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SPECIAL COVID-19 ISSUE

Several LIMR investigators have rapidly pivoted their research to battle the coronavirus | Pages 2, 3 & 5

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About Lankenau Institute for Medical Research (LIMR)

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. Faculty and staff are devoted to advancing innovative new approaches to formidable medical challenges, including cancer, cardiovascular disease, gastrointestinal disorders, autoimmune diseases, and regenerative medicine, as well as population health. LIMR's principal investigators conduct basic, preclinical and translational 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. For more information, visit limr.org.

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George C. Prendergast, PhD

The Havens Chair for Biomedical Research

President and CEO

*Lankenau Institute for Medical Research,
Main Line Health*

LIMR'S PIVOT TOWARD COVID-19

First and foremost, I hope this issue of *Catalyst* finds you and your family in good health during these challenging times.

While the news about the spread of COVID-19 has been grim, I am excited to report how several Lankenau Institute for Medical Research (LIMR) investigators have pivoted their teams' attention and considerable expertise to battling the SARS-CoV-2 virus and attenuating its reach.

The work of scientists at LIMR that involves collaborations around the world couldn't be more crucial. While our colleagues in the clinic continue their heroic fight to save patients stricken by the virus — as of early June, 1,650 COVID-19-positive patients had been treated across Main Line Health — the world's attention has now turned to science. To all, it's now apparent that the path out of this pandemic runs through the laboratory.

Throughout modern history, biomedical researchers have pondered, experimented, hypothesized, argued, and bent back over their microscopes, all in an unceasing drive to solve medical mysteries. What causes the onset of disease? Why are some patients more severely affected? What can eradicate dangerous microbes or at least stop them from causing harm in humans?

While researchers are not super-human, they do share an important characteristic — one that is particularly useful during difficult times such as these. They are curious. While others may shy away, biomedical researchers' natural tendency is to lean in, prodding for data, wondering why nature behaves as it does. We need this inquisitive mindset now more than ever.

In this issue of *Catalyst*, you'll read how several LIMR investigators have turned rapidly to try to solve some of the challenges posed by the coronavirus. You'll learn about a new antibody testing method, a brand-new way to develop vaccines to fight viruses, promising therapeutic investigations, and basic and clinical research in which faculty are presently engaged — all with the hope of helping to eradicate this terrible pandemic.

You'll also be among the first to read the results of an important consumer survey about the virus that was conducted by our colleagues at the Main Line Health Center for Population Health Research at LIMR. They surveyed close to 5,600 people around the country, the results of which are giving the research team significant insights into how people are handling the disruptions that the outbreak has wrought on their lives.

I am extremely proud of the rapid turn made by our teams whose work is most relevant to these times, highlighting the enormous value of research to solving human health challenges — not only for chronic deadly conditions such as cancer and cardiovascular disease, but also for serious emergent illnesses such as coronavirus infection.

All of us at LIMR thank you for supporting our work, and we hope for your continued health and well-being. *

Note: All of the photos for this issue were taken in early March, before social-distancing guidelines were put in place.

Fundraising Challenge Alert

A group of LIMR Board Members — spearheaded by Chairman Peter Havens and his wife Louise, Jonathan Fox and Suzanne Markel-Fox, and Leila Gordon — have generously initiated a 1:1 fundraising challenge match to support LIMR's COVID-19 Research Fund. Together, they have pledged a gift of \$80,000 if an additional \$80,000 can be raised by the end of 2020. You can accelerate this important coronavirus research by making a gift to help meet this challenge. For more information on the LIMR COVID-19 Research Fund, see inside back cover.

From Titers to Treatments: Cloning Antibodies from COVID-19 Patients

The researchers at LIMR are using a unique technology pioneered at the Institute that can quickly define and synthesize for study and mass production anti-SARS-CoV-2 antibodies from patients who have recovered from COVID-19 infection. This powerful technology is part of a clinical trial organized with physician colleagues at Lankenau Medical Center to recruit patients who consent to blood donation for this important work.

Many researchers and commercial interests are touting their antibody tests to COVID-19. But in truth, no one currently knows if the presence of anti-viral antibodies in the blood is a sure sign yet of immunity to coronavirus — and if it could be protective, for how long that immunity may last. Indeed, other kinds of coronaviruses that cause the common cold do not tend to confer long-lasting immunity.

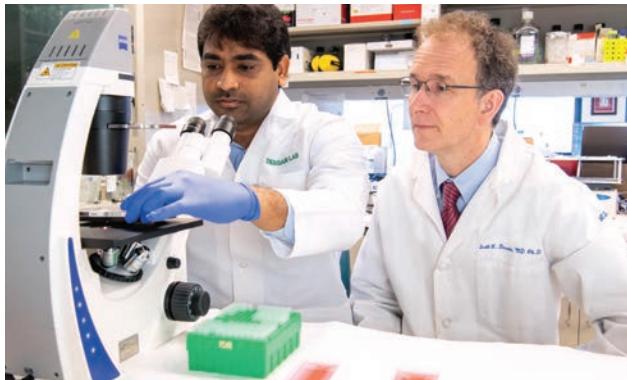
Along with his team members, scientific collaborators and clinical colleagues at Lankenau, LIMR Professor Scott Dessain, MD, PhD, is applying his technology and know-how to clone antibodies from COVID-19 patients whose immune systems successfully defeated the infection. What does an efficient SARS-CoV-2-stopping antibody look like?

The technology being used by Dr. Dessain's team offers a tool to sift through many antibodies that can recognize the virus and see whether there are any common or special characteristics. "If we found similar antibody patterns in different patients, we may begin to define structural foundations for immunity," noted Dr. Dessain who holds The Joseph and Ray Gordon Chair in Clinical Oncology and Research. "While such patterns would not be proof of immunity, it could put us on the pathway to discovery, and that's a step in the right direction."

Team members have two basic goals. First, they seek to develop a blood test to identify anti-viral antibodies. At present, no test can identify anti-viral antibodies that actually confer protection — these are the most important to define and a key goal of the team's work. Such a test would be an ideal diagnostic for Main Line Health patients, clinicians and staff members to help allay their fears about the virus.

Next step: Potential therapy?

Beyond simply identifying anti-viral antibodies, the team also seeks to determine if the antibodies they discover could offer an effective route to actually treat COVID-19, based on their natural development by the immune system in patients who have recovered. Indeed, since plasma transfer from recovered COVID-19 patients helps sick patients, it is clear that cloning the antibodies present in that plasma could offer an unlimited supply of therapy, *



LIMR Professor Scott Dessain, MD, PhD (right), and Rama Devudu Puligedda, PhD, biomedical research assistant, seek to develop a blood test to identify anti-viral antibodies to the coronavirus, work that may point to an effective treatment.

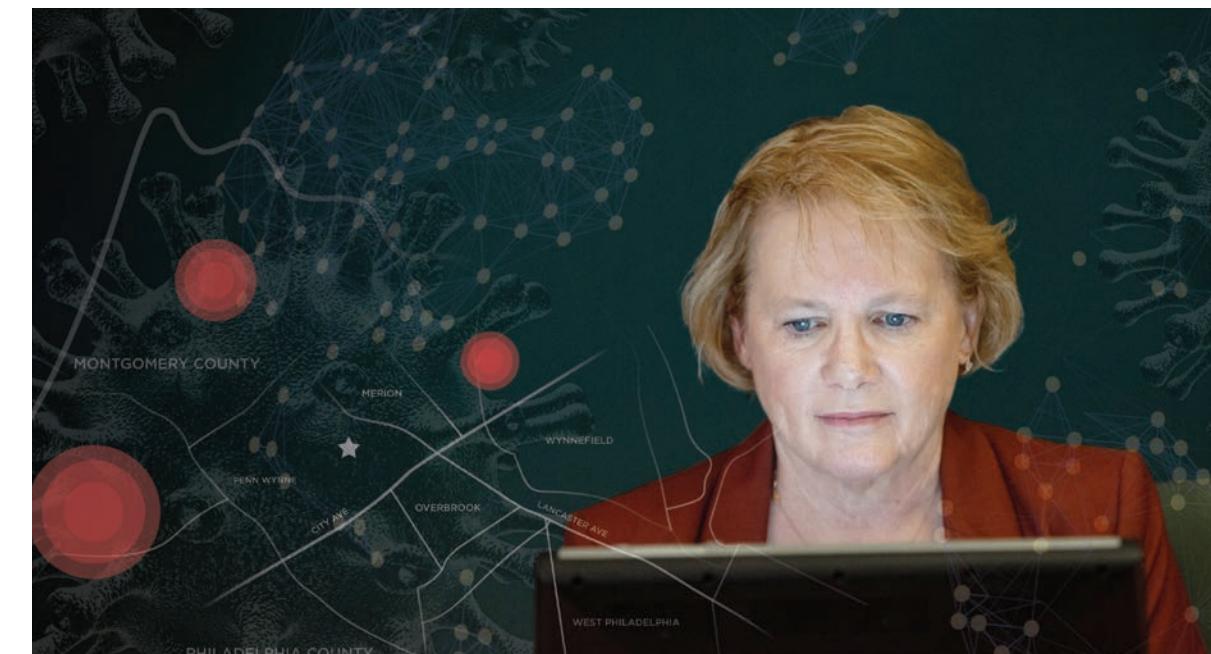
thus bypassing the limited supply and complexities of plasma transfer itself.

Dr. Dessain notes that while researchers elsewhere are also working in this area, LIMR's proprietary technology may provide a platform that can more quickly identify and mass produce the best antibodies needed for blood tests and immunotherapies. This technology uses a revolutionary antibody-discovery method invented at LIMR called On-Cell mAb Screening™ (OCMS) that has been applied in other disease settings to rapidly identify and isolate antibodies with the most desirable properties.

OCMS has an impressive track record already, having been used at LIMR to isolate the best patient-derived antibodies ever obtained against polio virus. In fact, these antibodies were designated recently as the International Reference Standard by the World Health Organization (WHO) and other global authorities for batch quality control of Sabin vaccines used to prevent polio worldwide.

Noted Dr. Prendergast, "In applying the powerful thrust of the new OCMS technology developed at LIMR, Dr. Dessain and his team are moving rapidly to illuminate secrets the human immune system has yet to reveal about how to defeat COVID-19. Accessing the antibodies from recovered patients with this technology is a new tool in the armamentarium to eradicate this virus." *

You can help Dr. Dessain and other LIMR researchers as they strive to eradicate the coronavirus. Please give to the COVID-19 Research Fund. See inside back cover for more.



Sharon Larson, PhD, is professor and executive director of the Main Line Health Center for Population Health Research at LIMR.

Research to Better Inform Clinicians Now and in the Future

When the COVID-19 pandemic was prompting governors around the nation to issue urgent stay-at-home orders to their citizenry in March, and U.S. health care providers were rushing to ramp up triage and treatment protocols, investigators at the Main Line Health Center for Population Health Research (CPHR) at LIMR had an emergency conference call.

During the call, Sharon Larson, PhD, professor and executive director of CPHR, wondered aloud about the overall impact the crisis would have on the lives of those in the community, not just on their physical health, but also on their finances, careers and stress levels.

"We know that many factors contribute to health status," noted Dr. Larson, who is trained as a psychiatric epidemiologist. "We wanted to get a good idea of how people were handling the situation, because that could better inform Main Line Health clinicians when treating patients both today and tomorrow."

Founded in 2016, CPHR is a collaboration between Main Line Health and Thomas Jefferson University's College of Population Health. The research center, which is located at LIMR with the basic and clinical science divisions, seeks to advance the understanding of population health by being a research and educational partner to Main Line Health, informing and assessing initiatives to improve the health status and quality of life in the myriad communities it serves. CPHR investigators spearhead studies that aim to illuminate

the underlying socioeconomic challenges inherent or under-addressed by current care models. And COVID-19 is one of the most monumental challenges we face today.

On that March conference call, the CPHR team set out to survey community members to discern how they were being impacted by the crisis. They devised an online questionnaire that took only about 10 minutes to complete; the results would be anonymous, used for research purposes only. The questions pertained to health and employment status before and after the lockdown, how people were getting information about the disease spread, and similar queries.

By the time the survey closed one month later (by April 24), about 5,600 people from around the country had answered either all or most of the questions. While tabulating the results, the researchers were struck by one finding in particular: Respondents' reported stress levels were alarmingly high.

An anxious nation

The CPHR team added to the survey several questions that draw from a screening tool for generalized anxiety disorder, called GAD-2. A GAD-2 score of 3 or higher is considered to be positive and often warrants either a referral for consultation with a behavioral health provider or additional conversation and counseling with a primary care provider.



Among its many ongoing research projects, Main Line Health's population health research team spearheaded consumer and clinician surveys about COVID-19 that are illuminating patient-care strategies.

"Worryingly, we found that nearly 46 percent of all survey respondents met the criteria for anxiety," said Dr. Larson. "And more than half of those aged 18 to 40 had generalized anxiety. We suspect this is due to financial and employment-related worries among those in this age group."

The real concern from these results, added Dr. Larson, is the long-term health of the population. "Generalized anxiety disorder often co-occurs with depressive disorders, chronic pain, substance use disorders, social phobia and panic disorders. And it is more likely to be reported in lower socioeconomic groups. We're worried about the ripple effect this pandemic will have on people's health in the future," she said.

While the survey also found that most respondents, understandably, were concerned about getting COVID-19, it also discovered that about a quarter of them said they did not have enough food in their homes to last two weeks — suggesting clinicians may begin seeing some patients with conditions complicated by dietary challenges.

The CPHR team is compiling these and other results of the survey and submitting papers to peer-reviewed journals. In this way, CPHR investigators are helping to alert the larger health care community of the possible downstream implications of the pandemic.

Equitable care for all

While the COVID-related research has taken center stage at CPHR, many of the studies the investigators were pursuing before the crisis continue. Indeed, at any given time, the CPHR team is working with partners in Main Line Health, the region and the nation on research projects studying barriers to care and whose results can be used to propose potential solutions.

For example, in its work with Main Line Health's Women's Heart Health program, CPHR researchers want to answer the question: What is the long-term care pathway offered to women diagnosed with pre-eclampsia,

a high-risk disorder of pregnancy characterized by high blood pressure?

"African American women are particularly prone to this condition, and we know their pre-eclampsia makes them more likely to have cardiovascular problems later in life," said Kyle McGregor, PhD, assistant professor and associate director of CPHR. "We want to find out if they're being referred to a cardiologist, and if not, why not?"

As part of its research, the CPHR team seeks to start a registry of these women so it can check in with them over a long period of time, as much as 10 to 15 years, to gauge their heart health. "Our goal is to set up a protocol that will help these women get the care they need in both the short and long term," said Dr. McGregor.

Physician burnout studied

Another current project centers on bioethics, one of Dr. McGregor's core research interests. Working with the Main Line Health Clinical Ethics Committee, he seeks to better understand issues that occur among clinicians, including physician burnout and moral injury, a hot topic in health care today. A pre-COVID national survey found 42 percent of physicians feel burned out from their workloads. While that number is down from 46 percent five years ago, it's still too high by most health system standards.

During the pandemic, Main Line Health administrators are concerned about burnout among the clinical staff, and they asked the CPHR team to survey System physicians. In all, 395 providers completed the survey, of which 70 percent had cared for at least one COVID-19 patient. Five providers had themselves tested positive for the virus, and 57 self-quarantined due to exposure.

Nearly 40 percent of respondents reported moderate to severe symptoms of burnout, and more than half reported feeling a great deal of stress because of their work. "Health systems around the world are grappling with how to keep their workforce healthy during this outbreak," noted Dr. Larson. "Main Line Health is keenly and actively focused on assisting its clinical staff through these difficult times."

The projects discussed above are only some of the many research projects ongoing by the CPHR team in their quest to advance patient care and health equity.

"With CPHR in place, Main Line Health has furthered its role as a thought leader in the field of community-based health care in America," said Jack Lynch, FACHE, President and CEO of Main Line Health. "Dr. Larson and her team's research oftentimes can be broadly generalizable for other health care systems around the nation to use to improve the well-being of their patient populations. Here at Main Line Health, we remain committed to knowing our community and providing high-quality equitable health care for all."

For more on the work of CPHR, visit mainlinehealth.org/cphr. *

LIMR Investigators Battle the Coronavirus on All Fronts



In addition to the COVID-19 research highlighted on previous pages, other LIMR investigators have turned their teams to fighting the pandemic.

Vaccine

LIMR Professor **Ellen Heber-Katz, PhD**, is focused on her previous work on a generalized vaccine strategy that may prevent infections from any virus, including SARS-CoV2.

While at the Wistar Institute before coming

to LIMR, she and a colleague developed a peptide-lipid-liposome compound as a potential vaccine for herpesvirus infection. In mice the compound showed a surprising result — no antibodies to the virus were created, but the animals had a powerful T cell response that protected them from a lethal viral dose. From this discovery the team learned that T cells alone can kill viruses and virally infected cells, thus leading to protection.

Intrigued by the unanticipated response to this agent, the team next tried the formulation on rabies and found protection there, too. Again, no antibodies were created, but T cells appeared and were implicated in the protection seen. The team published several papers, but this direction eventually was discouraged given resistance from many experts then to the idea that a pure T cell response in the absence of antibodies could lead to protection against a viral disease. But, as always, times change.

"The world continues to search for vaccines for viruses, and the focus is on an antibody response. But there are cases where antibodies actually enhance the deleterious effect of viruses; this may be true for HIV and SARS and now COVID-19," said Dr. Heber-Katz. "That's the inherent problem with traditional vaccine development and is something we at LIMR are trying to resolve."

Using her innovative vaccine approach she tested immune responses to an HIV analogue in primates, although protection studies weren't carried out. Still, this was a first step to translation into the clinic. Recently, her team modified the original concept, hoping to test a novel, potentially stimulatory, adjuvant to the vaccine construct. The peptides they'll use will be COVID-19 spike protein-derived.

Said Dr. Prendergast: "Her approach focuses more on an adjuvant therapeutic compound that can boost the immune system to fight any virus, not just COVID."

Therapies

In other COVID-19 research, LIMR Professor **Gan-Xin Yan, MD, PhD**, was asked by the U.S. Food and Drug Administration (FDA) to study aspects of the drug hydroxychloroquine for therapeutic use. The FDA is interested in a method employed by Dr. Yan's group: the arterially perfused ventricular wedge preparation (wedge prep), which can accurately record all electrical signals in the heart, even in innermost layers.

The LIMR team used wedge prep in preclinical studies of a drug combination — hydroxychloroquine, chloroquine and their combined use with the antibiotic azithromycin — to help determine if it leads to cardiac risk in COVID patients. FDA scientists received the data from Dr. Yan and are conveying it to the wider research community.

The FDA is also interested in lung cell culture methods employed by LIMR Professor **James Mullin, PhD**, and his team that build on their discovery that vitamin A and other micronutrients can tighten lung epithelial barrier function as an innate defense against viral infection, perhaps influencing or assisting effects of hydroxychloroquine and/or chloroquine. In fact, Dr. Mullin's group already is testing these drugs' effects on the lung epithelial lining.

Basic and clinical research

Sunil Thomas, PhD, LIMR research assistant professor, authored a new study describing the structure of the coronavirus membrane protein, data that may prove useful for other scientists around the world.

The **Clinical Research Center** (CRC) at LIMR, under the direction of Paul Gilman, MD, is supporting Main Line Health clinicians who want to administer convalescent human plasma to their COVID patients. Main Line Health is registered in a nationwide Expanded Access program being run through the Mayo Clinic to obtain donated plasma. The CRC staff is guiding clinicians through the process of registering for the program and then assisting them with the follow-up and reporting requirements. *

Your gift to the COVID-19 Research Fund will support LIMR scientists who are fighting the outbreak. See inside back cover for more.

NEWS

Updates from LIMR Researchers

Sunil Thomas, PhD; George Prendergast, PhD; and **James Mullin, PhD**, were awarded a U.S. patent for a new therapeutic approach to prevent or treat inflammatory bowel disease and tauopathies such as Alzheimer's disease. The research was funded by the Janssen Research Foundation, the Wawa Foundation, and the Women's Board of Lankenau Medical Center.



We are thrilled to report that **Charles Antzelevitch, PhD**, professor and executive director of cardiovascular research at LIMR, received the 2020 Lifetime Achievement Award from the American College of Cardiology (ACC), a non-profit medical association, for his groundbreaking research into abnormal heartbeat syndromes (arrhythmias).

Dr. Antzelevitch, who also serves as director of research for Lankenau Heart Institute, has devoted much of his career to the study of the mechanisms underlying arrhythmias, including atrial fibrillation (AF) and inherited cardiac conditions. He and his colleagues also have contributed significantly to studies aimed at the development of new medications to treat AF.

During his 42-year career, Dr. Antzelevitch's contributions to the scientific literature include more than 550 original papers and reviews, over 380 abstracts, and seven books. His research has been funded by the National Institutes of Health, the State of New York Department of Health, the State of New York Stem Cell Center, American Heart Association, Heart Rhythm Society, W.W. Smith Charitable Trust, Martha and Wistar Morris Fund, and several commercial firms.



LIMR Professor **Ellen Heber-Katz, PhD**, was invited to give a talk at Vision Weekend 2019 in San Francisco in November. Her talk was titled "Methuselah Rising: Materials for Regeneration and Longevity."

LIMR Assistant Professor **Marie Webster, PhD**, was the lead author of "Paradoxical role for wild-type p53 in driving therapy resistance in melanoma" in the prestigious journal *Molecular Cell*.

Research Associate Professor **Alexander Burashnikov, PhD**, received a grant from the W.W. Smith Charitable Trust for his proposal "Mechanisms underlying the development of atrial fibrillation in cancer." He also was invited to join the Editorial Board of *Journal of Cardiovascular Pharmacology*.

LIMR Professor **Gan-Xin Yan, MD, PhD**, was named a Top Doctor 2019 in cardiovascular disease by *Philadelphia Magazine*.

Kaitlyn Kennard, MD, a postdoctoral fellow at LIMR, presented an abstract at the Philadelphia Academy of Surgeons meeting in February. Her project, "Use of PECS II Block in Partial Mastectomy for Improving Postoperative Pain Control and Mitigating Narcotic Use – Initial Results from a Randomized Control Trial," was selected in the top five of more than 100 abstracts submitted by residents and fellows in the tri-state area, and it was awarded third place in the competition. The Sharpe-Strumia Research Foundation supported the PECS II project along with the lone Strauss Breast Cancer Research and Education Fund.

Laurence Belkoff, DO, director of Main Line Health's urology surgery residency program, was named an affiliated clinical professor at LIMR. He serves as director of research for MidLantic Urology. Dr. Belkoff previously served as program director of the urology residency program at Hahnemann University Hospital.

Q&A

Advancing Patient Care Through Research and Physician Training



Leonard Dreifus, MD, Lankenau Medical Center's former chief of cardiology, stepped down in 1989, Lankenau went searching for a department leader who could carry on his legacy in delivering world-class electrophysiology and cardiology services. Dr. Dreifus was an influential leader whose highly regarded work in

the field of cardiology included a term as president of the American College of Cardiology, so the bar for his successor was set high.

It was a sign of Lankenau's great status and enormous good fortune to recruit Peter Kowey, MD, who brought an impressive global reputation in patient care, a commitment to research and a generous spirit, the breadth of which grew ever larger during his career here.

Dr. Kowey graduated from the University of Pennsylvania Medical School and trained in cardiology at the Peter Bent Brigham Hospital (now Brigham and Women's Hospital) and the Harvard School of Public Health before spending nine years as an academic cardiologist at the Medical College of Pennsylvania. During the next 25 years, Dr. Kowey and his dedicated staff turned Lankenau into the internationally renowned heart-care hospital that it is today.

He has been a powerful influence not only at Lankenau and Main Line Health, but also in the field of cardiology around the world. He regularly chairs committees and moderates discussions at national and international conferences; consults extensively with industry and government agencies, including the Food and Drug Administration (FDA); gives presentations on cardiac arrhythmias; writes papers, textbooks and chapters (both alone and with faculty and fellows); and – pertinent to LIMR – advances basic and clinical cardiovascular research.

Although he stepped down as chair of cardiology in 2015, Dr. Kowey, who holds the William Wikoff Smith Chair in Cardiovascular Research at LIMR, continues to advance health care through his myriad research endeavors and unwavering dedication to training the next generation of physicians.

Q: Throughout your career you've retained a strong commitment not just to patient care, but also to research and scholarly activity. Why have those latter activities been especially important to you?

Dr. Kowey: Because they have a ripple effect. Taking care of patients is, of course, very important. But in that endeavor, a doctor sees one patient at a time. By doing research and teaching, I can magnify my impact. It's very gratifying for me to know that the research I've done has led to the development of new drugs, devices and procedures, many of which are now the standard of care for patients.

For example, I was the principal investigator for the clinical trials of intravenous amiodarone, a drug we use to treat arrhythmias [irregular heartbeats]. We began with preclinical research and continued through clinical trials and then to FDA approval. Today, amiodarone is the most commonly used drug for cardiac arrhythmias. Hundreds of thousands of patients feel better and live longer because of that drug and other agents we helped to develop.

I'm still doing research. I consult with the FDA and industry on drug development, and not just for heart disease, but also for experimental drugs for cancer, gastrointestinal disorders and other conditions. Many of those drugs have cardiovascular risk that I've helped pharmaceutical developers understand and address.

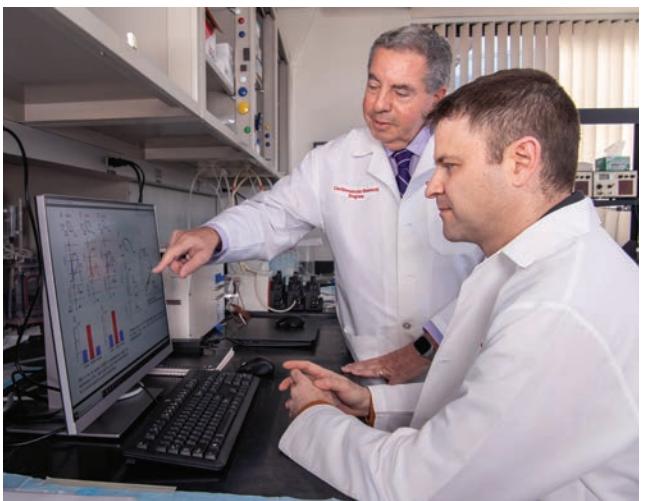
Q: You've had a tremendous influence on an entire generation of cardiovascular specialists. Why is physician training a driving force in your work?

Dr. Kowey: When you train the next generation of doctors, it impacts patients everywhere. Our trainees are disbursed around the world. I've been able to influence two generations of physicians: the generation I trained at the beginning of my career, and those more recently in training. Over the course of my career, I've trained thousands of fellows, residents and students, and taught legions of practicing physicians. Best of all, I continue to be active, helping with the fellowship program at Lankenau. I still see patients, much of the time with a fellow or student at my side.

Q: When you do get free time, how do you like to spend it?

Dr. Kowey: As many people know, I enjoy creative writing; I've penned five medical mystery books. The fifth, "Death by Your Own Device," was published by iUniverse in March. I've increasingly donated time to institutions I love. For example, I'm a member of the Board of Trustees at St. Joseph's University. And I spend as much time as possible with my wife, who is my best friend and confidant, and my family. I have six grandchildren, ages 12 to 20, who live in Boston and California, so we have those places as our preferred travel destinations. I also stay physically active, hiking, skiing, cycling, and playing golf and tennis. *

LISA Program: Developing Impactful Research Collaborations



The Lankenau-Israel Strategic Alliance (LISA) fosters mutually beneficial cardiology research at Lankenau Medical Center, LIMR and Israeli institutions. Professor Charles Antzelevitch, PhD (*left*), consults in his LIMR lab with the most recent LISA fellow, Gilad Margolis, MD, of Tel Aviv Medical Center.

Many of the biomedical research advancements in recent decades have been the result of fruitful collaborations among investigators from different institutions, even from different parts of the world. The innovative research being done at Main Line Health is no exception.

The Lankenau-Israel Strategic Alliance (LISA) cultivates synergistic networks among physicians and scientists at Lankenau Medical Center, LIMR and Israeli institutions. Under the umbrella of the Israel Heart Society, this program, which began in 2017, fosters mutually beneficial cardiology research.

"Lankenau Medical Center is known worldwide for being a leader in cardiac care delivery and research," said Charles Antzelevitch, PhD, professor and executive director of cardiovascular research at LIMR. "With the LISA program our goal is to cross-fertilize cardiac research between Lankenau and medical centers throughout Israel, helping to enrich scientific discovery and medical practice at both locations. Together, we're advancing cardiac medicine and further enhancing the quality of care delivered to patients."

The initiative was developed by Dr. Antzelevitch; Peter Kowey, MD, a Lankenau-based cardiologist; Jeannie and Mark Cohen; and Dr. Michael Glikson, past president of the Israel Heart Society. The Cohens along with other generous

donors, Lankenau Medical Center and the Israel Heart Society are enthusiastically funding the program.

The first LISA Fellow selected to participate was Itai Weissberg, MD, PhD, an internal medicine resident at Israel-based Soroko Medical Center. He joined the Cardiovascular Research Program at LIMR in 2017 and served in that role until 2019. As a LISA Fellow, Dr. Weissberg participated in several ongoing projects at LIMR, including studies examining genetic defects in ion channels found in both the brain and heart and responsible for sudden unexpected death among epileptics.

Gilad Margolis, MD, from Tel Aviv Medical Center, served as the second LISA Fellow at Lankenau. He was selected to participate in the program by the Israel Heart Society via a nationwide competition.

He spent a year in a basic science training program at LIMR, working with Dr. Antzelevitch and his research team. Dr. Margolis participated in studies to determine why patients with cancer are prone to developing irregular heartbeats and how best to treat them. He also studied mechanisms that lead to inherited cardiovascular syndromes and therapies to prevent sudden cardiac death in these patients.

"Through LISA we are able to support important collaborations among the world-renowned clinicians at Lankenau Heart Institute, the researchers at LIMR and their esteemed colleagues in Israel," said Mark Cohen, a member of Lankenau's President's Advisory Council. "The program sets the stage for an exciting exchange of ideas and best practices that can help improve cardiovascular research and patient care both here in the Philadelphia area and in Israel. I am thrilled to have been able to help launch this important program and am grateful to the other generous donors who have contributed to its resounding success." *

LISA Program Donors

We gratefully acknowledge the LISA program donors*

- Lisa and Arthur Berkowitz
- Jeannie and Mark Cohen
- Clayman Foundation/Mr. and Mrs. Stephen A. Cohen
- The Charlestein Foundation of Premier Dental Products Company
- The Daniel Veloric Foundation
- Mr. and Mrs. Bernard Zolot

*as of 2/28/20

If you would like to help ensure the future of this worthwhile program, contact Amy Mansky of the Lankenau Medical Center Foundation at 484.476.8070, or manskya@mlhs.org.

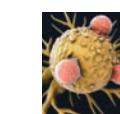
Your Investments in Research at LIMR Can Have a Significant Impact

You can designate a special fund to help precisely target your contributions to support what matters to you.



COVID-19 Research Fund

Your gift will support several biomedical scientists at LIMR who have pivoted their research toward battling the coronavirus. They are advancing studies to better diagnose, treat and prevent COVID-19 infection. Several LIMR Board Members have joined together to initiate a Challenge Match to help raise additional funds to support LIMR's COVID-19 research. For the remainder of 2020, they will match dollar-for-dollar all contributions to this fund up to \$80,000, thereby doubling your donation to this important research.



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.



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, for example, 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 after-effects 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.

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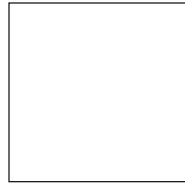
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Main Line Health®

ABOUT MAIN LINE HEALTH

Main Line Health® is an integrated health system serving the Philadelphia region, with more than 2,000 physicians, one quaternary and three tertiary care hospitals, a wide network of patient care locations and community health centers, specialized facilities for rehabilitative medicine and drug and alcohol recovery, a home health service, and a biomedical research institute. Collectively, Main Line Health's physicians, care teams, health care facilities, and researchers provide patients with primary through highly specialized care as well as access to clinical trials.