Main Line Health®

LANKENAU INSTITUTE FOR MEDICAL RESEARCH

CATALYST

FALL/WINTER 2025

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Lankenau Institute for Medical Research (LIMR) is a nonprofit biomedical research institute located on the campus of Lankenau Medical Center and is part of Main Line Health. Founded in 1927, LIMR's mission is to improve human health and well-being. Using its ACAPRENEURIAL™ organizational model that integrates academic and entrepreneurial approaches, faculty and staff are devoted to advancing innovative new strategies to address formidable medical challenges including cancer, cardiovascular disease, tissue regeneration, gastrointestinal disorders and autoimmune diseases such as rheumatoid arthritis. LIMR's principal investigators conduct basic, preclinical and clinical research, using their findings to explore ways to improve disease detection, diagnosis, treatment and prevention. They are committed to extending the boundaries of human health through technology transfer and training of the next generation of scientists and physicians.

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New Main Line Health President and CEO Ed Jimenez (right) is working collaboratively with Lankenau Institute for Medical Research President and CEO George Prendergast to chart innovative paths toward research breakthroughs.

New Main Line Health President and CEO sees a vital role for LIMR

ED JIMENEZ CAME TO MAIN LINE HEALTH AS PRESIDENT AND CEO IN JUNE 2025 FROM UNIVERSITY HOSPITAL IN NEWARK, NEW JERSEY, AND AFTER NEARLY 10 YEARS AS CEO AT UF HEALTH IN FLORIDA. HE SAT DOWN WITH GEORGE PRENDERGAST, PHD, PRESIDENT AND CEO OF LANKENAU INSTITUTE FOR MEDICAL RESEARCH (LIMR), THE SYSTEM'S RESEARCH ENTITY, TO DISCUSS ITS CRITICAL ROLE.

Why do you think research and LIMR are important to the mission of Main Line Health?

Having research as a mission at Main Line Health allows LIMR to serve both as an incubator for innovation and a bridge between scientific discovery and clinical application. LIMR provides the opportunity to test ideas, develop new initiatives and advance them toward meaningful breakthroughs. I view LIMR and Main Line Health as mutually reinforcing, each strengthening the other. Together, they create a more powerful platform for improving patient care and advancing medicine.

Since arriving at Main Line Health, you have spoken publicly about your high opinion of LIMR's work. Can you talk about what formed that impression?

When I was first approached about the opportunity to join Main Line Health, I declined multiple times. At the time, I simply wasn't familiar with the System. During a subsequent conversation, the recruiter took a different approach and shared what makes Main Line Health distinctive, including its commitment to research through LIMR. That was the first time I learned about LIMR, and it immediately captured my attention.

Despite living only 80 miles away in North Jersey, I didn't know about Main Line Health delivering such high-quality clinical care, or that it housed a research institute of LIMR's

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Barbara Wadsworth, DNP, RN, Executive Vice President and COO (left), and Tanara Boursiquot, DNP, RN, are two of Main Line Health's nurses-turned-inventors.

Inventing a safer future

AT MAIN LINE HEALTH, EVERYONE FROM COO TO FRONTLINE WORKERS DEVISING SOLUTIONS TO REDUCE HOSPITAL FALL INJURIES

One of the pillars of Main Line Health is patient safety, and one of the most critical elements supporting that pillar is preventing patient falls.

The health system is unwavering in its dedication to the problem because the consequences can go far beyond bumps and bruises, especially for older people. Nearly 1 million patients experience hospital falls annually, leading to over 250,000 injuries and approximately 11,000 deaths, according to a 2024 study.

"Fifty percent of hospital falls occur in the bathroom," says Barbara Wadsworth, DNP, RN, who is not only Executive Vice President and COO of Main Line Health but a nurse of nearly 40 years. "That's because no one wants to have another person in the bathroom with them. I mean, no one."

She adds, "We have a policy requiring fall-risk patients to be accompanied in the bathroom, but when the patient insists, the staff member waits outside the door. And then they fall. Bathrooms have very hard surfaces. The patient might get a head bleed or a laceration. They might break a rib or even a hip."

Another pillar at Main Line Health is rare among healthcare institutions: a culture of research focused on invention. Under the leadership of President and CEO George Prendergast, PhD, Lankenau Institute for Medical Research (LIMR), Main Line Health's research center, has turned ideas from everyone — frontline nurses to executives — toward addressing core issues like fall prevention.

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One of those inventors is Dr. Wadsworth. In July 2025, six years after she proposed the concept, the U.S. Patent and Trademark Office issued a patent for her device designed to prevent injuries from falls in hospitals and assisted living, home care or other facilities.

The portable airbag/cushion-deployment device features a sensor to detect if a patient is falling. It would deploy a protective device suitable for adequate protection in bathrooms. It could be used in hospitals as well as in nursing homes and private residences. The patent has been licensed to Lankenau Ventures, a joint venture among LIMR, Early Charm Ventures and L2C Partners, LIMR's partner for management of its patent portfolio.

"I'm thrilled that someone of Barbara's caliber is leading our drive to reduce fall injuries even further," says Dr. Prendergast. "People who are 65 and older who break a hip face a 50% mortality rate over the next 12 months. So this invention work is critical. And I believe more great things are to come."

Frontline workers step up

LIMR, which will turn 100 in 2027, started out as a leader in the fight against cancer, and then expanded its focus over the decades to improve treatment for cardiovascular, autoimmune and other diseases.

Under the two-decade leadership of Dr. Prendergast, a new direction arose: the ACAPRENEURIAL™ approach, which focuses research on practical invention and entrepreneurialism, not just new knowledge. The quintessential example came in 2019, when, working with L2C Partners, LIMR launched Lankenau Ventures LLC to bring the ideas of frontline workers to society.

"I started by telling Dr. Prendergast about my idea for something that would keep patients from getting injured if they fall," Dr. Wadsworth says. "He said, 'Wait, there could be an invention here.' And I was like, 'Oh yeah, I guess I might be an inventor!' I never thought of myself that way, yet here I am now with this patent, and it's super cool."

Another fall-safety invention in the patent process is a toilet privacy screen. During his tenure as a Main Line Health executive, Jeshahnton Essex, FACHE, now COO of Baylor University Medical Center — Baylor Scott & White Health, followed Dr. Wadsworth's leadership and conceived of a device allowing patients to be supervised to avoid falls yet maintain privacy. The device has an adjustable privacy screen and a white noise component to enhance privacy. It, too, is being developed by LIMR through Lankenau Ventures.

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THE CONSEQUENCES OF HOSPITAL FALLS

1 million
PATIENTS EXPERIENCE HOSPITAL FALLS ANNUALLY

250,000
INJURIES ANNUALLY

11,000
DEATHS ANNUALLY

PEOPLE WHO ARE 65 AND OLDER WHO BREAK A HIP FACE A 50% MORTALITY RATE OVER THE NEXT 12 MONTHS

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More than fall-injury-prevention devices

Fall prevention is just one of many areas where LIMR is developing devices. Longtime nurse Colleen Rogers had wondered how she could ease care for diabetic patients too weak to lift their leg and allow her to change the dressing on foot or limb wounds by herself. The result is now on the market: the Rogers Limb Support. It is height- and position-adjustable, allowing any limb to be comfortably supported. Only one nurse is needed, and back injuries are reduced.

Tanara Boursiquot, DNP, RN, frequently heard nurses discuss the difficulty of inserting urinary catheters in female patients. She conceived of the AccuCatheter Kit, allowing a nurse to insert a catheter reliably in one attempt without assistance, reducing the chance of a urinary tract infection. It is now in prototype.

Increased efforts toward patient falls

As the invention culture continues doing its work, the Main Line Health medical team continues pursuing innovative ways to prevent patient injuries from falls. Main Line Health's acute care hospitals consistently outperform national benchmarks in patient safety, particularly in the area of falls with injury. Using the National Database of Nursing Quality Indicators as the standard, the campuses demonstrate sustained excellence in reducing harm, with injury-related falls per 1,000 patient days well below national averages.

While not inventions per se, Main Line Health's initiatives are innovative in and of themselves. Main Line Health uses an AI-powered predictive model in the electronic medical record to identify patients at high risk of falling. It has a 94% accuracy rate. It also has personalized fall prevention plans tailored to each patient, with strategies including mobility support, alarms and visual cues.

"It's a productive culture," Dr. Wadsworth says. "We encourage our people to bring ideas forward. These amazing ideas shouldn't stay at the bedside. They should get out to LIMR so we can serve the community with the highest, most innovative level of care."

Lankenau Venutres — products invented by frontline workers

Essex Patient Privacy Screen
Invented by Jeshahnton (Shaun) Essex, FACHE

Rogers Limb Support
Invented by Colleen Rogers, RN

Boursiquot AccuCatheter
Invented by Tanara Boursiquot, RN

Images courtesy of Lankenau Ventures

A New Era in Heart Failure Care

LIMR PHYSICIAN-SCIENTISTS AT THE FOREFRONT OF DEVISING LIFE-CHANGING THERAPIES

Heart failure literally takes your breath away as years pass. Nearly 7 million Americans have this chronic condition, where the heart's inability to pump effectively can lead to fatigue, along with shortness of breath during exertion that can significantly limit activity.

Over the last 40 years, the development of multiple medications to manage heart failure has changed treatment and improved outcomes. While these treatments have become more effective over time, they can only do so much on their own. In the early 2000s, a new field called interventional heart failure began to emerge. This approach uses minimally invasive procedures to repair or replace damaged heart valves and improve how blood flows through the heart — leading to better outcomes for many patients.

Lankenau Institute for Medical Research (LIMR), working with the Lankenau Heart Institute, has an expert team of physician-scientists who are at the forefront of developing innovative ways to treat advanced heart failure.

"We are continually on the leading edge and looking for new ways to help our patients," says John Clark, DO, a Lankenau Heart Institute cardiologist who helps lead LIMR trials. "I think our leadership has been demonstrated over the years and only continues to grow."

Since joining Main Line Health, William Gray, MD, Chief of Cardiovascular Diseases and Co-director of the Lankenau Heart Institute, has helped position LIMR at the forefront of cardiovascular innovation. Dr. Gray, a LIMR professor, has been the national principal investigator (PI) for many first-in-human studies that allow developers to assess new medical devices before extensive testing.

Dr. Gray served as the national co-PI for the first-in-human ALT-FLOW trial, a groundbreaking study that successfully reduced shortness of breath in the majority of patients by using a device to redirect pressure from the left atrium to the right atrium, reducing the backed-up pressure seen in heart failure. In the follow-up trial, Dr. Gray continues his leadership, with Dr. Clark serving as the local PI.

"We were first in the U.S. (and second in the world) to implant this device, and I'm hopeful that ongoing trials will ultimately lead to it receiving Food and Drug Administration approval and being widely available for heart failure," Dr. Gray says. In this sense, Lankenau Heart Institute is making treatments available to patients well beyond its borders.

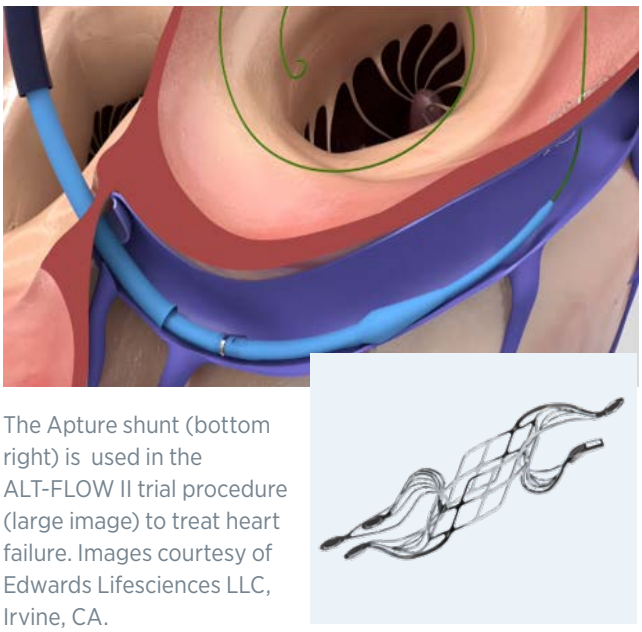
Dr. Gray was also a leader with a first-in-human trial of a tricuspid valve reconstruction system to prevent regurgitation (backward blood flow).

"Tricuspid regurgitation remains a challenging condition to treat," Dr. Clark says. "It often leads to frequent hospital readmissions and, unlike other valvular diseases such as aortic stenosis, has proven more difficult to address with minimally invasive, catheter-based procedures due to the complex and highly variable geometry of the tricuspid valve. Lankenau Heart Institute and LIMR have played an instrumental role in advancing the search for solutions."

LIMR also has conducted several studies for treating aortic valve and mitral valve disease, with Basel Ramlawi, MD, Chief of Cardiothoracic Disease, Co-director of the Lankenau Heart Institute and LIMR Professor, playing a leading role. Both nonsurgical transcatheter mitral valve repair and aortic valve replacements are performed regularly at Lankenau Heart Institute.

The future of treating heart failure involves further evolution of devices — for example, implantable monitors that can detect worsening heart failure and implantable devices that modulate the ability of heart muscle to contract. Expect LIMR and Lankenau Heart Institute to be at the forefront of these explorations, Dr. Clark says.

"We're innovators," Dr. Clark says. "We're always saying, 'What else can we do? What's next?'"



The Apture shunt (bottom right) is used in the ALT-FLOW II trial procedure (large image) to treat heart failure. Images courtesy of Edwards Lifesciences LLC, Irvine, CA.

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caliber. My experience with Scripps Research Florida during my tenure at the University of Florida had given me a broad understanding of the nation's leading freestanding research centers, yet LIMR was not on my radar at the time.

What did you see as you conducted your own research into LIMR?

I was struck by the Institute's focus on cardiovascular and oncology research, as well as its work in diabetes and endocrinology. To get an additional perspective, I reached out to colleagues in the field. One of them, at Memorial Sloan Kettering, connected me with a researcher familiar with LIMR. When I asked about LIMR's capabilities and credibility, his response was: "They do real science." I also spoke to an aortic surgeon I knew from Florida, who echoed the same thing, describing LIMR as an organization that produces great work in the field. Hearing that level of respect from people I trust confirmed to me that LIMR has a strong and well-earned reputation.

When you went on-site for the first time, what was your impression?

During my initial visit, I was struck by the depth and ambition of the research taking place. I recall stopping at a poster on regenerative science, specifically, Dr. Ellen Heber-Katz's pioneering work on scarless healing. It almost sounded like science fiction, yet the seriousness and rigor of the work made it clear that LIMR is deeply committed to advancing transformative science. That kind of research demands total dedication, and seeing it pursued here reaffirmed for me that LIMR is an elite center of discovery.

Can you share any of your perspectives from our discussions about how to further leverage our research for Main Line Health overall?

I think one of the most critical factors in translating research into improved patient outcomes is speed — how quickly we can move an idea from concept to impact. The traditional timeline for developing something like a therapeutic drug can span 15 years. If we can shorten that timeline to 12 years, then nine, and four, we will be well on our way to making a measurable difference. This year, we are taking initial steps to explore how Main Line Health can further support LIMR financially and operationally to help accelerate progress. Once we demonstrate that we can advance research more efficiently, we can create a foundation of even greater opportunities and broader impact.

What in your personal and professional life has shaped your views on the importance of research in patient care?

Throughout my career, I've had the privilege of working in academic medical environments where excellence in three areas is paramount: providing outstanding patient care, training the next generation of clinicians and advancing science through discovery. These principles have guided my professional journey and reinforced my belief that research is not a separate pursuit. It is an essential component of delivering the best possible care.

NEWS

LIMR faculty bolstered by new researchers

Mara Caroline, MD

A new infusion of talent has come to Lankenau Institute for Medical Research (LIMR). Four researchers have been appointed to the faculty, bringing expertise in cardiovascular disease, virus-host interactions and more.

- **Mara Caroline, MD,** has joined LIMR as an assistant professor on the resident faculty. The appointment enables Dr. Caroline to advance her research interests in preventive cardiology as part of LIMR's Cardiovascular Research Program. She has been an interventional cardiologist at Lankenau Medical Center since 2018.
- **Matthew Charman, PhD,** has joined LIMR as a research assistant professor, coming from Children's Hospital of Philadelphia and Perelman School of Medicine. His research interests include virus-host interactions, viral vectors and nanoparticles.
- **Dimitrios Magouliotis, MD, PhD, MSc,** has been appointed to the research faculty as research assistant professor. He has been a prolific author on cardiothoracic surgical topics.
- **Stephanie Kjelstrom, PhD, MPH**, has been appointed to the research faculty as research assistant professor after several years as biostatistician.

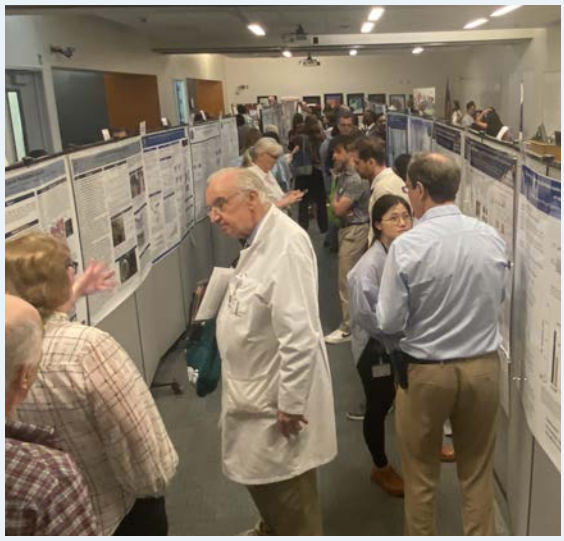
Dr. Sunil Thomas receives patent aimed at fighting Lyme disease

Sunil Thomas, PhD, a research professor with the Lankenau Institute for Medical Research, has been issued a patent that could be used in developing new diagnostics and vaccines for Lyme disease.

The patent is for several protein fragments derived from the bacteria causing Lyme disease that can be used for both detection through blood testing and prevention via vaccination.

The prevalence of Lyme disease is increasing in the United States, with approximately 476,000 Americans a year being treated for the tick-borne illness.

Lyme disease is caused by the bacterium Borrelia burgdorferi, transmitted to humans through the bite of infected ticks. Early symptoms often include fever, fatigue, joint stiffness and a distinctive bull's-eye rash, but if left undiagnosed and untreated, it can lead to serious complications.



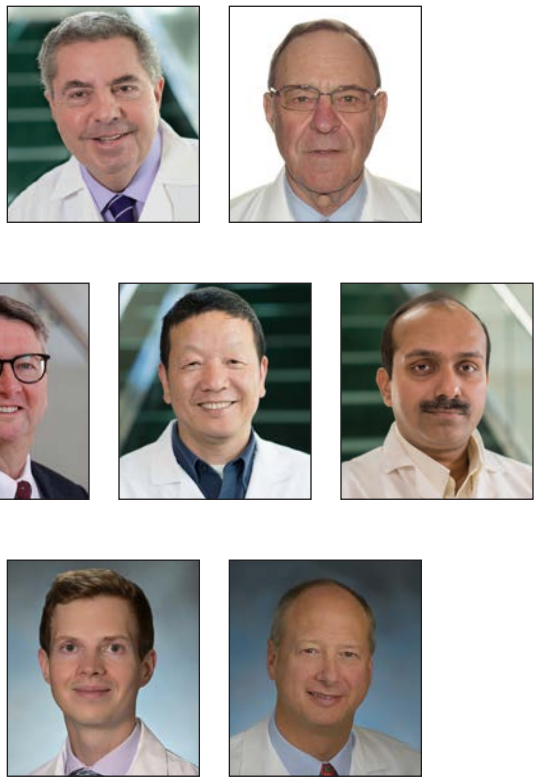
EXPERTISE ON DISPLAY: In June, Lankenau Institute for Medical Research held its third annual Research Day, featuring pioneering research presentations across multiple fields, including cardiac surgery, inflammatory disease and others. More than 30 poster presentations were provided, drawing the event's largest crowd to date.

Seven LIMR scientists ranked among World's Top 2%

Seven LIMR researchers are ranked in Stanford University's new list of the World's Top 2% of scientists. Stanford's Top 2% Scientists is an esteemed ranking that identifies the most cited scholars in their fields.

The LIMR scientists, in descending order of their rankings, are Charles Antzelevitch, PhD; Michael Ezekowitz, MD; George Prendergast, PhD; Gan-Xin Yan, PhD; Sunil Thomas, PhD; Dimitrios Magouliotis, MD, PhD, MSc; and John Marks, MD.

Stanford's Top 2% list is widely recognized as one of the most comprehensive evaluations of research impact, measuring citation metrics across more than 200,000 scholars worldwide. To be included reflects years of high-quality, influential work that is recognized by peers around the globe.



Top (left to right): Charles Antzelevitch, PhD, Michael Ezekowitz, MD. Middle: George Prendergast, PhD, Gan-Xin Yan, PhD, Sunil Thomas, PhD. Bottom: Dimitrios Magouliotis, MD, PhD, MSc, John Marks, MD.

A lifelong commitment to science and philanthropy

When I. Wistar Morris III first walked the halls of the Lankenau Hospital Research Institute — now the Lankenau Institute for Medical Research (LIMR) — at age 16, he unknowingly began a lifetime commitment to advancing medicine through philanthropy.

"Most of my friends were at the shore or relaxing, but the time I spent in the lab at Lankenau changed the course of my life," Morris recalls.

That summer, Morris worked with three Mennonite teenagers participating in a NASA-funded study exploring the effects of space on the human body. The volunteers remained on extended bed rest to simulate low- and zero-gravity atmospheres. Morris helped track vital data, including heart rate, blood pressure and calcium levels, and kept the group engaged through card games and conversation.

"I didn't realize it then, but logging data and playing cards ultimately contributed to helping NASA send a man to the moon," Morris says.

The experience inspired Morris to pursue biochemistry at Cornell. After earning an MBA from Harvard, he founded Morris Investment Management (later merged with Pennsylvania Trust Company) and became one of Philadelphia's most respected investors. Throughout his career, Morris and his wife, Martha, remained deeply committed to Lankenau Medical Center and LIMR.

In 1994, Morris founded The Cotswold Foundation, which has supported biomedical research across the country, including groundbreaking work at LIMR.

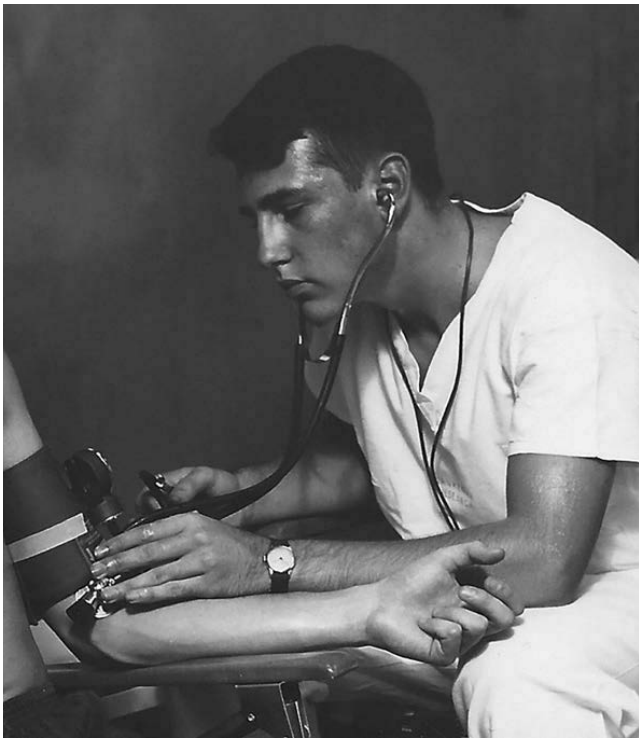
The Morris family's most recent gifts support a range of initiatives at Lankenau, including Labor and Delivery Unit renovations and innovative research at LIMR. One of these projects will advance acute inflammation research in the laboratory of Patrick Viatour, PharmD, PhD.

Dr. Viatour is leading research into stress myelopoiesis, a key process in many inflammatory diseases such as Crohn's, arthritis, sepsis and ischemia. During inflammation, this process causes blood stem cells in the bone marrow to shift into overdrive, producing an excess of inflammatory cells.

Dr. Viatour's team has identified three biological "arms" of this once poorly understood mechanism. Preclinical studies in models of colitis and arthritis show that simultaneously blocking all three arms with a cocktail of existing, commercially available drugs suppressed stress myelopoiesis and led to complete remission in 80–90% of cases, with minimal side effects.

This breakthrough suggests that targeting stress myelopoiesis could become effective across many inflammatory conditions. With continued research — and the philanthropic support that drives it — this work could be transformative for millions.

"My family has a longstanding history of philanthropy. I am committed to carrying that legacy forward by supporting efforts to advance medical science," says Morris, who still has a thank-you letter received at age six from Lankenau Medical Center's then-president for his first donation — $10 toward its move to Wynnewood. "Over the past 50 years, few investments have improved lives more than medical research. There is no greater gift we can give future generations than the chance to live longer, healthier lives thanks to medical breakthroughs."



Your investments in research at LIMR can have a significant impact

You can designate one of the following funds to direct your contributions and support research that is important to you.

Biotechnology Innovation Fund

This fund supports work on biological molecules engineered by LIMR scientists that can enhance the diagnosis, prognosis and treatment of disease. Your generous contributions to this fund can help advance the work of our researchers including our studies on targeted nano-carrier therapeutics as experimental treatments for cancer and our work on cloned human antibodies as treatments for infectious disease, cancer and neurological illnesses.

Cardiovascular Breakthrough Fund

Cardiovascular disease accounts for nearly 800,000 deaths in the United States every year, or about one of every three deaths. Additionally, about 92 million American adults are living with some form of heart disease or the aftereffects of stroke. LIMR is home to world-renowned cardiovascular researchers. Your gift to this fund will further research that could benefit the lives of millions of heart disease and stroke patients.

Immunotherapy Pioneer Fund

Immunotherapy entails the prevention or treatment of disease with substances that manage the immune system's capabilities to clear disease rather than attack the disease itself. LIMR has spearheaded unique studies of disease modifier pathways that impact immunity and cancer progression, developing new drugs to target them. Your generous contributions to this fund will help us to continue to advance these innovative directions.

Regenerative Medicine Vision Fund

Regenerative medicine deals with new processes of replacing, engineering or regenerating human tissues to restore or establish normal function. LIMR is privileged to have one of the pioneers in regenerative medicine, Professor Ellen Heber-Katz, PhD, who has discovered an experimental drug approach that may eliminate a need for stem cell transfer. Your contributions to the Regenerative Medicine Vision Fund will help further her research.

LIMR Unrestricted Fund

Unrestricted gifts to LIMR enable opportunities to target your gift where our doctors and scientists believe it can have the greatest impact.

To make a donation, please use the reply envelope inserted in this publication, or donate online at limr.org (click on Giving). You may also call Katie Beddis of the Lankenau Medical Center Foundation at 484.476.8067, or email her at beddisk@mlhs.org.

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Main Line Health®

ABOUT MAIN LINE HEALTH

Main Line Health® is a not-for-profit health system serving the Philadelphia region and beyond. Main Line Health consists of five hospitals, seven health centers and over 150 medical practice locations. The System has more than 14,000 employees and over 2,100 employed and independent physicians and advanced practice providers. At its core are four of the region's most respected acute care hospitals as well as one of the nation's premier facilities for rehabilitative medicine. Main Line Health also includes a treatment center for drug and alcohol recovery; skilled home healthcare and hospice; Main Line Health Centers, primary and specialty care, lab and radiology and other outpatient services; and a biomedical research organization.