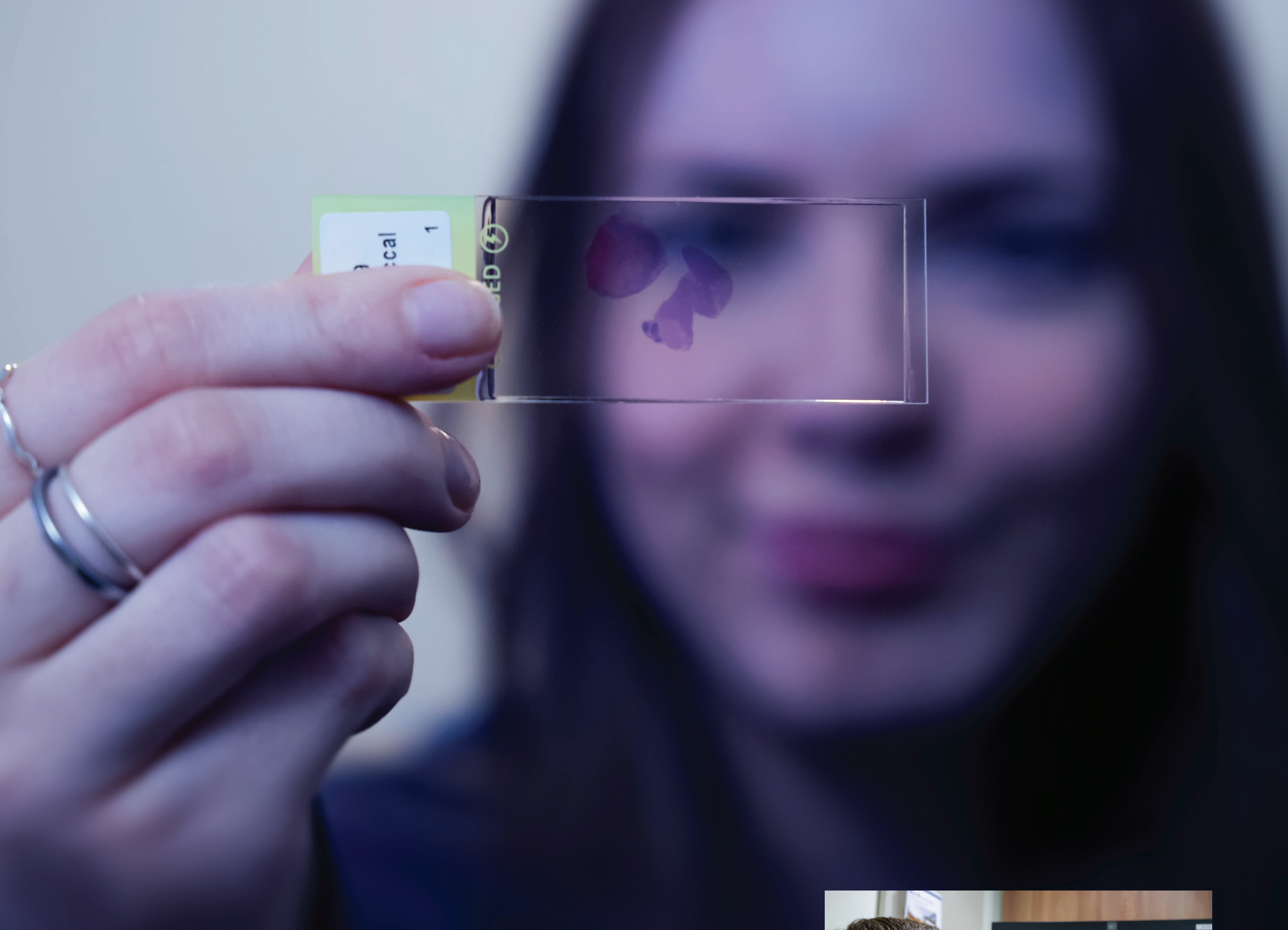
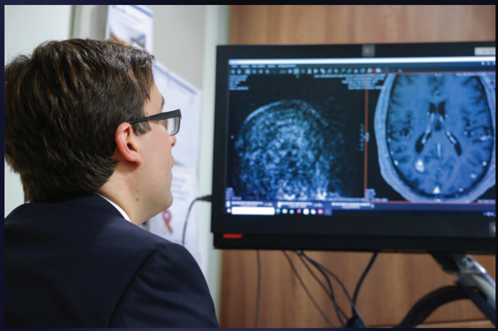
Duke Radiation Oncology
Duke University School of Medicine



DUKE RADIATION ONCOLOGY



2025 ANNUAL REPORT

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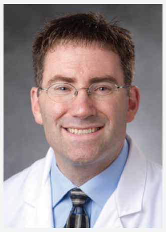

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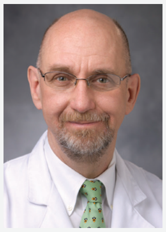

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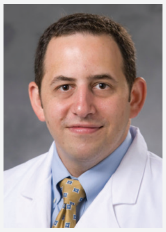

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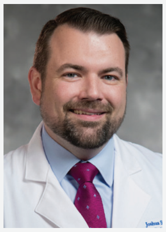

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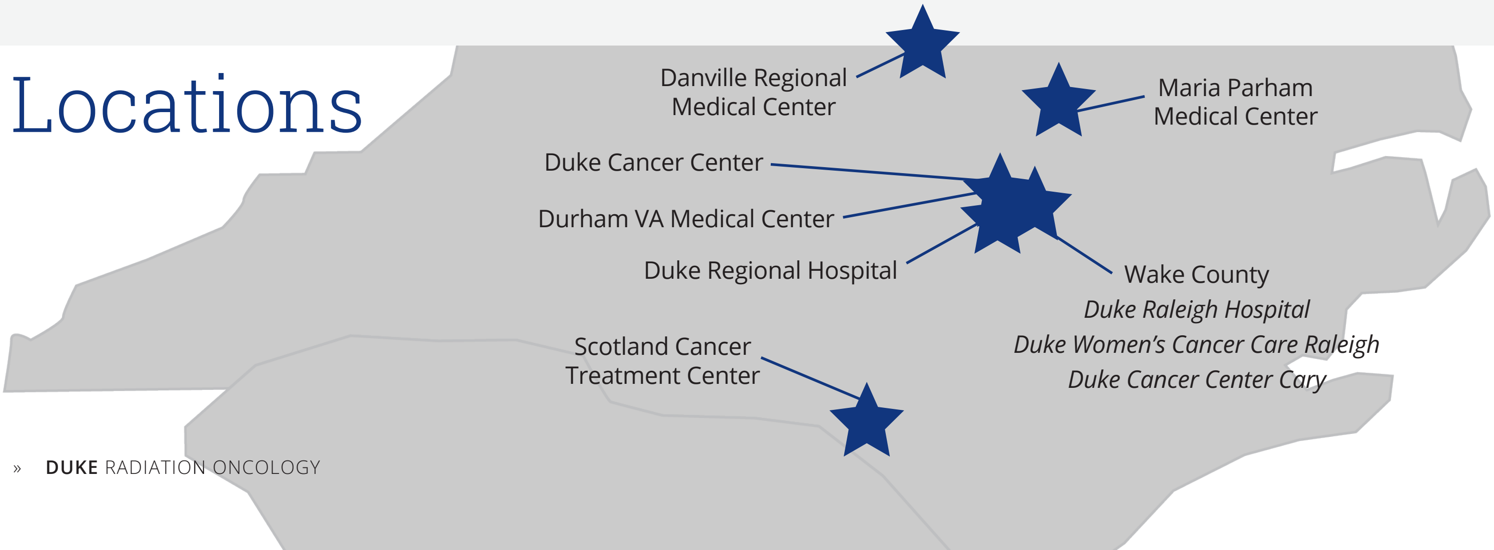


Chair's Message

It has been a privilege to serve as chair of Duke Radiation Oncology for the past two decades. Since 2004, we have grown into a globally recognized department, committed to advancing the field, fostering innovation and training the next generation of leaders in oncology. In this issue, we celebrate not only our collective achievements but also mark an important moment of transition. I am pleased to welcome Dr. Erik Sulman as the new chair of our department, effective August 1. His appointment ensures that Duke Radiation Oncology will continue to thrive across all our missions – clinical excellence, cutting-edge research and education.

This report highlights several key milestones, including the 20-year journey with the Medical Physics Graduate Program and the department's central role in the Duke Center for Brain and Spine Metastasis. You'll find stories of scientific advancement, like the way basic science interacts with scientific computing in the Lafata Lab, and reflections on leadership and impact. From the introduction of a new treatment system – the Varian Ethos with HyperSight – to a $50 million gift that will bring proton therapy to Duke, we remain at the forefront of innovation. As always, our mission is rooted in precision, compassion and results – and I'm proud of what we've built together.

Christopher Willett, MD

Acknowledgements

Thank you to everyone who contributed their time and expertise to this report, especially **Miriam Ellis**; **Wendy Graber**; **Randy Grimes**; **Lisa Hall**; **Crystal Hemminger, BSN, RN**; **Huth Photography**; **Nancy Pulliam, BSN, RN, CHPN**; **Shawn Rocco**; **J.T. Solomon, CPA, MBA**; **Heather Spencer, MHA**; **Michelle Ward**; and all those that provided quotes and information. This report was edited and designed by **Sarah Brady**.

Department Mission

We pledge to provide expert, compassionate and prompt clinical service to our patients; to generate new knowledge concerning causes, prevention and treatment of cancer; to transmit new knowledge from our clinical and laboratory research; and to actively participate in and further the missions of the Duke Cancer Institute, Duke Health and Duke University.

Recognizing Two Decades of Leadership

Since 2004, **Christopher Willett, MD**, has served as chair of the Department of Radiation Oncology; under his leadership, the Department has grown and thrived across all missions and has been recognized as a globally preeminent academic leader.

He is a graduate of Tufts University (BS, 1977) and Tufts University School of Medicine (MD, 1981). At the beginning of his career, during a residency at Massachusetts General Hospital, Dr. Willett wrote a series of seminal articles on radiation therapy for colon cancer. He continued to significantly impact the academic field, including authoring more than 400 scientific papers and reviews. He has also been involved in developing clinical protocols for both gastrointestinal cancer and intraoperative radiation therapy – two areas in which he is recognized as an international expert.

In addition to research and patient care, Dr. Willett has demonstrated a tremendous commitment to teaching, training and mentoring the next generation of radiation oncologists. In 2002, he received the Teacher of the Year Award from the Association of Residents in Radiation Oncology. In 2005, he received the Radiation Oncology Teaching Award at Duke. He has served as a mentor and reference for many trainees and has had a lasting impact on the field.

Dr. Willett is active in professional societies, including the American Society for Radiation Oncology (ASTRO), and his commitment has been recognized with honors including ASTRO's Gold Medal Award (2016); he has also been named a Fellow of ASTRO (2011).

Dr. Willett will continue to serve as the Mark W. Dewhirst Distinguished Professor of Radiation Oncology.

"Dr. Willett's contributions to patient care, research and education have greatly impacted countless lives. Having worked closely with him over the years, I have always been impressed by his thoughtful leadership through times of change and challenge, and his **unwavering commitment to clinical excellence and a culture of safety and quality**. He will leave a lasting legacy at Duke."

— **Tom Owens, MD**, Executive Vice President and Chief Operating Officer, Duke University Health System

"Under Dr. Willett's visionary leadership for the past two decades, the department has grown in both size and impact, and has **advanced in every mission from patient care to groundbreaking research**. His dedication to mentorship has transformed the careers of many trainees, and his contributions to the field, particularly in gastrointestinal cancers, have been truly pioneering."

— **Mary Klotman, MD**, Executive Vice President for Health Affairs, Duke University; Dean, Duke University School of Medicine; and Chief Academic Officer, Duke Health

"I knew very early in my residency at Duke that treating GI cancers was my calling. Dr. Willett **recognized and fostered this passion** as a trainee, provided guided mentorship throughout my early academic years, and subsequent sponsorship throughout my career. Any success I have achieved in academic medicine is, in large part, due to his investment in me."

— **Manisha Palta, MD**, Associate Professor of Radiation Oncology and residency class of 2012

"Dr. Willett has built one of the premier Departments of Radiation Oncology in the nation, and even the world. His **patient-focused approach** has resulted in significant clinical growth that has met both patient and provider needs."

— **Peter Allen, MD**, Duke University Health System Vice President for Cancer Services

"It was clear from the start that Dr. Willett had a **powerful and optimistic vision** for the department's future and that he possessed the leadership skills to make it happen. I have never had to question his motives or judgment; I have never had to question his ethics; I have never had to question his care for his faculty or for our patients."

— **Brian Quaranta, MD, MA**, Associate Professor of Radiation Oncology and residency class of 2003

"I would best describe Chris using the words that Sir William Olsen coined to describe the best physicians ... imperturbability and equanimity. What that means is that Chris is **calm and measured in the face of adversity**, and he is resilient. We will continue to benefit from his 'Osler like' wisdom as he returns to the bedside. Bravo!"

— **Richard Shannon, MD**, Senior Vice President and Chief Medical Officer, DUHS and Chief Quality Officer, Duke Health

Read about Duke Radiation Oncology's arriving hires and retirees at **duke.is/FY25**

Sulman Appointed Chair of Duke Radiation Oncology

Erik Sulman, MD, PhD, has been appointed the new chair of the Department of Radiation Oncology at Duke University School of Medicine, effective August 1.

Dr. Sulman joins us from NYU Langone Health, where he has held several key leadership positions, including vice chair for research with NYU Grossman School of Medicine's Department of Radiation Oncology and co-director of the Brain and Spine Tumor Center at NYU Langone's Perlmutter Cancer Center. He has also served as the assistant dean of physician scientist education and director of the MD/PhD Program at NYU. Dr. Sulman earned his medical and graduate degrees from Temple University School of Medicine, completed his clinical internship at Albert Einstein Medical Center and finished his residency at The University of Texas MD Anderson Cancer Center.

Dr. Sulman is a distinguished clinician and researcher with a robust background in the treatment of brain tumors and the development of novel therapeutic strategies. His research focuses on the molecular mechanisms of radiation resistance in glioblastoma and the development of targeted therapies to overcome these challenges. Additionally, he is involved in identifying molecular predictors of treatment response and improving the effectiveness of radiation therapy.

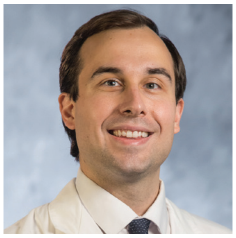
Precision, Compassion and Results: Duke Radiation Oncology at the DCBSM

by Sarah Brady

Ron Klarin's cancer journey began in Florida with a CT scan that revealed a small lung nodule – one that his doctors initially dismissed as low-risk. "They told me it was probably nothing. There was no urgency," he said.

At the time, Ron and his wife Bonnie were in the process of moving to North Carolina to be closer to family. After the move, his symptoms escalated, including severe coughing fits with any physical activity, prompting him to seek further care. A PET scan and biopsy at a hospital near his house revealed small cell lung cancer that had already spread to his bones and lymph nodes.

The initial rounds of chemotherapy were rough, leading to multiple hospitalizations. "After the first infusion, I was in the hospital for a week with sepsis. The second time, it was pneumonia and six days with chest tubes." Looking for a better option and a more coordinated approach, Ron turned to Duke.



At Duke, Ron was introduced to **Eugene Vaios, MD, MBA**, a radiation oncologist and a member of the Duke Center for Brain and Spine Metastasis (DCBSM), after an MRI revealed two metastases in his brain. "That was a blow. I was devastated," Ron said. "But meeting Dr. Vaios really changed my outlook. He put me so far at ease that I went from a state of high anxiety to, 'Okay. Let's go. Let's do it.'"

Dr. Vaios recommended stereotactic radiosurgery (SRS), a focused, high-dose form of radiation that allows for targeted treatment that spares healthy tissue, provides local control and reduces side effects. "Dr. Vaios was extremely thorough," said Ron. "We went through the scans multiple times and he explained everything in a way that made sense. That kind of attention builds trust. And I have to say, I love how he geeks out over what he does. I felt much more comfortable with SRS as opposed to whole-brain radiation," which he feared would significantly impact his cognitive abilities.

SRS treatments made a measurable difference for Ron. "Anything that has not decreased is static, and the metastases in my brain have basically been eliminated," said Ron. "There's still some inflammation and necrosis, but it's trending in the right direction."

Ron continues to receive care at Duke and remains optimistic about his progress. "Small cell lung cancer isn't easy to treat, but I'm very confident in the outcome of my treatment," he said. "Just simply, Duke is fantastic. The care you experience, especially as a cancer patient – it really makes a difference where you go for your treatment, and I've been so impressed with the quality of care I've received here."

Ron and Bonnie began donating to Duke in December 2024, and the couple recently became members of The Duke Tower Society – which honors those who have included Duke in their estate plans – when they committed a portion of their trust to the Duke Cancer Institute, with a focus on advancing cancer research. "I believe in the work being done here," Ron said. "And we want to support it in a meaningful way."

The DCBSM Model

Since its founding in 2017, the DCBSM has rapidly grown into one of the most comprehensive programs of its kind, treating patients whose cancer has spread to the brain, spine and other parts of the central nervous system. Duke Radiation Oncology is an integral part of the DCBSM team, delivering state-of-the-art SRS to patients with brain and spine metastases, as well as other complex

neurological conditions. Led by Radiation Oncology Director **John Kirkpatrick, MD, PhD**, the team has a core group of central nervous system (CNS)–specific faculty, as well as various other faculty members who perform SRS.

"We've been doing radiosurgery at Duke as a collaboration between neurosurgery and radiation oncology in earnest since the early 2000s," said Dr. Kirkpatrick. "But with the formation of the DCBSM, we've made the multidisciplinary secret sauce: adding palliative care and a strong medical oncology component to neurosurgery and radiation oncology."

At the core of the Radiation Oncology Metastasis Team is a dedicated group of clinicians committed to treating the most challenging cases with precision and empathy. "I am so proud to be part of a simply

outstanding multidisciplinary team that places top-level patient care first," said Radiation Oncology Deputy Director for Research **Scott Floyd, MD, PhD**. "I know that the brain and spine mets patients that come to Duke receive the best care provided by a thoughtful and truly caring team."

These providers routinely care for patients with multiple brain metastases – as well as other

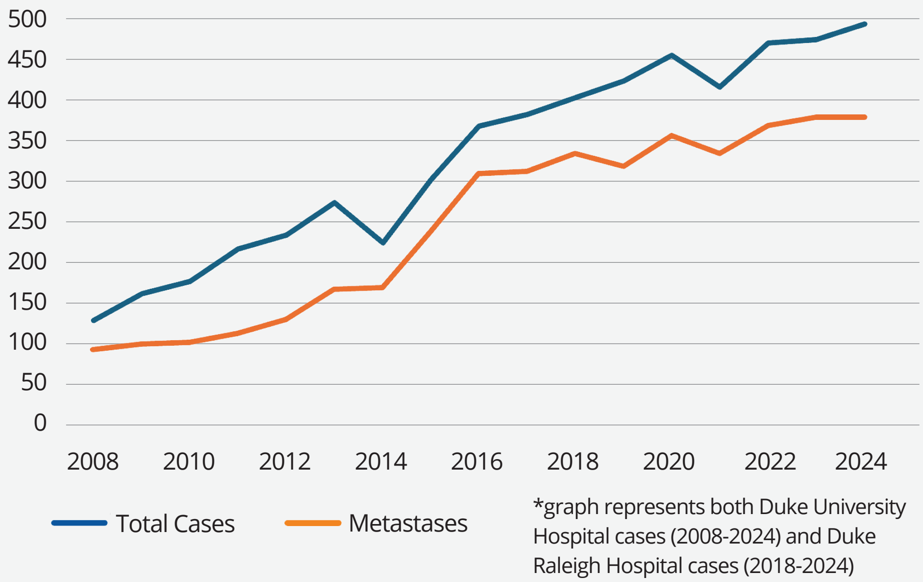
Palliative Care

In 2018, palliative care was integrated into the DCBSM as a half-day clinic in coordination with radiation oncology treatment, focused on supporting patients with serious illnesses and complex treatment plans. Since then, the service has expanded to five days a week, reflecting its increasing importance in enhancing patient care.

"The collaboration between palliative care and the DCBSM has been invaluable," said Palliative Care Director **Betsy Fricklas, PA-C, MMSc**. "It allows us to offer a holistic approach that prioritizes not only disease treatment but also symptom management and emotional well-being."

"Being part of the DCBSM has been a deeply meaningful and defining aspect of my career," she continued. "It has allowed me to make a significant difference in the lives of patients and families, offering essential care during some of their most challenging times."

Annual Radiosurgery Cases at Duke (2008-2024)



lesions like recurrent gliomas, acoustic neuromas, meningiomas and arteriovenous malformations – using SRS, "which has become a key weapon in the fight against brain, spine and base-of-skull disease," said Dr. Kirkpatrick. "Over the past 20 years, we have treated over 5,000 patients with SRS and SBRT (stereotactic body radiation therapy)."

The program's growth speaks for itself: in 2008, before the official founding of the DCBSM, Duke Radiation Oncology was treating just over 100 patients annually with SRS. By 2024, that number had surged to almost 500 patients annually, a 282% increase over a decade and a half.

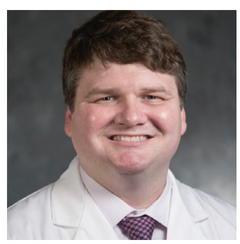
A foundation of the program has been the outstanding leadership of and support by our radiation physics team. Medical physicists – including **Justus Adamson, PhD**; **Yunfeng Cui, PhD**; **Joseph Kowalski, MS**; **Ke Lu, PhD**; **Julie Raffi, PhD**; **Anna Rodrigues, PhD**; **Chunhao Wang, PhD**; and **Yibo Xie, PhD** – play a vital role in the radiation treatment of metastatic diseases. Physicists work alongside a multidisciplinary team throughout the entire patient care process, from treatment simulation, anatomy delineation and treatment planning to pre-treatment quality assurance and image-guided verification on treatment days. "Our team is dedicated to delivering the highest quality care with efficiency and precision,"

said physicist **Chunhao Wang, PhD**. "Beyond clinical service, our physicists also lead cutting-edge research, focusing on advanced imaging methods and artificial intelligence to improve radiation treatment consistency and better monitor disease outcomes. As a physicist, I feel privileged to be part of this wonderful team, and I truly believe our patients at Duke receive the best possible radiation care."

This depth of experience – in both our physician and physicist teams – enables the team to tailor treatment strategies for individuals, optimizing outcomes and taking into account each patient's goals of care.

The DCBSM Patient Care Difference

DCBSM's model of care centers on rapid access and team-based navigation. Every patient referred to the Center is guaranteed an appointment within 72 hours. They are seen by a coordinated team of specialists – including radiation oncologists, neurosurgeons, medical oncologists and palliative care providers – on the same day and in one location. Each patient is matched with a navigator who helps streamline appointments and testing. "The treatment of patients with brain and spine metastases is often complex and requires input from



multiple medical specialists," said Radiation Oncology Deputy Director for Spine Metastases **Trey Mullikin, MD**. "Our Center excels at expediting multidisciplinary evaluations, enabling us to develop these patient-centered recommendations and ensuring that we deliver comprehensive treatment in a timely manner."

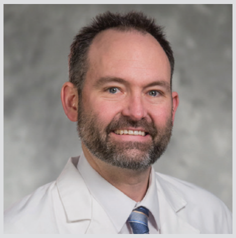
Hope – and Results

Ultimately, what sets Duke Radiation Oncology and the DCBSM apart is the unwavering commitment to excellence, innovation and patient-centered care. "Our faculty and residents are leaders nationally and internationally, driving critical research forward and translating discoveries into tangible real-world solutions for patients every day," said Dr. Vaios. "Because of the extraordinary people at Duke Radiation Oncology and the DCBSM, patients have access to best-in-class care, technology and clinical trials. This means better outcomes and a brighter future for patients at Duke and beyond."

Research, Innovation and Pushing Boundaries

"Looking forward, the really exciting part of the Center is that the research work we are doing will lead to even better results for our patients," said Dr. Floyd. Over the past decade, the core CNS radiation oncology team has received nine federal grants, eight institutional grants, 13 foundation grants and three industry or private grants.

One significant project, led by Dr. Floyd, involves a multi-institutional consortium aimed at translating therapies for neurological diseases using organotypic brain slice cultures – which holds promise for developing new treatments for disorders like glioblastoma. Another initiative is the NIH-funded K08 study led by Dr. Reitman on enhancing the efficacy of radiation therapy for pediatric brainstem gliomas by targeting ATM. Beyond federal funding, the team has entered into partnerships, like the recent collaboration with Caris Life Sciences, in which Drs. Vaios, Floyd and Reitman are investigating the potential of circulating tumor DNA as a non-invasive biomarker for glioblastoma. All of these efforts reflect the team's ongoing commitment to improving patient care through research and technology.



"The support from federal, foundational and philanthropic funding sources is critical to our mission of improving patient care for patients with brain and spine tumors," said **Zach Reitman, MD, PhD**.

New Research Insights

Major published findings in the last two years include the largest single-institution series to report outcomes with SRS and immunotherapy – and the first to evaluate long-term outcomes with dual immune-checkpoint inhibition (ICPI) – which found that offering dual ICPI to patients with melanoma or non-small cell lung cancer who are receiving SRS for brain metastases significantly improves local and distant intracranial control (*International Journal of Radiation Oncology, Biology, Physics*, 2024).

In addition, in 2025, the team found that the timing of radiosurgery and dual immune-checkpoint blockade matters. While combined modality therapy improved cancer control, patients receiving dual immune-checkpoint blockade within four weeks of radiosurgery had higher risk for symptomatic radiation necrosis, or injury and inflammation to normal brain tissue. These results from a cohort of 288 melanoma and lung cancer patients at Duke (*JAMA Network Open*, 2025) provide critical guidance for physicians to optimize the timing and sequencing of novel therapies to maximize cancer control while reducing risks for patients. Read more high-impact research at **duke.is/DCBSMstudies**.

Clinical Trials

Brain and spine metastases have often historically excluded patients from clinical trials. At the DCBSM, clinical trials are designed specifically for patients with metastases, and especially focused on personalized approaches.

From imaging techniques like quantitative magnetic resonance imaging to assess spinal metastases after SBRT (Dr. Mullikin); to exploring the diagnostic accuracy of delayed MRI contrast enhancement for radiation necrosis in brain metastases (Dr. Floyd); to trialing parenteral ascorbate-meglumine as a novel magnetic resonance imaging-guide adjunctive therapeutic for SRS (Dr. Kirkpatrick), the clinical trials offered at the DCBSM highlight Duke's leadership in precision medicine and commitment to our patients.

The Duke MPGP: 20 Years of Achievement and Ambition

by Sarah Brady

20 years. Over 340 students graduated. 260+ publications, 440+ scientific presentations, 120+ internal and external awards for students for academic and research excellence.

By the numbers, it's obvious that the Duke Medical Physics Graduate Program (MPGP) has made an indelible impact on the field in the two decades it's been in existence. Program Director and Professor of Radiation Oncology **Mark Oldham, PhD**, described how, at this milestone, it's critical to take a breath and reflect on achievements to-date – and also to dream of what may lie ahead. "There are many unsung heroes that make the program what it is, and I feel tremendous gratitude," he said. "So many students, faculty and staff have devoted hard work and effort and experienced so many moments of struggle, personal growth, human connection, joyful achievement and proud impactful scientific contribution during our time in the program."

But the MPGP of today, a thriving program that graduated 19 PhD and MS students in 2024, with a strong alumni base whose graduates have found success in the fields of clinical physics, industry and academia, didn't start this way – it took a lot of early effort to get it off the ground, spearheaded by

Founding Director Emeritus (2005-2015) **James "Jim" Dobbins III, PhD** (pictured right), and Founding Director of Graduate Studies and former Director (2015-2020) **Ehsan Samei, PhD** (pictured left).

From Early Collaborations to Formal Education

The program's roots trace back to early morning research meetings in the 1990s, where imaging physicists in the Department of Radiology and **Carl Ravin, MD** – then chair of Radiology – gathered to discuss the evolving field of digital imaging. Conversations eventually shifted toward the concept of a dedicated medical physics graduate program, housed in the Departments of Radiology and Radiation Oncology, which would help physicists in both departments "expand their academic and clinical work through collaboration," Dr. Dobbins explained, "and expand the impact of Duke scholarship on the field of medical physics as a whole."

In 2000, Dr. Samei, a newly hired medical physicist and assistant professor in radiology, re-energized discussions. "With a strong and growing cohort of

nearly 60 medical physicist faculty at Duke," he said, "the time seemed ripe for considering a new educational initiative that would better capture the strengths of Duke in medical physics into a formal training program."

Launching the program was no easy feat. A steering committee was formed, led by Dr. Dobbins and supported by Dr. Samei. A yearlong feasibility study was conducted; a preliminary proposal was created; and eventually the proposal earned the support of seven department chairs – including

Chair of Radiation Oncology **Christopher Willett, MD**, who was also a strong support for the program's creation – as well as five deans, four university committees and, finally, the Duke Board of Trustees.

that few things of value come about in life without hard work and some measure of risk."

The program welcomed its first class in the fall of 2005 after a whirlwind abbreviated recruitment season and only eight months to draft a curriculum (designed with four tracks of specialization, a first in medical physics education). By 2007, the program had secured an NIH training grant; the program was accredited by the Commission on Accreditation of Medical Physics Education Programs (CAMPEP) in 2008, and subsequently every five years since then.

Global Impact and Lasting Connections

Today, the program has become a cornerstone of medical education and research at Duke – and beyond. It's no exaggeration to say that the program has had national and international acclaim and impact. In 2008, Drs. Dobbins and Samei initiated the creation of the Society of Directors of Academic

Medical Physics Programs (SDAMPP), which continues to play a critical role in guiding medical physics educational standards nationwide. And in 2014, a second Duke medical physics graduate program, headed by **Fang-Fang Yin, PhD**, and Dr. Dobbins, was launched at Duke Kunshan University in China. In 2020, Dr. Oldham took the reins as program director, with **Joseph Lo, PhD** – professor in radiology; electrical and computer engineering; and biomedical engineering – as associate director. As the COVID-19 pandemic set in, the leadership team pivoted to continue to ensure the same level of excellence in teaching and research.

Establishing the Duke MPGP: A New Era in Medical Physics Education

On December 3, 2004, the Duke MPGP was officially minted, marking the first truly new PhD program at Duke in 13 years, and the first ever PhD program initiated from clinical departments. "There were many times when it seemed that we were at critical points when a single decision or event would determine whether we failed or succeeded," said Dr. Dobbins. "While these challenges presented risks and gave us anxiety on occasion, we remembered

My message to all future students is simple:
be curious and explore as much as possible.
The opportunities to learn via exposure at Duke are endless.

— Current MS student Lauren Neldner

In addition to concrete, measurable accomplishments, the program has other benefits. "One of the most meaningful and impactful aspects of our time in the program are the relationships and shared experiences between students, faculty, and staff at all levels," said Dr. Oldham. Students and alumni describe the program as a "close-knit family" that has such "a unique way of building friendships and bonds," and a "safe haven for students to make lifelong friends and develop relationships."

Many former students are now faculty in the program, including **Chunhao Wang, PhD**, who emphasized the strong program connections: "As an alumnus, if I have any questions, I can reach out to my classmates. It's pretty amazing that once I click send, I usually can get a reply in ten minutes. I don't think you can find this type of strong network and community everywhere. Once Duke, forever Duke."

Celebrating the Past and Shaping the Future: The MPGP's Next Chapter

"There is much to be proud and thankful for in what our program has given us and the world over the last 20 years," said Dr. Oldham. "But our anniversary celebrations are not only a celebration of the past, but also the start of the future."

Looking ahead, the program's future is bright. "It is clear we can expect great advances inspired by powerful and transformative new technologies and discoveries that are occurring throughout medicine and science," said Dr. Oldham. "Medical physicists, with their unique combination of expertise in the hard sciences and deep clinical experience, are uniquely well positioned to lead in this area and bring a promising future to fruition." Beyond technological advances, in 2021 the MPGP recruited a class that was majority female for the first time.

Alumnus **Jackie Maurer, PhD**, who was a member of one the first cohorts of students and is now a medical physicist at Bozeman Health Deaconess Cancer Center in Bozeman, Montana, recalled her time at Duke fondly: "I hope that the future of the Duke medical physics program will continue with the passion, pride and commitment that I experienced. I feel that I received an exceptionally well-rounded education and was challenged and grew in so many ways personally and professionally. I hope those values remain at the center of the program."

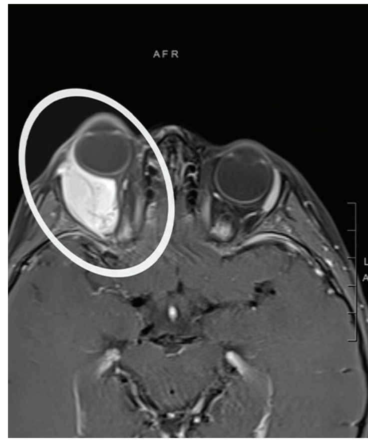
Dr. Oldham is confident that, with the strong leadership team, the cross-departmental collaborations, the exceptional student base and the feeling of "forever Duke" permeating the program, there are good things ahead. "Here's to the next 20 years!" he said. "May they be even more exciting, rewarding and impactful than the prior."

As an alumnus, if I have any questions, I can reach out to my classmates. I don't think you can find this type of community everywhere. Once Duke, forever Duke.

— Faculty Chunhao Wang, PhD

Historic Gift Will Bring Proton Therapy to Duke

by Wendy Graber



Colton Goodman was just 3 years old when he was referred to Duke after an MRI showed a growth behind his right eye. At Duke, he was diagnosed with rhabdomyosarcoma, a life-threatening muscle tissue cancer that is most often seen in children.

His doctor, **Lars Wagner, MD**, recommended chemotherapy and proton beam radiation. Proton therapy is a more precise type of radiation that has fewer side effects than conventional radiation therapy. The only catch was that proton therapy was not available at Duke, nor was it available anywhere in North Carolina. Colton would have to travel out of state for proton care.

But thanks to a $50 million gift from an anonymous donor, children like Colton will soon be able to get proton therapy at Duke. The gift is the largest philanthropic gift ever received by Duke University Health System.

"This is a historic gift, both for Duke and for the state of North Carolina," said **Vincent E. Price, PhD**, president of Duke University. "The Duke Proton Center will have a profound impact on cancer care in our region, and we are very grateful for the generous donor support that is making these advances possible."

"What makes proton therapy so desirable as a treatment is our ability to precisely target the radiation and then escalate the dose in increments to more effectively control and eradicate tumors," said **Christopher Willett, MD**, chair of the Department of Radiation Oncology. "As compared to standard X-ray radiation therapy, protons cause less damage to healthy tissue, less acute toxicity, and fewer follow-on complications. We want to reduce treatment side effects as much as possible to improve our patients' quality of life and function. For brain tumor patients that means reducing toxicity that damages cognition and in breast cancer patients that means limiting damage to heart function."

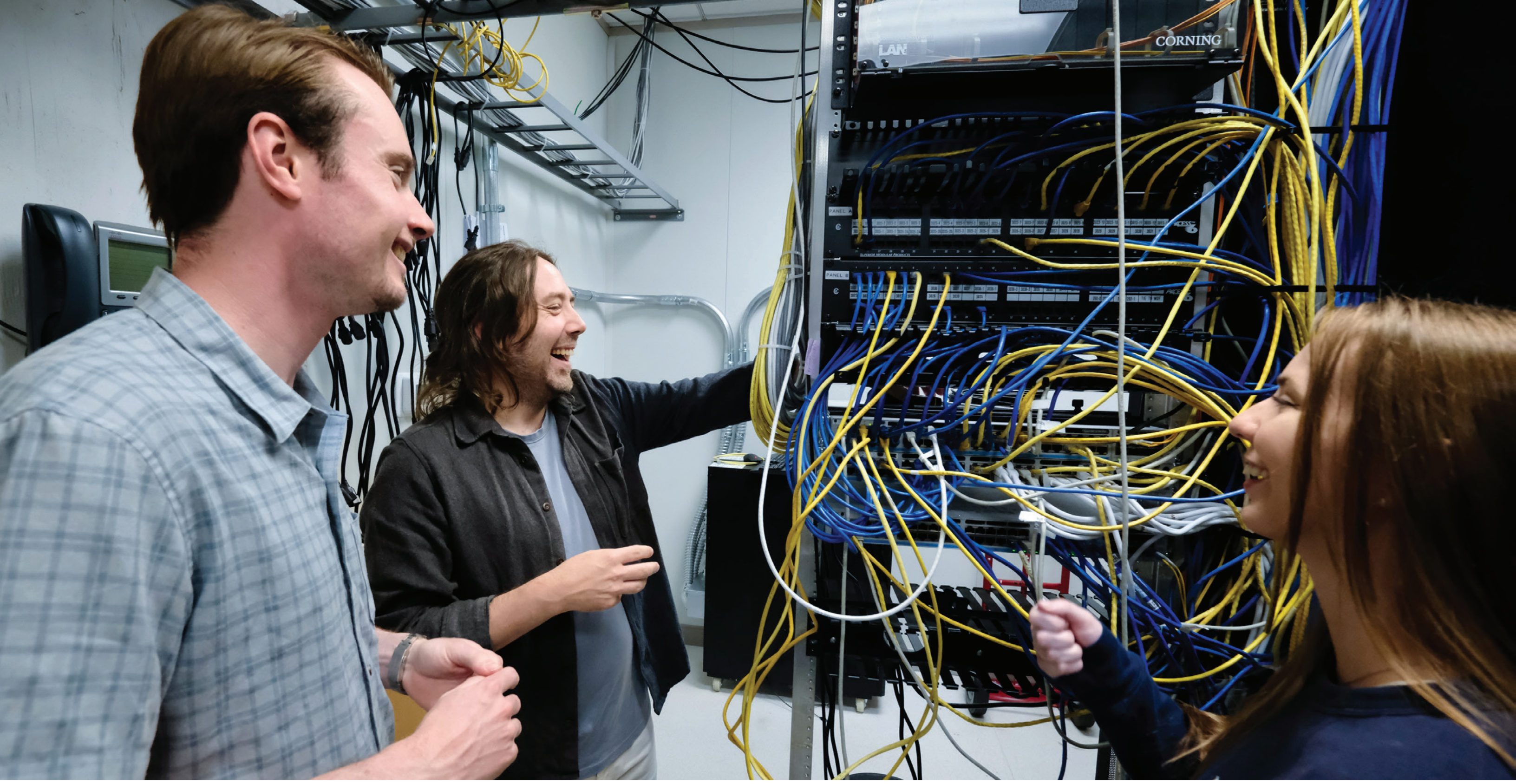
At capacity, Duke will be able to provide proton therapy to about 800 pediatric and adult patients each year. The facility is expected to open by 2029 with a total projected cost of $120 million. Read the full story at **duke.is/ProtonTherapy**.

New Treatment System: Varian Ethos with HyperSight

In January 2025, Duke Radiation Oncology installed a new treatment system – the Varian Ethos with HyperSight, which is the first system of its kind in the state. The Ethos offers image-guided radiation therapy (IGRT) with a faster treatment time than other machines and superior imaging quality.

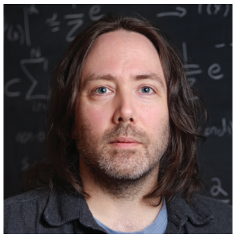
The system also offers real-time adaptive radiation therapy. Unlike traditional radiation therapy, in which a plan is set prior to radiation and followed until treatment is completed, the Ethos system allows for patients' treatment to be adjusted during treatment based on anatomy and other factors.

"With the Ethos system being the first of its kind in the state, this marks an incredibly exciting moment for us as we embark on a new chapter in providing adaptive therapy to our patients," said **Mohamed Badawi, CSTM, MBA**, technology and facilities administrative director and QI program director. "I am deeply grateful for the exceptional teamwork and collaboration that made this project a reality."



Basic Science Meets Scientific Computing in the Lafata Lab

by Sarah Brady



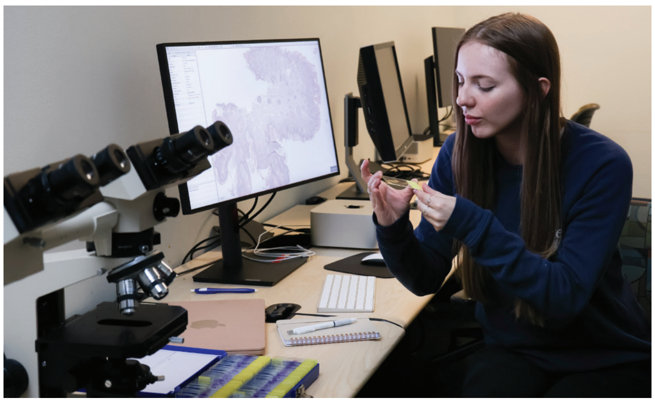
In the lab of scientist **Kyle Lafata, PhD**, research isn't confined to a single discipline – it spans high-performance scientific computing, experimental radiation biology and applied mathematics, forming an interdisciplinary approach where each part informs and strengthens the others.

"We do a little bit of everything" said Dr. Lafata, the Thaddeus V. Samulski Associate Professor of Radiation Oncology. "I think what makes the lab unique is the different areas of science we stitch together. We use many different mathematical and computational techniques – differential equations, stochastic processes, deep learning, agent-based models – to interrogate tumor dynamics, immune responses and radiation effects. At the same time, we conduct complementary experiments using systems biology approaches – mouse models, advanced imaging, digital pathology, single cell multiplex sequencing – to investigate the biological mechanisms driving radiation resistance."

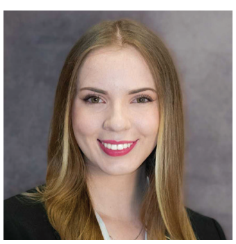
This integrated approach is central to Dr. Lafata's research program, which is federally funded on multiple grants from the National Institutes of Health and the Department of Defense. His three medical physics PhD students exemplify the lab's strategic commitment to multidisciplinary science. **Casey Heirman** tends towards the experimental – as Dr. Lafata explains it, "she's at the bench, working with mice, analyzing data – she's truly hands-on." At the other end of the spectrum is **Jack Stevens**, who has a physics background and works with simulations, exploring tumor growth modeling and response to radiation using applied mathematics. Bridging the experimental and theoretical is **Breylon Riley**, who works with advanced computational algorithms and the data science side of things.

For Dr. Lafata, the strength of this integrated lab model lies in the interplay between data-driven and mechanistic approaches. "While machine learning and other purely data-driven methods are highly effective at uncovering complex patterns, they typically do not capture underlying biological or physical mechanisms," he explained. "On the other hand, theoretical models offer mechanistic insight but are limited by oversimplification and ill-conditioned solutions. Hybrid models offer the best of both worlds by combining the mechanistic insight of theoretical frameworks with the flexibility of data-driven methods." The emerging field of physics-informed machine learning embeds physical laws into neural networks to improve generalization and ensure physically constrained predictions.

"Merging physics-informed machine learning with experimental cancer biology data creates a synergistic framework that leverages both real-world evidence and mechanistic understanding," he said.

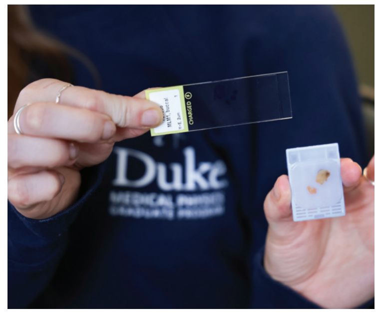


Beyond the Bench: Computational Radiation Biology



"I've always loved medicine and anatomy," said **Casey Heirman**, "but in college, physics caught me by surprise." As an undergraduate student, Casey chose to study both biology and physics, an unconventional combination that ended up defining her future. "I didn't even know medical physics was a field," she said. "But once I discovered it, it felt like everything I was interested in – everything I was good at – came together in one place." That realization led her to the Duke Medical Physics Graduate Program, and to the Lafata lab. "So many medical physics labs are very physics-heavy," said Casey. "I wanted to stay connected to biology – to the wet lab, to the exciting biological questions, so when I read that Dr. Lafata's work involved mouse models, I got really excited."

"When I joined the lab, I remember saying to Dr. Lafata, 'I really want to be part of the wet-lab side of our mission; is there any way I can work with the researchers doing mouse experiments?'" Dr. Lafata liked the idea and set Casey up with collaborating physician-scientists **Yvonne Mowery, MD, PhD**, and **Tammara Watts, MD, PhD**. "Dr. Lafata tailored the project to what I was excited about and introduced me to an incredible mentorship team, and that made all the difference," said Casey. "He didn't just let me bring my biology background to the lab – he made space for it and created projects around it. And I've seen him do the same thing with other students, too. That's why our lab is so dynamic. We're all working on different parts of the same problem, but from the angles that excite us most."

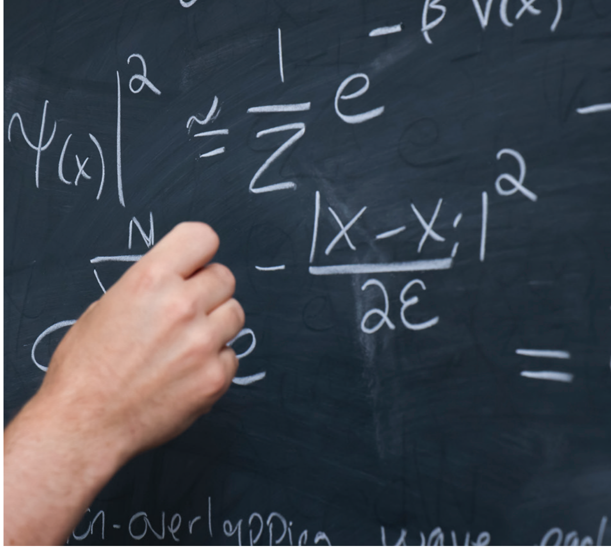


Casey's current research centers on using mouse models of head and neck cancer to explore whether imaging data – specifically PET/CT and digital pathology – can be analyzed using advanced computational algorithms to probe underlying biology and predict radiation response. "What I really like about working in the Lafata lab is that we all have our different niches. And we're constantly in conversation; if my lab mates need to better understand our experimental results or want to brainstorm the biological rationale of their models, I can help. If I need help writing computer code, they're only a cubicle away."

Applied Mathematics: Simulating Dynamic Tumor Behavior

For **Jack Stevens**, theory became most compelling when it stopped being theoretical. At the University of St. Andrews in Scotland, he trained in mathematics and theoretical physics before deciding to pivot toward something more applied. "I really enjoyed the analytical side of physics, but I was searching for a more tangible application." Medical physics – especially its overlap with radiology and oncology – offered that bridge.

Drawn to Duke's reputation for combining a research-heavy experience with clinical problems, Jack eventually joined Dr. Lafata's lab, where his work in applied mathematics is a critical piece of



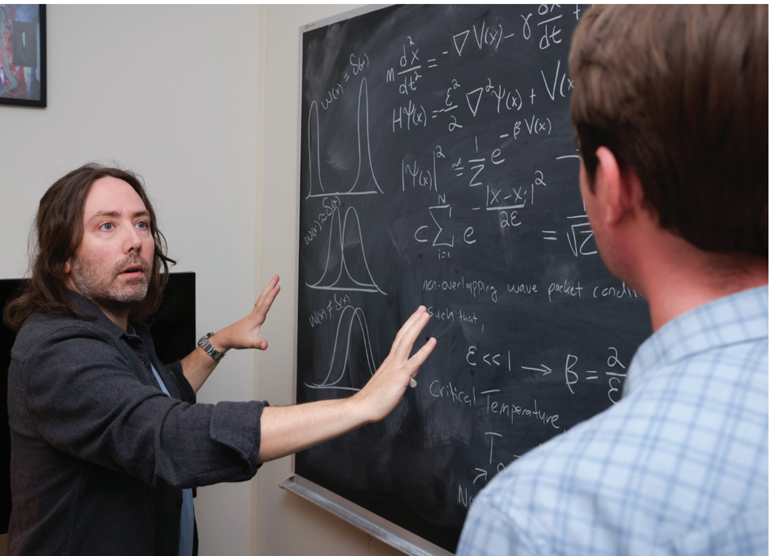
the lab's current science. "I think what really stood out to me when I learned about Dr. Lafata's work was the opportunity to use the tools I already had – differential equations, mathematical modeling – and apply them to challenges in cancer imaging and treatment."

Jack's current research sits at the intersection of quantitative imaging and simulation science. Using advanced mathematical tools like Fokker-Planck dynamics, he's developing methods that help better understand how cancer changes on medical images to simulate tumor evolution during radiation therapy. "The first big project I worked on was tied to a clinical trial at Duke involving patients with oropharyngeal cancer," he said. "These patients had imaging done before and during treatment, but we wanted to simulate what happened to patients in between the two scans."

Generating these "*in between*" images allow researchers to extract radiomic features over time, potentially identifying new biomarkers that better predict how tumors will respond to therapy. Jack's recent work extends this further, dividing tumors into spatial "habitats" that could one day help clinicians target treatment more precisely. "The ultimate hope is to make radiation therapy more personalized, and spare side effects of unnecessary dosing," he said.

> "It's rare to find a lab that spans this **full spectrum**. But it's exactly what makes our work more robust, relevant and hopefully, one day, **clinically impactful**.

Jack is quick to emphasize how essential the interdisciplinary structure and collaboration of the Lafata lab is to his work. "Having people like Casey, who's collecting this experimental data in real-time, and Breylon, who's testing our biomarker robustness using computational techniques – it's incredibly valuable, because both of them are invested in better understanding the underlying biological aspects of our work" he said. "For example, I've used data from Casey's animal model experiments to validate my simulations, and insights from Breylon's sensitivity analyses have helped me account for uncertainties in imaging parameters."



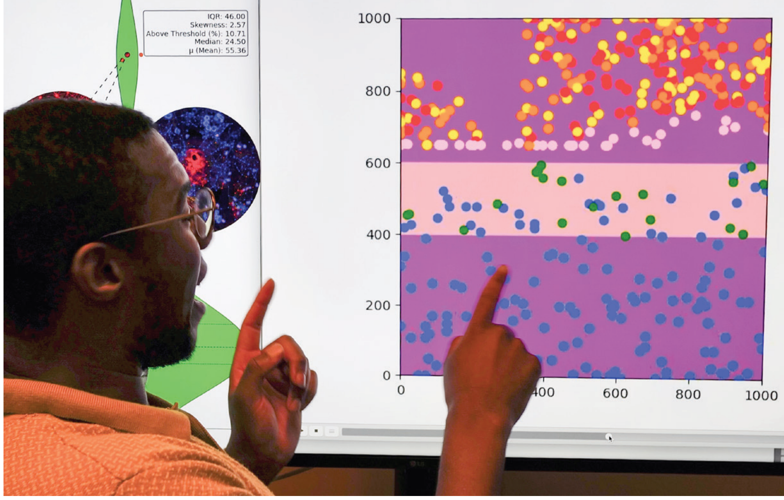
All this is to say, in Dr. Lafata's lab, theory doesn't exist in a vacuum – it's part of the feedback loop where computation, experimentation and simulation all inform each other. "It's rare to find a lab that spans this full spectrum," said Jack. "But it's exactly what makes our work more robust, relevant and hopefully, one day, clinically impactful."

Data Integration: Decoding Multiscale Tumor Biology

When **Breylon Riley** first stumbled across the field of medical physics, it was via a Google search. "I literally just typed in 'medicine' and 'physics' and medical physics popped up," he said with a laugh. That search led him from an applied physics undergraduate path at the University of California, Davis to the Duke Medical Physics Graduate Program – and to the Lafata lab, where he's been working for the past five years. Breylon's work stands at the intersection of imaging, pathology and transcriptomics, with a focus on head and neck squamous cell carcinoma. "Dr. Lafata recognized my interest in some of the non-traditional aspects of medical physics – not strictly radiation therapy, not strictly diagnostic imaging," he said. "So, I guess you can say what drew me in to the Lafata lab initially was the idea of going into this uncharted territory."

Breylon's research explores multiscale phenotyping, or investigating tumors from the level of radiological imaging all the way down to gene expression. His early work involved extracting radiomic features from PET/CT scans to predict treatment outcomes, though that scope has since expanded. His current projects aim to understand how spatial cell architecture and underlying gene expression impact a tumor's metabolic response to therapy – an effort that could help explain why immunotherapy has had limited success in improving survival rates for head and neck cancer patients, even as it proves successful with other cancer types. "We're trying to figure out what's going on in the tumor microenvironment and if we can use that knowledge, these measurements of gene expression, of cell topography, of tumor metabolism, to personalize treatment."

Breylon occupies a kind of middle ground between Casey and Jack, drawing on both wet-lab data and computational analysis. "I like to think of myself as squarely between them," he said. "Jack and I are constantly thinking about what's hidden in the data that the human eye can't see. And Casey's work helps validate those ideas with real biological systems."



That collaborative spirit is what keeps the research both fresh and grounded. "You're not just solving a problem in a vacuum," said Breylon. "You're building something together."

Toward New Frontiers: Cancer's Digital Revolution

After several years of foundational work in mathematical modeling, computational phenotyping and experimental cancer biology, the team is channeling these strengths into a unifying vision: digital twins of tumors. "We've started developing mechanistically informed and data-calibrated digital twins as virtual representations of tumors and their microenvironment," said Dr. Lafata. "Grounded in applied mathematics and informed by imaging, pathology and molecular data from preclinical and clinical sources, these models can serve as a data-driven simulation framework for mechanistic research, drug screening and biomarker discovery."

This work represents a natural progression of the lab's multidisciplinary efforts and provides a promising framework to better study tumor behavior and therapeutic resistance.

The Lafata lab is located in Hock Plaza within the Multiscale Imaging Research Laboratories – a joint venture between the Departments of Radiation Oncology and Radiology at Duke University.

Newsmakers

Blitzblau, Chino designated FASTRO

Rachel Blitzblau, MD, PhD, and **Junzo Chino, MD**, were among the 48 members of the American Society for Radiation Oncology (ASTRO) to be named Fellows for 2024. The ASTRO Fellow designation, FASTRO, honors individuals who have contributed to the Society through committee work, other volunteer service and to the field of radiation oncology in the areas of research, education, patient care or leadership.

Dr. Chino was also designated a Fellow of the American Brachytherapy Society (FABS) at the World Congress of Brachytherapy in July. Dr. Chino joins **W. Robert Lee, MD, MS, MEd** (designated FABS in 2017, the inaugural class), as our Department's FABS.

Lee awarded U01 for research on severe radiation injury

Chang-Lung Lee, PhD, was awarded a $2.4 million, five-year U01 grant by the NIH National Institute of Allergy and Infectious Diseases to support the investigation of lethality from radiation-induced damage to the gastrointestinal (GI) system, also known as GI acute radiation syndrome (GI-ARS). Dr. Lee is the contact PI on the grant, which runs through November 2029; co-PIs on the grant are **Jatin Roper, MD**, and previous faculty member **David Kirsch, MD, PhD**.

GI-ARS is a major cause of mortality after radiological disasters, including nuclear accidents or terrorist attacks. However, no FDA-approved medical countermeasures are available to mitigate GI-ARS beyond standard supportive care. "The long-term goal of this project is to develop novel therapies that promote clusterin-mediated regeneration of the small intestines following severe radiation injury," said Dr. Lee. "We anticipate that our findings will have significant and broad impacts on the rational design of medical countermeasures for mitigating GI-ARS."

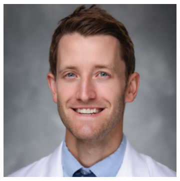
Eyler receives V Foundation grant

Christine Eyler, MD, PhD, has been awarded a V Foundation for Cancer Research "V Scholar Award" grant for her research on deciphering drivers of cell changes in response to rectal cancer radiation. The V Scholar Awards program is part of "A Grant of Her Own: The Women Scientists Innovation Award for Cancer Research" initiative; this year, 15 women scientists were awarded V Foundation grants. Dr. Eyler's specific grant is meant to invest in early career researchers with cutting-edge ideas; she will receive $600,000 over three years.

Vaios awarded K38 grant

Eugene Vaios, MD, MBA, was awarded a NIH Stimulating Access to Research in Residency Transition Scholar (StARRTS) K38 Career Development grant for his project "Cell-Free DNA Methylation Patterns as a Biomarker for Tumor Biology and Clinical Outcomes for Glioblastoma Patients." The StARRTS program is intended to provide support for continued research and career development opportunities for clinician-investigators who have completed the Stimulating Access to Research in Residency (StARR) R38 program. Dr. Vaios will receive $200,000 over the next two years. His mentors at Duke include **Scott Floyd, MD, PhD**; **Kyle Walsh, PhD**; and **Mustafa Khasraw, MD**. Dr. Vaios also received a 2024 DCI Pilot Award and a 2025 American Cancer Society Award to fund scientifically complimentary aims.

Hendrickson awarded Strong Start funding



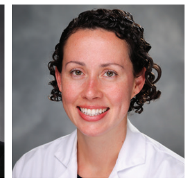
Congratulations to **Pete Hendrickson, MD, PhD**, who is one of five faculty members from the Duke University School of Medicine to receive a 2025 Physician-Scientist Strong Start award. Dr. Hendrickson will receive $120,000 annually for three years.

"My research focuses on a sarcoma subtype driven by a novel gene fusion called CIC::DUX4 sarcoma," said Dr. Hendrickson. "This award will support efforts to develop genetically engineered mouse models of this rare cancer and to characterize novel tumor-specific genetic vulnerabilities that leverage oncogenic hyperactivation. Ultimately, these initiatives will uncover new targets for precision therapy in pediatric sarcoma and provide a platform for rapid and effective clinical translation."

Floyd Lab receives $100,000 grant

Ian's Friends Foundation (IFF) is a nonprofit organization dedicated to funding novel pediatric brain tumor research. In September 2024, IFF held the 2024 WhatIFF Symposium, which featured doctors, clinicians and researchers from leading institutions around the globe, including **Scott Floyd, MD, PhD**, and lab members. In a Shark Tank–style event, participants pitched ideas for advancing pediatric brain cancer treatment. The top three projects received a grant of up to $100,000 each. Dr. Floyd and his lab were selected as winners; "the presentation yielded great promise with FLASH radiation and its capacity to deliver high doses of radiation while sparing healthy tissue, thereby increasing the potential for enhanced therapy and laying the groundwork for the delivery of combinational therapies."

Radiation therapy physics residency program CAMPEP reaccredited



The accreditation of Duke's radiation therapy physics residency training program has been renewed by the Board of Directors of the Commission on Accreditation of Medical Physics Education Programs (CAMPEP) through 2028. The program was initially accredited in 2009 and this is the third renewal. We extend our appreciation to program co-directors **Yongbok Kim, PhD**, and **Anna Rodrigues, PhD**.

Oldham reappointed director of MPGP

Mark Oldham, PhD, has been reappointed as director of the Medical Physics Graduate Program (MPGP). Dr. Oldham has been actively involved in teaching within the MPGP for more than 15 years.

Vaios, Floyd, Reitman to collaborate on pilot study

In 2022, **Eugene Vaios, MD, MBA**; **Scott Floyd, MD, PhD**; and **Zach Reitman, MD, PhD**, opened a biorepository trial to collect plasma samples from patients with primary and metastatic brain tumors receiving radiation therapy. The aim was to use these samples to identify liquid biomarkers that correlate with tumor biology, treatment response and clinical outcomes. After months of discussions, Duke Radiation Oncology entered a partnership with Caris Life Sciences, which will support a pilot study using the collected plasma samples to explore the potential of circulating tumor DNA (ctDNA) as a non-invasive biomarker for patients with glioblastoma.

"We hypothesize that ctDNA levels in plasma will correlate with tumor burden on MRI, and that changes in ctDNA during radiation therapy may reflect treatment response and predict clinical outcomes, such as progression-free survival," said Dr. Vaios.

Caris will use their FDA-approved assay to detect ctDNA levels in the blood, which may help distinguish recurrent tumor versus inflammatory changes; the goal of the project is to develop a non-invasive liquid biopsy surveillance platform for patients with brain tumors. Eventually, the data may pave the way for future clinical trials to validate these findings and potentially expand the application of this research to other primary brain tumors and patients with brain metastases.

Duke Radiation Oncology
BY THE NUMBERS

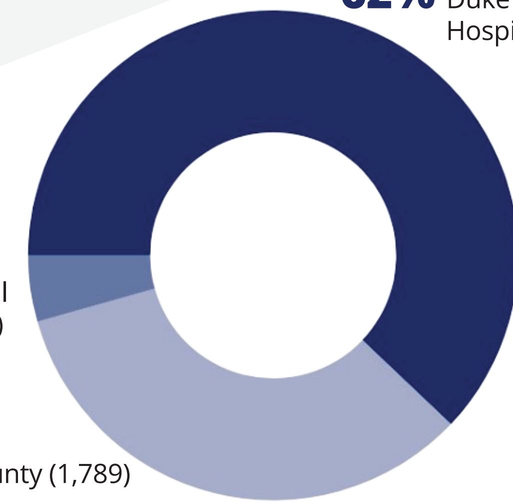
Patient Care

Our technology
*Duke Radiation Oncology–owned machines

13 linear accelerators
- **8** TrueBeam
- **3** STx Radiosurgery
- **1** Clinac 2100
- **1** Ethos-Adaptive RT

5 dedicated CT scanners
1 dedicated PET-CT scanner
1 dedicated MRI scanner (3T)
2 Varian GammaMed afterloaders
1 dedicated Mobil CT scanner

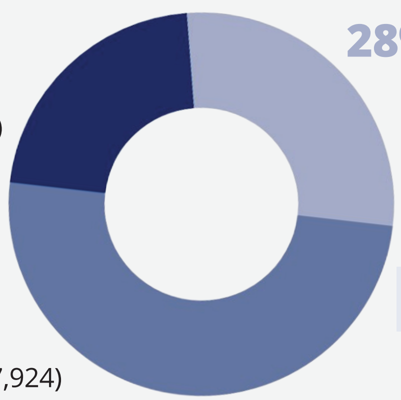
62% Duke University Hospital (3,313)
4% Duke Regional Hospital (233)
34% Wake County (1,789)



Annual new treatment starts
5,335, showing 7.2% overall growth since 2023; data represents calendar year 2024

Research

22% Nonprofit ($928,433)
28% Industry and other ($1,184,697)
50% NIH ($2,087,924)



857
5-year clinical trial accrual

Total research awards
$4,201,054; data represents financial year 2024

Education

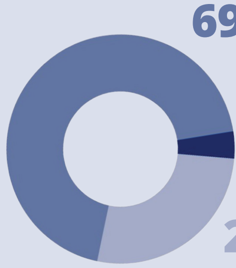
19 years in operation

96% ABR certifying exam pass rate

Postgraduate job placement

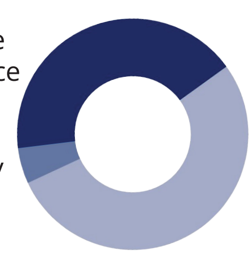
Radiation Therapy Physics Residency
2006-2025; 30 graduates

69% Academic
4% Industry
27% Clinical



Radiation Oncology Residency
1983-2025; 101 graduates

42% Private practice
5% Military
53% Academic



Ranked **#16** nationally

Ranked **#4** in the South