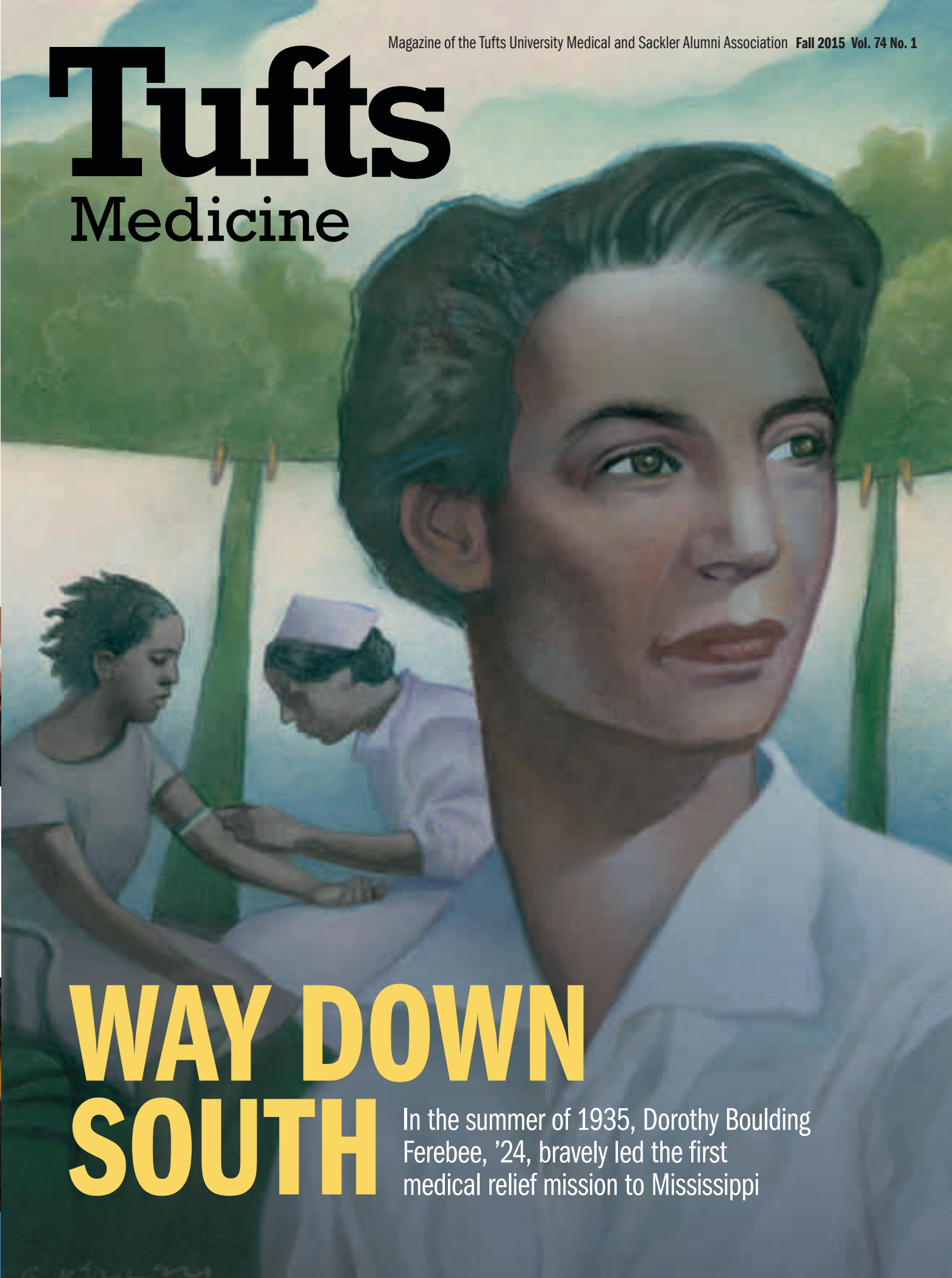


Tufts

Medicine



WAY DOWN SOUTH

In the summer of 1935, Dorothy Boulding Ferebee, '24, bravely led the first medical relief mission to Mississippi



LADY OF THE DANCE

We've all encountered the Lord of the Dance at some point. The 45-member assembly, known for its symmetrical, tightly ordered musical stage performances, represents a covey of the finest Irish step dancers in the world.

Kaitlin Haines, '16, certainly knows the drill. She discovered step dancing at age 4, then leaned in and rose steadily through the ranks.

Haines began by practicing on hardwood floors upstairs in her family home in Vernon, Connecticut. "That didn't go over too well," she jokes. Later her parents installed a dance floor in the basement. Haines practiced for hours daily. Every week, she would have her lesson on Friday night at the town's American Legion Hall; she would practice all day Saturday. On Sunday she would compete, routinely placing among the top three contestants in New England, and later, the country.

In college, Haines performed with Lord of the Dance across the eastern U.S. as one of just four Americans in the Irish/English mix.

How much fun was it? Haines describes herself as basically shy, but, she says, "There are no words for when you're on stage in front of an audience that's loving the show." —BRUCE MORGAN

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Cover illustration
by Gary Kelley





Chason with members of his soccer team in Gabon during the spring of 2014.

Update from Africa

Alert readers will recall our introducing them to Mattia Chason, '14, and his enterprising effort to create a soccer team from scratch among teenagers in Lambarene, Gabon, during his time working at the local hospital as an Albert Schweitzer Fellow ("Goal Keeper," Winter 2014). That was just the first part of the story. Upon his return to the U.S., Chason began hunting down desperately needed athletic equipment that he could send back to Lambarene. By this summer, with the help of the Gabonese Embassy in Washington, D.C., he had assembled and shipped two large boxes containing dozens of pairs of brand-new shoes and a nice batch of soccer balls.

"The kids will finally have the soccer cleats they've always wanted and needed," writes Chason, now in his second year of residency in pediatrics at Children's National Medical Center in Washington, D.C.

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CHANCES FOR RENEWAL



A CORE MISSION here at our school has to do with preparing students to be excellent physicians in service to the world. To do that, we are continually trying to provide students with new and better opportunities, expanding their horizons in every meaningful way we can. Our guiding belief is that they will benefit from this exposure in ways that make them better doctors.

In this spirit, I'd like to highlight two new options that may interest you, at whatever stage of your career you find yourself.

First is the MAVEN Project (Medical Alumni Volunteer Network), which you may have heard about already through an email we sent out earlier this year. Tufts is proud to be one of the founding medical schools—together with Harvard, Stanford, UCSF and UCLA—to be affiliated with this venture, for which our recent graduate, Lisa Shmerling, M.P.H. '14, M.P.H. '14P, serves as executive director. The driving idea here is to use telemedicine to connect the nation's medical school alumni with opportunities to volunteer their knowledge and expertise to sites around the country where it is most urgently needed. Experienced primary-care doctors and specialists of all kinds can lend value to situations where professional resources are slim.

Why not tap some of the accrued medical wisdom that doctors have acquired and spread that knowledge around? That's MAVEN in a nutshell. Len Rothman, '66, who retired from his ob/gyn practice 17 years ago and lately has been actively promoting the idea among medical colleagues throughout his California, reports that his overture is getting an enthusiastic response.

This should appeal to many doctors I know. The time commitment for volunteers is small, as little as four hours a month, and can be tailored to fit your schedule.

MAVEN is in a formative stage. Three pilot sites for the program, two in Massachusetts and one in California, were launched in late July. "We have the clinics [lined up]. We have volunteers now. We're working out logistics on

the technology side," Shmerling relates. Anyone intrigued by the prospect of signing on should contact erin.morgan@tufts.edu for more information.

A second tantalizing prospect that your medical school has created concerns the need that all of us share regarding adding critical skills and capabilities as we move through life.

Tufts has teamed up with the Heller School for Social Policy and Management at Brandeis University to offer a new degree program called the Executive M.B.A. for Physicians. Designed for practicing physicians who are—or seek to be—in positions of management or leadership, this is an accelerated 16-month program that integrates the physician's medical expertise with emergent knowledge in areas ranging from health policy and economics to operational systems management.

Because we have partnered with Brandeis previously on our M.D./M.B.A. degree program for students and enjoy a positive working relationship, the Heller School has agreed to offer a generous 50-percent tuition scholarship to any of our alums who enroll in the program beginning in January 2016. Talk about a deal! This could be a golden opportunity for you to further develop your education and career. For details, please contact kara.ray@tufts.edu.

Like anybody else, doctors need renewal from time to time. I invite you to take advantage of these opportunities.

Finally, I urge you to have a look at the stories in this issue about Te-Wen Chang ("Laboratory Ace," page 12) and Stuart Levy ("Resistance Fighter," page 14). These two are among the three members of the Tufts family due to receive Dean's Medals in a special ceremony honoring their respective achievements on November 5. By a nice coincidence, Sherwood Gorbach, our third medal recipient, appears in the Chang feature as well.

A handwritten signature in dark ink, appearing to read "Harris A. Berman".

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

Pulse



The Inner Life

Medical residents find value in reflecting on their interactions with patients **BY BRUCE MORGAN**

IN MEDICAL RESIDENCY, young doctors are often overwhelmed by all the fresh challenges that come their way, whether it's applying the right bit of newly acquired knowledge to a case or remembering to ask the most pertinent question when encountering a patient for the first time. The chance for private reflection that may lead to their providing better medical care may be squeezed out in the daily rush.

Researchers at Tufts School of Medicine and Boston College have undertaken a joint strategy aimed at cultivating the habit of reflectiveness. The study directors asked 33 family-medicine residents enrolled in the Tufts program at Cambridge Health Alliance to write

“open-ended reflections” that examined their interactions with patients over the course of a year. The project resulted in 756 personal reflections.

Sometimes the patient wanted the doctor to be a better listener. “This [teen] patient needed more trust and engagement. I wondered how I could have approached her better,” one resident wrote. In another case, a resident recalled a patient whom he informed that “these events could predict dementia. He looked at me blankly and said, ‘Events?’ I realized that I have to avoid BOTH jargon and ambiguous language.”

A second common failing that the new physicians recognized in themselves had to do with not getting to know the patient adequately before pressing ahead. “I wonder at what point I could have picked up the right clue that he was stressed and depressed by his family situation,” a resident wrote of one patient. Another resident recalled a personal stumble this way: “The patient’s fear and sadness about death was like a dagger to me. I grew defensive and tried to be jovial. It was hard to look him in the face... Today I felt helpless, overwhelmed, scared.”

Most residents reported that they came to know themselves better through the practice of introspection and vowed to adjust their former behaviors and beliefs. “I was surprised that there was more than one right answer,” one resident admitted. “I was worried that I was incompetent, but now I realize there are multiple right answers, and the situation and patient preferences make medicine more an art than I’d realized.”

Allen Shaughnessy, professor of public health and community medicine and director of the medical school’s Family Medicine Residency Program, is the senior author of the study, which was published in the July issue of the *Journal of Health Communication*.



Core Truth

In the latest shocking news from the world of nutrition, it seems an apple a day may not keep the doctor away after all. Turns out that people who munch apples daily have just as many doctor visits as those who don't, according to a recent study in *JAMA Internal Medicine*.

The conclusion came after researchers had examined 8,400 U.S. adults who took part in government surveys from 2007–08 and 2009–10.

Where did the familiar wisdom about apples come from in the first place? Alice Lichtenstein, professor of nutrition and of medicine at Tufts, told the Associated Press that the adage is thought to have originated in Wales in the 1800s, when apples were likely one of the few fruits available throughout the year.

DOUBLE JOB

Dan Hale, an assistant professor and chief of pediatrics at Lawrence General Hospital, grew up in a large family. His parents encouraged their kids to hold down two jobs to help with expenses if they could. He took the message to heart and now combines his physician life with often-exhausting duties as an on-call firefighter at home in Kittery, Maine.

“By day, he’s a doctor. Nights, weekends and holidays, he’s a firefighter,” Bella English wrote recently in a *Boston Globe* profile of Hale. “He keeps two pagers on his bedside table. In 2013, he was named Kittery firefighter of the year, and received the Excellence in Teaching award from the Tufts University School of Medicine.”

Hale seems to be one of the few people anywhere who does both jobs. English contacted the Professional Fire Fighters of Massachusetts, which represents some 12,000 members—as far as it knows, none of its

members are doctors. The whole double-it-up approach may have stemmed from Hale’s childhood in tiny Hartford, Wisconsin, where his grandfather, the town mayor, also fought fires. Hale has an uncle and a cousin who are firefighters, too. Clanging bells have a way of setting this family off.

The common link between medicine and firefighting is simply being of service to others. Hale, a devout Catholic, says that he feels he’s helping his neighbors when he responds to a fire. Not only that, but he loves the spirit of teamwork and camaraderie that he finds in the firehouse.

A spark has landed nearby. Hale and his wife, also a pediatrician, have a 4-year-old daughter, Anna, who tells people she wants to be a nurse and a firefighter when she grows up.

Both sides now: Dan Hale is equally at home in two different worlds. Top: he’s on duty at the firehouse in Kittery, Maine. Bottom: his pediatric side emerges.



NEEDLE DROPS

A public library in Worcester, Massachusetts, has become notorious lately as the site of habitual and illegal drug use, leading to 10 reported overdoses in the past year, according to a June report in *Worcester Magazine*. In an effort to reduce the risk of communicable disease such as hepatitis C and HIV, speakers at a recent public hearing in the city argued for putting needle disposal boxes in the library bathrooms.

Brian Bickford, director of homeless services at a local group called Community Healthlink, said that although his organization puts its emphasis on treatment, the boxes would help improve the overall quality of health.

Worcester City Manager Ed Augustus Jr., had moved to implement the drop-off boxes, but wanted to be sure that such a move did not send a message condoning drug use.

Assistant Professor of Public Health and Community Medicine Tom Stopka, an epidemiologist, fully supports the city manager's initiative. He has done data mapping for hepatitis C and HIV across the state and says Worcester is a "hotspot" for both diseases. "Sterile syringe programs, syringe discard programs, have been shown in scores of studies to be effective in reaching folks who are in need of public health services to decrease the risk of transmission of disease," he says.

“Don't forget to notice what's funny and what's beautiful. Eat good chocolate, swim naked when you can and savor all those things that will enrich your sweet life.”

Beth Rosenberg, assistant professor of public health and community medicine, in her remarks to the 2015 graduates of the medical and Sackler schools



GOAT TIME

CATHERINE SQUIRES, PROFESSOR emerita of molecular biology and microbiology and former chair of the department, has been retired since 2007 and now lives happily with a small crew of goats, chickens and peacocks on a farm in California's Sacramento Valley. Her friend, Naomi Rosenberg, dean of the Sackler School, stops by periodically to visit when she's out that way. "Sometimes there are also guinea fowl," she reports, "but I didn't see them last time. Perhaps they have been eaten up by the coyotes."

History Underfoot


A sidewalk plaque marks our school's original location

A FEW YEARS back, Henry Banks, '45, who served as dean of the medical school from 1983 to 1990, called the school to report that a historical marker badly needed cleaning. No one but Banks seemed to know anything about the marker, so Stephen Nasson, now the senior director of facilities services at Tufts, took a walk over to 188 Boylston Street with Jim Mooradian, the facilities manager in Boston. They discovered a copper marker, flush with the brick sidewalk, that reads, "Near this site stood the first School of Medicine of Tufts University."

"I've been at the university for 29 years, and thought I knew everything about the health sciences campus," says Nasson. "We were amazed the marker was there; we had had no idea."

The marker denotes the medical school's original location when it opened for business in 1893—on land now occupied by the Four Seasons Hotel. The school had 80 students, seven faculty members and quite a progressive gender balance for its time: 23 women and 57 men. The medical school was the first graduate program offered by Tufts College.

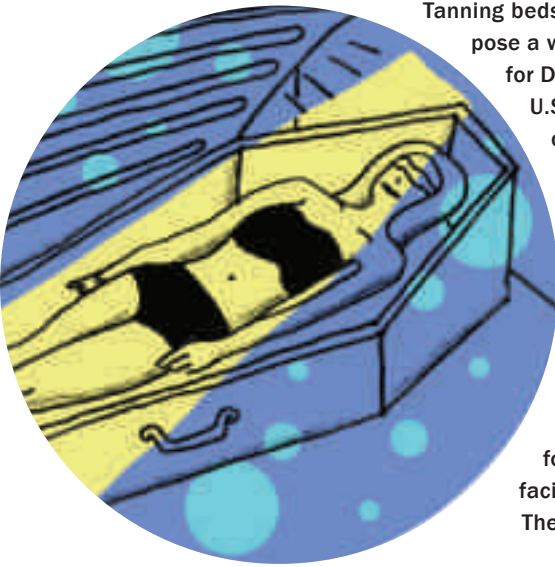
Just four years later, having outgrown its first home, the medical school moved to a remodeled Baptist church on Shawmut Avenue. In 1900 the school moved again, to 416 Huntington Avenue, along with the dental school. The School of Medicine has been at its current location on Harrison Avenue since 1949.



Gone but not forgotten: Tufts Medical School first stood near this spot in downtown Boston.

Nasson is mindful of tending the university's history: The Boston campus facilities crew now gives the copper marker an annual cleaning. "To me, it's a hidden gem," he says. —MARJORIE HOWARD

CANCER IN RESIDENCE



Tanning beds, with their elevated risk of melanoma from ultraviolet radiation exposure, pose a wider threat to public health than most people realize. According to the Centers for Disease Control and Prevention, nearly one third of white high school girls in the U.S. use tanning beds in a year. Worse, many apartment complexes located near college campuses offer their residents free indoor tanning, thereby encouraging the use of tanning beds. In some cases that skirts the law—which may require minors to have parental consent.

A recent study done in Texas looked at apartment complexes near the campuses of the University of Texas at Austin and Texas A&M University. The research team, which included Diana Bartenstein, '17, found that half the apartment buildings within a one-mile radius of UT-Austin offered free on-site tanning beds. Texas A&M was not much better: 31 percent of apartments within a two-mile radius had tanning beds ready for use.

The problem extends far beyond Texas. A recent study cited by the authors found that half of the top 125 colleges and universities either have indoor tanning facilities or make them available in nearby student housing.

The research findings were published in a *JAMA Dermatology* letter in early June.

Research



The word “contaminated” turned from blue to red in the presence of *E. coli* bacteria on a surgical glove.

HAND AND GLOVE

Silk proteins and an inkjet printer create an instant germ detector **BY JACQUELINE MITCHELL**

A SURGEON IS about to make an incision when the word “contaminated” appears in bright red letters across her gloves, which inadvertently have picked up harmful bacteria. What does it take to deliver that warning? Nothing more than a little silk and an inkjet printer.

Pioneering work by a team of Tufts researchers led by Fiorenzo Omenetto, the Frank C. Doble Professor of Engineering, has led to the development of “conformal” biosensors—silk-based inks containing any number of compounds and applied with an ordinary inkjet printer on multiple surfaces. Such sensors could, for example, detect

harmful bacteria on surgical gloves and help prevent some of the estimated 1.7 million infections that hospitalized patients acquire each year.

The research, published in the journal *Advanced Materials* in June, may be significant in medicine and other fields. The potential applications are limited only by the imagination, says Omenetto, the associate dean for research at Tufts School of Engineering.

In their paper, the researchers describe the development of customized silk-based inks containing molecules that change color in the presence of the bacterium *E. coli*, proteins that

stimulate tissue growth and gold nanoparticles that heat on demand or function as optical sensors, among other uses. The research was supported by the Office of Naval Research and the Air Force Office of Scientific Research.

“Silk is unique because it does multiple things well,” says Omenetto, the paper’s senior author. “The fact that we can now activate [the silk-based ink] with so many mixers makes it particularly powerful. It gives us the ability to print arbitrary sensors on arbitrary surfaces.”

Stable, chemically neutral and nontoxic, purified silk protein—or fibroin—achieves the perfect viscosity for use in an inkjet printer when it’s dissolved in water. It’s also biocompatible, meaning it doesn’t trigger an immune response when introduced into the body. This happy accident of nature is one reason why David Kaplan, the Stern Family Professor of Engineering and chair of the Department of Biomedical Engineering at Tufts, who is one of the paper’s coauthors, has been studying silk’s potential as a biomedical/bioengineering material for the past 15 years.

“Not only is the material naturally good, there happens to be a lot of resident expertise here at Tufts,” says Omenetto. “The body

of knowledge is growing every second here, and David [Kaplan] certainly was an amazing catalyst.”

In addition to the germ-detecting surgical gloves, Omenetto imagines one day taking a digital photo of a complex wound—maybe a battlefield injury—and sending that snapshot to an inkjet printer. The result might be a custom bandage that could be impregnated with antibiotics and tissue growth factors—compounds that encourage healing by stimulating skin, muscle and/or bone growth. Such a bandage could distribute the medicine to precisely targeted areas of the wound.

These ideas first percolated in Omenetto’s lab around 2007, he recalls, as the team was working on a drug-delivery project. The researchers added an optical element to silk film that reflected light differently under different conditions. In their early experiments, the team used it to detect the amount of oxygen present in a sample of blood. Omenetto and his colleagues soon came up with the idea of a silk film embedded with sensors that warn of the presence of harmful bacteria.

Because silk is extremely stable, easy to work with and nontoxic to people and the environment, Omenetto sees it as a

potential green replacement for plastics and other inorganic compounds used in high-tech fields. Harnessing silk's versatility, he says, could mean decreasing industry's carbon footprint and toxic-waste output without sacrificing technological performance.

"Eventually, materials will have to change," he says. "It's going to become simply unsustainable to live consuming nonrenewable materials the way we do today."

DOWN SCALE

Scientists are first to see elements transform at the atomic level, and their research may yield new cancer therapies

BY TAYLOR MCNEIL

IN A RESEARCH first, Tufts scientists have witnessed atoms of one chemical element morph into another—a feat of alchemy that could lead to safer, more effective cancer treatments.

Led by Charles Sykes, a professor of chemistry, the researchers worked with iodine-125—a radioactive form of the element iodine that is routinely used in cancer therapies. Using a scanning

tunneling microscope, which can produce images of each atom in the surface of a material, they observed individual atoms of iodine-125 decay, each losing a proton and becoming tellurium-125, a nonradioactive isotope of the element tellurium. They reported their findings online in the journal *Nature Materials* early this summer, on June 15.

The transformation of one element to another occurred when the researchers infused a single droplet of water with iodine-125 and deposited it on a thin layer of gold. When the water evaporated, the iodine atoms bonded with the gold. The researchers inserted the tiny sample—smaller than a dime—into the microscope.

Iodine-125 atoms have a half-life of 59 days,

meaning that at any time, any atom of the radioisotope can decay, giving off vast amounts of energy, and become the isotope of tellurium, with half of the atoms decaying every 59 days. (Iodine and tellurium are neighbors on the periodic table of elements, numbers 53 and 52, respectively.)

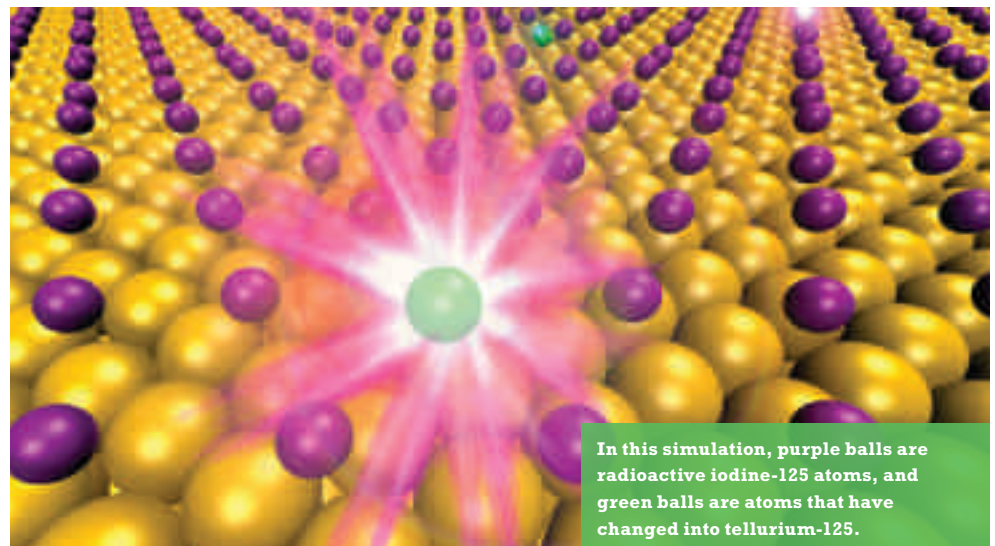
While the sample contained trillions of atoms of iodine, it was impossible to predict when any particular atom would transmute into tellurium, so the researchers worked up to 18 hours a day for several weeks. That way, they would be less likely to miss the transformations.

Eventually, they managed to take scanning tunneling microscope images that showed atom-sized spots all over the surface. An international collaboration with theorists

Angelos Michaelides and Philipp Pedevilla of University College London helped interpret these images and identify the features of newly formed tellurium atoms.

To verify that they had indeed seen the transformation, they took one of the samples and studied it over several months with an X-ray photoelectron spectrometer, which scientists use to determine the exact chemical makeup of materials. "By taking the measurement every week or two, we could see the chemical transmutation from one element to another," as the sample went from mostly iodine to mostly tellurium, says Sykes.

Then Alex Pronschinske, a postdoctoral researcher in Sykes' lab, suggested that they measure the electrons emitted by the



In this simulation, purple balls are radioactive iodine-125 atoms, and green balls are atoms that have changed into tellurium-125.

sample without prodding from X-rays in the photoelectron spectrometer. In particular, Pronschinske was interested in the emission of low-energy electrons, which have been shown to be very effective in radiation oncology, because they break the cancer cells' DNA into pieces.

The team calculated the number of low-energy electrons they expected would be emitted by the sample, with its 40 trillion iodine-125 atoms, based partly on data from simulations used by the medical community. But when their numbers came in, they found that the gold-bonded iodine-125 emitted six times as many low-energy electrons as plain iodine-125.

The reason was clear: The iodine-125 had bonded to gold, "which was acting like a reflector and an amplifier," says Sykes. "Every surface scientist knows that if you shine any kind of radiation on a metal, you get this big flux of low-energy electrons coming out."

The finding gave Sykes an idea: Bond iodine-125 to nanoparticles of gold, affix the nanoparticles to antibodies targeting malignant tumors and put it all in a liquid that cancer patients could take via a single injection. Theoretically, the nanoparticles would attach to the tumor and emit low-energy electrons,

effectively destroying the tumor's DNA.

It would likely be an improvement over current radiation therapy protocols, in which doctors treat some cancers by putting different radioisotopes, including iodine-125, into tiny titanium capsules and implanting the capsules in tumors. Instead of making more low-energy electrons, as the gold-bound iodine does, the titanium capsules inhibit radiation, Sykes says, meaning these current therapies are less effective than they could potentially be.

Low-energy electrons can travel only 1 to 2 nanometers—a human hair is about 60,000 nanometers wide—so being attached to tumors, they would not affect healthy tissue and organs nearby. Because gold-based nanoparticles would eventually be flushed out of the body, they would be safe to consume, Sykes says, unlike free iodine-125, which can accumulate in the thyroid gland and cause cancer.

"Our discovery has great promise for improving cancer therapies," says Sykes, who has applied for a patent.

Sykes' lab continues to investigate different aspects of the findings. Right now, the researchers are assessing precisely how the low-energy electrons travel through biological fluids.

THE LOADED DICE

In rare cases, prenatal screening finds genetic abnormalities that point to malignancies, says Tufts scientist

BY JACQUELINE MITCHELL

WHEN MARIN MEJIA got pregnant at age 39, she had a blood test to screen her fetus for genetic abnormalities. Children born to mothers 35 and older are at greater risk for Down syndrome and other conditions. The baby was fine. Mejia, however, was not. The genetic screening detected abnormalities that were subsequently shown to be caused by a tumor releasing abnormal DNA fragments into her blood.

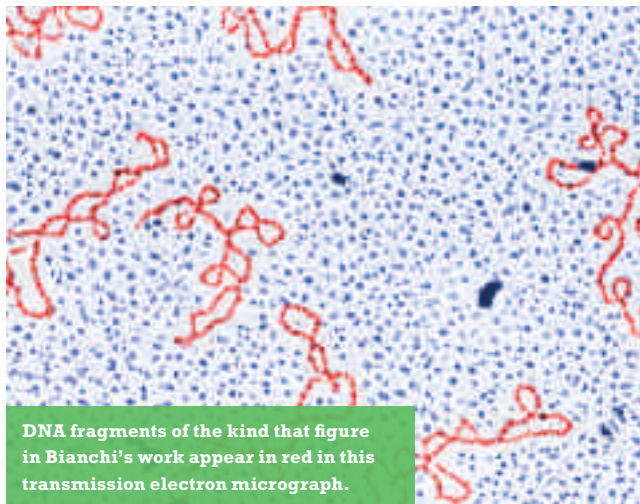
Sophisticated and highly sensitive noninvasive prenatal testing, like the kind Mejia received, was first introduced in 2011. "It picks up very unexpected things"—including imbalances in the genome of the expectant mothers that may be associated with a tumor, says Diana W. Bianchi, the Natalie V. Zucker Professor of Pediatrics, Obstetrics and Gynecology at Tufts School of Medicine.

For a paper published in the *Journal of the American Medical Association (JAMA)* in June, Bianchi and her research team

analyzed the noninvasive prenatal tests of 125,426 women whose fetuses were screened for chromosomal defects; they had abnormal test results but delivered healthy babies. Ten of these women's doctors told the laboratory that the women had been diagnosed with cancer after the prenatal tests were performed.

Unlike amniocentesis—an invasive prenatal test that samples the fluids directly around a developing fetus for genetic material—noninvasive tests analyze the genome of a fetus by sequencing DNA fragments floating in the mother's blood. As a fetus develops, some placenta cells die and release fragments of the baby's DNA into the mother's bloodstream. By the tenth week of pregnancy, says Bianchi, fetal DNA makes up as much as 10 percent of the DNA fragments in a mother's bloodstream, and the amount continues to increase as the pregnancy progresses.

The noninvasive screening, which can sample 20 million to 25 million fragments of DNA, does turn up the occasional false result. "We know of cases where the blood test is saying the baby is going to be a boy, and then the ultrasound shows it's a girl," Bianchi says. "And then we might find out the mother forgot to mention that she had a kidney transplant from her brother, so what's really being detected



DNA fragments of the kind that figure in Bianchi's work appear in red in this transmission electron micrograph.

is genetic material from the kidney," she says. "But we didn't know that tumors could be a source [of the false-positive DNA results] until 2013."

That was when a case report crossed Bianchi's desk for a professional journal she edits, *Prenatal Diagnosis*, about a mother whose test showed a false-positive result for two chromosomal abnormalities. Shortly after giving birth to a healthy son, the woman was diagnosed with cervical cancer. DNA from the cancer, the initial study authors reasoned, must have triggered the false-positive reading.

Bianchi, who is also executive director of the Mother Infant Research Institute at Tufts Medical Center, and her colleagues at Illumina—one biotech company that manufactures the genetic screening test—started keeping track of such cases, asking doctors to voluntarily report when women with

abnormal noninvasive prenatal tests who delivered healthy babies later turned up with cancer.

"We had no sense of how common it was or what you should do about it," she says.

TRACKING THE TESTS

Until recently, the consent forms for the prenatal tests didn't mention the possibility of producing findings about the health of the mother, says Bianchi. In a recent commentary in the journal *Nature*, she recommended that the consent forms be revised to indicate that expectant mothers and the health professionals who care for them need to be aware of such potential outcomes. "It's a problem, because some women, as soon as they get a positive screening test, are terminating their pregnancies without realizing the abnormal result could be from their own DNA and not the baby's," she says.

For two years, Bianchi

and her colleagues tracked prenatal tests that yielded unusual results. The lengthy tracking meant that "later patients in the study got the benefits of earlier patients," Bianchi says. "The word was out on the street about certain unusual DNA findings being associated with maternal cancer. The biggest red flag was the presence of more than one chromosomal abnormality detected," she adds, because if a fetus really has more than one, it probably wouldn't survive very long. Instead, multiple abnormalities more likely signal the presence of tumor DNA.

When Marin Mejia's test results came back with four chromosomal abnormalities, her doctors were more worried about her than her baby. She got a cancer screening right away and learned she had anal cancer while she was still pregnant with her son, Owen, who was born healthy. She chose to deliver early so she could begin her cancer treatment.

"We felt it was so important to publish our results in a broad-impact journal like *JAMA*," says Bianchi. "We wanted obstetricians, family practitioners and oncologists to be aware that a pregnant woman could have these abnormal results, and it could be cancer. In three of the women in our study, their cancers were definitely detected because of the abnormal prenatal test results."

Bianchi stresses that the prenatal test will never be used as a cancer screen. "We only detected the multiple chromosome abnormal results in 39 women out of 125,426, so it's an extremely rare finding," she says. "Of those, we know of only 10 who have had cancer."

The noninvasive prenatal test is marketed by several companies, including Illumina, which funded Bianchi's study and for which she serves as an expert clinical advisor. Over the past four years, more than 2 million women have undergone the screening worldwide. Such tests are generally reserved for high-risk pregnancies for certain genetic or chromosomal defects, including Down syndrome. In the United States, insurance covers the tests for women who are 35 or older, who have a family member with Down syndrome or whose fetuses have had structural abnormalities found by ultrasound examination.

To follow up on their retrospective study—in which the researchers looked at the test results of women who later were diagnosed with cancer—Bianchi wants to conduct a prospective study to look for patterns that might suggest which mothers are at risk for cancer. Such a finding could help physicians and others to improve care for these women.

Laboratory Ace

Almost 40 years ago, Te-Wen Chang was instrumental in determining the cause of a life-threatening disease **BY BRUCE MORGAN PHOTOGRAPH BY JOHN SOARES**

IT ALL BEGAN WITH A MEDICAL PUZZLE. A SEVERE DIARRHEAL DISEASE called pseudomembranous colitis, and later known as Clindamycin-induced colitis, had been observed by doctors since the 1890s. It spread dramatically with the rise of antibiotic use in the 20th century. In the mid-1970s, infectious-disease specialist Sherwood Gorbach, '62, J84P, organized his research team at Tufts—including Te-Wen Chang, M84P, and John Bartlett—to look into what was causing the colitis. “When humans take antibiotics, they develop diarrhea, and some develop a more severe form—colitis,” Chang says, speaking excitedly. “No one knew why. When an antibiotic is given to a [test] hamster, that hamster dies. Why did that happen? These were the questions.”

Suspecting a virus might be at work, Chang, who trained as a virologist, began to examine tissue cultures inoculated with the stools of affected hamsters. “I was working day and night,” he relates. “The hamster stool specimens caused damage to the tissue culture cells. I kept asking myself, What could be doing the damage? A virus was ruled out because the agent could not be propagated to fresh tissue cultures. If it’s a bacterial toxin, what kind of bacteria is it?”

To determine this, Chang applied gas-gangrene antitoxin to the tissue samples. The only form of bacteria the antitoxin neutralized was clostridium—“so I knew right away that a clostridium makes the toxin,” Chang explains. Bartlett recalls Chang’s high excitement as the hunt narrowed. “There are five antitoxins in gas gangrene, so we had to sort out which one was the bad bug,” says Bartlett. Further intense work in the lab told them that *C. difficile* (so-named at the time of its discovery

in 1935 because it proved hard to isolate and study in the lab) was the culprit.

“Before, we didn’t know what caused the disease in humans,” Chang points out. “Now we knew.” Bartlett, who left Tufts in 1980 to head up the infectious diseases division at Johns Hopkins for the next 26 years, calls the discovery “a seminal event in the history of *C. difficile*.” The Tufts lab’s achievement was noted in the article “Antibiotic-Associated Pseudomembranous Colitis Due to Toxin-Producing Clostridia,” published in the *New England Journal of Medicine* in March 1978 by Bartlett *et al.*

Because it is resistant to most antibiotics, *C. difficile* is a tough form of bacteria to stamp out. When a patient takes antibiotics, regular bacteria are reduced in the intestine, but *C. difficile* thrives. It benefits from the absence of the bacterial forces that normally act to suppress it while simultaneously tapping a greater store of colonic nutrients. The bacteria’s impact is enormous. An article

in the *Journal* this past April labeled *C. difficile* “a major enteric pathogen with worldwide distribution,” citing some 453,000 infections and 29,000 deaths in the U.S. in a single year.

The infection spreads easily along the fecal-oral route, and hospitals rank among the most hazardous sites.

Back in 1978, once news of the Gorbach lab’s discovery got around, Tufts’ Boston campus began receiving human stool samples from doctors seeking expert diagnosis. “That paper became very popular,” Chang recounts with a hearty laugh. “I got specimens from every state in the U.S.” For the next year or two, in fact, Tufts played a singular role. “That cytotoxin assay of Te-Wen became the only test for *C. difficile* available anywhere in the world,” Bartlett confirms.

Chang, 95, retired from Tufts in 1992 and plainly misses the excitement of those days. Bartlett, recently retired from Johns Hopkins and now living in Mississippi, remembers the camaraderie of life in the Tufts lab fondly as well. “Chang was a brilliant scientist, but quiet about it,” he says. “He was also lots of fun to have in the lab. I never had that kind of chemistry before, and I never had it again.”

It was an altogether special time. As Gorbach remarks, “This was one of the biggest discoveries ever at Tufts. After all, how often do you discover the cause of a life-threatening disease?”



Resistance Fighter

Longtime faculty member Stuart Levy has spent a lifetime studying mechanisms of antibiotic resistance and crusading to abolish the use of antibiotics in animal feed **BY ANNA AZVOLINSKY** PHOTOGRAPH BY KATHLEEN DOOHER

AS A VISITING RESEARCH FELLOW AT THE PASTEUR INSTITUTE IN 1962, on leave from medical school, Stuart Levy met a Japanese scientist who introduced him to an exciting recent breakthrough by researchers from his country. “The Japanese had discovered that resistance to antibiotics could be transferred from one bacterium to another,” Levy says—even across species. “This was unheard of previously. It was the beginning of studies on transferrable drug-resistance genes and infectious drug resistance.”

Inspired, Levy traveled to Tokyo’s Keio University in 1964 and spent several months in Tsutomu Watanabe’s laboratory, working on the so-called R (resistance) factors. Watanabe is credited with bringing the topic to a wide scientific audience with the publication of a 1963 review in English, highlighting the results of Japanese research on what he called the “infective heredity” of multidrug resistance.

Levy published several papers with Watanabe, including a description of episomal resistance factors of Enterobacteriaceae and an investigation of methods for inhibiting their transfer. “We didn’t know at the time about the mechanism, but we knew it was an exciting moment in the history of antibiotics and resistance,” says Levy. “Later, transfer was linked to small pieces of DNA—plasmids—that bore different resistances to antibiotics.”

In this interview, Levy talks about the prank he and his twin brother (Jay Levy, who was among the first to discover the HIV virus) executed

that earned them a brief spot in the limelight; how science allowed him to travel the world—and befriend Samuel Beckett; and an urgent call to a castle in Prague about chicken eggs.

LEVY LEARNS

SUNDAY MORNINGS. As young kids growing up in Wilmington, Delaware, Levy and his identical twin brother, Jay, used to accompany their father, a physician, on Sunday house calls. “House calls were not that common then, but not as rare as they are now,” says Levy. His father, who came from a poor immigrant family, would visit

patients, many of whom could only pay him with food grown in their gardens or with services. “He would see the Italian gardener who would exchange Dad’s expertise for his fruit. He was brought up under that kind of understanding, and the patients respected and loved him. He would sometimes discuss with us patients he was seeing; that is probably how my interest in medicine began.”

ALL IN THE FAMILY. “My twin brother, sister and I were all interested in biology. We lived in the country near a farm and spent a lot of time outdoors with the animals. All three of us went to medical school, but, unlike my father, we stayed in academic circles rather than going into private practice. My brother, Jay Levy, and my sister, Ellen Koenig, both do HIV research.”

PLAYING BOTH SIDES. At Williams College, Levy majored in English. “My brother knew by sophomore year that he wanted to go to medical school. I only made the decision my junior year. But I had lots of interests, namely literature and arts. I loved the fact that I could keep these interests and still go to medical school. When



I could do something and not give up another I loved, I was happy,” Levy says.

MISTAKEN IDENTITY. After exchanging identities for a day in high school, the Levy brothers took the prank even further in college. As sophomores, the twins swapped identities for an entire week, and each wrote an essay about the experience. Stuart lived life as Jay at Wesleyan University and Jay as Stuart at Williams. “This was our first taste of being in the limelight.”

LEVY LAUNCHES

MEDICAL-SCHOOL TRAVELS. Stuart Levy started medical school at the University of Pennsylvania in 1960. His brother, in medical school at Columbia University, received a Fulbright scholarship and studied at the Sorbonne Institute in Paris. “Our relationship was such that we wanted the other to have what we had, so when my brother was successful in getting a position in Paris at the Sorbonne, he told me, ‘You have to do this; it’s fantastic to be here on your own! There is never anyone directing you,’” says Levy. The next year, he followed Jay to Europe, first as a research scholar in Milan and then at the Pasteur Institute in Paris. There Levy worked on a model of viral resistance in a mammalian cell line in Raymond Latarjet’s laboratory. “To tell you the truth, I didn’t care what I was doing. I just wanted to have a new experience, and Latarjet was a wonderful mentor. He loved golf, which is what I was raised on. We had wonderful times golfing together at dusk,” Levy recalls.

FOR THE LOVE OF LITERATURE. “When my brother was first in Paris, he met Samuel Beckett. Jay had written his thesis at Wesleyan on Beckett and sent it to Sam’s address, which everyone said you could not get through to. Beckett liked what [Jay] had written. Beckett was not a snob; he was shy. So Jay introduced me to Beckett when I was in Paris, and every four to six

weeks we would have lunch together in the Latin Quarter. I’d tell him what we were doing in the laboratory, and he would share with me accounts about the production of his new play. It was such a unique opportunity.”

TANGENTS. Levy did his residency in medicine at Mount Sinai Hospital in New York City. While there, he spent much of his free time working in the laboratory of Charlotte Friend, a microbiologist who had discovered a virus that caused a leukemia-like disorder in mice. “She took me under her wing—I was always looking for something else to do other than look at pathology slides. Jay did the same. We weren’t interested in the status quo. We did what was needed to get the degree, but also pursued our own interests,” says Levy. Although his clinical focus was officially hematology, Levy continued to pursue his interest in antibiotic resistance. “I was so interested in infectious diseases that I used to go on the rounds with

the infectious-diseases group in addition to my regular clinical duties.”

A SYSTEM TO CALL HIS OWN. Levy became a staff scientist at the National Institutes of Health in 1967, working for two years in Loretta Leive’s lab on synthesis of the lipopolysaccharide that populates the outer membrane of *E. coli*. As an independent researcher on R plasmids and chromosomeless minicells, Levy developed a way to purify large amounts of these *E. coli* minicells, which form from an aberrant cell division site and possess no bacterial chromosome—what he calls the plasmid-in-minicell system. “The NIH brought me together with senior scientists in the field, but no one was interested in tetracycline resistance. They wanted to understand enzymatic resistance,” says Levy. In 1970, Levy demonstrated that the tetracycline resistance gene is found on plasmids that are transferred to minicells.

MECHANISM OF RESISTANCE. In 1971, Levy moved to Tufts University

GREATEST HITS

Discovered the first active efflux pump involved in tetracycline resistance in *Enterobacteriaceae*;

Identified the *mar* operon, a bacterial regulatory locus that results in multidrug resistance to different antibiotics as well as to disinfectants;

Provided some of the first evidence that feeding animals low doses of antibiotics leads to high levels of resistant bacterial strains that can spread to other animals, people and the environment;

Established the international Alliance for the Prudent Use of Antibiotics;

In 1993, published *The Antibiotic Paradox: How Miracle Drugs Are Destroying the Miracle*;

Served as an advisor on antibiotic resistance to multiple organizations, including the National Institutes of Health, the World Health Organization, the FDA and the Environmental Protection Agency.

School of Medicine as an assistant professor of medicine and of molecular biology and microbiology; he has remained ever since. [He is currently a professor of medicine, professor of molecular biology and microbiology and professor of public health and community medicine.] There, his lab went on to show that an R plasmid encoded a protein associated with tetracycline resistance and that no other positive regulation was required for the bacterium to synthesize this protein. “There could be several hundred genes on the plasmid, and in the 1970s, we were not that sophisticated yet to identify the specific gene,” says Levy.

In 1978, his lab determined that the plasmid-derived resistance to tetracycline involved a novel transport system for tetracyclines. Levy’s lab then discovered the first active efflux mechanism, showing that *E. coli* resistant to tetracycline actively pumped the drug out of the cell and that this mechanism of resistance was encoded by a single R-plasmid gene. Levy also showed that a nonefflux mechanism was present as well. Others subsequently demonstrated that this second mechanism for tetracycline resistance involved a ribosome-protection protein. “The use of minicells and the discovery of the mechanism of tetracycline resistance is what really put me on a clear path to a successful career,” says Levy.

AHEAD OF HIS TIME. The Animal Health Institute of New York asked Levy to study growth-promoting antibiotics in farm animals. “They were looking for scientists who had not spoken negatively about this use of antibiotics,” says Levy. Still a young investigator, Levy fit the bill. His lab found a farm outside of Boston that was willing to have scientists come in and raise chickens. Levy’s students raised 150 control and 150 experimental chickens fed regular and tetracycline-spiked feed, respectively.

“There is a funny story about me

at a castle in Prague and not remembering that I had placed an order for 300 eggs, one-half male and one-half female. Someone was looking for me all over the castle so that I would confirm [over the phone] that we should order the eggs anyway. There is no way to identify if eggs are male or female!”

The study, published in 1976 in the *New England Journal of Medicine*, showed the ecological effects of feeding farm animals low-dose antibiotics: not only did the antibiotic-resistant bacteria replace the microbiota in the animals’ intestines; they also altered the gut microbiome of the humans who lived and worked on the farm. Through contact with the chickens and their tetracycline-laced feed, resistance was in turn transferred to the microbiome of the animal handlers. Levy’s lab also demonstrated that animals can transfer antibiotic-resistance plasmids to humans and other animals. “That low-dose antibiotics given as growth promotion will lead to high levels of resistance was a surprise,” says Levy. “No one has tried to replicate that study to this day.”

ANTIBIOTICS AND POLITICS. Levy has testified many times before Congress on the subject of antibiotic resistance. “Our study from 1976 was [and still is] the only prospective U.S. study on this, and industry didn’t want more studies. They were upset that our data showed them to be wrong. This was highly political.” Levy says he is now more optimistic about prudent antibiotic use, as this issue has garnered more and more attention, especially since this past March, when the White House announced a national action plan, allocating \$1.2 billion to combat antibiotic-resistant bacteria. “I think the moment has come for new antibiotics and better use of antibiotics so that people are not as subject to resistance emerging through animal use of other drugs. We won’t see real change until there is a genuine commitment

to improve antibiotic use, and I think it’s coming.”

BANDING TOGETHER. In 1981, Levy founded the Alliance for the Prudent Use of Antibiotics (APUA), an international nonprofit with chapters in 65 countries. The idea started at a meeting in the Dominican Republic in the early 1980s because of concern about rising antibiotic resistance in the developing world. The organization provides funding for countries in the developing world to study antibiotic resistance. “I’ve learned a lot from being part of the APUA. The science is one thing, but you need to package the science with good politics to get what you want,” says Levy.

UP TO THE CHALLENGE. “We did the first study that took a patient-by-patient analysis of resistance in a [single] Chicago hospital and what the cost was,” says Levy. The analysis showed a cost of about \$21,000 per antimicrobial-resistant infection patient, producing a cost to the hospital of about \$4 million and a total societal cost of as high as \$15 million, including the loss of productivity. “[The study] came from a challenge that Ted Kennedy gave me. He said that if you are not going to save money, you won’t get much interest in [antibiotic resistance], and we took him up on the challenge.”

DREAM EXPERIMENT. If money were no object, Levy says, he would design an experiment that would definitively and quantitatively demonstrate the link between subtherapeutic use in animals and the emergence of antibiotic-resistant infections in people.

INFLUENTIAL MENTOR. “I think the biggest training I received was with Tsutomu Watanabe, and that was just for a summer! He was patient, methodical and a master.”

ANNA AZVOLINSKY is a freelance science and health writer in New York City. This profile originally appeared in the June 2015 issue of *The Scientist*. It is reprinted here with permission.

Field Marshal

At the height of the Depression and against all odds, Dorothy Boulding Ferebee, '24, ventured to Mississippi to blaze a resonant new trail in public health

BY DIANE KIESEL ILLUSTRATION BY GARY KELLEY

AN OFFHAND REMARK BY THE NOBEL LAUREATE TIM Hunt recently to the effect that women tend to be overly disruptive presences in the laboratory drew an immediate rebuke from the American Association of University Women, which issued a press release citing five women from history who had disrupted things for the better. Among their examples: Dorothy Boulding Ferebee, '24, one of the most notable early graduates of Tufts School of Medicine.

Raised in a solidly middle-class family on Boston's Beacon Hill and educated at Simmons College before

entering Tufts, Ferebee rose to become one of the best-known African-American women in the U.S. by the mid-20th century. Reaching neglected populations through medicine was her life's recurring theme, best evidenced in the case of the Mississippi Health Project, which she pursued every summer between 1935 and 1941.

Here, we present a portion of Diane Kiesel's just-published biography that highlights Ferebee's first visionary medical excursion to the Mississippi Delta in 1935, years before anyone else had imagined such a thing. —BRUCE MORGAN, EDITOR

THE POSTERS WENT UP in churches, on crepe myrtle trees and along rotting walls of one-room schoolhouses all over the Mississippi Delta, addressed to the “colored people” of Bolivar County and written in large letters, as if by a huckster announcing the arrival of the traveling circus: “Notice! Colored People! Everyone Come to a Clinic for Health Advice.” The anonymous author promised a genuine lady doctor from Washington, D.C., Dr. Dorothy Boulding Ferebee, and her staff of “trained colored assistants” who would treat the sick of their race. The Mississippi Health Project was coming to town.

Lord knows, the “colored people” of Bolivar County needed all the help they could get in the summer of 1936. While the rest of the population clawed their way out of the Great Depression that had engulfed the decade, blacks in the Delta still suffered the same miserable-existence they always had, with no end in sight. Nearly a quarter of all African Americans in Mississippi were illiterate. What little education was available in segregated schools in the Jim Crow South was abandoned during cotton-picking season so children as young as 8 could work the fields.

Most African-Americans in the Delta worked the land as tenant farmers or sharecroppers, akin to modern-day slavery. Entire families earned the grand sum of \$50 a year, sometimes less.

A dozen women had made their way to Mississippi in 1935 [the previous, inaugural year for the Health Project]. Besides Ferebee and Mary Williams [a nurse], the only volunteers with health-care experience were Ella Payne, a dietitian with a master's degree from the University of Kansas, and Genevieve Mayle, a graduate nurse. Ida Jackson [a native Mississippi educator who first conceived a public service program for her home state] ostensibly came to lead the teaching program, assisted by Ruth Handy, who held a master's degree from Columbia University, and Marion Carter. They, too, ended up acting as nurses. Ferebee's 20-year-old sister-in-law, Connie Ferebee, and a woman named Elsie Cain were brought along as secretarial assistants. Irma



Barbour, a Howard University student; Nell Jackson, who was Ida's niece and a student at the University of California studying French; and Alice Avery, who had a degree in art, came to help, too.

Looking back from the 21st-century of superhighways, central air-conditioning, jet travel and laws against racial discrimination, it is tempting to underestimate the strength and bravery of Ferebee and the women who went with her to Mississippi. Given the kudos it brought Ferebee and the sorority [Alpha Kappa Alpha, a black sorority known for its social activism that had conceived and funded the excursion, and of which Ferebee and Jackson were prominent members], it is equally tempting to accuse them of undertaking the project because of how it would enhance their reputations. But in 1935 they had no idea how it would turn out.

The sun rose at 4:48 on the morning of July 5, 1935; the temperature reached close to 90 degrees in Washington,

World War II could there be as much planning as that done by Alpha Kappa Alpha (AKA) to set up the Mississippi Health Project. The supreme allied commanders were Ida Jackson and Dorothy Ferebee, who took Jackson's inspiration and turned it into one of the most successful social welfare projects in history.

Dorothy provided the blueprint for a health clinic. The goal, she wrote, was to "carry medical service, its instruction and understanding, to a community where public health work has been greatly neglected." She did not exaggerate the need for the Mississippi Health Project.

All of Mississippi had its share of problems. The smallpox vaccine had existed since 1796, but between 1930 and 1932, there were nearly 2,000 cases of the disease in the state. Black infant mortality was 61 per thousand compared to 44 for whites. Holmes County residents suffered from TB, scarlet fever, typhoid and dysentery.

and pickling it. Yet it became clear that Dr. C.J. Vaughn [the sympathetic white male director of the Holmes County Health Department] was right [when he cautioned her not to expect much of a turnout]. Vaughn's warning that patients could not travel to the clinic was true, but poverty wasn't the only obstacle. The landowners were wary of allowing visits to a health clinic run by Negro strangers who, for all they knew, were more interested in agitating than inoculating. "To our astonishment, 13 owners refused our services and forbade their sharecropping families to leave the plantations to attend any one of the five proposed clinics," Ferebee wrote years later. Only one was willing to participate.

"So here we are, in Mississippi, with all the materials and drugs that we had bought, all of the things necessary for the health of young children, and we couldn't use them, because the plantation owners would not allow the Negroes to come to us. So we had a consultation and agreed, 'Well, if they can't come to us, we'll go to them,'" Ferebee recalled.

With Dr. Vaughn in tow, Ferebee, Ida Jackson and Ruth Handy drove from place to place to pay friendly calls on the recalcitrant landowners. All but one relented, but there was a condition: The sharecroppers were not allowed to leave the plantation, so the project team had to come to them.

The days were long and hard, starting before dawn and continuing into the evening. Rather than sip coffee in those calm moments at sunrise before the clinic opened, the volunteers used that precious time to warm up their cars and load them with vaccines, sheets, registration forms, needles and uniforms. They made a quick trip to the local ice house for ice to preserve the vaccines, and they were good to go.

The vehicles formed history's first mobile health-delivery system as the drivers fanned out through the broiling countryside, logging hundreds of miles each day. There were mishaps, documented

“Plantation owners would not allow the Negroes to come to us. So we agreed, ‘Well, we’ll go to them,’” Ferebee recalled.

D.C. [the group's embarkation point] and got steadily hotter farther south. It was hardly an ideal day to begin an 830-mile road trip. Cars were not air-conditioned, and decent middle-class women did not leave the house without wearing dresses, silk stockings and girdles. Ferebee loaded up her husband's car with medical supplies, three passengers and their luggage. Ever the field marshal, she dictated what the women could bring: one suitcase filled with white smocks and cool cotton dresses.

Not until Gen. Dwight D. Eisenhower plotted the invasion of Normandy in

From the moment she met Ida Jackson in December 1934 until she led a multicar caravan into the Deep South on July 5, 1935, Ferebee charmed, begged or bullied key people to support the AKA clinic. Together, they raised money, selected staff, arranged transportation to Mississippi, obtained medical supplies, secured the blessing of state and local—meaning, white—officials and tried to convince landowners to let their sharecroppers participate.

Ferebee arranged the clinic schedule to coincide with the summer lay-by, that period between chopping the cotton



Left: Ferebee, fifth from left, appears with her team members in Mississippi. Below: Always actively engaged, Ferebee administers a blood test to a woman at a Delta clinic in 1938.

in Ferebee's scrapbook. "Stuck in the mud—a frequent occurrence," was the caption she wrote beneath a picture of the health team pushing a car.

Once they reached the day's destination farm, they parked under a tree in the cotton field or next to an old school or crumbling church and set up a clinic. Behind the wheel in the lead car, Ferebee saw the grinding poverty of one-room shacks, some without screens or front doors. Within their crumbling walls they often housed 10 to 15 family members.

Ferebee led the automobile caravan over the dirt roads of Holmes County and would continue to do so year after year. Her colleagues came to trust her sense of direction after it became clear that following their own instincts led to ditches and dead ends. "When we traveled, we encountered nothing but dust. One couldn't see the car in front," Ferebee explained years later. "No routes were marked; you didn't know where you were. But fortunately, there's something about me that I can always come back from where I've been. So when the members of the team noticed that even without markings or signs, I could always get home, they made me the leader of the procession...Because they said, 'Wherever we've been, she can bring us home.' It was because I have a knack of recognizing a certain tree stump, or a certain rock, or a certain object that stands out, assuring me, 'This is the way I came.'"

At each location the volunteers set up clinics from scratch. They hung clothes lines between trees and placed sheets over them to create privacy. As many as 800 sharecroppers and their families



lived on each plantation. Once they got the OK from the owners, they came to the clinic in the morning on foot, in cars and in horse-drawn wagons. They didn't stop coming until nightfall.

The sharecroppers wanted health care, but some were wary. As parents lined up with their whining children for vaccinations, the plantation overseers sat close by on fidgety horses with guns in their belts and leather whips in their boots. They wanted to hear what their workers were telling Ferebee. There were other obstacles. Many of the mothers had their own "medicines." To ward off disease in their children, they placed bags of grasshoppers' nests around their tiny necks. To encourage the growth of healthy teeth, they put buzzards' feathers around their necks, too. Ignorance was pervasive. Some mothers struggled with simple questions from Ida Jackson and Ruth Handy, who were keeping the records. Child's name? "Fat Back." Date of birth? "She was born around

cotton-picking time." Hanging back, curious yet cautious, were dirt-poor whites. Their children could have benefited from Ferebee's services, but they did not dare step forward and ask; the taboos against racial mixing were just too great.

The Mississippi Health Project volunteers trudged home after three weeks, having endured 21 days of relentless heat, 5,324 miles of driving over the country's worst roads through swarms of mosquitoes. When all was said and done, the project was Dorothy Ferebee, Ida Jackson and AKA's shining hour. The sorority's tireless work in one of the worst parts of the country, at one of the worst times in history, brought health care to 15,000 of the nation's poorest and most powerless.

ADAPTED FROM *She Can Bring Us Home: Dr. Dorothy Boulding Ferebee, Civil Rights Pioneer*, by Diane Kiesel (University of Nebraska Press, © 2015 by the Board of Regents of the University of Nebraska). Used with permission. A former award-winning journalist, Kiesel is an acting justice of the New York State Supreme Court.

Fortune Teller

Barry Levy says worsening air pollution and frequent floods are just the start of public health hazards apt to occur with climate change

BY BRUCE MORGAN PHOTOGRAPH BY KELVIN MA

GROWING UP IN THE INDUSTRIAL COMMUNITY OF BAYONNE, New Jersey, Barry Levy, A66, began to take notice of environmental issues. “My dad often drove me through the industrial area of town, and I became interested in how the oil refineries and the factories there impacted the environment and people’s health,” he said. Levy later broadened his scope to include public health and preventive medicine.

After graduating summa cum laude from Tufts College in 1966, he earned his M.D. degree from Cornell and his M.P.H. from Harvard. Board-certified in internal medicine and occupational medicine, he has taught at UMass Medical School, where he was a professor in the Department of Family and Community Medicine from 1977 to 1988, and at Tufts, where he has been an adjunct professor of public health since 1993.

Levy has traveled the world extensively, teaching, studying, consulting or doing field research in some 20 countries, including two years in Kenya as a visiting research scientist, two months in Jamaica working in a rural health clinic, two months in China as a visiting professor and two months in Thailand working in a camp for Cambodian refugees. These global experiences inform his sense of climate threats in the world. “Having lived in Kenya and China, I know they are not far-off lands where the threats are theoretical,” he says. “I know people who are there now.”

These issues form the basis for the book *Climate Change and Public Health* (Oxford University Press, 2015), which Levy edited with Jonathan Patz. The book is scholarly, detailed and readable—not to mention sobering—as

it walks a reader through the health implications of a planet that’s growing warmer by the year. Levy recently talked with *Tufts Medicine* about the perils of climate change.

TUFTS MEDICINE: There has already been so much talk in the media about climate change. What don’t people understand about its impact on their health?

BARRY LEVY: One aspect of misunderstanding is that some people interpret what we’re talking about as simply “global warming.” Indeed, temperatures are increasing on average across the world. But as we’ve seen over the last two winters here in the Northeast, some parts of the world may have colder seasons, even though on average there’s a steady, progressive increase of warming temperatures.

People generally don’t understand

that air pollution will get worse with climate change; that pollen production will increase, causing more allergic disorders, like seasonal allergies; that change in the location of various vectors, such as ticks and mosquitoes, will have adverse effects.

Certain mosquitoes normally confined to the tropics are moving steadily northward. For example, Chikungunya fever, which is a viral illness, is spreading in Puerto Rico and other places in the Caribbean where it hasn’t been seen before. West Nile virus has spread more, in part because of changing climate conditions which affect the breeding of mosquitoes.

The change is not only geographic, but also reflective of changes in elevation. We are seeing changes in the pattern of malaria in Africa, in certain parts of East Africa in the highlands. Nairobi is a city at 5,000 feet that has been cooler than surrounding areas and has been protected in a sense by that coolness. As cities like Nairobi warm, that protection is no longer present. We’re finding that in certain parts of East Africa that have been malaria-free for many years, malaria is now occurring.

Rainfall patterns are changing, and even in places where there may not be a net change in rainfall, it’s likely that there will be more episodes of heavy rainfall, resulting in more floods.



When floods happen, there are a number of increased risks to health, not only related to people being displaced from their homes or seriously injured. In some places there is likely to be sewage contamination of drinking water, causing waterborne diseases. In fact, our contributing authors in

and suffering the effects of heat will see these problems increase significantly.

What about the effects on people with chronic conditions, such as heart, lung or kidney disease?

These people are often already at increased risk as a result of high heat.

are developing malnutrition. In some parts of the world there have been food riots as a result of food insecurity.

A number of these issues are tied together. The civil war in Syria is in part due to a drought that caused thousands of farmers to leave their farms and move to cities, where they failed to find jobs and protested against the government, which was not addressing their concerns.

“Climate change is a risk multiplier. What this means is that many of the existing public health problems will be enhanced.”

India performed a study showing that gastrointestinal illness increased after heavy rainfall.

I hear you saying that although people may have gotten the broad strokes of the climate-change story, the devil's in the details.

That's right. And certain parts of the world are going to feel this a lot more than others. Sea-level rise may be less of an issue for people living in the Midwest, but for those of us living in the Boston area, or Florida, or other parts of the East Coast, as the sea level rises, there are going to be profound changes—and even more profound changes in places like Bangladesh, much of which is at sea level and where well over 150 million people live. Many of these people will be displaced as “climate refugees.”

You use the term “risk multiplier” in the book. What does this mean, exactly? Climate change is a risk multiplier. What this means is that many of the existing public health problems will be enhanced, so that people who are already suffering from, say, ill effects of air pollution or water pollution, or living in areas where vector-borne diseases are endemic, or living in hot areas

Many of these people are older; many of them are living alone; many may not have air-conditioning. They may not have a social network of people supporting them. Increased heat often puts people with heart, lung or kidney disease at increased risk of morbidity and mortality.

The same is true with regard to air pollution. People with chronic obstructive lung disease and people with asthma are likely to have exacerbation of their chronic conditions, and there will be increased mortality as a result.

Let's talk about food. What is likely to happen to the world's food supply and security?

It's certainly being threatened. The food supply is always a challenge for a number of reasons, and it's not always an issue of growing enough food. It may be issues related to spoilage of food and to the price of food. In certain parts of the world, supply and demand are such that while there's enough food being produced, much of it is being exported to other countries. Prices are increasing as a result of food shortages in certain parts of the world so that people can no longer afford a sufficient diet, and adults and children

Where does mental health fit into the picture?

One way is that all the disorders related to climate change we've been talking about have a direct impact on mental health. Another way is that climate change may displace people from where they're living. People may be forced to move to different countries, or other areas within the same country. It may prevent some farmers from farming because there's inadequate rainfall. Yet another way where mental health fits into the picture has to do with people's overall anxiety about climate change.

You mention a farmer who can no longer farm the land and so must travel elsewhere for work. Are we looking at roving hordes of desperate people?

It's hard to predict how many climate refugees there will be—there could be millions. There are many models as to how climate change will evolve, but for a lot of this, we really won't know until it happens.

People need to be prepared; communities need to be prepared; countries need to be prepared.

From a public health perspective, we need to adapt to the likelihood of more heat waves, more air pollution and more vector-borne disease. One of the perennial challenges for public health is that a lot of what we do is invisible until a crisis comes along. Climate change is a global crisis. We need to act to address it. We need to be prepared, even for the unexpected.



Disease Detective

She grew up going off the beaten path; now at the CDC, Ashley Greiner hunts down potential health threats emerging from outbreaks around the world

BY BRUCE MORGAN PHOTOGRAPH BY MANDIE MILLS

BACK IN THE FIFTH GRADE, WHEN ASHLEY GREINER, M.D./M.P.H. '10, was asked by her teacher to write a few words about something on her mind, she didn't miss a beat. She leaned over her desk and got to it. "I didn't write about the local ice cream place, like the other kids," she says with a laugh. "I wrote about disease transmission in the southwestern United States."

Greiner, now 31, has retained her youthful focus. She remains fascinated by the intricate story of "how disease

moves through populations." The difference is that now she has the whole hulking operation of the Centers for Disease Control and Prevention (CDC) standing behind her. Greiner is a roving scientist who travels the world sniffing out emergent diseases and recommending the best ways to

head them off as a so-called “disease detective” for the CDC’s Epidemic Intelligence Services (EIS).

It’s a busy, whirling life. Greiner has some trouble naming all the places she’s been over the past year, saying first, “Oh, I don’t even know,” before citing Guatemala, Ghana, Côte D’Ivoire, India, Switzerland . . .” and drifting off. She generally travels to a site for several weeks, doing field work before returning to CDC headquarters in Atlanta to analyze and interpret her findings, write them up and distribute them for the sake of greater public awareness and safety. This is grunt work for a greater cause.

Greiner grew up in Winchester, Massachusetts, the daughter of an ophthalmologist dad and a neuroscientist mother who liked to go off the beaten path when the family traveled. Once, while vacationing in Costa Rica when Greiner was a child, her mother was outside at dusk and got bitten by a mosquito. A week later, back in the U.S., a rash flared up on her arm—she had contracted dengue. “I was amazed that this little bug could cause such a debilitating illness,” Greiner remembers.

As a medical student, she continued to think simultaneously on two tracks, one large, the other small. “I was always thinking about the individual and the population at the same time,” says Greiner. Anthony Schlaff, director of public health programs at Tufts and a CDC “disease detective” in a former life, describes Greiner as a serious, passionate woman well-matched to her job at CDC. “It’s perfect for her,” he remarks, “and I wouldn’t be surprised if she stays there for her whole career.”

Tufts is well-represented at the CDC. Joining Greiner in the 2015 EIS class, which totals 81 officers winnowed from 568 applications, are Negar Aliabadi, ’07; Ishani Pathmanathan, M.D./M.P.H. ’11; Misha Robyn, D.V.M./M.P.H. ’09; and Charnetta Smith, A03.

Greiner’s life can be intense and

unpredictable. Last fall, the CDC was contacted by its counterpart agency in the country of Georgia, part of the Soviet Union until 1991. The Georgian Ministry of Health wanted help investigating an outbreak of Crimean-Congo hemorrhagic fever, or CCHF, that had struck 22

ill. Their findings were promptly shared with the Georgia Ministry of Health in an effort “to strengthen health systems and control disease,” Greiner says. Her goal is always larger than the occasion, or the individual nation, because her job is never done. It’s like watching sparks

“Deadly infections that spring up in a distant land have a way of spreading from place to place, as has been the case with Ebola.”

of its citizens, resulting in three deaths. The CDC had two days to whip together and deploy a small team, led by Greiner, to determine the extent of the outbreak, identify risk factors and figure out just how the disease was spreading.

Now, 22 cases are a relatively small number. A basic underlying question, one that recurs again and again in Greiner’s work, had to do with whether the new occurrence of CCHF signaled an increase in amplitude of the disease or was simply a reflection of better surveillance—glimpsed one way, a sort of positive news; the other, a potential public health crisis.

On site in Georgia’s rural, rugged countryside, Greiner’s team used a combination of means to gather intelligence. Satellite technology available through Google Earth enabled the team to create a rough map of a dozen villages where CCHF had occurred. Then, over the course of a string of 20-hour days, the team went door to door, interviewing more than 600 residents and taking blood samples for later analysis.

CCHF normally spreads through ticks or contact with infected animal blood. The investigation in Georgia showed that most of the 22 people infected with CCHF had been exposed to ticks or animal blood before falling

jump from a campfire on a summer night. Deadly infections that spring up in a distant land have a way of spreading from place to place, as has been the case with Ebola. “Disease doesn’t respect borders” is the team leader’s mantra.

Tackling fever in the Georgian countryside may have been a successful campaign, but the path is not always so straight and clear. Greiner tells of traveling to India to investigate a recent bump in Kyasanur Forest disease, a tick-borne viral hemorrhagic fever. “I went there with my mosquito netting, my water-filtration kit and my tent,” she relates. But upon arrival, her hosts said, “Oh no, you won’t need a tent. We would like you to study this other disease.” She went where she was pointed, off to a nearby university lab, and set to work.

Greiner keeps moving on the trail of disasters lurking in the underbrush. She’s been to eight countries over the past year, never yet thrown by this or that unexpected wrinkle in the plan. Next up, she tells me at midsummer, she’s returning to her old haunts in Georgia to lead a door-to-door hepatitis survey, “and then, at the end of August, I’m off to Thailand for a month.”

BRUCE MORGAN, the editor of this magazine, can be reached at bruce.morgan@tufts.edu.



From All Corners

UNIVERSITY, SCHOOL & ALUMNI NEWS

WAY TOO SHORT

To celebrate his 93rd birthday, Alvin Bixon, '47, made his first jump from an airplane high over Sebastian, Florida, on June 30. "He had always felt it would be a great adventure and wanted to try it," daughter Ronda reports. On landing, Bixon, who worked as an obstetrician/gynecologist in Malden, Massachusetts, from 1955 to 1986, said the free fall was awesome, but way too short. Asked what he planned to do for his next birthday, he laughed and responded, "Still be breathing."

A student looks through material provided by donors' families on a table set up for that purpose at the reception.



The Long Goodbye

In an emotional program, medical, dental and P.A. students honor the anatomy lab donors who taught them so much **BY BRUCE MORGAN**

THERE WAS INSTRUMENTAL music, prayer, snatches of poetry, open-hearted solo singing and a recitation by six students of names that rang like somber chimes. There were speakers whose voices cracked and others often on the verge of tears at this annual memorial service held in honor of those who had freely given their mortal remains to the gross anatomy labs at Tufts for the education of medical, dental and physician assistant students on the Boston campus. “Our hearts are filled with gratitude,” one student said quietly during the service in late spring, and by the end, everyone in the Sackler auditorium knew the feeling.

Medical school Dean Harris Berman opened the formal program by thanking the donors and their families who had made the students’ learning possible through their generosity. “For the families,” he observed, “we hope this brings closure to their losses.” A moment later, Henry Klapholz, dean of clinical affairs at the medical school, noted that the donors’ gift of

their bodies was more than a one-time gift. Through their improved understanding of anatomy, the students would later extend the gift to their patients—and thus the wider world. Along these lines, Paul Kwan, course director for dental gross anatomy, had done some back-of-the-envelope calculations. Using 450 students as this year’s total number of anatomy-class participants—200 medical, 200 dental, plus 50 physician-assistant students—he estimated that hypothetically as many as 1.4 million patients stood to benefit from the gift over the course of the recipients’ careers.



Above: Dorothy Buccieri of Watertown, Massachusetts, daughter of Angela Barbato, pauses at the reception. Right: first-year dental student Chelsea Johnston greets Mary R. Thomas of Hingham, Massachusetts.



Jessie Paull, '15, understood the donors' bequest intimately. Her grandfather, Nason Burden, '42, had become an orthopedic surgeon because of his experience in the anatomy lab, she reported, and went on to enjoy a 69-year career in medicine. "His passion for surgery began here at Tufts," she said. Paull's father, David Paull, '78, caught the same passion; he has been a cardiovascular surgeon for the past few decades. Now came Jessie's turn. This summer she began her training as a general surgeon at Walter Reed Medical Center in Bethesda, Maryland.

At the close of the formal program, after Emily Mackey, '18, and her friend Cooper Lloyd had played a lilting duet of "Appalachian Waltz" on their twin violins, the hundreds of people gathered recessed to the second floor of Sackler for an informal lunch. This gave a chance for white-coated students to interact with the friends and family members of the donors, who sat nibbling pasta at

tables in several adjacent rooms.

The mood was settled and appreciative. Many guests called the day's event "inspirational." "I had no idea what to expect, and I was very impressed," one woman volunteered. Another guest commented on the unexpectedly high quality of the music he had heard, noting, "I think Berklee [College of Music] might have some competition."

Joe Maddux, a balding, middle-aged man who had been a close friend of a donor named Fred—the two men had played together in a bluegrass band for many years—took some credit for his friend's generosity. "I'm a chiropractor," Maddux explained, "and I told Fred about my experience in anatomy. I think that stuck in his head." The day before he died, Fred took off his oxygen mask and said, "How about Tufts?"

Maddux drew comfort from his friend's example, whose value had only been underscored by the morning ceremony. "It helps me knowing that's

what he wanted and that it benefits humanity," he said. Fred's 30-ish nephew, Billy, seated nearby, had found the Tufts program meaningful as well. "All his life he was a giving character," Billy said of his uncle, with a slow shake of his head. "He just took it one step further at the end." Billy said he now planned to follow suit and donate his own body when the time came.

The service seemed to provide the kind of closure that Berman had spoken of. Jeffrey Clemens's mother, who died of cancer in early January at age 71, had arranged in advance for her body's prompt disposition to Tufts. "She set it all up, and took care of everything," Clemens remarked "which meant that the night she passed, they took her body."

This abruptness at the end, and the immediate removal of his mother's body, had left a kind of emotional emptiness in him—an unfinished feeling, Clemens suggested, before adding, "Today was the first day that felt like there was peace."

POISED AND READY

In a time of rapid change, graduates are told they will succeed by tapping into what they know

THE DAY HELD promise, as always. “You can shape the health-care models of the future,” Harris Berman, medical school dean, told the 206 graduates at the 123rd commencement ceremonies for the School of Medicine and the 35th for the Sackler School of Graduate Biomedical Sciences.

The country is still adjusting to the new world created by national health reform and by constrained resources resulting from the recent recession and changing priorities in Washington, Berman observed at the ceremony on May 17.

“Those of you graduates who will practice medicine are likely to practice under new organizational models,” he pointed out. “You will have the opportunity to help figure out how to do more with less and more

importantly how to make the world’s costliest health-care system more efficient while preserving quality care for patients.”

He reminded the graduates that no matter how the health-care system evolves, they chose a career in medicine “to do good, to help people and to share their compassion. Patients will trust you, will confide in you, seek caring and solace and advice from you. Your compassion and caring will indeed make a difference. That is the ultimate reward.”

Sackler graduates face equal challenges in pursuing new treatments and cures at a time when there is less federal funding for research, said Sackler School Dean Naomi Rosenberg. She assured the graduates they will succeed if they channel their “fire of

curiosity and their need to know and understand.”

Funding is tight, but opportunities are vast in a time of unprecedented research breakthroughs, Rosenberg said. And Sackler School graduates are poised to continue this momentum.

“You each have found at least one, and generally more than one thing that no one else in the world knew before you actually figured it out here,” she said. “That’s not an easy thing to do, but you’ve all done it.”

Staying optimistic in the face of an uncertain future was also the advice of medical class president Courtney Harris, who reminded the future doctors they had been taught to keep attention, curiosity and compassion in the pockets of their white coats so they would always be ready to care for the patient and not just the disease. “Don’t become jaded... believe in the power of change,” she told her classmates.

Addressing her fellow Sackler students, Stephanie Gilley noted that the many opportunities before them also come with great responsibility. “We have trained to become experts in our field, and now we must be those experts,” Gilley said.

The first degree awarded at the ceremony was a posthumous one, to Mohamed (“Moe”) Zeidan, a fourth-year medical student who was killed in a bicycle accident in Medford, Massachusetts, on Sept. 5, 2014. He was 29 and greatly admired by faculty and students, Berman said. The audience gave a standing ovation.

“You all are poised to have wonderful careers doing good,” Berman said to the graduates. “Go do it.” —GAIL BAMBRICK



Lauren Rissman gives a hug to Karen Axten, '15



New Channel

A website is born for the community of almost-doctors

FOR THE MOST part, medical students are drowning in information; it comes with the territory. You could say that this naturally overwhelmed state of affairs supplied the starting point for Rohan Jotwani, M.D./M.B.A. '17, two years ago when he set about cofounding the “(Almost) Doctor’s Channel,” a collegial, relaxed-feeling website for anyone pursuing—or interested in pursuing—a medical career.

“If you spend all day looking at textbooks, you want the exact opposite of that in a website to put your mind at ease,” says Jotwani. He took what he calls “a minimalist approach” in designing the site, working to create an appealing mix of serious and light-hearted content ranging from discussions of recent research findings and health policy to tips on dating while in school or occasional restaurant reviews.

Everything here is bite-sized, perfect for a quick snack between classes and intense, sustained bouts of studying.

The site has drawn its share of laurels, most notably the Web Health Award’s bronze medal for Best Media Site for Health-care Professionals in 2014. Given that others vying for the award included such well-established venues as WebMD or Stanford Medicine, Jotwani’s channel is clearly punching above its weight.

Who visits the (Almost) Doctor’s Channel? The answer is medical students, of course, but also residents and college students, premed or otherwise, who may be considering the white-coated life. “There are those who are trying to figure out what it means to be a doctor, and we consider that audience just as legitimate,” says Jotwani, who serves as the site’s managing editor. Typical entries may address physician burnout, or what difference it makes where you take your residency, or the larger question of how a career in medicine shapes your life—topics largely ignored by conventional media.

Jotwani has earned his digital stripes. After graduating from Columbia University, he spent a year as a producer at the Doctor’s Channel in New York City, exploring ways of connecting online with that site’s more established, somewhat older medical audience. Then, a few months after landing at Tufts in the fall of 2013, he was one of the lead organizers of MedStart, a group that fosters innovation and collaboration between the medical and high-tech communities.

Last winter, in its third annual hackathon, MedStart drew more than 120 participants to the Boston campus.

It’s all of a piece, in his view. “My goal is to create platforms for medical students that fit within our lifestyle and reflect spaces that we’re already a part of,” Jotwani says. “That’s going to be important because as a generation, that’s where we live.”



Like Minds

Animal behavior research holds promise for better detection and treatment of compulsive disorders in people

IN 2011, SCIENCE threw a curve ball at Nicholas Dodman, head of the Behavior Clinic at the veterinary school at Tufts, and his colleague Alice Moon-Fanelli. The researchers were looking at bull terriers in hopes of finding the gene responsible for a debilitating behavior common in the breed. Up to 85 percent of any litter will compulsively chase their tails, sometimes to

the point of savaging themselves or anyone who tries to interrupt them.

A statistical analysis of data, including sex, medical history and other behaviors found in 145 affected bull terriers and 188 “control” pets revealed some surprises. The vast majority of affected dogs were males, and many had other strange behaviors or physical conditions that accompanied the tail chasing, such

as explosive aggression, partial seizures, phobias, skin conditions, gastrointestinal issues, object fixation and a tendency to shy away from people and other dogs.

“How could we possibly explain this?” Dodman recalls, before he realized there were similarities between these canine behaviors and autism in people. “The primary behavioral expression of autism in humans is that a child is slow to develop speech and other social behaviors,” he says. “But if you weren’t able to factor speech into the equation, you may still observe repetitive behaviors like spinning, rocking or flapping hands, temper outbursts and sometimes seizures. Affected bull terriers show many of these behaviors.”

Indeed, when Dodman, Moon-Fanelli and researchers from the Sackler School of Graduate Biomedical Sciences looked for biological similarities between the tail-chasing bull terriers and children diagnosed with autism, they found significantly elevated levels of two biomarkers in the children and the dogs. Their findings were published in *Translational Psychiatry* in October 2014.

QUELLING THE SKEPTICS

The notion that behavioral disorders in people and animals might share some commonalities has long met with skepticism in scientific circles. But Tufts researchers have helped move that concept from anthropomorphism to evidence-based science that has led to new treatments for people and pets—including a new patent on a drug to treat obsessive-compulsive disorder in humans.

Dodman never intended to specialize in the animal mind. However, not long after he arrived at Tufts’ veterinary school in 1981, he received a call from Louis Shuster, a pharmacologist at Tufts Medical School who was studying drug abuse.

Shuster had read a scientific paper about racehorses becoming increasingly sensitive to the stimulant effects of morphine with every dose, instead

of more tolerant of the drug as is typical in people. He had observed the same bizarre phenomenon in rodents exposed to opioids and enlisted Dodman for a study that confirmed that exposure to morphine indeed led to similar behaviors in horses.

The morphine-induced equine behaviors—endlessly pacing the stall or digging at the ground—overlapped with what equestrians call “stall vices,” says Dodman. In animals, these abnormal, seemingly pointless and sometimes self-injurious behaviors are referred to as “stereotypies.” Because stereotypies are common in horses kept stabled most of the time, Dodman wondered if that might mean the horses were “self-medicating” to cope with the stress of confinement. “I thought the abnormal behavior could be due to nature’s own morphine: the endorphins.”

Shuster agreed, and they set out to determine if a medication that blocks the body from responding to opioids and endorphins could rein in stall vices.

EUREKA POKER

They turned to Poker’s Queen Bee, a palomino mare that engaged in “cribbing,” a behavior in which horses clamp down on a stall door or fence, tense their neck muscles and repeatedly gulp air. Dodman and Shuster plotted the incidence of the mare’s cribbing before and after she was injected, first with control doses of saline and then with the opioid-blocking drug naloxone (the Narcan now used to treat heroin overdoses).

The opioid blocker worked. “We could control the horse’s behavior by controlling its brain behavior,” Dodman says. “We turned the infusion rate up, and the horse stopped cribbing. We turned it down, and it started cribbing again. It was the eureka moment that changed all our lives.”

Shuster shifted his research focus from the drugs of addiction to the behaviors of addiction. And Dodman

found a new calling: treating animal behavior problems.

After working with horses through the 1980s, Dodman and Shuster started studying dogs with stereotypies, particularly those with lick granulomas, a condition in which pets create an open wound by licking their leg repetitively. Again the duo found that drugs that blocked the body from responding to opioids lessened the repetitive behavior.

In both animals and people, repetitive behaviors often stem from anxiety, and engaging in them appears to bring some relief, says Dodman. But the relief is fleeting, and the OCD loop is on an endless repeat. While treatment for people with OCD usually involves cognitive behavioral therapy, pets’ compulsive behavior is managed by changes to their environment that will reduce stress and a class of mood-stabilizing drugs that includes Prozac.

Dodman and Shuster, now a professor emeritus, have identified a new OCD drug designed to improve the lives of animal with compulsive behaviors. When they studied opioid-blocking drugs in mice, dogs and horses, they realized that those same drugs also blocked NMDA receptors, which help the body process glutamate, a neurotransmitter that’s important for cognition, memory and learning. When they tested drugs that block glutamate, such as dextromethorphan or memantine, on compulsive behaviors, mice stopped their self-scratching, and many of the dogs showed a significant reduction in their compulsive behaviors.

The two approached Michael Jenike, head of the Obsessive Compulsive Disorders Institute at McLean Hospital in Belmont, Massachusetts, who was convinced enough to try memantine on a few of his patients who did not respond to selective serotonin reuptake inhibitors (SSRIs). After the patients reported improvements in their symptoms, the three researchers conducted a study comparing 22 people with OCD receiving

cognitive behavioral therapy with 22 OCD patients who also took memantine.

Only the memantine-takers saw significant decreases in their OCD symptoms, according to their study, published in the *Journal of Clinical Psychopharmacology* in 2013. Tufts patented memantine as a new treatment for OCD, and psychiatrists are now using it alongside SSRIs in people with better results.

Despite these outcomes, most scientists who study human psychiatric conditions, including Jenike, will not entertain the idea of too many similarities between a behavior disorder in humans, a species that has landed on the moon, and one in dogs, a species known to sneak snacks from unguarded litterboxes. “I have a hard time with the concept of a dog biting on his leg and calling it OCD,” Jenike told *Science* magazine in 2010. “With OCD, you need to know what’s going on in the head. It’s kind of a big leap for me.”

Nonetheless, pets—particularly purebred dogs and their very similar DNA blueprints—could play an important role in understanding which genes influence the brain and thus modify behavior in animals with compulsive tendencies. “It’s become very clear over the past decade that although we have amazing new genomic and genetic tools, it’s still very difficult to find disease genes [in humans] for many neuropsychiatric disorders, particularly those associated with behavioral differences such as what we observe in autism,” says Matthew Huentelman, an associate professor in the Neurogenomics Division of the Translational Genomics Research Institute in Arizona. “So while we aren’t stopping our work in human beings, working in purebred animals should dramatically simplify things for us on the genetics side.” —GENEVIEVE RAJEWSKI



This story first appeared in the Summer 2015 issue of *Cummings Veterinary Medicine* magazine. The author can be reached at genevieve.rajewski@tufts.edu.

HIS LAUREL CROWN

Michael Jaharis awarded honorary degree for lifetime of leadership, service

GREAT THINGS OFTEN start from a simple place. Over his lifetime, Michael Jaharis Jr., M87P, has made himself into a model of how to offer time, energy and intelligence in pursuit of a better world. In one way he is expressing the generous-hearted nature of his father, who landed in Boston as a penniless Greek immigrant in 1908. Cherishing faith, family, education and hard work, the man known affectionately within the family as “Papou” set about to rise and prosper. The seed was planted. The son took his father’s example to heart and built on its abiding spirit to achieve

even greater things for the betterment of human health and intellectual and spiritual well-being.

To recognize Jaharis’s commitment to service, which has included leadership at Tufts, the university awarded him an honorary Doctor of Public Service degree in at Commencement ceremonies in May.

Jaharis was born in Chicago in 1928. He earned his bachelor’s degree from Carroll College, now Carroll University, in Waukesha, Wisconsin, and then went on to earn his law degree from Chicago’s DePaul

University at night while working days as a pharmaceutical salesman for Miles Laboratories. He had found his calling. From 1961 to 1972, he worked for Miles as vice president and director of the Ethical Drug Division. In 1972, he became president and CEO of Key Pharmaceuticals, where he led the development of such products as Theo-Dur, the nation’s best-selling asthma remedy, and the Nitro-Dur nitroglycerine patch, the first major advance in the delivery of medicine through the skin.

Jaharis has been called a “pharmaceutical maverick” for his ability to recognize and pursue opportunities in the field that others have missed. In 1988, he founded Kos Pharmaceuticals Inc., a company named for the Greek island where the legendary physician Hippocrates was born. At Kos, he directed his team to produce a family of drugs sold under the names of Niaspan, Advicor and Simcor. These were potent, patient-friendly medicines designed to raise HDL, the “good” cholesterol. They proved wildly successful and improved the health of millions.

The importance of education in the family prompted Jaharis to assume a leadership role in the governance of Tufts. He served as a university trustee from 1993 to 2003, and is now a trustee emeritus. He was a longtime chair of the Board of Advisors to Tufts University School of Medicine and the Sackler School of Graduate Biomedical Sciences; he stepped down from that role last spring.



Steven Jaharis, M87, foreground, with his father, Michael, shortly before the dedication of the Jaharis Family Center for Biomedical and Nutrition Sciences on the Boston campus in 2002.

The generosity of the Jaharis Family Foundation, which includes Jaharis's wife, Mary, and their two children, Steven Jaharis, M87, and Kathryn, has utterly transformed Tufts' health sciences campus. Highlights include the foundation's cornerstone gift toward the building of the Jaharis Family Center for Biomedical and Nutrition Sciences, designed to expand research space and foster collaboration among faculty members in medicine, biomedical research and nutrition science; the dramatic renovation of the Sackler building, providing a more inviting and engaging home base for medical students; and the creation of the Clinical Skills and Medical Simulation Center, which enables students to gain critically important aptitude in physical diagnosis. The foundation also endowed the Jaharis Family Chair in Family Medicine in recognition of the importance of physicians who deliver the care that promotes the well-being of entire communities.

Jaharis's drive to improve the world extends far beyond Boston. In recent decades he has been one of the nation's leading supporters of Greek-American

causes, whether religious, cultural or secular. The family foundation has endowed permanent exhibitions of Greek and Byzantine art at the New York Metropolitan Museum of Art and at the Art Institute of Chicago. In 2013, the foundation endowed the Archbishop Demetrios Chair in Orthodox Theology and Culture at Fordham University. That same year, the Jaharis Family Foundation pledged \$2 million toward hunger and poverty relief in Greece.

Jaharis, now director of Arisaph Pharmaceuticals Inc., a company he cofounded, has also been intimately involved with the Greek Orthodox Church for many years. As vice chair of the Greek Orthodox Archdiocese of America, he has most recently volunteered his time in the effort to see New York City's St. Nicholas Greek Orthodox Church, the sole church destroyed in the 9/11 attacks at Ground Zero, rebuilt near its original site. "When finished," Jaharis told a church council in 2012, the new structure will provide "a shining spotlight on the Greek Orthodox faith and our core values of love, respect, peace, healing and forgiveness." —BRUCE MORGAN

LEADING THE WAY

After years of service to the university, Robert I. Tepper



has stepped into a greater leadership role. Last spring, he became the new chair of the

Board of Advisors to Tufts University School of Medicine and the Sackler School of Graduate Biomedical Sciences, assuming the reins from longtime chair Michael Jaharis Jr., M87P (see related story, facing page).

Tepper has served on the board of advisors for more than a decade. He is a cofounder of Third Rock Ventures, a Boston venture capital firm that invests in pharmaceutical and biotech companies. He also serves as an adjunct faculty member at Harvard Medical School and Massachusetts General Hospital.

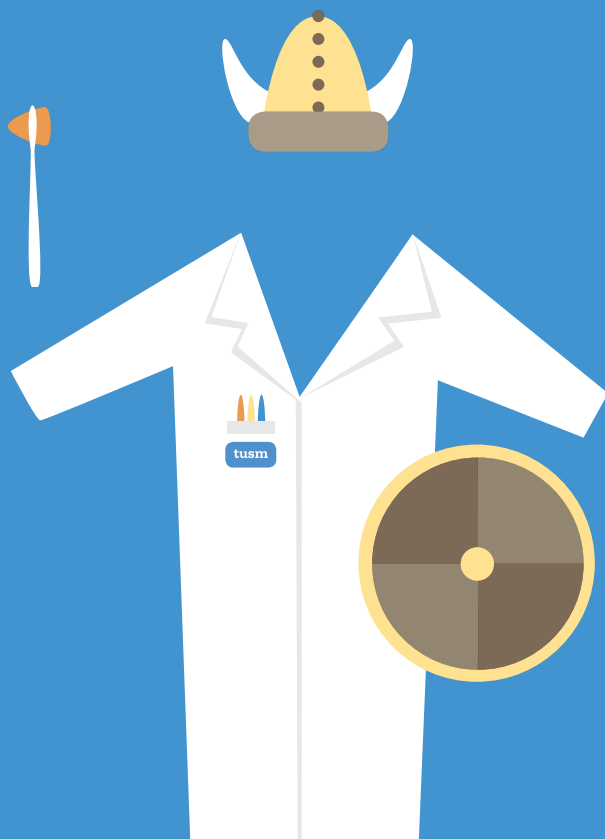
Although Tepper earned his bachelor's degree from Princeton University and his M.D. from Harvard Medical School, he has family ties to Tufts. His wife is M. Lynn Buttolph, J74, a psychiatrist.

Tepper and the other founders of Third Rock Ventures were honored by Tufts Medical Center earlier this year with the Ellen M. Zane Award for Visionary Leadership. The honor recognized their work in helping to develop such products as new gene therapies and cancer drugs.

why do we forget?
ever wonder?
Tufts psychologist Ayanna Thomas answers the question at everwonder.tufts.edu.

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April 8 — 10, 2016

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MOVING TOWARD THE SOURCE

When Ellie Anbinder found out she had breast cancer, she wanted to know why. Gail Sonenshein and Charlotte Kuperwasser also want to understand why Anbinder, and thousands of women like her with no family history, develop breast cancer.

Thanks to a grant from Anbinder's foundation, Sonenshein and Kuperwasser, a professor and associate professor, respectively, in the Department of Developmental, Molecular and Chemical Biology at Tufts School of Medicine, are working with a team to determine why the rate of breast cancer in the United States has risen so dramatically.

"You can ascribe 10 to 15 percent of cases of breast cancer to genetic causes," says Sonenshein. When it comes to the other 85 to 90 percent, "there clearly seem to be environmental factors at work."

After her diagnosis and treatment, Anbinder co-founded the Art beCAUSE Breast Cancer Foundation to fund research on environmental factors. With a grant from the nonprofit foundation, a group of researchers at Tufts and Boston University looks at how certain chemicals in the environment play a role.



Ellie Anbinder, a breast cancer survivor, is on a quest to understand the disease.

ALUMNI ASSOCIATION PRESIDENT

A TRADITION OF CARE



YOU AND I come from a long, proud tradition. In the 1920s, the Boston Dispensary, forerunner to Tufts Medical Center, was providing medical care in several neighborhood clinics, as well as maintaining the nation's first lung clinic and the first venereal disease clinic, among other distinctions. Tufts School of Medicine had survived the Flexner Report commentary on the state of American medical education in the early 1900s, but still did not have its own hospital. A new leader was needed to consolidate these centers of medical activity, and Joseph Pratt agreed to become chair of medicine at Tufts and the Boston Dispensary in 1927.

Pratt had always been concerned for the less privileged. For example, he arranged for tents to be constructed on the rooftops of tenements to simulate conditions the more affluent were receiving at spas to treat tuberculosis. Pratt once said, "Never forget that patients are persons. There is too much tendency to overlook this... you cannot treat your patient without considering his emotional life, all his surroundings—everything that bears on his life either as a well or a sick person."

Here at Tufts we carry on the example of Joseph Pratt by instilling his spirit in our medical students, offering them opportunities to serve the less fortunate among us.

Our student-run clinic, Sharewood, remains a successful enterprise where uninsured people can receive free health care. "Stepping Out of the Shadows" is a program where medical students provide HIV education to Boston high school students. The IDEAS in Medicine program sponsors medical students who mentor students at Chelsea High School who are interested in health careers. In addition, the medical school is now recruiting facilitators for a new course in ethics and professionalism. These are some of the activities that are funded through your annual Alumni Association dues. You can pay them online at giving.tufts.edu/med (click on Alumni Association in the drop-down menu for "Select an Area"). Or mail a check, payable to Trustees of Tufts University, to Tufts Medical Alumni Association, 136 Harrison Ave., Boston, MA 02111.

Please consider participating in these programs, and give what you can to the annual fund but first of all, remember to pay your dues. If each alum paid his or her, dues, we would have more than \$1 million—enough to fund many more projects for students and make a difference in many more lives.

THOMAS R. HEDGES, '75
President, Tufts Medical Alumni Association
thedges@tuftsmedicalcenter.org

Class Notes

1964

JACK ALPERT of Houston, Texas, has cut back a bit on his responsibilities as a professor of neurology at the UT Health Sciences Center in Houston. His new title is clinical professor of neurology, and he reports he works about three-quarters time these days. In 2011 Alpert published *The Neurologic Diagnosis: A Practical Bedside Approach*, which the author says is now being translated into Mandarin for wider application.

1968

Since leaving the practice of medicine, **STEVEN SOMKIN** of New York City has written nine full-length

and four one-act plays. His work has been produced off-Broadway, and has had many readings in a variety of venues in New York City and regionally; two of his plays have won national awards.

1972

RICHARD ALEXANDER of Marblehead, Massachusetts, retired this summer after a 39-year career as a primary-care physician at North Shore Medical Center. "You can look at my decision to remain on the North Shore and spend my entire career in one location as extraordinary or boring," he jokingly told a local newspaper. "Retiring was a

hard decision, but I have been honored to be able to care for people for almost 40 years." He intends to spend more time with his wife, children and grandchildren as well as traveling, he reports.

1976

ROBERT SCHAAF of Raleigh, North Carolina, who had served as president and managing partner of Wake Radiology for 27 years, was presented with the Order of the Long Leaf Pine at a ceremony this past April in recognition of his distinguished medical career. The Order of the Long Leaf Pine is an award established in 1963 by Gov. Terry Sanford to honor those who have demonstrated a lifetime of service to the people of North Carolina. A board-certified radiologist, SchAAF is president of the North Carolina Medical Society.

1979

FRANCISCO FERNANDEZ of Tampa, Florida, has been named president of the American College of Psychiatrists, an honorary association based in Chicago. He was formerly founding dean and vice president of medical affairs for the University of Texas Rio Grande Valley School of Medicine.

1981

JOHN K. ERBAN of Wakefield, Massachusetts, clinical director at the Tufts Cancer Center and the medical editor of this magazine, was honored by the Silent Spring Institute for his contributions to cancer research at a reception and

dinner on October 20 in Cambridge, Massachusetts. For nearly two decades, Erban has served as a member of the board of directors of the organization known for its pioneering environmental research, both locally and in collaboration with others throughout the U.S. The occasion featured guest speaker Siddhartha Mukherjee, Pulitzer-Prize-winning author of *The Emperor of All Maladies: A Biography of Cancer*. Enid Shapiro, social worker and community leader, was also honored at the event.

1987

RICHARD DUTTON of Columbia, Maryland, widely recognized as a leader in the field of anesthesia quality, has been named chief quality officer at U.S. Anesthesia Partners, a physician services organization with more than 1,800 anesthesia providers based in Florida, Texas and Colorado.

1999

ADAM WALSH, M.D./M.B.A., of Millbrae, California, has been named managing director and senior analyst covering the biotechnology/health-care sector at Stifel, an industry analyst firm based in St. Louis, Missouri. Walsh will be based in the firm's Boston office.

2001

RAHUL SHARMA, M.D./M.B.A., of New York City has won the New York Presbyterian-Weill Cornell Medical Center Patient Centered Care Physician Champion Award,

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given to one doctor each year who provides outstanding leadership and who inspires members of his or her team to provide excellent, compassionate and responsible care for patients and their families. Sharma is executive vice chief of the Division of Emergency Medicine and medical director of Strategic Initiatives and Making Care Better for NYP/Weill Cornell.

2003

JEFFREY LAZAR of Harlem, New York, was recently appointed medical director and vice chair of the Department of Emergency Medicine at St. Barnabas Hospital in the Bronx, a busy inner-city academic emergency department serving more than 90,000 patients a year. He has also been named a TEDMED Research Scholar. Away from the hospital, he can be found growing the rare *Amorphophallus* (also known as the corpse flower), practicing his fly-fishing cast in the Harlem Meer or hiking in the Hudson Valley.

2007

MAISHA ROBINSON of Los Angeles, was quoted recently in the *New Tri-State Defender*, a Tennessee newspaper, by former Memphis resident Kalimah Abioto, who was seeking African-American doctors after he and his family moved to Portland, Oregon. "Coming from a city where having a black doctor seemed the norm, I couldn't understand why I wasn't seeing black medical doctors, nurses, naturopaths and health workers," he wrote, before noting that fewer than 4 percent of U.S. doctors are of African-American descent. "Starting out in Inglewood, California, I was introduced to fellow Memphian Maisha Robinson, an

African-American neurologist, palliative medicine physician and teaching fellow at UCLA," he continued. "Buoyed by a family and a community of African-American doctors, Robinson was surrounded by mentors who encouraged and provided a vision of possibility that she too could one day be a doctor."

MY "LAST GIFT" TO TUFTS MEDICINE



Fifty-seven years ago, in 1958, after obtaining my undergraduate and master's degrees from Tufts, I graduated from Tufts University School of Medicine. Yes, I am a "triple Jumbo." My wife, Elaine, and I have been staunch supporters of Tufts University and the medical school ever since we lived together in an apartment on Harrison Avenue while I was a student there.

Many alumni have also expressed gratitude to the medical school through donations to the annual fund, scholarships, faculty and facilities and have put the medical school in their wills. For me, such gifts are the right way to say thank you for the good fortune I have enjoyed because I went to Tufts School of Medicine. Whatever I am or have today is partly due to what I learned from the people there.

I am hopeful that all medical school alumni have already or plan to share some of their good fortune similarly. We want to say, Thank you, Tufts! Here's my donation to help you continue to generate talented, well-educated medical professionals everywhere. Some of us have not yet donated for fear of not leaving enough resources for our families. That's understandable. However, these same alumni love Tufts and wish they could do more for the school. Well, there is a painless way to do so.

Plan to have memorial donations benefit your alma mater by adding a few words in your obituary. Instead of flowers, have donations support medical education at Tufts. Let your family know right now that they and your friends will best honor you with a donation to the school that you love. I asked our Development Office what words they suggest we use in an obituary. They suggest:

"In lieu of flowers, [Your First Name] and [his/her] family ask that memorial contributions, payable to Trustees of Tufts University, be sent to Tufts University School of Medicine, Development Office, 136 Harrison Avenue, Boston, MA 02111. Or, you may give online at giving.tufts.edu/med or by calling 617.636.6770."

In my case, I have asked my family to say in my obituary: "In lieu of flowers, Bill and his family ask that memorial contributions be made to the M58 Endowed Scholarship Fund. Send checks, payable to Trustees of Tufts University, to Tufts University School of Medicine, Development Office, 136 Harrison Avenue, Boston, MA 02111. Or, you may give online at giving.tufts.edu/med or by calling 617.636-6770."

Please join me in finding a way to say thank you to Tufts School of Medicine as one of our last gifts to this great school. Our legacies will live on through new generations of medical professionals who continue to benefit from a superb Tufts medical education. My thanks and good blessings to you all! –WILLIAM M. MCDERMOTT, A53, G54, M58, A84P

2011

LORETTA STEIN of San Diego, California, a lieutenant in the U.S. Navy, writes to say she will complete her ophthalmology residency at the Naval Medical Center in San Diego this year, and her next duty station will be at Naval Hospital Yokosuka outside Tokyo, Japan. There she will be the

only military ophthalmologist serving active-duty personnel, dependents and retired personnel.



LET US HEAR FROM YOU.

Email your news to

medicine-alumni@tufts.edu or send to
Tufts Medical Alumni Relations, 136
Harrison Ave., Boston, MA 02111.

In Memoriam

FRANKLYN BOUSQUET, '47, of Savannah, Georgia, died on April 17, 2015, at age 91. He had been an eye surgeon in Savannah for many years. He was an officer in the U.S. Navy from 1941 through the Korea War, serving as a medical officer aboard a naval ship as well as on the ground. He remained in the Naval Reserve until the late 1950s. A member of the Alliance Francaise, he was active in many civic and social organizations in Savannah. He is survived by four children and five grandchildren.

FRANCIS LOMBARDO, '53, of Winchester, Massachusetts, died on June 18, 2015, at age 86. He spent two years in the U.S. Navy at Quonset Point, Rhode Island, and practiced as an obstetrician/gynecologist in the Burlington, Winchester and Woburn, Massachusetts, area for 37 years before his retirement. A pioneer in the development of improved prenatal care and birthing classes, Lombardo delivered more than 8,000 babies. He was an active member of St. Eulalia's Church in Winchester and was honored for his volunteer efforts. He is survived by four children, six grandchildren and three great-grandchildren.

JACK MATLOFF, '58, of Los Angeles, an innovative heart surgeon and educator, died on August 20, 2015, at age 82. He had joined Cedars-Sinai Medical Center in Los Angeles in 1969 and was the founding chairman of its cardiothoracic surgery department.

"He was a first-class cardiac surgeon," said Toby Cosgrove, CEO and president of the Cleveland Clinic. "He went to Cedars and propelled it into one of the major cardiac centers on the West Coast." Over his career, Matloff performed more than 4,000 heart operations, including bypass surgeries for such Hollywood notables as James Garner, Milton Berle and Rock Hudson. He is survived by his wife, Martha, a daughter and six grandchildren.

RITA FAULISO, '60, of Seabrook Beach, New Hampshire, died on May 2, 2015, at age 80. She was an anesthesiologist on staff at Massachusetts General Hospital and later chief of anesthesiology at veterans hospitals in Newington and Rocky Hill, Connecticut. She taught at Harvard Medical School and the University of Connecticut School of Medicine. In her spare time, she was an avid horseback rider and traveled to horse shows around the U.S. and Canada. She is survived by two daughters and two grandchildren.

PETER BARRETT, '68, of Hingham, Massachusetts, a radiologist who practiced at Quincy Hospital and later was a clinical professor of radiology at New England Medical Center and the medical school, died on May 1, 2015, at age 72. He served in the U.S. Navy Reserve, eventually rising to the rank of commander. He founded a successful business that worked nationally evaluating cases of respiratory disease for the U.S.

government and for private clients. He was also known for his many contributions to charity, including the College of the Holy Cross, the Catholic Schools Foundation and the ALS Association. He is survived by two sons and six grandchildren.

HUBERT DERBY, '75, of Evergreen, Colorado, died on April 23, 2015, at age 67. He was director of the emergency department at Philadelphia's Misericordia Hospital in the 1980s and later worked as a specialist in emergency medicine throughout the greater Philadelphia area. Derby retired in 2014. He was physically active, having run the Boston Marathon five times, logged 120 sky dives and hiked the Appalachian Trail. He is survived by his wife, Patricia, two daughters and a son.

CHARLES RUBIN, '79, of La Grange, Illinois, a pediatric cancer specialist at the University of Chicago Medicine, died of heart failure while at work on July 17, 2015; he was 62. He was a respected authority on all aspects of pediatric cancers, with a particular interest in brain tumors and cancer occurring in children with genetic syndromes. He is survived by his wife, Gretchen, and four daughters, including **LUCY RUBIN, '18**.

LAURA FIXMAN, '88, of Barrington, Rhode Island, died on April 1, 2015, at age 54. She was a family psychiatrist with Family Associates of Warwick and Angel Street Psychiatry of Providence, both

in Rhode Island, for many years. She was a former captain in the U.S. Army Reserve and a member of the Rhode Island Psychiatric Society. She is survived by her husband, Kenath.

Faculty

MURRAY FEINGOLD of Bourne, Massachusetts, TV reporter and long-time professor of pediatrics, died July 17, 2015, at age 84. He was a pioneer in health journalism as well as in pediatrics and genetics. He was physician-in-chief at the Feingold Center for Children in Waltham, where he personally cared for thousands of patients. He is survived by his wife, Lorinda, three children and six grandchildren.

JOHN MCGOVERN, '53, of Eastham, Massachusetts, clinical professor of pathology, died on April 2, 2015, at age 89. His college career at Holy Cross was interrupted by service as a World War II Army medic in France and Germany. Following his medical training, he was appointed chief of pathology at Leonard Morse Hospital in Natick, Massachusetts, a position he held for more than a generation. He was active in the Massachusetts Medical Society, serving a term as president. He was also a long-term member of the Orleans Yacht Club, earning honorary status in his 50th year of membership. He is survived by Anna, his wife of 60 years, five children and six grandchildren.



“Charitable remainder trusts provide a great way to make an impact on the school’s future.”

Twenty years ago **Gilbert Shapiro, M57, J83P**, sought a way to make a donation to Tufts that would allow him to invest in the medical school’s future as well as his own. He and his wife, **Frima, J83P**, set up a charitable remainder trust at TUSM that will support the Shapiro Scholarship Fund and help “provide an opportunity for deserving students interested in medicine to pursue their dreams.”

In addition to his forward-thinking gift, Dr. Shapiro, an orthopedic surgeon practicing in New Bedford, Massachusetts, makes annual gifts to the school. He also donates his time to his local medical community. He is the former chair of Southcoast Health System and former chair and current executive committee member of the New England Orthopedic Society. The highlight of his career, he says, has been volunteering with Project HOPE and Help Volunteer Overseas, organizations that train doctors and provide patient care in countries such as Brazil, Bhutan, and Peru.

To learn how you and Tufts can benefit from a charitable remainder trust, contact the Tufts Gift Planning Office: 888.748.8387 | giftplanning@tufts.edu | www.tufts.edu/giftplanning

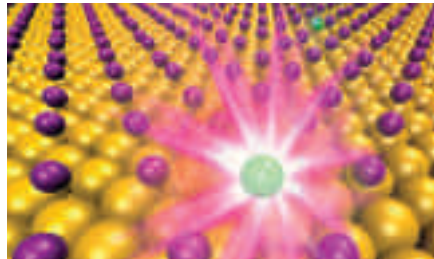


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7 Tanning beds



9 Atomic blast



14 Lone crusader



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