf Club Dr.,

Granite Bay, 6 p.m.

Information: Sonbol Aliabadi, (916) 789-2920 or

www.wethinkpink.org

November 7, 2006

“The Impact of a Cancer Diagnosis on Family Members”

A Learn at Lunch workshop

UC Davis Cancer Center auditorium, noon to 1 p.m.

Information: (916) 734-5935 or www.ucdmc.ucdavis.edu

CALENDAR OF EVENTS

November 16, 2006

"Breast CT: Toward Earlier Breast Cancer Detection"

Sponsored by the American Cancer Society and UC Davis Cancer Center

UC Davis Cancer Center auditorium, 5:30 to 7:30 p.m.

Information: (916) 734-5935 or www.ucdmc.ucdavis.edu

December 5, 2006

"Community Services for Cancer Patients"

A Learn at Lunch workshop

UC Davis Cancer Center auditorium, noon to 1 p.m.

Information: (916) 734-5935 or www.ucdmc.ucdavis.edu

December 18, 2006

Joan Giboney Tree of Hope Untrimming Party and Ornament Sale

Proceeds benefit breast cancer research at UC Davis UC Davis Cancer Center lobby, 11 a.m. to 3:30 p.m.

March 17, 2007

St. Baldrick's Worldwide Head-Shaving Celebration

Proceeds benefit childhood cancer research

Roseville Sports Complex, 1545 Pleasant Grove Blvd., Roseville

Information: www.childcancer.org or (916) 784-6786

March 20 - April 30, 2007

"Body Image - Body Essence: Viewing Ovarian Cancer through the Art of Sculpture"

A public art exhibit sponsored by the National Ovarian Cancer Coalition

University Library Gallery, California State University, Sacramento

Information: (916) 734-5935

April 29, 2007

Ridin' For Survivin' 4th Annual Aubrey Hoskinson Memorial Poker Run

Proceeds benefit the Keaton Raphael Memorial

Rocklin Harley Davidson/Buell, 4425 Granite Dr., Rocklin

Information: www.ChildCancer.org (916) 784-6786

For more information about these and other programs, call (916) 734-5807 or visit www.ucdmc.ucdavis.edu/cancer/calendar_events.

"Even though school food programs have very limited budgets, this study suggests that with leadership and a little bit of political will, food service for kids really can be improved," said lead author Diana Cassady, an assistant professor of public health sciences.

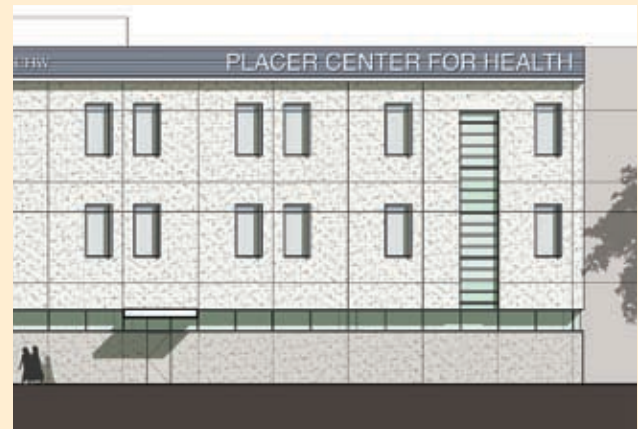
Planned Rocklin facility to offer outpatient cancer treatment

Catholic Healthcare West, which locally operates Mercy hospitals, and UC Davis Health System plan to break ground soon on a joint outpatient medical facility in Rocklin. The new Placer Center for Health will bring more primary and specialty care, including oncology services, to South Placer County, one of the fastest-growing areas in California.

UC Davis and Mercy will share the lease on the planned 66,000-square-foot facility, operating their respective primary and specialty-care services but sharing access to an outpatient pharmacy, clinical laboratory and array of diagnostic imaging services, including CT, MRI, ultrasound, general X-ray and mammography equipment.

UC Davis oncology specialists will see patients at the new center, which will include an on-site infusion center with 11 treatment stations.

The facility will be located within Rocklin's 115-acre Orchard Creek Business Park development, adjacent to approximately 15 acres also controlled by the University of California. UC Davis envisions that parcel as the future home for a regional ambulatory cancer treatment center and outpatient clinic.



Facility will be located near Highway 65 in Rocklin's new Orchard Creek Business Park.

Cancer help in Vietnamese

Cervical cancer is five times as common among Vietnamese American women as among white women, and Vietnamese American men have the country's highest liver cancer rate. Vietnamese Americans are also less likely than whites to get regular Pap tests, mammograms and other cancer screening tests.

A new Vietnamese-language cancer information and referral line, the first of its kind in the region, is helping to address such disparities. The number is (916) 449-5544. Vietnamese-speaking counselors, trained by the National Cancer Institute's Cancer Information Service, field the calls. The line was established by AANCART (for Asian American Network for Cancer Awareness Research and Treatment), an NCI-funded project headquartered at UC Davis Cancer Center.

Among major metropolitan areas nationwide, the Sacramento region has the 11th largest Vietnamese population. More than 18,000 Vietnamese live in Sacramento and Yolo counties.

"We are proud to be able to offer this service, which will help to arm Vietnamese Americans with the information they need to reduce their unequal and unnecessary cancer burden," said Moon S. Chen, Jr., associate director for cancer disparities and research at UC Davis Cancer Center and principal investigator of AANCART.

Do women who take tamoxifen to prevent breast cancer live longer?

New research from UC Davis and three other universities suggests that most women who take tamoxifen to prevent breast cancer do not extend their life expectancy. The study was published in the Sept. 1 issue of the American Cancer Society's journal *Cancer*.

"We found that for women at the lower end of the high-risk range for developing breast cancer, there is a very small likelihood that taking tamoxifen will reduce mortality," said lead author Joy Melnikow, a professor of family and community medicine at UC Davis.

Groups such as the U.S. Preventive Services Task Force now recommend that physicians counsel women who have at least a 1.67-percent chance

of developing breast cancer over the next five years about the benefits and risks of taking tamoxifen to prevent the disease.

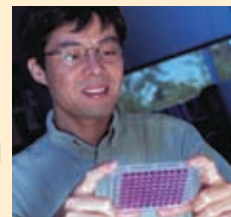
Melnikow's work suggests a 3-percent risk threshold is more appropriate. The study showed that women above this risk level can expect to live longer if they take tamoxifen for breast cancer prevention.

In addition to its use in breast cancer prevention, tamoxifen is an effective breast cancer treatment. The study did not question the drug's benefits as a treatment for the disease.

\$3.3 million for basic science research in cancer

Three investigators in the UC Davis Cancer Center Basic Science Program have received R01 grants from the National Cancer Institute. These highly competitive grants support specific projects in areas representing investigators' specific interests and competencies.

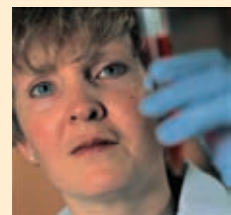
- Hongwu Chen, an assistant professor, received \$1.16 million to study co-activators in cell growth and tumorigenesis.
- Kermit Carraway, an associate professor, was granted \$1.15 million to explore regulation of protein degradation pathways.
- Colleen Sweeney, an adjunct professor, was awarded \$1 million to pursue her investigations into mechanisms of receptor tyrosine kinase inhibition.



Hongwu Chen



Kermit Carraway



Colleen Sweeney

Joyce Raley Teel Award

Helen K. Chew, director of the Clinical Breast Cancer Program at UC Davis Cancer Center, is the 2006 recipient of the Joyce Raley Teel Award for outstanding dedication to the cause of breast cancer. The award was presented at Sacramento's 10th annual Susan G. Komen Breast Cancer Foundation

Race for the Cure at Cal Expo in May.

Chew, an assistant professor of hematology and oncology, has treated hundreds of women with breast cancer from throughout Northern California and the Central Valley. She speaks frequently



Joyce Raley Teel and Helen Chew

about breast cancer screening, early detection and treatment to community groups throughout the region, with a particular focus on raising awareness among medically underserved women.

Among her many outreach activities, Chew is medical director of Sacramento AANCART, a National Cancer Institute-funded project headquartered at UC Davis that seeks to reduce cancer incidence and mortality among Asian Americans. In addition, Chew is an active research scientist with funding through the National Cancer Institute and the national Susan G. Komen Breast Cancer Foundation.

Honoring survivors

Cancer survivors, their family members, friends and caregivers celebrated National Cancer Survivors Day with a weeklong series of free programs and events at UC Davis Cancer Center.

The week included a panel discussion on the meaning of survivorship, a community forum about cancer clinical trials, a workshop on healing practices and an evening program for couples that explored the impact of cancer on



Sacramento chef Richard Pannell gave a healthy cooking demonstration at a picnic and art exhibit.

intimate relationships. A survivors' picnic and art exhibit capped the week.

National Cancer Survivors Day is celebrated the first weekend in June in hundreds of communities throughout North America to honor the 10 million Americans alive today who have had a cancer diagnosis.

Otto honored

Jim Otto, legendary center for the Oakland Raiders, is the recipient of the UC Davis Foundation's 2006 Charles J. Soderquist Award. The award recognizes Otto's extraordinary volunteer leadership and support of philanthropy at UC Davis.

Since undergoing treatment for prostate cancer at UC Davis Cancer Center in 2002, Otto has worked tirelessly to raise the institution's visibility regionally and nationally and to lead its Capital and Endowment Initiative. The initiative seeks to raise \$35 million for an expansion that will double the size of the Cancer Center and create new endowments in cancer research.

"Jim Otto's work to advance the mission and vision of UC Davis Cancer Center is an inspiration to all of us," said Chancellor Larry Vanderhoef at an awards ceremony on the UC Davis campus.

More than 100 people attended the luncheon ceremony, which included a special video testimonial from Otto's longtime coach, John Madden, now an NFL broadcaster.



Claire Pomeroy, vice chancellor for Human Health Sciences and dean of the School of Medicine; Jim and Sally Otto; Chancellor Larry Vanderhoef; and Ralph deVere White, director of the UC Davis Cancer Center and associate dean for cancer programs.



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Using LIGHT to *fight* CANCER. Now, *there's* an IDEA.

At UC Davis Cancer Center, we haven't just seen the light. We're putting it to work. From minimally invasive optical biopsy instruments to operating-room microscopes that instantly tell surgeons whether cancer is present, we're creating a new generation of tools to confront one of medicine's biggest challenges.

Through our unique partnership with Lawrence Livermore National Laboratory (home to the world's most powerful computer and a Human Genome Project center), our cancer experts are advancing biophotonics and biomedical technology to shed new light on cancer.

It's the latest manifestation of a multidisciplinary approach that sets UC Davis apart. Every day, our light physicists, biomedical engineers and oncologists partner with experts in dozens of other fields to develop the breakthroughs that will offer cancer patients fresh hope.

For our efforts, we've been recognized by the prestigious National Cancer Institute as being one of the finest cancer centers in the United States. It's good news for our many patients, who stand to be the first to benefit from our advances. And a big reason why, when it comes to the struggle against cancer, the prognosis is bright.



Our collaborative approach has made UC Davis Cancer Center one of only 60 cancer centers to have achieved NCI designation.



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And THEN SOME.

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S Y N T H E S I S

syn·the·sis (sin'thə sis) **n.**, *pl.* - **ses** (-sez') [[Gr. < syn-, together + *tithenai*, to place, DO¹]] **1** the putting together of parts or elements so as to form a whole **2** a whole made up of parts or elements put together **3** *Chem.* the formation of a complex compound by the combining of two or more simple compounds, elements, or radicals **4** *Philos.* in Hegelian philosophy, the unified whole in which opposites (thesis and antithesis) are reconciled.



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