Magazine of the Tufts University School of Medicine **Summer 2018 Vol. 76 No. 2**

Tufts Medicine

TAKING ON TB

Bree Aldridge and her team are revolutionizing how we understand and treat one of the world's deadliest diseases.

STAYING FOCUSED

When Ira Pastan, A53, M57, started a job at the National Institutes of Health in 1959, he set his student microscope on a shelf and planned to stay for two years. Almost six decades later, Pastan is still there—he's now a leader in cancer immunotherapy and co-chief of the Center for Cancer Research's Laboratory of Molecular Biology at the NIH's National Cancer Institute—and so is the microscope, a treasured reminder of his training. Pastan's recent work involves recombinant immunotoxins, chimeric molecules created by attaching part of an antibody to part of a bacterial toxin. The result is a cancer-fighting tag team: The antibody leads the molecule to a cancer cell so the toxin can kill it. Two of these immunotoxins are currently in clinical trials—one to treat refractory hairy cell leukemia (and possibly other leukemias), and one that targets mesothelin, a protein Pastan's lab discovered 15 years ago that's expressed in many cancers. "I'm like a kid with a chemistry set," he said about his lengthy career. "Now that we're getting positive results in treating diseases, I really just want to keep doing it." – COURTNEY HOLLANDS

PHOTO: STEPHEN VOSS

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ON THE COVER: Tuberculosis researcher Bree Aldridge photographed outside her lab on June 19, 2018. Photograph by Anna Miller

In Every Issue

KINDNESS ON 9/11

I am deeply saddened to hear of the loss of [former School of Medicine dean] Dr. Harrington ("Remembering John Harrington," Winter 2018). Admittedly, I did not interact with him much, but there was one particular day when he meant so much to my classmates and me: September 11, 2001. I was a second-year medical student, and in class in Sackler Hall. About halfway through the second hour, word started to spread about what had happened. We all went up to the lounge, where the televisions were mounted on the wall, and watched those horrific events unfold. Suddenly, Dr. Harrington emerged, with his hands outstretched. He said something to this effect: "I have canceled all classes the rest of day; you are welcome to stay here." I have no idea what else he said—that was enough. I was 3,000 miles from home and did not have a cellphone, and, as I recall, it was very hard to make outgoing calls on that day. Dr. Harrington was our father figure and our safety net. I will never forget that.

ALIREZA HALATI, M04

INSPIRED BY DR. GEIGER

I was born in Mound Bayou, Mississippi, where my grandfather, P.M. Smith, was instrumental in founding Taborian Hospital. I chose to go to Tufts because of the school's involvement with the community health center there. Thank you for the wonderful article on Dr. H. Jack Geiger ("Leading the Charge," Winter 2018). Please let him know his work and life continue to inspire.

EDWINA VERNER, M77

Looking Ahead

To prepare for the "125 Years and Counting" feature in the Winter 2018 issue, we polled students and alumni about the future of health care by asking them to finish a sentence. Here are some of their responses.

In 125 years, medicine will . . .

. . . be tailored to the individual more than we ever imagined possible. –Kristen Eckler, M94

. . . be unrecognizable and wondrous to behold. –Lawrence Zhang, M20

. . . slowly merge with public health. Prevention will be paramount, and we will learn to provide truly comprehensive care. –Rolvix Patterson, M20, MG20

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AN ENDURING PARTNERSHIP

NEXT YEAR WILL mark the tenth anniversary of our successful Maine Track program. When we launched the initiative in partnership with Maine Medical Center in 2009, we hoped to address the physician shortage in Maine, encourage graduates to go into rural care, and expand the medical school's class size. I'm pleased to report we've made significant progress on all fronts.

The Tufts University School of Medicine and Maine Medical Center have had a long, productive working relationship. From the 1930s through the early 1980s, private funding through the Bingham Program provided Tufts students opportunities to rotate in Maine hospitals. In fact, I worked in the state twice in the mid-'60s, during my training at the hospital now known as Tufts Medical Center. My very first rotation as an intern was for two wonderful months in Lewiston, where my wife and I had our first apartment as newlyweds and enjoyed the Maine seacoast and summer activities. Later, during my infectious-disease training at Tufts, I spent two weeks consulting and giving talks at the Knox Hospital in Penobscot Bay (now the Pen Bay Medical Center). Many other house staff and faculty members had similar experiences.

In 1980, Maine Medical Center started an affiliation with the University of Vermont—a split from Tufts that lasted 28 years. But the stars aligned again in the mid-2000s, when the hospital put out a bid to collaborate with a like-minded medical school on a track that would essentially create a pipeline of physicians for the state of Maine. Ultimately, MMC selected our proposal—and the Maine Track was born. It was very attractive for us because Maine Medical Center is a first-rate hospital with a first-rate faculty, so students get great training there. Plus, we were able to expand our class size from 165 to 200, which means more future doctors to care for aging baby boomers. And we have many alumni who practice in the state who were glad to see us return.

The Maine Track makes us unique among medical schools. With the eleven Longitudinal Integrated Clerkships around the state, we are putting serious effort into the challenges of staffing and caring for people in rural areas, a problem all over the world. We demonstrate to students the advantages of being part of a community—you can't imagine it; you have to go out and experience it. (To learn more about the Maine Track model, turn to page 14.)

A quick note of gratitude: None of this would have been possible without Dr. Peter Bates, our academic dean at Maine Medical Center. He really made the process work—Peter retired from his roles as chief academic officer and Tufts dean for academic affairs at the hospital in July, and we thank him for all his effort over the years. He is now on a well-deserved, year-long sabbatical.

There was a time when the School of Medicine was considered a New England school that trained doctors primarily for New England. We've grown past that, but the Maine Track brings us back into some balance. I love that we're providing physicians for a state that really needs them, yet we're also a school that trains doctors for the nation. We recently signed a new 10-year contract with Maine Medical Center to extend the Maine Track program—here's to another decade of partnership and innovation.

HARRIS A. BERMAN, M.D.
Dean, Tufts University School of Medicine

PHOTO: KELVIN MA

Mohan Thanikachalam.

Keeping Tabs on Hypertension

An innovative wearable device puts Tufts on the frontlines in fighting high blood pressure. BY COURTNEY HOLLANDS

DURING HIS CARDIOVASCULAR surgery training at Jackson Memorial Hospital in Miami in 2004, Mohan Thanikachalam recalls that at least once a week in the emergency room, he would see a patient in his early 30s or even late 20s with aortic destruction from undiagnosed high blood pressure. The next step? An expensive, somewhat risky surgery with a long recovery time. "That's the thing—just taking a pill would have controlled those issues," said Thanikachalam, now a research assistant professor of public health and community medicine at the School of Medicine.

Almost 1.4 billion people worldwide have high blood pressure, including more than 100 million in the United States, and hypertension is the leading cause of heart disease and stroke across the globe. But occasional cuff readings at the doctor's office—which can be affected by patient anxiety and other factors—aren't cutting it when it comes to effective maintenance and early intervention. Research has shown that continuous monitoring, including during sleep, is a better predictor of cardiovascular disease, while pressure variability over time can point to end-organ damage and dementia.

With all this in mind, Thanikachalam and a team from the Massachusetts Institute of Technology have spent three years developing a wearable Tactile Blood Pressure Imager (TBPI) with funding from the National Institutes of Health. "I made the decision to spend my time on this because it's going to create the greatest value," he said. "And there's no technology like this so far."

The TBPI is worn on the wrist, over the radial artery, and uses a sensor to capture skin-surface forces affected by blood in the artery, respiratory rhythm, and pulse rate. Proprietary algorithms incorporating these markers then provide a continuous estimate of heartbeat-to-heartbeat blood pressure. The TBPI is also worn overnight, and can be integrated with a mobile phone for remote monitoring by health-care professionals.

To validate the technology, the team inserted an arterial catheter in an animal model to measure blood pressure and then compared that to signals from the TBPI prototype strapped to the animal's leg. They then varied the blood pressure in the animals with drugs, which helped the researchers

PHOTO: ANNA MILLER

30 MILLION+

That's the number of American adults who became hypertensive overnight in late 2017, when the American Heart Association and the American College of Cardiology redefined "high blood pressure" as a reading of 130 over 80, down from 140 over 90. Nearly one in two adult Americans are now considered hypertensive.

tweak the algorithm for different pressure ranges. In clinical studies, the team demonstrated that the TBPI estimates blood pressure in accordance with FDA standards. Next up, the TBPI will be tested on human ICU patients who also have intra-arterial catheters to monitor blood pressure.

While the current TBPI prototype is bulky, Thanikachalam is working on a more streamlined model with a product-development company. Tufts and MIT have both patented the work; Thanikachalam and team will establish a start-up, which will license the technology from Tufts and raise private capital.

In getting the device to market, Thanikachalam is focusing on two factors: affordability and physician buy-in. Most importantly, health-care providers need to feel confident that "this is a reliable technology and I can make treatment decisions based on it," he said. If all goes according to plan, a person with hypertension—or at risk of hypertension—will be able to continuously monitor his blood pressure at home with the TBPI (marketed as the Vitrack), share the results with his doctor, and get ongoing treatment support. "This," Thanikachalam said, "is essentially empowering people to manage their disease."

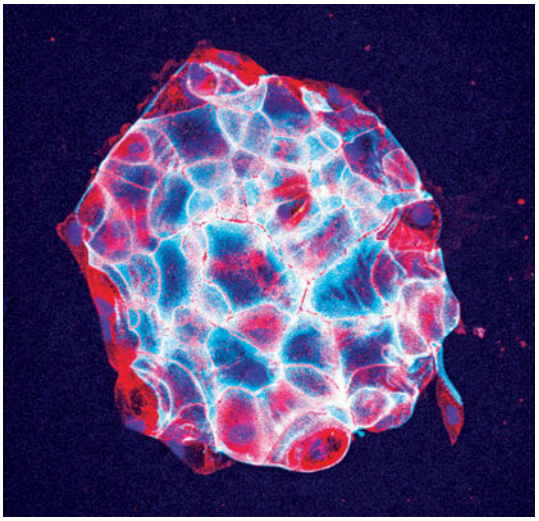
WORK FROM HOME

To shift chronic-disease management from the hospital to the community, "you have to make the technology available where people are," said Mohan Thanikachalam. That's why he is working with outside partners on these other mobile phone–enabled portable devices to help patients manage diabetes:

» **NEUROPATHY ANALYZER:** This tool tracks nerve function. Diabetes, which causes peripheral neuropathy, is the leading cause of amputation.

» **RETINA CAMERA:** Already in the hands of community health workers, this device takes images of patients' eyes to look for signs of diabetic retinopathy caused by damage to the blood vessels in the back of the eye.

» **ULTRASOUND:** Home monitoring of diabetes- or hypertension-related heart failure will be possible with this mobile technology.



GUT REACTION

Need proof that beauty is in all things? See "Enteroid Supernova," an image of enlarged, clumped-together human intestinal epithelial cells (or enteroids), which took first place in the Sackler Graduate Student Council's recent science-art contest. Molecular microbiology Ph.D. student Mary Hahm, M21—who studies *vibrio cholerae* infection of enteroid monolayers with a focus on quorum sensing—created the almost-psychedelic effect by staining the cells to highlight actin in blue and tight junctions in red. –COURTNEY HOLLANDS

PHOTO: COURTESY

HELP FOR THE MOST HELPLESS

A new app seeks to aid a growing number of drug-exposed newborns. BY MONICA JIMENEZ

AS THE OPIOID epidemic rages, more and more health professionals are treating newborns who have been exposed to drugs. "On any particular day, we can have ten to twelve babies withdrawing from narcotics," said Tufts Medical Center Chief of Newborn Medicine Jonathan Davis, who works with eight hospitals affiliated with the Tufts University School of Medicine.

Thanks to Davis, doctors from Massachusetts General Hospital and Baystate Medical Center, and the Cambridge-based company Dimagi, there will soon be an app to help. Called NASCare and developed with $1 million in federal funding over two years, the app will guide health professionals caring for drug-exposed newborns—especially physicians at community hospitals who lack the expertise or resources to treat them—and help standardize protocols.

Currently, most institutions use the Finnegan Scoring Tool to evaluate twenty-one common signs of neonatal abstinence syndrome (NAS)—including convulsions, poor feeding, high fever, and moist skin—and choose the appropriate treatment. But the parameters aren't cut-and-dry, and scoring is subjective: People have different definitions of what constitutes high-pitched crying or moderate tremors, for example. Opinions also vary about when to give pharmacological treatment. "No one is establishing best practices, which is a major flaw in our system," Davis said.

NASCare aims to change that, offering an interactive method to measure NAS symptoms. The tool will include features to mitigate subjectivity in scoring—such as videos of babies with varying degrees of tremors and recordings of infants crying at different pitches—plus data previously collected on each newborn so physicians can assess progress over time. It will also suggest treatment protocols for each score based on the latest research and industry best practices. "This will hopefully make interpretation easier and ratings more reliable across different doctors and nurses, even those with less experience dealing with this population," said Xian Ho, senior researcher at Dimagi. At Davis' urging, suggestions such as feeding and wrapping the baby, or keeping the infant in a dark, quiet place will be encouraged before pharmacological treatments—but there will also be guidance for putting a newborn back on opioids to control the symptoms, then slowly weaning them off those drugs.

Finally, the app will offer a continuing

ILLUSTRATION: ALEX NABAUM

medical education curriculum developed by Davis, his colleagues, and Harvard Medical School, which will also address newborns exposed to marijuana. Davis called that a rising population, pointing to a 2017 study in the *Journal of the American Medical Association* showing that from 2002 to 2014, the prevalence of self-reported, past-month marijuana use among U.S. adult pregnant women increased from 2.4 percent to 3.9 percent. "With marijuana use being widely legalized, people assume it must be safe," Davis said. "But marijuana is being engineered with much higher concentrations of THC." Between 1995 and 2014, the THC content of illicit marijuana seized by the U.S. Drug Enforcement Administration increased from four to twelve percent, according to a 2016 report in the journal *Biological Psychiatry*. "We really haven't studied the long-term neurological effects," Davis added.

NASCare will evolve as new information emerges. Eventually, developers hope to add functionality for users to collect data on new treatment methods to help researchers evaluate their effectiveness. The next steps, though, are to wrap up content development and test the app with representative users. Then the Android app will be made available to medical professionals at Tufts-affiliated hospitals for a clinical trial, before it's rolled out for paid use by other institutions (iPhone compatibility is also in the works). "We're very proud of this project because it is really addressing an immediate need," Ho said. "This is a terrible issue that families face in the U.S. and providers are dealing with in hospitals."

The NASCare project has been funded in whole or in part with federal funds from the National Institute on Drug Abuse, National Institutes of Health, Department of Health and Human Services, under Contract No. HHSN271201700065C.

Poised for the Future of Health Care

As health care continues to go digital, there's an increasing demand for health-informatics professionals to manage and analyze all that data from electronic health records and other sources. Indeed, the Bureau of Labor Statistics projects that employment for professionals with master's degrees in the field will grow 20 percent through 2026, almost triple the average growth rate across all occupations.

With an eye to that future, the Department of Public Health and Community Medicine at the School of Medicine is launching a new online health informatics and analytics master's degree and certificate program in fall 2019. "Virtually all aspects of health care for individuals and populations require familiarity with health-informatics concepts," said Anna Orlova, founding program director.

Full-time master's degree students can complete the 36-credit program in one-and-a-half years, or in three years of part-time work (there's also an accelerated one-year option). The certificate requires completion of five courses, totaling 15 credits. All classes will be online, and culminate in a required capstone practicum, which students will complete close to their homes.

"Graduates of the Tufts HIA program will have the knowledge and skills to support institutions and communities in their work towards healthier populations," said Aviva Must, dean of public health at the School of Medicine. Applications will be accepted starting in November 2018. –COURTNEY HOLLANDS

For more information about the new health informatics and analytics program, visit go.tufts.edu/health_informatics.

LAURELS

JOHN WONG—Tufts CTSI's director of comparative effectiveness research and Tufts Medical Center's chief of the division of clinical decision making—was recently appointed to the US Preventive Services Task Force, an independent, volunteer panel of national experts in disease prevention and evidence-based medicine.

LINDEN HU, professor of molecular biology & microbiology and vice dean for research at the School of Medicine, has been appointed to the Global Lyme Alliance's Scientific Advisory Board.

School of Medicine associate professor of immunology **PILAR ALCAIDE** received the American Society for Investigative Pathology's Cotran Early Career Investigator Award for her work on T-cell immune responses and cardiotropism in heart failure.

ISABEL ZACHARIAS, J97, M02, an assistant professor at the University of Massachusetts Medical School, was recently named the first female chair of the American Liver Foundation's New England Medical Advisory Committee.

PHOTO: MATTHEW MODOONO (WONG)

About Face

How a program launched by a Tufts student encourages women experiencing homelessness to remember self-care.

BY LAURA FERGUSON

WHILE VOLUNTEERING AT a dermatology clinic at Boston Health Care for the Homeless Program (BHCHP) during her third year at the School of Medicine, Diana Bartenstein, M18, combined her dual passions of skin wellness and public service. Plus, she was able to watch her mentor Jennifer Tan, BHCHP director of dermatology and Massachusetts General Hospital dermatology instructor, interact with patients. "What is really striking is how time stops in her clinic room," Bartenstein said. "Dr. Tan treats every single patient with the respect and compassion they deserve."

Inspired by Tan, Bartenstein launched her own skin-health initiative specifically for women experiencing homelessness at BHCHP in August 2017 with funding from an Albert Schweitzer Fellowship and the Tisch College Fund for Civic Engagement.

SPA Day—an acronym for "Skin care and emPowerment for All"—provides facemasks, foot soaks, hand massages, and other treatments. Each monthly pampering session is paired with workshops to teach participants how to identify pigmented lesions, prevent skin cancer, and more.

Bartenstein's vision for SPA Day is grounded in understanding the psychological and emotional challenges people experiencing homelessness face every day. "Many women have unique barriers to prioritizing their health, happiness, and self-worth, and that prevent them from self-care," she said. She knew helping them regain self-esteem was pivotal to changing their overall attitudes about their health. To do that, though, Bartenstein had to build trust; that's where the spa comes in. "During a foot soak, the women relax and open up—and that rapport is a vital first step in them taking charge of their health," she said. "And the best part is that they are so vocal about how much joy we bring to their lives."

As she recently graduated and is now in a one-year internal medicine internship at Brigham and Women's Hospital (her next stop is the Harvard Combined Dermatology Residency Training Program), Bartenstein handed over the SPA Day reins over

Left to right: Diana Bartenstein, M18, and Haya Raef, M20, work with women at BHCHP.

PHOTOS: KATHLEEN DOOHER

to Haya Raef, M20, and a Boston University medical student, who will continue the sessions at BHCHP and two affiliated local women's shelters.

Bartenstein is optimistic the program will continue to gain momentum. As she reported in her Schweitzer Fellowship poster presentation in the spring, SPA Days significantly reduced stress and increased self-confidence in participants. Nine out of ten participants polled said that after attending a SPA Day they were more likely to make a doctor's appointment. And one hundred percent reported taking better care of their skin and/or feeling better about themselves.

Out of all the survey data, Bartenstein proudly singled out one woman's response to the question: *What is the one thing you will do to keep your skin healthy in the future?* "Take care of me, too," she answered.

"That quote crystallizes the success of our approach," Bartenstein said. "I'm glad that SPA Days encouraged this woman to recognize the importance of prioritizing herself."

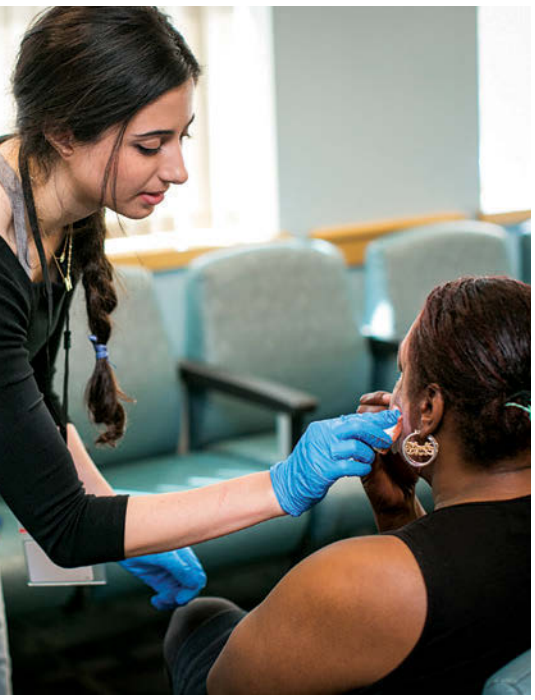
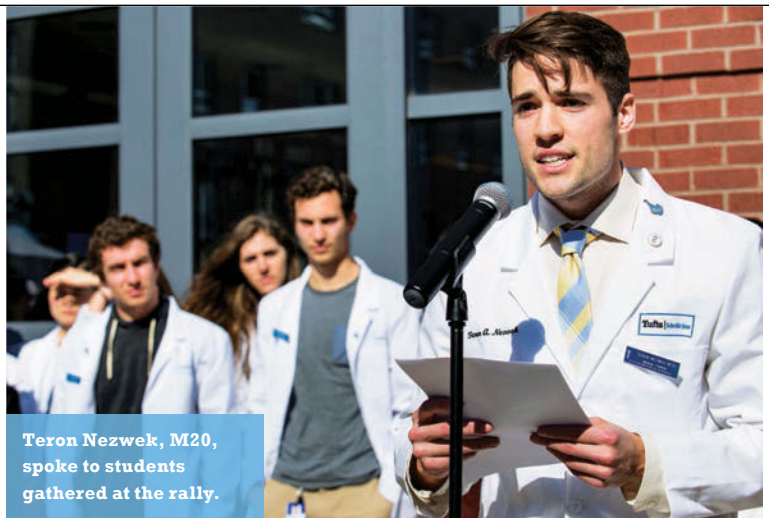


PHOTO: ALONSO NICHOLS



Teron Nezwek, M20, spoke to students gathered at the rally.

Taking a Stand Against Gun Violence

Donning white coats, School of Medicine students condemned the public-health crisis. BY LAURA FERGUSON

On February 21, more than 100 Tufts medical students came together to demonstrate against gun violence on the one-week anniversary of the deadly shootings at Marjory Stoneman Douglas High School in Parkland, Florida.

Teron Nezwek, M20, organized the rally at the Jaharis Courtyard to encourage health-care professionals to draw attention to gun violence as a public-health crisis. His own personal shock and grief at the Florida massacre spurred him to plan the gathering—he is a 2011 graduate of MSD High School, and his sister is still a student there. Nezwek asked his classmates to wear their white coats for a group photo to be posted on social media with the tag #whitecoatsagainstgunviolence, and also brought a poster bearing photographs of the seventeen victims for Tufts students to sign.

Nezwek, who is pursuing a dual M.D./M.B.A. in health management, said he was heartened by the turnout. "It was phenomenal," he said. Students and faculty spoke, including Sackler School dean Daniel Jay; dean for educational affairs Scott Epstein; and Aviva Must, dean of public health.

"More than 30,000 people are killed with guns in the U.S. every year," Nezwek said in his own remarks. "The government spends only about $22 million a year on research into gun violence. This dwarfs in comparison to funding for other major health threats, such as cancer, heart disease, and diabetes, where funding is in excess of $10 billion . . . I hope that you leave understanding this: Gun violence is a public health crisis that takes thousands of lives each year. And we, as future health providers, have a duty to address it."

Nezwek thanked the dean for student affairs, Amy Kuhlik, and others who helped him mobilize the rally on short notice. He is also working with Kuhlik to schedule a forum for students and faculty to, as he said, have a "serious debate about what we can do, as physicians, to prevent future tragedies."

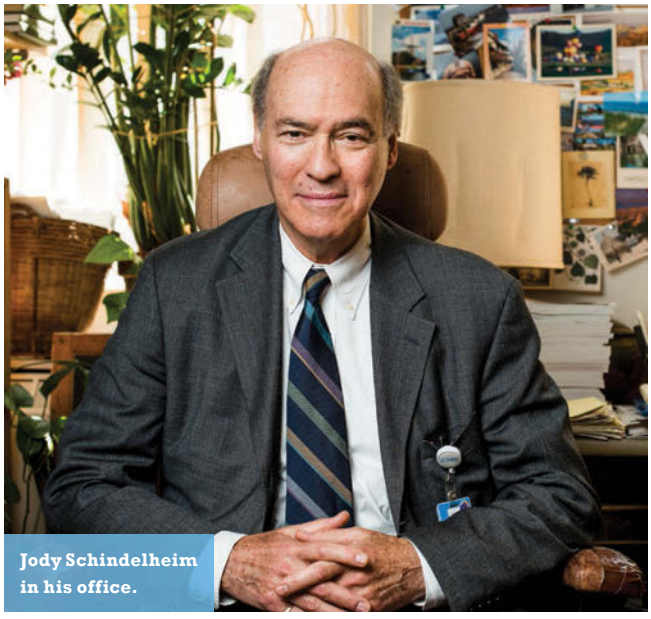
STAVING OFF BURNOUT

For almost four decades, Jody Schindelheim has helped budding physicians grapple with the emotional burdens of the profession. BY COURTNEY HOLLANDS

OF THE MORE than 14,000 U.S. physicians from 30-plus specialties polled for the 2017 Medscape Lifestyle Report, 51 percent reported feeling burned out—with emergency medicine, ob-gyn, and family medicine topping the list of the most stressed specialties. And compared to the general employed population, doctors worked more, displayed higher rates of emotional exhaustion, and reported lower satisfaction with work-life balance, according to a 2014 study by the American Medical Association and the Mayo Clinic.

"Medicine is a very intense field and a very intense life," Jody Schindelheim said recently in his office. "I hope that for students, learning to put some of these experiences into words is an inoculation against depression, anxiety, and burnout."

Since 1982, Schindelheim—the director of the adult psychiatry residency training program at Tufts Medical Center and the director of medical student education in psychiatry and a clinical professor at the School of Medicine—has been meeting with third-year medical students for an hour each week during their eight-week medicine clerkship. He books the room, convenes the meeting, and then mostly keeps quiet and stays out of the way as the eight to ten students compare notes and grapple with career decisions—required sessions that have affectionately come to be known as "Schindel-Time."



Jody Schindelheim in his office.

"The clerkship is the first official time that students are being exposed to the medical system and its personalities at such close range as well as to some of the most emotionally laden moments in people's lives," said Schindelheim, who first came to Tufts in 1977 for his psychiatry residency. "They're involved in very intimate working relationships and with patients from all walks of life who are in the throes of life-and-death situations." While more experienced colleagues have figured out ways to deal with these moments, fledgling doctors may not know how to process and vocalize their experiences, and there's a risk that they'll get overwhelmed by emotions or dissociate from them entirely. "Developing words to talk about the feelings makes them more understandable," he said. "Communicating the feelings with colleagues who are going through similar experiences can not only make them more acceptable, but can hopefully keep the students away from the emotional isolation that is fertile ground for the occupational hazards inherent in our profession."

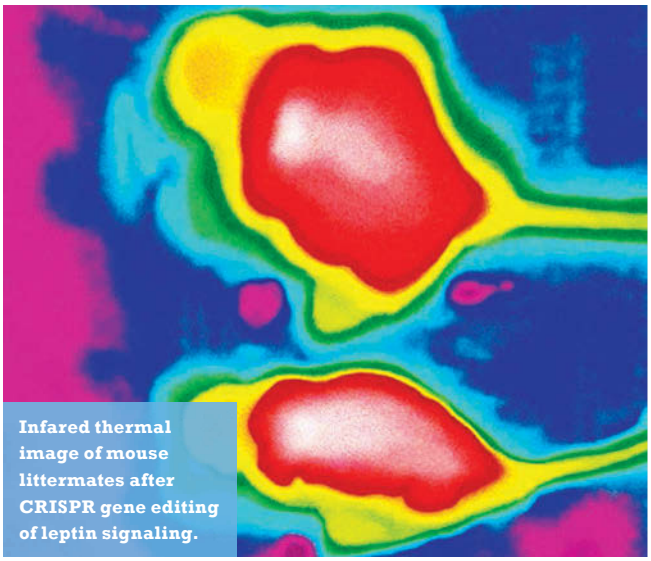
There are no lectures in "Schindel-Time" and the format is unstructured: "The only ground rules are those I saw in my daughter's preschool class—no hitting, no throwing, no spitting, no kicking," Schindelheim said with a laugh. It usually takes a few meetings for the students to loosen up, but "you can feel the ease developing. I think of it as improvisational jazz. They're all just doing their thing and riffing off each other."

Beyond weathering pivotal interactions with patients, third-year medical students are also weighing career options against well-meaning feedback from advisors, parents, and residents that might conflict with their own inclinations. "Medicine is going to be hard enough, so go where the wind is behind you," he said. "I always say that the best field to go into, is the field that you're really into—where your passion points you."

One way today's students are different from when "Schindel-Time" started 36 years ago is in their reliance on technology, with email and social media beckoning from ever-present smartphones. "I tell them that they should not jump out of the room through their devices," he said. "They should try to be with one another and be present." Yet, much has stayed the same, Schindelheim said. "The emotional burden that all physicians have to wrestle with—coming to terms with that in some way has been a constant."

PHOTO: ALONSO NICHOLS

Research Where Ideas Take Root



Infared thermal image of mouse littermates after CRISPR gene editing of leptin signaling.

Finding the Brain Pathway to Obesity

A new study reveals how leptin affects both weight gain and diabetes. BY HELENE RAGOVIN

IN 1994, GREAT expectations greeted the discovery of leptin, the hormone produced by white fat cells that regulates weight maintenance and appetite. Would this be the key to ending obesity? Leptin normally signals satiety after humans and other animals have eaten enough to maintain body weight—or, stimulates appetite when calories are needed. But for almost a quarter-century, identifying leptin's specific target in the brain has remained out-of-reach.

"A dramatic amount of effort went into understanding leptin," said Dong Kong, assistant professor of neuroscience at the School of Medicine. "Yet, sadly, from a neurobiological perspective, some very basic questions remained unsolved."

Now, Kong and a team of Tufts researchers have unraveled some of the biggest mysteries about how leptin works in the brain, and opened the door to new clinical approaches for both obesity and diabetes, two of the world's most-pressing health concerns. Their work identifying the neural pathway responsible for leptin's role in controlling energy balance and appetite, and in regulating glucose in the bloodstream, appeared in the journal *Nature* in April.

The Tufts team's findings have the potential to transform and accelerate all scientists' work on leptin, with important implications for obesity and diabetes research. "This is very big translational progress. Now people have a target, a system that they can focus on," Kong said

For Kong and his colleagues, finding leptin's target in the brain became a matter of reframing the question. Most leptin studies used obese animal models. But, Kong observed, it was also known that obese animals suffer from leptin resistance—the hormone's effects are blocked. "I was thinking, this kind of design is problematic," Kong recalled. "Could there be some ideal mouse models, some ideal system for us to really evaluate the leptin effects and the real target?"

A hint came from research that showed injections of leptin could reverse Type 1 diabetes in mice having the condition. (Mice and humans with Type 1 diabetes produce extremely low levels of leptin.) To Kong, this was an indicator that Type 1 diabetes involves some sort of neural dysregulation in the brain connected to leptin's activity. The researchers found that neurons in the hypothalamus—known as agouti-related protein-producing, or AgRP, neurons—were extremely active in the Type 1 mice, but quieted down after leptin was injected and the diabetes, in turn, was reversed. To further confirm that the AgRP neurons in the hypothalamus were reacting to the presence of leptin, Kong used CRISPR gene-editing technology to delete the leptin receptors in those neurons in healthy mice. The result: The mice became obese and resistant to insulin, turning diabetic.

The decades-old puzzle was solved—and with unexpected diabetes-related findings to boot. "This pushes our understanding of Type 1 diabetes to a different level," Kong said. "People never imagined leptin could replace insulin and be used to treat diabetes."

Translating these findings to human clinical trials, both for obesity and diabetes treatment, is still to come. The next big goal will be to understand more about what causes leptin resistance, Kong said, but he's hopeful. "Based on our findings, it will be easy to come to other conclusions," he said. "A lot of breakthroughs will be made very soon."

IMAGE: PEIYUAN ZHANG FOR TUFTS UNIVERSITY

Jamie Maguire (right) works alongside a lab assistant at Tufts in 2013.

NEW HOPE FOR POSTPARTUM DEPRESSION

Research by neuroscientist Jamie Maguire has led to an effective drug now under FDA review. BY TAYLOR MCNEIL

For women with postpartum depression—by some estimates, nearly one in five new mothers—the recent announcement of positive results in clinical trials of a drug to help alleviate their symptoms was welcome news.

For Jamie Maguire, an assistant professor of neuroscience at Tufts, it was a moment to savor. That's because the developer of the new drug had built on a discovery Maguire made almost a decade ago, when she was a postdoctoral researcher at UCLA, about specific receptors in the brain that seemed to be implicated in postpartum depression.

At the time, Maguire had made several discoveries "which implicated deficits in neurosteroid signaling in postpartum depression," said Philip Haydon, Annetta and Gustav Grisard Professor of Neuroscience at the Tufts School of Medicine. "Her research demonstrated that there are changes in the expression of receptors in the brain," he said, where neurosteroids are active in the last months of a pregnancy and the first months after delivery.

"We saw that animals which lack receptors which are sensitive to these neurosteroids develop maternal depression and exhibit deficits in maternal care," Maguire said. "Based in part on those studies, there was this idea that either there are deficits in neurosteroids themselves or in the actions of neurosteroids that makes this postpartum period vulnerable to mood disorders."

Subsequently, Haydon noted, Maguire "provided the first demonstration that neurosteroids are effective treatments for postpartum depression in this preclinical model." That work, "paved the way for the future drug-discovery efforts for treating postpartum depression."

Inspired by Maguire's findings, Sage Therapeutics of Cambridge, Massachusetts, started examining several neurosteroids, particularly allopregnanolone, to treat postpartum depression. Last November, the firm announced that Phase III clinical trials of its new allopregnanolone formulation, called brexanolone, had successfully mitigated postpartum depression symptoms. The firm is now seeking FDA approval for the drug, which Haydon points out is the first treatment to specifically target this population.

"One of the reasons I'm so excited about this is that there have been so few trials in mental health that have been successful," Maguire said. "There hasn't been a focus on women's health, and particularly postpartum depression—it's a really understudied area."

Maguire, whose work focuses on stress reactivity related to epilepsy as well as postpartum depression, has continued to investigate the mechanisms underlying postpartum depression. She and her colleagues have developed another preclinical model that also exhibits postpartum depression-like behaviors, and have been doing basic research work in collaboration with Sage, using the firm's compounds in their models.

Seeing her early work come to fruition is very rewarding, she added. "When you go into basic research, you hope that your work will make an impact, but you accept the fact that you won't likely get to see the impact during your lifetime," Maguire said. "The fact that my research efforts contributed to a successful clinical trial in such a short period of time is so gratifying."

PHOTO: ALONSO NICHOLS

Eating for Healthy Eyes

Why complex carbs are the clear choice for preserving vision. BY DAVID LEVIN

AGE-RELATED MACULAR DEGENERATION (AMD)—the leading cause of vision loss after age 50—can leave a person feeling powerless. Over months or years, AMD patients slowly lose their sight, moving ever closer to blindness. In most cases, there's no cure, but a team at Tufts has found signs that arresting the disease may not require creating new drugs, but simply tweaking patients' diets.

Sheldon Rowan, assistant professor of ophthalmology at the School of Medicine and a scientist in the Laboratory for Nutrition and Vision Research at the Human Nutrition Research Center on Aging at Tufts, said there are plenty of indications that the types of carbohydrates we eat play a role in the development of AMD. People who eat lots of simple carbohydrates, like those in white bread and sweetened beverages, are more likely to get the disease. This could be because simple carbs break down rapidly during digestion, creating a spike in blood sugar that can lead to widespread inflammation, a condition linked to AMD. Complex carbohydrates found in whole grains, however, break down more slowly, resulting in lower blood glucose. If blood glucose stays low over a long period, Rowan said, it can lower incidence of AMD.

To understand why, Rowan tested the two diets on laboratory mice. Over a year, he fed one group of mice "high-glycemic" foods—ones with lots of simple starches. A second group got a "low-glycemic" diet, rich in complex carbs, but otherwise identical in calories and nutrients. In a third group, Rowan switched the mice's diet from high- to low-glycemic foods halfway through the study.

Sure enough, mice with the low-glycemic diet did not develop AMD, while mice fed the high-glycemic diet almost all came down with the disease, a result in keeping with previous research. In the mice that switched diets, though, Rowan saw something completely unexpected: Not only did they avoid AMD, but the existing damage to their retinas was *reversed*. "No one had ever seen that before," Rowan said of the findings, which were reported in *Proceedings of the National Academy of Sciences*. "This suggests that just changing to a healthier eating pattern could have a huge impact."

Rowan found that mice with high-glycemic diets also had high levels of molecules called "advanced glycation end products" (AGEs) in their bodies. "AGEs are toxic end products of sugars," Rowan said. "They can damage the proteins and lipids that a cell needs to function." In the retina, these damaged proteins slowly accumulate in a sort of cellular garbage pile, forming yellow deposits called drusen, which destroy retinal cells.

Rowan also identified certain chemicals, including serotonin, in the mice's blood and urine that acted as markers for AMD. Because these chemicals have been linked to bacteria in the gut, Rowan wondered how microbes might be involved in AMD development. He reasoned that because simple carbohydrates are easy to digest, they are fully metabolized before entering the intestines and effectively "starve" microbes. This could discourage the growth of protective bacteria, while allowing species that create inflammation and other stresses to thrive. After testing the levels of various bacteria living in each mouse's gut, Rowan found some early evidence that may confirm this idea.

"There could be 'good' bacteria in the gut that are neuroprotective, and there could also be 'bad' bacteria that are proinflammatory," he said. "From this study, we can't parse out good versus bad, but it does show us that molecules associated with gut bacteria are playing a role in AMD."

Identifying those molecules could one day lead to new drug treatments. But until then, AMD patients may be able to improve their vision just by switching up their diet. "This gives us a tremendous opportunity," said Tufts biochemist Allen Taylor, director of the Laboratory for Nutrition and Vision Research. "In humans, this is the equivalent of switching out four or five slices of white bread each day for whole grains. It's a minor alteration that will pay great benefits."

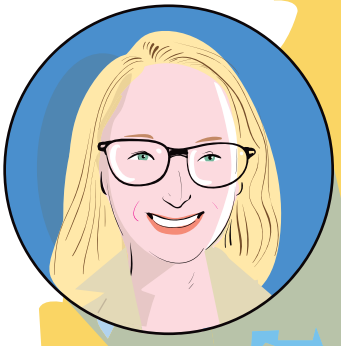
ILLUSTRATION: PETER CROWTHER

RIGHT ON TRACK

IN THE MID-2000S, MAINE was facing a dire physician shortage—and, with few state residents applying to medical school, there seemed little hope of reversing the trend. At the same time, Tufts University School of Medicine was looking to grow its class size to meet the growing demand for physicians to care for an aging U.S. population. Enter the Maine Track program: a partnership between the School of Medicine and Maine Medical Center that launched in 2009. The program offers scholarships to qualified Maine students and a curriculum focused on rural, community-based education designed to train and keep doctors in the Pine Tree State. It's been a resounding success—so much so that the school and the hospital just signed on for another ten years of partnership. Ahead, we hear from some of the graduates now practicing in Maine and from Peter Bates, one of the program's lead architects. **–COURTNEY HOLLANDS**

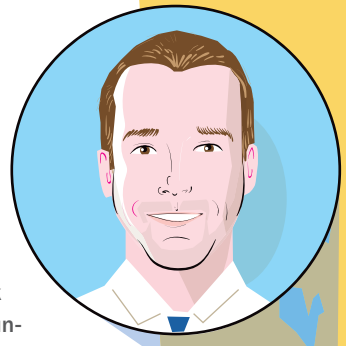
40%

INCREASE IN MAINE APPLICANTS TO MEDICAL SCHOOL OVERALL SINCE MAINE TRACK STARTED—THE SIXTH HIGHEST GROWTH RATE IN THE COUNTRY.



AMANDA MCDONOUGH, M13
Obstetrician and gynecologist, Maine General Medical Center's Alfond Center for Health, Augusta, Maine

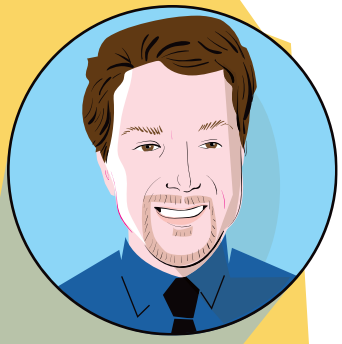
"Rural care is quite unique. I rotated very close to my hometown of Standish, which was an incredible experience. The providers were so aware of their patients as whole people; they understood family dynamics and how limited resources affected some patients. Rural primary care almost convinced me to do family medicine, but then ob-gyn won my heart."



JASON HINE, M13
Emergency medicine specialist and attending physician, Southern Maine Health Care, Biddeford and Sanford, Maine

"I first heard of the Maine Track program through my career counselor at Colby College, where I did my undergraduate studies. It really was the perfect combination of a well-resourced, respected medical education in a large urban setting and the peace and natural beauty of Maine-based living. It was a no-brainer."

ILLUSTRATIONS: BRIAN TAYLOR



JOHN L. DAGGETT JR., M14
Primary-care internist, Milo Family Practice, Milo, Maine; Hospitalist physician, Mayo Regional Hospital, Dover-Foxcroft, Maine

"There is a great need in Maine for physicians of all specialties. This is especially true in the more rural parts of the state. It was great to train in Maine because the network of providers is very collaborative, so I knew wherever I ended up practicing, that network could be utilized."

For more on the Maine Track program, visit medicine.tufts.edu/mainetrack.

Dover-Foxcroft

13

NUMBER OF ELIGIBLE MAINE TRACK GRADUATES WHO ARE PRACTICING IN MAINE, WITH MANY MORE NEARING THE END OF THEIR RESIDENCIES AND FELLOWSHIPS.

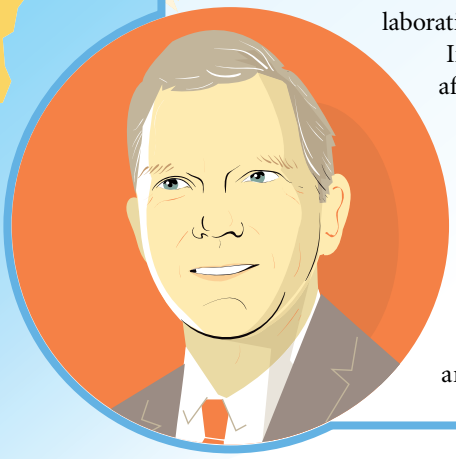
50%

SHARE OF MAINE TRACK GRADUATES WHO PURSUE A PRIMARY CARE–RELATED SPECIALTY.

A FOUNDER LOOKS TO THE FUTURE

FROM HIS EARLIEST days planning the Maine Track program, founding academic dean Peter Bates of Maine Medical Center knew it had to offer a signature educational experience if it was to fulfill its mission. "We had to familiarize students with the challenges and the pleasures, really, of practicing in a rural state," he recalled, "so that it would be imprinted on their development and encourage them to practice here."

To that end, during their third year, about half of the Maine Track class heads to a nine-month Longitudinal Integrated Clerkships at 10 community hospitals around the state (the other half stays at Maine Medical Center, the 11th LIC site). "This kind of distributed medical education model is perhaps a little harder to do than keeping everybody in the teaching center in a big city, but it can be done very well," Bates said. Students in the program get to develop relationships with patients, while local physicians and other clinicians get an opportunity to teach and mentor students—a boon to recruitment and retention at the LIC sites. School of Medicine Dean Harris Berman thanked Bates in his 2018 commencement speech, calling him "instrumental in developing the Maine Track program, and in making it the success that it is today." Bates, for his part, points to the truly collaborative effort among his many colleagues in Boston and Maine.



In July, Bates retired from his positions as senior vice president of academic affairs and chief academic officer at Maine Medical Center, but Maine Track will continue under interim academic dean Robert Bing-You, the hospital's vice president of medical education. Over the program's next decade, Bates hopes even more LIC sites will come on board, and that all the locations will consider participating in clinical research and providing residency programs to create a pipeline for rural positions (such as the internal medicine residency now offered by Stephens Memorial Hospital in Norway). "These additions will make these fully fledged academic centers in their own right," he said, "and part of Maine Medical Center and the School of Medicine's already strong partnership."

*ALL NUMBERS ARE AS OF PRESS TIME.

TAKING ON

Bree Aldridge and her team are revolutionizing how we understand—and treat—one of the world's deadliest diseases.

Aldridge lab members, left to right: Graduate students Jonah Larkins-Ford and Michelle Logsdon; Bree Aldridge; postdoc Trever Smith; and research technician Nhi Van.

TB

BY SHANNON FISCHER PHOTOGRAPH BY ANNA MILLER

WALKING INTO BREE ALDRIDGE'S EIGHTH-FLOOR LAB at Tufts University School of Medicine in Boston is not for the faint of heart. Step one, empty your pockets—phone, wallet, keys. What goes in doesn't come out—not even the air, and definitely not the lab notebooks, which is why the windows that look onto the hall are littered with Post-it notes of data points. Next comes the first layer of personal protective gear: respirator, gloves, hair cover, safety glasses. Finally, suit up in a pair of white Tyvek coveralls, booties, a second pair of gloves, and sleeve protectors, with tape securing every opening. A red line on the floor marks the point of no return; step over that, and you're officially ready to start the workday.

"It takes a couple months to get used to how it is, and then it's sort of like riding a bike," Aldridge said. Now a ten-year veteran of the process, she can do it in five minutes flat.

The reason for the precautions is that Aldridge and her eight-person lab study tuberculosis. It's one of the deadliest diseases in the world, responsible for up to one billion deaths over the last 200 years. Researchers can study it only in the confines of what's called a Biosafety Level-3 laboratory, the same level of biosafety required for anthrax, SARS, and other lethal pathogens.

Aldridge's BSL-3 lab was built specifically for studying TB—in fact, she is the Tufts University School of Medicine's first-ever hire in what the school hopes will become an innovative new TB research center. Such investigation is crucial: Besides being among the world's most prolific and difficult-to-treat killers, the bacteria that causes tuberculosis, *Mycobacterium tuberculosis* (*M. tuberculosis*) can't be easily studied with traditional microbiology. Even more than a century after its discovery, remarkably little is known about the microbe's most basic properties, including its behavior, growth, and life cycle.

But Aldridge is no traditional microbiologist—she's a bioengineer by training, with talents for intense computational modeling and mathematics that have already helped her break at least one new paradigm in the TB field. And now, with an interdisciplinary team of engineers-turned-biologists, and biologists newly trained in heavy computation, she has joined the vanguard in a new era of tuberculosis research, where her contributions could revolutionize how this deadly disease is understood and treated.

"Consumption" got its nickname for the way its victims waste away, as if consumed from the inside by their illness. Jane Austen is believed to have died from consumption as is gunslinger Doc Holliday. But TB is no scourge of the past—it is very much alive today, and growing stronger all the time. It recently had the dubious honor of exceeding both HIV/AIDS and malaria as the leading cause of death in the world from a single infectious agent. In 2016, more than 10 million people fell ill with tuberculosis; 1.7 million of them died from it. That's the equivalent of the entire population of Portugal getting sick every year, and two-and-a-half times the population of Boston dying.

If those numbers seem high, they pale in comparison to the fact that a full quarter of the global population carries the disease in its latent form—that's more than 1.9 billion carriers—and some 190 million of them are expected to one day get sick.

"TB is among the top infectious diseases affecting human health across the globe," said Jenifer Jaeger, who directs the Infectious Disease Bureau at the Boston Public Health Commission. "It's a *huge* public health issue."

Most of these cases are in middle- to low-income countries, such as India, Indonesia, and China, but every country is affected, including the U.S. Tuberculosis is even in Boston, where Jaeger's office helps manage a small, but steady number of active and latent cases every year.

No matter where tuberculosis turns up, Jaeger explained, treating it can seem nearly as onerous as the disease itself. Active cases require taking four or five different drugs for at least six months, often more. For drug-resistant tuberculosis, which is on the rise, doctors must turn to second- and third-line antibiotics, administered for up to two years. It can be a brutal regimen, with possible side effects that include hearing loss, blurred vision, psychiatric disorders, hypothyroidism, and organ damage. Even then, nearly half of these cases will not be cured, according to the Global Alliance for TB Drug Development.

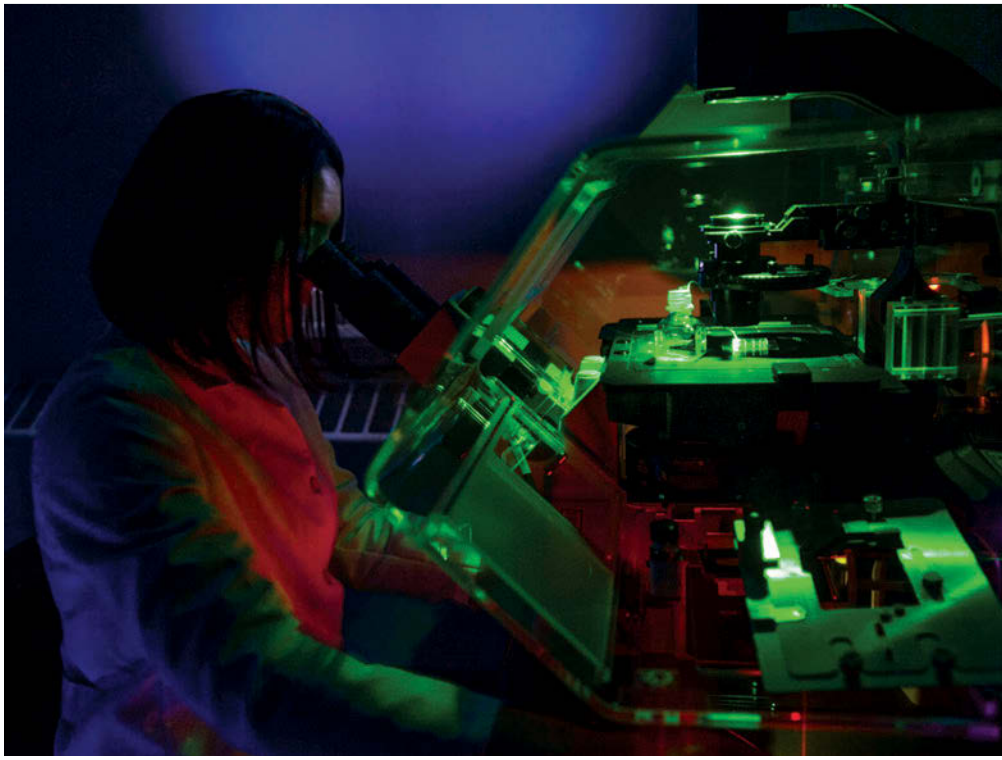
None of that was on Bree Aldridge's radar during the first chapter of her career. She was busy studying computer engineering and cellular biology in Arizona, then bioengineering for her Ph.D. at MIT, where she built cutting-edge mathematical models of cancer cell death. It wasn't until 2007, when she was nearly done with her MIT degree and on vacation in India, that she began to think seriously about infectious disease. India is a hot spot for many illnesses, including TB and HIV/AIDS, and as Aldridge walked through the

"TB IS AMONG THE TOP INFECTIOUS DISEASES AFFECTING HUMAN HEALTH ACROSS THE GLOBE," SAID THE DIRECTOR OF THE BOSTON PUBLIC HEALTH COMMISSION'S INFECTIOUS DISEASE BUREAU. "IT'S A *HUGE* PUBLIC HEALTH ISSUE."

streets of Mumbai, she observed many people coughing and obviously sick. "It made me wonder if maybe I should think outside of cancer," she recalled.

When she returned to Boston, Aldridge began to explore infectious diseases and quickly found herself fascinated by a puzzle that perplexed tuberculosis researchers. *Why* were the treatments so onerous? Most of the bacteria died in the first two weeks of treatment, just like any other infection. It was actually similar to cancer that way, she realized. "Both require multiple drugs for extended periods of time, and standard treatments don't always work," she said. "It's because of relapse. It's because there are some proportion of the target cells don't get killed by the drug therapy. Why is that?"

The real reason researchers couldn't perfect the drug treatments, she learned, was because they didn't know exactly what they were working with. Experiments with mycobacteria, the bacterial group that includes tuberculosis, notoriously produced more varied and fuzzy results than work with better-known organisms, such as *Escherichia coli*. But nobody could figure out why, because the bacteria were too hard to observe. Mycobacteria grow incredibly slowly—it takes 20 to 22 hours for an *M. tuberculosis* cell to divide (another mycobacterium, *M. leprae*, which causes leprosy, takes 14 *days*). *E. coli*, by contrast, divide about every 20 minutes. For a long time, researchers couldn't use traditional microscopes, because the light from the scope would kill the cells before they had a chance to grow—and if that didn't get them, the prolonged time in a standard culture dish without a steady flux of nutrients and oxygen would.



Bree Aldridge brings cells into focus under the microscope in preparation for making a video of bacterial growth.

So for decades, scientists did the next best thing. They studied easier bacteria and extrapolated, as many researchers do with mice when they want to ask questions about humans. "And that was fine; many of the bacteria they studied looked pretty similar," explained Chris Sassetti, who studies tuberculosis at the University of Massachusetts Medical School. "But what that ignored is that different species of bacteria are as distinct from each other as we are from yeast."

Things finally began to change by 2008, when Aldridge signed on as a postdoc in the lab of prominent tuberculosis researcher Sarah Fortune at the Harvard T.H. Chan School of Public Health. Aldridge's own field of bioengineering had actually devised a lot of new methods and technologies that might be able to overcome challenges in studying TB. And that's when Aldridge realized she could now do something no one ever had before: look at the tuberculosis-causing bacterium as it lives and grows.

PHOTO: KELVIN MA

"The first time I saw them, I thought they were really weird," Aldridge said. We were sitting in her office on the Tufts' Health Sciences campus, watching a video she had captured of TB bacteria dividing in culture.

Mycobacteria are named for the study of fungus—*mycology*—and it suits them. On a time-lapse video, they grow in an eerily slow, staggering motion. They're shaped like small, irregular rods, sticking close to one another as they pinch themselves off into new segments. The effect is that of slowly unfurling spider legs.

Getting video of these microbes for the first time wasn't easy. Although new microscopes and recording tools were available, it still took Aldridge almost a year of troubleshooting at Harvard to get everything working. She couldn't use normal cultures to grow the organisms, so she worked with a team of medical engineers at Massachusetts General Hospital to devise microfluidic plates—little silicon wafers carved with minute channels and wells. Using these, she could isolate a single *M. tuberculosis* bacterium and keep it alive through at least five divisions. Meanwhile, she needed to write a lot of code from scratch to be able to analyze her images, and tweak her microscope cameras before they could focus reliably on the bacterial cells, which are about twenty times thinner than mammalian ones.

But when the work was done, the beginnings of an extraordinary story had emerged. "These two are sisters," Aldridge said, gesturing to two long shapes, attached like sausage links. "You can see they're not dividing at the same time, and they're not growing from the middle or even at the same rate." This was rare for bacteria, which typically grow and divide neatly, splitting into two identical daughter cells. Not tuberculosis, though: As Aldridge discovered, every time an *M. tuberculosis* cell divides, it makes two daughter cells that look and behave distinctly, even though they are genetically identical. One is always larger and faster-growing—the one that inherited the mother's cell-growing machinery, or growth pole—while the other is invariably smaller, slower, and forced to make its own growing parts anew. These size differences become more pronounced as the cells progress through generations.

The asymmetric growth Aldridge discovered had profound clinical ramifications. In experiments, she found that the bigger, faster-growing cells—she named them accelerators—were sensitive to certain antibiotics that attacked their cell-wall making machinery, yet could withstand assaults from different antibiotics that targeted other cell operations. The little cells, which Aldridge called alternators, responded in the opposite pattern—perhaps because the alternators weren't making cell walls at the same rate as their sisters, they were less vulnerable to the first type of antibiotics, but suffered more from other drugs.

The stunning findings finally answered the question of why tuberculosis was so hard to treat: Though genetically identical, different *M. tuberculosis* cells seem to have a built-in ability to tolerate different drug regimens. "We didn't know that until we just started looking at the cells," Aldridge explained.

"It totally makes sense—once you see it. But somebody has to think of it," said Eric Rubin, M90, SK90, who leads a tuberculosis lab and chairs the Department of Immunology and Infectious Diseases at the Harvard T.H. Chan School of Public Health. That somebody, it turned out, was Bree Aldridge. Her insight, Rubin said, was "one of those pardigm-breaking things that instantly becomes a new paradigm."

PHOTO: KELVIN MA

Before 2012, the Tufts' Health Sciences campus didn't have a tuberculosis researcher, and didn't even have the right lab for it. But John Leong, chair of the Molecular Biology and Microbiology department, understood that modern technologies were likely to soon lead to major new discoveries in the TB field—and with Tufts' reputation for microbiology excellence, it could be at the forefront. He even persuaded the medical school's dean to promise several million dollars for a new Biosafety Level-3 lab, earmarked just for that disease.

All Leong needed next were scientists to populate the future facility. He'd heard about Aldridge from his friends, the two TB experts Rubin and Sassetti. "I didn't know who Bree Aldridge was, but she was all about this computational approach and this single-cell analysis, which was very groundbreaking," he said.

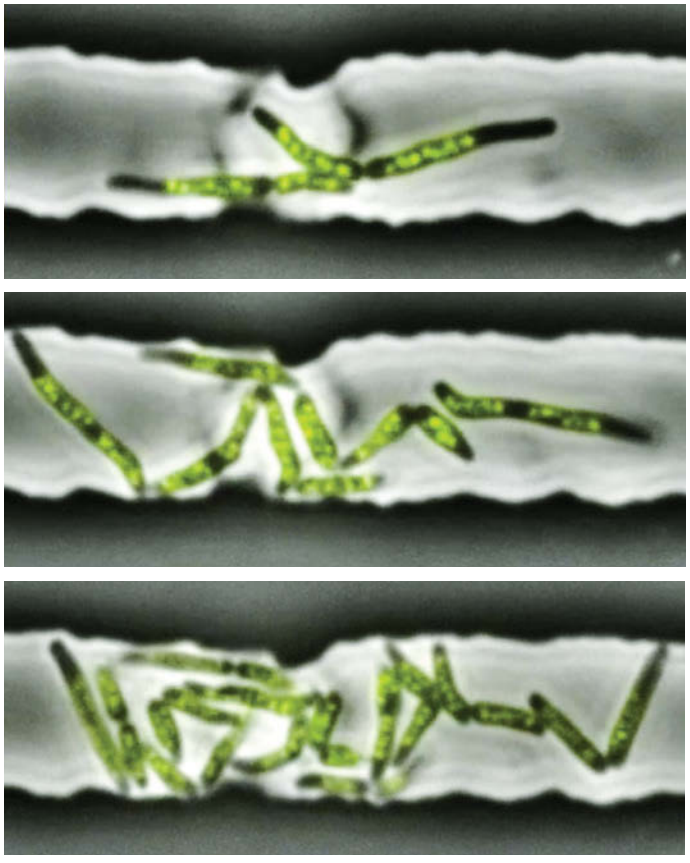
Before Leong had the chance to reach out to her, though, Aldridge spotted and applied for a pair of faculty openings at Tufts, in the departments of Molecular Biology and Microbiology at the medical school in Boston and Biomedical Engineering on the Medford/Somerville campus. Hoping to land one, she got them both. Her dual appointment was unprecedented for the departments. "We didn't have a structure to do this, so it was much more complicated," said Leong. But he anticipated that Aldridge would be a catalyst for more interaction between his and other groups at Tufts. "Interdisciplinary work is the wave of the future," he said. "Tufts has got to do that—and has to do that well—in order to thrive."

As soon as she arrived at Tufts in 2012, Aldridge began building her lab. She chose people less for their past expertise, and more for their future potential. "The work that we do is so specialized," she explained. "I'm not looking for people with a certain skill set. I'm looking for people with the drive to learn new things to help solve a particular problem, who are willing to learn another discipline."

Things were slow for the first year, and then in early 2013 she won a prestigious $50,000 fellowship grant from the Alfred P. Sloan Foundation. That fall, she followed it up by netting a $1.5 million NIH Director's New Innovator Award, one of only 41 scientists nationwide to receive the honor. "That's a major award," Leong said. "It really puts an investment into investigators the NIH sees as being highly innovative and potentially growing into real leaders in their field."

Aldridge has used her original time-lapse system as the foundation from which to study the odd TB microbes in greater detail. In one experiment, her lab studied how mycobacteria react to a single common antibiotic, rifampicin. They discovered the reaction is determined by a complex set of connected factors, such as how big and how old the cell is at the time a treatment starts, and where exactly the cell is in its growth cycle. And that's just against *one* antibiotic—it gets more complicated.

In another study led by collaborators in Vietnam, Aldridge helped



This page: Stills from a time-lapse video showing the asymmetrical growth and division of mycobacteria cells. Opposite page: Bree Aldridge working in the lab with former Tufts research technician Owen Bennion in 2013, shortly after she arrived at the university.

PHOTO: COURTESY

show that fighting the bacteria somehow *caused* some of the cell-size variation she had documented in her time-lapse studies. Clinical tuberculosis bacteria taken from patients showed a wide range of sizes—the more drug-resistant they were, and the worse the patient's symptoms, the more the cells varied. When the Vietnam team cultured some of these TB-causing bacteria in conditions resembling the stressors of a human host, or treated them with antibiotics, the microbes' lengths grew increasingly varied. And when the scientists exposed them to both conditions, the effect became even more pronounced.

What this means is that mycobacteria seem to change their size as a response, or maybe adaptation, to different stressors. Aldridge calls it a form of evolutionary "bet hedging." The more that's thrown at them, whether by the immune system or by antibiotics, the more the microbes divide into ever-varying lengths that somehow improve their ability to survive attack. What doesn't kill tuberculosis literally makes it stronger.

Expanding on this has become a main focus of Aldridge's lab, with postdocs and graduate students each tackling a piece of the mycobacterial response. One grad student, Michelle Logsdon, has already discovered how one of these species, *M. smegmatis,* controls its sizes in a different way than any other microbe studied. "I had my feet in two fields with this study," Logsdon said. There was the relatively new mycobacterial growth field—familiar territory for the biologist—and the older niche field of cell-size control, which is dominated by physicists and mathematicians. At one point, Logsdon showed the mycobacteria's bizarre abilities to their collaborators at Harvard's School of Engineering and Applied Sciences. "They're like, wait, bacteria can't do that!" she recalled. Up to then, of course, they had mostly studied established model bacteria like *E. coli*. Logsdon is now trying to figure out if the tuberculosis bacterium is similarly unusual.

Elsewhere in the Aldridge lab, postdoc Trever Smith and graduate student Jonah Larkins-Ford are developing culture conditions that are more similar to the human host. "Since what the bacterium is introduced to and what environment it is in will influence the degree of tolerance," Smith explained, "We're trying to systematically go through what tuberculosis may be experiencing in different parts of its host."

When Aldridge tested the antibiotic rifampicin, she compiled cell growth and cell-cycle parameters that she could use to make a computational filter of the different behavioral rules that the microbes seemed to follow. Working with Smith and Larkins-Ford, she's creating a compendium of all the bacteria's possible behaviors and abilities, adding each new one to the list as they uncover it. "If we're going to design new interventions," Aldridge said, "don't we have to understand the basic function of the cells and how they achieve their crazy ability to tolerate stress?"

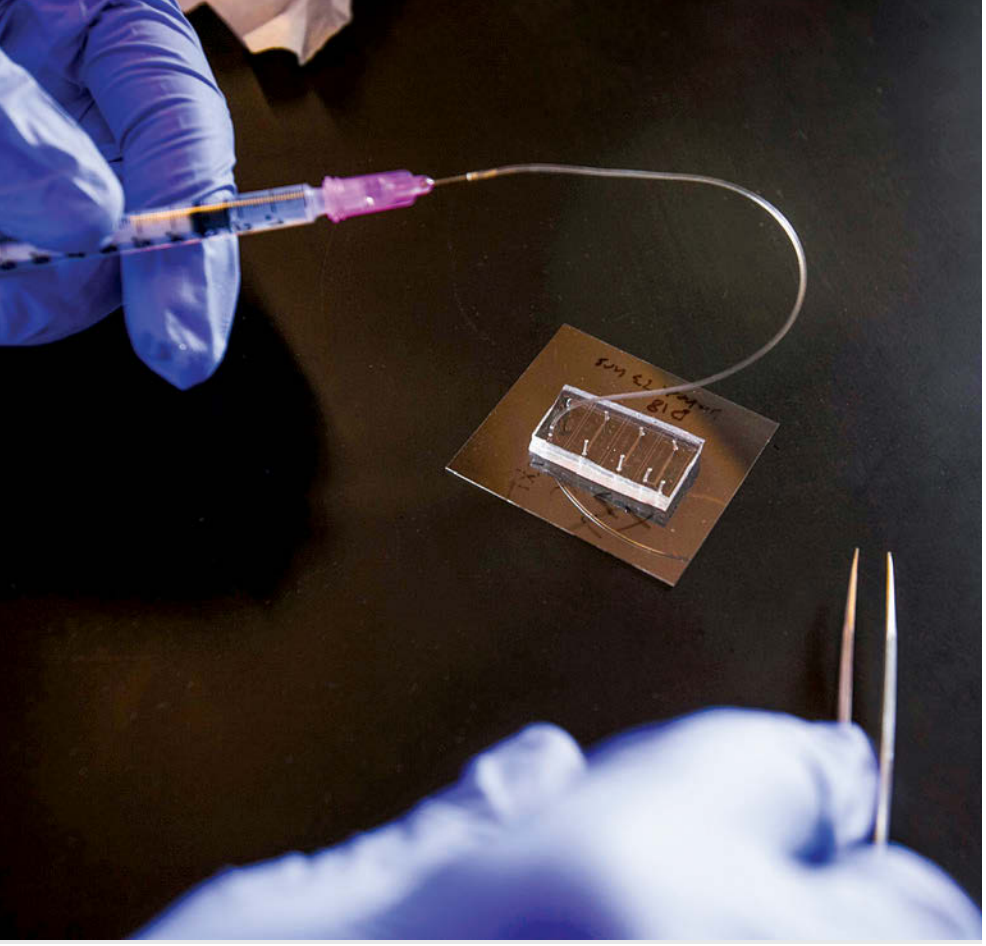
THE ALDRIDGE LAB'S WORK "HAS THE POTENTIAL TO MAKE THE DIFFERENCE IN HOW WE APPROACH THE DEVELOPMENT OF DRUG REGIMENS," SAID TUFTS' JOHN LEONG.

Last year, Aldridge came out with what others in the field call her most important work yet. It begins with the fact that treating TB requires taking multiple drugs at once. If scientists wanted to study how these drugs interacted with each other—if some of them negated another's effects, say, or synergistically enhanced them—they would use a "checkerboard assay" with 384-well plates, each filled with increasing doses of drugs mixed together to see how they perform against the bacteria.

But no one has systematically done this for all of the countless possible TB drug interactions. That's because while a single two-way drug analysis requires one such smartphone-size plate, a four-drug interaction requires 25 plates. "For a 10-way interaction, you'd have to stack them up as high as the Empire State Building," Aldridge said. "And this is why people don't measure drug interactions at high order."

Aldridge and a visiting scholar in her lab, Murat Cokol, however, recognized that the most important information a researcher needs is simply whether the drugs interact positively or negatively. For that, she didn't need data from every possible combination, just a very few key ones. So last fall, in collaboration with Cokol and others at Harvard and Sabanci universities, she helped develop a mathematical model that lets her extrapolate from a subset of those most important combinations. "It's not unfair to call it quick and dirty," she said of the new method. "It's just that in order to be quick and dirty, we're really careful about our experiments."

In her first paper on the method, which she has named DiaMOND for "Diagonal Measurement Of N-way Drug interactions," Aldridge easily identified new synergistic combinations of two, three, and four different TB drugs. "We've measured up to 10-way interactions now," she said. "You can keep piling this up." She has



Bree Aldridge and her team load mycobacteria into microfluidic devices to keep the cells growing for an extended period of time.

already started expanding this effort to create new tuberculosis drug combinations for preclinical testing with the help of a nearly $1.3 million grant awarded by the Bill & Melinda Gates Foundation this March.

"It takes somebody thinking about the complexity of the problem from a quantitative perspective to see the solution," said Sarah Fortune, Aldridge's postdoc advisor at the Harvard Chan School. "And I think it speaks to a larger problem, which is how do you develop combination therapy for anything, even cancer?"

At Tufts, Leong agrees. "This is really exciting," he said. "It has the potential to make the difference in how we approach the development of drug regimens. And that could be in TB, or any number of drug-resistant pathogens."

Aldridge is already working with other researchers at Tufts University School of Medicine to expand the DiaMOND method, including Joan Mecsas and Ralph Isberg, who study common hospital-acquired pathogens caused by bacteria such as *Klebsiella* and *Acinetobacter*. The mathematical model, Aldridge said, "is plug-and-play."

Those are far from Aldridge's only cross-department collaborations. She has a project in the works with biomedical engineer Fiorenzo Omenetto to develop even better testing and analytic technologies to study TB, and is in discussions with bioengineering chair David Kaplan about developing realistic 3D models of human lung tissue to study TB and other lung conditions, such as fibrosis.

Just as Leong had hoped, Aldridge's interdisciplinary approach has caught on throughout the microbiology and bioengineering departments. "When she came, we had virtually no interactions with the biomedical engineering department," Leong said. But as soon as she arrived, she got the two groups talking, sharing their research, finding new ways to blend their expertise. The departments ultimately netted a joint almost-$8 million grant from the NIH's National Institute of Allergy and Infectious Diseases to establish a research center dedicated to the study of dangerous bacteria in bioengineered models of the human intestine.

"Having faculty who are trained with one foot in engineering and one in biology is fantastic, because they understand the language in both places, and that can synergize this dual approach to research," said Kaplan, who is the grant's co-primary investigator with Isberg. Aldridge, he added, "was a catalyst, a translator—she helped to bring the two departments together."

Back in her lab, Aldridge plans to combine her two primary research threads, folding some of her work on the TB bacteria's response to immune and antibiotic stressors into her DiaMOND drug-interaction tool. "The principle of this method is that as long as each stressor has a dose-response, then you can use DiaMOND to efficiently measure how it all behaves in combination," Aldridge said. And that might eventually lead to shorter and more effective drug strategies that save lives.

Right now, everything is still very preliminary, but Smith and Larkins-Ford are already attempting to translate the more immune system-mimicking cultures they're creating into DiaMOND. "It's like all the tools we use in the lab are systematically meshing together in this beautiful way," Smith said.

Sometimes, bioengineers define their field as harnessing biology to engineer new systems. But Aldridge flips that on its head, using math and pattern-finding technologies to unravel biological puzzles. "That's the cool thing about these tools," Aldridge said. "You can have a huge problem that seems insurmountable when suddenly, you see a pattern."

"And then we can use that knowledge to cut through the complexity and understand biology in a way that we couldn't see before." TM

PHOTO: KELVIN MA


Dawn Gross D., Ph.D.

What Matters Most

Tufts alum Dawn Gross on why hard conversations about life and death are so important to have right now.

BY COURTNEY HOLLANDS
PHOTOGRAPHS BY TIMOTHY ARCHIBALD

DAWN GROSS REALLY WANTS to talk to you about death—but she's far from morbid. "As you start to have these conversations," she said, "you realize that even if it's in the context of imagining the end of life and how to support someone who's dying, what you're actually talking about is what matters most to a person while they are very much alive." Though it's hard to envision Gross, M96, SK96, a soulful Bay Area-based palliative care and hospice physician, doing anything else, she studied neuroscience and psychology as an undergrad and entered the Tufts M.D./Ph.D. program in the early 1990s, expecting to emerge a brain surgeon. (She even had a license plate that read BRNMD2B, or "Brain M.D. to be.") Switching to immunology, Gross was the sole student researcher on a breakthrough that identified the precise cause of an autoimmune reaction in the arthritic joints of patients with Lyme disease.

Yet her experiences caring for hematology and bone-marrow transplant patients during an internship year at Tufts Medical Center and a fellowship at Stanford University—coupled with a period of intense reflection following her father's death—led her to ponder big questions, and ultimately to her current career. Today the mother of three is an attending physician in the University of California San Francisco's Division of Palliative Medicine and host of the KALW radio show "Dying to Talk," on which she and expert guests grapple with the nuances of end-of-life conversations. On her campaign to encourage people to have these discussions early and often, Gross is writing a book and is co-creator of Death Ed, a high school course on the subject. Ahead, she talks about listening deeply, how doctors can stay attuned to patients' wishes, and the power of magic wands.

You started the M.D./Ph.D. program at Tufts, intending to become a scientist. What tipped the scales to medicine?
I did the first two years of medical school, went off to graduate school, and then showed up as a third-year med student with the confidence of a Ph.D. under my belt. As I was finishing the clinical years, my husband, Andy, M96, was four years ahead of me in his medical training at Tufts Medical Center. He really knew the lay of the land and started to see things I might be interested in. He also knew my immunology interests and had me come shadow him on bone-marrow transplant one day. Suddenly, I saw the science in every single patient—it was pretty cool. That's when being a doctor *and* a scientist really clicked.

How did Kellie Sprague, your mentor for the bone-marrow transplant rotation you did at Tufts Medical Center, influence your career?
Kellie was the first person to make a dramatic impression on me of what a doctor could be. She was a human being—a whole human being connecting to patients. Most of our bone marrow patients stayed in the hospital for a long time. Often, because of the isolation precautions, we were really their only contact with the outside world. And so the relationships we built with patients were unexpected and changed my perspective on what it meant to be a doctor. Not only was I interested from a scientific perspective, but these very human relationships were unfolding before me.

During your fellowship at Stanford, your dad became terminally ill. Did that set you on the path to palliative care?
The first year of fellowship was the really intense clinical year. When you're dealing with a population of really sick people, a lot of them die. We never talked about it as clinicians, ever, but it was absolutely affecting me. So I started to ask patients questions that no one else around me was asking: *Why do you want to live? Why do you want chemotherapy? Why do you want a bone marrow transplant?* And I wasn't asking them because I was opposed to offering any treatments. I just needed them to really know how it could go. As I started asking these questions, it just so happened that my father became ill.

My father had been very clear from my childhood about what mattered most to him. One day while we were walking down the halls of Kaiser Hospital, where he was an administrator, he showed me how he painted color-coded lines on the floor to guide visitors. He pointed out how the pink line went to the delivery room and the green line went to the intensive-care unit. And he stopped and said: *Now I need you to know something, Dawn. I would never want to go down that green line. If I were ever that sick, I need you to know that I would much rather have the time, energy, and money spent on my grandchildren's education.* What he really ingrained in me were the things he deeply valued: family, children, legacy, and education.

When he did become sick, my father was deeply conflicted—he wanted to honor my mother, his wife, and her desire to have him fight for his life. At the same time, his values never wavered—now that he had grandchildren, he knew how he wished for his time, energy, and money to be spent. He was the one who actually called his primary-care doctor and requested he be referred to hospice. He chose to receive hospice at our home on a Friday. And then it was Saturday, Sunday, and my father died. So all of that was happening at the same time I was asking patients these radical questions: My father was teaching me how to listen in ways I hadn't been taught in med school.

How can medical school better prepare students for end-of-life conversations?
There are certain clinical rotations required to graduate med school. One of them is ob-gyn. While 50 percent of the population isn't involved in the clinical application of ob-gyn, 100 percent of us will be touched by death. It's the human condition and yet there isn't a single mandated class, lecture, or rotation experience on this subject. You can imagine it two different ways: It becomes a *single* class thrown in with everything else, or we constantly incorporate it in everything we do. Making palliative care an integral part of curriculum signals that it's as important as learning how to take someone's blood pressure.

To renew your medical license, you have to demonstrate that you have enough continuing medical education credits in pain management. But there's no CME requirement for end-of-life management. What would it be like if we all needed that? That's a culture shift. That's a paradigm shift. That's a health-care system shift.

In a 2015 *New York Times* op-ed, you wrote the "only time doctors are left with nothing more we can do is when

TUSM Leads the Charge

In 2016, Dr. Atul Gawande, co-chair of the Massachusetts Coalition for Serious Illness Care, approached School of Medicine Dean Harris Berman about collaborating on curriculum changes concerning end-of-life care. Berman has since met with the academic deans from the state's medical schools to kick off the conversation about how best to train students in end-of-life discussions with patients.

In addition, the School of Medicine plans to introduce a new curriculum in the fall of 2019. Rather than a single class, a "Patient Experience" thread—encompassing end-of-life and palliative care, advanced communication, and impact of health on patients and their families—will follow students through all four years of medical school.

we fail to ask." How can physicians stay attuned to their patients' wishes?
Medical students and residents are taught a structure for writing medical notes. It starts with chief complaint, abbreviated as "CC." My dream is that instead of the chief complaint, it's "CW," or chief wish. What does the patient wish for? When we start to ask what's getting in the way of doing that, it changes how we care for people. It changes their experience of how they're cared for because now it's aligned with what matters most to them in life, and not what's wrong. It still ultimately addresses what's getting in the way, which is perhaps an illness—it's not making our training irrelevant. It's just aligning it in a way that actually is consistent with keeping a person engaged in his or her life.

How do you view your role on a person's health-care team?
I tell people I feel like a fairy godmother—I'm there to make people's wishes come true. The palliative care field has been described as the Grim Reaper, the death squad, you name it. But I don't experience it that way at all. It's an absolute gift. I feel that I get far more out of it than I possibly can give, because I get to dwell in these incredible conversations of discovering what's essential and then focusing on that. I'm there to highlight that we are all still very much alive. I know how to care for you and—most importantly at the very, very end of life—your family, however you define them. How do we navigate that relationship moving forward? So I'm very much about life.

What do you mean by supporting the family, however a person defines it?
I play a game called Go Wish with my patients, my colleagues, my family, total strangers. It's a way to help people dive into this conversation very quickly. It's a simple deck of 36 cards with single phrases on them and you ask people to talk about the cards that matter to them. And so anytime someone picks the "to have my family

Students play Go Wish in the Death Ed class Dawn Gross and Jessica Zitter led at Brightworks school in San Francisco.

Mortality 101

In designing their high-school Death Ed course, Dawn Gross and her colleague, critical and palliative care specialist Jessica Zitter, received the following advice from their advisory panel (i.e., their teenage children and their friends): make it interactive, show videos, and use candy whenever possible. With this advice in mind, the doctors developed a two-day curriculum they plan to make available to schools across the country:

DAY ONE

CREATE CONTEXT THROUGH CANDY. Students receive candies and Gross and Zitter explain what each color represents: red is a parent or sibling, yellow is a pet, and so on. If a student knows someone who died, he or she puts one of that color candy in a glass jar that's passed around the classroom. When she holds up the filled jar, students always notice the same two things, Gross said. "One is that there's every single color in the jar, and two, there are more candies in the jar than there are people in the room."

SEPARATE FANTASY FROM FACT. Because most of what passes for end-of-life education today comes from the media, Gross and Zitter show a clip from the TV drama *Grey's Anatomy* when the title character is brought back to life via medical heroics. Students "know it's not real, but they don't know why," Gross said. To illustrate the reality of life-and-death decisions, they then screen *Extremis*, an unflinching Netflix documentary. "Certainly, teens cried—but they all came back for day two," Gross said.

DAY TWO

CONSIDER THEIR PRIORITIES. Students are split into groups to identify and discuss the Go Wish cards that are most important to them. They then write the statements on Post-it notes and affix them to the white board, grouping like ones together. "And they step back and look," Gross said. "There were a couple cards that students care about universally, but mostly, they were across the board. It just shows there's a lot to talk about *and* that you can talk about it."

with me" card, I immediately ask them who they consider family; I don't assume. So often, people say: *well, you know my mom, my dad, my brother, my best friend.* Or it's much less straightforward: *actually, not my mom, but my stepmom.* So I never assume I have any idea what anything means, particularly a word as loaded as "family."

Was there a time when discovering what was important to a patient surprised you?

That happens a lot because I ask a particular question: *If I had a magic wand, what would you wish for?* You might think people would ask to live forever, or to cure their diseases. But every single time I've asked it, those aren't the answers I get. It's always instantaneous and could be: *I want to be with my family. I want to go sit in my garden. I want to go fishing.* And that's where the fairy-godmother thing really started to show up—I can make these things happen.

For one woman on her eighty-ninth birthday, I actually did bring out a wand. I asked: *What do you wish for?* And she said to be young again. *What would you do if you were young again?* She said she'd go shopping. She was happy for me to just pull out the newspaper and circle grocery-store coupons. It's an opportunity to give people context outside out of what they think doctors want to hear and put them back into their lives—which is the only place that matters.

How can end-of-life conversations inform the here and now?

My favorite author is Antoine de Saint-Exupéry. There's a quote in *The Little Prince* that my children know I want for my epitaph: "It is only with the heart that one can see rightly; what is essential is invisible to the eye." The practice of getting at what is essential and then being able to share that with the people around you so that they can indulge you and envelop you in it—that's a glorious life. And when you can do for that for the people around you, I don't know what more I could hope or wish for.

Dawn Gross, wearing her winged white coat, embraces her youngest son, Kalel.

Why did you start a radio show?

While I love—and will always love—having one-on-one conversations or one-on-five conversations with people and their families, I have a desire to let more people in on it. Radio is an incredibly powerful platform. Not only do you reach a lot of people, you can be in dialogue, and people can eavesdrop.

In one "Dying to Talk" episode, your family—husband, Andy, and your two eldest children, Josh and Isabell—joined you on-air to play Go Wish. What was that like?

That is my favorite episode, the one I've received the most feedback on. I had my kids each sort the Go Wish cards for my husband ahead of time, narrowing it down to what they thought were his top three cards; my husband also sorted the cards for himself. But the actual discussion and comparing of cards was live. You can hear my daughter becoming emotional. She was trying to imagine her dad not being there—who wouldn't get emotional about that? The cool part was watching Andy listen to his children talk about him in the past tense. It changes how you think about your relationships, how you communicate, and how you view what matters. That's why I say these are present-tense "affecting your life and your relationships right now" conversations.

You've played Go Wish with your kids for years. How young is too young to start talking about death?

If you observe little kids, they notice when things are not alive, and they talk about it. That's not something that they are wired to be afraid of. Then something happens in young adulthood, where it becomes completely taboo and inappropriate to talk about. So I don't know that there actually is too young an age. I think there are age-appropriate conversations and there's a way to keep what's naturally there open and developing, as opposed to getting narrower and shutdown by the time you reach adulthood, when we suddenly lose the ability to talk about death or don't even know where to start.

What do you hope high school students get out of the Death Ed course?

The schools gave us two hours for the pilot—an hour one day and an hour another day. Ultimately, we decided our objective was to help students learn to talk about death now and keep talking about it—that's the takeaway. We wanted to play Go Wish on day two, so day one became about identifying the problem, naming the problem, and figuring out how to get healthy teenagers wanting to talk about death and the end of life.

You have wings embroidered on the back of your white coat. Why?

I like to surround myself with things that remind me of who I am, what I do, and what I love in life. I think I've always gravitated toward wings and the idea of being free. There's truly something in the power of flight, and the power of wings to, in a sense, embrace and hold and even protect. When I started to do hospice work, the experience of people dying wasn't what it had been when I was a hematologist. Dying was expected; it wasn't a failure or something wrong. I had wings sewn into the back of my white coat to symbolize the continued presence of people I have cared for and served. I know who's got my back. They're all with me, guiding me. TM

Connect

News of 2018 Match Day sure traveled fast: Fourth-year medical students Emily Follo, Ryan Lena, and Kim Dao dialed in their friend and classmate, Christina Finch, via FaceTime to celebrate the annual event at the School of Medicine in March. Finch, who was in Guam for a psychiatry rotation at the time, is one of 22 students who matched in family medicine—the second most popular specialty after internal medicine, which saw 34 placements.

PHOTO: ALONSO NICHOLS

Caps Off

The 2018 School of Medicine graduates are ready to tackle health-care challenges. BY COURTNEY HOLLANDS

THE NEW GRADUATES of the School of Medicine and the Sackler School of Graduate Biomedical Sciences are poised to make the world a better place, said School of Medicine Dean Harris Berman at commencement exercises on Sunday, May 20.

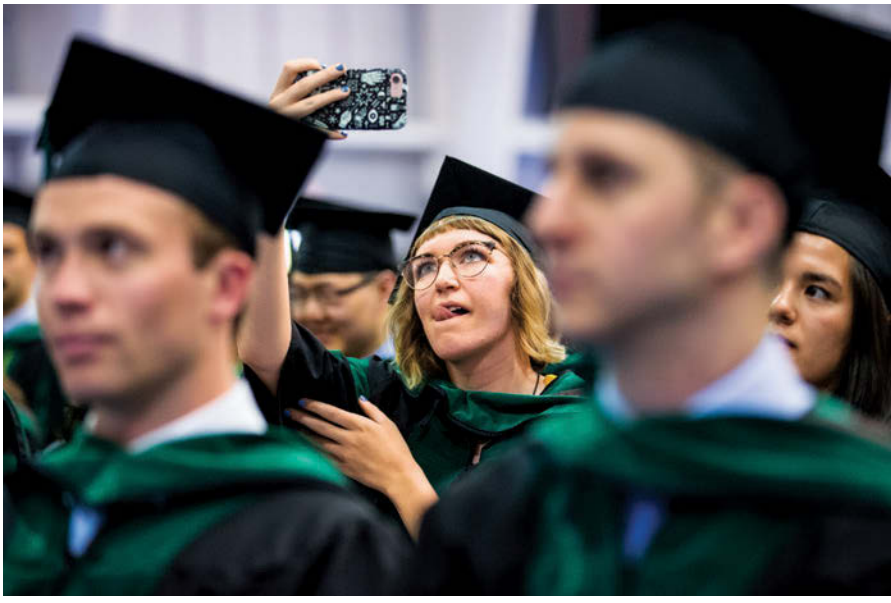
"The class of 2018 has more interest than previous classes in caring for communities that have been marginalized, specifically prison populations, the homeless, and immigrants," Berman said to the crowd gathered at the Gantcher Center. "It is powerful to see that the Tufts tradition of serving the underserved—from founding the nation's first community health centers in the late sixties to fighting Ebola from the frontlines in Sierra Leone—continues to pulse through your veins."

And as the health-care landscape evolves, graduates now have the tools they need to excel. "You will be going on to participate in programs around the country that will segue into dynamic, fulfilling careers that change lives and impact some of health and medicine's toughest challenges," Berman added.

Sackler School Dean Daniel Jay echoed that sentiment when he declared the world in the midst of a "biomedical revolution," and said graduates "will change human life in ways we cannot yet imagine." Invoking Dr. Seuss' *Oh, the Places You'll Go!*, Jay named a few students and talked about their diverse backgrounds and where they're headed. One of the graduates he mentioned, Elizabeth Erin Smith,

PHOTOS: MATTHEW HEALEY (MED)

This page, clockwise from top: Graduates wait to be called on stage at the Public Health and Professional Degree Programs ceremony; Tiffany Corlin, MG13, M18, snaps a selfie at the Gantcher Center; Sackler School Dean Daniel Jay shakes hands with Hasma Yousif Zahrani, SK18. Opposite page, clockwise from top left: Students gather and take photos before the PHPD ceremony; Ryan Noelle Walker, M18, MG18, holds her diploma; Public Health Student Senate president Kamisha Charles delivers remarks.



received her Ph.D. and gave the Sackler student address.

Smith thanked her support system, and then encouraged her classmates to be mentors to young scientists. "Let's strive to not only be leaders in our future endeavors," she said, "but also to help the next generation rise to excellence."

Medical class president Swetha Padma Iruku implored her fellow graduates to remember the faculty, friends, family members, and patients who made the last four years possible. "If I've learned anything over the last four years," she said, "it's that medicine is hard, but the people make it worth it."

At a separate ceremony for the School of Medicine's Public Health and Professional Degree Programs at Cohen Auditorium—one that saw the school's first graduate with a Doctorate of Public Health—Dean Aviva Must said that multidisciplinary approaches will be needed to tackle today's complex health issues, such as bacterial antibiotic resistance, the opioid epidemic, and gun violence.

"It has been our privilege to guide your learning and to learn from you," Must said. "The responsibility is now yours to keep up that education, stay abreast of new information, and most importantly, consider new perspectives."

Lisa Carron Shmerling, MG14, vice president of legal at Decibel Therapeutics, Inc., gave the alumni address, and James J. O'Connell, president of the Boston Health Care for the Homeless Program, delivered the faculty address.

In her class address, Public Health Student Senate president Kamisha Charles said she was first attracted to Tufts by this line in the medical school's mission statement: "To serve and advocate for all people, especially underserved and vulnerable patients and populations." And in the current national climate, as more and more people's rights are being infringed on, "advocacy has never been more urgent or important," she said. "Advocacy is not a sprint; it's a marathon. We have to work at things little by little, continuously building on the movements that came before us."

PHOTOS: RYAN MCBRIDE (PHPD)

Long-Distance Health

Tufts-affiliated doctors are participating in a new model of medical-care delivery. BY MONICA JIMENEZ

AT THE SAME time that physicians at resource-strapped clinics are struggling to care for their un- and underinsured patients, doctors with hours and skills to spare are looking to pay it forward. Connecting the dots is a national nonprofit called the Medical Alumni Volunteer Expert Network (MAVEN) Project. Founded by Pacific Women's Obstetrics & Gynecology managing partner and practitioner Laurie Green in 2012, and now driven by CEO Lisa Levine, M05, The MAVEN Project links physician volunteers—including a number of Tufts School of Medicine alumni and Tufts Medical Center physicians—with offsite clinics in need through a telehealth portal.

Primary-care providers in under-resourced clinics can book time with physician volunteers for provider-to-provider video and/or audio consults, education, and mentoring through The MAVEN Project's telehealth portal. The system eliminates geographic and socioeconomic obstacles, and now enables over forty clinics in Massachusetts, New York, Florida, California, Washington, and South Dakota to get immediate diagnoses, advice on which patients truly need to be seen by a specialist in-person, and specialist consults. Currently about 95 active volunteers—many from medical schools—mentor newer colleagues, get consults from doctors in thirty fields, and trade thirty-minute seminars on topics ranging from opioid management to rheumatoid arthritis

Some volunteers are looking for a way to stay active as they enter retirement. "This provides them an opportunity to continue to do what they love and are trained to do—and to flex those muscles they have developed in their respective specialties for often decades of their life," said Levine, who was The MAVEN Project's CMO before becoming chief executive last year. Her previous work centered on building innovative health-care delivery models to serve vulnerable groups.

John Mazzullo, an assistant clinical professor at the School of Medicine and a retired physician, is one such volunteer. "I had forty years of experience in primary care that I did not want to lay dormant," said Mazzullo, who is mentoring a nurse practitioner at a community health center in western Massachusetts, discussing cases, patient management, and clinic politics. "This knowledge base could be useful to young people just starting out in primary care," he said. "Especially in settings where they are more isolated from other clinicians."

As ophthalmologist Tom Hedges, M75, moves toward a part-time schedule, he will start studying photos of patients' eyes for signs of diabetic retinopathy for a Cape Cod clinic. "I'm a clinician first, and I like caring for people above and beyond my academic activities. Most of us at Tufts still feel that way," Hedges said. "As we retire and want to keep our hands in, what better way to do it than at clinics that are in need?" The MAVEN Project requires physicians to stay licensed and provides coverage for malpractice for activities related to the nonprofit.

A past president of the Tufts Medicine Alumni Association, Hedges is also recruiting fellow alumni to participate, in the hope that the program can take on additional clinics. In the meantime, The MAVEN Project is building several new features, such as an on-demand provider-to-provider consult that would allow a physician to step out of an exam room midappointment to consult with a volunteer then return with new info to aid in the treatment plan, plus a secure messaging platform that will enable clinic providers to send questions to the volunteers.

"The goal is to increase the knowledge and capacity of clinics caring for the uninsured and underinsured," said Levine. "The social determinants of health are suddenly being discussed more than ever before. Our whole model is based on leveraging technology to close that gap in access to care."

ILLUSTRATION: CHRIS GASH

WHY I GIVE

Ana Lopes Johnson, M01

FAMILY DOCTOR Lopes Johnson grew up in Rhode Island, the child of Cape Verdean immigrants. Her father developed Parkinson's disease and died from complications when she was sixteen—the experience of watching her parents navigate the world of doctors and hospitals set the course for her career. "There were not many physicians who looked like us," Lopes Johnson said. "There was always a language barrier. I wanted to rewrite the script." She chose primary care: "I had that vision of being that doctor who did everything." She practices family medicine with Facey Medical Group in Mission Hills, California, and is president of the Association of Black Women Physicians.

SUPPORT SYSTEM From the open-door policy at the office of student affairs, to the advice from deans during rotations and residency decisions, the School of Medicine buoyed Lopes Johnson and helped her succeed. In appreciation, she has been a loyal backer of the Annual Fund. "The challenges I had are similar to the ones students are facing now: the cost of attendance, the fears of the unknown," she said.

FULL CIRCLE Lopes Johnson and her family sponsored a dissection table in the new Michael Jaharis Jr. M87P, H15 Anatomy Lab. "I remember going to the anatomy lab the first day, and I couldn't cut the cadaver because I did not have closure on my father's death," recalled Lopes Johnson. So the School of Medicine connected her with a counselor. "It was transformational," she said. And so many years later, "when the opportunity to donate a table presented itself, it was an opportunity for me to build a legacy; to say thank you to the administrators who were kind and helped me find my way; and to change the future for another medical student who will write a new page in Tufts' history," she said. "It has given me a chance to go full circle." –HELENE RAGOVIN

EVERY GIFT COUNTS. However you choose to give to the university, you're helping light the way for students, faculty, and researchers to contribute to humanity, as well as advance it. Learn more at giving.tufts.edu.

SURGERY STAR STEPPING DOWN

BILL MACKEY, A nationally recognized expert on carotid disease, has announced his retirement as surgeon-in-chief at Tufts Medical Center and Benjamin Andrews Chair of Surgery at the School of Medicine, positions he held for seventeen years. He will stay on until his successor is chosen.

An Atlanta native and a Duke University School of Medicine alum, Mackey came to Tufts Medical Center in 1982, attracted by its vascular training program—one of the first accredited programs in the country. He was named assistant professor at the School of Medicine in 1984 and a professor of surgery in 1999. Triple board-certified in general surgery, vascular surgery, and surgical critical care, he is a past president of the New England Society of Vascular Surgery and the Boston Surgical Society, and also served on the editorial board of the *Journal of Vascular Surgery* for a decade.

As director of the surgical residency program, which he helped create, Mackey inspired future surgeons. Cited repeatedly for excellence in teaching, he received the 2014 Dean's Outstanding Mentor Award and the Distinguished Career in Teaching Award from the Class of 2018. "When you start out, you focus on becoming a confident and trusted surgeon; it's a long and arduous learning curve," Mackey said. "But as you mature, you become more comfortable with teaching and you want to pass along skills."

Growing interest in surgery and surgical specialties among Tufts students, he added, speaks to a supportive culture at the School of Medicine. "We pay a lot of attention to each individual, and that sets us apart," Mackey said. "Surgery can be very difficult—it has real highs and real lows—so you need to be in a supportive environment where you can learn without being afraid." –LAURA FERGUSON

PHOTOS: COURTESY OF LOPES JOHNSON AND MACKEY

Continuing Education

A generous donor teams up with Tufts to support research and teaching through the Professorship Partnership Challenge. BY LAURA FERGUSON

FOR THREE DECADES, trustee emerita and Board of Advisors chair for the School of Medicine, JoAnn Giffuni Wellner, J63, has been deeply engaged with Tufts. Now she's extending her impact with a flexible $1.5 million gift that the school can use to either endow a full professorship for a senior faculty member or create the school's first two endowed junior professorships. If this plan is approved by the trustees, the dean can use the gift at his discretion. The Kenneth and JoAnn G. Wellner Professorship is the school's first response to the Tufts' Professorship Partnership Challenge and will be matched by $1 million from the university. The challenge is one of the top priorities of Brighter World: The Campaign for Tufts, and Wellner is a member of the medical school's campaign committee.

Wellner's gift commemorates her late husband, who died in 2011 of a neurodegenerative disease. "I can't think of a better way to honor Kenneth's memory than through endowed professorships," Wellner said. "My husband's tireless optimism in the face of great difficulties continues to inspire me. This gift speaks to his spirit and to our belief that research is critical to advancing modern medicine."

"Professorships are so important to our faculty in providing them support that allows them to take risks and be creative in growing their research in new ways," said Linden Hu, the medical school's vice dean of research. "I particularly love that the Wellner Professorship is flexible and can be awarded to younger faculty to support them during a critical phase of their career development. This is a great new model for helping us expand research at the School of Medicine."

Wellner's deep engagement with Tufts, born out of her meaningful undergraduate experience, has continued for decades. She joined the university libraries' Board of Overseers in 1988, which she chaired from 1997 to 2000, founded and chaired the Friends of Tufts Libraries, and served on the Board of Advisors for the School of Arts and Sciences from 1998 to 2014. "JoAnn is one of the most engaged and effective champions of Tufts I have ever met," said Sol Gittleman, former provost and the Alice and Nathan Gantcher University Professor emeritus. "It is not an accident that her involvement with all the Tufts libraries coincided with the extraordinary growth on all campuses of this essential resource." She was also a Tufts University Trustee from 1989 to 2000, and joined the Board of Advisors for the School of Medicine in 2012, becoming chair this year.

After earning degrees in both government and education at Tufts, Wellner graduated from Fordham University's School of Law in 1966. She began her career at Manufacturers Hanover Trust Company, and in 1972, joined TIAA-CREF as a staff attorney, rising to an executive officer and vice president of external affairs. In 1988, she joined her family's New York-based real estate management business; today Wellner is principal of Merit Operating Corporation.

Wellner is just as dedicated to her considerable charitable work as she is to Tufts. She is president for her family's private foundations, the Joseph V. Giffuni Foundation and the JoAnn and Kenneth Wellner Foundation, and is director of the Flora Baldini Giffuni Foundation, named for her mother. She serves as treasurer and an honorary chair for the Pastel Society of America, the country's oldest pastel society, founded by her mother. She is also a director of the Open Mind Legacy Project, supported by the Alfred P. Sloan Foundation.

Gifts and pledges made to the Professorship Partnership Challenge before or on June 30, 2019, are eligible. For more information, contact Rebecca Scott, senior director of development and alumni relations at the medical school, at 617-636-2777 or rebecca.scott@tufts.edu.

PHOTO: MATTHEW MODOONO

Left to right: Two mobile clinic nurses and Colin Russell at a men's health event; Russell, far right, with Tufts students and clinic staffers.

NEW WORLDVIEW

School of Medicine students evaluate programs and policies to combat HIV in Namibia. BY HEATHER STEPHENSON

COLIN RUSSELL, M20, arrived in Namibia in the summer of 2017, expecting to evaluate the impact of a mobile clinic focused on men's health. But it wasn't ready yet. So he assisted wherever he could: scouting neighborhoods for places to park the van, developing pamphlets, printing maps.

Russell, who is working toward a dual degree in medicine and public health, was in the southwestern African nation to complete his public health fieldwork. Although about one in seven adults in Namibia is HIV positive, the country's public health efforts have been encouraging: About 80 percent of those with the virus are receiving life-saving antiretroviral therapy, one of the highest rates in sub-Saharan Africa. To learn from health-care practitioners there and help inform the government's policies, Tufts University School of Medicine students conduct research on HIV and related health issues in partnership with the country's Ministry of Health and Social Services for eight weeks each summer.

Later last summer, Russell was able to observe the mobile clinic's two male nurses offering free screenings in the settlements that ring the nation's capital, Windhoek. But in getting the project off the ground, he learned flexibility—a lesson that's paramount in the global health programs offered by the School of Medicine, said Alice Tang, associate professor of public health and community medicine and one of the mentors for students in Namibia. "If you're working in the field—and not just in international settings—things don't always go as planned," she said. "You have to problem solve."

This summer, two Tufts students studied whether the clinic, which was designed to identify HIV-positive men and make sure they receive treatment, is achieving its goal. To reduce the stigma associated with HIV, the clinic provides various screenings, and it seems to have been more successful in catching other health problems than HIV, Tang said. Forty percent of the men tested so far had high blood pressure, while only two percent were HIV positive. One student evaluated why the van wasn't reaching more men with the virus, and another evaluated what the men with high blood pressure learned about their condition and whether they were receiving ongoing care.

"The students are learning the importance of evaluation," Tang said. "Is the program doing what you want? If not, how do you improve it?" The other student participants this summer conducted research on support groups for people with HIV and on risk factors for obesity among women and girls in Windhoek.

Steven Hong, an adjunct assistant professor of medicine at Tufts who works for the Centers for Disease Control and Prevention, launched the Namibia program in 2011. It started out with a single student, but this year six students were selected from eleven applicants.

Tufts and the Namibian government work together to improve public health research and programming, Tang said, and the students are a "wonderful addition to the partnership."

"It was awesome to go there and feel like we did so much," said Russell, who assisted with research on HIV drug resistance and co-taught a course for Namibian pharmacy and medical students, in addition to his work with the mobile clinic. "It was really important to get outside of my comfort zone, to learn from other modes of health care, and watch other providers at work."

PHOTOS: COURTESY OF COLIN RUSSELL

Swinging Shape

Improve your game and your health with these tips from the Golf Doc.

BY COURTNEY HOLLANDS

WHILE AN INTERN, resident, and cardiology fellow at New England Medical Center (now Tufts Medical Center) and then as director of the cardiac catheterization lab at Landstuhl Medical Center in Germany during a stint in the Army, Edward Palank, M71, had little time for athletic pursuits. But when he established the New England Heart Institute at Catholic Medical Center in 1985 in Manchester, N.H., he became interested in the relationship between golf and health. Conversations with cardiac patients eager to return to the greens sparked his 1990 study, "The Benefits of Walking the Golf Course," which showed that players who eschewed a cart could lower total cholesterol and improve their risk ratios. The oft-cited research helped cement Palank's reputation as the "Golf Doc," which was also the title of his 1999 book. Ahead, the longtime *Golf Digest* writer and PGA and USGA consultant offers tips for staying in topflight shape on the links this summer.

TAKE HEART. The golf course is the fifth most common place for a person to suffer cardiac arrest—although the sport is relatively low-impact, 18 holes can take more than four hours. Make sure your clubhouse has a functioning Automated External Defibrillator (AED): A study Palank conducted in Florida, where he now lives, found that 100 percent of cardiac arrests on golf courses were fatal in the absence of an AED.

AIM FOR MORE WATER. Dehydration is bad for your body and bad for your game. Swig water at least every other hole, especially on warm afternoons (about 12 ounces per side of the course). And don't worry about sports drinks—plain old H_2O will do the trick.

ACE SKIN PROTECTION. Even if you spend most of the time in the trees—fore!—be sure to slather on a sunscreen of at least SPF 30 before leaving the house and liberally while on the course to keep harmful UVA and UVB rays at bay.

GET IN THE ZONE. When talking about the yips—the nervousness that causes putters to miss easy shots—Palank quotes the late golf icon Bobby Jones: "Golf is a game of inches, mainly the six inches between your ears." Back in the day, pros tried beta blockers to still their nerves—they didn't help. Positive thinking will.

STAY LOOSE. A player's driving distance and scoring potential declines with age. To gain power in your swing, focus on stretching and flexibility instead of strength training.

PHOTO: INGIMAGE.COM

ALUMNI ASSOCIATION PRESIDENT

125 Years of Making a Difference

I STARTED MEDICAL school at Tufts in 1988, nearly thirty years ago. I remember looking around the Sackler Auditorium at my new classmates. Although we were a diverse group from many states, with different backgrounds and interests, we had one thing in common: We were privileged to be there and ready to learn, collaborate, innovate, and use our skills to make a difference in the world. We knew a TUSM education was a gift, and we planned to pay it forward.

In 1893—125 years ago—seven doctors each contributed $50 to start TUSM on Boylston Street in Boston. These visionaries created opportunities for thousands of School of Medicine graduates, including me, and those before and after me. The school is now on Harrison Avenue, and expanding facilities and technological advances continue to enhance the student experience—from the Learning Communities created in 2010 at the medical education building to the new Michael J. Anatomy Lab. However, the core values of TUSM endure. We are committed to excellence, humanism, social responsibility, and professionalism, and I am continually awed by the accomplishments of our community. This starts with the current students, who make time in their busy schedules to provide health care and education for the local community (Sharewood Project, KICKS!, Community Service Learning, Chinatown Community initiatives); mentor youth (IDEAS in Medicine, Pipeline Programs); and even travel to aid underserved countries around the world (India, Haiti, and Ghana, to name a few). This extends to the devoted faculty members who have made tremendous contributions to our profession and fields, and continues with alumni who donate their time and money to support future TUSM generations.

I am honored and grateful to serve as president of our Medical Alumni Association this year. Thank you for all you do, every day. Your commitment and successes inspire me and my desire to be the change.

TEJAS S. MEHTA, M92, A19P
President, Tufts Medical Alumni Association
TMAAPRESIDENT@TUFTS.EDU

Class Notes

1963

ELISABETH A. MAILHOT, M63, of Millbrae, Calif., received an Excellence in Health Care Award on June 7 from the *Silicon Valley Business Journal*.

DAVID FISHER, M63, of San Francisco, reports that members of his high-achieving class—David Rosenthal, Arthur Papas, Joseph DiZoglio, Richard Wolk, David Khoury, Herbert Dean, Joseph Jankowski Jr., Lawrence Parish, Elisabeth Mailhot, Karl Benedict Jr., and Jack Meltzer—celebrated their 55th reunion with an elegant luncheon at the Four Seasons when they were all in Boston for the School of Medicine's Reunion Weekend in May. Fisher also had DiZoglio and his wife, Beata, an obstetrician, to dinner at his home in San Francisco, where they had a terrific time "reminiscing about the halcyon times on Harrison Avenue." Fisher invites any of his classmates visiting the Bay Area to do the same.

1965

HENRY M. GREENBERG, M65, of New York, has published *Enoch's Legacy: A Family Narrative*. The autobiography is available on amazon.com, and it details Greenberg's life through the late 1960s, including his time in medical school. From the author: "Neither I nor my cousins know much about our grandparents' early lives and their dramatic immigrant tales. I assume my young grandchildren will not appreciate knowing about their family history until we are gone, so I wrote it down."

1973

MALCOLM P. TAYLOR, M73, of Madison, Miss., has joined the Merit Health Medical Group.

1984

JOHN T. FRASCA, A80, M84, of Medfield, Mass., has been elected president of the Norwood Hospital Medical Staff Executive Board for a two-year term.

1988

THOMAS A. BUCHHOLZ, M88, of Houston, has been named medical director of San Diego's new Scripps MD Anderson Cancer Center, a clinically integrated cancer care program.

1995

DIANE ZENI DE FERRANTE, M95, of

PHOTO: COURTESY OF MEHTA

Syracuse, N.Y., has joined the palliative medicine team at Crouse Health.

1996

SHERIFF M. SAHADULLA, M96, of Bahrain, has been appointed chief executive and chief medical officer of KIMS GCC.

2000

ATHENA M. COUNTOURIOTIS, M00, of San Diego., has been appointed executive vice president and chief medical officer of TP Therapeutics, Inc.

2001

RAHUL SHARMA, M01, of New York, has been appointed the inaugural chairman of the new academic Department of Emergency Medicine at New York-Presbyterian/Weill Cornell Medical Center. In addition, Sharma has also been selected to serve as chief and medical director of the New York-Presbyterian Emergency Medical Services enterprise.

2009

JONATHAN G. ROGG, M09, and **ARIELLE CARPENTER, A10, MG11**, of Houston, tied the knot on December 16 in Deerfield Beach, Florida.

2010

BENJAMIN P. CAPLAN, M10, of Needham, Mass., started CED Foundation in 2017 to research medicinal cannabis.

2014

ALON B. NEIDICH, M14, and Julia Ann Connolly, of Boston, were married May 12 in a ceremony officiated by Rabbi Rachel Saphire at the Boston Public Library.

In Memoriam

JOHN H. BAKER, M54
April 21, 2018
Salisbury, Maryland

OTTO C. BROSIUS M47
February 7, 2018
San Diego, California

OWEN E. CHRISTENSEN, M56
March 14, 2018
Westminster, Massachusetts

A. PHILIP CONNELLY JR., M58
March 6, 2018
Norwood, Massachusetts

ROGER W. DIETRICH, M76
January 10, 2018
Vernon, Vermont

MARTIN E. FELDER, M56
December 31, 2017
Carlsbad, California

JAMES C. FERRUCCI, M48
December 1, 2017
Dorchester, Massachusetts

DENISE FORTE-PATHROFF, J78, M82
February 24, 2018
Bismarck, North Dakota

BRIAN M. GOLDEN, A61, M65, A89P
May 30, 2018
Winchester, Massachusetts

MARK A. GOULD, M56
April 5, 2018
Atlanta, Georgia

EUGENE W. GRABOWSKI M68
April 7, 2018
Bennington, Vermont

CHARLES E. HERLIHY, M49
January 28, 2018
Birmingham, Alabama

EDWARD W. HUGHES JR., M59
March 6, 2018
Worcester, Massachusetts

MELVIN I. KLAYMAN, M50
January 13, 2018
Chestnut Hill, Massachusetts

ROBERT I. KRAMER, M58
March 5, 2018
Dallas, Texas

JOHN E. LEDONNE, A43, M46
February 28, 2018
Fitchburg, Massachusetts

PETER M. LEVINE, M74
April 23, 2018
Brookfield, Massachusetts

BERNARD LOITMAN, M53, J81P
March 7, 2018
St. Louis, Missouri

DAVID T. LUNDIN, A65, M69
January 24, 2018
Beverly, Massachusetts

NATHANIEL A. MACDONALD, M50
December 20, 2017
Danvers, Massachusetts

RICHARD PORTER, M51
January 29, 2018
Peabody, Massachusetts

MARY A. RAVIN, M50, D87P
November 17, 2017
Scarborough, Maine

FREDERIC A. SCHULANER, A55, M59
February 20, 2018
Port Saint Lucie, Florida

RICHARD A. SCHWARTZ, M61
April 12, 2018
Three Rivers, Michigan

JORDAN J. SHUBERT, M70, M00P, A10P, M15P
April 1, 2018
Surry, Maine

ROBERT M. SULLIVAN, M59
May 3, 2018
Cromwell, Connecticut

JOSHUA M. TWERSKY, M59, D87P
February 26, 2018
Bridgeport, Connecticut

MICHAEL K. WALD, M62
February 13, 2018
Elmira, New York

DAVID L. WARREN, M48
January 10, 2018
Virginia Beach, Virginia

JEREMY B. WHITNEY, M54
February 13, 2018
South Dartmouth, Massachusetts

CHESTER C. WOOD II, M80
February 20, 2018
Woodbury, Connecticut

In 1893, seven doctors chipped in $50 each to found Tufts University School of Medicine, setting us on a course of 125 years of medical excellence.

What happens next is up to you.

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When Medicine Meets Fiction

A pediatric cardiologist reaches young patients through literature. **BY ISMÉE WILLIAMS, M99**

THE FIRST WEEK of my pediatrics residency at Columbia University Medical Center, I was assigned to care for a twelve-year-old boy with leukemia. I'll call him TJ. He had been in the hospital for 126 days after his third bone-marrow transplant. Since he was severely immunocompromised, TJ was in a room where all visitors had to don gowns, gloves, and masks. The interns rotated every four weeks, which meant I was probably the 30th resident assigned to him—and he was understandably resentful and distrusting of new medical personnel. Determined to win him over, I told him jokes day after the day. I kept at it, even though he crossed his arms and refused to look at me. At the end of our third week together, I recited the poem "Lazy Jane" by Shel Silverstein. It earned me a smirk. More importantly, it led to a conversation that wasn't about bowel movements or rashes. We talked about books.

I arrived home elated. When my boyfriend asked how I wanted to spend my first full weekend off, I told him we were going to the bookstore. TJ had been in and out of school much of his childhood and had never read poetry. I was a brand-new intern whose skills consisted of reporting vital signs and patient symptoms. There was little I could do to help my patient medically. But this was something I could fix.

Monday morning, I tucked a gift-wrapped *Where the Sidewalk Ends* in my bag. On my way to the hospital, I imagined TJ giggling at the poems. I could see him smile. I stepped off the elevator and into the residents' workroom to scan the white board that had the service list. TJ's name wasn't on it. The on-call intern, bleary-eyed and in wrinkled scrubs, delivered the news: TJ had passed away the night before.

At that moment I built a wall, the emotional divider all physicians erect to some degree or another to allow us to survive the tragedies we witness. After that day, I never cried at work. I rarely cried at home.

Over the years, I became a pediatric cardiology attending at an academic medical center, a NIH-funded researcher, and a mother. While pregnant with my third child and on bedrest, I picked up a book unrelated to medicine for the first time in over a decade, a young-adult book about a girl falling in love, and then losing that love. Swept into the story, I cried. That novel broke through my wall. It made me want to write something similar, a book that would cause readers to experience intense emotion.

It took four years of writing, rewriting, and editing, and learning about the publishing world before I began what would become my debut novel, *Water in May*. I drew from my clinical experience in fetal cardiology. Imagine being told your baby has only half a heart and might not survive. The main character is based on the young women I cared for while working in Washington Heights, New York: women who fought for their babies, teens who grew into mothers. Readers have told me my book deeply affected them. And if I can educate and spread awareness of the most common birth defect while moving my reader emotionally, even better.

I still see patients. I still rely on my wall to help me through difficult cases. But I also have my writing. And I have the books of others—the power of literature—for times when I want the wall to come down.

The daughter of a Cuban immigrant, ISMÉE WILLIAMS is a pediatric cardiologist who trained and practiced at Columbia University Medical Center for 15 years. She currently sees patients at Montefiore Hospital and lives in New York with her husband, three daughters, and a labradoodle.

ILLUSTRATION: CRISTINA SPANO

Tufts gave me a lot of opportunities, and I want to help others have a similar experience.

Richard A. Reines, A71, M76, A01P, A04P, M05P, has many passions and a special place in his heart for family medicine. In 2016, he established scholarships for students on a path to medicine at the School of Arts and Sciences and for those pursuing family medicine at the School of Medicine. Reines has recently provided further support for these scholarships by including them in his estate plan.

Reines knew in high school he wanted to be a doctor. "I had one doctor my whole life before college, and I wanted to emulate him," says Reines who has practiced family medicine for more than 40 years in Hollywood, Florida. A double Jumbo and proud parent of two alumni, one of whom is a colorectal surgeon, Reines has remained close to Tufts and helped to form its family medicine program in the early 1990s with TUSM's then dean, Morton Madoff, M.D., M.P.H.

His bequest also creates endowed funds for two activities that were especially meaningful to Reines as an undergraduate: the swimming and diving team (he was an all-American swimmer) and Tufts Hillel.

Reines' love for travel also developed during his time at Tufts. As a Thomas J. Watson Fellow, he studied medical care in developing countries for a year before starting at TUSM. He has since travelled to more than 175 countries—most recently to Jordan with his fiancée, Marcy Schackne, with whom he celebrates his 18th anniversary this year.

"I'm really glad Tufts and I found each other," he says. He is pleased that his gifts will provide opportunities for future generations of Tufts students who share his interests.

For information about including a gift for Tufts in your estate plans,
please contact the Gift Planning Office:
888.748.8387 • giftplanning@tufts.edu • tufts.edu/giftplanning

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WHAT MATTERS MOST

End-of-life conversations can illuminate the here and now in wonderful ways, says palliative care and hospice physician Dawn Gross, a School of Medicine alum.