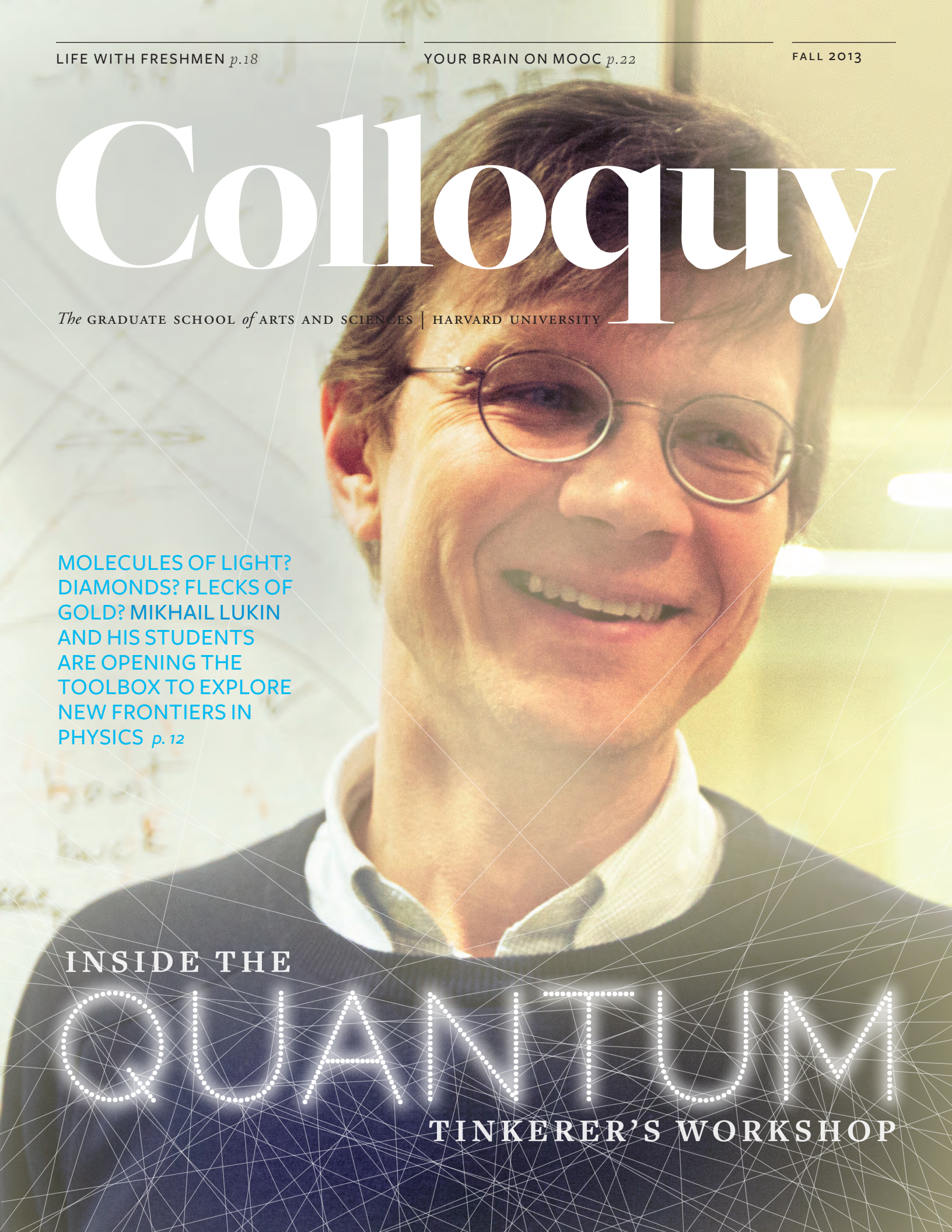
LIFE WITH FRESHMEN *p.18*

YOUR BRAIN ON MOOC *p.22*

FALL 2013

Colloquy

The GRADUATE SCHOOL *of* ARTS AND SCIENCES | HARVARD UNIVERSITY



MOLECULES OF LIGHT? DIAMONDS? FLECKS OF GOLD? MIKHAIL LUKIN AND HIS STUDENTS ARE OPENING THE TOOLBOX TO EXPLORE NEW FRONTIERS IN PHYSICS *p. 12*

INSIDE THE QUANTUM TINKERER'S WORKSHOP

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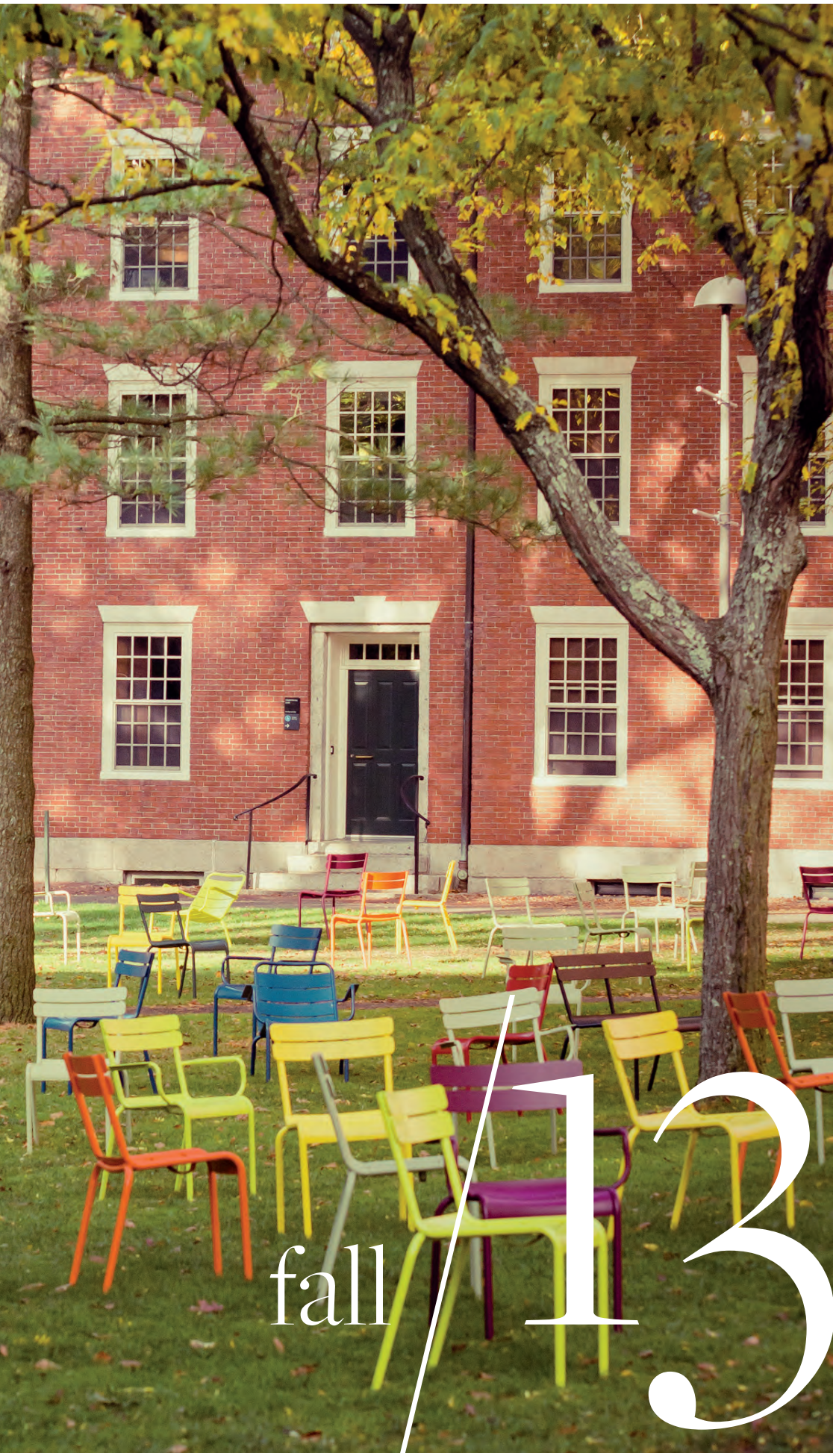


Colloquy

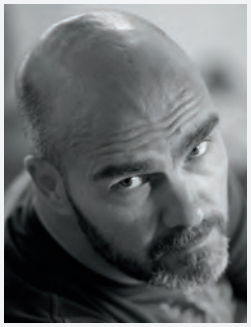
An alumni publication of Harvard's Graduate School of Arts and Sciences

Cover image: Professor of Physics Mikhail Lukin. Photograph by Kris Snibbe/Harvard Staff Photographer

Facing image: Colorful chairs adorn the lawns of the old Yard. Photograph by Ben Gebo

Colloquy

CONTRIBUTORS

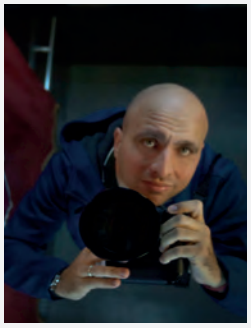


Harry Campbell, an illustrator based in Baltimore, created the art that accompanies our story on MCB80X, the new neuroscience course offered through HarvardX. Campbell's illustrations — recognizable for their precise line work and conceptual distillation — appear regularly in national and international publications, including the *New York Times*, *Time*, the *Wall Street Journal*, and many others.

Michael Fitzgerald, who wrote our story on Harvard's new neuroscience MOOC, also writes for the *Boston Globe Magazine*, *The Economist*, *Fast Company*, and the *New York Times*, among others, and has blogged on business ideas for BNET. He was a Nieman Fellow at Harvard in 2010–2011, and this fall he returned to teach a course on the history of narrative journalism at the Harvard Extension School.

Ben Gebo is a Boston-based photographer who followed a handful of GSAS proctors around Harvard Yard this fall for the "Life in the Yard" feature. Ben has shot a variety of student portraits for the Graduate School over the last year, including the 2013 Horizon Scholars. A partial list of his other clients includes British Airways, New England Conservatory, the Boston Public Library, *HGTV Magazine*, the *Boston Globe Magazine*, and *Boston Home*.

Science writer **Maggie McKee**, the author of this issue's cover story, has contributed to *New Scientist, Nature, Astronomy*, and *Health*, among other health and science publications. She was awarded high commendation in the first European Astronomy Journalism Prize competition for a feature on the Venus transit, published in *New Scientist*.



Kris Snibbe has been a university photographer at Harvard since 1994. Among many highlights of his tenure here was a group exhibition and photography book, *Explore Harvard*, published in 2011, with an introduction by the late Nobel laureate Seamus Heaney. His photography has taken him far beyond Cambridge, exploring cultural, geographical, and religious intersections in China, Tibet, Korea, Mexico, Brazil, and France.

both sides of the coin

Xiao-Li Meng, PhD '90, Dean, Graduate School of Arts and Sciences, Whipple V. N. Jones Professor of Statistics

As a graduate student, a faculty member, and now a dean, I have always embraced the notion that teaching and research are two side of the same coin. This stance has not always been fashionable; in many quarters, research is still seen as the primary duty and dominant rationale for a graduate student or a junior faculty member seeking to advance. Even today, when dramatic changes in the job market have made a strong teaching portfolio more essential than ever, graduate students often report that they receive mixed messages about just how much time or effort they should be spending on their teaching.

But the tension — and the assumptions that underpin it — is not only outmoded, it is increasingly irrelevant. That is true especially at Harvard, where a robust undergraduate course-building effort involves not just the faculty but also our graduate students in research-intensive ways.

My predecessor, Allan Brandt, pioneered this effort when he created a program called Graduate Seminars in General Education (GSGE) in 2008. As you may have read in this space, GSGE arose in response to the launch of Harvard's new undergraduate curriculum, the Program in General Education. The GSGE initiative recognized that the new curriculum would need new courses, and Allan understood that graduate students could be the innovators. In these seminars, graduate students work alongside faculty to explore a body of literature or a given cross-disciplinary topic. They develop a pedagogical approach, a syllabus, and a range of assignments and assessments. In many cases, these seminars form the foundations of new courses launched in Gen Ed. But even the ones that don't can generate heat and light of their own; there is rigorous scholarship involved in the exploration of these pedagogical potentials.

As a professor of statistics, I led or co-led two GSGE and saw firsthand how they integrate research and pedagogy. As seminar leader, I would ask small teams of students to make two-hour research presentations on a particular topic — to find out everything they could, from the origins of the problem to research milestones to open questions. I would then ask each team to think about how to present the topic and their findings to people with little background in statistics, as would be true of some students in Gen Ed. I'd ask them to make a second presentation for that purpose. A key realization of most students was that in order to do the second presentation well, they really had to do well on the first one. Learning and researching for the purpose of creating something tangible is a great motivator.

> The tension between teaching and research is not only outmoded, it is increasingly irrelevant.

Now the Graduate School is expanding the GSGE model, so that the same engine can be used to fuel concentration courses, not just Gen Ed courses. One of the first examples of this new varietal — the Graduate Seminars in Undergraduate Education (GSUE) — will be offered this spring. Called "Sicily," the seminar will design and prepare materials for a new undergraduate course required of classics concentrators.

Emma Dench and Paul Kosmin, the faculty members who will lead this GSUE, wrote in their course proposal that it will offer "an exceptional opportunity for graduate students to engage in cutting-edge research projects and to explore cutting-edge pedagogical issues. Sicily is extraordinarily rich in ancient materials of all kinds (literary, textual, archaeological, and environmental), and lends itself to the sorts of big questions that are most challenging and exciting in our field today."

I'm pleased that Harvard is taking a lead in these collaborative endeavors in intergenerational education. Our ability to expand the GSGE model to reach more students is made possible by a multi-year grant from HILT (the Harvard Initiative for Learning and Teaching), created in 2011 through a gift by Harvard Law School alumni Gustave and Rita Hauser. I want to take this opportunity to thank the Hausers, and so many other alumni, for their critical support in sustaining and enhancing Harvard's leadership in higher education.

STEPHANIE MITCHELL/HARVARD STAFF PHOTOGRAPHER

PHOTOGRAPHER
Ben Gebo

Finding Your Voice

How do you find your voice as a scholar? How do you claim an idea as yours, especially if you're building on an established body of literature, or on work shared by other people in your lab? And once you've found the confidence to stake your claim, how do you find the language to talk or write about it in a way that people outside of your immediate specialty will find persuasive?

These questions were at the heart of a mentoring and professional development process that engaged eight PhD students last spring, after they were selected to join a new fellowship cohort at GSAS called the Society of Horizon Scholars.

Each of the so-called Horizon Scholars — chosen from a pool of 55 PhD students who applied to the inaugural Harvard Horizons initiative — had a compelling research idea when they entered the competition. Over the course of six weeks, with targeted help from Harvard faculty and pedagogical experts at the Derek Bok Center for Teaching and Learning, the students polished and shaped those ideas into five-minute talks, delivered to a University-wide audience at Sanders Theatre last May.

But it wasn't just presentation skills that were sharpened; the ideas themselves became more precise, and the research direction clearer. What began as a communications initiative, in other words, wound up as an exercise in new ways to approach the scholarly enterprise.

All of which was gratifying to the faculty who led the initiative: Professor Shigehisa Kuriyama, AB '77, PhD '86, and GSAS Dean Xiao-Li Meng, PhD '90. Their goal was to encourage a broad recognition not only of the strengths of Harvard's PhD programs, but also of the skills that graduate students increasingly need in order to be effective teachers, to fund their work, and to navigate the job market. They hope that by making Harvard Horizons an annual event, best practices will emerge, and more students will benefit.

SAVE THE DATE:
The next Harvard Horizons Symposium will take place on April 22, 2014, at 4:30 p.m., in Sanders Theatre.

Watch videos of the 2013 Horizon Scholars and learn how the Horizons initiative helped shape their dissertation work:
www.gsas.harvard.edu/harvardhorizons

Fenna Krienen, a PhD candidate in psychology, talked about the emerging science of brain mapping at the inaugural Horizons Symposium.

Parenting and the PhD

A new effort to help graduate students and families

This fall, the Graduate School launched a new and long-anticipated initiative to support PhD students who are planning to become parents.

With funding provided in part through alumni donations to the Graduate School Fund, GSAS students in PhD programs can now request paid time off for six weeks following the birth or adoption of a child. Students who are receiving financial support will continue to receive that support during the time-off period, and they'll remain fully enrolled, with their benefits intact. Departmental G-clocks will be adjusted by one year.

The policy was formulated in collaboration with the Graduate Student Council and Harvard Graduate Women in Science and Engineering, after years of effort to come up with a funding plan that was feasible. The fiscal crisis that hit Harvard in the fall of 2008 was a derailment — GSAS had been close to enacting a policy at that time, but substantial budget cuts made the new initiative impossible.

"This is an issue we've worked on for quite a while, and something we've been committed to doing," says GSAS Dean for Student Affairs Garth McCavana, PhD '90, who started his own family while he was a Harvard graduate student. "We are pleased that we've now been able to come up with a solution that fits the many and varied needs of our PhD students."

Indeed, the flexibility of the new policy is key, since requirements and funding sources differ so widely from one field to another, and from one year to the next. Each student's situation is unique, says Bob LaPointe, the senior financial aid officer who was instrumental in pushing the policy forward. He and McCavana are meeting individually with each student who applies for the benefit, making sure that everyone is aware of their options and can structure the time off to greatest benefit. "No two solutions have been exactly the same," LaPointe adds. "We're not trying to make people fit into the same box."

The new policy creates a process and a structure just at a time when those things may be quite welcome. When Séverine Meunier, PhD '12, had her first child, "the problem was that there was no *category* for people like us; it was really up to each department to deal with expecting graduate students, with very little infrastructure to back them up."

Had this policy been in place when she and her husband — Lambert Williams, who also received his PhD in 2012 — were expecting, "we would have felt less ostracized. What I mean by that is that we would have felt like we were still fully part of the Harvard community and, maybe paradoxically, more involved in the intellectual and social life of GSAS. It would have made a significant difference materially speaking as well, of course."

Catherine Woodring, a PhD student in English who is expecting her first baby in late fall, says the change in policy is "an acknowledgement of the reality of what happens when you become a new parent." And it brings another level of comfort, she adds. "You're getting institutional support for your decision; it's sending a message that this is not something that's frowned upon and should be put off. It's great to know that Harvard will support you while you're still in graduate school."

Meunier says that institutions like Harvard have a clear role to play in leading national conversations about social norms and policies. "Harvard can be so innovative," Meunier says. "The same should be true when it comes to policies that ultimately make the university a better place to learn, to live, and to create."

WRITER
Bari Walsh

BREAKING BARRIERS

New Conversations about Diversity in the Academy

Next spring, Harvard and MIT will open their campuses to 150 promising undergraduates from across the country — students from minority and other underrepresented backgrounds — and give them a sampling of the research opportunities and professional rewards that come with graduate school.

The two universities — with significant leadership from the Graduate School of Arts and Sciences — will host the Ivy Plus Symposium (March 13–15), an annual event sponsored by Ivy League and peer institutions to boost diversity in higher education. For undergraduate scholars who might be uncertain about how best to pursue their academic interests or what exactly a graduate program might look like, the Ivy Plus Symposium aims to be a key point of entry.

It is the latest chapter in story that began three years ago, when Sheila Thomas, a cancer researcher at Harvard Medical School who had run diversity initiatives there, became assistant dean for diversity and minority affairs at GSAS. The goal was to stimulate conversations across disciplines about enhancing diversity in the academy — to think concretely about the role the Graduate School could play in building a diverse faculty and a diverse pool of leaders in any industry requiring advanced degrees.

With former and current GSAS deans Allan Brandt and Xiao-Li Meng, Thomas has worked to "change the conversation" among faculty members at admissions meetings, standardizing the practice of giving a second look to applications from students whose backgrounds may be unconventional or unfamiliar to the assessing faculty.

IVY+PLUS SYMPOSIUM

PhD students in the humanities and social sciences spoke to undergraduates in the GSAS summer research program.

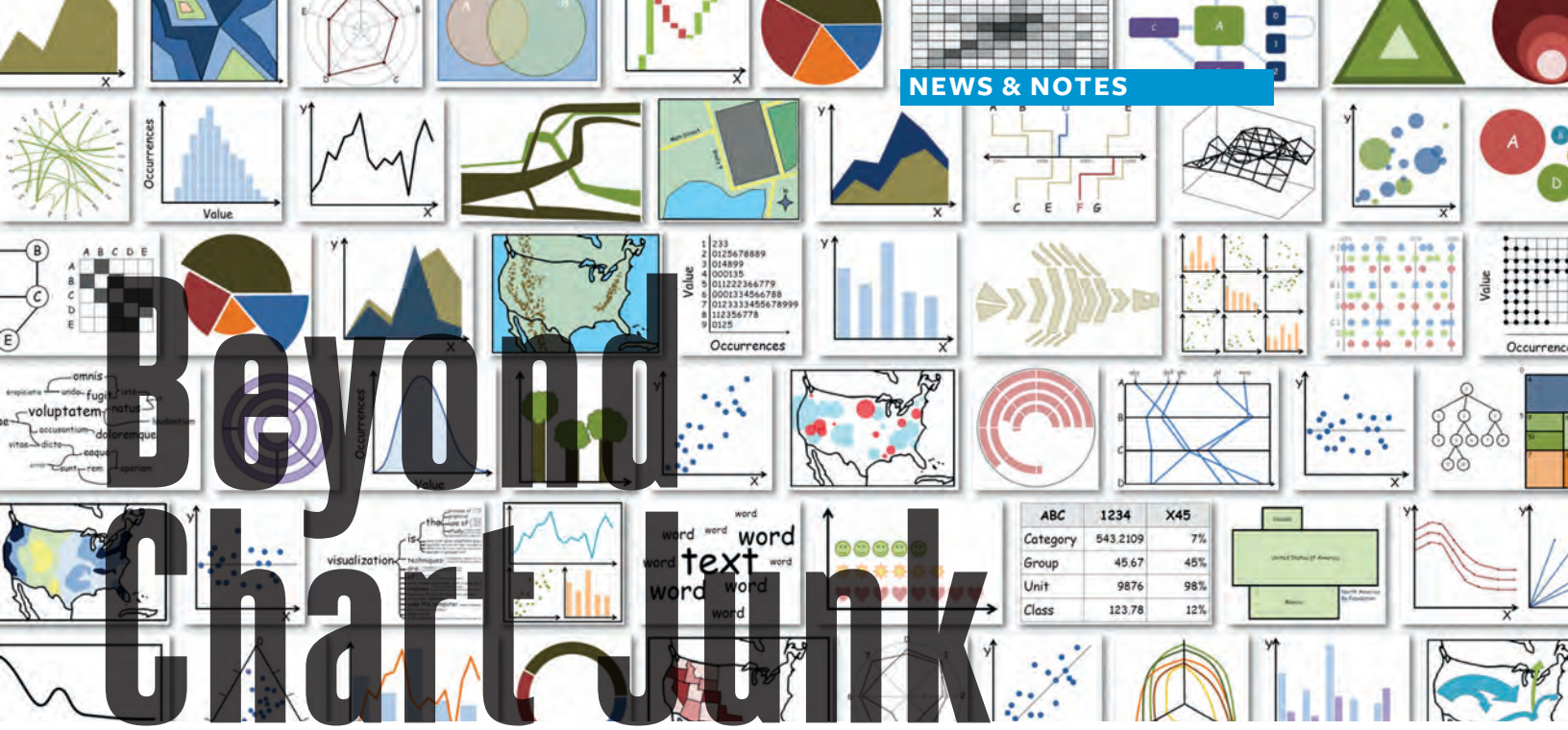
She has also instituted a robust program of recruitment activities. GSAS now runs a summer research program that brings college students to campus for 10-week internships, working alongside Harvard faculty and graduate students. And it launched the post-baccalaureate Research Scholars Program, taking a small number of talented candidates who were not ready for admission to a PhD program and giving them targeted, yearlong research assistantships with Harvard faculty. The first three Research Scholars were ultimately admitted to PhD programs at Harvard and elsewhere, and two are now at Harvard.

The percentage of incoming students who are members of underrepresented minority groups has doubled in three years, from 4 percent to 8 percent. Applications from minority candidates have remained relatively consistent, but there has been a steady rise in the number of admissions offers, a sign that the new conversations are bearing fruit.

#GSAStoday

This fall, as it has for 25 years now, Dudley House hosted a formal dinner (for 300!) for incoming international students and the veteran GSAS students who help them acclimate, serving as guides, friends, and sources of advice during the newcomers' first months at Harvard. The Host Student Program is a successful model at GSAS, where 36 percent of the student body hails from countries outside of the US. The dinner that caps off the program has become one of the most enjoyable events of the year at GSAS — a celebratory start to the academic year.

TOP: LULU LIU, BOTTOM: MARTHA STEWART



Beyond Chart Junk

What makes a data visualization memorable?

It's easy to spot a "bad" data visualization—one packed with too much text, excessive ornamentation, gaudy colors, and clip art. Design guru Edward Tufte derided such decorations as redundant at best, useless at worst, labeling them "chart junk." Yet a debate still rages among visualization experts: Can these reviled extra elements serve a purpose?

Taking a scientific approach to design, researchers from Harvard and MIT are offering a new take on that debate. In results presented in October at the IEEE Information Visualization (InfoVis) conference in Atlanta, hosted by the Institute of Electrical and Electronics Engineers, the team reported that the same design elements that attract so much criticism can also make a visualization more memorable.

For lead author Michelle Borkin, a PhD student in applied physics, memorability has a particular importance: "I spend a lot of my time reading these scientific papers, so I have to wonder, when I walk away from my desk, what am I going to remember?"

It's more than grad-school anxiety. Working at the interface of computer science and psychology, Borkin specializes in the visual representation of data, looking for the best ways to communicate and interpret complex information. The applications of her work have ranged from astronomy to medical diagnostics — watch her TED talk — and have shown particular promise in diagnosing heart disease. Her adviser, Hanspeter Pfister, An Wang Professor of Computer Science at the School of Engineering and Applied Sciences, was intrigued by the chart junk debate, a staple of design blogs and visualization conferences.

Together, they turned to Aude Oliva, a principal research scientist at MIT's Computer Science and Artificial Intelligence Lab and a cognitive psychologist by training. Oliva's lab has been studying visual memory for about six years now, finding that in photographs, faces and human-centric scenes are typically easy to remember; landscapes are not.

"All of us are sensitive to the same kinds of images, and we forget the same kind as well," Oliva says. "We like to believe our memories are unique, that they're like the soul of a person, but in certain situations it's as if we have the same algorithm in our heads that is going to be sensitive to a particular type of image. So when you find a result like this in photographs, you want to know: is it generalizable to many types of materials—words, sound, images, graphs?"

The team (including Harvard students Azalea A. Vo '13 and Shashank Sunkavalli, SM '13, as well as MIT graduate students Zoya Bylinskii and Phillip Isola) designed a large-scale study—in the form of an online game—to rigorously measure the memorability of a wide variety of visualizations. They collected more than 5,000 charts and graphics and manually categorized them by a wide range of attributes. Serving them up in brief glimpses—just one second each—to participants via Amazon Mechanical Turk, the researchers tested the influence of features like color, density, and content themes on users' ability to recognize which ones they had seen before.

The results meshed well with Oliva's previous results, but added several new insights. "A visualization will be instantly and overwhelmingly more memorable if it incorporates an image of a human-recognizable object—if it includes a photograph, people, cartoons, logos . . . any component that is not just an abstract data visualization," says Pfister.

Unusual types of charts, like tree diagrams, network diagrams, and grid matrices, were also memorable. "If you think about those types of diagrams—for example, tree diagrams that show relationships between species, or diagrams that explain a molecular chemical process—every one of them is going to be a little different, but the branching structures feel very natural to us," explains Borkin. "That combination of the familiar and the unique seems to influence the memorability."

Of course, memorability isn't the only thing that matters, Borkin cautions. "As a community we need to keep asking these types of questions: What makes a visualization engaging? What makes it comprehensible?"

—Caroline Perry, Harvard SEAS

MICHELLE BORKIN, HARVARD SEAS

Q+A Robert Stavins

An economist's pragmatic voice rings loudly in the polarized world of climate policy

Robert Stavins has long been one of the most insightful, pragmatic, and effective voices on the international climate policy stage. Stavins, the Albert Pratt Professor of Business and Government at the Harvard Kennedy School, is an economist by training and a pioneer in the subfield of environmental economics. He directs the Harvard Environmental Economics Program, a University-wide initiative to find innovative solutions to complex and multidisciplinary climate challenges. He also leads the globe-trotting efforts of a related initiative, the Harvard Project on Climate Agreements, which works with researchers, policymakers, and government leaders around the world to design scientifically sound, economically rational, and politically pragmatic policy options to address global climate change. Stavins is a regular presence at the international climate protocol talks, including the recently concluded round of talks in Warsaw. His research has examined market-based and government-led strategies, cap-and-trade systems, carbon sequestration, regulatory impact, and technology innovation and diffusion. His most recent book, brought out this year by Edward Elgar, is *Economics of Climate Change and Environmental Policy*, a retrospective of his papers published between 2000 and 2011. He writes a blog, An Economic View of the Environment, at www.robertstavinsblog.org. Beyond his policy and research roles, Stavins is a committed mentor, directing graduate studies for the PhD programs in public policy and in political economy and government.

Q+A ID

NAME:
Robert N. Stavins, PhD '88

FIELD OF STUDY:
Economics

TODAY:
Director of the Harvard Environmental Economics Program

You are known, among other things, for your work on the economics of cap-and-trade policies. Is cap and trade still the most effective kind of policy intervention — more than, say, a carbon tax?
When I teach these in class, I refer to them as symmetric instruments. One can design a cap and trade mechanism in which the elements look like a carbon tax — in other words, in which the policy affects different parts of the economy in the same way as a carbon tax would. And one can design a carbon tax to look like a cap-and-trade system.

But given the way they're typically designed, a cap-and-trade mechanism has advantages politically, and that's why it gets the upper hand.

That view is both validated and contradicted by what happened in the Congress with the Waxman-Markey bill, when conservatives demonized and stopped cap-and-trade legislation by labeling it as cap and tax. It validates what I said, because the way to stop cap-and-trade was to call it a tax; but it also contradicts it, in the sense that it's no longer clear that cap-and-trade has this political advantage. But in the EU, in Japan, Australia, China, in California at the state level, in New England at the regional level — in virtually every jurisdiction where there has been significant action on CO_2 emissions, it's been through a cap-and-trade mechanism.

You've done research to show that instituting a cap will produce results no matter how the cap is allocated or implemented — unlike other policies that are typically weakened in implementation.
There is going to be resistance to any method of curbing emissions. In a carbon tax, the resistance is typically that one firm after another, one sector after another, says, wait a minute, we're going to be terribly hurt by this in terms of our international competitiveness and our cost of production. So they get exempted. And each time you exempt a firm or a sector from a carbon tax, you reduce its effectiveness. And because you take some low-cost opportunities off the table, you reduce overall cost effectiveness as well.

With a cap-and-trade mechanism, the debate tends to be about people wanting more free allowances. And there is this wonderful feature of a cap-and-trade mechanism that the ultimate allocation of the allowances after the trading is *independent* completely of the initial allocation. It just depends on the relative costs. And what that means in political terms is that the government can set the overall cap on a scientific basis, an economic basis, or for that matter a religious basis, and then they can leave it up to the parliaments, the Congress, the representative democ-

WRITER
Bari Walsh

ILLUSTRATOR
Tina Berning

racy to do what they do well — that is, to fight over pieces of the pie. And in doing so, they will not reduce scientifically the effectiveness of the program nor drive up its costs. That is a remarkable property.

Why is a market-based system the way to go, rather than a system of regulations?

There is a very important reality, which is that the cost of abatement, of cutting back on pollution emissions, is tremendously heterogeneous across sources. To give you an example, in Los Angeles, the range in the cost of cutting back on a ton of volatile organic compound (VOC) emissions across sources is about 10,000 to 1. You've got dry cleaners and you've got refineries — operations with tremendous differences in marginal costs.

The way in which a given overall level of emissions reduction is achieved, at the lowest cost, is that everyone is controlling at the same marginal cost. So, if the government says that everyone has to cut back 10 percent, it's going to be hideously costly for what's achieved. You're making the source for which it's very costly cut back by 10 percent, and the source for which it's very cheap cut back by 10 percent.

Now, an alternative would be, you could have the government create a nonuniform standard. But the government doesn't have the information to do that. The government doesn't even know what the marginal costs are. Well, should the government just go and ask the sources? It can't do that because *everyone* is going to say, 'I'm a high-cost controller! Give me a low target.'

What a cap-and-trade mechanism, a carbon tax, or any kind of market-based instrument does is make it in the interest of every firm to wind up controlling at the same marginal cost. So for the same reason that the market is efficient for shoe production, it's efficient in this case.

As a longtime participant in the international climate negotiations, what changes have you noticed in people's willingness to engage?

We went from a situation in China where there was utter disregard to a situation where China is now very engaged and interested. And the US has gone from a position under the George W. Bush administration of being fundamentally uninterested in the global negotiations to the position under the Obama administration of wanting to play a leadership role. China and the US are the world's two largest emitters, and hence the two most important countries in the negotiations, so that's a significant change.

The way to think of these negotiations is not as a race to the finish line but as a relay race, and what you want is for Warsaw to pass the baton to the next negotiations, in Lima, Peru, in 2014, and then to the next, in Paris, in 2015.

International climate policy development, for a whole set of scientific, economic, and political reasons, is a very gradual process. Sometimes that's difficult for people in advocacy and the press to appreciate or accept. Here's an analogy: Let's say you and I agree that we need to get from Boston to Denver. But then you observe me going east, and you say, 'Wait — you're going in the wrong direction, and you're going much too slowly.' Well, I'm actually going to Logan Airport. In this case, the most efficient way to go west quickly is to go east slowly. The negotiations — on whole set of technical issues — are frequently that way as well.

If a new house was constructed across the street from you, you wouldn't see a thing for the first four weeks, because they're building a foundation. A lot of *this* is building a foundation for the next set of conversations, and if you don't do the foundation right, the house is going to collapse. Advocacy groups sometimes seem to be more focused on the second floor bedrooms and the window treatments.

Is there anything to feel encouraged about as you look ahead to the next round of negotiations?

I'm much more confident now than I was four or five years ago. Negotiators are moving away from the dichotomous distinction that goes back to 1992 and the first UN framework convention on climate change — which essentially put the world into two groups: the industrialized world and the other countries. That turned out to mean that nothing could be accomplished, because emissions in the industrialized countries that have targets for reducing emissions are actually flat or declining. All the emissions growth is in the emerging powerhouse economies in Asia and South America. The current system creates incentives for those countries to say, let's keep the current architecture, and you guys take on more stringent targets.

As a result of what happened in negotiations that culminated in Durbin, South Africa, in 2011, negotiators have agreed that the post-Kyoto climate policy architecture, to be developed by 2015 for implementation in 2020, will place all countries under the same legal framework. That's what our work on the Harvard Project for Climate Agreements is focusing on, trying to develop that new architecture.

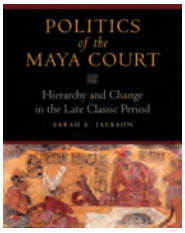
> "There is a window of opportunity now for outside-the-box thinking."

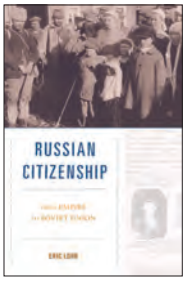
So there is a window of opportunity now for outside-the-box thinking, for thinking of ways in which we can differentiate among countries in a more sophisticated way than pretending that one group of countries is all the same, and another group of countries is all the same. We want to take into account that some countries are richer than others, but we want to do it in more nuanced ways.

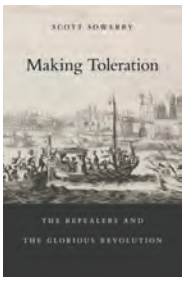
There is an opportunity for that to happen now. And that's the most promising development, I think, going back to 1970.

REVIEWER
James Clyde Sellman, PhD '93, history

Shelf Life







In Politics of the Maya Court (University of Oklahoma Press, 2013), **Sarah Jackson** (AB '98, PhD '05, anthropology) brings impeccable scholarship to the analysis of Mayan court elites, 600–900 AD. Drawing on hieroglyphic inscriptions, she identifies five distinct courtly titles and a host of individual officeholders. Most intriguingly, she maps the distribution of titles and officeholders to suggest that there was much greater complexity (even volatility) on the southwestern edge of the Mayan world. This volatility may have reflected elite pressure for more formal recognition, or perhaps rulers there wanted to broaden their base of support — the inscriptions remain mum. But Jackson's fine-grained structural analysis of the Mayan elite is a signal scholarly achievement.

Benefitting from access to untapped police and foreign affairs office sources, **Eric Lohr** (PhD '99, history) addresses Russia's history of insularity and xenophobia in ***Russian Citizenship from Empire to Soviet Union*** (Harvard University Press, 2012). Analyzing citizenship law and the legal status (and treatment) of minorities across all phases of modern Russia — Imperial (Czarist), Soviet, and post-Soviet Federation — Lohr notes a significant break at the 20th century. In the century prior, Russia had been narrowing its distance from other European countries, but Lohr finds that restrictions embraced by the Czar during World War I and sharpened under the Communist regime ultimately set it on a trajectory toward self-isolation.

In ***Making Toleration: The Repealers and the Glorious Revolution*** (Harvard University Press, 2013), **Scott Sowerby** (PhD '06, history) revisits the 1688 abdication of England's Catholic King James II and its significance for freedom of religion. Countering the typical emphasis on James II's persecution of Protestant opponents, Sowerby portrays a monarch who advocated liberty of conscience and sought repeal of laws targeting Catholics and non-Anglican Protestants. Sowerby also highlights the neglected "repealer" movement — James II's pro-toleration allies — including Quaker William Penn, who was a key "intellectual architect of James II's toleration project." Ultimately, however, James II fled England, and Protestant successors William and Mary achieved a far more limited toleration, one leaving Catholics beyond the pale.

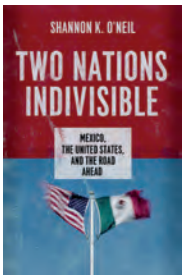
Sustaining Activism: A Brazilian Women's Movement and a Father-Daughter Collaboration (Duke University Press, 2013) tells the story of activists Gessi Bonês and Vera Fracasso, who in 1986 — as teenagers — founded the Movement of Rural Women Workers in southern Brazil. They did so despite the discouragement or outright opposition of family members, the Brazilian dictatorship, and male leaders of unions and other activist organizations. The Catholic Church alternately supported and discouraged them. Yet their organization succeeded and proved transformative. No less central to the analysis are the gender and generational challenges faced by father-daughter collaborators **Jeffrey W. Rubin** (AB '77, PhD '91, government) and Emily Sokoloff-Rubin (who was just 15 when they began their joint research).

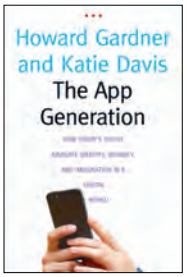
In her thought-provoking and irreverent new book, ***Wonder Women*** (Sarah Crichton Books, 2013), **Debora Spar** (PhD '90, government) writes as a nonfeminist product of the 1980s and '90s ruefully conceding the relevance of 1970s-style feminism. Single-parent families and poverty seem stubbornly, predominantly female. Gender-based inequities remain evident in academia, the professions, and the business world. Even successful women face a piling on of responsibilities — traditional (seeing to children, cooking meals, supervising the household) and more recent (higher educational, professional, and personal expectations, the latter often a byproduct of past feminist victories). Spar, who is president of Barnard College, seeks a return to the social goals, conscience, and solidarity of feminism, values she argues were lost in the individualistic "have it all" years.

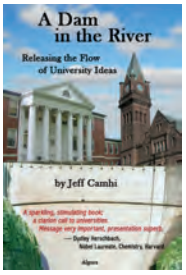
Two Nations Indivisible: Mexico, the United States, and the Road Ahead (Oxford University Press, 2013) tackles the thorny issues confronting these adjacent but dissimilar nations. Author **Shannon O'Neil** (PhD '06, government) highlights democracy-building in Mexico, immigration policy in the US, economic growth, and drug-trafficking. She urges that policy choices be non-recriminatory and collaborative. She also challenges many misperceptions and political gesturings: Mexico, a one-party state no longer, has a "vibrant (if imperfect) democracy." Increased US border patrols and higher walls offer far less — as curbs to illegal immigration — than a strong Mexican economy, which, in turn, will boost the US economy and expand American employment. The main threat in this generally hopeful picture is drug-related violence and corruption.

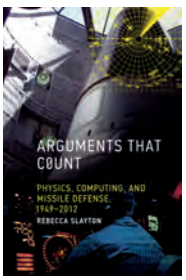
The App Generation (Yale University Press, 2013) is a well-reasoned study of today's young adepts of the Internet, Facebook, Instagram, and countless iPhone apps. **Howard Gardner** (AB '65, PhD '71, psychology) and Katie Davis

Alumni authors: Would you like your book (general interest, published within the past year) considered for inclusion? Send it to *Colloquy*, Harvard Graduate School of Arts and Sciences, Holyoke Center 350, 1350 Massachusetts Avenue, Cambridge, MA 02138. Questions? E-mail gsaa@fas.harvard.edu.









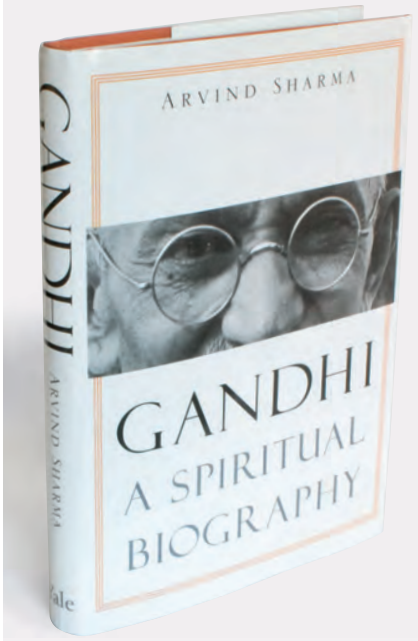
(EdM '02, '09; EdD '11) examine the effects of digital technologies on individuality, intimacy, and imagination. To do so, they conducted interviews with about 150 young "digital natives" and held focus groups with teachers, therapists, camp directors, and others who work with young people. While conceding the profound advantages of new technologies, the authors voice concerns that they may also be roiling the quest for personal identity, overly channeling (and restricting) creativity, and undermining true intimacy and boldness.

Jeff Camhi (PhD '68, organismic and evolutionary biology) is feeling beset. Too many Americans denigrate universities as hotbeds of radicalism, exemplars of pointless research, or ivory towers where pie-in-the-sky ideas trump specific, valuable career prep. ***A Dam in the River: Releasing the Flow of University Ideas*** (Algora, 2013) is both riposte and remedy for this state of affairs. Camhi wants academics to "share their ideas far more widely" — locally and beyond (as in the Harvard-MIT edX initiative). He also enjoins his colleagues to speak with greater clarity (neither "talking over people's heads" nor "dumbing down" their ideas). Through these and other suggestions, Camhi outlines a spirited defense of universities as crucibles of creativity and innovation.

Chinese Medicine and Healing (Belknap Press, 2013) is that rare achievement, a scholarly work that appeals to general readers as well as specialists. This comprehensive volume, edited by **T.J. Hinrichs** (AB '84, PhD '03, East Asian languages and civilizations) and **Linda Barnes** (MTS '83, PhD '95, religion), not only places Chinese medicine into a contemporary global context, it also explains the broad roots of these modalities — ancient folk beliefs, Confucian scholarly traditions, Daoist and Buddhist healing rituals, and concepts from surprisingly further afield. For example, Greek medical theories reached China via Arab translations, and Tuệ Tĩnh, a 14th-century Vietnamese physician, was detained for years so Chinese doctors could benefit from his learning.

Philosopher David Hume (1711–1776) is remembered as an empiricist and skeptic, not as a political theorist. **Andrew Sabl** (AB '90, PhD '97, government) wants to change that. In ***Hume's Politics*** (Princeton University Press, 2012), Sabl focuses on Hume's long-neglected *History of England* and finds an astute political observer—neither a rock-ribbed conservative discomfited by change, nor a Whig convinced that all change culminated in the British present. More important, Sabl identifies Hume's underlying theory of politics, which was coherent, dynamic, and subtle. In effect, Sabl concludes, Hume pioneered a contemporary form of analysis known as coordination theory, which stresses that group goals, strategies, and understandings aren't static but often change as a situation unfolds.

Arguments That Count (MIT Press, 2013) dissects America's often clumsy or ill-conceived efforts to develop anti-missile defenses. Though these systems were computer-controlled, **Rebecca Slayton** (PhD '02, chemistry and chemical biology) argues, elite science advisers (like MIT's Jerome Wiesner) knew little of computers and grievously underestimated the programming challenges. Equally disruptive were Army–Air Force turf fights. (In 1959, the Army — fearing Air Force competition — sought funds for full-scale production of its still-untested Nike-Zeus missile.) Meanwhile, some advisers viewed anti-missile systems as bargaining chips, apart from their actual feasibility. From the 1950s SAGE system (designed to counter attacking aircraft) to Reagan's "Star Wars" plan and beyond, wishful thinking trumped complex reality, allowing scientist-experts and politicians to put the misguided into guided missiles.



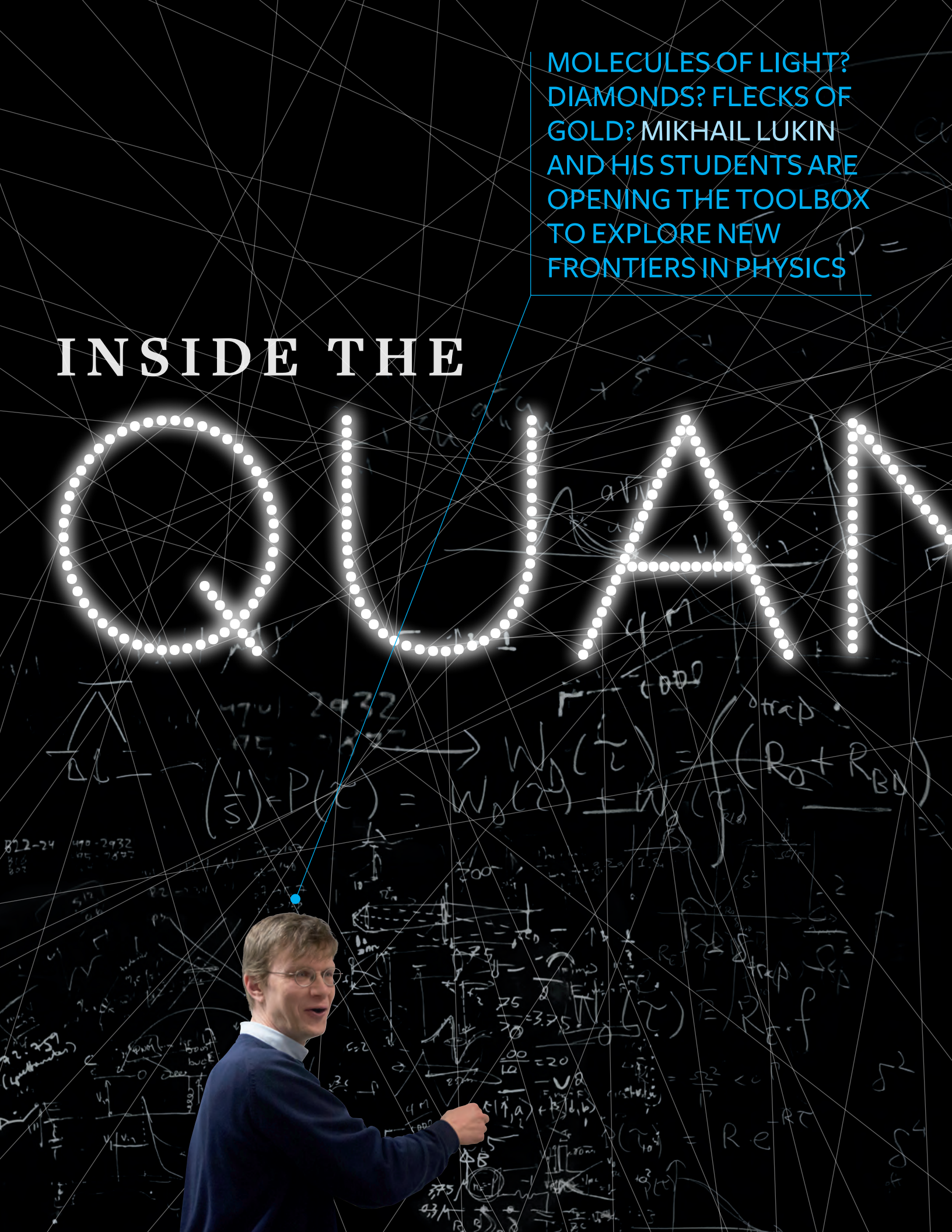
Arvind Sharma (MTS '74, PhD '78, Sanskrit and Indian studies) makes a vital contribution to the extensive literature on Mahatma Gandhi. Rather than focusing on nonviolence, movement-building, or national leadership, ***Gandhi: A Spiritual Biography*** (Yale University Press, 2013) highlights his spirituality. The narrative is two-part: one, straightforward and chronological; the other, thematic. Throughout, Sharma stresses Gandhi's faith, shaped by his parents and other key figures and by his own sojourns abroad.

Gandhi saw organized religion as wanting. After exploring Christianity in London, he travelled to South Africa and found racism (among supposed Christians) far beyond anything in England. Within Hinduism, he instinctively recoiled from the caste system and the treatment of untouchables. His activism, which began in South Africa, and his decision to cast his lot with the untouchables show the primacy of his spiritual inner compass over common practices or formal scriptures.

Sharma's second section addresses Gandhi's vegetarianism, the *Bhagavad Gita*'s role in his spirituality, and his views on celibacy. (The last is most curious: in 1906, at age 38, Gandhi took a vow of lifelong celibacy. Only afterward did he inform his wife Kasturba. Marriage to a selfless activist with his own spiritual GPS cannot have been easy.)

MOLECULES OF LIGHT? DIAMONDS? FLECKS OF GOLD? MIKHAIL LUKIN AND HIS STUDENTS ARE OPENING THE TOOLBOX TO EXPLORE NEW FRONTIERS IN PHYSICS

INSIDE THE QUAD



BY MAGGIE MCKEE
PHOTOGRAPHS
BY KRIS SNIBBE

TINKERER'S WORKSHOP

Mikhail Lukin is not a super villain — honest. Sure, the professor of physics keeps a hoard of lasers on hand and casually says things like, "I am of the opinion that we should be able to control nature." Yes, he dabbles in a strange brew of matter known as the "dark state" and has brought light, the ultimate speedy sprite, to a screeching halt. But — and on this point he is very clear — he is not a mad scientist trying to manipulate the weather or plot world domination.

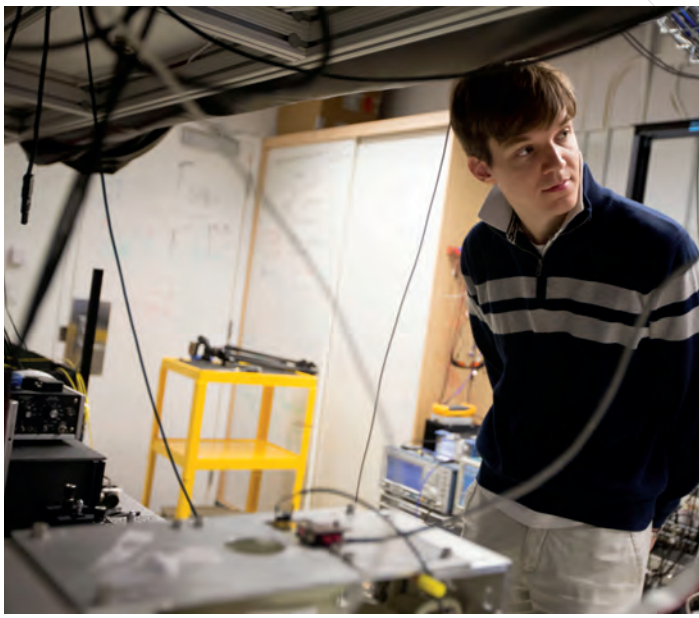
Instead, he is hoping to harness the bizarre properties of quantum physics — a branch of science that describes the microscopic world — to build devices that could actually help us.

Still, he does have an underground lair, where he and his minions — er, colleagues — construct these contraptions. "Now we will go all the way down to the minus fourth floor," Lukin says cheerfully to a visitor as the elevator door in the LISE building shuts off any chance of escape. Down there, in a warren of rooms filled with lasers and monitors, researchers use atoms, subatomic particles, and photons of light like Legos, making them interact in different combinations to perform different functions.

All of these building blocks follow the dicta of quantum physics, a branch of scientific inquiry that is notoriously

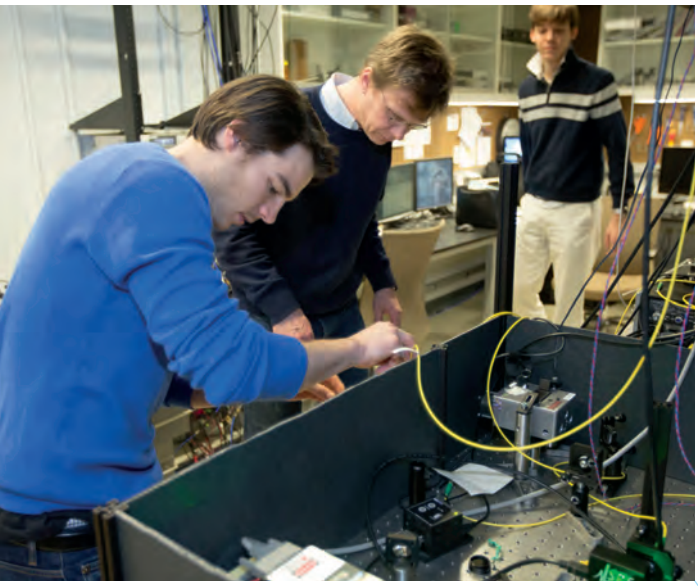
"THINGS WHICH SOUND VERY WEIRD ARE ACTUALLY REAL. WHAT WE AND OTHERS ARE TRYING TO DO NOW IS NOT JUST UNDERSTAND THE LAWS OF QUANTUM MECHANICS BUT ALSO USE THEM."

Among the potential applications: sensors that could probe the temperature of individual cells to help fight cancer, for example, or components of computers that could run calculations that are currently impossible or even unimaginable. "What we are trying to do is to create devices that make use of the fundamental laws of quantum theory," Lukin says. Just as earlier studies of electromagnetism led to the development of light bulbs and laptops, research into quantum physics could pave the way for a whole new era of technological wizardry, he says, sounding more like Inspector Gadget than Lex Luthor.



above: Professor of Physics Mikhail Lukin in his lab space

below: PhD candidate Peter Maurer



From left, PhD candidate Georg Kucsko, Professor Mikhail Lukin, and PhD candidate Peter Maurer collaborate quantumly.

weird. In the quantum realm, where the action happens at an atomic or subatomic scale, the certainties we take for granted every day — this table is here, this pen is there — are gone. Objects that display quantum properties can be everywhere at once and in multiple states at the same time — at least until they are observed. The theory chips away at the very notion of an objective reality, which led no less a light than Einstein to doubt that the universe really plays by quantum rules.

Yet experiments in the century or so since quantum theory was first formulated have shown time and again that it is rock solid, even if what it describes is anything but. "Things which sound very weird are actually real," Lukin says. "What we and others are trying to do now is not just to understand the laws of quantum mechanics but also use them."

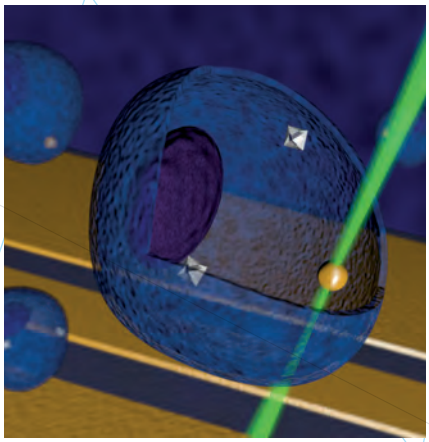
The ultimate application would be a quantum computer, which could in theory solve problems that would stump the most powerful processors in the world today. Regular computers crunch data stored as strings of binary bits — 1s or 0s. But quantum computers would use quantum bits, or qubits, that could each be in a "superposition" of both 1 and 0 at the same time. That would allow them to run multiple calculations simultaneously. "You can in principle do all the calculations in parallel," says Peter Maurer, one of Lukin's graduate students. "That's where the power of a quantum computer lies." That could enable quantum computers to unscramble encryption codes too complex for ordinary computers and to run simulations of particle interactions that could potentially turn up phenomena entirely new to science.

Researchers around the world, including Lukin and his lab mates, are looking into various quantum objects that could act as qubits — including photons and cooled atoms. Each has its pros and cons, but none has yet been completely tamed. At this point, Lukin laments, "The realization of a full-blown quantum computer is extremely challenging. No one knows at the moment how to do it."

"THE REALIZATION OF A FULL-BLOWN QUANTUM COMPUTER IS EXTREMELY CHALLENGING. NO ONE KNOWS AT THE MOMENT HOW TO DO IT."

One big problem is that the superposition states that would give quantum computers their oomph are very fragile. At the slightest nudge, say from a molecule of air, they are prone to collapsing into a single state — a 1 or a 0, ending the quantum calculation. So they must be isolated as much as possible from their surroundings, as if kept in a sensory deprivation tank.

Diamond acts like such a tank. Its regularly spaced carbon atoms hardly interact with the occasional nitrogen atom that inevitably finds its way into their midst. The carbon atoms slot together like puzzle pieces, but the nitrogen is an imperfect fit, so when it lodges in, it leaves an empty hole by its side. Together, the nitrogen and the hole, considered a defect in the diamond, act like an atom with a pair of electrons. The pair's spin can be used as a qubit — if it points up, it represents a 0, if down a 1, and any angle in between, a superposition of the two states. Their spin can then be used to control the spins of specific atomic nuclei nearby, which also act as qubits. The vast majority of carbon atoms interact very sparingly with the particles used as qubits, "as if you would have your particle hovering in a vacuum," says PhD student Georg Kucsko.



A graphic representation of a cellular thermometer.

Last year, Maurer, Kucsko and their colleagues were able to keep such qubits in a superposition state for longer than a second at room temperature. Even though that sounds short, it was a record for controlling single spins in a solid and suggested that these diamond defects could be used to store and crunch data in future quantum computers.

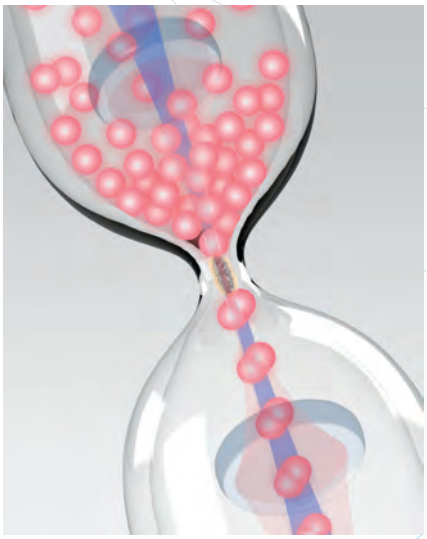
Building such a computer is still a long way off. But in the meantime, the researchers have figured out another way to use the defects — to measure the temperature inside a living cell. They put diamond dust specks, each less than a millionth of a meter across, into a human cell, along with tiny flecks of gold.

DIAGRAM: GEORG KUCSKO

They zapped the gold with a laser, heating it up. That heat caused the nearby diamonds to expand, which shifted the energy levels of their defects' electrons. Another laser was used to measure that shift, which revealed how much the diamonds had heated up in the process. The researchers also measured the temperature needed to kill the cell.

They say that diamonds could one day be used to monitor the temperature of cells in the body and spot irregularities that might be caused by cancer. Any tumor cells found could then be singled out and heated until they were destroyed, without damaging surrounding tissue.

The diamonds have other potential uses [see sidebar], but they are not the only materials in the tinkerers' toolbox. Ofer Firstenberg, a postdoctoral fellow in Lukin's group, recently led a team that managed to get two photons — which in a vacuum would simply pass through each other without interacting — to stick together like a molecule, as if they had mass.



A graphic representation of photons binding into molecules.

DIAGRAM: YOAV STERMAN AND OFER FIRSTENBERG

They did it by linking the photons with atoms of the element rubidium, creating one species in a whole menagerie of light-matter hybrids known as the "dark state." When a photon hits an atom under just the right circumstances, "they become one entity," says Firstenberg — like a "naked" hermit crab climbing into a shell. Encumbered by the shell, the new creature can no longer move as fast as it did as a freewheeling photon. (In fact, it can even be stopped completely — something teams led by Lukin and Lene Hau, Mallinckrodt Professor of Physics and Applied Physics at Harvard, first did in 2001.)

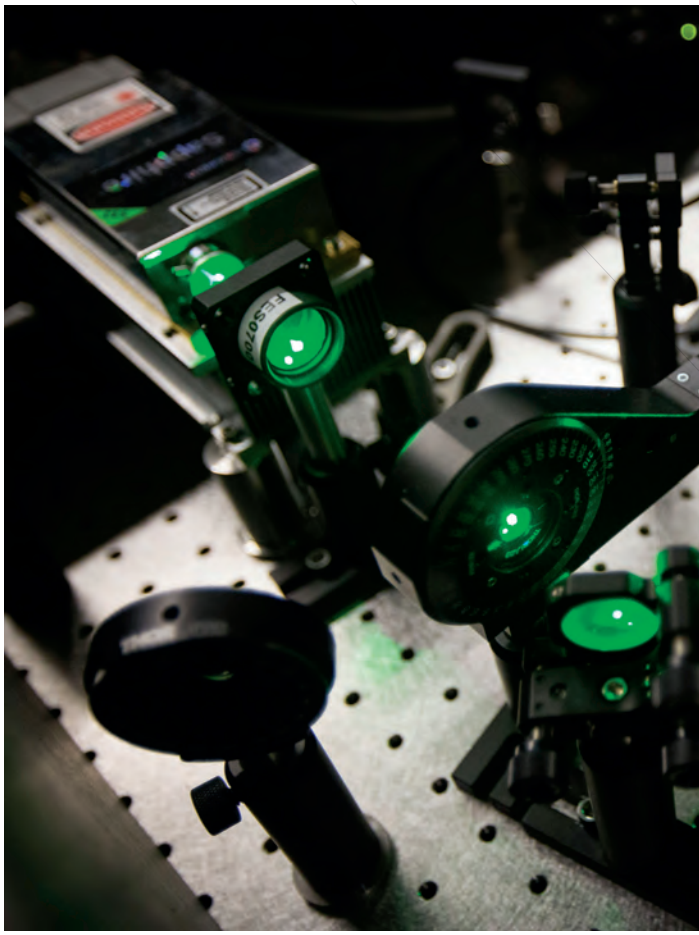
Still, even moving slowly, these beasts prefer to remain hermits. So to get them to interact, the researchers essentially put giant antennas on their backs. They did this by making sure that the photons they began with had just the right energy to push electrons orbiting the rubidium atoms to great distances, allowing these excited atoms to have an outsize electrical influence on their neighbors. "They can speak loudly with each other and interact strongly," says Firstenberg.

This interaction might help lay the groundwork for the use of photons to process information in quantum computers. Light is inherently slippery — it does not like to stand still, and photons barely interact with each other. This makes it ideal for conveying information, and indeed we can thank light traveling along optical fibers for our high-speed Internet. But getting photons to actually run calculations in a quantum computer would require them to be able to change each other's quantum state. That is tricky "because photons normally do not see each other," wrote Sougato Bose, of University College London, in *Nature*. "Firstenberg and colleagues' work is a milestone in remedying that."

While the photons in this experiment traveled through the cloud of atoms in pairs, as if they were attracted to each other, Firstenberg thinks the setup can be tweaked so that photons will repel each other. In that case, a group of photons might arrange themselves in an evenly spaced train, keeping the same distance apart from each neighbor. Such a train would provide a reliable source of single photons for sensitive experiments, says Firstenberg, since it is impossible to control exactly when a photon will emerge from a laser.

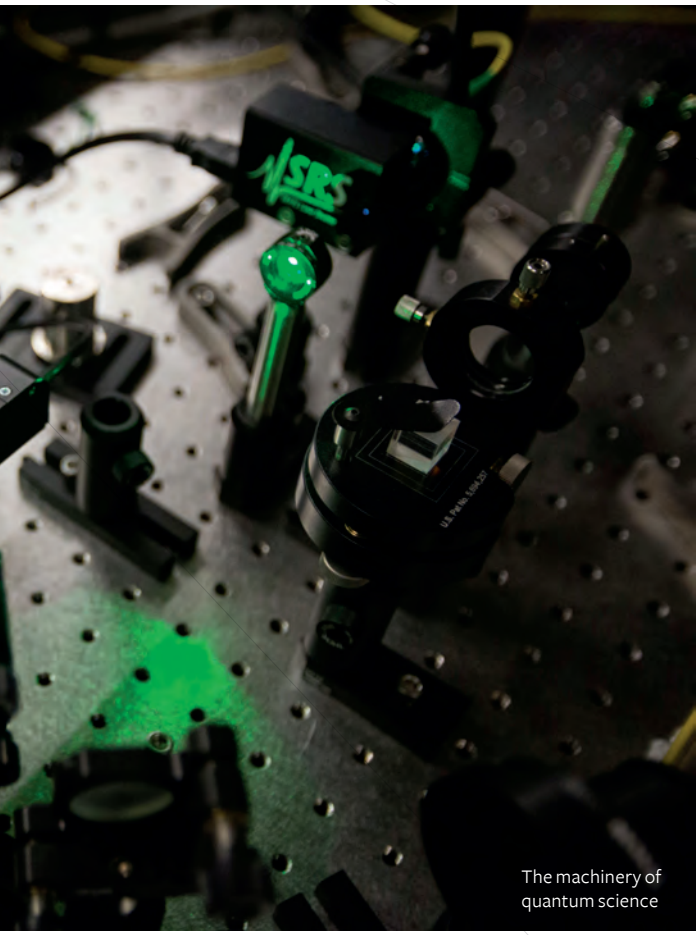
The fact that researchers in Lukin's group are working on so many different materials and projects is unusual, says Sebastian Hofferberth, a former postdoc in the group who is now at the University of Stuttgart in Germany. "He is just extremely willing to take risks and just try things," says Hofferberth. "[That] makes the Lukin group a very crazy but fun place to work."

"What is actually very nice about physics is that at the end of the day it's an experimental science," agrees Lukin. He rattles off other projects his team is working on, including a plan to create a global network of atomic clocks

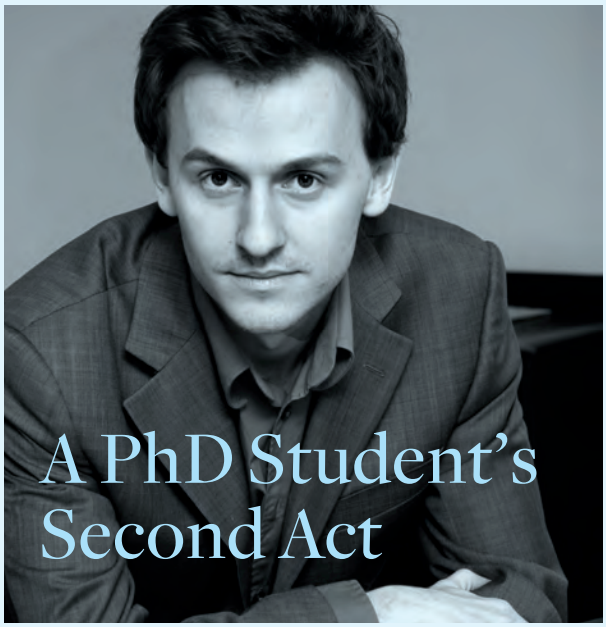


> "WHAT IS ACTUALLY VERY NICE ABOUT PHYSICS IS THAT AT THE END OF THE DAY IT'S AN EXPERIMENTAL SCIENCE."

that would pave the way for ultra-precise GPS devices that could help guide future driverless cars. In order to tap into this coveted network, he says, countries would have to refrain from war. "It's a long time until it might become practical," he says. "But things like this could potentially change the world." Super villains looking for new partners in crime, keep moving — it seems there really is nothing to see here.



The machinery of quantum science



A PhD Student's Second Act

COURTESY IGOR LOVCHINSKY

Of all the researchers tinkering with quantum gadgets in Mikhail Lukin's labs, one has especially deft hands. **Igor Lovchinsky**, a third-year PhD student, came to physics from a career as a top-ranked classical pianist.

"I started when I was two," he says. "I can't even remember a time when I didn't play." Born in Kazan, Russia, Lovchinsky moved to the US when he was 10 and began to rack up prizes at piano competitions, performing at venues such as the Kennedy Center for the Performing Arts in Washington, DC.

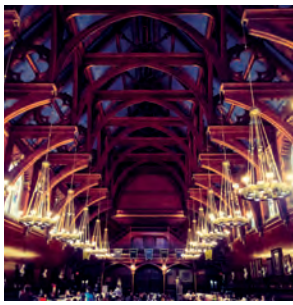
"I grew up in this musical bubble where I really didn't do anything outside of it," he says. But a few years ago, in his mid-20s, he began to read some books about physics and soon dove into it with a passion, watching free online lectures from MIT and working through textbooks. "It was certainly difficult to transition into," he says. "But if you're willing to learn, there are great resources out there to do it essentially for free. We live in an amazing time."

At Harvard, he is working on a way to make 3D images of individual molecules. Normally, imaging techniques such as MRIs view collections of trillions of molecules at a time, showing a region of tissue in the brain, for example. But imaging a single molecule, or dozens of molecules, could help diagnose and develop treatments for diseases. That's because the proteins that do such crucial jobs as copying DNA are made up of small numbers of molecules, and their shape dictates whether they function correctly.

"We're trying to use quantum physics to solve various kinds of problems in biology," says Lovchinsky. The idea is to put a molecule on top of a diamond, which contains atomic imperfections that act like tiny magnets. These magnets will interact with the magnet-like atomic nuclei in the molecule, and a laser will ping through both. The timing of the light signals that return should, in theory, reveal the molecule's structure. "It works very much like a conventional MRI," he says.

Lovchinsky keeps busy in the darkened rooms that house the lasers, occasionally dispensing bags of white tea purchased in Chinatown to his fellow quantum engineers. But he never wants to give up his first love, and he still plays the occasional concert. He says his devotion to music prepared him well for a life in the lab: "Having the ability to concentrate and work for long periods of time is crucial if one wants to get results."

LIFE IN THE YARD



The singular rewards of being a freshman proctor — and a PhD student.

BY NICHOLAS NARDINI

PHOTOGRAPHY BY BEN GEBO

IF there's one thing the college-bound student knows, it's how to arrive there. It's a scene rehearsed in a thousand movies: after mom and dad drive the hatchback through ivy-covered gates past Frat Row and the library, you'll step out of the car and walk toward your new dormitory. Everyone on campus will be watching you. Inside, you'll meet a football player, a long-haired guy with a guitar, a girl whose beauty shines through her thick glasses, and a funny best friend. Then you'll have to deal with your roommate; you'll be thick as thieves eventually, but for now you have differences to overcome.

In late August of 2011 and 2012, I had the pleasure of interrupting this script for some 82 Harvard freshmen. Before the new residents of Canaday Hall, Entryway D could get inside, they had to get past me, sitting outside the door in coat and tie. Their faces were priceless. I don't play guitar, and nobody would mistake me for a football player. I'm a twenty-something PhD student in English literature. As one freshman put it, "Aren't you... old?"

"Proctoring puts you back into the biorhythms of the University and lets you become a part of that culture again."
– ALISON CHAPMAN, PhD candidate

I was a freshman proctor. At almost any other US school, my position would have been filled by an upperclass undergraduate and called an RA. But one of Harvard's many proud idiosyncrasies is that its freshmen are overseen by a group of 71 adults living in the dormitories that ring the Yard, each responsible for an "entryway" of between 12 and 41 freshmen. Since tradition calls for proctors to dress up and greet each freshman as he or she arrives, the encounter that kicks off most Harvard students' residency is an awkward one, between people on opposite sides of an undergraduate education — between a recent high schooler just liberated from her parents, and the old person trying to explain why he's living in a suite down the hall.

The only people it's harder to explain it to are your friends. Why would anyone *choose* to live in a freshman dormitory without a private bathroom, eat in a cafeteria, and spend weekends patrolling the halls for parties to bust? Isn't the entire point of freshman year to leave it behind?

Proctors have been struggling to justify their position from the very beginning. The Harvard University Archives hold an October 18, 1805, letter from Samuel Willard, one of the first two men to hold the post, trying to explain the new job to his sister: "I have nothing to do with instruction in Harvard College," he admitted. Instead, his charge was "to keep order in one of the buildings, for which I receive about enough to pay my board. In addition to this I have the privilege of attending the medical lectures gratis," and "free use of the library." Back then, proctors were mainly charged with "inspection and authority" over their entryways, and were authorized to punish students to whatever extent necessary short of turning them over to the police. Later in the century, it became faddish among freshmen to test this authority by setting bonfires in the Yard and watching proctors scramble to put them out.

The emphasis now is on community building instead of punishment, and the only bonfires flaring up are the thousand little emergencies that pepper the lives of freshmen. But for many GSAS students busy with teaching and research, proctoring remains a hard sell. The vast majority of proctors come from the professional schools and Harvard staff; only 5 of the 71 proctors this year are PhD students, the lowest ratio in memory. (Three of them are from the English department.) More popular among graduate students is residential tutoring in the upperclass houses, a less parietal position that emphasizes academic and professional mentorship. I myself switched from proctoring to tutoring this year. But in October, I returned to the dorms to catch up with some of my former proctoring colleagues and ask them to share their experiences living in the Yard.

"Knowing that there are 15 people waiting at home, ready to talk with you about their day, gives you a pretty good reason to leave the library."
– JAKE RISINGER, PhD candidate

As soon as second-year proctor Alison Chapman sat down with me, she launched into a description of her proctoring philosophy. Alison is an old friend of mine from the English department, and I'd been hoping to catch up with some chit-chat first. "Nick, I live and breathe proctoring," she said. "This *is* my chit-chat." The daughter of academics, Alison likes the culture of university life. "But upper-level graduate students tend to become dislodged from that as the monastic experience of dissertation writing takes over. Proctoring puts you back into the biorhythms of the University and lets you become a part of that culture again." She calls proctoring "a lovely sort of obligation . . . They come to me with an interesting mix of micro and macro problems. On the one hand: what course do I need to take this semester. On the other: what am I going to do with my life? It's nice to have to think about a totally different set of problems from those faced by a typical grad student."

In the weeks after that first awkward encounter on move-in day,

"I told myself that if I was going back to Harvard, I was going to make the Harvard community central to my experience."

JOE VITTI, PhD candidate

proctors become students' primary contact for questions of all kinds. Jake Risinger, also of the English department, calls it becoming "the personification of a Harvard Google browser." September is hectic, but by being responsive and available, the best proctors move quickly from information sources to trusted confidantes.

For Jake, this is the most satisfying thing about the job. "Knowing that there are 15 people waiting at home, ready to talk with you about their day, gives you a pretty good reason to leave the library," he says. Jake has been proctoring for six years now, long enough to have been sold a life insurance policy by one of his former freshmen. He remembers arriving at Harvard with unrealistic expectations about what graduate school would be like. "I rented an apartment in Somerville and thought I'd take three classes a semester and spend a lot of time outside, traveling, with friends. Pretty soon you find your life is confined to traveling between the Barker Center and Widener Library."

Proctoring, Jake says, has allowed him to live a less myopic life. Along with his wife and co-proctor Memory Peebles, he's established a round of traditions that include nightly walks with his dog at the Law School and cross-country skiing in the Yard after snowstorms. And he's built a community that extends beyond his freshmen, to staff members and proctors from all corners of the University.

Joe Vitti, of the department of organismic and evolutionary biology, has maximized his Yard community by the clever trick of owning an enormous Great Dane. When I met up with him in the Annenberg freshman dining hall, he was inviting passing students to sign a rainbow flag in support of National Coming Out Day. An astonishing number replied by asking, "Aren't you the proctor with the awesome dog?" Joe was an undergraduate at Harvard once himself, and when he decided to return for a PhD, he says, "I told myself that if I was going back to Harvard, I was going to make the Harvard community central to my experience. The students here are all such awesome, interesting, enthusiastic people, and feeding off that is really rewarding."

In return, Joe tries to model academic life for his students, discussing his research and, recently, inviting biology lecturer Andrew Berry to a study break. "The room began evenly dispersed," he recalls, "but by the end of the hour everyone was clustered around Professor Berry."

One of proctoring's most important benefits, everyone agreed, was that it made them better teachers. "It's a great crash course for a career in teaching," Jake told me. "You get to see how students come to college and the different things they're involved in." "It's made me more tactful and helpful in the way I commiserate with students," said Alison. "I have a lot more respect for their extracurricular activities, now that I know that those activities *deserve* that respect. It can also help prepare for careers at small liberal arts colleges, where personal contact with students is more the norm."

Mike Ranen, one of the four resident deans who oversee all proctors in the Yard, says that GSAS proctors are especially valuable for freshmen as models of the pursuit of an intellectual passion. "There's so much emphasis

MIKE RANEN, PhD '08, resident dean

"There's so much emphasis these days on what job to get — so it's great when first-year students get excited about the cool things their proctors are studying."

these days on what job to get —so it's great when first-year students get excited about the cool things their proctors are studying."

But residential education can also lead to careers outside the classroom. Before he was a resident dean, Ranen was a Harvard PhD in earth and planetary sciences. By the time he graduated in 2008, he'd served five years as a resident tutor in Winthrop House and had decided that student mentorship, not academic research, was where he belonged. "There's a perception in the outside world that Harvard doesn't care about its students, but the opposite is true. *So* much emphasis is put on the houses and freshmen dorms. They make a huge university like Harvard feel much smaller."

Ranen became a high school teacher after graduation, and returned to Harvard this year. "Proctoring is a huge way to explore where you want your career path to go," he says. "It gives you a snapshot of how a university works, and exposes you to different disciplines, different types of teaching."

"Proctoring is more rewarding than anything else I do at Harvard," says Kathryn Roberts, another proctor from the English Department, who found graduate school a little lonely before she lived in the Yard. "Now I feel deeply essential to other people." Her dissertation is on writers' colonies, and since, as she says, "I've become a person profoundly interested in community and creativity," she has achieved a neat congruence between her academic and residential responsibilities. "I don't see it as that different from my other roles in the university, like teaching and participating in graduate student professionalization. My job in either case is asking insightful and difficult questions."

Every proctor is forthright about the challenges of the position. "I don't have free time," Joe puts it bluntly. "Any moment I'm not working on my research I know I could be working on something for my entryway." Even Kathryn admits, "It can burn you out. Once or twice a year you find yourself really having to drop everything to take care of student crises. And when you're in charge of thirty students, the chances are you're going to have something really scary happen: eating disorders, students whose relationship with alcohol has gone past the point of experimentation, serious conflicts at home."

KATHRYN ROBERTS, PhD candidate (left), with Moira McCavana, Harvard College sophomore

"Proctoring is more rewarding than anything else I do at Harvard."

But crises like these can also be where the best proctor-student relationships are forged. Kathryn's entryway last year was especially "high-drama," and she found herself almost constantly negotiating roommate conflicts. She was assisted by one especially composed freshman, Moira McCavana, whom other freshmen began calling "mom." This year, Moira serves as one of Kathryn's Peer Advising Fellows, upperclass deputies assigned to proctors, and I asked her to join Kathryn and me for our interview.

Watching them reminisce about the previous year, it was hard to remember that one had been a proctor and the other a freshman. They just seemed like good friends. Another of Moira's nicknames, it eventually came out, was "Mini Kathryn."

"Kathryn was just always present," Moira says. "She came to our games and performances, she was always around to talk to. We didn't really end up using too many other resources, because we had Kathryn to go to first."

"My students blow my mind," Kathryn says. "So many Harvard students have these revolutionary, paradigm-shifting ambitions. The proximity to undergraduates like that changes you as a person."

"And I get to be a freshman every year," she adds. "It keeps this place fresh."

MCB80x//

Neuroscience Comes Home

A new way to make a MOOC, a new way to teach science

By Michael Fitzgerald

Illustration by Harry Campbell

Dave Cox stands in the Gross Anatomy Lab at Harvard Medical School, wearing a white lab coat over a blue-and-white pinstriped shirt. "Now, in this bag we have a real human cadaver, so be prepared for what you're about to see," he says. He opens the black bag to reveal a cadaver lying on its front, soft tissues exposed, the cerebrum visible under a skull that looks something like the half-helmets worn by road-hardened motorcyclists.

Cox picks up a different brain, cradling it in hands clad in blue nitrile gloves, and describes its features. Then he says, "This was a person. Everything they remembered, everything they felt, everything they did, everything they aspired to was in this organ."

Next to him is Mohini Lutchman, a lecturer at Harvard Medical School. She dissects the brain and removes the spinal cord, accompanied by a soundtrack of electronica composed for the purpose. On Twitter, @GillLinfoot posts: *wow additional video is excellent. Have seen a brain many times but a dissected spinal cord was a first! Excited for rest of course!*

Welcome to the world's largest field trip. Cox was at the Gross Anatomy Lab filming bonus video for MCB80x, Fundamentals of Neuroscience, his new five-part rethinking of how an online course can work. And there with him — virtually, soaking up the multisensory experience — were the 40,000 people who registered for the course this fall via HarvardX, the online learning initiative launched in 2012.

Neuro-science Comes Home

Computational neuroscientist Dave Cox, right, with MD-PhD student Winston Yan

Cox is one of many people at Harvard exploring the possibilities of HarvardX, but his do-it-yourself ethos and a willingness to break apart conventional models make him an interesting case study in the entrepreneurial world of online course-building. He knows the landscape — he is a Harvard College graduate (2000) who received his PhD from MIT in computational neuroscience. He's back as an assistant professor of molecular and cellular biology and of computer science, running a lab that works to reverse-engineer the biological processes that give us sight. He's a member of Harvard's Center for Brain Science, and prior to that affiliation, he was a Junior Fellow at the Rowland Institute at Harvard, which focuses on high-risk, high-reward scientific research at the boundaries of traditional fields.

And above all that, "Dave's a wizard" when it comes to writing computer code, says Winston Yan, a PhD student in biophysics who is helping Cox bring MCB80x to life.

"This is what teaching is going to look like in the future."
— Dave Cox, MCB80x course leader

Yan, another College alum (2010), has already completed two years of medical school as part of the Harvard/MIT MD-PhD program. Even in the middle of an intense graduate program, he was drawn to Cox's project, he says, by the chance "to be part of something awesome."

The course came about because Cox liked the idea of MOOCs — massive open online courses — but didn't much like their reality. "I'd looked at MOOCs and thought, 'My God, these things actually kind of suck,'" he says, from his office in the Northwest Laboratory on Oxford Street. Despite perceptions, most MOOCs are not radical or disruptive, he says; most remain stubbornly reliant on standard classroom tropes — like the lecture, first and foremost.

"Great lecturers like Eric Lander are able to make a compelling product in spite of the limitations of translating the lecture format online," Cox says, referring to the dynamic former co-director of the Human Genome Project, who brings passion, humor, and a camera-friendly personality to the introductory biology course he teaches for MITx (and at MIT). But by and large, Cox continues, that traditional model does a terrible job of leveraging the incredible strengths of the Internet.

Recalling his own experiences of sitting in lectures and watching students tapping furiously on their cell phones, while Twitter and Facebook sit open on their computers, Cox decided to make a lecture-free MOOC. And because he sees MOOCs not as stand-alone courses, but as complements to classrooms, he decided to tie it to Harvard's MCB 80, Neurobiology of Behavior — a course that has been part of the brick-and-mortar curriculum for years.

What's different about the X version? Well, for one, it uses animated cartoon sailors masquerading as cations and anions to help illustrate the concepts of diffusion and electrostatic pressure. As you might imagine, the on-campus version of the course does not.

But as whimsical as some of its online units can be, building a MOOC this inventive took serious work. Besides the original cartoon animations, modules include original music, quick-cut videos, and on-camera field trips like the one to the anatomy lab. In fact, Cox's curriculum outstrips the current capabilities of edX, the open-source teaching platform launched by MIT and Harvard, so he hosts it himself. He wanted robust online forums to encourage class discussion, so he worked with an educational technology company called Piazza to integrate its forums and ensure they would serve his large audience.

Drunken sailors as cations and anions: a custom animation from MCB80x

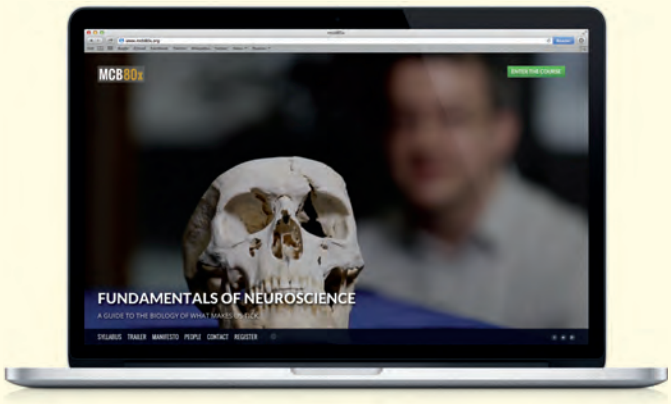
Moderating those forums is one of the tasks that occupy the days and nights of Yan and the third prime mover behind MCB80x, Nadja Oertelt, a HarvardX Fellow with an undergraduate neuroscience degree from MIT. Oertelt, who is a documentary film producer, worked in Cox's lab for several years.

The three have combined their coding skills, multimedia production chops, and understanding of neuroscience to assemble their course more or less from scratch, sharing an entrepreneurial mindset and a workload that mirrors what you'd find at a tech startup.

Thanks to their efforts, and those of other volunteers, when MCB80x launched on Halloween 2013, students indeed were treated to a lecture-free MOOC. Not that Cox doesn't talk. Registered students get to see plenty of him. But he's never in a lecture hall. He's often on location. When he's talking, what appears on screen is often not his smiling face, but a fast-paced video illustration, or an interactive simulation aimed at getting students to work through a concept. By the third class Cox was assigning students to go into the field and do experiments of their own, using a lab kit called a Spiker Box. (He raised money to purchase the kits through a Kickstarter campaign, as a citizen-science initiative.)

What do the students think? There is no control experi-

PHOTOGRAPHS: LULU LIU



ment, but on November 12, Cox sent a tweet saying "12 days, 74k visits from 29k unique visitors, 527k page views, 5mil logged interaction data pts w/ interactive sims." In non-Twitter parlance, that means that 29,000 people had visited the course site 74,000 times, viewed 527,000 pages, and clicked 5 million times on interactive simulations.

Comments posted in the forums have been overwhelmingly positive. But open debate is accepted. One student *hates* the cartoon animations of the sailors, and another, in a post headed "Questionable pedagogy," complains that the videos are too much like "attention deficit disorder PBS videos." Posts like that spark responses and counter-responses, and Cox himself weighs in.

Cox's unconventional approach aims to shake up notions of online education, but it also might shake up graduate student education. The typical teaching fellow model doesn't apply here. MOOCs, especially unconventional ones like MCB80x, give graduate students a different sort of training.

Yan knows Harvard well; he studied physics at the College, and he continues to live on campus as a resident tutor in Adams House. He cofounded a startup focusing on mobile apps as an undergrad, and the *Harvard Crimson* named him one of its 15 most interesting seniors.

He's aware that MOOCs don't offer a traditional teaching experience, but he thinks they're just as valuable.

Organizing a MOOC requires intense planning and preparation, he says, in part because whatever he posts will live on the Internet, and it needs to be good. Posting in the forums presents a deeper challenge than leading section discussions.

"You can't just wing the questions and put something together on the board, knowing that once it's erased, it's gone," he says.

He says the diversity of a MOOC means that answers have to make sense to high school students and to working neuroscience researchers alike; both groups are represented among the course's student body. While Cox and Yan commit to spending an hour a week in the forums for live questions, they're spending many more hours going through the posts — they respond to questions and comments within 36 minutes, on average. A tired-sounding Cox says on the phone in early November that "it's like herding a swarm of bees." Yan calls the forums "an obsession."

He estimates that he spends about 15 hours a week managing them, significantly more time than if he were holding office hours and attending lectures. He and Oertelt talk a lot about how to balance their time and how to foster constructive conversations among students.

"I didn't expect to do this course and be so involved and love it so much," says Yan. "I want to be a university professor, kind of be where Dave is, with my own lab, and I want to communicate science to the world. I think this is a step toward that. How do you teach to a very broad audience and communicate ideas effectively and in a logical manner to a very diverse group of people? I've learned to think much more broadly about how learning happens and can happen in a totally different way."

"You can't just wing the questions and put something together on the board, knowing that once it's erased, it's gone."

— Winston Yan, MD-PhD student, MCB80x developer

Cox thinks that courses that are integrated with a MOOC present a tremendous opportunity for graduate students. "This is what teaching is going to look like in the future," he says. "To say, 'I've done this new kind of teaching' should help students get jobs."

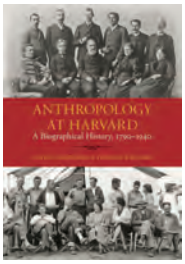
One question has to be: Can people do the new kind of teaching Cox's course invites? This is a difficult class to create. After launching the first lesson, Cox's small team struggles to get the second one out on November 14. It took a few all-nighters by Oertelt and Yan and plenty of work. In part, they have to spend unexpected time developing quizzes and review material. Cox loathes multiple-choice questions, but students posting on the forums want more ways to assess what they've learned.

Cox does not believe that MOOCs diminish the campus experience, and they certainly don't replace the personalized experience and the interaction with faculty that are the hallmarks of a traditional college education. But he thinks MOOCs, well done, will amplify both. "It's sort of paradoxical, but this could be a way to create more of a one-on-one experience," says Cox. As online platforms become more sophisticated, they'll be able to figure out, based on a student's interactions, where extra help or explanation is needed, he says.

Cox's radical rethinking of the MOOC includes keeping it available indefinitely, and even adding to it, so that MCB80x can be an ongoing resource for students and faculty. "We're flying by the seat of our pants this time around," Cox says. "The next iteration will go much more smoothly."

Left: Nadja Oertelt and Winston Yan, with Cox, monitor the course dashboard, which shows the online activity at any given time.

Noted



Anthropology

David Browman, PhD '70, is the co-author, with Stephen Williams, of *Anthropology at Harvard: A Biographical History, 1790–1940* (Peabody Museum Press, 2013). The book offers comprehensive insight into the origins of American anthropology as a scholarly practice and its development and growth at Harvard — home of the first museum of anthropology in North America. Through vignettes and anecdotes, Browman and Williams bring to life the scholars who shaped the field, even shedding light on Harvard anthropologists' involvement in wartime espionage. Browman is professor of archaeology at Washington University; Williams is Peabody Professor, emeritus, and former director of the Peabody Museum of Archaeology and Ethnology at Harvard.

Applied Physics

James J. Wynne, AB '64, PhD '69, has been awarded the 2011 National Medal of Technology, as well as the 2013 National Academy of Engineering's Fritz J. and Delores H. Russ Prize. The former was presented by President Barack Obama at a White House ceremony last year. Both awards recognize his discovery of excimer laser surgery, laying the foundation for the laser refractive surgical procedures known as LASIK and PRK, which have improved the vision of more than 25 million people. Wynne is a scientist at the IBM Thomas J. Watson Research Center in Yorktown Heights, NY, where he and two colleagues made their discovery in 1981. An employee of IBM Research for the past 44 years, his current work focuses on innovative applications of lasers to medicine and surgery.

Chemistry

Jay Labinger, PhD '74, has published, *Up from Generality: How Inorganic Chemistry Finally Became a Respectable Field* (Springer, 2013), an account of developments in his field (including a few comments on inorganic chemistry at Harvard). Labinger is administrator of the Beckman Institute and faculty associate in chemistry at Caltech, where he has been since 1986. His research interests are in the areas of organo-transition metal chemistry and homogeneous and heterogeneous catalysis, with a particular focus on conversion technologies and other energy-related applications.

Michael McAlpine, PhD '06, has constructed a synthetic, 3D-printed human ear that could potentially change the lives of people living with deafness or hearing loss. The prosthetic was created by layering conductive silver with live cells, resulting in a coil that

receives electromagnetic signals and forms a direct connection with the human brain. The device could not only alleviate hearing impairment, it could also improve the human capacity for hearing in general, giving users an ability to hear sounds outside of their normal spectrum. McAlpine is assistant professor of mechanical and aerospace engineering at Princeton University.

Economics

The Central Bank of Ireland has appointed **Cyril Roux, PhD '91**, as its new financial regulator, beginning this fall. Prior to this position, Roux served as the first deputy secretary general of the Autorité de Contrôle Prudentiel et de Résolution (ACPR), the French supervisory authority for banks and insurance companies. In his new role, he will manage all regulatory undertakings at the Central Bank, supervising the capital stress tests of Irish banks in early 2014.

Prasannan Parthasarathi, PhD '92, was awarded the 2012 Best Book Award from the World History Association for his book *Why Europe Grew Rich and Asia Did Not: Global Divergence from 1600 to 1850* (Cambridge University Press, 2011). The award recognizes outstanding contributions to the field of world history. Parthasarathi is professor of history at Boston College, where he teaches courses on modern South Asia and the British Empire.

English

Epifanio San Juan Jr., PhD '65, is the author of *Toward Filipino Self-Determination* (SUNY Press, 2009) and *Critical Interventions: From Joyce and Ibsen to Peirce and Kingston* (Lambert, 2010). The first describes the social, cultural, and political situation of Filipinos in the United States from the early period of US colonization of the Philippines in the last century up to the present, while the second examines the crucial debates in postcolonial and ethnic studies in the last three decades. San Juan was recently a fellow of the W.E.B. Du Bois Institute at Harvard University, and of the Harry Ransom Center at University of Texas, Austin.

Government

In *The Shining Sea* (Basic Books, 2013), historian **George C. Daughan, PhD '68**, tells the tragedy of the USS Essex, a naval ship under the command of Captain David Porter during the War of 1812. The account covers the crew's voyage

around Cape Horn and into the Pacific, in urgent pursuit of a British man-of-war. Daughan was a recipient of the Samuel Eliot Morison Award for *If By Sea* (Basic Books, 2011).

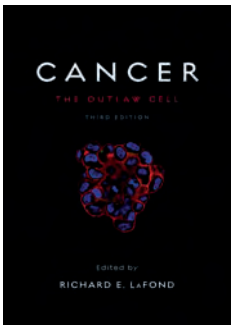
Mathematics

Jeffrey Rosenthal, PhD '92, was awarded the Statistical Society of Canada's 2013 gold medal for pioneering research in the probabilistic analysis of convergence of Markov chain Monte Carlo methods, randomized computer algorithms, and diverse interdisciplinary applications of statistics. Rosenthal is professor of statistics at the University of Toronto. Rosenthal was named a fellow of the Institute of Mathematical Statistics in 2005, received the CRM-SSC prize in 2006, and in 2007 was awarded the prestigious Presidents' Award from the Committee of Presidents of Statistical Societies (COPSS award).

Joseph R. Breton, AM '59, has published, *Playing with Einstein: Reflections on E=mc2* (The Foundation for Theoretical Physics, 2013), a booklet of mathematical musings in which Breton endeavors to debunk the myth that Einstein's most famous equation, E=mc2, can only be understood by a select audience. In his introduction, he "invites the reader to a joyful, although at times arduous, adventure in understanding," before launching into a breakdown of the fundamental building blocks of theoretical physics.

Medical Sciences

John Greene, PhD '89, is now senior director of bioinformatics for SRA International, Inc., a provider of bioinformatics professional services to the federal government. He works with clients at NIH and CDC and is preparing a bid for the National Cancer Institute's Cancer Knowledge Cloud pilots, named in Forbes as one of the "10 Game-Changing Developments In Government Clouds."



Richard E. LaFond, AM '72, is the editor of *Cancer: The Outlaw Cell* (Third Edition, Oxford University Press, 2012), a collection of scholarly articles and reports by leading scientists on the front lines of cancer research. The book is meant to hit pause in a field defined by its lightning-quick advances, and to provide a recap of how far we've come and where things stand, with a focus on the basic principles of biology and their influence on the study of cancer cells.

Organizational Behavior

Lisa Rohrer, PhD '04 has been appointed as the new executive director of Executive Education and the Case Development Initiative at Harvard Law School. Rohrer was formerly director of executive education at Georgetown University Law Center, where she organized and taught course sequences on business and leadership skills for law firms and departments. Her current research focuses on law firm culture and the strategic and organizational issues many firms now face in the wake of economic crisis.

Psychology

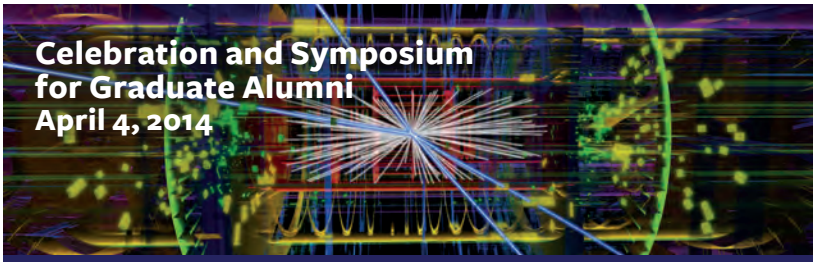
In *Barbara's Death – 1976: Memories and Reflections* (AuthorHouse, 2011), **Lewis M.K. Long, PhD '56**, offers a thoughtful and unsentimental reflection on what it is like to watch a loved one suffer through cancer. Long lost his first wife, Barbara, to brain cancer in 1976; his second wife, Alice, ultimately died of the same disease. But in this retelling, that pain shares equal billing with the joys and mundane challenges of family life.

Michael A. Wallach, PhD '58, is the co-author of *Seven Views of Mind* (Psychology Press, 2013). The work addresses the predominant views on the human mind within the contexts of psychology, philosophy, and neurosciences, offering candid insight and reflection on each leading theory. Wallach is professor emeritus of psychological and brain sciences at Duke University. He has published extensively on topics pertaining to cognitive, personality, social, clinical, developmental, educational, and theoretical psychology.

James E. Rothman, PhD '76, medical sciences, was awarded the 2013 Nobel Prize in Physiology or Medicine for his contributions toward the discovery "of machinery regulating vesicle traffic, a major transport system in our cells," said the Nobel committee in announcing the award. He shares the award with scientists Randy W. Schekman and Thomas C. Südhof, all "scientists who have solved the mystery of how the cell organizes its transport system," according to the Nobel committee. They have discovered "the molecular principles that govern how this cargo is delivered to the right place at the right time in the cell." Their findings have led to a greater understanding of epilepsy, diabetes, and other metabolism deficiencies and could pave the way for new treatments. Rothman is professor and chairman in the department of cell biology at Yale University.

touring innovation

In just two years, the Harvard Innovation Lab (the I-Lab, in local parlance) has established itself as the campus hub for entrepreneurship and discovery, drawing students from across disciplines and schools who want to turn their ideas into marketable ventures. During their November meeting, members of the GSAS Alumni Council toured the 30,000-square-foot space in Allston, alongside the I-Lab's faculty director, Joe Lassiter. They learned how the facility encourages cross-University collaboration, with an advisory board made up of the deans from almost every Harvard school — including GSAS Dean Xiao-Li Meng. (As Lassiter noted, "GSAS is a perfect supporter of the I-Lab, given how cross-disciplinary it is in its own design.") Lassiter described how the lab supports and incubates ventures that range from social and cultural entrepreneurship and health and sciences to technology and consumer fields. But he added that most I-Lab projects never move to commercial fruition. "And that's as it should be," he said. "Our metric is not ventures launched, it's people educated."



PHYSICS AT HARVARD

Physics is a fundamental science, and at Harvard it is also increasingly multidisciplinary, with physics students working in biology, chemistry, and engineering labs across Harvard. Next spring, Harvard will celebrate the venerable history of one of the country's great physics programs and assess discoveries past, present, and potential. Graduate alumni of the Physics Department, save the date for the celebration and symposium on April 4, 2014. Details to follow.

Spring Celebration

Save the date for Alumni Day, the Graduate School's festive annual tradition, planned for **April 5, 2014**, at Emerson Hall and the Faculty Club. This year's program will feature a keynote address by Louise Richardson, PhD '89, government, the principal and vice-chancellor of the University of St Andrews in Scotland (a title equivalent to that of president at US institutions). Richardson is a pioneering authority on terrorist movements and for years taught Harvard's only courses on the subject.

NEW ALUMNI LEADERSHIP

The Graduate School has appointed Jon Petitt to become the director of alumni relations and publications. Petitt brings eight years of experience in Harvard alumni roles, most recently serving as the associate director for College Alumni Programs in the Harvard Alumni Association. You can connect with him at petitt@fas.harvard.edu.

The Graduate School Alumni Association
Governed by its Alumni Council, the GSAA represents and advances the interests of alumni of the Graduate School of Arts and Sciences by sponsoring alumni events and by publishing *Colloquy* three times each year.

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TOURING INNOVATION PHOTO BY MOLLY AKIN

New Teaching, Old Texts

At Harvard, he discovered a modern approach to a classic subject

Historical musicology. It's an area of study that may not seem poised for a cutting-edge makeover. But in the hands of pedagogical innovator Louis Epstein, PhD '13, new approaches are the norm. Epstein is taking the ideas he incubated at Harvard into his newly launched professional life, now with an appointment as a lecturer in music history at the University of Massachusetts Amherst.

Epstein has always been interested in teaching that encourages his students to take risks, think critically, invest in their own learning, and gain the skills and tools they need to continue learning well after they leave the classroom. "It's not about hiding the tricks I use, it's about letting my students behind the curtain and giving them ownership of their own learning," he says.

At GSAS, Epstein took full advantage of the professional development and mentoring opportunities available in his department and at the Derek Bok Center for Teaching and Learning. With the aid of faculty who helped guide his grant applications and encourage his pedagogical interests, Epstein found himself the recipient of not one but multiple awards that would shape his future in both research and teaching.

As a recipient of a 2012–13 Hauser Grant, for example, he created and organized the Graduate Multimedia Fellows Program at the Bok Center. That adventurous program trained teaching fellows to design, implement, and evaluate student multimedia assignments. (See the program's blog at harvardgmfproject.wordpress.com.)

Since earning his PhD in May, Epstein has continued to push the limits and experiment with his approaches to teaching music history — going beyond the conventional and discovering new ways to get students to think about music.

"It's traditional to have students memorize details of the most important pieces of music and use those details to distinguish between different periods and styles in music history," explains Louis. "I also ask students to explore how ideas like control, genius, progress, and pleasure function diachronically, connecting music we normally think of as separated by time and tradition."

Harvard — always on the cutting edge of teaching and learning — is reimagining the possibilities of presenting traditional subjects in nontraditional ways. This incomparable pedagogical freedom is something that graduate students both foster and benefit from; like Epstein, they will carry their innovations into their own classrooms.

"When I'm teaching, the education I received and the coursework I did at GSAS emerges at every moment," continues Epstein. "I'm incredibly grateful for the pedagogy training they provided me."

JONATHAN RUEL

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