

Tufts Medicine

THE HUNT FOR

HOPE

IN

THE GENOME

How researchers found a flawed gene deep in the DNA of boys with a fatal form of muscular dystrophy





DO YOU KNOW THIS CHILD?

Is the tyke with the intent gaze in this famous, century-old black-and-white image a boy—as originally thought—or a girl? Why was he (or she) being treated at the Floating Hospital for Children in Boston? Daniel Bird, director of volunteer services and the unofficial historian at Tufts Medical Center, is hoping to find out. After stories about Bird's quest to identify the pint-size patient appeared in *The Boston Globe* and other outlets, a dozen emails

came in from as far away as the Netherlands, said medical center spokesperson Jeremy Lechan. Some respondents provided clues and others raised questions about the patient's gender and condition—one pointed out a possible hand deformity—but “unfortunately, nothing has led us to finding out the child's name and story,” Lechan said. Can you help crack the case? Email Lechan at jlechan@tuftsmedicalcenter.org. —COURTNEY HOLLANDS

Contents

SUMMER 2017
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Features

12 THE HUNT FOR HOPE IN THE GENOME

COVER STORY Three decades ago, a team of researchers—including future Tufts President Anthony P. Monaco—raced to find the flawed gene hidden in the DNA of boys suffering from a deadly form of muscular dystrophy. **BY BRUCE MORGAN**

18 WE ARE SHAREWOOD

A look back at how Tufts medical students started an urban pop-up treatment center offering free care, in the words of those who were there. **AS TOLD TO ELIZABETH GEHRMAN**

24 THE VISIONARY

Outgoing Sackler School Dean Naomi Rosenberg spent 40 years at Tufts boosting basic research and preparing the next generation of scientists. **BY COURTNEY HOLLANDS**



In Every Issue

- 2 **LETTER FROM THE EDITOR**
- 3 **FROM THE DEAN**
- 4 **PULSE**
News on the Beat
- 8 **RESEARCH**
Where Ideas Take Root
- 27 **FROM ALL CORNERS**
University, School & Alumni News
- 40 **ESSAY**
When a doctor is also a patient.

IT'S NICE TO MEET YOU

LIFE WORKS IN mysterious and wonderful ways. For the past 13 years, I've written and edited for magazines, newspapers and the web—most recently, I was the editor-in-chief at *Culture*, a national publication covering artisan cheese and food policy. I'm also the lone humanities pro in a science-minded family. My dad studied biology and business and has been a national accounts manager and sales director for several pharmaceutical companies. My mom worked in a lab and my younger sister is a pharmacist. Growing up, I always saw medical journals on the counter. So, in some ways, taking the reins at *Tufts Medicine* feels like a homecoming. (Plus as a Somerville resident for over a decade, Tufts' Medford/Somerville campus has been my backyard!)

I'm eager to get to know the School of Medicine and its faculty, staff, students and alumni and to tell your incredible stories in fresh and engaging ways. In this, my first issue, I had the pleasure of chatting with distinguished professor Dr. Jerome Kassirer about his lifetime in medicine ("Don't Plan on It," page 7) and getting the low-down on marijuana edibles from associate public health and community medicine professor Margie Skeer ("Edible Arrangements," page 4). And just as I say hello, Sackler School Dean Naomi Rosenberg is saying goodbye—turn to page 24 to read a profile of the outgoing dean and renowned scientist ("The Visionary"). Please keep the ideas coming—drop me a line anytime at courtney.hollands@tufts.edu. I look forward to hearing from you.

COURTNEY HOLLANDS
Editor, *Tufts Medicine*

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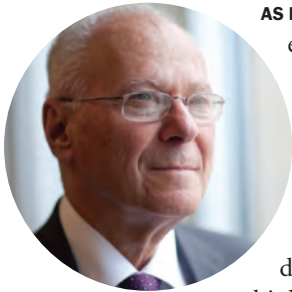
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DISCUSSING END-OF-LIFE CARE



AS MEDICAL PROFESSIONALS, most of us have experienced some variation on the following scene: An elderly patient is in a coma, her hospital bed surrounded by family members. Her long-lost son feels guilty because he hasn't visited his aging mother in five years and now wants everything that can possibly be done to keep her alive—he may not be thinking about what's best for Mom, per se.

His three sisters are more realistic about the prognosis. Yet because the patient has no designated health proxy, you don't know whom to listen to or who's in charge.

Such a difficult situation can be avoided with honest (and early) discussions about end-of-life plans. That's where the newly formed Massachusetts Coalition for Serious Illness Care comes in. Health professionals from across the Bay State are working together to further the coalition's mission: "To ensure that health care for everyone in Massachusetts is in accordance with their goals, values and preferences at all stages of life and in all steps of their care."

In 2016, the coalition conducted a survey and found while 85 percent of Massachusetts residents believe physicians and their patients should talk about end-of-life care, only 15 percent have had such conversations. Plus, one-third of those polled who had a loved one die in the past year said patient preferences were not fully followed—and one-fifth described the end-of-life care they witnessed as only fair or poor. (Read the report at maseriouscare.org.)

One of the group's core priorities is to make sure clinicians are adequately prepared to communicate with patients about end-of-life expectations, which is why coalition co-chair Dr. Atul Gawande approached me last year about collaborating on curriculum changes around these issues. I have great admiration for Dr. Gawande—he's a surgeon, writer and researcher who I think has done more for public health in the world than anyone else I know—and have since met with the academic deans from Massachusetts' four medical schools to kick off the conversation about how best to train our students to give them the tools they need to do this important work.

I think language is one of the keys in helping students feel comfortable broaching the subject. Talking about death can be tricky—so it's easy to avoid! But if you talk about end-of-life goals, it seems less ominous. Taking the medical history of a new patient is a good place to start. If you find that a patient's parents are deceased, you can use that as an entrée. Does she want to be treated the way her parents were in their final days? Has she nominated a proxy should she become incapacitated? Once you bring it up, patients are often happy, even relieved, to chat about it.

Students should also be aware that it's an ongoing discussion. They need to periodically check in with a patient about his wishes, just as a patient needs to share these evolving wishes with his proxy and family. Take my own situation: I had a heart attack at age 48. An episode like that makes you very aware of your mortality and so my wife and I talk through our end-of-life plans over and over with our kids; they sometimes think we're a bit morbid!

Although students already learn about end-of-life care at Tufts—and at the state's other medical schools—we intend to share best practices and standardize the training. It can't be achieved with one lecture. Like ethics, end-of-life planning is an issue that comes up all the time; it needs to be a continual lesson during the clinical years.

The next step is to get input from faculty and staff before curriculum changes are adopted. In the meantime, there are two upcoming events at Tufts focused on these issues. The keynote speaker for the Class of 2021's White Coat Ceremony on September 9 is alum Dawn Gross, M.D., Ph.D., a writer and educator who hosts the "Dying to Talk" radio program. And all incoming medical students are reading Dr. Gawande's 2014 best seller *Being Mortal*—the Common Book for fall—in advance of his on-campus Dr. Maurice Segal Lecture on September 15. These talks should help introduce the topic.

A handwritten signature in black ink that reads "Harris A. Berman".

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

Pulse



Q: Which of these candies contain weed?
A: All of them.

Edible Arrangements

Get ready: Marijuana-dosed foods are coming to a store near you. **BY COURTNEY HOLLANDS**

IN THE FIRST quarter of 2014—the year Colorado made it legal to sell recreational marijuana—cannabis-infused candies, pasta sauce, beef jerky and other foods made up 30 percent of legal sales. By the third quarter of 2016, that figure had grown to 45 percent. And the popularity of these so-called edibles will soar higher still: In the 2016 election, California, Maine, Massachusetts and Nevada all voted to join the Rocky Mountain State, Alaska, Washington, Oregon and Washington, D.C., in legalizing recreational weed.

These new markets should trouble parents, policy workers and professionals who work to prevent adolescent substance misuse, said Margie Skeer, associate professor of public health and community medicine at Tufts. “We’re masking a drug and making it seem less risky,” she said, adding that the younger people are when they start using drugs such as pot, the greater their risk of developing neurocognitive, mental health and substance-related problems. Ahead, Skeer outlines what you need to know about edibles—especially where kids are concerned.

THEY LOOK JUST LIKE TREATS

A recent study examined unintentional exposure to marijuana among children who were treated at a children’s hospital and regional poison center in Colorado between 2009 and 2015, the year after it became legal to sell recreational marijuana in the state. Findings indicated a five-fold increase in the number of children under 10 exposed to marijuana, from nine cases in 2009 to 47 cases in 2015. Marijuana edibles—including baked goods and candy—were implicated in more than half of the exposures.

So far, Colorado and Washington have enacted the most extensive policies

surrounding edibles and their appeal to children. In Colorado, for example, the word “candy” isn’t allowed on the packaging and manufacturing edibles in shapes that are attractive to kids, such as gummy bears, are also banned. Plus, a universal symbol is now required on all edibles to indicate that they contain THC. (The states that approved recreational marijuana sales in 2016 are drafting regulations regarding edibles.)

THEY MAY SEEM LESS RISKY

In 2015, only 12.3 percent of high school seniors believed that trying marijuana once or twice was harmful (down from 18.5 percent in 2009). The perceived risk of smoking marijuana regularly also dropped, to fewer than one in three believing it was harmful. Skeer thinks that edibles—which may appear less risky than smokable forms—will push these numbers even lower. “Smoking gives you a mental cue that you’re taking a drug,” she said. “Edibles remove part of that cue.” The THC-dosed snacks also make it significantly easier for adolescents to use pot covertly (and without the telltale odor), which could drive up use.

THEIR EFFECTS AREN’T IMMEDIATE

When marijuana is smoked, THC is quickly absorbed into the bloodstream and then travels to the brain in a matter of minutes, even seconds. But ingestion is a much slower process: An edible must be digested before the THC can enter the bloodstream through the stomach lining and small intestine. It can take about 30 to 60 minutes to feel the drug’s effects. Someone who is not aware of this delay might eat more, not recognizing the potential harms associated with the increased dose.



For more information, read Margie Skeer’s article “Edible marijuana: What we need to know” on *The Conversation* (theconversation.com).

GUT CHECK

Using tissue engineering to target enteric diseases.

Across the world, diarrheal diseases are important causes of morbidity and mortality. Now, with grants totaling \$8 million, a team from the School of Engineering, the School of Medicine and Tufts Medical Center can better address this pressing public health issue. The five years of funding from the National Institutes of Health—together with \$120,000 per year in combined support from the engineering and medical schools—has led to the opening of the Center for Enteric Diseases in Engineered Tissues (CEDET).

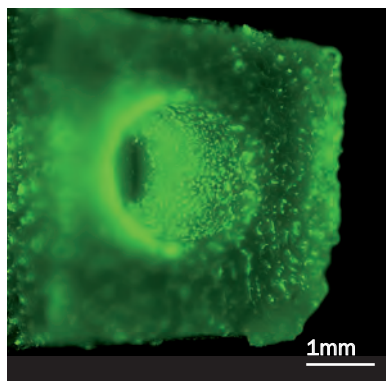
At the center, researchers will use tissue engineering to grow sections of human intestine and then infect them with pathogens. These scaffolds have complex cell populations and microvilli, and produce mucus and digestive enzymes, just like intestines that grow in the body, said biomedical engineering professor and chairman David Kaplan, CEDET associate director. “Over the years we’ve been trying to develop improved tools to grow all kinds of tissues to study disease and tissue development, damage and repair,” said Kaplan, whose team created the scaffolds and tissues. Essential to the work has been Dr. Jatin Roper, director of the Center for Hereditary Gastrointestinal Cancer at Tufts Medical Center, who seeds the scaffolds with intestinal stem cells isolated from patients.

Microbiology professor Ralph Isberg, CEDET director, said medical school faculty—Carol Kumamoto, Linc Sonenshein, Joan Meccas, Wai-Leung Ng and Honorine Ward—will research several clinically important pathogens. One is the potentially deadly *C. difficile*, which is sensitive to oxygen and so difficult to study. “We found that by using these engineered scaffolding tissues, we could actually get low-oxygen conditions,” Isberg said. “We’re hoping to uncover things we couldn’t

otherwise.” (Read about related work on page 8.)

The center has already bio-engineered tissues measuring 10 millimeters in diameter, and researchers plan to create hundreds of larger tissues to study everything from metabolism to cancer—even to screen drugs. “This is the kind of work where you must have a team of scientists to do it well,” Kaplan said. “The synergies are much greater than the sum of the parts.”

—MONICA JIMENEZ



3D sponge scaffolds prepared from silk protein for the intestinal tissues.

LAURELS

CLAIRE MOORE has been named to the Natalie V. Zucker Professorship, an endowed position that supports an out-



standing scholar and educator at the School of Medicine who is a role model for women scien-

tists. Moore, who researches mRNA processing, also directs the Training in Education and Critical Research Skills program, which expands education opportunities and preps postdocs for academic careers that involve mentoring a diverse student body.

The Massachusetts Breast Cancer Coalition (MBCC) recently honored professor **JOHN ERBAN, M81**, clinical director and associate director for clinical science at the Cancer Center at Tufts Medical Center. MBCC Executive Director Cheryl Osimo lauded his “ongoing dedication to our collective goal of cancer prevention for future generations.”

JOHN LEONG, chair of the Department of Molecular Biology and Microbiology, is a principal investigator on a project awarded an NIH Director’s Transformative Research Award. Funding will advance the team’s work designing probiotics to prevent and treat intestinal infection and inflammation, in part using technology developed by **CHUCK SHOEMAKER** at Cummings School of Veterinary Medicine.

—LAURA FERGUSON



“These are the resources to really launch careers.”
—Karen Freund, KL2 program director

PROMISING FUTURES

ALEXA CRAIG, a neonatal and pediatric neurologist, and Teresa May, a pulmonary and neurocritical care specialist, are the first Maine Medical Center faculty members funded through the Tufts Clinical and Translational Science Institute (CTSI) career development program.

They have been awarded KL2 awards (of around \$325,000 each)—only about 15 percent of applicants receive funding, which comes from the National Institutes of Health. Beyond research, the grants fund Sackler School coursework, training, mentoring and seminars, explained Karen Freund, professor at the School of Medicine and KL2 program director. “These are the resources to really launch careers.”

Craig is focused on improving long-term cognitive outcomes for babies who undergo heart surgery. Research has shown that slightly reducing infants’ temperatures appears to slow or halt brain cell damage in those who have been deprived of oxygen at birth. Similarly, babies undergoing operations to repair cardiac defects are cooled to protect their brains, Craig said, and the practice has been to then warm them quickly. “My hypothesis is that the rapid rewarming was contributing to poor developmental outcomes,” she said. Her solution is postoperative hypothermia intervention, or placing babies on cooling blankets to warm them more slowly.

May is reviewing the International Cardiac Arrest Registry to see how sedation affects brain function and neurological recovery in adults who have suffered cardiac arrest. Most patients were revived via CPR, then brought to the hospital, where therapeutic hypothermia is often used to slow or prevent cell damage. May is analyzing the link between sedatives used in this treatment and any subsequent brain damage.

The relationship between Tufts University and Maine Medical Center was always intended to extend beyond student education. “Our future as an academic health center relies on growing our own scientists, and the K awards are a critical step in a young person’s scientific career,” said Peter Bates, academic dean for Maine Medical Center-Tufts School of Medicine. “Having [May and Craig] do this now is inspiring for others here, and makes others think about a career path that’s possible for them at Maine Medical.” —HELENE RAGOVIN

Don't Plan on It

You never know just where a career in medicine will take you. **BY COURTNEY HOLLANDS**

WHEN DR. JEROME KASSIRER left the editorship of the *New England Journal of Medicine* in 1999, questions about his premature departure lingered. For years, he wondered whether the boxes of letters and memos he took with him might provide answers. “I finally decided to look through them to see what I could find,” said the Tufts University School of Medicine distinguished professor. The result is Kassirer’s new book, *Unanticipated Outcomes: A Medical Memoir*, which traces his career from medical school through his contentious ousting from the *Journal*—following disagreements with the Massachusetts Medical Society—and beyond.

TUFTS MEDICINE: You write that many would consider your career path “the American Dream.” Tell us more.

DR. JEROME KASSIRER: I never expected to be an academic physician, and yet I ended up at Tufts on the staff and on the faculty. And then I became vice chair of the department of medicine, though I never could have imagined earlier that I’d even end up as an academic. Then when I got invited to be involved with the American College of Physicians and the American Board of Internal

Medicine, I realized that I could function effectively in national organizations. Finally, the work I did in acid-base metabolism and clinical decision-making ultimately led to my nomination for the editorship of the *New England Journal*. Never in my wildest dreams had I ever imagined that I’d become the editor.

Hardly any of this trajectory was planned. It all happened along the way as opportunities came along, which explains the book’s title—few of my career outcomes were anticipated.

TM: What did you learn from your experience at the *Journal*?

JK: Well, it certainly humbled me when I was fired. Aside from that, I learned—to my satisfaction—that there are people who really care about the integrity of medicine and the quality of the *NEJM*. When I took over the job, I inherited a group of outstanding clinician-investigators who not only helped me with the task of editing the journal but supported the changes I made in the publication and my differences with management. Moreover, I learned that the public also valued the integrity of science.

TM: You’ve often decried financial conflicts of interest in medicine. Is this still a problem?

JK: I think we made some progress in

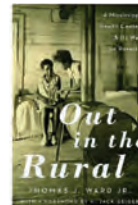
dealing with financial conflict of interest. Many institutions have policies now that had never existed. Both the Institute of Medicine and the Association of American Medical Colleges issued analyses about the conflict-of-interest problem, and Congress passed the [Physicians Payment] Sunshine Act. There has been modest progress.

But, at the same time, financial conflict of interest is still a very serious problem—made even more serious now that we have an administration in Washington where flagrant conflict of interest is the rule rather than the exception. I think this unprofessional attitude has spread across the country and infected medicine even more.

TM: What will you remember most from a lifetime of medicine?

JK: I greatly enjoyed taking care of the sick, doing clinical research, getting involved in major organizations, writing, editing and working with some of the great masters of American medicine. I am extraordinarily grateful to be part of this enterprise. (*The book can be purchased at jeromekassirer.com.*)

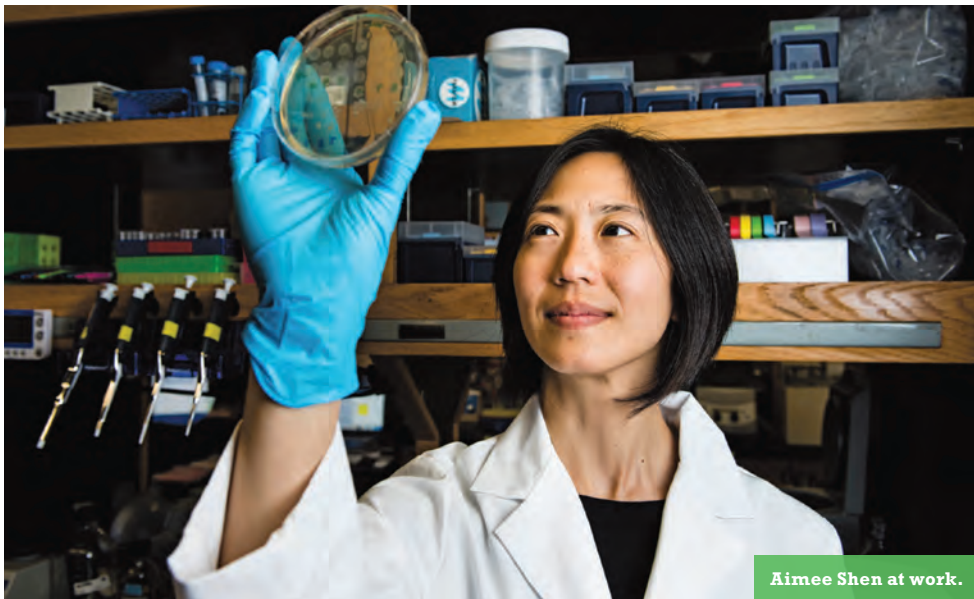
ALSO ON SHELVES...



In *Out in the Rural*, historian Thomas J. Ward Jr. relates the story of the country’s first rural community health center: The Tufts-Delta Health Center, established by School of Medicine faculty member Dr. H. Jack Geiger and his team in Mound Bayou, Miss., in 1967. “The ultimate goal,” Geiger writes in the foreword, “was to establish pathways out of poverty into a better life.”



Research



order to spread to new hosts, however, it needs to leave the body somehow, which means braving oxygen-rich air that will quickly kill it.

To get around this problem, the bacteria creates spores—seedlike capsules that keep their offspring in a dormant state—and send those into the world within a patient’s fecal material. Once outside the body, the spores can stick around for weeks, even years, until they get onto human hands and somehow make their way back into a new host, where they’ll sprout again into thriving bacteria.

Spores, Shen said, are tough little buggers—making the name *C. difficile* apt. “They’re resistant to commonly used disinfectants. The ethanol-based hand sanitizers you see everywhere in hospital settings don’t have any effect on spores,” she noted. “You can get rid of them with bleach, but you can’t necessarily use that in all settings—so it really takes special containment measures to stop them from spreading.”

A spore’s tenacity, she explains, is provided by a multilayer defense system. At the center is the “core,” made up of a nascent *C. diff* cell. A thick, tough structure called the cortex forms around it and expands, helping to squeeze water from the core and placing the cell into a sort of suspended animation. A third and final layer, a thin

FIGHTING A TREACHEROUS BACTERIA

Inside Aimee Shen’s quest to eradicate one of our most common—and potentially deadly—infections. **BY DAVID LEVIN**

WHEN PATIENTS VISIT a doctor’s office or a hospital, they’re usually seeking relief for an ailment. But many will leave with more than just a prescription. Seven to 10 percent of all patients receiving medical care come down with preventable infections—from pneumonia to sepsis to colitis—while inside a health-care facility, according to the World Health Organization.

Colitis can be especially pernicious. Caused by a bacterium named *Clostridium difficile* (*C. diff*, for short), it leads to painful swelling of the colon, diarrhea, fever,

dehydration and even death. In 2011 alone, an estimated 453,000 patients in the U.S. contracted *C. diff* infections—more than 293,000 of them in health-care settings—according to a 2015 study in the *New England Journal of Medicine*. At least 29,000 of those infected patients died, some 15,000 as a direct result of the disease.

“*C. diff* is everywhere,” said Aimee Shen, an assistant professor of molecular biology and microbiology at Tufts who studies the microbe. Luckily for most, the infection is rare in healthy people. A

functioning immune system, combined with communities of “good” bacteria already living in the gut, can fight off the microbes once they enter the body. But for people with weak immune systems or compromised gut bacteria, such as the elderly and some patients in hospitals, *C. diff* is much more dangerous.

Part of the microbe’s ability to wreak havoc in health-care settings is that it is naturally resistant to antibiotics, but that’s only part of the story, Shen said. *C. diff* is an anaerobic bacterium, meaning it can only live in low-oxygen environments, such as the human gut. In

sheet of proteins called the coat, forms a kind of protective shell.

The exact mechanism that lets these capsulelike spores produce living bacteria remains a bit of a mystery, but Shen is gathering clues. She's already discovered that the spores' germination process may rely on a protein trio in the cortex: CspA, CspB and CspC. When a *C. diff* spore reaches your gut, she says, bile salts in your digestive fluids are thought to bind to CspC, which activates CspB; CspA helps incorporate CspC into the spore. Once there, the proteins trigger an enzyme called SleC, which degrades the cortex, lets water inside and revives the microbe.

Shen's past studies hinted that Csp proteins play a major role in spore germination. Most recently, however, she found a protein called GerG that's unique to *C. diff* bacteria, and seems to control how much Csp makes it into a spore. When Shen's team removed that gene in the lab, many of her *C. diff* spores failed to open. If the mother cell doesn't have that gene, it'll still make same amount of Csp in cells making the spores—"but we think far less of the molecule makes it into the spore cortex itself," Shen said. "Whatever process allows the Csp proteins to become part of the spore may be defective."

Her lab is doing basic research to understand the

mechanisms that let spores germinate, but she hopes her work will eventually lead to treatments. By manipulating Csp proteins, for instance, it might be possible to trick spores into opening up and germinating when they're outside of the body. Without the protection of a tough cortex, the bacteria could be killed on hospital surfaces by traditional antiseptic sprays.

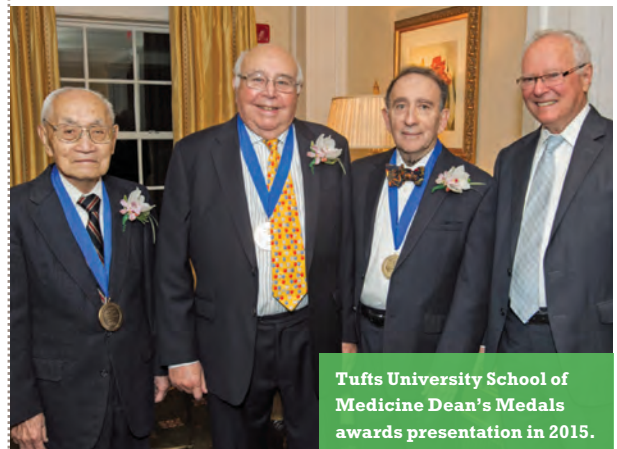
Shen's prowess with *C. diff* hasn't been lost on her funders at the U.S. Department of Health and Human Services. Late last year, they recommended her for the prestigious Presidential Early Career Award for Scientists and Engineers, which she received in January. "At first, I thought the email from the White House was very well-targeted spam," she said. "I couldn't believe it was real."

Awards are exciting—especially since Shen got an extra year of funding on her grant from this one—but she really gets a rush from unraveling biological mysteries. "When I started studying *C. diff*, we didn't know anything about how its spores worked," she said. "What drives me is the thrill of uncovering something new, and figuring out how it works. Right now, we're uncovering layers we didn't even know existed."

DAVID LEVIN is a freelance science writer based in Boston.

CRACKING THE *C. DIFF* CONNECTION

Doctors recognized colitis as far back as the 1890s, but the cause of the deadly diarrheal disease was a mystery for decades. In the mid-1970s, a Tufts research team—infectious-disease specialist Sherwood Gorbach, M62, J84P; Te-Wen Chang, M84P; and John Bartlett (who later went on to Johns Hopkins)—discovered that the *C. difficile* bacteria was to blame. They published their findings in the *New England Journal of Medicine* in March 1978, and Tufts has been a leader in *C. diff* research ever since, with studies conducted at the medical school and the Cummings School of Veterinary Medicine. In November 2015, Chang and Gorbach—as well as Stuart Levy, director of the medical school's Center for Adaptation Genetics and Drug Resistance—received prestigious Dean's Medals for their work on *C. diff*. "This was one of the biggest discoveries ever at Tufts," Gorbach told *Tufts Medicine* at the time. "After all, how often do you discover the cause of a life-threatening disease?"



Tufts University School of Medicine Dean's Medals awards presentation in 2015.

HOT SPOT HUNTING

To target hepatitis C prevention efforts, researchers had to find areas where transmission risk was the highest.

BY GENEVIEVE RAJEWSKI

THE OPIOID CRISIS shows few signs of slowing, with unintentional overdose deaths quintupling between 2000 and 2016 in Massachusetts alone. Meanwhile, as people who are addicted increasingly turn toward injectable street drugs—heroin now kills more Americans than prescription painkillers—two infections linked

to the sharing of dirty needles have also reached epidemic levels: hepatitis C, a potentially fatal liver disease, and bacterial endocarditis, a once-rare and life-threatening heart infection.

An estimated 3.2 million Americans have hepatitis C, which can lead to cirrhosis and liver cancer and costs tens of thousands of dollars per patient to treat. The scope of the problem is vast, but public-health funding to solve it is not. That’s why Thomas Stopka, an assistant professor of public health and community medicine at Tufts School of Medicine, recently led an innovative study to identify locations in Massachusetts where

targeted efforts to combat hepatitis C might have an outsized impact.

Stopka’s team, including colleagues from the School of Medicine, the Massachusetts Department of Public Health and Brown University, compared three separate kinds of data: more than 84,000 reports of hepatitis C infection between 2002 to 2013, sociodemographic data from 1,464 census tracts and hyper-local information, such as whether communities had programs that supply clean syringes. After geostatistical cluster analyses, the team could map not just hot spot areas with the highest number of hepatitis C cases—and the

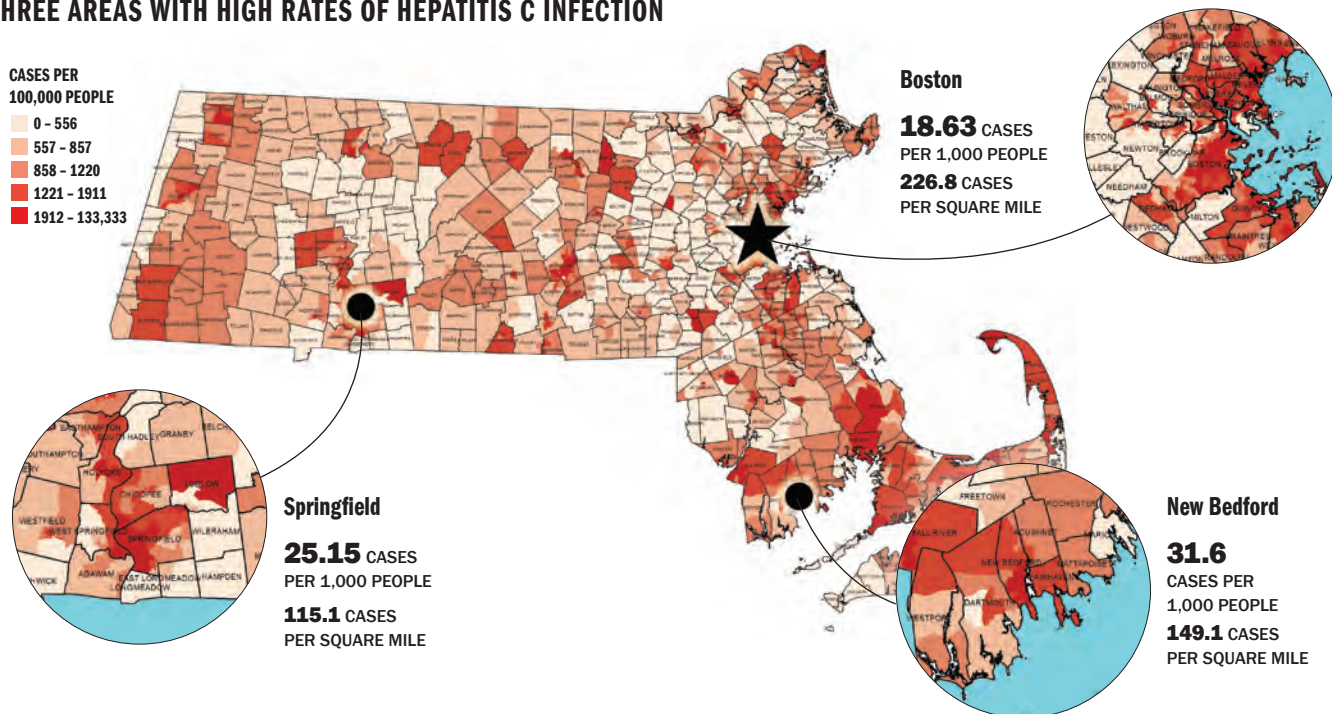
highest rates of infection—but also places where the chances of passing on the disease were higher than average. “Our analyses allow us to assess the geospatial relationships, patterns and trends that actually reveal where there’s truly a larger burden of disease,” Stopka explained. “And potentially more risk for transmission.”

The study, published in *BMC Infectious Disease*, found that census tracts around Boston, New Bedford and Springfield had the most significant rates of infection per 100,000 people. (At the time of the study, New Bedford and Springfield both

THREE AREAS WITH HIGH RATES OF HEPATITIS C INFECTION

CASES PER 100,000 PEOPLE

- 0 - 556
- 557 - 857
- 858 - 1220
- 1221 - 1911
- 1912 - 133,333



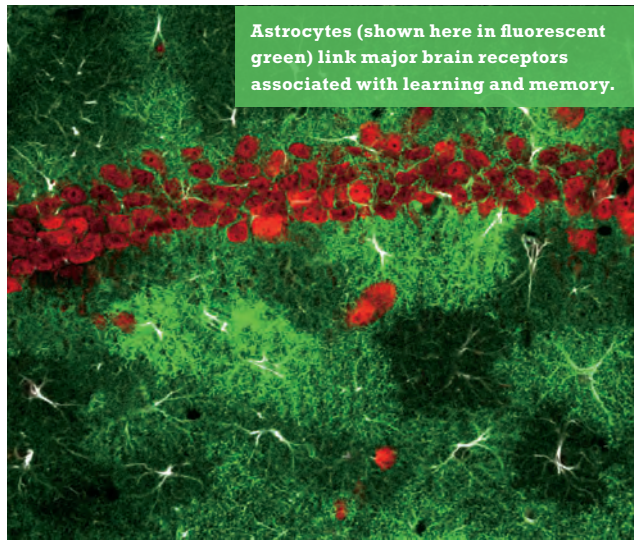
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lacked syringe-exchange programs; New Bedford recently authorized one.) The researchers also found high densities of disease in the smaller cities of Lawrence, Holyoke and Fitchburg, where results showed between 477 and 1,070 hepatitis C cases per square mile.

The researchers hope that their novel analysis of existing data will inform efforts to target public-health spending in the places where it can have the greatest impact. Fast-acting drugs that treat hepatitis C have been available since 2013—“They have amazing cure rates,” Stopka said, “greater than 95 percent in most populations”—yet they’re extremely expensive. Knowing the location of hepatitis C hot spots may help secure funding for treatment and prevention campaigns in those areas, treating people before they can infect others.

He has been working with communities affected by substance abuse for almost 20 years, ever since Stopka coordinated a government-funded study that put him in contact with people at risk of contracting HIV and hepatitis C through injection drug use. “Doing this work, you get to know people who are infected and affected by the virus,” he said. “And it’s hard to turn your back once you do.”

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Astrocytes (shown here in fluorescent green) link major brain receptors associated with learning and memory.

A NEW HOPE

This just-discovered pathway in the brain may hold promise for improving schizophrenia treatment.

BY DAVID LEVIN

LIFE CAN BE a constant struggle for patients with schizophrenia. The mental disorder can impair a person’s ability to manage emotions, make rational decisions and function socially. It can even blur the line between what’s imagined and what’s real, causing terrifying confusion.

A discovery by Tufts researchers may help change the way the disease is treated. In a paper published in *Neuron* in May, the team—led by Dr. Philip Haydon, director of Tufts Neuroscience Institute—revealed a previously unknown brain pathway

that could be related to schizophrenia, opening the door for new treatments and therapeutic drugs. The researchers suggest that while most existing schizophrenia drugs act directly on neurons, targeting certain supporting brain cells—called astrocytes—might be more effective.

Neurons are responsible for memory, activity and learning. If they are the brain’s pro athletes, then astrocytes act as their coaches. While neurons send commands to one another hundreds of times per second, astrocytes take a big-picture approach, telling neurons how active they should be throughout the day. “Astrocytes act sort of like dimmer switches,” said Thomas Papouin, the paper’s lead author and a research assistant professor at Tufts School of Medicine. “They can turn neuronal activity up or down on a large scale.”

One of the ways

astrocytes do this is by releasing a brain chemical called D-serine, though how the cells know when to release it—and in what quantities—was unclear until now. Papouin and his colleagues, including Jaclyn Dunphy, a Ph.D. candidate at the Sackler School, unraveled that mystery in their experiments. The group monitored D-serine levels in mice over time, finding that the levels appeared to rise and fall in concert with a molecule called acetylcholine. This chemical, they said, seems to trigger a response in astrocytes, prodding them to release D-serine, thereby regulating neuronal activity.

This could be good news for patients with schizophrenia, who have low levels of both acetylcholine and D-serine—deficits that may contribute to their disorder. “Giving schizophrenic patients D-serine directly can help counteract their symptoms, but can also cause serious kidney problems,” Dunphy said. “We think it might be better to manipulate D-serine levels in the brain by targeting astrocytes instead.”

Papouin said it may be years before this finding could be used to develop new medication—but the team is excited by the possibility. “It’s a step,” Papouin said. “We’ve found a relationship between two chemicals in the brain that are both implicated in schizophrenia, yet for a long time, were thought to be completely separate.”



**Tufts President
Anthony P. Monaco
photographed at
the university's
new Science and
Engineering Complex.**



THE HUNT FOR HOPE IN THE GENOME

Three decades ago, a team of researchers—including future Tufts President Anthony P. Monaco—combed through millions of DNA letters to find the flawed gene responsible for Duchenne muscular dystrophy. Here's how their work led to the first-ever FDA-approved drug for treating the deadly disease.

BY BRUCE MORGAN

PHOTOGRAPHS BY KATHLEEN DOOHER

CHRISTINE MCSHERRY'S SON, JETT, WAS A TODDLER when she began to notice that something wasn't quite right. He ran with a wobbly gait. He climbed stairs slowly, one deliberate step at a time. His calves looked slightly enlarged. In the winter of 2001, when Jett was 5, McSherry brought him for his annual visit to the pediatrician. After noticing that Jett had a slight difficulty in getting up off the ground, the pediatrician suggested he see a specialist in Boston. The diagnosis could not have been worse. "Take your son to an island for three weeks and give him all the love you can," the specialist said. "He will be gone by age 15."

Jett had Duchenne muscular dystrophy (DMD), a muscle-wasting disease for which there is no cure. DMD, one of nine types of muscular dystrophy, is the most common and lethal genetic disorder in children, affecting about one in every 3,500 male infants. Boys diagnosed with DMD—and almost all DMD patients are boys—tend to decline rapidly, their muscles progressively and irreversibly weakening. Typically, they are confined to a wheelchair by age 12, continue to lose muscle function through their teens and die of heart or respiratory failure in their twenties.


But today, 16 years after his diagnosis, Jett McSherry is defying the odds. It's true that he hasn't

taken a step since the age of 13, but at 21, his decline has now leveled off and he even shows signs of an upswing.

Jett just finished his sophomore year at Bridgewater State University, where he lives on campus with a roommate. When he's at his family's home in nearby Pembroke, Mass., he can bend down from his electric scooter to pat the family dog and then sit back upright unaided—something unimaginable just a few years ago. He has regained limited use of his hands as well—while hanging out with his older brother recently, he managed to open a beer. “He's never opened a bottle or a can in his life,” his mom marveled.

What exactly changed? Jett still has DMD, of course. Because the disease is caused by a flaw in his genetic code that renders his body unable to produce an essential muscle-protecting protein, his independence and mobility remain limited. He still faces a shortened lifespan. But for the past two years Jett has been taking a new drug called eteplirsen, which spurs his body to produce that missing protein, slowing the progress of DMD. The drug—marketed as Exondys 51 by the Massachusetts-based company Sarepta Therapeutics—is not a cure, but it's a start.

Before scientists could figure out a way to treat DMD, however, they had to find the one gene responsible for it among tens of thousands of them. The road to that discovery runs back to the early 1980s, two decades before the completion of the Human Genome Project, at a time when much about inherited diseases such as DMD seemed an impenetrable mystery. The attempt to identify the DMD gene struck many experts as destined to end in failure. But at Harvard Medical School, a pioneering geneticist named Louis Kunkel and his first graduate student, Anthony P. Monaco, a bright young researcher just out of Princeton, were about to take up the challenge. In time, they would make history.



IN 1983, THE FIELD OF molecular genetics was in its infancy. That year, James Watson—who had won a 1962 Nobel Prize for helping unravel the double-helix structure of DNA—oversaw a conference at Cold Spring Harbor Laboratory in New York. Attendees batted around some of the new field's most fundamental questions: What does a gene do, exactly? How would you go about looking for a one? At one point, after hours of discussion, a scientist stood up and asked, “You know, we've never seen a gene before. How will we know if we find it?” That question stumped everybody.

More than 200 miles away, at Boston Children's Hospital and Harvard Medical School in Boston, Louis Kunkel was already hard at work finding answers. Not long before the Cold Spring conference, he delivered a lecture in Harvard's neuroscience of disease course. During the next phase of his research, he announced to his students, he wanted to identify the genetic defect that caused Duchenne muscular dystrophy.

In the audience that day was Tony Monaco, a first-year graduate student then in the Harvard M.D./Ph.D. neuroscience program. Monaco, a member of the first generation of his family to attend college, was planning to become a physician, but Kunkel's lecture changed that. Monaco would go on to earn his M.D., but he embarked on a career hunting down disease genes through breakthroughs in the genetics lab. He started out by volunteering to help Kunkel search for the DMD gene. “I showed up at his office the next morning,” Monaco recalled, “and told him I wanted to be part of that.”

It didn't matter to Kunkel that Monaco had no lab experience in genetics or molecular biology. “I could see that he was smart, interested in the problem and willing to work,” Kunkel

said. And they had lots of work to do. They believed that DMD was the result of missing pieces, or deletions, in the DNA, and they knew that these deletions were somewhere on the X chromosome, but everything else was a mystery.

To find the genetic flaw behind DMD, Monaco became an expert in a new research method called “positional cloning,” which involves comparing vast quantities of DNA drawn from patients to find the specific site of the gene mutations causing their health problems. Monaco collected DNA samples from 55 or so DMD patients to study how they differed from those of healthy subjects. The more differences the team could chart, went the reasoning, the more detailed they could make their map to the DMD gene.

At the start, Monaco and Kunkel faced sorting through the entire X chromosome, which is made up of more than 150 million base pairs of DNA letters. After many months of winnowing, they still had 10 million pairs to analyze. The only way left to do that was to painstakingly compare the DNA of DMD patients and healthy people, piece by tiny piece, to find the spot where the two codes didn't match. “Looking for the Duchenne gene,” Monaco said, “was like driving from Boston to Los Angeles, and only knowing a dozen points in between, and trying to find a specific street in Phoenix.”

Keeping track of his progress over three years, Monaco gradually drew a six-foot-long illustration of the different genetic codes of the patients the team was studying. The illustration featured stretches of DNA at the top, followed by black bars down below representing gaps in the X chromosome. As Monaco added more bars, they began to give a hazy sense of where on the genetic code the DMD flaw must be located. “The goal was to find gaps in the chromosome, and then find the areas where those gaps overlapped,” said Donald Wood, then the director of research for the Muscular Dystrophy Association, an organization



Christine McSherry and her son, Jett, who is taking the newly approved drug Exondys 51 for his Duchenne muscular dystrophy.

famous for its annual Labor Day telethons hosted by Jerry Lewis that funded Kunkel team's work. (Wood is now a vice president for institutional effectiveness at Odessa College in Texas.)

The work was slow, and the Kunkel lab had competition. Other researchers, including groups based in Oxford, Leiden and Toronto, were unusually cooperative in terms of sharing resources and information, but were also working furiously to be the first to identify the DMD gene. "It was a footrace, and I didn't look back," Monaco recalled. He often worked straight through the weekends, yet still made time each week to visit young DMD patients and their families in the muscular dystrophy clinic at Boston Children's Hospital.

In the race to find the gene, Kunkel and Monaco eventually turned to animals. If the gene was so important for maintaining muscle in humans, it was

probably essential in other animals, too. "Genes are conserved across species," Monaco explained. "This means that the needle in a haystack we are looking for is going to be the same, or similar, across species."

Using what are known as "zoo blots," Monaco compared his samples of human DNA to samples from hamsters, monkeys, cows and other animals. Finally, one day in May 1986, more than three years into the search, everything snapped into focus: Some of the DNA on a zoo blot Monaco and Kunkel were reviewing—from a mouse and a chicken, as it turned out—matched up well with the lab's fragments of human genetic code. Found among millions of letters of DNA, this was the X that marked the spot on the map Monaco was drawing—the exact location of a piece of the DMD gene.

Monaco then screened a gene library

of human muscle against those pieces of DNA that were conserved in animals. He spent that weekend alone in the lab, developing radiograph images of his discovery. Early Monday morning, he hurried back to work to show his results to Kunkel. "When I brought them up for Lou to analyze over a light box," Monaco recalled, "he turned to me and said, 'I think we've done it!'"

Kunkel and Monaco had, in fact, done it. They'd found the gene responsible for causing DMD, as well as for causing Becker muscular dystrophy, a similar but less severe form of the disease. In October 1986, Monaco, Kunkel and their colleagues published their results in the scientific journal *Nature*. The news soon spread across the country. Just before Christmas, *USA Today* ran a front-page story on the DMD discovery under the headline "Jerry's Telethon Pays Off."

THE DISCOVERY OF where to look for the genetic flaw that causes DMD represented a great leap forward in diagnosing the disease in children, one that led to an in-utero scan with 80-percent accuracy. But the scientists in the Kunkel lab still lacked fundamental information about the disease, including exactly which muscle-protecting protein the damaged gene was failing to produce. Without that knowledge, their basic research, regardless of how groundbreaking, could never point the way to a treatment.

So the Kunkel lab began looking for the protein. In 1987, nearly a year into the search, a postdoc in Kunkel's lab named Eric Hoffman at last found it. (Hoffman today is a dean for research in the School of Pharmacy at SUNY/Binghamton University.) The lab called the protein dystrophin.

Now, the researchers could turn their attention to comparing three different sets of genetic code. The first was from healthy people who produced normal amounts of dystrophin. The next was from DMD patients, who couldn't produce any dystrophin at all. The final set was from patients with the less severe Becker disease, who produce limited dystrophin. The team wanted to figure out how differences in the genetic code resulted in varying levels of dystrophin production and severity of the disease.

The researchers knew that the body's instructions for creating dystrophin come arranged in three-letter sets of DNA, which are located in parts of genes called exons. To get a sense of how it works, imagine that, in a healthy person, exons are strung together along the gene to create the sentence "Run mad cat eat the big bat." That instruction directs the person's cells to produce a normal amount of dystrophin. In a DMD patient, however, exons are deleted and rejoined such that the "cat" three-letter

code might be missing the "c" and the "a," a deletion that shifts all the other letters in the sentence, resulting in "Run mad tea tth ebi gba t." The cells can't read that garbled instruction, so the person can't produce dystrophin.

When it came to the genetic code of a Becker patient, however, Monaco found something curious. In those genetic codes, entire exons had been deleted and rejoined without disrupting the reading frame of the three-letter codes, leading to such sentences as "Run mad cat eat bat." The dystrophin instruction was shorter than in a healthy subject, yet still readable. As a result, Becker patients produce some dystrophin, but less than a healthy person. And some dystrophin, it turned out, was far better than none. People

with Becker experience much less muscle wasting than those with DMD, and can expect to live decades longer.

When comparing the two forms of muscular dystrophy, Kunkel and Monaco had a revelation: There might be a way to trick the cells of DMD patients into skipping over deleted exons and continuing on to read the rest of the genetic instruction—like a boy hopping over a crack in the sidewalk and continuing on his way. If this turned out to be possible, a body that was producing no dystrophin could be spurred to produce at least some. The implications were staggering. "At one point," Monaco recalled, "Lou and I looked at each other and said, 'You could turn a Duchenne patient



Harvard geneticist Louis Kunkel at Boston Children's Hospital, where Anthony P. Monaco's drawing hangs on the wall as a reminder of their historic search.

into a Becker!” In 1988, Monaco and Kunkel published a paper on their breakthrough understanding of the reading-frame differences between Duchenne and Becker patients, but the exon-skipping idea was still just a theory. Close to a decade later, when the Australian scientist Steve Wilton started formulating the drug that would become Exondys 51, he called the work of his predecessors “pivotal” in developing the treatment.

For all its promise, Exondys 51 is not a miracle drug. For one thing, just 13 or so percent of DMD patients have the particular genetic makeup that responds to the treatment, and its effect on DMD symptoms can be modest. For another, a year of treatment can cost more than \$1 million, according to an analysis by the drug-benefit firm Prime Therapeutics. Still, the original study of 12 DMD patients—in addition to follow-up studies with Jett McSherry and others—demonstrated that Exondys 51 was the first treatment that could lessen the effect of the disease. “The results don’t knock your socks off, maybe,” said Donald Wood, the former Muscular Dystrophy Association official, “but they’re promising.”

In September 2016, the FDA saw enough promise in Exondys 51 to grant it accelerated approval, overriding its own advisory committee that had voted 7-6 against approval on grounds that the original 12-person study was not adequately controlled. Sarepta Therapeutics can now market the drug, but must conduct additional research to confirm its efficacy. If the results aren’t convincing, it could be taken off the market. (Meanwhile, some insurers are refusing to cover it.) Sarepta is also working on drugs that would skip both Exon 45 and Exon 53; each affects about 8 percent of DMD patients. Other companies are exploring additional treatments.

For now, though, Exondys 51 works just as Kunkel and Monaco imagined that it might 30 years ago:

by causing cells to skip over missing exons, thereby enabling the production of dystrophin that hadn’t been there before. In other words, by turning a Duchenne patient into a Becker.

A

NTHONY MONACO, OF course, went on to become the 13th president of Tufts University. Before that he spent 20 years at Oxford University,

immersed in genetics research and writing or co-writing more than more than 300 publications, many of them landmarks in the field. In 1995, he cofounded Oxford’s Wellcome Trust Centre for Human Genetics, now the UK’s largest externally funded, university-based research center, and served as its director for close to a decade. “He’s one of the most accomplished geneticists of his generation,” Kunkel said of his former student. “Tony has identified by positional cloning more genetic disorders than anybody else, notably in the areas of deafness, autism and certain speech problems.” And all these years later, the framed six-foot-long drawing Monaco made of DMD genetic code now hangs at Kunkel’s office in Boston Children’s Hospital.

Even for a basic researcher as accomplished as Monaco, it is rare to see the good your work can do out in the world. A willingness to endure high failure rates and years of toil in the lab is often what is required to eventually solve the big medical mysteries and pave the way for transformative treatments. Monaco knows this as well as anyone. And yet, earlier this year, Monaco got just such an opportunity—the chance to draw a line from his long-ago work at Harvard to the present day.

In February, he met with Christine McSherry, Jett’s mother, in Ballou Hall. McSherry, a former registered nurse at Tufts-New England Medical Center (now Tufts Medical Center), launched


the Jett Foundation shortly after her son’s diagnosis. The nonprofit has raised some \$18 million to date and helps guide families through their insurance appeals (McSherry’s insurer has agreed to cover Jett’s treatment through April 2018), funds DMD summer camps and builds social networks among DMD families. McSherry has also traveled the world consulting with experts and testifying about the disease. On this day, though, she just wanted to tell Monaco about the difference his research has made in the life of her son.

Whatever its limitations, Exondys 51 has been life-changing for McSherry’s family. She described for Monaco all the improvements she’d seen in Jett. He’d regained some limited movement, including in his hands, and he’d even been breathing better. When McSherry rose to leave, she gripped Monaco’s hand. “Thank you for the great work that you did,” she said. Monaco told her how happy he was to have done it.

Later, Monaco recalled the boys with muscular dystrophy he used to visit at Boston Children’s Hospital and said that he wished science had been able to work fast enough to also help those children and their families. But hearing McSherry talk about the improvements in Jett’s life left him feeling optimistic. “It gave me hope that genetic research can make a difference in people’s lives,” he said. “I hope this is the beginning of an era where treatments will be forthcoming for many different diseases.”

For McSherry, the big breakthroughs are taking place right here and now. During a routine visit to the doctor’s office recently, Jett smiled after a playful exchange with a nurse. From the outside, it may have looked like a small thing, but to Christine it was huge. “Jett had lost his smile years ago,” she said. “I hadn’t seen that smile since he was 12 years old.”

BRUCE MORGAN is the former editor of *Tufts Medicine*.



The inside story of one of the country's
first free, student-run medical
treatment centers.

AS TOLD TO ELIZABETH GEHRMAN

PHOTOGRAPHS BY ALONSO NICHOLS

We Are Sharewood

An Oral History

BACK IN 1996, A GROUP OF FIRST- AND SECOND-YEAR TUFTS medical students came up with a bold idea: to open a pop-up center offering free medical care to the underserved residents of Boston's Chinatown and Bay Village. And, at a time when there were only a few such initiatives in the country, they would run it themselves, from conducting intake interviews to offering treatment advice. Though faculty and administrators were skeptical at first, the students not only pulled it off but also passed their enthusiasm on to the following year's physicians-in-training. In honor of the Sharewood Project's 20th anniversary, here's a look at how it all happened, in the words of those who were there.



COLLEEN FINNEGAN, M99: We all went to Tufts because we wanted to make contributions to the world. So the idea behind Sharewood was, What can we do to give back and also further our own understanding of practical medicine at an earlier stage in our training?

JENNIFER SKOLNICK, M99, TUFTS UNIVERSITY SCHOOL OF MEDICINE (TUSM) CLINICAL ASSISTANT PROFESSOR: I spoke with Apple [Sussmann] and Pouné [Saber] about this ethereal idea of providing health care for the community around the medical center in Boston. I'm remembering that someone suggested the idea and then disappeared.

ROBERT CAMPBELL, M99: There were a couple of people in the class before us who'd tossed around the idea. There was a guy named Chris Engelman.

LIBBY BRADSHAW, TUSM ASSISTANT PROFESSOR OF PUBLIC HEALTH AND COMMUNITY MEDICINE: Chris was a medical student interested in doing community-service learning. Somehow I knew there was a conference going on, and we sent Chris.

CHRIS ENGELMAN, M98: It was at Northeastern. There was a poster there about a student-run medical clinic at another school.

BRADSHAW: He came back all excited about the idea of starting a free clinic. I thought, This is a horrible idea—it's so much work and so hard to get off the ground. But I felt like I was committed to him.

ENGELMAN: At that point it was like, How can we get something like that going here?

POUNÉ SABERI, M99, MG99: I have a distinct memory of us having an early meeting: Apple, Colleen, Jennifer Skolnick, Michael Greger and someone I didn't know as well—that must have

been Chris Engelman. With the help of them and the others, it kind of all came together.

With the idea in place, the new project needed a name.

SABERI: I said we should call it Sherwood for Sherwood Forest.

RAHUL PARIKH, M99: Taking resources from others and giving them to those in need. We had a debate.

SABERI: Everybody was like, That's offensive.

BRADSHAW: I thought that might both be too pointed and too obscure, and suggested Sharewood as one of several options.

SABERI: Sharewood—like, we share. Where the name came from would be our secret. Twenty years later, none of the students have any idea why we called it that.

The next step was convincing the Tufts School of Medicine—and the Massachusetts Department of Public Health—that students could actually pull it all off.

EZRA BARZILAY, A95, M01: We were largely dismissed by the folks in the more established routes of health care access. They were like, This is futile. You guys are students.

FINNEGAN: We presented our idea to the university leadership. A few people found it interesting but said we weren't going to get anywhere unless we found a legitimate medical doctor who would back us up.

SKOLNICK: We contacted Mark Pearlmutter and talked to him on the lawn at St. Elizabeth's Hospital during his workday.

MARK PEARLMUTTER, M84, TUSM ASSOCIATE PROFESSOR: For a good hour or two, I listened to their ideas. I remember saying to myself, *This is crazy*. But at the same time, they had so much passion I couldn't resist hearing them out. In any case, I couldn't dedicate the time needed to help build this with them, so that's when I brought in Brian.

BRIAN LISSE, TUSM CLINICAL ASSOCIATE PROFESSOR AND FOUNDING SHAREWOOD MEDICAL DIRECTOR/ADVISER (1997-'01): I had a job teaching at St. E's, where Mark Pearlmutter was my boss. I didn't know much about Tufts, but it seemed like a good idea for a medical school to have a free clinic.

PEARLMUTTER: The true hero behind that clinic and making it work was . . . me. No, I'm kidding! It was Brian Lisse. He threw himself into it as their mentor.

LISSE: John Harrington was the dean of the medical school at that time. He heard what we wanted to do and said, "As far as I'm concerned, this is a student club. If it works out, we're going to love it, and if it falls on its face, I've never heard of you." He figured out a way to disavow it if needed but at the same time be supportive.

BRADSHAW: We met over the summer with Pouné, Colleen and Apple. We heard the students out, but we also brainstormed with them about the issues that would be involved.

LISSE: One student had to figure out the legal part of it. He went to the Massachusetts Department of Public Health and came back shaking his head. He said, "I had the weirdest experience. I talked to the person and she kept saying, 'No, you don't want to open a clinic.'" Turns out the word *clinic* has requirements for a whole bunch of federal and state mandates that we did not want to get involved in.



Tufts medical students set up panels for the Sharewood Project in August 2011. Previous spread: Sharewood volunteer Will Long, M20, oversees an eye exam in June 2017.

The students came up with Sharewood Project instead.

The newly minted Sharewood Project got the greenlight, but the students still needed to find a space where they could see patients.

SABERI: There was a theater production—*Nunsense* or something—in a little building right next to New England Medical Center that housed the Church of All Nations. We wondered if that space could be available.

KAREN BRYANT, FORMER PASTOR AT THE CHURCH OF ALL NATIONS: We had a small congregation, but God is not small. I wanted to fill the church up with ministry, so we started a weekly prayer meeting about what to do with extra space in our building. We prayed to God, “We don’t have a lot of money, but we have this building. We surrender it to you and ask you to bring us what you want here.”

SKOLNICK: We went to see the pastor to ask if she would be interested in serving the community with a medical clinic.

BRYANT: I was alone in the church one day when there was a knock on the door. It was a shiny-faced first- or second-year medical student. I remember her saying, “We’re from Tufts, and we want to start a free medical clinic for the poor. Do you have any space?” I just grinned. I said,

“Come on in. We’ve been waiting for you.”

Bryant gave Sharewood the roughly 2,000-square-foot space to use, gratis, for four hours every Tuesday night. The church had some unused office dividers the students rolled out of storage every week to create temporary treatment rooms. To outfit the new center, they collected medical equipment and supplies from anyone willing to contribute.

SABERI: In my naiveté I was like, What could be easier than this? “If you build it, they will come.” But then, of course, there was a tremendous amount of detail that had to be worked out.

BARZILAY: Because we were so close to Chinatown, we were approaching a community of immigrants who were not particularly trustful of outsiders. We went door to door to some of the larger businesses and gave them brochures in different languages saying we’d have interpreters and that people didn’t need insurance.

ROBERT CAMPBELL, M99: I wrote some grant proposals. My dad was at IBM so he got me in touch with people there, and we got \$3,500 worth of equipment from them. The next grant was for \$10,000 from the Mass. Medical Society. There was \$5,000 from the McLeod charitable foundation and a bunch of small grants totaling \$4,000.

NEMC donated lab testing and X-ray services, and [TUSM Dean] Dr. Harrington gave us a little office in the hospital.

SKOLNICK: We met with pharmacy representatives and got samples for our free pharmacy. We used the same procedure to get used equipment from clinics that no longer needed it. I don’t remember where we got exam tables, but we had six or eight of them.

KEVIN DONAGHY, M99: The church board was worried Sharewood would become a target for people looking to steal drugs. We ended up having to hire an off-duty police officer because of security concerns. That was a huge expense.

SAUSAN CAMPBELL, M99: We decided to have an evening auction to raise money. Jennifer Skolnick and I went to every store on Newbury Street and Commonwealth Avenue to ask if they’d be willing to support us.

SKOLNICK: I remember walking the streets of Boston carrying home an enormous stuffed duck from FAO Schwartz that was much bigger than me. I got many strange looks.

SABERI: A professor donated three bottles of aged bourbon. As we were setting up for the silent auction, I dropped one of them and it shattered to pieces. I almost had a stroke. Then, at the auction, the professor was like, “I gave *three* bottles.”

Even with just two bottles of bourbon, the auction was a big success, raising the money the Sharewood Project needed to open its doors. On the evening of February 18, 1997, the first patients arrived.

LISSE: The first person a patient saw was someone in triage, who figured out whether they should be seen right away. Then usually two students would go in to see the patient. They’d take a history

and do a physical, then come upstairs and tell the attendings about it. Then we'd all go back down together and see the patient again. It may sound cumbersome, but it's the model you use when teaching third- and fourth-year students.

BARZILAY: My first patient was a very diminutive, elderly Asian woman. She needed an EKG. We had an old-fashioned machine, with metal wires hanging out with individual suction cups to position on the chest. I was like, What am I doing with all these? But the attending walked me through the process.

SAUSAN CAMPBELL: I had a woman come in with coughing, abdominal pain, maybe some vaginal bleeding. So I was going to do a full workup on her. I had a feeling like, Am I doing this right? I did a cardiac exam to make sure I didn't miss a heart murmur. And there was fluid in her lungs—I had never diagnosed someone with pneumonia before. It was definitely exciting and unnerving, but mostly I remember thinking, Wow, this person is trusting us, the attending and I, to come up with an answer for her. I felt very humbled by her trust.

FINNEGAN: After all those years of preparing for medical school, it was so thrilling just to put your hands on somebody, even if they just had a sinus infection.

LISSE: Almost the entire first-year medical-school class signed up to work there.

DONAGHY: This was a way to get hands-on experience and serve a community need. We liked that aspect. We were also eager to not overstep. We weren't trying to replace what a hospital can provide.

SKOLNICK: We were visited by psychiatrists and gynecologists on staff at Tufts who were interested in adding services. New England Eye Center saw a few patients for free.

BARZILAY: It was like watching fire spread. First, word spread within the rest of the classes within Tufts, then to Boston University and Harvard, where people started asking if they could come help with it. Then we started getting a much steadier stream of attendings who were willing to put in their evenings pro bono. All within one year.

As the founders moved into their third-year rotations, they could volunteer only at Sharewood sporadically, if at all, and turned over management to the incoming class—a model the project follows today. Things went relatively smoothly until 2001, when Pastor Karen Bryant learned her church was bringing in a new leader.

LISSE: Karen was very upset. They replaced her with someone who had an MBA and confronted us with something like \$35,000 a year in rent to stay there for four hours each Tuesday. We just said, *Are you kidding?*

BRYANT: They closed down the programs in the building one by one. I was shipped out to a church in Braintree.

LISSE: We tried to find middle ground but Karen's replacement said no. So the students started canvassing the area to find a new home.

JOSEPH GRAVEL JR., A82, M86, FORMER SHAREWOOD MEDICAL DIRECTOR AND ADVISER (2001-09): I knew some of the churches in Malden, so I started knocking on doors. I got a preliminary yes from the Centre United Methodist Church. We had to go before their board of trustees, and they approved it.

MARY Y. LEE, J75, M83, FORMER ASSOCIATE PROVOST AND TUSM DEAN FOR EDUCATIONAL AFFAIRS: Malden is one of the main sites for the Tufts family medicine residency. That turned out to be critical when they adopted Sharewood.

GRAVEL: The move was like the Battle of Dunkirk. The students were so organized and dedicated to keeping Sharewood open. They brought everything over in their cars to Malden in a weekend.

Every class coming through Sharewood would tackle its own challenges. In 2005,



students had to move the project again, to a second church in Malden. Around that time, a new problem cropped up: The number of patients was waning.

DANIEL SLATE, A11: When I started volunteering as an undergrad, there were more students who wanted to get involved than could every week because of low demand. They were seeing maybe five to six patients a night.

REBECCA SCOTT, TUSM SENIOR DIRECTOR OF DEVELOPMENT AND ALUMNI RELATIONS: When I got involved as a volunteer adviser, the med students said volunteering at Sharewood was a great opportunity to get some studying done.

SLATE: Rebecca connected with people in Medford, Malden, Somerville and Everett, so we started going to churches, soup kitchens, homeless shelters, places like that to build relationships with them and make them aware of our services.

SCOTT: Then the recession came, and that was a game-changer. Even people who had health insurance started coming to Sharewood because they could no longer afford their co-pays.

SLATE: Demand more than tripled. We were seeing 20 to 30 patients a night.

SCOTT: No one has called Sharewood a great opportunity to study since that time.

The number of undergraduates volunteering in the clinic also increased. Over time, students from the Friedman School of Nutrition Science and Policy and from the Tufts University School of Dental Medicine also got involved.

SCOTT: Dan [Slate] was the guy who changed Sharewood on the undergrad campus from being a subgroup of the Pre-Med Society to being its own

recognized, separate club—and one of the largest at the university.

SLATE: We needed more funding to handle the increased case load, and to get the funding we needed to measure our impact on the community. I brought in a computer science team from Tufts to work on building a first version of the electronic health-record system.

GREGORY SAWIN, TUFTS FAMILY MEDICINE RESIDENCY DIRECTOR AND SHAREWOOD MEDICAL DIRECTOR AND ADVISER: One of the big pushes I tried to make during my tenure was getting people signed up for insurance in hopes of transitioning them into long-term primary-care relationships.

NITIN JETHMALANI, A16, M20: Sharewood now helps one in six clients apply for MassHealth and consults with numerous others on food-stamp and WIC applications. Many clients are children who have recently moved to America and need a physical. Sharewood allows them to start school earlier than if they had to wait for an appointment at a traditional clinic, assuming they could afford one.

VIRGINIA (PAIGE) MURPHY, N17: There are 16 dietetic interns who are both graduate students at the Friedman School and rotating through the hospital. All 16 participate in the Sharewood Project to provide nutrition assessment and counseling to patients who require it.

DAVID LEADER, D85, MG13, DENTAL SCHOOL ASSOCIATE PROFESSOR AND DIRECTOR OF THE DMD/MPH DUAL-DEGREE TRACK: Two Tuesdays a month since 2010, a few dental students have been going to Sharewood to do fluoride treatments, head-and-neck cancer screenings and referrals. They get no course credit for it and have to miss clinic time, but it's a great opportunity for interprofessional education in real time. It helps students see how medicine and dentistry fit together.

MURPHY: The Sharewood Project is unique because it allows graduate students from a number of disciplines across the Tufts community to combine forces and give back.

The Sharewood Project, now based at St. Paul's Parish Church in Malden, sees about 950 people every year. The experience has had a lasting impact on those involved.

ERIC SWANSON, A12, MG16, M20: It's an excellent learning opportunity for first-years to have that direct interaction with people seeking care.

MICHAEL GREGER, M99: It makes them remember and keep that idealism they arrived with.

BARZILAY: There were five more years between our second year volunteering at Sharewood and getting through medical school. But it gave us a preview: We knew what it was like to actually care for someone.

ELENA HILL, A13, M17, MG17: I triaged a patient early on who was having a really tough time. A little while later I got a 10-page handwritten letter in the mail thanking me for taking the time to talk with her and make her feel normal again.

ROBERT CAMPBELL: Patients want that one-on-one connection. Things like Sharewood have a sort of magic; they establish a connection that's really at the base of what we do.

PEARLMUTTER: It makes students realize overnight that being a physician is often not always about making life-and-death decisions. It's about supporting the community and doing the little things that make a difference in someone's life.

ELIZABETH GEHRMAN is a writer based in Buffalo, N.Y.

The

Outgoing Sackler School Dean Naomi Rosenberg has left her mark on science—and the next generation.

Visionary

DURING HER LAST COMMENCEMENT ADDRESS AS dean of the Sackler School in May, Naomi Rosenberg told graduates: “You have more choices than I had when I was in your seat over 40 years ago.”

A few weeks later, sitting in her tidy office on the eighth floor of the Sackler Center, she elaborated. “I finished graduate school in 1973—there was no biotech industry then,” Rosenberg said. “Graduate school was about a career in academia, and that’s what I wanted.” But facing limited faculty positions and slashed research funding, today’s young scientists might head to jobs in the pharmaceutical industry, life-sciences consulting or patent law. And universities must continually evolve, she said, to prep students for wherever their careers take them.

Rosenberg has been doing that since the day she joined the Tufts University faculty in 1977. She was dedicated to advancing graduate education and fundamental science, first as a mentor for dozens in her thriving lab, then as the diversity-boosting dean of the Sackler School, the vice dean of research at the School of Medicine and as a leader on several national boards and task forces. Indeed, whether she was hosting a Ph.D. for a home-cooked meal or chairing the American Association of Medical College’s Graduate Research Education and Training group, Rosenberg always put students first.

“Naomi’s deep commitment to educating the next generation of scientists was a constant thread in her personal and professional life,” said Dr. Harris Berman, dean of the medical school. It’s a refrain you’ll hear often from those who know her best.

Rosenberg’s distinguished career began at the library. Raised by a cabinetmaker-father and a ceramicist-mother outside of rural North Westminster, Vermont, she remembers poring over

BY COURTNEY HOLLANDS

PHOTOGRAPH BY JOHN SOARES

scientist biographies and the classic book *Microbe Hunters*. She enrolled at Boston University in 1966—the first in her family to go to college—and graduated with a degree in microbiology. “I was fascinated by the fact that these tiny organisms could cause such incredible disease,” Rosenberg said.

After earning her Ph.D. at the University of Vermont, she started postdoc training at Nobel laureate David Baltimore’s lab at the Massachusetts Institute of Technology. In 1975, Rosenberg figured out how to turn murine blood cells into leukemic cells in a Petri dish, pioneering the first tractable model for studying leukemia development in tissue culture. (Her work was important in the later invention of imatinib, a drug used to treat chronic myelogenous leukemia.)

Dr. Robert Schwartz, then a professor at Tufts School of Medicine, recruited Rosenberg in 1977 for a cancer center he was establishing. While at Tufts, Rosenberg published more than 120 papers and the lab she ran through 2008 was continually funded by as many as three National Institutes of Health (NIH) grants per year. True to form, she’s quick to point to her students for that success. “A lot of the different pathways we took were determined by student research,” she said. “One person doesn’t have all the good ideas.”

Rosenberg wasn’t at Tufts long before she discovered how much she liked working with trainees. “It was so amazing to see how they changed and matured in their approaches to science,” she said. Over time, she mentored 29 Ph.D.s, including Lalita



Ramakrishnan, SK90, now a professor at the University of Cambridge and a member of the National Academy of Sciences. “I credit Naomi,” she said, “for turning me into a scientist.”

Rosenberg also worked in graduate admissions and as a student adviser, then became director of the Sackler School’s graduate genetics program. All this exposure to various areas of graduate education made Rosenberg a natural choice to take the Sackler School helm in 2004, associate dean Kathryn Lange said, adding that Rosenberg “does not ruffle very easily—and she’s really, really smart.”

Over 13 years as dean, Rosenberg encouraged the Sackler faculty to appoint chemistry, biology and biomedical engineering teaching staff from the Medford/Somerville campus, providing broader multidisciplinary training for students. She also supported faculty initiatives around diversity, including Building Diversity in Biomedical Sciences, a 10-week summer session, and the Post-Baccalaureate Research Program, which offers lab experience and mentorship for minority students who hope to go on to a Ph.D. The closer the school reflects our country’s population, “the better off we are and the more ideas we’ll have,” Rosenberg said.

Another way she is looking to the future is with the Naomi Rosenberg, Ph.D., and Morton B. Rosenberg, D.M.D., D74, Fellowship. She and her husband—a professor emeritus at the School of Dental Medicine and a professor at the School of Medicine—established the fellowship to promote discovery-based science. (The first recipient, Danish Saleh, M19, SK19, researched the body’s inflammatory response to infection or tissue injury in the lab of his doctoral adviser, Alexei Degterev. The fellowship covered Saleh’s stipend for a year, which freed up money for necessary research tools and led to the publication of their findings.) Rosenberg has also agreed

to stay on as a senior adviser to the interim director of the Human Nutrition Research Center on Aging at Tufts.

Throughout her career, Rosenberg was involved in the Leukemia and Lymphoma Society and the American Cancer Society, as well as with the American Association of Medical Colleges and the NIH. “Her reach goes far beyond her effect on the Sackler School students,” Berman said. “She carried the Tufts banner with her to Washington and made a name for herself—and for us.”

Closer to home, Rosenberg and her husband—who have been teaching at Tufts for almost 85 years combined—raised their daughter, Jessie, a 33-year-old attorney, and 31-year-old son, Ethan, who works in health-care marketing. “She has been an outstanding mother,” Mort said. In retirement, the couple plans to travel around Asia and spend plenty of time with family—especially their newborn grandson.

Rosenberg never felt like she was treated differently because of her gender, but colleagues and former students say she’s an inspiration for women in science. “Her students and others who weren’t even in her lab saw in her someone who could do it all,” Lange said.

Of course, it helped that Rosenberg was routinely at her desk (or lab bench) before 6:30 a.m. throughout her decades at Tufts. In recent years, she walked to work from her home in Boston’s Fort Point neighborhood—well into her day as the rest of the city was just waking up.

In her office one afternoon, Rosenberg didn’t hesitate when asked what she’ll cherish most about her time as dean. “Oh, I’ll miss the students,” she said. “For sure.”

COURTNEY HOLLANDS, the editor of this magazine, can be reached at courtney.hollands@tufts.edu.

A FEW WORDS ABOUT NAOMI ROSENBERG FROM FORMER PH.D. STUDENTS...



“Naomi did not talk about women in science; she just got on with being one and with training both men and women scientists. I appreciate this very much.”

—Lalita Ramakrishnan, SK90, professor of immunology and infectious diseases at the University of Cambridge.



“I felt, and continue to feel, equally free going to her for advice about a scientific question or a life question. She attended both my thesis defense and my wedding.”

—Caleb Lee, M08, SK08, associate medical director of global oncology R&D at Daiichi Sankyo, Inc.



“Naomi was a perfect mentor for me. She used the tough-love approach; in other words, she always expected the best, [giving] rather mild praise when it was achieved.”

—Alan N. Engelman, E81, EG85, SK90, professor of medicine at Harvard Medical School.




“Naomi is an incredibly thoughtful scientist. She taught me how to think, and I remember the joy of having an idea (and getting it out of my mouth) before she did.”

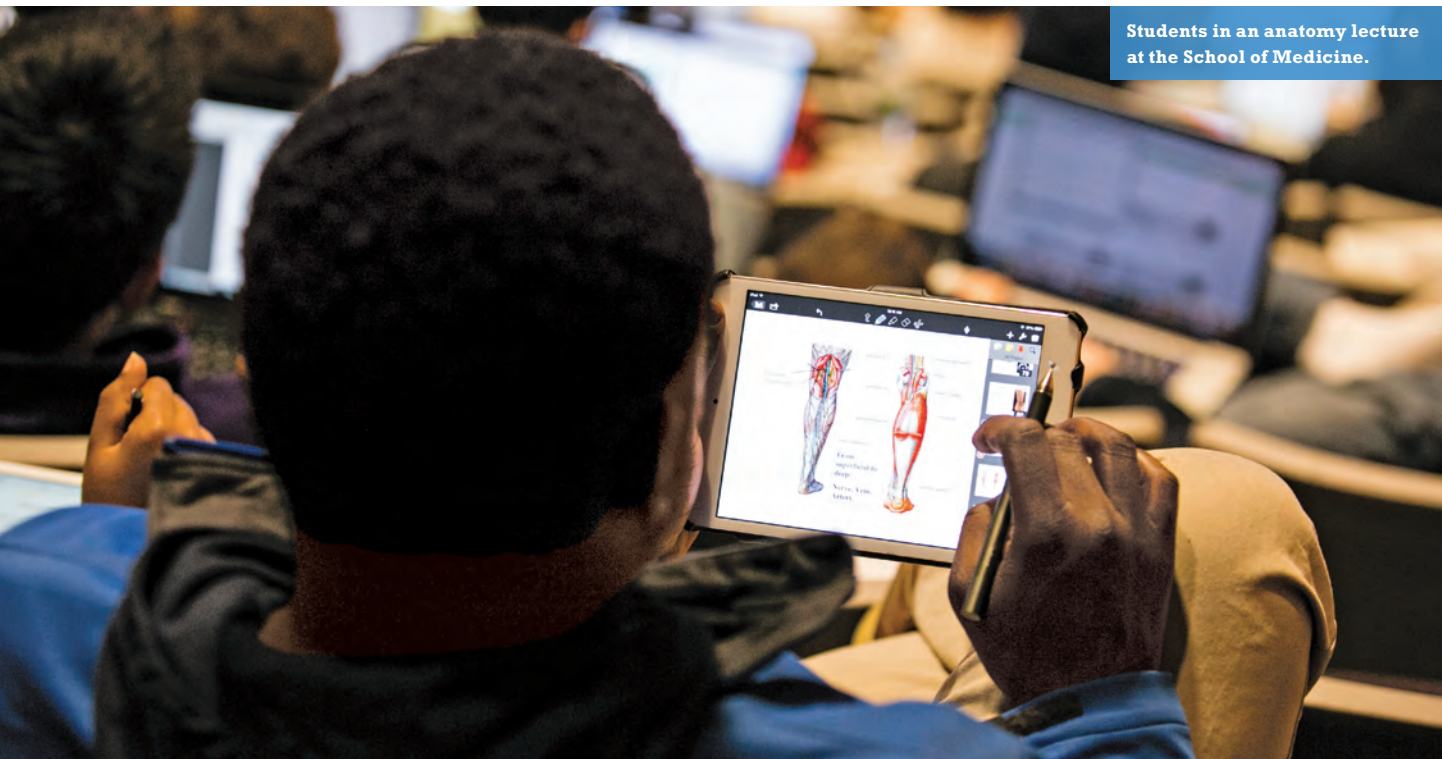
—Leslie Schiff, SK86, professor in the Department of Microbiology and Immunology and associate dean at the University of Minnesota.

From All Corners

UNIVERSITY, SCHOOL & ALUMNI NEWS



"You are poised to have wonderful careers doing good—go do it," School of Medicine Dean Harris Berman told graduates—including newly minted M.D. Anna Dukhovich, A13, M17, who's heading to Stamford Hospital in Connecticut for her residency—at May's commencement ceremony.



Students in an anatomy lecture at the School of Medicine.

The Classroom of the Future

Help equip tomorrow's doctors with the learning tools and technology they need today.

BY MONICA JIMENEZ

ONCE UPON A time, learning to be a doctor involved sitting in a classroom and listening to lectures. But today, medical students learn by doing. This means hands-on practice with ultrasound machines. It means walking through scenarios from drawing blood to complex medical emergencies. It means, in other words, more and better technology than ever before—and future doctors that are better prepared because of it. “Technology is a driving force for humanity. It’s integrated into every facet of society,” said Tufts University School of Medicine (TUSM) medical simulation specialist Chris McNeal. “Medicine and education are no exceptions.”

After receiving a \$15 million gift from the Jaharis Family Foundation in fall 2016 and embarking on a renovation and expansion of the gross anatomy lab and anatomical education suite, the school has established a fund to support faculty and equip its new spaces with the latest in medical technology. In addition to its gift, the Jaharis Family Foundation has challenged the medical school community to raise an additional \$10 million

to support this technology fund and other priorities, such as financial aid and faculty support.

Technology has long since been a cornerstone of the medical school. With the support and supervision of faculty in the Clinical Skills and Simulation Center, students are placing breathing tubes and chest tubes, inserting blood lines and learning to diagnose and treat illness and injury in computerized mannequins that talk and mimic real-life patient symptoms, such as dilated pupils, a low heart rate, coughing and sweating. “Simulation centers, or experiential centers, have become an integral training resource for a majority of paramedical,

nursing, medical and hospital programs,” McNeal said.

Now, after more than 10 years, TUSM’s mannequins are about to evolve. With support from the technology fund, the school is seeking to upgrade to newer models that include automatic drug recognition and Wi-Fi so they can move off-site, as well as additional faculty time to supervise students working with the mannequins.

The school is also looking to introduce simulation training with a technology that was once the sole purview of specialists, but is expected to one day become as ubiquitous as the stethoscope: ultrasound. TUSM plans to invest in ultrasound probes connected to laptops, which simulate real scans by producing results from a library of existing images. Students will also use portable ultrasound machines on cadavers in the soon-to-be-completed gross anatomy lab, which will also feature iPads and GoPro digital video cameras. Instead of poring over print textbooks, students will view photos and video of the anatomy they are learning with one swipe across the screen, and share work instantly with fellow students and instructors.

For their part, faculty will wear GoPros mounted on head harnesses and linked to shared screens, so all 200 students can see what a faculty member is pointing to at the same time.

“To produce clinicians skilled at problem solving and experts in clinical reasoning, Tufts medical school is moving away from traditional lectures to activities that emphasize engaged, interactive and team-based learning,” said Scott Epstein, M84, A15P, dean for educational affairs.

Technological investments to support hands-on, collaborative learning will include new dissection and two prosecution tables in the gross anatomy lab and a Technology Enabled Active Learning (TEAL) classroom based on a design by MIT, where students will work at

stations set up for interacting with each other and their instructor.

Those interested in supporting this technological transformation can give to the fund by naming spaces in the new anatomical education suite and in the simulation center, including the TEAL classroom, simulation rooms, patient exam rooms, locker rooms and dissection

tables. “Ongoing support for the technology fund will not only allow us to enhance existing programs,” McNeal said, “but develop new ones geared toward other specialties and areas of interest to the student population.”

MONICA JIMENEZ can be reached at monica.jimenez@tufts.edu.



For more information about giving to the Clinical Skills and Medical Education Technology Fund contact Rebecca Scott at rebecca.scott@tufts.edu or 617-636-2777.

BY THE NUMBERS

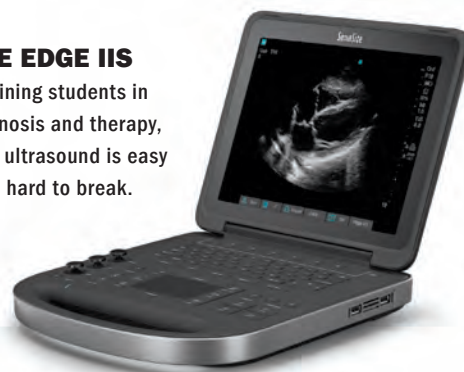
POWERING UP

These are just some of the tech tools the Clinical Skills and Medical Education Technology Fund will help stock in TUSM’s newly renovated facilities:

10

SONOSITE EDGE IIS

Handy for training students in bedside diagnosis and therapy, this compact ultrasound is easy to carry—and hard to break.



4

ADVANCED PATIENT SIMULATORS

The two SimMan 3G adult males, plus one full-term newborn and one adult female (also a childbirth simulator) give real-time feedback, encourage collaborative learning and improve decision-making.

200

SONOSIM GMES With probes that connect to laptop USB ports, these training systems transform computers into ultrasound simulators for on-demand scanning.

1

GOPRO CAMERA

Using a head-mounted camera long favored by skydivers and extreme skiers, instructors can project images from the prosecution table to the rest of the classroom, hands-free.

Love Match

Match Day 2017 found some Tufts medical students happily planning solo trips across the country, and some couples breathing a sigh of relief because they'll be able to stay together.

BY MONICA JIMENEZ

FOR FOURTH-YEAR MEDICAL students Bryan Walker and Ali McFarland, the approach of Match Day on March 17 was nerveracking. It is the same for every medical student in the country—the day they find out where they will spend the next several years in residency training. But Walker and McFarland, who started dating in their second year at Tufts School of Medicine, were hoping not just for placements at one of their top choices, but a match together.

Amid cries of “Oh my God!” and “Where are you going?” that filled a room in the Sackler Building as students waved sheets of paper, laughed and hugged, Walker and McFarland were all smiles: Both will do residencies in family medicine at Maine Medical Center in Portland, one of their top choices. “The best part of medical school was meeting Ali—and today,” Walker said.

They had prepared for the possibility of living and commuting between residencies in different cities. “We interviewed at all the same places, but there was a bit of worry, because at the bottom of the list, we had a few places that were different,” said McFarland. “We’re very

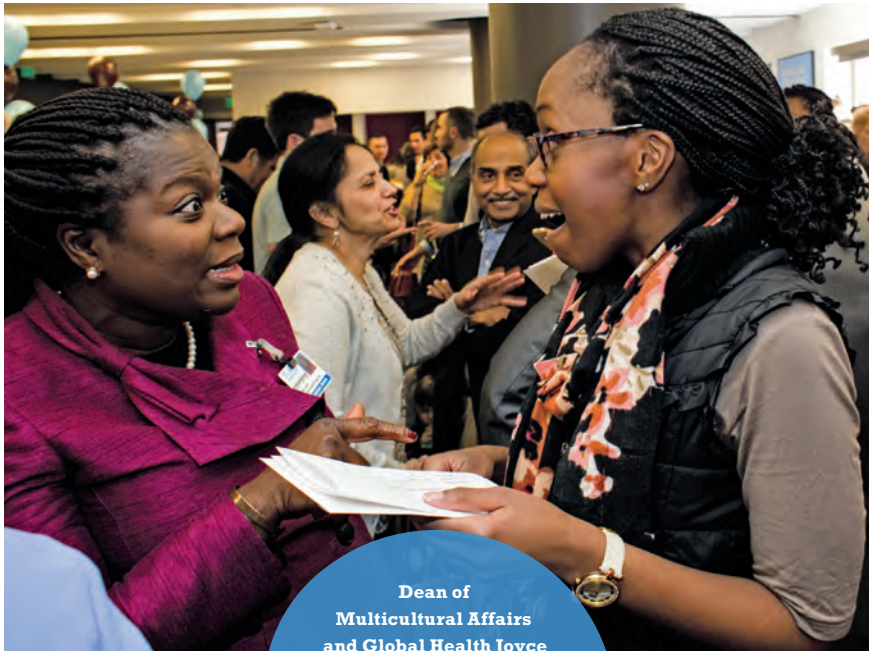
happy to be able to be together in an awesome program; we can’t wait.”

Family is important to McFarland, who comes from a big one herself. “That’s what drives me in medicine,” she said, “to connect with people and be able to care for them and their families.” Walker feels the same. “I’d like to develop a long-term relationship with patients, to be their doctor for anything that comes up and to take that journey with them to better health.”

An-Hoa Giang and her boyfriend, Daniel Chen, a second-year student at Tufts School of Dental Medicine, were also celebrating the news that they would be together. Giang was matched with the UMass Family Health Center



Bryan Walker, A13, M17, and Ali McFarland, M17, were all smiles as they opened the envelopes containing their residency assignments.



Dean of Multicultural Affairs and Global Health Joyce Sackey congratulated Mahawa Sam, M17, on her match at the Brown University program at Memorial Hospital in Pawtucket, R.I.

of Worcester for a residency in family medicine, close enough to the dental school in Boston. “I applied broadly—Alaska, Arizona, Ohio,” Giang said. “So being able to stay in Massachusetts is a big deal.”

It’s also a big deal because Worcester is home to large immigrant populations, including Hispanic and Vietnamese communities, said Giang, whose parents moved to the United States from Vietnam three years before she was born. “I’m very happy and excited, coming from an immigrant family, to be going to the UMass Family Health Center,” Giang said. “It’s a good fit.”

As an undergraduate, Giang initially thought she would go into research. She majored in microbiology and immunology at the University of Rochester and then worked as a research technician at Dana-Farber Cancer Institute in Boston. But then she started spending her evenings teaching English at Rosie’s Place, a women’s shelter, and reading to children at Horizons for Homeless Children in Boston.

“I realized the pure sciences were not for me,” she said. “I wanted something where I would be interacting with people and helping people.”

She decided to apply to medical school, hoping to serve immigrants and refugees. As a Tufts Student Service Scholar, she has received training and support to focus particularly on communities that lack access to health care.

Giang’s close friend, Michelle Bennett, also a Tufts Student Service Scholar, was also thrilled to be headed to an area where she can help people in need: SUNY Downstate Medical Center in Brooklyn.

“I wanted to be in an underserved area. This is right up my alley,” said Bennett, who grew up in the Bronx. Her mother, who raised her alone, still lives there. “I’m excited to be going home,” she said.

Bethany Harvey, who is going to the University of Buffalo for general surgery, felt the same. Harvey was at Match Day with her husband, as well as her



An-Hoa Giang, M17, and her boyfriend, Daniel Chen, D19, reacted to Giang’s residency assignment in Worcester on Match Day.

3½-year-old and 4-month-old children, both of whom wore T-shirts that read, “No worries—my mom’s a surgeon.”

Harvey is happy to be going to the University of Buffalo, not only for its variety of hospital rotations, but because she grew up in the area and her parents live nearby. “It’s been really great, and I’ve really enjoyed it,” Harvey said of her time in Boston. “But it’s time to move on.”



“I’ve realized that giving consistently, over time, will have a powerful impact. It’s empowering.”

THREE YEARS AND COUNTING...

In for the Long Haul

NAME: Joseph Bravoco, M14

RIGHT NOW: Radiology resident at Beth Israel Deaconess Medical Center, focusing on interventional radiology because he wants to “be on the side of cutting-edge medicine.”

STAYING LOCAL: Bravoco grew up in Boston and never left. He attended Boston University for undergrad and when he was visiting area medical schools, Tufts stood out as “the kind of place that values its students.”

BIG BROTHER: Bravoco initially considered going into orthopedic surgery, because as a medical student, he participated in an injury-reduction training program for athletes at Cathedral High School in the South End for two-and-a-half years. There, he mentored teens in health careers and provided preseason health screenings and basic medical care at games. He continues to keep in touch with many of those students.

LEADER OF THE PACK: He served for four years as a student representative to the Tufts


Medical Alumni Association executive council. He enjoyed connecting the student and alumni communities, and raising awareness among alumni about the impact of their gifts to the medical school. He continues to serve on the executive committee, now overseeing alumni association allocations for areas such as scholarships and global health programming.

GETTING YOUR MONEY’S WORTH: “Being a young alumnus, many people feel like they just spent a lot of money going to medical school and now they’re being asked to give back. When I go over annual expenditures at our meetings, I see where the money goes, and know there’s still a great need. I’ve realized that giving consistently, over time, will have a powerful impact. It’s empowering.”

EYES AND EARS: For giving every year since graduating, he has earned a spot in the Dean’s Inner Circle giving club.

“I get a sense of pride knowing I’m in a social network that is fully committed to the school’s future. We’ve got the dean’s trust, and that holds a special place.”

—DIVYA AMLADI

 **EVERY GIFT COUNTS.** Did you know that nearly 75 percent of donors to Tufts give \$250 or less each year? Learn more at go.tufts.edu/annualfund.

THREE QUESTIONS WITH

DR. HAROLD N. BORNSTEIN

A specialist in internal medicine and gastroenterology, Dr. Harold N. Bornstein, A68, M75, is the medical director of HNB Endoscopy and also a private practice in Manhattan: Jacob Bornstein, MD Harold N. Bornstein, MD, PC, which was started by his father at Lenox Hills Hospital more than 30 years ago.

TUFTS MEDICINE: NINETEEN MEMBERS OF YOUR EXTENDED FAMILY ATTENDED TUFTS OVER THE YEARS. WHAT MEANING DOES THIS HISTORY HOLD FOR YOU?

DR. HAROLD N. BORNSTEIN: I am proud of our Tufts legacy. The family immigrated to Boston from Eastern Europe and became enormously successful in the men's clothing business. They were the owners and founders of the famous Malcolm Kenneth overcoat company in Boston. They and

we are grateful that Tufts was there for us. At the medical school, Tufts gave its students a lot. Most important, though, it taught us not to be arrogant.

TM: YOU'VE ENJOYED CLOSE RELATIONSHIPS WITH MANY OF YOUR PATIENTS FOR DECADES NOW. WHAT IS THE VALUE OF THESE BONDS, AND HOW DO YOU SUSTAIN THEM?

HB: After my family, my patients are the most valuable people in my world. I love and respect them. The warmth between us stokes the relationship. We get a kick out of each other. I experience their lives with them, sharing happiness and sometimes sadness. I have never and will never take advantage of anyone's wealth or lack thereof.

We have managed to run a concierge medical practice for more than 50 years

years without any contracts with patients or any extra fees. However, my greatest successes have been avoiding managed-care medicine and refusing to have the conservative beard and haircut that my parents thought was necessary for success.

TM: MANY OF YOUR PATIENTS ARE WELL-KNOWN PUBLIC FIGURES. DOES BEING THE DOCTOR OF A CELEBRITY REQUIRE ANY SPECIAL SKILLS OR SENSITIVITIES?

HB: Not really. The most important skill is to be conscious of my obligation to my patients. Privacy and confidentiality are guaranteed. I am always myself with patients. I treat government officials, police detectives, counts, Wall Street financiers, real estate moguls, neighbors and friends. I am not judgmental about anyone; what they "do" doesn't matter. As a native New Yorker, my familiarity with many professions, cultures and ethnic origins allows me to relate well with anyone.



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Village Life — Italian Lakes
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ALUMNI ASSOCIATION PRESIDENT

GIFTS THAT KEEP ON GIVING



WHAT A PRIVILEGE it is to be president of your medical alumni association—so far, it's been one inspiration after another! Last September I spoke to the first-year class at its White Coat Ceremony. The students were so excited to begin their medical journey. Later in the fall I met with M.D./M.B.A. students to discuss how they might use their skills going forward. And at Match Day in March, I saw joy as our students learned where they will be embarking on their residencies. Tufts is unique in placing so many in family medicine, pediatrics and internal medicine—and its students are truly devoted to social justice. Through the Maine Track, student-run programs and community service learning projects, they exercise both skill and empathy for those in need. Your alumni dues support these initiatives, and the return on your investment is immeasurable.

Reacquainting myself with TUSM has affirmed its special attributes: excellence, opportunity and commitment. Not only

are faculty at the cutting edge of research, but combined-degree options are equipping our students to become leaders. The reach and networks of these programs offer opportunities for graduates to advance their careers and quality health care. TUSM's commitment to its students, alumni and the community is mirrored in the commitment of our students and alumni to providing the best, most patient-centered care possible.

In March, alumni and donors visited campus. We heard from faculty and student presenters and toured the space that will be—thanks to the Jaharis Family Foundation—a state-of-the-art gross anatomy lab. My appreciation for the first-class education TUSM provides only increased. As alumni, we must sustain our association and the annual fund, for the benefit of current and future students. Help out at giving.tufts.edu/med.

CAROLE E. ALLEN, M71

President, Tufts Medical Alumni Association
tmaapresident@tufts.edu

Class Notes

1961

MERRITT H. COHEN, M61, of East Hanover, N.J., released his new book, *In the Eye of the Hurricane*.

1965

EDWARD DUNN, M65, of West Dennis, Mass., along with the last active founding member of the Cervical Spine Research Society (CSRS), presented a talk about the early years of the CSRS at the society's annual meeting.

1976

ROWLAND W. CHANG, M76, of Chicago,

a rheumatologist and professor at Northwestern University Feinberg School of Medicine, is the new chair of the board of the Arthritis Foundation. He has been involved with the foundation for 30 years, focusing on advocacy, public policy, research and public health activities through his service on standing committees and on the board of directors.

1977

DANIEL EINHORN, M77, of La Jolla, Calif., was honored by the Endocrine Society as the 2017 recipient of the Outstanding Clinical Practitioner Award.

1979

ALEXANDER A. HANNENBERG, M79, of Wellesley, Mass., a clinical professor of anesthesiology at Tufts School of Medicine, has been recognized by the American Society of Anesthesiologists (ASA) with its highest honor, the Distinguished Service Award, for his passion for global health and humanitarian outreach. Following the 2010 earthquake in Haiti, he contributed to a coordinated response to deliver medical aid. In 2012, he was instrumental in creating Lifebox USA, an organization that improves anesthesia safety in low-income countries by providing pulse oximeters and encouraging the use of simple safety

checklists to help reduce surgical complications and mortality.

1980

GEORGIA A. TUTTLE, M80, of West Lebanon, N.H., was appointed to the board of directors at the Commission on Office Laboratory Accreditation. A practicing dermatologist in Lebanon, N.H., for 30 years, she was the first woman elected president of the New Hampshire Medical Society. She's served as chair of the New England delegation to the American Medical Association (AMA), state chair to the AMA Organized Medical Staff Section and a member of the AMA

Dermatology Section Council. She also served as Lebanon's mayor for seven consecutive terms.

1981

WALTER J. LEE, M81, of Newton Center, Mass., is a new member of the board of directors of Good Shepherd Community Care, a nonprofit focused on hospice and palliative care in Greater Boston. He's been providing care through the organization since his internship and residency at St. Elizabeth's Hospital. He served in the U.S. Army from 1975 to 1987 and serves on the faculties of TUSM and Northeastern University. He's a member of the American College of Physicians and the American Medical Directors Association and the past president of the Chinese-American Medical Society.

1984

CANDACE LAPIDUS SLOANE, M84, of Needham, Mass., was honored by the Massachusetts Medical Society with the 2017 Woman Physician Leadership Award for her outstanding leadership and contributions to patients and the medical profession.

1986

STEVEN LIMENTANI, M86, of Waxhaw, N.C., was appointed system service line cancer leader at Novant Health. He will lead hematology, medical oncology, radiation oncology, surgical oncology, gynecologic oncology, oncology research and more across the Novant Health system.

JAMES STEIN, M86, of Altadena, Calif., was named Children's Hospital Los Angeles' inaugural Chief Medical Officer

LINDA F. SMOTHERS, M86, of Lenox, Mass., was honored by the Berkshire District Medical Society as the 2017 Community Clinician of the Year, an award for her outstanding professionalism and contributions as a physician.

1988

NANCY RAPPAPORT, M88, of Cambridge, Mass., a psychiatrist and associate professor at Harvard Medical School, wrote a one-woman show, "Regeneration," based on her experience with breast cancer. It debuted in October 2016 at Mount Auburn Cemetery in Cambridge, Mass.

1996

SUNIL AGARWAL, M96, of Greenbrae,

Calif., was appointed President of Research and Development by Juno Therapeutics.

DEBORAH HARRIGAN, M96, of Dover, N.H., is the 185th president of the New Hampshire Medical Society. She is a family medicine physician and medical director of the ambulatory Physician Practices at Frisbie Memorial Hospital in Rochester, N.H.

1998

JACQUI BRYAN, MG98 (Health Comm.), of Rye, N.H., a registered nurse and whole health educator, led a "Chew on This" class at Wentworth by the Sea in New Castle, N.H.

2015

MANASA MOULI, M15, of Kingwood,

Texas, had a piece published on *In-Training: Stories from Tomorrow's Physicians*, an online magazine.

2017

PAMELA SHERWOOD, M17, of Boston, and Alexander Karlan were married on April 29, 2017, in Vero Beach, Fla. In attendance were alumni from the M17 class (unless otherwise noted), top row, from left: Turner Kufe; Natalie Sullivan; Victoria Padow, M18; David Dickson, M18; Laura Glassman, A11, M18; Sonika Patel, M16; Abigail Benudis; Alexander Karlan; Craig Maguire; Marla Jalbut; Amon-ra Gama, M18; Elena Hill; Lauren Meepos; and Jennifer Panosian. Bottom row, from left: Lauren Byrne; Taylor Johnson; Pamela Sherwood; Kailyn Kuzmuk; and Courtney Scanlon.



In Memoriam

BARTHOLOMEW R. ALFANO JR., M71
February 16, 2017
Dover, Massachusetts

DEWEY G. ARCHAMBAULT JR., M52
January 17, 2017
Dracut, Massachusetts

PAUL E. BARBER, M46, M79P
March 16, 2017
West Warwick, Rhode Island

THOMAS J. BERRY JR., M58
November 13, 2016
Scituate, Massachusetts

ROBERT D. BLUTE, M46, M74P
October 25, 2016
Shrewsbury, Massachusetts

RICHARD J. BROWN, M57
March 28, 2017
New York, New York

BRIAN C. CARROLL, M63
February 10, 2017
Brewster, Massachusetts

EDWARD S. CASEY, M54
November 9, 2016
Bridgewater, Massachusetts

REMEMBERING TIMOTHY EDGAR




TIMOTHY EDGAR, PH.D., a Tufts University School of Medicine professor of public health and community medicine, died on January 2, 2017, after a car accident in New Delhi, India. He was set to begin a month of work for Unite for Sight—a nonprofit that supports optical care in remote locales—at Kalinga Eye Hospital in Dhenkanal, Odisha, India. “The world of health communication lost a giant as the new year opened, and many of us also lost a cherished colleague and consummate friend,” said Aviva Must, dean of Public Health and Professional Degree Programs.

Edgar was a beloved mentor and teacher who joined the School of Medicine faculty in 2016 after 14 years with a secondary faculty appointment. Before coming to Tufts fulltime, he was on the Emerson College faculty and led its M.A. in health-communication degree program, which was offered in collaboration with Tufts’ M.S. in health communication. “He has inspired me to work just as hard in my future career, to have a finer attention to detail and to take pride in anything I set out to accomplish, no matter how big or small,” said Ryan Kelly, one of Edgar’s Tufts health communication students.

Edgar also made a mark outside academia. The methods he developed at the Centers for Disease Control and Prevention in the early 2000s to evaluate the impact and reach of its health communication campaigns are still in use today. His efforts to elevate the role of communication in agencies, such as the CDC and community-based organizations, earned him the 2016 K. Everett M. Rogers Award from the American Public Health Association.

A celebration of his life was held in Boston on March 4. The Public Health and Professional Degree Programs Alumni Association has established the Timothy Edgar Scholarship Fund to support the tuition of promising health communication or public health students.

 If you'd like to donate to the scholarship fund, go to giving.tufts.edu/med. Or you may mail a check, payable to Tufts University, with Tim Edgar Scholarship in the memo line, to Tufts University School of Medicine, Office of Development, 136 Harrison Ave., Boston, MA 02111.

DAVID M. CLEASBY, M52
January 2, 2017
Laconia, New Hampshire

WILLIAM B. COOK, M57
December 28, 2016
Lexington, Kentucky

RICHARD M. DEANER, M58
April 8, 2017
Dana Point, California

JOSEPH A. DEGRAZIA JR., M60
December 24, 2016
Alpharetta, Georgia

KEVIN B. DOLE, M74
April 23, 2017
Flower Mound, Texas

ELIAS C. DOW, M53, J85P, M85P, M87P
April 17, 2017
Brookline, Massachusetts

FRANCIS X. DUFAULT JR., M52
February 8, 2017
Worcester, Massachusetts

SAMUEL J. D'URSO JR., M70
January 10, 2017
Marco Island, Florida

JOHN E. FARLEY JR., M48
October 18, 2016
Riverside, Rhode Island

JULIUS FERNANDEZ, M99
February 22, 2017
Memphis, Tennessee

MELWYN E. FINE, M56
February 2, 2017
Stoughton, Massachusetts

JERALD N. FRIEDMAN, A62, M66
May 17, 2017
Easton, Pennsylvania

GREGORY J. GALLIVAN, A58, M62, J89P, M93P, MG93P, M95P, MG95P
October 1, 2016
Longmeadow, Massachusetts

JAMES L. GALVIN, M56
May 11, 2017
Canton, Massachusetts

RUSSELL GOLDBAUM, M48, J83P
April 30, 2017
San Francisco, California

JOSEPH L. KENNEDY III, M90
March 30, 2017
Johnson City, Tennessee

JOHN A. LYNCH, M48, E89P
October 27, 2016
North Falmouth, Massachusetts

SALVATORE N. MANGANO, M47, M85P
April 11, 2017
Scituate, Massachusetts

JOHN E. MANNING, M46, A74P
February 8, 2017
Boston, Massachusetts

NORMAN G. MARTEL, A45, A46, M50
December 2, 2016
Santa Rosa Valley, California

JOHN C. MCMANAMA, M41
February 10, 2017
Waltham, Massachusetts

RICHARD J. MILLER, M54
February 15, 2017
Fort Myers, Florida

ROBERT L. MULLIN, M55
January 20, 2017
Philadelphia, Pennsylvania

BERNARD PERCARPIO, M71
April 26, 2017
New Castle, New Hampshire

WILLIAM J. ROMANOS JR., M65
December 30, 2016
Palm Beach Gardens, Florida

DAVID W. SAUER, M62
December 14, 2016
Tryon, North Carolina

GEORGE SCHWARZ, M56
December 14, 2016
New York, New York

ROBERT I. SIMON, M60
November 3, 2016
Potomac, Maryland

JOSEPH L. SIROIS, M57, M83P
January 20, 2017
Danvers, Massachusetts

**GERALD L. SMOLENSKY,
A62, M66, A94P**
November 19, 2016
Dunedin, Florida

RICHARD R. STACEY, M62
March 12, 2017
Spokane, Washington

**ALBERT M. STARR,
M47, J75P**
April 13, 2017
Melrose, Massachusetts

TIMOTHY P. STONE, M42
October 24, 2016
Southborough, Massachusetts

RICHARD B. TICHNOR, M56
May 3, 2017
East Sandwich, Massachusetts

**MORRIS A. WEINBERGER,
A42, M46**
March 25, 2017
Delray Beach, Florida

JAMES S. WIENER, M56
November 23, 2016
Delray Beach, Florida

REMEMBERING ELIAS DOW



When ELIAS DOW, M53, J85P, M85P, M87P, presented cases for consultation, his son Edward, M85, noted that it always went the same way. Rather than the typical medical format—stating the patient’s age, medical status and so on—Elias would start with patient’s personal history. He saw the patient as a complete person and fellow human in need, Edward said, and exemplified the belief of famous 19th-century physician Rudolph Virchow that medicine is a social science. “Although he was a superb thyroid and endocrine subspecialist, he took care of the *entire* patient,” Edward said of his father, who died in April. “He was a true primary care physician.”

Born just before the Great Depression to parents who immigrated to the United States from Lebanon during World War I, Elias graduated from the prestigious Boston Latin School and entered Harvard when he was just 16, where he earned a degree in physics. Although World War II was coming to an end, he interrupted his studies to serve in the U.S. Army in Korea.

After studying medicine at Tufts, Elias drew on his physics training to pioneer research into the use of radioactive isotopes in medicine. He completed his specialty training at the renowned Mass. General Hospital Thyroid Group, was on the staff of Faulkner Hospitals and Beth Israel Deaconess and served as chief of endocrinology at his main hospital, the New England Baptist, from 1980 to 1993. He built a large private practice in Brookline starting in the early 1960s and retired in 2007. Committed always to Tufts University School of Medicine, he served as president of the school’s alumni council in the early ’90s.

Despite his success and the blistering pace of his day, Elias was never too busy to talk. In the halls, he warmly greeted everyone—janitors, receptionists, parking lot attendants. He spent real time with his patients. “Many of his patients would tell me that my father made them feel as if they were the only person in the world,” said Edward, a hematologist/oncologist who practiced at the Baptist with his father and often saw Elias’s patients for consultation and treatment. “He always had the patient’s nurses accompany him on hospital rounds. The patients loved it because they saw that all their caregivers were coordinated and involved in their care. The nurses felt like they truly were included in the decision process. It was an old-school way of doing things, but it worked well and now many hospitals are going back to that.”

Elias is survived by his wife of 60 years, Jody, as well as two sons, Edward and Charles, M87, an interventional cardiologist in Boston; his daughter, Andrea Dow Keough, J85; and six grandchildren. Gifts in his memory can be made to the Elias C. Dow, M53 Scholarship Fund, which he established in the 1970s. “He wanted to make sure that kid who was deserving and qualified but didn’t have the means to go to med school, had that opportunity,” Edward said. “He said this is how you build a strong medical school.”

The fund is far from the Elias’ only legacy: His approach to patient care constantly inspires Edward’s practice. “At the end of day, people all want the same thing—comfort, safety and security, and to be treated with respect,” he said. “If they’re in your hands as a physician, you have to have compassion.” —MONICA JIMENEZ



If you’d like to donate to the Elias C. Dow, M53 Scholarship Fund go to giving.tufts.edu/elldow.

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Richard P. Keeling, M.D.

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Richard P. Keeling
M73

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School of
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My Pain, My Passion

How a Tufts alum's illness became her life's work.

BY GINEVRA LIPTAN, M04

IHAD NEVER HEARD of fibromyalgia before I was diagnosed with it. In the spring of my first year at Tufts School of Medicine, I felt a searing pain in my neck while lifting weights. It was a minor injury, I thought, and expected it to heal with rest. But the burning ache—like the soreness that follows a flu shot—slowly spread from my neck to my thighs. Then the profound fatigue set in, along with the worry that something must be really wrong.

My doctor ordered labs and imaging—all came back normal—and then referred me to several specialists. Months went by without a verdict. Ultimately, a chiropractor told me I had fibromyalgia, a chronic illness characterized by widespread muscle pain and exhaustion. At first, I was relieved. But I quickly learned that it was a poorly understood and highly controversial condition, largely because

sufferers appear healthy and have normal test results. I wondered if it was all in my head. The day my favorite teaching physician told our class that he didn't believe in fibromyalgia, I decided to keep my diagnosis secret.

At the end of my second year of medical school, I took a yearlong leave. Desperate, I turned to alternative medicine. I consumed herbs and sought out homeopathic remedies, saw acupuncturists and naturopaths. These experiments were expensive, frustrating and ineffective. Swedish massage finally offered some short-term relief, and my therapist suggested I try myofascial release (MFR), a manual therapy that involves slow and sustained pressure to stretch and ease tension in the fascia that surround muscles.

It was a revelation. The neck pain that had been my constant companion for almost two years all but disappeared after three MFR sessions. A couple

more and I could exercise again, which lessened my fatigue. In a few months, I felt well enough to continue school, determined to complete my training and specialize in fibromyalgia.

After residency, I led a pilot study at Oregon Health and Science University that demonstrated MFR was more beneficial for fibromyalgia subjects than Swedish massage. While there is no cure for the condition, self-care can help manage symptoms, and MFR is a core component in the treatment plans I now offer patients at my private practice, The Frida Center for Fibromyalgia in Portland, Ore.

A few years after my diagnosis, a pioneering brain-imaging study indicated that fibromyalgia pain was real. But attitudes change slowly, and a stigma still exists around the illness. The most important thing I can offer patients is validation of their experience. When they describe bizarre flulike aches migrating around their body or weariness that persists no matter how much they sleep, I can say, *I know exactly what you mean*. Feeling truly heard and understood by a doctor can itself be powerful medicine.

However, enduring the same pain, fear and even shame as my patients also collapses the distance between us. I have to brace myself against the waves of their suffering—or risk drowning in it. Some days, when this visceral work hits too close to home, I contemplate moving to another medical field altogether.

But mostly I feel grateful for my fibromyalgia, as it has provided the unique opportunity to study this disorder from the inside and pushed me to be a better physician.

GINEVRA LIPTAN, M.D., is board-certified in internal medicine. Formerly an associate professor at Oregon Health and Science University, she founded and is the medical director of The Frida Center for Fibromyalgia (fridacenter.com) and the author of *The FibroManual: A Complete Fibromyalgia Treatment Guide for You and Your Doctor*.



“No institution has done more for me than Tufts University School of Medicine.”

“A mecca of medicine,” is how Dr. Robert Aaronson, M67, describes Boston as he experienced it during his years at Tufts University School of Medicine and as a young physician at Boston City Hospital (now Boston Medical Center). In 2015, Aaronson and his wife, Susan, established a charitable remainder trust to provide future support for Tufts and create an additional income stream for themselves during retirement. His motivations were simple: “There’s my absolute love for Tufts. I can give something back for all it’s given to me and my family. And I know exactly what I’m accomplishing: training great doctors.”

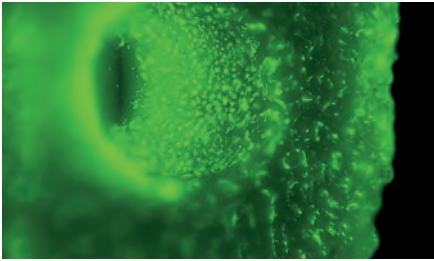
Among his own teachers was Dr. Jane F. Desforges, M45, a renowned hematologist whom Aaronson calls “the best professor I’ve ever run across [and] an incredible individual.” After training at Yale and a stint in the army, Aaronson returned to his home state of Connecticut where he practiced gastroenterology and taught at the Yale School of Medicine. Patient care and teaching are an essential combination, he believes, for the practice of “living medicine.”

Aaronson’s greatest avocations in retirement are his studies of Eastern European history, and the regional cuisines of Italy. He and his wife were thrilled to attend the Class of 1967’s 50th Reunion earlier this year. Their gift has deepened their connection to TUSM, and they hope to do more: “I’m not through giving,” he says.

For information about including a gift for Tufts in your estate plans,
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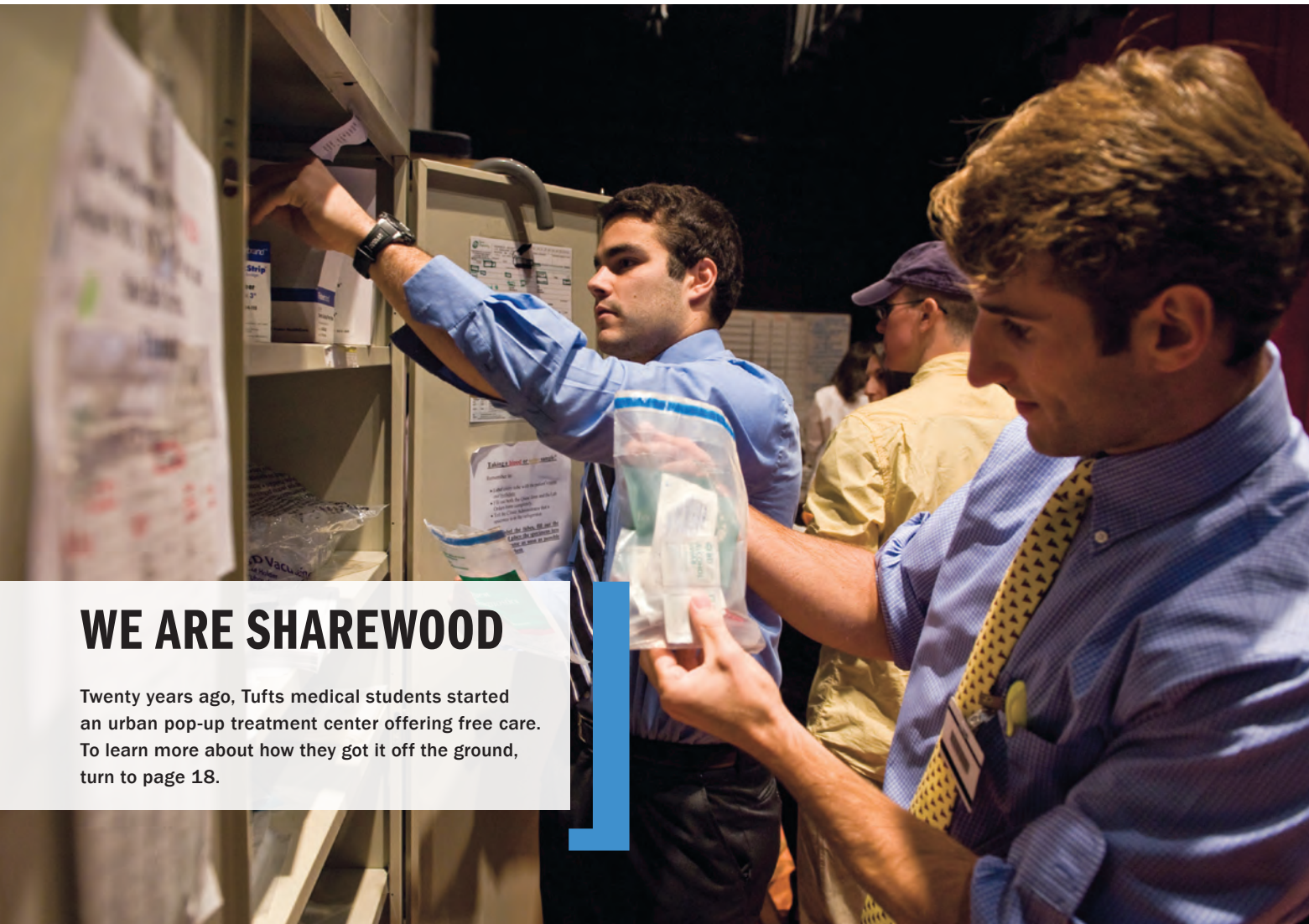
5 Gut Check



28 High-Tech Tools



32 Giving Back



WE ARE SHAREWOOD

Twenty years ago, Tufts medical students started an urban pop-up treatment center offering free care. To learn more about how they got it off the ground, turn to page 18.