Massachusetts Institute of Technology

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MIT Faculty Newsletter

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in this issue we feature the ongoing discussion of the fate of our graduate students (Editorial, below; Letter, page 17); From The Faculty Chair, "An Institute of Shared Governance," (page 4); "'Voodoo Science' at MIT?," (page 13); and "A Bit More About Paul and Priscilla Gray," (page 21).

The White House

Interview With Former Pro Football Player and Math PhD Candidate John Urschel

THE FOLLOWING INTERVIEW by the *Faculty Newsletter* (**FNL**) with John Urschel (**JU**) was held on October 26 of this year.

FNL: *Today's the 26th of October, I think, 2017.*

JU: I'm a mathematician. Don't ask me what day it is.

FNL: *I read that you grew up in Canada.*

JU: I was born in Winnipeg, Manitoba. I moved to the United States when I was four.

FNL: *Where did you live?*

JU: I lived in Buffalo, but I split time between Canada and the U.S. My father

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Boston Biotech Has a Woman Problem

Harvey Lodish and Nancy Hopkins

BOSTON'S BIOTECHNOLOGY INDUSTRY is envied and emulated around the world, and is poised to grow explosively in coming decades. It should continue to develop treatments for diseases and conditions thought incurable just a few years ago, based on advancements that emerge from research in our universities and hospitals and that are developed in innovative startup companies. Biotechnology depends on a rare group of scientists who are highly educated, productive, creative, and motivated. But at the highest levels – faculty founders of biotechnology companies and partners at venture capital firms – women have been routinely excluded.

The problem is not the pipeline – 25 to 30 percent of biology faculty at Boston's leading research universities are women and 50 percent of those who hold PhDs in

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Editorial

I. If Republican Tax Plan Undermines Graduate Education, MIT Needs to Protect Our Graduate Students
II. Effects of Trump/Republican Budget on Research

I. If Republican Tax Plan Undermines Graduate Education, MIT Needs to Protect Our Graduate Students

THE TAX CUTS AND JOBS ACT recently passed by the House of Representatives treats tuition waivers to graduate students as taxable income (by eliminating Section 117(d)(5) of the Internal Revenue code). Paying this tax will sharply lower the actual income and standard of living of the ~80,000 graduate students nationally who receive such waivers, including the 7,000 graduate students at MIT. Graduate students constitute the future of the U.S. scientific and technology communities.

The Senate bill lacks this provision, but it is difficult to predict what will come out of the Conference Committee, which will resolve House and Senate differences. Research universities and national scien-

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The MIT Faculty Newsletter
Editorial Board

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Republican Tax Plan
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tific societies have, of course, mobilized in opposition to this provision of the House version of the tax legislation.

MIT needs to prepare for the worst and plan to do what we can to protect our graduate student population. The biggest single expense for our students is housing. Taxing their tuition remission will reduce their income by many thousands of dollars, putting local market rate housing out of range. If the tax bill includes the House provision we recommend that MIT help subsidize graduate student housing.

The Graduate Student Council has documented the shortage of affordable graduate student housing (see their letter on page 17). The Graduate Student Apartments Now group cogently presented the need for MIT to provide 1800 affordable units in public testimony before the October 12 Ordnance Committee of the Cambridge City Council <*http://web.mit.edu/fnl/volume/302/gsan.pdf*>. The recent response of the MIT administration in offering to build 900 units of affordable housing was a step in the right direction, but still leaves thousands of graduate students dependent upon expensive market rate housing. MIT has the land, the financial resources, and the motivation to provide affordable housing for all our graduate students. The administration and its building committees, and the Planning Committee, established two years ago by vote of the Faculty, should begin immediately to make such plans.

Both the House and Senate plans are deeply inequitable, delivering tax advantages to top earners and corporations, and very little to those most in need of relief. A good summary is in Prof. Jeffrey Sach's Op-ed in the November 28 *Boston Globe*. According to the Congressional Budget Office, for instance, Americans making less than $30,000 in 2019 will pay $2,580,000,000 more in taxes – while those making over $200,000 will pay $118,550,000,000 less in taxes in 2019 <***https://www.sandersinstitute.com/blog/congressional-budget-office-cost-estimate-the-tax-cuts-and-jobs-act***>.

Now is the time to call or write your Representatives and Senators calling for a more equitable tax bill and for keeping tuition waivers off the income tax rolls.

II. Effects of Trump/Republican Budget On Research

The concern over the impact of the income tax bills has distracted attention from the potential damaging impact of the Trump/Republican federal budget proposal. Trump's budget cut $57 billion from the science programs such as DOE, NIH, and EPA, as well as the State Department, and other civilian programs in order to increase the military budget by that amount. That brought Pentagon budgets to about 55% of the total $1.15 trillion Congressional discretionary budget.

However, subsequently the Senate Armed Service Committee, chaired by John McCain, through the National Defense Authorization Act for FY18, authorized an increase of $80 billion, providing more than $700 billion in total for the Pentagon. This would result in more than 60% of our income tax dollars going to Pentagon accounts. Half of this would be for weapons purchases, the majority of which go to a few dozen large corporations. A third of that amount ~$100 billion, goes to the top five contractors – Lockheed Martin, Boeing, Northrop Grumman, Raytheon, and General Dynamics. Though such appropriations would certainly ensure defense industry profitability, this would be at the cost of civilian investment in transportation, education, healthcare, basic and biomedical research, housing, sustainable energy programs, and environmental protection. All these cuts in essential programs follow the anti-science policies of the current administration.

For comparison, the NIH budget responding to all diseases afflicting our nation's population is about $32 billion, and the national transportation budget about $28 billion. According to the alternate People's Budget proposed by the Congressional Progressive Caucus, civilian investment, for example in national water and transportation infrastructure repair, generates far more jobs and economic growth than does refinement of sophisticated weapons systems.

If the Appropriations Committee follows this policy, with the tax cuts proposed in the Senate and House income tax bills, even greater cuts will occur in civilian programs. Some of the costs will no doubt be added to the national debt, but such deficit spending will be limited by Republican deficit critics. However, even if, for example, the 18% cut in the NIH budget included in the Trump budget were limited to perhaps half that, the impact on graduate students and postdoctoral employment would be serious.

The Budget Control Act of 2011 caps Pentagon spending at $549 billion, so the path to the new budget is very complex, with Democrats opposing raising the budget caps for the Pentagon, without also raising the caps for civilian investment.

National organizations advocating for housing, veterans health, public transit, public education, and environmental protection will all be pressing Congress to respond to these needs. We in the scientific community need to join forces with these natural allies, as we press for protecting investment in scientific research and in educating future generations of scientists, engineers, and scholars. This is the time to let your elected representatives know your views, and to encourage your professional societies to be proactive in representing your interests.

Editorial Subcommittee

From The Faculty Chair

An Institute of Shared Governance

Susan S. Silbey

"A UNIVERSITY, LIKE ALL OTHER human institutions – like the church, like governments, like philanthropic organizations – is not outside, but inside the general social fabric of a given era," Abraham Flexner wrote in his classic 1930 text, *Universities*. Flexner continued, "It is … an expression of an age, as well as an influence operating upon both present and future." American universities developed in their present form – a unique synthesis of German and British predecessors – alongside the expansion and institutionalization of American democracy, simultaneously embedding both the openness and exclusions of the larger society. Over the last century, our universities have experienced a dramatic shift away from what during the nineteenth century had been the absolute power of presidents and trustees. We have moved toward what Jonathan Cole, sociologist and former provost of Columbia University, calls "*a company of equals.*"

Of course, we are not all equal; notably, university presidents still command the greatest authority within the university and also garner much public notice, serving as intellectual and moral leaders for the nation. Thus, the company of equals does not describe an empirically quantifiable balance, nor even assert formally equivalent power.

The university is a company of equals through a model of shared governance in which, as MIT Corporation Chairman Bob Millard recently remarked, each of the participating authorities, working within distinct, entwined, and sometimes overlapping jurisdictions, can exercise a veto. Loosely coupled organizations, universities are also loosely governed organizations. How does this shared governance work?

Meetings

A list of the meetings that your faculty officers attend, individually or as a group, is an obvious first observation about how this shared governance works: weekly meetings of the faculty officers, Academic Council, Dean's Group; bi-weekly meetings of the Faculty Policy Committee, Committee on the Undergraduate Program; a monthly meeting with the President, Provost, Chancellor, and Senior VP/Secretary of the Corporation to set the agenda for the monthly Institute faculty meeting (which few faculty – often a bare quorum of 30 – attend); and monthly department heads' lunches, random faculty dinners, and meetings of the Committee on Graduate Programs, Committee on Race and Diversity, International Advisory Committee, MITx Faculty Advisory Committee, and Enrollment Management Group. In addition, there are bi-weekly or monthly one-on-one meetings with the Provost, the President, the Chancellor, the Vice President, and the Chairman of the Corporation; quarterly meetings of the MIT Corporation, and the Corporation Joint Advisory Committee on Institute-Wide Affairs; semi-annual meetings of all faculty committee chairs and staff, and the Academic Appointments Subgroup of Academic Council; and annual meetings for new faculty orientation and new Corporation members orientation. Of course, there are also one-off meetings scheduled in response to requests to talk or desires to gather information, such as our recently initiated visits with School councils. Clearly, it is not possible for every officer to attend every meeting, as there are many conflicts. We divide the labor.

A Communication Link

Going from one meeting to another every day over these last two months, I have learned one lesson thus far about how shared governance works: I am a channel of communication, a link carrying information among various nodes in the MIT network. Like the transport of electronic excitation from one molecule to another that initiates chemical reactions, light harvesting or other energy transfer, I inject information from one node into another, perhaps with less predictability than the exciton, but nonetheless pushing conversations to consider alternative points of view and possible directions of action – at least in our presence; what happens afterward, I have not yet learned.

Of course, none of this is driven by the laws of physics, nor is it yet automated; it is coordinated by the wizardry of Tami Kaplan, the Faculty Governance Administrator, who is herself an extraordinary repository of institutional memory as well as wise judicious guidance that shepherds the process.

Discussion Topics

What goes on in these meetings? Discussion topics range from petty annoyances of one kind or another to significant challenges to the future of the American university, some raised by students, others by members of the faculty, and some by members of the administra-

tion. Less often, a query may come from a Corporation member. During the first two months of this semester, discussions addressed some of the following topics repeatedly and some less often: new faculty orientation, freshman adjustments, parking procedures in Stata, closing of Senior House, costs of graduate education, graduate housing, computational thinking, construction plans for Kendall Square as well as the Volpe site, students' emotional well-being, the academic calendar and the week between final grades and Commencement, consensual sexual relations among adults and sexual harassment training, freedom of expression on campus, federal challenges to the research overhead rate, competitiveness of graduate student stipends, inclusion of instructional staff as respected members of the Institute, expansion of kinds of degrees such as MicroMasters, MIT's historical relationship to slavery, the progress of the MIT Campaign for a Better World, revisions to *Rules and Regulations of the Faculty* to eliminate repeated amending and editing, COUHES procedures (the Committee on the Use of Humans as Experimental Subjects), instituting dinners for women faculty, a year-end retreat to discuss curricular changes, overlapping jurisdictions among some committees, housing costs nearby MIT, improving external recognition and perception of SHASS, analysis of undergraduate majors, communications requirement, classroom renewal and innovative design, faculty benefits, curricular experiments and, finally, the particular as well as general aims of an MIT education.

The Limits of Shared Governance

Clearly, shared governance does not mean that everyone is involved in everything. In the division of labor, there are topics the faculty officers have not discussed and about which our advice is not normally sought, for example, the Institute budget. There are also issues in which faculty are generally happy not to be involved, for example routine housekeeping, maintenance of vehicles, perhaps negotiations with Cambridge. Just as clearly, there are matters about which the faculty are passionate and would not only expect to discuss but to demand active participation in making the decisions. For example, this *Faculty Newsletter* began 30 years ago, in March 1988, in response to an administrative decision to close an academic department without faculty deliberation. In comparison, 30 years earlier, the School of Humanities, Arts, and Social Sciences was formed through an extended period of committee deliberation (i.e., The Report of the Committee on Educational Survey [also known as the Lewis Commission], November 15, 1949). Around the time of the Lewis Commission and the founding of SHASS, Alfred P. Sloan made a gift to MIT to establish a business school – the Sloan School of Management – but this was done without extensive prior faculty consultation. Just recently, *The Tech* published faculty letters calling for a new School of Computing at MIT. This proposal apparently followed tumultuous Visiting Committee sessions in which some members of EECS wished to divide the department. The peaceful resolution appears to not have satisfied everyone. What role does the MIT faculty as a whole play in such deliberations and decisions? What are the roles of the administration and the Corporation? The students?

Too narrowly defined, shared governance ignores the division of interest and labor, insisting on collaboration of all stakeholders, at every stage of a decision. Too broadly understood, the term becomes meaningless, ranging from assertions that faculty govern and administrators implement – without any notion of who is exchanging what with whom – to the opposite extreme where the administration sends out notices informing faculty of plans, processes, and decisions discussed with no others. At one end of a spectrum, the governance system might put a high premium on autonomy, with policies and programs designed and driven from the bottom up with the messiness and inconsistencies that come with that. At the other end of the spectrum, a governance system might value the formalism, constraint, and consistency that come with managerial initiatives, policies, and programs from the top. With its flat organizational structure and relative autonomy among the Schools, departments, labs, and centers, MIT seems to have chosen the more autonomous end of the spectrum. Yet, shared governance cannot be *every boat on its own bottom*, as some institutions practice. As Gary Olson wrote in the *Chronicle of Higher Education* some years ago, ". . . it is a delicate balance between faculty and staff participation in planning and decision-making processes on the one hand, and administrative accountability on the other."

Clearly, shared governance does not mean that everyone is involved in everything. . . . Too narrowly defined, shared governance ignores the division of interest and labor, insisting on collaboration of all stakeholders, at every stage of a decision. Too broadly understood, the term becomes meaningless . . . . How does MIT's particular organizational structure and culture achieve this delicate balance?

How does MIT's particular organizational structure and culture achieve this delicate balance? How do we steer through what can often seem disordered hyperactivity? Although shared governance begins with the legal authority vested in the Corporation, it embraces the faculty, administration, and students (who across generations become alumni

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An Institute of Shared Governance
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and may have the opportunity to join the Corporation). This model ensures, Bob Millard described in conversation with me, that all members can exercise a form of ownership. This is not the usual kind of material property; rather, this is an intangible form of ownership where each group has a vested interest in the excellence of the Institution. Thus, through shared governance, "It is run by the people who care about its long-term success, those who fund, identify, are invested in it for the long term, for long after any of us are here."

So, how does this work? Through talk, talk, and more talk. Alas, the talk rarely leads directly or immediately to decisions; the most common result of our conversations are more conversations where we speak with others to collect yet more information, to hear what the others know and can contribute to the conversation. This is what governance consists of; eventually, after lots of talk at many meetings, a decision may emerge. Emerge is the right word. We recognize emergent properties when actions, patterns, entities develop through interactions among participating entities but do not belong to any of the components alone. Of course, departments, groups, individuals – MIT components – come to faculty committees and administrative offices with proposals, such as the current discussion of a possible new GIR in computational thinking or a new School of Computing. These proposals are merely the impetus for myriad discussions, which will ultimately shape a decision and course of action (or inaction).

This tedious process is the source of many faculty members', students', and administrators' complaints that faculty governance is an obstacle to change and innovation. It is also, I would assert with Millard, the means of assuring long-term excellence, but not only because of a virtuous circle of mutual commitment, identity, and investment. Other institutions, such as museums, national trust properties, and archives, display similar features of shared governance. We share with those institutions trust in the plurality and diversity of the governing participants. However, museums, parks, etc. are not fundamentally knowledge-making organizations as we are. The independence of universities as knowledge producing organizations is a major historical achievement, of which our governance processes are a piece. If history is a story of wresting control of knowledge-making, as well as public power, away from the monarchical and religious authorities who claimed a monopoly to understanding the great chain of being, it is because of the scientific as well as democratic revolutions of the past 400 years.

The specific kind of trust that characterizes shared governance at MIT derives from the interdependence between the openness of our intellectual life and what might be considered the conservatism of our methodological demands. We can discuss any idea, no matter how threatening or radical it might appear, how abhorrent and offensive, because we demand evidence for those ideas to be accepted, validated, and acted upon – empirically valid and sound evidence.

The specific kind of trust that characterizes shared governance at MIT derives from the interdependence between the openness of our intellectual life and what might be considered the conservatism of our methodological demands. We can discuss any idea, no matter how threatening or radical it might appear, how abhorrent and offensive, because we demand evidence for those ideas to be accepted, validated, and acted upon – empirically valid and sound evidence. We set a high bar for knowledge, and we do the same for our policy and program decisions. These practices may produce more inaction than change, perhaps accounting in part for the longevity of universities, as compared, for example, with businesses more dependent on fickle markets. Our methods may feel unduly cumbersome and uncertain when there are so many calls for change, here and in the wider public arena, perhaps even threatening our ability to practice fully open debate. Nothing is more hazardous to the future of governance, no less to MIT itself.

The democratic and scientific revolutions brought universities to this current place of shared governance. No one ever said democracy was efficient, neat, orderly; indeed many have noted its inadequacies. As Winston Churchill famously remarked, ". . . democracy is the worst form of government, except for all the others. . . ." Contemplating the sluggishness of shared governance, our colleague Haynes Miller in Mathematics reminded me recently that Winston Churchill also remarked: "Success is the ability to go from one failure to another with no loss of enthusiasm." Here is one of the consistent pleasures of this work. Faculty governance is not only about communicating, but fundamentally about connecting with colleagues across the Institute, and in so doing sustaining enthusiasm.

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Boston Biotech Has a Woman Problem
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biology are female, according to a review of the universities' websites.

But at the level where biotech companies are launched – by entrepreneurial university faculty members and partners at VC firms – little has changed over the decades since Genzyme, Genentech, Biogen, and others were formed, in the late 1970s. Among current Harvard and MIT professors who have started biotech companies in the past six years, the overwhelming majority are male. It's the same for those who serve on the boards of directors and advisory boards. On the current websites of four top VC firms that fund biotech companies, we found only two female partners.

How startup biotechnology companies are founded is instructive. Genentech was among the first. It was founded by Herb Boyer of the University of California in San Francisco, which held patents on his recombinant DNA discoveries, and Bob Swanson, a graduate of MIT and its Sloan School of Management. Boyer described his first meeting with Swanson many years later:

"I didn't know what a venture capitalist was in those days. And he (Swanson) said he was interested in starting a company, he had some money to do so, and that's when I got interested, because laboratories always needed money. . . . Other than the suit and tie, he looked like one of my students."

Swanson and Boyer's historic meeting remains a model of how many biotech companies are founded. A discovery is made in a university lab and patented by the university's technology licensing office to create intellectual property. The professor who runs the lab, together with faculty colleagues, are often recruited by venture capitalists. The university licenses the intellectual property to the startup. The faculty and venture capitalists assemble a team of founders, a board of directors, and a scientific advisory board. Its drivers are university faculty and venture capitalists.

Our experience is that women faculty with greater expertise and stature are sometimes passed over for participation in biotech startups in favor of men who are part of the old boy network. This male-dominated culture needs to change for two reasons. First, in a highly competitive world, biotech will never reach its full potential as the number of men in the pipeline shrinks and while some of the most creative and innovative women scientists and entrepreneurs are systemically excluded. Second, unlike VC firms, universities have an obligation, moral and legal, to provide equal opportunities to the faculty they hire and the students they train. The exclusion of women from participation in the industry now precludes this.

We urge venture firms and related companies to institute programs to recruit talented women and prepare them for leadership positions in the firm. In addition, universities should institute formal programs to educate younger faculty members of both genders to become entrepreneurs. And faculty with experience in the industry should seek out women faculty with appropriate scientific expertise for inclusion as founders and members of boards of directors and scientific advisory boards.

Our experience is that women faculty with greater expertise and stature are sometimes passed over for participation in biotech startups in favor of men who are part of the old boy network. . . . We urge venture firms and related companies to institute programs to recruit talented women and prepare them for leadership positions in the firm. In addition, universities should institute formal programs to educate younger faculty members of both genders to become entrepreneurs.

Technology licensing offices at universities should also monitor the gender composition of VC firms and their current mentoring programs as well as the startups to whom they license IP. Any one startup company might have a skewed gender ratio, but collectively they should reflect the gender composition of the faculty and trainees in the field.

Including more women in the pool of venture and biotech leaders will ensure the success of the Massachusetts biopharmaceutical ecosystem, enabling it to develop new biotherapeutics for the benefit of all.

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Editor's Note: This article originally appeared in *The Boston Globe* on Wednesday, November 15.

John Urschel Interview
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lived in Canada; my mother lived in the States.

FNL: *And when do you remember being first interested in football?*

JU: I was fascinated with it when I was younger. My father played college football, so when I visited him, I saw photos of him playing.

FNL: *Were you a Buffalo Bills fan?*

JU: Unfortunately.

FNL: *Were you athletic in junior high and high school? Were sports important to you?*

JU: When I was in high school, I played football and, yes, there was an emphasis on it, but also I went to a Jesuit prep school, so the academics were far from trivial.

FNL: *And when did you first become interested in mathematics?*

JU: I didn't become interested in mathematics until I hit college.

FNL: *Penn State.*

JU: Correct. I was always good at math, but I wasn't necessarily interested in it.

FNL: *Did you go to Penn State primarily for football?*

JU: Yes, I was on a football scholarship.

FNL: *So briefly, what was the evolution from football to math?*

JU: I would say football came first. I was always strong at math, but just because you're the strongest math student at your high school doesn't mean you're extremely good at it. I didn't think much of it. Football was what I cared about most. My father played in college, and when I was young I wanted to be just like my father. In high school I watched tons of college football. Jake Long, the left tackle for the Michigan Wolverines, was my hero. I wanted to go to Michigan and I wanted to play left tackle. My dream was to play football in the Big Ten.

FNL: *So did you apply to Michigan?*

JU: College football works differently. You don't simply apply to the school you want to go to, the way you would as a normal high school senior. You get recruited. If they want you, they offer you an athletic scholarship. I wanted to go to Michigan more than anything, but they didn't offer me a scholarship. I was a decent player coming out of high school, but I don't think I was particularly good. I got an offer from Penn State very late in the process, and I took it.

FNL: *But Penn State wasn't really interested in you for academic reasons.*

JU: They cared, but only so that I would be able to play football.

FNL: *You mean remain academically eligible?*

JU: Exactly. There's something called the NCAA clearinghouse. They have this so-called sliding scale, dictating the minimum requirements for SAT scores and GPA. The higher your SAT score is, the lower your GPA can be. The lower your SAT score is the higher your GPA has to be. I think my SAT was something like a 1530.

FNL: *So your GPA could have been virtually non-existent.*

JU: Correct.

FNL: *So you get to Penn State and how did the football go?*

JU: Each college football team is allotted 85 scholarships. Every year a team can only bring in at most 25 new scholarship players. My first year, Penn State signed 27 people, but they're only allowed 25, so two people would have to be greyshirted. That means they sit the fall semester out, and then they enroll in the spring. I was concerned that I was going to be one of those two people because I was the 26th person signed.

FNL: *So now you're approaching the beginning of the semester and . . . ?*

JU: One person didn't get in because of grades, and another person had an underage drinking citation, and so . . . .

FNL: *So 27 got down to 25 and you get the scholarship.*

JU: Right. I'm on scholarship and working very hard at football, but at the same time I'm taking classes toward an engineering degree. Because I was strong in math and physics in high school, my mother told me to major in engineering, but I found that my favorite classes were my math classes. My engineering classes were more focused on the "how," whereas my math classes were more concerned with the "why." I liked the structure and rigor of mathematics more than the practical focus of my engineering courses. So during the summer of my freshman year, I took a senior level math course in probability, just to get a feel for the major. I loved it and immediately became a math major.

FNL: *How did you find the academics in general at Penn State?*

JU: I took very little English or history – the bare minimum. I know this is going to sound ridiculous, but I only took six non-mathematical classes my whole time at Penn State.

FNL: *Really? Not even non-engineering, just non-mathematical?*

JU: Yep, six. You had to take an intro to English, you had to take public speaking, you had to take technical writing, and then you had electives. For the arts electives, I took theory of music. I took the

most mathematical courses I could find. I didn't know what I was going to do with my math major, I just knew that I loved it.

FNL: *How much time would you say football took up?*

JU: In season, it certainly takes up well more than half your waking hours. There are rules in the NCAA about hour limits, but these rules are broken just about everywhere. It's well known that big-time college football is more or less a full-time job.

FNL: *The idea that you're really into math and that you're on the football team is kind of a cognitive dissonance. Did that affect you? Were you a different person when you were with your teammates?*

JU: I was, to some extent, because football culture and the culture of a math department are completely different.

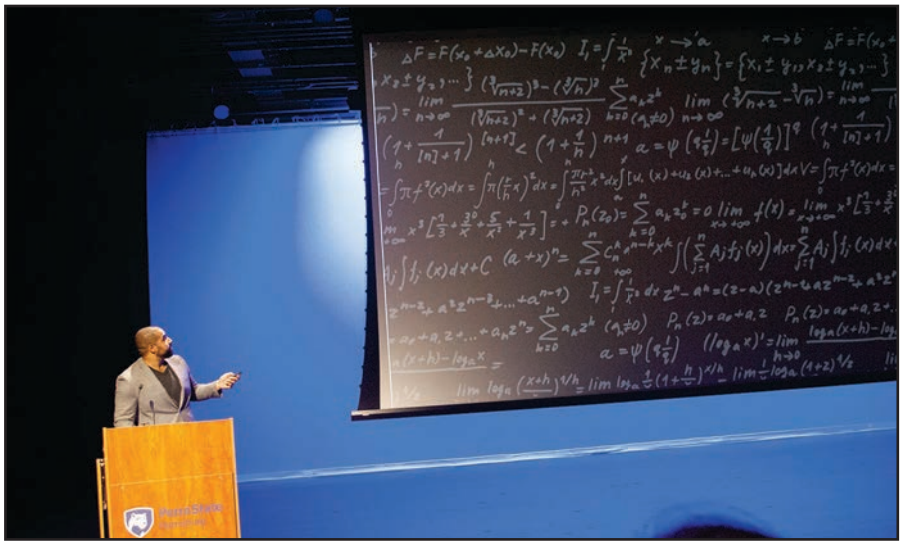
FNL: *And for you especially coming from a Jesuit school, the idea of that kind of moral or social upbringing, it's going to be a little different than Penn State or Big Ten football culture.*

JU: It's true, but I didn't feel particularly out of place. I got a tiny bit of pushback early on from the football team with respect to my coursework, but once they saw that I could play, everything was going to be fine.

FNL: *OK. So, freshman year, how did that go football wise? Did you start?*

JU: No, I was redshirted. It means you're on scholarship, but you don't play for a year and you save your eligibility. I was an offensive lineman, and offensive linemen are usually redshirted the first year. More than any other position, it's the one where high school kids need to develop in order to compete at higher levels.

FNL: *So, you have to go to school that fifth year and take classes as well, but you can play football into that fifth year.*



Giving a Mathematics Presentation at Penn State

JU: Right.

FNL: *And in your sophomore year?*

JU: I was a reserve during sophomore year. At that time, I decided I was a math major. I took this course called real analysis, taught by this math professor, Vadim Kaloshin, who got his PhD from Princeton. He's now the Brin Chair of Dynamical Systems at the University of Maryland. He recognized some potential and really took an interest in me. He was the person who really introduced me to the idea of what a mathematician does and what mathematical research is. I did my first project with him, which led to my first paper, a research paper on the three-body problem.

FNL: *Well, even though some of our readers may want to know what the three-body problem is, it might be a little too complicated for our interview.*

JU: It would be. I found that I really enjoyed it. He would send me problems and things to read, and the stuff I did with him took up 90% of my academic time. The other 10% was for all my classes.

FNL: *Then it's your junior year.*

JU: Correct, my junior year. I wasn't starting on the football team yet, but I was a split starter. I split every game with this other player who was a fourth-year senior. He played the first and third quarters at right guard and I played the second and fourth. That's how it went for my entire junior year. It was the same year that all this Paterno/Sandusky stuff came out.

FNL: *That was the child sex abuse scandal concerning assistant football coach Jerry Sandusky, resulting in his conviction and the firing of long-time head football coach Joe Paterno.*

JU: Right.

FNL: *Was it more difficult playing football because of the scandal and the firing of Paterno?*

JU: Not really. I loved our new coach, Bill O'Brien. And what can you say about it? It was just this awful tragedy, an awful, awful tragedy, and I'm not sure there's much for me to say to do it justice.

FNL: *And the academic side?*

JU: That year, my junior year, I started taking my first graduate courses in math-

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ematics. Vadim left, going back to the University of Maryland. I was uncertain about what I should study. I started doing some graduate course work in numerical analysis, and getting into this and that. I finished my undergraduate degree in my third year, and so in my fourth year I started my Masters in math. I thought about starting my PhD, but I wanted to have time to focus on football, and I thought I wanted to do my PhD somewhere other than Penn State. Penn State is a great institution, but I felt that I was a very strong math candidate, and I wanted to go to a top math PhD program – not for the name, but to be around brilliant people. It's not always fair, but where you do your PhD matters.

FNL: *So, that's your fourth year, but it's your third year of football.*

JU: Right. I was taking PhD-level coursework. Penn State doesn't really have a Masters program; it consists of taking PhD coursework, a little bit of undergrad coursework, and doing a thesis. I was also a starter on the football team. I ended up earning First Team Big 10 honors, which was a huge thing for me. That spring, I wrote my thesis and taught a course in trigonometry and analytic geometry, not as a TA. I loved teaching, which I took as another a sign that I wanted to be a professor.

FNL: *Then it's your fifth year.*

JU: During my fifth year, I taught another course, vector calculus. Since I had graduated that previous spring with my Masters, I needed to enroll in something, so I enrolled in a math education Masters. It's a great field, but not really for me. I signed up for it just to be eligible to play football. I didn't take any math education classes. I signed up for reading courses with some professors that I was already doing research with, so it was like I wasn't taking any classes at all, which is just what I wanted. I wanted to focus on football my

As a Baltimore Raven

last semester, because ideally I was going to the NFL.

FNL: *So now it seems the dichotomy between football and academia is getting stronger and stronger.*

JU: It is. It started out very mild. I do a little bit of math, I do a little bit of football, but how good am I at either? I don't know. It turns out I'm very good at both, but it all kind of feels the same to me. I was drafted by the Baltimore Ravens in the fifth round.

FNL: *That's pretty high, fifth round.*

JU: It's not bad. I was drafted as a center. Centers usually aren't drafted very high.

FNL: *And what about academia?*

JU: Well, I was not in any math programs during my first year in the NFL. I was focusing on football. I was still doing some research with professors I know and doing some reading and things on my own. But after my first year, I very much missed the academic culture. So I applied to MIT.

FNL: *Did you apply just to MIT?*

JU: Just to MIT.

FNL: *Did you have any connections or know people who were connected to MIT?*

JU: I didn't really. I looked at different math programs and I thought MIT was the best one for me. I was accepted, and I started going to school here while playing in the NFL. Because I was playing pro football, the MIT Math Department was very understanding. They let me start that spring semester, 2016, instead of the following fall semester.

FNL: *So now you're playing in the NFL and attending MIT. And that football/academia dichotomy – how do you think it affected you?*

JU: Truthfully, I was never concerned about it. I never really experienced any problems from either side. I think this is either one of my good qualities or one of my very bad qualities. I don't really care what people say. I say: This is what I'm going to do and you can say what you want about it.

I love MIT. I took four classes my first semester just because I saw all these amazing PhD courses and I couldn't choose among them. I ended up being advised by Michel Goemans, who's now the Department Head. He wrote one of the most beautiful papers I'd ever seen, on the max cut. He always has time for me, and he really emphasizes learning. I am very thankful to have him as my advisor.

FNL: *So the spring semester ends and it's back to football.*

JU: Yeah. Leaving MIT was hard because I loved it here so much, and frankly I've never been happier anywhere else.

FNL: *Right. So, you're here for spring and summer and . . .*

JU: No, just spring. During summer I've got football training.

FNL: *Right. And when you leave here there are no side courses when you're playing football the way it was at Penn State.*

JU: No, that fall I took a course in probability theory and a reading course too.

FNL: B*ut you're not here.*

JU: I'm not here, but I send in my assignments via correspondence while playing my third year. Then the season ends in January and I come back to MIT. I've got my qualifying exams as soon as I get back at the beginning of February. So I'm studying like crazy as soon as the season ends. I pass my quals, am working with Michel, and am still training for football. Meanwhile, I'm thinking, do I want to go back to Baltimore? I'm really loving things at MIT.

FNL: *Have you ever had any injuries?*

JU: I was lucky. I've had some hip injuries. I've broken some fingers. My fingers don't look the best. I had a concussion one year. I did something to my MCL, no, PCL – I don't remember. One of the CLs. I separated my AC joint one year. These are small.

FNL: *What about money? Were you financially secure from your NFL salary?*

JU: Let me see. I made about two million from the NFL, but I also had income from endorsements, speaking engagements, things of that sort.

FNL: *Just from being an NFL player?*

JU: The endorsements and appearances had to do a lot with the fact that I was so unique. Offensive linemen don't usually get those endorsements.

FNL: *So the NFL money frees you from having to worry about getting money from MIT.*

JU: And I'm so thankful. I loved my time in the NFL. It's an amazing thing to be able to play at the elite level, and I'm thankful for the money I was able to make. I'm not a billionaire, but I'm at a point where I'm financially stable. I don't ever need to worry about money. I buy things like math books and coffee. I don't own a car. I live in Cambridge and I walk to work.

FNL: *So it's the end of the spring semester of your second year at MIT and it's time to go back and play football.*

JU: And I have a child on the way, too. I am very happy at MIT. So I decide to retire from pro football.

FNL: *Well let's back up a little. I read that when you had the concussion you found you couldn't do the math for a while.*

JU: It's natural when you get a concussion. I mean it was a little frustrating – more than a little. It was frustrating.

FNL: *Did it scare you? Did you think about the findings on CTE?*

JU: No, it didn't really scare me. I knew that my brain was going to recover. The CTE stuff, it's one of those things where the rate of CTE in the NFL is not zero percent, and it's not 99%. It's somewhere in between. It's not surprising. I didn't spend a lot of time wondering about it. I just said to myself, it is what it is.

FNL: *So you'd say that your decision to quit football had to do with MIT and your family, not any kind of concern about your physical health?*

JU: Well, I wouldn't say zero concern. I began to care a lot more about my longevity. I'd say it was really two things. One, I loved MIT and I just didn't want to spend time away from it anymore. I wanted to focus on becoming a very good mathematician. And two, I started caring about longevity. I wanted to be able to walk my daughter down the aisle and things like that.

FNL: *Do you have any regrets about playing professional football and possibly risking your future?*

FNL: *So you'd say that your decision to quit football had to do with MIT and your family, not any kind of concern about your physical health?*

JU: Well, I wouldn't say zero concern. I began to care a lot more about my longevity. I'd say it was really two things. One, I loved MIT and I just didn't want to spend time away from it anymore. I wanted to focus on becoming a very good mathematician. And two, I started caring about longevity. I wanted to be able to walk my daughter down the aisle and things like that.

JU: In hindsight, would I have done anything different? No. I loved my time in the NFL. I'm proud of being able to play the sport at the elite level. I started playoff games and played against the world's best. I'll have those experiences for the rest of my life, and I don't regret them. Now, though, I'm ready to move on and focus on math. I have math goals. I love being here. If I had it my way, I'd love to be a professor here.

FNL: *What are your math goals?*

JU: One, I'd like to do good research. I'm drawn both to problems that have importance in our world, and problems that are interesting for their elegance. I want people to look back and say, "John Urschel, he did some things."

FNL: *Would teaching and research be the way to do that?*

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John Urschel Interview
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JU: Right now I'm doing some research. I also want to inspire young people in mathematics. And there is something that I don't ever talk about – but maybe I should. I'm Black. I like the fact being Black has nothing to do with how good of a mathematician I am or how people perceive me as a mathematician. I fully believe that, and it's a beautiful thing about math: it's very merit-based. I believe that's true in the majority of sciences.

But one of the realities is that the percentage of African Americans in fields like mathematics is pretty low. And if you look up famous African American mathematicians, the majority of them are famous for being the first African American to do something, instead of for the work they did. The first African American to get a PhD; the first African American to get a PhD from Yale; the first African American woman to do this or that. And you know what? I'm thankful for those pioneering people. But what I'm really looking forward to is the day when being an African American mathematician doesn't really mean much. I want to be a person who does something and who just happens to be African American. I am aware that I have some responsibility there. I don't take it lightly.

FNL: *Thank you so much for sharing that.*

JU: Of course. I don't like talking about it much, because I don't like bringing attention to differences. I can't wait for the day when it's just not a thing. I can't wait for the day when the idea of having a conference and awards for African American mathematicians sounds absolutely ridiculous, almost as ridiculous as having a conference and awards for Caucasian American mathematicians.

FNL: *For years MIT has been concerned about increasing the number of underrepresented minorities at the Institute – both students and faculty. Have you explored participating in that type of activity?*

JU: I'm aware of the problem, but I don't know how to fix it. I do a decent amount of outreach, visiting schools, trying to do things, but I actually try to do these things irrespective of race, color, or background. I try to inspire all young people in mathematics, including African Americans. It's a tough subject, and I might not be the right person to talk to about it. I haven't studied racial inequality or diversity initiatives. But here I am. I'm a mathematician, and I'm African American. I've been in the national spotlight, and there aren't many like me.

FNL: *And you're a role model. You can't help but be one.*

JU: Yes. I want to do good things not only for my own sake. I'd like to be a mathematician who is remembered for his work, adding to the list of Black mathematicians who are known for good results.

FNL: *So what are your goals for the future now that you've retired from professional football and are a full-time PhD candidate?*

JU: My goal is to prepare to be a good mathematician. I will probably do a post-doc somewhere, and then see what places will have me.

FNL: *After that what kind of work? What are the job opportunities for mathematicians?*

JU: I want to stay in academia, so I'm only looking for academic positions. I love it here at MIT, so when I'm done with my post-doc and I'm applying to places, if MIT would have me, I'd come back in a heartbeat.

FNL: *And what are the job opportunities for mathematicians outside of academia?*

JU: Mathematicians often get hired on Wall Street and by tech companies: your Amazons, your Googles, your Yahoos. I believe the NSA claims that they're the single biggest employer of mathematicians in the country. But did I mention I really love MIT? [LAUGHTER]

FNL: *Anything else you'd like to say?*

JU: Just that I wake up in the morning and I say to myself: Where else would I rather be? What else would I rather be doing? And there's nowhere else in the world I'd rather be. There's nothing else I'd rather be doing. That's just a beautiful thing.

FNL: *Well thank you, John, for your time.*

JU: Thank you, it's been fun.

"Voodoo Science" at MIT?

Michel DeGraff

LUNCHTIME ON WEDNESDAY, October 25, 2017, started with a typical scene at MIT's Faculty Lunchroom at the Ray and Maria Stata Center. At one large round table nearby: A group of students sitting with one faculty member explaining some difficult scientific concept and related innovations in technology. But one word kept coming up and drawing my attention: ". . . Voodoo. . . Voodoo. . . ." So I listened more closely, and heard things like: "This is a beautiful proof, but there's some *Voodoo* in that equation that no one can figure out. . . ." then "This machine worked, then some *Voodoo* happened, and it broke. . . ." At that point, I began wondering if I should consider my MIT colleague's use of the word "Voodoo" as a micro aggression against Black lives, Black cultures, etc.? Or, perhaps, this was simply another banal instance of the English language borrowing words from other languages, in this case from my native Haitian Creole – just like English has borrowed words such as "salsa" from Spanish and "voila" from French and "eureka" from Greek?

As I processed these thoughts I felt knots in my throat and stomach, and I could no longer swallow my food. I was reminded that I have long tried, with relatively little success to date, to have some MIT colleagues and students question the use of the word "Voo Doo" in the title of MIT's humor magazine. This title was chosen some 100 years ago, clearly as a racist insult against Blacks in my native Haiti and in the U.S. Indeed, the inaugural issue of MIT's only "humorous" magazine reads:

"The very name under which the Being makes its appearance, is clothed in mystery, for Voo Doo is that name given to certain magical practises, superstitions and secret rites prevalent among the Negroes of the West Indies, and more particularly in the Republic of Haiti. We need not, however, travel so far to find references to the Voo Doo. In our own southern states, before the Civil war, voodooing was generally practised among the slaves, and voodoo doctors were common.

While the great mass of their professed art was a rank imposture, still they possessed enough of devilish skill to make them wholesome objects of dread. Their incantations and spell workings were always conducted in secret, no one being allowed to witness the more occult and potent portion of their ritual."

(From: ***http://web.mit.edu/voodoo/www/archive/pdfs/1919-Mar.pdf.***)

Historians such as Laurent Dubois, in his book *Haiti: The aftershocks of history*, have documented one reason why Voo Doo practitioners became "wholesome objects of dread." It's because their religion (yes, Voodoo, or more accurately, Vodou in Haiti), alongside the Haitian Creole ("Kreyòl") language, was a source of solidarity among the enslaved Africans. Vodou and Kreyòl helped these Africans, from various ethnic and linguistic groups, unite their forces and military know-how in order to launch and win the only successful slave revolution in history.

This revolution started at the end of the eighteenth century when it was unthinkable that Black lives could ever matter. At the end of that epic revolution, the Haitians won their freedom after fighting against some of the most powerful European armies – from France, Spain, and England. In so doing, the Haitians proved that Black lives did matter, and that Blacks too entertained profoundly enlightened ideas of universal human freedom and dignity – ideas at odds with the colonial world order whereby everything African (i.e., the Africans' intellect, culture, language, religion, etc.) was deemed inferior vis-à-vis the ideals of the European "enlightenment."

As it turns out, it was the Africans who ended up teaching the slave owners in colonial Haiti and their sponsors and philosophers in Paris what "liberté, égalité, fraternité" really meant. Indeed, though the French revolution had "liberty, equality, fraternity" as slogan, these concepts were not taken to hold universally, especially when they risked undermining France's profits from Haiti, which, then, was the most profitable colony on earth, from slave labor! Therefore, the enslaved Africans and their Creole descendants in Haiti were not, and could not be, considered free, equal, and siblings to the French. Yet it is these very Haitians who, as they abolished slavery and created the first Black republic in modern times, gave "liberty" and "equality" and "fraternity" their true universal meaning. Haiti's 1804 Declaration of Independence, with its desiderata of freedom and equal opportu-

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"Voodoo Science" at MIT?
DeGraff, from preceding page

nity for *all*, went squarely against the wishes and the profit motives of France and other slave-holding powers in Europe and the Americas, including the U.S., where "pursuit of happiness" excluded the Blacks whose personhood was legally reduced to "three-fifths" of that of the Whites. So Haiti had to be punished, and punished it was, in many ways, including an indemnity paid to France for "lost property" – such as the monetary value of the very slaves who fought and won to liberate themselves! This indemnity amounted to what is now worth tens of billions of dollars.

Returning to the present and to that MIT Faculty Lunchroom in October 2017: I approached the dining table of my unwittingly Vodou-bashing colleague, and I politely introduced myself as a Haitian faculty at MIT Linguistics (***http://linguistics.mit.edu***). Then I explained to him and his students that, although the English word "Voodoo" would have it otherwise, its Haitian cognate "Vodou" refers to the ancestral religion of millions of Haitians.

Some of the students giggled at my explanation, but my MIT faculty colleague unhesitatingly rushed to say that he meant no offense. He said that he "only used 'Voodoo' with the meaning of 'not understandable'. . . ." Then he added that he does not understand other religions either. I asked him whether one could similarly have the English language use the words "Christianity" or "Judaism" with the same derisive connotation as "Voodoo" in "Voodoo equation," "Voodoo technology," "Voodoo Economics," "Voodoo Science," etc. I think he got my drift, as he earnestly apologized.

Why has Vodou been so "denigrated" for centuries, especially through European and American racist propaganda and various kinds of intellectual and visual trumpery, some of which has infiltrated our everyday language, including conversations among well-meaning MIT scientists? In the analyses of many scholars, the anti-Vodou prejudices of the past two centuries are rooted in the "dread" inspired by the eighteenth-century Haitian revolution against the French colonial system, followed by the "dread" inspired by the Haitian resistance to the U.S. occupation of Haiti from 1915 to 1934. Both the French colonial system and the U.S. occupation were steeped in racist rhetorics and practices. Between these two events, the Vatican, in 1860 (some 60 years after refusing to recognize Haiti as an independent country), signed an accord (a "Concordat") with the Haitian government in order to "Christianize" the country. Such "Christianization" included murderous anti-Vodou campaigns (so called "anti-superstition campaigns"), alongside a broader campaign to turn Haitians into "colored Frenchmen," a campaign that entailed a pathology of "collective Bovarysm" still evident in Haiti today. This pathology was analyzed by Haitian anthropologist Jean Price-Mars, in his classic *Ainsi Parla L'oncle: Essais d'ethnographie*. Max Beauvoir, Rachel Beauvoir-Dominique, Patrick Bellegarde-Smith, Jean Casimir, Joan Dayan, Leslie Desmangles, Carolyn Fick, Jerry and Yvrose Gilles, Laënnec Hurbon, Claudine Michel, Kate Ramsey, et al. have described related historical and sociological patterns with great insight. Anti-Vodou sentiments are even found in picture books for children, such as the one by Dav Pilkey with the title *Ricky Ricotta's Mighty Robot Against The Voodoo Vultures From Venus*, where the word "Voodoo" is synonymous with "vicious." Now this book's French translation is teaching Vodou bashing for White Supremacy among French-speaking children as well (***http://www.facebook.com/michel.degraff/posts/10155919729283872***).

Why has Vodou been so "denigrated" for centuries, especially through European and American racist propaganda and various kinds of intellectual and visual trumpery, some of which has infiltrated our everyday language, including conversations among well-meaning MIT scientists? In the analyses of many scholars, the anti-Vodou prejudices of the past two centuries are rooted in the "dread" inspired by the eighteenth-century Haitian revolution against the French colonial system, followed by the "dread" inspired by the Haitian resistance to the U.S. occupation of Haiti from 1915 to 1934.

So the European "dread" of Vodou and of all things perceived as "African" has had a profoundly negative impact on Haiti and its (mis-)representations in popular culture. This is due both to direct actions by France and the U.S. and to the internalization of these mis-representations by Haitians themselves, especially the country's anti-Vodou and Francophile élites. So much so that even our national Kreyòl language, though spoken by every Haitian, is considered secondary to French, which is spoken fluently by very few.

Today, through the work of practitioners, activists, artists, and scholars, both Vodou and Kreyòl are becoming more accepted. In 2003 Vodou was recognized as an official religion of Haiti. Before that,

in 1987, Kreyòl was legally recognized as the sole national language of Haiti and as co-official with French. However, French is still treated de facto as the single official language in the formal domains of education, justice, government, etc. So, there is still much work to be done. I am a co-founder of the MIT-Haiti Initiative, which is working with Haitian educators to modernize and democratize Haitian pedagogy. The systematic use of Kreyòl is indispensable for this improvement and, indeed, for all national development and for the respect of human rights in Haiti (***http://linguistics.mit.edu/linguistics_haiti***). A big part of our work is aimed at helping Kreyòl gain the recognition and stature it needs to function as an efficient tool for quality education and for development.

Of course I understand that my MIT colleague's and others' casual use of the word "Voodoo" is not, and could not be, responsible for all the ills that have befallen Haiti. But, from my perspective, this disparaging use of the word functions as a reflex, and as a painful reminder, of centuries of ongoing structural and symbolic violence against masses of Haitians, against our ancestors and against other Black and Brown people worldwide. So, my hope is that more of us, at MIT and beyond, will become linguistically (and socially?) more enlightened and empathetic around the use of historically and politically loaded Kreyòl-derived words with African origins, such as "Voodoo."

Perhaps this article will encourage readers to take another (or a first?) look at the history of Haiti and its entangled relationship with the U.S. and Europe. I think that there's value in realizing that, as far back as the eighteenth century, Haiti, partly thanks to Vodou (and to Kreyòl as well), is where the Black Lives Matter movement really started (***http://www.facebook.com/BlackLivesMatter/***) – long before it was called that in the U.S.

And, who knows, perhaps the Executive Board of MIT's *Voo Doo* magazine will, at long last, consider renaming their "humor" magazine – apparently the only university-based "humor" magazine named after a religion. . . .

Can "Black Lives Matter" if our languages, cultures, religions, etc., do not matter?

Manbo Maude Evans and Master Drummer Jean Marseille during their visit to my MIT Black Matters class, on March 23, 2017, where they described basic principles of Vodou. The word "Milokan" on the blackboard, in the upper left of the photo, is a very important word: it refers to the pantheon of the Vodou divinities (the "lwa" of Vodou).

Michel DeGraff is a Professor of Linguistics in the Department of Linguistics and Philosophy, Director of the MIT-Haiti Initiative, and a founding member of Haiti's Haitian Creole Academy (Akademi Kreyòl Ayisyen) *(degraff@mit.edu)*.

Author's Note: I have shared in a DropBox folder a selection of Vodou-related readings, including some of those that I usually assign to students in MIT's "Black Matters" class: ***https://www.dropbox.com/sh/5c51iii37ss9tgc/AAC-frvlZKt3PK_EwkA39rL7a?dl=0***. Also of note is the stunningly beautiful, if somewhat dated, documentary video in English by Maya Deren: "Divine Horsemen: The Living Gods of Haiti": ***https://youtu.be/hX3ZMDR2N5c***.

Designing the First Year at MIT

It's not a faculty committee, it's a class

Ian A. Waitz

Colleagues,

IN MY ROLE AS VICE CHANCELLOR, I have been charged with exploring and enhancing the first year undergraduate experience (FYE) at MIT. Inspired by leaders in the Undergraduate Association, we (a team of around 30+ faculty, students, and staff) are taking an atypical approach. Rather than standing up a faculty committee, we have put our efforts into developing a new course.

Launching in the spring of 2018, "Designing the First Year at MIT" will be open to all enrolled undergraduate and graduate students. The design-intensive course will use the MIT First Year Experience as a way to teach different methods for how to examine an issue, understand it better, tease out what constituents prioritize changing, design alternate prototypes, evaluate those, and iterate.

What's neat (and I think unprecedented) is that the class will incorporate design methods from across all of MIT's Schools. Right now, the FYE core team is soliciting feedback from faculty, students, and other stakeholders ("What are the objectives of the first year and how we are meeting them?"), conducting a full literature and data review (including internal student survey and alumni data as well as past curricular reform efforts), and using an outside marketing firm to do fieldwork and focus groups.

Members of the class – and we'd love it if as many students signed up as possible – will use this initial landscape analysis as a starting point and then conduct stakeholder needs identification that will involve reaching out directly to the MIT community.

The course, led by faculty in our Systems Design and Management (SDM) program, will be team-based and project-focused, offering students an opportunity to present the audacious and incremental options developed to senior MIT stakeholders, perhaps even members of the MIT Corporation.

Why are we taking this approach? At MIT, we've learned our students are the best advocates for the change they want to see at MIT. And ultimately, we hope what we learn in the fall, and what comes out of the class, will serve to make MIT's first year the best that MIT can offer to future students.

As said, we want as broad a representation of students as possible to help ensure the class, and the broader effort to enhance the first year, is a success. I'd encourage you to promote it far and wide.

My thanks,
Ian A. Waitz, Vice Chancellor
(*iaw@mit.edu*)

Quick Facts

• Course #: 2.S991(U), 2.S990 (G), CMS.S63 (U), CMS.S99 (G) | 12 units (3-0-9) | HASS-E credit for undergraduates | Eligible for design minor credit

• Monday, Wednesday, 9:30-11:00 am in 56-154 (lectures) and 66-168 (breakouts)

• Instructors: Bryan Moser, Bruce Cameron, Glen Urban, Maria Yang, Justin Reich

• Advisors: Peko Hosoi, Ian Waitz, Dan Frey, Justin Steil, Susan Silbey, Dennis Kim

Subject Description

• Open to all enrolled undergraduate and graduate students

• Uses the MIT First Year Experience as the basis for teaching design methods from across all five of MIT's Schools

• Team-based and project-focused, students will present their audacious and incremental options to senior MIT stakeholders

Engage

• For students . . . If you would like to learn more about the course and want to express your interest in enrolling, sign up for a future reminder when the course opens for registration in December. ***http://bit.ly/fyeupdates***

• For faculty and other members of the MIT community . . . We encourage you to promote the course to students, attend future information sessions, and send your ideas to: *fye-comms@mit.edu*.

More Information: ***https://ovc.mit.edu/fye_course/***

letters

Correcting the Record of the GSC

To The Faculty Newsletter,

THANK YOU FOR RAISING THE important issue of graduate student housing in last issue's Editorial [*MIT Faculty Newsletter*, Vol. XXX No. 1, September/October 2017]. However, we saw that some of the work and motives of the MIT Graduate Student Council (GSC) were misrepresented, and we would like to take this opportunity to correct the record. The GSC has been extensively working on graduate student housing for many decades, and that work will continue indefinitely. As you described, we recently intensified our work last spring, and our decisions on this matter, as in everything we do, have been guided by what we believe to be in the best long-term interest of MIT graduate students.

The following is a brief overview of our activity this year. At our June 7th General Council Meeting, we passed a resolution authorizing GSC Officers and Committees to advocate for graduate housing in conjunction with the Volpe site redevelopment. This resolution passed with a vote of 36 to 2, but it in no way suggested that a zoning petition was the most effective course of action, though that was one option we considered. To inform our advocacy, we completed a preliminary Graduate Housing Survey in July. The resulting data suggested there was significant unmet need for graduate housing not captured by the 2014 Clay Report or other Institute data sources.

We took our findings to the MIT administration and were encouraged to hear that they were already looking at graduate housing and were willing to jump-start the effort with a new Graduate Housing Working Group, announced August 3rd. We understand that some, including the FNL Editorial Board and a number of our graduate student colleagues, were not impressed with the promise of another working group on this important issue. However, we knew that an organized process would be needed to gather additional data and develop detailed plans for new graduate housing. We had our own concerns about the previous group and process that led to the Clay Report, but we had good reason to believe the new group would be the real deal. Its membership included key decision-makers and 50% graduate students, and it employed rigorous methodology to fulfill its broad but concrete charge.

The Working Group's Interim Report confirmed additional need for graduate housing and offered insights on how to fulfill that need. The administration followed up with a significant commitment on October 16th to expand MIT's graduate housing stock by 950+ beds over the 2016-2017 baseline. At least 500 of those beds will come from construction of a new graduate dormitory. The administration also committed to partner with the GSC to comprehensively review the graduate housing situation every three years, which will help ensure the issue remains a top priority at MIT.

We look forward to continuing our work to improve graduate student housing at MIT. Please feel free to reach out to us at *gsc@mit.edu* with any questions or suggestions.

Sincerely,
Sarah Goodman, GSC President
Lisa Guay, GSC Vice President

Praise for Susan Silbey

To The Faculty Newsletter:

BRAVO TO SUSAN SILBEY for her profound and provocative (dare I write "awesome"?) welcome message from the Faculty Chair ["The Fundamental Challenge Facing Higher Education Today," *MIT Faculty Newsletter*, September/October, 2017].

With MIT and Kendall Square becoming more and more the "epicenter of innovation" (to quote our campaign Web page at <***betterworld.mit.edu/epicenter-innovation-mit-kendall-square/***>, it seems appropriate to consider in our educational practice the relation between innovation and improvement, and to remember (as in Jill Lepore's article to which Susan refers) that "disruptive" has not been generally considered a positive attribute.

Susan refers to the work of Ben Snyder on the hidden curriculum. She might also have mentioned Ben's oft-repeated comment that we focus on giving our students an outstanding education in problem solving, but the more important issue might be problem setting. Perhaps in today's alignment around MIT's campaign to "build a better world" we might also make room for building a more thoughtful world.

Hal Abelson
Professor of Computer Science and Engineering

Teach Talk

Python With First Year Physics: What We Taught and What We Learned

Paola Rebusco
Analia Barrantes
Bettina McGimsey
Leigh Royden

The Experimental Study Group (ESG) is MIT's original freshman learning community, founded in 1969 and focused on teaching the GIRs in a small-class, discussion-based, and contextualized learning environment. Peer teaching is a cornerstone of ESG, based on the tenet that teaching and learning are symbiotic processes and that students learn in a profound way through teaching others.

IT'S DANGEROUS TO TAKE *mechanics alone. Take Python too!* This is the title of a new Freshman Advising Seminar offered by ESG in the fall of 2016. The origins of this seminar go back several years, growing out of discussions among ESG staff about how to offer computational learning as part of the first year curriculum at ESG. We envisioned an experimental seminar that would link the learning of Python to the subject matter of one of the GIRs, but the prospect was somewhat daunting. While ESG teaching staff had broad expertise in science and mathematics, we felt a lack of skills needed to teach a programming language.

In the fall of 2014, we found a teaching partner in ESG's pool of undergraduate Teaching Assistants. Joe Griffin ('16) was a Course 6 major with a strong physics background and the requisite programming expertise in Python. A junior at the time, Joe had already taken ESG's teaching seminar (a "how to teach" seminar required of all first-time TAs at ESG) and served as a TA for a number of physics courses with glowing reviews. When we suggested that he co-teach a "physics with Python" seminar with ESG physics instructors, Drs. Paola Rebusco and Analia Barrantes, he was more than enthusiastic. Over the course of that semester, the three collaborators developed the first iteration of Python-with-Physics, a six-unit seminar called *Programmable Physics: E&M and Python*.

8.02 Weekly Topic	Python Topic
Vectors visualization	Installation (Python, numpy, matplotlib, Vpython, *git*)
Charges, Fields	Variables, Data Types, Functions
Gauss' Law	Control Flow (while, for, if)
Electric potential	Numpy, matplotlib
Conductors, Capacitors	Other Data Types: dictionaries, functions, and classes
Current, Ohm's law	Project 1: DC Circuits
Magnetic field and Force	File I/O, integration algorithms
Biot-Savart's law	Errors and debugging
Biot-Savart's law/Ampere/induction	Syntactic sugar in Python
AC Circuits	Project 2: AC Circuits
EM Waves	Matlab (chosen by students)
Application: analyzing solar wind data from Wind	Excel (chosen by students)

E&M and Python was designed to introduce students concurrently or formerly enrolled in the Electricity and Magnetism GIRs (8.02/8.022) to algorithmic thinking. It was also designed to reinforce their understanding of E&M by writing Python code to model and visualize physical systems. Typical of all ESG seminars, it was small, with only 10 students, and included freshmen, sophomores, juniors, and seniors. Although the seminar was aimed at students with little or no programming experience, the students who enrolled had varied programming experience ranging from none to advanced.

We planned weekly topics that related to what the students were learning (or had learned) in the E&M classes (see table), and all three teachers were present in the classroom to help students master the material. As lead instructor for the class, Joe Griffin presented the in-class material, which was initially a challenge for him. Joe reports: "For the first few lectures I had to do full rehearsals of the lectures with Analia and Paola but after a while I was able to get by on abbreviated rehearsals." The seminar was a success, with a number of students who were inspired by Joe and were eager to help with teaching the seminar in future semesters.

Since the pilot in the spring of 2015, ESG has run the *E&M and Python* seminar twice, in the spring terms of 2016 and 2017. Each of these seminars was taught entirely by undergraduates, with supervision by Dr. Rebusco and Dr. Barrantes. The student instructors included at least one student who had taught the seminar previously. That student would be the lead teacher and helped to train the newer student instructors. In spring 2016, Joe Griffin was the lead instructor, working with two other undergraduate instructors, Lisa Zahray ('17, Course 6) and Lotta Blumberg ('18, Course 6). In spring 2017, Lisa Zahray and Caity Looby ('19, Course 8) were the lead instructors.

After the first offering of *E&M and Python* seminar in spring 2015, we wanted to experiment with introducing Python to a large mainstream class. Together with Physics Professor Deepto Chakrabarty and Senior Lecturer Peter Dourmashkin, we developed an experimental workshop for 8.01 TEAL for the fall of 2015. During the two-hour workshop, students applied Python to some of the basic concepts learned in 8.01 (circular motion, universal law of gravity, and Hooke's law) to model the landing of a spacecraft (the Philae lander) on a comet (the Rosetta mission, ***https://www.nasa.gov/rosetta***). The students were excited to see how 8.01 physics concepts could be relevant to real world problems. Although the two-hour time constraint limited the students from thinking through a problem systematically from beginning to end, as was possible in the *E&M and Python* seminar, the workshop exposed the inexperienced students to basic programming skills while the experienced students were able to program more difficult parts of the problem and use their programming knowledge to help their peers. In addition to experimenting with physics concepts, the students learned that writing computer simulations was achievable, and could even be fun.

In May of 2016, MIT created the Computational Study Group (CSG) to study how MIT undergraduates learn "algorithmic reasoning and computational thinking" and to recommend ways to incorporate digital learning into the general curriculum. We were eager to learn more about this effort and to merge our experience with the *E&M and Python* seminar with experiences of others all across the Institute. In recommending that there be a new computation requirement for MIT undergraduates, the CSG recognized the same issue that we had struggled with at ESG, that many departments wishing to add programming components to classes would not necessarily have the requisite computational expertise. They also recognized that avoiding student-overload was critical in the design of courses that would be adding a computational-thinking component.

In the fall of 2016, with the support of Dean Freeman and Professor Kim Vandiver, we decided to teach the E&M/Physics seminar in a new context by offering it as a freshman advising seminar. *It's dangerous to take mechanics alone. Take Python too!* was taught by Drs. Rebusco and Barrantes and the now-very-experienced Joe Griffin. ESG Director and EAPS Professor Leigh Royden also contributed to the physics and advising side of the seminar. Although she was experienced in programming, she had never used Python and began learning Python alongside the students, sharing their excitement and difficulties.

> Midway through the term we held a whole-class discussion to assess the class pace and material. The students made it clear that our teaching approach was not working well for many of them. For some of these first-semester freshmen, the class was moving far too fast, and we were giving too much homework. . . .

Twenty first-semester freshmen registered for the course. Like the E&M/Python seminar, the advising seminar was advertised as teaching basic level programming in Python, but the students who enrolled had a wide range of physics and programming backgrounds. The initial setup of the seminar was similar to the E&M/Python seminar, coordinating programming activities with the mechanics topics that the students encountered in their physics GIRs. To address the students' varying levels of physics and programming knowledge, we organized the class into three groups that offered different problems at varying degrees of difficulty. Each class began with an hour of lecture for all the students, during which we reviewed physical concepts and introduced algorithmic ideas and Python syntax. During the second hour the group would split into the three groups, one at each of three tables, with one instructor and one undergraduate TA per table. Students with little program-

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Python With Freshman Physics
Rebusco et al., from preceding page

ming experience were provided with a skeleton of a script to guide them in the process. For students with a strong programming background, we provided more open-ended questions, allowing them to write their own scripts.

Midway through the term we held a whole-class discussion to assess the class pace and material. The students made it clear that our teaching approach was not working well for many of them. For some of these first-semester freshmen, the class was moving far too fast, and we were giving too much homework (our seminar had several hours of homework while many FASs have virtually none). The students did feel that the seminar was helping them to understand the physics in their GIRs, but students with little or no previous programming experience found that it was too difficult to learn new physics and new computational skills at the same time. For students with a stronger programming background, the course was not challenging enough. The students felt that it was not important for the physics implemented in the seminar to be concurrent with what they were learning in their GIRs. They would have preferred to work on physics topics that they had already mastered (e.g., kinematics) while learning new algorithms and Python skills during the first weeks of the seminar. After becoming more proficient in Python, they felt that they were ready to move on and apply their programming skills to new concepts in physics.

Based on this feedback, we revised the course format for the last five weeks of the term. We reintroduced pre-programming, syntax-free activities in which the students had to challenge each other with writing, solving, and optimizing basic problems, such as ordering or searching the minimum from a list of numbers. Next, the students divided into small groups of two or three to design a physics-based video game. The only requirement was that the game should contain some of the physics concepts learned in 8.01. The students worked in these groups with the support of instructors and TAs both in and out of the classroom. The change in the classroom atmosphere was palpable as we moved to project-based learning conducted by small teams of students with mixed programming abilities. The concept of "fun" emerged as the students challenged themselves to create games that involved real physics and creative visualization. The experience helped to solidify the students' understanding of the underlying physics concepts, improved their programming and teamwork skills, and left the students with a feeling of accomplishment.

The process through which we developed this freshman advising seminar addresses some of the challenges identified by the CSG, particularly in terms of the potential lack of programming expertise needed to teach such a class at a departmental level. Our experience shows that working with student instructors who have computational backgrounds and previous TA experience is a viable solution. With supervision and coaching, undergraduate teachers can become valuable partners, and even lead teachers. This approach greatly benefits the undergraduate teachers, giving them teaching skills, self-confidence, and a sense of giving-back to the students who follow after them. Peer instruction within the class, where students with more programming experience helped those with less programming knowledge, benefited both the advanced and less advanced students.

At present, the biggest challenge to a computational course requirement is avoiding overload for incoming freshmen when they are adjusting to the fast-paced and demanding MIT classes in their first semester. One way to address this might be to give the students two hours of structured class time and two hours of project-based work with TAs per week, with no homework. We are considering experimenting with such a format at ESG.

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These Physics-with-Python seminars are but a few of the many innovative seminars we teach at ESG every year. ESG's six-unit seminars, open to all students at MIT, cover a huge range of topics and provide an excellent vehicle for experimenting with curricula and teaching modalities. We would like to invite you, faculty from every MIT department, to work with us at ESG in teaching new seminars and exploring new teaching strategies, including experimentation with computational and algorithmic thinking in context. If you are interested in brainstorming about, teaching, or co-teaching a seminar at ESG, please contact Dr. Paola Rebusco at *pao@mit.edu*.

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Bettina McGimsey is a Development Associate in the Experimental Study Group *(mcgimsey@mit.edu);*
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A Bit More About Paul and Priscilla Gray

Clarence Williams
Mary Rowe

WE WRITE TO ADD A FEW LINES to the outpouring of respect and affection for Paul Gray. We were given an unparalleled opportunity to work for a leader who helped MIT to make progress with respect to race and gender – and for all human concerns. (Mary's 1973 job description as Special Assistant in the President's Office read in its entirety: "To help make humans more visible at MIT." Each of us worked with everyone at MIT who wanted to contact us – men and women, in every kind of position, and of every race, religion, and ethnic background.)

Chancellor Paul Gray (from 1971-1980) and then-President Jerome Wiesner had been working on issues of inclusion for years before they hired us. Notably, with respect to socio-economic class, national origin and religion, as well as race and gender, MIT had and continues to have a long history of "inclusion" achievements. The MIT Archives and *MIT News* include many such initiatives by MIT Presidents and senior leaders.

We write here just a little of what we knew personally of Paul Gray's "diversity accomplishments" from 1972 to 1990, as he assisted Jerry Wiesner and then became President (from 1980-1990). This article includes only a few examples of his efforts to build bridges by allowing and encouraging others to transform MIT into a more welcoming and nurturing environment for people of color and women. (We apologize to everyone who will tell us how much we left out.)

Some early changes at MIT were momentous. Beginning in 1972, MIT was one of the first, if not *the* first major institution to designate departments (as well as Lincoln Laboratory), in addition to the overall university, as responsible for affirmative action. ("The departments are where hiring and promotions originate," said Gray). In 1973, MIT seems to have been the first major organization anywhere to enunciate a harassment policy – one that explicitly included sexual, racial, and religious harassment but declared that *harassment of every kind is unacceptable* to the mission of a research university.

In the 1970s, MIT equalized pension plans with respect to gender and provided early forms of parental leave, for men and women – before being required by law to do so. Paul Gray personally oversaw studies of salary equity and hundreds of changes in salary for women and people of color. He oversaw major changes in recruiting, recruitment standards, financial aid, student housing, and student support, working hard on issues of race and gender for undergraduates and graduate students. As one specific example, Paul was an undergraduate advisor to a gay student whose leadership led to a number of changes for the then LBG community. Wiesner and Gray worked hard to make MIT more accessible for students, faculty, and staff with disabilities and different modes of learning, for our many ethnic, international, and faith-based communities, and for veterans.

Priscilla and Paul Gray hosted events at the President's House and the third floor of Building 10, many of them for students, seemingly almost every day of the year – providing a sense of caring and family. Walking the halls with either of them was a slow process as faculty, staff, and students stopped them to talk. Paul and Priscilla could and did often greet custodians, faculty wives, research staff, athletic, support and medical staff – and many others – by name, wherever they went on campus.

Paul personally monitored the promotion cases of minority and women faculty, and faculty known to be gay. Wiesner's and Gray's leadership was felt in many domains. Numerous Title IX changes occurred throughout Athletics and in other areas. The Medical Department began a number of services for women, and childcare and daycare resources were expanded. Part-time jobs and flexible-

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A Bit More About Paul and Priscilla Gray
Williams and Rowe, from preceding page

time possibilities were initiated. Many Women's Forum and Working Group recommendations were adopted, including adding support staff to many committees. (And support staff members were suddenly included in the MIT telephone directory.)

MIT affinity groups (there were at least 100 such groups over 18 years) made hundreds of suggestions and recommendations in support of inclusion, and in support of a more humane environment for everyone. In one six-year period (1972 to 1978) there were ~600 small and large changes to policies and procedures and structures at MIT as a result of suggestions and recommendations.

Almost all of Paul's educational and professional experiences were at MIT. However, he said that it was as a leader that he began to work hard to learn about race in America. He noted in 2002 that it was not until 1968 – when he was asked by President Howard Johnson to work with the newly formed Task Force on Educational Opportunity of Black Students regarding their demands to increase the presence of black students, black faculty and administrators, and financial support – that he had an opportunity at MIT to have a true leadership role. He noted, ". . . I came away with an understanding I had had none of, two years before – as best a white person *can* understand what it was like to be black in the United States in the era before and during the civil rights revolution. It was a powerful experience."

His early experience and constant learning created a legacy of policies to bridge cultural, racial, religious, and ethnic divisions at MIT. We heard many times from him how Paul's bridging leadership was inspired by early experiences. As examples, with respect to race, he left a foundation of bridging practices inspired in part by learning in1968 from his interactions with MIT black students. With respect to women at MIT, Paul was deeply impressed by a Women's Forum group, when they addressed the Academic Council in 1972. Paul occasionally spoke of what he learned serving with one of the first Jewish university presidents. Paul, supported always by Priscilla, emerged with an interior empathy for justice, fairness, and understanding of individuals who were so different from him as a white professional male in higher education.

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At the request of a group of MIT black administrators, President Wiesner and Chancellor Gray made the birthday of Martin Luther King, Jr. an official Institute holiday in 1976 – 10 years before a federal holiday was established. President Wiesner and Chancellor Gray established MIT's MLK annual celebrations and programs beginning in 1975.

President Gray hosted and actively participated in two of the most successful national conferences on "Issues Facing Black Administrators and Faculty at Predominantly White Colleges and Universities" in 1982 and 1984, each drawing approximately 800 administrators and faculty from across the country. As host President, he noted in the 1982 Proceeding, " . . . This conference provided a national forum for the discussion of the current economic and social climate in this country. . . . Analysis of these issues in the context of the problems faced by black administrators (and black faculty) who seek to contribute and participate fully in predominantly white institutions provided keen insight into the priorities and apparent direction of American higher education. Such insight is essential if we are to succeed in reversing the trends that promise to undo the work of decades." (Proceedings, First National Conference on Issues Facing Black Administrators (Faculty) at Predominantly White Colleges and Universities, 1982, p.1).

As President and Chairman of the Corporation (from 1991-1997) Paul forthrightly supported the idea that became The Blacks at MIT History Project (***https://libraries.mit.edu/mithistory/impact/diversity/blacks-at-mit-history-project/***), with initial funding for its startup in 2001 and beyond. This Project has searched for dialogues with MIT constituents – on campus and across the country – about their perspectives on the MIT black experience extending over a 50-year period. President Charles M. Vest continued to support the Project in many ways, with early involvement, wise counsel, and advocacy. With their support, *Technology and the Dream: Reflections on the Black Experience at MIT, 1941-1999* (MIT Press) was published to acclaim in 2001. President Vest noted in its Forward, "This volume sets before us the challenges, triumphs, and failures of a great research university as it has grappled with its role in bridging the racial divides that continue to plague our nation."

From the research related to the publication of *Technology and the Dream*, a new concept emerged – Bridge Leadership. As Chairman of the Corporation, Paul supported the idea to explore this concept by examining and identifying potential qualities of bridge leaders in higher education. This Project supports interviews using reliable criteria at 16 major universities, including MIT and Harvard, Dartmouth, Emory, and Occidental. The Bridge Leadership Project is in process and continues to be supported by President Rafael Reif.

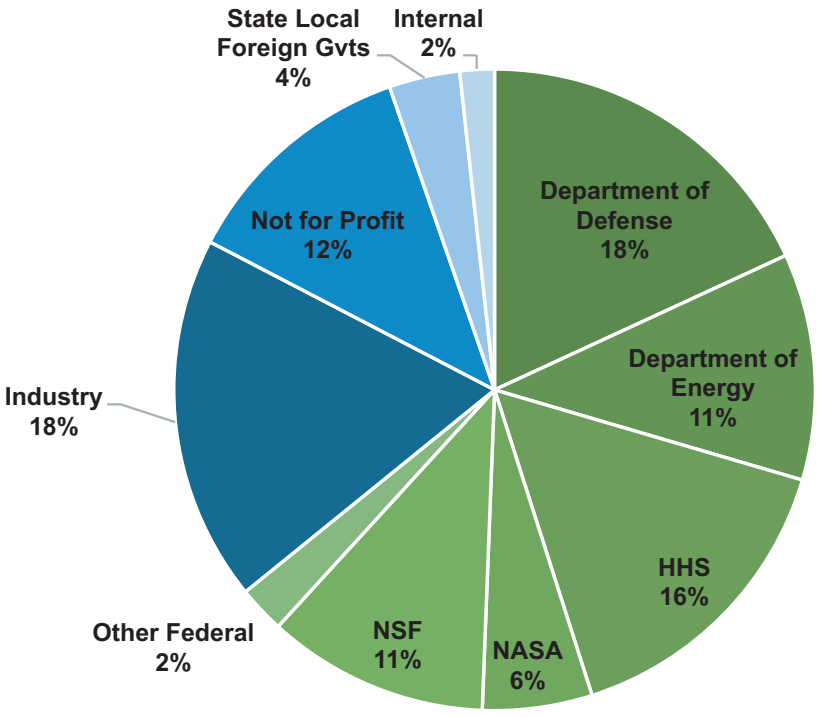
In one of his last reflective interviews about his longstanding involvement with minority affairs, Paul said, "This institution, over the last 35 years, has become much more representative of society than it was in my early days at MIT. It's not there yet – the job is not done – but it is more representative, more a home, a satisfactory home, to underrepresented minority people than it used to be. That comes about by a change in attitude, which over a period of time changes the culture of the institution. Institutions like this have to change. If we don't change, the society is going to leave us behind. You and I won't see it, but America in 2100 is not going to be a predominantly white society, and if the institutions don't evolve, they'll die." (Bridge Leader Project Transcription, Interviewee, Paul Gray, by Clarence G. Williams, April 3, 2002, p. 23.)

Paul never thought he had done enough. He remained concerned about all forms of discrimination and the stresses experienced by each person at MIT. In 2014, he said of pace and pressure, "I never laid a finger on it; we have not done enough to support the lives of MIT men and women as human beings." However, the Paul Gray we knew worked hard to design a better future. Paul was a very dear friend, mentor, and guiding force for many decades. Paul and Priscilla Gray – together with the leaders and teams that they inspired and supported – improved the lives of people of color and whites, women and men, in ways that have left an important legacy at MIT and beyond. ■

Clarence Williams joined MIT in 1972 as Assistant Dean of the Graduate School, was named Special Assistant to the President and Chancellor for Minority Affairs in 1974; was named Ombudsperson in 1980; was named to additional duty as Acting Director of the Office of Minority Education, 1980-82; was named for additional duty as Assistant Opportunity Officer, 1984-1994; and became Adjunct Professor in 1992 at the School of Architecture and Planning (*cgwm@mit.edu*);

Mary Rowe joined MIT in early 1973 as Special Assistant to the President and Chancellor for Women and Work, was named Ombudsperson in 1980, and became Adjunct Professor of Negotiation and Conflict Management at the MIT Sloan School of Management in 1985 *(mrowe@mit.edu)*.

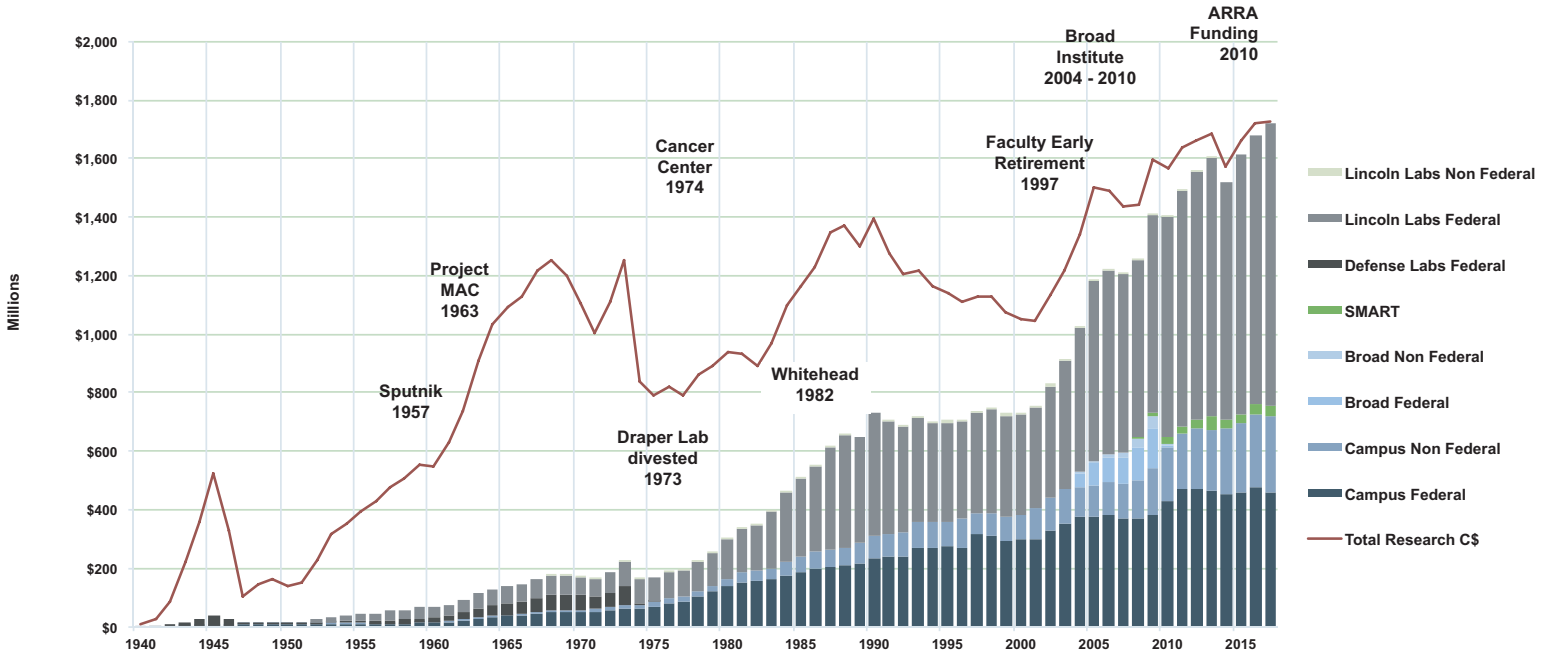
M.I.T. Numbers
FY2017 Campus Research Expenditures



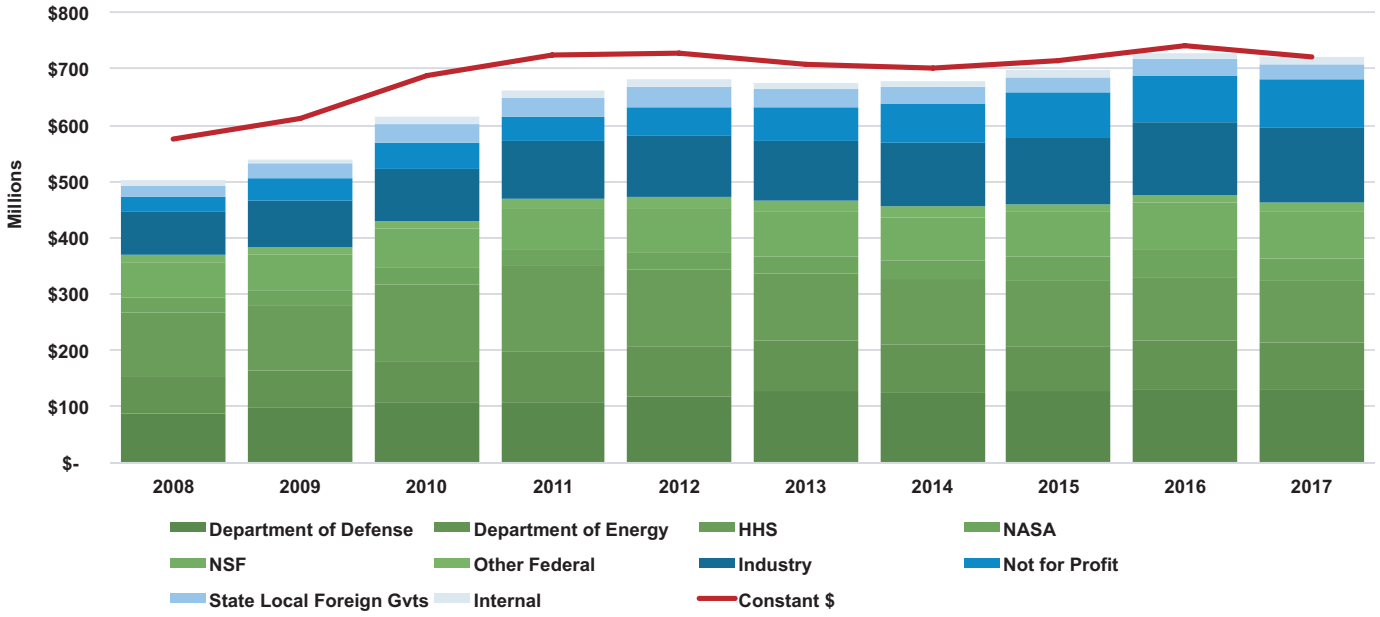
Source: Office of the Provost/Institutional Research

M.I.T. Numbers

MIT Research Expenditures



Campus Research Expenditures Excluding the Broad Institute



Source: Office of the Provost/Institutional Research