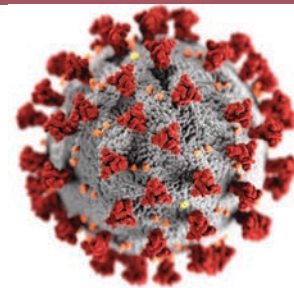


MIT Faculty Newsletter

<http://web.mit.edu/fnl>

in this issue we offer information about and a variety of the Institute's responses to the Covid-19 pandemic (see below, and page 15); we also submit "Notes from the MIT Faculty Town Hall," (page 11) and "Introducing an Institute-Wide Referendum at MIT," (page 12).



Enhanced Electron Micrograph of Coronavirus

Coronavirus Structure, Vaccine and Therapy Development

Jonathan King, Melissa Kosinski-Collins,
Eric Sundberg

Structure and Organization of Coronaviruses

MANY CONCERNED OVER THE coronavirus outbreak may find it useful to understand more about coronaviruses than is currently being communicated by media sources. As long-time structural biologists we offer below basic information on coronavirus, that may be of assistance to those who have not studied virology.

All viruses are parasites which can only reproduce within cells. Thus, they are very different from bacteria and fungi, which are self-reproducing, often in soil, water, organic wastes, sewage, or within organisms.

Animal and plant viruses fall into two general classes, those in which the genetic material is long DNA molecules, and

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From The Faculty Chair Education in the Time of Covid-19

Rick L. Danheiser

THE CRISIS BROUGHT ON by the Covid-19 global pandemic has turned all of our worlds upside down. For me, a bright spot has been seeing how the Institute and the MIT community has responded to this unprecedented emergency. There are many unsung heroes among our staff, administration, faculty, and students, and I hope that their contributions will receive the recognition they deserve when we return to some semblance of normalcy. I regret that I cannot spare the time to celebrate them here, as like many colleagues I have been working overtime seven days a week and participating in up to eight Zoom conferences in a single day. Instead, in this column I expand on some of what was a major focus of Faculty Governance during the first weeks of the crisis – adjusting our academic policies to accommodate the

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Editorial

I. Responding to the Coronavirus Outbreak; II. Lemonade from Lemons: Making the Most out of our Current Crisis; III. Publication Policies of the FNL; IV. Professor Rajagopal Joins UN Human Rights Council

AS WE GO TO PRESS, more than 95% of the U.S. population has been told to stay home. Over 22 million people have filed for unemployment and, as of today, April 19, 2020, more than 40,000 people have died. Globally over two million people have been infected, and tens of thousands have lost their lives to Covid-19. We do not know how and when this pandemic will end. What we do know is that things will get substantially worse before they get better. We also know that those who are most vulnerable in our world will bear the highest cost of this pandemic for years to come.

In response, MIT – like many leading higher education institutions – has focused its attention on the safety and well-being of its community, on accelerated research and innovation to fight the spread and impact of Covid-19, and on

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Responding to the Coronavirus Outbreak
continued from page 1

support for shifting all teaching, operations, and scholarly activities online. MIT's response so far has taken extreme dedication and endless hours of work from people across the Institute.

Over the past three weeks MIT has undergone unprecedented changes. Twelve hundred courses have moved online, with grades changed to pass/fail. Thousands of undergraduate students were sent home, and many graduate students were asked to leave campus housing. All non-essential employees are working from home. These are but some of the many changes that have swept through MIT.

Yet, amid these changes, faculty, staff, and students have stepped up to contribute to the fight against Covid-19. A group of our colleagues at the Sloan School has formed a Covid-19 Policy Alliance (<https://www.covidalliance.com/>). At the Media Lab, researchers are developing [Safe Paths](#), a privacy-focused app for contact tracing and a [#BeatTheVirus](#) campaign to counter misinformation on Covid-19. Colleagues at the Ragon and the Broad Institutes are working directly on the development of improved devices, tests, vaccines, and therapies. Others among us are working with colleagues to focus attention on emerging needs. These are just a few of the efforts happening at MIT. As people have said, responding to this kind of world crisis is what MIT is good at.

As we acknowledge the responsive efforts of so many at MIT, we must also be mindful that decisions made in response to Covid-19 can place an excessive burden on the more vulnerable members of our community. The abrupt removal of most undergraduate and many graduate students from campus was needed to slow the spread, but it also created anxiety and stress for students. For some students, returning home meant putting their family at risk, and for some, home is not a safe place. We understand that academic advisors and mentors have been asked to

stay in touch with their student advisees and to be available to offer support and advice, and we believe this is indeed very important.

Recently the Provost announced a one-year tenure-clock extension for untenured faculty due to the disruption of life during Covid-19. This is an impor-

It is very important to include the staff members of our community when considering the negative effects of the current situation. Our staff are dedicated members of the MIT community and critical to the success of our efforts. We expect that the Administration will continue to pay close attention to the needs of these community members as well.

tant acknowledgment of the burdens – academic, personal, and familial – imposed by the crisis. Of course, the disruption will impact faculty in very different ways: those with extra familial responsibilities that cannot be handled by partners or paid caregivers will be especially affected. One effect of the extension will be that faculty who opt for the extra year will delay the salary bump that tenure brings, and this will have a cumulative impact on lifetime income. The difference is not trivial. We hear that there are ongoing discussions about such concerns and we hope that they yield effective solutions.

Similar considerations need to be provided for graduate students and research staff/postdocs who are vulnerable to the same distractions that faculty are facing. The case is even worse for adjunct faculty who are often here on a temporary contract but who are also vital members of our community.

It is very important to include the staff members of our community when considering the negative effects of the current situation. Our staff are dedicated members of the MIT community and critical to the success of our efforts. We expect that the Administration will continue to pay close attention to the needs of these community members as well.

Looking forward, enormous challenges lie ahead from the economic and social repercussions unleashed by the pandemic, including the deep global recession, job losses, and their impact on the well-being of our students and their families, on research and administrative staff, and on faculty.

This academic year, the leadership at MIT has faced extreme challenges. The Epstein case called into question the judgment of members and former members of the Institute's senior leadership team. It also highlighted systemic/structural problems with democratic representation at MIT and the disenfranchisement of several communities within the Institute.

Covid-19 asks that same leadership step up with a moral clarity that will ensure the care and support of our entire community. Despite problematic communication with our undergraduates early in the process, the leadership has risen to this task. As we move into an uncertain future and face new challenges with diverse repercussions, let us all demonstrate our capacity to maintain that moral clarity.

Editorial Board
MIT Faculty Newsletter

Lemonade from Lemons: Making the Most out of our Current Crisis

The Covid-19 outbreak has compelled MIT faculty meetings to now be held virtually (see March 17, 2020 email from Faculty Chair Rick Danheiser, "March 18 Faculty Meeting; Zoom Meeting Info and

[continued on next page](#)

Responding to the Coronavirus Outbreak
continued from preceding page

Request for Questions”). When the need for faculty voting arises in this new virtual context, as it invariably must, then this will of necessity require some form of electronic voting. This would be a welcome step forward for MIT. E-voting is technologically and operationally feasible, and is likely to be more secret and universal. E-voting may also increase faculty attendance. There’s plenty of evidence for this: Participation in the FNL faculty-wide Editorial Board election is much higher than votes at the faculty meeting for faculty committees; states that have adopted mail-in ballots as a default, like Washington, have seen the voter turnout increase by more than 10% above the national average. There is strong reason to believe that e-voting can similarly boost faculty participation.

E-voting can also ensure the secrecy of voting, one hallmark of a genuinely democratic process. Open voting by a show of hands at faculty meetings always has the potential to subject faculty members to unwarranted peer pressure and, for untenured faculty, fear of retaliation. E-voting avoids this defect as well as others such as miscounting, and so may well lead to a more genuine and honest expression of views by faculty members, especially when voting on controversial issues.

It turns out that there is nothing in the *Rules and Regulations of the Faculty* that explicitly prevents virtual meetings from taking place – and now, such meetings will take place. Similarly, nothing in the faculty regulations prevents e-voting, which of necessity will now also take its place for the time being at faculty meetings. We have no doubt that both will work, providing empirical evidence of improvement. The only remaining question: Once the current crisis passes, why roll back this better engineering to the more imperfect past? That would be very unlike MIT. Rather, it seems to us that the successful use of both e-meeting and e-voting for faculty meetings points the way ahead to a permanent move for a better

MIT during the remainder of the twenty-first century – squeezing at least a little bit of lemonade from the terrible times we now navigate.

Publication Policies of the FNL

The *Faculty Newsletter* periodically receives criticism of its content. An example is Professor Weinberg’s pointed letter in the current issue (see next page), where he inquires about the multiplicity of voices in the FNL, and which deserves response.

The pages of the *Faculty Newsletter* exist to enable the faculty to share ideas, perspectives, opinions – and, in so doing, to make our work environment more vibrant and our actions more informed, responsive, and responsible. The articles express the views of those members of the faculty who choose to take the time to express them.

The pages of the *Faculty Newsletter* exist to enable the faculty to share ideas, perspectives, opinions – and, in so doing, to make our work environment more vibrant and our actions more informed, responsive, and responsible. The articles express the views of those members of the faculty who choose to take the time to express them. The FNL Editorial Board welcomes and encourages contributions from any and all faculty members, particularly those who feel that important perspectives are not being included. Submissions should not be libelous, and should bear some connection to issues and concerns of the MIT faculty. Other than those general filters, the Editorial Board does not exercise limitations on articles submitted for publication by faculty members.

The Editorials are the views of either the Editorial Subcommittee responsible for that issue, or the entire Editorial Board. These pieces are not intended to represent average, median, or popular representation of faculty views. Rather they represent the views of the Editorial Board members, who have been elected by the faculty at large in an electronic elec-

tion. Many more faculty vote in the election of FNL Board members than vote for the Standing Committees of the Faculty. The FNL Editorial Board is also the only committee of the Institute for which only faculty, and all faculty, can vote. (The preceding editorial calls for changing the current situation, and having the full faculty vote electronically for all faculty membership on all committees.)

Articles submitted to the *Faculty Newsletter* by faculty are not vetted or sent out for review beforehand. We publish

opposing views, refutations, or corrections, typically in the subsequent issue. (Though given some uncertainty during this Coronavirus emergency of when the next issue of the FNL will be published, we are responding to Professor Weinberg’s letter in this issue.)

Editorial Board members receive little academic or professional credit for their service. In general, they are colleagues who strongly believe that the faculty form an absolutely essential constituency at MIT (as opposed, for example, to the model of the faculty as simply individual employees of the Corporation), deserving and requiring an independent and active voice. Given the absence of an elected Faculty Senate or Council, the FNL role in providing independent faculty expression is particularly valuable. This imperative is what launched the *Faculty Newsletter* [see: <http://web.mit.edu/fnl/vol/archives/fnl00.pdf>] and this ethos is deeply engrained in FNL function. Some of these beliefs stem from a conservative viewpoint with respect to the privileges of academia, stemming from the medieval tradition of the autonomous university. Others come from a more progressive view that faculty

have special responsibilities in society in their role as teachers of the next generation. Periodically we also publish submissions from postdocs, graduate students, research staff, administrators, and others when in our assessment the expressed views need to be heard by our colleagues.

We urge you – members of our esteemed faculty – to share your views, concerns, and proposals with your colleagues [through the pages of this Faculty Newsletter](#).

Professor Rajagopal Joins UN Human Rights Council

We also acknowledge some good news: a member of the Editorial Board of the *Faculty Newsletter*, and a faculty colleague from the Department of Urban Studies and Planning, Balakrishnan Rajagopal, has recently been voted by the UN Human Rights Council as the next UN Special Rapporteur on the Right to Adequate Housing. No MIT faculty member has ever been elected to this important position in the human rights field, as far as we know.

The human rights work of the UN is led by the UN Human Rights Council (47 States elected by the UN General Assembly yearly), representing member States from around the world. The Special Rapporteurs are independent experts who are selected for their expertise, independence, impartiality, and objectivity to be in charge of specific issues areas. Those areas include a range of human rights matters such as freedom of expression, torture, racism, housing, health, food, water and sanitation, etc. Major investigative and legal work on the topics which the FNL has covered recently, such as the Saudi-led war in Yemen, or the killing of Jamal Khashoggi by Prince Salman's coterie, have been led by Special Rapporteurs on torture, illegal executions, etc. The Special Rapporteurs are appointed in their personal capacity by the UN Human Rights Council for three years initially, and the positions are honorary.

The Rapporteurs have three main kinds of duties: first, they submit thematic reports on major issues of concern, to the UN General Assembly and the UN Human

Rights Council. Second, the Rapporteurs deal with urgent calls/complaints about human rights violations within their mandates. Those are received on a daily basis and require public and private interventions with countries and other parties. Third, the Rapporteurs conduct selected country visits and then file reports based on their detailed field investigations on the status of human rights adherence in those countries. In addition, the Rapporteurs are also often called upon to speak at various forums at the UN, engage in public communication and advocacy, and function as the global voice on the issues within their mandates. For a general description of Special Rapporteurs, see: <https://www.ohchr.org/EN/HRBodies/SP/Pages/Introduction.aspx>. ■

Editorial Subcommittee

letters

Questioning Structure of the Faculty Newsletter

To The Faculty Newsletter:

I WONDER SOMETIMES WHETHER there is any pretense that the *Faculty Newsletter* attempts to represent the general sentiments of our faculty or, instead, the crusading and tendentious spirit of a couple of its Editorial Board

members? Maybe even one of them?

Who chose the membership of this Editorial Board, and why/how can they have the pretense of representing sentiments that are widely spread among the faculty?

Robert A. Weinberg, Ph.D.

Member Whitehead Institute for Biomedical Research
Professor of Biology, MIT
Director, MIT Ludwig Center for Molecular Oncology

Education in the Time of Covid-19

Danheiser, from page 1

profound impact of Covid-19 on our educational enterprise.

A principal consequence of the requirement to “de-densify” the MIT campus was the need to develop online, “remote” versions of our subjects. Designing and implementing remote equivalents for our courses in less than two weeks was no easy task, but by and large our faculty, instructors, and teaching assistants rose to the challenge. In the case of some subjects that already incorporated significant online components, this did not require major changes, but for most subjects a daunting amount of work was necessary. As we have worked on crafting remote versions of our subjects, a key guiding principle has been to focus on identifying the essential *learning goals* of our courses. Our overriding aim has been for students to emerge from this novel and difficult semester equipped with the essential knowledge and tools they would have acquired in a normal spring term. I have to say that I have been very impressed by the creativity and rigor of many of the offerings that instructors have developed to meet this extraordinary challenge.

While our faculty and instructors were working to design remote versions of their subjects, the Faculty Officers were considering what changes in our normal academic procedures would be required. It turns out that in the event of a “Significant Disruption” of academic activities, [Section 2.102](#) of the *Rules and Regulations of the Faculty* permits the Chair of the Faculty to declare that “**emergency academic procedures**” are in effect and to impose temporary changes in the regulations regarding the academic calendar, registration, assignments and examinations, grades, the procedures for accepting theses, and the awarding of degrees. It appears that this addition to *Rules and Regulations* was made after the disruptions in 1970 during the time of the Vietnam War, and it is interesting that the regulation specifically defines “significant disruptions” as includ-

ing “natural disaster, civil unrest, or pandemic illness.” Perhaps a Professor Nostradamus played a role in the development of this amendment to *Rules and Regulations* 50 years ago.

The Emergency Academic Regulations (“EARs”) were developed by a team that I led and which included my fellow Faculty Officers Professors Duane Boning and David Singer, Tami Kaplan (Faculty Governance Administrator), and (alphabetically) Professor Arthur Bahr (Chair of CUP), Chris Bourq, Registrar Mary Callahan, Professor Dan Frey (Chair of

“alternate” grading system provided for in the Institute’s *Rules and Regulations* for times of emergency would be mandated for all subjects this semester. This decision was not made lightly, and was made only after extensive deliberation and consultation with other faculty, mental health and wellness professionals, and student leaders. Appreciating the importance of grades to MIT students, the team spent an enormous amount of time considering when “alternate grades” should be employed during this period of significant disruption. Four scenarios were discussed

It turns out that in the event of a “Significant Disruption” of academic activities, [Section 2.102](#) of the *Rules and Regulations of the Faculty* permits the Chair of the Faculty to declare that “emergency academic procedures” are in effect and to impose temporary changes in the regulations regarding the academic calendar, registration, assignments and examinations, grades, the procedures for accepting theses, and the awarding of degrees.

CGP), Professor Anne McCants, Professor Kris Prather (Chair of CAP), Professor Krishna Rajagopal (Dean of Digital Learning), Professor Larry Vale (Associate Dean, SA+P), and Professor and Vice Chancellor Ian Waitz. We also consulted with the officers of the Undergraduate Association and the Graduate Student Council, and they provided valuable input during our deliberations.

Developing emergency regulations that take into consideration the diversity of our educational offerings, that anticipate exceptional situations, and which are sensitive to the difficult and unusual circumstances confronting our students, our faculty, and all members of the MIT community who support our educational programs, was no easy task. Some decisions were especially difficult and in these cases we made a particular effort to consult widely and to carefully consider diverse views.

To enable and support our focus on learning goals and innovative pedagogy, we announced on March 12 that the

extensively: (a) Individual Instructors could choose whether to use normal letter grades or alternate grades on a subject-by-subject basis; (b) Alternate grades would be mandated for all subjects; (c) Alternate grades would be the default grading system but individual students would have an opportunity to “opt in” for letter grades in a subject; (d) Letter grades would be the default grading system but individual students would have an opportunity to “opt in” for alternate grades in a subject. After extensive deliberation, which included important input from Student Support and Wellbeing, the Team unanimously decided to mandate alternate grades for all subjects, i.e., Scenario (b). As explained below, the Team concluded that this is most consistent with the intent of *Rules and Regulations*, would best mitigate current and future stress and anxiety of students, and most importantly, it is the grading system that recognizes and responds to the significant disruption that impacts all students and our entire shared academic endeavor.

While many students expressed gratitude and applauded our decision to mandate “universal” pass/no record grading, other students were dismayed and appealed to us to reconsider. Students expressed the concern that not having letter grades this semester might adversely impact their applications for graduate school, medical school, internships, and other positions outside MIT. The Emergency Academic Regulations Team took this concern most seriously but concluded that having alternate grades this semester will not negatively affect applications for jobs and admission to programs outside MIT. The current global pandemic affects everyone and the unusual circumstances of this semester will certainly be taken into account in the future as professional schools and companies evaluate applications. It is likely that other measures of performance will have greater than usual importance, including, for example, letters of recommendation which provide Instructors with an opportunity to elaborate in detail on a student’s performance. In fact, as we expected, one by one graduate and professional schools have published assurances that they will evaluate students holistically and that applicants will not be at a disadvantage if they were graded P/NR this semester.

In summary, the Emergency Academic Regulations Team concluded that adopting alternate grades this semester will not have a detrimental effect on the competitiveness of MIT students seeking positions outside the Institute. A number of considerations then led the Team to decide that mandating alternate grades was the best grading scheme for the Institute to adopt during this period of disruption.

- The original intent of *Rules and Regulations* 2.64 is that alternate grades would be employed in the event of a natural disaster or pandemic illness as a result of which Instructors would be unable to make the usual distinction between (for example) A-level, B-level, and C-level work due to the disruption. The Team decided that to think that Instructors would be able to assign a letter

grade for some students in a class and not for other students is not consistent with [Section 2.64](#) of *Rules and Regulations*.

- The Team concluded after extensive consultation and discussion that the nature and magnitude of the disruption caused by Covid-19 is such that assigning accurate letter grades will not be possible in essentially all full-term (and H4) subjects this semester. There are several reasons for this. Few if any Instructors have experience with the evaluation of a student’s mastery of material via remote means. In fact, many faculty have no experience whatsoever in delivering class material via online vehicles and the time available for Instructors to get up to speed is limited. The Team expects that there will have to be quite a lot of experimentation this spring with Instructors trying out alternative ways to evaluate progress and performance.

- It is also worth bearing in mind that these are also difficult times for our Instructors and for all of the members of our Teaching Staffs as well. The lives of everyone are being disrupted and teaching from home is not easy for many Instructors, some of whom have to deal with having young children at home due to the closing of schools and daycare facilities. In summary, the Team concluded that the accurate determination of grades will be especially challenging this semester and it is not reasonable to expect Instructors to be able to make the usual distinctions required in a letter grade system.

- Students are accustomed to studying together and benefiting from support groups of classmates and it is very uncertain to what extent this can be reproduced remotely in the coming months. The impact of this on different students is likely to vary considerably and Instructors will not be in a position to take this accurately into account in assigning grades.

- The Team was also concerned that different students will be experiencing dif-

ferent situations at home, and for some students it may be very challenging to focus on studying. This is in addition to the general stress and anxiety that the Covid-19 crisis is causing in everyone, students, their families, and the members of our teaching staff.

- The Team was advised that giving students a letter grade “opt in” choice would in fact lead to increased stress and anxiety for many students. For example, some students would feel pressured to choose to opt in for a letter grade because not doing so would be interpreted to mean that their performance was not strong.

- The Team discussed a number of other considerations. One was associated with the question of final exams. Some of our peer schools require that remote final exams be “open book.” A number of faculty instructors here at MIT have suggested that “open book” exams necessarily have to be different and perhaps more difficult as compared to exams conducted in person in past years. Mandating that alternate grades are in effect relieves the concerns of Instructors in this regard, allowing them to be comfortable designing exams to be conducted remotely that are similar to exams of past years.

The decision to mandate alternate grades for all subjects was announced on March 12. MIT was one of the very first schools to adopt what some have referred to as “universal pass/no record grading,” and it has been gratifying to see that a number of our peers such as Columbia and Harvard have followed our lead, in some cases even reversing their initial decisions. The Faculty Officers believe that the Institute has taken the correct course with the emergency academic regulations that have been promulgated thus far, and we hope to continue to make the right decisions as we help steer our academic program through the rough waters ahead. ■

Rick L. Danheiser is the Arthur C. Cope Professor of Chemistry and Chair of the Faculty (danheiser@mit.edu).

Coronavirus Structure

King et al., from page 1

those in which the genetic material is RNA molecules. Among the DNA viruses are Herpes, Adenoviruses, and wart viruses. Coronaviruses, named for their “sun-like” shape observed in the electron microscope, use RNA molecules to encode their genes, as do influenza viruses, HIV, and rhinoviruses (common cold). SARS-CoV-2, the virus that causes Covid-19, infects mammals and birds. It is closely related to the viruses causing the earlier SARS (Severe Acute Respiratory Syndrome) and MERS (Middle East Respiratory Syndrome) outbreaks.

The coronavirus particles are organized with long RNA polymers tightly packed into the center of the particle, and surrounded by a protective capsid, which is a lattice of repeated protein molecules referred to as coat or capsid proteins. In coronavirus, these proteins are called nucleocapsid (N). The coronavirus core particle is further surrounded by an outer membrane envelope made of lipids (fats) with proteins inserted. These membranes derive from the cells in which the virus was last assembled but are modified to contain specific viral proteins, including the spike (S), membrane (M), and envelope (E) proteins.

A key set of the proteins in the outer membrane project out from the particle and are known as spike proteins (S). It is these proteins which are recognized by receptor proteins on the host cells which will be infected.

Coronavirus particles are rapidly inactivated – killed – by exposure to 70% ethanol or 90% isopropanol (rubbing alcohol), hydrogen peroxide solutions, hypochlorite bleach, soaps and detergents, as well as by UV light and the high temperatures of cooking.

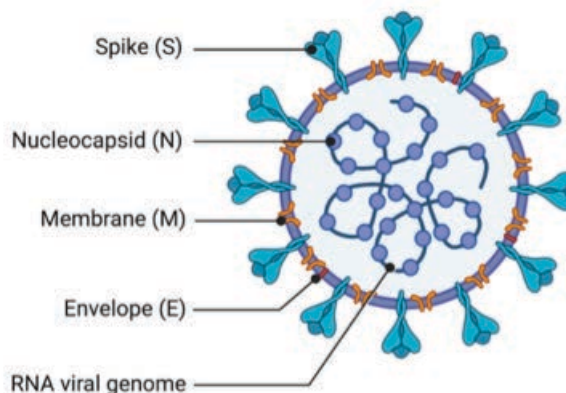
Coronaviruses primarily infect human lung cells through a receptor for an enzyme called Angiotensin Converting Enzyme 2 (ACE2). ACE2 is a member of the family of angiotensin converting enzymes that includes ACE, for which many Americans take blood pressure

medicines composed of chemicals that act by inhibiting ACE. As the first step leading to viral infection, the virus spike protein recognizes and binds to the ACE2 receptor. The virus is then incorporated into the lung cells and the viral RNA is released into the cytoplasm. The viral RNA mole-

primers, which are synthesized in the laboratory.

The existence of these assays is testimony to the value of prior investment of federal National Institutes of Health, National Science Foundation, and Department of Energy funds into

Coronavirus Structure



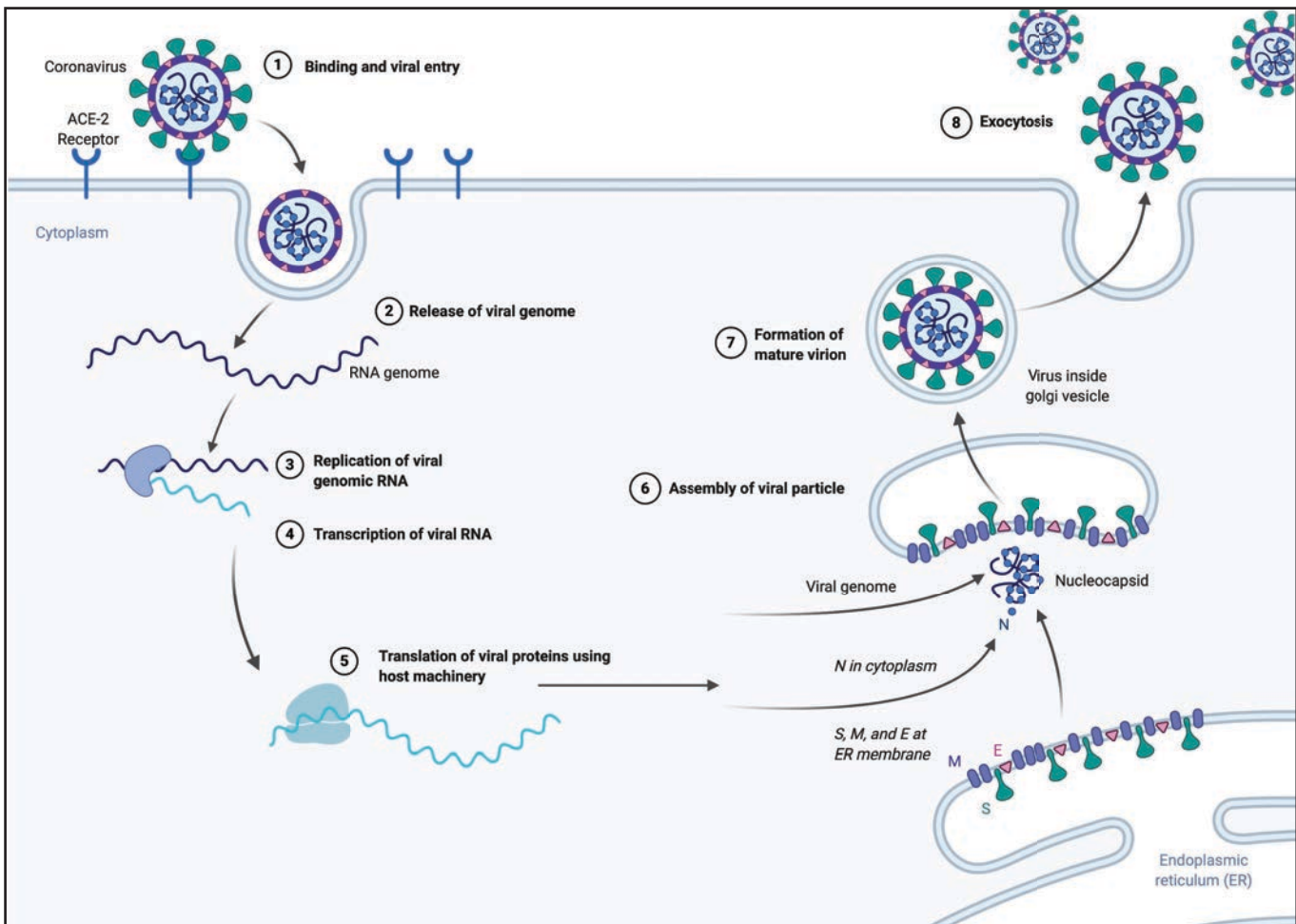
cules recruit the cellular apparatus to make thousands of copies of the viral RNA and also instruct the cells to synthesize hundreds of thousands of nucleocapsid, membrane, envelope, and spike proteins. These assemble into new virus particles which bud out of the cell surface membrane. The cells release the newly formed viral particles propagating the infection and eventually die.

Testing for the Virus

The nucleotide sequence of the viral RNA molecules is not found in human DNA or RNA sequences. The test for the presence of the virus, thus, tests for the presence of the viral RNA sequences in tissue samples. The current assay technology is called “RT-PCR”. RT stands for Reverse Transcriptase, an enzyme which copies RNA sequences into DNA sequences. PCR stands for Polymerase Chain Reaction, which reproduces and amplifies the DNA sequences for subsequent breakdown for determining the order of the individual nucleotides strung together in the original RNA polymer. The kits also require short DNA sequences called

genomics and sequencing technology. The test requires adequate supplies of two enzymes and the primers, specialized instruments for running the reaction at elevated temperatures, and trained personnel. Hundreds of colleges and universities across the nation provide the training needed, but not the actual employees conducting the tests. Ramping up capacity to be able to perform millions of tests requires billions of dollars in immediate investment.

A more traditional test for virus infection is the presence of antibodies (more below) that bind to the virus. Such tests identify individuals who are now healthy but have previously been infected. Antibody tests require a small drop of blood and are much more rapid than the current nucleotide sequencing tests. The absence and/or poor implementation of both RT-PCR and antibody-based tests early in the outbreak represents one of the failures of our healthcare/public health system to properly prepare for viral outbreak, particularly after the experiences of the SARS and MERS viruses.



Coronavirus Binding and Assembly

The Immune System and Vaccine Development

Our blood, lymph, and organs are host to the white cells of the immune system, which are continually checking for the presence of foreign elements such as viruses, bacteria, fungi, parasites, tumor cells, and toxins. These white cells are made in the bone marrow.

One type of white cell is called a B-cell. B-cells are specific to a particular pathogen and secrete antibodies that detect that pathogen. Antibodies are proteins that bind to a foreign antigen, inactivate it, and/or target it for destruction by other white cells. When a person is infected by a foreign substance, B-cells will begin making and excreting antibodies into the bloodstream that recognize the outer surface of the pathogen. For viruses, it is often the spike proteins that are recog-

nized. Some antibodies that bind to the viral spike proteins can prevent the viral particles from infecting the cells. Other white cells (macrophages) can engulf these compromised particles, removing them from circulation. B-cells can also keep a “memory” of the antibody that recognized a past pathogen and, in the case of another exposure, mount a response that is quicker and more efficient.

A second class of white cells are known as “killer” cells. Some of these white cells can recognize a cell that is infected by the virus and kill those cells. The phlegm that you cough up in a respiratory infection is full of debris from infected cells lysed by killer white cells.

One of the best ways to protect against infection is to stimulate the immune system with a vaccine. For example, the polio vaccine consists of inactivated viral

particles. These are unable to initiate an infection but are recognized by the white cells of the immune system. Over a period of weeks, the white cells that recognize the virus reproduce in the body. These white cells synthesize and secrete antibodies that can bind to the virus in the vaccine. If the individual is then exposed to infectious poliovirus, the circulating antibodies are already present and are able to inactivate the infecting particles. This immunity may last for decades, though that differs depending on the antigen.

Developing a vaccine requires growing large amounts of virus, often in animals, or in tissue culture at large scale. The viruses are inactivated by radiation, heat, or chemicals, or are derived from genetically weakened strains. Another alterna-

[continued on next page](#)

Coronavirus Structure

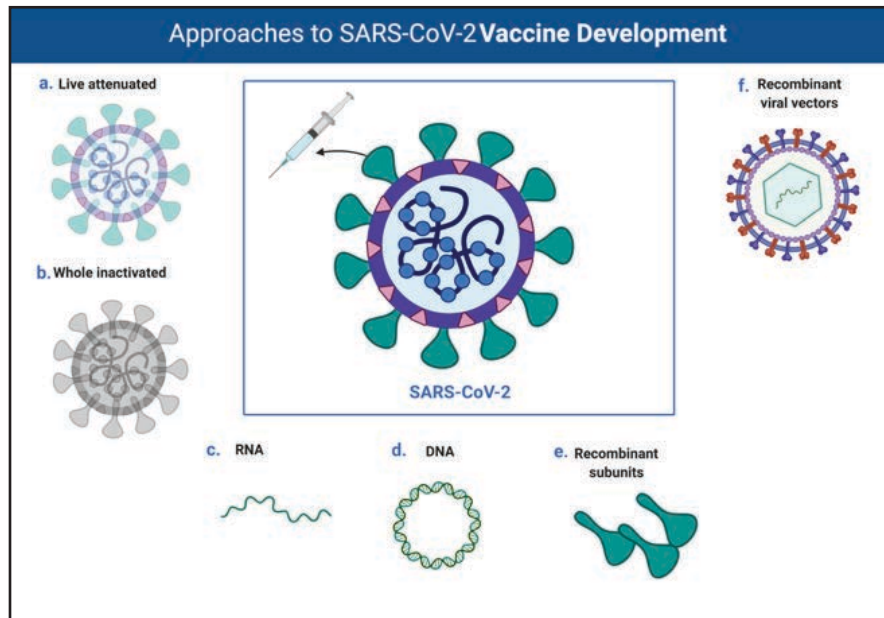
King et al., from preceding page

tive is to purify not the complete virus, but isolated viral proteins like spike. This is safer and easier to scale up, but the immune system response to the isolated protein is often not as robust as it is to the organized lattice of the intact virus particle. A more recent strategy involves injecting individuals with RNA or DNA encoding for viral proteins. These nucleic acids can be administered alone or through man-made vectors that help deliver material into the body. In any strategy, however, enough material is needed to inject reasonable doses into millions of people.

But before doing this one has to know that the vaccine works to stimulate a protective immune response. This requires recruiting human volunteers to be vaccinated and then be challenged with the infectious virus. All of this takes time and skilled personnel and money. However, with sufficient investment, success is highly likely in most cases. Note that vaccination is typically preventive – most vaccines do not provide relief for someone already infected.

Antiviral Therapies for Infected Individuals

Addressing the health hazards of coronavirus infections would benefit greatly by antiviral drugs that act to block the attachment and internalization process or the replication of the virus within infected cells. Antivirals that interfere with the viral lifecycle without significantly impacting normal cellular function are critical to combating viral infections. Such therapies are in use for other RNA viruses, like influenza, and are administered generally as small molecules, taken in pill form. These antivirals act by binding to and interfering with viral proteins needed to replicate the viral RNA or facilitate binding and entry of the virus into the cell. Another class of antiviral drugs, which are effective with HIV, act by interfering with the synthesis and assembly of the coat proteins into the viral capsid. The U.S. phar-



maceutical industry already has the capacity to produce millions of doses of small molecules, so the rate limiting step in this case is more likely to be at the laboratory research and development stage.

Needed Public Investments

The initial Congressional vote for \$8.3 billion to speed up the response to the coronavirus was a step in the right direction. The March 27 CARES Act stimulus vote went further on the biomedical research front, providing \$1 billion to the NIH, \$4.5 billion to the CDC, and \$27 billion to the Biomedical Advanced Research Projects Authority. This is still far from what is needed to address the public health need.

Covid-19 and other emerging infectious diseases represent global threats to our national security. They require a substantial increased investment in fundamental biomedical science, if we are to develop the tests, vaccines, and remedies required to protect those at risk in a reasonable timeframe. Just as we have massive and sustained funding for the military and other efforts to fight more traditional and visible threats to our national security, the “invisible” killers require a similar budgetary effort.

The system already lacked sufficient funds to continue with vaccine develop-

ment for the SARS-CoV virus after that threat subsided. We need a scientific and biomedical research infrastructure that can respond to the next threats, and of course a healthcare system and healthcare financing that can ensure high quality treatment for all.

Resources

- [Coronavirus Structure](#)
- [American Public Health Association](#)
- [Inactivation](#)
- [Vaccine Development](#)
- [Review of Treatments and Vaccines](#)

Jonathan King and Eric Sundberg have directed biomedical research projects on viruses and viral proteins supported by the National Institutes of Health and National Science Foundation. They are both members of the Public Affairs Committee of the Biophysical Society. Melissa Kosinski-Collins has led HHMI and AAU-funded research programs in Biology Education.

This article also appeared at: <https://www.biophysics.org/>.

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Notes from the MIT Faculty Town Hall

Bevin P. Engelward

BELOW IS A LIST of what I heard to be some of the main points of faculty who shared their thoughts at the Faculty Town Hall on Wednesday, February 5, 2020. I am sharing this list to update those who weren't able to attend to know some of what had been discussed, but this is not meant to be an official record of the meeting. Note that I have attempted a non-biased recording, and that I do not necessarily share these views.

The purpose of the meeting was to discuss the opportunity to change the structure of governance to ensure that the faculty have a stronger voice in leadership of MIT. Three working groups were proposed with the following themes: 1) assessment of governance, 2) ways to ensure faculty views are consistently represented, and 3) how to enhance MIT culture to ensure that everyone feels that they are being treated with respect.

Views from various faculty included the following:

- It was noted that while many are happy at MIT, there are also a lot of people who don't feel supported.
- It was noted that we are not functioning well as a team, and part of the reason is because the Administration has not ensured that everyone feels valued and appreciated.
- Many faculty members simply do not participate in governance at all. Only ~20% of the faculty attended the Town Hall Meeting and many fewer attend Institute faculty meetings. The suggestion was made that we leverage new ways of communicating.
- Several stated that MIT would benefit from enhanced cohesiveness, and that faculty need more opportunities to inter-

act. Currently effort is being made to create Random Faculty Lunches. There is discussion of creation of a faculty club that works to bring faculty together.

- There was a big emphasis on loss of trust in the Administration. It was pointed out that trust depends on accountability, and on knowing someone. The view was shared that there are not enough interactions between the Administration and the greater MIT community.

- There was the opinion that it is time for a change in leadership.

- There were also several people who were outspoken regarding their appreciation of Rafael Reif. They noted that he cares deeply, that he has compassion, and that he has been a strong leader.

- Concern was raised that we might lose Rafael Reif, and if so, it could be difficult to find a strong replacement.

- The Administration acknowledges that mistakes in judgement were made. It is poignant that none of the members of the Administration who participated in the bad decisions benefited directly from those decisions.

- It was pointed out that Rafael Reif immediately accepted responsibility, took action to seek truth, and shared reports promptly. It was stated that this spirit of openness enables MIT to continue to improve.

- It was noted that we are constantly racing to stay competitive, and that racing comes with risk, and so mistakes are inevitable.

- It was emphasized that it should not be about "us" vs. "them", and that many people playing leadership roles in the Administration are themselves faculty members.

- One person emphasized that while it is always good to consider weaknesses and opportunities for improvement, we should not lose sight of our strengths and many successes. MIT's rank has improved under Presidents Hockfield and Reif.

- It was noted that there have been many statements about what the faculty want, but we don't really know what the faculty want, because we don't have mechanisms in place to gather opinions. In addition, there are a range of views.

- While there is a call for an MIT values statement, it was emphasized that there is no one value system. We are a composite of many different value structures, and so we run the risk of people feeling that their views are not represented.

- There is concern about the makeup of the Corporation, and in particular, the lack of faculty representation. It was emphasized that the faculty define MIT, and that it is important that we not let money and finances dominate over the values that we embrace. There is also a concern that the length of service on the Corporation is very long. The suggestion was made that shorter term limits might help to create a more dynamic leadership.

- One person emphasized that many of the problems that we face are not unique to MIT, that it is important to consider what is happening at a national level, and that there are clear trends across the nation that impact our community.

- In terms of next steps related to governance, concern was raised that the proposed working groups be sufficiently empowered so that recommendations can be implemented. ■

Bevin P. Engelward is a Professor in the Department of Biological Engineering (bevin@mit.edu).

Introducing an Institute-Wide Referendum at MIT

Can and should MIT selectively adopt the tools of direct democracy?

Olivier L. de Weck

I ATTENDED THE MIT Faculty Forum on February 5, 2020 in 10-250 as I wanted to hear what is on the minds of my colleagues on the current state of affairs at MIT in terms of governance and the general climate. This was especially important to me as I recently returned from a two-year leave of absence from MIT in France and had felt a bit out of touch. I did not speak during the meeting but listened carefully to my colleagues and took mental notes.

At the core the issue seems to be that *large portions of the MIT community (not only the faculty) feel disempowered* and have the impression that their views and opinions cannot currently influence the way in which the Institute is managed and how it is evolving in the future. Specific contentious issues that have affected the MIT-wide community in recent years are:

- Accepting major financial gifts and donations from individuals who have been convicted of criminal acts and/or whose actions are demonstrably in conflict with MIT's mission and values (even if some of those individuals are MIT alumni/ae);

- Major changes to MIT's campus and physical plant such as the demolition of beloved but unsafe or outdated dormitories or the leasing of land for 99 years, or the building of lucrative commercial real estate on land owned or controlled by MIT;

- The creation of major new initiatives and organizational structures that touch more than one School and the disman-

ting of programs that may be perceived by the Administration as non-competitive or obsolete.

On any of these issues we find and will continue to find a wide range of opinions amongst faculty, students, staff, and the Administration. Some pro, some contra, and many ambivalent somewhere in the middle.

I am personally in favor of a strong Administration with a clear vision and ability to execute this vision to help maintain MIT at the forefront of universities and progressive academic institutions in the world¹. For example, I do not favor the establishment of a "faculty senate" which might act as a separate check and balance against the Administration, but not automatically include the voice of other stakeholders on campus such as the students and the staff. It seems that there is a distinct impression that has formed on campus that the Executive Committee of the MIT Corporation effectively runs MIT with no direct accountability or ability by the MIT community to influence or override decisions made by the Senior Administration and Executive Committee of the Corporation and that several recent decisions run counter to the beliefs and opinions of a majority of the MIT community. However, this is really unsubstantiated speculation on my part

¹ It is difficult to argue that MIT is not and does not continue to be one of the, if not the top university in the world with a focus on the "arts and sciences" as reflected by many international rankings such as the [QS Rating of World Universities](#) where MIT has been rated #1 for many years. Side note: My alma mater ETH Zurich in Switzerland is rated 6th.

from reading the *MIT Faculty Newsletter*² (FNL) and *The Tech* and participating in faculty meetings, the Random (formerly Keyser) Faculty Dinners and listening to students, staff, and colleagues sharing their impressions.

Without explicitly asking and "voting" on specific issues it is impossible to know what the will or preference of the MIT community really is. Formation of opinions through mechanisms such as discussion panels, community forums, and so on will only give a partial view and reflect only the opinion of a small and often vocal subset of MIT.

An answer or partial answer may be found in the *principles and instruments of direct democracy* as I experienced them as a child and young adult growing up in Switzerland. I remember the tradition, every three to four months, of going to the local polling place with my parents and my brother and dropping off the paper voting slips in a sealed gray envelope on specific issues that affected us all. This act of direct voting was and is deeply ingrained in the culture of what has often been described as one of the most successful pluralistic societies and countries on Earth³.

Some of the more memorable votes that I can recall were:

² I served on the Editorial Board of the FNL from 2004 to 2013.

³ Switzerland is ranked first or at least in the top 10 globally in a number of categories such as Global Competitiveness (WEF), Global Innovation Index (WIPO), Prosperity Index (Legatum Institute), Happiness (Gallup), Income per Capita in PPP (IMF), and Human Development Index (UN). It is difficult to argue that direct democracy does not work or has not worked for Switzerland based on the merits.

- Lowering the retirement age (1978, 20.6% For, 79.4% Against)
- Abolition of the Swiss Army (1989, 35.6% For, 64.4% Against)
- Lowering the voting age to 18 (1991, 72.7% For, 27.3% Against)
- Joining the European Economic Area (1992, 49.7% For, 50.3% Against)
- Sunday shopping in Transit Hubs (2005, 50.6% For, 49.4% Against)
- Building of the new Gotthard Trans-Alpine Tunnel (2016, 57% For, 43% Against)

The outcomes of some of these votes were clear, while others were a very close call. Most of them ended up with what in retrospect I would personally qualify as the “right decision”, a form of collective intelligence⁴. Even the fact that a population would voluntarily raise its own tax rates is possible as long as it is clear what the money will be used for. It has to be acknowledged, however, that some votes led to results that I personally found to be wrong, even shameful:

- Prohibition regarding the building of minarets (2009, 57.5% For, 42.5% Against)
- Imposition of immigration quotas by country (2014, 50.3% For, 49.7% Against)

I am not arguing that direct democracy is perfect, but that it is a powerful form of governance that gives the population the distinct feeling and real possibility of being able to influence the course of history, even if not all decisions turn out “perfectly”. One of the beneficial side effects of direct democracy is that both the executive branch and the legislature have to explain their positions in detail even as the government has the right to offer up counterproposals. Each

cycle of referenda voting is accompanied not only by the ballot itself, but also by a carefully prepared booklet presenting the arguments “pro” and “contra” with data, facts, and interpretations in a balanced fashion. An external neutral watchdog organization ensures the fairness of the way the information is presented to voters.

Anchored in MIT's Bylaws and Regulations	Yes	No	
Who gets to vote	Faculty only	Faculty and Students	Faculty, Students, and full-time Staff
Impact of vote	Consultation only (non-binding)	Mixed (binding only for some issues)	Binding (effectively a veto right)
Issues subject to Referendum and Initiative	Academic only (Curriculum)	Academic and Operations (including Infrastructure)	All
Instrument	Referendum only	Initiative only	Both
Minimum number of signatures required	Fixed number (e.g., 1000)	Relative number (e.g., 5% or 10%)	
Frequency	Annually	Twice per year	Quarterly

With this article I want to raise the possibility that two specific instruments of direct democracy, the *initiative* and the *referendum*, may become new tools of MIT governance that would give the larger community a voice, while preserving in parallel the hierarchical management structure (corporation-senior administration-school / college-department) that is needed to run a complex enterprise such as MIT with an annual budget on the order of \$4 billion (including Lincoln Laboratory) and over 14,000 faculty and staff and 7,000 students.

What exactly are we talking about here?

*MIT Initiative*⁵: A vote by the MIT

community on a particular issue of interest could be forced by the collection of a sufficient number of validated physical or electronic signatures.

MIT Referendum: A major announcement or decision by the MIT Administration and/or Corporation Executive Committee could be challenged or overturned by the MIT community.

What might MIT’s version of an initiative or referendum look like?

The referendum and initiative as instruments of direct democracy are not set in stone or a one-size-fits-all solution. There are many ways in which these tools can be designed to have more or less teeth and be more or less easy to initiate. The key is to hear from the community directly on specific issues using either an open or secret ballot. The table above shows a range of potential implementations of direct democratic principles and tools at MIT. By selecting one alternative from each row a particular “MIT version” of a referendum or initiative could be created.

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⁴ For MIT research on collective intelligence, see: <https://cci.mit.edu/>.

⁵ The word “referendum” was first used in the Swiss canton of Graubünden in the 16th Century. In Switzerland a referendum requires 50,000 validated signatures and an initiative 100,000. Unfortunately these numbers are fixed constants in the constitution and not expressed as a percentage of the population.

As a result, now that Switzerland’s population has grown to nearly 10 million, it has become easier and easier to launch a referendum, leading to an overload of issues to be voted on.

An Institute-Wide Referendum

de Weck, from preceding page

Arguments in favor of introducing such instruments of governance at MIT are that they would empower the members of the MIT community to voice their opinions – through an official vote – on issues of common interest. It might lead to higher levels of engagement, and potentially less conflict between the Administration/Corporation and faculty, students, and staff. It would also force the Administration to better explain its rationale for major decisions.

Arguments against direct democracy at MIT that I have heard are that it may lead to a de facto shackling of the Administration in launching major new initiatives and moving the Institute forward in important ways that may be unpopular but necessary. Other arguments are that major strategic issues and smaller tactical and operational issues would become co-mingled leading to a confusing thicket of new regulations, rules, and contradictory directives.

I am not yet convinced that an MIT initiative and/or referendum is the right way forward but I am hoping we can have an active discussion and perhaps implement an *MIT-wide initiative and referendum on a trial basis* as an experiment for a period of one or two years. This would probably be an initiative or referendum of the non-binding kind and would allow us to gather some experience with direct democracy at MIT.

What would this look like in practice?

Imagine receiving a future email such as this one:

27 March 2023

MIT is considering the elimination of all car parking (except for electric vehicles and visitor parking) on campus and converting

Arguments in favor of introducing such instruments of governance at MIT are that they would empower the members of the MIT community to voice their opinions – through an official vote – on issues of common interest. . . . Arguments against direct democracy at MIT that I have heard are that it may lead to a de facto shackling of the Administration in launching major new initiatives and moving the Institute forward in important ways that may be unpopular but necessary.

existing parking lots and garages to other uses such as student and faculty housing and research laboratories. Current car commuters will receive free passes for public transportation on the T and MBTA network and subsidized parking at official park-and-ride facilities in Massachusetts, New Hampshire, and Rhode Island. Are you in favor of this proposal?

Yes

No

Abstain

Please submit your kerberos certified vote at <https://voting.mit.edu/2023/parking> by 1 May 2023.

Would you like to participate in MIT governance in this way?

Or do you trust the Administration to make the right decision on behalf of all of us?

We have a history of experimentation at MIT, for example we have made significant changes to our first-year curriculum such as PNR. Why not experiment with direct democracy in this way? Here are some topics that might be potential subjects of upcoming MIT-wide interest that could yield a meaningful community-wide referendum:

- Future campus development beyond the current MIT 2030 framework;

- Overhaul of the current General Institute Requirements (GIRs), impacting particularly the first-year experience for undergraduates;

- Policies for how MIT defends not only itself as an institution but also members of the community, including faculty, staff, and students who are accused by the federal government and its agencies of having broken the law;

- Major structural changes at MIT such as the creation of a new School or College.

I look forward to your feedback and comments on whether you think some instruments of direct democracy such as a referendum and/or initiative should have a place at MIT. Should the Institute launch an experiment with an MIT-wide referendum in the future? ■

Olivier L. de Weck is Professor of Aeronautics and Astronautics and Engineering Systems, and Faculty Director [MIT-Switzerland Program / MISTI](#) (deweck@mit.edu).

Author's Note: This article was submitted before the current Covid-19 crisis and is not meant as a criticism of the current Administration, who has handled the situation very well, but as a contribution to discuss longer term governance issues at MIT.

PKG Center Connects MIT Students with Broader Community Needs

Alison Hynd

AS THE NOW FREQUENT MIT Alert emails demonstrate, staff and faculty have worked from their home offices and kitchen tables to help thousands of students to move off campus at short notice, quickly translate curriculum to virtual formats, provide essential medical services while protecting patients and practitioners, and a thousand other challenges that we hadn't anticipated at the start of the semester.

While we settle into our new normal, the MIT community is also thinking about how to support our broader communities as businesses are shuttered and income streams suddenly disappear. Social media feeds are full of ideas for quick actions that we can take to help support employees of local businesses:

- Buy restaurant gift certificates and order curbside pickup from those that have transitioned to takeout (leaving a tip if you are able);
- Continue paying gym memberships while you run around the park and do crunches in your living room;
- Make kid-friendly virtual lessons about your academic area for those who are homeschooling and working from home.

All good ideas, but this is also a critical time to support and learn more about the nonprofit and government agencies who work with vulnerable populations year-round and are rising to the current chal-

lenges. At the Priscilla King Gray Center for Public Service ([PKG Center](#)), we're putting together resources for helping others during a public health crisis and connecting students to summer work with social impact agencies. We'll be sharing these with the MIT community, but also ask for your connections and suggestions to help us develop the resources.

[At the PKG Center] we educate students to collaborate ethically and effectively with community partners in order to engage in meaningful public service, today and in their lives beyond MIT. We help students connect with a wide variety of public service projects in local, national, and global communities.

First a quick introduction for those who don't know us: The PKG Center builds on MIT students' unique skills and interests and prepares them to address complex social and environmental challenges. We educate students to collaborate ethically and effectively with community partners in order to engage in meaningful public service, today and in their lives beyond MIT. We help students connect with a wide variety of public service projects in local, national, and global communities. We also provide guidance – and often funding – for their projects.

To do this, we collaborate with a diverse set of community agencies (non-profits, public agencies, social enterprises, corporate social responsibility divisions, and others) whose missions and values align with our own and who see mutual

value in working with MIT students to address community challenges and opportunities. Many agencies are flipping their usual work modes to support their clients while following social distance regulations and are devising creative ways that the public can volunteer remotely. We'll be adding these to an online resource library of practical opportunities

to support the work of local agencies as well as articles on best practices and self-care for volunteers.

Here are some ideas for starters:

Connect

- **Connect students to paid social impact work.** Many of our students were depending on MIT programs or corporate internships for summer income and are now facing significant financial hardship as a result of program cancellations and office closures.

At the PKG Center, we are connecting students with social impact agencies for paid remote internships over the summer with up to 75% of the student wages

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PKG Center Connects MIT Students

Hynd, from preceding page

coming from Federal Work-Study or PKG Center funds. If you collaborate with a great social impact agency in your work or personal life and you think they would value the input of an MIT student (or two!) over the summer, please let us know. We are particularly interested in opportunities related to computational tech for the social good, health, and climate change, but all ideas are welcomed. For the time being, we are focusing on work that can be done remotely, but also appreciate contacts for in-person opportunities for the future. You can [learn more here](#) and use [this form](#) to share contacts and ideas.

If you know students whose summer plans have fallen through and who would be interested in a paid social impact internship, please ask them to complete [this form](#) and direct them to the [guide to helping students find summer opportunities](#) produced by our colleagues at CAPD.

• **Connect your team and stay fit.**

Work groups from across MIT are getting creative about how to stay connected and keep positive team dynamics while working from home and many are sharing their tips and resources for staying fit while gyms and fitness studios are closed. Consider contracting Kendall Square favorite InnerCity Weightlifting to help you do both at once! InnerCity Weightlifting reduces community violence by connecting victims of trauma and racial segregation to new opportunities, including meaningful career tracks in and beyond personal training. Although their gym is closed, you can hire trainers for virtual group workouts or purchase workout videos of routines that can be done at home without equipment. Email iank@innercityweightlifting.org.

Engage

• **PKG webinar.** Many of us are asking how we can use our skills to help others in these new circumstances. We want to

As job losses hit our communities, the non-profits tackling food insecurity, homelessness, and other critical issues will need donations more than ever. In Cambridge, the Mayor's Disaster Relief Fund for Covid-19 has been created to provide emergency assistance in partnership with non-profit organizations to individuals and families in Cambridge who are experiencing extreme financial hardship caused by the current Covid-19 crisis.

support those around us, respond to urgent community needs, and connect with others. You may have joined us for a webinar recently where we shared ideas and resources to support our local communities and to aid in combatting the impacts of Covid-19. We will have a closed-captioned recording available soon at pkgcenter.mit.edu and may offer new webinar dates as more opportunities to help emerge. Together, with community-informed perspectives, we can support our neighbors and each other.

• **Resource Library.** We are collaborating with colleagues at other higher education social impact centers to produce a resource library of practical opportunities and best practices for local community engagement. Access the work in progress library here:

- [1 Page Overview of Webinar Contents](#)
- [Community Engagement Self-Checklist](#)
- [Stay Informed – Covid-19](#)
- [Volunteering Locally & Remotely](#)
- [Cambridge + Boston Opportunities](#)
- [Civic Participation & Advocacy](#)
- [Philanthropy](#)

We welcome suggestions for engaging with organizations that you support and are in your communities.

Donate

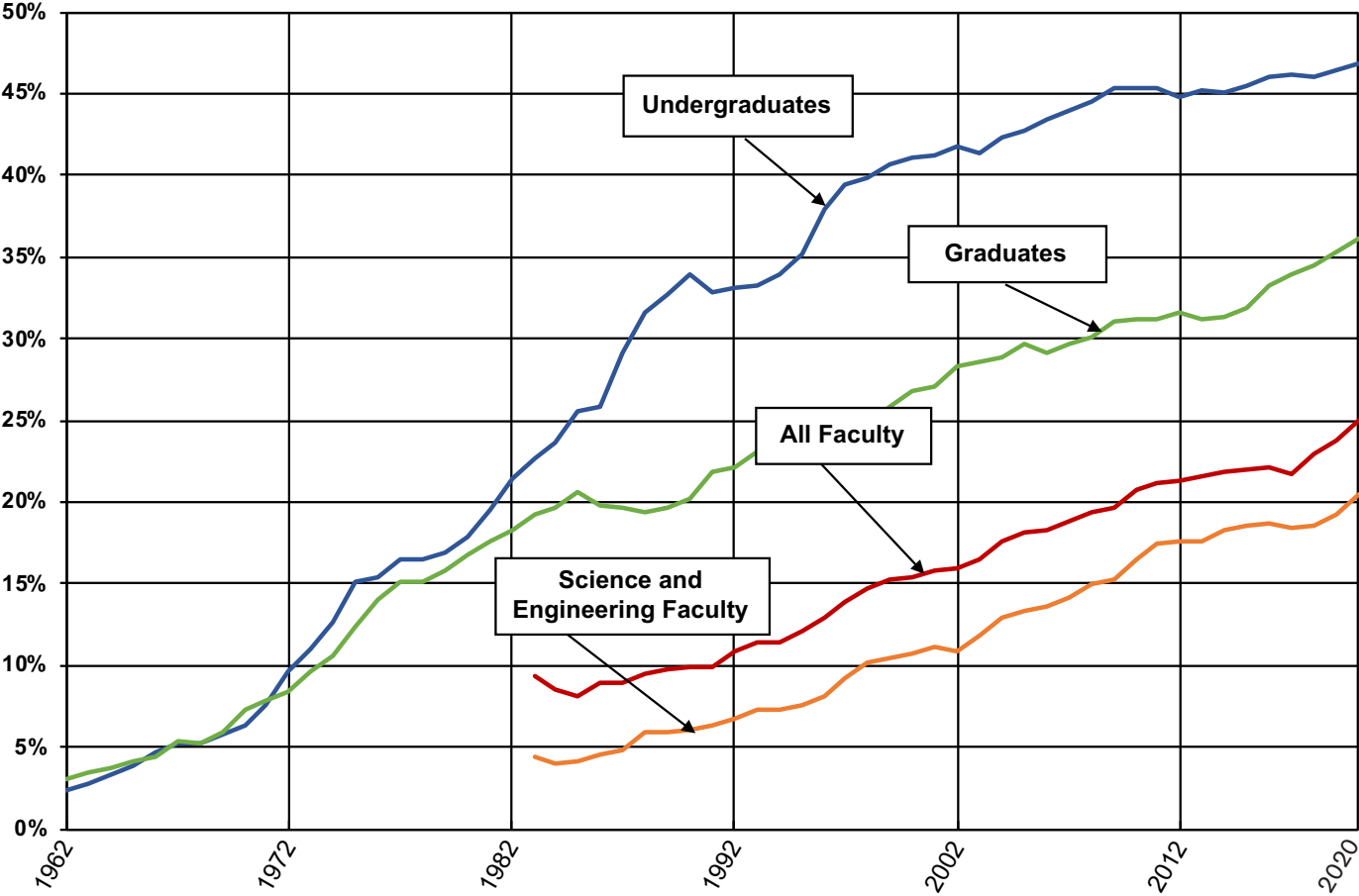
• **Donate money.** As job losses hit our communities, the non-profits tackling food insecurity, homelessness, and other critical issues will need donations more than ever. In Cambridge, the [Mayor's Disaster Relief Fund for Covid-19](#) has been created to provide emergency assistance in partnership with non-profit organizations to individuals and families in Cambridge who are experiencing extreme financial hardship caused by the current Covid-19 crisis. Look for similar initiatives in your hometown or contribute directly to agencies with which you are familiar.

• **Donate lab supplies.** Boston area hospitals need donations of personal protective equipment to keep front-line health workers safe. [MIT encourages](#) labs to donate supplies, and has a team to coordinate donations and funnel them to local health care facilities. ■

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M.I.T. Numbers

Women at MIT 1962-2020



Source: Office of the Provost/Institutional Research