

Creating Futures

University of Colorado *Anschutz Medical Campus*



*New Hope for Patients and
Families with Lung Cancer*

University of Colorado Cancer Center Lung Cancer Program



Ana Oton, MD,
examines lung cancer
patient **Marion Denton.**



Lung Cancer: An Urgent Problem

Americans are more likely to die from lung cancer than from breast, prostate, colon and kidney cancers combined. Lung cancer affects nonsmokers, those who have quit smoking and those who are still smoking. Lung cancer has the potential to affect every family.

The statistics are daunting. Lung cancer is the leading cause of cancer death in the United States and in the world. Each year, more than 200,000 Americans will be diagnosed with lung cancer, and 160,000 of them will die from the disease.*

More than half of those diagnosed with lung cancer are diagnosed after the cancer has spread (metastasized), when the outlook is particularly poor.

In women, lung cancer kills twice as many women as breast cancer and all gynecological cancers combined.

Those with lung cancer also suffer the stigma that the risk of the disease is known to be increased by smoking. In fact, half of Americans diagnosed with lung cancer had already quit smoking many years beforehand, and 15 percent of cases occur in people who have never smoked. This rate

Each year, more than 200,000 Americans will be diagnosed with lung cancer, and 160,000 of them will die from the disease.

is even higher among women. Because lung cancer is so common overall, even if lung cancer in nonsmokers were tracked as its own disease, it would still be among the seven most deadly malignancies in America, killing up to 26,000 people a year.

Although lung cancer is so pernicious and far more pervasive than most people understand it to be, research into its prevention and treatment remains seriously underfunded. In 2007, the National Cancer Institute invested \$4.8 billion in cancer research. Despite its status as the leading cause of cancer death, lung cancer received only 5 percent of that year's research budget.

Yet, the research opportunities to impact the disease are at an all-time high.

*Sources for information and statistics: www.cancer.gov, www.cdc.gov, www.cancer.org, www.lungcancerresearchfoundation.org.

Leading the Way to the Solution: University of Colorado Cancer Center at the Anschutz Medical Campus

Even though the problem is huge, we believe we are at a tipping point in the treatment of this disease. We are now starting to identify the precise molecular change that triggers lung cancer in the first place, allowing us to perfectly match each different cancer with a specific targeted therapy that may stop it in its tracks.

At the University of Colorado Cancer Center, we know that when it comes to treating lung cancer, one size definitely does not fit all. We are already global leaders in turning this theory into practice. Now we must invest in the talent and resources needed to accelerate the pace of discovery and application. Together, we can create new hope in the fight against diseases like lung cancer.

We can treat patients more effectively, establish long-term control of a fast-moving and lethal disease and make breakthroughs in detecting the cancer earlier and even preventing its occurrence in the first place.

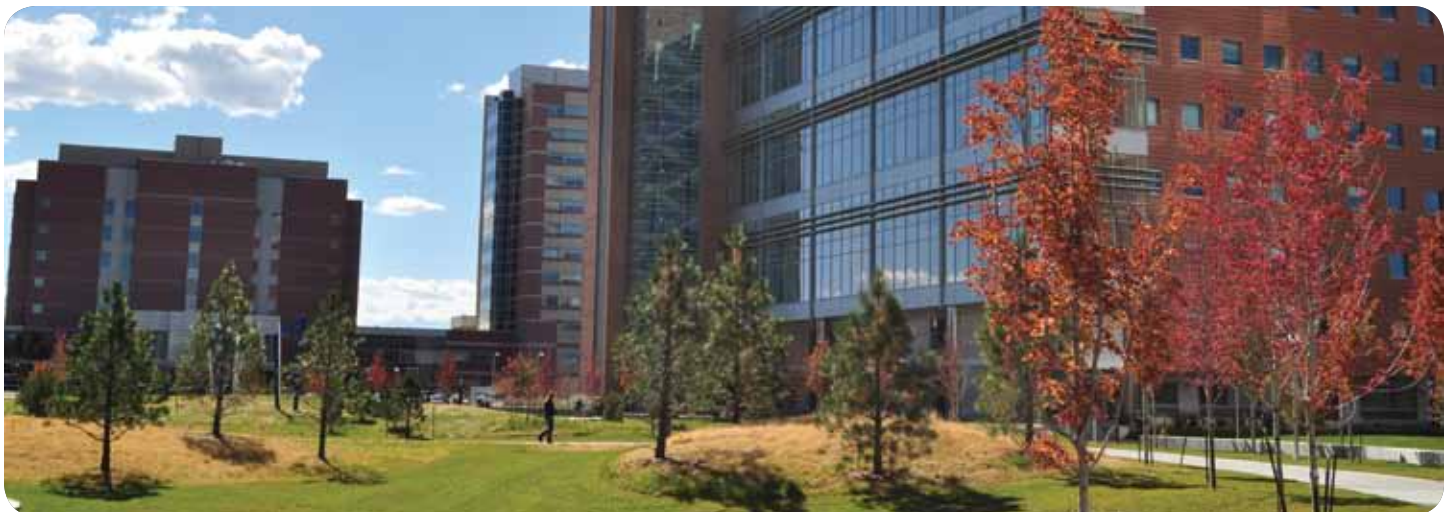
The rest of the nation looks to the University of Colorado for leading research and clinical care, and we are poised to make an impact in the way we combat one of our nation's deadliest diseases.

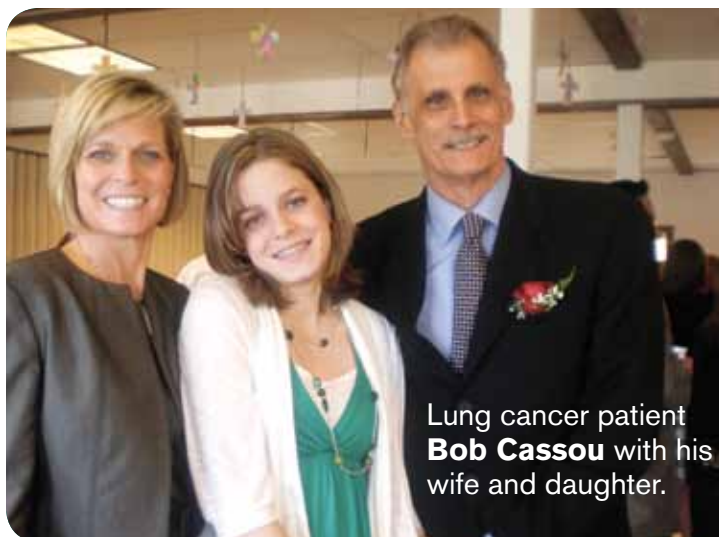
Imagine a future in which:

- Lung cancer is detected earlier than ever before using screening techniques that are as common as mammograms are for breast cancer and PSA tests are for prostate cancer—yet even more effective.
- People at high risk for lung cancer are identified and receive treatment to prevent its development.
- Every patient receives personalized treatment that takes into account their genetic makeup and their specific type of tumor, allowing them to receive the right drug therapy from the start.
- The most tenacious lung cancer cells are halted in their tracks, reducing the current problem of aggressive metastasis and increasing survival rates dramatically.

We can transform the world's most lethal cancer from a stigmatized, underfunded problem into one of hope and possibility. With your help, we can save and improve the lives of so many who suffer from this complex disease.

Now we must invest in the talent and resources needed to accelerate the pace of discovery and application. Together, we can create new hope in the fight against diseases like lung cancer.





Lung cancer patient **Bob Cassou** with his wife and daughter.

We're Going to Keep This Going for Years

Lung Cancer Patient Bob Cassou

When Bob Cassou was diagnosed with lung cancer at age 61, he was in top physical condition. He felt great, had no symptoms and had never smoked. A routine test showed some calcium buildup in his heart, so he went to a cardiologist.

A few days later, Cassou received a call from his doctor who told him he had a tumor in his right lung.

After surgery to remove the tumor, he received more devastating news: his cancer was stage 3B and had spread to his pleural cavity across his chest wall.

"Of course I was devastated," Cassou says. "The cancer is very difficult to understand when your whole experience is you don't smoke, you eat the right food, you stay in shape... I went through the whole process with my family of 'What do I do?'"

After doing research, talking to specialists, friends and other cancer patients, he sought a second opinion from Ross Camidge, MD, PhD, at the University of Colorado Cancer Center.

He was impressed with Dr. Camidge's breadth of knowledge, his personal approach and his feel for everything going on in lung cancer.

"You listen to doctors, they talk about chances of survival in percentages... it is gruesome," Cassou says. "Dr. Camidge honed in on me, specifically. 'Everyone is different,' he says. They wanted to run genetic tests on the tumors in order to recommend the best treatment."

"In Bob's case, we proved he had a specific genetic mutation that caused his cancer in the first place," Camidge says. "We

walked away from a one-size-fits-all treatment and found a specific molecular treatment to which Bob could respond."

Cassou underwent chemotherapy and then started on a clinical trial of a drug called erlotinib.

"There was not that mentality of giving up," Cassou says. "Dr. Camidge said to me, 'We're going to keep this going for years.' And it becomes the only hope you have in lung cancer, that they will turn this into some sort of chronic disease."

"I have just passed my two-year anniversary. Two brain scans and five PET scans later, I don't have any cancer that they can see," Cassou says. Camidge concurs that Cassou has no evidence of active cancer.

Cassou says his medicine is working... but the doctors assure him the cancer will come back someday, which is always the case with lung cancer. He feels confident, however, that if a new treatment arises anywhere in the world, Dr. Camidge will know about it and share the information with him.

So Cassou has returned to a sense of normalcy: traveling, working, playing tennis and spending a lot of time with his family.

"We walked away from a one-size-fits-all treatment and found a specific molecular treatment to which Bob could respond."

-Ross Camidge MD, PhD





Positioned for Breakthroughs

The University of Colorado Cancer Center's Lung Cancer Program is among the world's best.

We are the Rocky Mountain region's only National Cancer Institute-designated comprehensive cancer center—the elite of the elite, with only 40 in the entire country.

Our faculty members are national leaders in drug development, basic science and cancer prevention and control. They influence science and practice not only in Colorado, but also on the national and world scenes.

Our clinical care is the best in Colorado, with lung cancer survival rates up to two to three times the state and national averages.

Our research program receives funding from the most prestigious and competitive programs in the world. For example, our SPORE grant (Specialized Program of Research Excellence) from the National Cancer Institute was the first program that the institute funded. It is still only one of eight currently funded and one of only two that have been continuously funded since SPORE's inception in 1992.

We are innovating in all areas of treatment: early detection, surgery, radiation therapy and targeted therapies using both drugs and chemotherapy.

We are the only place in the Rocky Mountain region with pulmonologists, thoracic surgeons, medical oncologists, radiation oncologists and pathologists dedicated exclusively to lung cancer; the only place in the region routinely matching drug therapies to the molecular profile of individual tumors; and the only place in the region with a dedicated lung cancer tissue bank.

With ongoing support from the National Institutes of Health, the Boettcher Foundation, the Coleman Institute, the Adelson Medical Research Foundation, the International Association for the Study of Lung Cancer (IASLC), the Flight Attendant Medical Research Institute (FAMRI) and industry partners, we are set to leverage every piece of extra support into new breakthroughs.

Our location on the Anschutz Medical Campus (AMC) offers an unmatched resource for the fight against lung cancer. The AMC is the region's largest research, patient care and education facility and one of the newest comprehensive health care campuses in the world. It provides the infrastructure to achieve innovation in every aspect of biomedical science—from laboratory research to clinical trials and from pharmaceutical development to commercialization—all in one place.

The Convergence of Discovery and Donor Investment

New understandings about the biology of lung cancer are driving major advances. At the University of Colorado Cancer Center, our clinical services are informed directly by discoveries emerging from our laboratories. In turn, our basic researchers have access to a steady stream of new clinical data that they can apply immediately to their explorations into the molecular basis of lung cancer.

It is an ideal bench-to-bedside-and-back-again model for making—and applying—new discoveries.

The Lung Cancer Mutation Consortium: Helping Lung Cancer Patients Live Longer and Better

Paul Bunn, MD, professor of medical oncology, is a world-renowned lung cancer clinician and researcher. He is currently leading a nationwide lung cancer mutation consortium to study genetic mutations in lung cancer patients. This two-year study, funded by the National Cancer Institute, will help advance personalized medicine and treatment options for lung cancer patients. And like everything else that Bunn does in cancer research and treatment, this study will help lung cancer patients live longer and better.

“The Lung Cancer Mutation Consortium will allow our Cancer Center, along with 13 others, to test lung cancer tumors for specific mutations so we can understand their frequency, their relationship to each other and their association with the tumor’s clinical features,” says pathologist Wilbur Franklin, MD. “We will also be investigating what drugs work against these mutations and how often they work.”

According to Bunn, if you take 100 patients and give them chemotherapy, it will elicit a response in 25 percent of them. In personalized medicine, you might take the same 100 patients, but by giving different groups of patients different drugs matched to their individual profile, the rate of success would be much higher, in the range of 70 to 80 percent.



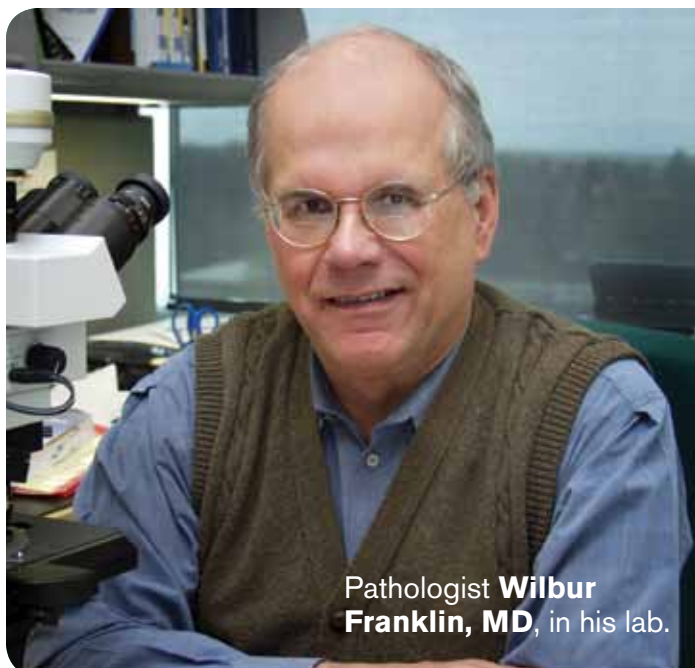
Paul Bunn, MD, (above right) with UCCC supporter **Gary Burge**. Funds from the Christine Burge Endowment support research into cell lines of individuals who never smoked as part of the Lung Cancer Mutation Consortium.

Bunn and his colleagues at the University of Colorado Cancer Center (UCCC) have already shown that patients who have a particular genetic mutation in their tumors can double their life expectancy by taking a drug called erlotinib (Tarceva), yet if you did not have the mutation the drug did very little. The same UCCC scientists developed one of the most common screening tools associated with expression of the mutation.

Bunn says we now know of at least ten genes that are activated by mutations or fusions that can be tested for in lung cancer patients. These changes are most common in the tumors of people with little in the way of a smoking history, but they can be found in anyone with lung cancer. For each of these ten genes, there are potential treatments that might work. Coloradans with lung cancer can now receive free genetic testing of their tumors as part of the study and can get involved in clinical therapeutic trials if they happen to have one of these ten mutations.

Scientists are working to discover more mutations for which they can develop therapies. This study will hopefully be a part of that new discovery.

“We’d like to be able to identify one good target gene for everybody’s tumor and have a treatment for everybody’s tumor,” says Bunn. “The goal is personalized therapy that is more effective and less toxic for each patient.”



Pathologist **Wilbur Franklin, MD**, in his lab.

With Increased Donor Investment, We Will...

Develop New Understandings about the Biology of Lung Cancer

Recent breakthroughs suggest that lung cancer is not a single disease. A series of different molecular changes drive different lung cancers—each one of which may need a specific, targeted treatment. We are working to understand these varied diagnoses and treat each appropriately and more effectively.

There will never be a single answer to the whole of lung cancer, but lots of different meaningful answers for different subgroups of patients are coming to light. These amazing breakthroughs show just what can be done with the right combination of laboratory and clinical research, offering the promise of many more examples of personalized treatment for lung cancer to come. For example:

- **EGFR mutations** - Since the beginning of 2008, all UCCC lung cancer patients have routinely been molecularly profiled for sensitivity to a class of drugs called EGFR-inhibitors. We were well ahead of the curve—nearly a year after we started, it was demonstrated that in patients with these mutations in their tumors, EGFR-inhibitor drugs were more effective than traditional chemotherapy.
- **ALK gene rearrangement** - In 2007 a new molecular subtype of lung cancer called an ALK gene rearrangement was identified in Japan. Marileila Varella Garcia, PhD, has developed the technology to screen for this subtype of lung cancer here in Colorado, where it may be present in up to one in 20 lung cancer patients. In

2007, Ross Camidge, MD, PhD, helped the University of Colorado Anschutz Medical Campus become one of only seven centers in the world that paired molecular testing for the ALK gene rearrangement with a specific ALK inhibitor. In 2009, results from this work presented at the world's largest oncology meeting (ASCO) showed that over 90 percent of patients whose tumors were positive in the ALK test benefited from the ALK inhibitor drug.

“Now we have a subset of patients who didn't have any hope with other medications, and who are dramatically responding to this new drug.”

-Marileila Varella Garcia, PhD

Having samples of different cancers stored in our tissue bank is an enormous help, allowing researchers to test their theories on what may be driving different cancers early on.

State-of-the art imaging and the university's groundbreaking work in stereotactic body radiation therapy (SBRT) are leading the treatment of cancer in even more exciting new directions. Improvements in PET imaging allow us to see previously unsuspected spread of lung cancer, and then use highly targeted radiation therapy to eradicate these cancer seeds long before they can cause problems.

Detect Lung Cancer Earlier

We are working to make screening and early detection easier, and to recognize precancerous conditions more readily. The earlier we can diagnose lung cancer, the better the patient's chance for a good outcome.

Fred Hirsch, MD, PhD, manages several laboratory projects aimed toward early detection of lung cancer. One such project attempts to “smell” the cancer by detecting the biomarkers (metabolites) in exhaled breath from high-risk individuals, based on a new nanoparticle chip technology for early detection of lung cancer. By having a patient merely breathe into a specially developed tube and then analyzing the breath, researchers hope to be able to diagnose lung cancer noninvasively. The results to date have been very promising.

The Cancer Center has two additional initiatives to screen and detect cancer earlier: the Prostate, Lung, Colorectal and Ovarian Screening Trial (PLCO) and the National Lung Screening Trial (NLST). The PLCO began in 1992 to determine whether various screening exams might reduce death risk for these cancers. The NLST has 50,000 participants nationwide, and UCCC is following 3,700. The study will determine whether either a spiral CT or standard chest x-ray decreases lung cancer mortality. Data is currently being analyzed for both projects and results will be published in the next few years.

Prevent Cancer in the First Place

A study led by Robert Keith, MD, associate professor of pulmonary medicine at the University of Colorado Anschutz Medical Campus and Denver Veterans Affairs Medical Center, shows that a tablet called iloprost significantly repaired smoking-caused lung damage in former smokers—and may keep former smokers from developing lung cancer.

Researchers examined lung biopsies of 152 people who had smoked at least the equivalent of one pack a day for 20 years—before and after six months of treatment with either the iloprost tablets or a placebo. On iloprost, but not on placebo, the early signs of cancer in the former smokers' lungs showed a significant improvement.

“These results are exciting because they show we can actually keep former smokers from developing lung cancer with a drug that has been used routinely for other problems,” says Keith.

Keith says the next step is to test the drug in a much bigger study to determine exactly who will benefit most from taking the drug.

Translate New Discoveries into Targeted Therapies

We have the infrastructure to translate new information obtained through basic research into new drugs and new tests, and get the therapies into the clinic.

With our breakthroughs we can already predict who will respond to EGFR inhibitors and ALK inhibitors. Through more advanced genetic screening and access to new drugs through clinical trials, we hope to eventually be able to offer the same personalized treatment to every patient.

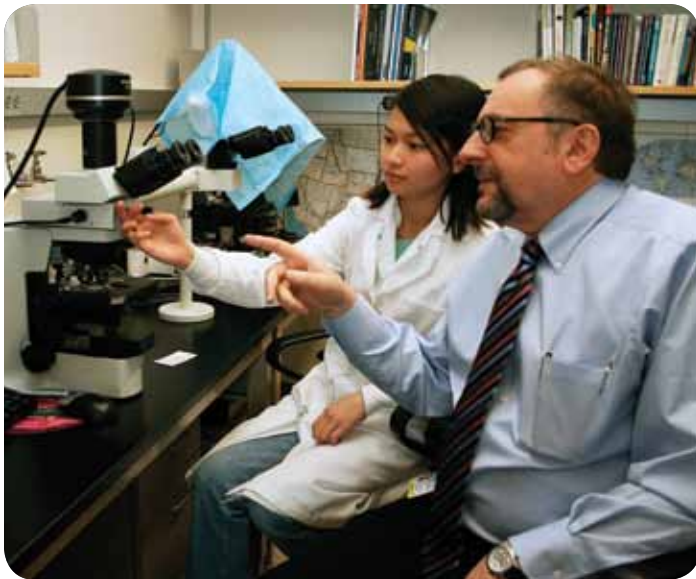
Treat More Patients

At the University of Colorado Cancer Center, we are on a mission to change the way lung cancer is treated. Building the program and spreading the word is essential in allowing us to increase the number of patients we see, to provide them with cutting-edge services, technology and treatment.

We offer an unparalleled number of clinical trials. We have doubled the number of lung cancer patients going on clinical trials every two years since 2005. The national average of lung cancer patients on clinical trials is 3 percent. At 38 percent, we are offering more than 12 times as many patients access to clinical trials than the typical provider. Often these are treatments not available anywhere else in the world.



Just a few members of the UCCC lung cancer team, left to right: **Wilbur Franklin, MD; Fred Hirsch, MD, PhD; Marileila Garcia, PhD; Paul Bunn, MD.**



Fred Hirsch, MD, PhD, is not only a leader in finding new ways to detect lung cancer before it spreads, but also trains the next generation of researchers. Here, he is working with fellow **Cindy Tran, MD**, in his lab.

Serve the Whole Patient

The diagnosis of lung cancer is devastating to patients and family, so in addition to a team of experts fighting the cancer, we are building a complete support system to help the whole family cope with their loved one's diagnosis.

We will increase our capacity to provide psychosocial and other complementary services to patients, creating a generation of "super-survivors" who emerge from therapy with a high quality of life.

Prepare the Most Highly Trained Specialists

Our vision of the future is possible because, as a renowned educator in health disciplines, we are training the next generation of experts to deliver on the promise. And we are attracting the brightest minds from around the world who are working on some of the most exciting ideas.

Investments in Talent and Infrastructure Will Make All the Difference

Our ability to accelerate our research program depends upon growth—in the clinic and in the lab. This growth will be achieved through investments in:

Leadership and Talent—endowments to recruit more faculty dedicated to the problem of lung cancer.

Research—seed grants to transform ideas into action, and attract new collaborative grants and money to fund the work of new faculty.

Infrastructure—for enhancements to our state-of-the-art biorepository. A world-class tissue bank and associated database will facilitate targeted treatments for every patient and enhance follow-up to help with long-term survivorship. It also aids our clinical trials and ability to serve the region and nation.

Patient Support—to provide care for the whole patient and ensure the highest quality of life. We want every new patient and their family to have access to a clinical psychologist and a social worker to support their entire cancer treatment journey. Additional resources such as a financial hardship counselor, palliative care nurse practitioner, bereavement counselor and patient navigator are particularly in need of private investment as they receive minimal insurance coverage and cannot be billed to the patient.



Researchers and clinicians work together in multidisciplinary teams. From left to right, back row: **Ross Camidge, MD, PhD; Robert C. Doeble, MD, PhD; Derek Linderman, MD; Paul Bunn, MD; Jeffrey Kern, MD**. Front row: **Kavita Garg, MD; Marileila Garcia, PhD; and Ana Oton, MD**.



Gary Burge
(seated) with his
children Kate
and Peter.

Donors Bring New Hope

Honoring a Life, Changing the Course of Cancer in the Future:

The Burge Family

Christine Burge never smoked and played tennis nearly every day, yet in July 2004 was diagnosed with stage IV lung cancer. Though she outlived the average life expectancy for someone with such cancer, she died in January 2007.

In the wake of their enormous loss, Gary Burge and his children, Kate and Peter, have become strong supporters of the University of Colorado Cancer Center.

“It was really hard to understand because Chris was a nonsmoker,” Gary says. Unfortunately, Chris Burge perfectly fit the profile of the fastest-growing group of lung cancer patients: nonsmoking females in their 50s.

“When Christine was diagnosed, once we got over the shock, we just wanted to go to the best place we could find,” Gary says. Paul Bunn, MD, was recommended to the Burges by physicians across the country.

The Burges discovered that lung cancer carries with it the stigma of a disease that someone “brought on themselves” by smoking (even though she was a nonsmoker). That stigma became an additional difficult aspect of Chris’s illness.

After multiple treatments and approaches to halting the cancer, it was clear a reversal was not in sight. “Dr. Bunn’s program provided a very good quality of life,” Kate says.

Chris consistently talked to her family about the need to find a cure for lung cancer.

“When you survive a cancer, you rally to the cure—particularly women. Maybe this is why breast cancer has had such success raising funds and awareness. But in the case of lung cancer, there are few survivors to rally and raise money, raise awareness,” says Gary. “We ought to be doing just that with lung cancer.”

To that end, the Burges established the Christine Burge Endowment with gifts made in honor of Christine and with funds of their own. Earnings from the endowment support lung cancer research.

This year the funds will support the Lung Cancer Mutation Consortium (see p. 7). Funds from the Burge Endowment will enable researchers to establish cell lines from individuals who had never smoked, to study any genetic abnormalities those cell lines possess. The study will ultimately help determine the most effective therapy for someone with those genetic abnormalities.

“It’s exciting for all of us,” Gary says of the research.

Peter adds, “We’re a very Colorado-type family. It’s cool that the University of Colorado Cancer Center is here in our own backyard.”



Support Early Detection of Lung Cancer

The Gift of Life and Breath is a 5K run and walk that raises awareness and funding to support the critical research needed for early detection of lung cancer. Thelissa Zollinger (pictured with her husband Gary) started the event to honor Gary in his battle against lung cancer, which ended in 2007.



In its three years, the successful event has raised nearly \$350,000 for The Gary L. and Thelissa Zollinger Early Detection of Lung Cancer Endowment, which supports lung cancer research at UCCC. Michael Weyant, MD, surgical oncologist, leads a research project that is supported in part by the Zollinger Endowment. He is pictured at left with his daughter at the 2009 Gift of Life and Breath event on the Anschutz Medical Campus.

To learn about the many ways you can make a gift:

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With Your Help, Success is Possible

We are at a crossroads in the story of lung cancer. We must be bold and ambitious in order to create the positive outcomes we know are possible.

The convergence of expertise and world-class resources at the University of Colorado Cancer Center is extraordinary. Your investment at this time, in this place, will make a real difference.



UNIVERSITY OF COLORADO
CANCER CENTER

In addition to donating to the University of Colorado Foundation, directly supporting clinical and laboratory research and care, you may also consider supporting the University of Colorado Hospital Foundation to help support capital projects, infrastructure and patient financial assistance programs.



University of Colorado Hospital