

PENN Medicine



WHAT IF THE NEXT PANDEMIC IS CARRIED BY A BUG?

Plus:
Medical School, Refocused for a Changed World
COVID-19 Vaccines' Research Roots at Penn





For a patient with breast cancer, this type of drawing could help them better understand each step of their treatment plan. Here, a student uses sketches and symbols to explain a radiation and infusion schedule.

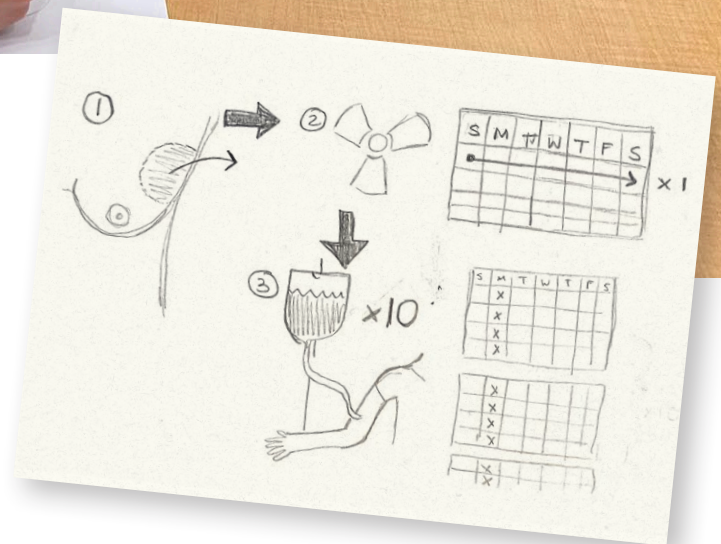
Stethoscope, Scalpel, Sketchbook

By MaryKate Wust

Imagine a classroom buzzing with the sounds of pencils scribbling, students chatting about shapes and shading, and instructors offering encouraging feedback on line quality and proportions. Sounds like the perfect space for art majors, right? Last February, though, students at the Perelman School of Medicine discovered that this creative environment could foster the observation, analysis, and artistic skills of future physicians too. Spearheaded by two PSOM students, the new “Drawing for Visual Communication in Medicine” elective aims to help medical students add a basic yet transformative skill to their repertoire.

Communication barriers like language differences and low health literacy can make it difficult for providers to convey medical information to patients verbally, but visual aids can enhance understanding and improve the patient experience. “By teaching physicians to draw, it empowers them to empower their patients and bolsters the shared decision-making part of medicine. Drawing is a powerful tool all of us can use, regardless of specialty. It just takes practice,” said Elizabeth (Lizz) Card, an artist and fourth-year student who plans to specialize in Plastic and Reconstructive Surgery.

Card co-taught the course with a classmate and medical illustration colleague. They showed third- and fourth-year



med students how to translate the lines, shapes, and proportions of the human body into sketches and explain medical information through images and universal symbols. Visual communication isn't a standard topic covered in medical school, so this collaboration with Julian Lejbman, MD'20, now a first-year Internal Medicine-Pediatrics resident at UCLA, and Eo Trueblood, lead illustrator and co-founder of Stream Studios at Children's Hospital of Philadelphia (CHOP), aimed to address this gap.

Card and Trueblood plan to teach the class again this spring—virtually due to the ongoing pandemic. Though she won't be able to pore over students' drawings in person this time, Card is confident that, via webcam, her peers will still be able to hone their artistic abilities and appreciate the broad application of visual communication skills in medicine. □

► Read more online at PennMedicine.org/magazine/drawingdocs



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PENN MEDICINE

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16 Pest Control *By Lauren Ingeno*

After nearly 20 years researching the intersection of ecology, public health, and urban policy, epidemiologist Michael Z. Levy, PhD, understands, better than most, how infectious disease outbreaks happen—and that we're not doing enough to prevent them.

"My big worry right now is that we're going to have warehouses full of masks, and the next pandemic won't be airborne," he says. "It's going to be carried by a bug."

28 Back to School Never Looked Like This

By Christina Hernandez Sherwood

The earthquake that is COVID-19 rocked the ground on which modern medical education was built. But after the dust cleared, certain foundational principles of training to be a doctor today still stand. As medical education is rebuilt around these foundational principles, the structure will remain familiar while the particulars are permanently altered.

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The Places We Inhabit



A year into the COVID-19 pandemic, we've settled into a change of place: Elementary school classes take place remotely from dozens of kitchen tables, while work meetings once held in conference rooms now convene from spare bedrooms and that little corner tucked away by the stairs. Most of our social lives have shifted to happen exclusively outdoors, and as the fall progressed to winter we've huddled (not too close) around our new patio heaters. Quite simply, a lot of activities have moved to new places thanks to COVID-19. These pandemic-induced changes in venue may seem so familiar as to be prosaic at this point. But the places we inhabit are a detail worth noting, in particular for this issue of the magazine, which ventures into ways these places matter both more and less than we might have thought.

In planning our feature story about medical education (p.28), Suzanne Rose, MD, MEd, the senior vice dean for medical education in the Perelman School of Medicine, told me that students miss being able to meet in person and en masse in the Jordan Medical Education Center (JMEC)—and she misses them, too. Yet the story shows that the physical spaces where people learn and connect sometimes matter less than the quality and frequency of that connection. The essential parts of the medical student experience that had to endure during the pandemic, did endure, and will outlast this disease. For a brief period as the first wave of COVID-19 hit, students' clinical clerkships converted to virtual learning electives that were closely shaped by students' input into the developing the curriculum. While clinical trainees are now back in the hospital—an instance where the place remains foundational—the learner-centered approach to shaping the curriculum is here to stay.

But sometimes a physical place has everything to do with health and disease. Unsafe or unstable housing conditions, poverty, and related social inequities are deeply linked with well-being. The nature of such connections are what you will find once you dig beneath the creepy-crawly surface of our cover story (p.16). What begins as an exploration of vector-borne diseases, and a tale of two cities with distinct pest control concerns, ultimately yields lessons about the intimate connections between housing and public health. “Policy matters,” as the story’s central expert, epidemiologist Michael Z. Levy, PhD, says. A change in zoning policy affecting settlement patterns in Arequipa, Peru, made the difference in sparking a once-mysterious outbreak of Chagas disease there, as his team’s research helped show. Since then, in Philadelphia, Levy has used his research to advocate for housing policies that can mitigate bedbug infestations in the city—and more recently for moratoria on evictions to reduce the spread of COVID-19.

So many of us are experiencing places differently during the pandemic, or have experienced some form of displacement, whether from workplaces, schools, jobs, routines, or celebrations. But there is some comfort in knowing that the most valued places we've lost, may yet be places we'll return to. And vaccines are the reason (see our coverage on pages 3-5 and 48-49). The arrival of vaccines to Penn Medicine in mid-December brought not only pride in the achievements of our own scientists in helping to make this possible, but also a new energy and relief among faculty and staff who have worked so hard all year to care for our community. Though there remain uncertainties as this issue goes to press about the supply and procedures for more widespread vaccination, it is time to celebrate that a remarkable feat of science is giving us a path toward a different place.

RE

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Correction: In the Fall 2020 issue, alongside the obituary for Richard L. Tannen, MD, we erroneously printed a photo of Lawrence S. Weisberg, MD, GM'87, who continues to serve as a professor of Medicine and head of the Division of Nephrology at Cooper University Health Care. We extend our apologies for the error to Dr. Weisberg and to his concerned friends and colleagues, as well as to the family and friends of Dr. Tannen.

UNLOCKING NEW THERAPIES AFTER COVID VACCINES

The mRNA vaccine technology now in widespread use in new COVID-19 vaccines is built on research at Penn Medicine. It has extraordinary potential in the prevention and treatment of numerous intractable diseases.

The spike protein is the entry key for a coronavirus to attach to and infect a human cell. But when the body can make that key for itself, it can learn to lock the virus out. Such is the promise of the first two COVID-19 vaccines produced by Pfizer/BioNTech and Moderna.

The week before both vaccines were approved by the Food and Drug Administration for emergency use in December 2020, the *Washington Post* editorial board lauded the remarkable science behind them—and two major advances in that science begun decades ago at Penn—as “an extraordinary advance in technology, never before used on such a scale, with great promise for the future, and some uncertainties.”

These vaccines involve injecting modified synthetic messenger RNA (mRNA) molecules that code for the SARS-CoV-2 spike protein into the body. The cells use the mRNA as a template to build the spike protein to which the body then mounts an immune response to learn to fight the virus, should it ever encounter the real thing.

It is the first time approved human vaccines have used mRNA to teach the body to make viral proteins, rather than introducing a viral protein or weakened virus itself to prime the immune system as in most traditional vaccines. The vaccines are new—but the technology has been long in development. And now mRNA has a promising future for countless new vaccines and therapies.

The vaccine’s story begins in the early 2000s, when Drew Weissman, MD, PhD, a professor of Infectious Diseases at the Perelman School of Medicine, and Katalin Karikó, PhD, an adjunct associate professor, began working together at Penn. One major advance they made was to modify the

mRNA molecule itself so that it could avoid attack from the immune system and the inflammatory response in the body that was seen in early animal studies. The other advance was enclosing the mRNA in a lipid nanoparticle envelope to deliver mRNA safely and efficiently into the body—a delivery mechanism that is already part of multiple approved drugs at higher concentrations and one that, fortuitously, turned out to also function as an adjuvant to enhance the effectiveness of the COVID-19 vaccines.

The discovery has been hailed by some as Nobel Prize-worthy. “If anyone asks me whom to vote for some day down the line, I would put them front and center,” Derrick Rossi, PhD, co-founder of Moderna, told *STAT News*. “That fundamental discovery is going to go into medicines that help the world.”

Penn Medicine scientists first began exploring the possibility of using mRNA vaccines for HIV more than 20 years ago, and in recent years have turned to developing them for malaria, influenza, and other infectious diseases. Cancer immunotherapy researchers are investigating ways to make personalized cancer “vaccines.”

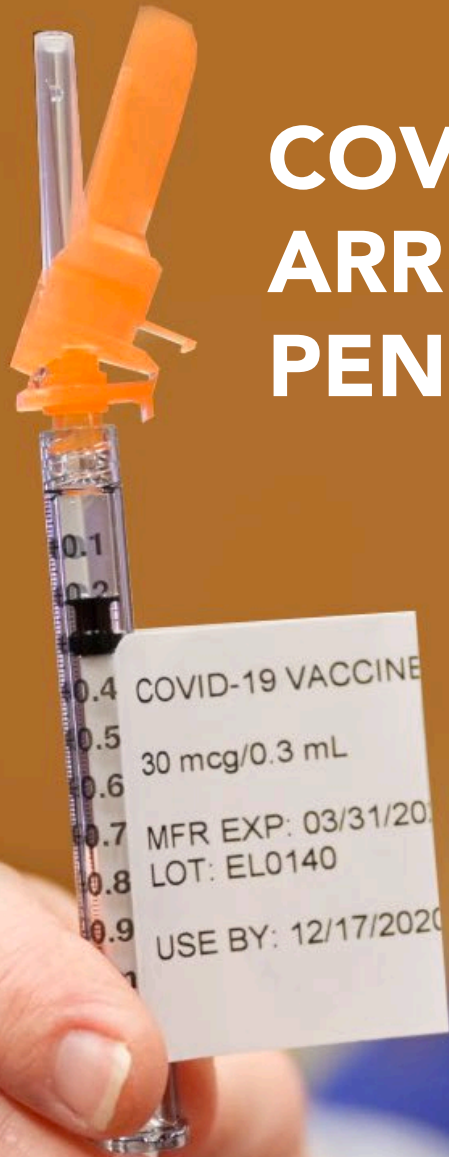
In Weissman’s lab at Penn, he and Norbert Pardi, PhD, a research assistant professor, are developing new mRNA vaccines for 30 different infectious diseases. Five are already being tested in humans—against HIV, the genital herpes virus, and the influenza virus. The team is also involved in a clinical trial for a universal flu vaccine to replace an annual one.

Weissman also anticipates opportunities to develop pan-coronavirus vaccines to address not only newer variants of SARS-CoV-2, but also any future related viruses that may cross over into humans from other species—a possibility to take seriously, considering that it has happened three times in the last 20 years, with SARS, MERS, and the current pandemic.

Therapeutic uses of mRNA are yet another new possibility opened by the success of the platform in COVID-19 vaccines. The same technology could be used as a basis for gene therapies that could target stem cells and fix genetic mutations, or as a treatment method for acute and chronic diseases—enabling the body to produce therapeutic proteins within specific organs or cell types where they are needed.

'I GOT THE SHOT'

COVID-19 VACCINE ARRIVES AT PENN MEDICINE



After wrapping up his night shift at 6:15 a.m. on December 16, 2020, Emergency Department nurse Eric Young, RN, BSN, was the first to receive the COVID-19 vaccine at Pennsylvania Hospital—marking what many saw as the “beginning of the end” of the pandemic at Penn Medicine.

Within a month, Penn Medicine had administered over 43,000 doses of the Pfizer/BioNTech and Moderna vaccines.

Faculty and staff from Penn Medicine were eager to share their excitement and confidence in the science behind the vaccines’ effectiveness and safety. In a series of posters, screensavers, and internal messages, dozens proudly proclaimed “I Got the Shot.” Concurrently, Black faculty and staff have spearheaded efforts to address vaccine hesitancy that remains widespread, particularly among people of color. (See one such perspective on p.48 in this issue.)

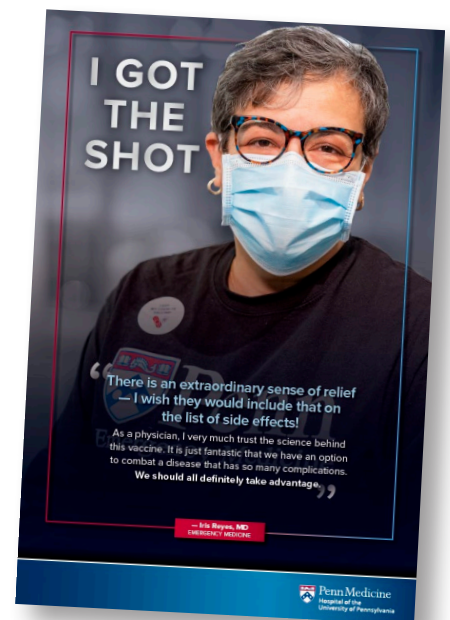
The goal of such outreach efforts is to support, educate, and be responsive to questions and concerns among colleagues and patients who may be more hesitant to receive a new vaccine—and ultimately to bring a swifter end to the pandemic.



The first vaccines arrived at Penn Medicine packed in dry ice inside of special “pizza boxes,” each containing 975 vials which had to be carefully and quickly unpacked and stored in sub-zero freezers. That step is so important that each box of the Pfizer vaccine included a monitor to track freezer temperatures.



Joanne Ruggiero, RN, MSN, clinical director for Women’s Health and Behavioral Health at Pennsylvania Hospital, administers the COVID-19 vaccine to Emergency Department nurse Eric Young, RN, BSN.



“There is an extraordinary sense of relief—I wish they would include that on the list of side effects!” Iris Reyes, MD, a professor of Emergency Medicine at the Perelman School of Medicine, is one of dozens of ambassadors for vaccination featured in a Penn Medicine poster campaign.



COMING TOGETHER ON THE HUP CAMPUS

This fall, steel frames for two bridge structures were assembled on the ground and lifted into place, connecting the buildings of the Hospital of the University of Pennsylvania (HUP). The new Pavilion (HUP East) will ultimately be connected to HUP West through one of these new bridges and an underground tunnel that span 33rd and 34th Streets, and to the Perelman Center for Advanced Medicine through two bridges above Convention Avenue. A fourth, open-air pedestrian walkway will connect to SEPTA's Penn Medicine Station.

JAMESON TAKES HELM OF AAMC BOARD

In November, J. Larry Jameson, MD, PhD, executive vice president of the University of Pennsylvania for the Health System and dean of the Perelman School of Medicine, became the new chair of the Board of Directors for the Association of American Medical Colleges (AAMC). Jameson has been a member of the AAMC Board of Directors since 2017, and during that time also served as chair of the AAMC Council of Deans. The AAMC, a not-for-profit association dedicated to transforming health through medical education, health care, medical research, and community collaborations, leads and serves America's medical schools and teaching hospitals.

Jameson assumes this new national leadership role while continuing to lead at Penn Medicine. In December, University of Pennsylvania President

Amy Gutmann, PhD, announced the extension of Jameson's term through June 30, 2025. He came to Penn Medicine from his post as dean of the Feinberg School of Medicine and Vice President of Medical Affairs at Northwestern University in 2011.

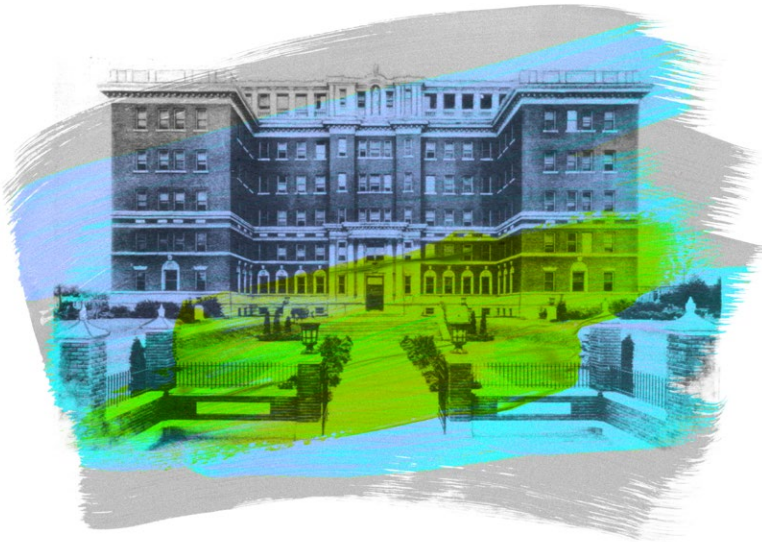
"As we continue confronting a global pandemic and envisioning our future as a University and a society, Larry's leadership of Penn Medicine and the Perelman School coupled with his consummate university citizenship are universally praised and admired," Gutmann said.

Among the many markers of Jameson's service as executive vice president and dean that Gutmann cited are the growth in both quality and diversity of PSOM's faculty, staff, and students; the strength of both educational and research programs; strong financial performance

and fundraising; improvements to facilities and infrastructure; and important and measured growth of the health system. Gutmann also specifically lauded Jameson's efforts to advance diversity, equity, and inclusion across Penn Medicine and the University.



A NEW PUBLIC HEALTH CAMPUS IN WEST PHILADELPHIA



Penn Medicine has joined forces as part of a coalition of the region's premier health care organizations transform Mercy Philadelphia Hospital at 54th and Cedar Ave. into a thriving, reimagined campus that will provide high-quality, community-informed health care and services centered on the public health needs of the facility's West Philadelphia neighbors.

Coalition partners—Public Health Management Corporation (PHMC), Penn Medicine, Trinity Health Mid-Atlantic, and Independence Blue Cross—plan to develop a campus

focused on health equity. Its operations will rely heavily on a patient-centered approach to high-quality medical care, behavioral health, and social services. Children's Hospital of Philadelphia (CHOP) is also exploring the option to offer pediatric behavioral health services on the campus. Penn Medicine plans to take over operation of emergency and acute care services on the campus in late March.

"The COVID-19 epidemic has underscored the necessity of working together past the walls of individual institutions," said Kevin B. Mahoney, CEO of the University of Pennsylvania Health System. "Collaboration and bringing together diverse expertise is the best way to make a difference for our communities."

While some acute care beds will be retained to support the emergency department, providers will work to connect patients to primary and community care providers. Unlike the recent closure of Hahnemann Hospital, which remains a stark example of the perils of any wind-down process, the coalition partners will provide an array of medical, behavioral, and social service program options that will maintain—and ultimately improve—community access to care, while retaining jobs and ensuring the reimagined Mercy campus is a thriving center of activity.

PHMC, Penn Medicine, and Independence Blue Cross will explore community partnerships to identify supplemental offerings to address key community issues, such as food insecurity, health and wellness education, and activities to support the community.

STERILE GOES BIG



Penn Medicine's new Interventional Support Center (ISC) opened in February and is now the centralized hub for processing instruments from both the Hospital of the University of Pennsylvania (HUP) and Pennsylvania Hospital. At nearly 110,000 square feet, it is the largest instrument processing and supply picking facility in the country, supporting up to 250 surgical cases each day.

Clean instruments are a crucial element of patient safety. By centralizing processing from multiple hospitals at this new facility with plans to include the Pavilion (HUP East) and potentially more hospitals in the future, Penn Medicine can ensure consistent, state-of-the-art processing that complies with evolving standards.

Employee well-being has been a central tenet in the facility's design. Ergonomic features include height-adjustable decontamination sinks and a rotating storage rack—analogue to the device that rotates clothing to move it through a dry cleaner's—to deliver instrument trays to workstations without requiring staff to reach or bend as they would with traditional racks.

FILTERING BIAS OUT OF KIDNEY TESTING

Q&A with Nwamaka Eneanya, MD, MPH, on Advancing Health Equity and Removing Race from Assessment of Renal Function—a Driver of Disparities in Timely Access to Care

Two female patients with advanced kidney disease walk into a physician's office. Their heights and weights are equal, their ages the same, their laboratory reports identical. They are alike in almost every way, yet only one qualifies for a transplant list. The other does not—because she is Black.

For the last two decades, a clinical laboratory test called eGFR—which stands for estimated glomerular filtration rate—has been used to evaluate how efficiently a person's kidneys removes creatinine, a waste product they filter out of blood. The eGFR equation reports a score based on measured cre-

atinine levels while also considering a patient's age, gender, and race. Nephrologist Nwamaka Eneanya, MD, MPH, an assistant professor in Epidemiology and in Renal-Electrolyte and Hypertension at the Perelman School of Medicine, is working to eliminate race from the formula. She has lobbied extensively for this change, including in a wave-making 2019 *Journal of the American Medical Association* paper that helped propel the issue to a national stage.

How does race affect a person's eGFR?

The researchers who developed these equations discovered that Black study participants had higher creatinine levels compared to white study participants—despite having similar kidney function. The researchers proposed that the reasons for their findings were due to Black people having more muscle mass than white people. Since people with more muscle mass make more creatinine, they concluded that Black patients'

eGFR scores should be adjusted with a multiplication factor. Clinicians have been performing this “race correction” for more than 20 years, so Black patients are routinely assigned higher kidney function than those of other races.

Why is this race multiplier problematic?

Human genome studies have shown there are no inherent biological differences between races. Those studies reporting that Black people had greater muscle mass were flawed, but no one questioned them. Patients' eGFR scores inform many clinical decisions; guidelines recommend a chronic kidney disease diagnosis at less than 60, a specialist referral at less than 30, and placement on a transplant list at less than 20. If we “correct” Black patients' scores, we refer them for care too late. This is a big deal because Black people are disproportionately affected with more advanced stages of kidney disease—they are also known to progress



more quickly than others to needing dialysis and transplant.

If the multiplier can cause harm, why do physicians continue using it?

Not everyone approaches medicine with a health equity lens. Many clinicians are not aware of existing disparities—how Black patients do not get referred to nephrology as early as white patients and do not have sufficient access to transplant [procedures]. In medicine, the tendency is to say, “This is what a study showed, so this is what we should do,” focusing on biomarkers and statistical tests without examining issues of ethics or health equity.

How can physicians make sure Black patients are getting proper care?

I sit on a joint American Society of Nephrology-National Kidney Foundation task force that is revising formal eGFR reporting guidelines to exclude racial bias. Many physicians across the country, including some at Penn, have stopped using the race multiplier al-



ready. And while the eGFR is a front-line test for kidney function, there are other tests that don't incorporate race. When there is any doubt about the accuracy of an eGFR score, other confirmatory tests that do not use race should be performed.

You serve as director of Health Equity, Anti-Racism, and Community Engagement in the Renal Electrolyte and Hypertension Division. What does that role entail?

Internally, I focus on diversity, inclusion, and relationship-building among staff, faculty, and trainees. Our division

employs many individuals from minority racial and ethnic backgrounds, and I make sure they feel seen, heard, and valued. For example, in the dialysis unit, we are putting up a board with everyone's pictures and names, because colleagues feel unseen if you don't know them by name. We also recently held an inaugural staff awards ceremony, which was a big success.

There's more to the job than staff initiatives. I'm currently looking into creating endowments for racial/ethnic minority student research pipeline programs, so our division can support them perpetually. And out in the community, we have a kidney disease awareness and screening program that's run completely by undergraduate students—I'm helping them apply for a grant to incorporate food insecurity into their screenings.

Penn has done a great thing in appointing diversity and inclusion directors for every department and allowing them to implement changes that are reformative, not performative. We all need to work harder to advance equity—and here, I am empowered to do that.

— Interview by Karen Brooks

PENN MEDICINE'S STEPS TO ACT ON DIVERSITY, EQUITY, AND INCLUSION



Penn Medicine's Action for Cultural Transformation (**ACT**), officially launched on July 1, 2020, is an ongoing extensive institutional effort to ensure equity, mitigate bias and eliminate racism at Penn Medicine. The Office of Inclusion, Diversity and Equity (OIDE), in partnership with representatives from across the institution, has been working to chart the course for **ACT** to bring substantive change. Within weeks of launching the **ACT** effort, Penn Medicine departments, centers, and entities identified dozens of new, impactful, inclusive, and sustainable actions to pursue immediately as “Just Do It” goals. Meanwhile, longer-term strategic planning for the full, comprehensive effort was underway, engaging thousands of faculty, staff, and students in the effort.

The strategy and implementation plan was released on the OIDE website this winter and is publicly available at www.med.upenn.edu/inclusion-and-diversity.

“The charge to **ACT** is clear,” said Eve J. Higginbotham, SM, MD, ML, vice dean for Inclusion, Diversity and Equity in the Perelman School of Medicine, and Dwaine Duckett, senior vice president for Human Resources at the University of Pennsylvania Health System, in announcing the plan. “We aim to eliminate structural injustice across Penn Medicine and the communities we serve to achieve our vision for the future: Penn Medicine is united as an anti-racist, equitable, diverse and inclusive organization.”

A BARD FOR HEALTH EQUITY LEADS FAMILY MEDICINE AND COMMUNITY HEALTH DEPARTMENT



Richard Wender, MD'79 is in his element. “COVID virus has exposed unjust disparities,” he sings with gusto to the virtual audience on the other side of his computer screen. “We join as one to raise our voice as NCCRT . . . We will screen you. We will screen you.” Anyone fortunate enough to attend the annual meeting of the National Colorectal Cancer Roundtable can look forward to a musical performance by the Chair, and this year’s virtual meeting was no exception. “We Will Screen You” was Wender’s adaptation of *Ragtime*’s “Make Them Hear You” to reaffirm the medical community’s commitment to providing preventive care during the COVID-19 pandemic. If Wender had not become a professor and physician, he might have taken his lyrical prowess to the stage.

Broadway’s loss is Penn Medicine’s gain. As Wender settles into his new role as chair of Family Medicine and Community Health in the Perelman School of Medicine, he has already made an impression with his quick wit and empathetic nature. After joining Penn in August 2020, he spent his first

several months on the job scheduling one-on-one conversations with every faculty member and nurse practitioner in the department. “I’m very much a believer in creating a loving, supportive culture,” he says.

Prior to joining Penn Medicine, Wender served for 12 years as chair of Family and Community Medicine at Thomas Jefferson University, where he helped catalyze the creation of the Division of Geriatric Medicine and a Palliative Care program. Wender also served as the first ever Chief Cancer Control Officer for the American Cancer Society. As his job titles and areas of responsibility have changed, the themes of health equity and social justice have permeated his life’s work.

Wender joins Penn Medicine at what he calls an “extraordinary moment in health care,” a confluence of events that has exposed the gaping inequity in health access and outcomes. “In an environment of national disunity and racial injustice arose a pandemic that has not only exposed disparities but helped people understand how they came about,” he reflects.

Wender has long pointed to social determinants of health—factors like household income, educational attainment, and workplace safety—to explain why certain populations experience worse health outcomes than others. “What we’ve now realized is that structural racism is one of the most important social determinants of health,” he says.

An inextricable link between primary care and the goal of equity are at the core of his commitments both to growing Family Medicine and Community Health and to working with other departments within Penn Medicine to expand primary care access in West Philadelphia and beyond. “We have a crucial role to play as an anchor institution in our city and neighborhood,” he says. Yet when it comes to social determinants of health, Wender also sees Penn Medicine’s role as one voice in a larger chorus. “Health care providers, try as they might, can’t carry the act alone.”

He is enthusiastic about taking the stage to play his part. “One of the primary reasons I came to Penn Medicine is because my new colleagues are deeply committed to grappling with issues of social justice,” he says. “The holistic pursuit of health equity is in their DNA.”

— Ashley Rabinovitch

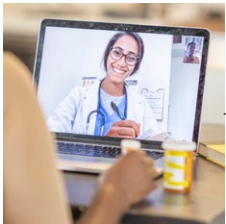
RESEARCH REVEALS...

From basic science to public health, discovery at Penn Medicine is constantly unveiling answers to key questions that can lead to better treatments for disease and prevention of harm. Below are just a handful of recent examples.



How many firearm injuries are there in total?

A study published in *JAMA Internal Medicine* showed that there are about 329 firearm injuries each day in the U.S., or about two nonfatal injuries for every firearm-related death. The study signifies the importance of evaluating firearm prevention policies that address these more common cases where victims survive, in addition to preventing deaths.



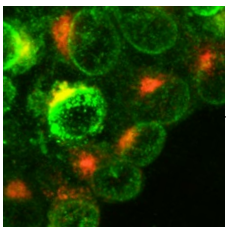
Does telemedicine equitably expand access to care?

Older patients as well as minorities, non-English speakers, and those with lower incomes faced inequities in accessing care during the spring of 2020 when many in-person visits were shifted to telemedicine during the initial COVID-19 surge, according to an analysis published in *JAMA Network Open*. Recognizing and addressing barriers will be crucial to implementing virtual care strategies that benefit all patients, the researchers say.



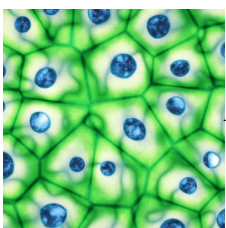
Where do (and don't) killer T cells go?

So-called “killer” T cells, the immune cells that recognize and destroy other cells that have a particular target they are trained to attack, normally do not migrate out of the bloodstream. By analyzing samples from both blood and lymph—a whitish, watery fluid that flows between tissues and organs and the bloodstream—the researchers were able to catalogue the detailed molecular characteristics of T cells collected from both fluids in the same subjects, for the first time. The findings, published in *Cell*, could help explain why therapies that use modified killer T cells do not work well against solid tumors, among other medical mysteries.



What is a cytokine storm?

In the *New England Journal of Medicine*, Penn Medicine researchers published a unifying definition of “cytokine storm” as a framework to assess and treat severely ill patients whose immune systems have gone rogue—something that has become a major challenge with COVID-19. Characteristics of a cytokine storm in their definition include elevated circulating cytokine levels, acute systematic inflammatory symptoms, and a secondary organ dysfunction beyond what could be attributed to a normal response to a pathogen.



What transforms a normal cell into a cancer cell?

Two universal metabolic pathways may tie together the means by which cancer arises in cell types all over the body, according to a study published in *Cell Metabolism*. The two key elements: antioxidant defense and nucleotide synthesis.



FOCUSED ON WHAT'S POSSIBLE

By Julie Wood

Photos by Zonía Moore



Phone, keys, mask, camera. It's a Saturday evening, and Zonía Moore has everything she needs to go out. She begins her adventure looking for scenes that catch her interest, noticing an abandoned building with its intricate architecture still intact. Lifting her Mirrorless Nikon Z Series camera, she carefully selects which lens to use to highlight this hidden gem. Does she

want a close-up of the structure or a farther away shot? Would a wide-angle lens be best, or could that distort the straight lines of the building?

Much like her thought process for capturing a photo, Moore finds that patience and careful decision-making have benefited her as a medical student at the Perelman School of Medicine (PSOM).

"Ever since I was a kid, I've wanted to become a physician," Moore says. "And then in high school, my love of photography was born."

Growing up in Pittsburgh, Moore saw her mother, a physician, take calls and care for patients. Even in the first grade, when she was assigned to draw a

picture of herself in her dream career, she depicted herself on green construction paper in a white coat with a stethoscope in hand and light on her head.

As a high school student, Moore discovered the art of photography when her father found his old camera in their basement. Together, they bought her first basic camera, then went out and took photos.

Now a medical student at Penn, Moore draws on the same observational

skills she has honed through photography in her medical training. In photography, she wonders what story is being told through a photo based on her subject's facial features and posture. Is the subject smiling and posing with their hand on their hip, exuding happiness and confidence? Are their eyebrows furrowed with their arms crossed, displaying a scene of anger? In medicine, Moore also spends time observing her

patients, trying to understand how they're feeling through their emotions and actions.

"One patient told us she was experiencing stomach issues, but she had difficulty explaining what exactly those stomach issues were," Moore says. "Through asking probing questions and watching the physician do the physical exam, I had to discern what sort of pain she was actually experiencing based off of how she was reacting. The patient held her breath but didn't flinch when the physician pressed on the spot that hurt, indicating that her pain was dull and not sharp. She was able to walk with head held high, not nursing her stomach or doubled over in pain."

Moore is also involved with PSOM's student-run magazine *apenndx*. She writes both articles and poetry in addition to submitting photos that highlight life around her.

One photo features a little girl smiling and posing in front of a colorful wall with whimsical shapes and designs. The little girl saw her camera and immediately requested to have her photo taken, Moore explains. "Being in front of a camera was a way of expressing her confidence. I think the theme of building confidence in most individuals can happen through photography," she says. "A lot of my photography focuses on things that you see every day, and not just necessarily like the beautiful travel photos that people like to dream about."

Another series of photos depicts a protest for the Black Lives Matter movement in Pittsburgh in the spring of 2020 following the death of George Floyd. The powerful monochromatic images feature people with masks marching through the streets, carrying signs, and raising their fists in the air high above the crowd.

"What the media has chosen to display is the sensationalist people — some people who aren't even part of the movement, taking an opportunistic moment to engage in civil disobedience," Moore says. "It's very important to showcase at this stage how inte-



For Zonia Moore, photography is much more than a hobby. It allows her to hone her observational skills—which are key as she pursues her medical training—and to share the beauty and power of everyday things and people.



grated the movement is. How people of all walks of life are out there being safe and wearing masks, because there's a pandemic, but still supporting the idea that every single Black life matters."

Moore plans on creating more photo series during her time at Penn, and she hopes to feature portraits of Black

medical students to change the narrative of what a doctor can look like.

"I think that representation is fundamentally important, especially when talking to someone who is younger and still growing up," Moore says. "If one can't envision oneself in a particular spot in the future, one is not even go-

ing to go out and look for opportunities to build a path towards that direction. I like to use photography to show people what is possible." ▢

► **To view Moore's collection of photo series and portraits, visit her portfolio: distractedlens.com.**



PEST CO

Epidemiologist Michael Z. Levy curbed a Chagas disease epidemic in Arequipa, Peru. Can he prevent an outbreak in Philadelphia?





NITRO L

By Lauren Ingeno

The signs are subtle, at first. You notice two pink bumps on your ankle, and then another, on your wrist. “Mosquitoes,” you think. But then, you wake up scratching a line of itchy bites across your torso. “Maybe fleas?” your doctor suggests. One month later, you find a handful of bedbugs—flat and brown like apple seeds—burrowed in a crevice of your box spring. You squish one and watch your own blood spatter from its abdomen.

Your landlord refuses to foot the \$800 exterminator bill, so you dip into your savings to cover the treatment. While lugging trash bags of clothes to the laundromat, you unknowingly spread the pests to a neighbor. Months later, your building is finally declared “bedbug-free.” Still, the scars have not yet faded on your skin. You lie awake at night, fearing that the parasites are hiding in the cracks of your floorboards, waiting to make their return.

Michael Z. Levy, PhD, an associate professor of Epidemiology in the Perelman School of Medicine, has heard versions of this story from Philadelphians—some much more haunting—dozens of times.

After nearly 20 years researching the intersection of ecology, public health, and urban policy, Levy understands, better than most, how infectious disease outbreaks happen—and that we’re not doing enough to prevent them.



“My big worry right now is that we’re going to have warehouses full of masks, and the next pandemic won’t be airborne—it’s going to be carried by a bug,” Levy says. “If we wait until bedbugs start spreading disease, then we are going to be in the same situation we are in now with COVID. We’ll have missed any opportunity to stop it.”

A BABY DIES IN AREQUIPA

The *chirimacha* is not a bedbug, or even closely related, but it behaves almost identically—hiding in the corners of bedrooms, feeding on humans at night, and reproducing rapidly.

“It’s a miracle of convergent evolution,” Levy says of the similarities between the two species.

The insect has fascinated Levy for more than 15 years.

Though it’s known best as the *chirimacha* locally in Arequipa, Peru, its scientific name is *Triatoma infestans*. The bug and its relatives are most abundant in South America, Central America, Mexico, and the southern United States, but have been found as far north as New Jersey.

In the U.S., they are called triatomines, or, more often, “kissing bugs.” The affectionate name comes from the insect’s decidedly unromantic way of earning its blood meal: As you sleep soundly at night, the bug—large and brown, with orange stripes around its perimeter—bites and then defecates near your mouth (or eyes, or open wound).



“My big worry right now is that we’re going to have warehouses full of masks, and the next pandemic won’t be airborne — it’s going to be carried by a bug.”

– Michael Z. Levy, PhD



Photo by Peggy Peterson

If you're especially unlucky, that deposit might expose you to *Trypanosoma cruzi* (*T. cruzi*)—the parasite carried by the bugs that causes life-threatening Chagas disease.

It is unclear how many people Chagas affects worldwide, but Levy suspects the number is around 6 million. Most people have few symptoms and may never know that they were infected. For about 30 percent of its victims, Chagas disease causes chronic health problems, and can even be deadly. Sometimes, the complications—like heart failure—might strike many years after the *chirimacha* bites.

Levy first came to fear the *chirimacha* after reading about the bug in an old “Lonely Planet” guide about Chile. He had graduated from Amherst College and was spending a year bouncing around the country’s southern border with a traveling circus. (It’s a long story, but one worth listening to if you ever find yourself spending long afternoons in City Hall with Levy, as this writer did in the fall of 2019.)

While sleeping in all sorts of places with the circus, Levy would lie awake at night, a flashlight in hand, scanning his sheets for the lethal insect. “I had this real phobia of the Chagas bugs. It’s a terrifying disease,” he says.

Fear gradually turned into obsession, with both the *chirimacha* and the parasite it spread.

“In college, I loved a class about the evolution of infectious disease. So I knew I was interested in how things evolve to make you sick,” he says. “Eventually, the circus broke up. I started going to the library to read up about the evolution of Chagas. And that’s when I decided to go to grad school.”

Levy returned to his Philadelphia hometown to take pre-graduate courses at Penn, where he interned in the lab of Susan Weiss, PhD, a professor of Microbiology who specializes in coronaviruses. He was accepted into a PhD program at Emory University in Atlanta but spent most of his time during graduate school flying to Peru’s capital city of Lima, where he worked with a scientist who was studying infectious diseases. When Levy said that he was interested in Chagas, his advisor told him, “You’re too late. It’s already gone.”

What Levy’s “Lonely Planet” guidebook didn’t say, but he would later learn, was that the *chirimacha* had been essentially eliminated from Chile years before he arrived. Chagas was largely seen as a rare disease exclusive to poor, rural areas. The scientist turned his attention, instead, to tuberculosis.

Then, in 2001, tragedy struck. Spread across the front pages of newspapers in Peru, Levy read: *Aquí, un bebé muere de la enfermedad de Chagas.*

Chagas had killed a baby in Arequipa, Peru’s sprawling, second-largest city of one million people.

“When an infant has an acute case of Chagas disease, that means there is usually another 1,000 cases that you’re not seeing,” Levy says.

The burgeoning epidemiologist knew he needed to go to Arequipa to battle the disease that had haunted and captivated him for years.

Once he arrived in the White City—nicknamed for Arequipa’s white, volcanic stone architecture—Levy and a colleague from the Centers for Disease Control and Prevention met with representatives from the city’s Ministry of Health, who introduced them to Arequipa’s resident Chagas expert: the late Eleazar Córdova, then a microbiologist at the Universidad Nacional de San Agustín.

With funding from the Canadian government, the Ministry of Health embarked on a conventional door-to-door insecticidal treatment campaign, with methods dictated from afar by the Pan American Health Organization. Levy worked with Córdova to embed studies into the effort in order to understand the local epidemic—the largest ever in a city—and to tailor and recreate control strategies for other urban areas.

“There was a lot of press, and press gets politicians moving,” Levy says. “When there is political will, you can control a disease.”

In 2004, the Zoonotic Disease Research Center, located in the center of Arequipa, was created, funded by a Tropical Medicine Research Center award. The researchers planned to find the households where the infected insects were hiding, target those homes with insecticide, and then use data and epidemiological modeling to track where the next outbreak of disease might occur.

It would take more than 10 years to achieve their goals.

IN PHILADELPHIA, THE BEDBUG BATTLE HEATS UP

By the fall of 2019, Levy had been back in Philadelphia for almost a decade, facing another nightmarish insect: He was confident that the city was finally ready to do something about bedbugs.

For the past four years, he had served on a city-commissioned Bedbug Task Force—composed of local scientists, pest management experts, and community activists—who worked diligently on a bill intended to stop the spread of the pests in a city that has been dubbed by Terminix as “the most bedbug-infested” in the country.





© Google Maps

Researchers from the Zoonotic Disease Research Center spent years surveilling Arequipa to find households where Chagas-infected insects were hiding, target those homes with insecticide, and then use data and epidemiological modeling to track where the next outbreak of disease might occur.

In October, Levy was scheduled to testify in favor of the bill, which was expected to pass easily through the Committee on Licenses and Inspections and on to a full City Council vote a few days later. He made plans for celebratory beers with friends after the meeting.

But by the time his name was called to testify, the scientist was conspicuously absent from the room.

“Michael Levy,” Councilmember Maria D. Quiñones Sánchez called into her microphone. Silence followed. “Michael Z. Levy?”

Two doors down the hall, Levy was caught in the middle of a heated argument between activists, landlord lobbyists, and city staffers about an amendment added to the bill—one he learned about just minutes before he was set to testify.

The bill, as originally written, would require landlords to notify tenants about past bedbug issues, develop bedbug control plans, and, most critically, to pay for the treatment of infestations in a timely fashion. However, the eleventh-hour amendment—pushed by the city’s landlord lobby—would shift costs of treatment to tenants if the infestation was de-

tected after the 90th day of a lease. Levy and his task force colleagues found the amendment antithetical to the intent of the original legislation and argued that it would move the city backward in the fight against bedbugs.

Levy reentered the room, threw his planned testimony on a chair, and faced the row of four councilmembers with an indignant scowl.

“I’m Mike Levy, an associate professor at the University of Pennsylvania and a lifelong Philadelphian...” he began, with urgency and desperation mounting in his voice.

“As far as I know, I’m the only person here who has actually eliminated a bug from a city. And I’m here to tell you today that it *can be done*,” he continued. “What you need is smart policy that will encourage people to report the infestation, *quickly*. And that’s why I’m so concerned with the amendment to this bill. If you put the onus on the tenant to pay for treatment, they may not report it. I don’t care who is responsible—if they’re not reporting it, it’s going to spread.”

CHASING CHIRIMACHAS

Each morning in October 2004, Levy rose at dawn in Arequipa. Already a Spanish speaker, his language skills reached fluency, as he followed behind the Ministry of Health workers, who were sent to spray insecticides at homes in Tiabaya, one of the city’s 29 districts. Tiabaya was located in the center of Arequipa, near where the baby had died three years earlier.

The workers, clad in green coveralls, sprayed the walls—as the *chirimachas* were often squeezed between bricks—while

Levy and his colleagues caught the scurrying bugs. If they were agreeable, the residents of the infested homes were also screened for Chagas with a blood draw and an antibody test. By nightfall, Levy and the fieldworkers returned to Córdova's lab and ate empanadas before they began the dirty work: carefully squeezing out the contents of the insects' guts to observe under the microscope in search of the Chagas parasite.

After spraying households in Tiabaya, the team moved on to Guadalupe, a rural community of just 400 homes atop a hill on the southwestern edge of the city.

As Levy collected data from the inspections, he would use an old GPS to plot what he found on a map, with green dots showing parasite-free households, and red dots for those infested with *chirimachas* that were carrying *T. cruzi*.

Observing the map, Levy saw that about half of the homes in Guadalupe were infested with *chirimachas*. Some areas of the community had bugs, but those bugs had not been infected by the *T. cruzi* parasite. Within the areas that did have the parasite present, Levy noticed hot spots of human disease. Those who were infected were not living in random areas throughout the community, but instead, they were clustered in space.

"This told me that if we could figure out where the hot spots were, we could target our diagnosis and treatment," Levy explains.

Over the next five years, the insecticide applicators, Levy, and his team repeated this pattern, in a new district each year, moving west to east, from rural to fully urban neighborhoods.

"Screening blood supply is the first step, then getting rid of the bugs is the second, and then treating people is the third," Levy says. "The government usually won't treat people until they get rid of the bugs, because they think they'll just get re-infected."

As the team reached more parts of the city, Levy's maps began to reveal something unexpected: The prevalence of infected *chirimachas* was high in older communities nearer to the city center (though not in the center itself). Yet *chirimachas* were very rare in the recently established, poor communities at the far eastern areas of Arequipa.

The researchers had two hypotheses for the unusual pattern: Either the *chirimachas* were moving slowly throughout the city and had yet to reach the eastern outskirts; or the bugs had reached an environmental limit—perhaps some combination of temperature, humidity, and other factors.

To figure out why disease was spreading in some areas of the city and not others, the researchers needed to find out when the bugs had first arrived in a person's home—a kind of critter-based contact tracing for Chagas.

"We asked everyone when they had first seen the bugs in their house. No one could answer that question," Levy says. "That's not something that people remember."

Instead, the researchers used a surveying approach called event history calendars, in which households were questioned about important life events (like the birth of a child or an earthquake), and then those events were used to jog

their memory. "Were you worried about the *chirimachas* when your son was born?" an interviewer might ask.

The field workers also surveyed the houses for bugs, documented domestic animal populations at the properties, and recorded descriptions of the homes' construction.

From these site visits, Levy and his team were able to slowly piece together a likely story of the *chirimachas*' voyage.

"*Chirimachas* were very common in the 1960s, but then they went away. Then, poverty was so high in the rural areas of Peru, that people started immigrating into the cities in large numbers, during the '80s and '90s," explains Claudia Arevalo-Nieto, a biologist at the Zoonotic Disease Research Center.

During this time period, Peru created legislation aimed at formalizing property rights, which led to 1.4 million new land titles issued in the country between 1996 and 2004.

Photo by Laura Tamayo



The triatomine bug, *Triatoma infestans*, is best known in Arequipa as the *chirimacha*. The insects can transmit Chagas disease when infected bugs defecate near the mouth, eyes, or broken skin of a human or other animal host.

Once migrants who had moved into Arequipa obtained title to their land, they could build up their homes without fear of eviction, bringing with them lots of belongings—not only furniture and goods, but also guinea pigs, chickens, dogs, and cows.

In Peru, *chirimachas* dine on guinea pigs, animals that are commonly traded and eaten. And crowded, densely packed homes become ideal hiding places for the bugs.

Meanwhile, other, poorer migrants continued to occupy vacant land on the eastern outskirts of the city. These settlements are known in Peru as "invasions," and in contrast



to the land-owning communities, they might remain underdeveloped for many years.

What the *chirimacha* research team discovered was that the bugs never crossed the line from the formalized property areas into the invasions, even if there was only a street separating them. It seemed that formalizing property rights may have inadvertently created conditions that favored the proliferation of the bugs, and, eventually, Chagas disease in these areas.

“Formalization of land invasions brings numerous social, economic and health benefits to residents of these communities, as well as increased tax revenue to local and regional governments,” Levy and his colleagues wrote in a 2014 paper about the trends they observed.

However, the researchers warned, “when such formalization is not accompanied by reasonable and enforceable zoning codes, it leads to an influx of building materials, people, and animals that creates prime habitats for triatomine bugs and other insects of epidemiological importance.”

Levy says the study opened his eyes to how thoughtful housing policy can mitigate disease spread. While potentially difficult to enforce, zoning codes—such as those related to how property owners house small animals or measures to prevent cock fighting—could go a long way in Arequipa.

“Policy matters,” Levy likes to say.

In 2010, Levy accepted an assistant professorship at Penn. While no longer living in Peru full-time, he continued to oversee the disease control campaign in Arequipa and returned frequently to the field. He also retained his connection with the Zoonotic Disease Research Center that had been established in Arequipa when he was in graduate school. Today, the center is a collaboration between Penn’s Center for Global Health and the Universidad Peruana Cayetano Heredia, which is co-led by Levy and employs a group of full-time biologists, epidemiologists, veterinarians, health communicators, nurses, and data managers.

By 2011, the insecticide spraying—which had been put on hold by the government for three years—resumed, and in 2014, international funders were ready to declare the city free of Chagas disease transmission.

Yet Levy was wary. The claimed victory was not so simple. “There were still a lot of bugs, but the government was calling the campaign a success based on negative serology tests in kids,” Levy says. “We knew that once they declared that it was free of transmission, then all the resources and personnel would be reassigned from Chagas.”

Levy and his team pushed on. By 2016, they had reached all 29 city districts and treated an estimated 70,000 homes. The *chirimacha* was essentially eliminated from the city.

Still, the work is not over, Levy says.

“It’s like cleaning your house—you have three rooms, and then two, and then, finally, you get to the last room. So, OK, the house is pretty clean. That doesn’t mean you won’t have to keep sweeping,” Levy says. “For one day, it feels pretty good to be in that house...until the kids get the Legos out.”

With just a few new infestations—left unreported and untreated—Chagas disease could reemerge.


“After a very long spraying campaign, surveillance is the most important step,” Arevalo-Nieto says. “If you don’t have a plan for surveillance, then you were wasting all of your efforts.”

The surveillance program Levy’s team has created is called “An Immune System for the City,” which “adapts aspects of the immune system from the scale of cells to that of landscapes.”

In this program, community health workers are the circulating “immune cells.” They travel around their neighborhoods asking neighbors if they have seen *chirimachas*. If they hear about an infestation, they signal an alarm to bring in the “effector cells”—the insecticide applicators. They also “clonally expand” by training others in the area to serve, for a time, as more community health workers.

Levy is hopeful that this grassroots strategy will help to control any potential disease outbreaks, at a time when political will and resources for the project are in short supply—and a different epidemic is monopolizing his attention in Philadelphia.





The ongoing surveillance program in Arequipa protects the city from Chagas disease by “adapt[ing] aspects of the immune system from the scale of cells to that of landscapes.”



COMPETENT VECTORS

When Levy inspects a bedbug-infested home, the first place he looks is under the sink. There, he's not searching for bugs, but for chemicals. When people can't afford an expensive extermination, they often turn to risky DIY treatments.

"I've seen a lot of dangerous, unmarked bottles obtained second-hand," he says.

Many infested bedrooms resemble snow globes: White diatomaceous earth—a bug-killing powder intended to be sprayed lightly into cracks and crevices—is instead dumped on every inch of the floor.

Eliminating bedbugs from a home is not an easy task for anyone. "But wealthy people can get rid of them," Levy says. "Poor people can't."

Reports of victims dousing their homes in alcohol, setting their beds on fire, and even attempting suicide, show the psychological turmoil that the bloodsucking terrors can inflict. Moreover, bedbugs—though they can strike anywhere, from five-star hotels to nursing homes—are still accompanied by stigma, and so the infested end up battling them silently and alone.

For homebound people, bedbugs can cause even greater harm. Since health workers are often reluctant to enter infested houses, they can prevent people with disabilities, senior citizens, and the chronically ill from receiving care. The loss of home care means more individuals who might otherwise live independently are being left with no option but to enter assisted living facilities—many of which, of course, are also struggling with infestations.

"The effect of bedbugs on our society is huge, pervasive, and hidden," Levy says.

According to Jeni Wright, a housing attorney at Philadelphia's AIDS Law Project, many low-income residents in Philadelphia have leases that specify that the tenant is responsible for bedbug remediation—even though it is virtually impossible to know how or who introduced the bugs into a residence.

During the October 2019 City Council hearing, Wright told the story of a 51-year-old man living with HIV who discovered a bedbug infestation in his rented apartment. His landlord said the tenant was responsible for treatment.

"My client knew if he paid the \$500 extermination fee, he wouldn't be able to pay his rent. So what did he do? He started sleeping in the kitchen. When bugs followed him to the kitchen, he started sleeping in the bathtub," she said.

When Levy began his professorship at Penn in 2010, the transition from *chirimachas* to bedbugs seemed natural. Bedbug horror stories were all over the newspapers and whispered through his neighborhood, and he felt confident that he could replicate his Arequipa success story in Philadelphia. Surely, if a major public health fight could be won with limited resources and grassroots efforts in a developing country, then the same could be possible in a major American metropolis.

He was surprised at what he found. Without the same kind of support that the local and federal government had awarded him in Peru, tracking the spread of bedbugs in Philadelphia proved more difficult than hunting *chirimachas* in Arequipa.

In the summer of 2013, Levy and his research team decided to focus their efforts on a single part of the city—South Philadelphia—to conduct a door-to-door campaign, similar to the efforts made in Arequipa.

After interviewing residents in 596 households, the researchers found that 11 percent—or 66 homes—were infested with bedbugs.


"That was more than we expected," Levy says.

While large cities like New York, San Francisco, and Detroit all have bedbug policies requiring landlords to report and pay for treatment, Philadelphia had never enacted such a law. In 2014, after suffering from an infestation himself, Philadelphia City Councilmember Mark Squilla created Philadelphia's first bedbug task force, which was charged with establishing legal requirements for landlords and tenants related to bedbug infestations.

The idea that legislation could reverse the course of an epidemic was more than a pipe dream. Research led by Kathryn Hacker, PhD, a postdoctoral fellow in the Perelman School of Medicine, shows that in New York City—which has enforced an intense and proactive campaign to detect, report, and treat bedbugs—infestations have declined. The city is not just flattening the entomologic curve, but forcing the effective reproductive number—the average number of newly infested homes that arise from a single infested property—below one, which leads to the end of an epidemic.

"It's really hard to get bedbugs out of a home. It's not so hard to get them out of a city," Levy says.

In Philadelphia, the city decided early on that the proposed bedbug ordinance would be enforced by the Department of Licenses and Inspections, rather than the Department of Public Health.



"The effect of bedbugs on our society is huge, pervasive, and hidden."

Photo by Peggy Peterson



Levy testifies before City Council in Philadelphia in October 2019.

That is because Philadelphia's health department contends that bedbugs are not a public health issue. "Vector Control Services does not provide control services for bedbugs. This program is charged with the abatement of disease-carrying pests like rats and mosquitoes, of which bedbugs are not one," a health department spokesperson explained in an email this past summer.

However, Levy's research suggests that is untrue. Bedbugs are in fact "competent vectors" for at least two diseases: Trench fever and Chagas.

Back in Arequipa, in 2016, just as the *chirimacha* problem was dwindling, local bedbug infestations were picking up. Curious as to whether there may be a connection between bedbugs and Chagas disease, Levy's collaborator Renzo Salazar searched through the scientific literature.

There, he found one, single-page manuscript—detailing findings from a study conducted in 1912 by the French scientist Emile Brumpt. Three years after Carlos Chagas had described Chagas disease, Brumpt infected two mice with *T. cruzi* and fed them to 100 hungry bedbugs. Nearly all 100 bugs contracted the parasite.

Salazar and Levy decided to repeat the experiment. In their lab in Peru, they exposed 10 mice infected with *T. cruzi* to 20 uninfected bedbugs. Almost all the bedbugs eventually acquired the parasite. When they reversed the experiment—exposing infected bedbugs to healthy mice—9 out of 12 mice tested positive for the parasite.

But these were manipulations in a laboratory. It doesn't mean that bedbugs are picking up and transmitting Chagas in real-world settings—at least not yet.

"It's possible," Levy told City Council. "It means they are competent vectors."

And it's that possibility that worries Levy the most.

He says there are thousands of people already living with Chagas in the United States (mostly people who became infected in other countries). Let's say that, in a bedbug-infested

"The truth is, we need to stop preparing for epidemics, and start dealing with the conditions that we are creating, which the pathogens are able to take advantage of."

home, a bug might bite a father who is already infected with Chagas disease. That bug then bites a newborn sleeping in a crib next to her parents' bed. There haven't been many documented instances of people contracting Chagas while in the United States so far. But *it's possible*, we know now, that in this scenario, that the baby could then also contract Chagas. Or perhaps it's already happening on a small scale, and we are just blind to it.

Would this lead to an uncontrollable Chagas outbreak in a city or state? Most likely not, Levy posits. However, something else is possible, he says: If bedbugs cause an epidemic, it wouldn't necessarily be Chagas, but something else entirely—a brand new virus, perhaps.

“Competent means they *can* transmit it. We don’t know if they *will*. We use a term called ‘vectorial capacity,’ which is basically a measure of how many of them there are, and how frequently they bite us. On those numbers, the math is really worrisome,” Levy testified.

The plea was to Council’s Licenses and Inspections Committee, but it was also an argument for the health department.

“If there is an epidemic of a mosquito-borne illness, we can go inside. We can put on DEET. What are we going to do if there’s an epidemic of bedbugs? You can’t hide.”

SMALL VICTORIES

On a chilly Thursday morning in December 2019, Levy and a small group from the Bedbug Task Force were shuffled into an over-crowded room on the fourth floor of City Hall. It was the final meeting of the year, before Council would break for the holidays. Bedbugs were finally back on the day’s agenda after the landlord lobby’s surprise amendment ended the October vote in a stalemate.

Oblivious to the new, mysterious virus that was sickening dozens of people 7,000 miles away in Wuhan, China, the mood in the room was cheerful and energetic. Organizers pushing for the city to eliminate paper bags mingled with those opposed to the 10-year real estate tax abatement. Old friends hugged goodbye to Councilmember Jannie Blackwell, who had lost her seat in the Third District to a political newcomer. A team of middle school football players elbowed each other while waiting to receive an honor from the city.

Amid the commotion, George Gould shuffled through the crowds, shaking hands with members of Council and whispering in their ears.

Gould, an attorney with Philadelphia’s Community Legal Services since 1970, is a fixture at Council, with a long track record of fighting for—and winning—major housing policy battles. In 2019, for example, legislation requiring Philadelphia landlords to conduct lead testing every four years on housing units built before 1978 was passed, in large part, thanks to Gould’s lobbying.

After making his rounds, Gould huddled with Levy and the rest of the task force.

“Okay, we’re good. They promised they’re not going to change it,” he told the group.

After four years of drafting bedbug legislation and two months of intense lobbying with Council members to backtrack on the “90 day” amendment, the task force had finally come to a compromise with the lobbyists and the city.

The bill being voted on that afternoon would require landlords to pay for bedbug remediation up until one year into the lease. After that first year, extermination becomes a shared cost between tenant and landlord. The landlord also must disclose to new tenants any bedbug infestations in the previous 120 days.

Levy sat down in a wooden chair and sighed.

“You know, in Peru, you’re going door to door, interacting with people. You feel like you’re making a difference. Here, you’re just part of a circus,” he said.

Hours later, Bill 190106 passed quickly through Council, without protest or fanfare. There were no celebration beers.

The ordinance took effect on January 1, 2021. After a four-year battle, Levy knows he hasn’t yet won the war.

“It’s a start,” he says.

THE CURRENT PANDEMIC, AND THE NEXT ONE?

“One thing I’ve learned from being an epidemiologist is that the past is not a good predictor of the future. While it may be comforting to say that we haven’t seen an epidemic of Chagas disease caused by bedbugs, the truth is we haven’t been looking.... No one foresaw the emergence of Zika virus, but we all knew that the *Aedes* mosquitoes that transmit it were at dangerously high densities.... Our only recourse is prevention—to use policy to keep their numbers low.”

These are the final words Levy submitted in his written testimony to City Council a year and a half ago. Today, in a world upended by COVID-19, the warning reads like a prophecy. That’s the thing about epidemics: They are at once inevitable and unpredictable.

And while the COVID pandemic has complicated Levy’s work—both at home and abroad—it also seems as if years of debugging cities have led him precisely to this moment. He has pivoted his research focus, once again, from *chirimachas*, to bedbugs, and now to SARS-CoV-2. His latest study shows how renter evictions could fuel uncontrollable COVID spread in cities across the U.S.

That’s how Levy found himself once again in front of City Council in October 2020—this time via Zoom—testifying in favor of a city-wide eviction moratorium. Testifying opposite him were the same landlord lobbyists who had attempted to reverse the bedbug legislation exactly one year earlier.

The irony is not lost on the epidemiologist.

In Peru, it wasn’t *T. cruzi* alone that killed a baby all those years ago—it was, at least in part, political neglect that opened the door to the Chagas epidemic. Likewise, elsewhere, personal responsibility alone won’t evict a parasite or pandemic from a city—bedbugs, viruses, or otherwise. It will require the will of public officials to protect and strengthen communities.

“The truth is, we need to stop preparing for epidemics,” Levy says, “and start dealing with the conditions that we are creating, which the pathogens are able to take advantage of.” ☐

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Back to School Never Looked Like This

By Christina Hernandez Sherwood

The medical school curriculum was already on the verge of change. Then came COVID-19.

October 2020 On the rooftop patio of the Jordan Medical Education Center (JMEC), the fleshy sedum plants are flashing their pink and yellow autumn blooms. The days are growing shorter; it's fall and a new academic year is well underway at the Perelman School of Medicine. But this is 2020, and as is true in just about every other aspect of life these days, medical school doesn't look quite the same as it did a year ago.

The earthquake that is COVID-19 rocked the ground on which modern medical education was built. Gone are the learning teams reviewing flash cards late into the night in the bright JMEC atrium. Gone are the pre-clerkship students hurrying after the physicians they're shadowing in the clinic. Gone are clusters of clerkship students huddled around a patient's bedside. But after the dust cleared, certain foundational principles

of training to be a doctor today—collaborating with a team, prioritizing wellness, adopting technology, and embracing adaptability—still stand. As medical education is rebuilt around these foundational principles, the structure will remain familiar while the particulars are permanently altered.

“Going through the upheaval of the last year has forced us to shift our approach to medical education unexpectedly, necessarily, and quickly, leading us to innovate in ways we're still learning from,” said Suzanne Rose, MD, MEd, Perelman's senior vice dean for medical education. “We committed every step of the way to tell our students that though the process is different, our goal was for the result to be even better. We're going to help students be the best prepared physicians they can be.”



Fourth-year medical student Sarah Santucci was among the first to return to clinical rotations after a pause in the spring, first for an internal medicine sub-internship and later for radiology.

Players in Place for the Changing Game

Rose stepped into the senior vice dean role in February 2018, following the tenure of Gail Morrison, MD'71, GME'76, and just over a year later established a diverse leadership team of both new and familiar faces. Longtime academic programs stalwart Anna Delaney, MBA, is chief operating officer. Associate deans are Nadia Bennett, MD, MSED'18, and Dennis Dlugos, MD, MSCE'02, sharing the curriculum role; Horace DeLisser, MD'85, heading diversity and inclusion; Judy Shea, PhD, in research and assessment; and Neha Vapiwala, MD'01, running admissions. In a newly created position, Jennifer Kogan, MD'95, serves as associate dean for student success and professional development. DaCarla Albright, MD, joined the team in July 2020 to lead student affairs and wellness.

After settling into their roles, the undergraduate medical education leadership team convened last winter for a one-day retreat to develop their playbook. By the end of the day of goal setting and strategic planning, they had renewed their investment in preserving Perelman's top strengths: team-facilitated learning, flexibility, diversity, and the long legacy of Penn Medicine. They decided to kick off their efforts to reach their ambitious goals—including advancing technology in medical education, encouraging earlier clinical encounters for students, and engaging in more active formats of pedagogy—in eight weeks' time.

Six weeks later, things changed, all over the world.

It was early March. First-year medical student Jeromy Gotschall was leading a student group on an educational Spring Break trip in Cuba when he received word the University of Pennsylvania had moved classes online for the remainder of the semester and asked students not to return to campus. "Everything escalated tremendously," he said. Leaving Cuba, Gotschall headed to his family's home in Wisconsin.



40+ virtual electives launched to support clinical learning for clerkship students away from the hospital.

"Going through the upheaval of the last year has forced us to shift our approach to medical education unexpectedly, necessarily, and quickly, leading us to innovate in ways we're still learning from."

- Suzanne Rose, MD, MSED

Back in Philadelphia, Rose had recently returned from a meeting in Florida and had noticed several people on her return flight wearing face masks. She soon began hearing from clinical faculty who were concerned about the safety of medical students on rotations in hospitals when national supply chain issues with personal protective equipment were becoming apparent. "That was a really quick transformation," Rose said.

There was no national guidance at the time for how to handle medical students in clinical rotations. But Penn's decision was swift. At 11:39 a.m., on the morning of Friday, March 13, Rose sent an email blast to the entire student body with the urgent message: Clinical rotations will be suspended at noon.

Building the New Playbook

By Monday, March 16, Rose and her team, who initially hoped the clinical hiatus for students would last two weeks, began planning for a whole new vision of medical school for a longer term. They dove into designing a new clinical curriculum that met the same goals and objectives, on the same timeline, but was entirely remote. "It was basically deconstructing the clerkship year and the sub-internship year," said Bennett, associate dean for clinical and health systems science curriculum, "and seeing how we could put back in its core components... in a virtual manner."

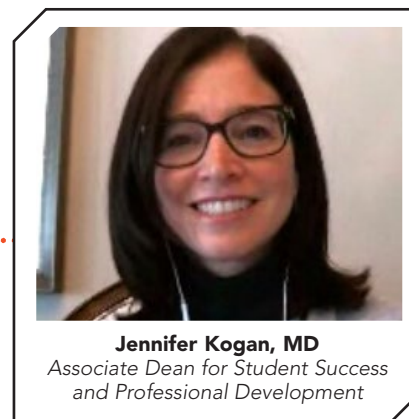
The first step was to develop dozens of virtual electives—there were zero before—for clerkship students who needed clinical experience to graduate, but couldn't enter a hospital, said Kogan, the associate dean for student success and professional development who took the lead on developing the elective program. To do this, she leaned on teams of administrators, faculty, and students, who took a larger role in the curriculum development process than ever before. Unlike faculty who had jumped into action to care for COVID-19 patients or scale up telehealth infrastructure, Kogan said, students had time, and many had an interest in future ca-



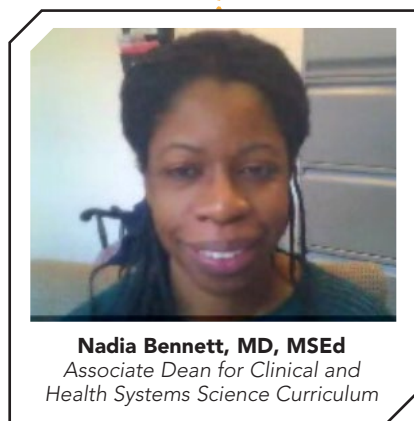
Suzanne Rose, MD, MEd
Senior Vice Dean for Medical Education



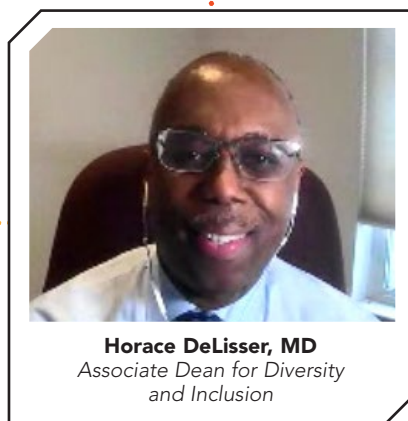
Dennis Dlugos, MD, MSCE
Associate Dean for Science
and Discovery Curriculum



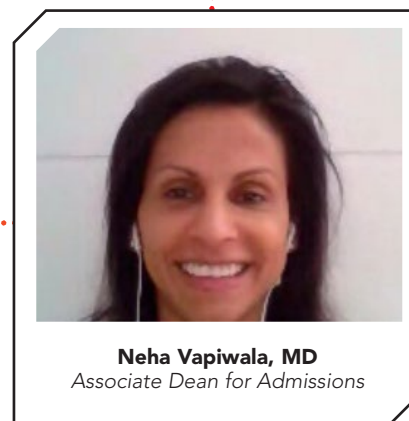
Jennifer Kogan, MD
Associate Dean for Student Success
and Professional Development



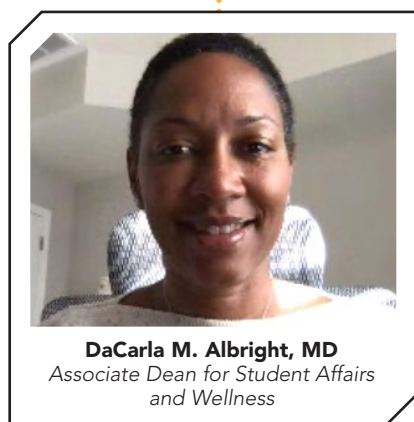
Nadia Bennett, MD, MEd
Associate Dean for Clinical and
Health Systems Science Curriculum



Horace Delisser, MD
Associate Dean for Diversity
and Inclusion



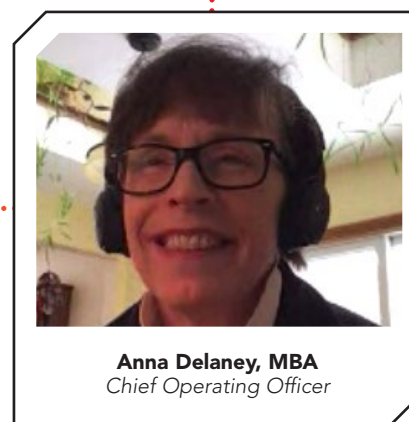
Neha Vapiwala, MD
Associate Dean for Admissions



DaCarla M. Albright, MD
Associate Dean for Student Affairs
and Wellness



Judy Shea, PhD
Associate Dean for Research
and Assessment



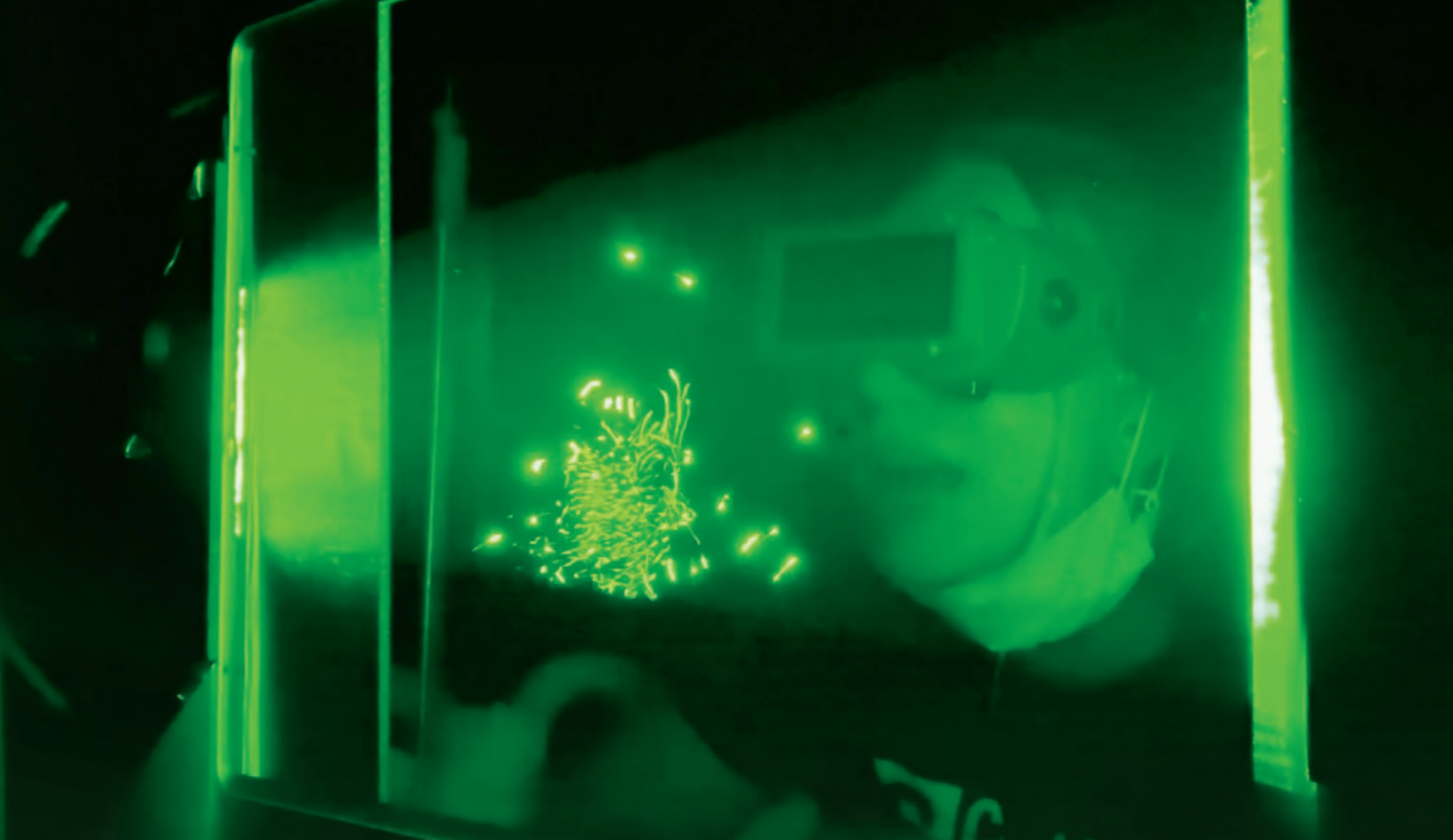
Anna Delaney, MBA
Chief Operating Officer

The Perelman School of Medicine Undergraduate Medical Education Leadership Team stayed connected via video chat while planning robust changes to medical education concurrent with the COVID-19 pandemic.

reers as medical educators. And, she said, it made sense to involve students in creating courses they would be taking in a matter of days. “For me having learners participate in the development of curriculum alongside faculty was valuable,” Kogan said, “and a helpful learner-centered approach to thinking about medical education.”

Jeremy Jones, then a third-year student, helped create an elective that let students provide virtual clinical care to hos-

pitalized patients. “We were able to—from our house—help clinical teams and help our classmates feel like they were actually moving forward in their clinical training,” Jones said. A survey of the students who took the course, Virtual Clinical Support, found that taking the elective increased their confidence in writing discharge summaries to 4.4 out of 5, from 2.5. Pediatrics faculty and residents later ran a similar course supporting clinical teams at Children’s Hos-



As a third-year medical student, Christina Bax helped design experiments and co-authored research on the role of speech droplets in COVID-19 in the *New England Journal of Medicine* and *The Lancet*.

pital of Philadelphia, in which Jones, who plans to specialize in pediatrics, enrolled.

Meanwhile, administrative staff were working nights and weekends to move academic programs online. Throughout the spring, Rose and her team worked to ensure the quick pivot to virtual electives didn't cause any accreditation problems. They kept students apprised of these and other updates through virtual town halls, some schoolwide and others by class. To support students' non-academic needs, the administration arranged one-on-one virtual calls between some 600 Perelman students and members of the leadership team and advisory deans.

Virtual No Longer Optional

Within weeks, Perelman's first-year, pre-clerkship students were settling into a new, virtual routine. Though the school was advanced in using digital and virtual tools for lectures—offering online streaming and replay of recorded lectures for more than 15 years—it was no longer optional. The quarter of the class who attended lectures in person before the pandemic no longer could, and learning teams now met exclusively online, said Dlugos, associate dean for science and discovery curriculum. But for the most part, he said, “the pre-clerkship curriculum was nicely positioned to pivot.”

Clerkship students—unable to be in the hospitals for the final seven weeks of the spring semester—enrolled in the vir-

tual electives newly created with their classmates' input, mostly two-week courses in fields including surgery, dermatology, radiology and anesthesia. With more than 40 virtual electives to choose from, students could learn about antibiotic stewardship, take a deep dive into palliative care, earn a certificate in quality improvement, or study culinary medicine.

One elective, Research During COVID-19, enabled medical students to earn academic credit for pandemic-related work. Christina Bax, then a third-year medical student who had returned home to Maryland in March, began working with her father, Adriaan Bax, PhD, a chemical physicist at the National Institutes of Health. The younger Bax, who had been researching autoimmune skin diseases in Philadelphia pre-pandemic, helped her father's team design experiments on the role of speech droplets in COVID-19 transmission, publish their results in journals including the *New England Journal of Medicine* and *The Lancet*, and translate the findings into videos for the public at a crucial time when



Approximately 300 medical students returned to clinical clerkships and sub-internships after successful smaller pilots in the spring.

the airborne spread of the virus was considered uncertain and contentious. “[The medical school] made it so accessible for students to become involved [in COVID-19 work] and have it count,” she said. “With a lot of medicine you can’t just completely switch focus so quickly and so easily.”

Clinical Learning from a Safe Distance

Rose and her team never counted on virtual electives as a long-term replacement for medical students’ clinical rotations; they were always a stopgap measure. “During your elective year, most of the learning is experiential, doing specialty rotations in the hospital with patients,” Kogan said.

By June, with COVID-19 cases trending downward and personal protective equipment widely available, it was time to reinstate those clinical experiences. Instead of sending hundreds of clerkship students back at once, the leadership team began with a pilot of about two dozen students in sub-internships, which are post-clerkship rotations with increased responsibilities similar to those of a first-year resident. “We made sure it was safe, but we wanted to start with a small group,” Bennett said. “The goal was to make sure everything was in place for them.”

Fourth-year student Hannah Schwennesen, on her sub-internship at Children’s Hospital of Philadelphia, said she found the integration of COVID-19 protocols to be seamless. New physical distancing guidelines and personal protective equipment requirements quickly felt normal. But the pandemic did impact Schwennesen’s patient care experience. As a medical student, she was not able to be part of the teams treating patients who were positive or suspected for COVID-19.

Sarah Santucci, a fourth-year on her sub-internship at Pennsylvania Hospital, said the biggest change was having to keep a distance from the attending physician and residents on her team. Packed bedside rounding sessions were replaced with socially distant table rounds. Lunches in the residents’ lounge were swapped for outdoor meals, where a resident picked up a big group take-out order and students and residents grabbed containers and dispersed to their individual benches to socialize from a safe distance. “It was still a great bonding experience,” she said, “but it was just not the same.”

After a smooth pilot and hundreds of negative COVID-19 tests, some 300 clerkship and sub-internship students returned to the clinic on July 6. And just as educational leaders had adapted nimbly to a changed environment, it was clear that the clinical workforce had lessons to share about their own nimble transformations. Sophia Yapalater, then a third-year student, was struck by how doctors on her gynecology-oncology sub-internship adapted to COVID-19 visitation restrictions to help families reunite quickly. Patients

wanted more time with their families than the hospital could allow, Yapalater said, so doctors made extra efforts to speed their discharge. “It was remarkable how the teams had integrated that understanding into how they were taking care of people,” she said. “I think [the pandemic has] forced us all to learn more of that adaptability that we’ll need throughout our careers.”



As a first-year MD/PhD student, Noa ERLITZKI was a leader of PPEnn PALS, a student volunteer effort to coordinate PPE donations across campus.

Helping Hands in the Pandemic

At the same time that the curriculum was being reimagined, Cindy Christian, MD, assistant dean of community engagement, set out to channel medical students’ volunteer efforts to safe avenues. Shutdown rules and social distancing had limited or closed off their usual opportunities, yet the desire to make a positive impact and help in the unfolding crisis had grown that much stronger. “Imagine that you’re a medical student and there’s a huge pandemic,” she said. “They don’t have all the necessary skills, but they have lots of skills and they wanted to help in some way.” Christian reached out to the Penn Medicine community with a simple ask: How can our students help you? She was inundated with hundreds of replies, detailing opportunities in research laboratories, in clinical settings, and throughout Philadelphia’s communities.

Heart Health Bridge to Care, a clinic for diabetes and hypertension patients, transitioned to virtual care to continue providing essential monitoring and medication. The clinic mailed patients blood pressure cuffs, checked in with them by phone, and supplied their medications through a partnership

MD/PhD student Lev Litchievskiy volunteered in the spring with One Extra Bag, an initiative created by first-year classmate Eden Engel-Rebitzer. The program paired medical students with medically vulnerable homebound seniors to purchase and deliver groceries during their own regular shopping trips.



with the Hospital of the University of Pennsylvania pharmacy. “It has been a time for us to plan, reevaluate and restructure,” said second-year medical student David Hsu, the clinic’s leader. This reimagining of the clinic has worked so well, Hsu said, that when its doors eventually reopen, stable patients will likely continue to be monitored virtually.

Just as medical education leaders found that involving students in planning the new curriculum was key to delivering on what they needed, so too did student leaders engaged with members of the community. The United Community Clinic in the West Philadelphia Parkside neighborhood where—where pre-clerkship medical students often get their first experiences interacting with patients—paused its operations in March. As the pandemic raged through the spring, the clinic’s student volunteers initiated countless conversations with community members, establishing connections and strengthening partnerships in the process, said Amanda Gottschalk, then a first-year medical student co-running the clinic with classmate John Connolly. Parkside residents were interested in personal protective equipment, so the students assembled and distributed thousands of “COVID Survival Kits,” which included masks and hand sanitizer. With funding support from the Penn Medicine CAREs grant program and other sources, they continued distributing the kits into the pandemic’s second peak in the late fall and winter.

“COVID, especially being in the community clinic space, has laid bare the huge health disparities that are prevalent in our country,” Gottschalk said. “Seeing that has shaped my trajectory as a future physician, to be an advocate for my patients, for the community, for the population that I’m serving. I don’t think I would have said that in that exact way [last] January.”

In the elective, entitled Service Learning During COVID-19, students earned academic credit for their volunteer work while learning the principles of service learning. One community service project, dubbed One Extra Bag, involved students buying and delivering groceries to homebound geriatric patients when food shopping was fraught at the height of the pandemic.

Third-year Sophia Yapalater volunteered with a virtual visitation program to provide emotional and communication support to families of critically ill, hospitalized patients. Later, she attended a Zoom funeral for one of her patients and wrote about the virtual visitation experience in the *Annals of Internal Medicine*. After witnessing so much suffering and loss from this vantage point on the pandemic, Yapalater decided to specialize in internal medicine with a subspecialty in critical care. The pandemic’s hardships are an experience no one would wish for, she said, “but that program helped me figure out what I want to do with my life.”



Photo courtesy of Michael Burch

While unable to provide volunteer medical services at the United Community Clinic in the Parkside neighborhood, Penn medical students distributed thousands of “COVID Survival Kits” containing PPE for West Philadelphia residents.

Back to (Virtual) School Season

Before COVID-19, orientation week for the incoming class at the Perelman School of Medicine was a whirlwind of hands-on experience coupled with a crash course in team building with 150 new classmates. For the class of 2024, however, the live program had to be transitioned to a fully virtual experience. To reimagine the student-centered aspects of the program, Christian, the assistant dean of community engagement, recruited second-year medical students whose summer plans had been disrupted by the pandemic. The rationale echoed the planning behind the new virtual electives in the spring: “We do our best work,” Christian said, “when we partner with our students, who have tremendous insight and knowledge about what they need from their education.”

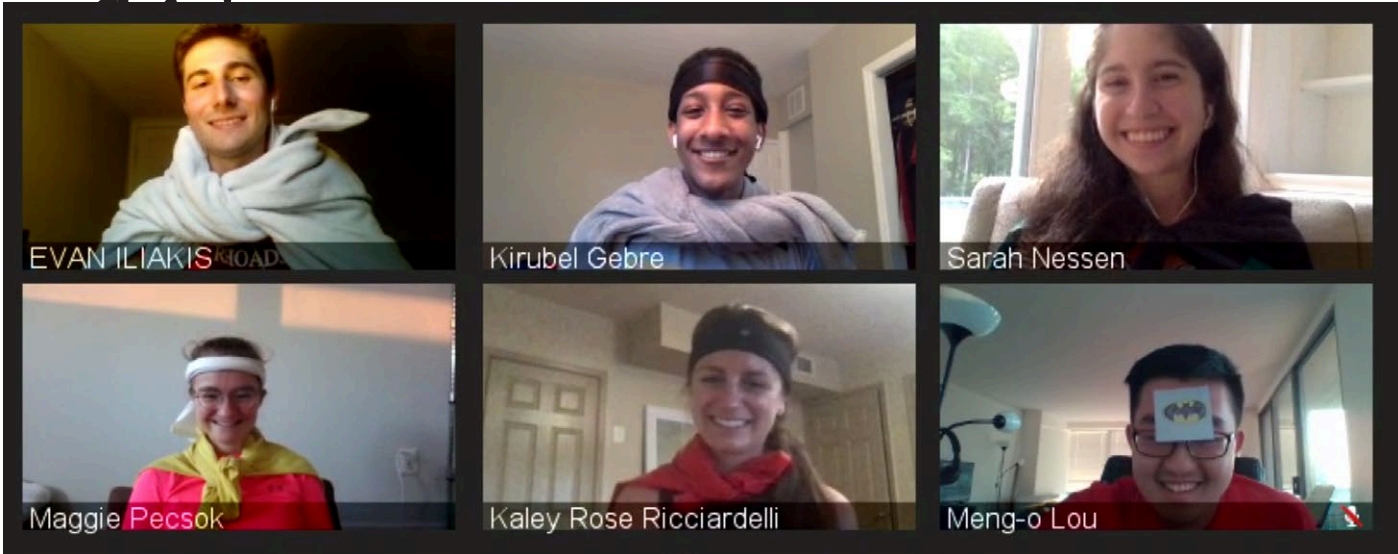
For new medical students, one of the most memorable moments of orientation is meeting their learning team, the



medical students entered the Perelman School of Medicine in August 2020 with an all-virtual orientation experience.



Future Health Care Heroes, Unite: As part of their virtual orientation, first-year medical students were assigned costumes and asked to find the others whose costumes matched their theme. In this case, medical student superheroes discovered sartorial similarities in their blanket capes.



small group of other first-years who will be their core study partners in the coming months. But how could incoming students connect with these vitally important participants in their medical education when everyone was a disembodied face on a computer screen? The solution, it turned out, was to ramp up the silliness factor. Zoe Ruhl, Lina Ibrahim, and Jeromy Gotschall, now in their second year, dreamed up this creative approach.

On the first evening of orientation, the new first-years entered a video call with their entire house—made up of about six learning teams—dressed in a themed costume, such as a pirate or an organ system (this is medical school, after all) or a vegetable. Find your fellow produce, they were told, and you’ve found your learning team. “We just wanted to increase the engagement and adrenaline, even if students were a little embarrassed,” Ibrahim said. “You’re letting go of your pride a little bit and saying, ‘Hey, we’re all in this together.’”

It could be easy for new students to fall through the cracks this year when the already challenging transition to medical school is compounded by the isolation of the pandemic, DaCarla Albright, the associate dean for student affairs and wellness, pointed out. She has introduced students to the resources on the digital platform for mental health and support, Penn COBALT; connected them with academic resilience groups; and reminded them they are colleagues, not competitors. “[I’ve tried to] help students understand that you don’t have to be absolutely 100 percent perfect to make it through medical school,” she said.

The New Normal

The fall semester at Perelman has shaped up to be an amalgamation of the former ways of medical school before COVID-19 and the new norms established at the height of the spring shutdown. Pre-clerkship students chose fully remote schooling or a hybrid option that allows them to attend some class sessions in person, but at a physical distance.

While the cadaver laboratory was temporarily struck from the curriculum, first-year students did gather in small groups at the medical school for two hands-on ultrasound practice sessions this fall. While serving as an ultrasound teaching assistant, fourth-year student Sarah Santucci was struck by how prepared the first-years were for the hour-long sessions. “All the prep they had done was virtual and yet they were able to get in there and do an awesome job,” she said. “They were so excited about getting some actual hands-on experience.”

Second-year students, despite being unable to shadow doctors in the hospital or volunteer with patients, got some unique in-person clinical skills practice before their January clerkships. In an effort to prevent the spread of COVID-19, traditional standardized patients from the local community were eschewed in favor of Penn physicians, residents and senior medical students who took their place serving as actor patients, also known as patient instructors. “I’ve really benefited a lot from that,” said David Hsu. “We’re able to get very unique feedback in terms of how we’re supposed to approach asking patient history and what is appropriate from an experienced provider’s point of view.”

With greater flexibility in students' mostly virtual fall schedules, Christian said she moved forward on a long-term goal to expand cross-school integration of community-focused programs. Medical students joined their peers in other health care-related programs, such as nursing and public health, for virtual evening sessions on community health. "It's something we had been thinking about and working toward for a long time," Christian said. "We got to accelerate things a little bit."

Still, the sheer volume of virtual offerings for pre-clerkship students can cause a real-life headache. First-year Love Osunnuga is one of several course representatives who take student feedback to weekly meetings with faculty and administration. Early in the semester, Osunnuga and other representatives pushed for adjustments to students' virtual schedules, successfully advocating for more breaks away from the screen to combat "Zoom fatigue."

Clerkship students are back on hospital rotations, but some elements of the spring's virtual electives remain. Students might take a virtual elective if, for instance, they need to quarantine for two weeks after a trip away from campus. Some of the new virtual electives that have not continued have instead been repurposed as coaching tools or other forms of learning support.

Fourth-year students spent the fall in an unprecedented, and delayed, residency application process. While interviewing for residency virtually is saving them thousands in travel costs, the process is rife with challenges. How do you look professional on a video call from your bedroom? Fourth-year student Jennifer Wineke's solution: wear a suit jacket and angle the camera away from your bed. The school has also provided dedicated space for professional backgrounds and reliable internet for the fourth year interviewees as an answer to this challenge. How do you get a sense of the residency program without seeing it firsthand? Attend the program's virtual Happy Hour, Wineke said, and watch how current residents interact. How do you make your ranking decision, sight unseen, in January? Review your interview notes, talk to medical school friends and, as Jeremy Jones put it, hope for a "blast of clarity."

Never Going Back

It has been almost a year since the COVID-19 pandemic forced a rapid rethinking of medical education. But its impact could last decades or more. "Education is forever changed—I don't think we'll ever go back," Rose said. "Before we do something, let's ask a question about how we did it before. Was that better than what we transitioned to? Is there a different way? There's an opportunity now to ask those questions about everything."

January 2021 marked the start of a new clerkship year at the Perelman School of Medicine, and second-year students

have stepped into a revamped program, shaped both by pre-COVID feedback and post-COVID learnings. Instead of interrupting rotations for intermittent classroom instruction, now each 12-week clerkship block begins with two weeks of inter-session training. This schedule change has the added benefits of providing didactic content up front and giving students time to bond as a class throughout the busy rotation experience, said Bennett, associate dean for the clinical curriculum. "COVID forced us to do things quickly. Now we have some time to... create an optimal curriculum on our terms that takes the best of the COVID curriculum in ways that may actually solve issues that arose pre-COVID."

Also in the works before COVID: more student involvement in curriculum. A new governance committee for undergraduate medical education comprised of faculty and students convened in November after being deferred from its planned start in March. (Its chair, Keith Hamilton, MD, an associate professor of Infectious Diseases, was on the front lines of the clinical response to COVID-19.) Complementing this initiative—both to support input into the curriculum and to facilitate communication between different student groups—students led by third-year Olivia Oldridge created a structured Student Curriculum Council which has met monthly since August. Students have also pulled up seats at the (virtual) tables of a number of other committees for Rose's leadership team.

COVID-19 compelled an overhaul of medical education that would have been unthinkable pre-pandemic. But why, Albright asked, should we stop innovating now? "We have potential where we may not have considered it prior," she said. "That may create greater agility in learning, even for some of us who remember what it was like to take notes while somebody was writing on a chalkboard."

Despite the stresses of COVID-19, first-year student Maurizio Porco said he optimistically sees himself as part of a crucial moment that could impact medical education forever—and his class's pandemic-era education as an opportunity. "It's a challenge we have that no one else has gone through," he said. "If something like that ever presents again... we know how to respond."

Albright agreed, adding that this COVID-19 cohort of medical students will use their unparalleled experience to advance not only their own education, but also the health care profession in ways that have yet to be imagined. Can we push the use of technology—already ramped up by the pandemic—even further to enable earlier interactions between pre-clerkship students and patients, for instance? What efficiency improvements for electronic health records might tech-savvy students dream up if we let them? "They're the students who are really going to turn medicine on its tail," she said, "in a good way." ▢

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GIFTS THAT SHIFT RESEARCH INTO HIGH GEAR



ADVANCING PENN'S IMMUNOREVOLUTION TO MYELOMA

Pushing science forward takes teamwork, and at Penn Medicine, Alfred Garfall, MD, has found that in spades—from working with colleagues who share his passion for patients and research, to finding partners—including his 10-year-old son, Alex—to ride alongside in the Break-through Bike Challenge (BBC), an annual fundraiser to support cancer research at the Abramson Cancer Center.

As a physician-scientist and assistant professor of Medicine at the Perelman School of Medicine, Garfall has discovered that philanthropy, no matter the size, can be an indispensable player. He's received support from grassroots-style fundraisers that rely on a collective community to make an impact, including \$30,000 from the BBC that helped launch a very promising project.

Garfall focuses on multiple myeloma, a blood cancer that affects plasma cells found in bone marrow. Each year, about 30,000 Americans are diagnosed. "The problem with myeloma is relapse," says Garfall, who studied biology as an undergraduate at Princeton and attended medical school at New York University. "We have really good therapies that can kill the myeloma cells, but eventually the cells are likely to grow back with resistance to therapy."

A South Jersey native and father of two, Garfall first came to Penn for a hematology/oncology fellowship in 2011, during the run up to what has become known as the ImmunoRevolution: the institution's all-out pursuit of novel ways to use CAR T cell and other immunotherapy approaches to cure cancer and myriad other diseases. It was sparked by Penn's renowned immunologist/oncologist Carl June, MD, director of the Center for Cellular Immunotherapies, whose team's first success came in a CAR T cell therapy that showed long-lasting remissions in children and adults with B-cell acute lymphoblastic leukemia and was the first FDA-approved therapy of its kind.

Two years ago, Garfall launched an immunotherapy study thanks to the BBC support. As a result, his team was able to gather promising, early-stage data—enough to attract a \$275,000 award from the National Institutes of Health to continue the investigation.



Alfred Garfall, MD, and his son, Alex

A GERM OF AN IDEA READY FOR SEED FUNDING

With the support of both June and of his mentor, Edward Stadtmauer, MD, chief of hematologic malignancies, Garfall started a clinical trial to test CART-19, the therapy June's team had its first success with in B-cell leukemia, in myeloma patients: a first for the disease.

The results were illuminating. "We had this one patient who was dying of myeloma, for whom nothing whatsoever was working," Garfall says. "Now six years later, she's disease free, but she was also the only one who did that well—and I wanted to know why."



They found that her immune system had developed an exceptional response to SOX2, a protein that gives embryonic stem cells the ability to grow an entire human being from one cell. Dr. Garfall knew the finding might be significant; a connection between immune responses to SOX2 and the development of myeloma had been established years before.

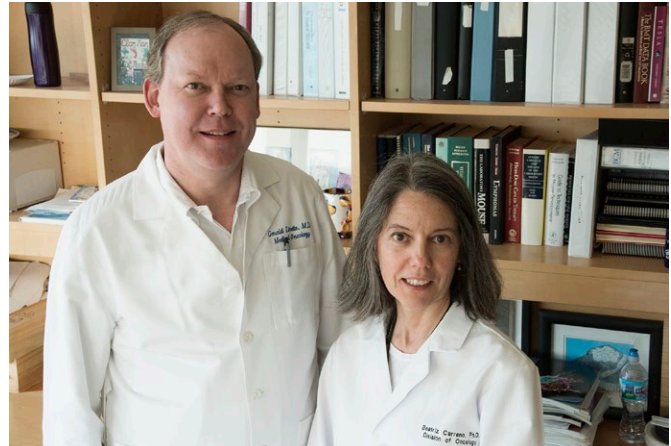
“Perhaps she did so well because CART-19 created new anti-SOX2 immune responses and those may be keeping her in remission,” Garfall says.

Now the question became “can we replicate that outcome for other patients?” Garfall was in the right place to find out.

INSPIRED AND SUPPORTED BY PENN’S IMMUNOLOGY LEADERS

“As I was thinking about this idea, I was surrounded by colleagues in our Center for Cellular Immunotherapies, hearing their stories about bridging clinical observations and the lab, chasing down remarkable findings and trying to figure out what’s going on in their patients,” Garfall says.

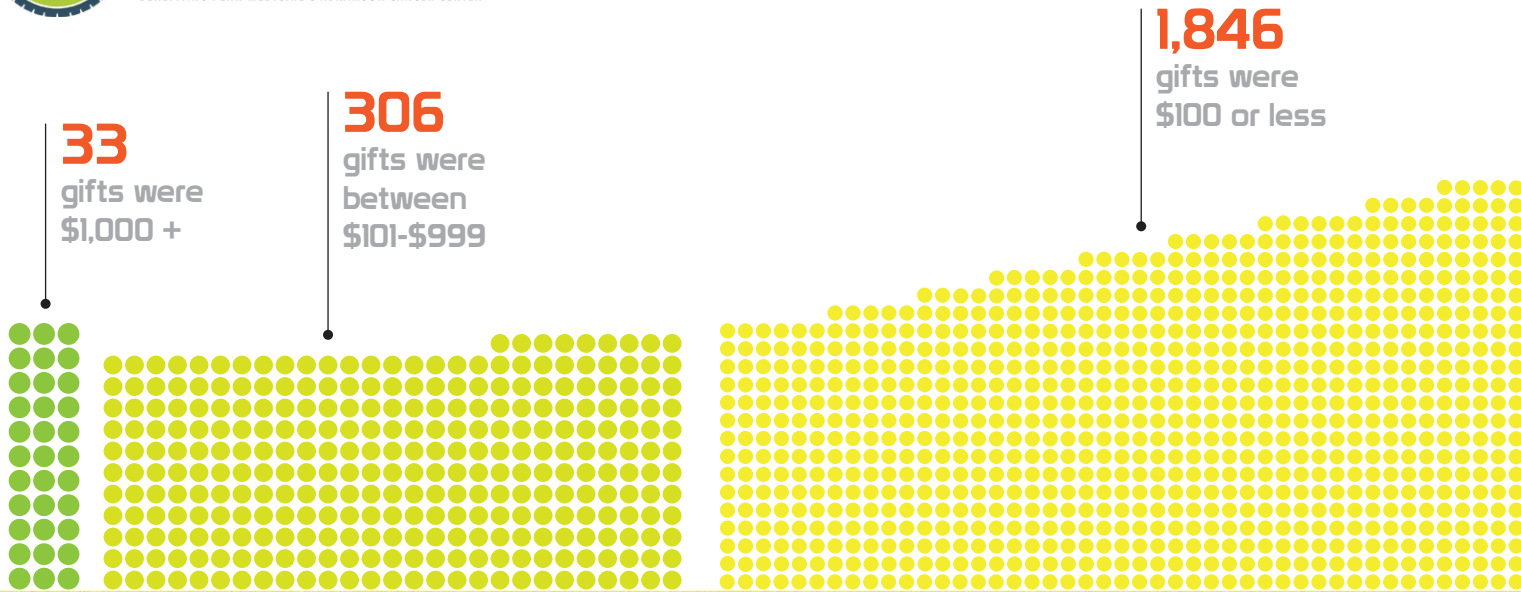
Inspired by the community’s “dogged curiosity,” Garfall reached out to Gerald Linette, MD, PhD, who, along with his partner, Beatriz Carreno, PhD, heads a lab focused on cancer immunology research. “Even though I hadn’t met or



Gerald Linette, MD, PhD, and Beatriz Carreno, PhD

worked with Gerry and Beatriz before, their lab is just a few floors below my office and in the same building as the patient clinic—so we’re set up to collaborate in a really special way to make advances for patients,” Garfall says.

Linette suggested they try to isolate the T cell receptors responsible for bringing on the SOX2 response and potentially turn it into a therapy for other patients. By finding the genetic sequence of T cells that recognize SOX2, they can re-engineer any patient’s T cells into ones that mimic that response.



2,185 donations for the 2020 BBC



Sandra Susanibar Adaniya, MD

Currently, with the help of patients who donate their T cells, the Linette/Carreno lab is providing the expertise for the collection and re-engineering of T cell receptors. Hematology/Oncology fellow Sandra Susanibar Adaniya, MD, has worked with Garfall and the Linette/Carreno lab to push the

project forward, recruiting patient volunteers in the clinic and working in the lab to isolate and characterize their T cells that recognize SOX2.

EVERYONE CAN BE A PARTNER IN PROGRESS

If all goes well, a clinical trial will begin, and Garfall hopes that results will be published in a few years. In the meantime, he realizes his good fortune in getting his project off the ground with a grant from the Breakthrough Bike Challenge, which this year was held virtually due to COVID-19. In the spirit of paying it forward, Garfall and his son pedaled 100 miles last summer for the cause, joining

nearly 500 fellow bikers, spinners, runners, and walkers who logged 20,875 miles in all.

The event raised an impressive \$275,000, with an average donation of just over \$115. But as Garfall knows from his experience two years ago, every penny counts for early investigator projects. Although this year's BBC funds have not yet been disbursed, 2019 monies have helped support three prostate cancer studies.

“Potential donors to research may think: These projects take so much money, how could I possibly make a difference?” Garfall says. “But the key is that the effect multiplies. That seed funding, even if it’s modest, enables us to get larger amounts from outside sources.”

The BBC funding, he says, did exactly what pilot grants are designed to do—provide the spark to launch projects on the path toward discoveries and cures. “You can have a lot of good ideas but if you can’t put together a team and do the initial experiments that will attract outside resources, your projects won’t get going.” □

► To get involved, contact Abramson-Gifts@upenn.edu or (215) 898-0578.



\$275k total

The Abramson Cancer Center was rated “exceptional” by the National Cancer Institute (NCI). This is the highest possible rating for an NCI-designated comprehensive cancer center.

Penn Medicine’s six hospitals were named 2020’s “LGBTQ Healthcare Equality Leaders” by the Human Rights Campaign Foundation, the largest national LGBTQ civil rights organization.



Christina Bach, MSW’96, MBE’12, LCSW, a clinical oncology social worker, bioethicist, and social work educator, received the Association of Oncology Social Work’s Quality of Life in Cancer Care Award.

Rinad S. Beidas, PhD, director of the Penn Implementation Science Center at the Leonard Davis Institute of Health Economics and an associate professor of Psychiatry; **Justin E. Bekelman**, MD, director of the Penn Center for Cancer Care Innovation at the Abramson Cancer Center (ACC) and a professor of Radiation Oncology; and **Robert A. Schnoll**, PhD, associate director of Population Science at the ACC, co-leader of the Tobacco and Environmental Carcinogenesis Program at the ACC, a senior fellow in the Center for Public Health Initiatives, and a research professor of Psychiatry, earned a nearly \$5 million award by the National Cancer Institute to support research centered on implementation science, behavioral economics, and cancer care innovation.

Roberto Bonasio, PhD, an associate professor of Cell and Developmental Biology, received the Max Planck-Humboldt Research Award in recognition of his outstanding research in the field of epigenetics.

Cesar de la Fuente, PhD, a Presidential Assistant Professor in Psychiatry, Microbiology, and Bioengineering, received a 35 Under 35 Award from the American Institute of Chemical Engineers for his efforts to develop computer made tools and medicines to combat antibiotic resistance.

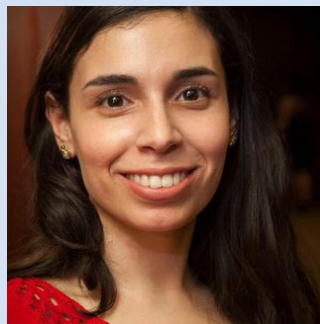
M. Kit Delgado, MD, MS, an assistant professor of Emergency Medicine and Epidemiology, **Krisda Chaayachati**, MD, MPH, MSHP’17, medical director of Penn Medicine OnDemand Virtual Care, clinical Innovation Manager of the Center for Health Care Innovation, and an assistant professor of Medicine, and **Anna Morgan**, MD, MSc, MSHP’17, an assistant professor of Internal Medicine, received a \$2.5 million grant from the Patient-Centered Outcomes Research Institute to study the impact of Penn Medicine’s COVID Watch program.

Five Penn faculty members were elected to the National Academy of Medicine, including three Perelman School of Medicine faculty: **Ronald DeMatteo**, MD, the John Rhea Barton Professor and chair of Surgery; **Raina Merchant**, MD, MSHP’09, associate vice president and director of the Center for Digital Health and an associate professor of Emergency Medicine; and **Hongjun Song**, PhD, the Perelman Professor of Neuroscience and co-director of the Institute for Regenerative Medicine Neurodevelopment and Regeneration Program.

An international collaboration led by **Jonathon Epstein**, MD, executive vice dean, chief scientific officer, and the William Wikoff Smith Professor of Cardiovascular Research, received a \$6.5 million Leducq Foundation grant to pioneer the field of immune-cardiology. **Benjamin L. Prosser**, PhD, an assistant professor of Physiology, served as a coordinator for a second Leducq award.

John J. Gallagher, DNP, RN, trauma program manager for Traumatology, Surgical Critical Care, and Emergency Surgery, was elected secretary of the National Board of Directors of the American Association of Critical Care Nurses.

Rebecca Hubbard, PhD, a professor of Biostatistics, was appointed to the National Academies of Sciences, Engineering and Medicine Committee on Applied and Theoretical Statistics.



Yasmin Kadry, PhD, a postdoctoral researcher, was named an Oncology Educational Fellow by a joint initiative of the American Association for Cancer Research and the U.S. Food and Drug Administration.

Patricia A. Kapur, MD’76, a clinical professor of Anesthesiology and Critical Care, was awarded the 2019 Distinguished Service Award by the American Society of Anesthesiologists.

L. Scott Levin, MD, the Paul B. Magnuson Professor of Bone and Joint Surgery, chair of Orthopaedic Surgery, and a professor of Plastic Surgery, was elected chair of the Board of Regents of the American College of Surgeons.

Brian Litt, MD, a professor of Neurology, Neurosurgery, and Bioengineering, and **Gregory Corder**, PhD, an assistant professor of Psychiatry and Neuroscience, received Director’s Awards from the National Institutes of Health.

Kenneth B. Margulies, MD, a professor of Cardiovascular Medicine, and a multi-institutional team of researchers received a \$3.2 million grant from the National Institutes of Health to explore the use of AI-driven analysis to determine the likelihood of cardiac patients accepting a new heart.

Katherine L. Nathanson, MD’93, deputy director of the Abramson Cancer Center and the Pearl Basser Professor for BRCA-Related Research, and a team of researchers received a

\$5.4 million grant from the National Institutes of Health to continue the work of the Testicular Cancer Consortium.

E. Michael Ostap, PhD, director of the Pennsylvania Muscle Institute and a professor of Physiology, and **Qi Long**, PhD, director of the Center for Cancer Data Science, associate director for cancer informatics of the Penn Institute for Biomedical Informatics, and a professor of Biostatistics, were named 2020 Fellows of the American Association for the Advancement of Science.

Farzana Rashid (Hossain), MD, director of Women’s Gastrointestinal Health Program and an associate professor of Clinical Medicine, was awarded the Gold Medallion Award from the Crohn’s and Colitis Foundation in recognition of her care for inflammatory bowel disease patients.

Michael Restuccia, chief information officer (CIO) of Penn Medicine, was named the health care winner of the Philadelphia CIO of the Year ORBIE Awards.

Walter Witschey, PhD’09, an associate professor of Radiology, and **Ari Borthakur**, PhD’00, MBA’14, associate director of the Center for Magnetic Resonance & Optical Imaging and a senior research investigator of Radiology, received the 2020 Imaging Innovation Award from *Radiology Business Journal*.



Gary Wu, MD, associate chief for Research in Gastroenterology and the Ferdinand G. Weisbrod Professor in Gastroenterology, won the Sherman Prize for his research investigating how diet and nutrition can affect Crohn’s disease and ulcerative colitis.

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1960s

Lee B. Martin, Jr., MD'69, announced his retirement after practicing family medicine for almost 50 years and serving on the staff at Virginia Hospital Center in Arlington, Va., and at Northern Virginia Doctors' Hospital, where he was chief of Family Practice and served on the Board of Directors. He also served as an adviser for the Visiting Nurses' Association of Northern Virginia and on the Arlington County Board Nursing Home Commission.

1970s

George M. Wohlreich, MD'79, the director and CEO of the College of Physicians of Philadelphia and its Mutter Museum, will retire in June. Since 2006, he has overseen the additions of the Center for Education and Templeton veranda, musical programming in concert with the Philadelphia Orchestra, the Delaware Valley Medical Student Wellness Collaborative, and the college's first comprehensive capital campaign, which was designed to endow staff positions and programs.

1980s

Douglas G. Cole, MD'86, was named the co-founder of Foghorn Therapeutics, Inc., a biotechnology company developing gene regulation treatments. The company has 10 therapies in development that would target cancer and expects to begin its first clinical trials in the near future.



Jeffrey Alan Golden, MD'88, has been appointed vice dean of research and graduate education and director of the Burns and Allen Research Institute at Cedars-Sinai Hospital. He most recently served as the Ramzi S. Cotran Professor of Pathology at Harvard Medical School and chair of Pathology at Brigham and Women's Hospital in Boston.



Mark Shlomchik, MD'89, PhD'89 (right), and his brother **Warren Shlomchik**, MD'89 (left), have founded BlueSphere Bio, a biotech company that aims to unlock the potential of personalized T cell therapy for the treatment of cancer using novel TCXpress technology. The platform uses a patient's own immune defenses to attack their cancer specifically without touching normal tissues. In addition to this newest venture—the latest of many collaborations—Mark and Warren both hold positions at the University of Pittsburgh. Mark is the chair of Immunology and an Endowed and Distinguished Professor of Immunology, and Warren is a professor of Immunology and Medicine, director of the Hematopoietic Stem Cell Transplant and Cell Therapy, and vice-chief of Hematologic Malignancies, Hematopoietic Stem Cell Transplantation, and T cell Immunotherapy.

1990s



Ralph G. Nader, MD, GME'90, has established a concierge medicine program in collaboration with Castles Connolly Private Health Partners, LLC, in conjunction with his existing cardiology practice. He has been in private practice for 30 years as a clinical and interventional cardiologist. He founded the Miami Center for Advanced Cardiology in 2008.

Valerie Dawn Weber, MD'91, MS, FACP, has been appointed dean of the Wright State University Boonshoft School of Medicine. She most recently served as a professor of Medicine and the Deborah J. Tuttle, MD, and John P. Piper, MD, Senior Vice Dean for Educational Affairs at Drexel University College of Medicine.

Mark D. Eisner, MD'92, MPH, has been appointed chief medical officer at FibroGen, Inc., a biopharmaceutical company. He previously served as senior vice president and global head of product development of immunology, infectious disease, and ophthalmology at Genentech.

Mariana Nacht, PhD'93, has been appointed chief scientific officer at LogicBio Therapeutics, Inc., a company that pioneers targeted delivery platforms to extend the reach of genetic medicine. She recently served as chief scientific officer at Cereius, where she led a small internal research team and a group of collaborators to develop treatments for brain metastases.

Todd M. Fruchterman, MD'96, PhD, has been named president of the reliability solutions segment of Flex, Ltd., an American Singaporean-based multinational electronics contract manufacturer. He most recently served as president and general manager of medical solutions at 3M Company.

2000s

Daniel M. Skovronsky, MD'00, PhD'01, was named chief scientific officer and president of Lilly Research Laboratories, a biotechnology company that announced a global antibody manufacturing collaboration with Amgen. The collaboration would enable rapid production of Lilly's potential COVID-19 therapies should one or more of them prove successful in clinical testing and receive regulatory approval.

Robert Doebele, MD'01, PhD'01, has been appointed executive vice president and chief scientific officer at Rain Therapeutics, Inc., a clinical stage biotechnology company focused on targeted therapies for patients with cancer. He co-founded the company in 2017 and served as chair of the Scientific Advisory Board.



Carissa M. Baker-Smith, MD'03, MS, MPH, has been appointed director of Preventative Cardiology at the Nemours Cardiac Center at Nemours/Alfred I. DuPont Hospital for Children. She most recently served as an associate professor of Pediatrics and as the primary pediatric cardiologist for the Cardiovascular Genetics Program and the heart transplantation program.

Amy T. Campbell, JD, MBE'03, has been named associate dean of law and health sciences and is one of the newest members of tenured faculty at UIC Law in Chicago. She specializes in health policy, health justice, and health equity, with a focus on the role of policy in preventing childhood and community trauma.

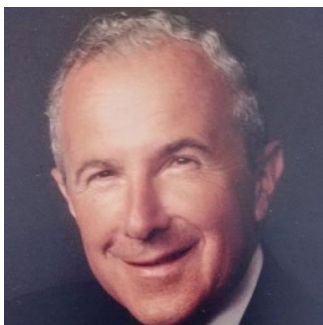


Dave A. Chokshi, MD'09, MSc, has been appointed commissioner of New York City's Department of Health and Mental Hygiene by Mayor Bill de Blasio. He has served at the highest level of local, state, and federal health agencies, including NYC Health + Hospitals, where he was in senior leadership roles over the past six years. Most recently, he was the chief population health officer, where he transformed healthcare delivery for over one million New Yorkers.

OBITUARIES

1940s

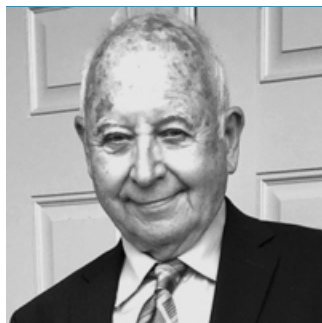
Howard E. First, BS'46, MD'50, an obstetrician; July 11. After earning both his bachelor's degree and medical degree from the University of Pennsylvania, First completed his residency at



Thomas Jefferson University Hospital. He practiced obstetrics and gynecology in the Philadelphia area until retiring to Florida in 2000. He also enjoyed giving back to the Jewish community in both Philadelphia and Palm Beach Gardens.

Park W. Gloyd, MD'48, an orthopaedic surgeon; July 21. After earning his medical degree from the University of Pennsylvania School of Medicine, he completed his training at the University of California-San Francisco and the University of Washington. Gloyd served in the U.S. Army as a surgeon during and after the Korean War. He later became director of Orthopaedics and president of the medical staff at Children's Orthopedic Hospital, as well as a clinical professor at the University of Washington. The Park W. Gloyd annual lecture series was created in 1982 to honor his contributions.

1950s



John Donnell Bacon, MD'51, a surgeon; June 26. After graduating from Swarthmore College, he earned his medical degree from the University of Pennsylvania School of Medicine. He served in the U.S. Navy, then settled in Florida and practiced medicine for more than 30 years throughout Palm Beach County. Bacon also traveled the world as an underwater and nature photographer.

George P. Highsmith, MD, GME'51, FACP, an internist; Aug. 7. After earning his medical degree at Wake Forest University, he continued his training at Georgetown University, Wake Forest University, and the University of Pennsylvania. He

served as a captain in the U.S. Army, then set up his medical practice. Highsmith served the residents of Thomasville and Davidson County, N.C., for over 40 years. He also practiced in the old Thomasville Memorial Hospital and the Community General Hospital of Thomasville.

C. Parker Long, MD'51, a physician; Oct. 6. He served in the Marine Corps during World War II and earned his medical degree from the University of Pennsylvania. Long practiced family medicine in Naples, N.Y., for nearly 40 years and was a president of the New York State Academy of Family Physicians. He was a man who valued medicine, family, friends, and faith.

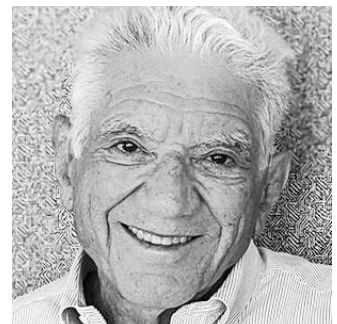
Gerald Goldstein, MD'52, an internist; July 23. After earning a medical degree from the University of Pennsylvania School of Medicine, he completed residencies at the Children's Hospital of Philadelphia, Dallas Veterans Hospital, and the Martinsburg VA Hospital. He later became an emeritus professor of Medicine and Microbiology at the University of Virginia, where he established an adult oncology program, served as director of the first inpatient palliative care unit, and conducted research in the field of fluorescent immunology. Throughout his career, he continued to educate himself through apprenticeships around the world in research and clinical oncology, and he served as president of the Virginia division of the American Cancer Society.

Richard M. Barry, MD'54, an internist; Sep. 18. After serving in the U.S. Navy in World War II, he earned degrees from Yale University and the University of Pennsylvania School of Medicine. He completed his training at New York Hospital Medical Center and Massachusetts General Hospital before practicing at Mystic Medical Group, now part of Hartford Health Care. Barry served on the board of managers at Lawrence + Memorial Hospital and helped implement the first physician staffing system for the emergency room. He also helped establish the first health

maintenance organization (HMO) in southeastern Connecticut, serving as the chairman of the board.

Dwight Jordan Hotchkiss, Jr., MD'54, a physician; Aug. 30. After earning his medical degree from the University of Pennsylvania School of Medicine, he served in the U.S. Army and was stationed in Germany. After his military service, he completed his residency at the University of Colorado Medical School. He practiced at the Hunterdon Medical Center in Flemington, N.J., for 30 years, where he became board-certified in oncology. Upon retirement, Hotchkiss worked as a locum tenens physician in Keowee Key, S.C., and served as president of the board at the Hospice of the Foothills.

John F. Strahan, MD, GME'55, a dermatologist; July 12. After serving in the U.S. Navy during the Korean War, he completed his dermatology training at the University of Pennsylvania School of Medicine. He was appointed the first chief resident in Dermatology at the University of Maryland, then went into private practice in Baltimore for over 50 years. Strahan was an instructor at the University of Maryland School of Medicine, and an assistant professor of Medicine at the Johns Hopkins University School of Medicine. He held a variety of additional roles, such as president of the Maryland Dermatological Society.



Stephen Herbert Rovno, MD'58, an anesthesiologist; Nov 2020. After earning his medical degree from the University of Pennsylvania School of Medicine, he completed his training at Albert Einstein Medical Center and

the University of California-San Francisco. As a lieutenant commander in the U.S. Navy during the Vietnam War, he established the anesthesia department at the Naval hospital in Guam. Following his service, Rovno practiced at Mills Memorial Hospital in San Mateo, Calif., for 35 years and volunteered for Vision Health International for 13 years, performing international medical missions for people in need of eye surgery and glasses.

David C. Cottrell, MD'59, GME'66, an orthopaedic surgeon; June 5. After earning a medical degree at the University of Pennsylvania School of Medicine, he was stationed in Okinawa with the U.S. Army. Following his military service, he completed an internship and residency at the Hospital of the University of Pennsylvania (HUP). Cottrell taught orthopaedic surgery at Penn and was an attending physician at HUP. He worked in private practice in Bryn Mawr and Selinsgrove, Pa., and was a surgeon at the Sunbury Community Hospital and Evangelical Community Hospital in Lewisburg, Pa., and held many professional memberships.



Thomas French Whyne, Jr., BS'59, MD'63, PhD, a cardiologist; June 19. After earning his chemistry and medical degrees from the University of Pennsylvania, he pursued his biochemistry degree at the University of California-San Francisco. He was a professor at Ohio State University, an associate professor at the University of Oklahoma, and a cardiologist at the Lexington Clinic prior to joining the faculty at the University of Kentucky. Whyne published more than

150 medical articles, gave lectures in Spanish around the world, and was honored with the Thomas F. Whyne Professor of Women's Heart Health at the U.K. College of Medicine.

1960s

William B. Carey, MD, GME'60, a pediatrician; July 26. After earning his medical degree at Harvard University, he interned at Children's Hospital of Philadelphia, where he taught and practiced for almost 60 years. He was also a clinical professor of pediatrics at the University of Pennsylvania School of Medicine. His research into the temperamental differences in developing children gained international attention, and he advanced the field by helping to create a clinical questionnaire to measure and group children's behaviors. Carey published more than 130 research papers, reviews, and books. He received the American Academy of Pediatrics' Aldrich Award in Child Development and its Practitioner Research Award, and he was elected to the National Academy of Medicine.

David Abraham Sommer, MD'60, an internist; Sep. 12. After earning a medical degree from the University of Pennsylvania School of Medicine, he completed an internship at Jackson Memorial Hospital in Miami, and was drafted into the U.S. Army during the Berlin Crisis. He became a captain in the U.S. Army First Armored Division and received a service commendation from President John F. Kennedy. Following his military service, Sommer completed residencies at Jackson Memorial Hospital in internal medicine and gastroenterology. He entered private practice and joined the staff of some of the most highly-regarded hospitals in Miami-Dade County. Throughout his career, he earned the trust of his colleagues and his patients' families as much for his professional abilities as for his warmth, joyfulness, and vibrant personality.



MarJeanne (Mimi) Collins, MD'61, GME'66, an emeritus associate professor at the Perelman School of Medicine; Oct. 8. After earning her medical degree from the University of Pennsylvania School of Medicine, she interned at Bryn Mawr Hospital and completed residencies in physical medicine, rehabilitation, and pediatrics at the Hospital of the University of Pennsylvania. She practiced pediatrics in West Philadelphia while advancing her career at Penn, becoming an assistant professor of Pediatrics, an assistant professor at the Children's Hospital of Philadelphia (CHOP), and director of Penn's Student Health Services until her retirement in 2000. Collins was instrumental in creating an adolescent medicine unit at CHOP and served as its inaugural director. She published many influential papers and received many awards, including the American College Health Association Edward Buck Award.

Malcolm Henderson Rourk, Jr., MD'63, a pediatrician; Sep. 4. After spending a year studying in Germany as a Fulbright scholar, he earned his medical degree from the University of Pennsylvania School of Medicine. He served as a captain in the U.S. Air Force before completing his training in pediatrics and pulmonology. Rourk was an associate clinical professor at Duke University, where he created the Division of Pediatric GI and Nutrition, became the director of the Pediatric Residency Program, and served on the medical school admissions committee. Travel, music, gardening, and his beloved corgis were among his greatest loves.

Bertram H. Lubin, GME'66, a pediatrician; June 27. After earning a medical degree from the University of Pittsburgh and completing a pediatric residency at Children's Hospital of Philadelphia (CHOP), he served as an U.S. Army physician in Vietnam, then completed a fellowship at Boston Children's Hospital. He returned to CHOP as director of the Hematology Lab and was an assistant professor of Pediatrics at the University of Pennsylvania School of Medicine. Lubin later became the president and CEO



of Children's Hospital Oakland, which he affiliated with the University of California-San Francisco, creating UCSF Benioff Children's Hospital Oakland. He became associate dean for children's health and founded the Center for Community Health and Engagement.

Donald C. Steckel, MD'67, a physician; Aug. 28. After earning a medical degree from the University of Pennsylvania School of Medicine, he practiced internal medicine at Evangelical Community Hospital in Lewisburg, Pa., where he served on the board of directors, as chief of staff and chief of medicine, and founded the hospital's Cardiac Rehabilitation Center. Steckel was president of the Union County Medical Society and led medical mission trips to Kenya, Guatemala, and Nicaragua. He was also a founding member of the Lewisburg Christian and Missionary Alliance Church and an elder of the First Presbyterian Church of Lewisburg.

Robert P. Gordon, MD'68, a psychoanalyst; Jan. 10. After earning his medical degree from the University of Pennsylvania School of Medicine, he served in the U.S. Indian Health Service and directed a mental health program for eight Native American tribes. He completed a psychiatric residency at the University of Chicago and became a psychoanalyst through the Chicago Psychoanalytic Institute, where he joined the faculty and served terms as assistant dean, dean, and director. Gordon also contributed his time and talents to Northwestern University's department of Psychiatry and Behavioral Sciences in the Feinberg School of Medicine, Friends of the Parks, and Family Focus in both Englewood and Evanston.

E. Barry Topham, MD'68, a dermatologist; Sep. 21. After earning a medical degree from the University of Pennsylvania School of Medicine, he served in the military and completed a residency in dermatology in the VA Long Beach Healthcare System. Returning to his home state of Utah, Topham established his Holladay Dermatology Clinic, where he worked for 46 years in private practice, the last 22 in partnership with his son. His loved ones fondly remember that 15-minute appointments would often run much longer given his love of catching up with his patients.



Ann Hanahoe Hines, MD'69, a pediatrician; Sep. 7. After earning a medical degree from the University of Pennsylvania School of Medicine, she founded the Cyril and Mary Hanahoe Memorial Children's Clinic in Danbury,

Conn., where she served as sole pediatrician and executive director for 35 years, providing outpatient medical services to children whose families could not afford private pediatric care. Hines' accolades include the National Jefferson Award for Outstanding Public Service and the Ladies Home Journal Award.

1970s



Gerd Muehlehner, PhD, GME'72, a radiologist; June 2020. After earning a PhD in nuclear physics at the University of Michigan, he came to the University of Pennsylvania School of Medicine as a lecturer in Radiology, ultimately becoming a full professor in Radiologic Physics. He helped launch the modern generation of Positron Emission Tomography (PET) imaging devices and commercialized PET technology at UGM Medical Systems. Along with his wife and friends, he established the Gerd Muehlehner Professorship of Radiology.

David Hollander Grossman, MD'76, a physician; May 31. After earning his medical degree from the University of Pennsylvania School of Medicine, he was an emergency room physician for 38 years, including 10 years as chief of the Emergency Department at Lankenau Hospital in Wynnewood, Pa. Grossman also served as a Board Member of Kitty Cottage Adoption Center.

Martin G. St. John Sutton, MD, GME'79, an emeritus professor at the Perelman School of Medicine; June 8. He earned his medical degree at Guy's Hospital



Medical School in London. As a fellow at the Mayo Clinic, he studied the use of ultrasound in fetal physiology and turned his focus to congenital heart diseases. He joined the faculty at the University of Pennsylvania School of Medicine in 1979, where he worked on clinical applications of echocardiography and became an assistant professor of Medicine and co-director of the Non-Invasive Cardiac Laboratory. At Brigham and Women's Hospital of the Harvard Medical School, Sutton's seminal research began a new era of post-infarction therapy and provided the foundation for all subsequent studies of ventricular remodeling. He returned to Penn in 1993 as the John W. Bryfogle Professor of Medicine, and served as the director of the Cardiovascular Imaging Program and Cardiology Fellowship Program, established the first joint Adult Congenital Heart Disease program between the Hospital of the University of Pennsylvania (HUP) and the Children's Hospital of Philadelphia, and created the Center for Quantitative Echocardiography at HUP.

1980s

John K. Erban III, MD, GME'84, an oncologist; Sep. 2. Between a residency and chief residency at the Hospital of the University of Pennsylvania, he spent two years in the National Health Service Corps in rural Florida. After a fellowship at Tufts Medical Center in Boston, Erban joined the faculty, serving as chief of Hematology/Oncology, co-director of the Breast Cancer Program, and a professor of Medicine. He also served on

the boards of the Silent Spring Institute and the Cam Neely Foundation for Cancer Care. A devoted clinician, researcher, and teacher, he worked tirelessly to treat and prevent cancer.

Christina Doll, MD'85, a physician; Jan. 12. After double majoring in biology and chemistry at Seton Hill University, she earned her medical degree at the University of Pennsylvania School of Medicine. She cared for patients in Pittsburgh, York, and on the campuses of Penn State University and Bucknell University. She worked for an outpatient private practice in Happy Valley, then later at SCI Rockview and Smithfield. She also consulted with Cove Forge Rehabilitation Center and the State College Area School District for student health screenings. When she was not with patients, Doll loved cooking, traveling, and tap dancing.



Margaret Grace Stineman, MD, GME'87, an emeritus professor at the Perelman School of Medicine; July 9. After earning a medical degree at Hahnemann University, she came to the University of Pennsylvania as a resident, was awarded the Robert Wood Johnson Clinical Scholarship, and went on to hold positions in rehabilitation medicine, internal medicine, and biostatistics and epidemiology. She served as vice chair and director for research in Physical Medicine and Rehabilitation and was a senior fellow at the Leonard Davis Institute of Health Economics. In addition to earning many prestigious awards, Stineman helped develop a patient classification approach that became the basis for Medicare's national payment

system for inpatient rehabilitation, and pioneered the Functional Independence Measure that became the national standard for measuring inpatient rehabilitative progress.

Ned Charlton Sacktor, MD'88, a neurologist; Nov. 11. After earning a medical degree from the University of Pennsylvania School of Medicine, he completed a neurology residency at Columbia University's Neurological Institute and was awarded a behavioral neurology fellowship at Columbia's Presbyterian Hospital. There, he launched his research in the cognitive manifestations of HIV/AIDS. At Johns Hopkins University's School of Medicine, he was instrumental in developing the HIV dementia program that remains a driver of studies relating to cognitive disorders in HIV/AIDS. Sacktor produced over 190 research articles and gave lectures around the world. He was president of the Maryland Neurological Society in 1998 and was asked to serve as president of the World Neurology Foundation in 2016.

FACULTY

MarJeanne (Mimi) Collins, MD. See Class of 1961.



Trevor R. Hadley, PhD, an emeritus professor at the Perelman School of Medicine; Oct. 29. He received his PhD from the University of Pittsburgh and led a distinguished career across public mental health policy and research environments. He served the mental health center director and then the state mental health

deputy commissioner for the Commonwealth of Pennsylvania and as commissioner of mental health for the State of Maryland. Hadley later became the founding director of the Center for Mental Health Policy and Services Research at the University of Pennsylvania, where he created a Fellowship Community in Psychiatry program to train future leaders in public mental health systems. He also became an emeritus professor of Psychology in Psychiatry.

Margaret Grace Stineman, MD. See Class of 1987.

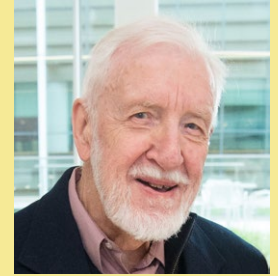
Martin G. St. John Sutton, MD. See Class of 1979.

Donald S. Young, MD, an emeritus professor at the Perelman School of Medicine; July 4. He earned his medical degree at the University of Aberdeen in Scotland, his PhD in chemical pathology from the University of London, and completed his training at the Royal Postgraduate Medical School and Hammersmith Hospital in London. He served as a visiting scientist in clinical pathology at the National Institutes of Health in Bethesda, Md., where he later became chief of the Clinical Chemistry Service and was appointed head of Clinical Chemistry at the Mayo Clinic in 1977. He served the faculty at the University of Pennsylvania School of Medicine in 1984, where he oversaw Laboratory Medicine and the William Pepper Laboratory until 2009. For 20 years, he served on the board of editors for the journal *Clinical Chemistry*. Throughout his career, he served in many capacities for a variety of organizations, such as the Expert Advisory Panel on Health Laboratory Services for the World Health Organization, and he received numerous awards, such as the Luigi Mastroianni Clinical Innovator Award.

LEGACY GIVING

Leaving a Legacy of Support for MD/PhD Students

For Theo George Wilson, MD'61, the decision to pursue his medical degree at the University of Pennsylvania was easy: "I wanted to go to Penn because it was the best—and it's still the best."



When Wilson arrived in the United States as a Fulbright Scholar, he already held a PhD in biochemistry from Imperial College, University of London. He conducted biomedical research at the Enzyme Institute at the University of Wisconsin-Madison, the Johnson Foundation in Philadelphia, and Princeton University, before attending medical school.

Upon completing his training, Wilson launched a remarkable career that spanned many roles—scientist, physician, internist, administrator, and state official. He held academic appointments at Temple University, Wayne State University, and Stanford; served as an administrator for two hospitals; and served as the chief of medical policy and chief medical officer of the MediCal program. Wilson was also deeply involved with the civil rights movement and human health rights issues, which shifted his focus into public health as his career progressed.

He credits much of his impact to having both a PhD and MD, and he believes this path is important for the next generations of doctors too. "Many disciplines are involved with dealing with medical and physiological problems, so both backgrounds are helpful," he said. "There is a real future for people who are dually qualified."

For this reason, Wilson chose to create the Theo George Wilson MD/PhD Scholarship Fund to support students in Perelman School of Medicine's (PSOM) MD/PhD program—one of the oldest, most influential, and prestigious in the country. The Wilson Fund was the first of its kind for the program, as well as his first gift to Penn Medicine.

Wilson established this scholarship through a blended gift, which means he made one part of the contribution outright and the other part through planned giving using a Transfer on Death (TOD). Unlike making a bequest in a will, TODs allow donors to name beneficiaries who will receive assets at the time of the donor's death without going through probate.

Naming Penn Medicine a beneficiary is just one of the many ways donors can create a legacy for themselves and opportunities for PSOM students. "I'm the last of my family line, the last of my name. I would like to have it live on in some way," Wilson said. "I always had great feelings toward Penn, and I want to do as much good as I can with what I am leaving behind."

Planned giving is often described as the final piece of a philanthropic puzzle. Figuring out how this important puzzle piece can work best for you, your family, and your philanthropic goals is what we do best. Speak with us to learn more about giving options. Contact Christine S. Ewan, JD, executive director of Planned Giving, at 215-898-9486 or cewan@upenn.edu

► For more information, please visit our website at www.plannedgiving.med.upenn.edu.

EMPOWERMENT, NOT EXPLOITATION

By Abike James, MD, MPH



Adeola James, 85, received her first dose of the COVID-19 vaccine on Jan. 21, 2021. James, originally from Nigeria, migrated to the U.S. to join her children, including Abike James, and grandchildren after retiring from teaching literature at the University of Guyana.

I'm a physician, a mom, wife, and middle daughter of five children of Nigerian and Guyanese descent. The morning after my first shot of the COVID-19 vaccine, I had an intense argument with my siblings who are scattered across the globe. My elation about receiving the vaccine was met with reprimand from two of my siblings, telling me to just make sure I did not influence our mother to get it or let her be used as a guinea pig. I was devastated. My mother is the highest risk amongst us. The isolation during the first part of the pandemic, when she couldn't see her children or grandchildren, was too much, and I made the decision to bring her back into my bubble. But every day since then,

I've walked around with the fear that as a health care provider, I could bring COVID to her and the rest of my family.

I had begun to feel hopeless after the third surge of COVID-19 cases hit right around Thanksgiving. I felt as if COVID was crowding in on me, my colleagues, and my patients' families. That it was just a matter of time. Would I have to return my mother to her isolation? Would this go on forever?

Though a few months earlier I would have said I would not get the vaccine because it was too new, at this time it felt like a glimmer of hope. I talked to the experts, I did my research, I listened to my trusted friends and colleagues. I

Why I Got the COVID-19 Vaccine



"I leaned into hope," Abike James, MD, MPH, said of getting her COVID-19 vaccine. "I was amazed to see myself surrounded by colleagues, many of whom were Black and brown, there for their shot also. We bonded by this opportunity to receive our shots together."



learned that while the vaccine was new, the technology was not. I learned about where the first trials were done, in the UK and Germany—not Africa, as was rumored. I believed the science. The vaccine was safe and effective. It prevented disease with 95 percent efficacy, and severe disease with 100 percent efficacy. I was sold, but some of my family members clearly were not, and it soon became apparent that their hesitancy was matched by hesitancy amongst my Black colleagues, friends, staff at work—literally everywhere I turned. I understood why.

There have been terrible injustices against Black and brown people in the U.S. and across the African diaspora, in health care and beyond. But the COVID-19 vaccine is different. We've been fortunate to have Black scientists involved in the technology behind vaccine development, and involved in vaccine trials. I balanced this knowledge with the reality of the COVID-19 pandemic itself. The legacy of systemic racism created fertile ground for this pandemic to disproportionately ravage people of color. We're getting sick and dying at higher rates than our white counterparts.

If as Black and brown individuals with access to the vaccine, we turn around and then decline it, where does this leave us in a few years? Our communities are losing so many lives to COVID-19. What happens when COVID-19 slows down for the vaccinated community, and continues for the non-vaccinated?

As a community we have to be all in. We cannot afford to continue to lose those nearest and dearest to us. And we cannot afford to let the divide continue to grow.

Abike James, MD, MPH, is an associate professor and vice chair for diversity, inclusion, and equity in Obstetrics and Gynecology in the Perelman School of Medicine.

This story has been adapted and condensed for print from a spoken essay shared through the Penn Listening Lab. Encompassing the voices of patients, caregivers, staff, and health care providers, the Listening Lab is a storytelling initiative that embraces the power of listening as a form of care. Listen to James' story in her own voice, and others, at pennlisteninglab.org.

Health Care Heroes in Training

Many of the traditional rites of passage in medical school have transitioned from in-person activities to virtual ones this year—but that doesn't mean they can't still be fun. Second-year medical students assured it by planning virtual orientation activities for entering students at the Perelman School of Medicine this fall. In one activity, first-year students were assigned costumes and asked to find the others whose costumes matched their theme. In this case, medical student superheroes discovered sartorial similarities in their blanket capes.

► **Read more about what has changed—and what remains the same—in medical education on p. 28.**

