UT Southwestern
Harold C. Simmons
Comprehensive Cancer Center

THE TARGET

DEPARTMENT OF RADIATION ONCOLOGY

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Message from the Chair

For years, UT Southwestern Medical Center has been a recognized leader in the field of radiation oncology, advancing research in stereotactic ablative radiotherapy, immunotherapy, and personalized patient care through the use of artificial intelligence. Now, we are paving the way for a significant breakthrough in our field – a new phase that is not just the next iteration in patient care, but a paradigm shift.

In this publication, you will learn about our department's recent shifted focus to adaptive therapy, which uses advanced technology to measure and react to patient-specific biological responses in overcoming cancer treatment resistance. To deliver this new, unique therapy, we now house one of the largest collections of state-of-the-art adaptive radiotherapy machines within one facility. For our unique implementation of adaptive radiotherapy, we are developing and testing more effective and personalized treatments called Personalized Ultrafractionated Stereotactic Adaptive Radiotherapy (PULSAR™).

Also in this issue:

We describe exciting advancements in one of our head and neck clinical trials, which will help us achieve our ultimate goal of delivering customized and minimally invasive treatments to patients.

Through new molecular biology research, we continue to improve our ways of understanding how to treat cancer with our own immune systems, and, with further development of our team's artificial intelligence models, we continue to improve our efficiency and accuracy in dose-planning.

On the following pages you will get a glimpse of the exciting future of radiation oncology here at UT Southwestern, along with the technology, research, treatments, and people that make it all possible. I believe you will see why our dedication to this rapidly changing field provides our patients with the highest level of care available.

– Professor & Chair

Robert Timmerman, M.D., FASTRO, FACR
Effie Marie Cain Distinguished Chair in Cancer Therapy Research

The MR-Linac is one of two of its kind, and one of seven adaptive treatment machines in the department.

MR-Linac Technology

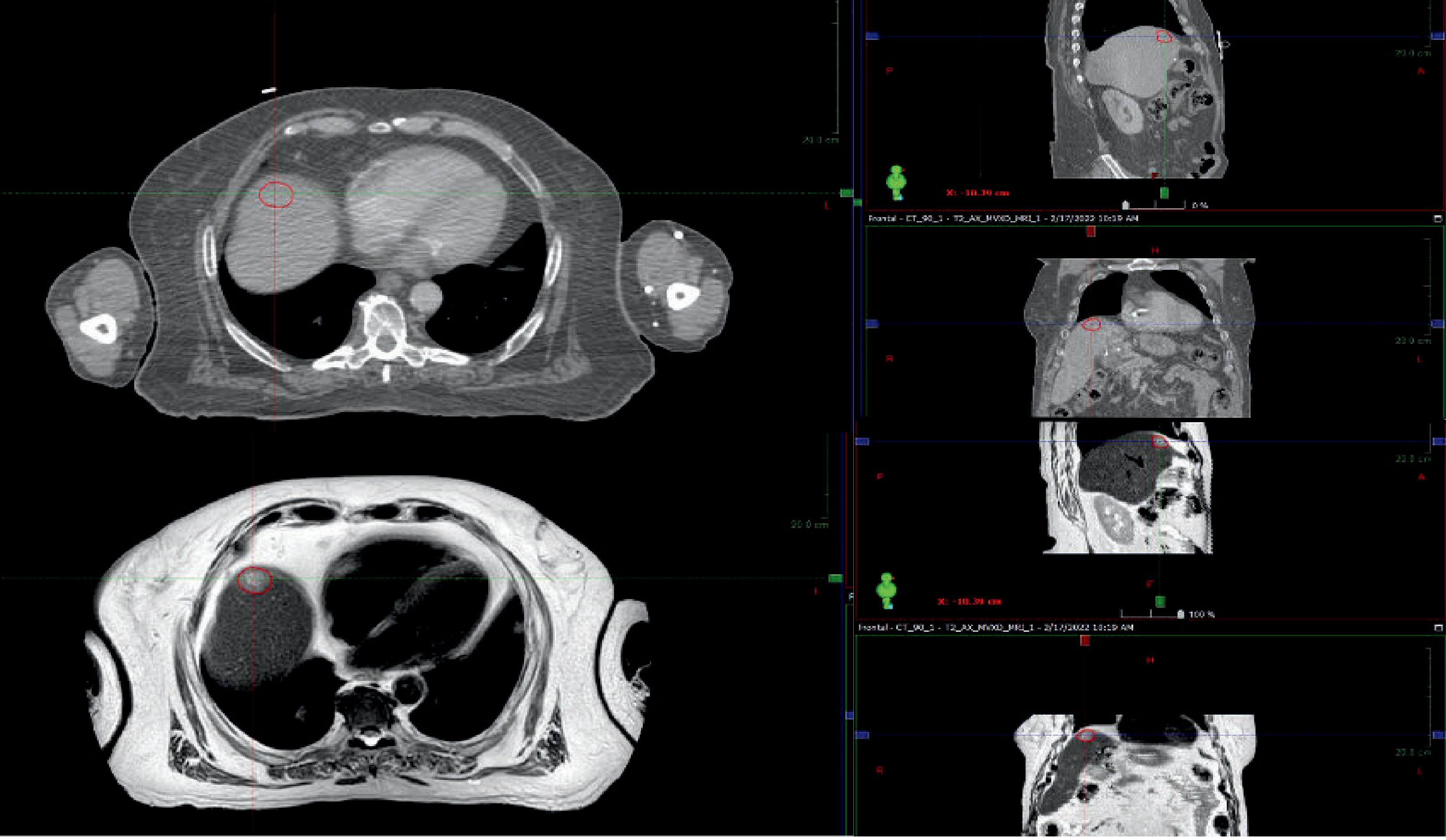
Featured Story
By Ryan Daugherty

In May 2021, the Department of Radiation Oncology at UT Southwestern Medical Center expanded its space, ushering in a new avenue – adaptive therapy – which combines real-time, high-resolution imaging and modern radiation techniques to deliver ultra-precise treatment that can be quickly adapted to changes in patients' tumor size, normal organ relationships, and daily position on the treatment couch.

"We believe as a department that in the future, adaptive treatments will be the standard of care – the norm," says Puneeth Iyengar, M.D., Ph.D., Associate Professor of Radiation Oncology, Medical Director, and Chief of Lung Radiation Oncology Service. "Right now, it's still in a phase of evolution and development, and we would like to be on the forefront of that."

No other department in the world has a larger repertoire of adaptive-capable machines than UT Southwestern's Department of Radiation Oncology. Housed in a new 71,000-square-foot expansion are seven state-of-the-art adaptive imaging and treatment machines. Among these unique machines are two magnetic resonance (MR) linear accelerators – Unity MR-Linacs.

For cancer patients, changes in anatomy can be an issue while undergoing treatments as the tumor may shrink or normal tissues and organs might migrate. Avoiding damage to critical organs is crucial. The MR-Linac brings the highest level of image-guidance to the table with on-board anatomical and functional MR imaging to guide and provide critical information.



A liver lesion target viewed with CT imaging (top) vs. MR imaging (bottom).

"We have CT-guided imaging machines that all have on-board cone beam CT, but the image quality isn't on par with the MR-Linac," says Steve Jiang, Ph.D., Professor of Radiation Oncology, Vice Chair, and Chief of the Division of Medical Physics & Engineering. "We wanted these MR-Linacs so we could visualize very precisely and clearly where the tumor and organs are, and then adapt treatment based on that information."

Dr. Jiang was able to first look at this technology during a visit at a public research university in the Netherlands in 2019. Utrecht University, the originator and developer of this technology, was the only institution in the world with two MR-Linacs at the time.

Now, less than three years later, UT Southwestern has become the second institution in the world with two of these machines. No other place in the world has more than one.

"What this basically says is how serious we are about this technology and that we are planning to use it for a broader percentage of our patients, when it makes sense, for tumors hidden in the soft tissue," says Dr. Iyengar.

Traditional approaches use X-ray imaging, which is adequate for delineating differences between areas such as soft tissue and bone, but these are not as effective in imaging within the soft tissues. Some tumors can have compartmental relationships with other soft tissues, such as a malignant lymph node hidden in the abdomen or pelvis.

Previously, these would be difficult to find on X-ray-based scans because the images would "blend in" together. The MR-Linac provides the ability to differentiate between a tumor and blood vessels as well as other soft tissues, such as fibrous tissues and muscles. It is also helpful in locating tumors that are in soft tissue compartments that move, such as liver lesions near the diaphragm where respiratory motion is greatest.

Because MR imaging works well differentiating between various soft tissues, the MR-Linac is able to make this distinction, allowing radiation oncologists to replan in minutes rather than days and generate an adapted plan of the treatment while the patient lies on the table.

A number of disease sites will be able to be treated more effectively with the MR-Linac. One primary example is the prostate; avoiding surrounding soft tissues such as the bladder and rectum while radiating the prostate tumor effectively is a great benefit of this technology. Other beneficial sites of disease include cancers of the brain and lung, liver primary cancers, metastatic disease to the adrenal glands, pancreatic tumors, primary and secondary cancers of the kidney, and gynecological cancers.

The MR-Linac is also extremely well-tailored to the department's direction of Personalized Ultrafractionated Stereotactic Adaptive Radiotherapy, or PULSAR™. In the PULSAR paradigm, patients receive just a few large dose "pulses," delivered with sophisticated, image-guided precision, at least one week and even months apart.

Many tumors are located in toxicity-prone locations, most being in areas of soft tissue. PULSAR treatments are less toxic and allow for radiation oncologists to fine-tune and adapt treatment if the tumor changes shape, size, position, or functionality.

"Toxicity is a particularly problematic issue that faces patients if their tumor abuts soft tissue, and that is a prominent reason for the inclusion of PULSAR," says Robert Timmerman, M.D., FASTRO, FACR, Professor and Chair of the Department of Radiation Oncology. "PULSAR paired with the MR-Linac is going to make a significant difference by allowing smaller target margins and more accurate, less toxic care."

Justin Park, Ph.D., Assistant Professor of Radiation Oncology and Director of Adaptive Therapy, is a physicist in the department and an expert on the MR-Linac side. He has played a lead role in creating the backbone of the adaptive program on the MR-Linac. His efforts have included coordination of clinical tasks, quality assurance, overseeing the technology, and bringing it up to the clinic. As a researcher, he will also help determine what tools are available and what will need to be developed to further expand its capabilities.

Like Dr. Park, the department has several physicists who are experts in clinical usage of MR-Linacs and who provide a clinical service at each of its two machines. These physicists are assigned to oversee the treatment process in close collaboration with attending physicians.

Selecting the right technology, designing a clinical building to house it, preparing safe operation procedures, and then obtaining and interpreting MR images requires very specialized skills. To help with all these, the Department of Radiology, UH imaging services, and the UTSW Office of Safety and Business Continuity have been of significant help.

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PULSAR paired with the MR-Linac is going to make a significant difference ***by allowing smaller target margins and more accurate, less toxic care.***

"Any clinical and research operation that involves MR imaging must follow strict guidelines to ensure the safety of both patients and personnel," says Ivan Pedrosa, M.D., Ph.D., Professor of Radiology and Vice Chair of Radiology Research. "The involvement of key individuals with expertise in MRI safety and workflow operations was not only critical in the initial steps of implementation of the MR-Linac, but an ongoing process that emphasizes the multidisciplinary nature of an innovative program like this one."

Some of the key players were Takeshi Yokoo, M.D., Ph.D., Associate Professor of Radiology and Medical Director of Magnetic Resonance Imaging; Brian Fox, Director of Imaging Services UH; Adrian Gaspar, Supervisor of Technical Imaging Services UH; and Rebecca Grabarkewitz, Director of Radiation Safety. In addition, Neil Rofsky, M.D., Professor and Chair of the Department of Radiology and Dr. Pedrosa were involved in the initial evaluation of the MR-Linac.

“We are excited about the future clinical and research collaborations between both departments around the MR-Linac,” says Dr. Rofsky.

A physicist is present for each patient’s treatment on the MR-Linac.

Over the first several months this group helped radiation oncology physicists, including Arnold Pompos, Ph.D., Associate Professor of Radiation Oncology and Director of Strategic Expansion Plans, learn which images were most useful and how the MR-Linac could be optimized to get those images and MRI.

“This has been a real team, interdepartmental effort and because of it our patients are being treated increasingly fast,” says Dr. Pompos.

MRI sequences are radiofrequency pulses and gradients that result in a set of images with a particular appearance. In contrast to CT imaging, there can be as many as 15 to 20 different sequences that are imaging the same area. In the routine MR-Linac workflow, physicians need to differentiate healthy tissue from tumor targets, find hypoxic regions, and use diffusion and perfusion MR.

Jie Deng, Ph.D., Associate Professor of Radiation Oncology and certified magnetic resonance imaging medical physicist by the American Board of Medical Physics, plays a vital role in this process. She advises which sequence or MR technique could be used as well as which technique would be most useful for the patient.

What is next for this technology?

While early treatments have gone well and are steadily improving, the two MR-Linacs were acquired not for what they are capable of now, but for what they are capable of going forward and within the next couple of years, according to Dr. Pompos. Physicists in the department are working with vendors to deliver improved capabilities, including workflow, hardware, new software such as automated gating, and inclusion of UT Southwestern results and products into the adaptive workflow.

Moving forward, MR-Linac treatments will serve as an integral part of the department’s direction and improvements will continue to be made. Treatment times will be reduced, allowing patients to be more comfortable, and physicians will be able to drive the machines more efficiently.

“These machines are very specialized, and their application and impact are yet to be fully defined,” says Dr. Timmerman. “But once we are using them regularly and can exploit their strengths, I suspect we’ll eventually wonder how we ever lived without them.”

Patient Spotlight: **Patrick Calloway's Story**

By Ryan Daugherty

On Dec. 19, 2017, Patrick Calloway, 51, of Fishers, Indiana, was diagnosed with kidney cancer.

He went to Indiana University Health where surgery was performed, resulting in the removal of one of his kidneys. Two years later, during a routine checkup, a spot was found on his lung. Rather than stay in his home state, he traveled to Chicago for treatment at Northwestern where the lung metastasis was removed surgically.

Mr. Calloway has lived in Indiana for 22 years and is married with three children and six grandchildren. For eight years he has been an operating partner for Vontra Foods, a food management and catering company, where he has been in charge of staffing, menu development, restaurant operations, catering sales, and scheduling, among other duties.

Under his leadership, Vontra Foods has managed a number of different concepts, including contracting for Aramark Foods in hospital, university, and large office building cafeterias in Indianapolis. The focus was shifted to catering during the COVID pandemic, all while still operating three restaurants.

However, in June of 2021 his focus was re-shifted to his health when another routine checkup revealed a lymph node on his lung. The location of the lymph node limited his treatment choices. Surgery was not an option, and while standard radiation and stereotactic body radiation therapy was a possibility, it would be difficult.

Mr. Calloway decided he'd feel more comfortable with a second opinion elsewhere. He and his family looked at multiple options including a hospital just over 900 miles away in Dallas, Texas.

"We stumbled upon UT Southwestern and after reading about the department and Dr. Hannan, it was a pretty easy decision," says Mr. Calloway.

Patrick Calloway and his wife.

Raquibul Hannan, M.D., Ph.D., Associate Professor of Radiation Oncology, is Chief of Genitourinary Radiation Oncology Service in the Department of Radiation Oncology at UT Southwestern Medical Center. He specializes in radiation treatment of many genitourinary cancers, including prostate, kidney, bladder, penile, testicular, and ureteral cancer. He is also knowledgeable in a range of radiation techniques that include IMRT, IGRT, linac-based SRS, SBRT, and now, adaptive radiation therapy.

During his initial visit, Mr. Calloway recalls being impressed, particularly with a first-year radiation oncology medical resident, Mihailo Miljanic, M.D., who helped any initial fears go away. In a following meeting with Dr. Hannan, it was explained to Mr. Calloway and his wife the exact location of his tumor, what kind of treatment he would be receiving, and how long the treatments would be given.

"His tumor was located right in the middle of his chest (sub carina) surrounded by the heart, lung, esophagus, trachea, and the main bronchus; this is considered to be one of the toughest locations to treat by any modality," says Dr. Hannan. "He was an oligometastatic patient with this metastasis being the only site of tumor present, and if this could be eradicated, he could potentially be cured."

With the department's commitment to innovation and applying the most state-of-the-art technology in improving radiation precision and delivery, Mr.

Raquibul Hannan, M.D., Ph.D.

Calloway was a prime candidate to be treated with PULSAR on one of the department's two Unity MR-Linacs.

In the PULSAR paradigm, patients receive only a few large ablative radiation dose "pulses," delivered with sophisticated, MRI-guided precision, at least a week or even months apart — a significant difference from the daily, long-course, conventional radiation treatments that last six to nine weeks. These treatments allow radiation oncologists to adapt to the tumor and normal tissue changes in real time while patients are on the table.

The MRI-based image guidance allows precise delineation of the tumor and surrounding normal tissues. The large pulses of radiation increases anti-tumor efficacy, and the long interval between the large pulses allows adapting to a shrinking tumor to further focus the radiation and reduce dosage to critical surrounding normal structures. This result is that PULSAR can treat a tumor in locations that previously were not possible, as is the case for Mr. Calloway.

With the MR-Linac, there were a lot of benefits for Mr. Calloway that would not have been possible on other machines. Normally, there would be a challenge when looking at scans like this, particularly not being able to tell the boundary between where the lymph node ends and surrounding organs begin.

"The MR-Linac really gives us an advantage where we can see the node and the boundary of the esophagus, trachea, and the heart very clearly, allowing us to focus the radiation more accurately and safely into the tumor," says Dr. Hannan.

Mr. Calloway's treatments have gone extremely well. His tumor has halted growth as compared to his previous scans that showed persistent growth and even started decreasing in size. While he has noted mild fatigue, he has not experienced any difficulty in swallowing, which would otherwise be prevalent in patients receiving treatment to a tumor where his was located.

"Similarly, we expect that PULSAR may eliminate the rare, yet serious side effects of radiation treatment of central lung tumors such as hemothorax or pneumothorax, which would otherwise not be possible," says Dr. Hannan.

The outlook for Mr. Calloway appears promising. While the tumor is not expected to shrink significantly more because the body's immune cells take time to remove dead tumor cells, the tumor cells are all dead, according to Dr. Hannan. A close eye will be kept on his regular interval scans, and if no other metastasis arises then he will be cured of his metastatic kidney cancer.

"When someone hears cancer, obviously they get pretty scared," says Mr. Calloway. "At UT Southwestern they make it easy for the patient and equally as calming for the patient's family. The staff is fantastic, they know you by name, and you never feel rushed. I couldn't be more thankful for them."

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FEATURED CLINICAL TRIAL: **DARTBOARD**

STU 2021-0401: A Prospective Randomized Phase II Study of Daily Adaptive Radiotherapy to Better Organ-at-Risk Doses in Head and Neck Cancer (DARTBOARD)

- Condition: T1-4, N0-3 oropharynx, larynx, and hypopharynx cancer
- Treatment: Personalized treatment through daily optimization of the radiation plan using two cutting-edge Ethos adaptive radiotherapy linear accelerators. Patients will be randomized to arm 1 or 2:

  Arm 1: Involved nodal radiation therapy
  Arm 2: Near marginless daily adaptive involved nodal radiation therapy

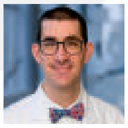
- Benefit: Improved patient quality of life, particularly in terms of acute and late toxicity, as more healthy tissue is spared with precision therapy. Specifically, reduced side effects, especially with patient-reported salivary function.

DARTBOARD is a cutting-edge trial that is the first of its kind – treating the tightest volumes ever in head and neck cancer. Through daily reduction of volumes and the use of adaptation to account for the changing anatomy of the patient, the dose of radiotherapy delivered to the patient's normal tissues will be significantly reduced.

The hypothesis is that this new method of treatment will minimize toxicity and improve patient-reported outcomes, especially those associated with salivary function. Most head and neck cancer patients who come to be treated at our clinic will be eligible for this trial. This study follows the previously successful studies, INFIELD and INRT-AIR, which progressively limited the dose and volume to uninvolved areas of the neck. Both of these trials resulted in highly favorable outcomes in patients, leading the way to engender the idea of shrinking margins in head and neck cancer management. In fact, INRT-AIR outcomes were deemed so successful that patients on the non-randomized arm of DARTBOARD will receive the INRT-AIR approach to neck radiation.

"The great next frontier in treating head and neck cancers is margin reduction and adaption, and having moved through previous paradigms of treating the neck, we are optimally suited to investigate this and see if the theoretical ideas translate to real clinical outcomes," says Dr. David Sher. "With this study, we are excited about the potential for a dramatic improvement in treating head and neck cancers. We are hoping this study can be a paradigm shifter, with our ultimate goal to hyperpersonalize the treatment."

With success of this trial, radiation treatment plans for all cancers could change and follow this model, improving patient outcomes and quality of life in a long-term, meaningful way.

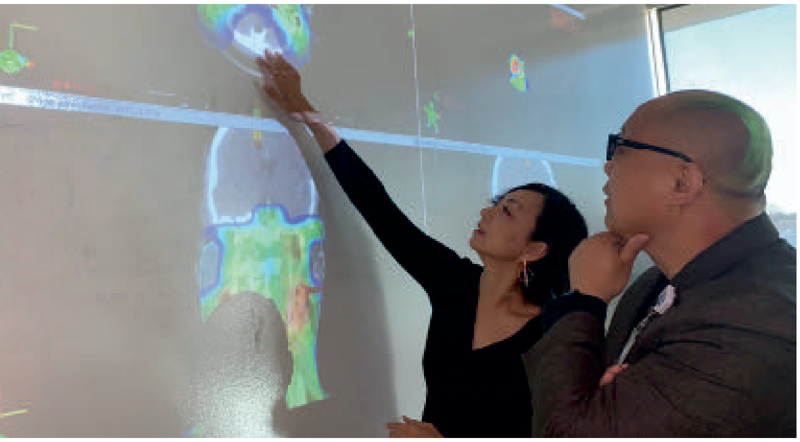


David Sher, M.D., M.P.H.
Professor of Radiation Oncology, Associate Vice Chair for Clinical Operations, and Chief of Head and Neck Radiation Oncology Service

Physics Core: **AI Treatment Planning**

By Sepeadeh Radpour, M.A., M.S.

With the development of more robust prediction models using artificial intelligence (AI), procedures are changing rapidly to involve AI-based directives to complement the treatment-planning process. In particular, deep learning models are being implemented and have been used over 250 times within the department's head and neck clinic to complement traditional treatment-planning methods for more efficient and uniform dose planning. Radiation oncologists such as David Sher, M.D., M.P.H., Professor of Radiation Oncology and Chief of Head and Neck Radiation Oncology Service, are reaping the benefits of this technology.



Mu-Han Lin, Ph.D. (left), and Steve Jiang, Ph.D.

"We have built a very robust model using AI, and having contours estimated beforehand maximizes planning efficiency," says Dr. Sher. "It is remarkable what the model is able to provide us with."

Patients who are scheduled to receive radiation treatment typically must wait a few days to a week to start treatment due to the need for collaboration and adjustment within the treatment-planning team. The use of these models has the potential to expedite the start of patient treatment, with the endeavor of improving patient outcomes and survival rates. So far, there has been a demonstrated improvement in practice uniformity, achievability, and overall plan quality. The deep learning model is capable of generating treatment plans in seconds, streamlining the overall treatment-planning process by cutting out much of the back and forth between physician and dosimetrist, as well as assisting in avoiding delivery of higher-than-needed doses of radiation. A metric used to measure success is achievability of the physician's directive, and this is now at an impressive 80%.

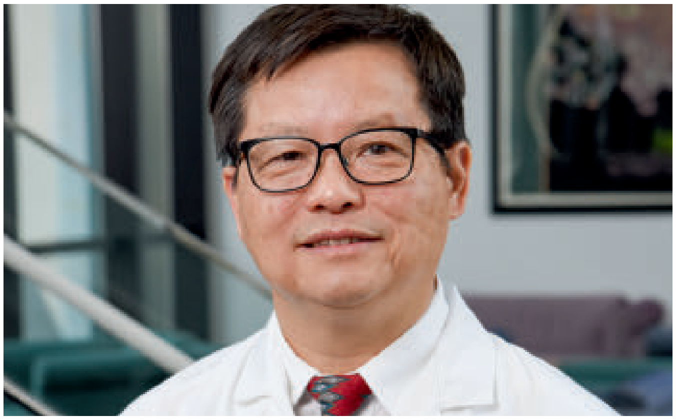
Machine learning is a branch of AI that involves computers "learning" without specific programming to do so, specifically by using algorithms that improve through data and experience. Deep learning is a part of machine learning, and consists of artificial neural networks, a pattern of connectivity modeled after the human brain. These dose-prediction models employ U-net, a deep learning model that was developed for biomedical image segmentation. The models being employed in radiation oncology can take in images of the patient and render a 3D radiation plan, and even estimate the uncertainty of the plan it just generated using Monte Carlo dropout (MCDO). Implementation of a physician-oriented workflow that allows the physician to preview the 3D prediction, as well as the uncertainty estimate so they can incorporate these data before starting the planning process, will revolutionize the field of radiation oncology.

"We hope we can expend usage of the AI dose predictor to other disease sites, and also use it for candidate selection," says Mu-Han Lin, Ph.D., Associate Professor of Radiation Oncology and Director of Treatment Planning.

Treatment planning for areas of the head and neck is historically complex compared to other areas, and the fact that such promising results are already being seen by these models is very exciting. Models have been built, and are ready to be tailored and deployed for clinical use for the lung and prostate with the goal of "building more models tailored to our needs and improving our efficiency and quality in the clinic," says Dr. Lin. "In the past we had to go through a planning process of days; now with AI, we can know the dose distribution with only the patient image and contour. We can predict something reasonable and achievable."

Harnessing the Power of **Deviant DNA** for Immunotherapy

Preclinical Research Highlights
By Sepeadeh Radpour, M.A., M.S.



Guo-Min Li, Ph.D.

By unlocking the mystery of immune response mechanisms not previously well understood, UTSW researcher Guo-Min Li, Ph.D., Professor of Radiation Oncology, leads the way for a deeper understanding of certain types of immunotherapy.

DNA mismatch repair (MMR) factors locate and repair mismatched nucleotide bases generated during DNA replication to ensure replication fidelity and genomic integrity. Defects in MMR can cause various cancers that mutate rapidly and, therefore, resist traditional cancer therapies such as chemotherapy and radiation therapy. Interestingly, what these MMR-deficient cancers respond to well is a type of immunotherapy called checkpoint blockade. It is currently thought that the high number of mutations in these MMR-deficient cancers generate neoantigens – mutated antigens that form on the surface of some tumors that the immune system recognizes and elicits an immune response to. Of note, only about 50% of these tumors respond to this type of immunotherapy, which suggests that factors other than neoantigens are also involved in these cancers' responsiveness to treatment.

Recent collaborative studies in the labs of Dr. Li and immunologist Yang-Xin Fu, M.D., Ph.D., Professor of Pathology, led to a breakthrough discovery that has illuminated the molecular basis on which cancers deficient in DNA mismatch repair respond to checkpoint blockade immunotherapy. Their findings, published in back-to-back papers in *Cancer Cell*, show that defective DNA MMR causes severe DNA damage that stimulates the DNA sensing pathway known as cGAS-STING (cyclic GMP-AMP synthase-stimulator of interferon genes), subsequently initiating the immune response against the tumor. Their studies show that tumor cells defective in the key mismatch repair factor *MLH1* express increased cytosolic DNA, activating the cGAS-STING pathway, which is essential to triggering immune responses against these cancers.

Specifically, defects in the MMR factor *MLH1* lead to uncontrolled DNA excision during repair. This augments DNA damage and results in chromosomal abnormalities and the release of nuclear DNA into the cytoplasm, where it is detected by the cGAS-STING pathway. In tumor models deficient in *MLH1*, cytosolic DNA accumulates and triggers the cGAS-STING pathway, which activates the immune system, rendering these tumors more responsive to immunotherapy.

Radiation treatment can facilitate such DNA sensing, as it stimulates the immune system by inducing DNA breaks, triggering mismatch repair deficient tumor cells to increase DNA damage, ultimately activating the cGAS-STING immune signaling pathway. This mechanism aids in understanding why administering radiation therapy prior to immunotherapy has shown positive clinical outcomes. Further understanding of the molecular basis for these tumors' responses to immunotherapy will help clinicians select and optimize treatments for more personalized and effective cancer care.

Dr. Li holds the Reece A. Overcash, Jr. Distinguished Chair for Research on Colon Cancer.

Diversity, Equity & Inclusion

By Ryan Daugherty

At UT Southwestern Medical Center we have a reputation for excellence in research and clinical care. Our physicians, researchers, and therapists are among the most respected in the nation and provide the medical and scientific leadership that enables us to make an important difference in the lives of patients. In addition, we also believe diversity, equity, and inclusion are critical to the mission of UT Southwestern.

The Division of Diversity and Inclusion is fueled by a passion for equity, inclusive patient care, and enabling the full human potential of UT Southwestern employees. By achieving and maintaining a diverse and inclusive constituency of administrators, faculty, students, and staff, UT Southwestern expands its potential to advance in educational and research opportunities, prepares our health care providers for delivering culturally competent patient care, and equips our staff to provide excellent customer service and care to an increasingly diverse nation.

In the Department of Radiation Oncology, we are equally committed to advancing and promoting a diverse and inclusive work environment. In January 2022, Asal Rahimi, M.D., M.S., Associate Professor of Radiation Oncology and Chief of Breast Radiation Oncology Service, was elected as the department's Associate Vice Chair of Diversity, Equity, and Inclusion.

In this role, Dr. Rahimi will serve as an adviser on issues relating to diversity, equity, and inclusion and will work closely with Quinn Capers, M.D., Professor of Internal Medicine, Associate Dean for Faculty Diversity, and Vice Chair for Diversity and Inclusion, Department of Internal Medicine, and his group to collaborate on important initiatives to address challenges and opportunities in this area and to share best practices across departments.

"Diversity is not just race or ethnicity, but also gender, age, sexual orientation, socioeconomic status, religious and political beliefs, physical beliefs, and life and cultural experiences, among other aspects," says Dr. Rahimi. "We want to have a multicultural and multifaceted population that is unified, where anyone who walks through our doors will immediately feel included."

Dr. Rahimi will form a committee within the department that focuses on developing competencies around diversity, equity, and inclusion; some of these areas include professional development, recruitment efforts, and other engagement opportunities. Having a staff that can be present emotionally for patients will also be a key facet, in addition to the state-of-the-art technology, leading clinical trials, and top research and residency programs in the department. Maximizing this will allow for the best possible care.

"With the ongoing global pandemic and other hardships the human race has suffered over the past several years, this emotional aspect remains and will continue to be vital," says Dr. Rahimi. "Ultimately, if the culture of your employees shines through to your patients, it will make an even greater difference in their lives."

NEW FACULTY

Our Team

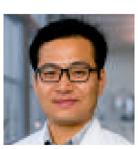
CLINICAL

Andrew Wang, M.D., Professor, earned his medical degree from the Harvard-MIT Health Sciences and Technology (HST) program at Harvard Medical School. Dr. Wang holds the A. Kenneth Pye Professorship in Cancer Research and is the Associate Vice Chair for Research in our department. Dr. Wang's research is focused on the application of biomedical engineering to cancer research. Clinically, he specializes in the treatment of GU and GI cancers.

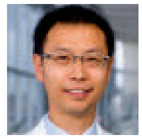
Yuanyuan Zhang, M.D., Ph.D., Assistant Professor, earned her medical degree from UT Southwestern Medical School. After finishing her residency in our department, she joined our lung disease-oriented team. She is the recipient of the 2021 Conquer Cancer-AACR Young Investigator Award for Translational Cancer Research as well as the Roentgen Resident Research Award.

PHYSICS

Kin Man Au, Ph.D., Instructor, received his Ph.D. in chemistry from the University of Sheffield. His research interests include cancer, drug delivery, polymer chemistry, biomedical imaging, photothermal therapy, radiotherapy and nuclear medicine, and cancer immunotherapy.

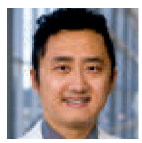


Ti Bai, Ph.D., Instructor, earned his Ph.D. at the Xi'an Jiaotong University, where he majored in low-dose CT reconstruction. He is part of the MAIA Lab where his research is focused on designing, developing, and translating innovative and practical artificial intelligence technologies to improve health care performance and efficiency.

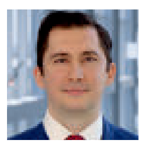


Bin Cai, Ph.D., Associate Professor, received his Ph.D. from Ohio University. His research interests include adaptive radiotherapy, automation and artificial intelligence in modern radiation therapy, biology-guided radiotherapy, and MR-guided radiotherapy. Dr. Cai also serves as Director of Advanced Physics Service.

Jie Deng, Ph.D., Associate Professor, received her Ph.D. in biomedical engineering from Northwestern University. Her research interests include adaptive radiotherapy, artificial intelligence in modern radiation therapy, functional oncological MRI, and MR-guided radiation therapy.



Zijian Deng, Ph.D., Instructor, earned his Ph.D. in natural science from Peking University in China. His research interests include biomedical optics, in vivo cell tracking, and optical tomography-guided radiation therapy.



Viktor Iakovenko, Ph.D., Assistant Professor, received his Ph.D. in particle physics at Paris-Sud University in Orsay, France. His research interests include MR-guided adaptive radiation therapy, development of novel detector systems for radiation therapy, dosimetry for emerging treatment modalities, and stereotactic radiotherapy.

Heejung Kim, Ph.D., Assistant Professor, earned her Ph.D. in biomedical engineering at Seoul National University. Her research focus is on adaptive radiotherapy and artificial intelligence.

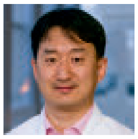
David Parsons, Ph.D., Assistant Professor, received his Ph.D. from Dalhousie University. His research interests include image guidance in radiotherapy, motion management, novel treatment techniques, and the use of Monte Carlo simulation in radiotherapy. Dr. Parsons also serves as Associate Program Director of our Medical Physics Residency.

Shu Zhang, Ph.D., Instructor, received her Ph.D. from UT Southwestern. Her research interests include low-field MRI, medical image processing and reconstruction, MR-guided radiation therapy, and quantitative MRI.

Tingliang Zhuang, Ph.D., Assistant Professor, earned his Ph.D. in medical physics from the University of Wisconsin-Madison. His research interests include adaptive radiotherapy and cone-beam CT image reconstruction.

FACULTY **PROMOTIONS**

Neil Desai, M.D., M.H.S., was promoted to Associate Professor. Dr. Desai is part of our genitourinary disease-oriented team.



Yang Kyun Park, Ph.D., was promoted to Associate Professor. Dr. Park is the lead physicist on our CNS disease-oriented team.

Puneeth Iyengar, M.D., Ph.D., was promoted to Associate Professor and Medical Director of Radiation Oncology. Dr. Iyengar is Chief of the Lung Radiation Oncology Service.

Laurentiu Pop, M.D., was promoted to Assistant Professor. Dr. Pop is a certified principal investigator and works in the Hannan Lab.

GRANTS & AWARDS

Todd Aguilera, M.D., Ph.D., a member of the Experimental Therapeutics Research Program, along with a multi-PI team consisting of Andrew Jamieson, Ph.D., Assistant Professor of Bioinformatics; Ravikanth Maddipati, M.D., Assistant Professor of Internal Medicine; and Megan Wachsmann, M.D., Assistant Professor of Pathology, were awarded a $100,000 SCCC Translational Pilot Award for "Interrogation of the Therapeutic Response in Pancreatic Adenocarcinoma to Identify Opportunities to Target the Tumor Immune Microenvironment."

Prasanna Alluri, M.D., Ph.D., received a $1.5 million Breast Cancer Research Program Breakthrough Award from the U.S. Department of Defense (DoD) in partnership with Dr. Ram Mani in the Department of Pathology. Their study will define how reprogramming of transcriptional and DNA repair pathways drives resistance to endocrine therapies and CDK4/6 inhibitors in breast cancer patients. They will also develop new targeted therapies that reverse treatment resistance by targeting this pathological reprogramming, expanding treatment options for breast cancer patients who have become unresponsive to existing treatments. DoD-funded breast cancer grants are some of the most competitive federal grants with a funding rate of only 5-6%.

Puneeth Iyengar, M.D., Ph.D., and Rodney Infante, M.D., Ph.D., Assistant Professor of Internal Medicine, were awarded a grant for $2,585,230 from the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) to study how "LIFR-alpha/JAK/STAT3-dependent adipose inflammation contributes to obesity-associated NAFLD."

Xun Jia, Ph.D., received a $250,000 CPRIT grant to develop a new MRI scanner that will help keep radiation focus on tumors in radiotherapy.

Steve Jiang, Ph.D., Xun Jia, Ph.D., and **Dan Nguyen, Ph.D.,** all part of the MAIA Lab, in collaboration with Varian Medical Systems Inc., received a $2.9M NIH Academic-Industrial Partnerships RO1 grant to develop human-like AI agents for better and faster radiotherapy treatment planning. This is only the second RO1 grant received by three multiple principal investigators to develop AI tools for improving cancer radiotherapy.

Yiping Shao, Ph.D., was awarded a grant in the amount of $164,000 from the National Institute of Biomedical Imaging and Bioengineering for "Flexible, ultrahigh-throughput and easy-implementing distributed coincidence for improving PET imaging performance."

Michael Story, Ph.D., Debabrata Saha, Ph.D., and **Narasimha Kumar Karanam, Ph.D.,** were granted a patent for developing a novel method of killing cancer cells that combines a PARP inhibitor, such as Olaparib, with Tumor Treating Fields. Novocure sought and acquired exclusive license to the patent.

Kenneth Westover, M.D., Ph.D., was awarded a Developmental Research Program award for $50,000 as part of UT Southwestern's collaboration with the Developmental and Hyperactive Ras Tumor (DHART) SPORE. He was also awarded an SCCC Translational Pilot Award for "KRAS Zygosity as a Biomarker for Lung Cancer Therapy" for $100,000. The Westover Lab received a $25,000 Lung SPORE grant to study drug resistance to targeted therapies.

RECOGNITION

Neil Desai, M.D., M.H.S.

Neil Desai, M.D., M.H.S., was one of the recipients in 2020 of UT Southwestern's Leaders in Clinical Excellence Rising Star Award, which recognizes exceptional early career clinical faculty whose actions and activities consistently exemplify commitment, professionalism, and leadership.

"To be recognized with this award is an acknowledgment of the humbling opportunities I have been given in spades here — by the colleagues with whom I work, the patients we serve, and the culture of love for one's calling that we all share. It is a privilege and pleasure to be part of programs that treasure progress and compassion in equal measure. I thank my mentors, colleagues, and patients for the fulfillment and pride they have given and my patient wife and children for their support," says Dr. Desai.

Steve Jiang, Ph.D.

Steve Jiang, Ph.D., was elected to the American Institute for Medical & Biological Engineering (AIMBE) College of Fellows Class of 2022, which is one of the highest professional distinctions awarded to a medical and biological engineer. According to AIMBE, "College membership honors those who have made outstanding contributions to engineering and medicine research, practice, or education and to the pioneering of new and developing fields of technology, making major advancements in traditional fields of medical and biological engineering, or developing/implementing innovative approaches to bioengineering education."

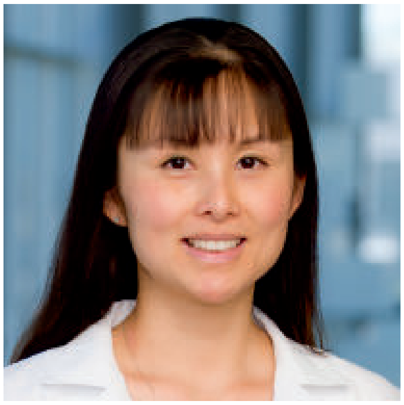
AIMBE Fellows — comprised of academia, industry, education, clinical practice, and government — represent only the top 2% of the most accomplished medical and biological engineers.

Kiran Kumar, M.D., M.B.A.

Kiran Kumar, M.D., M.B.A., was the department's 2021 Educator of the Year, which is awarded by residents to the physician who had the most profound impact on their residency education. This award is designed to recognize faculty members who promote educational excellence. With an overwhelming number of votes from the residents, Dr. Kumar was noted to go above and beyond during his rotations, to be heavily involved in resident didactic lectures, and to have an open-door policy.

Chika Nwachukwu, M.D., Ph.D.

Chika Nwachukwu, M.D., Ph.D., a member of the SCCC Cellular Networks in Cancer Research Program, is one of two recipients of the 2021 Eugene P. Frenkel, M.D., Clinical Scholars Program. This program provides funding over four years to recruit and support new faculty members and promote enduring excellence in patient care in oncology. Dr. Eugene P. Frenkel, an internationally recognized cancer researcher and admired clinician and educator, led the Division of Hematology and Oncology at UTSW for 30 years.



Nina Sanford, M.D.

Nina Sanford, M.D., was one of the recipients in 2021 of UT Southwestern's Leaders in Clinical Excellence Rising Star Award, which recognizes exceptional early career clinical faculty whose actions and activities consistently exemplify commitment, professionalism, and leadership.

"It is a tremendous honor to be recognized with this award. I feel incredibly lucky to have the opportunity to come to work daily and do what I love to do – teach trainees, participate in cutting-edge research, and above all, care for patients with cancer. I owe enormous thanks to all my colleagues in Radiation Oncology, the gastrointestinal disease-oriented team, and the Cancer Center, who have been like family to me over the past three years (and to me, UTSW is truly family because two of my children were born at Clements University Hospital!). Lastly, a huge thanks to my husband, who has put up with me since 2009," says Dr. Sanford.

UTSW

For the fifth consecutive year, we have been named the No. 1 hospital in Dallas-Fort Worth by *U.S. News & World Report*. Additionally, nine specialties earned recognition as being among the nation's top 50 – with eight of those in the top 25. We are among the top 25 Best Hospitals in the nation for cancer care and the best in North Texas.

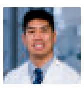
+ OUR FACULTY

Todd Aguilera, M.D., Ph.D.
Assistant Professor

Kevin Albuquerque, M.D., FACR
Professor and Director of Quality Improvement/Quality Assurance
Chief of Gynecological Radiation Oncology Service
Holder of the Ken Sharma Professorship in Radiation Oncology

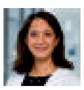
Prasanna Alluri, M.D., Ph.D.
Assistant Professor

Vladimir Avkshtol, M.D.
Assistant Professor

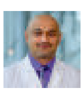


Tu Dan, M.D.
Assistant Professor

Neil Desai, M.D., M.H.S.
Associate Professor
Dedman Family Scholar in Clinical Care



Aurelie Garant, M.D.
Assistant Professor



Raquibul Hannan, M.D., Ph.D.
Associate Professor
Chief of Genitourinary Radiation Oncology Service

Puneeth Iyengar, M.D., Ph.D.
Associate Professor and Medical Director
Chief of Lung Radiation Oncology Service

Nathan Kim, M.D., Ph.D.
Associate Professor

Kiran Kumar, M.D., M.B.A.
Assistant Professor
Director of the Medical Residency Program
Chief of Lymphoma and Pediatrics Radiation Oncology Services

Dominic Moon, M.D.
Assistant Professor

Chika Nwachukwu, M.D., Ph.D.
Assistant Professor
Associate Director of the Medical Residency Program
Eugene P. Frenkel, M.D., Clinical Scholar

Asal Rahimi, M.D., M.S.
Associate Professor
Chief of Breast Radiation Oncology Service
Medical Director of the SCCC Clinical Research Office
Department Associate Vice Chair of Diversity, Equity, and Inclusion

Nina Sanford, M.D.
Assistant Professor
Chief of Gastrointestinal Radiation Oncology Service
Dedman Family Scholar in Clinical Care

David Sher, M.D., M.P.H.
Professor and Associate Vice Chair for Clinical Operations
Chief of Head and Neck Radiation Oncology Service

Robert Timmerman, M.D., FASTRO, FACR
Professor and Chair
Holder of the Effie Marie Cain Distinguished Chair in Cancer Therapy Research

Dat Vo, M.D., Ph.D.
Assistant Professor

Andrew Wang, M.D.
Professor and Associate Vice Chair for Research
Holder of the A. Kenneth Pye Professorship in Cancer Research

Zabi Wardak, M.D.
Assistant Professor and Medical Director of the Gamma Knife Program
Chief of Central Nervous System Radiation Oncology Service

Kenneth Westover, M.D., Ph.D.
Associate Professor
Director of Clinical Innovation and Information Systems

Yuanyuan Zhang, M.D., Ph.D.
Assistant Professor

FEATURED **PUBLICATIONS**

The Department of Radiation Oncology publishes more than 130 articles per year. Our department's unique research teams cross-collaborate to contribute to research advancement in the field of radiation oncology.

PHYSICS

Bai T, Wang B, Nguyen D, Wang B, Dong B, Cong W, Kalra MK, Jiang S. Deep interactive denoiser (DID) for X-ray computed tomography. *IEEE Trans Med Imaging*. 2021 Nov;40(11):2965-2975. PMID: 34329156.

Balagopal A, Nguyen D, Morgan H, Weng Y, Dohopolski M, Lin MH, Barkousaraie AS, Gonzalez Y, Garant A, Desai N, Hannan R, Jiang S. A deep learning-based framework for segmenting invisible clinical target volumes with estimated uncertainties for postoperative prostate cancer radiotherapy. *Med Image Anal.* 2021 Aug;72:102101. PMID: 34111573.

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CLINICAL

Folkert MR, Zelefsky MJ, Hannan R, Desai NB, Lotan Y, Laine AM, Kim DWN, Neufeld SH, Hornberger B, Kollmeier MA, McBride S, Ahn C, Roehrborn C, Timmerman RD. A multi-institutional phase II trial of high-dose SAbR for prostate cancer using rectal spacer. *Int J Radiat Oncol Biol Phys.* 2021 Sep 1;111(1):101-109. PMID: 33753140.

Hannan R, Mohamad O, Diaz de Leon A, Manna S, Pop LM, Zhang Z, Mannala S, Christie A, Christley S, Monson N, Ishihara D, Hsu EJ, Ahn C, Kapur P, Chen M, Arriaga Y, Courtney K, Cantarel B, Wakeland EK, Fu YX, Pedrosa I, Cowell L, Wang T, Margulis V, Choy H, Timmerman RD, Brugarolas J. Outcome and immune correlates of a phase II trial of high-dose interleukin-2 and stereotactic ablative radiotherapy for metastatic renal cell carcinoma. *Clin Cancer Res.* 2021 Dec 15;27(24):6716-6725. PMID: 34551906.

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NCI Designated Comprehensive Cancer Center

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Photos by Brian Coats

For referrals or to schedule an appointment,
please call 214-645-8525.