

yale medicine



A fresh start for medical education

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Jewish law and stem cell research

The recent issue of *Yale Medicine* [Spring 2016] devoted to stem cell research highlighted the decade-long debates as to the ethical implications. Of interest was the presentation of the religious view, primarily from the traditional Catholic perspective. Conspicuously absent was the Jewish point of view, which I recently summarized in an article published in *Nature Medicine* in 2009, "The preimplantation embryo and Jewish law." I am attaching excerpts from this summary, which details the basis for the Jewish Halacha (religious law) that licenses the use of preimplantation tissue for research

and permits the creation of embryos explicitly for research with no concern of violating the dignity of life.

"It is clear that the preimplantation embryo itself does not have the capacity to develop into a human being. If it is intended to be implanted, and if it is successfully done, only then does it acquire the full potential to become a human being. Thus, it is universally agreed by all Jewish law authorities that the preimplantation embryo does not have the same sacred title to life as the implanted embryo. Therefore, preimplanted embryos that are not designated for implantation, including their stem cell lines, can be used for potentially

lifescaping and disease-curing purposes. In addition, the creation of in vitro preimplantation embryos for research is allowed, if it is probable that the research will ultimately help in saving human life."

My hope is that in the future, this perspective will be included in the deliberations of the committee devoted to discussions of the ethics of the use of stem cells in medical care and research.

*Arthur I. Eidelman, M.D., HS '67
Jerusalem, Israel*

Yale Medicine wins top national honor

In June we learned that *Yale Medicine* had received a Gold Award from the Council for Advancement and Support of Education (CASE). The award, part of CASE's annual Circle of Excellence program, is in the category of Special Constituency Magazines. *Yale Medicine* was one of 323 entries from 185 institutions in 10 countries.

In their report, the CASE judges said, "This magazine packed a punch." The judges went on to cite "Beautiful illustrations on the interior. Well-written stories. Nice clean layout, simple headlines. Substantive writing that grabbed your attention and was easily read and understood."

We wish to take this opportunity to extend our thanks and appreciation to all the writers, photographers, illustrators, and staff who collaborate with us and have made this honor possible.

*John Curtis
Editor*

SECOND OPINION BY SIDNEY HARRIS



"ABSOLUTELY — 'DIAGNOSIS' IS A MUCH BETTER WORD THAN 'GUESS'."

Send letters and news items to

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Abbreviations used in *Yale Medicine* include HS to denote the final year of residency for house staff, FW for the final year of a fellowship, and YNH for Yale New Haven Hospital.

Yale SCHOOL OF MEDICINE

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Starting anew: how forces internal and external have led to a new curriculum

AS A POSTDOCTORAL FELLOW at the University of California, San Francisco, Dean Robert J. Alpern, M.D., received this advice: “Don’t ever join a curriculum committee.” It came from a visiting professor—Yale physiologist Gerhard Hans Giebisch, M.D. “Many curriculum committees have met at medical schools over the years, and sometimes nothing happened because there is so much resistance to change,” said Alpern, Ensign Professor of Medicine. In 2008, a strategic planning committee recommended that the School of Medicine pursue a fresh approach to medical education, and last year the school rolled out a new curriculum. This summer, Alpern discussed the importance of scholarly medical learning with *Yale Medicine*.

What is driving change in medical education? There are good forces and bad forces. A good force is the acknowledgment that education is a specialty in which there are those with expertise. For a long time, the thinking was that doctors could do everything and we thought we were experts in education. Now the two groups are working together. A bad force is a national desire to train more doctors quickly. We are at risk of a dichotomy between established top medical schools that emphasize scholarship as well as training, and other medical schools that due to costs place more focus on training doctors.

Which aspect of the curriculum rebuild was a ‘must-have’ for you? My major impetus was to bring together the sciences with the practice of medicine. In medical school we’ve traditionally taught the basic sciences in the first year and diseases in the second year. With the new curriculum, one hour you are learning about calcium ion channels in the heart, and the next hour you are learning how to treat cardiac arrhythmias.

Why is it important to support physician-educators? Because much of our teaching occurs in groups of 10 or smaller, tuition cannot cover the cost of education. Basic science faculty get paid to teach, but physicians do not. They generate the revenue that pays for their salary in the clinic. If they take students with them, they generate less revenue. But the faculty know this, and one of the main reasons they join the faculty at Yale is because they value education.

How has medical education changed since you were a student in the mid-1970s? When I went through, it was mostly lectures and textbooks, with some small-group teaching. We knew the knowledge base of medicine would change over time, but we had no idea it would change so rapidly. Now the emphasis is on creating physicians who are continuous learners.





More mom, fewer drugs

A pediatrician finds a new approach to treating babies born to addicted mothers.



For 40 years, virtually every hospital in the United States has treated babies born to mothers who are addicted to heroin and other opioids the same way.

Newborns are sent straight to intensive care and given morphine, phenobarbital, or other medications to ease their withdrawal symptoms. A children's ward is the next stop, where doctors and nurses continue administering medication to slowly wean babies from drugs they were exposed to in utero. The painstaking process typically takes three to four weeks, sometimes stretching to more than two months.

Matthew R. Grossman, M.D., HS '06, assistant professor of pediatrics and a hospitalist at Yale New Haven Hospital (YNHH), has found a better way. Most of the withdrawing infants he treats skip intensive care. Only 24 percent receive morphine or other drugs, compared to 70-80 percent at most hospitals. When they do, it's often only a few doses. Virtually all are drug-free and home in a week or less—more than three times faster than the best results from current methods.

Grossman's breakthrough therapy? More mom, fewer drugs. "The babies need love, really," the 41-year-old physician said. "It's only slightly more complicated than that."

About 2009, Grossman and other staff at YNHH's pediatric care unit noticed that the more time that the mothers spent with their withdrawing

babies, the better the infants did. The hospital began encouraging the moms to stay on the ward longer, and the average withdrawal time fell from 28 to 22 days. When physicians at a nearby hospital heard about Grossman's success, they asked him to give a talk. To prepare, he reviewed the medical literature on treating opioid addiction in newborns.

"I saw some strange things when I went through the studies," he said.

Virtually all hospitals then and now use a tool called the Finnegan Neonatal Abstinence Scoring System to manage infant opioid withdrawal. The system, developed in the early 1970s by a doctor in Philadelphia, requires hospital personnel to record 29 symptoms ranging from sneezing to tremors to digestive distress. The data yield a score that dictates when to administer morphine and how much.

"You would sit around a table and read off their scores, and decide whether you went up on their morphine or down on their morphine," said Grossman, who, like all hospitalists, used the system. "It would take about 30 seconds."

What surprised Grossman when he began reading studies was their almost singular focus on identifying the best combination of drugs to manage withdrawal. None of the researchers and physicians were scrutinizing Finnegan scoring or looking at alternatives.

"None of them really talk about nonpharmacologic care," Grossman said. "If they do, they just say, 'We tried to do that,' but they don't control for it."

Grossman already had data indicating that increased contact between mothers and their newborns shortened the withdrawal process. What if moms were with their babies even more? He decided to find out.

"That was where the hard work began," he said. "Let's try to standardize this nonpharmacologic care and treat it like a real treatment, like we would if it were a medication."

Grossman and his staff began by trying to cut out the intensive care stage. Noisy ICU units with their bright lights and harried staff were the last place for already agitated and hyperstimulated infants, he reasoned. The wards' restricted visiting hours also limit mother-infant contact, which appeared to speed the babies' withdrawal. The goal became to get the babies onto the pediatric ward immediately, if possible.

Once on the ward, mothers were encouraged to spend as much time as possible with their infants. Private rooms with cots, bathrooms, and TVs allowed them to stay indefinitely. Instead of nurses—babies can sense strangers—mothers fed, comforted, and swaddled the infants.

"We talked to the moms and said, 'You are the treatment for this child,'" Grossman said.

Pediatrician Matt Grossman and nurse Camisha Taylor found a new way to manage withdrawal in infants born to opiate-addicted mothers. "The babies need love, really. It's only slightly more complicated than that," Grossman said.



ONLINE EXCLUSIVES

In a meeting at West Campus in May, U.S. Sen. Chris Murphy and U.S. Rep. Rosa DeLauro urged biomedical researchers to join with them and other elected representatives to advocate for increased federal biomedical research funding. Their call to action came at a forum at Yale School of Nursing to discuss the National Cancer Moonshot initiative.

Full stories and event photo galleries, as well as other online-only content, can be found on our home page at yalemedicine.yale.edu.

“You have to be here because you are what your child needs.”

Grossman also came to question the Finnegan scoring system. Its rigid protocols for administering medication all but guarantee a hospital stay of at least three weeks, he said. Why should staff give morphine, he asked, after the baby sneezes three times in a given time period versus twice? Grossman replaced the system’s 29 measurements with three: Is the baby eating, is it sleeping, and can it be calmed when upset? Even if the scores were bad, Grossman tried to avoid medication.

“The first thing we say is, ‘Is mom here?’” he said. “Let’s call and get her back.”

The results have been dramatic. In addition to the average hospital stay falling by more than two-thirds, Grossman said, only about 30 percent of babies spend any time in the ICU—most of them for non-withdrawal issues. Among the babies who avoid the ICU, just 6 percent receive morphine or other drugs to manage withdrawal. “The more time they [mothers] spend with their babies, the better the kid does, basically,” Grossman said. “When you give them drugs, you end up prolonging the withdrawal.”

Assistant Patient Services Manager Camisha Taylor, R.N., said the treatment is the most dramatic change she has seen in her 13 years as a pediatric nurse at YNHH. But it did not come

without challenges, Taylor said. The biggest was cultural. The babies’ mothers typically feel guilty and judged, feelings that hospital staff encouraged, she said.

“We helped foster that guilt,” Taylor said. “It was very, ‘You stay over there; you did this to your child. We’ll take care of them.’”

At first, some staff resisted having mothers so involved, Taylor said. That evaporated after about a year, when the treatment’s success became clear. Mothers embraced the new culture as well, she said. “For them to feel like they were helping their infant was the biggest difference,” Taylor said. “We washed the guilt away.”

Grossman’s new treatment is well timed, given skyrocketing opioid abuse rates. In the mid-2000s, when Grossman was a resident, 10 to 20 babies a year were born to opioid-addicted mothers at YNHH. That number is now about 75, an approximately fourfold increase mirrored nationwide, especially in New England, Grossman said.

In spite of its success, Grossman’s new protocol is so far confined to YNHH and Dartmouth-Hitchcock Medical Center in New Hampshire. He hopes that will change once his paper on the subject, which is under peer review, is published.

“Our goal is to see this everywhere because we can really have an impact on these babies,” Grossman said.

—Christopher Hoffman



Nicotine receptors linked to ADHD

Doctors have long recommended that pregnant women avoid smoking. Among the many reasons is a link between early nicotine exposure and attention deficit hyperactivity disorder. A recent study in *Nature Neuroscience* by Yale researchers helps explain the connection between the nicotine in tobacco and these observed behavioral changes in children.

“I’m interested in the molecules that are responsible for complex behaviors,” said Marina Picciotto, Ph.D., the Charles B.G. Murphy Professor of Psychiatry. “The messiness of behavior is what makes neuroscience so interesting because there’s so much to know.” Her team’s most recent discovery began with a simple observation. They taught mice to avoid a dark chamber by giving them a light shock when they entered. The mice learned quickly—all it took was one trial.

Then they gave a different group of mice a lighter shock that should have been mild enough to ignore. But if they altered the nicotine receptors in the mouse’s brain or gave the mouse nicotine during development, it wouldn’t ignore the shock. In other words, it responded to stimuli that a normal mouse would ignore. This inability to ignore particular stimuli also underlies attention deficit disorder. Picciotto’s interest was piqued.

The team then exposed mice to nicotine early in development

and looked for changes in gene expression. “If we can manipulate the function, level, or location of particular molecules we think are important for the cellular and circuit-level function of the brain,” said Picciotto, “we can then ask questions about what that does to behavior in the whole animal.”

After experiments in the lab and computer analysis, Picciotto’s team identified a “master regulator”—a gene that plays a role in controlling gene expression. Early exposure to nicotine, they found, triggered the master regulator, called *ASH2L*, which led them to the link to behavior—the gene’s role in a process called

histone methylation. To form a chromosome, DNA wraps itself around a core of histone proteins. If this process is altered, it can affect the transcription of genes. Early nicotine exposure altered histone methylation at sites along the genome responsible for processes like the regulation of synapses. This explained on a biochemical level why early nicotine exposure could affect behavior.

But Picciotto and her team took it a step further. They wanted to see the biochemical

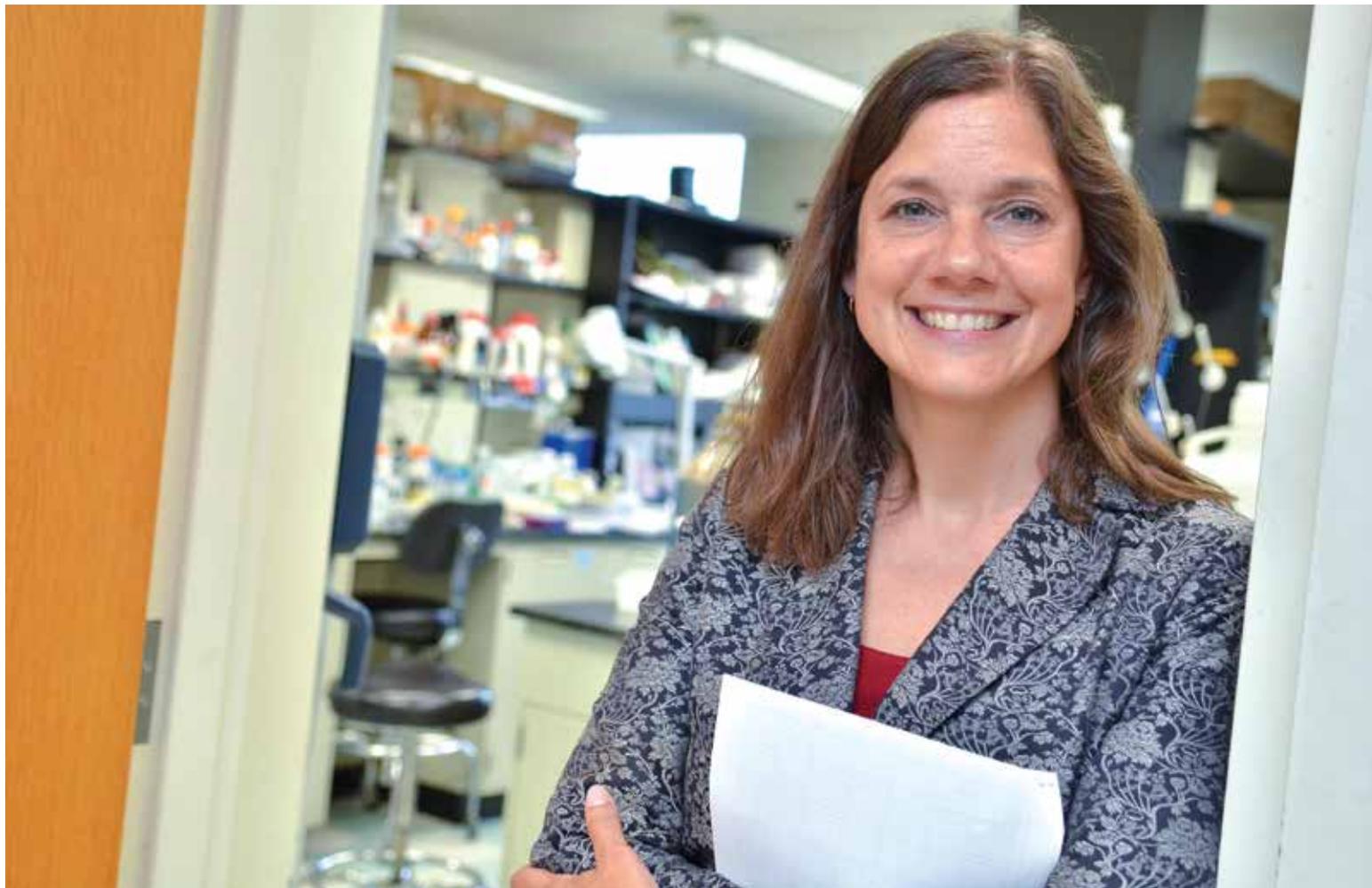
mechanism in action. They had already seen that the mice exposed to nicotine couldn’t ignore certain stimuli. When they turned off the master regulator in those mice, the animals could ignore the stimuli even after early nicotine exposure.

Then the researchers did the opposite. They turned on the master regulator in mice that were never exposed to nicotine—the mice couldn’t ignore the stimuli. They had uncovered a clear biochemical link between early nicotine exposure and behavior.

“This was a true discovery of a mechanism we did not know existed,” Picciotto said.

—Sarah Faulkner

Marina Picciotto and her lab team discovered a biochemical connection between smoking by pregnant women and attention deficit hyperactivity disorder in their children. Nicotine, they found, affects a gene that plays a role in gene expression.





ONLINE EXCLUSIVES

Can I trust you with my patient? At Medical Education Day, keynote speaker Olle ten Cate posed a simple question to assess the competence of students and residents—can they be trusted to care for a patient?

Full stories and event photo galleries, as well as other online-only content, can be found on our home page at yalemedicine.yale.edu.



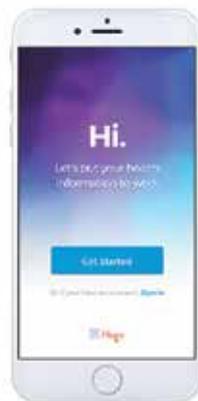
Patient access to medical information can spur research

It's called Hugo, and it aims to provide patients with unprecedented control over their medical records while unleashing the enormous research potential of digital medical data.

The brainchild of a Yale faculty member, Hugo is a mobile application for individuals that collects their medical information from multiple sources and stores it in a single secure cloud-based location. The data will be comprehensive—everything from hospital records, doctor visits, and test results to prescriptions, vital sign readings, and data from wearable devices, said Harlan M. Krumholz, M.D., the Harold H. Hines, Jr. Professor of Medicine, director of the hospital's Center for Outcomes Research and Evaluation, and a member of the Hugo team.

Hugo is not an electronic medical records (EMR) system, Krumholz emphasized. "Instead, it helps patients obtain, collate, and organize their health-related information, much of which may come from an EMR," he said. "Hugo is a personal health information system, a way for people to automatically pull together all their health-related data, contribute to it, and share it with whomever they want."

It is the sharing part that the Hugo team hopes will spark a revolution in medical research.



Hugo will ask patients to share their data with researchers, Krumholz said. No information—not even anonymous information—will be shared without the person's permission. Researchers who sign up with Hugo will be able to track down subjects, collect their information, and enter it into a database, Krumholz said. "Researchers can use Hugo to replace the manual method of collecting data and following research participants over time," he said. "Hugo has the potential to make it easy for people to participate in research, give them more options, and reduce the costs of research."

One potential obstacle to Hugo is different EMR systems that can't talk to each other. The Hugo team has developed software to overcome that barrier.

Inspiration for Hugo sprang from Krumholz's reflections on "the next big change" in medicine. He concluded that the explosion of digital data—more than 90 percent of hospitals now use electronic medical records compared to just 18 percent

in 2010—will lead to immense innovation and transform medicine. To trigger that revolution, patients need access to their data and the ability to share with researchers, he said. "The only way to get there was to put people in a position where they could acquire their data from disparate sources and have it organized and harmonized. I felt Hugo could be the critical lynchpin that could release a lot of that capability."

After almost two years of development, testing on Hugo began last summer. About 75 to 100 patients who come to the Yale New Haven Hospital emergency department with chest pain will be offered the app in exchange for releasing their data to a study. In addition, the Hugo team is seeking volunteers to test the platform, which will operate on mobile devices, tablets, and desktop computers. The app, which developers currently plan to offer at no cost to patients, will be ready for launch to the general public in 2017, Krumholz said. The team will introduce Hugo in stages, starting at Yale and in Connecticut and some other prominent institutions, and then rapidly expanding to other parts of the country.

"We developed Hugo to empower people with their own health-related data," Krumholz said. "There's no system that engenders the technology and people-centeredness quite like it."

—Christopher Hoffman

round up

a collection of recent scientific findings

CELL PHONES, EARTHQUAKES, AND MENTAL HEALTH

When earthquakes and tsunamis strike in Asia, there are few resources to treat the resulting psychological trauma. Southeast Asia, according to the World Health Organization, has only two psychiatrists per 1 million people. Cell phones, reports Yale psychiatry resident Kunmi Sobowale, M.D., in the *Asian Journal of Psychiatry*, may provide a way to treat post-traumatic stress disorder (PTSD) and depression after a natural disaster. Since cell phones are becoming widely available

throughout Asia, Sobowale wrote, they present an opportunity to reach a large population with digital therapy. Cell phones could also be used, the paper suggested, to better understand who is at risk of mental illness and how many people are suffering from PTSD or depression before and after a natural disaster. And the phones could direct people to evacuation sites, connect family members, or point people toward their nearest mental health provider.



A CHEMICAL TWEAK TO THE GENOME

For the past 40 years, biologists have been searching for something they weren't sure even existed—a chemical modification of DNA (or, a new base) that changes the functions of the mammalian genome. Although such bases exist in bacteria, until several months ago it was widely accepted that they do not exist in mammals, with one exception. Andrew Xiao, Ph.D., associate professor of genetics, and his lab have discovered a second elusive base hidden within an ancient virus that inserted itself into the genome 1.5 million years ago, according to a study funded by an anonymous donor and published in *Nature*. This mechanism can turn off neighboring genes along the genome, and it's also responsible for determining the sex ratio in mammalian populations. (When the gene underlying this mechanism is deleted, twice as many males are born as females.) But Xiao sees another use for this modification. "Because it's so rare, it must be upregulated in certain disease conditions," he said. In other words, in certain disease states, this modification may kick into action as emergency relief.

HPV VACCINE COULD REDUCE CERVICAL CANCER



The new HPV vaccine, Gardasil 9, could reduce cervical cancer incidence and mortality if adopted widely across the United States, according to a study by Yale researchers led by David P. Durham, Ph.D., associate research scientist in epidemiology. HPV is the most common sexually transmitted infection in the country and the primary cause of cervical cancer. The study, published in *Proceedings of the National Academy of Sciences*—which considered 10 types of HPV, demographics of each state, age, sexual behavior, and state-specific vaccine policy—found that the new vaccine could reduce cervical cancer incidence by 73 percent, compared to 63 percent with the old vaccine. It could also reduce mortality by 49 percent versus 43 percent. And, the analysis showed, the cost would be the same as or less than that of the old vaccine. Study authors suggest that states could benefit if they all got on board for a uniform vaccination policy, since people often move between states. The authors also showed that the most cost-efficient way to implement the vaccine is to increase funding to the states with low coverage.



CANCER AND THE CHAOS OF LUPUS

Antibodies in lupus patients are the culprits of chaos—they cause the patient's immune system to attack healthy tissue. But these antibodies may also prove useful in preventing some types of cancer, says a team of Yale researchers led by James E. Hansen, M.D., assistant professor of therapeutic radiology, and published in *Nature Reviews: Rheumatology*. Patients with lupus have reduced rates of certain cancers, like breast cancer, and Yale researchers are now saying that antibodies may explain why. Lupus antibodies attack healthy tissue by infiltrating and damaging host DNA. Some cancers, like the ones seen at lesser rates in lupus patients, are especially vulnerable to DNA damage. The paper's authors suggest that the very thing that makes lupus antibodies so destructive could also be protective against cancers that are susceptible to DNA damage. Researchers hope that eventually these antibodies could be harnessed as a cancer therapy.

A fresh start for medical education

IN 1910, THE YEAR THAT ABRAHAM FLEXNER issued his landmark report on the state of medical education in the United States, another report was in the works. The Committee on Revision of the United States Pharmacopeia was evaluating the effectiveness of the handful of medicines available at the time. That year also marked the 15th anniversary of the opening of the world's first pharmaceutical lab. And only 15 years had passed since the first clinical application of the X-ray. The deciphering of the structure of DNA was decades away.

More than a hundred years on, doctors have upwards of 3,300 medicines available to them. Genome sequencing for individual patients has become routine. In a nod to the importance of the effects of our social and physical environments on our health, physicians pay as much attention to patients' zip codes as to their genetic codes. Yet despite advances in what we know about disease and the human body, the social and economic factors that affect health, and the ways in which we provide medical care, a century-old model of medical education has prevailed. To be sure, recent years have seen efforts around the country to teach the underlying science of health in the context of disease and other insults to the human body.

Last fall the School of Medicine embarked on its own effort to devise a curriculum that reflects the changes, not just in medicine, but in society's expectations of its physicians. Among the features of the new curriculum are the merging of basic science and clinical training, with clinical experiences starting in the first year. Third-year students have a chance to revisit key clinical concepts at the start of each clerkship. And medical students also train with the nursing and physician associate students who will become their colleagues on the wards.

In this issue of *Yale Medicine*, we look at this changing landscape and how the School of Medicine has responded with new approaches to training the next generation of leaders in medicine.

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New ways of teaching, new ways of learning

As the century-old model of medical education shows its age, the School of Medicine rebuilds its curriculum to keep up with changes in medicine.

By Jenny Blair



In this photo, taken around 1900, the legendary surgeon and medical educator William Carmalt (standing at left) lectures at the medical school, then located on York Street. Ten years later, Abraham Flexner's model of medical education—training in basic science followed by training in the hospital—would become the norm. Now medical educators are revising the model to merge science and clinical education.



Two years of science, two years on the wards

That familiar structure of the American medical curriculum took shape over a century ago. But it's showing its age. Medicine is changing faster than that structure can keep up.

So at Yale, the medical school's legacy curriculum is now no more. In a process that started in 2008, hundreds of faculty, students, and alumni dismantled the old and built a brand-new curriculum. It launched last fall, with first- and third-year medical students becoming the first to experience the new coursework and clerkships.

"The way we practice medicine has changed drastically. People's expectations of doctors are changing, too," says Richard Belitsky, M.D., HS '82, FW '83, the Harold W. Jockers Associate Professor of Medical Education, associate professor of psychiatry, and deputy dean for education. "We took a fresh look at everything we're teaching, which included what we were teaching, when and where in the curriculum we were teaching it, and how we were teaching it."

Belitsky called the rebuild process a "steep uphill climb" at an internal medicine grand rounds in the spring of 2015, as the school prepared to launch the new curriculum. "But I'm here to reassure you that the view from the top is spectacular," he told the assembled faculty.

It's quite a vista—one that has changed dramatically since 1910, when the two-and-two curricular structure appeared in Abraham Flexner's critical report on then-shoddy American standards of medical education. The

Flexner report transformed those standards, which have remained high to this day. But arguably, medical practice is no longer the same straightforward exercise in scientific diagnosis and treatment that it was even 30 years ago. Physicians must now think of the whole patient, her culture and socioeconomic setting, the medical system, and societal dynamics that lead to disparities. Disease prevention is gaining great importance. Electronic medical records and the bottom line haunt practice; genomics offers unheard-of insights; simulation technology and digital devices change the learning process. Teamwork is supplanting the old doc-on-top hierarchy.

There's only so much of this you can tack on to a traditional curriculum. So Yale's starts fresh.

A BREAK WITH THE PAST

Rather than the traditional year of basic science followed by a year of clinical science, the new curriculum weaves them together. Now first- and second-years take eight integrated courses over a year and a half. Each course goes broad as well as deep on themes like "cell energy," "plasticity and disease," and "the reproductive years and middle age." The last course, for instance, includes elements of embryology, pathology, cell biology, epidemiology, and pathophysiology of both the female and male urogenital systems. New subject matter is also appearing, including information on aging.

That first year and a half also includes longer courses in professional responsibility and scientific inquiry as well as clinical experience: students see patients in "pre-clerkships" throughout the first 18 months of school.

Whereas students traditionally began formal clerkships on July 1 of the third year, they'll now take an earlier jump to the wards in January of the second year. (How will that change affect the second-year students' annual stage-and-video spoof of faculty, the Second-Year Show? Read on.) Earlier clinical experiences offer several advantages, Belitsky says, including motivating students, offering context for what they're learning, and providing a longitudinal view of care.

The clerkships themselves have changed. Rather than one- or two-month rotations, students now enter 12-week clerkships that combine specialties with similar approaches to the patient, like internal medicine



Medical students learn from each other in the anatomy lab, as part of the new curriculum. In February students took turns teaching and learning about upper and lower extremities. Arash Fereydooni (at the computer) worked with (from left) Raman Nelakanti, Douglas Rioux, Michelle Ferreira, Sora Tannenbaum, and Brian Barron.

Students teaching students

In the dissection lab on the third floor of The Anlyan Center, first-year student Rachel Nelson guides a small group of her classmates through the anatomy of the shoulder. Nelson's gloved hands point out muscles and nerves, and some students move their arms to mimic the motions these muscles were made to make. This is a peer teaching session, an educational innovation added to Yale's gross anatomy course this year. Half of the 104 students in the class dissect their donors' arms and shoulders, while the others master the hips and legs. An hour later, the groups switch—those who studied the upper limb teach those who had studied the lower limb. Each student needs to teach, and each needs to be taught.

"I enjoy peer teaching," says Nelson. "It can be valuable to solidify information. When I am teaching others, I hold myself even more accountable for being on top of the information and presenting it accurately."

As the students work, William B. Stewart, Ph.D., who leads the course with Lawrence J. Rizzolo, Ph.D., stands back, looking on. "I try to observe rather than participate," says Stewart, associate professor of surgery (gross anatomy), but it is clear that after 38 years of teaching anatomy, he would like to "get in there" and examine along with the students. Instead, he walks from group to group, listening.

"The Latin root of the word 'doctor' is 'teacher,'" Stewart says. As physicians, students will be teaching for the rest of their lives; they will teach their colleagues as well as their patients. "It's a lifelong commitment. Teaching is a skill that has to be practiced. There are no natural-born teachers."

Formalized peer teaching is a core aspect of the redesigned gross anatomy course, launched as part of the medical school's curriculum rebuild in the 2015-2016 academic year. The new curriculum has gross anatomy, traditionally taught in the first semester of the first year, beginning in January of the first year and running through December of the second year. It has also been reduced from approximately 110 hours to 75 hours. Fifteen hours were cut entirely, Rizzolo said, while the remaining hours were redistributed to such courses as radiology or pathophysiology, in which there has been an overlap of material.

As with the new curriculum, emphasis has shifted from the classroom to the clinic. "Our philosophy has always been to make the lab as much like the clinic as possible, and as little like college as possible," says Rizzolo, professor of surgery (gross anatomy) and director of medical studies.

Rizzolo watches as students grapple with the intricacies of the brachial plexus, drawing on a chalkboard a diagram of the complex system of nerves that runs through the neck and shoulder. He sees a mistake—what they are sketching is not reflected in the donor, but he holds off. In the peer teaching process, "there's a real desire to jump in and fix it, when the best way is to allow students to discover and correct their mistakes," he notes. "Mistakes are teaching opportunities. Celebrate them. In the anatomy lab, we make all the mistakes we want. And then the knowledge gained will stick."

—Jeanna Canapari

and neurology. According to Michael L. Schwartz, Ph.D., associate dean for curriculum, attendings in one specialty are now taking the initiative to point out connections to the other: “There’s a change in the culture of the clerkship to think about this as a shared enterprise,” Schwartz says.

Students also come together as a class for “shared precedes,” short courses that kick off each clerkship period and cover topics like informed consent and patient safety. Regularly reuniting as a class during the clinical years is a novel approach, as students previously went their own ways as clerkships began.

“In the past, there may have been important aspects of communication with patients that were taught in

transparent standards for faculty and students to offer each other feedback. Through it all, administrators will measure student and instructor performance and keep tweaking the new curriculum.

YALE NOT ALONE IN A REBUILT CURRICULUM

Yale is far from the only medical school rethinking its approach. In fact, as of the 2012-2013 academic year—the most recent for which data are available—127 of 136 U.S. medical schools responding to a survey by the Liaison Committee on Medical Education were planning, were amidst, or had just completed a curriculum change. (There were 141 accredited M.D.-granting medical schools in the United States that autumn.) The trend is a response

“It’s been remarkable how supportive the faculty have been in taking on these new roles.”

—Michael Schwartz, Ph.D.

the psychiatry clerkship that students should be aware of and practicing in all clerkships,” Schwartz says.

“We’ve cherry-picked those things that we think are useful for all the clerkships and put them into these common precedes.”

Students wrap up rotations in December of the third year. That leaves an unprecedented 17 months of time for research and thesis writing, electives and subinternships, and the boards. Under the old curriculum, time for these activities had been shrinking: In recent years, 60 to 70 percent of students have taken the optional fifth year, according to Belitsky, some because they felt they didn’t have time to finish in four. The new schedule may allow more students to graduate in four years.

The new curriculum also focuses on teaching. Faculty development is a priority, as are new, more

to numerous calls for reform beginning in the early 2000s by major groups like the American Medical Association.

At Yale, the process began in the autumn of 2008, when Dean Robert J. Alpern, M.D., Ensign Professor of Medicine, asked Belitsky and other faculty to begin planning for change. The Strategic Planning Committee for Medical Education was born. Two years later, the committee issued a formal report calling on the school to reform the curriculum and to elevate the status of teaching at Yale. Four previous strategic-planning efforts in 20 years had identified those needs, the report pointed out, but the school had implemented them at best only partially.

This time, the ball kept rolling. In 2011, the outlines of a new curriculum appeared in the report of the Curriculum Design Committee. The next four years were spent planning the details, and by 2015, the committee was unveiling the new curriculum.

The process was painstaking. Formal principles and overarching goals guided scores of discussions among faculty who formerly had taught independently of one another. Now, they sifted through the content of nearly 30 courses and modules “with a fresh set of eyes,” Belitsky recalls. Numerous committees combed Excel spreadsheets, adding new content, figuring out when to introduce each topic, deciding what should be taught more than once and what was redundant. This process amounted to centralized coordination, which a new accreditation standard calls upon medical schools to put in place. But it’s much harder than letting departments teach independently.

Schwartz says it was a “healthy discussion, with some people seeing that what was already being done was adequate and appropriate, and others pushing for change in some areas. ... You might expect those would be really contentious and laden with potential problems, but it was surprising how collaborative it was.”

According to Lisa P. Howley, Ph.D., senior director of educational affairs of the Association of American Medical Colleges, these changes mark a larger shift away from an older so-called process orientation of medical education to a competency-based educational program. These aren’t retrofits; they’re overhauls.

“Periodically, medical schools will revise, refresh, revamp their curriculum,” Howley says. “But what we’re seeing recently is that those efforts are much more substantive or significant with regard to changing not just content and experiences, but actually changing the structure of the curriculum. Schools are moving away from ‘What are we teaching and for how long and in what order?’ to an outcomes focus, so the question becomes ‘What are the actual competencies that we expect from our graduates?’,” Howley says. “The way we deliver instruction is changing.”

Howley sees a lot of schools integrating basic and clinical sciences in the preclinical years. Many besides Yale are changing clinical training, too. At 12 weeks, Yale’s new combined clerkships are substantially longer than the traditional one- to two-month kind. Some schools are going even further, implementing longitudinal clerkships that combine several disciplines for a six-month or longer period. Yale’s clerkship innovation may be that it pairs psychiatry with primary care,

recognizing that those disciplines take very similar approaches to the patient. Howley and Belitsky say they don’t know of other schools that have put those two specialties together.

THE YALE SYSTEM STANDS

Despite all the changes, the Yale system remains intact. Changing the thesis requirement, Belitsky says, was never on the table. Emphasis on flexibility and student choice hasn’t changed, either. Optional self-assessments will continue to precede mandatory qualifiers in the pre-clinical years. (The clerkships’ old rating system is under scrutiny for a possible update.)

On the other hand: nudged aside by clerkships, the Second-Year Show is no more. But don’t panic. It’ll become the Fourth-Year Show—again, since the first student show, in 1949, was written and performed by fourth-years. (The second-years took over in the 1960s.) Schwartz points out that the curricular changes will infuse much-needed variety into the show: “They’ll have four years of faculty and staff to spoof as opposed to only two.”

Those instructors will likely take it in good spirits. There’s a sense of new energy at the school as the curriculum rolls out and as faculty and students try on new ways to teach and to learn together.

“It’s been remarkable how supportive the faculty have been in taking on these new roles,” Schwartz says. “There was a point where I think the energy in the process shifted from ‘Oh, my gosh, this is really hard,’ to ‘You know, this is exciting.’” [/yale medicine](#)

Jenny Blair, M.D. '04, is a frequent contributor to Yale Medicine.

A new approach to clinical clerkships

As students begin their clinical training, they revisit key principles.

By Karen Zusi





Before they begin their clerkships, medical students devote time to the “precede,” in which all students gather to focus on relevant topics and skills. Following the precede, students enter a “boot camp” that focuses on the specific skills of the specialties in that clerkship. Robert Fogerty, an assistant professor of medicine, discussed cases of medical errors with third-year students as they began a new clerkship in March.

On the ninth floor of a building on George Street,

in the School of Medicine's psychiatry department, third-year medical students gathered for a Thursday afternoon class in the fall of 2015. Portraits of august professors looked down from the walls as the students trickled into the conference room, swapping notes, napkins, and silverware while they opened their lunches. MacBooks and iPads came out as the minutes ticked by until Peter J. Ellis, M.D., M.P.H., assistant professor of medicine, stood at the front of the room. He was there to discuss case studies of lower back pain.

Lower back pain in the psychiatry office? What gives? An hour and a half later, Ellis and his co-educators stepped to the side, and Beth D. Grunschel, M.D., Sc.M., assistant professor of psychiatry, then a fellow in the addiction psychiatry program, took over. She offered behavioral change as a management plan for chronic pain instead of prescription painkillers. Students divided into pairs to role-play patients consulting doctors about their chronic pain. "Figure out a way to do a little less talking and make him talk instead," Grunschel advised one "doctor." At the conclusion, she counseled the group. "It's practice. You're going to have a lot of patient interactions that aren't going to go well. You'll learn how to phrase it."

Mental health and primary care would seem like an unusual combination at first blush. Across the country, when medical education combines disciplines, usually primary care and internal medicine are paired together—leaving psychiatry joined with neurology. But primary care doctors often see cases of depression and anxiety in their routine practice; and at Yale, an early spotlight on this type of multidisciplinary question will soon become routine.

Cross-discipline integration is a hallmark of the new curriculum being rolled out in the School of Medicine—particularly in the third-year clerkships, when students traditionally begin their hands-on experience with patients. "We recognize that patients have symptoms that can be addressed in many different disciplines," said Kirsten M. Wilkins, M.D., FW '06, director of the YSM clerkship curriculum and associate professor of

psychiatry as well as director of the psychiatry clerkship. "Being able to integrate all of that from the student standpoint will hopefully be more effective for them."

Julia Raney, then a third-year student in the primary care and psychiatry clerkship, found it helpful in her own rotations. "It's a good emphasis," she said. Near the end of her primary care rotation following her rotation in psychiatry, Raney saw a female patient. "Her chief complaint was anxiety. It was so interesting to think about all the treatment that might be expected for her; what stressors; what other mental health conditions she might have that I should look for; how I should structure the interview. I was falling back on the skills I had just gained." While the length of traditional primary care appointments is often much shorter than appointments in psychiatry, Raney said that patients in primary care often had mental conditions affecting their lives: "It made a lot of sense to me why they combined these two. You'll need to know psychiatry in every field you go into."

STARTING THE CLINICAL EXPERIENCE

All 104 third-year students gathered on June 15, 2015, for a daylong series of activities to prepare them for the clerkships to come. The orientation focused on integrating science, professionalism, and clinical care. Students toured the Yale Center for Medical Simulation to practice technical procedures (see sidebar, page 23), and participated in an interactive session on how to give and receive feedback during their clerkships. Over lunch, they heard from health care professionals about the types of hospital personnel they would soon encounter. The following day, the students divided into their respective clerkships—but unlike previous years, in which students were sent to one of 10 different clerkships, students train for 12 weeks at a time in four integrated clerkships.

Previously, 10 clerkships meant that students spent only two weeks in some specialties and up to eight weeks in others. They moved rapidly among patients, teams, and disciplines, and their experiences varied widely depending on which types of patients they saw. The School of Medicine is moving to a system of integrated 12-week blocks, allowing the students longer and more predictable clinical experiences.



Third-year clinical clerkships began with an introduction called a “precede,” in which students revisit concepts relevant to the specialty they’re about to enter. The precede includes lectures and practice sessions in clinical exam suites. In the clinical exam room, Emily Yin role-played a patient while Radovan Vasic conducted an exam and Amit Mittal observed. Marina di Bartolo, a medical student in her final year, supervised the session. Frances Javier, below, conducted an interview while Peter Ellis observed.



While third-year students always began their clerkships in June, under the new curriculum clerkships will begin in January. This change will give students more flexibility to pursue subinternships, electives, and research after the clerkship year.

Whittling down 10 separate clerkships into four integrated modules also streamlined the educational material. The clinical year now comprises “Medical Approach to the Patient,” bringing together training in internal medicine and neurology; “Surgical Approach to the Patient,” including surgery and emergency medicine; “Women’s and Children’s Health,” focusing on pediatrics and obstetrics and gynecology; and “Primary Care and Psychiatry.” Anesthesiology has morphed into an elective within “Surgical Approach to the Patient.”

Each block unites two disciplines that share aspects of their approach to patient care. “The integrated model forced us to really reevaluate our curriculum,” said Wilkins. “We had to think about the essential psychiatry experiences that students need to have. It forced us to critically evaluate every element of what we do. We’ve had some exciting debates.”

Not every student progresses through the clerkships in the same order, but over the course of the year, all the themes cover critical material. For example, in the primary care and psychiatry clerkship, students focus on health promotion, preventive care, the social determinants of health, behavior change, and chronic disease management. This lineup contrasts with the “Surgical Approach to the Patient” clerkship, in which students learn emergency management and operating room procedures. While there may be some overlap, the themes are meant to provide direction, reinforced in the weekly didactic sessions, to students as they progress.

Didactic sessions emphasize the themes for the students more directly, as with the psychiatry conference on lower back pain. The integrated series includes case-based learning and reasoning workshops. “When you bring students together for these shared didactics, they can look at how two disciplines approach the care of the patient, and they can better understand the patient’s experience as well,” said Richard Belitsky, M.D., HS ’82, FW ’83, deputy dean for education, in a faculty presentation during an internal medicine departmental meeting. That patient experience,

Belitsky explained, is critical for students to grasp—a patient often sees multiple doctors from different disciplines. “This is a chance for students to come together and see: what each specialty contributes, and when a discipline decides to consult with another discipline? And when they do, what actually happens, and how does that affect patient care?”

Between each of the 12 clerkship weeks, all third-year students also come together for one day of interactive sessions as part of a developmental curriculum. These group sessions continue to build the students’ skills in communication, professionalism, and teamwork. And at the beginning of each new integrated clerkship, students go through a one-day “boot camp” to help them prepare for more discipline-specific experiences and refresh their background knowledge. “It is a lot of information,” said Wilkins, “but I think everybody has done a really good job of making it concise and high-yield instead of belaboring any one point for two hours.”

WRAPPING IT UP

Throughout the clerkship year, students are asked to reflect on their personal education; any distressing experiences with their clinical teams; and ways to improve the program. The curriculum steering committees often included third- and fourth-year students during planning to help ensure the best possible outcomes. Wilkins commented, “I did hear one of our senior students on our committees say that she wished she could go back and do her third year [in this new model]. Several of us faculty members have also said we want to go back to medical school. We are really excited by the changes.” As recipients of the first roll-out from the larger curriculum revamp, the clerkship students’ feedback will be critical—and when asked how it feels to be among the first students in the new program herself, Raney answered, “We’ve learned on the fly.” [/yale medicine](#)

Karen Zusi was Yale Medicine’s writing intern in 2015.

Learning through simulation

A group of third-year students crowds into a room at the Yale Center for Medical Simulation (YCMS), listening to a description of the robotic manikin lying on a nearby bed. When the group hears that the manikin's pupils can dilate and constrict in response to stimuli, one student eagerly pulls a cell phone from his pocket and taps a few buttons, producing a light to shine into the manikin's face. A collective murmur ripples through the students standing next to him as they observe the phenomenon, and a few linger behind as the group moves to the next room, waiting for a turn to see for themselves.

This short introduction to the manikins is only the beginning for these students; they will soon be spending much more time here. In the fall of 2015, third-year medical students began to use simulation throughout their clerkships, leading weekly case presentations and practicing technical skills at the new center, which opened in January 2015.

Before simulation became an available educational tool, medical students learned primarily through apprenticeship. "You walked around the hospital and learned from whomever you were working with—residents, faculty, attendings—in the real clinical setting," said Leigh V. Evans, M.D., HS '02, associate professor of emergency medicine, and executive director of YCMS. "The problem is, there are so many things you're working with that you're just too junior, too inexperienced, to practice. And then when it comes your time, usually when you're an intern, you start by trial by fire."

In medical school training, simulation allows students to hone their communication, leadership, and clinical decision-making skills in a safe, nonthreatening environment, away from flesh-and-blood patients. Instead of being thrust onto the hospital wards armed largely with textbook knowledge, students can learn on the robotic manikins. "We want you to practice, so when you're there for the real thing, you'll be confident, you'll have the skills, and you'll know what to do," Tiffany Moadel, M.D., FW '15, director of medical student simulation at YCMS, told the students on their first day.

The new center has four simulation rooms: a trauma resuscitation room; an emergency room/intensive care unit; a pediatric resuscitation room; and a multipurpose "procedural suite" used as an operating and delivery room. The manikins residing there—SimMan, SimMom, SimBaby, and SimNewB—produce realistic heart, lung, and bowel sounds as well as a palpable pulse and responsive pupil size. Students also use partial-body "task-trainers" at the center to practice procedures

like lumbar punctures, intubation, chest tube insertion, IV placement, urinary catheterization, and nasogastric tube insertion.

Beyond placing tubes and monitoring vital signs, students learn primarily from the manikins during case studies, following a model that Evans started 10 years ago in the surgery and emergency medicine clerkship. Students previously worked through 24 case studies over a 12-week period in a small office with a single manikin. Staff programmed the manikin to present with a patient's symptoms and "spoke" as the patient through a microphone-and-speaker system; students alternated leading teams to diagnose and treat the patient. Evans developed every case based on real patients she had seen in the emergency department, using the patient's history, laboratory results, and radiology images sans identifying information.

Now, nearly every clerkship has a simulation module. Residents and faculty have helped develop hundreds of simulated cases, and Evans is always looking for more: "When I see a patient in the emergency department and I think it's an interesting case, something that I've learned from, I take that case and make it into something that the students and residents can be exposed to," she said. "I'd love for the faculty to get into that mentality: When they see a case, let us know about it, and we'll make it into a case so that everyone can learn from that patient as well."

To build the new simulation curriculum, Moadel worked with the clerkship directors and selected scenarios from the case bank relevant to each discipline. No case shows up more than once in the curriculum, and students agree not to discuss cases outside the center in order to ensure that each learner receives the same experience. In teams of four to six students, they work through the 15-minute scenarios and then participate in a faculty-led debriefing session, in which they discuss communication, teamwork, and clinical management of each case. The students are graded only on attendance and participation; the center creates a safe, low-risk learning environment to encourage students to learn from their mistakes as well as their successes. "I remember as a medical student how much I enjoyed simulation," said Moadel. "You remember the cases. It's different from passive learning where you sit and read a textbook or an article. If you do a simulation case and you make a mistake, you remember that forever."

—Karen Zusi



Preparation for clinical clerkships includes a session in the Yale Center for Medical Simulation, where students hone their clinical skills on manikins that simulate vital signs and medical emergencies, even childbirth.

A new introduction to medicine

By Kathleen Raven

Last fall, Dervin Cunningham and a few of his classmates gathered around the hospital bed of a young woman who had complained of nausea and cramps. Before probing her health history, the first-year medical students politely asked the patient's boyfriend to step outside. "We found out that she actually missed her period," Cunningham said. A few more questions and the students offered their diagnosis: the patient, a female manikin at the Yale Center for Medical Simulation, was pregnant.

Under the medical school curriculum rolled out last fall, all first-years completed "Introduction to the

Profession," nicknamed i-Pro, during their first two weeks on campus. As she planned the course, said Nancy Angoff, M.P.H. '81, M.D. '90, HS '93, associate dean for student affairs, she emphasized activities in Yale New Haven Hospital (YNHH) and the New Haven community rather than in the classroom. Students would make rounds with nurses, physical therapists, dietitians, chaplains, interpreters, and social workers in the hospital. They would also visit the Errera Community Care Center and Columbus House, both centers for homeless members of the community. By immersing themselves in both the hospital and the community, students explored three themes: teamwork and communication, the patient experience of illness, and what goes into medical decision making.



As part of a new course, "Introduction to the Profession," medical student Robert Rock led first-years on a tour of the Yale University Art Gallery. Through discussions of three paintings, the students explored their own beliefs and biases about other cultures, religions, ethnicities, and sexual orientations.

THROUGH PATIENTS' EYES

During another i-Pro class, Cunningham stood near the bed of a patient—a real one this time—on the pediatrics floor at YNHH. He watched a doctor, an interpreter, and a patient's parent exchange a flurry of information in English and Spanish. For another assignment, he crisscrossed New Haven on city buses with third- and fourth-year medical students. Patients treated at YNHH or area clinics might be staying at the Columbus House homeless shelter, Angoff said. If students experienced a small part of that journey and the shelter itself, they might become more empathetic doctors, she said.

“One of the most important things i-Pro did was encourage us to become citizens of New Haven,” said Andrea Roberts. “We can think of our time at Yale as the next stop on our way to Mass General, or we can really engage this community and give back to it—and we should try to do the latter,” said Roberts, whose visit to Columbus House was her first to a homeless shelter. The students learned how local physicians fought for and created a medical respite program at the shelter for patients well enough to be released from the emergency room but still in need of medical oversight. “Now I'm wondering how I can apply advocacy to my own career and if there are things I could do for women's health,” Roberts said.

UNCOVERING BIASES

Before students arrived at Yale, they completed the online Harvard Implicit Association Test. Through i-Pro, students had a forum to discuss openly what the questionnaire revealed about how they viewed other beliefs, cultures, religions, ethnicities, and sexual orientations. They also discussed ways in which to address their preconceptions and implicit and explicit biases. “We want them thinking about how those biases shape the physician they will become and may affect their interactions with patients,” Angoff said.

At the Yale University Art Gallery, third-year student Robert Rock, who as a first-year had co-organized an elective course in health justice, helped them explore race, gender, and class issues through the observation of three paintings. In *Whispered Words*, an oil painting of a scene in Tahiti by Paul Gauguin,

Rock explained that the image suggests a return to nature and simpler times. Historical accounts offer a different interpretation—Tahiti had long been colonized by the French and the artist exploited the native people. Another from the 1920s by the German painter George Grosz showed German high society at a lavish party, while outside their window a man on crutches holds out his hand for alms. “We can be primed to interpret reality in ways desirable to one group or individual, but detrimental to another,” Rock said.

IMMERSED IN STORIES

Mark R. Mercurio, M.D., HS '85, FW '88, professor of pediatrics (neonatology), director of the Program for Biomedical Ethics, and lecturer in i-Pro, said it was no accident that i-Pro falls first in the new curriculum. “Very quickly, once school begins, students will necessarily be immersed in learning the language of medicine and the details,” Mercurio said. “It's helpful to start with something that gives you some perspective about why you are here.”

The i-Pro course, said Roberts, now in her second year of medical school, “really showed me the bigger picture of what medicine is.”

Whether or not doctors realize it, Angoff said, they are enmeshed in patient stories. At the end of two weeks, Angoff asked students to reflect on their experiences during the course and put words to paper. She invited Anna B. Reisman, M.D., whose essays have appeared in *Slate* and *The Atlantic*, to discuss writing tips. Reisman, associate professor of medicine, is also director of the Humanities in Medicine Program. Lisa Sanders, M.D. '97, HS '01, associate professor of medicine, who writes the “Diagnosis” column in *The New York Times Magazine*, discussed how physicians benefit from keeping personal journals.

“We want you to be thinking about stories of the profession, both noble and shameful, the stories of your patients, the story of your community, and your own story as an emerging physician,” Angoff said.

Flipping the classroom

By Jill Max

On a Friday morning in March, Charles C. Duncan, M.D.; William B. Stewart, Ph.D.; and Shanta E. Kapadia, M.B.B.S., gathered in the anatomy lab to deliver a lesson on chest dissection. Stewart, associate professor of surgery (gross anatomy), explained the vessels and structures revealed, as Kapadia, lecturer in surgery (gross anatomy), dissected them. There were no students present, because they were on spring break. Instead, the three prepared a demonstration of the dissection. Duncan, professor of neurosurgery and of pediatrics, taped the rehearsed lesson so that students could view it prior to their lab.

The anatomy team's efforts are part of a new approach to education, the "flipped classroom," which some faculty at the School of Medicine have adopted. Instead of conveying information during class with self-study afterward, students watch a short video beforehand, then discuss the material in class. "If they come in prepared and know the material, this makes it a better learning experience," said Duncan.

This approach stems from an effort led by Michael L. Schwartz, Ph.D., associate professor of neuroscience and associate dean for curriculum, to apply technologies that enhance learning in the classroom. The notion of videos is not new—in the 1960s and 1970s, the late Edmund S. Crelin Jr., Ph.D. '51, an anatomy professor at Yale, shot black-and-white videos for students. The flipped classroom concept got a boost at Harvard in 1997, when physicist Eric Mazur, Ph.D., outlined this approach in *Peer Instruction: A User's Manual*. The goal was to move the transfer of information out of the classroom so that students would use class time to assimilate what they'd learned. A few years later, Salman Khan based the academy that bears his name on this model.

One of the first lessons Yale educators learned when the flipped classroom approach was introduced two years ago was to keep videos short—no more than eight to 12 minutes. Schwartz set up a studio in his office and invited faculty to try out the idea. Now, in a studio in the medical library, instructional design librarian Lei

Wang, M.L.S., helps faculty transform their lectures from PowerPoint presentations into bite-sized instructional videos. Wang helps faculty incorporate animation or additional images to keep viewers engaged. A simple and accessible production process is key; once Wang shows them the ropes, faculty can usually shoot and edit videos on their own after the first session.

In the flipped classroom, because the videos deliver ever-increasing amounts of information beforehand, there's more time for hands-on practice activities that require a physical presence. "The videos generate a much richer in-class discussion than just talking at students with lecture-based content," said Jaideep Talwalkar, M.D., HS '04, assistant professor of medicine and of pediatrics, who uses pre-class videos for about half of the class sessions in the clinical skills course he directs. Video demonstrations of components of the physical exam allow students to spend more time practicing their skills in class.

Although this approach is more time-consuming for instructors—they produce videos and modify their lectures—Talwalkar and others are enthusiastic. Participation is voluntary, and faculty response is building, said Schwartz. Students seem to like it too, provided the videos tie in with the lectures and facilitate interactive engagement with the material. Tracking of one of the first videos made by Duncan on endoscopic treatment of hydrocephalus showed that of 104 students, about 78 had viewed the video before class.

Although the flipped classroom approach began to be integrated before his time, third-year medical student Moises Dominguez said he often finds himself viewing videos on YouTube to help him understand physiological processes. He is working with Jeremy J. Moeller, M.D., assistant professor of neurology, to adapt the model for the neurology clerkship.

"More and more, students are expecting to see things packaged digitally in a way that's palatable," noted Stewart. "We all have short attention spans."

[/yale medicine](#)

Jill Max is a senior communications officer at the School of Medicine.



A camera records Shanta Kapadia's dissection while Charles Duncan (left) and William Stewart observe on a monitor. Video instruction is a key part of the flipped classroom.

What students say

By Sarah Faulkner

A year after the initiation of the new curriculum at the School of Medicine, *Yale Medicine* spoke to eight students, four of whom had just completed their first year, and four who had just completed their third year. The students offered their thoughts and insights on their medical education and the new curriculum.

on the first-year curriculum



SHAYAN CHERAGHLOU

“We got a lot of patient contact from really early on. I interviewed a patient with heart failure before we had learned about it in a lecture. After you talk to someone like that, it makes it tough to forget.”



KEVAL DESAI

“It’s great to have pathology along with the basic sciences; I think it helps us when we go into the hospital and we’re shadowing people. ... A significant difference in the Longitudinal Clinical Experience was being with students from the nursing school and Physician Associate Program. They brought so much knowledge.”



CARRIE FLYNN

“To be a first-year medical student and learning about real diseases that affect real people—that was very exciting. It kept me engaged and motivated. The first year of medical school is all about adjusting to the volume of information you’re learning. It really is like learning how to drink through a fire hose.”



CONSTANCE ZOU

“Many students have their own styles of learning, their unique sets of talents and passions. I spend a lot of time thinking about how I can become competent in the future, when patient management assumes such an important role. I also think about how I can most effectively take control of my own development. The new curriculum is set up so that I have to learn both pathology and clinical skills at the same time. This has increased the amount of information that we need to know, but the Yale system allows me the freedom to pursue topics that I love in depth and to learn at a comfortable pace.”

on the third-year curriculum



ERIN FEENEY

“I had a lot of really great experiences with clinical teams. I worked with residents who were very enthusiastic about teaching, and I think that it makes a world of difference to have good teachers on your team. No matter how you change the external structure of the curriculum, it really comes down to whom you’re working with in the clinic.”



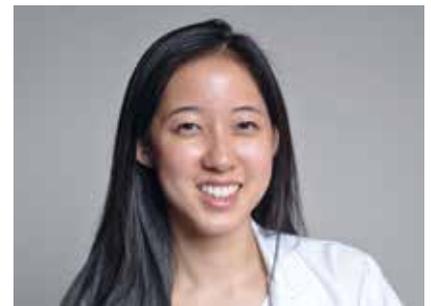
CHARUTA GAVANKAR

“The integration of ob/gyn and pediatrics clerkships—I really enjoyed that. At one point, we had a woman who delivered at 18 weeks, and the baby was going to the NICU. I got to see the delivery, watch the neonatal resuscitation, and then follow the patient the next couple of weeks. It was an incredible way to see medicine.”



PAULA WU

“The precedes are incredibly thorough, thoughtful, and information-rich. One of the best precedes was for the internal medicine clerkship. Dr. Mark Siegel and Dr. Michael Bennick talked about what it means to care for your patients and how to perform a high-quality history and exam, which really set the tone for our clerkship. The precedes helped to ground the entire experience—they reminded us of why we’re doing what we’re doing.”



EMILY YIN

“They’ve done a good job integrating the clerkships and giving the class an opportunity to come together throughout the clerkship year, where traditionally everyone is spread out.”

Learning with each other

A new program has medical, nursing, and physician associate students training together for the workplace they'll see in the future.

By Jeanna Canapari

Medical students are sharing the wards with students in nursing and the Physician Associate program in an effort to encourage a team approach to care. The program brings inter-professional education into the Longitudinal Clinical Experience (LCE). Pediatrician Eve Colson, co-director of LCE, worked with nursing students Noelle Kellicker and Emily Sousa, medical student Jonathan Gaillard on the pediatric wards.





“What the hell is going on?”

In a lecture hall at the School of Medicine, a group of students is having a boisterous discussion. David N. Berg, Ph.D., a clinical professor of psychiatry who specializes in group relationships, has presented a hypothetical clinical situation: A team leader is outlining new procedures on the wards. When a team member reacts with snide comments, the leader asks, in frustration, the question above.

From all over the lecture hall, students shout out ideas as to how to respond.

“This could be you,” Berg said. “You could be a team leader someday.” In health care, he points out, this is a quick transition: “You rise up the ladder in the shortest period of time of any profession. You go from intern to team leader in two years and a day.”

Berg was a guest lecturer in the Longitudinal Clinical Experience (LCE), a class that prepares students for the challenges they will face as clinicians. Part of that preparation is working with caregivers from different health professions. A major component of Yale’s new effort to incorporate interprofessional education, or IPE, into each health care program’s curriculum, LCE mimics the structure of team-based care and trains medical, nursing, and physician associate (PA) students together. IPE courses such as this one aim to acclimate clinicians to working together early in their education, so they will leave training prepared to collaborate effectively.

LCE, a joint effort among the School of Medicine, the School of Nursing, and the Physician Associate Program, places first-year students from each of the three professional schools in the classroom for 15 weeks of didactic lectures and “boot camps” that teach common skills (including history taking, vital signs, and physical examination). They then spend 15 weeks shadowing an interprofessional team at a clinical site, either at the hospital or in a community practice.

LCE began three years ago as a pilot program with nine students. Beginning this academic year, it will include all first-year students from the School of Medicine, the School of Nursing’s Graduate Entry Prespecialty in Nursing, and the PA Program. The impetus for the course was a desire, as the School of Medicine

revised its curriculum, to introduce medical students to clinical care earlier in their education in an authentic setting with health care professionals. This year, more than 250 students will participate, along with more than 100 clinical coaches at more than 60 sites.

LCE was also a chance to incorporate IPE into the curriculum. The accrediting body for medical schools, the Liaison Committee on Medical Education, now requires students to have an IPE experience. LCE and IPE seemed to be a natural fit, as long-term clinical experiences are about building relationships with both patients and co-workers, said Eve R. Colson, M.D. ’89, M.Ed., professor of pediatrics and co-director of LCE.

“What we are doing in combining LCE with IPE has never been done anywhere else,” said Colson. “Nationally, IPE has been hard to implement. We are used to training our students in silos, and it’s been hard to change that paradigm. But I think we’ve come a long way at Yale, and we are now in a position to model how this can be done.”

According to the American Association of Medical Colleges (AAMC), IPE is on the rise nationally. In the 2013-14 academic year, 119 American medical schools required some form of IPE for medical students, up from 85 schools three years earlier. The challenges, Colson noted, include expanding IPE to include more students. Another challenge is logistics: often, schools in the health professions at the same university are not always located in the same place, said Maryellen E. Gusic, M.D., chief medical education officer of the AAMC.

Before IPE, medical, nursing, and PA students trained separately, and never crossed paths in clinical education. According to a 2010 report from the Institute of Medicine (now the National Academy of Medicine), said Linda Honan, Ph.D., M.S.N., associate professor of nursing and co-director of LCE. “If we really want to improve patient care delivery, and we want to avoid medical errors, then we cannot continue to believe that training in silos graduates people who know how to work together, and know the value of ‘other,’ whoever that other is.”

“All students come in with their biases or unknowns, but I think this experience will help them realize that we are all learning at the same level and we can rise together,” said David Brissette, PA-C, M.M.Sc., assistant professor in the PA Program.



Interprofessional education brings together students in medicine, nursing, and the Physician Associate Program. “We are used to training our students in silos ... but I think we’ve come a long way at Yale,” said Eve Colson.

Working together helps LCE students address biases and preconceptions about each other’s role. “People would say to me that everyone looks down on nurses,” said first-year nursing student Brittany Hughes. “But in this course, I’ve noticed the opposite. People seem to appreciate how knowledgeable we are.” Unlike medical students, who first encounter patients in their third year, nursing students begin learning clinical skills from nearly the first day of school. PAs begin clinical training in their second year. (The new curriculum at the School of Medicine has first-year students beginning a longitudinal clinical experience in their first year.)

What has become clear as the course develops is that despite differences in their roles and approaches to care, the three professions have a lot in common. This commonality not only serves to foster collaboration and understanding, but has an economic benefit also. “We have been teaching the same skills to three different types of clinicians,” said Honan. For example, medical students, nursing students, and PA students

learn physical examination skills the same way. “If we can find more threads that are similar—and we can—then why are the three of us spending the time, money, and energy replicating it three times?”

With all first-year students in all three schools taking the class, the challenge has been to find clinical sites to house all of the students as the program grows, manage disparate class and clinic schedules, and convince busy clinicians to incorporate another team of students into their already hectic practices. “It’s a herculean effort to find the sites,” Honan said. But in the end, she said, LCE will help Yale send clinicians to hospitals prepared to thrive in the new team-based paradigms of care. [/yale medicine](#)

Jeanna Canapari is a frequent contributor to Yale Medicine.

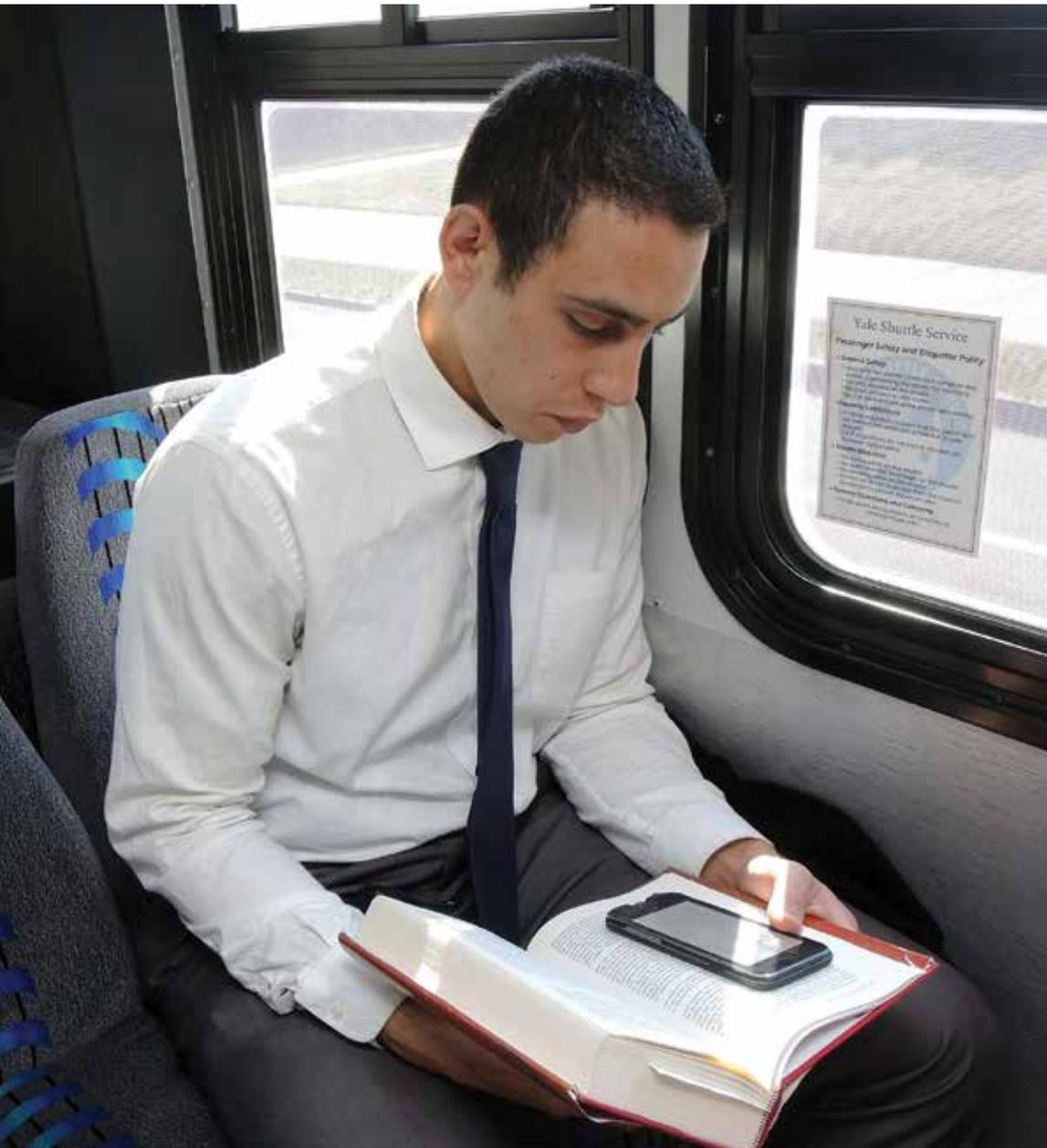
A day in the life of a student

This spring, *Yale Medicine* asked Frankie Stiles-Hanna, a 2015 journalism graduate from the University of North Carolina, to document a day in the life of first-year medical student Jonathan Hanna, who happens to be her husband. On a Thursday in May, Stiles-Hanna shadowed her husband throughout his day, in the library studying, in class, at the gym, in a session with standardized patients, and at a Bible study in the evening. What follows is her report on a day in the life of a medical student.

**A first-year medical student navigates
the new curriculum.**

By Frankie Stiles-Hanna





6:50 A.M.

Jonathan Hanna's iPhone alarm plays its preprogrammed "Uplift" alarm tune at 6:45. If we're honest, he usually hits "snooze" at least once.

7:00 A.M.

He is up and takes Apollos, our 7-month-old puppy, out to the yard, then feeds him breakfast.

7:10 A.M.

Hanna starts the coffee, brushes his teeth, shaves, and puts a quick dab of gel in his hair. He dresses in slacks, a button-down shirt, and navy tie, and downs a steaming-hot cup of coffee. He takes the puppy out once more, then returns to wake me for work.

7:30 A.M.

The Yale shuttle app says the bus is 3 minutes from the stop, four blocks from our Cottage Street apartment. He grabs his briefcase and runs.



8:00 A.M.

Instead of going to class, Hanna sets up his laptop, mouse, and mouse pad at a work station in the library. “I absorb material much more efficiently and effectively by chugging through textbooks instead of listening to lectures,” he says. “It’s really whatever works for you; lots of people would not be able to read for hours on end, and for them listening to a lecture and taking notes is more effective. ... The beauty of Yale Med is it gives you the freedom to choose which method you want to use.”

Hanna’s preferred method includes online textbooks. “I use a million different sources. I usually have some kind of basic science text ... and some pathology/pathophysiology text to understand the disease process. Then I have a clinically oriented text that describes clinical management of disease. My text of choice, which I love dearly, is called *Current Medical Diagnosis & Treatment*.”

Hanna also uses such supplementary sources as review books for breaking down dense concepts. He loosely aligns his studying with the class schedule, which covers one topic at a time. “I often go off track because there are certain things I like to learn more in depth. Like today, one of the topics is chronic kidney disease, and I’ll study that more in depth on my own.



9:50 A.M.

With a takeout breakfast from the hospital cafeteria, he makes it to Hope 309 in time for a workshop, led today by Francis Perry Wilson, M.D., M.S., a nephrologist, and Sudhir Perincheri, M.D., Ph.D., a pathologist. Two faculty members lead each workshop, helping to conceptualize and expand upon the information studied independently or taught in lecture.

Hanna chooses a seat at the end of the 8-foot table, which fills most of the space in the classroom. About 10 students open up their laptops. Hanna eats his breakfast—bacon, eggs, corned beef hash, and a blueberry muffin—while the class discusses kidney disease. The students look at pathology slides of kidney specimens, make diagnoses, and plan treatment for three cases. The session ends at noon.

12:00 P.M.

Hanna heads for the gym in the basement of Harkness dormitory for a workout that is meticulously timed (with his iPhone) and executed—a circuit of weighted squats, lunges, and crunches. The gym is small, so he does 10 sprints in the hallway. “I do cardio and weights together so I don’t waste time.” Panting, he changes back to his slacks, shirt, and tie.



12:30 P.M.

It’s a sunny day, so Hanna chats with classmates in the Harkness courtyard before a clinical skills class at 1:00. Today, they are interviewing standardized patients. Hanna reviews the interview questions on his iPhone. “I’m good at the interview process, but I don’t have it memorized. I’ll memorize it when I understand why I’m asking the questions I’m asking, but I feel comfortable with patient interviewing in general.”



1:00 P.M.

Hanna and three classmates join Auguste H. Fortin VI, M.D., M.P.H., associate professor of medicine, in a practice exam room filled to the brim with purple chairs and examination tables. It is frigid with the air conditioning on high and the door to the tiny room closed. Fortin explains how the session will work. Four standardized patients (actors who role-play different medical situations) come in one by one to be interviewed by a student. The others, along with Fortin, give constructive feedback.

“Remember, these are actors, not real patients,” Fortin says. “You can’t hurt them and you can call a time-out.”

Hanna goes first. To simulate a real doctor-patient encounter, he goes into the hallway and knocks on the door after the actor has walked in.

“Hi, Mr. Micella,” he says. “I’m Jonathan. I’m a Yale medical student, and I’m going to be part of your care team. What brings you in to see us today?”

The patient describes sharp recurrent chest pain that began this morning at work.

After ensuring that the patient is not having a heart attack, Hanna

guides the patient into a discussion of his past medical, social, and family history. He summarizes what Micella says to make sure he understands what is going on and to reassure the patient that he is being heard. He pauses to check the order of his questions on his phone, then finishes the interview.

Fortin tells Hanna that he likes the way he approached Micella—he did not interrupt or talk over him, allowing the patient to elaborate on the situation. Fortin opens up the discussion to comments from the other students in the room. Classmates praise Hanna for his laid-back but professional conversational style. They like that he validated what the patient was saying. Last, they say that Hanna should have used less jargon with the patient, avoiding words like hypertension and family history.

Hanna nods to his peers in thanks. They then ask Fortin to help them make a diagnosis. Turns out the actor probably had angina, secondary to coronary artery disease.

“Practicing patient interviewing in a one-on-one setting with Dr. Fortin was a really great learning opportunity, as he is an expert in

patient-centered interviewing,” Hanna says, “and it gave me a stronger sense of how to make the patient feel comfortable while also efficiently obtaining necessary information.”

3:45 P.M.

Hanna grabs a snack from a food truck on Cedar Street. Then it’s time to meet with Daniel Coman, Ph.D., an associate research scientist in radiology and biomedical imaging, to discuss a research project Hanna is working on this summer. They walk across the street to the computer labs in the basement of the Boardman Building. To their disappointment, they do not have the login information they need, so they plan to meet at another time. The warm spring weather makes Hanna change his plans for the afternoon. “Usually, I’d go to the library and study again

for a few hours, but it’s so nice, and I’m pretty caught up, so I think I’m just going to go home and relax.”

4:30 P.M.

He takes the shuttle back to East Rock and takes Apolos to the backyard to play. After many tries, we teach the pup to catch a Frisbee in midair. It is a joyous occasion. Hanna goes back inside, and I heat up some leftovers for dinner.

7:30 P.M.

After dinner we head out to Hamden for Bible study and prayer with about a dozen friends. Rob Dunlop leads the group at his house, and we are just finishing up the Epistles of John. We leave at 10:00. Hanna drives us home, takes the dog outside one last time, and falls into bed about 11:00. “Got a lot to do tomorrow,” he says.



A brief window for a deep connection

By Sarah Faulkner

In the brief window of a doctor's appointment, doctors and patients traverse an interaction that isn't easy to teach in a classroom. Auguste H. Fortin VI, M.D., M.P.H., has spent the last 16 years teaching medical students at Yale how to interact with patients while inviting emotion, narrative, and connection into the interview.

In 1985, when he graduated from Tufts University School of Medicine, Fortin found himself frustrated. "I wasn't making the sort of connections that I felt I should be making as a doctor," he said. It wasn't until he met Robert Smith, M.D., an internist at Michigan State University and a scholar, that he learned about a different approach to interacting with patients: patient-centered interviewing.

Fortin, an associate professor of medicine, began to follow the patient-centered model developed by Smith. The model's focus on open-ended questions, he found, encouraged patients to tell their own stories about their illness. His patients felt better just by talking with him, they said. "That was incredibly reinforcing for me because that's the sort of doctor I had always wanted to be—somebody who could be therapeutic in real time."

Fortin has been teaching patient-centered interviewing to medical students at Yale since 2000, when he started teaching the medical interview component of the preclinical clerkship. The model consists of five basic steps: establishing a relationship, setting an agenda for the appointment, asking open-ended questions, learning the personal and emotional context of the symptoms, and transitioning to the next part of the interview—collecting information like blood pressure.

At Yale, students learn to listen and ask questions that let the patient do the talking. Witnessing patients' emotional burdens is the best way to get them on a path toward feeling better, Fortin says. "Over the last 100 years, many patients have been cured of disease but have not been healed," he says. "We're hoping that we can both cure disease and heal the patient in the process. The interaction between doctor and patient is one way to do that."

Initially, medical students may see this technique as counterintuitive. "I think in a lot of students' eyes, acting like a doctor means hammering off questions and taking charge of the interview," said Anna B. Reisman, M.D., associate professor of medicine and director of the Standardized Patient Program at Yale. Interacting with standardized patients gives students the opportunity to exercise their ability to let patients tell their stories. "The medical stuff is straightforward. The patient's personality, emotional state, life experience—these complicate and enrich the interaction. Being interested in the person beyond their symptoms not only makes for a more interesting conversation, but it's more therapeutic."

Fortin and Reisman acknowledge that students often don't often see this type of interviewing modeled when they begin their residencies. Fortin plans to extend his training to include residents and attending physicians, in the hopes of establishing patient-centered interviewing as the norm. Michael Bennick, M.D., director of patient experience at Yale New Haven Hospital, says that in order to incorporate good communication between doctors and patients, the culture in hospitals needs to change. Training people across departments will create a lingua franca of communication skills, says Bennick. "The fact is—words matter. What clinicians say and how they say it hugely affects patients," he said.

Bennick, Fortin, and Reisman hope that by training the next generation of doctors to communicate, they will enter the workforce ready to address some of the problems that face a system that often seems to be increasingly impersonal. "My argument is that we can change the nature of health care," said Bennick, "by changing how we interact with our patients." [/yale medicine](#)

Sarah Faulkner was Yale Medicine's 2016 writing intern.



First-year medical student Jonathan Hanna greets a standardized patient while his classmates and Auguste Fortin observe. After the encounter, they will offer praise and critiques of his approach to the interview.

The Yale system —91 years and counting...

An experiment in medical education followed “a very wise direction.”

By Kathleen Raven

On his first day as an intern at the Hospital of the University of Pennsylvania, Antony Chu, M.D. '02, had to borrow another doctor's white coat bearing that doctor's name. An observant colleague noticed the embroidered misnomer. “Who are you, and where are you from?” asked Mindy G. Schuster, M.D. '87, now a professor of medicine at the hospital, during a shared elevator ride. After his reply, she smiled and told Chu the story of that time when 17 Yale students failed Step 1 of their national board exams. “That was my class,” Schuster said. Despite a generation gap, she and Chu bonded immediately over their Yale system experiences. (The board failures caused deep concern among basic science faculty, and the subsequent implementation of mandatory anonymous qualifying exams meant that a mass failure never happened again.)

Chu, now a cardiologist at Brown University's Warren Alpert Medical School, said the Yale system fostered collegiality to a degree he has not experienced since medical school. “One of my classmates was interested in climbing Mount Everest, and the faculty worked with him to create

studies around high-altitude medicine,” Chu said.

The Yale system has undergone some changes throughout its nearly 100-year history, but for years it has been one of the main reasons students study medicine at Yale. Daniel Barson and Abigail Greene, both third-year M.D./Ph.D.

students, chose Yale because of it. “To me, the Yale system is the option of what to study, when to study, and how to study without the stress of a test to pass in one week,” Barson said. During her first two years, Greene went to “every class and every workshop—which isn't totally the norm,” she said. Even with packed schedules, Barson and Greene found time for lab experiments and behind-the-scenes roles in the Second-Year Show, the students' annual spoof of faculty. As a result of such independence, Yale medical students must look inward to understand what motivates them to learn,



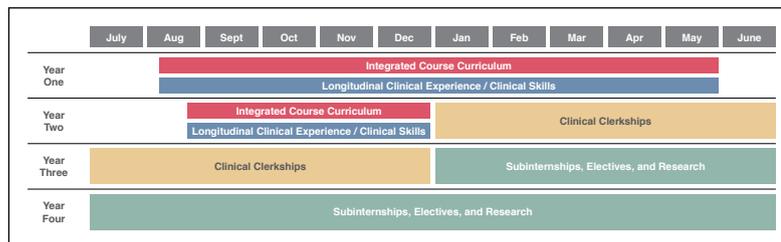
A major change in the curriculum since Milton Winternitz was dean is the introduction of clinical training in the first years of medical school. In August, first-years

Nikitha Murali, Charles Hsu, and Dennis Wang, learned how to do ultrasounds under the tutelage of Jonathan Kirsch. Kim Siefert, a resident, played the role of patient.

Greene said. “It’s a really valuable skill, and an enjoyable way to learn medicine, keeping us grounded, happy, engaged, and passionate.”

“In the early days,” said Robert H. Gifford, M.D., HS ’67, professor emeritus of medicine, and the school’s first deputy dean for education, “you didn’t have to go to class if you felt you knew the material. You were responsible for your education.”

What is accepted as a given today began as a pedagogical experiment spearheaded by Dean Milton C. Winternitz, M.D., in the 1920s. About that time, medical faculty across the country were following the model laid out in the Flexner Report of 1910, which recommended two years of basic science followed by two years of clinical instruction. Winternitz added additional core concepts to Yale’s approach: fewer required classes, a senior thesis, optional lecture attendance, no grades, and no individual course exams. Winternitz believed students needed to show mastery of material, but should be treated as scholarly adults and not forced to regurgitate facts or repeat science experiments as expected of their vocational school counterparts. Writing in the *Journal of the American Medical Association* in 1926, Charles R. Stockard, M.D., Ph.D., of Cornell University,



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SYNOPSIS OF REQUIRED COURSES, 1925-26

	First Term	Second Term	Total Hours for year
FIRST YEAR			
Anatomy	12	12	260
Microscopic Anatomy	8	..	120
Embryology and Anatomy of the Central Nervous System	..	8	120
Physiological Chemistry	12	..	180
Physiology	..	12	180
Elementary Bacteriology	7	..	105
Total			1065
SECOND YEAR			
Pathology	9	4	195
Gross Pathology	2	2	60
Pharmacology and Toxicology	9	..	135
Medicine	4	2	90
Biochemical Methods	6	..	90
Clinical Microscopy	1	4	75
Bacteriology	1	4	75
Physical Diagnosis	1	4	75
Electives	90
Total			885
THIRD YEAR			
Surgery	2	2	60
Surgical Clinic	1	1	30
Obstetrics and Gynecology	4	1	75
Gynecological Clinic	..	1	15
Manikin	1	..	15
Gynecological Pathology	..	2	30
Medical Clinic	1	1	30
Therapeutics	2	..	30
Psychiatry	..	2	30
Hospital Ward Work, Medicine	}		168
Hospital Ward Work, Surgery	}		168
Hospital Ward Work, Obstetrics and Gynecology	} 28 hours a week for 6 weeks		168
Hospital Ward Work, Pediatrics	}		168
Electives	90
Total			1077

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FOURTH YEAR

	First Term	Second Term	Total Hours for year
Medical Clinic	1	1	30
Dermatology	1	1	30
Surgical Clinic	1	1	30
Oto-Rhino-Laryngology	1	1	30
Ophthalmology	1	1	30
Public Health	6	..	90
Pediatrics	..	3	45
Pediatric Clinic	1	1	30
Medical Dispensary	} 18 hours a week for 6 weeks		108
Surgical " "	}		108
Pediatrics " "	}		108
Dermatology Dispensary	} 4 1/2 hours a week for 6 weeks		27
Urology	7 1/2	"	45
Orthopedics	4 1/2	"	27
Laryngology	3	"	18
Ophthalmology	4 1/2	"	27
Electives	135
Total			918

said “The country at large owes its thanks to the faculty of the Yale medical school for having taken a definite step in what is probably a very wise direction.”

Dean Milton Winternitz (top, right), who instituted the Yale system, felt that medical students were mature, competent, and capable adults who could find their own way of learning and studying.

and two years of clinical training. For the 2015-2016 academic year (top, left), the color-coded course outline featured clinical experiences from the first day of medical school.

The course listings for the 1925-1926 academic year (above), the first to reflect the reforms of Dean Milton Winternitz, filled only a page and half. The four-year curriculum was neatly divided into two years of science



A love of books— and people

THE LOVE JOHN GALLAGHER, M.L.S., has for his job is obvious. His eyes twinkle more brightly than usual when he talks about the rare book stacks in the Harvey Cushing/John Hay Whitney Medical Library. “I never thought I would ever have the opportunity to pick up and hold in my hand a treatise by Copernicus on heliocentricity from 1543,” he said. “To work that closely with something so unique ... what’s not to love?”

Sixteen years before he was holding historical manuscripts and transcripts, he had an entry-level job placing books on the library shelves. In May, Gallagher became director of the medical library after serving as interim director since 2014, when his predecessor, Regina (Kenny) Marone, retired. As director he oversees 38 staff members who manage a collection of more than 400,000 physical volumes, 22,000 electronic journals, and 36,000 electronic books.

“My story is not a particularly traditional one for libraries,” Gallagher said. His work life began in an assortment of settings far from libraries—like going door to door to sell radio advertising for businesses. He

was spending 70-80 hours a week as a building manager for RPS, now FedEx Ground, and had three young daughters when he decided that he needed a change from a hectic lifestyle that kept him away from his family. Not long after he joined the staff at the Library Shelving Facility in 1999, his managerial experience caught the attention of the library’s staff.

In April 2000, Gallagher became the medical library’s evening and weekend supervisor. Three months later he was promoted to head of circulation. “It was a no-brainer,” said librarian Jan Glover, M.L.S., who was then acting head of circulation.

As Gallagher garnered more responsibility, Marone encouraged him to pursue a master of library science degree. He took night classes and graduated from Southern Connecticut State University in 2005. He

continued to move up, advancing from access and delivery services librarian to associate director. When Marone retired in 2014, Gallagher was appointed interim director.

Melissa Grafe, Ph.D., the John R. Bumstead Librarian for Medical History, said that Gallagher is perhaps best known for his people skills. “He’s good at bringing people together to generate ideas that move the library forward,” she said. “He knows the strengths of his staff, and he uses those strengths to create programs that best serve the patrons of the library.”

A year and a half ago, for example, he established weekly staff meetings and once a month invited guest speakers from the



John Gallagher started at the Harvey Cushing/John Hay Whitney Medical Library putting books on the shelves. This year he was named its director.



ONLINE EXCLUSIVE

At a weekend-long workshop in May, leaders from the Union of Medical Care and Relief Organizations and the Syrian American Medical Society worked with Yale medical and public health faculty to find ways to support the Free Aleppo University (FAU) Medical School in Syria through textbooks and online resources.

Full stories and event photo galleries, as well as other online-only content, can be found on our home page at yalemedicine.yale.edu.

schools of medicine and public health or Yale New Haven Hospital to discuss their work. “It really puts all the paperwork and day-to-day stuff into perspective,” said Katie Hart, senior administrative assistant in the library. “Working at a medical school, you know you have some bearing on the clinical practice, but to have people come in and tell us how they’ve used the library for their own research—that’s really meaningful.”

Gallagher’s unforeseen career path is a message he has tried to pass along to his daughters as they consider college. His second-youngest is interested in psychology, but she also loves music. His advice: “Keep your options open, because you never know just how much you might enjoy something. Connect what you do for work with something you love.”

Gallagher’s flexibility in his work life has helped him think innovatively about the trajectory of libraries in a modern digital world. While many people see libraries as old-fashioned, Gallagher looks at them differently. “I’m not worried about the future of libraries. We evolve,” he said. “We have a really talented staff who constantly look for opportunities and novel ways to best assist our users.” While information has gone from print to digital, Gallagher said that librarians are still needed to organize, preserve, curate, and disseminate information.

Even the physical space of the library holds a sense of magic to Gallagher. He sees the library as a place of refuge for users from the often hectic and overwhelming world of medicine. “As amazing as the Yale University Library is, it’s wonderful to be connected with something as special as the Yale medical center,” he said. “With health care, you’re engaged in something fundamental, and librarians have so much to contribute to the medical center’s missions.”

When you ask the people Gallagher works with to describe him, words like “focused,” “motivated,” and “vision” come up frequently. But perhaps the best description of what makes Gallagher such a great leader comes from Grafe: “Sheer charisma,” she said with a chuckle.

—Sarah Faulkner



A Yale pharmacologist pursues the therapeutic potential of a psychedelic drug

Pharmacologist Gary Rudnick, Ph.D., names coffee as his personal drug of choice. He’s spent most of his career studying the serotonin transporter, a regulator of neuronal signaling, which is inhibited by such drugs as the antidepressants Lexapro and Prozac. But in the last few years, his research has led him to probe the pharmacological potential of a drug off the beaten

path: the hallucinogen ibogaine, which is illegal in the United States. Its medical appeal? Anecdotal reports suggesting that the drug can help opiate addicts kick their habits.

Rudnick “met” ibogaine, in a research sense, through serotonin, the neurotransmitter that passes signals from neuron to neuron in the brain, and the serotonin transporter, which is the focus of his research. The transporter stops serotonin’s signal by pumping the neurotransmitter from the synapse, where it is active, back into the neurons that release it. Like Lexapro and Prozac, ibogaine inhibits the serotonin transporter.

“When I found out that there was an inhibitor of the serotonin transporter that had sort of an interesting pharmacological past, I thought it would be interesting to investigate it,” said Rudnick, a professor of pharmacology. Now he is working to develop ibogaine-based drugs that might have therapeutic uses.

Ibogaine’s “pharmacological past” goes back to the 1960s, when 19-year-old Howard Lotsof was traveling the world and taking mind-altering drugs. He had developed an opiate addiction and landed in the Central African country of Gabon, where native people used ibogaine in a coming-of-age ritual that Rudnick refers to as a “psychedelic bar mitzvah.” After taking the drug—probably in the form of the mashed root of the plant *Tabernanthe iboga*, from

which the drug is derived—Lots of reported that he no longer craved heroin. He spent the rest of his life advocating for ibogaine as a cure for opiate addiction.

In the years that followed, Lots of and others had successfully treated opiate addicts with ibogaine in countries where the hallucinogen is legal. One study estimates that as of 2006, 3,414 people had taken ibogaine, most of them to treat opiate withdrawal (others took it to treat other addictions; some took it for spiritual or other reasons). However, there were also deaths associated with ibogaine ingestion. Though it was unclear whether ibogaine caused the deaths, Rudnick said, “the whole treatment process and ibogaine got a bad name from this, and it made it even harder for people who were trying to study it seriously.”

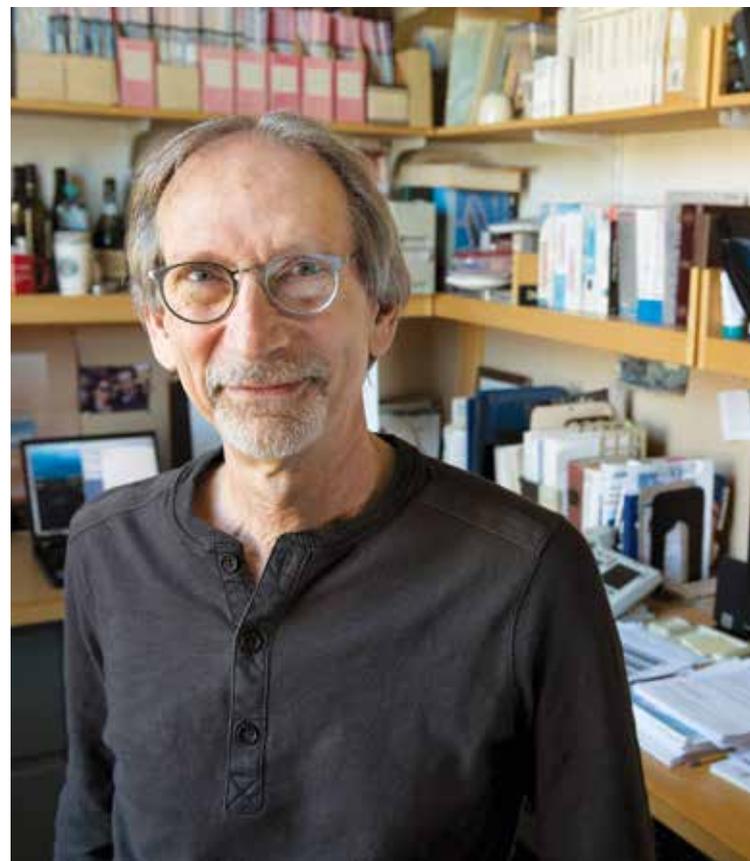
Ibogaine’s status as a Schedule I drug in the United States—which means that it is illegal, has no accepted medical use, and is thought to have potential for abuse—only adds to that difficulty. However, Stanley Glick, M.D., Ph.D., professor emeritus at New York’s Albany Medical College, said it’s unlikely that ibogaine is addictive. “Most people report [taking ibogaine] as a rather unpleasant experience,” said Glick, who began researching ibogaine after Lots of contacted him and touted its potential. Unpleasant how? In addition to inducing hallucinations, ibogaine can slow the heart, hamper

muscle coordination, and cause nausea and vomiting.

Perhaps due to these obstacles, there have been no placebo-controlled trials of ibogaine’s therapeutic effectiveness in humans. Glick calls this lack of clinical testing “a real tragedy,” adding that “the anecdotal evidence can only go so far. ... It does not constitute scientific proof.” There has, however, been promising animal research on ibogaine. Glick has reported that ibogaine eased the symptoms of rodents withdrawing from the opiate morphine, and also reduced animals’ appetites for a variety of drugs.

Rudnick found that ibogaine interacts with the serotonin transporter in an unusual way. All currently approved serotonin transporter inhibitors jam the transporter’s opening and block serotonin’s binding. Rudnick found that ibogaine blocks the transporter in another orientation, in which it is open to the inside of the cell. “Drugs that inhibit the transporter by a different mechanism might have some kind of unique properties in terms of their action on any kind of psychiatric disorder that may involve serotonin transporter function,” he said.

But ibogaine has too many molecular targets to make it a precision therapy. To gain more control over the drug’s actions, Rudnick wants to develop ibogaine-like compounds that target the serotonin transporter. To that end, Rudnick is working



with Brian Shoichet, Ph.D., of the University of California, San Francisco, who uses computer models to simulate the way proteins interact with potential drugs, to identify ibogaine-related drugs that bind to the serotonin transporter in its inward-open state.

Such a drug could have applications for opiate withdrawal, Rudnick said, or it might do something else completely novel: “There may be other potential problems that could be treated with drugs that act on these proteins, and we won’t know that until we actually have the drugs.”

—By Ashley P. Taylor

Gary Rudnick has found that a hallucinogen used in Central African coming-of-age rites may be useful in weaning people from opiate addiction.

How Richard Belitsky led medical education at Yale into the 21st century

THE WAY STUDENTS LEARNED MEDICINE and doctors practiced it looked quite different in 1979. That was the year Richard Belitsky, M.D., HS '82, FW '83, the Harold W. Jockers Associate Professor of Medical Education, associate professor of psychiatry, and deputy dean for education, arrived at Yale as a psychiatry resident after graduating from the University of Florida's medical school. After his residency, Belitsky stayed on as the unit chief of an inpatient psychiatric service at the Connecticut Mental Health Center. He logged tireless hours for his first passion: patient care. "I was moved by how hard it is not just for patients to cope with their illness, but also the stigma that goes with it," Belitsky said. As he guided and mentored medical students, residents, and other trainees, he discovered a second love: teaching. His supervisors picked up on this, too, and afforded him opportunities to become further involved in medical student and residency education.

In 2006, he became the school's third deputy dean for education. Two years after his appointment, Dean Robert J. Alpern, M.D., Ensign Professor of Medicine, charged Belitsky with spearheading a strategic planning process for medical education. Belitsky, who has twice won the medical school's top teaching award, did not hesitate. He began an in-depth assessment of the school's

medical education and resources that recommended building a new curriculum and creating a Teaching and Learning Center that would provide expertise in best teaching practices, program evaluation, student assessment, and use of technology to promote learning. Starting in 2010 until the curriculum rollout in August 2015, Belitsky and countless colleagues redesigned how medical students are taught at Yale. "One of the proudest and most wonderful moments," Belitsky said, "was seeing

the shift from all of the understandable worries and concerns about a new curriculum to seeing the excitement and enthusiasm of our faculty sitting around the table, planning parts of the curriculum."

At the end of the curriculum's first year, Belitsky and the faculty await data and assessments to know how the rebuild is affecting student learning.



watch a short interview
with Richard Belitsky at
yalemedicine.yale.edu/qa

{ To nominate a subject for Q&A, contact
[Yale Medicine, 1 Church Street, Suite 300, New Haven, CT 06510 or email yymm@yale.edu](mailto:yymm@yale.edu)

Why did you decide to do the curriculum rebuild?

We looked at the explosion in scientific knowledge—like proteomics and genomics—that was changing our understanding of the disease process. We looked at the shift from inpatient to ambulatory care, the increase in chronic illnesses like hypertension, diabetes, and obesity. We looked at the change in structure and financing of health care. We considered the changing expectations of society—more patient-centered care, greater communication, more attention to cultural competence, greater fiscal responsibility, and more attention to patient safety. We were also aware that technology was changing the way students receive and expected to get information. They want it remotely, they want it immediately, they want it always accessible, and they want it to be up to date at all times. With all the changes going on, it made the most sense for us to build a new curriculum from the ground up.

What was one of the most challenging aspects of the rebuild? It meant bringing together people with very

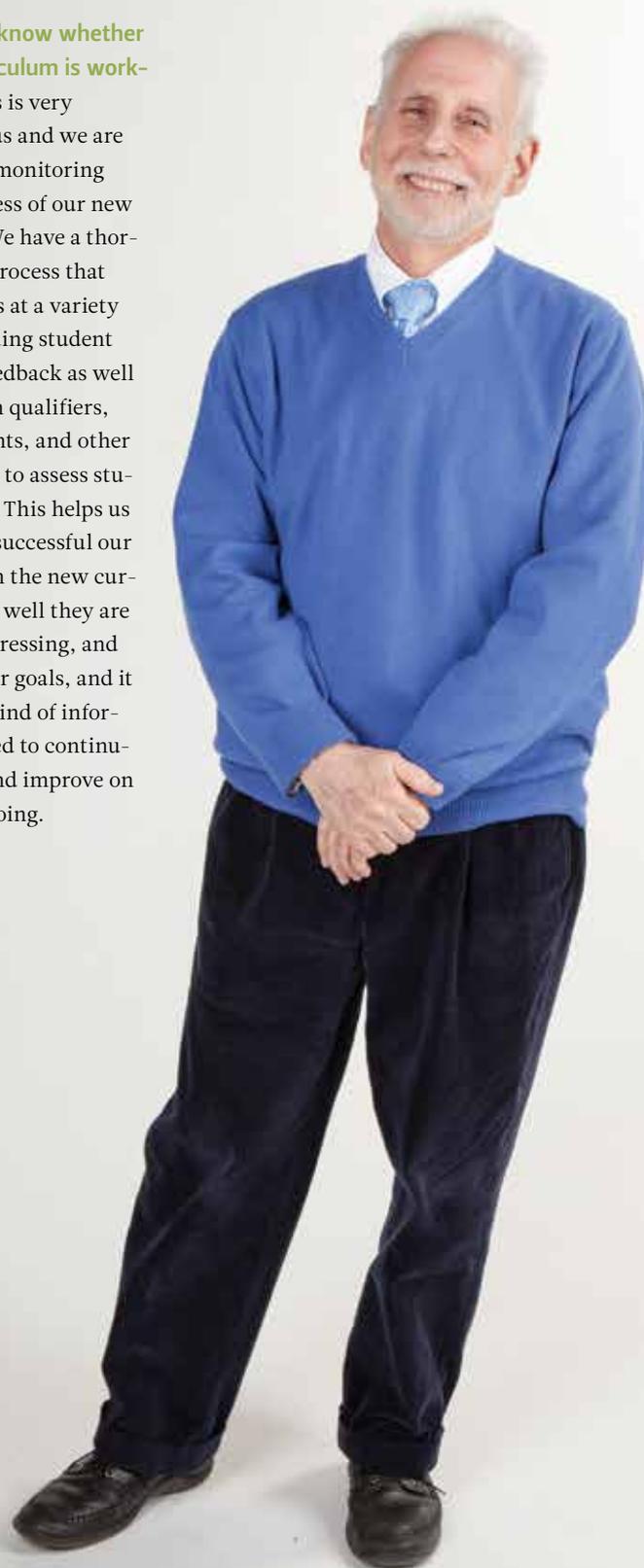
different ideas and opinions about medical education, what we should be teaching, and how we should be teaching it—bringing those people together to share ideas, to plan, and to achieve consensus. That really was the biggest challenge. We were able to achieve this by a steadfast commitment to an open, inclusive process with ongoing communications, meetings, conversations, and discussions over several years.

What has been your proudest moment so far?

We have Second Look Weekend, which is when applicants who have been accepted to the school come back and take another look. During the most recent Second Look, we had a panel discussion, and our students who had just completed their first year in the new curriculum talked to prospective students about their experience. They highlighted how much they liked the integration of material and how well thought out it seemed to be. They explained that it gives them context and helps them understand the importance of the basic sciences in becoming a physician. It meant that our students understood what we were trying to accomplish, and even though not perfect, they understood the value of the changes that we were making.

How will you know whether the new curriculum is working well?

This is very important to us and we are continuously monitoring the effectiveness of our new curriculum. We have a thorough review process that carefully looks at a variety of data, including student and faculty feedback as well as results from qualifiers, self-assessments, and other tools designed to assess student learning. This helps us to know how successful our students are in the new curriculum—how well they are learning, progressing, and achieving their goals, and it provides the kind of information we need to continuously revise and improve on what we are doing.



Survival traits that are killing us

By Cathy Shufro

The Biblical admonition that “the meek will inherit the earth,” said cardiologist Lee Goldman, M.D. ’73, M.P.H. ’73, is just not true. “We’re not the descendants of people who got killed; we’re the descendants of people who killed other people.”

Knowing how to survive violence was one of four bedrock traits that allowed our ancestors to pass on their genes for more than 200,000 years. The others are appetite, which leads to gorging and storing fat; craving water and salt, which staves off dehydration; and the ability to clot, which minimizes blood loss after injury or childbirth. These traits distinguish the lineages of people alive today from those that perished, said Goldman, dean of the faculties of health sciences and medicine at Columbia University Medical Center.

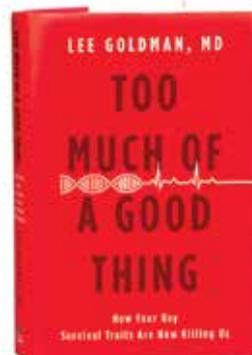
And yet in the 21st century, Goldman argues, our lives are increasingly threatened by those very traits. That is the central argument of his new book, *Too Much of a Good Thing: How Four Key Survival Traits Are Now*

Killing Us. “Now each of those traits is overprotective, doing more than we need.”

The problem is recent. For millennia, rates of random genetic change arising from mutations, combined with natural selection, matched the generally slow rate of change in the natural environment. But during the past two centuries, Goldman said, labor-saving technologies like cars and elevators have made us sedentary. We sweat less but still crave salt; we burn fewer calories but can’t resist calorie-dense foods.

As for clotting, Goldman writes, “veins were built for constant motion,” and if we sit and sit, our life-saving clotting ability can turn on us. Video-game addict Chris Staniforth, Goldman notes, died at age 20 after a long session at the computer. A clot that formed in his leg migrated to cause a fatal blockage in his lungs.

Vigilance against danger once protected us, but can now cause anxiety or even post-traumatic stress



disorder, and the ancient ability to act submissive to avoid aggression can lead to depression. Whereas archeologists estimate that violence killed about one in six hunter-gatherers, Americans are now twice as likely to commit suicide as to be killed by a fellow human.

“Our genes just can’t keep up,” Goldman writes. “And as long as modern killers [such as chronic disease] afflict us *after* we bear children, who will in turn have their own children, there’s no natural selection process to give an advantage to genes that hypothetically could help us catch up.”

Goldman has little hope that willpower or shaming can overcome our attraction to potato chips or M&Ms. Policy measures will serve us better than attempts at self-control, he said. In Finland, for example, efforts to cut sodium consumption through nutrition labeling and lowering the salt content of foods have reduced deaths from heart attack and stroke among middle-aged Finns. Goldman also believes that medications

will become more effective as they are increasingly tailored to individuals’ genes and biomarkers.

Goldman’s 284-page book, packed with science, is his first for a lay audience. He is well known for his landmark Goldman Index. Developed with colleagues in 1977 and revised in 1999, the index predicts the likelihood that a person undergoing non-cardiac surgery will suffer postoperative heart problems. Goldman is also the lead editor of the 3,000-page internal medicine textbook, *Goldman-Cecil Medicine*.

Too Much of a Good Thing grew partly out of questions from patients—“questions like, Why is it so hard to lose weight? Do I really have to take my blood pressure medication? Should I take an aspirin every day?”

Goldman chose to write for “a well-informed public interested in medical science,” he said. “I decided it was going to be a serious read, not a watered-down self-help book.”

{ Send notices of new books to
Yale Medicine, 1 Church Street, Suite 300, New Haven, CT 06510 or email yymm@yale.edu



Not by the numbers

LUCY GODDARD KALANITHI, M.D. '07, RETURNED TO NEW HAVEN on May 12 as the featured guest at the School of Medicine's first Community-Wide Read-In, which filled Harkness Auditorium with students, staff, and faculty. She read from *When Breath Becomes Air*, a memoir by her late husband, neurosurgeon Paul Kalanithi, M.A., M.D. '07. In it, he describes his journey from literature to medicine, and how he came to terms with his lung cancer. He died in 2015 at the age of 36.

Even as her husband's body failed him, Kalanithi said, writing the book gave him satisfaction. "It's useful to feel purposeful and helpful even when you're ill," she said.

The community reading fostered a sense that "we're all in this together," said Nancy R. Angoff, M.P.H. '81, M.D. '90, HS '93, associate dean for student affairs, who organized the event with Anna Reisman, M.D., associate professor of medicine and director of the Humanities in Medicine Program. "The work we do takes a toll," Angoff said. "Coming together as a community around literature to discuss a topic of interest to all of us is on some level therapeutic."

—Cathy Shufro