BROWN MEDICINE

Volume 23 | Number 2 | Spring 2017

PLUS:

Cracking the Code

Biomedical informatics unlocks data to transform health care.

LETTER FROM THE DEAN

Taking Action

In this issue of *Brown Medicine*, you'll read about the Warren Alpert Medical School's newly adopted Diversity and Inclusion Action Plan (DIAP). Our faculty, students, residents, and staff have worked very hard on developing this plan during the past year, and we are pleased to share it with the broader medical community.

Any type of action plan such as this needs the complete support of an institution's leadership in order to be successful. We have seen this exemplified by President Christina Paxson and Provost Richard Locke at the University level as *Pathways to Diversity and Inclusion: An Action Plan for Brown* was developed and implemented. As you will read in the article, the Medical School's DIAP was formulated with input from representatives of our community, and my associate deans and I wholeheartedly support it. We will work to facilitate the initiatives put forth in this plan, and hold ourselves accountable for their implementation.

The DIAP is comprehensive, outlining steps that will impact faculty, residents and fellows, and students. It goes beyond just increasing the number of individuals from groups underrepresented in medicine in our faculty ranks and student cohorts, and it encompasses all forms of diversity, including sexual and gender identity, socioeconomic status, and political point of view. We want the culture at Warren Alpert Medical School to be one where all members of our community feel respected and valued.

All of us can benefit from exposure to varying viewpoints and experiences different from our own. In medicine, we are charged with caring for an infinitely diverse array of patients. Learning and working with individuals from a similarly diverse array of backgrounds will help us provide more appropriate care to all patients.

Sincerely,

Jack A. Elias M.D.

Jack A. Elias, MD
Senior Vice President for Health Affairs
Dean of Medicine and Biological Sciences

SCOTT KINGSLEY

20


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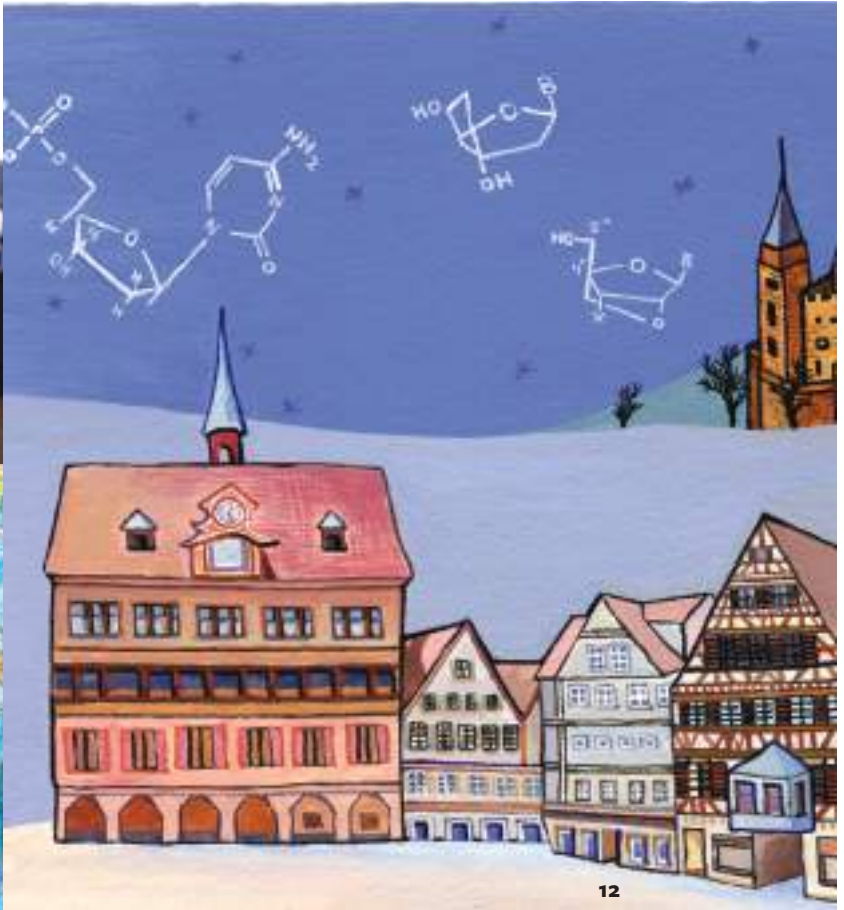
12

FEATURES

"It comes as a rude shock to find we're spending our days in front of a computer screen."

—Betsy Toll, MD, page 38

DEPARTMENTS

COVER

Illustration by Christopher Brand

AL WEEMS; JESSICA DEANE ROSNER; ©2011 TOM MURPHY

LETTER FROM THE EDITOR

We're Watching You

Me: I love this electronic health record! All of my information is in one place.

Also me: Why doesn't my doctor ever look up from the screen?

Writing this issue's feature on electronic health records made me think back on physician behavior around technology that I have observed. There's my allergist, who only asks questions prompted by the EHR and types away the whole time I'm answering. There's the orthopedist who breezes in the room, shows me the relevant images on a screen, and then whisks away in a practice that I know boasts about its efficient patient visits. I assume his total lack of charting means he dictates notes that some unseen transcriptionist will put into the record later.

The one who gets it most close to correct is my children's pediatrician. She sets her laptop down and after a quick hello, glances over the computer screen to look at the problem list or touch base on vaccinations or screenings that are needed. Then she shuts the laptop and we have her full attention for the exam and discussion. Then she's back at the screen checking off lists and typing notes. This is the imperfect portion of the visit, where I sit there awkwardly, unsure of the correct etiquette. Is it acceptable to chat with the kids? Check my phone? What are patients supposed to do during the typing time?

I found few solutions in talking with faculty and other stakeholders who are experiencing the pleasure and the pain of EHRs. I hate to imagine any of the doctors in my life charting at home, taking time from people or activities they love. In this imperfect system where clunky technology, external regulations, and diversified insurers make the EHR agonizing, physicians have no choice but to find their own style for getting the work done.

But as you do that, know that your patients are observing you. They want your undivided time and attention. Whatever style you adopt, look at it from your patient's angle. You don't want to see the back of your own head.

Kris Cambra

BROWN MEDICINE

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STUDENTS

CALL TO ACTION: Warren Alpert medical students, including Natasha Kumar MD'17, right, gather to support the ACA at a forum in January.

DAVID DELPOIO (2)

Speak Out

The ACA repeal effort inspires medical student activism.

As Congressional Republicans made their first attempt to dismantle the Affordable Care Act in January, a group of Warren Alpert medical students organized a Health Justice Forum to voice their support for the legislation.

Jonathan Staloff '14 ScM'19 MD'19 spoke at the event about a taxi driver he had seen at a free health screening. "When I pricked his finger, he smiled, and told me that one day his then-12-year-old son would be sitting in my chair, on the path to becoming a doctor," he said. "I was so flattered I nearly failed to notice that the glucometer read 453 mg/dl."

Staloff said when he asked the patient which doctor was helping him manage his diabetes, he learned the "true underlying condition: he was uninsured, and had no doctor to treat him." Staloff referred him to Clínica Esperanza, and a year later, he had received medical care through the expanded Medicaid program under the ACA. It's patients like these, Staloff said, that inspired him to speak out against repeal.

Matthew Perry ScM'19 MD'19 spoke about his work with an organization that provides health services to young people living with HIV. "For the first time in this disease's history, our system has the capacity to care for people with HIV, regardless of income status, to the degree that the weight on their backs is lighter," Perry said. He worried that ACA repeal would put that progress in jeopardy.

Concern about patients losing their insurance has inspired a wave of med student activism across the US, says Natasha Kumar MD'17, who helped organize the forum as well as an effort to urge the Medical School leadership to speak out in support of the ACA.

"Physicians have always been a neutral counterpart in any political proceedings," Kumar says. "That's been shifting a lot in recent years, particularly since the [2016] election."

The ACA, she says, has been integral to the way students view and administer patient care. "We truly are the Obamacare generation," she says. "My class in particular started college when the ACA was first introduced. This is the framework of our understanding of medicine."

As Washington grapples with health care reform, medical students will continue to advocate for their patients, Kumar says. "Who we are as a generation of physicians leads us to see the white coat differently than many of our predecessors, leading us to be more vocal," she says. "This is all part of a bigger picture around issues like gender, like race—a whole host of things that drive inequality in our country that we're starting to speak up about."

—Aneeqah Naeem '20 MD'24

THE BEAT

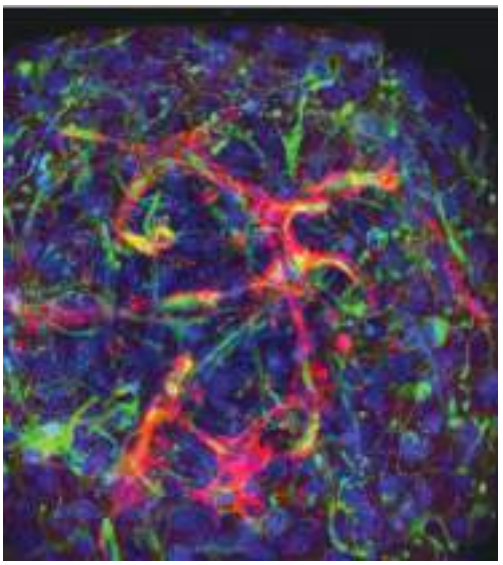
COOL TOOL

Grow a Brain

Neural model gives rise to vessels, too.

Using nerve cells from an animal, a petri dish, and a little patience, Diane Hoffman-Kim's lab first described a method for growing mini-brains in 2015. Now a new finding is exciting in an entirely new vein: these mini-brains can also grow blood vessels.

"This is exciting because real brains have vasculature. We rely on it," says Hoffman-Kim PhD'93, an associate professor of medical science and of engineering, whose lab collaborated with others at Brown to build the mini-brains.



"For our neurons to do their thing, they have to be close to some blood vessels. If we are going to study lab models of the brain, we would love for them to have vasculature, too," she says.

Hoffman-Kim, who is the senior author of a study published in the *Journal of Neuroscience Methods* in January, says the networks of capillaries within the little balls of nervous system cells could enable new kinds of large-scale lab investigations into diseases, such as stroke or concussion, where the interaction between the brain and its circulatory system is paramount.

Right now there's no blood in the mini-brains, she says; they exist in an agarose wellplate, not a living animal. But she's working with a colleague at Brown to find a way to connect the mini-brains with a microfluidic apparatus that could produce an external source of circulation, to make the model more realistic. "We've sketched on a few napkins together," she says.

She notes that the capillary networks are not as dense as they would be in a real brain. The study also shows that they don't last longer than about a week or two. But they can be made by the hundreds, and could allow scientists to observe how the brain responds to injury and other lab-created conditions, with less need for animal models.

—David Orenstein

ANATOMY OF A PC-PM STUDENT

Physician Plus

Austin Tam '15 ScM'19 MD'19 had a tropical fish tank when he was growing up in Cumberland, RI. When one day he noticed a fish struggling to swim, he didn't think much of it."It was just one fish," he says. Within days, the whole tank was dead. Clearly, "this environment wasn't so hot for the rest of the fish," Tam realized. It taught him a valuable lesson, though he didn't understand it until he came to Brown. "An individual in a population can reflect the health of an entire population," he says. "If one patient is presenting with, say, asthma, it might indicate that there might be mold in an apartment complex." Tam is making these connections as an inaugural member of the Primary Care-Population Medicine Program, where in addition to the standard medical curriculum, students take courses like health policy, quantitative methods, and health care leadership. "Part of the mission of this program is to create 'physicians plus,'" Tam says. "They want us to be involved [in more] than just our patients; to be more active in the community." To that end, Tam founded a chapter of Fostering Hope at the Medical School with PC-PM classmate Alice Cao ScM'19 MD'19, to work with kids in foster care; they want to eventually create a patient navigation experience connecting med students with foster youth. The opportunity to follow patients long term, as students do in PC-PM's Longitudinal Integrated Clerkship, is a powerful one. Working with a man co-infected with HIV and hepatitis C, Tam is seeing firsthand the challenges of managing chronic disease, and was present when the patient received devastating news. It was "one of the hallmarks of my medical education thus far, being part of that conversation," Tam says.

—Phoebe Hall

Read about Fostering Hope *at brownmedicinemagazine.org.*

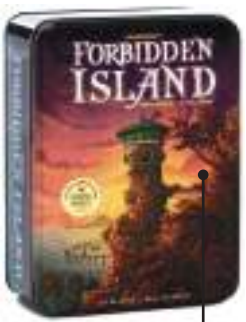
ADAM MASTOON (8); COURTESY HOFFMAN-KIM LAB

BADGE OF HONOR

Scouting was "the biggest thing that impacted my childhood," says Tam, who ultimately attained Eagle rank. A fellow scout's Eagle project first piqued his interest in working with foster youth.

NAMESAKE

Tam's parents owned two family-style chicken restaurants in Bellingham, MA; they named this one after him.

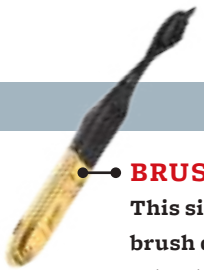


TEAMWORK

Tam loves playing collaborative games with his classmates, like this board game and Escape the Room puzzles. "I really like mysteries," he says. "I'm good at finding the hidden stuff."

GIFT BAG

A med school friend, whose family's sailboat is the *Truancy*, gave Tam this backpack for Christmas. "It's one of my favorite gifts," he says.



BRUSH THIS WAY

This singing Lady Gaga toothbrush commemorates Tam's high school valedictorian speech, which he sang to the tune of "Born This Way."

TRILINGUAL

Tam got this pin when he took a Mandarin language summer program in high school. He also knows conversational Cantonese from his parents, who are from Hong Kong.

DESK JOB

"It was a bit premature," Tam says of this gift from his mom, but when he gets his MD, "I plan to put this on my office desk."

BE PREPARED

Tam says he always wears this paracord bracelet, because "you never know when you're going to need rope."

STUDY TOOL

For their Scholarly Concentration in Medical Education project, Tam and Alice Cao created three volumes of rhymes, acronyms, and cartoons to help students learn the first-year curriculum.

"QUOTEABLE"

"I think there are animal rights people who have a perfectly valid point of view in thinking that the cat shouldn't be killed, and I think there's also a perfectly valid point of view that you should control this nonnative population if it's hurting native species."

—**ASSOCIATE PROFESSOR OF ECOLOGY AND EVOLUTIONARY BIOLOGY DOV SAX, PHD,** about a Wisconsin man who hunts invasive species, including feral cats, *Washington Post*, February 23

"We hate winter."

—**PROFESSOR OF BIOLOGY ROB REENAN, PHD,** who with his wife has summited all 46 designated Adirondack High Peaks in the winter, *Providence Journal*, March 3

"We know that evidence-based policymaking works—that policies based on credible scientific work produce positive health outcomes, keep people safe, improve the quality of drinking water, improve access to education and jobs, and protect our planet."

—**BROWN UNIVERSITY PRESIDENT CHRISTINA PAXSON** in introductory remarks at the 2017 annual meeting of the American Association for the Advancement of Science, February 16

"Programs that fail to abide are supposed to be identified and temporarily banned from the match, but few are actually sanctioned. It is time for that to change."

—**KUNAL SINDHU MD'17** in a *Stat* opinion piece on how medical students and residency programs game the match, March 10

WHO KNEW?

Multitalented Docs

The stars were out in March at the 2017 Hasbro Children's Hospital Heroes Ball, where Phyllis Dennery, MD, the Sylvia Kay Hassenfeld Chair of Pediatrics and pediatrician-in-chief at Rhode Island Hospital (left), and François Luks, MD, professor of surgery and interim chief of the Division of Pediatric Surgery, picked up their instruments and joined the band. This is the third time Luks has performed at the ball since 2014; prior to that, he hadn't played since his own wedding. "In other words," he says, "I only play saxophone in a tux." It's all for a great cause: the Heroes Ball raised nearly $1 million for the hospital. —*Kris Cambra*

AL WEEMS

ASK
The Expert

Questionable Advice

Does taking antibiotics until they're gone really prevent resistance?

Antibiotics are usually dispensed with the caution to take the full course, even if the patient feels better, because it prevents resistance. The problem with this axiom is that it's not, and never was, based on evidence. Infectious disease expert Louis B. Rice, MD, the Joukowsky Family Professor of Medicine and chair of the Department of Medicine, explains how this old saw came about and where we go from here.

To get antibiotics licensed, pharmaceutical companies had to choose a period of time for their clinical studies. If a drug was approved after a 10-day trial, the 10-day regimen was codified. But there's no scientific basis for many of the regimen lengths we prescribe. It reflected the notion that antibiotics are safe drugs, they don't have a lot of side effects, and so why not give more?

The reality is any dose of antibiotics that you take beyond what is absolutely needed only promotes resistance. Now we have a big resistance problem and we must find ways of reducing our consumption of antibiotics in order to decrease the selective pressure for resistance. You can't and shouldn't withhold antibiotics at the time of an acute infection. But two days later, when the patient feels better, that's when you have a lot of leeway to say, you probably don't need it anymore.

That's why I think we should focus on treatment duration, because it doesn't put the "antibiotic police" between a physician and his or her patient during the time of acute illness. Of course, we have to present our colleagues with data to show this practice is safe or, in fact, safer than continuing the antibiotic. The NIH is supporting studies that look at what the lengths of therapy should be, and identifying biomarkers that suggest a patient's infected or that an infection is already treated.

If I could get people to stop thinking that taking the full course of antibiotics prevents resistance, I would be happy, because it makes absolutely no sense from a microbiologic, evolutionary, genetic point of view. ***—Edited by P.H.***

SERVICE

A BRYTE Future

A refugee tutoring organization partners with the Medical School to keep kids healthy.

Last year 292 refugees were settled in Providence, nearly half of them children. Many came from countries embroiled in deep conflict, such as the Democratic Republic of Congo and Syria; speak very little English; and lack access to basic needs like health care and education.

For 10 years, Brown undergraduates and medical students have been helping refugee kids make a home in Rhode Island. Brown Refugee Youth Tutoring and Enrichment, or BRYTE, pairs volunteers with children ages 6 to 18 to tutor them in English. This year is the organization's biggest yet, with more than 160 kids enrolled.

Warren Alpert Medical School has granted BRYTE more than $10,000 over the years, including two grants that "help us examine students' well-being and if they were emotionally and mentally ready to enter school," tutor and leadership coordinator Julia Chang '18 MD'22 says.

In January, that support was formalized when the organization moved from the Swearer Center for Public Service on the main campus to the Medical School.

"The move makes sense," says VyVy Trinh '11 MD'17, a long-time BRYTE volunteer and former director of its summer camp. She says Allan R. Tunkel, MD, PhD, associate dean of medical education, was particularly receptive to the move.

"He said, 'This fits in with what we do here,'" Trinh says. "Community-based work contributes to the health of this population, which makes the program so perfect for the Medical School."

Because BRYTE volunteers go to mentees' homes, their work often goes beyond language and cultural education. "As a tutor working in the home, you're lucky enough to be privy to a lot of information that doesn't come up in a school setting," Chang says. "This means along with academic tutoring, we also help our students navigate the health care system here, among other things."

> "For refugee children in particular, school is one of the biggest factors of their well-being."

Trinh says the Medical School setting will further strengthen the program's link between health and education. Studies show that less education is associated with earlier onset of chronic disease, disability, and declining functional status. Other health impacts of education relate to occupational status, income, neighborhood, and wealth.

"Health is interconnected with everything. For refugee children in particular, school is one of the biggest factors of their well-being," says Carol Lewis, MD RES'83, clinical associate professor of pediatrics. She's the director of the Refugee Health Clinic at Hasbro Children's Hospital and a BRYTE faculty adviser.

"Troubles in school will often have a physical presentation, for example. In this way, physicians can serve as broader advocates for their patients beyond just the 20-minute visit we have with them," Lewis says. "Medicine is not just about fixing a bump, it's about wellness. For [children] to be well, they need to know they're doing well in school."

Many BRYTE volunteers develop close relationships with the refugees they tutor, further helping them excel in school and their new community. The volunteers benefit, too. Chang says of her mentee: "I started working with her when I was a freshman in college and she was a freshman in high school. We're planning to graduate together." ***—A.N.***

JOVAN JULIEN '10

SMILE: BRYTE summer campers and volunteers, from left, Vanessa Malkia, Sara Winnick '15, VyVy Trinh '11 MD'17, and Maria del Mar Fletcher '17, in 2015.

SKEWED RESULT A routine blood sugar test may underestimate diabetes risk in patients with SCT.

RESEARCH

Under the Radar

Sickle cell trait may confound blood glucose readings.

More than 29 million Americans have diabetes—and a quarter of them don't know it. A person with diabetes can experience anything from heart disease to blindness if it isn't managed properly. It's the seventh leading cause of death in the US, yet many people who die of diabetes never even knew they had it.

The severity of diabetes means that it's incredibly important for doctors to correctly diagnose it, and for patients to consistently and correctly monitor and maintain their blood glucose levels. But for a specific set of the population, this can be a problem.

A February study in *JAMA* provides evidence that hemoglobin A1c (HbA1c), a common blood biomarker used to measure glucose over time, may not perform as accurately among patients with sickle cell trait and could be leading to a systemic underestimation of blood sugar control among that population.

Sickle cell trait (SCT) is a genetic hemoglobin variant found in 1 million to 3 million Americans, including 8 percent to 10 percent of African-Americans. It occurs in people with one copy of the mutation; people with two copies have sickle cell disease. SCT is a routine part of newborn blood screening in the US.

The researchers, led by Mary Lacy PhD'17, an epidemiology student at the Brown School of Public Health, analyzed data from more than 4,600 African-Americans and found that SCT can skew HbA1c results, resulting in underdiagnosis: among people with the trait, 40 percent fewer potential cases of prediabetes and 48 percent fewer potential cases of diabetes were diagnosed, compared to people without SCT.

These findings matter for treatment as well as diagnosis, says senior author Wen-Chih Wu, MD F'02 MPH'10, associate professor of medicine and of epidemiology.

"The clinical implications of these results are highly relevant," says Wu, a cardiologist at the Providence VA Medical Center. "For patients with diabetes, HbA1c is often used as a marker of how well they are managing their diabetes, so having an underestimation of their blood sugars is problematic because they might have a false sense of security, thinking they are doing OK when they are not."

The authors couldn't explain why the HbA1c readings differ; they hypothesized it could be a consequence of the underlying biology of SCT. "Irrespective of the reason," Wu says, "the underestimation is very real, and clinicians should consider screening for sickle cell trait and account for the difference in HbA1c."

Practitioners following patients with SCT whose HbA1c levels are within 0.3 percentage points of a diagnostic cutoff also should use additional blood glucose screenings, the study authors wrote. ***—D.O.***

ISTOCK PHOTO

GOOD NEWS

Measuring Up

The Medical School jumps ahead in the latest rankings.

Investments in research and education are paying off for Warren Alpert Medical School in the national rankings.

The *US News & World Report* 2018 Best Medical Schools Rankings listed Brown at No. 31 for research, which is in the top quartile of US allopathic medical schools. The metric factors in total National Institutes of Health research grant dollars and NIH grant funding per faculty member. The Medical School was ranked 35 last year.

On the primary care list, the Medical School ranked No. 21, up from 32 a year ago—placing it in the top 15 percent of US allopathic med schools. The score takes into account the number of graduates who enter primary care residency programs as well as the academic record of entering medical students.

With these two rankings, Warren Alpert Medical School joined a select group: only 14 schools were in the top quartile for both research and primary care; Brown, Harvard, and Penn were the only Ivies.

"I see that as evidence that we are living up to our commitment to our students to make the Warren Alpert Medical School a place where each and every student can have world-class experiences along the spectrum from research to primary care as they find and follow their passion," says Jack A. Elias, MD, dean of medicine and biological sciences.

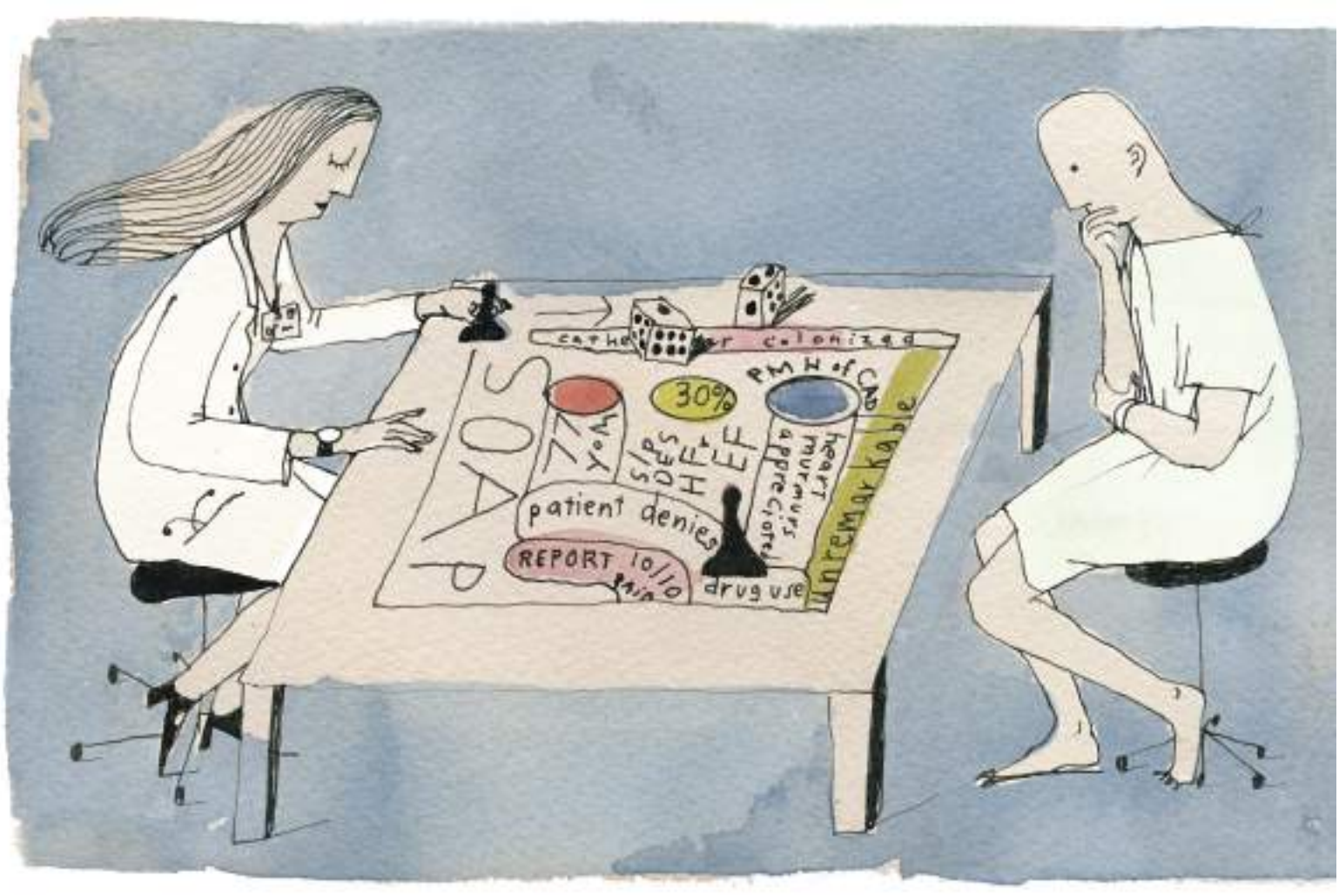
He adds, "This external metric is just one way to gauge our progress, highlighting our increased research activity and our ability to continue to attract the best and brightest students." ***—A.N.***

RESIDENT EXPERT

BY MINOO D'CRUZ '11 MD'16 RES'19

Word Play

A resident learns the secret language of medicine.



BLAIR THORNLEY

For anyone who has been in the company of medical professionals, it is immediately apparent (and possibly nauseating) that we share a complex jargon that can be hard to switch off. Recently, a colleague and I were musing over the medical hijacking of familiar English words. Wandering through the hallways of a hospital during change of shift, it is not uncommon to hear descriptions of "heart murmurs appreciated," "diets tolerated," and "catheters colonized." Are those with a "productive cough" to be proud of their contribution to society, while those with a radiologically "unremarkable liver" considered subordinate citizens, I wonder?

The impact of language in medicine extends far beyond vocabulary. Every medical trainee becomes well-versed in the "SOAP" format for presenting patients: "Subjective, Objective, Assessment, and Plan." This widely used format evolved from the Problem-Oriented Medical Record first proposed by Lawrence Weed, MD, an academic physician and developer of one of the first electronic health records, in the *New England Journal of Medicine* in 1968. By dividing impressions of the patient into "Subjective" and "Objective" components, the presenter can substantiate the patient's own experience of their symptoms such

as "feeling feverish" with concrete information such as a recorded elevated temperature. He or she then moves on to the "Assessment" or conclusion statement—the grand finale. Here, the presenter skillfully synthesizes all of the data gathered and makes an argument for a particular diagnosis that will shape the treatment plan. A true connoisseur will list several possible diagnoses in order of likelihood and offer evidence for or against each one, in this way convincing the listener that he or she has cast a wide net and carefully considered multiple possibilities before reaching the conclusion. Finally, we arrive at the "Plan," which is the first time that the presenter proposes a treatment plan based on the working diagnosis.

By holding the SOAP format sacred, and in communicating about patients in this disciplined way, physicians like Weed believed we could optimize the care provided to each individual patient and minimize "anchoring bias," or the willingness to accept another's initial diagnosis without further thought.

TALK THE TALK

As a generalist, I also have encountered the power of language in effectively liaising with specialists. On an emergency medicine elective as a medical student I was tasked with consulting the on-call cardiologist about a patient with persistent chest pain in the setting of a recent cardiac catheterization. Several minutes into our conversation the cardiologist asked a series of questions concerning the patient's symptoms and medical history that I felt ill-prepared to answer. Sensing his mounting frustration, I apologized and sheepishly handed the phone to my attending to finish discussing the patient. "It's all in the way you sell it to them," I was told later. "You've got to know your audience and hook them with your opening line." Mrs. Bowker, my fifth-grade English teacher, had been right all along. Yet as a physician-in-training you quickly learn to code switch between the methodical way of communicating with colleagues and more natural speech with patients and families.

> Are those with a "productive cough" to be proud of their contribution to society?

When I began my pediatrics clerkship during medical school, one of the most terrifying parts of the six weeks that lay ahead of me had little to do with examining inconsolable infants or forging connections with jaded teens at risk. Instead, the challenge lay in deciphering the craft of presenting on "family-centered rounds." A well-established model of care in the inpatient pediatrics world practiced by more than 44 percent of pediatric hospitalists in the US, it has given new life to the age-old, forgotten tradition of bedside rounds by discussing the patient in their room and incorporating patients and families in decision-making. While studies show that family-centered rounds improve parental satisfaction and coordination of care, as a student I found myself having to repress months of training how to "talk like a doctor" and relearn the art of everyday communication while involving parents in complex medical discussions in their own lexicon.

Reflexively, we emphasize the subjective when talking about patients by using terms such as "the patient denies drug use" or "he reports 10/10 pain." For the recently sober patient, or those who consciously avoid illicit substances, or for patients with persistent pain of unknown etiology, these terms can be perceived hurtfully. As physicians, we also thrive on acronyms. Why waste time talking about the "77-year-old male with past medical history significant for systolic congestive heart failure with 30-percent ejection fraction who presents with shortness of breath" when I can just say "77yo M with PMH of HFrEF (EF 30%) p/w SOB?" Much to the patient's (and physician's) horror, commonly employed acronyms can be misconstrued as a reflection of the provider's opinion of them or their family members. An unfortunate double entendre.

The practice of medicine undoubtedly relies equally on data and how they are expressed. Much like every clinical test we use, increased sensitivity (toward patients or colleagues) and specificity (of language utilized) results in far more effective care. And as I've learned repeatedly, good communication, like a whopping heart murmur, is always appreciated.

Minoo D'Cruz *is a family medicine resident at Brown. She grew up in Oman, and was a human biology concentrator as an undergraduate. She is interested in global maternal and child health and plans to practice full-spectrum family medicine, including obstetrics, in underserved settings, locally and abroad.*

BY SEAN LOVE MD'17

State-of-the-Art Lessons in a Medieval Town

Medical students get critical care training in Tübingen, Germany.

What do Goethe, Hegel, Kepler, Alois Alzheimer, and Pope Benedict XVI have in common? At some point in their careers, they either studied or worked at the University of Tübingen. Founded in 1477, nearly 290 years before Brown, the university is one of the oldest in Europe and is one of the most enchanting. Situated in the beautifully preserved medieval town for which it is named, near the fabled Black Forest and some 20 miles south of Stuttgart, the university has long been known for its theologians and scientists. For instance, the Stiftskirche, the oldest and largest church in Tübingen, was one of the first to convert to Lutheran Protestantism, shortly after its completion in 1470. And it was in the kitchen of the Schloss Hohentübingen (Tübingen Castle) where nucleic acids were first isolated, by Friedrich Miescher, who in 1869 used an innovative technique to extract and purify DNA from white blood cells.

It was in this storied setting that five members of the MD Class of 2017—three fresh off the residency interview trail (including me) and two directly from their honeymoon in Mexico—gathered for two chilly weeks in February, to attend Winter School. This annual international exchange course on critical care medicine is hosted by Reimer Riessen, a professor of critical care at Universitätsklinikum Tübingen, or the Tübingen Faculty of Medicine, one of the leading medical centers in Europe. We were joined by three medical students from the University of Kyoto and eight from the University of Tübingen for didactics, clinical skills workshops, simulations, and discussions on the practice of medicine in our respective countries. Conducted in English, the centerpiece of the course was the Fundamental Critical Care Support Program, a curriculum established by the Society for Critical Care Medicine and for which my fellow students and I received a certificate after passing a comprehensive written exam on our final day.

Morning didactics were led by Dr. Riessen and other Tübingen faculty members, as well as Brown's own Assistant Professor of Medicine Matthew Jankowich, MD, and Pulmonology and Critical Care fellow Amanpreet Kaur, MD F'17, both excellent and enthusiastic teachers who joined us for the whole course. These interactive lectures focused mostly on evidence and theory pertinent to critical care, including acid-base analysis, neurologic support, life-threatening infections, acute coronary syndromes, and numerous other high-yield topics. Afternoons involved more practical, hands-on experiences. These

JESSICA DEANE ROSNER

included rounding in two large, high-acuity medical and surgical intensive care units, where students broke into small groups to see patients and learn about invasive monitoring, mechanical ventilation, and the management of shock. Students also received detailed instruction in conducting bedside ultrasound assessments and gained valuable practice using several state-of-the-art sonography machines, which the university had purchased exclusively for teaching purposes. Participants also were guided through chest tube placement, establishing central venous access, and obtaining arterial blood gases, first using dummies, and later during a cadaver workshop in the university's impressive, technologically advanced anatomy lab.

SANGFROID

When not learning how to stabilize acutely ill patients, we had ample time to get to know our international colleagues. As is common throughout Germany, most medical students and faculty take a proper, sit-down lunch in the hospital cafeteria, which provided a daily opportunity to share our stories and perspectives with one another. Over traditional Swabian cuisine, including staples like Käsespätzle (a cheesy noodle dish), Maultaschen (a kind of minced-meat-filled dumpling), lentils, and sausage, we compared the different approaches to medical education in our countries. Both Germans and Japanese begin medical school after high school and spend six years before moving on to pursue general training in medicine or surgery. Many in Germany take on part-time jobs in research labs or skilled nursing facilities to help pay for living expenses, though their medical education is entirely free. In Japan, fewer take jobs, and tuition is typically only a few thousand dollars per year. Both Japanese and German medical students commented how American medical students seem to be given more responsibility and to have more direct interaction with patients during their clinical rotations, perhaps in lieu of some additional didactic instruction.

We also made several outings as a group, including a visit to the massive, Guggenheim-like Mercedes-Benz Museum in Stuttgart and a tour of Hohenzollern Castle, a popular tourist destination in a nearby town. Probably the most memorable event involved learning to bake traditional Swabian pretzels at a local bakery in Tübingen from a man who'd been baking for more than 30 years, and then getting to take the tasty, aesthetically pleasing results back to our guesthouse by the bag full.

> We developed trust in each other and respect for our international colleagues.

During the last two days of Winter School, we worked together and put our skills to the test during a series of simulations at TüPASS (Tübingen Patientensicherheit und Simulation), the university's anesthesia-run center for patient safety and simulation. After lectures on airway management and advanced cardiac life support and some practice with intubation skills, we were oriented to a room fully equipped with everything you would find in a modern ICU, plus a dummy capable of producing its own heart and lung sounds, mimicking a difficult airway, and expressing neurological symptoms such as mydriasis. We split into teams, each with at least one American, German, and Japanese student, and took on assigned roles: lead doctor, two nurses, a respiratory therapist, and a consulting physician. Meanwhile, the rest of the class watched and listened from the lecture hall via remote video feed. Teams encountered a range of simulated clinical scenarios, from post-operative pulmonary embolism to septic shock to even a team member syncopizing during a code.

After each simulation, we had the opportunity to review highlights of our performance on a video recording and discuss what did and didn't go well. We learned several things from this experience: the importance of teamwork and of having designated roles and sticking to them; closed-loop communication; and techniques to keep patients safe and error to a minimum. We also developed trust in each other and a great deal of respect for our international colleagues.

I am looking forward to bringing these lessons to bear in my career. As someone interested in an academic career in anesthesiology and critical care, my two weeks in Germany working with Brown, Kyoto, and Tübingen colleagues were some of my most formative.

In July, **Sean Love** *will begin a preliminary year in surgery at Brigham & Women's Hospital in Boston. He'll then start a combined anesthesiology residency and critical care fellowship program at Johns Hopkins School of Medicine.*

MUTUALLY

DREAM TEAM: The staff of the Office of Diversity and Multicultural Affairs, from left, Zoila Quezada, Ry Garcia-Sampson, Tracey Guthrie, and Joseph Diaz.

INCLUSIVE

BY PHOEBE HALL

PHOTOGRAPH BY KAREN PHILIPPI

With a new action plan, the Medical School strives to make medicine as diverse as the society it serves.

When Tracey Guthrie, MD RES'99 came to Providence in 1995, as an intern in Brown's psychiatry program, she joined a residency class with people from Pakistan, Eastern Europe, and other far-flung places. United by their shared passions for psychiatry, learning, and the University (not to mention the "amazing food" they made for each other), Guthrie says they were able to build an inclusive, supportive community.

"While I did not look around and see a lot of people that had my exact background, I didn't feel marginalized," says Guthrie, who is African-American. She became chief resident and then, in 1999, joined the faculty; she's now a clinical associate professor of psychiatry and human behavior and of medical science, and the director of the General Psychiatry Residency Program. "Brown is such a warm place," she says.

But, she's quick to add, "That is not to say that that's everyone's story."

It wasn't for Bryan Leyva MD'18 when he arrived at Brown nearly 20 years later. A native of Colombia who grew up in Central Falls, RI, Leyva knew he'd be one of the few Latino men at Warren Alpert Medical School. But he was caught off guard by how isolated he felt.

"The fact that I wasn't represented in my faculty," he says, "and the fact that there weren't as many black or brown males in my class and in the classes after me—those things really, really affected me."

Guthrie and Leyva are working to make inclusiveness, rather than isolation, the norm for new medical students,

residents, and faculty. Both sat on the task force that drafted the Medical School's new Diversity and Inclusion Action Plan (DIAP), released last fall, which enumerates priorities, proposes timelines, and establishes accountability. It spells out, with statistics and unflinching prose, the sometimes grim reality at Brown: that 2 percent of clinical faculty are Hispanic or Latino, and only a little more than 1 percent are black or African-American; that students need support services to deal with the racism, sexism, homophobia, and other forms of exclusion they report; that medicine in general has a "history of colonialism, racism, bigotry, and violence against marginalized people."

"Diversity" is a much-maligned term in some circles, but it's misunderstood.

"Diversity is not just about numbers or quotas, or checking a box that labels a person's race or ethnicity," Guthrie says. At Brown, she says, it's about creating an inclusive community that welcomes and encourages people of all backgrounds and perspectives. It's a more rigorous academic environment, a modernized curriculum, and a more culturally competent medical workforce. It's an explicit message to groups who historically have been underrepresented or overlooked in medicine: "Brown is not a closed door to you," Guthrie says.

Joseph Diaz MD'96 RES'99 F'01 MPH'09, the chair of the DIAP task force, says fostering a physician population that reflects the US population overall "just makes perfect sense."

"The whole reason that we're going to medical school, teaching medical students, training medical residents is the community," he says. "Whether it's here in Providence, or in Rhode Island, or in the US, or around the world, we're taking care of an incredibly diverse group of patients and communities."

Furthermore, different people from different backgrounds bring different experiences and ideas—which benefits students and physician colleagues, as well. Research clearly shows, Diaz says, that with "a more diverse and inclusive workforce in business or health care, you have more innovation and better ideas and different perspectives, which leads to better quality and better care for patients."

'A LOT OF WORK TO DO'

Diaz has cared for underserved communities since before he even wanted to be a physician. A Pennsylvania native, he earned a history degree at Boston College and moved to Los Angeles to work for a social services agency, connecting clients with health and other resources. He came to see medicine as an ideal way to help people, completed his postbaccalaureate at Bryn Mawr, and linked to Brown. As he continued through residency and fellowship, and ultimately joined the faculty, Providence's diverse patient population further honed his interests in health disparities and the cultural and linguistic barriers to care delivery.

Now the medical director of population health and Medicaid for Care New England's ACO, a preceptor for the Student Free Clinic at Clínica Esperanza in Providence, and codirector of the Medical School's Scholarly Concentration in Caring for Underserved Communities, Diaz was a natural fit to lead the Office of Diversity and Multicultural Affairs (ODMA) when the School was looking for an interim associate dean in 2015. (He was named associate dean in November 2016.) "The other work that I do, it's consistent or synergistic with the work in ODMA," he says, "but I was doing it without necessarily having the label, 'ODMA.'"

Michele G. Cyr, MD, who as associate dean for academic affairs oversees the office, says Diaz "emerged as an ideal candidate" not only because of his commitment to caring for underserved populations and to increasing diversity at the Medical School, but because "he's had administrative and educational leadership roles at all levels of training."

For 40 years, the ODMA has worked to foster and support

US medical school graduates, 2015

White **58.8%**
Asian **19.8%**
Black or African-American **5.7%**
Hispanic or Latino **4.6%**
American Indian or Alaska Native **0.1%**
Multiple Race and Ethnicity **7.1%**
Other **4%**

SOURCE: AAMC

Warren Alpert Medical School graduates, 2016

White **45%**
Asian **25%**
Hispanic or Latino **11%**
Black or African-American **9%**
Multiracial **3%**
International **1%**
American Indian or Alaska Native **0**
Native Hawaiian or other Pacific Islander **0**
Not specified **5%**

SOURCE: DIAP

diversity among students, residents, and faculty, including individuals who identify as LGBTQ and groups underrepresented in medicine (URM), meaning racial and ethnic populations whose representation in the medical profession is lower relative to their numbers in the general population. Shortly after Diaz took the helm of the ODMA, the University released an action plan, *Pathways to Diversity and Inclusion*, which lays out specific steps to achieve its goals and charged each school to write its own DIAP. Now Diaz's office had a mission: he headed up the Medical School task force of faculty, students, residents, alumni, and staff, who identified six priority areas and, for each, defined the actions to be taken and how to measure them, as well as the individuals or offices responsible for each step.

"People" is the first priority area, for good reason: although, relative to all US medical schools, Warren Alpert Medical School has higher percentages of URM students (see sidebar), its racial diversity doesn't reflect the nation's. Faculty statistics lag even more. "We have a lot of work to do," Cyr says.

To that end, the Medical School DIAP prioritizes recruitment of URM residents and faculty, and directs each clinical department to write up its own diversity plan. Because the affiliated hospitals select residents and hire clinical faculty, the Medical School is collaborating with representatives at the respective health systems. The ODMA is helping them draft their strategies, says Allan R. Tunkel, MD, PhD, associate dean of medical education.

"If you have diversity in the faculty, you'll have the role models, the mentors, the sponsors [who] may encourage our diverse medical students to stay on in our programs to do their residency training"—which in turn is a pipeline to join the faculty, Tunkel says. "The accountability piece of [the DIAP] is also critical. We have to create an environment where expectations are high around diversity and inclusion. That will be important to moving this plan forward."

Zoila Quezada, MEd, who is in her ninth year as assistant director of the ODMA, says the office has a renewed focus on faculty recruitment. Already, she and Diaz are meeting with representatives from clinical departments. "The programs are actually reaching out to Joe, too, to meet with candidates," Quezada says. The hospitals understand "how important it is for us to recruit URM faculty for the sake of teaching our students, because our students are very sheltered here in the building, but once they go to clerkships, they say, there's no one here that looks like me, that I can identify with."

"Seeing someone who represents you in medicine … that's such a critical thing for someone learning to be a physician," Ry Garcia-Sampson '12 MD'19 MPH'19 says, adding that LGBTQ underrepresentation in the curriculum, faculty, and student body "is something that has been a real struggle for me as an openly genderqueer student."

"Seeing someone who represents you in medicine … that's such a critical thing for someone learning to be a physician."

Guthrie says the hospitals and the Medical School have "a mutually agreed-upon goal: we should provide the best." She adds: "That's the benefit of being an academic environment—the growth that occurs at many levels. The challenge to your thinking at every level is why we're all here."

Cyr, who chairs the Committee on Medical Faculty Appointments and oversees the Office of Women in Medicine and Science, says she's learned over the years that increasing diversity "is very labor intensive." "It requires calling department chairs across the country, asking, who is your up-and-coming star who might be appropriate for this position? And then individually contacting them," she says. "And it requires somebody in a position of authority to drive this initiative and to fully support it. That makes all the difference in the world."

That's why Tunkel says one of the most important proposals in the DIAP is the diversity council. Composed of associate deans (including Tunkel, Cyr, and Diaz); a medical student, resident, and alum; and representatives from clinical departments, the affiliated health systems, the Providence VA Medical Center, and the community, the council will report to Dean of Biology and Medicine Jack A. Elias, MD, and health system leaders. "The fact that we'll be engaging the leadership of the Medical School and the health systems in this process will be critically important in moving initiatives forward," Tunkel says.

The University's leadership has been critical to these initiatives as well. Quezada says support from President Christina Paxson, Provost Richard Locke, and Brown's Office of Institutional Diversity and Inclusion "has helped us tremendously." She adds: "When we were drafting the DIAP, the president came and sat with our students. That was amazing."

"Without institutional commitment, without leadership being on your side, you're always going to be pushing

upstream," Leyva says. "And I think we've been lucky that the administration has recognized the need for enhanced attention to diversity and inclusion."

In addition to the DIAP task force, Leyva sits on the Diversity Recruitment, Social Mission, and Race in Medicine task forces—all of which the Medical School administration supports and encourages, he says. "Everyone is coming together around a common issue and a common goal," he says. "I think this larger commitment can really propel Brown to really be a thought leader and a change agent."

CORE SUPPORT

The DIAP calls for expanding the role of the ODMA to address and implement its goals—and more staff to make that possible. For years the office has consisted only of a full-time assistant director and a part-time associate dean (like his predecessors, Diaz is maintaining some of his other responsibilities, including his clinical practice). Now the office is creating new positions, two of which they filled this spring: a student fellow, Garcia-Sampson; and a core faculty member, Guthrie.

"I'm really thrilled and honored to be able to be part of this very significant and important undertaking," Guthrie says. Among her priorities is developing a minority faculty association and mentorship program. "That sounds fun," she says. "I'm looking forward to getting to know [other URM] faculty members. We're very siloed because we're not in one main hospital." By spending more time at the Medical School, she'll also get to meet first- and second-year students.

It's a great fit for Garcia-Sampson, too, who will take a year off for the paid, one-year fellowship. "I really wanted to spend a year doing something that felt meaningful to me, getting experience and skills that I wouldn't get just through medical training," Garcia-Sampson says. In addition to promoting the office's diversity initiatives, "moving forward, a lot of work I want to do is with people who are underserved: people of color, LGBT, low income, who have addiction, who are homeless. [The fellowship] feels like a natural way for me to be able to spend time connecting with organizations who do this work."

Under the DIAP, recruiting and supporting students will continue to be a key focus for the ODMA. The office organizes networking events and a mentoring program to connect underrepresented students, residents, and faculty; supports professional development opportunities and memberships in local and national organizations that promote diversity; and is working with the Office of Medical Education to review the curriculum for unscientific and biased teaching and to incorporate more inclusive content.

The ODMA also is partnering more closely with the Office of Admissions. "We are very active from the time [students] come here to interview to the time that they actually graduate," Quezada says. They greet applicants and answer their questions on interview days; call to congratulate them when they're accepted; and hold a reception during Second Look, so admitted students can mingle with current students, residents, and faculty, "and know that there's a community here beyond just me and Joe," she says.

She laughs, but it's serious business: "Even after we do all the things we do, there are still people who are like, no. Still doesn't feel like home," Quezada says. Garcia-Sampson says the number of students of color who are admitted yet decide to go to medical school elsewhere "speaks to the work that needs to be done to support and encourage those students to see Brown as a place where they'll be supported."

Students can turn to the ODMA if they experience discrimination, for documentation as well as a sympathetic ear. "There is mistreatment in the clinical years," Quezada says. Leyva learned this firsthand last year. He was shadowing his Doctoring mentor in the emergency department when a patient came in, who "happened to be a dark-skinned woman," he says. A nurse asked him "to move out of the way, confusing me as the relative of this patient." Leyva was wearing a shirt and tie and his white coat; but also, "I was the only person of color in the room. I think it makes you feel a certain kind of way when you're told to step out of the room because of how you look."

> "Even after we do all the things we do, there are still people who are like, no. Still doesn't feel like home."

It's a textbook example of implicit, or unconscious, bias: "how we make assumptions so quickly about people based on what we see," Cyr says. "It's a shortcut. And it's what everybody does, unfortunately." To raise consciousness about unconscious bias, the DIAP calls for staff and faculty training sessions at the Medical School, other areas of the University, and at the hospitals. (Diaz and Quezada are trained unconscious bias educators.) "It's a real eye-opener for a lot of people," Cyr says.

And it can make for better care providers. The Accredi-

tation Council for Graduate Medical Education, Guthrie says, "wants our residents and future doctors to be educated on these topics. This is the community you're treating. You should know something about how you interact with them and how they interact with you, and how to do your best to be able to recognize anything that could be in the way."

She adds: "I think that people have also done a very good job of removing the stigma of unconscious bias. It's, like, we all have it. Let's just admit it and move on."

BEGIN AT THE BEGINNING

Implicit bias is insidious because it can be internalized, and at a young age. "Representation matters. Kids' early experiences shape what they imagine to be possible," Leyva says. "That's why it's important for young black and Latino boys to see physicians who look like them and come from where they come from. It's empowering."

For that reason, the Medical School DIAP calls for reaching students a whole lot earlier. "Grammar school is where things start to diverge," Diaz says. Children who are members of underrepresented groups are statistically more likely to attend underresourced schools and lack access to educational opportunities, not to mention mentors and role models.

"There is not a great pipeline," Tunkel says. "We're looking to reach back into high schools and even middle schools, to engage underrepresented students early in the science disciplines—and get them excited, perhaps, about careers as physicians."

The ODMA supports, to varying degrees, pipeline programs like Pathways, which pairs med student mentors with local high school students interested in careers in health care; Summer@Brown, an intensive pre-college program; and the Early Identification Program with Tougaloo College, a historically black college in Jackson, MS. This summer the ODMA is piloting a Medical School partnership with the Leadership Alliance, a national research program for undergraduates underrepresented in the sciences, to bring three students to Brown to work in the labs of physician faculty and prepare them to pursue admission to competitive MD-PhD programs.

The office also promotes ideas they get from students, Diaz says, like a workshop to help local premed students from underrepresented groups navigate the medical school application process, from the MCAT to the personal statement to financial aid. "They had great success," Diaz says of the first workshop, held last year. "There's at least one student who attended who has been accepted" to Warren Alpert Medical School.

It's just one student, at a small, New England school. Many medical schools across the country struggle with these issues, and at least one is in danger of losing accreditation because it has not met the Liaison Committee on Medical Education's standards for diversity/pipeline programming. But with students and administrators working cooperatively, and with a leadership team that has committed to the real investments in personnel and dollars that it will take to move the needle, there's more optimism that Brown's initiatives will be successful.

"Generations cause shifts. This generation is causing a shift," Guthrie says. "It's a movement that is, I hope, unstoppable."

US full-time medical school faculty, 2015

White **63.1%**
Asian **14.6%**
Hispanic or Latino **2.1%**
Black or African American **3%**
American Indian or Alaska Native **0.1%**
Multiple race **5.3%**
Other **0.5%**

SOURCE: AAMC

Warren Alpert Medical School clinical faculty, 2016

White **68.63%**
Asian **10.58%**
Hispanic or Latino **1.98%**
Black or African-American **1.35%**
Multiracial **0.28%**
American Indian or Alaska Native **0**
Native Hawaiian or other Pacific Islander **0**
Not specified **17.16%**

SOURCE: DIAP

US population, 2015

White **77.1%**
Hispanic or Latino* **17.6%**
Black or African American **13.3%**
Asian **5.6%**
American Indian or Alaska Native **1.2%**
Native Hawaiian or other Pacific Islander **0.2%**
Two or more races **2.6%**

SOURCE: US CENSUS

* OF ANY RACE; ALSO INCLUDED IN APPLICABLE RACE CATEGORIES

THE OTHER SIDE OF MATCH DAY

BY PHOEBE HALL

PHOTOGRAPH BY AL WEEMS

For residency program directors, there's less drama, but still plenty of excitement.

As the Medical School erupted in cheers and screams at noon on Match Day, it was business as usual at the residency program offices where students will begin their medical careers in July.

"Match Day is like any other day," says Craig P. Eberson, MD RES'00 F'01, director of the Brown University Orthopaedic Surgery Residency Program. "There's less drinking involved on our end."

That's partly due to timing. Residency program directors got the news, via email, the day before. They just couldn't tell anyone. "It's cool to have a secret, but then you can't say it. So what's the fun in that?" says John Kawaoka '00 MD'04 RES'08, director of Brown's dermatology residency program.

Program directors admit it's a slightly less pivotal day for them than it is for fourth-year medical students. Though of course programs have favorites, and rank them accordingly on the list they submit to the National Resident Matching Program (NRMP), they like and want to work with every candidate they've listed. "I don't put them on the list if I don't want them in my program," Emergency Medicine Residency Program Director Jessica Smith, MD, says.

But the match is still a thrill for program directors, no matter where they are. "Last year I was in Miami at a conference, and I was on my phone constantly checking [email]," Eberson says. "No one else could care less, and I'm in the back of the room—'Yes! We got that guy!'"

PLAYING THE NUMBERS

For residency program applicants and directors alike, the match is the culmination of an intense, months-long slog that essentially places the futures of tens of thousands of aspiring physicians at the mercy of a computer program.

In an oversimplified nutshell, the NRMP fills available hospital intern slots each year by taking graduating medical students' ranked lists of programs and programs' ranked lists of candidates and feeding them into an algorithm that attempts to match each applicant with their highest-possible choice. The results are binding for both parties—so stakes are high.

It's a remarkably effective system: this year, according to the NRMP, 94.3 percent of fourth-year MD students matched to PGY-1 (first postgraduate year, or intern) programs. More than three-quarters of all applicants matched to one of their top three choices.

That success rate, however, belies the angst and uncertainty of an undertaking that residency program directors call "heartbreaking," "out of control," and "*Game-of-Thrones*-like." "Not matching is horrendously traumatic," says Eberson, an associate professor of orthopaedic surgery.

While the number of people seeking US residencies continues to rise, residency positions have not kept pace. This year, 35,969 candidates competed for 31,757 spots—both record highs, the NRMP reports. Though fourth-year allopathic students have consistently matched at rates

PRIVATE PARTY: While med students celebrate with family and friends, Residency Program Director Craig Eberson emails the news to his orthopedics colleagues. "It is exciting," he says.

between 92 percent and 95 percent over the decades, they're applying to 50 percent more programs now than they were 10 years ago, according to research by Warren Alpert Medical School professors Phil Gruppuso, MD, and Eli Y. Adashi, MD, that was published in *Academic Medicine* last year. Though no data support it, they wrote, "The notion that 'more is better' appears to have taken hold."

And perception is everything. "It's just known that, really, if you want to increase your chances, you just have to apply as many places as you can," says Kawaoka, an assistant professor of dermatology.

His field is a case in point: nationwide this year, there were 651 dermatology applicants; more than 550 of them applied to Brown. "So they're applying to pretty much every [program]," says Karen Medici, the program coordinator. And they were vying for only 423 available PGY-2 dermatology slots nationally (four of them at Brown). In other words, about a third of aspiring dermatologists failed to match. "The joke that the people who are in derm now say is that if we had to apply now, we would never get in," Kawaoka says.

The avalanche of applications that programs receive each fall means that, by necessity, most candidates begin as little more than words and digits on paper. Most programs have a minimum threshold for board scores, grades, and other criteria, including the Internal Medicine Residency Program at Morristown Medical Center in New Jersey, associate program director David Kuo '89 MD'93 F'98 says. His program gets well over 5,000 applications each year, for 50 categorical and prelim slots; the cutoff "helps us separate the wheat from the chaff," he says.

That concerns program directors and educators. Not only can reliance on quantitative metrics "further erode emphasis on students' backgrounds and qualitative indicators of performance," Gruppuso and Adashi wrote, it may penalize "students from disadvantaged educational backgrounds who may be at risk for underperformance on standardized examinations."

With that in mind, even program directors who have thresholds read every application. "One of the things we like to do is recognize potential," says Smith, a clinical associate professor of emergency medicine. "If your board scores are not at the top of the charts but you've done really well clinically, you've had great scholarly productivity, you've rebounded [from Step 1 to Step 2] ... that is a sign that academic potential is there."

For some candidates, cost can be a further disadvantage. "It's a huge financial strain on students to have to travel to 30 programs to interview, when the reality is they probably don't even need to interview at 30 programs," Smith says.

Students are "taking nearly two months off from medical school to engage in what is a nonstop, travel-across-the-country process," says Simone Thavaseelan, MD RES'10 F'11, director of Brown's Urology Residency Training Program and a clinical assistant professor. The average urology

candidate does 14 interviews, she says, and "that cost is many thousands of dollars to them to travel, to visit, to lodge, to crisscross the country."

That doesn't even include several month-long away rotations during fourth year, which increasingly have become the norm for competitive residencies. Also called audition rotations, they're opportunities for both sides to make a good impression and see if they'll be a good fit. According to a study Eberson coauthored in January in the *Journal of the American Academy of Orthopaedic Surgeons*, the average orthopedics aspirant completes 2.4 away rotations and spends $2,799 to do them. Furthermore, he and his coauthors wrote, the rotations may not align "with the mission of undergraduate medical education."

Yet again, Gruppuso and Adashi found no data to support the belief that away rotations improve the odds of a match. But they're part of the culture in certain specialties, including urology, Thavaseelan says: "I'm convinced that my away rotation at Brown was critical to my successful match."

IF THE PROGRAM FITS

Fit is a top concern of program directors as they sift through mountains of applications. Kuo says as he reads them, "I try to ferret out if they're a good fit for this program, which for me, it's finding out if they have good team spirit, a strong work ethic, if they'll fit in with our culture here."

But the electronic application lets students effortlessly play the odds, and apply to dozens of programs they may know little about—which worries program directors. "It's just click, click, click," Thavaseelan says. "It's very difficult to discern who might actually be interested in Brown Urology."

Program directors "agonize" over interviewee selection, Smith says, because they know, inevitably, they will give some of their precious few interview slots to candidates who really have no interest in their program—and pass over others who would thrive there. "It's really heartbreaking to say, oh, god, we have to reject someone because they're average," she says. "That person could come here and do amazing things."

"You're reading through [the applications] and you're saying, yes, no, yes, no," Kawaoka says. But "every single one of them is amazing. … It's a skewed viewpoint of the world." He adds: "These are real people. This is not Monopoly money. This is real. Real chances, real opportunities."

Interview days are as long and exhausting for program staff and faculty as they are for candidates, with everyone trying to impress. They conduct dozens of interviews each day; depending on the size of the program, directors meet with most or all of the interviewees. Kuo says it's one of his favorite things. "It gives us an opportunity to meet these fresh and enthusiastic faces. We only meet for 30 minutes at a time, but it's a lot of fun to interview them," he says. "We're interviewing them as much as they're interviewing us."

"We hope it's not a lot of pressure," Smith says. "We really want to get to know the students. The hard part is getting the interview." She tells candidates, "By virtue of the fact that you are in these seats, we like you. We want you."

With their focus on fit, many interviewers don't ask candidates about medicine. "We take into account interesting stories about their childhood, their background," Eberson says. "Those intangibles are important; otherwise why invite them to interview?" Thavaseelan says her go-to questions include "what do you think makes a good resident? … What are those qualities that you want to emulate?"

Naturally, programs want—and need—team players. "Some [orthopedics] programs don't have an ER. Here the ER is slamming," Eberson says. "It's an enormous team atmosphere." But directors want their residents to gain from the programs they join, too: fit is as important for their well-being as for the team's.

"You've got to be in a place where you're going to feel as supported as you can with a network of friends that's going to carry you through the tough years of residency," Smith says. "They might be a great applicant, but who are their friends going to be here? And that is a legitimate question that we ask ourselves because we don't want someone to feel isolated or alone."

BY VIRTUE OF THE FACT YOU ARE IN THESE SEATS, WE WANT YOU.

It's a lot to assess in only a few minutes, and Kawaoka finds it stressful. "They try to figure out what we're like, we try to figure out what they're like," he says. "That's just bound to not work out sometimes."

LEAP OF FAITH

To finalize the rank order lists for the match, most departments hold several meetings, attended by program directors, faculty, senior residents, and others, where they compare notes about interviewees and arrange and tweak (and rearrange and retweak) the list in order of favorites.

"We have a number of people who interview, and then a lot

of opinions," Kawaoka says. "There's definitely some heated discussions at times, but no one's thrown a punch yet."

Most programs discuss and rank every interviewee, save one or two who may have taken themselves out of the running voluntarily—or behaved unprofessionally on interview day. "If on the one day you need to put your best face forward, if you cannot get through an interview without profanity, that's a red flag," Smith says.

"Anyone who goes on the list, we want to be very, very sure that we want to have them in the program," Thavaseelan says. Disagreements are inevitable, and reputations may be on the line. "Everyone remembers when you really advocate for someone, so when they match, god forbid they're not perfect," Eberson says.

Despite the hours upon hours of application review and interviews and deliberations and debates, there's simply no way to know what a candidate will be like until they report for duty, as a resident. "It's like if the NBA draft got numbers from the weight room and a speed test but they have never seen [the player] shoot a basketball," Eberson says.

"We're doing our best to make the list full of people who we think are going to work well together and contribute. And it's hard," Kawaoka says. "It's hard."

There probably is no way to make the ultimate task of residency program directors—annually creating the best possible class of new physicians for their departments—any easier. But some reforms, if widely adopted, could ease the stress and burden for everyone involved.

In their *Academic Medicine* article, Gruppuso and Adashi suggest that "capping the number of interviews per student would go a long way towards stemming the time and resource drain on both applicants and GME [graduate medical education] programs."

Thavaseelan would go even further. "If you consider application caps, perhaps it limits free choice, but it would increase, on the program side, the percentage of people that we review who are truly interested in our program," she says. Her program received 270 applications this year for just two positions. "We're flying by the seat of our pants trying to get all our work done and all these applications reviewed in a meaningful way."

But, she acknowledges, the intense competition for urology's limited spots—it has only a 75 percent acceptance rate nationwide—prevents "wholesale change." "It's hard to counsel a candidate against them trying to increase their odds," she says.

Advisers help, Smith says—as long as they're "honest and realistic with [students] about their competitiveness as an applicant so that way they can target an appropriate number of programs to apply to." This might mean counseling them to consider a different specialty. "Sometimes it feels like you're crushing someone's hope or dream," Thavaseelan says.

There's more that programs could do: for example, conducting a first round of interviews online via Skype or another platform is a potential money- and timesaver, Gruppuso and Adashi wrote. They also advocate coordinating the timing of interviews, across all disciplines. Thavaseelan says New England urology programs already do this, so interviewees can schedule one visit to the region. Brown's dermatology program is one of only a handful nationwide that hold their interviews on Saturdays, instead of weekdays, which Medici says reduces conflicts for candidates.

But it's unlikely any changes can ever alleviate the anxiety of the residency placement process. Because once the matches are finalized, everyone's fates are sealed.

"What the match is, is it's a contract," Eberson says. "On the surface everyone knows the contract says: you agree to train, you agree to come. What it really means is, if you show up here and you have an issue—a personality problem, you're stressed out, you don't work well under pressure, you're not a good surgeon—we have no test for dexterity—we agree we will do everything in our power to help you graduate a confident and competent surgeon."

THE BIG DAY

After the lists are submitted, it's a waiting game until the third week of March—Match Week. The big day, for most program directors, is Thursday: at 2 p.m. Eastern, they receive, via email, their uber-confidential match list. And at 2:01, they start getting phone calls and texts and personal visits from colleagues: "How did we do? Who's on the list? Who did we get?" Smith says. "It is a wild secret. I can't even tell the chair who is on that list." Only associate program directors and program coordinators can know; she avoids everyone else. "I do not have a very good poker face," she says.

But on Friday, at 1 p.m., the list is public, and the celebrations can begin—muted though they may be. "Is there champagne? No, not usually. … I'll be at the clinic," Kuo says. But "generally there's a lot of happiness." Faculty are especially thrilled about the people they vouched for, he says: "If we know someone will be really good and we have them accepted to the program, it is a great accomplishment all around."

Program directors and other interviewers usually call the new interns Friday afternoon to congratulate and welcome them. But that's just a short break from an otherwise regular day. "We're pretty much back to work 10 minutes after we find out," Thavaseelan says.

But maybe with a smile on their face, or a little skip to their step. "These are people we spend a tremendous amount of time working with, and they're really part of our family," Eberson says. "It's a big deal to us."

BEFORE/AFTER: Top left, Director of Career Development Alex Morang takes the stage to ask the excited students to line up. Top right, a group gathers for a picture before the mayhem. Bottom, as the clock strikes noon, balloons fall and envelopes are torn open.

PHOTOGRAPHY BY DAVID DELPOIO

IT'S A MATCH

MD'17 students match with top residency programs across the country.

Irish or not, Warren Alpert medical students were feeling lucky on March 17 as they tore open their red envelopes and got their residency assignments—many at their top-choice programs.

St. Patrick's Day 2017 coincided with the biggest Match Day yet at Brown, with 115 medical students learning where they'll begin practicing medicine after they graduate this spring.

At exactly noon Eastern Time, as balloons dropped and music played, students passed their champagne flutes to family members and unfolded their letters. Some whooped and screamed, some cried, and some held their loved ones for a long, long time. For all, fates were sealed.

This year saw big numbers of Warren Alpert medical students—42 in all—matching to primary care programs, which include family medicine, internal medicine, and pediatrics. Emergency medicine drew another dozen students. Obstetrics and gynecology, with 11 matches, and radiology, including interventional radiology, with nine, rounded out the most popular specialties this year.

Most MD'17 graduates will stay in the Northeast, with 15 training at Brown-affiliated programs in Rhode Island. One student participated in the military match and will complete his residency at the Eisenhower Army Medical Center in Georgia. To see the match list, turn the page. ***—Phoebe Hall***

POCKET FULL OF POSY: Christina Lam '13 MD'17 enjoys the festivities.

For more photos go to brownmedicinemagazine.org.

The List

• *Anesthesiology*

SOPHIA LIN
Lemuel Shattuck Hospital/Tufts University School of Medicine (*Transitional*); Johns Hopkins Hospital/Johns Hopkins University School of Medicine

OJAS MAINKAR
NewYork-Presbyterian/Weill Cornell Medical Center

LIAM SULLIVAN
University of California, Los Angeles Medical Center/David Geffen School of Medicine at UCLA

• *Anesthesiology/ Critical Care*

SEAN LOVE
Brigham and Women's Hospital/Harvard Medical School (*Surgery-Prelim*); Johns Hopkins Hospital/Johns Hopkins University School of Medicine

• *Dermatology*

RACHEL DUNLAP
Cambridge Health Alliance/Harvard Medical School (*Transitional*); Oregon Health & Science University

COURTNEY JOHNSON
Jackson Memorial Hospital/Leonard M. Miller School of Medicine (*Medicine-Prelim*); Johns Hopkins Hospital/Johns Hopkins University School of Medicine

JORDAN THOMPSON
St. Luke's-Roosevelt Hospital/Icahn School of Medicine (*Medicine-Prelim*); Rhode Island Hospital/Warren Alpert Medical School

• *Emergency Medicine*

ALANNA DARLING
Beth Israel Deaconess Medical Center/Harvard Medical School

CHRISTOPHER HASSLINGER
Maine Medical Center/Tufts University School of Medicine

ELANA HAYASAKA
Boston Medical Center/Boston University School of Medicine

SARA IOSIFESCU
St. Luke's-Roosevelt Hospital/Icahn School of Medicine

BRIAN KWAN
Highland Hospital/Alameda Health System

DANIEL PATINO
University of Connecticut School of Medicine

NERY PORRAS
McGaw Medical Center/Feinberg School of Medicine

CAITLIN RYUS
Yale-New Haven Hospital/Yale School of Medicine

SACHIN SANTHAKUMAR
State University of New York Upstate Medical University

KEEGAN SKIDMORE
Temple University Hospital/Lewis Katz School of Medicine

ABDUL WASEY
St. Luke's University Health Network/Lewis Katz School of Medicine

MICHAEL YACOVELLI
MedStar Washington Hospital Center/Georgetown University Medical Center

• *Family Medicine*

GERICA ALVARADO
Memorial Hospital of Rhode Island/Warren Alpert Medical School

NELL BALDWIN
Montefiore Medical Center/Albert Einstein College of Medicine

DAVID CORNER
Boston Medical Center/Boston University School of Medicine

SARA GUEVARA
Montefiore Medical Center/Albert Einstein College of Medicine

SHARDALE MCAFEE
Kent Hospital/University of New England College of Osteopathic Medicine

LAURA UCIK
Montefiore Medical Center/Albert Einstein College of Medicine

• *Family Medicine/ Obstetrics*

ELISE TRINH
University of California, Davis Medical Center/UC Davis School of Medicine

MAP OF THE STARS: Vladimir Suric MD'17 looks over the match list.

SWEET RELIEF: Meeka Gandhi MD'17, left, and Ryan Clodfelter MD'18. Meeka is headed west to the University of Washington.

GAME, SET, MATCH: Joshua Chao MD'17 will stay on the East Coast for a residency in surgery.

COUPLE MATCH: Geoffrey McCrossan MD'17 and Julie Gutierrez '13 MD'17 met and started dating during the first year of medical school. They got engaged March 4 and are headed to Texas together.

• ***Interventional Radiology***

MANGALADEVI PATIL
Emory University School of Medicine (*Transitional*); Emory University School of Medicine

TINA SANKHLA
Bassett Medical Center/ Columbia University College of Physicians and Surgeons (*Transitional*); Emory University School of Medicine

• ***Medicine***

BRIANNA BAKOW
Rhode Island Hospital/ Warren Alpert Medical School

SARA CLEMENS
Hospital of the University of Pennsylvania/Perelman School of Medicine

ALISSA COOPER
Brigham & Women's Hospital/Harvard Medical School

ROOP DUTTA
University of Massachusetts Medical School

TAMARA FEINGOLD-LINK
Brigham & Women's Hospital/Harvard Medical School

KAIO FERREIRA
Rhode Island Hospital/ Warren Alpert Medical School

ALEXANDRA GRIEB
University of Colorado School of Medicine

LUBIN JUAREZ
Rhode Island Hospital/ Warren Alpert Medical School

JENNIFER LEE
Beth Israel Deaconess Medical Center/Harvard Medical School

GEOFFREY MCCROSSAN
University of Texas Southwestern Medical School

NATHANIEL NELSON
New York University School of Medicine

SARAH NORTON
Duke University Medical Center/Duke University School of Medicine

HYEON JU RYOO
Rhode Island Hospital/ Warren Alpert Medical School

RACHEL SCHRIER
Yale-New Haven Hospital/ Yale School of Medicine

HONG GI SHIM
Tufts Medical Center/ Tufts University School of Medicine

SANCHITA SINGAL
Rhode Island Hospital/ Warren Alpert Medical School

SHIROU WU
University of Washington Affiliated Hospitals/ UW School of Medicine

JAMILA WYNTER
Brigham & Women's

Hospital/Harvard Medical School

• ***Medicine-Primary***

NORIN ANSARI
Yale-New Haven Hospital/ Yale School of Medicine

KATIE BAIRD
Brigham & Women's Hospital/Harvard Medical School

AMED LOGRONO
Yale-New Haven Hospital/ Yale School of Medicine

• ***Medicine-Pediatrics***

ANJALI CHANDRA
Jackson Memorial Hospital/ Leonard M. Miller School of Medicine

JULIA DING
Rhode Island Hospital/ Warren Alpert Medical School

CHRISTINE KRUEGER
Johns Hopkins Hospital/ Johns Hopkins University School of Medicine

• ***Medicine-Preliminary***

NOVA SHU
University of California, Irvine Medical Center/UC Irvine School of Medicine

• ***Medicine (Urban Health)***

JULIUS HO
Johns Hopkins Hospital/ Johns Hopkins University School of Medicine

• ***Neurological Surgery***

JOSEPH CARNEVALE
NewYork-Presbyterian/ Weill Cornell Medical Center

• ***Neurology***

ANUJ PATEL
Boston Medical Center/ Boston University School of Medicine (*Medicine-Prelim*); Boston Medical Center/BU School of Medicine

#MEDSCHOOLGOALS: Left to right, Nova Shu '13 MD'17, Dorothy Liu MD'17, Nery Porras MD'17, and Rachel Sargent '13 MD'17.

• ***Obstetrics/Gynecology***

SUSIE AHN
University of North Carolina Hospitals/UNC School of Medicine

SAMANTHA DEANDRADE
Brigham & Women's Hospital/Harvard Medical School

DIVYA DETHIER
Brigham & Women's Hospital/Harvard Medical School

GABRIELE DUVERNOIS
University of Texas Southwestern Medical School

JULIA GUTIERREZ
University of Texas Southwestern Medical School

HUGS ALL AROUND: Two revelers get caught up in the emotion of the day.

DAVID HUANG
University of California, San Francisco School of Medicine

GOPIKA KRISHNA
Emory University School of Medicine

AMITA KULKARNI
Women & Infant's Hospital/ Warren Alpert Medical School

NATASHA KUMAR
McGaw Medical Center/ Feinberg School of Medicine

ON BENDED KNEE: Moments after Courtney Johnson PhD'15 MD'17 learned she matched to her first-choice dermatology program, at Johns Hopkins, Rimsky Denis, MD, MBA, MPH, RES'17 proposed to her. "I was truly floating on cloud nine!" she said later. They'll have one year together in Miami, where Johnson will do her prelim while Denis begins a three-year cardiology fellowship.

CHRISTINA LAM
University of California, San Diego Medical Center/UCSD School of Medicine

KATIE PIVARNIK
Albany Medical Center/Albany Medical College

• ***Ophthalmology***

DAVID BOOY
Steward Carney Hospital/Tufts University School of Medicine (*Transitional*); Rhode Island Hospital/Warren Alpert Medical School

ALLISON CHEN
Roger Williams Medical Center/Boston University School of Medicine (*Medicine-Prelim*); Shiley Eye Institute/University of California, San Diego School of Medicine

JARA CREAR
University of Maryland Medical Center-Midtown/University of Maryland School of Medicine (*Transitional*); Kellogg Eye Center/University of Michigan Medical School

HOMEGROWN: Amita Kulkarni MD'17 will stay in Providence for ob/gyn at Women & Infants Hospital.

TAYLER SCHWARTZ
St. Luke's Hospital/Icahn School of Medicine (*Medicine-Prelim*); NewYork Presbyterian/Weill Cornell Medical Center

ANNIE WU
Santa Clara Valley Medical Center/Stanford University School of Medicine (*Transitional*); Kellogg Eye Center/University of Michigan School of Medicine

CONNIE WU
Santa Clara Valley Medical Center/Stanford University School of Medicine (*Transitional*); Wills Eye Hospital/Thomas Jefferson University

• *Orthopedic Surgery*

ADAM DRIESMAN
Hospital of Joint Diseases/New York University School of Medicine

STEPHEN MARCACCIO
Rhode Island Hospital/Warren Alpert Medical School

• *Otolaryngology*

PRASHANTHI DIVIKAR
Dartmouth-Hitchcock Medical Center/Geisel School of Medicine

ANDREW KATZ
Jackson Memorial Hospital/Leonard M. Miller School of Medicine

• *Pathology*

TIFFANY CHAMBERS
Stanford University School of Medicine

• *Pediatrics*

KIMBERLY ALZUPHAR
Mount Sinai Medical Center/Icahn School of Medicine

MICHELLE CHIU
Massachusetts General Hospital/Harvard Medical School

KELLY FITZGERALD
Boston Children's Hospital/Harvard Medical School

MEEKA GANDHI
University of Washington Affiliated Hospitals/UW School of Medicine

FAMILY AFFAIR: Adam Driesman '12 MD'17 with mom, Shelley Driesman MD'80, P'07, and dad, Mitchell Driesman '74 MD'77, P'07.

KAMARIS LOOR
Massachusetts General Hospital/Harvard Medical School

KARA MESZNIK
Kaiser Permanente-Oakland/Kaiser Permanente Healthcare

MATTHEW WIELER
University of California, San Diego Medical Center/UCSD School of Medicine

RIAN YALAMANCHILI
John A. Burns School of Medicine at the University of Hawai'i

• *Pediatrics-Primary Care*

ANNE STEPTOE
University of North Carolina Hospital/UNC School of Medicine

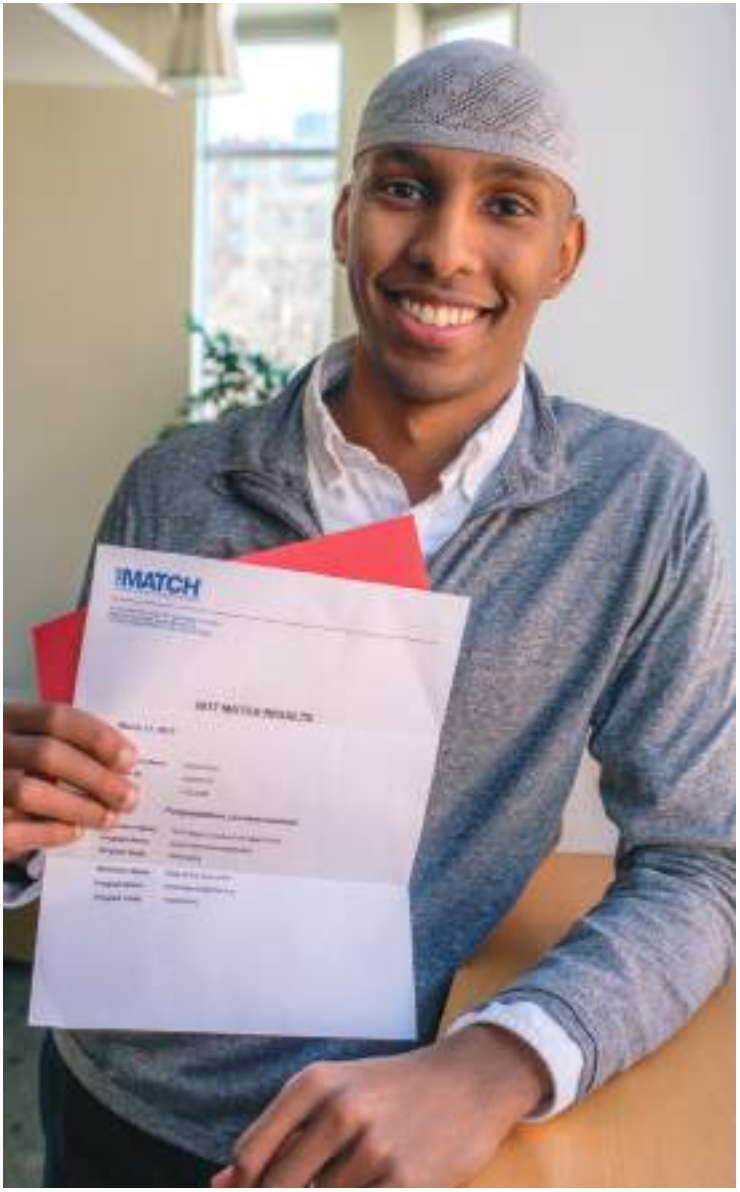
• *Pediatrics-Primary Care Community Health*

JEANNE DELGADO
Children's National Medical Center/George Washington School of Medicine & Health Sciences

• *Physical Medicine and Rehabilitation*

VLADIMIR SURIC
Roger Williams Medical Center/Boston University School of Medicine (*Medicine-Prelim*); Metro Health Medical Center/Case Western

PROOF: Katie Pivarnik MD'17, right, snaps a photo of VyVy Trinh '11 MD'17's letter.



IVY BOUND: Abass Noor MD'17 will land at UPenn after a year of preliminary training at Columbia.

Reserve University School of Medicine

• *Plastic Surgery*

RAJIV IYENGAR
Yale-New Haven Hospital/ Yale School of Medicine
BREANNA JEDRZEJEWSKI
Oregon Health & Science University
VINAY RAO
Rhode Island Hospital/ Warren Alpert Medical School

• *Psychiatry*

ZACHARY COHEN
University of North Carolina Hospitals/UNC School of Medicine
ADAM HENDERSON
Massachusetts General Hospital/Harvard Medical School
RONALD MAGEE
Mountain Area Health Education Center/University of North Carolina School of Medicine
JOYCE NGUYEN
Georgetown University Hospital/Georgetown University School of Medicine
AMY RASMUSSEN
University of Pittsburgh Medical Center/University of Pittsburgh School of Medicine

• *Radiation-Oncology*

KUNAL SINDHU
Beth Israel Medical Center/ Icahn School of Medicine (*Medicine-Prelim*); Mount Sinai Medical Center/ Icahn School of Medicine

• *Radiology*

HOLLY BRIDEAU
Beth Israel Deaconess Medical Center/Harvard Medical School (*Transitional*); Massachusetts General Hospital/Harvard Medical School
MAGGIE CHUNG
Scripps Mercy Hospital/ University of California, San Diego School of Medicine (*Transitional*); University of California, San Francisco School of Medicine
ALEXANDER MERRITT
Steward Carney Hospital/ Tufts University School of Medicine (*Medicine-Prelim*); Boston Medical Center/ Boston University School of Medicine
ABASS NOOR
NewYork-Presbyterian/ Columbia University College of Physicians and Surgeons (*Surgery-Prelim*); Hospital of the University of Pennsylvania/Perelman School of Medicine
LAKIR PATEL
Mercy Medical Center/ University of Maryland School of Medicine (*Medicine-Prelim*); University of Maryland Medical Center/University of Maryland School of Medicine
KEVIN SUN
Roger Williams Medical Center/Boston University School of Medicine (*Medicine-Prelim*); Beth Israel Deaconess Medical Center/ Harvard Medical School

• *Surgery*

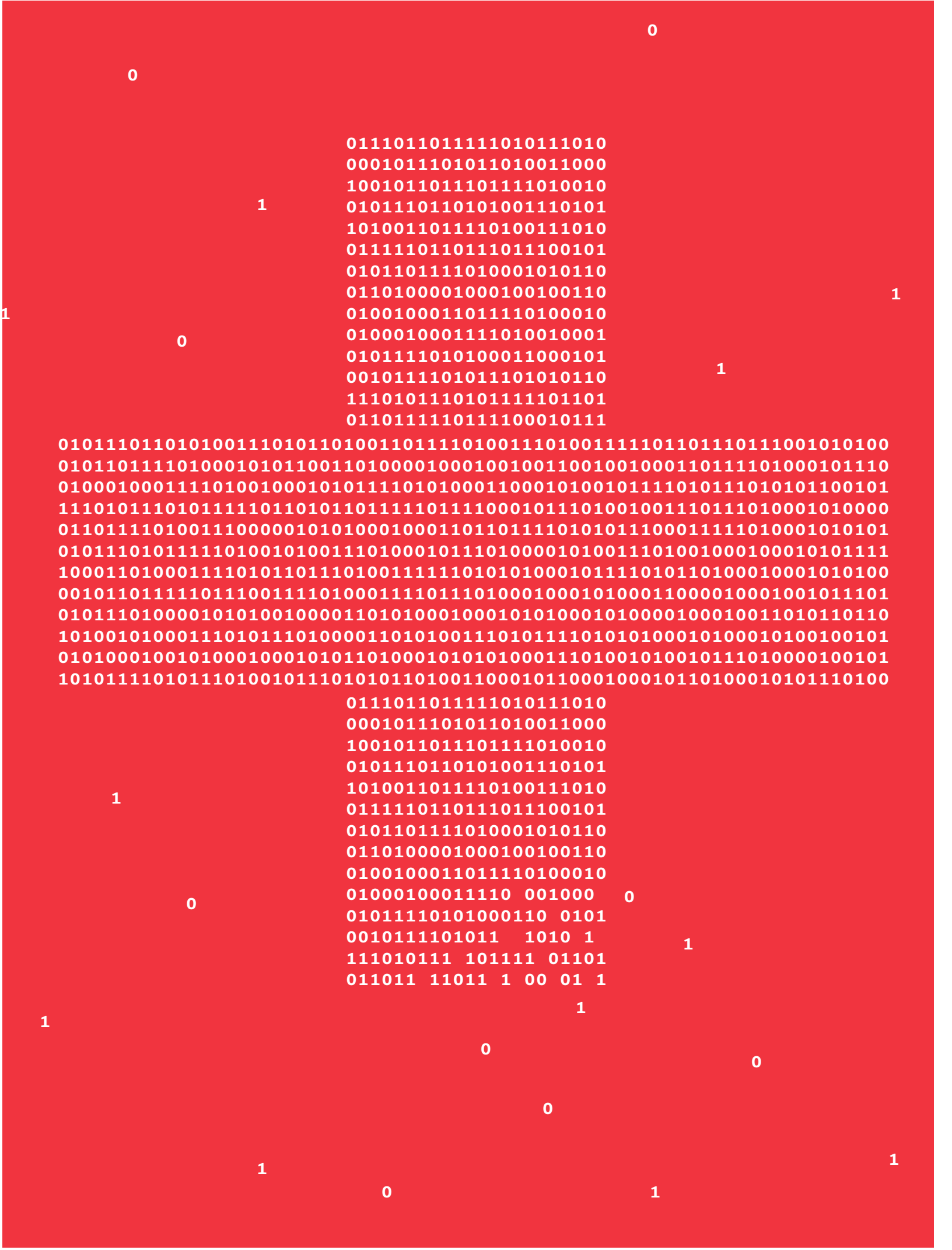
MARCOS ARANDA
Eisenhower Army Medical Center
JOSHUA CHAO
Rutgers Robert Wood Johnson Medical School
DOROTHY LIU
University of Massachusetts Medical School
RACHEL SARGENT
Keck School of Medicine of the University of Southern California
ANDREW VARONE
Rhode Island Hospital/ Warren Alpert Medical School

• *Surgery-Preliminary*

DANIELLE COMISSIONG
Rhode Island Hospital/ Warren Alpert Medical School
DANIEL FRIEDLANDER
University of Colorado School of Medicine

• *Urology*

DANLY OMIL-LIMA
University Hospitals/Case Western Reserve University Medical School (*Surgery-Prelim*); University Hospitals/ Case Western Reserve University Medical School
MEREDITH WASSERMAN
Rhode Island Hospital/ Warren Alpert Medical School (*Surgery-Prelim*); Rhode Island Hospital/ Warren Alpert Medical School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BY DAVID LEVIN

ILLUSTRATION BY CHRISTOPHER BRAND

HEALTH BY THE NUMBERS

WITH A NEW BIOMEDICAL INFORMATICS CENTER, BROWN IS TAKING A DEEP DIVE INTO BIG HEALTH DATA.

On a chilly evening in downtown Providence, a gaunt man is rushed to the hospital, unconscious. He knows no one; no one knows him. Yet his doctor, whom he's never met, already has an intimate knowledge of his health. His history of asthma. His heart problems. His struggle with opioid addiction.

This man is fictional, but his circumstances might well be real. New electronic health data systems are improving care for countless patients by sharing their data instantly—not just with physicians, but with pharmacists, public health researchers, academics, and scientists.

If harnessed correctly, circulating "big health data" among all these players may change the face of medical treatment. The information is useful not just in the clinic, but behind the scenes, helping to inform public health policy, to create new treatments or consumer products, and even to shed light on the mysteries of the human genome as they pertain to human health. In order to use it, though, you first need to build the right tools and safeguards to work with vast datasets.

Meeting that need is the driving force behind the new Brown Center for Biomedical Informatics (BCBI). Its founding director, Indra "Neil" Sarkar, PhD, MLIS, and associate director, Elizabeth Chen, PhD, who are also associate professors in both the Warren Alpert Medical School and the Brown School of Public Health, are creating ways to harness electronic health data securely from a wide range of sources—like electronic health records, gene sequences, or even wearable devices like a Fitbit.

"[The health care community] is collecting information that we can use to learn about our patients. We can use it to study populations, develop models, and predict if a patient is at risk for a particular illness," Chen says. "We're all about trying to improve health in general—using data, data science, information technology, or some combination of those."

"[DOCTORS] HAD TO MAKE SOME CLINICAL JUDGMENTS ON THE BASIS OF VERY LIMITED DATA. IN SOME CASES, ACTUAL HARM WAS DONE TO THE PATIENT THAT COULD HAVE BEEN AVOIDED."

Through a unique blend of collaborative research, educational outreach, and community partnerships, she says, the work being done at BCBI could help create a new personalized standard of care in Rhode Island and beyond.

STATEWIDE EXPERIMENTS

Both Sarkar and Chen have celebrated careers working with biomedical and health data, and have been collaborating since graduate school—so much so, they've been called an "informatics power couple" by a close colleague. Before coming to Brown in 2015, the pair—both elected fellows of the American College of Medical Informatics—worked at the University of Vermont, where they developed projects that they're now continuing at BCBI. Chen's work has focused mainly on clinical informatics, finding ways to extract and analyze information in electronic health records; Sarkar has worked largely in translational bioinformatics, creating tools to sort through mountains of genetic and evolutionary data in the lab.

When the opportunity arose to start a new center at Brown, they say, it offered an ideal place to put their multifaceted research into practice. "Rhode Island is a perfect petri dish to do population studies and longitudinal studies with patients," Sarkar says. "The state is the nation's smallest geographically, but at least 60 or 70 percent of the people who are born here, stay here. And because we have only one medical school that partners with the largest civilian health care providers in the state—as well as the Department of Veterans Affairs—we can figure out a way to coordinate all those data into one spot, and can do very powerful population analysis."

One of Sarkar and Chen's first goals for the center is to improve access to health data across the state. "BCBI's greatest advantage is our access to those data," Chen says. "It can be challenging for researchers to get that, and there's no systematic process for it."

Right now, they are working to create partnerships to share data between health care systems like Lifespan, Care New England, and the Providence VA Medical Center, as well as with the Rhode Island Department of Health and Rhode Island Quality Institute (RIQI). The overall goal of this collaboration, Chen says, is to build a computing infrastructure at Brown that can intelligently comb through disparate systems and pull relevant data from patients' health records—essentially creating an ultra-secure, "one-stop shop" for health information that reflects the state's entire population.

Those new computing tools will build on work that the state is already doing, says Laura Adams, president of RIQI, a nonprofit that works to solve regional health issues. (The group also runs CurrentCare, Rhode Island's health infor-

mation exchange.) By spreading health information freely between all care providers, she says, the state is able to provide emergency departments with lifesaving information for unconscious patients, like our hypothetical stranger. Before CurrentCare, if the patient wasn't in a particular hospital's health records system, doctors had to guess at his medical history when his gurney was wheeled in the door—meaning they had no way of knowing in advance if the patient was deathly allergic to a certain drug, or taking medication that might interfere with treatment.

"[Doctors] had to make some clinical judgments on the basis of very limited data. In some cases, actual harm was done to the patient that could have been avoided if they had data from competing systems," Adams says.

Letting both clinicians and researchers access this data will be essential for improving care, Chen adds. In addition to giving new insight in the clinic, she's hopeful that CurrentCare will be able to inform new scientific studies.

"That's one of our big initiatives," she says. "We want researchers to be able to come to us if they're designing a study and ask, 'How many patients meet my inclusion/exclusion criteria? If I'm doing a study on asthma, how do we actually find those patients?'"

One of the challenges of doing this, she notes, will be creating software that can deal with many different formats of health records. Certain hospitals may use a records system that's formatted in a different way than another's. Even a clinician's own note-taking habits come into play—some may record a patient's care as a narrative paragraph, whereas others create something akin to an Excel spreadsheet—yet each version has the same valuable information scattered within it.

To make sense of these data, Chen says it's necessary to develop computational tools that can analyze natural language and intelligently summarize data for researchers—not an easy task by any standard. According to Sarkar, though, it's just part of the bargain when it comes to the work being done at BCBI.

"One thing that is essential in informatics is to avoid getting in the way of a doctor being a doctor," he says. "We want the technology to work behind the scenes—so we spend a lot of time studying the process, studying what a care provider is doing, and teaching computers cues to follow through based on that. If we're truly successful, clinicians and patients don't even know we're there."

By looking deeply into data from multiple hospitals, the BCBI team is also hoping to uncover trends in patient outcomes that hint at how well specific interventions actually work. Ideally, Sarkar says, these tools may help fine-tune best practices that clinicians follow in emergency situations—not just by improving them for the field as a whole, but by customizing them to the needs of patients in specific geographic areas.

DECISIONS, DECISIONS

Orthopedic surgery offers one example. Given the icy winters of New England, slip-and-fall accidents happen at a much different rate here than in, say, Miami. Surgical treatments for broken bones and torn ligaments are costly not only in terms of dollars, but in quality of life: recovery, especially for elderly patients, can be long and painful after going under the knife. So, Sarkar asks, in each location, what factors lead a surgeon to choose either a full hip replacement or care that would simply make a patient more comfortable?

"Medicine is very well informed, but most of the guidelines and standards are based on measures that were developed at a single institution—and that place may be nothing like *your* institution," Sarkar says. "We have the opportunity to look at all the data produced by patients in a single region, and build a quality registry to guide physicians working there. That's our grand vision."

In addition to shaping best practices, those data could also help clinicians decide when to use specific procedures or treatments in complex cases, especially ones where time is of the essence. Powerful computer algorithms may help them narrow down and diagnose ailments that aren't immediately obvious, and automatically suggest the best course of action to support their own judgment.

"As a young intern or resident, there is a massive amount of information that you are expected to be the conduit for," says Cedric Priebe, MD. "You're taking information from the laboratory, from diagnostic imaging, from bedside monitoring, the pharmacy, pulling that all together, synthesizing it, and then sharing it with your team and your supervisors."

Priebe is a practicing pediatrician and chief information officer at Lifespan. He's working with BCBI to share electronic health data for research purposes, and plans to use those data to develop and improve existing decision support tools. Along with shaping best practices in the emergency department, he adds, these sorts of tools are helping to spot dangerous ailments that develop in patients over several days, catching them while they're still easily treatable.

In cases like sepsis, a severe immune reaction that attacks all organs of the body, improved decision support would be potentially useful. At its onset, the condition can be difficult to spot, and if it advances, it can become deadly. By looking for a combination of early symptoms—like elevated heart rate, low blood pressure, high temperature, and high levels of lactate in the blood stream—

new algorithms could automatically flag information that a single physician might otherwise miss.

"The ultimate secret sauce would be an algorithm that you can use in cases where you *don't* know a problem is going to develop," Priebe says. "That's the essence of predictive analytics—it needs big data, sophisticated math, and electronic systems that can make those decisions actionable by caregivers." In short, it needs areas of expertise that BCBI is helping to develop.

DATA IN THE GENOME

Although the center is focused mainly on improving care in health care settings, it's also working to provide data for researchers outside of the clinic. The same analytic tools and techniques used to comb through a patient record, Sarkar says, can also be adapted to spot patterns in genetic information. Our genome, after all, is just another form of coded data—a string of molecules laid out in a specific order—and finding patterns in data is one of the calling cards of biomedical informatics.

"We're using informatics tools to look at the basic biology of an individual," Sarkar says. "Understanding that biology, combined with understanding their lifestyle choices and environmental factors, will give us a precise description of an individual *before* we move them through the health care system. If we have enough information about those individuals at the genomic level, we might be able to better customize their treatment."

Sarkar is also examining genetic data to understand how certain diseases develop in the first place. He's continuing work he started at the University of Vermont, where he developed new techniques to examine genes associated with Alzheimer's—a disease that is exceedingly difficult to study. No definitive diagnosis can be made until an autopsy examines brain tissue, and tracking its progression in living patients is a challenge.

It's possible to simulate the disease in specially bred mice, but that's by no means an ideal method, Sarkar says; first, researchers must "humanize" the mouse, altering it physically and genetically, by adding genes related to Alzheimer's into its DNA. Only then can they follow the disease as it spreads in the mutant mouse.

Instead of going through all the work of adding a gene into a tiny mammal, Sarkar says, it may make more sense to study simpler organisms that have the gene already. By carefully analyzing the gene's evolutionary history, he was able to trace it back to animals that have been around since the evolution of metazoans—creatures like sea squirts and anemones. In their DNA, he found, they carry a close relative to the genes associated with Alzheimer's in humans, meaning that they could be ideal for understanding how the gene itself works, and could help identify the process that causes damaging plaques to form in the brain.

Eventually, this approach could lead to new treatments for a number of conditions. Sarkar is developing similar techniques to study parturition. Better understanding of the genes associated with childbearing, he says, may offer a better understanding of certain pregnancy complications, like preeclampsia or spontaneous preterm birth.

"In many ways, we're detectives, trying to piece together [disease] genes' stories using informatics," Sarkar says. "But the techniques that we use to identify which organisms to look at—data mining, machine learning—all those things are identical whether we're looking at a clinical context or a biological context."

From sea squirts to humans, BCBI is working to share genetic information with researchers across the nation—and just like electronic health records, Chen and Sarkar say it's essential to set up a secure and standardized infrastructure to house those data. It may be several years before they're ready to open up genetic and health information for national use, but right now, they're already starting to experiment locally. Advance Clinical and Translational Research (Advance-CTR), an NIH-funded partnership between Brown, the University of Rhode Island, and several state health care systems, is already using local data to develop real-world treatments for patients in Rhode Island.

GETTING THE WORD OUT

When it comes to using biomedical informatics, however, both Sarkar and Chen feel that the next big improvement will come not through any particular research initiative, but through education. No matter how good data tools become, they're useless unless future academicians, clinicians, scientists, and even patients know how to use them. In that sense, Chen says, promoting data literacy will be key.

"I think we have a lot of work to do when it comes to both training medical and other students about informatics and working more closely with patients," she says. "We can develop all these tools and all these systems, but are they really useful to the patient and clinician? We have to do more about involving them, educating them, and developing solutions that are directly useful to them."

Sarkar echoes that sentiment wholeheartedly. One of his major educational initiatives at BCBI is expanding not only a scholarly concentration for Warren Alpert medical students, but eventually creating master's and PhD programs and hosting classes for undergraduates.

"Brown's academic culture of letting students take their own path is a big part of why our work is thriving here," Sarkar says. "It allows a biology major to take a computer science class, and no one raises an eyebrow. It allows a med-

> **"IN MANY WAYS, WE'RE DETECTIVES, TRYING TO PIECE TOGETHER [DISEASE] GENES' STORIES USING INFORMATICS."**

ical student to explore computer stuff. That's baked right into the Brown culture." These students are also incredibly self-motivated, he adds. "We showed up in July 2015, and immediately four medical students came knocking at our door, wanting to work with us. In a very short time, the original four grew to 10 students. We were just flooded."

The immediate interest, he thinks, may stem from the fact that informatics is an interdisciplinary field, so a growing number of students' interests—be they policy, computer science, biology, or public health—overlap widely with the work being done at BCBI.

In a student hackathon cosponsored by the center in 2016, Sarkar and Chen worked closely with students in a variety of disciplines to create new health care innovations over the course of one weekend. The ideas varied widely, from custom breast prostheses to apps that provide information to surgical patients.

Sachin Pendse '17, an international relations and computer science concentrator, worked on software that could help patients identify the side effects of medications and offer suggestions to cope with them, like deep breathing, meditation, or alternative medicine. Informatics, he says, would play a big role in improving the app's content. By collecting data on what helps patients in need (and what doesn't), its code could be tweaked to make better suggestions, or to shift its focus to more successful interventions.

"Neil was an amazing mentor for that sort of thing," Pendse says. "He ended up giving us his personal cell phone number and saying, if you want any information about how biomedical informatics works in the real world, just text me. I've never had that sort of access before."

PATHWAY TO INFORMATICS

Until BCBI was founded, students at Brown had no direct pathway to biomedical informatics, and had to find their own way in a growing discipline. Biomedical informatics, according to the American Medical Informatics Association (AMIA), "studies and pursues the effective uses of biomedical data, information, and knowledge for scientific inquiry, problem solving, and decision making, motivated by efforts to improve human health." BCBI is working with partners across Brown, including the Center for Computational Molecular Biology, School of Engineering, School of Public Health, and the Data Science Initiative, to develop complementary educational offerings for students at all levels. Many current giants in the field—like Isaac Kohane, MD, PhD '81, inaugural chair of the Department of Biomedical Informatics at Harvard Medical School—started out by studying unrelated disciplines at Brown, and entered a career in informatics without the benefits of direct mentorship.

"I think having a center like this when I was a student would have caused me to focus much more rapidly on applications to medicine," says Kohane, who studied biology as an undergraduate. "There are still only a small number of schools that have excellence in both biology and in computing in the way that Brown does, along with leaders in informatics like Neil and Liz to train people in the discipline. I'm really pleased to see that this center has been established, and I'm confident it means the next generation of leaders in biomedical informatics will be from Brown."

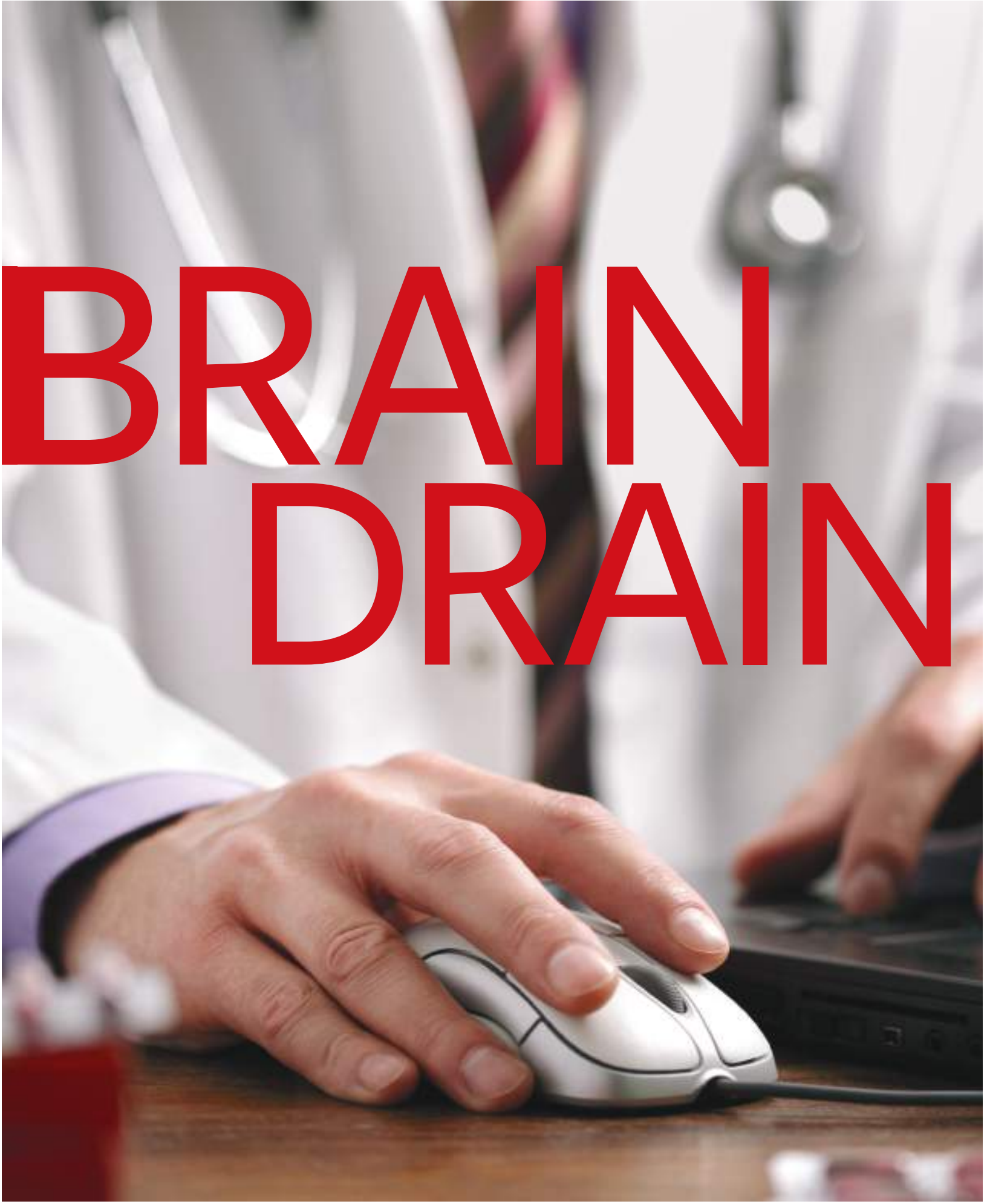
That's a goal the BCBI team is working toward. In addition to teaching and mentoring within the greater Brown community, Sarkar and Chen are also focusing on students before they even reach the undergraduate level. They've created summer programs and workshops for high school audiences, where they aim to seed an interest in informatics from an early age.

"Neil and Liz are pioneers in that area," says Doug Fridsma, MD, PhD, president of the AMIA. "At first, we all thought it was a little crazy, but if you think about it, if you're a kid interested in technology or computers, and you also want to do something that helps people and contributes to society, informatics provides a pathway to combine those interests."

For both Sarkar and Chen, it doesn't matter how old or young a student is when they enter the field, so long as they share a passion for positively impacting human health. Using data, they say, can unite expertise from a number of different fields, and have a large-scale impact on patients.

"We're all on the same team here," Sarkar says. "In the end, it's all about providing better patient care, with the best available data, in the most efficient way, whether it be through inspiring students or working directly with researchers and clinicians."

David Levin *is a freelance science writer based in Boston.*



BRAIN DRAIN

ISTOCK.PTOTO; ©TOM MURPHY

Electronic health records are sucking the joy out of physicians and leading to burnout.

Can we remedy the digital malaise?

BY KRIS CAMBRA

It started with

a picture drawn by a 7-year-old girl. In brilliant color, she depicted herself and her happy family in a physician's exam room. The doctor, though smiling kindly, is typing away at the computer, his back to the family.

The image was a wake-up call for the physician in the picture, Thomas Murphy, MD RES'12 F'15, and his colleagues at Rhode Island Hospital. Murphy was a pediatric resident at the time, a "very special resident," according to Elizabeth "Betsy" Toll, MD, clinical associate professor of

pediatrics and of medicine. He had already done a Navy internship and served two years as chief medical officer on an aircraft carrier of 2,500 people.

"He arrived, as an intern, a fully trained physician," she says. "And yet, he was very humble, and very beloved by his colleagues, and his patients, and their parents. So along with the powerful message of this drawing came the sickening feeling: if this is how patients are looking at *Tom Murphy*, how are they seeing the rest of us?"

Toll was determined to find a way to share that picture and to get people to recognize how computers, and specifically the electronic health record (EHR), were intruding in the exam room. She wrote a reflective essay, called "The Cost of Technology," that was published in the *Journal of the American Medical Association* in 2012.

That was exciting, she says, "but even more exciting was what happened afterward. People wrote from all over the United States and other countries like Argentina and Australia—doctors, nurses, lawyers, all kinds of medical professionals, most of them sharing my angst that their jobs had been stolen from them, and that they'd spent huge amounts of money to have this machine that doesn't work well, that interferes with their ability to connect with their patients, the most meaningful and enjoyable part of their work."

A few voices said it didn't have to be that way, that physicians just needed to learn how to use the technology with the patient.

One voice belonged to Shmuel Reis, MD, an Israeli family physician, educator, and researcher on effective integration of technology in clinical care who has had a longstanding relationship with the Warren Alpert Medical School.

"We started a dialogue, and we had really diametrically opposite experiences," Reis says. "As much as Betsy was in the angst of having to have a computer, I was already there in my 20-something year with computers in my practice, and I love my computer."

Reis is part of a group of educators working on communication methods to use the computer effectively as part of the patient encounter "as an enabler, not a disabler," he says. But the challenge is two-fold, as records systems used in the US are part of the problem, their design interfering and altering, wholesale, the work of the physician.

After communicating with others in the field who were thinking about and researching the topic, Toll and Reis decided there was a need for an entire conference devoted to how the electronic health record has affected the patient-practitioner relationship. In 2015, Allan R. Tunkel, MD, PhD, associate dean of medical education, gave them the green light to host an international conference at Brown, beginning an 18-month planning period with the support of Warren Alpert Medical School's Office of Continuing Medical Education.

The payoff was "The Patient, the Practitioner, and the Computer: Holding on to the Core of Our Healing Professions in a Time of Technological Change," a three-day conference held in March that brought together patients and practitioners—including physicians, nurses, nurse practitioners, medical assistants, and mental health professionals— as well as vendors and technology designers, health care stakeholders, and government officials from seven countries to study the impact of the EHR on the patient-practitioner interaction. Believed to be the first meeting of its kind, its goals were to open a dialogue among these stakeholders, determine what can and should be changed, and chart a course for getting there.

> "When you sit with patients and understand what's going on with them and help them and they're grateful, they, in turn, restore you."

DATE NIGHT

In theory, the EHR sounds like a perfect idea. We all walk around with computers in our pockets anyway, so why not harness the technology in health care? Sharing medical records across systems, even competing ones, can improve patient safety and decrease duplication of care. With such potential, the federal government provided financial carrots to get providers to adopt EHRs, writing a $20 billion provision into the economic stimulus bill in 2009. The

Health Information Technology for Economic and Clinical Health (HITECH) Act provided Medicare and Medicaid incentive payments to practices and hospitals that demonstrated "meaningful use" of EHR technology certified by the Department of Health and Human Services. Later, in 2015, the carrot became a stick: providers faced a reduction in Medicare and Medicaid reimbursement of 1 percent that increased each year that they did not demonstrate meaningful use of the technology, to a maximum of 5 percent.

According to the Office of the National Coordinator for Health Information Technology, by 2015, 87 percent of office-based physicians had some form of EHR. The same year, nearly all (96 percent) non-federal acute care hospitals had a certified EHR.

Indeed, the EHR hasn't been all bad. Respondents on one panel at the conference were asked to list the unintended positive benefits of their system. They unanimously agreed on a few: patients have more information about their health because of access to patient portals driven by the EHR; practitioners can see other physicians' documentation, noting their concerns, which helps with coordinating care; and, when properly designed and implemented, EHRs can actually save time, improve efficiency, and decrease administrative burden.

Hedy Wald, PhD, a member of the planning committee and an expert in physician resiliency and professional identity formation, saw the value of the EHR in patient education when she became the cancer caregiver for a family member. "The physician opened up the scans, showed us on the screen what was happening in the brain. It helped us understand so much better," she says.

Negative consequences, however, have eclipsed the positive, and according to the literature, EHRs are spurring physician burnout and even driving some out of practice.

According to a study by the American Medical Association, more than half of US medical doctors report symptoms of burnout such as emotional exhaustion and depersonalization. Burnout rose tenfold in three years—almost double the rate in the general population. Typically, higher levels of education are protective, but not so for physicians.

Christine Sinsky, MD, the AMA vice president for professional satisfaction, delivered the conference's keynote lecture. A study she coauthored found that the major driver of professional dissatisfaction among physicians was the EHR. The chief complaint: "too much time per task." She described a time-motion study published last year in the *Annals of Internal Medicine* that found that physicians spent a full 50 percent of the workday doing EHR and desk work.

And it's not just the workday. Other studies have found that every hour of direct patient contact generates two hours of computer work. You don't have to be a mathematician to predict what comes when the hours no longer fit in the prescribed workday: after-hours charting.

THE COST OF TECHNOLOGY: This drawing by a 7-year-old raised the alarm about the impact of computers on the patient-practitioner relationship.

If Norman Rockwell were alive today, he might paint a tableau of the modern physician described by Betsy Toll. Every night, she and her husband, a pediatrician, get in their pajamas, build a fire, pull out their laptops, and chart across a card table from one another. "We're empty nesters now, but I wonder, how are doctors with young children managing their work?" she says. "What kind of attention are their children getting?"

Ross Hilliard, MD RES'15, assistant professor of medicine (clinical), sees patients in the ambulatory clinic at Rhode Island Hospital and at University Medicine. He's a certified physician builder on Epic, the nation's second-largest health record system and the one used by Lifespan and Care New England. He says based on their usage data, they see some clear trends in EHR use.

"People are spending a lot of time outside of the office charting," Hilliard says. "A look at our provider data shows us people are on the system as early as 4 a.m., then there's what we call the 'commuting dip' between 7 and 8, and after that the system is active until 1 a.m." On the ambulatory side, the only lull in usage occurs between 1 and 4 a.m.

Other studies have shown similar trends. "Saturday night belongs to Epic," Sinsky said at the conference, noting one study that found system traffic peaks on the weekend.

One of the most lamented aspects of the electronic record systems is the endless checking of boxes. Sinsky worries that clicking through the tasks as prompted by the

system leads to automation. "If we march through the visit in a generic way," she said in her remarks, "we'll start to see our patients as generic, and stop listening to their stories." In her role at the AMA, Sinsky travels the country taking the pulse of the nation's physicians. They tell her things like, "I became a doctor to take care of patients. I have become the typist."

Those check boxes, Toll says, are not designed with the patient visit in mind, but to serve billing and regulatory systems. The number of checked items determines the level of reimbursement insurers will pay, or demonstrates compliance with Medicare regulations. Other regulatory-driven questions come from The Joint Commission, the state, and hospitals' or practices' own policies. And every little click adds up.

Shmuel Reis offers an international perspective. In Israel, where the electronic health record system was paid for by the government, the physician workflow is the driver. "They wanted people to be efficient. They wanted all the functions of prescribing, refilling, and documenting to be efficient and as few clicks away as possible," he says. And in a single-payer health system, there are no insurance-driven questions.

"In my practice," Toll says, "it takes five clicks to order one flu shot." Studies have shown the average emergency room shift includes 4,000 physician clicks.

Interfaces that are not well designed are going to cause problems even for digital natives. Hilliard, who entered practice just as the transition from paper charts to EHRs was happening, says: "The biggest predictor [of problems] is how many clicks it takes to do something in the record. That's going to be painful for anybody."

Overly busy screens can lead to information overload. Toll uses the example of ordering prescriptions. Prescribing an antibiotic can involve searching through a long list of options to make the right selection. "What if I click the wrong one?" she says. Information processing like this increases cognitive workload.

TEXTING AND DRIVING

Reis says the problem isn't just the EHR itself, it's that practitioners are not learning how to use it in their communication with patients. They are not learning how to shift attention from the computer to the patient, in order to maintain eye contact. They are trying to multitask, in real time, with the patient watching.

"It's like texting and driving," Toll says. Continuously dividing one's attention is damaging to the physician-patient relationship.

By design, patients were front and center at the Patient, the Practitioner, and the Computer conference. The planning committee, Toll says, wanted patients to be an integral part of the discussion, and included one on every panel. Most patients living with chronic conditions said they like the electronic health record because they feel it helps their doctors manage their complex care. One patient, Nicole Purcell, said during a stressful period in her life she had become less vigilant in caring for her type 1 diabetes. Sitting down with her doctor at the computer, and seeing her lab values in black and white, helped her get back on track.

But other patients report having less eye contact with their physicians makes them feel they do not have their full attention. The problem is not unique to the US: Reis says he hears it wherever he goes.

"Whenever I was traveling, and I was in a cab—whenever a cabby asked me what do I do, and I spoke about dealing with the computer in the exam room, invariably, cabbies all around the world said, 'Oh, me, my daughter, my mother went to the physician, and they didn't look us in the eye. They just look in the computer.' So it was a realization that, worldwide, people and professionals are experiencing some damage, some issue when it comes to communication," Reis says.

That's the heart of the problem, according to Toll. Think about why people go into healing professions in the first place. "It probably has to do with healing parts of ourselves," she says. "When you sit with patients and understand what's going on with them and help them and they're grateful, they, in turn, restore you."

Toll adds, "And I think for people who entered this field with the need—whether conscious or unconscious—to be healed in the course of healing, it comes as a rude shock to find we're spending our days in front of a computer screen."

SHARE THE CARE

Though the three days of the conference offered plenty of time for venting, a number of sessions provided workable solutions to improve or stave off EHR burnout and use the computer to improve patient care. Suggestions ranged from the individual level to the practice level, to larger-scale change involving software design and regulatory agencies.

One ongoing theme was greater involvement of patients in their own care, ranging from increased patient-physician interaction through portals to patients having access to their own office notes. Practices also can move toward a team-care delivery model using medical assistants and nurses for documentation and wraparound patient care. It follows the adage "everyone working at the top of their license," so physicians are doing the things only the physician can do, not documenting the visit, or doing billing and follow-up paperwork and calls. This is different from using scribes, who are simply documenting the visit.

Sinsky uses this model in her practice, and pointed out "that the delivery models of the future cannot be managed

with the staffing models of the past. The ideal is two to three medical assistants or nurses per physician." At first, she was concerned patients would be wary of having another person in the room, but in practice it has only enhanced relationships with patients. They appreciate having another person looking out for them, she said. And patients always have the option of not having the medical assistant present.

At the tech design level, practitioners asked vendors to listen to their concerns and to think about real practice issues, rather than trying to replicate paper charts in a computerized format. One vendor, Christine Tremblay, director of product strategy for Rhode Island's Amazing Charts, said she wants next-generation records systems to incorporate machine learning and natural-language processing. That would free up physicians to document visits in a narrative rather than checkbox form.

Hilliard says health systems, too, need to involve practitioners in the adoption and development of their EHRs. "One of the things I was surprised to learn at the conference," he says, "was that more places than I thought really don't have providers at the table when making these decisions." Both Lifespan and University Medicine included providers in the process, he says.

He adds, "And don't just pick the most tech-savvy doctor, but maybe the least tech-savvy, too, to point out the painful and non-intuitive parts."

AN OUNCE OF PREVENTION

At the Warren Alpert Medical School, using the electronic health record is part of the curriculum, thanks in part to work done by Wald, Reis, Paul George, MHPE '01 MD'05 RES'08, assistant dean for medical education, and Julie S. Taylor, MD, MS, adjunct professor of family medicine. In 2014 they published a paper in *Academic Medicine* on teaching students how to enhance patient-centered care using the computer. The skills include positioning the patient, the practitioner, and the computer for optimal interaction; starting the encounter with the patient's concerns; and verbalizing a shift to the computer. Advanced skills encourage the patient's participation in building the chart, utilizing information from the chart for shared decision-making and to reinforce discussion as well as communicating a note to the interprofessional team.

Wald, a clinical professor of family medicine and director of Resident Resilience and Wellbeing for the residency programs in Child Neurology and Neurodevelopmental Disabilities at Boston Children's Hospital, lectures around the world on physician resilience and well-being, the state of which she calls "a public health crisis." In addition to the damage to physicians themselves, "it relates to patient safety," she says, "and to patient satisfaction. Data show that more engaged doctors have higher levels of patient satisfaction."

"Don't just pick the most tech-savvy doctor, but maybe the least tech-savvy, too, to point out the painful and non-intuitive parts."

The answer is not to throw the EHRs out the window, however, nor is it to "fix the physician" alone. She advocates for organizations to cultivate a culture of resiliency in which leaders listen and respond to physicians' concerns. "There is an organizational strategy to reduce burnout," Wald says.

While no silver bullet was found in the course of the conference, just talking about the issues seemed to help. "There was a lot of creative energy and thinking about next steps," Toll says. Since the conference she's been reframing her thinking about the EHR. "Emotions are contagious. Patients are going to pick up on my attitude about the computer, positive or negative," she says. She has been preparing for visits in new ways, engaging nurses more in care, and doing more teaching using the EHR.

Tom Murphy, who's now a neonatologist in New Jersey, brought his patient's original drawing to the conference. He told the crowd that his feelings about the picture have shifted.

"It changed from a cautionary tale to a tale of hope," he said. "That interaction and human connection will not be lost, just changed, so long as there are those of us who care enough to talk about these issues, who care enough to make these issues matter."

ALUMNI ALBUM

CHECKING IN WITH BROWN MEDICAL ALUMNI

TIME FLIES: In what has become an annual tradition for graduating medical students, the MD Class of 1977 gathers for its group photo. The class is celebrating its 40th reunion this May.

WARREN ALPERT MEDICAL SCHOOL ARCHIVE

CLASS NOTES

MD

1975

Anthony A. Caldamone '72 MMS'75, P'06 received the Distinguished Contribution Award from the American Urological Association in May for his contributions to academic urology and exemplary humanitarian dedication to pediatric urologic missions in Asia, Africa, the Middle East, and South America. Tony is a professor of surgery (urology) at the Warren Alpert Medical School.

1980

Judith Owens, MPH '77 F'87 organized Adolescent Sleep, Health, and School Start Times, a national conference held in late April in Washington, DC, to discuss why and how school districts can change their start times to help teens get adequate sleep. Judy is the director of the Center for Pediatric Sleep Disorders at Boston Children's Hospital and a member of the Faculty of Neurology at Harvard Medical School.

EYE
ON ALUMNI

Leading for Change

An alum heads a university with a mission to combat health disparities.

When Charles R. Drew University of Medicine and Science in Los Angeles needed a new leader, taking on the role was a no-brainer for David M. Carlisle, PhD MD'81.

The historically black university, known as CDU, established its medical school to care for underserved populations following the 1965 Watts riots, when more than 30 people were killed in the South Los Angeles neighborhood while protesting allegations of police brutality against a black resident.

"We're in the middle of a community where health disparities are incredibly important," Carlisle says. "We train health professionals who intend to combat those disparities."

Carlisle's commitment to caring for underserved communities isn't just professional—it's personal. His family is from South Los Angeles, and he grew up in the View Park neighborhood, one of the dozens of predominantly African-American neighborhoods that make up the region.

"I've seen what happens to relatives or friends when they don't have access to mainstream medical care, and it's particularly frustrating when you know it's available right around the corner," Carlisle says.

CDU students perform a rotation at the Venice Family Clinic, the largest free clinic in the nation, which provides health care to more than 25,000 patients in Los Angeles County each year. Carlisle volunteered at the clinic for many years and now sits on its board.

"A resident of Watts deserves the same high-quality health care as a resident of Beverly Hills," he says.

David M. Carlisle

CAROLINE GOLLUB

Carlisle became president of CDU in July 2011, a tumultuous time for the university. It was facing serious financial problems; two years earlier, it had nearly lost its accreditation.

He credits the intervention of community members and local agencies with helping to turn things around, and he says he was "humbled" to be chosen as the university's president. After he took over, enrollment at CDU increased, as did federal funding for research. Recently, the university expanded its undergraduate program.

Prior to joining CDU, Carlisle was the director of California's Office of Statewide Health Planning and Development, serving for 11 years under the administrations of three different governors. He has been an adjunct professor in the Department of Medicine at the David Geffen School of Medicine at UCLA since 1992. He is also a professor in the College of Medicine at CDU.

Reflecting on his time at Brown, Carlisle credits the Medical School's "exceptional" clinical training environment and its proximity to major teaching hospitals for his ability to expertly care for critically ill patients.

He transferred from the Stanford University School of Medicine to Brown to join his wife, Sylvia Gates Carlisle, MBA MD'82, a senior medical director for Aetna Better Health who is also a board-certified internal medicine specialist and geriatrician. The couple has two grown children: David, a public defender in Oakland, CA, and Aimee, a public defender in the Bronx.

"The thing that makes me proudest is having conversations with our students and feeling motivated and inspired by the young people on campus who are dedicated to achieving the same mission as the university," Carlisle says. ***—Amy Anthony***

ALUMNI ALBUM

1982

Jacqueline A. French '77 is a member of the scientific advisory board of Ovid Therapeutics. She is also a professor in the Department of Neurology, director of translational research and clinical trials in epilepsy, and a neurologist at the Comprehensive Epilepsy Center at NYU Langone Medical Center. A founder and director of the Epilepsy Study Consortium, she serves as chief scientific officer of the Epilepsy Foundation.

1983

Peter Hollmann '79 is academic director of the Executive Master of Healthcare Leadership program at the Brown University School of Professional Studies. He's also chief medical officer for University Medicine, a Rhode Island-based academic and patient care medical group, and clinical assistant professor of family medicine at the Warren Alpert Medical School. He practices geriatric primary care in East Providence.

Mitchell Lester '79 practices allergy and immunology in lower Fairfield County, CT. He's involved with the New England Society of Allergy and was recently elected to the Board of Regents of the American College of Allergy, Asthma, and Immunology. His wife, Jill, is a school psychologist, and their daughter, Beth, is graduating from Elon University with a degree in industrial design studies; for her thesis project she designed a walker with a distance sensor and an automatic braking system for going downhill.

1989

Timothy J. Hunter P'12 performed the first left ventricular assist device implantation at University Hospital in Augusta, GA, in March. Tim has been working on starting the program for three years, making trips to Atlanta's Piedmont Hospital to refine his skill in implanting the device. He is certified by Medicare to perform the procedure, which helps the heart pump blood in patients with advanced heart failure.

1996

Jennifer Friedman, MPH, PhD '92 is a co-investigator on a project studying how the interactions of undernutrition, alcohol use, and helminthiasis affect risk for adverse pregnancy outcomes. The research was funded by a $1 million grant from the National Institute on Alcohol Abuse and Alcoholism. Jennifer is a professor of pediatrics at the Warren Alpert Medical School and of epidemi-

Timothy J. Hunter performed the first left ventricular assist device implantation at University Hospital in Augusta, GA.

GOT NEWS?

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EYE ON ALUMNI

Gripping Sidelines

A career in interventional radiology inspires an action-adventure fiction writer.

A lost treasure. A mysterious explorer. Bad guys chasing unsuspecting academics. It's not the plot of the latest Indiana Jones adventure but of *The Lost Book of Wonders*, the debut novel of Chad Brecher '94 MD'98. Published this spring, it's a fast-paced historical mystery that involves a metal chest once in the possession of the explorer Marco Polo that is unearthed by modern-day archeologists.

By day (and nights too, when on call) Brecher is an interventional radiologist at Southeast Radiology, just outside Philadelphia. He focuses on vein disease and interventional oncology, although his practice is within a health system that has a Level II trauma center, so there's a great deal of variety in his day. He's also an involved parent of children ages 4, 8, and 11. How does he find the time to write?

His published book has been in the works for 10 years, he says. "Most physicians have their creative outlet," he says. "For surgeons, it might be the artistry in how they tie sutures. For me, it's writing." Brecher says he's already written a sequel and several other manuscripts, although this is the first novel he's pushed to get published.

Brecher was inspired to write about Marco Polo because of the controversies surrounding Polo's life and legacy. "Did he really bring pasta back from China? Did he even really go to China, and what

Chad Brecher

RACHEL MCGINN; COURTESY DEEDS PUBLISHING

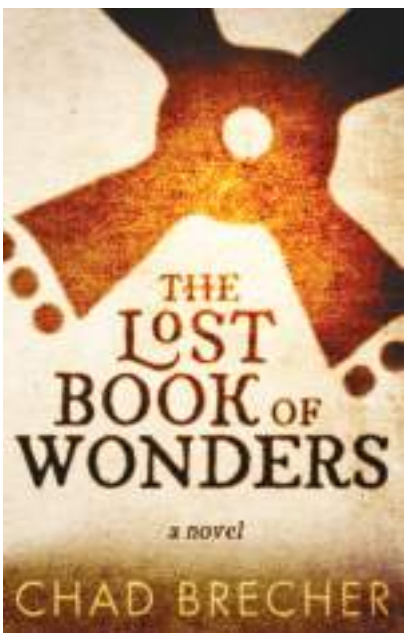
> "For surgeons, it might be the artistry in how they tie sutures. For me, it's writing."

was he doing there?" Brecher says. The idea for the novel was cemented on a trip to Venice with his wife. As he contemplated how ancient the city is while peering into one of the canals, he remembers wondering, "How many things have been dropped into this water over the years?"

Brecher did much of the research for the novel after he completed his fellowship at Johns Hopkins and joined his wife, a historian who was finishing graduate school, in Boston. As a clinical instructor at one of Harvard's teaching hospitals, Brecher gained access to Harvard's vast library and would spend hours taking books down from the stacks to do research.

The young protagonists of *The Lost Book of Wonders* are Ellie, an expert in pre-Biblical and Biblical archaeology, and Alex, a graduate student in history. The two academics come into possession of a historical treasure and are thrust into an adventure when they're pursued by murderous thugs.

Does Brecher relate to his heroes? "Maybe a little bit," he says. "Growing up in the '80s, I loved Indiana Jones. And, while radiology generally can be



academic and scholarly, interventional radiologists do procedures that can be life threatening. There is more stress, more of an adventure." His discipline, he notes, combines the processes of trying to figure something out and actively intervening on a disease. "Yes, it does play a role in how I view these characters," he says. ***—Mary Stuart***

The Lost Book of Wonders *is available from Deeds Publishing and Amazon. Learn more at www.chadbrecher.com.*

EYE ON ALUMNI

Ars Medica

'Return to play' has broader meaning for artists.

Amity Rubeor

Performing artists have much in common with athletes, Amity Rubeor, DO RES'05 says. Their activities result in specific types of injuries and strains—tennis elbow, in the case of the violinist who practices three hours a day, or Achilles tendonitis in the dancer—and they are just as eager to return to play as the football player who's suffered a concussion.

"Their identity is wrapped up in it," she says.

Rubeor is the first physician in Rhode Island to receive certification in performance medicine, an expertise centered on the specialized musculoskeletal issues of musicians and dancers. Performance medicine is a natural offshoot of her practice at Care New England's Affinity Sports Medicine.

Rubeor treats many concussions, and says it's important to consider the role that other activities play in "return to play" strategies. "I had a young hockey player who was also in the band," she says. "I realized that he shouldn't play the tuba while he was recovering from a concussion, because of high pressure required to play that instrument."

That was one of her earliest insights into the medical needs of performers, and it was confirmed by observations of her daughter's dance classes, and the particular types of injuries to which dance students are prone. She pursued her interest by taking a workshop on performance medicine with the American College of Sports Medicine, and followed that up in July 2016 by earning certification from the Performing Arts Medical Association.

For Rubeor, this focus on performance medicine isn't just a desire to treat a specific type of patient using specialized skills; it's a tool for understanding important dimensions of the patients she already has in her practice. For example, one patient who had been struggling with intractable back pain after a car accident is a music teacher who plays the saxophone. "I have to think about her posture and how she holds her sax. I have to balance what I want to see a musician do as far as posture and behavior, with what they have been taught to do and have been doing for years," she says.

"Before I took the course, I might have told a violin student, 'Just don't play for two weeks,'" Rubeor adds. "But now I realize that they can't. Performance matters so much in their lives." Now she gives performing artists and athletes the same reassurances: "I'm going to get you back to doing what you love and need to do as quickly as possible, but I'm going to take into account what that is doing to your body. We are going to try to make that work." ***—M.S.***

ology at the Brown School of Public Health.

Jake Kurtis '89 PhD'96 will become the chair of the Department of Pathology and Laboratory Medicine and director of the Warren Alpert Physician-Scientist and MD/PhD Training Program at the Warren Alpert Medical School on July 1. He studies malaria immunity and has identified and characterized new malaria vaccine candidates; he is poised to begin a Phase 1 human trial under the aegis of the Brown Institute for Translational Science and the Lifespan Clinical Research Center. He has also been appointed the inaugural Stanley M. Aronson Professor.

1997

Daniel Dickstein '93 RES'02, an associate professor of psychiatry and human behavior, of pediatrics, and of diagnostic imaging at the Warren Alpert Medical School, received a $2 million grant from the National Institute of Mental Health for his work studying brain-behavior mechanisms of irritability and cognitive flexibility in children. He is a physician at Bradley Hospital in East Providence, where he leads the Pediatric Mood, Imaging, and NeuroDevelopment (PediMIND) program.

2003

Jaya Agrawal, MPH '97, a physician with Hampshire Gastroenterology in Florence, MA, was named the 2017 Community Clinician of the Year by the Hampshire District Medical Society. According to a press release from the Massachusetts Medical Society, which established the awards, "her colleagues noted her kindness, compassion, and abilities as a communicator along with her skills and expertise in providing medical care to her patients." Jaya is chief of endoscopy at Cooley Dickinson

COURTESY RUBEOR

Hospital in Northampton and a founding member and president-elect of the Massachusetts Gastroenterology Association. She lives in Florence.

2005

George Hardy RES'09 joined the board of directors of the Rhode Island Parent Information Network, a nonprofit that provides health care and education support and advocacy for individuals and families. A pediatrician at Anchor Medical Associates in Warwick, where he's practiced since 2010, he has two young children.

2006

Christine Montross MMSc'07 RES'10 was awarded a Brown University Faculty Fellowship at the Cogut Center for the Humanities for 2017-2018. The Cogut Center sponsors semester-long fellowships for Brown faculty members who wish to be affiliated with and residents at the center while pursuing their research on campus. Christine is an assistant professor of psychiatry and human behavior at the Warren Alpert Medical School.

2009

George Turini III '05 RES'14 F'16 ScM'16, a clinical instructor in medical science at the Warren Alpert Medical School and a urologist with Southcoast Physicians Group, was lead author of a study published in *Urology* in March that found that only 30 percent of men discussed the benefits and risks of the PSA blood test for prostate cancer with their doctor. Furthermore, even fewer patients were having these prescreening discussions after the US Preventive Services Task Force's 2012 recommendation against the test for healthy men. The authors concluded that their findings "should not only be viewed as a serious problem but acted upon swiftly so as to minimize the chances of cultivating a growing cohort of patients ill-prepared to handle the repercussions of prostate cancer screening."

2013

Jessica Hart Heney RES'16 is a family physician at Thundermist Health Center in Woonsocket, RI. She completed her family medicine residency at Memorial Hospital of Rhode Island, while continuing to work with students at Central Falls High School on a health curriculum she began during medical school. She and her husband, **Ryan Heney** MD'15 RES'18, a family medicine resident at Memorial, live in Cumberland with their daughter, Phoebe.

John Luo '09 was appointed to the Rhode Island Parent Information Network board of directors. He is founder and president of Doctor's Choice, an organization that helps patients choose Medicare coverage.

2015

Ryan Heney RES'18. See **Jessica Hart Heney** MD'13 RES'16.

RESIDENTS

1979

Penelope Hill Dennehy, MD, professor and vice chair of Pediatrics at the Warren Alpert Medical School, has been named the 2017 Rhode Island Medical Women's Association Woman Physician of the Year. She is the director of the Division of Pediatric Infectious Diseases at Hasbro Children's Hospital.

1985

Deborah L. Myers, MD P'17 received the Distinguished Surgeon Award at the 43rd annual Scientific Meeting of the Society of Gynecologic Surgeons. She is a board certified female pelvic medicine and reconstructive surgeon and director of the Division of Urogynecology and Reconstructive Pelvic Surgery at Women & Infants Hospital, where she completed the residency in obstetrics and gynecology. She is professor and vice chair of the Department of Obstetrics and Gynecology at the Warren Alpert Medical School and the director of Continuing Medical Education at Women & Infants.

Jaya Agrawal was named Community Clinician of the Year by the Hampshire District Medical Society.

1994

Paul A. DiSilvestro, MD, was appointed director of the Program in Women's Oncology at Women & Infants Hospital. He is also the cochair of the Ovarian and Breast Cancer Committees at NRG Oncology and has been study chair or cochair of multiple National Cancer Institute-sponsored gynecologic oncol-

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ogy group trials. Paul is the division director for gynecologic oncology. He completed his residency in obstetrics and gynecology at Women & Infants and the Warren Alpert Medical School, where he is a professor.

1999

Kristine J. Guleserian, MD, is the director of the Heart Failure and Transplant Program at Nicklaus Children's Hospital in Miami. Her clinical interests include cardiac morphology and pathology and minimally invasive cardiac surgery. She is the author of the forthcoming book *Surgeon's Story*.

2008

Linda Wendell, MD, received the 2017 American Academy of Neurology A.B. Baker Teacher Recognition Award for her work at the Warren Alpert Medical School, where she is an assistant professor of neurology and of neurosurgery. The award recognizes excellent teachers for their contributions to improving neurology now and in the future. Linda attended medical school at the University of Tennessee and completed the neurology residency at Brown/Rhode Island Hospital.

2012

Jodi Roque, MD, is a family medicine physician at Thundermist Health Center of Woonsocket, RI. She completed her family medicine residency at Brown, where she is a clinical assistant professor. Her areas of interest are in women's health and care of the underserved.

2018

Pooja Niraj Pandit, MD, and **Brian Baturin**, MD, married March 19 at the Liberty House restaurant in Jersey City. They met in August 2011, when they started at Rutgers New Jersey Medical School. Both are second-year internal medicine residents at the Warren Alpert Medical School.

FELLOWS

1997

Brian Silver, MD, is the first Endowed Chair in Neuroscience Research at the University of Massachusetts Medical School, which he joined last year as vice chair and professor of neurology. Through his research on the prevention of stroke, he has developed effective new approaches to stroke therapy. Previously he was a professor of neurology at the Warren Alpert Medical School.

2006

Kevin Martin, MD, was appointed to the board of trustees of Reliant Medical Group in central Massachusetts. A pulmonologist who practices at Worcester Medical Center, he completed his fellowship in pulmonary disease and critical care medicine at Brown. His specialties include asthma, COPD, and interstitial lung disease.

2008

Gwynne Bragdon, MD, joined the Division of Hand, Upper Extremity, and Microvascular Surgery in the Department of Orthopedic Surgery at Newport Hospital. After completing a fellowship in hand and upper extremity surgery at Brown, she practiced orthopedic surgery and hand surgery in Pittsburgh. She lives in Barrington, RI, with her husband, Andrew Evans, MD, an assistant professor of orthopaedics at the Warren Alpert Medical School, and their two children.

2009

Nicole Alexander-Scott, MD MPH'11 and Julian Drix '08 of the Rhode Island Department of Health were selected as members of the second cohort of The Kresge Foundation's Emerging Leaders in Public Health initiative. The initiative grants each team up to $125,000 as well as coaching and technical assistance to help them gain additional knowledge and skills to tackle their communities' health challenges.

Theresa Ruddy, MD, MPH, joined the General Surgery Associates practice of Oswego Health in Oswego, NY. She completed her colorectal surgery fellowship at the Warren Alpert Medical School, where she also served as a teaching fellow in surgery. She is married and has four children.

Internal medicine residents Pooja Niraj Pandit and Brian Baturin were married March 19 in Jersey City.

REACH OUT

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OBITUARIES

ALUMNI

NATHAN S. ROSS '76 MD'79

Nathan Ross, 61, of Tacoma, WA, died January 27, 2016. A native of Worcester, MA, he did his residency, including a year as chief resident, at Case Western. He began his career in medicine at the West Los Angeles VA Medical Center, where he was assistant chief of endocrinology. He went on to become the chief of medicine at the Huntington VAMC in West Virginia and then the chief of staff at the VA in Columbus, OH. He later worked in private practice in Amarillo, TX, and Tacoma, WA.

Dr. Ross was a generous supporter of the University Place School District that his sons attended near Tacoma. A devoted reader, he bought all the books at the annual book fair on each teacher's wish list for their students. In the same generous spirit, he regularly treated patients without private insurance. Dr. Ross was well known among family and friends for his wit, dry sense of humor, and compassion toward others.

He is survived by his wife, Patricia; two sons; his father; two brothers; two sisters-in-law; and 14 nieces and nephews. Donations in his honor may be made to the National Multiple Sclerosis Society at www.nationalmssociety.org/donate or 800-344-4867.

JOANNE GIUTTARI MITCHELL MD'87

Joanne Mitchell, 70, of Holliston, MA, died August 15, 2016. Born in Providence, she studied German and premed at Trinity College in Washington, DC, and earned her Master of Education in Child Studies at Tufts. In 1978, she decided to pursue her dream of a career in medicine; she completed her MD at age 41, and then her pediatrics residency at UMass Medical Center and a fellowship at Boston Children's Hospital. Dr. Mitchell's career focused largely on the care of children and young adults with developmental and other disabilities. She was on staff at Boston Children's for 20 years, receiving their Community Pediatrician Award in 2006. She taught and oversaw research for more than 15 years at Harvard, and also served at the Massachusetts Hospital School in Canton throughout her career. Dr. Mitchell is survived by her husband, Jon; two sons; and three brothers. Donations in her memory may be made to United Cerebral Palsy of MetroWest, 71 Arsenal St., Watertown, MA 02472, www.ucpboston.org.

FACULTY

PAUL M. KNOPF, PHD

Paul Knopf, 80, of Barrington, RI, died January 31. He was the Charles A. and Helen B. Stuart Professor Emeritus of Medical Science at Brown. After receiving his bachelor's and his PhD, in biophysics, from MIT, he completed a two-year, National Institutes of Health-sponsored postdoctoral fellowship at the MRC Laboratory of Molecular Biology, in Cambridge, England, in the research group of Nobel laureate Francis Crick. He then spent eight years at the Salk Institute for Biological Studies before coming to Brown as an associate professor of medical science in 1972.

> He was the first chair of Brown's Department of Molecular Microbiology and Immunology.

Professor Knopf was the first chair of the new Department of Molecular Microbiology and Immunology, from 1994 to 1997. His research focused on three areas: the basic biology of protein synthesis—which led to his co-discovery of the polyribosome in 1963 and the cell-free, reticulocyte based protein translation system in 1964; humoral immunity to the parasite *Schistosoma mansoni*; and immune privilege in the brain. He served as a scientific adviser to the Progeria Research Foundation. In addition to his research accomplishments, Professor Knopf was a dedicated mentor to more than 35 graduate students and postdoctoral scholars. In 1998 he was honored as Teacher of the Year in the Life Sciences for his undergraduate courses in immunology. He attained emeritus status in 2003.

Paul M. Knopf

He loved traveling and lived and worked abroad throughout his career. He enjoyed doing puzzles and playing bridge. An avid baseball fan, he closely followed the career of Willie Mays from his days as a minor league player for the Trenton Giants. He is survived by his wife of 58 years, Carol; three children; and three grandsons. Donations in his memory may be made to Temple Habonim, 165 New Meadow Road, Barrington, RI 02806; the American Parkinson Disease Association, Rhode Island chapter, www.riapda.org; or the Progeria Research Foundation, www.progeriaresearch.org.

COURTESY CAROL KNOPF

IMPRESSION

Beads on a String

When Nicole Heinl MD'18 was commuting from Barrington to her hospital rotations in Providence, she occasionally would stop at the Osamequin Nature Trails and Bird Sanctuary along the Wampanoag Trail (Route 114) to eat breakfast and watch the sun rise. "The conditions were beautiful that morning," Heinl says of one stopover in September 2016. "The rising sun was burning off a dense mist and I was actually leaving when I noticed the dew on a spider web. It was a special moment—there was enough sun to make everything glow orange, but not so much that the dew had burned off entirely." Heinl graduated from Stanford in 2013, and has done some professional photography, but mostly takes pictures as a hobby. This photo is part of the Third Annual Warren Alpert Medical School Art Council Exhibition at the Medical School building.—*Kris Cambra*

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"The Warren Alpert Medical School has given me the opportunity and confidence to pursue a diverse skill set. It's very empowering to know that in the future, I won't just be a physician—I'll also be a coder, a businesswoman, and a teacher." —KARISHMA BHATIA '15 MD'20

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BROWN TOGETHER