Mission
The mission of The University of Texas MD Anderson Cancer Center is to eliminate cancer in Texas, the nation and the world through outstanding programs that integrate patient care, research and prevention, and through education for undergraduate and graduate students, trainees, professionals, employees and the public.

Vision
We shall be the premier cancer center in the world, based on the excellence of our people, our research-driven patient care and our science.

We are Making Cancer History®.

Core values
Caring
By our words and actions, we create a caring environment for everyone.

Integrity
We work together to merit the trust of our colleagues and those we serve.

Discovery
We embrace creativity and seek new knowledge.
Wheeler Williams’ “Wave of Life” was the centerpiece of the fountain located in front of MD Anderson’s Houston Main Building (formerly the Prudential Building) until 2012. The sculpture can still be seen outside the Dan L. Duncan Building.
From March 1, 1944, when The University of Texas' M.D. Anderson Hospital for Cancer Research admitted its first patient, a 57-year-old man with lymphoma, to last year when The University of Texas MD Anderson Cancer Center served close to 135,000 patients, the institution has never slowed in its drive to advance cancer medicine through its patient care, research, prevention and education initiatives.

Much of that success is due to the bold, brilliant and dedicated faculty members and staff who have never stopped learning, evolving and bringing new approaches to the understanding and treatment of cancer. The MD Anderson team is committed to defeating cancer because it’s one of humanity’s most important pursuits.

Cancer also evolves. It changes to become resistant to medication. It’s also determined, evasive, extremely complex and, in its way, intelligent.

But our intelligence and ability to adapt to change is far greater. And in evolution and transition, there is opportunity. As an institution, MD Anderson is evolving and changing with the current health care environment. This time of transformation has made us stronger, and in the past year we’ve continued to make significant progress toward our goal of ending cancer.

Through strong strategic alliances, MD Anderson has created the nation’s leading drug discovery infrastructure, which has led to new therapies and numerous clinical trials for patients failing the current standard of care. The program has yielded major contracts with biopharmaceutical companies, enabled transformative agreements, catalyzed significant funding channels and created new companies that will advance our knowledge and provide long-term sources of revenue to support our mission. You’ll read stories about such groundbreaking work in drug development in the pages of the annual report.

We continue an unprecedented effort to more rapidly convert scientific discoveries into lifesaving advances through our Moon Shots Program™. Launched in 2012 with six Moon Shots™, the program has expanded to 13 multidisciplinary teams of cancer experts collaborating and innovating to stop close to 20 types of the disease, which collectively account for 63% of cancer deaths annually. Of course, MD Anderson addresses all forms of cancer in its broad research portfolio and vast clinical enterprise.

Through the Moon Shots’ APOLLO (Adaptive Patient-Oriented Longitudinal Learning and Optimization) platform, high-quality biopsies and blood samples are being collected from patients before, during and after treatment. Deep genomic and immune profile analysis of these longitudinally collected samples provides a “moving picture” of cancer's adaptability and enables our researchers to understand why some cancers respond to or resist certain treatments such as immunotherapy. APOLLO provides an opportunity to learn from every patient and have every patient benefit from research. It is true precision medicine.

Over the next two years, such penetrating analysis will be conducted in thousands of tumor biopsies in more than 2,000 patients enrolled in 28 clinical trials for a number of cancers. The development of “liquid biopsies” holds the potential to replace tumor biopsies with blood-based profiling, providing a less invasive way to detect certain tumor mutations or changes in the immune cells that can point toward the best therapy for a specific person. A multi-year partnership recently was announced to make comprehensive liquid biopsy technology the standard of care in cancer treatment.
His commitment to forward-looking cancer prevention is found in the DNA of other institutional tobacco-control policies such as the EndTobacco program and tobacco-free hiring policy. MD Anderson’s expertise and leadership in prevention set an important example for the entire University of Texas System and helped pave the way for the system’s Eliminate Tobacco Use initiative. Because of that initiative, all 14 UT System institutions will be tobacco-free by June 1.

In September, nearly 54 years to the day after President John F. Kennedy inspired the nation to lead the world in innovation and space exploration with his “We choose to go the moon” speech at Rice University, Vice President Joe Biden shared a deeply personal message about his family’s battle with cancer and their experience with the brilliant team of physicians and nurses at MD Anderson. He also emphasized ideas critical to both the Moon Shots Program and the national Cancer Moonshot initiative — increased collaboration, the importance of sharing data and the need for better access to clinical trials.

The vice president returned a few months later to join more than 2,000 guests, including dignitaries from around the world such as former President George H.W. Bush — a past Board of Visitors chair — at a stellar gala honoring MD Anderson’s 75th anniversary. During the celebration, the creation of the Beau Biden Chair for Brain Cancer Research was officially announced. It was part of an exciting week of events that raised close to $15 million to support our cancer-fighting efforts.

It’s philanthropic support such as this that makes our mission possible. Without your commitment, the institution wouldn’t be able to test the limits with high-impact, high-reward research projects. We couldn’t take aim at major breakthroughs in patient care and hope to dramatically reduce mortality and suffering sooner through the Moon Shots Program and its platforms.

Without you, we wouldn’t be the No. 1 cancer hospital in the nation and the most impactful cancer institution in the world as we look back over 75 years of Making Cancer History.
When the MD Anderson Cancer Center opened its doors to patients in 1944, the standard method for removing tumors was surgery. Then came radiation treatment, its use accelerated by Drs. Gilbert Fletcher and Leonard Grimmett, pioneers in the field and MD Anderson faculty members, who designed the first affordable radiotherapy machine. Approved by the U.S. Atomic Commission in 1950, the cobalt-60 unit proved to be a more effective source of radiotherapy than existing machines and quickly became used around the world.

The methods and machines that deliver radiation therapy have steadily improved since — and MD Anderson led the way. From the use of the betatron in the mid-1950s, to high-voltage linear accelerators (also developed by Fletcher) and the development of interventional radiology in the 1970s, to fractionated radiotherapy and intraoperative radiotherapy in the 1980s, in addition to many other breakthroughs, such as the combination of radiation and surgery or chemotherapy, MD Anderson was on the leading edge of what is known as the second pillar of cancer treatment.

In the decades that followed, more effective, targeted and personalized approaches to treating cancer were developed and emerged as major pillars of modern cancer treatment. These include combination chemotherapy, in which multiple anticancer drugs are given simultaneously; targeted therapy, which uses drugs or other substances to more precisely identify and kill cancer cells without harming surrounding healthy tissue; and immunotherapy, an approach that enlists the body’s own immune system to fight cancer.

As with radiotherapy, MD Anderson has been at the forefront of creating, improving and implementing these new treatments.

Three of the institution’s trailblazers, in particular, are among the physicians and researchers throughout the world who have discovered new approaches that would forever change the way cancer care is delivered.
Chemotherapy

Emil J Freireich, M.D., clinical professor of Leukemia

When Emil J Freireich, M.D., arrived at the National Cancer Institute (NCI) in 1955 to head its leukemia program, the disease was a virtual death sentence. Newly diagnosed patients soon died, usually from massive hemorrhaging or infections. “Back then, the treatment for acute leukemia was very primitive,” says Freireich. “Chemotherapy drugs had recently become available, but patients died before the drugs had a chance to work.”

To buy time for patients while the drugs killed cancer cells, Freireich knew he needed to halt the nonstop bleeding that is the hallmark of leukemia.

He conducted studies that revealed patients’ bleeding was caused by an insufficient number of platelets — the tiny, colorless discs that circulate in blood and promote clotting. Further studies by Freireich showed that platelets needed to be obtained from freshly donated blood.

“Platelets in blood only last 48 hours,” he explains. “At the time, blood bank protocol specified that the oldest blood on the shelf be used first. So the platelets patients were getting didn’t work — they had already expired.”

These findings inspired Freireich to help invent a machine to separate blood into three components: plasma, red blood cells and white blood cells. Separating the blood into parts let patients get only the specific part of the blood they needed to combat infections, control hemorrhaging and help manage other complications of cancer and its treatment. Later models are used around the world today.

With bleeding as a cause of death essentially eliminated, Freireich, who was assigned to the pediatric leukemia ward, turned his attention to curing children.

Another difficult-to-treat disease, tuberculosis, recently had been cured by administering three drugs simultaneously. When given separately, they didn’t work.

Freireich believed this approach might work for leukemia as well. So he began combining chemotherapy drugs instead of giving them one at a time.

First he administered two of the highly toxic drugs, then three. With each addition, children became sicker from the drugs’ side effects. Some almost died. When he upped the ante to four drugs in a 1961 trial, an outcry arose from the medical establishment. Freireich’s toxic cocktail would kill the children, they said. Instead, 90% went into remission immediately.

Once children were in remission, Freireich continued their four-drug regimen for a full year to kill any residual cancer cells. That exact strategy, called early intensification, is still used today, and the cure rate for childhood leukemia is 92%.

“The disease recurs in some patients, but not many,” Freireich says. “Most are cured for the duration of their lifetime. Their survival rates are the same as for people who hadn’t had leukemia.”

He next applied this approach to Hodgkin’s disease, also rendering it curable in many cases.

Combination chemotherapy is now a standard treatment for a wide range of cancers, including breast, bone and testicular, and has been credited with saving millions of lives worldwide.

In 1965, Freireich and his NCI friend and collaborator Tom Frei, M.D., were recruited by MD Anderson to launch a chemotherapy program. Until then, the cancer center had treated patients with surgery and radiation. The two doctors formed the Department of Developmental Therapeutics and hired brilliant young scientists who developed drug combinations that cured various cancers based on the same methods used to treat childhood leukemia. Today, nearly all successful chemotherapy regimens use this approach of administering multiple drugs simultaneously.
Targeted Therapy

John Mendelsohn, M.D., professor of Genomic Medicine and director of the Sheikh Khalifa Bin Zayed Al Nahyan Institute for Personalized Cancer Therapy

While the 1970s and ’80s continued to see progress arising from innovations in surgery, radiation and chemotherapy, as well as bone marrow transplantation, the late 1990s ushered in the era of targeted therapies — drugs and other agents like antibodies that interfere with specific molecules found inside and on the surface of cancer cells, effectively blocking the disease's growth.

Unlike chemotherapy’s random blast, which kills both healthy and cancerous cells, targeted therapies, also called precision medicine, act like a sniper shot aimed precisely at the growth signal in malignant tumors. Targeted therapies usually are not cures, but they stop tumors from growing and spreading, which is significant because it’s a tumor’s ability to reproduce and metastasize throughout the body that makes it deadly. By stopping cancer growth, targeted therapies often work in combination with other treatments, such as surgery, chemotherapy or radiation, to effectively remove, shrink or destroy tumors.

The advent of targeted therapy saw the creation of precision drugs by scientists worldwide, including rituximab (Rituxan), which targets certain forms of lymphoma and leukemia; imatinib (Gleevec), for the treatment of certain leukemias, skin cancers, and stomach and digestive system cancers; and trastuzumab (Herceptin), which targets the product of a gene in breast cancers.

One of the very first targeted drugs, cetuximab (Erbitux) was born from research conducted by John Mendelsohn, M.D., and Gordon Sato, Ph.D., while they were faculty members at the University of California, San Diego. Mendelsohn would later become president of MD Anderson, which under his leadership in the early 2000s, became the leading clinical trial site for smart drugs that target cancers at the molecular level. Today, Erbitux is used for colon, pancreatic, head and neck, and lung cancers.

Simply put, here’s how it works: Many cancer cells have receptors called epidermal growth factor receptors (EGFR) on their surfaces. A protein produced naturally in the body called epidermal growth factor (EGF) attaches to these receptors. This triggers the cancer cell to grow and divide into more cancer cells. Erbitux works by attaching itself to the EGF receptors and turning them off by preventing them from binding to EGF.

Mendelsohn likens the process to “putting chewing gum in a car’s ignition to prevent the key from turning on the engine.”

For this discovery, he and Sato are widely acknowledged as the physician-scientists who shaped the landscape for today’s research into targeted therapies.

Mendelsohn says he had the privilege of benefiting from the influence of a number of physicians and mentors early in his career, including James D. Watson, Ph.D., who won the Nobel Prize in Medicine for identifying the structure of DNA. While working toward his bachelor’s degree at Harvard College, Mendelsohn became the first undergraduate student in Watson’s lab.

“The field of molecular biology was in its infancy, ready to explode,” he recalls. “I was introduced into rigorous experimental science and new technologies in a superb scientific environment.”

The past several decades have witnessed a quantum leap in understanding the genetic and molecular causes of cancer, Mendelsohn says, and the pace of drug discoveries is increasing as more abnormal molecular signals and pathways are discovered.

“It’s an exhilarating time to be part of the growing rise of precision medicine,” he says.

Mendelsohn stepped down in 2011 after 15 years of leadership as MD Anderson’s president. He remains on faculty as a professor of Genomic Medicine and director of the Sheikh Khalifa Bin Zayed Al Nahyan Institute for Personalized Cancer Therapy. The institute focuses on targeting the abnormal genes and products of genes that cause cancer, tailoring specific treatments for individual patients.

“I remain committed to doing what I can to translate the many new scientific discoveries about cancer into better treatments that ease the burden of cancer on our patients today and in future generations.”
Immunotherapy

Jim Allison, Ph.D., chair of Immunology

For more than 100 years, scientists and physicians found tantalizing hints that our immune system is capable of detecting, destroying, remembering and permanently stifling cancer, as it does viral or bacterial infections.

In 1891, surgeon William Coley began treating patients with a mixture of bacteria and bacterial fragments called Coley’s Toxins. Coley cured a few patients, but the treatment failed for most and was completely unpredictable. By the early 1900s, it was superseded by radiation, a new therapy with more consistent results.

German scientist and 1908 Nobel Laureate Paul Ehrlich, M.D., proposed that the immune system routinely suppresses tumor formation, a hotly contested hypothesis for decades.

A trickle of immune-related cancer therapies emerged. These included the tuberculosis vaccine Bacillus Calmette-Guérin for non-invasive bladder cancer; an immune signaling molecule, interleukin-2, a harsh drug that helps a small percentage of melanoma patients; and a host of therapeutic vaccines designed to stimulate an immune attack on cancer, which largely failed.

Basic science breaks through

A combination of curiosity-driven basic science research and an intimate familiarity with the personal tragedy of cancer helped Jim Allison, Ph.D., chair of Immunology, lay the foundation for immunotherapy to emerge as the next pillar of cancer treatment.

“I’ve always wanted to know how things work,” Allison says. “I became fascinated with the immune system as an undergraduate, and eventually settled on studying T cells — these remarkable cells that travel all over our bodies detecting and destroying infections and abnormal cells, usually without harming normal cells.”

As a young scientist, he immersed himself and his lab in understanding the basic biology of T cells, first at MD Anderson’s Science Park-Research Division in Smithville, Texas, and later at the University of California, Berkeley.

Allison helped identify a brake on the immune system, an off-switch on T cells that for decades eluded investigators trying to develop immune treatments.

Treating T cells, not cancer

Allison’s key insight was to block the brake with an antibody, freeing T cells to attack cancer.

“I didn’t set out in my research to treat cancer, but it was in the back of my mind,” Allison says. “My mother died of lymphoma when I was 11, and she suffered greatly from the effects of chemotherapy and radiation. An uncle died of prostate cancer, and another of lung cancer.”

His drug treated the immune system, not the cancer, with powerful results in mice.

Given the past failures of immune-based therapies, it took Allison years to persuade a small biotech company to develop the treatment for people. Ipilimumab, a drug developed from his research, became the first ever to extend the survival of patients with late-stage melanoma.

His efforts cleared the way, both scientifically and commercially, for a new class of drugs.

Today, immune checkpoint blockade drugs are approved for late-stage lung, kidney, bladder, head and neck cancers, melanoma and Hodgkin lymphoma; with 15 to 30% of patients responding. Allison’s drug, known commercially as Yervoy, has been in the clinic the longest, and research shows that approximately 22% of late-stage patients live for 10 years or longer — previously unprecedented results.

Hundreds of clinical trials are expanding the reach of these drugs to other cancers and to earlier stages of disease. The answer to higher response rates and longer survival in more cancers, Allison says, is more science.

As executive director of the immunotherapy platform of MD Anderson’s Moon Shots Program™, Allison and colleagues seek to identify new checkpoints to block, and new immune-stimulating molecules to activate and protect. Examination of tumors before, during and after treatment has provided a scientific basis for drug combinations that might make immunotherapy work for prostate, colorectal and other common cancers.

And scientists have developed and are testing new therapies that expand a patient’s own T cells in the lab or genetically modify them to attack specific targets before infusing them back into patients.

“All cancer immunotherapy is still in its early stages, but as science progresses and clinical research grows, we’ll be able to talk about curing or greatly extending the lives of more cancer patients,” Allison says.

Over 3,500 patients have been enrolled in more than 165 immunotherapy clinical trials at MD Anderson.
At MD Anderson, everything revolves around patients, which is why it’s been ranked the nation’s top cancer hospital for nine of the past 10 years. The institution has changed the world by turning research discoveries into life-saving care. Through its Moon Shots Program®, these breakthroughs are being converted into clinical advances more quickly than ever. Here are some of the highlights of what’s been accomplished over the past 75 years.

1941
The Texas Legislature votes to establish a state cancer hospital devoted to research and treatment. It’s placed under the jurisdiction of The University of Texas and its Board of Regents.

1944
M. D. Anderson Hospital for Cancer Research is dedicated on February 17. On March 1, the hospital, with fewer than 25 full-time employees, takes in its first patient in a makeshift clinic at the Baker Estate. Admission is limited to indigent Texas residents without treatment facilities in their home communities, though staff seek to make the hospital available to all Texans as quickly as possible.

Physician R. Lee Clark, M.D., is appointed director and surgeon-in-chief. Clark immediately begins planning for permanent facilities.

1946

1949

English physicist Leonard Grimmett, M.D. (bottom row, middle) arrives to work with French-born physician Gilbert Fletcher, M.D. Within months, they design a 1,000-Curie cobalt-60 unit that will revolutionize radiation therapy.

1950
The U.S. Atomic Energy Commission approves Fletcher (second from left) and Grimmett’s original concept for the cobalt-60 unit. The machines deliver more effective, less expensive radiation therapy and will eventually be used in nearly all of the world’s hospitals.

1954
Forty-six patients from the Baker Estate are moved to the new hospital in the Texas Medical Center. The 320,000 square-foot facility has 310 beds and is hailed as the most modern hospital in the nation.
1958
Emil J Freireich, M.D., designs the continuous-flow blood cell separator, which greatly improves the process of removing white blood cells from donor blood. The technique will later be adapted for both immunotherapy and bone marrow transplantation. Soon after, Freireich, a legendary figure in oncology, joins MD Anderson.

1960
A landmark study shows the effectiveness of mammography in detecting early breast cancers, paving the way for routine use of screening mammograms for women throughout the world.

1964
Wataru Sutow, M.D., greatly improves survival rates for children with Wilms’ tumor by introducing the first successful chemotherapy to treat the inoperable kidney cancer.

1966
Microscopes such as this one were used in the study of tumor virology, a field that has led to breakthrough discoveries and a better understanding of cancer over the years. These discoveries have resulted in improved treatments and ways to prevent many forms of the disease.

1967
The effects of hyperbaric oxygen therapy are tested on mice in the Department of Experimental Radiotherapy.

1968
The National Cancer Institute (NCI) selects MD Anderson to become the headquarters for a new program designed to make sure radiation dosimetry is uniform at all institutions participating in NCI-cooperative clinical trials. The Radiological Physics Center establishes MD Anderson as a primary radiation physics resource for hospitals throughout the U.S.

1971
President Richard Nixon declares war on cancer by signing the National Cancer Act, which appropriates millions of dollars to cancer research. The majority of funds are designated for NCI-recognized “comprehensive cancer centers,” of which MD Anderson is one of the first three.
1973
Isaiah Fidler, D.V.M., Ph.D., finds that cancerous tumors are composed of many distinct cell types. Fidler proposes and confirms that metastasis is a non-random event unique to specific cell types within a tumor environment, a breakthrough that will transform the study of tumors, drug development and targeted cancer treatments. He will bring his research to MD Anderson and continue on as one of the foremost experts on cancer metastasis.

1976
MD Anderson demonstrates in clinical studies that “lumpectomy” followed by radiation therapy for breast cancer can be as effective as radical surgical mastectomy. The new procedure becomes a worldwide standard and replaces the highly invasive and widely practiced radical mastectomy.

1978
MD Anderson physicians collaborate with the IBM Corporation to develop and introduce a simplified blood-cell separator for practical use in small hospitals. The machine revolutionizes the availability and use of blood component therapy throughout the U.S.

1981
With a $2.8 million grant from the National Cancer Institute, installation of the country’s first medical cyclotron begins.

1985
Gabriel Lopez-Berestein, M.D., develops an antifungal, liposomal-encapsulated agent for the treatment of potentially life-threatening systemic fungal infections, common among patients with reduced immunity due to chemotherapy. Lopez-Berestein’s development is an incredible advancement, as regular antibiotics have proven too toxic for cancer patients to withstand.

1986
A team directed by Waun Ki Hong, M.D., proves the effectiveness of chemoprevention by showing that synthetic vitamin A can significantly reduce the incidence of second primary tumors in head and neck cancer patients.

1988
MD Anderson becomes the first hospital in the country to open an operating room that includes a linear accelerator to treat tumors with electron beam radiotherapy during surgery.

An organic vapor chromatograph such as this one was used to check the parts per million of gas in areas such as laboratories, where potentially dangerous chemicals were used.
1992
The National Institutes of Health gives MD Anderson approval to conduct gene therapy trials for patients with lung cancer. MD Anderson doctors use gene therapy for ovarian and breast cancer patients, and within six years, the techniques will be applied to multiple types of cancer.

1994
Scientists at MD Anderson invent the concept of varying the intensity of radiation beams, leading to the revolutionary development of intensity-modulated radiation therapy, in which radiation doses are tightly conformed in three dimensions to the shape of the tumor.

2005
MD Anderson pioneers the first pencil beam scanning capability in the nation’s most advanced proton therapy facility. The precise treatment builds upon proton therapy, which uses protons to deliver radiation directly to a tumor, leaving surrounding healthy tissue unharmed.

2000
The institution’s first international partnership, MD Anderson Madrid, opens, giving patients access to many MD Anderson clinical trials closer to home, and allowing specialists at each center to exchange expertise in clinical care and basic science research.

2009
An experimental drug developed at MD Anderson is able to starve human neuroblastoma cells by shutting down their energy source. The drug, 3-BrOP, is found to reduce tumor growth by more than 75% as a single agent. Pre-clinically, this drug has proven effective against other cancers, including glioblastoma, colon cancer, lymphoma and acute leukemia.

2012
Jim Allison, Ph.D., a pioneer in the innovative field of immunotherapy, joins MD Anderson to lead critical immunology research and work with the Moon Shots Program™. Allison’s groundbreaking discoveries have led the way for oncologists to unleash the immune system to attack cancer.

2013
Juan Fuego, M.D., and Candelaria Gomez-Manzano, M.D., create an experimental therapy that genetically modifies the adenovirus that causes the common cold, transforming it into a cancer-seeking missile that attacks brain tumors.
During a routine checkup, Kylie Delaney’s pediatrician noticed an unusual mass in her middle ear that turned out to be an extremely rare bone tumor called an osteoblastoma. Her parents brought the 8-year-old to MD Anderson, whose cancer experts are renown for treating rare and uncommon forms of the disease. Surgeons Paul Gidley, M.D., and Franco DeMonte, M.D., successfully removed the entire tumor. Read Kylie’s story on Page 21.

photo by Wyatt McSpadden
For 75 years, one determined patient effort to end cancer

Seventy-five years. Think about it. That’s 900 months. 27,375 days. 657,000 hours. That’s a lot of time committed to treating, researching, studying and learning about one thing: cancer.

Since 1941, MD Anderson has attracted many of the brightest minds in medicine to Houston, where they’ve changed the world and the way cancer is treated through innovation, creativity and breakthroughs. They’ve developed and put into practice leading-edge technologies. Their commitment has resulted in improved outcomes and a steady rise in survival rates for cancer patients around the world.

That tradition of discovery continues in 2017, and will carry the institution through the years to come as the advances of today lay the foundation for the cancer care of tomorrow.

And care is the operative word, because in addition to discovery and integrity, it’s one of the three keystones of what has been — and will be — built at MD Anderson.
Rosa Hwang, M.D., associate professor of Breast Surgical Oncology

photo by Wyatt McSpadden
Treatment puts the freeze on breast cancer

By Ronda Wendler

W hen Jo Ann West learned she had early-stage breast cancer, her doctor suggested an inventive new treatment that involves no major surgery, no chemotherapy and no radiation.

The simple outpatient procedure, called cryoablation, “deep-freezes” tumors, killing cancer cells on the spot. Recovery is measured in minutes instead of months.

“It sounded like science fiction to me, but I thought, ‘why not try it?’” says West, 79. “It sure beat the alternatives.”

The retired elementary school teacher said yes, and was placed in a clinical trial designed to determine cryoablation’s effectiveness.

The study took place at 19 cancer centers across the country, including MD Anderson.

“Cryoablation has been used for years to successfully treat benign breast tumors called fibroadenomas, as well as other cancers such as prostate and kidney,” says Rosa Hwang, M.D., associate professor of Breast Surgical Oncology and principal investigator of MD Anderson’s trial site. “It worked for other cancers, so we thought, ‘let’s try it on breast cancer.’”

How it works

To perform the procedure, doctors use ultrasound imaging to guide a thin, needle-like device through the skin and into the breast tumor, where it blasts liquid nitrogen to freeze and destroy the cancerous tissue.

“Everyone in the treatment room, including the patient, watches the action in real time on the ultrasound screen,” Hwang says. “An ice ball forms around the tumor and freezes it from the inside out. It’s visually impressive.”

The regimen includes a 6- to 8-minute freeze at temperatures 40 degrees below zero or colder, followed by a 10-minute thaw, then another 6- to 8-minute freeze. Doctors then remove the probe, place a Band-Aid over the tiny incision, and the patient goes home.

The entire procedure takes less than half an hour. There’s no hospitalization, no sedation, no scarring and no pain.

“I’ve prescribed pain pills but no one fills their prescriptions,” Hwang says. “They simply don’t need to.”

Recovery is instantaneous, she says. Some women have even walked out of the hospital and gone shopping or to a restaurant.

After cryoablation, patients are seen for follow-ups, including mammograms, every six months for the first five years, then annually after that. Some may be followed more frequently, depending on their individual health.

Promising results

In the multicenter trial, cryoablation was performed on women with early-stage breast cancer whose tumors were 2 centimeters or smaller.

“Before and after” MRI images were taken so doctors could examine each patient’s tumor to confirm it had been fully frozen.

Several weeks after cryoablation, the women’s now-dead tumors were surgically removed and examined so doctors could confirm that all cancer cells were killed.

The results: At all 19 cancer centers, cryoablation killed 92% of cancers — meaning no remaining cancer was found — and 100% of tumors smaller than 1 centimeter. In the MD Anderson trial, 100% of all tumors were killed.

“This is a huge advance for women,” Hwang says. “I think it could be the wave of the future.”

Boosting an immune response

Besides the advantages of no pain, no downtime and no scarring, there’s another potential perk with this technique: It appears to stimulate an anti-cancer immune response, Hwang says.

“We think that cryoablation causes tumor cells to burst and release their cancer genetic material into the body,” Hwang explains. “The patient’s immune system ramps up to attack this flood of cancer.”

Immune cells, researchers believe, will attack the primary cancer, as well as cancer cells that have spread to other areas in the body. And because the immune system “remembers” the cancer cells, it will annihilate any cancer that attempts to recur.

Researchers have confirmed this revved-up immune response in mice, and they’re preparing to test it on people.

“Only time and further research will uncover the full benefits of cryoablation for breast cancer,” Hwang says. “But right now the potential looks promising.”
Study draws attention to what could be a costly trend in treatment

By Laura Sussman

When Caroline Wetherall of Kentucky was diagnosed with early-stage breast cancer at age 43, her doctors recommended a complete mastectomy. Stunned by her diagnosis and her doctors’ aggressive recommendation, Wetherall returned to her hometown of Houston seeking a second opinion.

There, she met radiation oncologist Benjamin Smith, M.D., and was immediately relieved to learn her treatment could be limited to lumpectomy — surgery in which only the tumor and some surrounding tissue is removed — and three weeks of radiation.

“Personally, I couldn’t imagine having both of my breasts unnecessarily removed at such a young age if I didn’t have to,” Wetherall says.

Women with early-stage breast cancer have a number of treatment options, including lumpectomy plus whole breast radiation, lumpectomy plus brachytherapy, in which tiny radioactive seeds are implanted to destroy cancer cells, mastectomy alone, mastectomy plus reconstruction, and, in older women, lumpectomy alone. These therapies offer equal survival profiles, explains Smith, an associate professor of Radiation Oncology, but differ greatly in terms of what patients endure.

“We haven’t had a nuanced understanding of the pros and cons of these different treatment approaches,” says Smith. That is, until now.

In a study published in the Journal of the National Cancer Institute, Smith and colleagues found that mastectomy followed by reconstruction had the highest rate of complications and complication-related costs for women with early-stage breast cancer, regardless of their age.

“There’s been little data to understand the differences in complications, and even less data to understand the difference in cost between those options,” says Smith. “Quantifying this information is helpful both for patients making treatment decisions and for payers.”

In conducting the study, researchers analyzed data from more than 100,000 early-stage breast cancer patients who were split into two age groups — younger than 65 and 66 and older. Data was collected from Medicare and other insurance claim databases.

In both age groups, the risk of complications in patients undergoing mastectomy and reconstruction was almost twice that of patients undergoing lumpectomy and radiation. The most common problems were infections, fluid buildup, breast pain, blood clots, implant removal or graft failure.

Mastectomy and reconstruction was the most expensive therapy. The total cost within two years of diagnosis in the younger population was about $88,000, which was $22,000 more expensive than lumpectomy followed by radiation. In the older population, lumpectomy with brachytherapy was most expensive, at approximately $38,000. Mastectomy and reconstruction was around $36,000, while lumpectomy with radiation was $34,000.

Smith says he found the results shocking, especially the fact that, on average, insurance companies pay roughly $10,000 in the two years following diagnosis to deal with complications experienced by patients who chose mastectomy and reconstruction.

“For the first time, we show that while the patient is undergoing more surgery, she is also taking on a considerable amount of risk with regard to what could happen,” Smith says. “If the patient can have a lumpectomy and radiation, it may be a smoother course than going through a mastectomy, reconstruction and, potentially, other surgeries.”

He stresses decisions shouldn’t be based solely on cost, but instead on what’s personally best for each patient.

“Many women with early-stage breast cancer differ in their family histories, genetic profiles and experiences and situations,” he says.

Wetherall says she’s relieved to have been offered lumpectomy with radiation.

“The ‘less-is-more’ option was the right decision for me.”
Partnerships expand MD Anderson’s reach from coast to coast

MD Anderson’s four newest partnerships are providing adult cancer patients in California, Texas and New Jersey with access to the most advanced oncology care in the country.

In November, MD Anderson and The University of Texas Health Science Center at San Antonio announced an affiliation that will provide care for patients in 38 South Texas counties. Through this agreement, the Cancer Therapy & Research Center of the UT Health Science Center will be known as UT Health San Antonio MD Anderson Cancer Center when it opens this year. At the new center, patients will have access to MD Anderson’s treatment protocols, standards of care, extensive clinical trials and translational research.

“Beyond all these obvious advantages is that we will be able to offer our region the very best care close to home,” says UT Health Science Center President William Henrich, M.D.

**Leveraging the UT System’s strengths**

In another move toward collaboration across the UT System, MD Anderson and The University of Texas Health Science Center at Tyler announced a partnership in December that will provide care for patients in northeast Texas and the surrounding region. Through this agreement, UT Health Northeast’s Cancer Treatment and Prevention Center will be known as UT Health Northeast MD Anderson Cancer Center when it officially launches in late 2017.

The new cancer center will be fully integrated with MD Anderson in Houston, which means Tyler patients will have access to the same high level of cancer care and clinical trials as those in Houston.

UT Health Northeast MD Anderson will practice multidisciplinary care based on MD Anderson’s model, and physicians in Tyler will collaborate with MD Anderson faculty members on clinical discussions and tumor boards to make recommendations for individual patients.

“This partnership will help reduce cancer rates in our region, where citizens are among the unhealthiest in the state due to lack of access to care,” says Kirk Calhoun, M.D., president of UT Health Northeast.

The agreements between MD Anderson, UT Health San Antonio and UT Health Northeast support the vision of UT System Chancellor William McRaven to create a “quantum leap” by building collaborative teams of UT System institutions based on the respective strengths and expertise of the institutions within the UT System.

**Growing in the Garden State**

In April, MD Anderson and Summit Medical Group, the largest and oldest physician-owned multispecialty practice in New Jersey, announced they would join together to form the Summit Medical Group MD Anderson Cancer Center, bringing world-class cancer services to patients in northern New Jersey and the surrounding area. MD Anderson first brought its top-ranked cancer care to the state in 2013, when it partnered with Cooper University Health Care to create MD Anderson Cancer Center at Cooper in Camden, New Jersey. Summit Medical Group is an extension of MD Anderson at Cooper. MD Anderson’s partnership with Summit is the first time the cancer center has partnered with a physician-owned-and-governed multispecialty group.

**Better care for Southern California**

In August, MD Anderson and San Diego-based Scripps Health agreed to an affiliation that creates Scripps MD Anderson Cancer Center. The center provides care to patients in eight Southern California counties, from Santa Barbara to the U.S.-Mexico border.

“This new alliance gives Southern Californians easy access to MD Anderson’s proven, research-based approach to cancer care,” says Scripps Health President and CEO Chris Van Gorder. “Our partnership builds on Scripps’ history of providing exceptional cancer care to our region and allows us to offer the best cancer treatment available anywhere.”

Physicians and administrators from MD Anderson and Scripps together oversee patient care and research at Scripps MD Anderson, where patients have access to comprehensive cancer care, including medical, radiation and surgical oncology; pathology; laboratory and diagnostic imaging; and other clinical and support services.

These most recent partnerships make Scripps MD Anderson, UT Health San Antonio MD Anderson and UT Health Northeast MD Anderson part of MD Anderson Cancer Network, a global collaborative network of hospitals and health care systems dedicated to MD Anderson’s mission to end cancer.

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**The Cancer Network by the numbers**

**Partner Members:**
- Banner MD Anderson Cancer Center (Gilbert, Arizona)
- MD Anderson Cancer Center at Cooper (Camden, New Jersey)
- Baptist MD Anderson Cancer Center (Jacksonville, Florida)
- Summit Medical Group MD Anderson Cancer Center (Berkeley Heights, New Jersey)
- Scripps MD Anderson Cancer Center (San Diego)

**On the way:** Announced partnerships UT Health San Antonio MD Anderson Cancer Center and UT Health Northeast MD Anderson Cancer Center take effect later in 2017.

**Certified Members:** 15

**15 health systems and hospitals in 12 states**

**Associate Members:**
- Hospital Israelita Albert Einstein (São Paulo)
- MD Anderson Cancer Center Madrid
- Vehbi Koc Foundation American Hospital (Istanbul)

**Affiliates:** 2

- MD Anderson Radiation Treatment Center at American Hospital (Istanbul)
- Presbyterian MD Anderson Radiation Treatment Center (Albuquerque, New Mexico)
Tonya Edwards helps patients deal with pain caused by their disease and treatment.

photo by Wyatt McSpadden
One nurse’s prescription for curbing pain pill addiction

Ask Tonya Edwards how frequently she encounters cancer patients addicted to prescription painkillers, and she offers a weary reply.

“Every day,” she sighs.

Edwards is a nurse in MD Anderson's Supportive Care Center, where health care providers help patients deal with pain caused not only by their disease, but also their treatment.

“Not everyone with cancer will have pain, but more than half will,” Edwards says. “Our mission is to lessen their suffering.”

Prescription opioids, with brand names such as Vicodin, Oxycontin, Percocet and Fentanyl, have long proven superior to other drugs for easing cancer-related discomfort.

“These drugs interact with receptors in the brain to produce a powerful, pain-numbing effect,” says Eduardo Bruera, M.D., chair of Palliative Care and Rehabilitation Medicine. “They also make some patients feel happy, relaxed, even euphoric.”

Such soothing and pleasurable effects can lead to addiction. Most people won’t run into trouble when taking opioids prescribed for pain, but some will.

“One in five people have a larger than average number of opioid receptors in the brain,” Bruera explains. “These are the individuals who are predisposed to getting hooked.”

Opioid epidemic

The lure of addiction is the driving force behind an opioid epidemic that began slowly in the late 1990s and today has burgeoned into a public health crisis. Overdoses of prescription painkillers and the illegal opioid heroin are killing more than 27,000 people a year.

“No one is immune,” Bruera says. “Emergency rooms across the country are treating young and old, professional and blue-collar, urban and rural, all races and backgrounds. The problem is seen everywhere, Bruera says, including MD Anderson.

“Opioids are essential to controlling cancer pain,” he says, “but those who fail to take the drugs strictly as prescribed may find themselves dealing with cancer and addiction.”

First responder

As a nurse, Edwards is on the front lines of the addiction crisis. She’s first to see patients who show up unannounced, demanding, cajoling or asking politely for more medication.

Some claim their pills have been lost or stolen, while others say they’ve run out of pills early, with no explanation. Then there are the “doctor shoppers” who seek opioids from multiple MD Anderson doctors in the hospital’s various departments. A few go so far as to visit emergency rooms at other hospitals.

“They use excuses — whiplash, back pain, toothache — anything they can think of, to get the drugs,” Edwards says.

A quick check of MD Anderson’s computerized patient records and Texas’ statewide drug dispensing registry reveals who’s been making the rounds in search of prescriptions.

Over time, Edwards has learned to sense when she’s being “gamed,” but she doesn’t judge. Her first concern always is for each patient’s safety.

“This is a chronic disease that patients didn’t choose,” she says. “No one wakes up one morning and says, ‘I want to get addicted to my opioid pills because it’ll be fun.’ This could happen to me, and it could happen to you.”

Extra attention

Realizing the magnitude of the problem, Edwards devised a plan to help patients at risk, with assistance from Bruera and Supportive Care Center colleagues.

Put simply, it works like this:

Every patient who’s newly admitted to the Palliative Care Center completes two written tests that reveal whether they’re susceptible to addiction and how much supervision they may need.

Those whose test scores raise a red flag for potential abuse are closely monitored by clinic staff. If their behavior suggests they’re already abusing drugs — for example, they ask for new prescriptions, claim their pills were lost, or request stronger opioids — they undergo a urine drug screen.

When drug misuse is detected, MD Anderson's Opioid Safety Initiative squad pays the patient a visit. Team members include Edwards, as well as a doctor, patient advocate, pharmacist and psychologist. Only a handful of hospitals across the country have such a resource.

Compassionate care

“This isn’t about playing detective, spying on patients, or reprimanding them,” says Suresh Reddy, M.D., professor of Palliative Care and Rehabilitation Medicine. “The team’s sole purpose is to provide compassionate care to those who need our help and to see them safely through their cancer journey.”

Together, patients, their families and team members agree upon a plan of action that includes rules, boundaries and interventions.

Almost always, the plan calls for more frequent clinic visits — perhaps twice a week instead of twice a month — to ensure opioids are being taken as prescribed. Patients meet regularly with an addiction counselor. Those on stronger pain pills are transitioned to weaker ones and offered other forms of pain management. Claims of lost or stolen medication must be backed up by a police report before a new prescription can be written.

And to prepare for a “worst-case” scenario, patients’ family members are provided with Narcan, a prescription nasal spray that blocks the effects of opioids and reverses an overdose.

All these measures can help, Edwards says, but patient cooperation is key.

“Our message to patients is, ‘We’ll control your pain. It’s up to you to control your behavior.’”

The program launched a year ago and is working, says Edwards, who for her efforts won this year’s Brown Foundation Award for Excellence in Oncology Nursing. The award is MD Anderson’s highest nursing honor.

“Most patients do much better when they understand that certain behaviors are required,” she says. “A little extra attention makes a big difference.”
Leukemia was no match for her donor sister and a ‘reduced-intensity’ stem cell transplant

Matthews’ sister Debbie was found to be a perfect match, and she happily donated stem cells to help her sibling battle cancer.

The transplant kept Matthews in remission for 18 months, but her cancer came back. Her sister donated a second time in 2006, and Matthews’ remission has lasted ever since.

“After each transplant, I was hospitalized for four weeks, then I had home care,” she says. “Since my second transplant, I see my doctor monthly and after each visit I receive five booster shots of azacitidine, an anticancer chemotherapy drug. It’s obviously been and will continue to be a long process, but the entire treatment has not been painful and I continue to live my life fully.”

After her second transplant, Matthews decided to join the ranks of the volunteers who spent time with her during treatment. “I enjoyed visiting with the volunteers and appreciated their work during both of my long-term stays,” she says. “I’m so grateful for my treatment at MD Anderson and wanted to give to others something of what had been given to me.”

As a volunteer, Matthews is especially touched by young mothers and fathers who undergo treatment and have to leave young children at home, often far away.

“One of the things that I learned from this experience is that many things happen in life beyond our control, and that caring people can make all the difference. My disease as well as the treatment process has caused me to appreciate my many blessings. It’s deepened and strengthened my faith and my relationships.”

When Cinda Matthews began working as a speech therapist in the 1960s at the Houston Speech and Hearing Center on the campus of the Texas Medical Center, there were more trees than buildings.

Little did Matthews know that years later, her life would depend on MD Anderson Cancer Center, only blocks from where she worked. That life-altering revelation came in 2003, when Matthews was diagnosed with chronic myelomonocytic leukemia (CMML), a blood cancer that at the time had an average survival rate of two to five years.

“I was totally surprised and upset with the initial diagnosis,” Matthews says. “I’d always been healthy. I was told that chemotherapy might put my disease in remission, but it wouldn’t last. My only hope for long-term remission was a stem cell transplant.”

Although Matthews wasn’t considered young enough for a full stem cell transplant, a less rigorous method of infusing stem cells from a matching donor had recently been introduced. Known as a “reduced-intensity” transplant, the procedure uses lower levels of chemotherapy and radiation to wipe out most, but not all, of the cancer cells in the patient’s own bone marrow before replacing them with a donor’s healthy cells.

“The advantage was that the reduced-intensity transplant was much less risky,” says Matthews, “but my doctor also told me that only 1 in 3 patients who undergo the procedure experience long-term remission.”

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As a volunteer, Matthews is especially touched by young mothers and fathers who undergo treatment and have to leave young children at home, often far away.

“Some tell me they just want to survive to see their children grow up,” she says. “Seeing my grandchildren develop and grow was very important to me, so I can only imagine what a parent must feel.”

Today, Matthews, 74, enjoys time with her six grandchildren, husband, three daughters and friends.

“I learned from this experience that many things happen in life beyond our control,” she says, “and that caring, smart doctors and nurses, as well as loving family and friends, can make all the difference. The disease as well as the treatment process has caused me to appreciate my many blessings. It’s deepened and strengthened my faith and my relationships.”
Routine pediatric exam uncovers extremely rare tumor

By India Ogazi

Like many parents, San Antonio residents Richard and Heather Delaney almost skipped their daughter Kylie’s annual checkup. The 8-year-old seemed healthy and wasn’t due for immunizations. But Heather decided to keep the appointment anyway.

“Looking back, I’m so glad I did,” she says.

During Kylie’s checkup, the pediatrician noticed an unusual mass in the girl’s middle ear and referred her to a nearby hospital for further testing.

The result? Kylie was diagnosed with a rare, noncancerous bone tumor called an osteoblastoma. These tumors usually develop in the bones of the spine, legs, hands and feet. But Kylie’s tumor was located in her temporal bone, which encloses the ear.

“Only 35 cases of this tumor type have ever been documented, and Kylie is one of the youngest patients ever,” says Paul Gidley, M.D., a neurotologist and skull base tumor surgeon at MD Anderson.

The Delaneys, doctors themselves, selected Gidley to perform their daughter’s surgery.

“After speaking with the skull base tumor experts at MD Anderson, we knew this was the place for Kylie,” Heather says. “And, when we came to stay in the MD Anderson Rotary House Hotel, everyone was so nice — it just felt right.”

“Plus, it was so close to San Antonio, which made it very convenient for us,” adds Richard.

Before surgery, the couple met with Gidley and neurosurgeon Franco DeMonte, M.D., co-director of the Skull Base Tumor Program. The doctors would work together to remove the portion of the tumor near Kylie’s brain.

“They were thorough, knowledgeable and answered all of our questions,” Richard says. “As a physician, I really appreciated that.”

Before surgery, Heather shaved Kylie’s favorite stuffed animal — a kitten — to match Kylie’s pre-surgical haircut. Gidley and DeMonte successfully removed Kylie’s entire tumor, and the only remnant of her disease is mild hearing loss.

“I’m so grateful we took Kylie for her checkup,” says her mom. “If we had waited one more year, the tumor could have grown into her brain.”

Gidley also points to the important role Kylie’s annual exam played in the discovery of her tumor.

“The fact that her pediatrician completed a thorough checkup and recognized the abnormality makes her the hero in this story,” Gidley says.
Cancer Prevention: How a division came together

By Clayton Boldt, Ph.D.

The commitment to ending cancer through prevention isn’t new for MD Anderson, but it has evolved over time.

The institution’s Division of Cancer Prevention and Population Sciences began as a fledgling program with just 35 faculty and staff members in 1979. Today it’s one of the largest and most respected prevention programs in the nation.

Over the past four decades, the division’s success and growth required strong institutional dedication and just the right catalyst to get things started.

That initial push came from Charles LeMaistre, M.D., the second president of MD Anderson.

“Dr. LeMaistre possessed a longtime interest in cancer prevention,” says Bernard Levin, M.D., the first vice president and head of the division. “He really believed this was an important new direction for the institution. It would never have happened without him.”

LeMaistre bolstered the existing cancer prevention program by raising it to new prominence and formally creating the Division of Cancer Prevention. He envisioned recruiting a multidisciplinary group with an initial focus on tobacco, says Levin.

However, LeMaistre’s efforts were not met without controversy. Levin, who’s now retired and living in New York, recalls opposition from senior scientists and clinicians who either did not understand the vision or thought resources were better used elsewhere.

Nevertheless, with LeMaistre’s support, Levin was able to turn the dream into reality. He recruited leading faculty in the field of prevention, which helped MD Anderson build a strong reputation in the cancer prevention community.

“These were really first-rate people,” Levin says. “The prominence of these individuals at a national level helped establish this as an effort of high quality. It was pulling its own weight in every sense.”

For 13 years, Levin oversaw expansion of research and clinical services, new departments and even a new division name. When he retired, he transferred the reigns to current vice president and division head, Ernest Hawk, M.D., who he describes as “the clear choice.”

Hawk focused first on clarifying the division’s four mission-oriented domains — research; clinical care; education, training and mentoring; and cancer control — all with a focus on translating research into services that benefit individuals, future generations, and the community at large. This required better communication across departments and establishing a clear vision for progress in each of these domains, he says.

“The vision was much aligned with the institution’s vision to be a change agent in cancer prevention,” says Hawk. “It was all about making science relevant to the clinic and the patients we serve as well as to the broader public.”

Hawk’s vision was aided by “transformative” philanthropic gifts, which established the Duncan Family Institute for Cancer Prevention and Risk Assessment and the Lyda Hill Cancer Prevention Clinic.

Now with more than 500 faculty and staff, the division continues to provide high-quality care to patients and to help implement and disseminate evidence-based actions in public policy, public and professional education, and community-based services.

When it was created in 1979, the Division of Cancer Prevention, which is now known as the Division of Cancer Prevention and Population Sciences, was focused on three main areas: Preventive Epidemiology, to identify markers of risk; Health Maintenance, to detect and remove cancers early; and Health Education, to disseminate information on the causes of cancer and community-based services.

In 1979, Charles LeMaistre, M.D., then president of MD Anderson, created the Division of Cancer Prevention. He envisioned recruiting a multidisciplinary group of doctors and scientists, with an initial focus on tobacco.

The Department of Cancer Prevention and Control — the division’s only department — oversees four main programs: Clinical Epidemiology, Nutrition, Community Oncology and Behavioral Research.

All prevention activities are placed under the direction of the VP for Academic Affairs.

The division expands to two departments, Cancer Prevention and Control and Patient Studies. Its programs include Clinical Epidemiology, Nutrition Research and Application, Behavioral Research, Prevention Clinic, Professional Education, Outreach Activities and the Cancer Prevention and Detection Program.

In 1991, Bernard Levin, M.D., is named ad interim vice president of Cancer Prevention.

The Department of Behavioral Science is created.

In 1992, the division raises its profile in public policy, public and professional education, and community-based services.
The Division of Cancer Prevention is formed on Aug. 1, 1994, and Levin is named vice president and division head. In December 1994, the division expands to three departments: Behavioral Science, Epidemiology, Clinical Cancer Prevention and one core, the Basic Science Laboratory.

To better reflect its expanded scope, the division is renamed the Division of Cancer Prevention and Population Sciences.

Levin retires as vice president and division head in August. In November, Ernest Hawk is named vice president and division head.

The Duncan Family Institute for Cancer Prevention and Risk Assessment is created.

The Department of Health Services Research is created.

The Moon Shots Program and the Cancer Prevention and Control Platform are created.

The Lyda Hill Cancer Prevention Center is established.

Responding to a growing need to better understand and demonstrate the value of all aspects of cancer care, Hawk led the creation of the Department of Health Services Research. The department’s goal is to study health care delivery and its outcomes, so that safety, timeliness, effectiveness, efficiency and equity of care will be better measured and promoted. Researchers use a patient-centered approach that addresses each person’s cultural, socioeconomic and medical needs. Research focuses on healthy individuals, those currently battling cancer, and those who have completed cancer treatment.

The cancer prevention and control platform, part of MD Anderson’s Moon Shots Program™, is committed to extending prevention efforts beyond MD Anderson’s walls, particularly for the uninsured and underserved.

“Serving those in greatest need is something I think everyone in our division is very passionate about, but it’s hard to reach all the places where it’s needed,” says Hawk. “So I think we’ve been creative in trying to study and serve those communities in a variety of ways.”

With a foundation in stellar research, Hawk looks forward to continued success for the division. As new discoveries clarify the connections between lifestyle factors and cancer risk, MD Anderson will continue to translate those discoveries into actionable interventions.

“It’s the greatest place in the world for these types of initiatives,” Hawk says.
Since day one, MD Anderson researchers have worked tirelessly to find an answer to cancer. In that time, they’ve made great progress in understanding the disease — how it adapts, survives and spreads. Three-quarters of a century later, the institution’s labs and research institutes continue to turn out discoveries and breakthroughs that lead to better and more effective treatments for cancer patients.

In many of today’s labs, experts from different fields who have a shared research vision are brought together in the same space to encourage collaboration, communication and creativity, which are vital to the rapid and dramatic reductions in death and suffering that are at the heart of the Moon Shots Program™.

MD Anderson doctors and researchers are building on the success of immune checkpoint blockade drugs, which are now approved for many late-stage cancers. They also are learning why these drugs don’t work for all patients. And through the Moon Shots™ platforms, new and innovative drugs and therapies are being developed to fight the disease.

And the research continues to pay off. Just as the amount of money invested in cancer research at MD Anderson has grown each year — from just over $15,000 in 1944, to more than $787.3 million in 2016 — the five-year survival rates for cancer patients have continued to rise.
Impressive results against BRCA-positive breast cancer show drug’s game-changing potential

By Scott Merville

After every breast cancer patient responded positively to a new targeted therapy in a first-of-its-kind clinical trial, MD Anderson researchers have quickly taken the next step toward potentially establishing a new standard of care.

“After we saw the extensive clinical response, confirmed by ultrasound, and with a favorable toxicity profile, we really wanted to move forward into an extension to evaluate this drug as a single treatment,” Litton says. “If the extension study produces similarly strong results, the next step would be to directly compare talazoparib to chemotherapy in the presurgical, curative setting.”

Chemotherapy may even be delayed or replaced if the extension trial is similarly effective and shows less toxicity than the initial trial, she adds.

PARP inhibitors are approved by the Food and Drug Administration for advanced ovarian cancer, but are not yet approved for breast cancer.

The Moon Shots Program is paving the way to faster results

In addition to the trials above, Litton is principal investigator of an international clinical trial of talazoparib for patients with advanced or metastatic breast cancer who have been previously treated.

To more quickly offer talazoparib to newly diagnosed patients who have not undergone surgery, Litton proposed an investigator-initiated pilot study backed by MD Anderson’s Moon Shots Program™. The pharmaceutical company that owns the drug agreed to the study.

Litton noted that institutional support through the Moon Shots Program helped convince the company to provide the drug for her trials. Moon Shot™ backing decreased the time needed to launch the first trial by about two years, she estimates.

Extensive, unique biomarker research

The pilot and extension studies also tap Moon Shots Program resources for extensive biomarker evaluation, providing a unique opportunity for researchers and the drug company to better understand how the drug works and identify patients who will respond in advance.

Biopsies taken before and after PARP inhibition are evaluated for DNA and RNA changes, and proteomics (proteins) by Gordon Mills, M.D., Ph.D., chair and professor of Systems Biology.

Helen Piwnica-Worms, Ph.D., vice provost for science and professor of Experimental Radiation Oncology, and colleagues harvest tissue samples from patients’ tumors that can be transplanted into mice to further study how tumors respond to treatment.

“We will be able to learn a great deal,” Litton says. “These models that are being built will be available for multiple investigators in the future to study and test other drugs and drug combinations.”
BRCA1 and BRCA2 are tumor-suppressing genes and are found to have mutations in 5 to 10% of all breast cancer patients. BRCA-related cancers, including ovarian cancer, are thought to be vulnerable to PARP inhibitors.
For decades, combination chemotherapy has been the main treatment for patients with acute myeloid leukemia (AML) – an aggressive cancer of the blood and bone marrow.

“About 40 percent of younger patients survive long term, and for those over 65, survival drops to 10 percent,” says Marina Konopleva, M.D., Ph.D., professor of Leukemia. “There’s been no drug approved for the last 40 years for AML, and outcomes haven’t significantly improved with targeted therapies.”

Researchers at MD Anderson’s Institute for Applied Cancer Science (IACS) are hoping to put an end to that drought with a drug they developed to starve these malignant blood cells to death.

The initial Phase I clinical trial of the drug known as IACS-10759 opened for patients in October, a milestone for IACS, which acts as a biotech company embedded in a cancer center. The institute connects MD Anderson faculty with drug discovery and development expertise.

“We’re hopeful we’ll soon see in patients the promising response to IACS-10759 that we observed in preclinical models,” says Giulio Draetta, M.D., Ph.D., head of Therapeutics Development and director of IACS.

While researchers have found AML to be vulnerable, they’ve also discovered that subgroups of tumors in lymphoma, glioblastoma, melanoma, colorectal and pancreatic cancers harbor this weakness.

Leukemia and Lymphoma Society funds innovative trial

Konopleva and Naval Daver, M.D., assistant professor of Leukemia, lead the AML trial, which is funded by a $3.5 million investment from the Leukemia and Lymphoma Society under its Therapy Acceleration Program, part of an intensive campaign the society launched against AML in late 2016.

IACS aims to provide MD Anderson physicians and patients access to novel drugs tailored specifically to vulnerabilities found in tumors of unique groups of patients. These projects are based on findings coming from basic scientists at MD Anderson.

“The IACS model emphasizes the need for us to deeply understand the biological effects of drugs,” Draetta says. “We want to increase the precision with which we identify and develop new molecules, and to ask critical questions about the effects of any new drug within the most relevant contexts.”

Putting cancer on a lethal diet

Based on an approach discovered by the institute, IACS-10759 is designed to target a metabolic vulnerability of AML cells.

Most cells rely on two metabolic processes to survive. Cellular organelles called mitochondria use oxygen to convert energy stored in sugars, fatty acids and proteins into energy through a process called oxidative phosphorylation (OXPHOS). Cells also convert glucose to energy in the absence of oxygen through a less efficient process called glycolysis. IACS-10759 inhibits OXPHOS, thus one of two arms of metabolism that provide energy and building blocks to cancer cells.
Konopleva says her team’s research has shown that AML cells are highly dependent on these mitochondria-driven processes. “OXPHOS is how they survive, but no one has had a clinically viable inhibitor,” she says.

Enter IACS, where scientists, applying their drug development expertise and capacity for rapidly testing and understanding the mechanism of possible drugs in preclinical models, developed IACS-10759.

“Normal cells can get around OXPHOS inhibition by turning up glycolysis, but we’ve identified some cancers like AML that can’t do that enough to survive,” says Joseph Marszalek, Ph.D., head of Translational Biology for the Center for Co-Clinical Trials.

“We’re already working closely with several MD Anderson Cancer Moon Shots Program™ teams to develop IACS-10759 treatment for patients whose tumors rely on oxidative phosphorylation,” says IACS Executive Director Philip Jones, Ph.D.

**Create, test, refine, test again**

It’s taken a team of more than 25 people to successfully bring IACS-10759 into clinical trials. Emilia Di Francesco, Ph.D., associate director of Medicinal Chemistry at IACS, leads a group that crafts small-molecule drugs to efficiently hit targets in cancer cells while avoiding off-target effects.

Marszalek’s group puts those drugs to the test in cell lines and mouse models. What they discover about the drug’s efficacy and side effects is fed back to Di Francesco’s group, which fine-tunes the drug.

This intensive, reiterative process allowed them to analyze a series of molecules over 18 months before zeroing in on IACS-10759 for development.

“We needed to refine the drug for the clinic and build in all the properties to make it more effective in patients,” Di Francesco says.

Marszalek and Di Francesco say the collaborative nature of MD Anderson clinicians is invaluable. They connected with Konopleva, whose knowledge of AML and preclinical models was vital to developing IACS-10759 and has enabled the development of clinical assays to study the biology of OXPHOS inhibition in the ongoing clinical trial. Additionally, the institute has a pipeline of other experimental drugs working their way toward first-in-human use, with others expected to enter clinical trials in the next year.

“There’s no shortage of good ideas at a place like MD Anderson,” Jones says. “Identifying therapies that will be impactful for specific patient populations and moving those medicines into clinical trials at MD Anderson is our mission.”

**AML FACTS**

Acute myeloid leukemia occurs when the myeloid stem cells that usually become healthy versions of some types of white blood cells, platelets or red blood cells instead become immature versions of those cells.

The Leukemia and Lymphoma Society estimates there were 19,960 new cases of AML diagnosed in 2016, mostly in adults, and the disease caused some 10,430 deaths.

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Conoleva says her team’s research has shown that AML cells are highly dependent on these mitochondria-driven processes. “OXPHOS is how they survive, but no one has had a clinically viable inhibitor,” she says.

Enter IACS, where scientists, applying their drug development expertise and capacity for rapidly testing and understanding the mechanism of possible drugs in preclinical models, developed IACS-10759.

“Normal cells can get around OXPHOS inhibition by turning up glycolysis, but we’ve identified some cancers like AML that can’t do that enough to survive,” says Joseph Marszalek, Ph.D., head of Translational Biology for the Center for Co-Clinical Trials.

“We’re already working closely with several MD Anderson Cancer Moon Shots Program™ teams to develop IACS-10759 treatment for patients whose tumors rely on oxidative phosphorylation,” says IACS Executive Director Philip Jones, Ph.D.

**Create, test, refine, test again**

It’s taken a team of more than 25 people to successfully bring IACS-10759 into clinical trials. Emilia Di Francesco, Ph.D., associate director of Medicinal Chemistry at IACS, leads a group that crafts small-molecule drugs to efficiently hit targets in cancer cells while avoiding off-target effects.

Marszalek’s group puts those drugs to the test in cell lines and mouse models. What they discover about the drug’s efficacy and side effects is fed back to Di Francesco’s group, which fine-tunes the drug.

This intensive, reiterative process allowed them to analyze a series of molecules over 18 months before zeroing in on IACS-10759 for development.

“We needed to refine the drug for the clinic and build in all the properties to make it more effective in patients,” Di Francesco says.

Marszalek and Di Francesco say the collaborative nature of MD Anderson clinicians is invaluable. They connected with Konopleva, whose knowledge of AML and preclinical models was vital to developing IACS-10759 and has enabled the development of clinical assays to study the biology of OXPHOS inhibition in the ongoing clinical trial. Additionally, the institute has a pipeline of other experimental drugs working their way toward first-in-human use, with others expected to enter clinical trials in the next year.

“There’s no shortage of good ideas at a place like MD Anderson,” Jones says. “Identifying therapies that will be impactful for specific patient populations and moving those medicines into clinical trials at MD Anderson is our mission.”

**A clinical trial takes on a deadly blood cancer with an experimental drug**

IACS-10759 was developed by the Institute for Applied Cancer Science, which was established in 2011 to develop new treatment options for cancer patients. IACS is a platform of the Moon Shots Program™ — the ambitious effort launched in 2012 to reduce cancer deaths by more rapidly developing and implementing advances in prevention, early detection and treatment based on scientific discoveries.

**The trial will enroll up to 48 patients** with relapsed or resistant AML.

**Primary goals:** Determine the safety and tolerability of the drug, establish a maximum tolerated dose and a recommended dose for a Phase II trial.

**Secondary goals:** Learn more about the drug’s pharmacokinetics and early indications of clinical impact, including overall response rates, duration of response, progression-free survival and overall survival.

**The expansion phase allows for enrollment of 12 patients** to receive the recommended Phase II dose.

Leukemia and Lymphoma Society funding also provides for analysis and development of biomarkers for the drug.
Breakthrough research leads to new hope for patients resistant to immunotherapy

By Leslie Loddeke

Stories of immunotherapy’s success against metastatic melanoma in patients such as former President Jimmy Carter are well publicized, but the treatment doesn’t work for everyone.

In fact, checkpoint blockade drugs such as pembrolizumab and nivolumab, which inhibit protein molecules on T cells that keep the immune system from attacking tumors, only work for about one-third of patients.

Why do some tumors respond to immunotherapy and others don’t? That’s a question MD Anderson’s Weiyi Peng, M.D., Ph.D., and her team of investigators are getting closer to answering.

Peng, an assistant professor of Melanoma Medical Oncology, led a study that showed a link between the loss of a tumor-suppressor gene called PTEN and resistance to checkpoint inhibitor immunotherapy.

Patients with inactive PTEN had fewer T cells in their tumors, indicating that a lack of PTEN suppresses the immune response against melanoma. Patients with inactive PTEN also had worse outcomes when treated with checkpoint inhibitors compared to melanoma patients with intact PTEN.

These findings indicate PTEN loss may be an important biomarker to predict melanoma patients’ resistance to immunotherapy. The study also showed that treatment with an experimental drug that blocks a molecular pathway called PI3K improved the effectiveness of anti-PD-1 treatment in laboratory models of melanomas with loss of the PTEN gene.

“These results allowed us to devise a means of combating resistance to immunotherapy due to PTEN loss in melanoma patients,” Peng says.

Findings of the study, which was Cancer Discovery’s February 2016 cover story, have led to a Phase I and II clinical trial that will test a combination of immunotherapy and targeted therapy in patients with metastatic melanoma who lack the PTEN gene.

Hussein Tawbi, M.D., Ph.D., associate professor of Melanoma Medical Oncology, is leading the Phase I and II clinical trial of pembrolizumab, an FDA-approved anti-PD-1 antibody, and GSK2636771, a PI3K-beta inhibitor, in patients with metastatic melanoma who lack the PTEN gene.

The study represents the first clinical trial to test the effects of the PI3K-beta inhibitor in melanoma patients — and the first to test its effects in combination with immunotherapy in any cancer type.

“About one-third of melanoma patients respond to pembrolizumab, which means there are two-thirds of patients in whom we need to do better,” Tawbi says. “This trial is a very significant step in that direction.”

This research and trial capitalize on the skills of targeted therapy experts such as Michael Davies, M.D., Ph.D., deputy chair of Melanoma Medical Oncology and co-leader of the Melanoma Moon Shot, and immune therapy experts like Peng and Patrick Hwu, M.D., chair of Melanoma Medical Oncology and head of Cancer Medicine. Davies and Hwu were co-senior authors on the article.

“This exciting clinical trial builds upon the collaborative research we have undertaken at MD Anderson to understand the interactions between oncogenic signaling pathways in cancer cells and the regulation of the anti-tumor immune response, based on our extensive expertise and resources in these two areas,” Davies says. “In addition to representing an important new clinical trial for patients with advanced melanoma, the results and translational research from this trial may have impact for the many other cancer types in which loss of PTEN occurs.”

How checkpoint blockade drugs work

PD-1 is a checkpoint protein on T cells — white blood cells that find and kill invaders — that acts as an “off switch” when it binds with the protein PD-L1 on healthy cells, protecting them from attack. However, PD-L1 can also be found on cancer cells, allowing them to prevent an immune response by joining with a T cell’s PD-1.

Anti-PD-1 immunotherapies target the checkpoint and prevent it from binding with PD-L1 on a cancer cell, effectively turning “on” an immune attack against cancer.
Weiyi Peng, M.D., Ph.D., assistant professor of Melanoma Medical Oncology

photo by Wyatt McSpadden
Meet the visionary leader of Pediatrics who’s on a ‘research and destroy’ mission

By Katrina Burton

After his own diagnosis at age 13, Richard Gorlick, M.D., set out on a lifelong journey to end cancer in children.

Along the way, he has focused his clinical and research studies on sarcomas — tumors that grow in connective tissues including the bones, muscles, tendons and cartilage. These are the same tumors that interrupted his teenage years.

Now, the physician-scientist’s journey has brought him to MD Anderson Cancer Center, where, as division head and chair of Pediatrics, he’ll use his pediatric oncology expertise and experience as an educator, clinician, scientist and cancer survivor to help children, adolescents and young adults treated at MD Anderson Children's Cancer Hospital.

"Research, clinical care and education are all important priorities," says Gorlick. "Providing multi-disciplinary care, minimizing the burden to patients and families, and developing a global model for treating young cancer patients are all important to me."

Gorlick’s MD Anderson laboratory focuses on targeted therapies, new drugs for childhood cancers, and understanding the mechanisms behind the development and progression of osteosarcoma, the most common form of childhood bone cancer.

Gorlick, whose research resulted in the establishment of the world’s largest osteosarcoma tissue bank, leads the Bone Tumor Disease Committee for the Children’s Oncology Group, a collaborative clinical trials system and the largest organization focused exclusively on pediatric cancer research.

He is drawing on that spirit of teamwork to forge collaborations with MD Anderson colleagues who’ve seen success using adult therapies such as immunotherapy and genetic profiling, which can ensure the right drugs get to the right patients.

"Therapies developed for adults don’t become effective therapies for children as quickly as they should," says Gorlick. "Children aren’t simply small adults, they are unique, and we must acknowledge and study their uniqueness. That includes pursuing funding to support childhood cancer research, which is often lacking."
“Cancers are exceptionally adaptive in the face of treatment pressure,” says Andrew Futreal, Ph.D., chair of Genomic Medicine and co-leader of MD Anderson’s Moon Shots Program™.

“We know a tumor after therapy is likely to be different than before, but we haven’t done a good job of tackling this from a research perspective until now.”

To understand how tumors evolve and resist treatment, Futreal is helping lead APOLLO, which stands for Adaptive Patient-Oriented Longitudinal Learning and Optimization. It’s a systematic approach that relies on taking blood samples and biopsies before, during and after treatment, and conducting deep molecular and immune analysis of those tumor samples to understand what causes them to respond to or resist a given treatment.

In the next two years, APOLLO is scheduled to conduct such analyses in 2,100 patients enrolled in 28 high-priority clinical trials for melanoma, multiple myeloma, glioblastoma, lymphoma, sarcoma, lung, breast, colorectal, pancreas and ovarian cancers, and cancers caused by the human papillomavirus.

Results of these analyses, plus clinical information, will be added to the Translational Research Accelerator (TRA), which is a big data platform that integrates longitudinal clinical and research data — the same sample tracked at different points in time — to support translational research throughout the institution. These enormous amounts of data are housed in data centers like the one pictured here.

Information from approximately 250,000 patients treated at MD Anderson since 2012, along with research data from Moon Shots” platforms, has been loaded into the secure database. The TRA will provide researchers with an unprecedented capacity to more quickly and efficiently generate science-based inquiries in the pursuit of better cancer treatment.

“APOLLO, with its pipeline of comprehensive data feeding the Translational Research Accelerator, drives our vision of every patient contributing to, and potentially benefiting from, research,” says Futreal.

— Scott Merville
ORBIT revolves around collaborative partnerships

by Ron Gilmore

MD Anderson's ORBIT program may have an otherworldly name, but the Oncology Research for Biologics and Immunotherapy Translation unit was established and continues to thrive through purely Earth-bound partnerships that pair novel therapeutic targets discovered at MD Anderson with state-of-the-art pharmaceutical technologies for biologic drug development.

Since its inception in 2014, ORBIT's primary mission has been to develop innovative monoclonal antibodies — "magic bullets" that first recognize specific target molecules on the surface of cancer cells, then zero in to kill the cells.

ORBIT is one of the three drug development platforms that support MD Anderson's Moon Shots Program™ and grew out of a $330 million alliance with GlaxoSmithKline to develop in the clinic an OX40 agonist antibody generated at MD Anderson. The OX40 mAb, now named GSK3174998, entered the clinic in late 2015 and is now in the advanced stage of a Phase I trial. ORBIT works closely with MD Anderson's Strategic Industry Ventures (SIV) office to develop partnerships — primarily with biotech and pharmaceutical companies — in an effort to quickly develop new antibody-based cancer therapies that can be brought to clinical trials at an accelerated pace.

Today, ORBIT is comprised of a core group of 16 people led by Executive Director Carlo Toniatti, M.D., Ph.D., and Scientific Directors Jeffrey Molldrem, M.D., professor of Stem Cell Transplantation and Cellular Therapy, and Michael Curran, Ph.D., assistant professor of Immunology. The team works closely with colleagues in a number of MD Anderson's clinical departments to fight melanoma, prostate, ovarian and hematologic cancers, among others.

Although ORBIT is focused on advancing novel therapeutics for several forms of cancer, the development of a novel antibody-based therapy for hematologic cancers has shown great promise and will enter Phase I trials early this year.

"Hematologic cancer is certainly a current area of interest for ORBIT in terms of novel mAb discovery," says Toniatti. "However, we are agnostic about tumor type as far as we have good targets. The reason why we can be agnostic is that MD Anderson has experts in almost every type of cancer."

One potential new therapy for leukemia is h8F4, a mAbs invented by Molldrem, which targets a specific peptide expressed on the surface of acute lymphoblastic leukemia. ORBIT accelerated its development by funding the start of the manufacturing process for the antibody, creating a detailed, three-year plan to bring the drug to clinic, and contacting potential pharmaceutical company partners.

As a result, in April 2015, MD Anderson signed an agreement with the international drug company Astellas Pharma Inc., to develop h8F4, which will enter the clinic in mid 2017.

"Current treatments for aggressive leukemias are often toxic," says Molldrem. "We are developing a safer, more potent therapy for cancers with poor survival outcomes. We hope this important collaboration will allow us to deliver much-needed antibody-based treatment to patients’ bedsides more quickly."

Collaboration with biotech and pharmaceutical companies is crucial given the high cost of drug development. In addition to h8F4, ORBIT has four immune checkpoint programs and one T cell receptor antibody in various stages of development.
Graduate School emphasizes ‘core’ value for research students

By Gillian Kruse

The transition from undergraduate studies to graduate research can be daunting. But for first-year students at The University of Texas MD Anderson Cancer Center UT Health Graduate School of Biomedical Sciences (GSBS), the school’s Core Course is cushioning that bumpy ride.

“The Core Course helped me adjust to the life of a researcher in a big way,” says Kimiya Memarzadeh, a third-year graduate student in Neuroscience. “It really helped me become more analytical and not take things at face value.”

The GSBS premiered the course for incoming first-year students in the fall of 2014 to give them a foundation of science and research skills they’d need to succeed in their individual programs.

Previously, each of the 13 GSBS programs had its own curriculum and graduation requirements, with no course standardization and very little communication between programs. Dean Michelle Barton, Ph.D., knew a core course for every first-year student would help new students become acclimated to the many aspects of the academic biomedical research world.

“We develop the leaders of the future here,” she says. “In any field they enter — research, science policy, law, pharmaceuticals or biotechnology — it will be ingrained in them to use their leadership skills and work collaboratively.”

Starting from scratch

Based on input from all 13 GSBS programs, the course, titled Foundations of Biomedical Research, launched in January 2014 with 41 students enrolled. A different faculty member led each of the 15 weeks, with guest lecturers from various departments giving overviews of their areas. Wednesday mornings were reserved for biostatistics, since that had been identified as a weak area for young researchers.

There were no exams; instead students were evaluated on take-home exercises and group projects. By the time the course ended, students had interacted with more than 70 faculty members from different specialties.

“But because we’d received practice and tips on presentation skills each week in the core course, I was confident I’d deliver a solid presentation.”

Students also formed friendships that may someday further their careers.

“People often say that it’s not what you know, but who you know,” Memarzadeh notes. “I’ve formed relationships with fellow students and faculty members I wouldn’t have encountered otherwise. These people are my future mentors, collaborators and potential employers.”

This story originally appeared in Messenger, MD Anderson’s magazine for employees, volunteers, retirees and their families.

The course evolved as students and instructors adjusted to the new format. Students gave feedback in weekly surveys on what worked and what didn’t, and their suggestions were included in the following week’s sessions.

The nontraditional structure also meant students were able to pick up some of the soft skills necessary for becoming successful scientists.

“I had to give a presentation to about 30 people in another course, which I normally would have found nerve-racking,” Memarzadeh says. “But because we’d received practice and tips on presentation skills each week in the core course, I was confident I’d deliver a solid presentation.”

EDUCATION AND TRAINING

With a commitment to educating and training the next generation of cancer doctors, researchers, nurses and health care professionals, MD Anderson offers a number of degrees in biomedical sciences and allied health professions, as well as nursing training programs and more.

Graduate School of Biomedical Sciences

Degrees awarded

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<th>Degree Type</th>
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<tr>
<td>Specialized Master of Science</td>
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<td>Combined M.D./Ph.D.</td>
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<td>Ph.D.</td>
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Most degrees awarded

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<td>Biomedical Sciences</td>
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School of Health Professions

Bachelor of Science degrees awarded

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Master of Science degrees awarded

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Educational trainees

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<td>School of Health Professions</td>
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<td><strong>Patient Revenue</strong></td>
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<td>Gross patient revenue</td>
<td>$6,144,132,636</td>
<td>$6,582,112,827</td>
<td>$6,994,996,215</td>
<td>$7,567,179,285</td>
<td>$7,571,426,899</td>
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<td>Deductions from gross patient revenue</td>
<td>$3,185,346,342</td>
<td>$3,403,247,816</td>
<td>$3,659,313,782</td>
<td>$3,935,319,324</td>
<td>$4,044,324,615</td>
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<tr>
<td><strong>Net patient revenue</strong></td>
<td>$2,958,786,294</td>
<td>$3,178,865,011</td>
<td>$3,335,682,434</td>
<td>$3,631,859,960</td>
<td>$3,527,102,284</td>
</tr>
<tr>
<td>Restricted grants and contracts, philanthropy</td>
<td>$426,455,579</td>
<td>$505,144,559</td>
<td>$421,761,275</td>
<td>$402,702,183</td>
<td>$466,883,217</td>
</tr>
<tr>
<td>State-appropriated general revenue</td>
<td>$170,383,019</td>
<td>$154,562,093</td>
<td>$185,393,182</td>
<td>$187,350,746</td>
<td>$201,848,484</td>
</tr>
<tr>
<td>Auxiliary income</td>
<td>$36,957,473</td>
<td>$40,674,618</td>
<td>$41,502,690</td>
<td>$44,808,473</td>
<td>$42,462,462</td>
</tr>
<tr>
<td>Other income</td>
<td>$56,151,131</td>
<td>$75,564,178</td>
<td>$99,702,455</td>
<td>$107,422,200</td>
<td>$112,515,085</td>
</tr>
<tr>
<td>Investment and other non-operating income</td>
<td>$87,098,290</td>
<td>$180,428,432</td>
<td>$328,881,907</td>
<td>$121,624,475</td>
<td>$129,632,830</td>
</tr>
<tr>
<td><strong>TOTAL REVENUE</strong></td>
<td>$3,735,831,786</td>
<td>$4,135,238,891</td>
<td>$4,412,923,943</td>
<td>$4,495,768,037</td>
<td>$4,480,444,361</td>
</tr>
</tbody>
</table>

1 Amounts discounted from established rates as a result of agreements with third-party payors, including Medicare, Medicaid and insurance companies. Also includes deductions associated with indigent care and bad debt.

2 Funds received from parking fees, valet services, dining facilities, hotel charges, gift shop sales and vending-machine sales

3 Includes tuition and student fees, Children’s Art Project sales, management fees and other sources

### Sources of revenue (in millions)

- **$3,527.1** | Net Patient Revenue | 78.7%
- **$466.9** | Restricted Grants and Contracts, Philanthropy | 10.4%
- **$201.8** | State Appropriated General Revenue | 4.5%
- **$42.4** | Auxiliary Income | 0.9%
- **$129.6** | Investment and Other Non-Operating Income | 2.5%
- **$112.5** | Other Income | 2.9%
## Uses of revenue

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Research</td>
<td>$546,836,560</td>
<td>$588,664,553</td>
<td>$631,944,987</td>
<td>$688,243,371</td>
<td>$687,940,063</td>
</tr>
<tr>
<td>Instruction, academic support and public service</td>
<td>164,580,132</td>
<td>209,633,502</td>
<td>195,958,981</td>
<td>225,871,577</td>
<td>234,488,229</td>
</tr>
<tr>
<td>Patient care</td>
<td>1,880,230,560</td>
<td>2,013,554,826</td>
<td>2,055,617,566</td>
<td>2,369,972,993</td>
<td>2,642,145,329</td>
</tr>
<tr>
<td>Facilities and depreciation</td>
<td>460,445,328</td>
<td>471,335,938</td>
<td>486,793,306</td>
<td>508,973,014</td>
<td>550,277,895</td>
</tr>
<tr>
<td>Institutional support, auxiliary and other 4</td>
<td>280,844,123</td>
<td>305,390,616</td>
<td>312,865,408</td>
<td>155,828,553</td>
<td>158,060,132</td>
</tr>
<tr>
<td>Allocation to capital plan (For future projects to replace and improve facilities and technology)</td>
<td>402,895,083</td>
<td>546,059,455</td>
<td>729,743,695</td>
<td>566,878,529</td>
<td>207,532,714</td>
</tr>
<tr>
<td><strong>TOTAL EXPENSES</strong></td>
<td><strong>$3,735,831,786</strong></td>
<td><strong>$4,135,238,891</strong></td>
<td><strong>$4,412,923,943</strong></td>
<td><strong>$4,495,768,037</strong></td>
<td><strong>$4,480,444,361</strong></td>
</tr>
</tbody>
</table>

### Uses of revenue (in millions)

- **Patient Care**: $2,642.1 (59.0%)
- **Facilities and Depreciation**: $550.3 (12.3%)
- **Research**: $687.9 (15.4%)
- **Institutional Support, Auxiliary and Other**: $158.1 (3.5%)
- **Allocation to Capital Plan**: $207.5 (4.6%)
- **Instruction, Academic Support and Public Service**: $234.5 (5.2%)

### Gross revenue by payor classification (in millions)

- **Managed Care**: $4,179.6 (55.2%)
- **Medicaid**: $211.0 (2.8%)
- **Medicare**: $2,800.4 (37.0%)
- **Other (International/Self Pay/Other)**: $327.5 (4.3%)
- **Indigent**: $52.9 (0.7%)

4 Includes support for parking, food and gift shop services, as well as general institutional support (e.g. information technology, human resources, administration, development activities, etc.)
### Clinical profile

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Hospital admissions</td>
<td>26,726</td>
<td>27,905</td>
<td>27,761</td>
<td>28,167</td>
<td>27,391</td>
</tr>
<tr>
<td>Patient days</td>
<td>191,735</td>
<td>202,553</td>
<td>202,636</td>
<td>202,483</td>
<td>198,080</td>
</tr>
<tr>
<td>Average daily census</td>
<td>536</td>
<td>569</td>
<td>571</td>
<td>574</td>
<td>561</td>
</tr>
<tr>
<td>Average length of stay</td>
<td>7.2</td>
<td>7.3</td>
<td>7.3</td>
<td>7.2</td>
<td>7.2</td>
</tr>
<tr>
<td>Average number of inpatient beds</td>
<td>616</td>
<td>635</td>
<td>654</td>
<td>665</td>
<td>661</td>
</tr>
<tr>
<td>Outpatient clinic visits, treatments, procedures</td>
<td>1,281,489</td>
<td>1,338,706</td>
<td>1,363,008</td>
<td>1,440,684</td>
<td>1,404,329</td>
</tr>
<tr>
<td>Pathology/laboratory medicine procedures</td>
<td>11,619,591</td>
<td>11,718,405</td>
<td>12,005,766</td>
<td>12,334,917</td>
<td>12,073,679</td>
</tr>
<tr>
<td>Diagnostic imaging procedures</td>
<td>497,660</td>
<td>501,887</td>
<td>523,297</td>
<td>530,590</td>
<td>524,044</td>
</tr>
<tr>
<td>Surgery hours</td>
<td>66,241</td>
<td>70,221</td>
<td>69,506</td>
<td>69,987</td>
<td>67,936</td>
</tr>
<tr>
<td>Total active clinical protocols</td>
<td>1,078</td>
<td>1,065</td>
<td>1,101</td>
<td>1,197</td>
<td>1,202</td>
</tr>
</tbody>
</table>

### Workforce

- **21,119** total employees
- **1,711** faculty
- **953** onsite trained volunteers
- **2,146** offsite myCancerConnection trained survivor volunteers

MD Anderson provided more than **$287.3 million** in uncompensated care to Texans with cancer in FY16.*

*This figure includes unreimbursed costs of care for patients who either have no insurance or are underinsured, or whose care was not fully covered by government-sponsored health programs.

121,356 volunteer hours
Total philanthropic gift support by type

<table>
<thead>
<tr>
<th>Cash gifts</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporations</td>
<td>$11,248,710</td>
</tr>
<tr>
<td>Foundations</td>
<td>33,921,440</td>
</tr>
<tr>
<td>Individuals</td>
<td>61,162,580</td>
</tr>
<tr>
<td>Organizations</td>
<td>3,716,324</td>
</tr>
<tr>
<td>Trusts and estates</td>
<td>7,838,449</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>$117,887,503</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pledge gifts</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporations</td>
<td>$13,586,781</td>
</tr>
<tr>
<td>Foundations</td>
<td>42,853,552</td>
</tr>
<tr>
<td>Individuals</td>
<td>45,965,177</td>
</tr>
<tr>
<td>Organizations</td>
<td>18,605,370</td>
</tr>
<tr>
<td>Trusts and estates</td>
<td>54,896,801</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>$175,907,681</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gifts-in-kind</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporations</td>
<td>$216,271</td>
</tr>
<tr>
<td>Foundations</td>
<td>1,771</td>
</tr>
<tr>
<td>Individuals</td>
<td>18,396</td>
</tr>
<tr>
<td>Organizations</td>
<td>6</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>$236,444</strong></td>
</tr>
</tbody>
</table>

**TOTAL**          | **$294,031,628**

Total philanthropic gift support by purpose (in millions)

- **$267.6** | Research | **91.0%**
- **$14.7** | Annual/unrestricted/undesignated | **5.0%**
- **$11.8** | Education/prevention/patient assistance | **4.0%**

---

1 These dollars fund institutional peer-reviewed research.
2 Donor-targeted gifts to research conducted in all mission areas.
### Sources of research expenditures

#### External funding for research

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</thead>
<tbody>
<tr>
<td>Federal grants, contracts</td>
<td>$196,753,104</td>
<td>$182,970,502</td>
<td>$158,986,303</td>
<td>$161,170,908</td>
<td>$155,043,499</td>
</tr>
<tr>
<td>Private industry grants, contracts</td>
<td>68,413,794</td>
<td>65,579,036</td>
<td>75,307,463</td>
<td>81,076,353</td>
<td>89,454,454</td>
</tr>
<tr>
<td>Philanthropy, foundations</td>
<td>100,794,491</td>
<td>101,642,898</td>
<td>147,016,586</td>
<td>172,412,727</td>
<td>166,374,314</td>
</tr>
<tr>
<td><strong>Total external funding</strong></td>
<td><strong>$365,961,389</strong></td>
<td><strong>$350,192,436</strong></td>
<td><strong>$381,310,352</strong></td>
<td><strong>$414,659,988</strong></td>
<td><strong>$410,872,268</strong></td>
</tr>
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</table>

#### State funding allocated for research

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</tr>
</thead>
<tbody>
<tr>
<td>State-appropriated general revenue</td>
<td>11,618,126</td>
<td>11,776,785</td>
<td>13,636,669</td>
<td>13,658,113</td>
<td>14,991,640</td>
</tr>
<tr>
<td>Tobacco settlement receipts</td>
<td>8,854,774</td>
<td>5,837,249</td>
<td>11,175,016</td>
<td>10,227,690</td>
<td>12,188,092</td>
</tr>
<tr>
<td>CPRIT</td>
<td>19,546,278</td>
<td>24,262,525</td>
<td>25,072,890</td>
<td>32,049,453</td>
<td>40,227,040</td>
</tr>
<tr>
<td><strong>Total state funding</strong></td>
<td><strong>$40,019,178</strong></td>
<td><strong>$41,876,559</strong></td>
<td><strong>$49,884,575</strong></td>
<td><strong>$55,935,256</strong></td>
<td><strong>$67,406,772</strong></td>
</tr>
</tbody>
</table>

#### Internal funding allocated for research

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Hospital operating margins</td>
<td>215,527,886</td>
<td>182,770,342</td>
<td>202,607,346</td>
<td>198,607,568</td>
<td>193,071,901</td>
</tr>
<tr>
<td>Institutional grants*</td>
<td>26,032,444</td>
<td>95,730,271</td>
<td>102,391,157</td>
<td>111,374,655</td>
<td>115,938,206</td>
</tr>
<tr>
<td><strong>Total internal funding</strong></td>
<td><strong>$241,560,330</strong></td>
<td><strong>$278,500,613</strong></td>
<td><strong>$304,998,503</strong></td>
<td><strong>$309,982,223</strong></td>
<td><strong>$309,010,107</strong></td>
</tr>
</tbody>
</table>

**TOTAL RESEARCH EXPENDITURES**

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<tbody>
<tr>
<td></td>
<td><strong>$647,540,897</strong></td>
<td><strong>$670,569,608</strong></td>
<td><strong>$736,193,430</strong></td>
<td><strong>$780,577,467</strong></td>
<td><strong>$787,289,147</strong></td>
</tr>
</tbody>
</table>

### Education profile

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</tr>
</thead>
<tbody>
<tr>
<td>Clinical residents, fellows</td>
<td>1,187</td>
<td>1,231</td>
<td>1,276</td>
<td>1,507</td>
<td>1,693</td>
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<tr>
<td>Research trainees</td>
<td>1,714</td>
<td>1,743</td>
<td>1,853</td>
<td>1,890</td>
<td>1,847</td>
</tr>
<tr>
<td>Observers, visitors, special programs</td>
<td>431</td>
<td>507</td>
<td>452</td>
<td>752</td>
<td>838</td>
</tr>
<tr>
<td>Nursing trainees</td>
<td>2,531</td>
<td>1,306*</td>
<td>1,238</td>
<td>1,352</td>
<td>1,499</td>
</tr>
<tr>
<td>Student programs participants</td>
<td>1,317</td>
<td>1,396</td>
<td>1,204</td>
<td>817</td>
<td>810</td>
</tr>
<tr>
<td>School of Health Professions students</td>
<td>316</td>
<td>291</td>
<td>318</td>
<td>303</td>
<td>317</td>
</tr>
<tr>
<td><strong>TOTAL TRAINEES</strong></td>
<td><strong>7,496</strong></td>
<td><strong>6,474</strong></td>
<td><strong>6,341</strong></td>
<td><strong>6,621</strong></td>
<td><strong>7,004</strong></td>
</tr>
</tbody>
</table>

*Total includes academic credit clinical placement only. Previous data included outreach and CPRIT education programs.*
In honor of Charles Aubrey “Mickey” LeMaistre, M.D.
Feb. 10, 1924 – Jan. 28, 2017

Charles LeMaistre, M.D., was the second full-time president of The University of Texas MD Anderson Cancer Center, serving for 18 years, from 1978-1996. Before taking the reins from R. Lee Clark, M.D., LeMaistre spent seven years as chancellor of The University of Texas System.

A pioneering figure in cancer prevention, LeMaistre served on the first U.S. Surgeon General’s Advisory Committee on Smoking and Health, which in 1964 issued its landmark report identifying cigarettes as a major health hazard.

Under his leadership, MD Anderson’s prevention program became an international model of research and service initiatives that advanced the science and application of cancer prevention and population sciences. He also pioneered multidisciplinary care.

“Mickey’s passing causes us to pause and remember his tremendous contributions to the growth and scope of MD Anderson,” says John Mendelsohn, M.D., MD Anderson’s third full-time president and director of the Khalifa Institute for Personalized Cancer Therapy. “MD Anderson experienced happy and productive years under Mickey’s leadership, and I was fortunate to have the privilege of building upon his legacy when I succeeded him as president in 1996.”

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LOCATIONS

MD Anderson has Houston-area locations in the Texas Medical Center, Bay Area, Katy, Sugar Land, The Woodlands, Bellaire and West Houston (diagnostic imaging), Memorial City (surgery) and The Woman’s Hospital of Texas (gynecologic oncology). MD Anderson physicians also provide cancer care to Harris County’s underserved patients at Lyndon B. Johnson Hospital. In addition, there are two research campuses in Bastrop County, Texas. The institution also has developed a network of national and international locations.

MD ANDERSON CANCER NETWORK®
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