SPRING/SUMMER | 2024

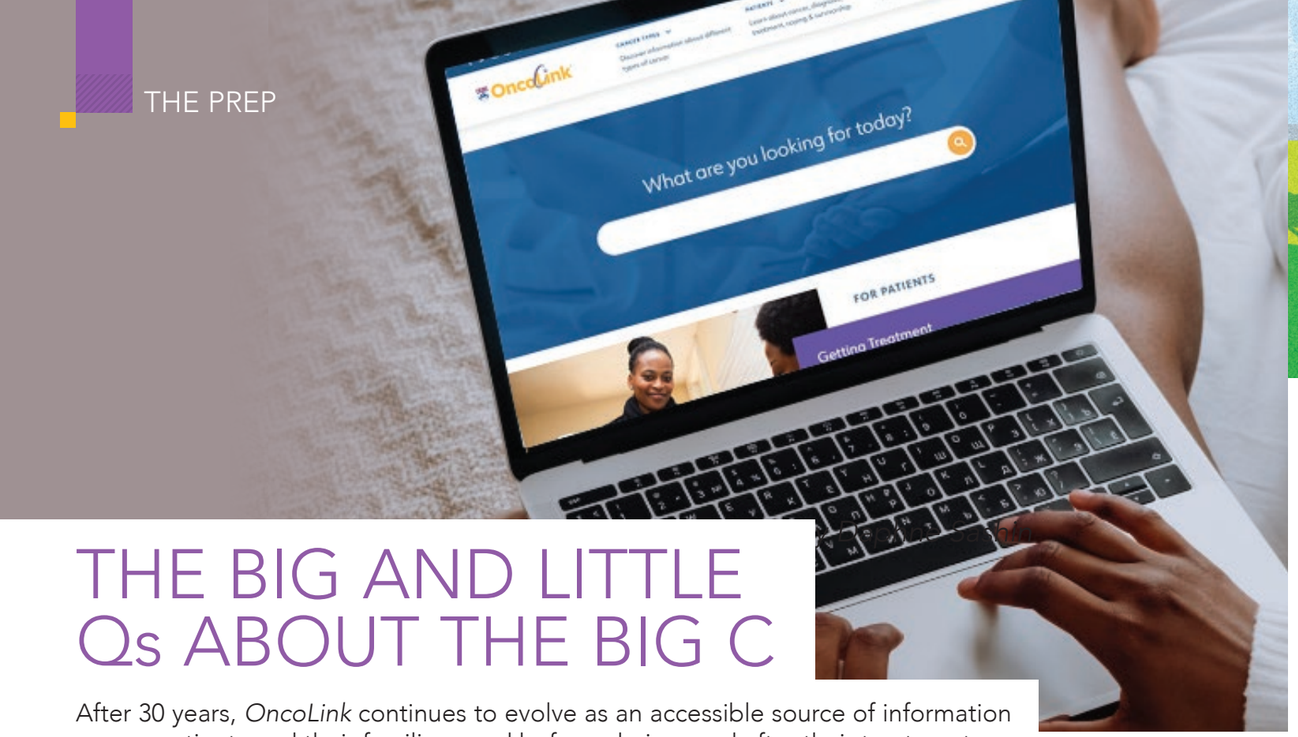
PENN Medicine

BEING GREEN

THE ROAD TO BECOMING THE NATION'S MOST ENVIRONMENTALLY FRIENDLY HEALTH CARE SYSTEM

Plus:
Proton Power: The World's Busiest Proton Therapy Center Keeps Pushing the Boundaries

LGBTQ+ Health Care in the Spotlight



THE BIG AND LITTLE Qs ABOUT THE BIG C

After 30 years, *OncoLink* continues to evolve as an accessible source of information cancer patients and their families need before, during, and after their treatment.

When Heather Badt and her husband learned within a week and a half of each other that they both had cancer, she felt like she had another question every hour.

"There were all these different components beyond what is the cancer or what is chemo—like all the symptoms and side effects that were impacting our quality of life, and mental health pieces we were experiencing—those were our real day-in and day-out needs," Badt said.

Badt turned to the Internet with her nagging but non-emergency queries. She noticed one site often appeared high in the search results: Penn Medicine's *OncoLink* (OncoLink.org), a massive library of patient education that seemed to have answers to every possible question.

Launched in the spring of 1994, *OncoLink*'s mission has always been "to be the premier website for cancer information," available when and where it's most useful to patients and providers, said James Metz, MD, Penn Medicine's chair of Radiation Oncology and *OncoLink*'s executive director. The *OncoLink* staff takes pride in the fact that all site content is created and vetted by Penn oncology professionals who know what patients need at every stage.

By 2020, as health care had become more patient-centered, over half the site's users were nurses looking for reliable material to educate patients. In response, the *OncoLink* team had an app built inside PennChart so that Penn Medicine staff can pick whatever handouts they want to share, and the information is seamlessly added to the patient's online portal. That means these days, patients like the Badts don't even have to search for the information.

Looking ahead, the team is thinking about how to deliver more personalized content to patients, through artificial intelligence, to make it even easier for patients to receive the information they specifically need, Metz said.

"After 30 years, we're still innovating, doing novel stuff, and I'm excited about where this goes in the next 30 years. I have no doubt we will continue to lead the way."

Read more online at PennMedicine.org/blog

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PENNMEDICINE
SPRING/SUMMER 2024 / VOLUME XXXIV NUMBER 2

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How 'One Penn Medicine' Makes Care Better

Over the course of three weeks this spring, a phalanx of consultants in an unglamorous specialty took a thorough behind-the-scenes tour of Penn Medicine's loading docks, storerooms, clinical labs, and patient rooms. Their goal was to better understand the trajectories of trash cans. Specifically, they examined where trash, recyclables, and other waste materials flow, where they end up, and how they can be better managed. The audit team traveled through all six of Penn Medicine's acute-care hospital entities and several outpatient facilities, spanned hundreds of miles across the region, and also included more than two dozen hospital personnel, from environmental services managers to senior administrators.

This waste audit was an important part of Penn Medicine's ongoing effort to become the nation's most environmentally friendly health care system—the focus of this issue's cover story (see page 16). However messy, complex, or difficult it may be to conduct a thorough audit of a complex system, the insights gleaned in this way can make a big difference in building a systemic solution.

This comprehensive approach also represents an important aspect of how health care can work better, and smarter, by looking at all the parts to improve an entire system. Doing so is essential as Penn Medicine works to implement its 2023-2028 strategic plan, "Serving a Changing World."

Developing a stronger "systemness" in both operations and culture across one Penn Medicine has been a priority within this organization for some time. As an organizing principle, it is typically capitalized as a formal term, "One Penn Medicine," and serves as an imperative for work at every level. It is only by pulling together in one direction that we can begin to solve some of the most vexing challenges in medicine.

Turning Discovery Into Treatments

One case in point is turning biomedical research into medicines available to patients nationwide. Going back almost two decades, grim discussions swirled on the national stage about the "valley of death," a drop-off in the progress of research that happened in between basic scientific discoveries made in research labs and the ultimate goal of translating those findings into new treatments and cures for diseases. As Jonathan A. Epstein, MD, interim executive vice president of the University of Pennsylvania for the Health System and dean of the Perelman School of Medicine, recently remarked, "We listened to that debate and did something about it. We took a series of steps that made us the best place for translational research." For evidence of that success, look no further than the growing, carefully vetted list of FDA-approved treatments that trace back to research advancements made at Penn Medicine (see page 8).

A waste audit tour of HUP included both the inpatient hospital buildings and the Perelman Center for Advanced Medicine.

Bringing care within patients' Reach

Meanwhile, Penn Medicine has grown its physical presence thoughtfully across a wide geographic region in the past decade, providing access to care for patients from the Susquehanna River to New Jersey. Doylestown Health may be the next new piece of UPHS, pending a review process underway this year (see page 6).

This growth is designed to diversify and strengthen the types of care offered in different places in order to make "One Penn Medicine" a greater system than just the sum of its parts.

Penn Medicine's investment in cancer care as a system exemplifies this principle. Where once patients had to travel to Philadelphia from across the region to get the most advanced cancer treatments, Penn Medicine has focused on opening doors to care closer to where patients are. Sometimes, this even means that chemotherapy or post-surgical care can be delivered at home. Or, for radiation therapy, proton therapy is available to patients at three locations, still leveraging the centralized treatment planning expertise with the world-leading team at the Roberts Proton Therapy Center in Philadelphia, through a unique hub-and-spoke model (see feature story on page 28).

This model brings to life a key pillar of Penn Medicine's strategic plan: to make care easy and put it within reach. Becoming the nation's most environmentally friendly health system is another key goal of the plan.

The idea of working together as "One Penn Medicine" makes it possible to soar toward these lofty goals because when we move together, we can move in one direction—for the good of patients, the wider community, and the planet.

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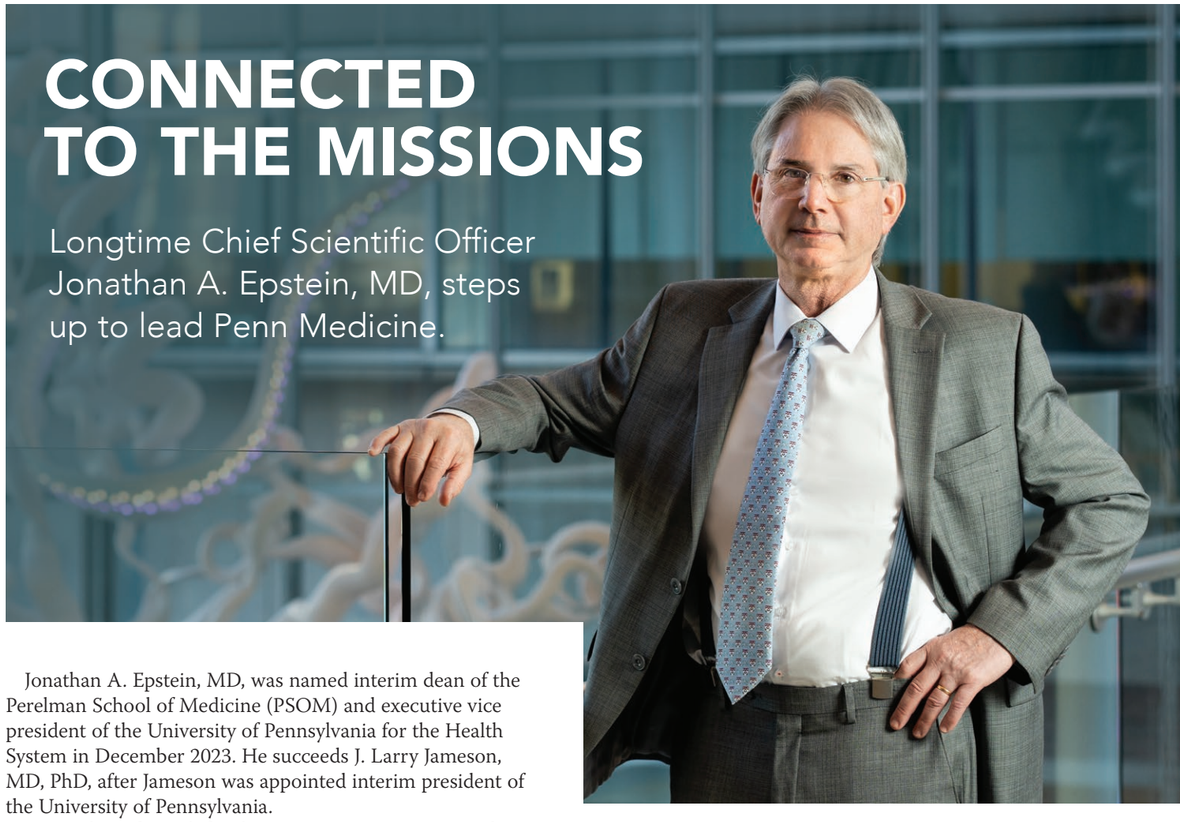
CONNECTED TO THE MISSIONS

Longtime Chief Scientific Officer Jonathan A. Epstein, MD, steps up to lead Penn Medicine.



Jonathan A. Epstein, MD, was named interim dean of the Perelman School of Medicine (PSOM) and executive vice president of the University of Pennsylvania for the Health System in December 2023. He succeeds J. Larry Jameson, MD, PhD, after Jameson was appointed interim president of the University of Pennsylvania.

A member of Penn's faculty since 1996, Epstein spent his first decade as an attending cardiologist at Penn Medicine and the Corporal Michael J. Crescenz Department of Veterans Affairs Medical Center, while conducting research on the cellular mechanisms of heart disease. In 2006 he was offered the opportunity to become chair of Cell and Developmental Biology, a basic science department—a rare leadership role for a clinical faculty member. He rose to become PSOM's chief scientific officer (CSO) and executive vice dean for research in 2015 and added a post as CSO for the University of Pennsylvania Health System in 2021, to reflect the expansive nature of Penn Medicine's research portfolio across its clinical enterprise.

The transition from scientific leadership to overseeing all of Penn Medicine's mission areas is one he has embraced with pride and excitement. He is a steadfast booster for the aims of the 2023-2028 strategic plan, *Serving a Changing World*, which sets a path for Penn's medical innovations to deliver care that the world needs. The connection between the institution's research and clinical missions is especially evident in its growing renown as an engine for FDA-approved new therapies that got their start with bold ideas incubated in our own laboratories and clinics. (See more in "A New Measure of Research Impact" on page 8.)

"I think there are more translations of fundamental new discoveries into real therapies for patients happening here at Penn than at any other medical center in the world right now," Epstein said. "These successes that include most prominently CAR T cells, mRNA vaccines, and gene therapy for blindness, have helped to transform the culture such that today's physicians and scientists at PSOM have the confidence and motivation to not only disseminate discoveries, but to turn them into life-saving therapies at an unprecedented pace and frequency."

Epstein's own work, using mRNA to transiently create CAR T cells in the body to fight heart disease, is advancing through preclinical research and may be ready for human trials as soon as next year.

While keeping the future of medicine in his sights, Epstein holds the patient's perspective of Penn Medicine at the center of it all—and that element is also personal. "I have never learned so much about doctoring as when I needed care," he said, reflecting on his own past cancer treatment. "I learned the importance of every act of kindness, of our many devoted staff, of those who are often unseen. Penn Medicine is full of quiet gifts and daily generosity that change lives."

LEADERSHIP TO MEET THE NEEDS OF LGBTQ PATIENTS

Photo by Margo Reed

"Patients should be able to go anywhere at Penn Medicine and know they will get LGBTQ+ affirming care."

"So, do you have a girlfriend?"

It's what Kevin Kline, MD, was inevitably asked anytime he saw a doctor as a young man.

"And it immediately shut down any response to the contrary," recalled Kline, now an assistant professor of Family Medicine and Community Health in the Perelman School of Medicine at the University of Pennsylvania.

"I came out in college and didn't really know how to interact with medical providers around my own sexual health," he said.

Ironically, Kline was studying to become a family doctor himself.

"Being in my early 20s and feeling uncomfortable and ashamed around physicians while in medical school made me think: 'I'm part of this community. I have plenty of privilege and know how to navigate things. What's it like for the people who don't have these advantages?'" he said.

A Champion for Inclusive Care

A key reason Kline chose Penn Medicine for his family medicine residency program was Penn's work with the LGBTQ+ community. In 2018, he accepted a faculty position, and quickly became the go-to source for answers when his colleagues had questions regarding LGBTQ+ clinical care: When patients requested gender-affirming hormone therapy, which labs did they need to order, and how should they interpret the results? Or which specialists in other departments would their patients feel safest going to? In July 2022, Kline became the department of Family Medicine and Community Health's director of LGBTQ+ Health.

One year later, he was appointed to the newly created position of medical director for LGBTQ+ Health, applying his expertise to the entire health system. In this role, Kline will lead the program in expanding access to high-quality patient care.

"Initially, the LGBTQ+ Health program was focused on improving the climate … whether you're coming here as a patient or as an employee," Kline said of the decade-old program. This ranged from creating a welcoming environment for patients to partnering with Human Resources to ensure inclusion in the workplace.

"As we grew and instituted better policies for our patients and staff, we realized it was time to focus more specifically on the actual health care people were receiving," he added.

Building Trust Within the LGBTQ+ Community

Much of that work centers on the need for rebuilding trust. For example: A man who has sex with men asks his doctor to prescribe post-exposure prophylaxis to reduce the risk of sexually transmitted diseases. The patient wonders why he's educating the doctor, rather than the reverse. Or a doctor asks a female, cis-gender patient if she's using birth control without first asking if she has heterosexual intercourse and is concerned about pregnancy. "Oftentimes it's not ill-intended, but gives the patient the sense that the provider doesn't understand them," Kline said.

Kline said his next responsibility will be helping clinicians expand their affirming care and training other staff with less experience treating the LGBTQ+ population.

Feeling Seen, Safe, and Supported

It's not just patients who benefit from Penn Medicine's commitment to LGBTQ+ care. "I take care of a number of our staff who've let me know they feel seen and safer and more respected knowing that the institution they work for is actively seeking to improve the care provided to their community," Kline said.

For Mick Masaba, BSN, RN, a nurse in the Medical-Surgical unit at Pennsylvania Hospital (PAH), and his wife, Jennifer Anderson, an executive assistant for Penn Medicine Corporate Finance, Penn Medicine's supportive policies toward LGBTQ+ patients and employees have been life-changing.

Jennifer Anderson and Mick Masaba have experienced Penn Medicine's supportive policies toward LGBTQ+ individuals both as employees and as patients.

Masaba, a transgender man, had been dating Anderson long-distance and was thinking about moving from Toronto, Canada, to join her in Philadelphia—specifically, at Penn Medicine. "I asked, 'If I make this move, what's my new work environment going to be like? Is it going to be safe for me?' And she'd show me their policies, which my old employer didn't have," Masaba said.

"Changing hospital systems as a nurse and as a patient was very eye-opening," Masaba said. At Penn Medicine, it didn't take him long to get an endocrinologist and a prescription for testosterone.

When the couple decided to pursue parenthood, "We were worried about being able to get a doctor who could do what we wanted to do, because for our fertility journey, we ended up using Mick's eggs," said Anderson, who became pregnant under the care of endocrinologist Scott Edwards, MD, last summer. The couple joyously welcomed their baby in early April.

Masaba praised Edwards and his team for making the couple feel safe. And that's precisely what Kline wants everyone in the LGBTQ+ community to feel—whenever and wherever they seek care:

"They deserve exceptional care and should be able to receive that here at Penn."

—Abby Alten Schwartz

View this article online at PennMedicine.org/magazine

PENN MEDICINE AND DOYLESTOWN HEALTH ANNOUNCE INTEGRATION PLANS

Penn Medicine signed a letter of intent with Doylestown Health in January to explore the possibility of that system joining the University of Pennsylvania Health System (UPHS).

The process, which can take up to a year to complete, involves collaborating with state and federal agencies and evaluating the proposed deal's financial and clinical ramifications to ensure it makes sense for both health systems and their communities.

The proposal involves Doylestown Hospital, Doylestown Health Physicians, and all of the related divisions and service sites, including Doylestown Home Health Care.

"Doylestown Health shares our values and commitment to serving patients across all four sites of care—in hospitals, outpatient facilities, in the home, and via telemedicine," said UPHS CEO Kevin B. Mahoney. "Moving forward, we hope to build on several longstanding clinical partnerships that are already in place between UPHS and Doylestown Health."

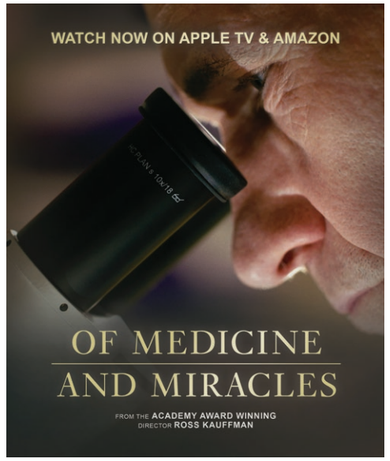
NOW STREAMING: "OF MEDICINE AND MIRACLES"

The award-winning documentary "Of Medicine and Miracles" details the emotional journey of one family alongside a team of Penn Medicine and Children's Hospital of Philadelphia (CHOP) doctors who developed a revolutionary cancer cure with CAR T cell therapy technology.

"Of Medicine and Miracles" was 10 years in the making. The poignant, yet uplifting story is told through home videos from the Whitehead family and interviews with the family and a team of Penn Medicine and CHOP doctors and researchers, including Carl June, MD, who candidly shares his personal connection to cancer and motivation for doggedly pursuing his research despite setbacks and initial skepticism from the oncology field at large.

The film "tugs on the heartstrings and opens the mind," proclaimed *The Hollywood Reporter*, while *IndieWire* praised the filmmakers' focus on teasing out the story of "the crucial role that emotion can play in the advancement of science."

The documentary is now available to watch for the first time on major streaming platforms, including Apple TV+, Amazon, Google Play, and Vimeo on Demand.



THE NEXT STEP IN SERVICE

Match Day launched the class of 2024 into the next phase of their medical careers—including some who, like Nate McLauchlan, learned of their match earlier.

After opening his Match Day envelope, Victor Ayeni—whose years at Penn involved lots of community engagement, through the Student National Medical Association, the Gold Humanism Honor Society, and more—wore his internal medicine residency destination on his T-shirt: Duke University.

As the clock counted down to noon on Friday, March 15th, the Jordan Medical Education Center was buzzing with excitement. On Match Day, many Perelman School of Medicine (PSOM) class of 2024 matching students were moments from finding out where they'll be headed for the next phase of their medical training.

When the envelopes were opened, 42 students—30 percent—learned they'd complete their residencies at Penn or Children's Hospital of Philadelphia. Come summer, the 143 students in the class, nearly one-third of whom pursued dual degrees, will be fanning out to 21 states and Canada. The most popular specialties were internal medicine, anesthesiology, dermatology, and general surgery.

A handful of students, like Nate McLauchlan, already knew their fate. As a participant in the "military match" for residents who pursue their training through the U.S. Armed Forces and who attend medical school on a military scholarship, he learned late last year that his urology residency would be at the Naval Medical Center San Diego.

It's the latest chapter in the career trajectory McLauchlan has been on since he followed in his father's footsteps at the U.S. Naval Academy in Annapolis, MD, for college. From there, he went to graduate school at the Massachusetts Institute of Technology, and then spent time on active duty in the Navy's nuclear submarine program before pivoting to medicine.

McLauchlan feels called to serve others: "At its core, service is about dedication to helping others. My personality and skills align well with both the military and medicine, so a career in Navy medicine feels like a very apt way for me to serve."

He was fortunate to earn one of the Navy's three residency spots for Urology and looks forward to new adventures in San Diego. But McLauchlan, who sought mentors among the Navy trauma team embedded at Penn Presbyterian Medical Center, isn't ruling out an eventual return to Philadelphia: "This is years off, but if the stars align, I would love to come back for fellowship training."

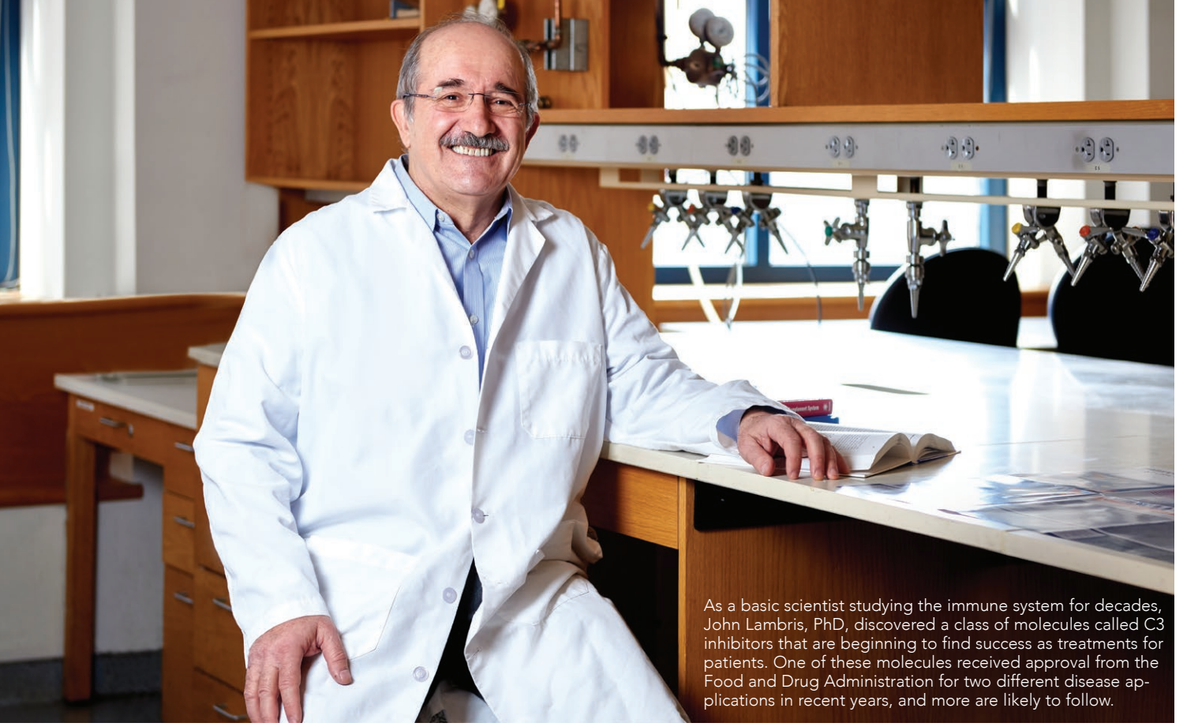
Even though he learned from the military match in December that his medical career would continue in San Diego, Nate McLauchlan still attended Match Day with his wife, Megan Andre, to celebrate.

Although he matched months earlier, McLauchlan and his wife headed to Match Day to share in the celebration with his classmates. As anticipation buzzed all around them, the couple was in a state of calm contentment amid all the dizzy anticipation when Senior Vice Dean for Medical Education Suzanne Rose, MD, MSEd, kicked off the event with her annual "Welcome to your future!" exclamation.

McLauchlan and his classmates were also the first recipients of a Match Day address by PSOM Interim Dean Jonathan Epstein, MD, who told them, "Wherever you go, you're going to bring the lessons you learned here, and be ambassadors of Penn."

— Meredith Mann

Read more about other members of the 2024 class and watch a video from Match Day online at PennMedicine.org/blog



As a basic scientist studying the immune system for decades, John Lambris, PhD, discovered a class of molecules called C3 inhibitors that are beginning to find success as treatments for patients. One of these molecules received approval from the Food and Drug Administration for two different disease applications in recent years, and more are likely to follow.

A NEW MEASURE OF RESEARCH IMPACT

Penn's investment in translating research discoveries into products that benefit patients is paying off in a big way. A newly centralized initiative seeks to quantify—and celebrate—the impact of research that is translated into FDA-approved treatments.

An ancient arm of the immune system called complement comprises approximately 50 components. Like rows of falling dominoes, interactions among these proteins cascade along three pathways, enabling it to attack microbes and promote inflammation, among other things. But, like the rest of the immune system, complement can sometimes contribute to, rather than prevent, disease.

Understanding and modifying these complex molecular interactions is the realm of basic biomedical research that unfolds over decades in labs like that of John Lambris, PhD, on Penn Medicine's campus just steps away from the hospitals where patients receive care. Basic research and medical treatments may seem like separate worlds—but, given time and focused effort, they do converge.

Within the last three years, a molecule Lambris and his colleagues discovered through their research on complement has twice been approved as a drug that is available for patients. This journey of an idea from a Penn Medicine lab to a patient's medicine cabinet is one that leaders are now tracking through a formal process. The aim is to better quantify the real-world impact of Penn's research on patients worldwide.

From Molecule to Medicine

When Lambris, the Dr. Ralph and Sallie Weaver Professor of Research Medicine in the Perelman School of Medicine, and his colleagues first set out to halt problematic complement activity in the 1990s, they focused on a single component, C3, situated at the convergence of the system's three pathways. They then screened millions of molecules to see which could break the chain by blocking C3 and, potentially, open the door to new therapies for autoimmune and other inflammatory conditions.

"C3 is a huge protein, and you expect to get many compounds," Lambris said. "We got only one and it had these unique properties to bind to a specific spot on C3 and inhibit complement activation."

They reported their discovery, which they called compstatin, in 1996. Since then, that single molecule has led to many others. Lambris and his collaborators have continued refining compstatin and its successors and patenting their discoveries, creating versions that bind ever more tightly to C3, show enhanced inhibitory activity, and last ever longer in the body.

In parallel, Lambris' discoveries have continued on the path into clinical practice. In 2021, the FDA granted approval to the pharmaceutical company Apellis Pharmaceuticals to manufacture and market pegcetacoplan, a modified C3 inhibitor, to treat a rare blood disorder, paroxysmal nocturnal hemoglobinuria (PNH). Two years later, the agency approved the same compound to treat a prevalent eye condition called geographic atrophy, an advanced form of age-related macular degeneration. Apellis developed both therapies after licensing this C3 inhibitor from Penn, which holds Lambris' more than 200 patents, mainly for compstatin and its relatives.

Tracking Innovation, One Approval at a Time

In 2023, Penn Medicine's Office of Clinical Research (OCR) began formally tracking FDA approvals that result, in a substantial way, from the work of the institution's faculty.

This type of tracking is a new way of thinking about research contributions from an academic institution. In part, that's because the FDA issues its approvals to the company making a drug or device, for a specific indication, and as more evidence is presented, the agency can add approval for more indications. Pharmaceutical, biotechnology, and medical device companies tend to get the spotlight when the FDA approves a new treatment or indication. But, quite often, it would not have happened without academic research.

Faculty contributions that "count" for Penn's tracking can occur at any point on the development continuum, from experiments in the lab on through the clinical trials that demonstrate safety and effectiveness. The wave of such approvals reflects both a shift toward therapies derived from basic studies of disease mechanisms and Penn's commitment to clearing the path from discovery to commercialization for potentially transformative products.

The count originated in Penn Medicine's Abramson Cancer Center after Robert Vonderheide, MD, DPhil, became director in 2017. That same year, CART19, a personalized immune cell therapy developed by Carl June, MD, and his team at Penn, received the FDA's approval to treat acute lymphoblastic leukemia—the first in a string of approvals to Novartis for treating several cancers with this form of CAR T cell therapy.

Now Penn has expanded that count to other fields.

The initiative is looking back to the point, around 2013, when Penn made the strategic decision to support the translation of its faculty's discoveries.

"Given our unbelievable success following our shift in emphasis, we want to fully reflect our faculty's engagement in drug and device development," said Emma Meagher, MD, senior vice dean of clinical and translational research.

As a widely respected academic institution, Penn is well positioned to share stories of how publicly funded research can generate potentially life-changing or lifesaving new products. But this opportunity comes with a responsibility to evaluate these cases according to consistent criteria, according to Meagher.

"We are upholding our ethical responsibility to appropriately represent the work we are doing," she says.

The Complexities of Counting

As of late March 2024, the initial release of a comprehensive list contained approvals for 29 indications.

The goal is not to take credit for the product owned by a company that receives the FDA approval directly. Instead, it is to carefully vet and recognize contributions of Penn faculty deemed crucial to arriving at that approval. These may include originating intellectual property, designing the proof-of-concept preclinical or clinical trial, or leading the phase 3 clinical trial, including being senior author on the publication.

Biologics, especially those in oncology, dominate Penn Medicine's current count of FDA approvals; however, OCR is also tracking device-related approvals, whether for new inventions or new uses of existing ones. The current list includes one such example: a new technique developed by Gregory Weinstein, MD, a professor of Otorhinolaryngology, for using a surgical robot to remove malignant tumors in the pharynx and larynx.

An approval may also qualify for Penn Medicine's official list if a faculty member developed a new indication or method of use that led to an FDA label change. Twelve of the 29 indications on the current Penn list are new indications for existing products.

Penn Medicine faculty are able to submit information about FDA-approved drugs and devices toward which their research contributed to a new annual OCR-run survey and other mechanisms for consideration. A pair of committees—one focused on cancer, and one for all other conditions—then carefully evaluates the role the Penn scientists played in the development process for each drug or device suggested for inclusion. In some cases, like Lambris', the decision is straightforward—because of patents or licensing agreements documented by the Penn Center for Innovation (PCI).

Other cases require more careful consideration. These contributions are typically substantiated by journal publications.

"We need to read the papers, we need to talk to the physicians, we need to clearly understand more of what they've done before we claim it as Penn's," said Deanna Condit-DiDonato, OCR's director of regulatory services, who manages the annual survey, collates responses, and gathers additional details needed to complete the vetting process.

New C3 inhibitors may one day join the count.

Amyndas Pharmaceuticals has licensed more recent versions of compstatin and is now investigating their potential against disorders that include severe periodontitis, certain rare diseases, ophthalmic and neurological conditions, kidney disease, and transplant rejection. Lambris, meanwhile, continues refining his inhibitors.

"Science does not stop," he said.

—Wynne Parry

Read more online, including the challenges of the first FDA-approved drug for fibrodysplasia ossificans progressiva (FOP), a rare disorder extensively studied at Penn that turns muscle to bone. Visit PennMedicine.org/magazine

CHEERING FOR THE SAME WINNING TEAM

Emma Meagher, MD, and Noel Williams, MD, have built independently powerful careers at Penn Medicine while remaining committed partners, parents, and now grandparents together in their personal lives.

Graduates of the Perelman School of Medicine (PSOM) over the past 30 years often remember a sharp-eyed, sharp-witted pharmacology professor named Emma Meagher, MD. They might also have been surgery clerkship students with bariatric surgeon Noel Williams, MD. But most students have never realized that, despite different last names and different specialties, Meagher and Williams are two halves of an extraordinary partnership.

This past year, Williams, the medical director of Penn Medicine Metabolic and Bariatric Surgery, was honored by their joint alma mater, the Royal College of Surgeons in Ireland (RCSI), with an Honorary Fellowship—the highest honor the college bestows. At the same time, he and Meagher, now senior vice dean of clinical and translational research in the PSOM and vice president for clinical research at the University of Pennsylvania Health System, were celebrating another milestone: their 35th year of marriage.

"In addition to being husband and wife, parents, and best friends," Williams said, "we have been committed partners in the pursuit of our careers."

Across the Atlantic and Back

Both were the children of doctors, but they grew up an ocean apart. Born in Jamaica, Williams attended medical school at RCSI in Dublin like his father and two uncles before him. He was a surgical trainee at the time he met Meagher, and she a first-year medical student. She, along with five of her seven siblings, was inspired to enter medicine by her father, a well-known OB/GYN in Dublin.

The couple married after Meagher completed her internship year in Dublin, and for a brief stint, she joined Williams in Philadelphia where he was then halfway through a postdoctoral research fellowship.

After returning to Dublin, they might have stayed forever. Over a busy five-year period, they both completed their clinical training and had four children. "Life was a blur," Meagher said.

Then in 1994, Meagher's boss, Garret A. FitzGerald, MD, was recruited to Penn and invited Meagher to join his team as an instructor in Medicine. The Department of Surgery offered Williams, their former research fellow, a place in their residency program.

It was an exciting professional opportunity, but there would be sacrifices. Williams recalled how they agonized over the choice: "Go to sleep: 'We're going.' Wake at three in the morning: 'We can't leave our country and our family.' Wake at 6: 'We've got to go.'"

"It was far and away the most difficult decision we've ever made," Meagher said.

The family finally made the monumental leap in June 1994.

Celebrating Career Successes

In her current clinical research leadership roles that she has held for more than a decade, Meagher sets the strategy for Penn Medicine's clinical research enterprise. She has overseen the growth of clinical research support that helps Penn scientists successfully execute their clinical and translational research programs and efficiently translate their discoveries into FDA-approved therapies. (See more on page 8.)

Williams has had an accomplished career at Penn of his own. He leads one of the largest and most successful academic programs in bariatric surgery in the U.S. He introduced robotic bariatric surgery at Penn almost 20 years ago, played a critical role in the education of several generations of surgical residents, and launched the surgical careers of numerous international medical graduates as the director of the Preliminary Surgery Residency Program.

As each has grown in their career and become, in different ways, a fixture at Penn Medicine, it has brought them even closer together, Meagher said.

"We feel very fortunate. We're both absolute institutionalists at heart. Cheering for the same winning team is a great feeling."

— S.I. Rosenbaum

BUILDING A GROUNDSWELL

The Penn- and CHOP-led Alliance for Minority Physicians expands its efforts toward a more diverse clinical workforce across the Philadelphia region.

At AMP's first Med Immersion Day, Claudia Gambrah-Lyles, MD (far right) facilitated medical simulations in heart and respiration monitoring for pediatric patients. Students did assessments on the mannequin of a 5-year-old trauma patient, interpreting changes in vital signs and responding accordingly.

Growth—in every sense of the word—is happening at the Alliance for Minority Physicians. The 12-year-old organization is expanding its reach and resources to provide opportunities for learning, mentoring, and relationship-building to historically underrepresented in medicine (URiM) students and trainees.

AMP engages its audience—underrepresented minorities in medicine—through a variety of programs, from seminars to networking and more. And now they're open not only to Penn and Children's Hospital of Philadelphia (CHOP) participants, but also to students and trainees from six medical schools across Philadelphia.

The growth rate accelerated in 2023, when AMP received a grant from the Independence Blue Cross (IBX) Foundation's Institute for Health Equity to fund programming specifically focused on recruitment and retention of URiM doctors-in-training. "The IBX Foundation was really interested in creating a pathway for URiM students and trainees to set down roots and stay in the Philadelphia area," said AMP founder Iris Reyes, MD, a professor of Clinical Emergency Medicine at the Perelman School of Medicine (PSOM). "As we've continued this growth, we've opted to start from the ground up, targeting the greenest of the green: first year medical students," through offerings like the IBX Foundation Staff Scholars and IBX Foundation Faculty Mentors.

AMP has leveraged its partnerships with IBX and other institutions to launch a new effort, the Pathways to Excellence in Medicine (PEM) initiative, offering students hands-on training, expert perspectives, and career guidance. New programs like PEM's first Med Immersion Day, designed to entice high school students to consider medical careers, are especially meaningful to Claudia Gambrah-Lyles, MD. The Child Neurology resident at CHOP and Penn first got involved with AMP during her PSOM days and finds it fulfilling "to contribute to AMP's mission by supporting each new cohort of students along their path."

From left: Todd Hecht, MD, and Hospital Medicine chief S. Ryan Greysen, MD, are helping to train the next generation of hospitalists.

QUARTERBACKS OF INPATIENT CARE

Hospitalists in the new Division of Hospital Medicine lead the team in getting patients to the goal line.

When Todd Hecht, MD, was asked if he wanted to become one of the first hospitalists at the Hospital of the University of Pennsylvania (HUP), he had one question: "Sounds good—what's a hospitalist?"

That was in 1997. The Hospital Medicine program at HUP launched a year later, making history as one of the first programs in the field.

The program reached another milestone on July 1, 2023 when Penn Medicine established a new Division of Hospital Medicine, within the Department of Medicine.

The division's inaugural chief, S. Ryan Greysen, MD, who served as section chief since 2016, aspires to make Penn Medicine the premier academic hospital medicine program in the United States.

A Win for Everyone

But back to Hecht's question: What is a hospitalist?

In simplest terms, hospitalists are physicians who specialize in providing care exclusively within the hospital environment. They typically undergo residency training in internal medicine, general pediatrics, or family practice and play a pivotal role in providing and coordinating care during a patient's hospital stay.

"Hospitalists are the captains of the ship, the quarterbacks of the team," said Jennifer Myers, MD, a hospitalist for more than 20 years and associate chief for Faculty Affairs in the Division of Hospital Medicine, as well as creator and director of the Center for Healthcare Improvement and Patient Safety (PennCHIPS, a center that focuses on education and training in quality and safety). "We know what needs to be done and how to get it done in the most patient-centered and efficient way possible."

Hospitalists see inpatients regularly, order tests and scans, write prescriptions, and work closely with their teammates—nurses, social workers, therapists, pharmacists, specialists, and primary care providers—to diagnose and monitor patients and execute the treatment plan. And when a patient is discharged, it's a win for everyone.

To Greysen, the elevation of Hospital Medicine as a division at Penn Medicine recognizes hospitalists' role in ensuring safe, high-quality patient care and their contributions to overall hospital operations.

"We often say the hospital is our second patient," Greysen said. "When the hospital is functioning well, the patients get the best care."

The value hospitalists bring was never clearer than during the COVID-19 pandemic. Hospitalists were key to providing bedside clinical care and were instrumental leaders in developing strategies to meet COVID-19 surges. Like an experienced quarterback who decides to call an audible, hospitalists quickly adapted to the rapidly evolving situation.

"We took care of the most patients and had to become experts at how to manage COVID," Greysen said. "When there were surges, we were able to move staff around, which enabled us to see more patients."

In addition to HUP, the Division of Hospital Medicine at Penn Medicine also provides services at Penn Presbyterian Medical Center, Good Shepherd Penn Partners, and the Philadelphia Veterans Administration Medical Center. Today, the division includes more than 70 faculty members, including leaders in clinical operations, quality and safety, informatics, health services research, and medical education.

Getting It Right

Hospitalists are instrumental in managing patient flow, a major challenge in many hospitals. Because they monitor the capacity of different teams—cardiology, pulmonary, GI, for instance—they can direct patients to where they'll get the most appropriate care in the most efficient manner.

"We get the patients the care they need, and we're not keeping them in the hospital longer than they need to be," Greysen said.

Put another way, hospitalists are in charge of getting the right patient the right care from the right team at the right time.

"My three main goals for our division are to provide the best patient care possible, to be nationally known as the quality experts and the leaders in innovative hospital operations, and to disseminate knowledge through scholarship, including robust studies and publication of those studies," Greysen said. Faculty are at the forefront of quality and safety efforts, and faculty development is also a priority, he added.

"Fun to Pass on Knowledge"

The opportunity to teach and care for patients attracted Erik Tan, MD, to a residency in hospital medicine at Penn Medicine.

"My goal eventually is to practice hospital medicine as well as be an educator," said Tan, who is an internal medicine resident at HUP and has a special interest in how medical education is delivered. "It's fun to pass on knowledge."

Tan noted that even though hospitalists may not have long-term relationships with patients like a primary care physician would, they can still form bonds.

"You really are able to develop close connections with patients in the short amount of time you're with them," Tan said. "You're the face they see every day."

A Special Team

During Hecht's 25 years at Penn Medicine, he has treated thousands of patients and seen these special relationships develop many times. One recent example is colleague Veronica "Ronni" Elena, an award-winning unit secretary at HUP, whom Hecht had known for more than a decade. In March 2022, Elena landed in the Emergency Department at HUP after suffering with gastrointestinal discomfort, swelling, and other mysterious symptoms for months. Upon her admission, Hecht ordered a range of tests and worked with several specialists.

The hospital is the "second patient" of hospitalists, according to Chief of Hospital Medicine S. Ryan Greysen, MD: "When the hospital is functioning well, patients get the best care."

Ultimately, the team diagnosed a potentially life-threatening condition caused by a partial obstruction of Elena's thoracic duct, the main vessel in the lymphatic system. They developed a treatment plan and today, Elena is feeling more like herself.

The case deepened Hecht's relationship with Elena and renewed his pride in his work.

"Patients benefit because they have an inpatient expert advocating for them and managing their care, and you can really bond with people over that short period when they're in the hospital," he said. "To me, it's really fulfilling."

— Kim Maialetti

Research That Resonates

Penn Medicine bridges medical science with the arts to assist in world's first project to image double basses.

By Darcy Lewis

The team behind the world's first project to image double basses, from left: Philadelphia Orchestra bassist Duane Rosengard, luthier Zachary S. Martin, Mark Kindig, University of Pennsylvania School of Medicine Director of CT Research Peter Noël, PhD, and Leening Liu, a PhD student in Noël's lab.

When you're an expert in medical CT imaging, two things are bound to happen, says Peter Noël, PhD, an associate professor of Radiology and director of CT Research at the Perelman School of Medicine. One: You develop an insatiable curiosity about the inner workings of all kinds of objects, including those unrelated to your research. And two: Both colleagues and complete strangers will ask for your help in imaging a wide variety of unexpected items.

Over the course of his career, in between managing his own research projects, Noël has imaged diverse objects ranging from animal skulls to tree samples from a German forest, all in the name of furthering scientific knowledge. But none has intrigued him as much as his current extracurricular project: the first known attempt to perform CT imaging of some of the world's finest string basses.

The goal is to crack the code on what makes a world-class instrument. This knowledge could inform how to better care for masterworks built between the 17th and 19th centuries, as well as how to build new ones, while potentially shifting from older, scarcer European wood to the use of sustainably harvested U.S. wood.

That's why Noël and Leening Liu, a PhD student in Noël's Laboratory of Advanced Computed Tomography Imaging, have found themselves volunteering to run the basses through a Penn CT occasionally, when they're not developing next-generation CT technology.

"We always learn something out of projects like this," Noël said. "We have the opportunity to take what we learn in medicine and use it for something else—in this case, moving the arts forward."

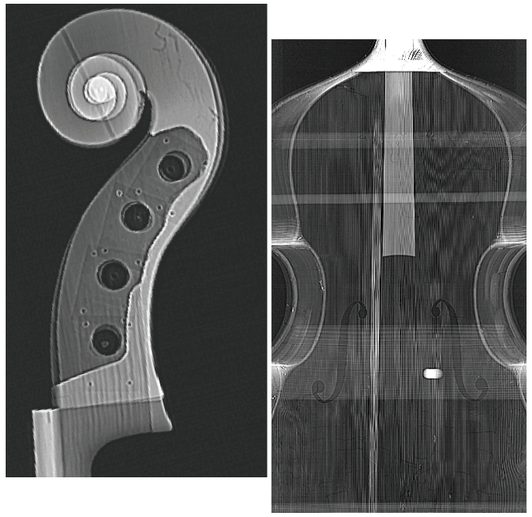
All About That Bass

The project was born out of a partnership among Philadelphia bassist Duane Rosengard, a member of the Philadelphia Orchestra since 1986; along with amateur bassist Mark Kindig of Maryland; and Rhode Island luthier Zachary S. Martin.

To grasp the project's potential scholarly and artistic importance, it helps to understand a bit about the bass itself. Taller and wider than most people, the bass's sonorous tones create an aural anchor whenever and wherever it's played, ranging from classical to jazz, rockabilly, bluegrass, and beyond.

"The double bass is the only stringed instrument that's used in virtually all genres of music around the world," Rosengard said. "With the bass, we often use descriptor words like organ-like, chocolatey, or velvety to describe the sound. We'd like to understand more of the 'why' of that."

Developed in the late 16th century, the bass exists today as a delightfully nonconformist instrument of which none of the dimensions—not even its basic shape—is fully standardized.



Imaging some of the finest string basses could inform how to better care for the world-class instruments as well as build new ones.

This is in marked contrast with the violin, whose size, shape, and other specs have been established since about 1560, Martin said. As a luthier, the term for craftspeople who build and restore stringed instruments, Martin has restored many fine old basses, some as old as 400 years.

The team has set its focus on exploring two data points for each bass: internal air volume and the density of its wood. "We believe the air volume has everything to do with why a bass sounds the way it does, because it directly relates to the sonority of a particular instrument and its presence or power," Martin said. "And wood density very much plays into the instrument's structure, flexibility, and responsiveness."

The Medical Connection

Liu operates the scanner when Rosengard and Martin bring in one of their rare basses. She also helps calculate the instruments' internal volumes. "From the internal corpus volume perspective, it's a straightforward calculation for us," she said. "It means segmentation, counting the pixels, and then using the pixel volume to calculate how much volume is within the bass itself."

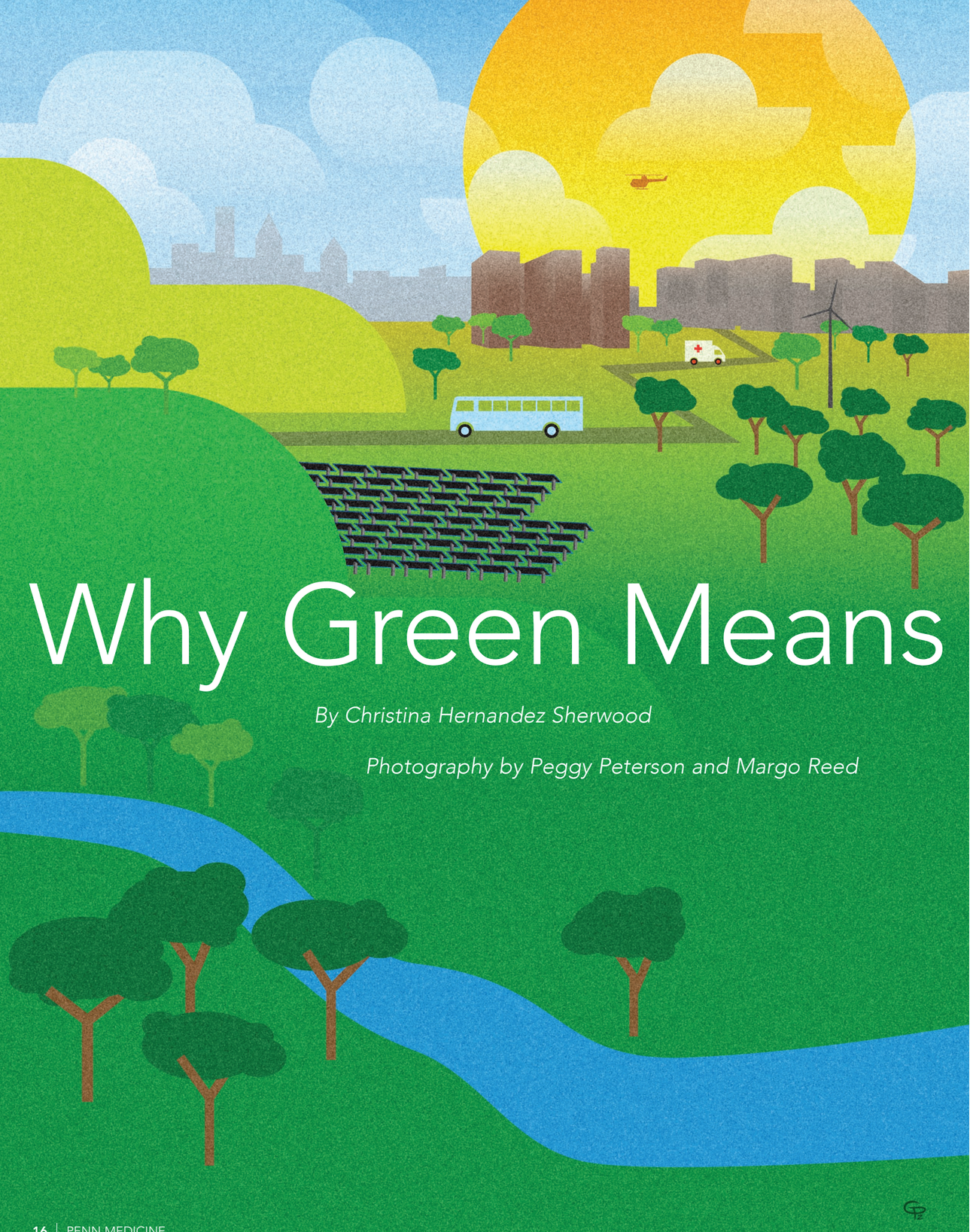
As for mapping the density of the wood, this issue is more relevant to Liu's PhD research than you might expect. Her thesis focuses on using physical density to measure temperatures within the human body, specifically for thermal ablation, a minimally invasive treatment for cancers, including those of the liver and kidney. Carefully directed high temperatures are used to kill both tumor cells and a surrounding safety margin of healthy tissue, and knowing the temperature at which the tissue is burned gives an idea of the treatment's effectiveness.

So far at least, the wood density component is the more challenging scientifically, Liu said.

"In the temperature project, the scanner outputs quantitative maps that we can use to successfully generate physical density maps," she explained. "We were hoping that translating that for the bass would also be possible, but there are still some challenges with that approach we're trying to resolve."

Challenges aside, these collaborators from both creative and quantitative disciplines are delighted to be working together. "We scientists love to talk about the science part and the musicians feel the same way about music," Noël said. "We all have a common sense of what we want to achieve, but it's inspiring and amazing to see what happens when two totally different worlds talk to each other."

Read more about the project, including how the instruments are prepared for scanning, at PennMedicine.org/magazine.



Why Green Means Good Health

By Christina Hernandez Sherwood

Photography by Peggy Peterson and Margo Reed

To improve health while addressing climate change, Penn Medicine aims to become the most environmentally friendly health care system in the country.

The patient lies still on the operating table, softly inhaling the anesthetic gases that keep her safely sedated during surgery. Then she breathes out, and the anesthesia that wasn't metabolized by her body—roughly 95 percent of what she took in—is exhaled, unused and unchanged. That gas is ultimately vented outside into the atmosphere, another greenhouse gas emission contributing to a warming planet.

There's little doubt that anesthesia is a necessary and important part of surgical practice, but anesthetic gases have represented a three-way loss for the health care sector for decades. Most of the gases purchased by a hospital are exhaled and wasted. This anesthetic waste alone makes up at least five percent of a health care facility's total greenhouse gas emissions, with warming effects in the atmosphere that are hundreds or even thousands of times more potent than the equivalent weight of carbon dioxide. And climate change in turn is known to worsen public health by increasing rates of respiratory and cardiovascular diseases, causing extreme weather events, and giving rise to infectious diseases.

The health care sector has an outsized impact on the Earth's changing climate, responsible for an estimated 8.5 percent of all greenhouse gas emissions in the United States. At the same time, the mission of health care—to improve an individual's health—sits at odds with its negative contributions to the environment and public health.

But does providing health care to patients have to contribute to worsening the health of other people and the planet?

Increasingly, health care professionals and organizations are saying no. A green health care system is not only attainable, but makes it possible to achieve three-way wins: a win for a patient's health, a win for the health of the planet and public health, and a win in the form of cost savings.

One case in point: An initiative from Penn Medicine anesthesiologists to reduce the flow rate of anesthesia gases for patients—while still delivering safe care—slashed greenhouse gas emissions by the equivalent of 30 metric tons of carbon in the space of only three months at the Hospital of the University of Pennsylvania last year.

Now imagine multiplying that reduction across all of Penn Medicine's six hospital entities and dozens of outpatient sites, and the scale of impact grows by orders of magnitude. If other health systems followsuit, and take other steps to mitigate health care's impact on the health of the planet—the potential benefits are staggering.

Penn Medicine is making many other such moves. From large-scale efforts, like a commitment to sustainable building design and a massive renewable power purchase agreement in collaboration with the university, to more localized initiatives in hospital operating rooms and offices, the changes are meant to move toward the same goal, articulated in the organization's recent strategic plan: making Penn Medicine the most environmentally friendly health care organization in the nation.

"Health care is dedicated to healing, but the industry has played a role in the changing climate," said Kevin B. Mahoney, chief executive officer of the University of Pennsylvania Health System (UPHS). "It's our responsibility now to balance

Greg Evans, corporate director of sustainability for the University of Pennsylvania Health System

health care with impact. We can do this by fostering engagement around climate-related initiatives, improving sustainability within our own health systems and beyond, and setting an example for the field. It's the right thing to do for our patients, the community, and the generations to come."

Penn Medicine, which encompasses UPHS and the Perelman School of Medicine, currently has a climate footprint that rivals the rest of the university combined. The health system has committed to the university's Climate and Sustainability Action Plan, which includes adopting the "audacious yet achievable" goal of reaching 100 percent carbon neutrality by 2042, said Greg Evans, UPHS corporate director of sustainability. The goal is even more ambitious than the White House and U.S. Department of Health and Human Services Health Sector Climate Pledge, a voluntary commitment that Penn Medicine has also signed onto, that includes a goal of net zero emissions by 2050.

Building Toward an Ambitious Carbon-Neutral Goal

Penn Medicine conducted a carbon baseline audit in 2023 that quantified energy usage and carbon emissions from all areas of UPHS, including anesthetic gases, waste disposal, airline travel, and more, from roughly 2018 through 2022. It encompassed all of the health system's owned properties and also broke down information by hospital entity. "We'll take that system baseline number and figure out across each entity how to reduce those numbers and get to carbon neutrality by 2042," Evans said.

The health system will take a balanced approach to assessing its impact. There are some aspects of modern health care that, at least in the short term, can't be made "greener," such as proton therapy, a type of radiation treatment for certain cancers. But these energy-intensive treatments can be delivered at a lower overall impact by considering the full picture of the health system's footprint and making strategic savings in other areas.

A huge step toward carbon neutrality came last December, when Great Cove Solar Energy Facilities, a massive solar array in Central Pennsylvania, began producing 220 megawatts of electricity. The energy, purchased by the university and the health system, will supply about 70 percent of the total electricity demand of the two entities' facilities in the greater Philadelphia area. Meanwhile, a growing set of solar panels and a co-generation plant at the Princeton Medical Center campus will soon supply 90 percent of that hospital's electrical needs.

Penn Medicine is also helping UPHS employees to reduce their personal carbon footprints by offering discounted public transportation passes—costing $10, compared to the standard $96 for a monthly pass from SEPTA. Switching from driving to riding public transit can cut each employee's annual carbon emissions by more than 4,800 pounds, or about a 10 percent reduction in all greenhouse gases produced by the typical two-adult, two-car household.

At the same time, Penn Medicine has committed to ensuring all new building projects incorporate recycled materials, integrate expansive greenery, use less water, use less energy, and qualify for Leadership in Energy and Environmental Design (LEED) Silver, or better, certification through the U.S. Green Building Council. Already, more than 40 buildings on the Penn campus have earned LEED Gold or Silver status.

When it opened in 2021, Penn Medicine's 1.5-million-square-foot Pavilion became the largest LEED Healthcare certified project in the world to receive a gold certification for green design and construction. The Pavilion was built with both energy-efficient features and plumbing fixtures designed to cut 30 percent of typical indoor water use. In addition, more than 20 percent of the water required for the building's HVAC equipment is captured and reused on site, such as rainwater, condensate, and foundation dewatering.

During construction, the Pavilion project used recycled materials—including 17,000 tons of concrete—reclaimed from the demolition of Penn Tower, which previously stood at the hospital's site. Additionally, about a quarter of the Pavilion's materials were prefabricated and manufactured off-site, a process that minimized on-site waste, reduced traffic impact and site congestion, increased quality, and lowered cost.

Mahoney, who oversaw the Pavilion project, said there is a misconception that it takes significant resources to be green, but that is not the case. "It's a matter of finding opportunities for simple, but smart solutions and getting to work. Sustainability benefits our patients, our planet, and the bottom line."

Planning for a new cancer center on the Princeton Medical Center campus recently began with LEED goals in mind, bringing key stakeholders, including a general contractor, architect, and engineer, together to collaborate from the start, said Evans, who was previously director of sustainability at Penn Medicine Princeton Health. "That's very different from traditional construction," he said. "But [traditional construction] doesn't produce the most energy-efficient building. It starts on Day 1."

Penn Medicine is getting help on its path to carbon neutrality from its partnership with Practice Greenhealth, a national nonprofit membership organization that supports hospitals and health systems on sustainability initiatives. Princeton Medical Center had been a member of the cohort for years—in 2021 it won the organization's Environmental Excellence Award for "significant achievement in building a more environmentally sustainable organization." (During Evans' two years at Princeton Medical Center, the institution also implemented a pilot effort that diverted eight tons of landfill-bound food waste to a nearby farm for livestock feed or mulch and more than doubled its collection and reprocessing of single-use medical devices.)

Courtesy of AES

By the end of 2023, all Penn Medicine hospitals had joined Practice Greenhealth, which Evans said offers an annual conference, cohort groups, educational resources, data and metrics, and more. "All [Penn Medicine] entities will be part of Practice Greenhealth working under the same structure," he said, "moving together in an organized way."

On a smaller scale within Penn Medicine, individuals, divisions, and departments have been working on their own environmentally friendly initiatives for years. They have begun to unite in their goals since at least 2019, when CIRCE: Medicine, an offshoot of the Faculty Senate Select Committee on the Institutional Response to the Climate Emergency (CIRCE), formed to involve providers from UPHS and Children's Hospital of Philadelphia in sustainability efforts. Misha Rosenbach, MD, the Paul R. Gross Professor of Dermatology in the Perelman School of Medicine, who does research on the link between climate change and dermatological conditions, leads the group with Hari Shankar, MD, an assistant professor of Pulmonary, Allergy and Critical Care. CIRCE: Medicine members work on projects that aim to safely decrease the health system's carbon footprint.

CIRCE: Medicine members are among many others at the front lines at Penn who are identifying ways to make the organization one of the most sustainable companies in health care, from reusing expired materials for training programs to partnering with manufacturers to recycle single-use medical devices.

"Climate change is here. We're dealing with it every day," Evans said. "[People] want to be part of an organization that cares about climate change… Penn is spearheading this effort, and everybody needs to be part of the mission."

A Wake-up Call in Anesthesia

When Caoimhe Duffy, MD, an assistant professor in the Department of Anesthesiology and Critical Care in the Perelman School of Medicine, came to Penn from her home in Ireland in 2020, she was surprised more wasn't being done to mitigate the negative impacts of anesthetic gases.

Anesthesiologist Caoimhe Duffy, MD, spearheaded efforts at the Hospital of the University of Pennsylvania to adjust the flow of anesthesia gases during surgery to the amount patients truly needed—reducing waste gases that could have potent harmful effects in the atmosphere.

(Ireland's neighbor Scotland was moving toward a 2023 ban of desflurane, an inhaled anesthetic with the highest global warming potential.) Duffy, a member of CIRCE: Medicine, decided to start an anesthesia "greening" project with her residents.

The first step was to reduce anesthesia "flow rates" to more precisely control the speed at which gas flows from the anesthesia machine to the patient. Traditionally, anesthesiologists have preferred higher flow rates to ensure patients receive enough medication, Duffy said. But modern anesthesia machines make it possible to closely match the amount a patient actually needs, while they are carefully monitored—and waste less gas.

After validating that lower flows would be safe for patients, Duffy and her team of residents educated their colleagues about the benefits of reducing flow rate, and affixed magnets to anesthesia machines encouraging use of lower flows.

From April to June 2023, the Hospital of the University of Pennsylvania saw its greenhouse gas emissions drop by the equivalent of 30 metric tons of carbon dioxide because of the low-flow anesthesia initiative alone, said John (Jack) Berger, MD, chief resident of quality improvement and patient safety in the Department of Anesthesiology and Critical Care.

"There are a lot of different ways we can deliver anesthetic to a patient in a safe and effective way," he said. "We're educating people about the impact of their decisions and teaching them new, but equivalent, ways to achieve the same goal."

With the team's support, ORs across Penn Medicine are phasing out the use of desflurane, an anesthetic gas that remains in the atmosphere for 14 years and is often the most expensive option. The process included reducing the

Looking at the Landscape

Sometimes "going green" at Penn Medicine involves the actual greenery and landscaping used in and around its facilities. Penn Medicine Radnor recently became the first corporate recipient of the Eco-Friendly Yard Award by the Radnor Environmental Advisory Council in recognition of the self-sustaining and environmentally friendly meadow on the property. The Radnor meadow also has earned three Leadership in Energy and Environmental Design (LEED) credits: for protecting and restoring habitats, maximizing open space, and water-efficient landscaping.

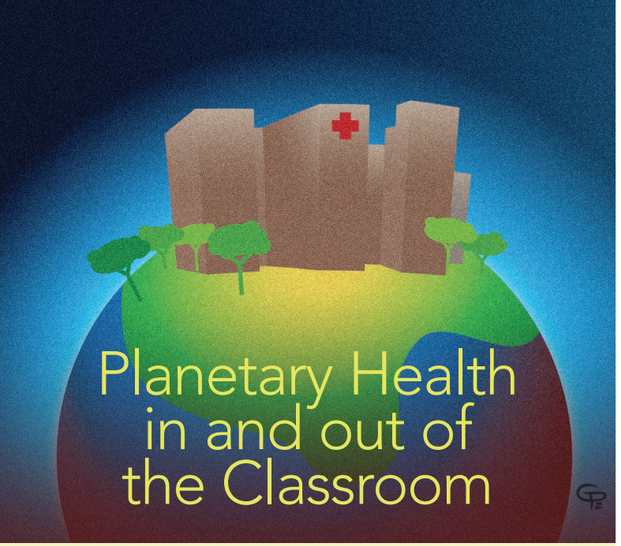
The facility's meadow and inner courtyard, featuring an abundance of native plants, has reduced the facility's carbon footprint by about 100 metric tons and has reduced dependency on fossil fuels compared to what would be needed for a grass lawn. And it does it all while providing a calming space and view for those working and being cared for in the building.

"This meadow plays a big role in the health and wellness of our staff and the patients we serve," said Tracey Commack, associate chief operating officer at the Hospital of the University of Pennsylvania and former associate executive director at Penn Medicine Radnor. "Because it's self-sustaining, it reduces water run-off, and since it requires very little maintenance, we are reducing pollutants and our use of fuel and chemicals. We're doing what we can to create a healthier environment for our community."

At Pennsylvania Hospital, long renowned for its historic gardens, similar efforts include repurposing plants and incorporating more native plants. According to Dan Bangert, lead horticulturist, the grounds team has also started to switch from gas-powered lawn care tools to battery-powered ones to cut down on the use of fuel.

"Our goal is to be more efficient," said Bangert. "By trying to repurpose things out of necessity, it ultimately cuts down on waste."

—Christina Smith



The next generation of physicians will enter the workforce ready to help make health care greener—and students at the Perelman School of Medicine (PSOM) are not waiting until then.

"We're fixing this paradox of physicians trying to 'do no harm,' yet also being part of the health care industry, which is a primary contributor to global warming," said Sarah Wornow, a first-year medical student and board member of PSOM's Healthcare Sustainability Group. Wornow has experienced the effects of climate change firsthand. Growing up in California, she recalled days her school would close due to unhealthy air from wildfire smoke. "Climate change is an issue that everyone should care about," she said, "but as future physicians, we have an obligation to our patients to help shape and improve the environment we want to live in."

The group's student-driven initiatives include the Planetary Health Report Card, a nationally-known metric tool to evaluate and improve planetary health programming in medical education, and members also assist with an ongoing physician-led sustainability projects like OR greening.

Meanwhile, climate health topics are now integrated into PSOM's courses, centered on basic science and organ systems, through lectures, slides in course presentations, or supplemental materials in the syllabus for self-directed learning. It's part of a formalized planetary health curriculum launched in 2022.

"The health of the planet is directly related to human health," said Farah Hussain, MD, a hospitalist and associate professor of Medicine who is the planetary health curriculum's inaugural director. "The consequences of climate change are going to be at the forefront of some of the challenges students will face in their careers."

— Julie Wood

number of canisters used, ending the contract for the gas, and fully ending its use at HUP by the end of 2023. While it's too soon to quantify the cost and climate impacts of the change, Penn Medicine Princeton Medical Center, which ceased use of desflurane in 2021, has saved an estimated $30,000 a year by using an alternative anesthetic. The health system as a whole is expected to phase out desflurane by the end of 2024.

"We can always improve our practice," Duffy said. "By improving our practice, we can reduce our waste and make a lot of savings for both the environment and the institution. It really is a three-way win."

How Surgical Teams Go Greener

Another CIRCE: Medicine member who now leads sustainability initiatives in the hospital operating rooms, Julia Tchou, MD, PhD, a professor of Clinical Surgery, began her efforts in the Division of Breast Surgery at the Hospital of the University of Pennsylvania, where she practices. Tchou and her colleagues in the OR have pursued material and energy use changes that are emblematic of ways to go greener in other areas of health care.

First, Tchou removed some 20 little-used tools from the standard set of about 100 surgical instruments that are prepared for each procedure, snapped a picture, and sent it to her colleagues. She asked, would anyone object to these instruments being removed from the kit? "I trimmed off at least 15 instruments just by doing that," Tchou said.

Trash that has been soiled with blood or bodily fluids must be disposed of in red bags—and disposing of this waste generates more pollution than regular trash disposal. Simple behavioral nudges like using smaller cans are reducing unnecessary red bag waste.

Breast surgeon Julia Tchou, MD, PhD, has partnered with colleagues in the OR to reduce waste in multiple ways, from instrument sets to streamlining disposal of blood-contaminated waste.

Removing unused instruments means fewer chemical solvents are used during cleaning, making the process quicker and less costly, Tchou said. (The less-common instruments remain available as standalone tools.) Tchou is working to expand this project to other divisions in 2024.

Red bag waste—that is, any medical waste that is stained or saturated with blood—was another area Tchou targeted. Processing red bag waste is more expensive and energy intensive than standard municipal waste, so Tchou borrowed an idea from behavioral economics to pilot a program to prevent uncontaminated waste from being dropped in red bags. "We could probably implement a really simple change," she said, "to help change people's habits and practice."

Tchou swapped the standard-sized red bag bins for smaller bins in the Perelman Center's outpatient Surgicentre, while keeping the municipal waste bins the same. The move, she said, was a "game changer." Tchou said the center's environmental supervisor told her the change effectively halved the amount of red bag waste produced there. The project is now being implemented at the Pavilion.

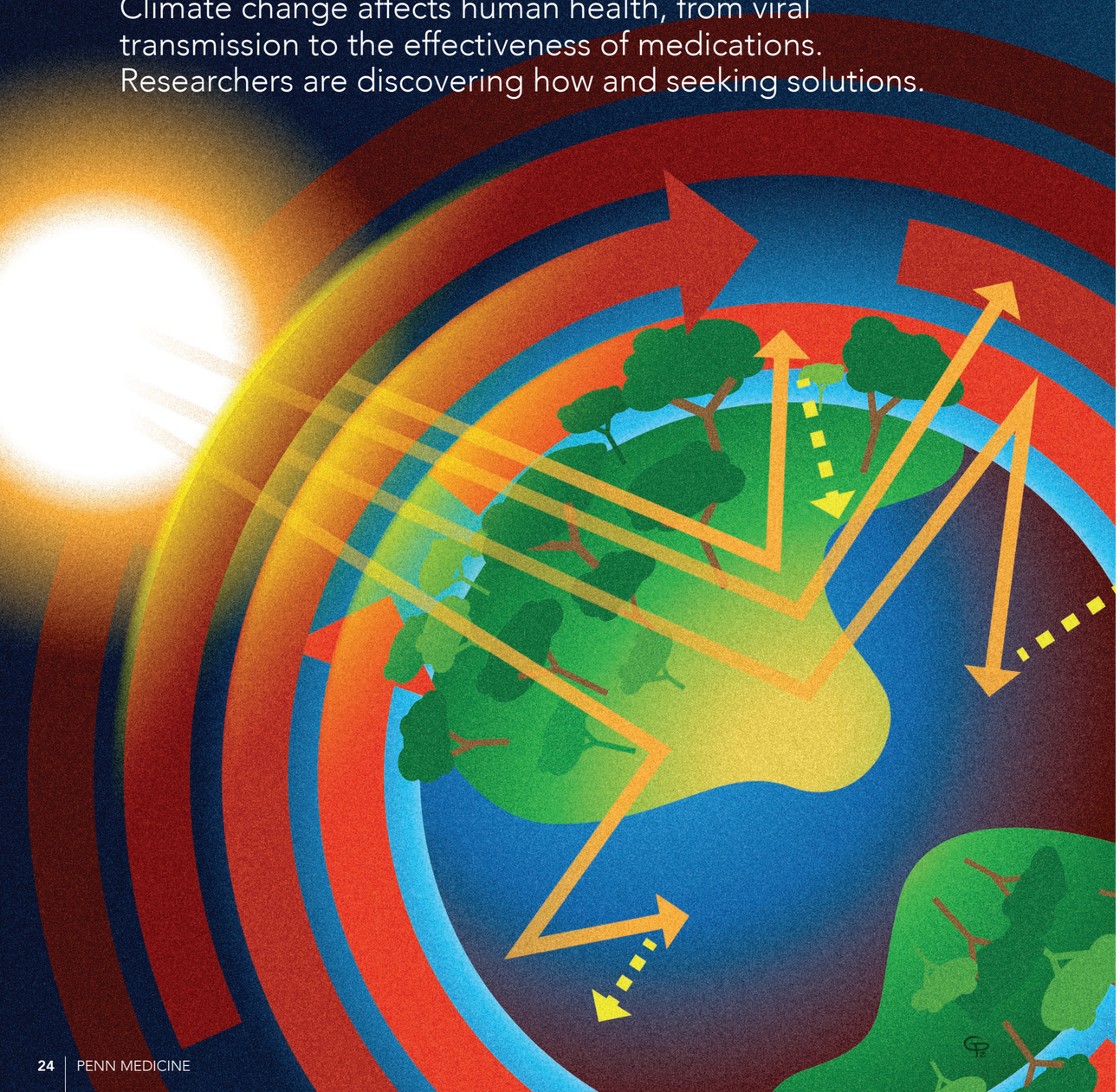
Tchou is also working on a "no print" option that would not only save paper—a financial and environmental win—but could also noticeably improve patient care.

Shifting from paper to electronic consultation requests would streamline processes so the patient receives a call to schedule a follow-up appointment when they need it—instead of requiring the patient to call a phone number on the printout they bring home. It makes care easier, while reducing waste at the same time.

As Rosenbach puts it: "The goal is to take equally good or better care of the patient in front of you without negatively hurting population health with the downstream byproducts of the practice of medicine."

Health Research on a Warming Planet

Climate change affects human health, from viral transmission to the effectiveness of medications. Researchers are discovering how and seeking solutions.



About a dozen years ago, Misha Rosenbach, MD, the Paul R. Gross Professor of Dermatology in the Perelman School of Medicine, noticed a spate of adult patients coming to the hospital with hand, foot, and mouth disease, which causes telltale sores in the mouth and a rash on the hands and feet. The virus is a scourge for the daycare set, but was unusual among adults.

"It was a little uncommon to have these clusters of otherwise healthy-appearing adults having pretty severe hand, foot, and mouth disease," said Rosenbach. He soon presented the findings in the Infectious Disease Division's clinical case conference. Afterward, another doctor approached Rosenbach with a theory: Perhaps the rise in cases was related to the region's increasingly mild winters. It had been predicted, Rosenbach said, that changing weather patterns would impact viral disease spread.

A scan of hand, foot, and mouth disease data in China, where the virus is a reportable illness, confirmed that diagnoses increased during hot and humid periods. "When you start looking into it," Rosenbach said, "there are a lot of [dermatological conditions that are affected by the changing climate]."

The findings inspired a 2017 paper in the *Journal of the American Academy of Dermatology*, co-authored by Rosenbach, that described how several North American diseases—including hand, foot, and mouth disease; Lyme disease; and Zika virus—could expand their geographic footprint or cause longer, more intense seasons of illness due to climate change. Those predictions were since borne out for Lyme and Zika, and also proved true for certain fungal and parasitic infections.

"Climate touches everything, and the skin is a big environmental interface organ, so it's not surprising that there is a relationship between them," Rosenbach said. "This is an area of medicine that's just starting to be explored."

Penn Medicine researchers like Rosenbach are adding to a growing body of evidence showing the many ways climate change touches human health. Their work elucidates how the climate affects skin conditions, cardiovascular events, maternal health, and even the effectiveness of medications. This research represents a key component of Penn Medicine's mission as a health care organization: to improve well-being not only for individual patients, but for the community at large.

People and Planet are 'Inextricably Linked'

It was the Pacific Northwest heat wave of 2021, which caused hundreds of deaths in the region, that opened the eyes of Sameed Khatana, MD, MPH, an assistant professor of Cardiovascular Medicine in the Perelman School of Medicine. "It's not an area that traditionally we associate with extreme heat," he said. "When these communities are now being exposed to extreme heat, you're starting to see a greater impact on the health of the populations there."

When we get overheated, mechanisms in our bodies work hard to release excess heat, Khatana said. This effort causes the heart to beat faster and harder—a strain that can make certain people susceptible to a heart attack or other cardiovascular event. In fact, as Khatana outlined in an October 2023 paper in the journal *Circulation*, because of climate change, heat-related cardiovascular deaths would be predicted to increase in the United States over the next four decades, with older adults and Black adults experiencing the greatest impact. (Black adults already have a higher risk of cardiovascular disease, which can be tied to both social determinants of health and clinical factors like high blood pressure.)

Health care providers should consider counseling patients with pre-existing conditions—or those with jobs that expose them to high temperatures, such as construction or agricultural workers—to recognize symptoms of heat exposure, Khatana said. Leaders of health systems should think about how they'll respond to a community heat wave, he said, perhaps by setting up cooling tents near the emergency department and increasing staff.

"What happens to the environment impacts our health," Khatana said. "The health of the planet and the health of the individuals living on the planet are inextricably linked."

Climate change can even disrupt sleep. An observational study published in *Sleep Health* by researchers from the Perelman School of Medicine and the University of Louisville

found that a warm bedroom, air pollution, and high levels of carbon dioxide were all independently linked to lower sleep efficiency, the time spent sleeping relative to the time available for sleep.

"These findings highlight the importance of the bedroom environment for high-quality sleep," said study lead author Mathias Basner, MD, PhD, a professor and director of the division of Sleep and Chronobiology in Psychiatry at Penn Medicine.

While certain medications are known to make people more susceptible to high temperatures, Sean Hennessy, PharmD, PhD, a professor in the Department of Biostatistics, Epidemiology and Informatics in the Perelman School of Medicine, has identified one drug that appears to have a protective effect.

Statins, which are taken to lower cholesterol levels, also improve the body's ability to dilate blood vessels in the skin, which help release excess heat. In a 2019 paper in *Scientific Reports*, Hennessy quantified the connection, showing that statin use had a stronger effect on survival during hot weather than milder temperatures. While the benefit needs more study, he said the research shows that it's particularly important for people who use statins to remember to take the medication when it's hot out.

In related work, Hennessey also found that patients taking diuretics can reduce their risk of death by taking prescription potassium supplements during hot weather. "Climate change is probably the largest threat to human health in the 21st century," he said. "It's going to affect the treatment of virtually every [medical] condition."

A Healthier World for All

Every time there's a flood in Philadelphia's Eastwick neighborhood, which sits at the confluence of Cobbs and Darby Creeks in the southwestern corner of the city, locals face a deluge of water that flows first into a landfill site, then into their homes. In the aftermath, there are concerns about toxic chemicals, mold, and asthma, said Marilyn Howarth, MD, director of community engagement at the Center of Excellence in Environmental Toxicology at the Perelman School of Medicine.

"Imagine the health impacts of repeated flooding," said Howarth, also an adjunct associate professor in the Department of Systems Pharmacology and Translational Therapeutics. "Imagine the mental health toll that takes."

The center, funded by the National Institute of Environmental Health Sciences, researches local issues of environmental concern, including flooding, heat, and air pollution. In its years of work with the Eastwick community, the center has engaged with residents about how to safely clean up following a flood and assisted residents as they work with municipal, state, and federal agencies in developing a potential solution to the ongoing flooding.

"Usually what is good for the environment is also good for human health," Howarth said. "Better management of stormwater through reduction of impervious ground not only improves the flooding, but creates a healthier neighborhood for all."

The Urban Health Lab at the Penn Medicine Center for Health Justice houses a repository of population-level research that highlights the connection between our surroundings and what's happening in our bodies, said Eugenia South, MD, MS, the center's executive director and the Ralph Muller Presidential Associate Professor of Emergency Medicine in the Perelman School of Medicine.

There is research showing that people's heart rates calm when they walk past green space, that pregnant people have better cardiovascular outcomes when they live near green space, and that greenery has a positive impact on blood pressure and cortisol levels. "There are many studies that paint a convincing picture of the importance of nature and green space," said South, who is also associate vice president of Health Justice at UPHS. "We know these things work to promote health and safety. We should be doing them."

South and her team spearheaded Deeply Rooted, a community-academic collaborative that translates research about the benefits of nature into boots-on-the-ground action. In collaboration with over 20 community partners in West and Southwest Philadelphia, Deeply Rooted is planting trees, greening vacant lots, and building miniature parks. Deeply Rooted engages with local youth to teach the health benefits of nature and use nature as a tool to teach civic engagement and leadership. Additionally, local community residents and organizations receive grants from Penn Medicine and Children's Hospital of Philadelphia to realize their visions for greener neighborhoods, whether by creating community gardens, organizing bike rides in nature, or completing another nature-inspired project. "All aspects of health, ultimately, are shaped by our environment," South said. "The hope is that we [as researchers] can contribute to a conversation about solutions."

The Power of Protons

By Kirsten Weir *Photography by Peggy Peterson*

Penn Medicine has treated more than 10,000 cancer patients at three proton therapy centers across the region, including the largest and busiest center in the world—while also leading the way in research to expand the healing potential of these positive particles.

Radiation oncologist Pamela Boimel, MD, PhD, treated Lindsay Schoenberger's brain cancer with proton therapy at Penn Medicine Lancaster General Health.

Lindsay Schoenberger had suffered from headaches since she was a teenager. But in early 2023, when she was 36, things took a turn. She started having intense headaches every day, often accompanied by dizzy spells. "When I had a headache, I felt like I was in a bubble. I couldn't even think of simple words," she said. "It was impacting my entire life." Her doctor prescribed migraine medication, but it didn't help. Then an MRI revealed stage four glioblastoma, a serious brain cancer.

The next few weeks were a blur: Travel from her home in Lancaster to Philadelphia for surgery to remove the tumor at the Hospital of the University of Pennsylvania, and meetings with oncologists to discuss a plan for chemotherapy and radiation that she could receive closer to home. In the whirlwind of information coming at her, Schoenberger remembers her radiation oncologist, Pamela Boimel, MD, PhD, carefully describing a special kind of radiation that could help protect her brain from radiation side effects.

"When we treat a patient with X-rays, there is an entry dose where the radiation enters the body, and an exit dose where it leaves," explained Boimel, the director of proton therapy at Penn Medicine Lancaster General Health. Protons, by contrast, have no exit dose. That meant the beam could be tailored to stop precisely at the edge of Schoenberger's tumor, limiting the amount of radiation to the normal tissues in her brain. "By stopping the proton beam before it reaches healthy tissue beyond the tumor, we can decrease radiation side effects," Boimel said.

For the better part of a century, proton therapy has occupied a small niche within the field of radiation oncology. But over the last decade or so, demand for proton therapy has grown as evidence for its benefits has piled up. Much of that evidence traces back to Penn Medicine, which has played a leading role in championing proton therapy and moving the field forward.

A Central Hub for Proton Therapy

The Roberts Proton Therapy Center at Penn Medicine's Abramson Cancer Center opened in 2010 as the largest and busiest center in the world for proton therapy. That's still true today, with more than 100 patients coming for treatment each day. Over the past two years, Penn Medicine has also expanded access to the specialized therapy by opening proton centers at Penn Medicine Lancaster General Health in Lancaster, where Schoenberger was treated, and at Virtua Health in Voorhees, New Jersey. (See "Extending the Reach of Proton Therapy.") Collectively across these three centers, Penn Medicine recently surpassed 10,000 patients treated with proton therapy. Meanwhile, research teams across the University of Pennsylvania continue to push the boundaries of these positive particles.

In the early years of the Roberts Proton Therapy Center, the treatment was used in only a small number of cancer types, said the center's leader, James Metz, MD, chair and Henry K. Pancoast Professor of Radiation Oncology at the Perelman School of Medicine. "Over the past decade and a half, we've developed new techniques, new technologies, and new imaging modalities that allow us to deliver proton therapy more effectively," Metz said. "Now we can treat virtually every disease site with protons, and it's a very important tool in our toolbox."

Penn Medicine's chair of Radiation Oncology, James Metz, MD, oversees a unique "hub-and-spoke" model for delivering proton therapy guided by Penn experts at multiple locations across the region. He is also a researcher who has helped to establish the growing evidence base on when and how proton therapy offers benefits compared to conventional radiation.

Unlike conventional radiation therapy, which uses X-ray photons to kill cancer cells, proton therapy uses a beam of high-energy protons (positively charged particles) accelerated to two-thirds the speed of light. Though the treatments are similarly effective at killing tumors, protons offer some notable benefits. Most significantly, they can cause less damage to tissues surrounding a tumor. That makes protons especially valuable when treating cancers near vital organs like the heart or close to critical structures in the brain.

For her brain cancer, Schoenberger didn't hesitate when she learned she could have proton therapy at Lancaster General Health's Ann B. Barshinger Cancer Institute, just a 10-minute drive from her home. A year later, her headaches have eased and she's able to get back outside for bird-watching hikes, one of her favorite pastimes. "The fact that the proton beam could stop right where it was needed, instead of going straight through my brain, made it the clear way to go," she said. "It was the least invasive of all of my treatments, and I'm extremely grateful it was an option."

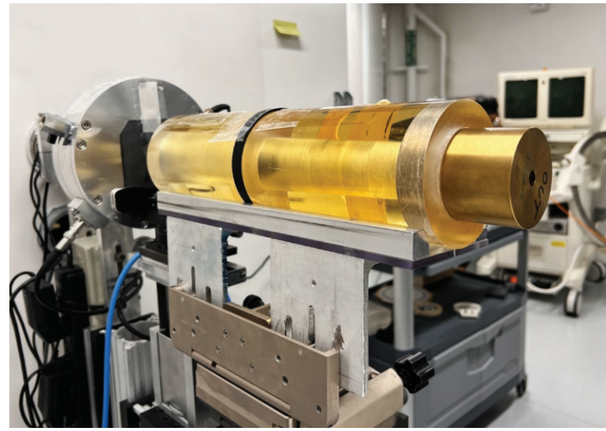
The Pros in Proton

Protons aren't a panacea. Depending on a tumor's location and a patient's anatomy, proton therapy may not offer an advantage over traditional radiation therapy. But for those who are good candidates, the benefits can be significant. "It can be particularly important in situations where we're treating near organs with very high sensitivity to radiation—or when a patient is getting chemotherapy at the same time," Metz said.

Metz and his colleagues demonstrated the benefits of using proton therapy alongside chemotherapy in a 2020 paper published in *JAMA Oncology*. The study showed that patients with locally advanced cancers had significantly lower risk of severe side effects when chemotherapy was combined with proton therapy versus traditional X-ray radiation. The researchers assessed side effects such as pain, difficulty breathing, trouble swallowing, and nausea, focusing on side effects severe enough that patients had to be hospitalized. They found that proton therapy reduced the relative risk of severe side effects by two-thirds, while cure rates for the two groups remained the same.

Proton therapy can also be helpful for re-irradiating patients whose cancer has returned, said Graeme Williams, MD, MBA, a Penn Medicine radiation oncologist who treats patients at the Penn Medicine | Virtua Health Proton Therapy Center in Voorhees, New Jersey. "When you treat an area of the body with radiation, it's as if the tissues remember. There's a certain amount of radiation the tissues can tolerate over their lifetime, at which point the risk of side effects increases substantially," he said. "Because protons allow us to spare tissues near the tumor, this treatment gives us an option when we don't have a safe way to offer traditional radiation therapy."

Protons are also an important tool for treating children. Human tissues are particularly sensitive to radiation when they're growing, and radiation can impair bone and muscle growth in kids. Because proton therapy is less damaging to healthy tissues, it's now the go-to choice for children who require radiation, Metz said. Through a partnership with Children's Hospital of Philadelphia (CHOP), specialty-trained pediatric radiation oncologists treat children at the Roberts Proton Therapy Center.



The Roberts Proton Therapy Center includes a dedicated research room for studying proton therapy techniques for humans and animals.

Mapping the Future of Proton Therapy

Proton therapy was first used to treat cancer in the 1950s, but the technique was slow to gain momentum. Now the tide is turning as researchers hone the technology and expand its use. Radiation oncologists at the Roberts Proton Therapy Center were the first to integrate soft-tissue imaging into proton therapy, making the treatment even more precise. Penn Medicine experts were also at the forefront of a new approach known as pencil-beam scanning. With this technique, radiation oncologists use a proton beam a few millimeters wide—about the width of a pencil—to carefully target a tumor layer by layer, almost like painting by numbers. "Over the past 10 years, our ability to shape the proton beams has gotten so much better. We're able to use very sophisticated methods to shape the beam and deliver the treatment very precisely," Boimel said.

Penn Medicine is also one of the world's leading centers for proton research. In addition to its treatment rooms, the

Roberts Proton Therapy Center features a dedicated research room outfitted for studying proton therapy in humans and animals. The center is also actively involved in clinical trials, including several national multisite trials currently underway. Many of those trials focus on comparing protons to traditional X-ray radiation for different cancer types, such as esophageal or breast cancer. The ongoing Radiotherapy Comparative Effectiveness (RadComp) Consortium Trial, for example, is the largest clinical trial to date to compare proton and photon therapy for patients with locally advanced breast cancer.

One important aim of RadComp and other proton trials is to follow patients over time to assess long-term outcomes, said Randall Oyer, MD, executive medical director of the Ann B. Barshinger Cancer Institute at Penn Medicine Lancaster General Health. "We can show definitively that proton beams have an advantage in sparing healthy tissue, and we know some treatment side effects are reduced. But proton therapy is new enough that we don't yet have the long-term data to determine whether there are differences in survival," Oyer said. Clinical trials are helping to answer those questions, he added. "We try to learn from every patient we treat, and treat every patient according to what we've learned."

Meanwhile, experts across Penn Medicine are teaming up to study a promising new form of radiation therapy known as FLASH. A new paradigm for radiotherapy, FLASH delivers an entire course of radiation in just a few ultra-high doses lasting less than a second each. In recent years, Penn Medicine scientists have laid the groundwork for FLASH proton therapy in mouse models and veterinary studies, and they're preparing to launch human trials in the coming year. (See "FLASH Forward.")

Patient-Powered Proton Study Looks at Long-Term Side Effects

Radiation therapy is an integral part of the treatment picture for many patients with breast cancer. But it sometimes comes at a cost: side effects including heart problems years later. Could proton therapy reduce some of those side effects while maintaining comparable cure rates to traditional radiation?

"We did this study because we knew this was an important problem that patients cared deeply about," said Justin Bekelman, MD, the Marietta and Howard Stoeckel Professor at Penn Medicine, who designed and leads the Radiotherapy Comparative Effectiveness (RadComp) trial, the world's largest randomized clinical trial of proton therapy.

Launched in 2016 with funding from the Patient-Centered Outcomes Research Institute, the RadComp study compares long-term heart outcomes and cancer control among 1,239 breast cancer patients randomly assigned to receive proton therapy or photon radiation therapy across the United States. In March 2024, the study reached the key milestone of completing patient enrollment.

From the start, the trial was designed to be "patient powered." Bekelman and his colleagues worked closely with breast cancer patient advocates to design a study that would address patients' concerns while making it easier for patients to participate in the research. The researchers also made sure patients were compensated appropriately for the time and effort they devoted to participating — an approach that is more common in 2024, Bekelman notes, but was novel when RadComp began in 2016.

Cynthia Chauhan, a retired social worker from Wichita, Kansas, who was treated for breast cancer at the Mayo Clinic in 2001, has been involved with RadComp since the beginning. She and other patient advocates meet regularly with the study leaders. They helped shape the trial's key questions, trouble-shoot challenges and provide input on everything from communicating with participants to better engaging research participants from underserved communities. "This trial has involved patient voices from the very beginning, and we have been actively engaged throughout," Chauhan said. "Whenever I'm speaking with someone about how to design a patient-centered trial, I tell them to call Justin Bekelman to find out how to do it right."

Bekelman and his colleagues will follow participants through 2031. Though it will be some time before final results are available, the team expects to publish analyses of patient-reported outcomes in early 2025 and cancer control several years after.

Chauhan said she looks forward to the findings helping patients distinguish between two reliable treatment options to "guide us and our physicians in choosing the better approach to lengthen and improve our lives."

Whatever the findings, Bekelman said, the trial is already a success.

"RadComp is patient-centered and highly collaborative among enrolling institutions and physicians nationwide. And it will report on side effects and cancer control outcomes that are tremendously important to patients," Bekelman said. "Those features make this study we designed at Penn an exemplary model for how to conduct randomized trials of advanced technologies, within cancer and beyond."

The Roberts Proton Therapy Center is the largest and busiest such center in the world, where more than 100 patients per day come for treatment.

Comprehensive Training

Thanks in part to research findings from Penn Medicine, patient demand for proton therapy is growing. But specialized training is necessary to administer the treatment, which has limited the growth of proton centers. To meet that need, Penn Medicine has established itself as a proton training ground to prepare professionals worldwide in all aspects of providing patients with proton therapy—not just the medical care, but also operational and infrastructure aspects of running a center.

Through a comprehensive training program, Penn Medicine educates providers including radiation oncologists, medical physicists, medical dosimetrists, and radiation therapists through web-based training and on-site programs in Philadelphia and Lancaster. Since 2014, the Roberts Proton Therapy Center has hosted more than 350 health care professionals for on-site training and provided education to 18 proton centers outside the U.S., in countries such as Poland, Spain, Singapore, China, and India. The curriculum can be customized to meet the needs of visiting trainees, who come from a variety of diverse backgrounds and education levels within the field of radiation oncology. Last year, the center formalized its educational offerings with the launch of the Penn Radiation Medicine Institute, a program to provide training and supportive services to proton centers around the world.

Such training initiatives are helping to grow the reach of proton therapy around the world. Still, few centers match the scale of Penn Medicine's program. Fewer than 50 proton centers are operating in the U.S., and most consist of a single treatment room, said Jeffrey Bradley, MD, vice chair of Proton Therapy & Technology Development at Penn Medicine. The Roberts Proton Therapy Center features five treatment rooms and is one of only a handful of proton programs fully integrated into a National Cancer Institute-designated comprehensive cancer center.

Bradley joined Penn's faculty in 2023, drawn by the size and reputation of the program's clinical and research programs in proton therapy. "So many of the technological advances in proton therapy were first implemented here at Penn, and we continue to be the leader in protons around the world," he said. "We're seeing more and more data to show that protons can offer an advantage, for many types of cancer. Having proton therapy available makes a big difference to the patients we serve."

Extending the Reach of Proton Therapy

The largest and most advanced center in the world for proton beam radiation is applying its expertise to treat patients in communities beyond Philadelphia.

When the Roberts Proton Therapy Center opened at Penn Medicine's Abramson Cancer Center in 2010, patients came from far and wide to access the pioneering cancer treatment. Now, the largest and most advanced center in the world for proton beam radiation is applying its expertise to communities beyond Philadelphia. This expanded reach is part of Penn Medicine's unique "hub-and-spoke" model to open the door for patients to receive world-class cancer care closer to their homes.

In late 2022, Penn Medicine Lancaster General Health's Ann B. Barshinger Cancer Institute opened the only proton center in central Pennsylvania. The following spring, Penn Medicine partnered with Virtua Health to open southern New Jersey's first proton therapy center on the Virtua Voorhees Hospital campus. "The hub-and-spoke model for proton therapy doesn't exist anywhere else," said Jeffrey Bradley, MD, vice chair of Proton Therapy & Technology Development at Penn Medicine. "Proton therapy provides advantages for many people with cancer, and increasing access to people in their communities makes a big difference to the populations we serve."

For the right patients, proton therapy offers significant benefits, including better sparing of healthy tissue and lower radiation toxicity. Until recently, patients in central Pennsylvania and southern New Jersey had to travel to Philadelphia to receive the treatment—a significant burden, since proton therapy is typically administered daily for six to eight weeks.

"Many patients came to the Roberts Center from very far away, yet we were still seeing only a small sliver of the patients who would be candidates for proton therapy," said Graeme Williams, MD, MBA, a Penn Medicine radiation oncologist who trained at the Philadelphia facility before being hired to build out the proton therapy program Penn now runs in partnership with Virtua Health. "This hub-and-spoke model is an innovative investment in a treatment that is still only available at a limited number of places across the country."

The Gift of Time

Penn Medicine's investment in region-wide access to proton therapy made all the difference to Lindsay Schoenberger of Lancaster, who was diagnosed with stage four glioblastoma at age 36. After surgery to remove the tumor, she began chemotherapy and six weeks of daily proton therapy. If she'd been treated at the Roberts Proton Center, she said, her mom would have had to take time off work to care for her in temporary housing in Philadelphia. And Schoenberger would have had to scramble to find someone to watch her dog Ruby and ferret Booker. "It would have disrupted our lives," she said. Instead, she had proton therapy in Lancaster, close to her home and her support network. "I was so grateful to get the treatment just 10 minutes from my house. Everyone at the radiation center was so friendly, and seeing their familiar faces each day made the treatment easier," she said.

Schoenberger's experience is a familiar one to Randall Oyer, MD, executive medical director of the Ann B. Barshinger Cancer Institute. "One of the things that is so important to cancer patients is time. The time saved by being treated close to home has really been a gift to patients and their families," he said. "They tell us that because proton therapy is located locally, they can take less time off work or take their children to school. They have more time for the things that matter most to them."

Centralized Expertise

Proton therapy requires a significant financial investment, since proton accelerators are expensive to install and maintain. But cost is just one limitation. "There's a big learning curve for providers to become proficient with the therapy," said James Metz, MD, chair of Radiation Oncology. In Penn Medicine's model, physicists and dosimetrists at the Roberts Proton Therapy Center develop individualized plans for each patient. Those plans are sent to community centers in Lancaster and at Virtua in New Jersey, where local oncologists administer the treatments to patients.

"By centralizing the planning process and standardizing care across all our facilities, we've been able to open new centers that offer the highest standard of care from day one," Metz said. "This model allows us to make sure all of our treatment teams have access to all the tools in the toolbox, so they can determine which therapies are right for individual patients."

Thanks to Penn Medicine's long history with proton therapy, staff have expertise in practical aspects of insurance and billing as well. Because proton therapy is less established than conventional radiation, insurance companies have more restrictions on what it can be used for. Part of the success of the hub-and-spoke model stems from Penn Medicine's expertise in advocating for patients who would benefit from the treatment.

Lindsay Schoenberger of Lancaster was able to receive proton therapy treatments only 10 minutes from her home at the Ann B. Barshinger Cancer Institute of Penn Medicine Lancaster General Health, instead of temporarily moving to Philadelphia.

The Abramson Cancer Center has thought carefully about how to distribute many kinds of specialized services across the region, Metz added. Within radiation oncology, treatments including brachytherapy, stereotactic radiation, and proton therapy are all offered at select community cancer centers. "By offering those services at some but not all locations, we can provide regional access while making sure we maintain enough patient volume so that providers can stay highly proficient," Metz said.

The success of Penn Medicine's regional care model also owes its success to the quality of its training programs, said Pamela Boimel, MD, PhD, medical director of Radiation Oncology and director of Proton Therapy at Penn Medicine Lancaster General Health, who, like Graeme Williams, trained as a resident in Radiation Oncology at Penn in Philadelphia. "Penn Medicine has worked hard to develop a global education platform that prepares physicians to provide proton therapy, both across our system and around the world," she said.

As research continues to propel proton therapy forward, patients at Lancaster and Virtua are poised to reap even further benefits, she added. "As we learn more from clinical trials, we can roll out what we've learned to community cancer centers—and potentially even offer the opportunity to participate in trials to patients at our community sites. That really speaks to Penn's mission of providing equitable care," she said.

Ultimately, Penn Medicine's commitment to establishing a cohesive system of advanced care across its facilities will serve as a model for other health systems to follow, Oyer predicts. "Penn is the only system so far that has put proton therapy into community sites while maintaining centralized protocols, safety, and standards of care," he said. "It is an extraordinary gift that I believe will transform the way cancer care is provided across the country."

FLASH Forward

An experimental method delivering proton therapy radiation in just a few ultra-fast doses could be a paradigm shift in radiation therapy.

Researchers at Penn Medicine are pioneering a new type of radiation therapy that could force textbooks to be rewritten. For decades, the concept of "fractionation" has been dogma in radiation oncology. A total dose of radiation is divided into smaller doses, or fractions, delivered to the patient in a series of treatments over days or weeks. But an experimental new form of radiation, known as FLASH, upends that tried-and-true approach. "The traditional idea is that by fractionating radiation, we can kill tumor cells while sparing healthy tissue. FLASH turns this idea on its head," said Constantinos Koumenis, PhD, the Richard H. Chamberlain Professor of Radiation Oncology at Penn Medicine.

Conventional X-ray and proton therapies deliver a beam of radiation over the course of two to five minutes. FLASH therapy blasts tumors with an ultra-high dose of radiation in less than a second. And instead of spacing out the total dose across dozens of treatments, FLASH could be delivered in just one to five treatments, rather than 30 or 40. "Our research suggests that by delivering an entire dose of radiation in a few ultra-fast treatments, we may be able to kill the tumor while sparing healthy tissue," Koumenis said.

Koumenis is co-principal investigator of a $12.3 million, five-year grant from the National Institutes of Health (NIH) to study proton FLASH, along with Alexander Lin, MD, the Morton M. Kligerman Professor of Radiation Oncology. The research builds on Penn Medicine's preclinical research of FLASH radiation, with the goal of launching human clinical trials in late 2024. Making that happen is an interdisciplinary team of more than two dozen scientists, including biologists, physicists, and clinicians in human and veterinary medicine.

Over the last decade, that team has collaborated to position the University of Pennsylvania as a global leader in this new approach to radiation therapy. "FLASH is still experimental, but it has jumped through every hoop we've put it through so far," said James Metz, MD, chair of Radiation Oncology at the Perelman School of Medicine and leader of the Roberts Proton Therapy Center at the Abramson Cancer Center. "We're very excited about where this is headed."

Breaking New Ground

FLASH was born in 2014, when French scientists reported results of a study using ultra-fast, high-dose-rate radiation in laboratory animals. They showed the FLASH technique had the same tumor-fighting effects as a conventional dose rate, but was better at protecting healthy tissue. Those early studies used electrons to produce the FLASH effect. While the technique showed promise, it had limited potential for human treatment, since commercially available electron radiotherapy machines can only treat tumors about 2.5 inches deep inside the human body. But almost immediately, researchers at Penn Medicine recognized the potential of protons.

By the time the French study was published, the Roberts Proton Therapy Center had already established itself as a world leader in proton therapy, a type of radiation therapy that uses these positively charged particles to treat a tumor. In addition to five proton therapy treatment rooms where more than 100 patients receive care each day, the center includes a dedicated research room for animal and human research on proton therapy. FLASH was an obvious next step for that research, though it took some creativity to get started. To generate and accurately measure the ultra-high proton beam dose rates, Penn scientists incorporated novel design features into their proton beam research room. Later, Penn scientists collaborated with an industry partner to bring FLASH proton radiotherapy into clinical treatment rooms to make it possible to conduct advanced veterinary clinical trials. That unique infrastructure, equipped with small-animal imaging capabilities and located just steps from the clinic, has allowed Penn to spearhead research on FLASH proton therapy.

In 2020, Penn Medicine researchers published a landmark study in mice, demonstrating that it was feasible to deliver ultra-high-dose proton therapy. The study, led by senior authors Metz, Koumenis, and Keith A. Cengel, MD, PhD, a professor of Radiation Oncology at Penn Medicine, compared FLASH to traditional proton therapy in a mouse model of pancreatic cancer. They found FLASH was just as effective at controlling tumors but spared more healthy tissue. The resulting paper, published in the *International Journal of Radiation Oncology, Biology, and Physics*, was among the journal's most-cited papers that year. "The reason proton therapy is so exciting is that it already spares more normal tissue than traditional radiation. Our hope is that with FLASH, we can spare even more," Koumenis said.

In a series of additional animal studies, the team found that FLASH radiation might also improve survival—in part because it reduces the incidence of toxic side effects. Rodents treated with FLASH for intestinal cancer were less likely to develop skin infections and lymphedema, a serious condition which is also observed in patients receiving radiation therapy. Those treated for head and neck cancers had lower rates of severe side effects like reduced saliva production or difficulty swallowing, which can interfere with eating and nutrition. In both cases, the reduction of side effects from FLASH treatment led to mice living longer. "We're cautiously optimistic that if these results translate to human patients, this could have significant benefits for patient survival and quality of life," Koumenis said.

FLASH for Fido

Following those promising animal studies, the Department of Radiation Oncology received more than $12 million in new funding from the NIH in 2022 to study FLASH in a collaborative effort with scientists and clinicians at Penn and the Universities of Heidelberg, Oxford, and Toronto. The funding supports a variety of studies on FLASH, including a trial treating pet dogs with the bone cancer osteosarcoma. That study, currently underway, is led jointly by medical school faculty and researchers at the School of Veterinary Medicine.

In the first phase of the canine study, led by Radiation Oncology Professor Theresa Busch, PhD, the researchers used FLASH to treat pet dogs who were brought to the vet school for treatment of osteosarcoma of the leg. After the FLASH treatment, the affected limb was amputated—the standard treatment for this type of cancer. Researchers then collected the tumor and surrounding tissues to assess them for molecular and immunological changes that occurred as the result of the treatment. Their findings were similar to those in lab animals: Treatment with FLASH reduced markers of skin toxicity in the canine patients.

After demonstrating that the treatment was feasible and safe in those first canine patients, the team began treating pet dogs with tumors of the head and neck where surgical removal was not a good option. Through this phase of the study, the radiation oncology team is honing their technique in preparation for eventual human trials, explained Lillian Duda, VMD, MBE, a clinical professor of Radiation Oncology at Penn Vet. "We're refining the proton FLASH technology as we go," Duda said.

That refinement, in collaboration with industry partners, has not only brought FLASH proton radiotherapy into clinical treatment rooms, but further developed the technology to make the treatment conformal, added Michele Kim, PhD, an assistant professor of Radiation Oncology at Penn Medicine. In conformal radiation, providers use CT scans to create

Canine patient Ruthie was the first participant in a trial using conformal FLASH proton radiation.

three-dimensional maps of the tumor. Then they use a series of attachments and 3D-printed devices to shape the radiation beam precisely to match the unique shape and size of the tumor while providing customized protection of surrounding normal tissues. While conformal radiation is common in forms of radiation therapy used clinically today, it had never been done with FLASH, Kim said.

In fact, while there are already human clinical trials underway using proton FLASH at the University of Cincinnati for patients with metastatic bone cancer, the beam of protons in those trials is used in a "shoot through" mode, where the protons do not stop at the site of the tumors (i.e., they hit the target and exit the patient).

"We're the first in the world to deliver conformal FLASH on a patient—in this case, a canine patient," Kim said. This type of innovation is possible thanks to Penn's foresight and vision, Duda said. The university strategically located the vet school's facility for treating small animals like cats and dogs near to the medical school to facilitate interdisciplinary research. "This kind of collaboration can happen here because people are willing to listen to one another and cross-pollinate ideas," she said.

"In complex diseases like cancer, rodent models can only tell you so much. Companion animals are more genetically variable than rodents, live in the same environments we do, and have spontaneously occurring cancers that more closely mimic human disease," Duda added. "That makes this research very beneficial, and the data we collect will directly inform efforts to launch a human trial."

Human Trials and How FLASH Works

Penn researchers hope to launch their own human trial later this year. Unlike trials that have begun to date, the Penn team hopes to use conformal FLASH because they believe it represents the best approach to take full advantage of protons' physical properties in sparing normal tissues.

Lin will lead the planned FLASH trial for patients with head and neck cancers, his clinical specialty. The study will focus on patients who require re-irradiation because their cancer recurred or because they developed a new cancer. Radiation in the head and neck area can cause significant side effects, including fractures of the jaw, serious wounds in the mouth and throat, and even potentially fatal damage to the carotid artery. "Re-irradiation in this population can be very toxic, and our standard approaches aren't very effective," Lin said. "We're hoping to try something different."

Some patients who need a second course of radiation for head and neck cancer can receive treatment in as few as five sessions, with each session lasting several minutes. In the FLASH trial, Lin and his colleagues plan to deliver each session with FLASH radiation in a matter of milliseconds. By doing so, the team hopes to show that FLASH is both safe and feasible. If that first study is a success, they plan to launch a larger trial to assess the treatment's efficacy.

Meanwhile, Penn scientists are investing heavily in molecular research to understand how and why FLASH might have an advantage over standard radiotherapy, with support from both the NIH grant for FLASH research and the Mark Foundation Center for Immunotherapy, Immune Signaling and Radiation. "There are a lot of hypotheses about why normal tissues are spared with FLASH, but nothing conclusive yet," Koumenis said. Studies done in collaboration with the lab of Andy Minn, MD, PhD, a professor of Radiation Oncology, showed strong evidence that FLASH appears to spare progenitor stem cells that then allow tissue to regenerate after radiation therapy. "We're looking into the mechanisms by which that might happen at a single-cell resolution," Koumenis said.

The researchers are also pursuing intriguing evidence that FLASH may help protect immune function. Research on medulloblastoma, a type of brain tumor, suggests that treatment with FLASH may change the immune microenvironment around the tumor, making it more vulnerable to treatment with CAR T cell therapy. "So far, trials that attempt to combine radiation therapy and immunotherapy have been disappointing. That's probably because when we're giving radiation every day for six or seven weeks, you blunt your body's immune function and response, which are critical for response to immunotherapy," Lin said. "We're hopeful that by treating with FLASH, and better preserving one's natural immune system, patients may have a better response to immunotherapy."

There is a lot still to learn, but Penn researchers are moving full speed toward an era of FLASH radiation therapy. If the trials bear fruit, the proton therapy equipment already in use at Penn could be easily adapted to provide FLASH treatment. "We have all the necessary ingredients to investigate this in the most rigorous way, and to take our findings from bench to bedside as safely and effectively as possible," Lin said.

From basic research in mice to trials in dogs and eventually humans, advancing the field of FLASH depends on the type of interdisciplinary research that Penn makes possible, Kim added. "This has truly been a team effort with clinicians, biologists, engineers, and physicists. None of us could do this on our own," she said. "We're all talking and working and learning together, and it's sparking a lot of new ideas."

THE SCIENCE OF A LONG, HEALTHY LIFE

Philanthropy, a supportive culture for junior faculty, and a robust research and technology-development infrastructure are among the many ways Penn Medicine is expanding the potential for active aging for our patients and the population beyond.

After getting healthy stretching and exercise prep tips from Orthopaedic Surgery Chair Scott Levin, MD, guests of Penn Medicine's afternoon at Naples Pickleball Center took to the courts.

One of the most striking changes seen in most of our lifetimes has been in global life expectancy—and at Penn Medicine, we're also seeing patients who have faced devastating illness in their later years not only survive, but then thrive during their renewed time with family, friends, and the world around them.

"I think one of the most important paradigm shifts is just how we think of people as they age," said Tiffany Peng Hwa, MD, an assistant professor of Otorhinolaryngology: Head and Neck Surgery at the Hospital of the University of Pennsylvania and Director of the Penn Center for Adult-Onset Hearing Loss. "I think it's an increasingly bad bet, actually, to make assumptions about their level of activity, employment, or engagement with the world."

"Some of my patients are out there doing philanthropic efforts, they're volunteering, they're very involved in their families. They're still involved in the companies they work for. For clinicians at Penn Medicine, we're already thinking about maximizing our patients' 'healthspan,' as well as their years, to enjoy the most out of active aging."

After Penn Medicine's exclusive dinner event at The Ritz-Carlton, Naples, Interim Dean Jonathan Epstein, MD, moderated a panel with Ryan Offer, MD; Douglas Jacoby, MD; and Flavia Vitale, PhD.

In a similar vein, philanthropic support of leading-edge medicine and clinical trials also helps answer questions about countering or even preventing age-related illnesses and disability. Christoph A. Thaiss, PhD, an assistant professor of Microbiology and basic scientist who is fascinated by the human microbiome, credits donor gifts for building flexibility and speed into his work. "If it was not for philanthropic funding, many of our research projects would be much slower and much more restricted in their scope," he explained, "and what's even more important is that philanthropic funding is usually the catalyzer for large-scale projects that come down the road."

One great example has been the Dean's Innovation Fund: Fueled by more than $15 million in donor support, it helps some early-stage investigators pursue bold ideas that otherwise may not have attracted traditional funding. Hwa is grateful for the long-time support of Joseph Gates and the Ware Foundation to the Center for Adult-Onset Hearing Loss, saying, "Our team has been really fortunate to have received the Foundation's support on multiple occasions—and having that commitment renewed."

Interim Executive Vice President of the University of Pennsylvania for the Health System and Dean of the Perelman School of Medicine, Jonathan A. Epstein, MD, is excited about this new area of translation and discovery. "The potential in the 'active aging' space is difficult to condense—and because aging happens at the cellular and molecular level, it affects every organ and tissue. That also means success will come naturally from Penn Medicine's collaborative interactions between physicians, scientists, and their multidisciplinary teams."

UPHS CEO Kevin Mahoney with Marketa Wills, M'99, Chair of the Medical Alumni Advisory Council.

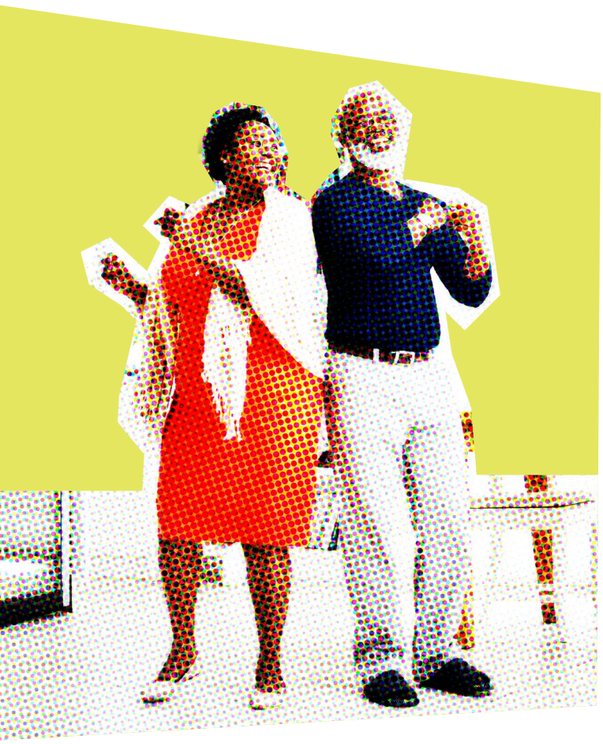
Developing Scientific Leaders

Interim Dean Epstein is also excited about how many of Penn Medicine's junior faculty are seizing the opportunity to lead. "We've fostered and are enjoying the benefits of a significant culture change in which junior faculty now have the support and confidence to advance their own ideas, as opposed to making the discovery and depending on others to take it to the next level."

"Our strategic plan's focus on faculty growth and development, and the strategic plan's commitment to our evolving research infrastructure, means we can better define and capture data, design new clinical trials, and—by increasing representation in our community—seamlessly weave health equity throughout."

Douglas S. Jacoby, MD, who is now the Louis R. Dinon, MD Teaching Chair of Clinical Cardiology and chief of Cardiology at Pennsylvania Hospital, knew that from his very first days at Penn Medicine. "My specialty was not something that other places supported," he recalled. "It was when I interviewed with Penn that the faculty said they'd work with me and foster my interest in cardiovascular disease prevention."

Another faculty member able to carve her own path is Flavia Vitale, PhD, an assistant professor of Neurology and Physical Medicine and Rehabilitation at the Perelman School of Medicine and assistant professor of Bioengineering at Penn's School of Engineering and Applied Sciences. It's at this intersection where she is exploring sleep disorders and



how they factor into brain decline, as well as refining intracerebral gene and drug delivery tools.

"It's thrilling, as an engineer, to be able to have real-world patients in mind and that there is a direct translation from my lab to the clinic—there's no artificial barrier at Penn Medicine," she explains. "Too often, technologies are designed as 'black boxes,' and my dream is to make them fully accessible and useful for my physician colleagues. Then they can become powerful tools for saving lives and improving care and quality of life."

She credits the Penn Center for Innovation and Penn Health-Tech for accelerating the lab-to-bedside (whether in the home or hospital) impact. "And philanthropy continues to play a huge role in 'bridging the gaps,' in my case providing the resources for prototype development and fabrications to the most exacting standards required by medicine."

Active Aging: Enhancing Lives Through Purposeful Years

Kevin B. Mahoney, the CEO of the University of Pennsylvania Health System, describes the essence of "active aging": "It's not merely about extending lifespans; it's about enriching the quality of those additional years. For example, patients who underwent groundbreaking CAR T cell therapy have not simply survived. They are thriving and are living embodiments of resilience and purpose. Many of their journeys exemplify the transformative power of active aging—a force that transcends medicine and touches the very core of human existence.

"At Penn Medicine, this remarkable opportunity reverberates across every facet of our work. We stand committed to not only adding years to our patients' lives but also ensuring that these years are vibrant, purposeful, and deeply fulfilling."

The proportion of older adults is rapidly increasing. By 2050, there will be twice as many individuals aged 60 and above as there are young children in most countries. It's a demographic shift that challenges researchers, physicians, and systems to reimagine health care, tailoring it to the unique needs of this aging population. In the clinic, Hwa works hand-in-hand with an on-staff genetic counselor who "takes a whole picture": dedicating the time to learn about the patient, their family, and their journey to receiving care. Vitale deeply values the contributions her device work can make in shortening and simplifying doctor visits—as well as transferring more of that care to the home, thanks to personalized rehabilitation and at-home monitoring.

The Penn Medicine community's work reinforces the reality that active aging isn't a solitary endeavor: It's a collective commitment to honor every individual's journey, whether they're running marathons or savoring quiet moments with loved ones. In partnership with Penn's donor and volunteer community, they are forging a path toward purposeful years, where age becomes a canvas for resilience, wisdom, and boundless possibility.

PENN MEDICINE IN NAPLES

Local members of the Council of Discovery Science had an opportunity to "convene" for Penn Medicine's dinner at The Ritz-Carlton: Brenda Moriarty, Marketa Wills, M'99, WG'06, Puja Aggarwal, MD, Jayaram Brindala, MD, M'06, Jim Moriarty, Jack Hoopes, Rob Corrato, MD, WG'00, Donna Corrato, Jonathan A. Epstein, MD, Jonathan Doft, and Joe Zebrowitz, MD, C'88.

Penn Medicine's events in Florida provide the opportunity to introduce friends and alumni to a tremendous group of colleagues: just a small sample of the faculty, students, and health care professionals who share a deep commitment to and abiding love for Penn Medicine. Among those who helped make Penn Medicine's 2024 visit successful were Amy and Joe Frick; Joan and Dan Hilferty; Graceanne and Jack Hoopes; Donna and Robert Corrato; Annette and Don Parker; and members of the Penn Medicine Board, Medical Alumni Advisory Council, and Council for Discovery Science.

At this year's exclusive dinner, Health System CEO Kevin Mahoney welcomed our guests and introduced the panel discussion moderated by Interim Dean Jonathan A. Epstein, MD, featuring Flavia Vitale, PhD, an assistant professor of Neurology and Physical Medicine and Rehabilitation and assistant professor of Bioengineering in Penn's School of Engineering and Applied Sciences; Douglas Jacoby, MD, the Louis R. Dinon, MD Teaching Chair of Clinical Cardiology and medical director of the Penn Medicine Center for Preventive Cardiology and Lipid Management; and Ryan Offer, MD, an associate professor of Clinical Obstetrics and Gynecology and medical director of Penn Health for Women at Penn Medicine Radnor.

The many informative discussions—over private gatherings, on the pickleball court, or in a panel—help demonstrate how the gifts donors have been making create maximum impact. Not only do they speak to Penn Medicine's compelling mission of science, medical education, and health care, but they also make its faculty, health care teams, and students feel energized, supported, and valued.

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1960s

Patricia Gabow, MD'69, GME'70, GME'73, has written and published *The Catholic Church and Its Hospitals: A Marriage Made in Heaven?*, which focuses on re-examining policies and practices to ensure the Catholic health system stays true to its roots of service and charity.

1990s

Michael D. Cabana, MD'94, MA'94, a professor and chair of Pediatrics at the Albert Einstein College of Medicine in New York City and physician-in-chief at the Children's Hospital at Montefiore, was awarded the 2023 Miller-Sarkin Research Mentoring Award from the Academic Pediatrics Association at the Pediatric Academic Societies Meeting in Washington, DC. He was recognized for outstanding mentorship to learners, both locally and nationally.

2000s

Nzinga Harrison, MD'02, has written and published *Un-Addiction*, which draws on peer-reviewed research and decades of expertise to describe the factors that predict one's risk for addiction and tackles stigma surrounding addiction.

2010s

Ben Hunter, MD, GME'17, has been selected as chief medical officer of Skyland Trail, an Atlanta-based nonprofit mental health treatment organization. He will provide leadership and oversight for all clinical services, research, and outcomes analysis and reporting.

"Citizen of the Year" Receives $48M Grant for Rare Disease Research

It's the kind of story movies are made of—after five near-death experiences, a physician-scientist puts his training to work and discovers a cure for his own disease. That's exactly what **David Fajgenbaum**, MD'13, MBA'15, did. In December, *The Philadelphia Citizen* honored him as their 2023 Citizen of the Year.

Fajgenbaum, an associate professor of Translational Medicine and Human Genetics in the Perelman School of Medicine, found a drug to treat himself for Castleman disease and went on to co-create the nonprofit Every Cure, which aims to harness the world's medical data to systematically repurpose the 3,000 medicines approved to treat 12,000 known diseases. In February 2024, the nonprofit received more than $48 million in federal funding from the Advanced Research Projects Agency for Health, or ARPA-H, to expand this work at a large scale.

The *Citizen* called Fajgenbaum, "the ultimate example of citizenship, marrying his personal experience with cutting-edge innovation to solve the challenges of people around the world."

Steven Douglas, Pioneering Immunologist, Innovative Clinician, and Revered Teacher

Steven D. Douglas, MD, an immunologist at Children's Hospital of Philadelphia; March 13. Douglas made significant contributions to immunology during his long and productive career, including important insights into primary immunodeficiencies as well as helping to understand and treat HIV. He was continuously funded by the National Institutes of Health for five decades and generated over 500 publications, and he was a mentor and a guiding light for countless trainees. A giant in the field, Douglas' influence was deeply woven into immunology around the world and in the CHOP and Penn community since 1980. He was the founding father of Allergy-Immunology at CHOP. Douglas infused rigorous technologic advances to understand primary immunodeficiencies at the dawn of the era of flow cytometry and was instrumental in transitioning many assays to the Clinical Immunology Laboratory at CHOP.

OBITUARIES

1950s

Jose J. Figueroa-Colon, MD'51, a urology physician; Dec. 28. Figueroa-Colon completed a surgical internship at Pennsylvania Hospital, and then returned to Penn to complete his urology residency. He served a tour of duty as a captain in the U.S. Army, stationed in Germany. Figueroa-Colon practiced urology for 51 years, retiring at 83 years old.

Donald W. Maloney, MD'52, an internal medicine physician; June 30. Maloney completed his internship at Abington Memorial Hospital. In 1953, he was drafted for military service and received assignments in Austria and Germany, where he served as a U.S. Army Captain in leadership roles with the medical corps until 1956.

Upon returning to the United States, Maloney completed his residency at Abington Memorial and the Philadelphia VA Hospitals and entered private medical practice in Lansdale, PA, while also serving as chief of the Medical Department at North Penn Hospital. After returning to Abington in 1963, he joined a small medical group which grew into Abington Medical Specialists during his tenure, where he practiced until his retirement in 2006. He was longtime chief of the Pulmonary division, director and later co-director of the Respiratory Care department. He also served as adjunct medical instructor at both Penn and Temple Schools of Medicine and headed the Philadelphia Doctor's Symphony.

William N. Mebane III, MD'54, an associate professor of Family Practice & Community Medicine; Oct. 1. Mebane interned at Philadelphia General Hospital, then served in the U.S. Army as a battalion surgeon at Fort Benning in Georgia. He returned to Philadelphia in 1957 for a residency in pediatrics at St. Christopher's Hospital for Children. In 1959, he joined the Chestnut Hill Pediatric Group and the staff of Chestnut Hill Hospital—now renamed Temple Health Chestnut Hill—where he practiced for several decades.

Along with serving as a clinical associate professor of Family Practice & Community Medicine at the Perelman School of Medicine from 1997 to 1999, Mebane had a faculty position at Jefferson Medical College. He was an active member of the Presbyterian Church of Chestnut Hill, where he performed community volunteer work at home and in Haiti. Mebane and his wife Marianne built houses for Habitat for Humanity and taught school groups at the Morris Arboretum.

James Robert Scott-Miller, MD, GME'55, an orthopaedic surgeon; Nov. 19. Scott-Miller completed an internship at Penn and practiced orthopaedic surgery in Omaha, NE, until his retirement.

Merle John Wampler, MD'57, an internal medicine physician; July 11. Wampler graduated from Franklin and Marshall College's pre-medical program in 1953 and was selected for membership in the Phi Beta Kappa Society. After graduating from the Perelman School of Medicine, he began his one-year internship at York Hospital. After his internship, he left for Officer Training School in San Antonio, TX, where he received his commission as a captain in the Medical Branch of The United States Air Force, spending most of his military service as a flight surgeon at Edwards AFB in California.

Wampler eventually moved back to York and completed his residency in Internal Medicine in Baltimore.

Wampler then began his solo private practice in York. He served as the medical director for York College's Student Health Center, medical director of Rest Haven and Misericordia nursing homes, and the Hahn Home, and provided care to patients at various hospitals and convalescent homes across York County, making house calls at all hours. Wampler also served as president of the York County chapter of the American Heart Association and retired from practice in 2005.

1970s

Charles Maltz, MD'74, PhD, a gastroenterologist; Nov. 3. Maltz earned a doctorate degree in Physical Chemistry from Harvard University and taught at Harvard; the University of California, Berkeley; and the University of Maryland. He specialized

in the treatment of common gastroenterological issues, with a special interest in gastrointestinal bleeding, often made complex by the concurrence of other health conditions. He began a career at Weill Cornell Medicine in New York in 1997 as a clinical instructor in Medicine and served as an associate professor of Clinical Medicine from 2005 until 2023. Maltz was published in the *American Journal of Gastroenterology*, among other journals.

FACULTY

Virginia LiVolsi, MD, a professor of Pathology and Laboratory Medicine; March 7. Her contributions to the field of pathology span research, teaching, and dedication to improving pathology organizations, and especially her

mentorship. Raised in the Bronx, NY, she attended medical school at Columbia University College of Physicians and Surgeons. Her love of thyroid gland pathology began early in her residency in Anatomic Pathology at Columbia. She joined the University of Pennsylvania faculty in 1983 as the director of Surgical Pathology. For decades, she was a leading expert in pathologic classification and management of thyroid neoplasms, serving on the pathology panel of the Chernobyl Tumor Bank for more than 20 years. LiVolsi was recently honored with the 2022 Endocrine Pathology Society Lifetime Achievement Award for her extraordinary contributions to pathology-based study of endocrine disease.

William N. Mebane III, MD. See Class of 1954.

Willys Silvers, PhD, a professor of Genetics; January 24, 2024. Silvers received his PhD from the University of Chicago, doing thesis research and later postdoctoral work at the Jackson Laboratory, as well as at Brown University (Providence, RI). He was later recruited to the Wistar Institute, while his wife Abigail Adams Silvers attended medical school at Penn. Silvers joined the University of Pennsylvania School of Medicine as an associate professor 1965 as a faculty member in a new department known as the Department of Medical Genetics (now the Department of Genetics). He ultimately served as an acting chair of the department for nine years. He retired in 1996 but continued to do research at Fox Chase Cancer Center as a visiting scientist.

Silvers' primary research interests were in the field of transplantation biology and the genetics of pigment-forming cells. His lifelong "hobby" resulted in a book *Coat Colors of Mice*, published in 1978, which is still a go-to classic of the scientific literature.

Judy Shea, Medical Education Research Maven and Mentor

Judy A. Shea, PhD, the Leon Hess Professor of Medicine; March 14. Remembered as one of the greatest mentors and collaborators at Penn Medicine, Shea received her PhD in Human Development and Family Studies from Pennsylvania State University in 1981. She had a successful early career at the American Board of Internal Medicine and then came to Penn in 1991 as a project manager. In 1998 she was appointed to the faculty of the Division of General Internal Medicine, rising rapidly to professor as a health services and medical education research methodologist. Shea dedicated her entire career to working with faculty and fellows to design and execute research projects. She was PSOM's go-to expert in quantitative survey research and qualitative methods including focus groups and interviews and critical to the success of Penn's reputation as a leader in the field of medical education research. Along the way, she held many other leadership roles.

Shea received numerous prestigious awards at Penn and nationally. At Penn she received the FOCUS Award for the Advancement of Women in Medicine (2009), the Arthur K. Asbury Outstanding Faculty Mentor Award (2018), and the Christian R. and Mary F. Lindback Award for Distinguished Teaching (2020), the University's highest teaching honor. Nationally she received the Society of General Internal Medicine Career Achievement in Medical Education Award (2011), the Hubbard Award from the National Board of Medical Examiners (2011), the AAMC NEGEA Distinguished Educator Award (2016), and the AAMC Merrell Flair Award (2018).

Throughout her career Shea was a tireless mentor, meeting her students where they were and helping them to successfully navigate research careers. She published over 375 peer-reviewed articles, many with junior colleagues and mentees. Shea's mentees are now leaders in medical institutions at Penn and across the country, where they are themselves mentoring the next generation. In a memorial statement, Judith A Long, MD, chief of General Internal Medicine, and Michael S. Parmacek, MD, chair of Medicine, wrote, "her impact will be felt for generations of medical educators and health services researchers who were directly or indirectly the recipients of her insights and attention."

Making Your Legacy One-of-a-Kind

An unusual portrait and a sterling career at Pennsylvania Hospital—an annual income for his life partner, and an endowed fund—all are part of Dr. J. Paul Decker's thoughtful legacy.

J. Paul Decker, MD, came to Pennsylvania Hospital in 1946 for a one-year internship—and ended up growing a connection that continues bearing fruit to this day.

A graduate of Jefferson Medical College, Decker had spent six years at the Mallory Institute in Boston, among the most prestigious pathology training programs in the U.S. While in Boston, he met John F. Davis, Jr., a talented silversmith and jeweler studying at the School of the Museum of Fine Arts, who became his life partner. Decker returned to Pennsylvania Hospital as a staff pathologist and found a professional home where his intellect, love of excellence, and collegiality could thrive. He spent his entire career there (1953-1987) and was promoted from faculty member to chair of the Department of Pathology in 1974.

"At that time, Pennsylvania Hospital with its storied history stood out from all others in terms of preeminence," said Santo Longo, MD, who trained under and then worked alongside Decker in the 1960s and 70s. "Dr. Decker perpetuated and represented the spirit, excellence, and elegance of Pennsylvania Hospital in the modern era. He was a guiding light: a consummate gentleman, a kind friend, and first and foremost a great teacher."

That spirit is now on full display, with the pose shown in his portrait—as requested by Decker: It is one of few showing a physician in action in the halls of Pennsylvania Hospital. Decker even generously gifted his microscope after his retirement to Michael A. Husson, MD, who is the Hospital's current Vice Chair of Pathology.

Decker's carefully crafted estate plans evidence his concern for both the people and the places he loved. "People are often surprised at what they can accomplish with their resources," said Robert Vosburgh, JD, executive director of Planned Giving at Penn Medicine. "With today's estate planning tools, you can generously support both your heirs and the charitable causes that mean the most to you—it's not an 'either/or' proposition—you just have to let your advisors know your intent."

Upon his death in 2008, Decker's will established a trust that provided an annual income to Davis for the rest of his life. When Davis passed away at age 98 in 2022, the trust remainder was divided between Pennsylvania Hospital and the First Presbyterian Church where Decker was a long-time congregant. (One of Davis' ecclesiastical commissions include a pair of candlesticks and baptismal bowl for the Church.) The $2 million Decker gave to Penn established an endowed unrestricted fund to support Pennsylvania Hospital—which is, fittingly, being put to use to help with the preservation of the Hospital's historic Pine Building.

"I try to emulate Dr. Decker every day of my life when I'm teaching, and I still miss him sorely," Longo said.

—Robert Vosburgh

What do you want your one-of-a-kind legacy to be? You or your advisors can contact Robert with your questions at 215-898-5341 or vosburgh@upenn.edu.

WHAT MAKES A BREAKTHROUGH?

By Meagan Raeke

Penn Medicine's most decorated innovators don't attribute success to big "eureka" moments. Instead, scientific breakthroughs are the result of years of hard work, perseverance, and determination to keep going, despite repeated, often discouraging, barriers and setbacks.

"Research is [like taking], four, or six, or eight steps back, and then a little stumble forward," said Drew Weissman, MD, PhD, the Roberts Family Professor of Vaccine Research. "You keep doing that over and over and somehow, rarely, you can get to the top of the step."

For Weissman and his research partner, Katalin Karikó, PhD, an adjunct professor of Neurosurgery, that persistence—documented in thousands of news stories across the globe—led to the mRNA technology that enabled two lifesaving COVID-19 vaccines, earning the duo numerous accolades, including the highest scientific honor, the 2023 Nobel Prize Physiology or in Medicine.

Weissman and Karikó were also among the 2022 recipients of the Breakthrough Prize in Life Sciences, among the world's largest science awards, popularly known as the "Oscars of Science." Founded in 2012 by a group of web and tech luminaries including Google co-founder Sergey Brin and Meta CEO Mark Zuckerberg, the Breakthrough Prizes recognize "the world's top scientists working in the fundamental sciences—the disciplines that ask the biggest questions and find the deepest explanations." With six total winners, including four from the Perelman School of Medicine (PSOM), Penn stands alongside Harvard and MIT as the institutions whose researchers have been honored with the most Breakthrough Prizes.

Breakthrough Prize recipients Katalin Karikó , PhD, and Virginia M.-Y. Lee, PhD, take a moment to celebrate with their powerhouse Penn Medicine women colleagues Marisa Bartolomei, PhD; Amita Sehgal, PhD; Sarah Tishkoff, PhD; and Shelley Berger, PhD.

The four Penn Medicine Breakthrough winners—also including 2020 awardee Virginia M.-Y. Lee, PhD, the John H. Ware 3rd Endowed Professor in Alzheimer's Research, and 2024 winner Carl June, MD, the Richard W. Vague Professor in Immunotherapy—gathered this February for the unveiling of a new large-scale installation in the Biomedical Research Building to celebrate each laureate and their life-changing discoveries.

During a light hearted panel discussion, the honorees shared how a clear purpose, dogged determination, and a good sense of humor enabled their momentum forward. Lee, for example, shared that she never really did well in science. "I just kept going," she said. Karikó's career hardships and resolve—including immigrating from communist Hungary to the United States with her young daughter and husband to pursue science—have made her an inspiration to young scientists. Karikó shared a sense of disbelief at the sharp 180-degree recognition of her work over the last five years, encouraging those struggling to gain a foothold in their career: "If you're having difficulties in your position, cheer up, because the future might be bright!"

Carl June, MD, with his wife Lisa Speicher, PhD, and Penn Medicine volunteer leader Mary Braun.

The Luck of the Unexpected

For June, the closest thing resembling a "eureka" moment came from a mistake, a lapse in protocol in his lab: failure to eliminate a research mouse at the end of an experiment that involved studying CAR T cell therapy to assess immune response to the approach. Instead of simply correcting the mistake and moving on, he took the opportunity to learn from it. When June's team realized that the mouse was still carrying viable CAR T cells, six months after they were delivered, they knew it was the first proof that they were working on a living drug with the potential to cure cancer.

Raising a glass before the unveiling of the new displays in the Biomedical Research Building: Drew Weissman, MD, PhD; Virginia M.-Y. Lee, PhD; Katalin Karikó, PhD; and Carl June, MD.

That same instinct for curiosity is what continues to drive June as a scientist and mentor. Every Wednesday, he shared, his lab members meet to discuss what's happening in their research projects. Without fail, "something unexpected" always comes up—a result of an experiment or an observation that wasn't predicted along the path of well-crafted experiments.

Each time, June said he feels incredibly lucky to be the second person, as principal investigator, to learn about it, but even more excited for his trainees, who get to experience the joy and wonder of seeing something new for the first time. As a scientist, June explained, that's "the adrenaline and the dopamine that keeps you going back." ▽

Read more at PennMedicine.org/magazine.

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CUTTING GREENHOUSE GASES IN THE OPERATING ROOM

Most of the anesthetics used in surgery are ultimately exhaled from the patient unchanged. When they reach the Earth's atmosphere, their impacts are hundreds or even several thousand times greater than an equivalent amount of carbon dioxide. Anesthesia teams at Penn Medicine are working to reduce that environmental harm, in part by encouraging anesthesiologists to modify the flow rates of these gases so that patients receive only the amount they need with less excess. Penn Medicine hospitals are also phasing out desflurane, an anesthesia gas with the most potent negative climate impact.

Read more about how Penn Medicine is helping health care go greener on page 16.