SUMMER/FALL 2018

NYU LANGONE HEALTH MAGAZINE

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Doctors, Data and the Future of Medical Education

8 Women Surgeons Make History

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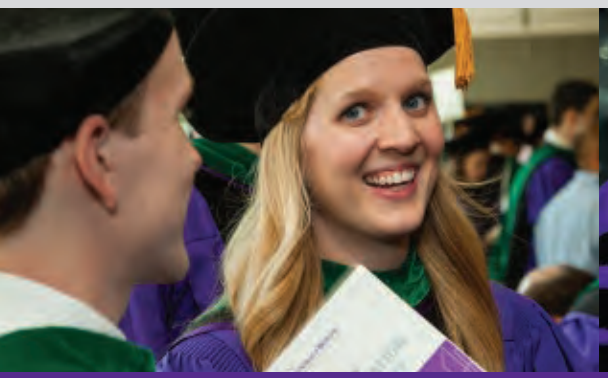

NYU School of Medicine

Thank you for your generosity.

When Form Meets Function

Message from the Dean and CEO

JULIANA THOMAS

IF YOU WERE TO wander into the lobby of the new Helen L. and Martin S. Kimmel Pavilion at the northern end of NYU Langone Health's main campus, you might think you were in an art museum. The modern, light-filled atrium, with its undulating wood-faced balconies stacked five stories high, bears little resemblance to a traditional healthcare setting. And that's quite the point: of all the places in the world that ought to uplift visitors, shouldn't it be one intended to help people heal and restore wellness?

The opening of the Kimmel Pavilion and Hassenfeld Children's Hospital on June 24 marked the culmination of a decade-long effort by the Real Estate Development and Facilities Department, in collaboration with our administrative leadership, faculty, staff, and generous philanthropic community. Together, we have achieved a top institutional priority: to construct a state-of-the-art, fully integrated clinical facility that is as beautiful as it is functional, and that will raise the bar in patient-centered care for years to come.

You'll read about these and other exciting advances across all of our mission areas in this issue of *NYU Langone Health Magazine*. From the discovery of a potential new organ that's upending conventional notions of human anatomy (p. 18), to mining Big Data to bridge the gap between medical education and patient outcomes (p. 46), to NYU School of Medicine's historic all-female class of chief surgical residents (p. 28), NYU Langone Health continues to set new standards.

I couldn't be prouder of our entire community of doers and achievers. We have built not only magnificent structures, but also a state-of-the-art healthcare system worthy of our world-class stature.

Robert I. Grossman, MD, Saul J. Farber Dean and CEO

ON THE COVER:

Photograph by Jeff Goldberg/Esto

NYU Langone Health

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NYU Langone's new Kimmel Pavilion and Hassenfeld Children's Hospital push the boundaries of integrated technology, setting a new standard for patient-centered care. **BY DAVID FREEDMAN**

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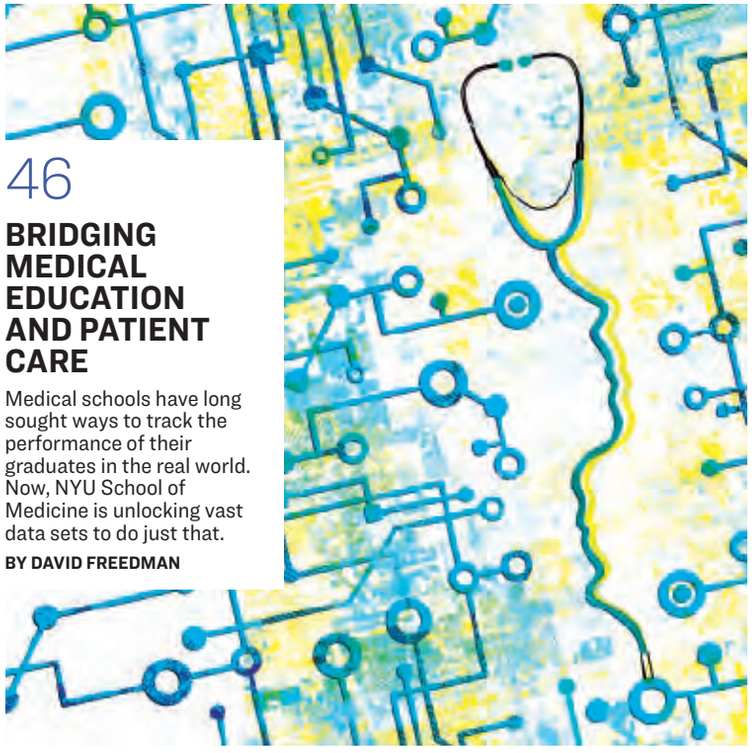
THE AMAZING EIGHT

The first all-female class of chief surgical residents at NYU Langone is saving lives—and breaking long-established barriers.

BY LISA DAVIS



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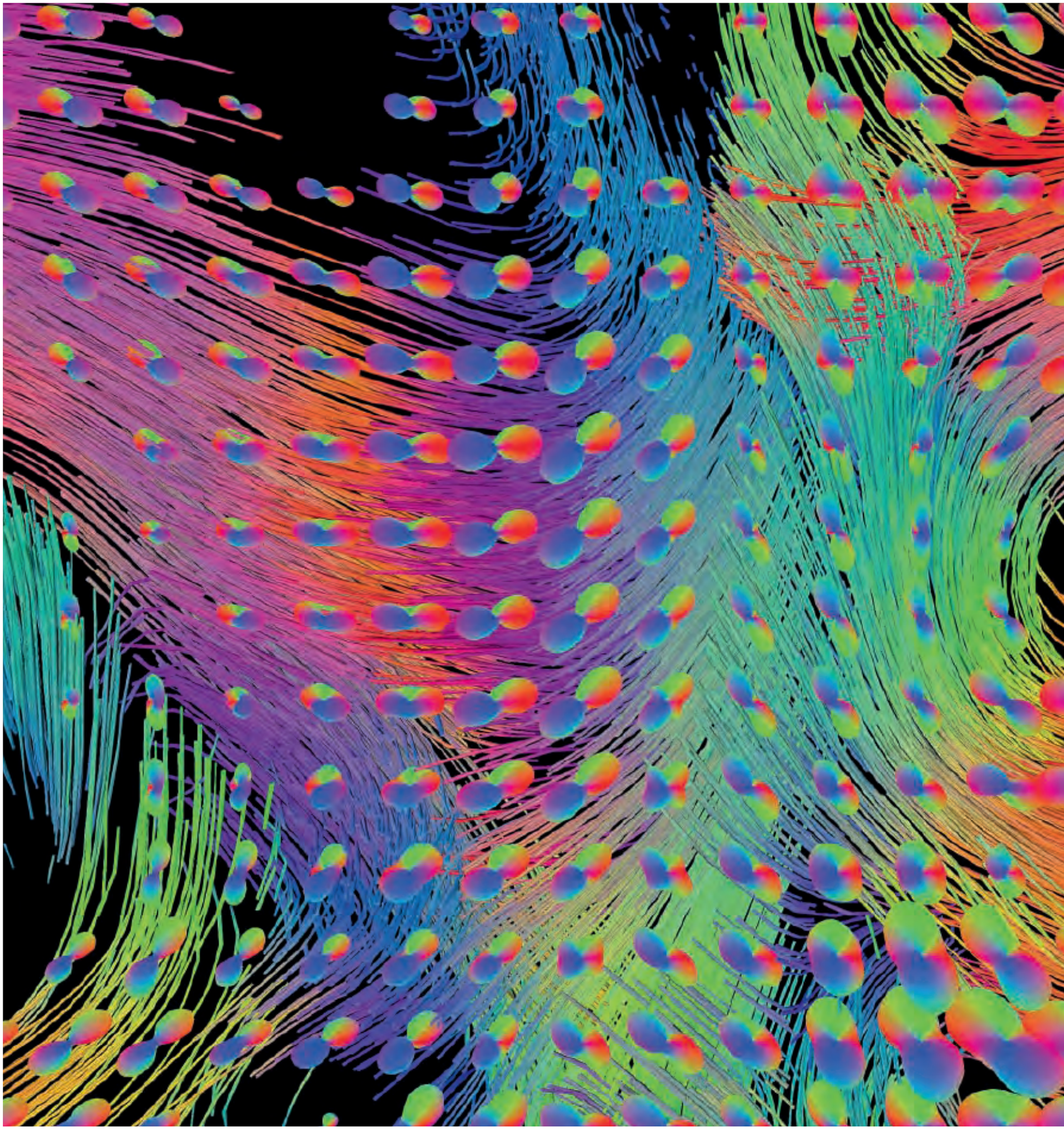
BRIDGING MEDICAL EDUCATION AND PATIENT CARE

Medical schools have long sought ways to track the performance of their graduates in the real world. Now, NYU School of Medicine is unlocking vast data sets to do just that.

BY DAVID FREEDMAN



Scope

White Matter, In Living Color

Last winter, the Office of Science and Research invited researchers across NYU Langone Health to enter their most dazzling scientific images into its first-ever visual competition, called Eye on Science. Among the finalists was this computer rendering of white matter in the human brain. Physicist Steven H. Baete, PhD, assistant professor of radiology, created it using a technique called MR tractography, in which magnets help trace the diffusion of water through brain tissue.

Banking on Personalized Medicine

NYU Langone Health's biorepository is a capital investment in research that will pay lofty dividends in science and patient care.

By David Sparrow

Her parents were both investment bankers, so perhaps it was inevitable that Iman Osman, MD, would follow in their footsteps. But Dr. Osman, a medical oncologist, deals in a kind of currency different from that of her mom and dad. As founder of the Center for Biospecimen Research and Development (CBRD), which launched in 2015, she oversees NYU Langone Health's burgeoning repository of donated patient samples—a collection that includes everything from cancerous tissue and blood to stool and fat cells. Together, these samples are helping investigators across the institution to spark medical discoveries, support clinical trials, and help doctors develop diagnostics, therapies, and preventive treatments based on an individual's genetic makeup.

Personalized medicine has become a priority for top medical institutions nationwide following breakthroughs in genome sequencing, which can reveal DNA mutations that influence the treatment of a variety of diseases. Biobanks like CBRD are an essential resource for providing patients' samples and clinical information to support scientific studies and potential breakthroughs in care.

It's an ambitious undertaking. During the past 18 months, Dr. Osman, professor of medicine and urology, and professor of dermatology in the Ronald O. Perelman Department of Dermatology, who previously led a melanoma-focused clinical and biobank database at NYU Langone, has spearheaded an effort to establish a universal consent form that simplifies the institution's process of obtaining permission to collect tissue, blood, stool, and bodily fluids when a patient arrives for care. More than 11,000 patients have already signed off on donating their "leftover" samples from surgeries and other procedures, and agreed to donate extra blood as needed for follow-up research.

While the meticulously crafted one-page release, presented as an opt-in at registration, has been a major factor in the exceptional 70% acceptance rate thus far, Dr. Osman also points to another component. "Patients come to NYU Langone for the best clinical care, but they also see the value of helping to advance research, knowing that NYU Langone is also a respected academic institution," she says.

Iman Osman, MD (right), with a few of the many thousands of specimens at the CBRD lab; below, a tissue microarray preserved in a paraffin block.

That value has appreciated considerably due to two other transformations: First, the CBRD is no longer exclusively for tumor and tissue specimens. While cancer excisions still account for roughly 90% of its samples (whether frozen or preserved in paraffin wax), that is evolving. Newly launched strategic initiatives enable the study of obesity, diabetes, and inflammatory bowel disease, among others. The goal is to discover biomarkers pointing to genetic and other susceptibilities for these conditions and, ultimately, to develop more effective, targeted treatments.

"NYU Langone does more than 1,000 bariatric surgeries a year," says Dr. Osman, associate dean for translational research support. "The CBRD is supporting research on donated fat cells, as well as blood and stool samples, to investigate how genetic and microbial factors might impact patients' ability to keep the weight off."

The other unique aspect of NYU Langone's biorepository is that samples and clinical records (with a patient's personal information protected) can be accessed together electronically, creating a sort of one-stop shopping for investigators, says Andre Moreira, MD, PhD, a professor of pathology and director of the CBRD. He points to a recent lung cancer study published in *Nature Medicine*, in which a team of investigators led by NYU Langone researcher Thales Papagiannakopoulos, PhD, of Perlmutter Cancer Center, obtained frozen and paraffin-embedded

Photographs by **Tony Luong**

tissue samples along with clinical annotations. This enabled the scientists to identify a potential new approach to treating patients whose tumors feature specific genetic mutations. "The CBRD's banking system is very dynamic" in that it provides a centralized place for accessing tissue and information, says Dr. Moreira. No longer do investigators need to approach surgeons directly to see if they're willing to collaborate.

The CBRD utilizes cutting-edge technology to assure that samples retain their optimal composition. One recent piece of equipment added last year, called the PrestoCHILL, flash-freezes tissue without compressing or distorting the delicate cells inside. "It's pretty cool. You put the sample in the tube, cover it, and in 60 seconds, it's frozen," says Sandra Mendoza, assistant director of the CBRD. Next, samples are categorized by disease type and stored in liquid nitrogen—or, for fluids, in large freezers at –80° C—preserving their integrity for many years. Aside from lots of cold storage, the biobank, housed in NYU Langone's Science Building, has centrifuges for separating blood components, and specialized workstations that prevent contamination.

"Patients come to NYU Langone for the best clinical care, but they also see the value of helping to advance research," says medical oncologist Iman Osman, MD, professor in the Ronald O. Perelman Department of Dermatology.

While Dr. Osman aims to grow the CBRD's collection of patient samples to more than 10,000 within five years, she believes donors may benefit much sooner than that in terms of their own care. "We are talking about the near future," she says. So if a patient has cancer surgery, donates tissue from the excised tumor, and then has a recurrence in a couple of years, "the research that will be done with their specimen can potentially help us offer a better treatment."

A Balancing Act

May 16, 2018
8:56 a.m.

When Amanda PeBenito, MD ('18), strode across the stage of Alice Tully Hall at graduation with her daughter, Carmen, it occurred to her that only nine months earlier, she wore a different sort of gown and had another reason to celebrate. While examining a patient, Amanda went into labor. So she calmly traded her white coat for a hospital robe, and soon gave birth to her first child. Dr. PeBenito's pregnancy coincided with her Honors Program research under the tutelage of Martin Blaser, MD, the Muriel G. and George W. Singer Professor of Translational Medicine. The first physician in her family, Dr. PeBenito recently began a residency in internal medicine at Massachusetts General Hospital and has her sights set on a fellowship in gastroenterology. "My husband and I wanted to start a family before my residency," Dr. PeBenito says. "I was crazy busy, but you can make anything work if you really want to."

Photograph by **Joshua Bright**

Quote

"Recognizing that design can profoundly influence the patient experience and even improve health outcomes, our team focused on creating warm and welcoming environments, where patients can find comfort and draw inspiration from their surroundings."

Vicki Match Suna, AIA, senior vice president and vice dean for Real Estate Development and Facilities at NYU Langone Health, on planning and building the new Helen L. and Martin S. Kimmel Pavilion and Hassenfeld Children's Hospital, the first inpatient facility in New York City to offer exclusively private rooms. Its opening in June caps a sweeping, decade-long revitalization project to secure NYU Langone Health's position at the forefront of academic medicine.

Yes, We Cannabidiol

For the first time, researchers show that a standardized marijuana extract reduces seizures in a treatment-resistant form of epilepsy.

By Kenneth Miller

Five years ago, media reports surfaced of a home remedy that could quell seizures in children with severe epilepsy. The reputed "miracle drug" was a tincture of marijuana, made from a strain high in cannabidiol—the plant's main nonpsychoactive chemical component—and low in intoxicating tetrahydrocannabinol (THC). "The father of a little boy I treated, who was responding poorly to medication, asked me whether this stuff worked," recalls Orrin Devinsky, MD, professor of neurology, neurosurgery, and psychiatry, and director of NYU Langone Health's Comprehensive Epilepsy Center. "Unfortunately, I couldn't say." One of the country's leading epilepsy researchers, Dr. Devinsky knew that conventional anticonvulsants failed many patients: 30% continued to have seizures even when taking multiple drugs, and the side effects were often brutal. Anecdotal evidence and animal studies suggested that cannabidiol might be an effective alternative. But no one had clinically tested it.

"The father of a little boy I treated, who was responding poorly to medication, asked me whether this stuff worked. Unfortunately, I couldn't say."

ORRIN DEVINSKY, MD

Dr. Devinsky set out to change that. After completing the exhaustive permitting process for researching a federally restricted substance (and installing the required heavyweight safe to store it in), he worked with GW Pharmaceuticals, a British manufacturer of cannabis-based medications to test a standardized extract. In May 2017, he and his team published the first double-blind, placebo-controlled study of cannabidiol's effects on patients with epilepsy in *The New England Journal of Medicine*. Although the results weren't miraculous, they clearly demonstrated that the drug is an effective and valuable new weapon against this group of brain disorders.

The researchers gave cannabidiol or a placebo along with standard medications to 120 children and young adults with Dravet syndrome—a rare, treatment-resistant form of epilepsy characterized by seizures so frequent and prolonged that they lead to developmental and cognitive delays. Nearly a quarter of patients die by age 20. After 14 weeks, 43% of subjects in the cannabidiol group showed at least a 50% reduction in the frequency of convulsive seizures, compared to 27% in the placebo group; 5% of subjects on

KARSTEN MORAN

Illustration by **Jason Holley**

cannabidiol (versus none on placebo) became seizure-free. Most patients experienced mild to moderate side effects with cannabidiol, but only eight had reactions serious enough to make them discontinue the treatment. "Some children who haven't responded to other medications do exceptionally well on this drug," says Dr. Devinsky, "and its safety profile compares favorably with anticonvulsants already on the market."

Unlike THC, cannabidiol produces no high and has no addictive properties. Forty-four states have legalized its use, yet the US Drug Enforcement Administration still classifies all marijuana derivatives—along with the plant itself—as Schedule I controlled substances, equivalent to heroin and LSD. Besides putting providers at risk of prosecution, the classification forces researchers to navigate daunting regulatory hurdles. As a result, Dr. Devinsky observes, other countries are ahead of the US in exploring the therapeutic potential of cannabidiol and the other 80-odd cannabinoids that constitute marijuana's active ingredients. In recent years, the American Medical Association and more than 30 other mainstream medical groups have asked the government to consider reclassification.

The growing evidence of cannabidiol's potential may hasten such a change, at least for this particular compound. This past May, Dr. Devinsky published the results for another randomized trial of cannabidiol in a second form of severe epilepsy, Lennox-Gastaut syndrome, that show benefits similar to those for Dravet. A month later, the FDA approved the extract, branded as Epidiolex, to treat both of these syndromes.

Cannabidiol also shows promise, Dr. Devinsky notes, for treating other neurological, psychiatric, and medical ailments, ranging from Parkinson's disease to post-traumatic stress disorder. As for the boy who inspired his investigation, he adds, "Cannabidiol hasn't controlled his seizures completely, but he's doing much better. And his parents want this medication to be available to other kids with uncontrolled epilepsy."

THE ART OF REBUILDING EARS

A long-standing collaboration between a plastic surgeon and a tissue engineer makes 3-D printing of surgical models for ear reconstruction seamless and affordable. **By Nicole Dyer**

DURING HIS LONG CAREER AS A PLASTIC SURGEON, Roberto Flores, MD, has reconstructed more than 40 ears—some for children born without them, others for people who have lost ears to trauma or disease. The procedure, commonly performed in two stages, is considered one of the most challenging in the field. Surprisingly, the part surgeons find most formidable has nothing to do with surgery, Dr. Flores says. Rather, it's the artful, painstaking sculpture required to transform cartilage carved from the patient's rib cage into the intricate shape of an ear. "We all know what an ear looks like, but try to reproduce it," notes Dr. Flores, the Joseph G. McCarthy Associate Professor of Reconstructive Plastic Surgery in the Hansjörg Wyss Department of Plastic Surgery at NYU Langone Health. "We're using true artist techniques that can take a lifetime to perfect."

Surgeons whittle strips of cartilage using only a crude outline of the patient's healthy ear as a guide. Last year, feeling frustrated about the rudimentary reproduction one of these drawings offered, Dr. Flores thought of a better way. He was already collaborating with tissue engineers at NYU College of Dentistry on a federally funded project to create 3-D–printed bone replacements to help heal skull and jaw defects in children. Why not use those same resources to print 3-D replicas of patients' ears as visual guides, he thought.

It seemed like such a commonsense idea, but when Dr. Flores combed the scientific literature for information about 3-D surgical models for ear reconstructions, he found nothing. "It was so hard to believe that in 2018 a pencil drawing would be standard-of-care practice for one of the most difficult technical procedures in plastic surgery," he says. One barrier, he realized, was the expense of 3-D printing. If outsourced to a commercial printer, such models could cost up to $3,000. "It would come out of the patient's pocket one way or another," he notes. An additional challenge was the time and expertise required to generate and manipulate the digital models, and then sterilize them for the procedure.

For Dr. Flores, it was a matter of tapping his friend and colleague, tissue engineer Paulo G. Coelho, DDS, PhD, whose expansive team of researchers possessed all the necessary hardware and skills to print the models on demand. "It's actually very

easy for us," says Dr. Coelho, the Leonard I. Linkow Professor of Biomaterials and Biomimetics at NYU College of Dentistry and professor in the Hansjörg Wyss Department of Plastic Surgery. The only real expense would be the "ink," a sugar-like filament also used in dissolvable stitches. Total cost per ear: less than a dollar.

Since they began collaborating over a year ago, Dr. Flores has used 3-D–printed models for several ear reconstructions, including a recent case in which the patient's ear was mauled by a dog. "The 3-D models reveal the complicated contours of the ear so much better than the drawings," says Dr. Flores. "They eliminate much of the guesswork that goes into the reconstruction, and ultimately result in more efficient and precise outcomes."

For Dr. Coelho's part, his team can produce models within 24 hours. They upload a 3-D photograph of the patient's unaffected ear, and then use software to create digital templates of the five different cartilage structures Dr. Flores will model during the surgery. The printing and sterilization process can take 14 hours, but most of it is automated. "You can press print and walk away," notes Dr. Coelho.

The models have been so successful that Dr. Flores has begun using them in his cosmetic surgery practice, both as visual references during surgery and as props during patient consults. "With a model of the patient's nose, you can say, 'This is our goal,' " Dr. Flores says. "And the patient can say, 'I like that' or 'I don't like this.' "

Dr. Flores is eager to share his knowledge of 3-D printing and the collaboration that made it possible. He's presented his technique at conferences nationwide and published two papers about it in peer-reviewed journals. "I predict that 3-D printing will change the way plastic surgery of the face is performed," he says. "My message is that it's not about the technology. It's about bringing together the right kind of people."

ARTIFACT

The Mission of a Medical School—Then and Now

"MEDICAL KNOWLEDGE IS advancing at an almost unprecedented speed."

"A large fraction of the population still fails to reap the full benefits that medicine has to offer."

"Medical education is too long and too expensive."

True statements all—and as accurate today as when they appeared 73 years ago in *The Mission of a Medical School*, a prospectus issued in 1945 by New York University College of Medicine and University Hospital, the precursors of NYU School of Medicine and NYU Langone Health. The 104-page booklet is one of several items found inside a time capsule uncovered last August when construction workers happened upon a rectangular metal container, not much larger than a shoe box, buried in the cornerstone of the Medical Science Building. Back in 1952, the structure—currently under renovation—was part of a master plan for a new medical campus to replace the one previously housed in buildings just south along First Avenue. At the cornerstone ceremony on November 7 of that year, the keynote speaker was Robert Moses, master builder of mid-20th-century New York.

The time capsule, fashioned from sheets of lead-painted copper soldered together, contained an assortment of other artifacts: a list of the 143 members of the incoming class; a reproduction of the 1837 letter requesting the establishment of NYU Medical College; vials of animal proteins; and a copy of *The New York Times* from November 5, 1952, bearing the page-one headline "Eisenhower Wins in a Landslide."

Of all the wisdom preserved in the prospectus that still holds true seven decades later, perhaps none is more enduring than this sentence from its introduction: "Medical schools are the ultimate guardians of the health of the community." **THOMAS RANIERI**

DEVIN JARVIS

Separation of the Sexes

A new study of neural circuits in mice may help explain why males tend to be more sexually aggressive than females.

By Karen Hopkin

We've all heard the cliché: men and women are "wired" differently. Now, researchers at NYU School of Medicine have discovered that there may be some truth to it. In a study published in *Nature Neuroscience*, a team led by Dayu Lin, PhD, associate professor of psychiatry and neuroscience and physiology at NYU Langone Health's Neuroscience Institute, has found that the cells that control aggression and sexual behaviors in mice are sexually dimorphic—that is, they look different in males and females.

Dr. Lin has been studying the neurobiology of aggression for a decade. In a study published in *Nature* in 2011, she and her colleagues showed that in male mice, the seat of aggression lies within the hypothalamus, a structure that regulates essential bodily functions such as hunger and sleep. When the researchers activated this aggression center, located along the underside of the hypothalamus in a region called the ventromedial hypothalamus (VMHvl), they could induce a male mouse to attack another animal, or even an inflated rubber glove.

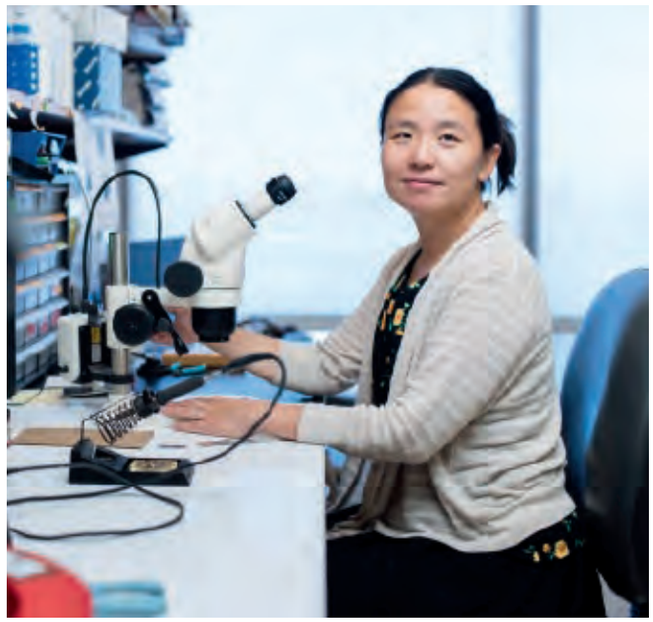
But what happens with females? "I get that question whenever I give talks," says Dr. Lin. Evidence suggested that the same cellular circuit did not provoke confrontations in females. "But those studies focused on male mice, and females were just kind of tested on the side," notes Dr. Lin. "The conditions weren't optimized for studying female aggression."

So Dr. Lin and her colleagues identified a mouse strain, called Swiss Webster, in which the females are more prone to pounce, especially when lactating. "They basically attack anybody that comes into their cage," notes Dr. Lin.

With the right mouse model, the scientists then set out to identify the cells that drive female mice to fight. First, using molecular markers and advanced recording techniques to track cell activation in real time, they located a set of neurons in the VMHvl that are switched on when females respond aggressively to an intruder, either a juvenile or—in the case of the mama mice—just about anyone. "As long as the female attacks," Lin says, "activity in this brain region goes up."

Further, the researchers could incite or subdue the animals by manipulating the activity of these cells: temporarily shutting the cells down eliminated pugilistic behavior, while artificially exciting them precipitated an assault.

"The conditions weren't optimized for studying female aggression," says neurobiologist Dayu Lin, PhD.



So, like males, females receive violent impulses from VMHvl. But that's where the wiring gets interesting. In previous studies, scientists had linked this region to female sexual behavior. That made Dr. Lin wonder: Do the same cells control both mating and mauling? Again, Dr. Lin and her lab painstakingly tracked exactly which cells become active when females are exposed to objects of affection or targets of aggression. The results were crystal clear: individual cells in the region respond to one condition or the other—but never to both. "We were quite surprised by how clearly these two cell populations segregate from each other," says Dr. Lin.

Cells activated by aggressive altercations are concentrated in the central part of the female VMHvl, while those that respond to romance line its outer edges. In addition to their distinctive location, these cells also express different genes and connect with different neurons—producing parallel circuits that control different social functions.

Male mice show no such separation. Instead, cells in the male VMHvl involved with mating are mixed with those that mediate aggression "like salt and pepper," says Dr. Lin. "Some individual cells will even respond to both." That distinction is something we need to know, says Dr. Lin, if we hope to develop interventions that will suppress unwanted behaviors while leaving other social interactions intact.

Illustration by **Brian Stauffer**

Healing Mind and Body

In a bustling Brooklyn clinic, primary care and behavioral health merge.

By David Freedman

During the past four years, more than 500 patients at a Brooklyn clinic have filled out a questionnaire intended to screen for common health conditions and risks such as diabetes and smoking.

That may sound as routine as it gets in terms of a healthcare visit. But, in fact, that questionnaire is part of an innovation that aims to bridge the mind-body divide in healthcare. It's taking shape in a southwest Brooklyn clinic called Sunset Terrace Family Health Center at NYU Langone that integrates mental health and primary care—often in the same day—for a large percentage of its patients.

Sunset Terrace—one of the 10 clinics that make up the Brooklyn-based Family Health Centers at NYU Langone—annually cares for some 3,000 patients who grapple with serious mental health problems. As is standard practice in the mental health field, patients at Sunset Terrace had always been referred to one of the other nine clinics, or to another healthcare facility, for primary care. But that traditional division between mental and physical healthcare sometimes poorly serves patients' need for coordinated care, notes Jon Marrelli, PsyD, NYU Langone Health's program manager for behavioral health and primary care integration. "It's well known that patients with serious mental health challenges die on average 15 to 25 years earlier, largely due to preventable reasons," says Dr. Marrelli. "General health and mental health can interact with and reinforce one another, so a care plan should take both into account."

One big challenge with referring mental health patients to a different facility for primary care screening and treatment is that often these patients simply don't follow up, explains Dr. Marrelli, whether because transportation is a problem, or because patients fail to prioritize a health checkup. Even if they do make it to a primary care clinic, he adds, they may have difficulty following the prescribed treatment plan. "It's hard enough for those without mental illness to quit smoking, lose weight, or manage diabetes," he says. "If you overlay depression or schizophrenia on those challenges, the barriers are much higher."

Aided by a four-year, $1.7 million grant in 2014 from the Federal Substance Abuse and Mental Health Services Administration, Sunset Terrace has tried to bridge the gap by establishing the Sunset Terrace Integration and Recovery (STIR) program. STIR zeroed in on smoking cessation, healthy eating, and diabetes—three very common health challenges among patients at the clinic, according to Dr.

Illustration by **Josh Cochran**

Marrelli, who directs the STIR program. "The goal is to use assessment tools to gain insights into the primary health issues patients need help with, and then to incorporate those issues into an overall treatment plan," he says. "Everything is tailored to achieving measurable improvements over a 12-month period."

To help patients meet their STIR health goals, Sunset Terrace brought in a nurse practitioner, a medical assistant, and a smoking-cessation specialist to supplement its mental health staff. Patients who enter the year-long STIR program are given an initial assessment that includes the questionnaire and measurements such as weight, waist circumference, blood sugar, and a lipids panel. Services include health-literacy classes and support groups aimed at improving nutrition, coping with diabetes, and sleep hygiene, among other health-related self-management skills. The patients are reassessed after 6 months, and then for a final time at 12 months.

By the time the STIR grant ends this fall, Dr. Marrelli expects the program will have served around 600 patients. Outcomes for the nearly 300 patients who had already completed their year-long participation as of April have been impressive overall. "Not everyone improves," he says, "but most have made tremendous strides." About half the graduates improved their lipids profiles, for example, and about 20% of the patients with high blood pressure reversed that diagnosis by the end of the year. More than half of the patients self-reported positive outcomes for 10 out of 12 behavioral and everyday-functioning indicators, including psychological distress, overall health, and a sense of social connection.

The integrated approach is likely to remain in place at Sunset Terrace and may be supported by new grants. In fact, the push to integrate behavioral health and primary care is starting to broaden within NYU Langone overall, according to Larry McReynolds, executive director of Family Health Centers. That includes not only a push to have behavioral health facilities add primary care, says McReynolds, but also to have primary care facilities integrate behavioral health. "To truly improve the health of populations and communities, medical providers have to be able to bring behavioral healthcare into all settings," he says. "Patients shouldn't have to go to a different location to get it."

In that sense, the STIR program's impact seems destined to go well beyond the 600 patients it will have directly served.

A Discovery So Big No One Could See It

An NYU School of Medicine pathologist uncovers a potential new organ, making international headlines and setting off a fiery debate about its implications for medicine.

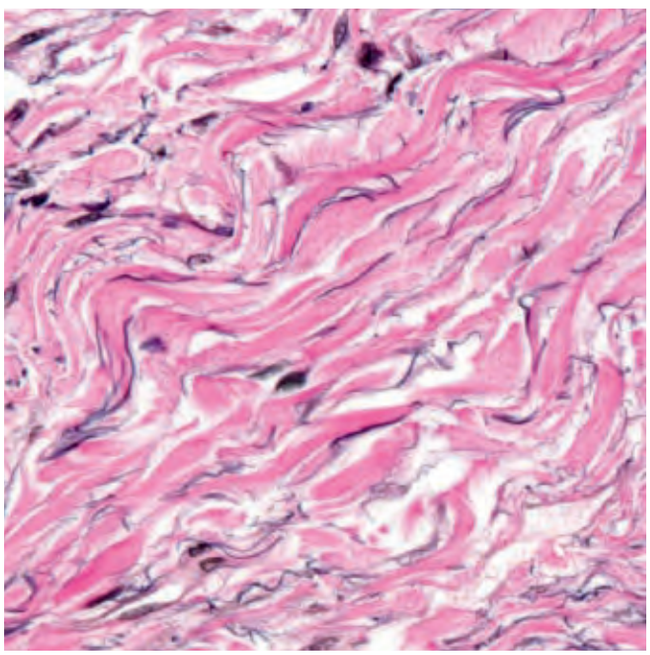
By David Sparrow

In March, when Neil D. Theise, MD, published a study in *Scientific Reports* promoting an unsung network of fluid-filled compartments beneath the skin—known collectively as the interstitium—as a full-fledged human organ, he knew he was onto something big. He just didn't know how big. The report was greeted by 2,400 news articles, nearly 3.8 billion online views, and no small bit of controversy, as scientists continue to debate the implications of his discovery. For his part, Dr. Theise, professor of pathology, is more interested in uncovering the intricacies and implications of what would, if accepted by scientific consensus, be the human body's 80th organ.

There's debate over whether the interstitium, long thought to be mere connective tissue, qualifies as an organ. What's your take?
There's no governing body that says, "Yes, this meets the definition of an organ." It's how the collective community treats it over time. But to me there's no doubt it's an organ. The interstitium is large and present in many places: beneath the skin, in the lining of all the visceral organs, in the fascia between all muscles, and in the connective tissue around every artery and vein. Wherever you examine it, the structure is unitary and unique, which is one qualification for being an organ.

Another qualification is that it serves a unique and critical function. We strongly believe it has a shock-absorber effect that protects tissue from the constant movement of organs, like peristalsis in the digestive tract. No one seems to have questioned why this dense connective tissue around the body doesn't wear down and tear over time. But that's because it's not stiff—it's fluid-filled space that's compressible.

What has surprised you most about the scientific community's response?
I knew there would be pushback and criticism because that comes with anything that changes paradigms. We're an interdisciplinary research team, so far including endoscopists, a hepatologist who is also a cell and molecular biologist, and a pathologist. We came in from left field, and naturally those who are in the fascia world or the interstitial world say, "Who are you to say we missed all of this stuff?" I would have the same resistance if someone from neuropathology made a liver discovery that upended my assumptions.



Pathologist Neil D. Theise, MD, at right, in the new Science Building, describes the interstitium (below) as a "shock absorber" that pads organs, tissue, and blood vessels.

Despite the study's significance, scientific publishers weren't breaking down your lab door to publish it, were they?
We sent it to all the top biomedical journals. None of them even reviewed it because they didn't think it would be of interest to their audience. Well, it turns out they were wrong. Every time we got a rejection letter, I thought, "We're onto something so big they can't see it."

How have you handled the massive response?
The media explosion kept me very busy. I experienced four days of fame, and now it's over—and that's a relief. The more important thing is that we suddenly have these relationships with physicians and scientists around the world who are picking up on this new understanding of the interstitium and running with it. We have to adjust to the idea that we're not going to be able to do all the work on this project, and pretty soon we won't even be able to keep up. The baby is up and walking.

Could the interstitium lead to new categories of disease diagnosis?
Absolutely. Patients have been emailing me saying, "I have a very rare, unclassifiable disease, and I think what is diseased is what you've discovered." The condition that's popped up the most is fibromyalgia. Scientists can't

Photograph by **Sasha Nialla**

even agree on whether it's a single physiological disease. Maybe the reason why fibromyalgia has been opaque is because we haven't recognized the compartment of the body that's affected.

If this organ is present in every tissue and other organ the way the cardiovascular and lymphatic systems are, then we have an incomplete understanding of the entire body. This is basic anatomy, basic physiology. I don't think there's anything that doesn't get changed by this.

You made this finding with technology that allows you to observe living cells instead of studying dead cells fixed on a slide. Does this approach have broader implications for other parts of the body?

Everything we know about the body is a reflection of the methods we use to examine it. I had been looking at the interstitium for 30 years and never really noticed it before. The history of microanatomy is that first we simply looked through a microscope without any special preparation techniques. Then, we learned to fix tissues in formaldehyde and to stain them to highlight molecules or structures. Now, we're viewing living tissue at the microscopic level, which has enabled us to stumble onto this.

Scientists tend to look at certain aspects of the human body as being inert. But the body is an ecosystem, not a machine. Nothing is without a biological purpose, and you can't change one piece without everything else changing. It's all interwoven.

Inside Our Digital Transformation

NYU Langone's new Kimmel Pavilion and Hassenfeld Children's Hospital push the boundaries of integrated technology, setting a new standard for patient-centered care.

BY DAVID FREEDMAN

RENDERING BY ENNEAD

We broke ground

on the new Helen L. and Martin S. Kimmel Pavilion and Hassenfeld Children's Hospital in February 2014. But in a sense, the foundation for the building—one of the most technologically integrated and digitally sophisticated inpatient facilities in the country—was laid a decade ago. As part of NYU Langone Health's sweeping Campus Transformation plan, the information technology for the entire institution had to be reimagined and redesigned. NYU Langone has invested more than $400 million in a host of IT initiatives and systems. "These new facilities are linchpins of our broader transformation," notes Vicki Match Suna, AIA, senior vice president and vice dean for Real Estate Development and Facilities. "Their design has enabled us to introduce innovative digital technologies that provide the safest, most advanced, and most compassionate patient-centered care." Many of these projects—including NYU Langone's electronic medical record system, Epic—were implemented well in advance of Kimmel's debut. They modernize and streamline many patient-related activities previously performed in person or on paper.

As a new facility, the Kimmel Pavilion and Hassenfeld Children's Hospital provided a blank slate for devising fresh ways to enhance patient-centered care. "All of these digital devices talk to each other," explains Nader Mherabi, senior vice president, vice dean, and chief information officer *(at right)*. The result is a truly digital inpatient experience. "The idea is to support physicians and nurses with real-time data at the bedside, as well as their connections with other clinicians across NYU Langone and the entire health system," adds Paul Testa, MD, chief medical information officer and a member of the technology leadership team.

These innovations were developed with input from clinicians and patients. They span a range of applications—from pocket-size workstations for caregivers, to robots that transport meals and linens, to surgical navigation displays in the OR. But what they share in common, notes Mherabi, is their value to patients, their families, and caregivers. "Our goal was to push the boundaries of the digital frontier," says Mherabi. "But we've been very careful not to implement technology for technology's sake. Every decision was guided by what's right and best for the people we serve. We're empowering patients with personalized, convenient, state-of-the-art tools that enhance their hospital experience before, during, and after their stay."

JEFF GOLDBERG/ESTO

If This Wall Could Talk—and It Does

Even its name—MyWall—speaks volumes about the digital communications hub that's integral to every patient room in the Kimmel Pavilion and Hassenfeld Children's Hospital. The full-service electronic system empowers patients by allowing them to customize their personal space. From a bedside tablet or remote control, the patient commands the content of a 75-inch-wide high-resolution monitor. MyWall offers an impressive array of conveniences and amenities, introduced to new patients upon arrival in a welcome video. At the touch of a screen or button, patients can get to know their care team, review test results with physicians, ask questions about their treatment plan, view educational videos, and order meals according to the prescribed diet. They can also transcend the confines of a hospital room by Skyping with family and friends, surfing the web, and watching TV or movies. MyWall gives patients a say in their environment, allowing them to adjust the room's temperature, lighting, and window shades to their own preferences. They can further enhance the ambience by displaying digital artwork or uploading personal photos. In children's rooms, a video game player with parental controls is integrated into the system.

AUTOMATING THE LEGWORK

Patients may never glimpse the mobile robots that roam the service corridors, but these behind-the-scenes utility-cabinets-on-wheels will benefit them in unseen ways. A fleet of 31 autonomous robots transports linens, supplies, and meal trays; removes medical waste; and delivers medications to pharmacy hubs on each patient floor, freeing up staff and caregivers to focus on the needs of patients. The robots use lasers to build a detailed 3-D map of their environment, and infrared and ultrasonic sensors to avoid collisions. As they navigate hallways, they communicate via Wi-Fi with elevators and automatic doors, as well as passersby. The well-mannered machines cede the right of way to human coworkers, announce their arrival, and issue a warning before backing up. On a weekly basis, each robot traverses many miles, sparing the staff lots of time and legwork.

Smarter, Safer Bed Rest

Most hospital beds are adjustable, but some modifications, such as lowering the bedrails or elevating parts of the bed at a steep incline, can be harmful to patients who are at risk for falls or whose range of motion is restricted by wounds, back injuries, or other medical issues. The new iBed system addresses these concerns with a host of sophisticated electronic features that enhance patient safety and comfort. Communicating wirelessly with Epic, NYU Langone's electronic health record system, the iBed conforms to prescribed guidelines for the patient's risks and restrictions. In addition to automatically measuring the patient's weight, the iBed issues critical alerts, notifying caregivers when patients leave their bed and when it's time to reposition them to help prevent pressure sores or ventilator-associated pneumonia.

CLOCKWISE: ANDREW NEARY; JEFF GOLDBERG/ESTO; SEAN AIRHART/NBBJ; JULIANA THOMAS

A Personalized Micropharmacy

Managing and distributing medications to hundreds of patients who are on multiple prescriptions that may change over time is one of the most daunting challenges—and most critical responsibilities—for any hospital. NYU Langone makes this process faster, safer, and more efficient with the use of the digital medication drawer, the first technology of its kind implemented at any hospital in the US. This medication storage system syncs prescriptions and dosages with the patient's electronic medical record, customizing and updating its inventory. A kind of micropharmacy, the digital medication drawer is located just outside every patient's room. Nurses access the locked system by using a fingerprint scanner, and use another scanner to read the unique barcode assigned to each patient—the same one that appears on the patient's hospital- issued wristband. As medications are stocked, retrieved, and administered, they are checked and rechecked to ensure that the right ones reach the right patient at the right time.

MRI in the OR

During an operation, images from an MRI can provide the surgeon with critical information, confirming the success of the procedure in real time, indicating where additional surgery is needed, or even changing the course of the operation. Obtaining that information, however, would require the patient to be transported to the nonsterile environment of a radiology suite, raising the risk of infection and extending the length of the operation. At the Kimmel Pavilion and Hassenfeld Children's Hospital, MRI equipment is available in the OR itself, where it can be positioned around the patient and the surgical bed. Called intraoperative MRI, or iMRI, this technology is particularly valuable to neurosurgeons because it enables them to differentiate tumor tissue from normal tissue, minimize disturbance of critical regions, and make adjustments to their approach without moving the patient.

A Handheld Workstation

The stream of patient-related information that doctors and nurses must navigate as they move from patient to patient within a hospital is not only enormous, but virtually continuous. An iPhone is a valuable resource for managing the flow, and NYU Langone has designed a suite of innovative applications that bring the device to another level. The Clinical Mobile Companion, installed on 2,600 iPhones, incorporates a unique set of tools that enable the patient's care team to stay on top of urgent developments. From the palms of their hands, nurses can access the patient's medical record, monitor vital signs, review lab results, send secure text messages, receive alerts from patient-monitoring devices, and scan identification barcodes on medication containers and wristbands. The augmented iPhones are equipped with long-life batteries to ensure all-day service.

ANDREW NEARY

VISUALS GIVE SURGEONS A BETTER VIEW

To help surgeons plan a procedure, monitor its progress, and modify their approach in response to changing situations, ORs are typically equipped with numerous display screens. So much clinical and visual data bombards the surgical team, however, that unless it's integrated, it can be difficult to obtain a high-level overview of the patient's status and the procedure in progress. Enter the OR Audio Visual Management System, a centralized information hub installed in the pavilion's 30 operating rooms and image-guided labs. The system gathers a wealth of critical information and images, and displays it on as many as eight large monitors. The largest ones help the surgeon visualize, navigate, and evaluate even the most complex procedures in real time. The surgeon can call up multiple live video feeds from a variety of imaging equipment, and can record, enhance, and interact with the images. The system can also draw information from the patient's electronic medical record and allow the surgeon to video-consult directly with a pathologist. Even before an operation begins, the system goes to work, projecting soothing nature scenes on the monitors before anesthesia is administered to the patient.

Clinical Snapshots of Critical Patients

When a nurse or physician checks on a patient in a critical care unit, getting up to speed on the patient's status can take time away from interacting with the patient and their family. To make the most of a caregiver's time, each of the 170 patient rooms devoted to critical care at the Kimmel Pavilion and Hassenfeld Children's Hospital is equipped with a 42-inch-wide wall-mounted touchscreen monitor that provides an instant overview of the patient's current condition. A physician or nurse can bring up real-time data about the patient, viewing it in greater depth or over a longer time frame if desired. On the same high-resolution touchscreen, the care team can also huddle together and review radiology images.

THE AMAZING EIGHT

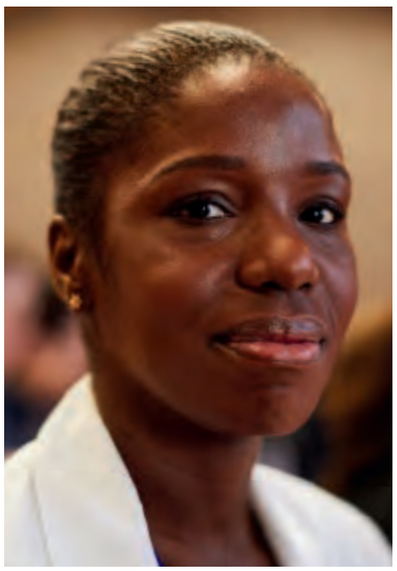
BY LISA DAVIS

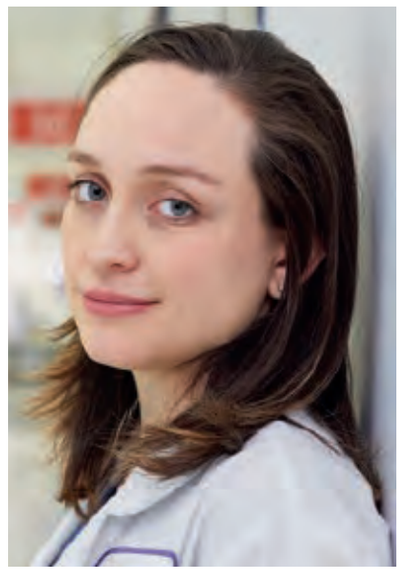
PHOTOGRAPHS BY JONATHAN KOZOWYK




MANY MILESTONES ARE OVERSTATED. This one is simply overdue: For the first time in NYU School of Medicine's history, the entire group of chief residents in the Department of Surgery—eight in all—are women. "This historic class reflects a slow but inexorable change in our nation's attitude about which fields in medical science women can pursue," says H. Leon Pachter, MD, the George David Stewart Professor of Surgery and chair of the Department of Surgery.

Nationwide, the percentage of female surgeons has inched up from 12% in 1980 to 19% today. NYU School of Medicine is committed to doing better. The School has a long tradition of nurturing women in science and medicine—women have been on the faculty since 1891 and enrolled as students since 1919—but this latest landmark isn't about any single institutional initiative. Rather, it's a reflection of the skill, drive, and commitment of these eight young surgeons, who will soon make their mark in a variety of surgical subspecialties and settings. "We appointed the most qualified, competent people for these positions," says Dr. Pachter. "It's about merit, not gender."



MIA SHAPIRO, MD

MINIMALLY INVASIVE SURGERY

Frogs and therapists—those might be the main reasons Mia Shapiro, MD, went into medicine. The frogs lived in the pond on her family's 25-acre property in upstate New York, where Dr. Shapiro spent hours catching and studying tadpoles. Her parents were psychotherapists who dedicated their lives to helping others. They taught Dr. Shapiro that her career should include some form of service. "Medicine felt like the right fit," she says. "I could use my love of science and still help people."

After majoring in biology at Oberlin College, Dr. Shapiro did research in cardiology—the specialty she thought she'd choose—at the University of California, San Francisco. She then attended Albert Einstein College of Medicine, where she began to see herself as a surgeon. "I've always liked working with my hands, doing photography and painting," she says. "Surgery allows me to be a little artistic, not just cerebral. As a surgeon, it feels amazing to be able to have such a huge impact on someone's life."

Dr. Shapiro chose NYU Langone Health for her residency in general surgery because of the diversity of New York City and its patient population. "You see a lot of different kinds of pathology, and you treat people from all different cultures and backgrounds," she says. "It gives you a good base to work from in the future."

Her next move is to Providence, Rhode Island, where she'll begin a fellowship in minimally invasive surgery at Brown University.


Bellevue
Bellevue
Bellevue

RACHEL WEBMAN, MD

GENERAL SURGERY

"I was not someone who went to college intending to be pre-med," says Rachel Webman, MD. At Yale, she initially planned to pursue engineering, but after a friend encouraged her to take an EMT course, she realized she could direct her aptitude for math and science toward helping people.

As an undergraduate, Dr. Webman became one of the first volunteers at Yale's free clinic, dedicating herself to working with the uninsured—a population she has continued to serve during her time at NYU School of Medicine. "You're not just helping sick people," she says. "You're helping sick people who might not otherwise get that care."

Dr. Webman chose general surgery as much for its breadth and variety of procedures as for the way it made her feel. "It was the one rotation where, even though I was waking up at 5:00 a.m., I was excited to get to work and see how my patients were doing after an operation," she says.

Surgery is also a portable skill, one she intends to put to good use doing humanitarian work abroad. For now, though, she is seeking a general surgery position in the Northeast. "My life is here, and my family is here," she says.

DONNELE DALEY, MD

SURGICAL ONCOLOGY

"Growing up in Jamaica, I was always interested in medicine," explains Donnele Daley, MD, whose mother was a child psychologist and whose father was an economist. "During holidays and summer breaks, I would volunteer in hospitals, especially children's hospitals." But Dr. Daley was also interested in physics and math, so she ventured to the US, where she felt she had the best opportunity to pursue both passions. She entered a five-year dual-degree program, earning a BS in physics and math at Vassar and a BE in engineering at Dartmouth.

At Dartmouth, Dr. Daley worked with surgeons to reconfigure a device to correct sunken chest in children that was safer and more efficient than existing ones. That experience sparked her interest in surgery. "I realized that I preferred to be the one implanting the devices rather than the one designing them," she says.

She chose Penn State College of Medicine for its bioengineering department within the medical school, then did her residency at NYU Langone, where she conducted research on immunotherapy in solid tumors. "I wanted to train at a place where I could treat patients from a broad range of cultures and develop a deeper understanding of their unique healthcare needs," she explains. "If I decide to go back to Jamaica or practice elsewhere, I want to feel comfortable treating anyone."

For now, Dr. Daley will pursue a fellowship in surgical oncology at Memorial Sloan Kettering Cancer Center, where she'll continue her research in tumor immunology to help identify targets for new cancer drugs.

07:15
A.M.

**TISCH HOSPITAL,
SCHWARTZ AUDITORIUM**

WEEKLY REVIEW OF
SURGICAL CASES

02:30
P.M.

BELLEVUE HOSPITAL
CLINIC

ALEXANDRA H. LEON GUERRERO, MD

MINIMALLY INVASIVE SURGERY

In 1972, Dr. Alexandra Leon Guerrero's grandfather founded the Bank of Guam, a community institution dedicated to helping the people of the Micronesian island. "He instilled the idea of service to the community," says Dr. Leon Guerrero, who was born in San Francisco while her father was finishing his MBA at Stanford, but raised in Guam. "That's something I've always valued."

While virtually everyone else in her family works at the bank, Dr. Leon Guerrero knew she wanted to do something different. But what that would be, exactly, remained a mystery until she was an undergraduate at Stanford. While there, two life-altering things happened: she became enchanted by science courses, and her father was diagnosed with a rare form of head and neck cancer. "I spent a lot of time with him and my mom going to doctors, and I became much more interested in medicine," she says.

Dr. Leon Guerrero is headed to the University of Southern California to begin a fellowship in minimally invasive surgery, which she feels is the best way to bring advanced medicine back home. "My long-term goal," she says, "has always been to return to Guam," which suffers from many of the same healthcare deficiencies as rural America. She notes that there are far too few specialists, and only a handful of surgeons, to serve the island's 160,000 residents. Her training will allow her to perform advanced laparoscopic surgeries as well as much-needed endoscopies and colonoscopies—procedures performed by gastroenterologists in the US but often by general surgeons in underserved areas. "My expertise will help me bring a new standard of care to Guam," she says. "I really love operating, and what better place to do that than in a community where I care about making a difference."

09:15
A.M.

BELLEVUE HOSPITAL

SURGICAL INTENSIVE CARE UNIT

(WITH ZACHARY BORAT, MD, A RESIDENT IN PLASTIC SURGERY AT NYU LANGONE)

GABRIELA GARCIA NORES, MD

PLASTIC SURGERY

Back in high school, Gabriela Garcia Nores, MD, spent summer vacations shadowing her two uncles, both orthopedic surgeons, in Buenos Aires and Córdoba, Argentina. “I remember watching one of my uncles reconstruct a hip,” says Dr. Garcia Nores. “It changed the patient’s life.” It changed hers, too.

Dr. Garcia Nores, who was born in Peru but spent most of her childhood in France due to political unrest in her native country, learned the value of civic engagement from her mother, founder and president of Instituto Trabajo y Familia, an organization that seeks to improve the living conditions of Peruvian families living at high elevation. During med school in Lima, Dr. Garcia Nores volunteered for surgical missions around the country, traveling to remote areas with virtually no medical care.

“I had the opportunity to meet and learn from wonderful medical professionals from all over the world,” she says. Her work with Smile Train and Smile Network, which provide facial reconstructive surgeries to people in the developing world, was particularly inspiring. “That’s where I began to see the transformative power of reconstructive plastic surgery.”

Dr. Garcia Nores hopes to return to Peru someday to launch a reconstructive plastic surgery clinic in Lima, where there’s little surgical training in the field, and nearly all plastic surgeons work in private practice, focusing on more lucrative cosmetic procedures. “Having seen the wonderful potential of reconstructive surgery, I want to be able to provide those options to Peruvian patients,” she says. But first, she’s off to a plastic surgery fellowship at Emory University in Atlanta.

08:55
A.M.

TISCH HOSPITAL

SIXTH-FLOOR OR

(WITH H. LEON PACHTER, MD, THE GEORGE DAVID STEWART PROFESSOR OF SURGERY AND CHAIR OF THE DEPARTMENT OF SURGERY)

MEGAN JENKINS, MD

MINIMALLY INVASIVE SURGERY

Growing up in a small town in central New York State, Megan Jenkins, MD, had two dreams: becoming a doctor and living in the Big Apple. "I yearned for the hustle and bustle of the city," she says.

She's achieved both at NYU School of Medicine. What changed was her specialty. "I always thought I'd go into pediatrics," says Dr. Jenkins, who idolized her own pediatrician. But during medical school, she fell in love with the fast pace and excitement of surgery. "There's very little downtime," she says. "Decisions are made very quickly, and your day is full of action."

She was also drawn to the collaborative spirit. "Surgery, more than any other specialty, is very team oriented," she says. "You work with circulating nurses and techs and anesthesiologists. It's very dynamic."

Minimally invasive surgery, with its sophisticated tools, seemed like a natural outgrowth of the engineering classes she took at the University of Rochester, where she majored in biochemistry. Dr. Jenkins will go on to a fellowship at Hackensack Meridian Health in New Jersey.

IRIS LIM, MD

PEDIATRIC COLORECTAL SURGERY

Irene Isabel Lim, MD—"Iris" to friends and family—has long understood how to adapt to difficult circumstances. At age six, her family left Quezon City, Philippines, for the suburbs of New York. "We were the first Asian family at my school in Rye," says Dr. Lim. "I was picked on because of that, but it toughened me up." The hurdles Dr. Lim faced as a child gave her a unique perspective on the value of resilience.

But it was another experience that set her on the path toward medicine. When Dr. Lim was eight, her parents learned that Iris's new brother might be born with omphalocele, a rare defect in which the abdominal wall fails to close, exposing the organs. Her brother's condition ultimately resolved in utero, but the ordeal sparked her enduring fascination with surgery.

Dr. Lim majored in engineering at Cornell University and then enrolled at NYU School of Medicine. In July, she began a fellowship in pediatric colorectal surgery at Cincinnati Children's Hospital Medical Center.

Dr. Lim's ultimate goal is to give her career what she calls "an international spin." She recently joined colleagues on a trip to Zambia, where Mary Ann Hopkins, MD, associate professor of surgery and director for global health initiatives, is partnering with the University Teaching Hospital in Lusaka to build an adult trauma registry and create a collaborative research program. The project perfectly unites Dr. Lim's passion for surgery and humanitarian work. "Being able to do surgery is one way of giving back for all that I've been given," she says.

JACLYN CLARK, MD

CRITICAL CARE, TRAUMA, ACUTE-CARE SURGERY

At age three, while most other kids were clinging to stuffed animals, Jaclyn Clark, MD, had her doctor's kit. That was the year her baby cousin was born with brain cancer. "I grew up knowing I was going to be a doctor," says Dr. Clark, from Bergen County, New Jersey. "There was never any other career path I wanted to explore."

In her teens, Dr. Clark worked as an EMT but didn't enjoy it. So she was more surprised than anyone when, after majoring in biology and history at Johns Hopkins University and enrolling at NYU School of Medicine, she ultimately decided to go into critical care, trauma, and acute-care surgery. "Trauma is the last thing I ever thought I'd do," she says, "but I love the adrenaline and knowing how to handle an injury anywhere in the body."

Dr. Clark also likes being the person called in as a last resort—the cool head in an emergency situation. "I can deal with anything that comes my way," she says. It's the ideal mind-set for the next phase of her training, a fellowship at the University of Maryland Medical Center's R Adams Cowley Shock Trauma Center in Baltimore.


10:20
A.M.
BELLEVUE HOSPITAL
TRAUMA BAY
NYU Langone
MEDICAL CENTER

Medical schools have long sought ways to track the performance of their graduates in the real world. Now, NYU School of Medicine is unlocking vast data sets to do just that.

By **David Freedman**
ILLUSTRATIONS BY GARY NEILL

Bridging Medical Education and Patient Care

The ultimate measure of a doctor's medical education

is the quality of care provided to their patients. But how do you connect the two? How do medical educators know when their curriculum is making a positive impact where it matters most: in practice?

These questions have challenged medical school and residency leadership for as long as medical education has existed. At NYU School of Medicine, the curriculum has been revamped numerous times over the years to reflect new insights into how care should be delivered, most recently with the introduction of the Curriculum for the 21st Century, which emphasizes informatics, among other innovations. Residency training, too, has been continually updated at NYU Langone Health.

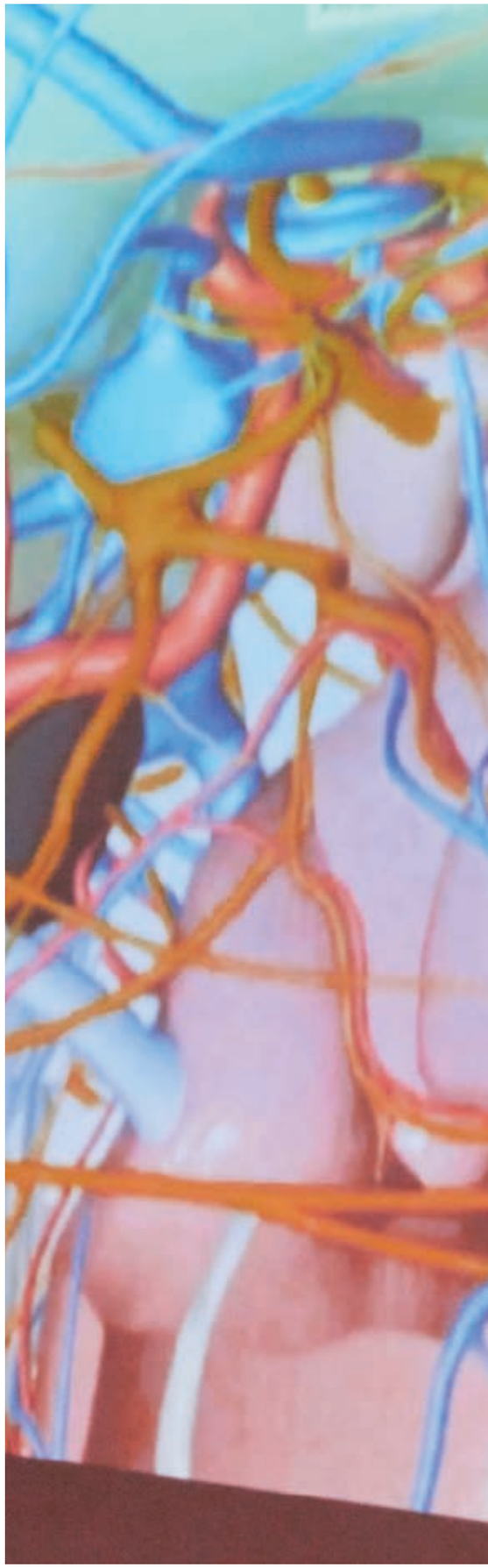
But frustratingly even for highly data-driven institutions such as NYU Langone, confirming which changes in education and training actually translate to better care has been more a matter of judgment than solid numbers. "We do surveys among our graduates, but very little data comes back to us," says Marc M. Triola, MD, NYU School of Medicine's associate dean for educational informatics, and the founding director of the School's Institute for Innovations in Medical Education.

That's about to change. Dr. Triola has been heading up a groundbreaking effort to use big data to bridge the gap between medical education and patient outcomes. "We finally have a trove of data that will enable us to answer some fundamental questions," he says, "and we're going to take full advantage of it."

The turning point came in 2013 when the federal government began granting public access to hundreds of health data sets from the Centers for Medicare and Medicaid Services (CMS). This windfall of information offered valuable insights into myriad facets of patient care, from tests and diagnoses to costs and outcomes—especially when coupled with similar treatment data on non-CMS patients made available by several states, including New York.

Still, there was a hitch when it came to tying that data back to medical school: the government data are linked to physicians not by their names, but by their National Provider Identifier, or NPI, a 10-digit number assigned to every practicing physician. That final piece of the puzzle fell into place for Dr. Triola's team in 2015 when the American Medical Association (AMA) provided access to its database of NPIs, along with a $1 million grant to support the team's work. "We've been wondering for years how changing the way we train physicians can make a difference," says Susan Skochelak, MD, the AMA's group vice president for medical education. "Marc has been wonderful at conceptualizing how big data can help tell us that."

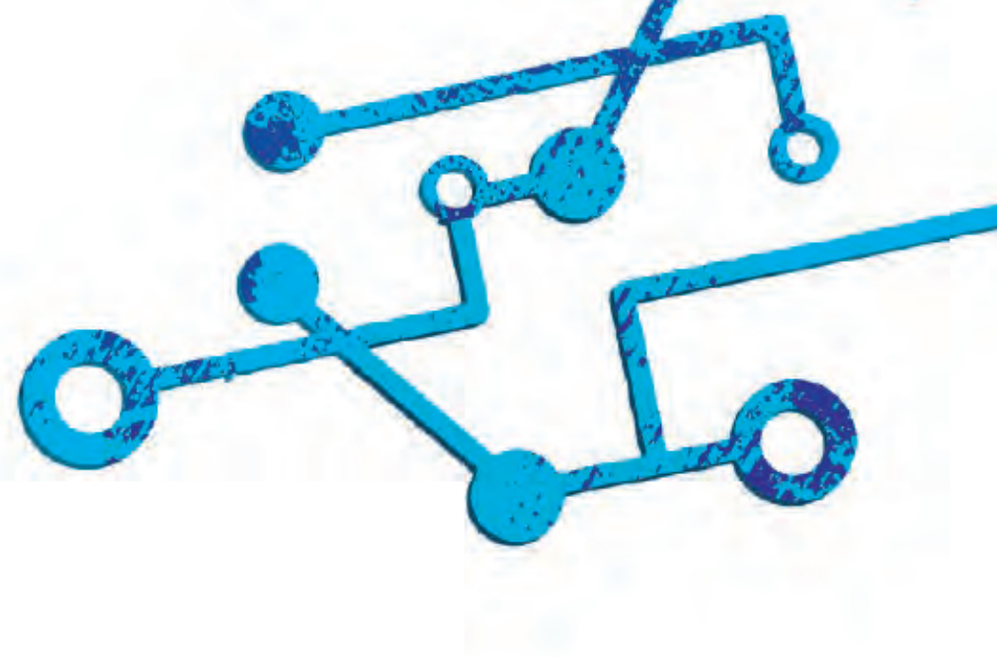
Since then, Dr. Triola has identified the detailed practice data of some 8,500 graduates of NYU School of Medicine, and about 12,000 graduates of NYU Langone's residency training programs. The data set is capable of



“We finally have a trove of data that will enable us to answer some fundamental questions, and we’re going to take full advantage of it.”

MARC M. TRIOLA, MD, NYU SCHOOL OF MEDICINE’S ASSOCIATE DEAN FOR EDUCATIONAL INFORMATICS, AND THE FOUNDING DIRECTOR OF THE SCHOOL’S INSTITUTE FOR INNOVATIONS IN MEDICAL EDUCATION

Photograph by **Sasha Nialla**



"Our data could give real visibility to a possible need to move some residency training from the hospital to clinics and ambulatory facilities."

MARC M. TRIOLA, MD

shedding light on any number of queries about how instituting curriculum changes impacts medical practice. In a sense, they are the sorts of questions that Dr. Triola was born to tackle. "I was raised in a statistics family," he explains. "My parents were both teachers, and my father wrote a popular textbook on statistics."

FOR THE PAST YEAR, Dr. Triola and his team have been focused on the massive challenge of organizing and warehousing the disparate databases. However, as an early proof of concept, the team has already published data showing how curriculum reforms at NYU School of Medicine influenced the prescribing behavior of its graduates. One query looked at prescriptions for benzodiazepine-based anti-anxiety medicines, which have come to be seen as risky for patients over the age of 65. While the data show that prescription rates declined fairly smoothly year over year among physicians in general, the results were quite different for NYU School of Medicine graduates. "We clearly see two distinctive drops in prescription rates that coincide with two separate reforms to our pharmacology curriculum," says Dr. Triola.

That insight might seem obvious—one expects graduates to follow their training—but curriculum and residency program changes don't necessarily translate to practice changes over the long haul, Dr. Triola points out. In the years after medical school, when practice data accumulate, graduates can be influenced by their residency, their fellowships, the systems they practice within, their colleagues, and other factors. These influences all serve as potential confounders when trying to isolate correlations between education and practice data.

The good news, Dr. Triola notes, is that in many cases, these variables can be controlled for by comparing NYU School of Medicine graduates with graduates of other schools who end up practicing in the same settings. "That should allow us to see whether physicians continue to bear the imprint of the school they attended, or whether that imprint is largely erased over time by the healthcare system," he says.

In the meantime, Dr. Triola's insights into prescription trends not only validate an important curriculum change, but also suggest that broader changes in medicine can be quickly incorporated into medical school training. The latter point particularly resonates with the AMA. "We think there's been a gap between what's taught in medical school and how medicine has been shifting to working in teams, to working within healthcare systems, and to focusing on outcomes and patient safety," says Dr. Skochelak. "We want to know what can be done in education to close that gap." To answer that particular question, Dr. Triola says his team plans to look at whether recent curriculum changes that focus on improving how physicians work in teams can be tied to improvements in patient outcomes. If so, those elements might be expanded; if not, different approaches to teaching teamwork might be in order.

Another important area of inquiry is the ongoing shift in surgery from inpatient to outpatient settings. "Our data could give real visibility to a possible need to move some residency training from the hospital to clinics and ambulatory facilities," Dr. Triola says. Such a hypothetical change would go against a long tradition of embedding residencies firmly in hospitals, he notes, but if the data indicate the shift would improve patient outcomes, there might be a compelling case for enacting it. Likewise, notes Dr. Triola, a potentially data-driven target for the medical school curriculum might be the way students learn to help patients with smoking cessation, hypertension control, and other medical-intervention "hot spots" that can have a major impact on patient health at a relatively minor cost. Any curriculum change that can be linked to even a small improvement in those hot spots might benefit healthcare enormously, and Dr. Triola and his team will be looking for those links.

ONE FACULTY MEMBER eager to glean insights from the new data warehouse is Joan Cangiarella, MD, associate dean for education, faculty, and academic affairs, and director of NYU School of Medicine's pioneering Three-Year MD Degree Pathway program. "We'd like to study comparisons between the three-year and four-year programs,"

says Dr. Cangiarella. "Will the graduates' residency and practice metrics show that there are differences in professionalism, maturity, and development? Without good data, it's very hard to assess that."

Dr. Triola contends that for these questions, among many others, the data might indicate that even small changes to education and training could end up making big differences in the healthcare system. "That's the whole point of medical education," he says. "But now we can achieve it with an evidence-based feedback loop." While his team's efforts will be focused on NYU School of Medicine's medical and residents, he notes that it's hard to overestimate the impact of those graduates on US healthcare, given that collectively they treat millions of patients a year.

Since embarking on this project three years ago, Dr. Triola has seen other medical schools set up similar big-data efforts. The AMA has given grants to 10 other schools and is also sharing its NPI data with four of them. "When other schools see what NYU School of Medicine is doing with this data to try to improve healthcare, they come to us to see if they can try to do the same thing," says Dr. Skochelak. "NYU School of Medicine has really been at the forefront of applying informatics to medicine."

Dr. Triola points out that it's important to be wary of taking the dependence on data too far. The risk, he explains, might be that schools keep expanding those elements of education that can be clearly linked by data to improved outcomes and value while shrinking those more personal elements that pay off in ways that aren't easily quantified by numbers—aspects such as instilling passion, dedication, and integrity. "Our educators have first and foremost a human relationship with their students, not a data-driven relationship," Dr. Triola says. "Instead of replacing that relationship, the data can and should be used to make it richer."

POST

New People, Places, and Projects at NYU Langone Health

Faculty Conversation

WHY HASSENFELD CHILDREN'S HOSPITAL IS A GAME CHANGER

Catherine S. Manno, MD, the Pat and John Rosenwald Professor of Pediatrics and chair of the Department of Pediatrics, discusses the significance of NYU Langone Health's new state-of-the-art hospital for children.

When she joined NYU Langone in 2008, Dr. Manno set out to expand the depth and breadth of children's health services. A decade later, she has done just that. In June, the opening of Hassenfeld Children's Hospital, a 168,000-square-foot facility within the new Helen L. and Martin S. Kimmel Pavilion, marked an exciting new chapter in pediatric care at NYU Langone. We caught up with Dr. Manno, a pediatric hematologist and oncologist who specializes in bleeding disorders, on the eve of the ribbon-cutting to find out how this new milestone will benefit clinical care for children and their families. ▸

Catherine Manno, MD,
in the lobby of Hassenfeld
Children's Hospital

Photograph by **Jonathan Kozowyk**

What does it mean to you to see this vision fulfilled?

Having been on the faculty at the Children's Hospital of Philadelphia for over two decades, I know that it's vitally important to treat children in an environment separate from adults. Likewise, Dean Grossman realized that to be a great medical center, you need world-class children's healthcare. The building of the children's hospital recognizes that pediatric healthcare is every bit as vibrant and interesting as adult healthcare, and the therapeutics are just as cutting-edge.

Why is Hassenfeld Children's Hospital uniquely positioned to help New York City families?

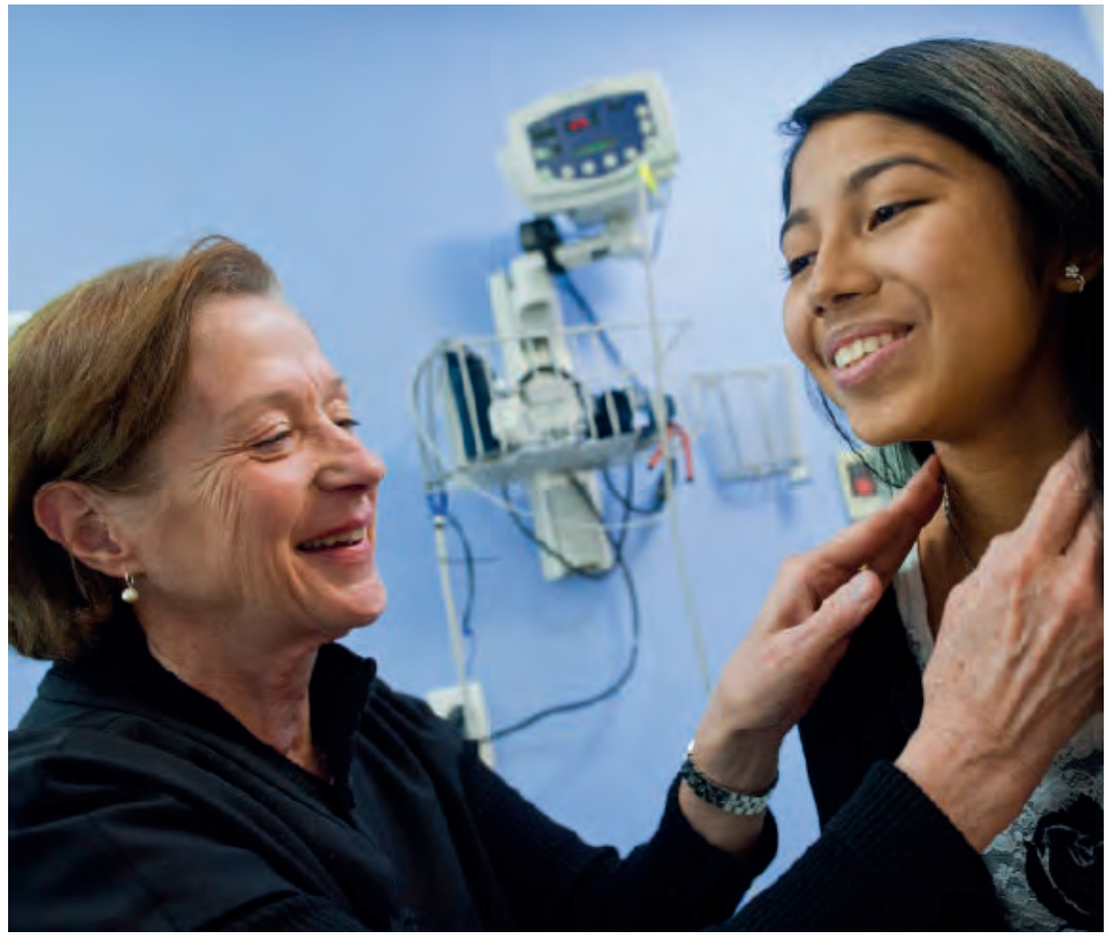
We have only single-patient rooms, which is unique in the city. This gives children and their families greater privacy. Family members can also comfortably stay overnight because there's a dedicated sleeping space in each room. From a medical perspective, it reduces the risk of infection and makes it easier to care for patients since we no longer need to designate rooms according to gender and age.

Are there unique clinical services or areas of expertise that you'll now be able to provide patients and their families?

Absolutely. We have established new programs in every medical and surgical division so that every child who comes through our Emergency Department or one of our outpatient practices with an urgent or complex need can be quickly diagnosed and treated.

With this state-of-the-art facility, do you have an advantage in recruiting top talent?

Having an appealing, child-centered environment is not only great for patients, but of course, it also helps attract the highest-caliber care provider. Anyone who visits this children's hospital will be wowed, not just by the physical environment but also by the quality of care we provide.



How will the environment make life less stressful for families?

When you walk the floors, with their wide corridors and spacious single-patient rooms, it feels very peaceful. The atmosphere reflects a respect for what children and families are going through. We promote a healing, welcoming environment, but of course, it will never be home, and at the end of the day, we just want our patients to get better and enjoy life beyond their illness.

Do children experience disease or an illness differently from their parents?

Many young children don't project very far into the future. They're most concerned about avoiding immediate pain or being separated from their family. However, once they reach pre-adolescence, children begin to worry about if something bad is going to happen to them, which is a bit more

THIS PAGE: JOSHUA BRIGHT

"We promote a healing, welcoming environment, but of course, it will never be home. At the end of the day, we just want our patients to get better and enjoy life beyond their illness."

consistent with what their parents worry about: How could this happen to me? Why did this happen to me?

Is it true that My Wall, the 75-inch display screen in every room, will allow kids with longer inpatient stays to connect with their classrooms?

Yes, isn't that great? The touchscreen tablet also lets children adjust the window shades, lighting, and room temperature to their liking; order meals; Skype with their friends and loved ones; view their daily goals from the care team to assist in recovery; and of course, watch TV and movies and play video games.

How do the supportive resources offered by the Sala Institute for Child and Family Centered Care complement Hassenfeld's clinical services?

We can't properly care for children without considering their psychosocial well-being and the disruption that an illness can cause. The Sala Institute helps provide that additional layer of support to children and their families. Its KiDS of NYU Foundation Center for Child and Family Resilience designs and implements programs that enable our health professionals to deliver innovative psychosocial care and wellness services. The goal is to anticipate the needs of children and their families, provide emotional support, and promote positive outcomes. Sala's Youth Advisory Council and Family Advisory Council, meanwhile, inform decisions on nutrition, wellness, family-centered rounds, educational materials—all of which are critical for truly comprehensive care. The insights that children and parents have contributed are fascinating, and they've truly made a difference in our thinking.

Is there a particular example that comes to mind?

Early on, we talked to a mother on the Family Advisory Council whose daughter had been hospitalized multiple times. She talked about the need for fresh air and quiet time. That inspired us to include a terrace overlooking the city skyline that includes a roof garden so that families can step away from the illness for a while. We also followed the suggestions of children on the Youth Advisory Council in designing separate, dedicated playrooms for teenagers, young children, and toddlers.

Can you talk about the importance of connecting with parents in a child's treatment?

We see ourselves as partners in their child's healthcare. This partnership is fostered by the Sala Institute. We provide as much information as requested, and we make it digestible. One important connection is made when we welcome parents as participants in rounds. The doctors will enter a patient room, introduce themselves, and say, "We're here to talk about your child's progress." After reviewing the previous day's information, they'll discuss the case together with the family. You might have a five-year-old with leukemia who's on day three of chemotherapy. The doctors will talk about the specific medications and the related side effects, and then ask, "Do you have any comments about how your child is doing with the treatment? Do you have any concerns?" This collaboration benefits not only families, but also the quality of the patient care.

NEW FUNDING

THE GRANT

Center of Excellence in Genome Science

HOW MUCH

$8 million

HOW LONG

Five years

SOURCE

The NIH's National Human Genome Research Institute

LEAD INVESTIGATOR

▸ **Jef D. Boeke**, PhD, director, Institute for Systems Genetics

WHY IT MATTERS

The majority of the human genome was once dismissed as "junk DNA" because it appeared to have no function. In recent years, however, geneticists have turned that notion on its head, revealing a vast hidden world of genetic master switches that regulate the tiny amount of DNA that makes proteins—the building blocks of life. Intriguingly, genome-wide association studies in which geneticists compare the DNA of patients and healthy people have shown that most mutations linked to disease occur within this ocean of noncoding DNA, the so-called "dark matter" of biology. But little is understood about exactly how it influences disease. "Biological dark matter may not encode proteins, but we know it's important," says Dr. Boeke.

WHAT IT FUNDS

Dr. Boeke and his team are using technology to effectively reverse engineer biological dark matter. His team will synthesize DNA associated with diseases like lupus and diabetes using yeast cells as assembly tools. "We can put dozens of DNA molecules into the yeast, and it will stitch them together in the right order," Dr. Boeke explains. The first project, with Timothy Niewold, MD, the Judith and Stewart Colton Professor of Medicine, will synthesize different versions of an "extra spicy" stretch of DNA called *IRF5* linked to lupus. (Amazingly, this segment matches the DNA of Neanderthals, who long ago interbred with the ancestors of modern Eurasians.) The next step is to insert the DNA into embryonic stem cells and watch its impact on development. "Everybody else is probing the genome to see what natural variation can tell us," says Dr. Boeke. "But we can actually go in there and, in effect, bend it to our will."

Photograph by **Jonathan Kozowyk**

BLDG BOOM

SPOT-ON ARTWORK

SPOT IS HARDLY your typical therapy dog. This female Dalmatian pup stands 38 feet tall. On the tip of her nose, she balances an actual New York City taxicab. And she greets patients not at the bedside, but at the 34th Street entrance to Hassenfeld Children's Hospital. The 68-bed inpatient unit, housed within the new Helen L. and Martin S. Kimmel Pavilion, is the first children's hospital built in New York City in nearly 15 years. Spot, made of steel and fiberglass, is a hurricane-proof sculpture commissioned by NYU Langone's Art Program from award-winning artist Donald Lipski, known for public artworks that surprise our sense of scale. "I wanted to make something so astounding that it would delight and distract," says Lipski. His creation was trucked in from a Wisconsin factory and assembled on site. The taxi, a Prius donated by Toyota, has no interior parts, but its headlights shine at night, and the windshield wipers operate when it rains. "Spot is probably the most whimsical piece in our diverse portfolio of artworks, installed across campus to capture art's power to engage, comfort, and heal," says Vicki Match Suna, AIA, senior vice president and vice dean for Real Estate Development and Facilities and head of NYU Langone's Art Program. "This sculpture embodies playfulness but also determination and dignity," adds Catherine Manno, MD, the Pat and John Rosenwald Professor of Pediatrics and chair of the Department of Pediatrics. "That's really what's needed to get through a childhood illness."

New Leaders

Elizabeth A. Raetz, MD, and Theodore P. Nicolaides, MD

Leading up to the opening of NYU Langone Health's Hassenfeld Children's Hospital this past June, two distinguished pediatric oncology leaders have returned to the NYU Langone Health team. Elizabeth A. Raetz, MD, is the new director of the Division of Pediatric Hematology/Oncology and medical director of the Stephen D. Hassenfeld Children's Center for Cancer and Blood Disorders, and Theodore P. Nicolaides, MD, is the new director of pediatric neuro-oncology.

Dr. Raetz, who spent 12 years as a faculty member at NYU Langone—most recently as professor in the Department of Pediatrics—returns to head the pediatric hematology-oncology division. Her research focuses on the clinical testing of new treatments for childhood and young adult acute lymphoblastic leukemia (ALL), with a particular emphasis on high-risk and relapsed patients. Previously, she was clinical professor in the Department of Pediatrics and director of the leukemia program at the University of Utah and Primary Children's Hospital. After receiving her medical degree from the University of Wisconsin, where she also completed her internship and residency, she completed a fellowship in pediatric hematology/oncology at the University of Utah. She has also authored more than 80 peer-reviewed papers.

It is a homecoming as well for Dr. Nicolaides, who received his medical degree from NYU School of Medicine and completed his residency in pediatrics at NYU Langone. He rejoins NYU Langone from the University of California, San Francisco (UCSF), where he was assistant professor in residence in the Division of Hematology/Oncology in the Department of Pediatrics, and director of the UCSF Brain Tumor Research Center Pre-Clinical Core. His research has focused on uncovering targeted therapies to treat pediatric patients with brain tumors while preserving cognitive function and normal development. His emphasis is to pair leading-edge translational research with individualized clinical care.

NEW FUNDING

THE GRANT

Altered Mechanotransduction as a Therapeutic Target for Thoracic Aortic Aneurysm

HOW MUCH

$12.1 million

HOW LONG

Five years

SOURCE

The NIH's National Heart, Lung, and Blood Institute

LEAD INVESTIGATOR

▸ **Daniel Rifkin**, PhD, the Charles Aden Poindexter Professor of Medicine, Department of Medicine

WHY IT MATTERS

The aorta is the body's largest blood vessel, routing from the heart down to the pelvis, where it branches off to the legs. In about 100,000 people, a genetic mutation that affects the body's connective tissue weakens the walls of the aorta, causing this massive vessel to bulge in the arch-shaped area just outside the heart. Most people with this condition, known as an aortic aneurysm, eventually will require a risky surgical intervention called an open thoracic aortic aneurysm repair to avoid a rupture that can cause fatal bleeding. "We need to understand the cellular basis of thoracic aortic aneurysms so we can treat them in a way that doesn't require surgery," says Dr. Rifkin.

WHAT IT FUNDS

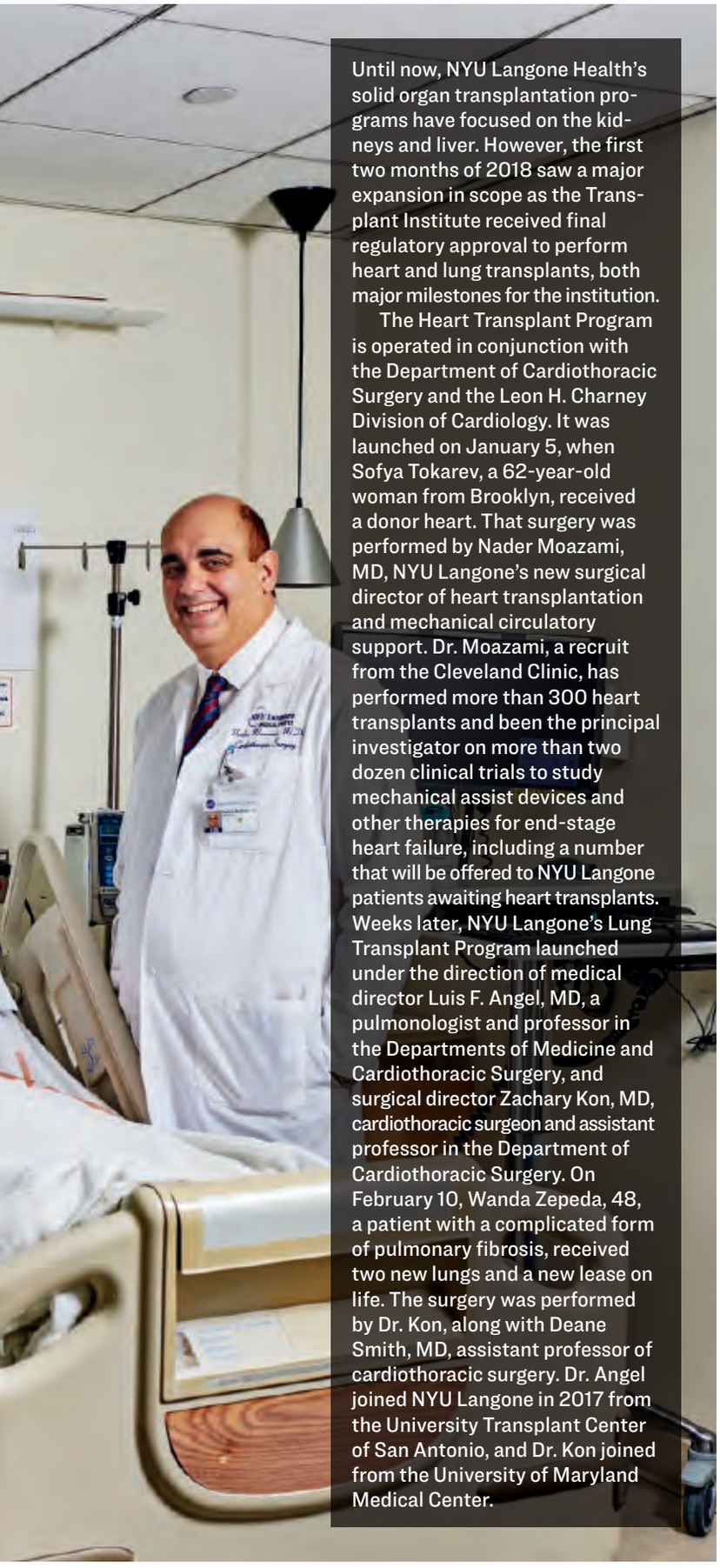
A protein called fibrillin-1 contributes to the strength of the aortic wall and detects the pressure changes as the wall expands and contracts. "Earlier studies indicated that thoracic aortic aneurysms result not from a structural defect but a cell-signaling problem caused by a fibrillin-1 mutation," says Dr. Rifkin. One project of this multisite study will alter the amount of the mutated protein in mice and study the aorta's response to pressure changes. Two others will examine whether a regulating protein called TGF-beta (which is inhibited by the mutation) is sensitive to pressure changes in rodents and in human tissue samples. The fourth will examine whether endothelial cells lining the aorta send signals to the underlying smooth muscle cells that may result in bulge formation; if true, drugs that block these signals might be beneficial.

New Programs

TRANSPLANT INSTITUTE EXPANDS ITS EXPERTISE

Dr. Nader Moazami (far right) performed NYU Langone's first heart transplant on Sofya Tokarev (center). Pictured at left is Alex Reyentovich, MD, medical director of the new Heart Transplant Program.

Photograph by **Tony Luong**



Until now, NYU Langone Health's solid organ transplantation programs have focused on the kidneys and liver. However, the first two months of 2018 saw a major expansion in scope as the Transplant Institute received final regulatory approval to perform heart and lung transplants, both major milestones for the institution.

The Heart Transplant Program is operated in conjunction with the Department of Cardiothoracic Surgery and the Leon H. Charney Division of Cardiology. It was launched on January 5, when Sofya Tokarev, a 62-year-old woman from Brooklyn, received a donor heart. That surgery was performed by Nader Moazami, MD, NYU Langone's new surgical director of heart transplantation and mechanical circulatory support. Dr. Moazami, a recruit from the Cleveland Clinic, has performed more than 300 heart transplants and been the principal investigator on more than two dozen clinical trials to study mechanical assist devices and other therapies for end-stage heart failure, including a number that will be offered to NYU Langone patients awaiting heart transplants. Weeks later, NYU Langone's Lung Transplant Program launched under the direction of medical director Luis F. Angel, MD, a pulmonologist and professor in the Departments of Medicine and Cardiothoracic Surgery, and surgical director Zachary Kon, MD, cardiothoracic surgeon and assistant professor in the Department of Cardiothoracic Surgery. On February 10, Wanda Zepeda, 48, a patient with a complicated form of pulmonary fibrosis, received two new lungs and a new lease on life. The surgery was performed by Dr. Kon, along with Deane Smith, MD, assistant professor of cardiothoracic surgery. Dr. Angel joined NYU Langone in 2017 from the University Transplant Center of San Antonio, and Dr. Kon joined from the University of Maryland Medical Center.

New Appointment

Robert J. Cerfolio, MD

CARDIOTHORACIC SURGEON Robert J. Cerfolio, MD, has been appointed senior vice president and vice dean, chief of hospital operations. Last year, Dr. Cerfolio joined NYU Langone Health as chief of clinical thoracic surgery and the inaugural director of the Lung Cancer Center at Perlmutter Cancer Center. In his new role, he will oversee all patient care activity, ensuring the highest levels of quality and safety.

Throughout his career, Dr. Cerfolio has earned a reputation for clinical innovations that have led to advances in patient care. He pioneered a robotic approach designed for patients who require lung-cancer excisions, removal of esophageal tumors, and tumor resections within the thoracic cavity. This technique has led to some of the highest survival rates for surgically resected lung cancer, and has helped reduce complications, extend life, improve quality of life, and shorten hospital stays. Inspired to pursue medicine by his father, a urologist, Dr. Cerfolio is one of the most prolific thoracic surgeons anywhere, having performed 18,000 such operations, the most in his field, and 1,770 of them using robotic procedures, more than any other surgeon in the world. Dr. Cerfolio centers his practice around the patient experience, innovating ways to care for people.

Prior to joining NYU Langone, Dr. Cerfolio was the James H. Estes Family Lung Cancer Research Endowed Chair and chief of thoracic surgery at the University of Alabama Hospital in Birmingham. He developed the hospital's renowned minimally invasive thoracic surgery program and also served as chair of its Business Intelligence Committee.

At the University of Rochester School of Medicine, Dr. Cerfolio excelled academically and athletically, becoming a first-team Academic All-American baseball player. He did the first two years of his postdoctoral surgical training at the University of Connecticut–St. Francis Hospital and Medical Center. He then trained in urologic surgery at Cornell University Medical College, Memorial Sloan Kettering Cancer Center, and completed his general surgical residency at the Mayo Clinic, where he also completed a fellowship in cardiothoracic surgery.

In Memoriam
Vittorio Defendi, MD
1928–2018

Vittorio Defendi, MD, who served as chair of NYU Langone Health's Department of Pathology for nearly three decades and director of its Cancer Center for almost two decades, died on February 12. He was 89.

A distinguished viral oncologist, he presciently studied the carcinogenic properties of the human papilloma virus. A native of Italy, Dr. Defendi earned his MD from the University of Pavia in 1951. He joined the faculty of NYU School of Medicine in 1974 as professor of pathology and chair of the Department of Pathology. Previously, Dr. Defendi was a senior member of The Wistar Institute, the nation's first independent biomedical research institution, also serving as the Wistar Professor of Pathology at the University of Pennsylvania. Dr. Defendi became a protégé of Hilary Koprowski, MD, a renowned biomedical researcher. Dr. Defendi served as editor-in-chief of Wistar's *Journal of Cellular Physiology* from 1970 to 1996.

From 1978 to 1997, Dr. Defendi served as director of NYU Langone's Cancer Center, and in 1982, he was named the May Ellen and Gerald Jay Ritter Professor of Oncology. Upon his retirement in 2009, he was named professor emeritus of pathology. Throughout his career, Dr. Defendi championed graduate and medical education, emphasizing the cross talk between cancer, immunology, and disease pathogenesis. In 1977, he established NYU Langone's first NIH-funded program for pathology residents and fellows. To honor Dr. Defendi's lifelong service to science, the Department of Pathology, and graduate education, NYU Langone established the Vittorio Defendi Fellowship in Pathobiology in 2008.

In Memoriam
Ruth Nussenzweig, MD, PhD
1928–2018

Ruth Nussenzweig, MD, PhD, an internationally acclaimed leader in the study of tropical and parasitic diseases who devoted a half-century to the quest for a malaria vaccine, died on April 1. She was 89.

Dr. Nussenzweig, professor emerita of microbiology and pathology, and her husband, Victor Nussenzweig, MD, PhD, professor emeritus of pathology, began working at NYU Langone Health's malaria research program in the 1960s. Their groundbreaking discoveries paved the way for the development of the first human malaria vaccine, recently approved by the World Health Organization for use in Africa.

A native of Vienna, Austria, Dr. Nussenzweig received her MD and PhD from the University of São Paulo, Brazil, where she met her husband. While medical students, Ruth and Victor Nussenzweig studied the insect-borne Chagas disease. They found that gentian violet dye kills Chagas parasites in blood destined for transfusion without toxifying the blood. Until recently, all transfused blood in Brazil was blue.

Dr. Nussenzweig and her husband also collaborated on ways to prevent the transmission of malaria, a disease that kills millions of children every year. In 1967, they found in animal models that irradiating malaria-infected mosquitoes with X-rays weakened sporozoites, the form of the parasite transmitted to humans through mosquito bites. Weakened sporozoites triggered immunity against malaria, paving the way for a potential vaccine. As *The New York Times* reported, research conducted by Dr. Nussenzweig and her husband not only helped elucidate how the parasite inflicted its damage and when it might be thwarted, but also attracted funding for vaccine development from sources such as the Bill and Melinda Gates Foundation.

Dr. Nussenzweig and her husband joined the faculty of NYU School of Medicine as assistant professors in 1965. During her tenure, Dr. Nussenzweig held several leadership positions, including director of the Division of Parasitology in the Department of Microbiology. As the first chair of the Department of Medical and Molecular Parasitology, a position she held for nearly 20 years, Dr. Nussenzweig earned the distinction of being the first woman to chair an academic department at NYU School of Medicine.

The author of more than 200 peer-reviewed publications, Dr. Nussenzweig served on the editorial boards of several prestigious journals. She was elected to the National Academy of Medicine in 2006 and the National Academy of Sciences in 2013. Dr. Nussenzweig is survived by her husband, Victor; their sons, Andre and Michel; their daughter, Sonia; and six grandchildren.

Ruth Nussenzweig, MD, PhD, with her husband Victor Nussenzweig, MD, PhD.

Photograph by **Mike Weymouth**

"Seek out a mentor who will provide feedback and perspective that you wouldn't otherwise get from your circle of friends."

WHO:

Nancy Sanchez

Senior Vice President and Vice Dean, Human Resources and Organizational Development and Learning

Adjunct Professor of Medical Center Administration

During the past decade as the head of Human Resources at NYU Langone Health, Nancy Sanchez has overseen a period of unprecedented growth at the institution. The number of employees has quadrupled from 9,000 in 2008 to 37,000 today, making NYU Langone one of the nation's fastest-growing medical centers. Last spring, Sanchez spoke to first-year medical students about what she's learned during her 36 years with the organization. The conversation was part of NYU School of Medicine's Leaders and Teams lecture series. Here, a few highlights.

• • •

Look for learning opportunities. I started at NYU Langone as a recruiter. I knew the best way to evolve into a leader was to work in each area of HR but also to go beyond that. I had to learn about medicine and some of the nuances that were not addressed in the employee handbook—the politics, the personalities, and so forth.

Use your observational skills. You need to understand what makes an organization work, and that involves listening, watching, and observing. When you attend meetings, when you have conversations, note what happens between people. Because that's how you master interpersonal dynamics.

Find mentors you trust. I was fortunate to find people who allowed me to feel comfortable expressing opinions that differed from theirs. We'd sometimes have fierce debates, and it taught me how to present information and advocate for others. I'd recommend seeking out a mentor who's different from you and who will provide feedback and perspective that you wouldn't otherwise get from your circle of friends.

Criticism can be more helpful than praise. One of the first things Dean Grossman asked me when he was appointed was, "How am I doing?" I said, "Oh, we're doing well." And he responded, "No, don't tell me what I'm doing well. Tell me what I'm not doing well, because that affords me the greatest opportunity to improve." He has been consistent about that ever since. When he makes a mistake, I tell him, and he's open to the feedback, even if he doesn't agree.

One size doesn't fit all. To be successful, you need to know how to use different communication and engagement styles to reach a variety of people. The wrong approach won't get the outcome you want.

Don't lose sight of what really matters. I tell employees all the time, "It is all about the patient. That's why we're here."

Be true to yourself. I've been told I don't look Hispanic, and I've had to prove I am to those within the Hispanic community because some people can't see past stereotypes. I've also had people discriminate against me because of my ethnicity. So I've seen it from both sides. My advice: You have to feel comfortable in your own skin. There will always be biased people out there, those who are quick to judge the limits of your ability. But you should not allow that to deter you from getting where you want to be.

Managing is part of the job. Most physicians will deal with employee behavioral issues at some point. If you do that effectively, it won't become a distraction. If you don't, even in a small practice, it will consume your time. Take advantage of the many opportunities along the way to educate yourself about leading and motivating others. It's critically important for whatever your future holds.

Tune out the noise. Forget about what other people are saying—that can hold you back from being the best at what you do. Above all, simply focus on a goal and pursue it. Don't let anybody stop you.

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PHOTO BY THOMAS HABR ON UPSPLASH

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