MIT Faculty Newsletter

in this issue we take a look at *MITx*. Beginning with the Editorial and Teach Talk pieces below, we continue with "Freshman Advising and *MITx*" by Faculty Chair Sam Allen (page 4) and "*MITx:* MIT's Vision for Online Learning" by Provost Rafael Reif (page 8). We also offer "FPC Subcommittee to Review IAP" (page 10); and "Glass at MIT: Beauty and Utility" (page 12).

Teach Talk
A Contrarian View of *MITx*: What Are We Doing!?

Woodie Flowers

I LOVE MIT BUT confess being frustrated. The *MITx* announcement added to my frustration. As outlined below, I argued against OpenCourseWare (OCW) before it was announced. I was not persuasive and lost the debate. My view of how MIT should take advantage of the digital revolution was unusual then, but is more common now.

Twelve years ago, I wrote a book chapter for the Forum on the Future of Higher Education. That chapter, titled "New Media's Impact on Education Strategies," is posted here (*net.educause.edu/ir/library/pdf/ffpiu016.pdf*). From the chapter introduction:

"Higher education should have a larger positive influence. A change in the basic vehicle used for learning, from archetypical courses, lectures and textbooks to

First Generation Project Launched

Miri Skolnik and John Belcher

MIT IS PROUD OF its commitment to First Generation students. First Generation students, those whose parents do not have college degrees, comprise 16% of the MIT student population, approximately 800 students in total (undergraduate and graduate).

The critical importance of this population surpasses its sheer numbers, as this segment of the student body plays a vital role in the richness of an MIT education. Moreover, the presence of First Generation students reflects one of MIT's key values: its dedication to guaranteeing equal and affordable access to higher education. Yet, in spite of their essential contribution to MIT, this population has been largely invisible as a distinct group – until now.

In the spring of 2011, the Office of Undergraduate Advising and Academic

Editorial
MITx

THE PROVOST'S *MITX* announcement stimulated a little buzz in the halls, but not nearly enough. We could well be at an educational tipping point, where during the next 10 years MIT's educational mode will change more than it has in the past 100.

Out of the buzz, limited as it has been, has come a spectrum of opinion. On one end you hear, "Distance education is when we pretend to teach and the students pretend to learn." On the other end, "Our students have been on-line since kindergarten; much of what they have learned, they have learned in front of a computer; we have an obligation to work with them in cyberspace, along with fantastic opportunity to find new and better ways to engage with all their learning faculties." The distinction between the distance comment and the online comment

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Photo credit: *Page 1,* Wikimedia Commons; *Page 9,* Elizabeth McGrath

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is important. MIT has not announced it is entering the distance education business – the Provost was very clear about that when he wrote:

"*Many members of the MIT faculty have been experimenting with integrating online tools into the campus education. We will facilitate those efforts, many of which will lead to novel learning technologies that offer the best possible online educational experience to nonresidential learners. Both parts of this new initiative are extremely important to the future of high-quality, affordable, accessible education.*"

Global and distance-education will be a natural by-product of that portion of online education that we need to do anyway.

Going online may free us all up to have more one-on-one and small group interaction with our students. It may free us all up for more one-on-one and small group interaction with our graduate students. But it may not free us up at all. One senior faculty member speculated that going online, with a global component, will be 1,000 times more work than writing a book. It was not clear if he was using hyperbole.

A better reason to go online is that learning online is different, sometimes better, sometimes not as good. Watching a simulation of the earth turning red hot after a big asteroid collision is engaging and inspiring; watching someone speed-read PowerPoint slides in a lecture is soporific. What's new is that technological advances have gone beyond the threshold where online is not just a poor shadow of the real thing but rather a different thing with relative advantages and disadvantages, just as movies are different from live theater, with relative advantages and disadvantages.

Of course, the Provost is right. We have been experimenting – most conspicuously, from the online perspective, with OpenCourseWare, but also conspicuously with TEAL, and going way back, with the Education Division experiment; and less conspicuously in dozens of subjects taught in many innovative ways, many of which include impressive online demonstrations and tutors.

But we need more than individual initiative with individual subjects if we are to be in online education what we are in the areas of engineering, science, and the arts in which we do research.

Where might all this end up? Everyone is excited by or worried about the future because enormous change is within the envelope of possible evolutions, especially with the introduction of certificates.

Here is one example: It's 2030. Many other universities are on board and use our system to deliver their online education to whoever wants it, any time, anywhere, any place, at any pace, at any age, with a certificate for successful skill acquisition. Many smaller universities have become *certificate schools* and proudly advertise themselves as such:

No boring lectures ever. We help you put together a plan that educates you by the best and brightest from all over the world. You learn physics and computer science from MIT; philosophy and Sanskrit from Harvard. Art history from Yale. All our faculty live within a five-minute walk from the center of campus. They are always around to help you through the rough spots, to learn with you rather than teach you. And of course, we have a great emphasis on project-based learning. Once you have gotten through a combination of 32 certificates and projects, you graduate. We don't care how long it takes; take time off whenever you want.

And who's to say it wouldn't be a fine experience, better than that most students experience today? And it would be far less expensive, because someone else pays the star performers who populate the global subject catalog. It's the first real improvement in academic productivity since Gutenberg.

So what should we tell a prospective student about why it is best to have an experience at MIT, possibly an experience much like that offered at the certificate schools? There are at least three reasons, all of which have always been in place, none of which has to do with skill acquisition. First, you will be around people who are off-scale smart, just like you, which is humbling while you are here and empowering afterward. Second, you will develop a network of off-scale smart people you will carry with you for the rest of your life. And third, something or someone will inspire you in a way that will change your life.

MITx will not, after all, deliver the benefits of human-to-human interaction via late night talks, camaraderie-developing activities, accidental conversations, in-the-office critiques, UROPs, probing debates, intellectual wrestling, and other on-site elements of a university education in general and an MIT education in particular.

Not yet anyway. And too bad we have no way of measuring the benefits of all those resident experiences other than anecdotally from our own experiences or the testimonies of others.

The future is murky, and change may happen fast: The 50-minute lecture may turn obsolete overnight, yielding to 12-minute video chunks; we may lead, or we may fall behind; we may resist, or we may embrace; but one thing is clear, we better not ignore.

No one has a crystal ball good enough to give us much of a clue about what actually will happen, but we all need help make it happen right and make it happen here, because it is the kind of challenge we like and have an obligation to take on. The Provost has lit a match. It is up to all of us to catch fire, to participate, to innovate, to promote, to argue, and to help MIT manage its way through a time that will be partly exciting, partly scary, but certainly defining. ■

Editorial Subcommittee

From The Faculty Chair
Freshman Advising and *MITx*

Samuel M. Allen

MOST PEOPLE, ESPECIALLY OUTSIDE MIT, are surprised to learn that I teach blacksmithing at MIT. I was inspired to do so in 1984, when it struck me that I could learn much from the craft that would add to my knowledge of my professional field, physical metallurgy. That's proven true over and over again.

My department, Materials Science and Engineering (MSE), is one of the Engineering School's smaller departments, and we have striven to build our undergraduate enrollment for as long as I've been on the faculty. The challenge has been to inform students that the field of materials science and engineering exists, what it's about, and that it abounds with professional opportunities. While the field's prominence has gradually increased, we still actively recruit MIT freshmen.

When I conceived of the idea of introducing blacksmithing, it was an easy sell to my department head, on the basis that it could help "spread the word" about MSE by first engaging students with the craft, then weaving into the experience explanations of how the material they were working with was behaving, and finally broadening the discussion to the MSE field. I first offered a class during IAP, then it became a Freshman Seminar, and it was among the first group of six Freshman Advisor Seminars that were launched in 1986, largely through Travis Merrit's efforts. Much of the initial success of the seminar was due to the early

involvement of a highly skilled local blacksmith, Forrest Whitcher. Over the years, I've had the assistance of a Technical Instructor and often an Associate Advisor, who had previously been my freshman advisee.

Over the past 25 years the Freshman Advisor Seminar has been taught nearly every year, as has an IAP blacksmithing activity. We've certainly gained a significant number of majors in Course III via the classes we offer, so the effort has paid off for my department, too.

Combining freshman advising with a six-credit seminar was a brilliant idea. A challenge of being a "traditional" freshman advisor (advising without having your advisees in a seminar) is establishing a relationship and maintaining regular contact with one's advisees. The seminar meets weekly, and as a Freshman Advisor Seminar leader you get to see all of your advisees, as a group, at least once per week. I meet with my advisees for an hour in my office, and for an evening blacksmithing session in our forge. The informal setting of the forge makes a great environment for developing close relationships with my advisees, and among the advisees themselves.

As we look to the future, interactions of the type I'm experiencing with my freshman advisees need to be a greater part of the residential educational experience. I'm certain that most faculty have interests that could be shared with freshmen or other groups of undergraduates

that would foster advising/mentoring relationships and contribute significantly to our students' education. Creating opportunities for these relationships to develop and flourish needs to become an Institute priority. Faculty need to know that their investment of time and energy into the advising/mentoring sphere is highly valued.

As Chair of the Faculty, I've been surprised to see how broad the spectrum is for annual reporting of our individual activities and contributions to "Institute Commons," such as teaching GIR subjects, freshman advising, reading freshman admissions folders, serving as a Housemaster, and UROP supervision. Some departments ask for such data specifically, and others don't. By asking for the data, the message is conveyed that contributions to Institute Commons are valued. If the data are collected, how are they evaluated? Are they important enough to factor into annual salary increases? To help make a successful promotion case? If faculty participation in these activities needs to be increased, these questions need definite answers.

Integrating *MITx*
In December, MIT announced the bold extension of OpenCourseWare (OCW) into *MITx*. OCW has delivered online course materials for free, and *MITx* aims to provide an environment for free online learning. A major question about the potential impact of *MITx* is this: If *MITx* is

wildly successful, what is the future of the residential education experience that has been our mode of teaching for MIT's entire history? If students can master course materials online for free (or for a modest "credentialing" fee), what incentives would there be for anyone to invest in an expensive residential college education? In short, what will be the "added value" of a residential education that will justify a residential student's financial investment?

Considerable effort over the past four years has been directed at envisioning the ways in which technology-enhanced learning will affect MIT's residential educational experience, but from my perspective this has been a challenging task that is by no means conclusive. There has certainly been focus on what technology-enhanced delivery of courses might look

like, but not so much on the long-term impact on our residential students. But the long-range projection that distance learning may ultimately jeopardize the viability of our current residential education experience has received insufficient attention, in my view.

Clearly activities like the blacksmithing Freshman Advisor Seminar (and many of our current offerings) cannot be replicated in an online learning environment. I believe we need to consider the inherent value of the activities that can't be replicated online, and to diversify our offerings to ensure that every student participates in them. This can't be left to chance. The Institute's value system needs to ensure that faculty who develop innovative ways to learn and emphasize interpersonal experience are appropriately recognized.

Currently, 72 faculty serve as Freshman Advisors, and 27 lead Freshman Advisor Seminars. We are approaching the time of year when the Dean for Undergraduate Education and others will make appeals for more faculty to participate in freshman advising. The specific satisfactions that come from being a freshman advisor have not been the focus of this article; rather, the aim has been to emphasize the need for activities like the Freshman Advisor Seminar to proliferate. That said, participating in freshman advising is extremely important and holds the potential for great personal satisfaction. Please give the Dean's invitation to participate serious consideration. ■

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Teaching this spring? You should know …

the faculty regulates examinations and assignments for all subjects.

Check the Web at *web.mit.edu/faculty/termregs.html* for the complete regulations.
Questions: Contact Faculty Chair Sam Allen at x3-6939 or *smallen@mit.edu*.

No required classes, examinations, exercises, or assignments of any kind may be scheduled after the last regularly scheduled class in a subject, except for final examinations scheduled through the Schedules Office.

First and Third Week of the Term
By the end of the **first week** of classes, you must provide a clear and complete description of:
- required work, including the number and kinds of assignments;
- an approximate schedule of tests and due dates for major projects;
- an indication of whether or not there will be a final examination;
- grading criteria; and
- a clear presentation of your expectations about working alone or working with other students.

By the end of the **third week**, you must provide a precise schedule of tests and major assignments.

For all Undergraduate Subjects, Tests Outside Scheduled Class Times:
- may begin no earlier than 7:30 P.M., when held in the evening;
- may not be held on Monday evenings;
- may not exceed two hours in length; and
- must be scheduled through the Schedules Office.

For subjects in which there is testing during the final examination period, no assignment may fall due after Friday, May 11.

For subjects in which there is not testing during the final examination period, at most one assignment may fall due between May 11 and the end of the last scheduled class period in the subject.

Collaboration Policy and Expectations for Academic Conduct
Due to varying faculty attitudes towards collaboration and diverse cultural values and priorities regarding academic honesty, students are often confused about expectations regarding permissible academic conduct. It is important to clarify, in writing, expectations regarding collaboration and academic conduct at the beginning of each semester. This could include a reference to the MIT Academic Integrity Handbook *web.mit.edu/academicintegrity/*.

interactive electronically portable media, could be the seed for positive change in our entire education system. These new media learning materials could enhance the academy's contribution to society by improving learning efficiency and expanding higher education's impact. Both the quantity and quality of learning could increase.

"Properly designed new media materials can improve K–12, residential, distance, and life-long learning. In their highly developed form, these learning materials would be as elegantly produced as movies and video games and would be as engaging as a great novel. They would be 'smart' to both accommodate the learners' varied styles and yield data to facilitate their continuous improvement. Very popular and required topics provide the most attractive initial opportunities. For example, codified knowledge such as calculus or foreign languages would be most easily adapted to semi-automated training systems."

I have given many presentations about a new education system. One example from 2007 was part of the Engineer of the Future Summit (***www.youtube.com/ watch?v=F84LtXvLTtA***). At 25 minutes into the lecture, I focus on my dream system for education and training.

I believe that education and training are different. To me, training is an essential commodity that will certainly be outsourced to digital systems and be dramatically improved in the process. Education is much more subtle and complex and is likely to be accomplished through mentorship or apprentice-like interactions between a learner and an expert. The "Holy Grail" of true education is exemplified by the professor-doctoral student interaction, UROP, courses like 2.009 Product Engineering Process (***web.mit.edu/2.009/www/***), and the FIRST robotics competitions (***www.usfirst.org/***).

Education is the source of comparative advantage for students. Education is worth its cost. Person-to-person training often is not worth its cost.

To clarify a bit: Learning a CAD program is training while learning to design requires education; learning spelling and grammar is training while learning to communicate requires education; learning calculus is training while learning to think using calculus requires education. In many cases, learning the parts is training while understanding and being creative about the whole requires education.

In the United States, our "education" system is choking to death on a failed training system. Each year, 600,000 first-year college students take calculus; 250,000 fail. At $2000/failed-course, that is half-a-billion dollars. That happens to be the approximate cost of the movie *Avatar*, a movie that took a thousand people four years to make. Many of those involved in the movie were the best in their field. The present worth of losses of $500 million/year, especially at current discount rates, is an enormous number. I believe even a $100 million investment could cut the calculus failure rate in half.

Why Not OpenCourseWare?

I argued that the program that became OpenCourseWare should have focused its original $100 million estimated budget on two topics. I suggested microbiology and electromechanical systems as examples. Had we done that, I believe we would have accelerated changing education. We decided, however, to assume that the world could hardly wait to see our huge pile of PDFs, PowerPoint presentations,

classroom locations, teaching assistant lists, and other assorted bits of information about our courses. We now have a large database developing digital rot and becoming increasingly irrelevant. It is unlikely OCW will be systematically Facebooked, or Twittered, or HTML5ed, or deFlashed. It is an expensive and unsustainable "free" system.

We have spent about $40 million over 10 years. Powered by MIT's incredible

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brand recognition, OCW has made an impact and been celebrated with awards. About seven years after OCW was launched, Salman Khan, our next graduation speaker, started posting a coherent, concise set of tutorials that were inexpensively produced but backed by a pedagogic philosophy. When I last checked Google Trends, the Khan Academy's (***www.khanacademy.org/***) search hits exceeded OCW's by an order of magnitude. Khan designed a product that teachers and students want and need. His modestly-produced presentations are used by millions. Starting with zero brand recognition, he has matched or exceeded OCW's impact. What might we have done with $40 million, 10 years, and the most powerful technology education brand on the planet?

Now *MITx*?

I believe the "sweet spot" for expensive universities like MIT is:

1) access to highly-produced training systems accompanied by
2) a rich on-campus opportunity to become educated.

MITx seems aimed at neither.

The administration presentation I heard focused on "easy" and "maybe during a summer" to design the online course through which we could sell badges. [See "'Badges' Earned Online Pose Challenge to Traditional College Diplomas" (*chronicle.com/article/Badges-Earned-Online-Pose/130241/*) a recent article in the *Chronicle of Higher Education* that references the Khan Academy and *MITx* as examples of badge vendors.] There was no discussion of a commitment to quality, sustainability, or elegant production.

We seem to have decided to offer "courses" rather than participate in the exciting new process of replacing textbooks with more effective training tools.

Apple just announced their software system to support new-media texts. If they do for textbooks what iTunes did for music distribution, the tipping point will be passed.

All early indicators are that E. O. Wilson's *Life on Earth* (*eowilsonfoundation.org/*) is the current gold standard for digital biology texts. The first two chapters are already offered through Apple's new e-text system. These chapters are impressive. The entire text will require years of work by a talented team and already represents an investment of millions.

If I were a biology professor aspiring to publish a basic biology text, I would abandon the effort. Maybe having my *MITx* nonresidential badge seekers use Professor Wilson's e-text would be my best bet for having an impact outside MIT. *MITx*, as I understand it, distracts MIT faculty from textbooks' future.

As was the case for OCW discussions, holding the for-profit world at bay seems to be one of the unwritten strategic goals of *MITx*. One also hears whispers about getting ahead of other great universities.

I hope:

• We will do nothing that is motivated by negatives.

Our strategic goal will be to provide profoundly robust education to our students, not to beat another university at anything.

• We will do nothing to undermine for-profit organizations that are trying to help educate young people.

• We will compete based on the quality of the students' residential experience.

Cultural inertia and capital investment will be our enemy. We tenure faculty for writing paper documents. We have thousands of lecture hall seats. Shifting to asking students to do things rather than just listen will be hard. The rooms are wrong. The schedules are wrong.

• We will engage in both competition and cooperation with other institutions with similar goals.

MIT is in a powerful position to influence industry, governments, and other academic institutions to work together to develop systems that enhance education. Our hubris is getting in the way. How many of us would be enthusiastic about joining a project titled *Stanfordx*? How about sharing production teams rather than software platforms? Production costs are a bigger barrier than software. Society cannot afford massively redundant digital texts. We could divide the jobs among universities and industry partners.

Paper textbooks, 50-minute monologues, and passive learning are on the way out. We should be working toward making that transition as fast and efficiently as possible by working with, rather than against, others.

Our students face interesting lives. To offset what they consume, those in the developed world must be at least twice as productive as others. An education that doubles one's effectiveness is a high bar. It must change mindset, convey information, and enhance creative thinking.

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In 2000, during a fit of excess optimism, at the end of that book chapter, I wrote:

Imagine an article in USA SOMEDAY, *October 21, 2010:*

Somewhere, USA: *Today Dr. Barbara Runningbear departed for Stockholm to receive the first Nobel Prize for Education. In an emotional send-off party, her faculty colleagues hailed her as a strong leader who courageously supported the University Learning Alliance's (ULA) early entry into 21st century education. The ULA was described as the most powerful educational force on the planet, with over a billion e-text customers. Some students attending residential universities, especially in developing countries, claim to be influenced more by ULA than by the faculty at the university they attend. The celebration flowed into the streets as Dr. Runningbear boarded a limousine.*

A Nobel Prize in Education? Why not? All other Nobel Prizes are the children of education.

I hope we get back on schedule and help restore the prestige once enjoyed by higher education. ∎

Woodie Flowers is Pappalardo Professor Emeritus in the Department of Mechanical Engineering *(flowers@mit.edu)*.

MITx: MIT's Vision for Online Learning

L. Rafael Reif

ON DECEMBER 19, 2011, approximately 10 years after announcing OpenCourseWare, MIT announced its next step in opening our educational doors to the world. *MITx* is a new learning initiative that will publish online interactive courses, and offer learners the opportunity to earn certificates of completion. MIT OpenCourseWare was the genesis of today's worldwide movement of Open Educational Resources, and *MITx* will follow in that tradition. *MITx's* technology is envisioned to:

- Organize and present course material to enable students to learn at their own pace;
- Feature interactivity, online laboratories, and student-to-student communication;
- Allow for the assessment of individual student work and enable students who demonstrate their mastery of subjects to earn a certificate of completion awarded by *MITx*; and
- Operate on an open-source, scalable software infrastructure in order to support continuous improvement and make it readily available to other educational institutions.

Within the MIT community, the response to this announcement has been encouraging: many students, faculty, staff, alumni, and Corporation members are excited by the possibilities *MITx* presents. Outside MIT, the reaction has been similarly positive: strong press coverage has signaled both interest in and enthusiasm for what MIT might do in online learning, and we are receiving streams of inquiries from people and institutions eager to be a part of *MITx.*

With a great deal of work now before us, this article summarizes the rationale behind *MITx* and briefly describes how MIT is approaching *MITx's* development.

Why Is MIT Creating *MITx*?

Three imperatives drive the creation of *MITx.*

First, MIT must always use or develop the best teaching and learning tools possible for our students. Toward that end, in 2007, we asked Daniel E. Hastings, Dean for Undergraduate Education (DUE) and Professor of Engineering Systems and Aeronautics and Astronautics, to explore the use of online technologies in our residential campus environment. Furthermore, the 2009 Institute-wide Planning Task Force included online technologies among its recommendations for residential and non-residential learners. Finally, in 2010 we charged MIT's Council on Educational Technology, co-chaired by Dan Hastings and Hal Abelson, Class of 1922 Professor of Electrical Engineering and Computer Science, to identify opportunities to integrate online technologies into the MIT campus environment with the objective of enhancing the learning experience of our residential students. In addition, and simultaneously, we charged an *ad hoc* committee chaired by Dick K. P. Yue, Philip J. Solondz Professor of Engineering, with exploring an expansion, domestically and globally, of MIT's educational leadership, excellence and impact through the use of online tools, and the offering of certification to nonresidential learners. We believed it was important to carefully and thoroughly assess and brainstorm the role of online

technologies with these two complementary objectives in mind.

These efforts provided the Institute insight into how digital technology can enrich learning. That insight led to the *MITx* concept and vision that now guides Anant Agarwal, Professor of Electrical Engineering and Computer Science and Director of MIT's Computer Science and Artificial Intelligence Laboratory, as he leads the development of the open source platform and the posting of the first *MITx* courses. Moreover, once *MITx* is up and running, it will serve as a laboratory for online learning: *MITx* will offer new opportunities to study how people learn best online – whether those learners are our on-campus students, university students elsewhere, or non-university learners – and how virtual communities of learners are built. Studies like these will be part of an MIT-wide research initiative on online teaching and learning. Key objectives are to further enrich the residential learning experience and to learn about online learning.

Second, *MITx* offers MIT the opportunity to shatter barriers to education. Only a tiny fraction of the world's population who are capable and motivated to learn MIT content has the privilege of attending MIT. We currently admit less than 10 percent of our undergraduate applicants: many more people have the capacity, motivation, and drive to learn our material than we can admit. At the same time, MIT content and knowledge are vast. They could be used to enrich and augment the education and livelihood of many learners who cannot attend MIT.

It is important to keep in mind that our campus residential model not only provides the best education environment to MIT students, but it is also at the heart of knowledge creation and dissemination. Without MIT, there is no *MITx*. Similarly, *MITx* is not MIT. Each offers a different educational environment and experience.

Third, MIT has the opportunity – and we feel that it has an obligation – to help preserve U.S. higher education as a public good by offering a not-for-profit option in online education. In the United States, we have dedicated public and private assets in enormous amounts to the public good of higher education. This commitment and dedication might change dramatically if privately financed, for-profit enterprises dominate the education-delivery vehicle of the future. *MITx* is a competitive alternative to proprietary higher education – and the time to establish it is now.

The Path Ahead

At this writing, Anant Agarwal and his team are hard at work developing, in prototype form, the first *MITx* course. As *MITx* launches, it will feature three important characteristics.

Community: While *MITx* cannot hope to replicate the educational experience that is found on our campus, it will work to create a new kind of virtual learning community, an "infinite campus." *MITx* will offer educators new ways of lecturing and doing demonstrations online, while also facilitating communication among learners. As learners begin to use *MITx*, we will learn how they connect and will work to ensure that connecting with others is a vital part of their experience.

Credentialing: The creation of an online learning platform provides the opportunity to allow students not only to learn, but also to demonstrate that they have mastered the content. Once we move out of the prototyping phase, we will begin to offer credentialing, at the level of the individual course, for a fee. We have not yet determined what that fee will be, but our objective is to make it affordable worldwide. We may create different pricing structures so that *MITx* is affordable in an equitable way to anyone in the world.

Open-source architecture: *MITx* courses will be built using an open-source software platform to allow our *MITx* development team as well as contributors from around the world to innovate and improve the platform infrastructure rapidly and build on each other's work. This will enable the platform to evolve and support learning experiences that are as rich and effective as possible. In addition to helping the *MITx* platform thrive, the open-source software approach may prove valuable to learning institutions around the world, because all of them will be free to use the open software infrastructure for their own online content.

In the coming months, *MITx* will focus on the development of the platform and the implementation of our first prototype course. Detailed relevant policies will be formulated, and plans to expand *MITx's* offerings will be outlined.

There is an enormous amount of work ahead of us, and we will not accomplish the entire *MITx* vision at once. Indeed, *MITx* will surely evolve over time in exciting ways that today we do not anticipate. The path ahead entails bold experimental risk-taking reflecting the best MIT values and culture. The objectives, if MIT achieves them, will dramatically improve the productivity of education and the access to quality education worldwide, and will transform the nature of our residential learning environment. These objectives are worth our efforts and commitment.

For more information and updates, please visit ***www.mitx.mit.edu/***. ■

L. Rafael Reif is Provost *(reif@mit.edu)*.

Memorial Service for Bob Silbey

A MEMORIAL SERVICE FOR Robert J. Silbey, former Dean of Science, and Class of 1942 Professor of Chemistry, will be held on Saturday, March 17 at 2 pm in the Brain and Cognitive Sciences atrium on the MIT campus.

Silbey was known for his leadership and political acumen as dean, his commitment to enhancing MIT's education and research, and his work in condensed phase theory and quantum biology, fields that he helped to pioneer.

Silbey joined the MIT faculty in 1966, becoming head of the Department of Chemistry in 1990 and director of the Center for Materials Science and Engineering in 1998. He took over as Interim Dean of Science in February 2000 and was named permanent dean the following year, a position he held until 2007 when he returned to his faculty position in the Department of Chemistry. ■

FPC Subcommittee to Review IAP

Aaron Weinberger

SINCE ITS INTRODUCTION IN 1971, Independent Activities Period (IAP) has seen significant growth in both the number of academic subjects offered and the number of students who enroll. IAP was established as a break from the rigorous academic routine of the fall and spring semesters. It was intended to offer opportunities for "creativity and flexibility in teaching and learning during which students are encouraged to set their own educational agendas, pursue independent projects, meet with faculty, or pursue many other options not possible during the semester. Faculty are free to introduce innovative education experiments as IAP activities."

Does this description still accurately reflect the nature of IAP? Has the evolution of IAP over the past 40 years been so great that IAP no longer meets the Institute's original intent? And, if so, is that a bad thing?

During the fall semester, to gain a deeper understanding of the evolution of IAP, the Faculty Policy Committee (FPC) met with Registrar Mary Callahan and Senior Associate Dean and Director of the Office of Undergraduate Advising and Academic Programming (UAAP) Julie Norman, whose office oversees IAP. In that meeting, the FPC reviewed data that illustrate the significance of the changes to IAP, in particular over the last 20 years. Since 1991, graduate student enrollment in IAP has increased by 273% and undergraduate enrollment by 131%. The number of graduate subjects offered has increased by 125% and undergraduate subjects by 59%. Almost 45% of all MIT students now take subjects for academic credit during IAP.

Relatedly, IAP has come to resemble the fall and spring terms in a number of ways. For instance, some departments now offer required for-credit subjects during IAP as part of a particular major. Also, during IAP the academic calendar defines the first day of instruction, students may preregister for subjects, subjects are evaluated, and grades must be reported to the Registrar at the end of the period. However, IAP continues to function like an *ad hoc* period: There is neither a registration process, nor an add/drop period, nor a formal advising role. Moreover, faculty rules governing the conduct of graduate and undergraduate subjects during the term do not apply.

Until its dissolution in 2000, the IAP Policy Committee – a presidential committee that consisted largely of faculty – examined policy matters and evaluated IAP within the context of the total academic program. The Committee on Curricula (CoC) and the Committee on Graduate Programs (CGP) now have responsibility for monitoring for-credit proposals for compliance. But there has been no comprehensive review of IAP since 2000. In light of the changes noted above, the FPC has charged an *ad hoc* subcommittee to examine IAP, with particular regard to the following questions:

- Is the high level of academic activity during IAP at odds with the flexibility and creativity that IAP was designed to encourage?

- Should required subjects be permitted during IAP? If so, should they be restricted to pass/fail grading?

- Should faculty rules governing the conduct of graduate and undergraduate subjects during the fall and spring semesters apply during IAP?

- Should there be a consistent rule across Schools and departments regarding the annual course load expectations for faculty who teach during IAP?

- Should IAP be shortened, thus allowing the spring term to begin and end earlier along with extending the reading period?

- Should a formal registration process and add/drop period be established for IAP?

- Should a formal advising element be added for the students enrolled in for-credit IAP activities?

The subcommittee will begin meeting early in the spring semester to discuss these issues. It will present a preliminary report to the FPC at the end of the term and a final report of its findings and recommendations early in the fall 2012 term. Professor Lisa Steiner of the Department of Biology has graciously agreed to chair the subcommittee, which will include faculty representatives from the FPC, CoC, CGP, and the Committee on the Undergraduate Program, undergraduate and graduate representatives, and designees from the Office of the Registrar and the UAAP. Professor Sam Allen, Chair of the Faculty and Chair of the FPC, will provide an update to the faculty at a fall 2012 Institute faculty meeting. ◼

Aaron Weinberger is HR and Faculty Governance Administrator *(aweinber@mit.edu).*

We Gotta Have HOPE

Alexander Slocum

January 12, 2012

Dear FNL Readers:

READING THE VOL. XXIV NO. 2 *Faculty Newsletter* catalyzed me to try to see if I could bring together different viewpoints that flowed from its pages into a more coherent vision for MIT's future. To start, I thought what are the Functional Requirements (FRs) of MIT? I started to create a list that coalesced into one simple FR that, if met, might take care of everything:

• Take in people with great *minds*, mix them with other great people and resources to help them realize their full personal and societal potential.

Next I thought what Design Parameters (DPs) are required to meet the functional requirements? Once again my ADHD++ operating system went wild; once again order was brought to chaos in my mind and for MIT with a single simple parameter:

• *Manus*

And what are the scientific, engineering, and humanistic aspects associated with the *manus*?

• The hands are filled with nerve endings that are connected to the brain, and the structure of the hand not only enables manipulation of objects, but also sensory input that helps to wire neurons to enable synthesis of ideas. The *manus* enables the mind and the mind enables the *manus*: It is humanity's demon/savior.

What is the history behind all this?

• *Mens et manus* is the *Cor* of humanity. It is what has allowed humans to become everything they are and can be: the good, the bad, the barren, and the bountiful. People invented tools and built shelters which protected them from the harsh environment, and then within the shelters their minds and hands worked in concert to create a symphony of ideas and products. The coalescence of these shelters into cities hastened the process. MIT was one of those shelters (for geeks!) and as the buildings multiplied, history repeated itself on a small yet grand scale.

What are the risks/countermeasures?

• History teaches us that every great civilization rises and falls. Thermodynamics takes no prisoners. Nature doesn't give a dam(n) (except maybe for beavers!). There is an approaching asteroid that will soon come online and wipe out the dinosaurs: The cost of MIT will soon become so great as we add ever more nifty physical resources we risk pricing ourselves out of existence. Great people launch great companies and send thank you checks, and companies license intellectual property….

What's next? I propose we shoot for infinity and beyond: We must ask not what MIT can do for geeks, but what geeks can do for MIT! We must use our minds to address the real last question, "How can we use chaos to achieve order?" I propose:

We the people of the Massachusetts Institute of Technology, in Order to form a more perfect world, establish truth, enable per-sonal development, provide for the common defense of our world, promote the general Welfare, and secure the Blessings of Liberty to all, do ordain and establish this vision for the future. That we here highly resolve that others shall not have created in vain, that this Institute under us all shall have a new birth of creativity, and that leadership of the geeks, by the geeks, for all people shall always have online HOPE:

For *Mens*

   Hands On Professional Education

For *Manus*

   Hands On Physical Education

For *Cor*

   Hands On Personal Education

We all claim to see the future coming, we all cry out Gimme Shelter, if we don't get some shelter, we are going to fade away, unless we come together to make rainbow stew underneath a sky of blue. The most important shelter we can build is one where all geeks of all types can come together to ask and answer questions by creating and building stuff. A shelter where our random vibrations enable us to bump into each other to catalyze further creativity by serendipity, until eventually the last question is asked and answered (and really great stuff gets made). Only then will we truly see the light. Chaos is the key to unlocking *hope.mit.edu.* ∎

Alexander Slocum is a Professor in the Department of Mechanical Engineering *(slocum@mit.edu).*

Glass at MIT: Beauty and Utility

Nancy Schrock

IN MIT'S GLASS LAB, students gracefully shape glowing, molten glass into works of art, while in an MIT research lab researchers explore the use of nano-sized glass stamps for tiny, precise biosensors to enable clinicians to test for disease.

Glass at MIT is ubiquitous. Since MIT's first classes in 1865, its labs have contained test tubes, retorts, vacuum lines, and vessels of all sizes and shapes essential to scientific work. Learning to blow glass was a standard part of a chemistry student's education, while architecture students studied its central role in the design and construction of buildings. Glassmaking is nearly 4000 years old, but scientists and artists today, like the alchemists of the past, remain fascinated by the "frozen liquids" that can be manipulated at high temperatures and cooled to rigidity.

A new exhibition by the MIT Libraries takes a historic view, tracing the evolution of glassmaking from the sixteenth to the twentieth century. It features a recent gift to the Libraries: the Charles J. Connick Stained Glass Foundation Collection, as well as rare books from the Institute Archives and Special Collections. Stunning stained glass windows, sketches, full-size drawings, tools, and objects from the Connick collection, the MIT Glass Lab, and the MIT Museum are on display along with video of artists working in the medium.

Glass at MIT: Beauty and Utility opened February 10, 2012 in the Maihaugen Gallery (14N-130) and is on view through July 2012. See *libraries.mit.edu/maihaugen* for hours and information. ■

Nancy Schrock is the Thomas F. Peterson (1957) Conservator, MIT Libraries (*nschrock@mit.edu*).
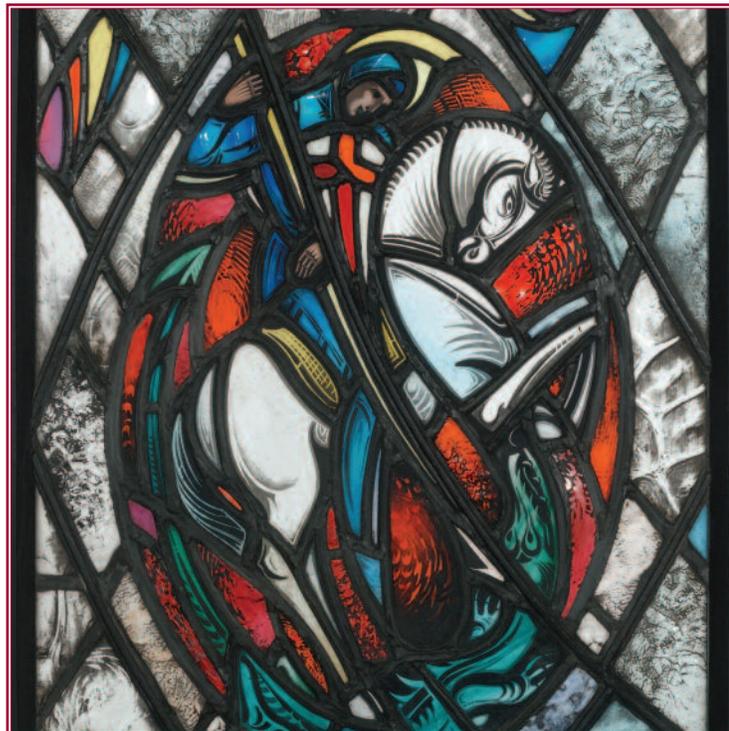
A stained glass depiction of St. George slaying the dragon by Charles J. Connick.
Photo Credit: MIT Libraries

Glass used in an MIT Research Lab.
Photo Credit: Stuart Darsch

Glass blowing in the Rad Lab (Building 52) during World War II. Photo Credit: MIT Museum

A glass blower in the MIT Glass Lab creating a glass pumpkin. Photo Credit: Forrest Whitcher

MIT Glass Lab pumpkin.
Photo Credit: P. Bailey

First Generation Project Launched
Skolnik and Belcher, from page 1

Programming launched the First Generation Project (FGP), in order to bring more visibility to the unique needs and remarkable accomplishments of these students (see the message from the FGP Student Executive Board in an accompanying article, page 15). A public forum now exists for these students to address their shared experiences, the challenges they face, and the collective resourcefulness they bring to bear as the "first in the family" to attain such achievement.

The need for such a forum was inspired by hearing students' personal stories. In our roles at Students Support Services (MS) and as a teacher in the GIRs (JB), we have found that many First Generation students grapple with their common challenges in isolation, believing that they are alone in their experiences. Our hope is that the First Generation Project, and the sense of community it provides, will help replace this isolation with an empowering sense of connection for these students.

Over the past year, important collective themes have emerged as First Generation students, faculty, and staff have come together at various events hosted by the FGP. These themes represent the following important lessons that:

• FG students often face pronounced financial hardships and concerns about providing for their family's well-being. This concern often influences their choice of major, the need to work many hours while in school, and the recurring dilemma of whether to stay in school, or go home and work full time to help support their families.

• FG students experience the challenge of navigating the university system on their own, without the specific first-hand knowledge that comes from parents who are college graduates, resulting in a lack of familiarity with how to approach professors, engage in professional networking, or know the unwritten norms

or "social script" that helps most students negotiate university culture. Many FG students reported that upon applying to MIT, their parents did not know where, or what, MIT was, nor would their parents have the opportunity to visit MIT until their son or daughter graduates.

• FG students often cope with a sense of alienation from peers who are more financially privileged and shoulder fewer family responsibilities.

• FG students often experience an increasing gulf between themselves and their own families, who do not share their growing exposure to new regions, new concepts, new populations, new resources, new technologies, and, at times, new value systems.

• FG often feel significant pressure to excel as the "first in the family" to make it to college, and the one who can provide social mobility to their family.

It goes without saying that in spite of these circumstances, FG students possess tremendous resourcefulness, survival skills, initiative, and self-reliance. Additionally, FG students often have a commitment to giving back to their communities, and a sensitivity to what their communities need.

From these FGP events came a resounding consensus that an ongoing, Institute-supported program was needed to address the concerns of this population. Since then, a Student Executive Board has been formed, with a faculty advisor (JB). If you resonate with this issue and would like to get involved in helping MIT become a more supportive place for First Generation students, please e-mail either one of the authors (*mskolnik@mit.edu or jbelcher@mit.edu*) or the Student Executive Board of the FGP (*firstgen-exec@mit.edu*).

First Generation Student Voices
The following is a personal reflection from Ruben Alonzo, one of the founding

members of this project. A recent MIT graduate, and winner of the national Truman Scholarship for outstanding achievement in public service, Ruben's story exemplifies both the struggles, and tremendous resilience, of MIT's First Generation students.

Ruben Alonzo's Story
"When I look back at my time at MIT, two days in particular stand out from the rest. The first, my visit in April 2008: Campus Preview Weekend. I had only found out about MIT three months before the application was due. My high-school calculus teacher, Ms. Martinez, introduced me to the idea only after hearing about my decision to enlist in the military – a decision I was making to help support my family.

"My family and I were migrant farm workers living in Crystal City, Texas. In 1999, Crystal City was among the top 25 poorest cities in America. I had lost my father to drugs and my older brother was serving a six-year prison sentence. At that point in time, joining the armed forces wasn't such a bad idea. However, when I visited MIT, it was unlike anything I had ever seen. Never in my life was I surrounded by so many intellectuals. To this day, I describe MIT students as ambitious young people using their talents for the common good. April 10, 2008: that was the day I decided I would use MIT as the vehicle to lift my family out of poverty.

"The other day I will cherish forever is June 3, 2011: Commencement Day. After four brutal years, my classmates and I had finally made it to graduation. However, this road had almost ended just as soon as it had begun. In only my second week of class during my freshman year, my mother delivered the news that she had been diagnosed with stage-four breast cancer. Treatments required traveling to a cancer clinic 100 miles away from Crystal City, a trip she could barely afford. Without a father or older brother to rely on, the financial burden fell on my shoulders. After my freshman fall semester, I never purchased another textbook again, in order to send all of my money home to

my family. The absence of textbooks never compared to the days I went hungry. One person who got me through this difficult time was my academic advisor, Dr. Karl W. Reid, who at the time was the director of the Office of Minority Education. My advisor made an effort to understand and empathize with my desire to leave MIT and return home to my family. Dr. Reid did not pretend to care – he cared. He was invested in my family's uncertain future. Despite the difficult journey, my mother and I made it to graduation. Sitting there in the audience as I walked across the

stage was my mother, who had never seen MIT before. Accompanying her in the audience was Ms. Martinez, my high-school calculus teacher, who went on to win MIT's Inspirational Teacher of the Year Award.

"In my desire to help close the achievement gap in our nation, I am currently attending the Harvard Graduate School of Education. There I am in the process of creating smart and thoughtful charter school designs. These designs will provide structural influences and professional development in public schools to help

reduce racial stratification and injustice. MIT provided the fuel to keep my passion lit. It is my hope that other first generation students will also pursue their heart's work, and will be guided by caring mentors such as my advisor." ■

Miri Skolnik is Assistant Dean – Student Support Services. She is strongly committed to raising awareness about First Generation Student concerns and experiences *(mskolnik@mit.edu)*.

John Belcher is a Professor in the Department of Physics. His father dropped out of school in the seventh grade *(jbelcher@mit.edu)*.

A Message from the First Generation Project Student Executive Board

Melanie Adams
Melanie Alba
Luis Juarez
Peter Nguyen

OVER THE PAST YEAR, as First Generation students at MIT, we have mobilized to bring greater visibility to our achievements and experiences. With approximately 800 First Generation students currently enrolled, we comprise 16% of the student population. To better address our needs as a distinct group, we have helped establish the First Generation Project (FGP) at MIT. As the FGP Student Executive Board, we are dedicated to supporting and empowering all of the pioneering students breaking new ground in higher education. The FGP serves to represent the diverse interests of these First Generation students and those who are interested in learning more about the First Generation experience.

Our goals in participating in the First Generation Project are:

• To provide a strong sense of community for First Generation students;

• To raise awareness about First Generation experiences;

• To provide academic and professional opportunities for First Generation students through networking, and sharing information;

• To provide community service to assist future First Generation students.

If you want to be a part of our effort to make this project a successful student initiative, we ask that you e-mail us at *first-gen-exec@mit.edu*. First generation faculty can also identify themselves by emailing us and submitting a short bio for our Website: *web.mit.edu/uaap/firstgen/*. We will be hosting events all spring semester and welcome all faculty members to come speak about their work and meet our students. By e-mailing us we will be able to update you on other events as well. ■

Melanie Adams is a junior in Materials Science and Engineering. Her parents emigrated from the Caribbean, where Melanie acknowledges that "college enrollment is far behind the U.S., and academic credentials are not always viewed as being achieved on equal or consistent standards." This view led her parents to stress the importance of a college education, and led Melanie to MIT.

Melanie Alba is a junior in Mechanical Engineering. "Both of my parents were born in Cuba and moved to the United States in the 1970s as political refugees. Having grown up in a working class neighborhood in the Miami area, I understand the difference a college degree can make. One of my goals is to eventually return to Miami, change the conversation about college, and improve education there."

Luis Juarez is a junior in Biological Engineering, whose family immigrated to Texas from Mexico when he was a child, seeking a better education for him and his younger brother. Luis plays soccer for the MIT Men's Varsity Soccer team, and is interested in pursuing biomedical research relating to the heart.

Peter Nguyen is a sophomore majoring in Molecular Biology and Computer Science. "Both my parents moved to the United States just before I was born and knew very limited English. Neither attended college, and they decided to move to the U.S. in search of a better future. It is my dream to make that future a reality." Peter is also the liaison for the Questbridge Scholars program, a scholarship program for academically talented low-income students.

M.I.T. Numbers
Historical Data

Under-Represented Minority Faculty and Students: 1987–2012
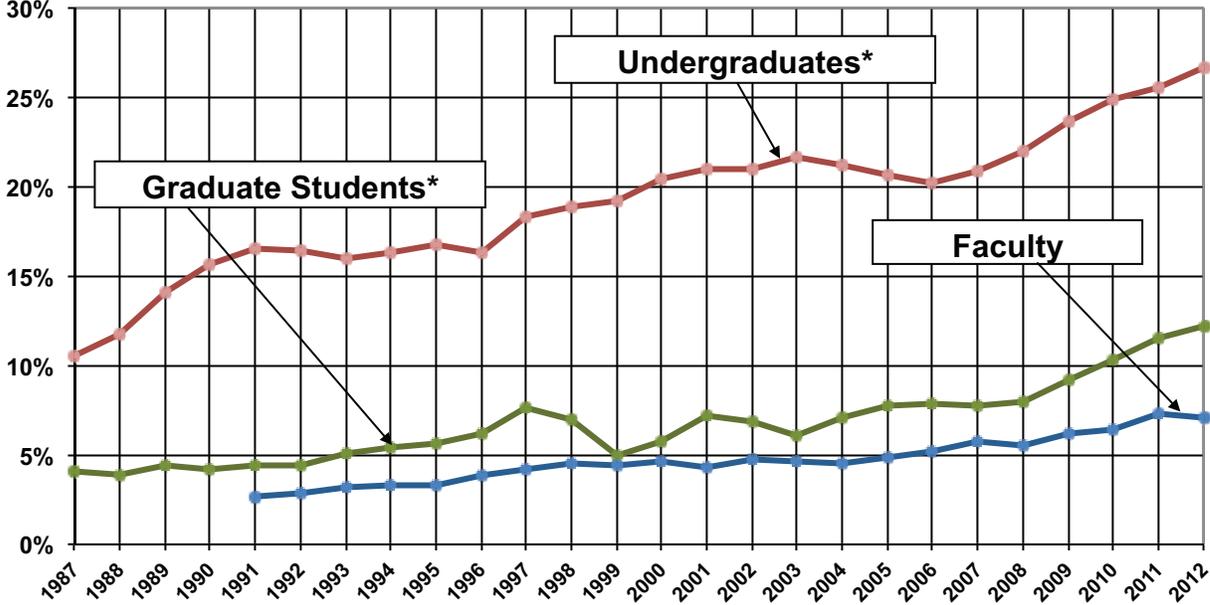
*As percent of domestic (U.S. and Permanent Resident) total

Women as Percentage of Total Undergraduates, Graduate Students, and Faculty: 1901–2012
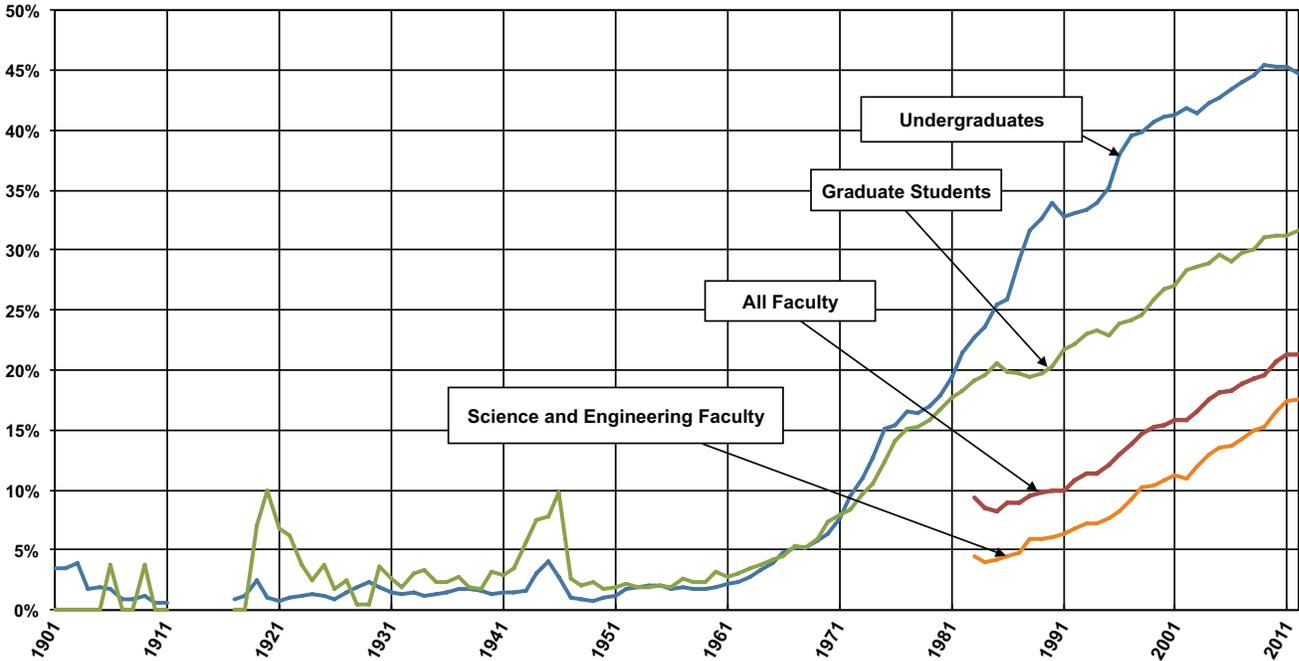
Source: Office of the Provost/Institutional Research