



The dome atop Building 7 undergoes renovations.

NATHAN LIANG—THE TECH

Spring 2021 semester delayed, regular spring break canceled

Presentation by Chancellor Barnhart recommends inviting three undergraduate classes back to campus

By Kristina Chen and Kerri Lu
NEWS EDITORS

Spring 2021 registration week will be from Feb. 8–12 while the first day of classes will be Feb. 16, according to the academic calendar on the registrar's website. Classes authorized to have in-person components will be remote until March 1. In addition, the usual week-long spring break has been replaced by three- and four-day weekends.

MIT still plans to invite first years, sophomores, and juniors to campus

in the spring, according to a presentation by Chancellor Cynthia Barnhart PhD '88 at an Oct. 23 meeting. About 3,000 undergraduates and up to about 1,800 graduate students would live on campus in the spring under this plan.

The decision to delay the Spring start date by two weeks and to hold classes remotely for the first two weeks of the semester was made “based on consultation with public health experts,” Chair of Faculty and the Academic Policy and Regulations Team (APART) Rick Danheiser

and Registrar Brian Canavan wrote in an email to the MIT community.

Danheiser and Canavan added that spring break was removed “to avoid the usual travel away from MIT.” Six break days, consisting of two four-day weekends and two three-day weekends, have been designated instead. The calendar will have “the same number of break days as in fall semesters.”

Barnhart's presentation writes that spring campus operations will

Spring Semester, Page 8

Andrea Ghez '87 awarded 2020 Nobel Prize in Physics for supermassive compact object

Ghez: being a woman in science is like being ‘accused stupid until you prove you’re smart,’ which ‘really pushes you to prove that you belong’ in the field

By Shelley Choi
ASSOCIATE NEWS EDITOR

Astrophysicist Andrea Ghez '87 was awarded the 2020 Nobel Prize in Physics by the Royal Swedish Academy of Sciences Oct. 6. She received half of the prize jointly with Reinhard Genzel “for the discovery of a supermassive compact object at the centre of our galaxy.” Ghez is currently the Lauren B. Leichtman and Arthur E. Levine Professor of physics and astronomy at the University of California, Los Angeles. She received a B.S. in physics at MIT, and is the 38th MIT alumnus to receive a Nobel Prize.

The Tech spoke with Ghez over the phone to discuss her winning of the Nobel Prize, research, and experiences as a MIT undergraduate student. This interview has been lightly edited for clarity and length.

***The Tech:* What does winning the Nobel Prize in Physics mean to you?**

Andrea Ghez: Oh gosh, I'm just thrilled. I'm thrilled that the work was recognized at this level. It's a wonderful opportunity to highlight the kind of science that we're doing and the technology that enabled it. I guess I sort of see it as both a recognition and an opportunity.

TT: When were you initially interested in astrophysics and what fueled that interest?

Ghez: It's hard to identify the true start. I'd always been interested in the universe from a very early age, but I came to MIT actually wanting to be a math major. Formally, I switched my focus to astrophysics somewhere between my freshman and sophomore year.

I first got interested in astrophysics through the moon landing [which happened when I was four]. I got really captivated by imagination about the scale and size of the universe; when you start thinking about that you immediately come up against

these concepts of boundaries and edges and infinity, which I think initially took me in the direction of math. Ultimately, I came back to a more pure approach to thinking about the universe directly rather than through math. MIT really developed that in a professional way, from a childish fascination to a much deeper understanding of what aspects of the universe I found compelling.

TT: In the realm of astrophysics, why did you choose to specifically research black holes?

Ghez: They are so simple yet hard to understand. They're where

Nobel Prize, Page 8

IN SHORT

Election Day is Nov. 3.

To register for Spring classes, all MIT students must **submit proof of receiving a flu shot** by Oct. 30.

The **last day to add half-term classes for H2** is Oct. 30.

Nominations for recent MIT graduates to the MIT Corporation are open until Oct. 30.

The deadline to nominate faculty members for the **2020 School of Science Teaching Prizes** is Oct. 30.

Halloween is Oct. 31.

Interested in **joining The Tech?** Email join@tech.mit.edu.

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MIT students enjoy a nice day in marked, socially distanced circles on Kresge Saturday Oct. 24.

NATHAN LIANG—THE TECH

AI Policy Forum launched by SCC

Policy forum will bring together global stakeholders to ‘provide a focal point for work to move from AI principles to practice’

By Nicole Chan

The Schwarzman College of Computing (SCC) has launched a yearlong AI Policy Forum starting this fall.

Provost Martin A. Schmidt PhD '88 and SCC Dean Dan Huttenlocher PhD '88 wrote in an Oct. 19 email to the MIT community that the forum “will engage a broad set of stakeholders with the goal of moving the global conversation on AI policy from principles to implementation.”

The AI Policy Forum website writes that the forum will develop a policy framework building on “high-level principles on social and ethical issues such as privacy, fairness, bias, transparency, and accountability.” Additionally, the forum aims to “have real impact in the world of AI policy, as measured by

clear action from governments and companies.”

SCC Director of Communications Terri Park wrote in an email to *The Tech* that the forum will begin with “a series of preparatory task forces that will explore some of the most pressing issues of AI policy — mobility, finance, healthcare, climate change, and food supply.” Moreover, the specific policy issues addressed will be “specific — or granular — enough, while also being relevant across countries, regions and cities.”

Each task force will be “chaired by an MIT researcher” and include “a diverse range of technical and policy experts from around the world.” Park wrote that “the charge of the task forces is to present a report at the end of the period which will feed into the development of the AI Policy Framework.”

Park wrote that “these activities will culminate in the AI Policy Forum Summit, a two-day collaborative gathering (most likely taking place online) on May 6–7, 2021” to “discuss the progress of the task forces.” A fall 2021 “follow-on event” at MIT “will bring together leaders from across sectors and countries” to “provide a focal point for work to move from AI principles to AI practice.”

Park wrote that the goal of the forum is to “develop frameworks and tools for governments and companies to implement policies in concrete ways.” “This is the time to take the next step by building on those broader principles to help policymakers in making practical decisions about AI,” she added.

MIT community members can send questions or comments to aipolicyforum@mit.edu.

COMPASSION FIRST

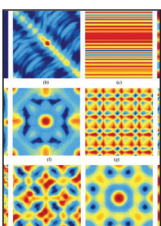
Science should not decide what is worthy and unworthy. **OPINION, p. 4**

SPEAK UP

How a generation of Nigerian youth mobilized against injustice. **OPINION, p. 5**

WRITING THE FUTURE

Capturing anti-establishment energy in all its glorious heterogeneity. **ARTS, p. 6**



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ALUMNA OLYMPIAN

Cycling from Cambridge to Tokyo 2021. **SPORTS, p. 12**

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WEATHER

Boston cooling as Election Day looms near

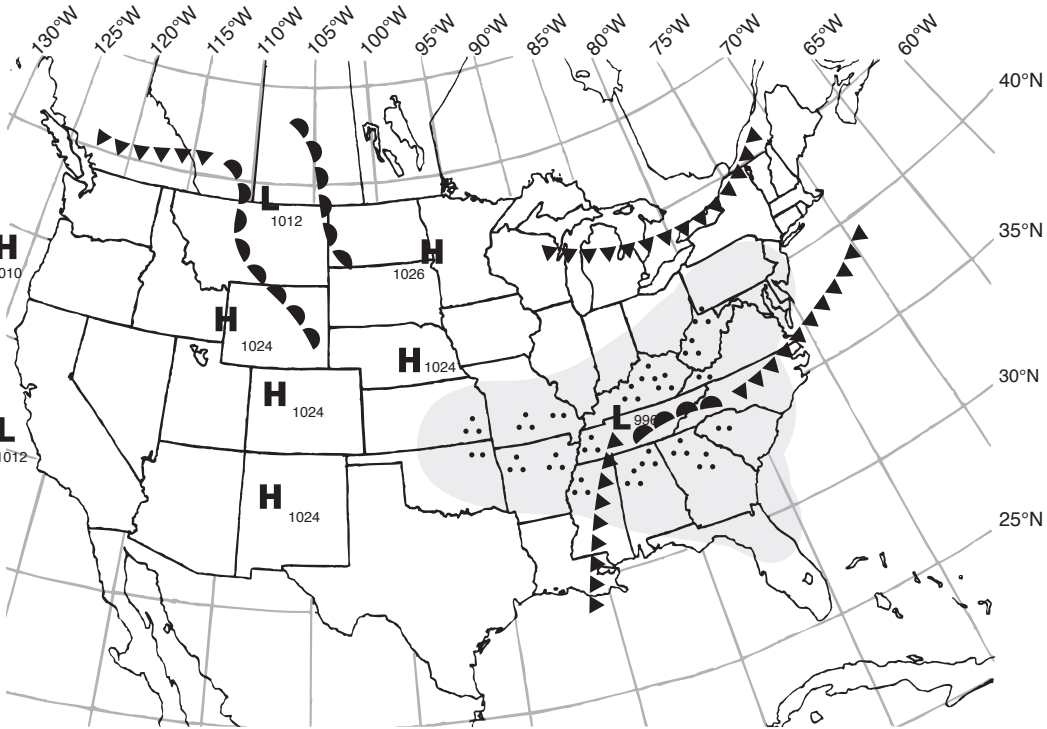
By Francesca Macchiavello

This week in Boston, we can expect a couple of consecutive days of grey skies and gloomy conditions. With rain and low temperatures coming up, fret not, the sun will come back out to play on Saturday, so make sure you spend some time outside and soak up those UV rays. On Sunday, the rain is likely to come back, but with slightly higher temperatures. As the weather starts to get cooler by the day, predictions for when the first snow in Boston are ramping up, so make sure to

check out the National Weather Services predictions and join some friendly neighborhood betting circles. Elsewhere in the U.S., there will be a variety of experiences. In the southwest, it will be much warmer than Boston and there will be plenty of sunshine. For those in Louisiana, do your best to stay safe as Hurricane Zeta runs its course. Make sure you're prepared for what's happening where you live whether that is a jacket or shorts. You wouldn't want to be reading the forecast for another city!

Extended Forecast

Today: Rain, mainly after 2pm. High near 50 °F (10 °C). Light and variable wind becoming east 5 to 7 mph in the afternoon.
Tonight: Rain before 8pm, then showers after 8pm. Low around 38 °F (3 °C).
Tomorrow: Showers likely, mainly before 10am. Mostly cloudy, with a high near 42 °F (6 °C). Breezy, with a north wind 17 to 23 mph. Low around 30 °F (-1 °C).
Saturday: Sunny, with a high near 44 °F (6 °C). Northwest wind 7 to 9 mph. Low around 34 °F (1 °F).
Sunday: A chance of showers after 9am. Partly sunny, with a high near 57 °F (13 °C). South wind 9 to 15 mph.



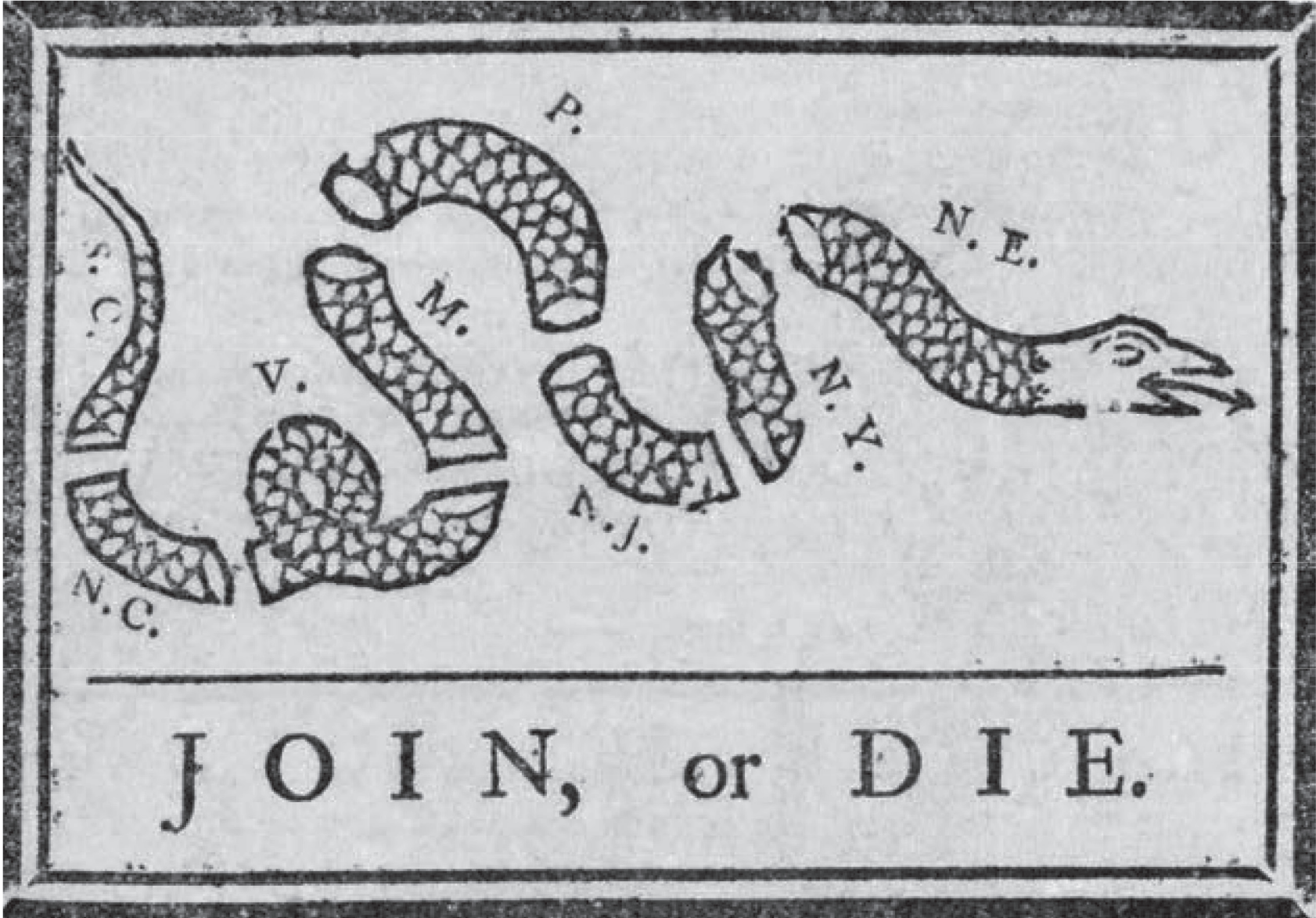
Situation for Noon Eastern Time, Thursday, October 29, 2020

| Weather Systems | Weather Fronts | Precipitation Symbols | | Other Symbols |
|------------------------|-----------------------|-----------------------|------|----------------|
| H High Pressure | - - - Trough | Snow | Rain | ☁ Fog |
| L Low Pressure | —••• Warm Front | Showers | ☂ | ⚡ Thunderstorm |
| § Hurricane | ▲▲▲ Cold Front | Light | * | ∞ Haze |
| | —••• Stationary Front | Moderate | ** | |
| | | Heavy | *** | |

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ME VS. ME

A ramble I am not quite qualified to ramble about

Too many thoughts and not enough sleep

By Joanna Lin
EDITOR

I'll be honest: I didn't really know what to write about this week. I still have a lot of internal debates, but none seem more important than the election that's happening in only a handful of days. There's a feeling of impending doom that even if Biden wins, we are too far down this rabbit hole to ever emerge whole again, that the Democratic party is very nearly as bad as the Republican party, and neither represents anybody in our country.

The United Nations recognizes 195 sovereign states. Why are we even obsessed about being number one? It feels woven into the American mindset on a national and individual level that we should always win, and by miles, no less. Maybe it takes being a student at MIT to start understanding that getting by is equally commendable as being the best.

Speaking of "getting by," some of my classes have acknowledged the enormity of the coming week, while others haven't. Part of me wants to buy into the illusion that life can carry on as normal if I just bury myself in a pset. The other part of me just gets distracted too easily by the news and can't even finish one reading over an entire weekend.

While my peers and I have grown used to calling each other out for problematic words or actions, talking to those in a wider circle is a completely different experience. For example, nearly all the parents of my family friends are voting for Trump. And it would be "ungrateful to argue with them when they fed me and loved me when I was a child," as I've been told. At the very least, it would isolate my parents from their friends. Venturing further, it's clear that some teenagers are no more progressive than their parents and grandparents, with more and more videos surfacing of high school students slinging incredibly racist slurs.

Part of me wants to buy into the illusion that life can carry on as normal if I just bury myself in a pset.

Four years ago, I couldn't do anything but watch the television with a knot in my stomach. And now, voting in the overwhelmingly blue (but only in cities — a whole other discussion) California, it feels exactly the same as when I couldn't vote.

I can completely understand people who don't vote in states where it really doesn't matter. Even Among Us, a game with absolutely no consequences, uses the popular vote. Still, how could anyone *not vote*?

In my history class, we're discussing the interwar period. In some ways, our current experience is drastically different, like the immediate access to news and, as of yet, the undeclared war. But in other ways, the polarizing ideologies and inability to reach common ground are so similar to the 1920s.

I'm not even sure I can feel more desolate about the state of U.S. politics than I already do.

One of my professors emphasized that we need to set aside time to process the results, whatever they may be. I'm not even sure I can feel more desolate about the state of U.S. politics, and the world, than I already do. Everything is disappointing, but nothing is shocking. And I'm not nearly educated enough on anything to be able to

hold a full conversation about it, much less change someone's mind.

Instead, here's a short, noncomprehensive list of recent or current topics about which I've been thinking and into which I've been throwing my measly UROP money.

- Amy Coney Barrett's confirmation to the Supreme Court, just eight days before the election.
- The quickly dissipating support for #BlackLivesMatter as everyone returns to their lives.
- Azerbaijan and Turkish attacks on Armenians in Artsakh.
- #EndSARS protests in Nigeria against the Special Anti-Robbery Squad.
- Youth protests against the Thai Prime Minister.
- Floods and landslides in Vietnam.
- The beheading of a French teacher by an Islamic terrorist, and the French Minister of National Education's decision to blame it on *intersectionalist theory from American universities*.
- Still-increasing COVID-19 case numbers, both in the U.S. and worldwide.

So, in conclusion, midterm season and election season have converged to a perfect storm. I am simultaneously *no thoughts, head empty* and *many thoughts, head exploding*, and I think I will be stuck this way for the next few weeks.

CAMPUS LIFE CAMPUS LIFE CAMPUS LIFE CAMPUS LIFE



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Neurodivergents deserve better

I was diagnosed with Autism Spectrum Disorder at 18 years old. At 18 years old, I began to understand myself. Finally, I understood why I am this way. Why I can never stomach fish, why scented candles give me nausea, why eye contact is painful, why I don't shut up, why I keep repeating the same phrases over and over again, why I can smell the barbeque from three doors down, why jokes can go over my head, why I laugh when no one else does, why I've failed at femininity, why I've been a pretender, why I've stuck out, why I've been sensitive, why I've been taken advantage of, why I had to take a break from school. At 18 years old, my life was no longer a random series of episodes in pain and suffering, but a riddle, finally deciphered.

**To attempt or to remove
or “cure” my Autism,
would be ego murder.**

I believe that my Autism is a fundamental part of my existence and a fundamental part of my personality and perspective. My successes and strengths exist because of my Autism, not in spite of it. To attempt or to remove or "cure" my Autism, would be ego murder.

Why then is my life and those of others like and unlike me a playground for a debate of "ethics"? Why is the erasure of my experiences and those of future neurodivergents even a question? Why do I have to argue for my right to exist?

Despite my wishes or those of other Autistics, millions of dollars each year go to Autism genetics and neuroscience research. In 2016 (the most recent year I could find comprehensive data for), of \$364,435,254 spent in Autism research in the United States, 24% went to genetics and 35% went to biology. Despite studies indicating that Autistic people live shorter lives (some indicate a life expectancy as low as 36 years old), are more likely to commit suicide, and face a 58% young adult employment rate, only two percent of those millions went to "lifespan issues." ("Lifespan issues," of course, is a euphemism for anything that happens to Autistic people past the age of 18.) At the risk of sounding anti-intellectual, I do not care what causes Autism nor do I care what makes our brains

so different. Generously, I will say that pure curiosity motivates most of these researchers, but what happens once we find “the cause” of Autism? It's not ludicrous to assume that in vitro fertilization clinics would quickly implement Autism-screenings, selecting only for zygotes least likely to be disabled and disposing of the rest. Start-ups will create prenatal tests to determine if your child could be anything like me, giving you a chance to terminate. This is already happening with Down syndrome. Science does not exist in a vacuum, and if it can be applied to make a profit (or to do evil) it will be!

Despite my wishes or those of other Autistics, millions of dollars each year go to Autism genetics and neuroscience research.

Defenders of these looming eugenicist practices claim they want to “minimize human suffering.” But what suffering? The suffering I have experienced has been because of misunderstanding, rejection, judgement, isolation, and abuse. The suffering I have experienced has been because of how others perceive and treat me as an Autistic person.

My suffering is not intrinsic to my Autism. If what truly interested them was suffering and not conformity, they would be working to change the conditions that are currently causing suffering: poverty, racism, police violence, transphobia, incarceration, colonization, ostracization, ableism, etc. There are many systems that are actively doing harm that NEED to be dismantled to ensure the safety and well being of all people, so why are we working to annihilate neurodiversity?

My suffering is not intrinsic to my Autism.

Autism research and paradigms have shifted from finding a cure to early detection and intervention; even the notorious Autism Speaks has removed the word “cure” from its mission. But I am hesitant to applaud this as a victory, because these interventions may be another method of

enforcing conformity, leaving the ableist status quo unquestioned. Even children diagnosed early can suffer lasting trauma from Applied Behavior Analysis therapies and Special Education classes. Why are we working to annihilate neurodiversity?

Why are we working to annihilate neurodiversity?

Everyone deserves to live a full, dignified life. And by everyone, I mean everyone. Even those with high support needs, those with intellectual disabilities, those who exhibit emotional outbursts, those who are non-verbal, those who have been convicted of crimes, those who may pose danger to themselves, those who may pose dangers to others. We all deserve better than extinction. We deserve better than bleach drinks and enemas, we deserve better than inspiring an anti-vaccine/ anti-science movement, we deserve better than sedation via psychiatry. We deserve better than trauma, abuse, and extinction. We deserve better than a measly two percent in lifespan issues.

Everyone deserves to live a full, dignified life. And by everyone, I mean everyone.

Ultimately, I hope that Autism research will shift to finding radical and innovative ways to support people with Autism and challenge the neurotypical hegemony. Beyond that, to paraphrase Mia Mingus, we need to dismantle systems that decide who is worthy and unworthy of being “typical,” of having their needs met, or of even living; further, we need to build a world that values all bodies and minds as “unique and essential.” I hope that all researchers can uphold these truths and consider the effects that their research will have in one, two, five, or more years. And that scientific curiosity always considers compassion first.

If you are interested in learning more about Autism from an Autistic perspective and supporting Autistic voices, visit the web-page for the Autism Self Advocacy Network.

D. Catalá is an undergraduate on medical leave.

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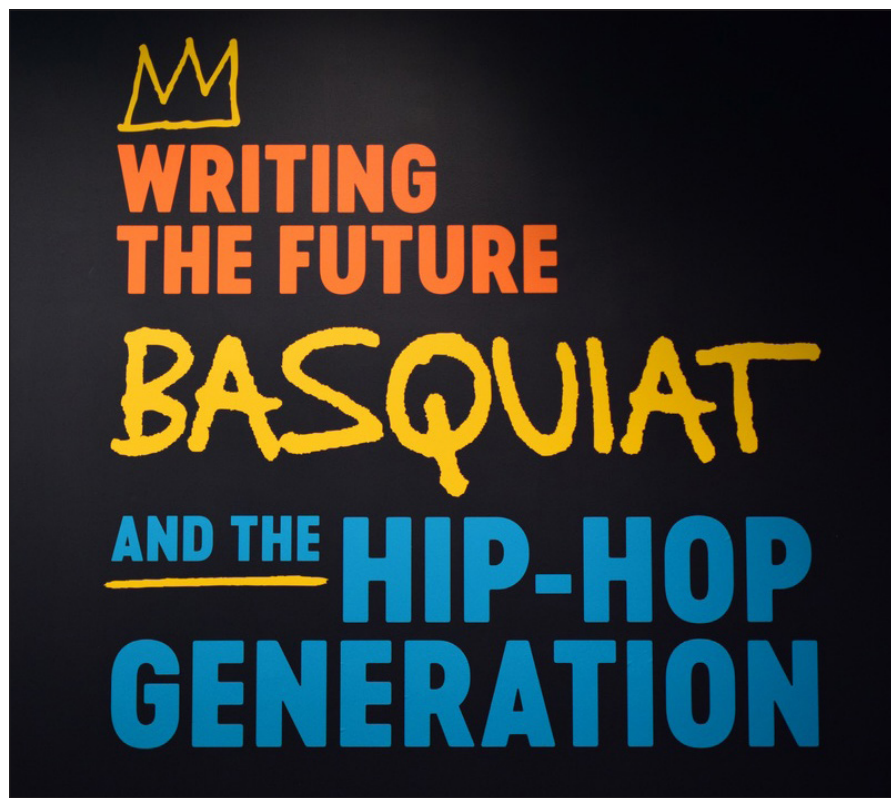
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ART EXHIBITION REVIEW

***Writing the Future* distills the artistic origins of hip-hop culture into a coherent experience**

The MFA's latest exhibit beautifully captures the diverse voices of 1980s New York street art



COURTESY OF MUSEUM OF FINE ARTS, BOSTON

The MFA's exhibition *Writing the Future: Basquiat and the Hip-Hop Generation* displays the anti-establishment themes of 1980s New York street art.

By Raj Movva

1980s New York street art was about subversion. Subversion of the dominant trends on canvas, yes, but also a broader subversion of how art gets made and who gets to make it. Subversion of the police and their attempts to stifle the burgeoning hip-hop movement. Subversion of society's supposed economic and scientific advancement, which failed to deliver progress to the most marginalized.

Writing the Future, now on display at the Museum of Fine Arts, beautifully captures this anti-establishment energy in all its glorious heterogeneity. The exhibition centers on Jean-Michel Basquiat, perhaps the most well-known of the so-called “post-graffiti” artists. Basquiat’s works are most distinguished by their liberal use of text; much of his art features short phrases and rough sketches of objects and symbols littered across the canvas. It’s up to the viewer to sift through this thought-dump and find meaning, which ends up being a pretty entertaining task. Sometimes, as in *Hollywood Africans*, there are clear messages of social commentary, whereas a piece like *Untitled* (1983) offers several cryptic panels of text to mull over. I spent several minutes staring at the latter work, every few seconds finding another amusing connection between the different words and icons on the canvas.

These iconic Basquiat canvases are riveting, and the sheer number of them alone

probably makes *Writing the Future* worth the visit. But unlike Basquiat shows before, this one stands out for all its other details. Walk down the steps leading in, and you're met with a montage of clips from the 80s of graffiti, breakdancing, and DJ-ing. Open the door to the exhibit, and you'll hear music playing — the likes of Kurtis Blow and Whodini, who established the roots of rap as we know it today. You can't help but tap your foot to the beat.

Then, in that first room, instead of just a wall of solo paintings, you're instantly greeted by unorthodox, collaborative pieces. There's Basquiat's leather jacket, signed by him and several of his friends, highlighting the intersection between fashion and the hip-hop movement. In the middle of the room, you'll find the *Fun Fridge*, a Dada-esque refrigerator full of tags from contemporaries like Fab 5 Freddy and Koolhaas. These initial moments at the exhibition immediately set the tone for your ensuing immersion in 80s street art and all its subcultures. Thanks to the music and the chaotic structure of it all, the vibe the whole way through is casual and experiential, a welcome twist from the typical buttoned-up nature of established art galleries. In that sense, the exhibition upholds the same nonconformist ethos that guided Basquiat and his peers.

But if the post-graffiti movement truly was a democratic approach to the arts in which all had a say, shouldn't we be celebrating more than just Jean-Michel? Ad-

mittedly, Basquiat and all his modern cachet were what convinced me to attend, but the rich diversity of creative styles made me stay. The first couple of rooms introduce Basquiat's supporting cast as central to his work, but the rest of the exhibit forces you to recognize the prodigiousness of their work on its own. A-One and Fab 5 Freddy's use of vibrant, clashing colors span large sections of the wall, analogous to how their graffiti might've looked on the metal doors of the subway. In *Untitled (Yellow and Black)*, Keith Haring's distinctive use of bold lines to express energy and movement is married with LA2's rich hues and precise calligraphy.

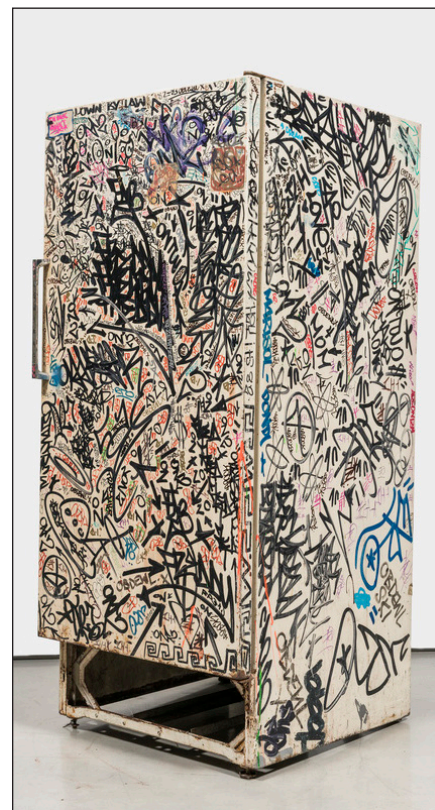
To me though, the standouts were Rammellzee and Lady Pink, for whom the exhibit managed to convey a broader ideology beyond their artistic styles. Rammellzee was the founder of “gothic futurism,” a subculture of Afrofuturism that revolts against the English alphabet as a medium for change. On the one hand, part of his oeuvre directly subverts oppressive power structures as in *Super Robber*, but his other works ascend past the worldly to imagine an unbounded, interstellar future free of authoritarian control. Even within this latter category, Rammellzee manages to carve out distinctive styles: in *Evolution of the World*, he carefully constructs a galactic universe with precise lines and a consistent color palette, while *Gothic Futurism Ratio Envelope Map-A-Matics Star Empllosion* uses the soft textures of spray paint to place planetary objects onto a dynamic, atmospheric background.

Meanwhile, Lady Pink is a Latina woman whose femininity is a core tenet of her artistic identity. Instead of rejecting her femininity to fit in with her peers, she embraces it; *Yellow Building* uses loud yellows and pinks to depict an imprisoned woman peering into a decaying cityscape. In *Tear Ducts Seem to Be a Grief Provision*, Lady Pink collaborates with Jenny Holzer to grapple with death, acknowledging the emotions of loss but in a tough, resolved way. Lady Pink's

unique intersectional voice comes through in the exhibit's selected works, but she's still presented in a way that naturally interlaces with her contemporaries.

When walking through a gallery, I'm often wondering how the works in front of me were perceived by people who grew up with them. Basquiat is now a staple in art history curricula, but what did 80s New Yorkers on the subway think of him? *Writing the Future* has an answer to that, too. Next to the standard information panel, many of the works had additional quotes from artists, activists, and community leaders with relevant cultural knowledge. These voices offer key additional context, for example by speaking to what Rammellzee meant for the larger Afrofuturism movement or how Lady Pink's work was influential to other young girls wanting to break into the scene. It's another nice touch that gives the exhibition more of a grassroots, art-for-everyone feel.

In curating *Writing the Future*, Liz Munsell and Greg Tate are faced with a difficult task: distilling such a multifaceted, evolving era of culture into the narrow confines of a museum gallery. Ultimately, they've built an innovative, immersive space that pulls it off with grace, subverting many of the standard principles that define traditional Eurocentric art shows. The art's been stuck in my head for days since my visit, and I'm left craving a similar vibe in the future exhibitions I'll attend.



COURTESY OF MUSEUM OF FINE ARTS, BOSTON
Fun Fridge is a Dada-esque refrigerator
with tags from Basquiat's contemporaries.

★★★★★

Writing the Future: Basquiat and the Hip-Hop Generation

**Curated by Liz Munsell
and Greg Tate**

**Museum of Fine Arts,
Boston**

**On display from Oct. 18,
2020 to May 16, 2021**

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How the leopard gets its spots

Alan Turing and the math behind biological development

By Albert Liu

Every computer scientist is familiar with some of British mathematician Alan Turing’s contributions to the field, from creating arguably the first computer to greatly advancing computability theory. However, outside the world of algorithms and electronics, one of Turing’s most important scientific legacies is in a seemingly disjoint field entirely: developmental biology.

For some background, one of the key questions in developmental biology is how a single cell, the zygote, can generate the complex pattern that is an organism. The consensus today relies on chemicals known as morphogens, whose distribution dictates the morphology, or overall form, of the organism as it develops. For example, the first discovered morphogen is a gene in fruit flies known as Bicoid, whose product concentrates in the front of an embryo and canonically helps establish what is known as the A-P axis — it demarcates which side is the front and which side is the back. Since the discovery of Bicoid, dozens of other morphogens have been reported, and how these compounds interact during the course of development remains an area of intense research.

But how did the concept of morphogens arise? As it turns out, the term itself was coined by Turing in his 1952 paper, “The Chemical Basis of Morphogenesis” (Turing, Alan Mathison. 1952 The chemical basis of morphogenesis. *Phil. Trans. R. Soc. Lond. B* 237: 37–72). Within this paper, Turing outlines that in order for a set of chemicals to shape a complex organism, there must be a mechanism to break the symmetry of its embryo. The developing embryo is initially roughly spherical and homogeneous, meaning that no part of the cell is more likely to grow into a head or arm than any other. It’s seemingly impossible that random fluctuations within such a uniform system could lead to a patterned distribution of morphogens. However, Turing showed that with a combination of chemical kinetics (reaction speeds) and diffusion, structures now eponymously known as Turing patterns emerge.

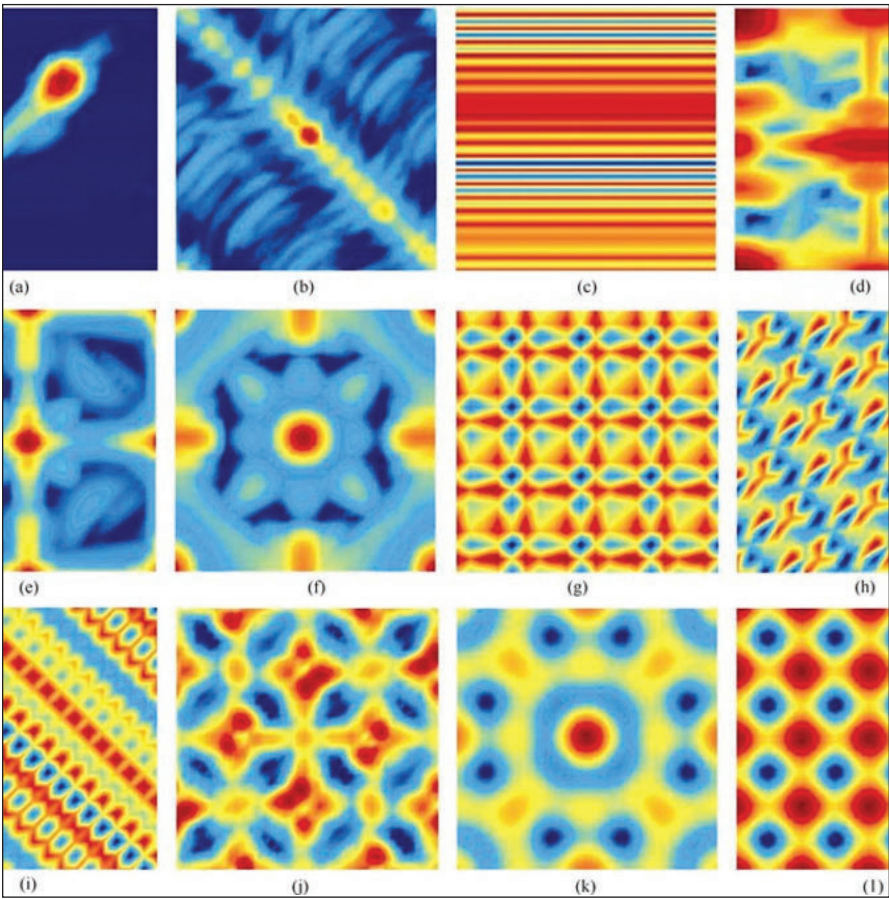
Turing patterns rely on the synthesis of morphogens at a specific location, as well as the flow of morphogens between locations. The simplest such system to analyze relies

on two morphogens within many different cells. The rate of synthesis of each morphogen is dependent on one another’s concentrations. However, if only chemical kinetics are considered, no spatial pattern would be produced, since no information is traveling between cells. This is where diffusion plays a role: each cell is able to exchange chemicals with its immediate neighbors based on the concentration differences of each of the two morphogens. With these two factors, this type of setup is known as a reaction-diffusion system.

Physics aficionados and those familiar with coupled differential equations will recognize this as similar to the setup for coupled oscillators and standing waves on a string. Without delving too deep into the math, these types of systems gradually shift towards a stationary pattern. As it turns out, reaction-diffusion systems also establish a semi-regular wave pattern of concentrations, which are the Turing patterns.

This type of reaction-diffusion system appears in many places throughout nature. In developmental biology, Turing patterns are commonly found on the skin. For example, the pattern found in a leopard’s spots have been rationalized as Turing patterns. Other animals can be found to have Turing patterns as well, such as the stripes on a zebra or the maze on a puffer fish. Even humans have examples of Turing patterns: your fingerprints can be modeled as Turing patterns, as can the distribution of sweat glands, etc.

Turing patterns have also been found to be far more pervasive than just in the realm of biology. Indeed, while the original “reaction-diffusion” system was proposed for a biological model of cells, many other phenomena exist because of a movement of material coupled with formation of structures. For example, the shape of sand ripples in a desert as well as star formations within galaxies can be traced back to Turing-like patterns. Even modern-day materials science has manifestations of Turing patterns. One instance is in liquid crystals, a phase of matter with applications including optical displays and biological membranes, among others. Recent studies have shown that even these materials exhibit Turing patterns, with isomerization reactions occurring in standing wave-like formations.



COURTESY OF XIAO, J., LI, H., YANG, J. ET AL. FROM “CHAOTIC TURING PATTERN FORMATION IN SPATIOTEMPORAL SYSTEMS.” *FRONT. PHYS. CHINA*

Turing patterns spontaneously arise in a wide variety of chaotic yet beautiful structures.

As powerful as Turing patterns are in explaining symmetry breaking processes, they do not fully explain how these strange designs give rise to something like an animal. One of the main challenges to moving from an elementary treatment of Turing patterns to explaining developmental patterns is exactly this: Turing patterns break from spherical symmetry to the strange symmetry possessed by the patterns themselves. Explaining how to break from this, in turn, requires focusing on the nature of the morphogens. In biology, most molecules are chiral, meaning that they are different from their mirror image. For example, while a basketball is achiral, since it’s the same as its reflection, your hands are not — your left and right hands are distinct. In the same way, biological morphogens are “left”

and “right” handed, which biases them to react in certain ways. Although the details are complicated, it’s not difficult to see that morphogens with an intrinsic handedness can give Turing patterns polarity, which eventually leads to the form of an organism.

Turing patterns represent a fascinating understanding of symmetry and asymmetry in nature. And while scientists currently implement more complex modifications of the basic Turing model, due to the volatility of Turing patterns, this type of analysis still is quite powerful. The power of Turing’s application of mathematics in biology helped establish the canon to this day. Although his life was limited by his untimely death two years after he published this paper, Alan Turing’s contributions and the beauty of his patterns certainly are not.















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Learning Equity and Diversity postpones microaggressions and bias workshop to review after Trump executive order

ICEO Head Dozier writes that the order will not be ‘disruptive’ to MIT’s ‘bias-related training’ programs

By Cher Jiang

The MIT Social Justice Programming and Cross Cultural Engagement Intercultural Center (SPXCE) will reschedule a Learning Equity and Diversity (LEAD) workshop, titled “Microaggressions and Implicit Bias,” that had originally been slated for Oct. 15. The decision comes after President Donald Trump issued an executive order Sept. 22.

The order prohibits federal contractors and grant recipients from teaching members “divisive concepts” in the form of diversity trainings or instructional materials.

Institute Community and Equity Office (ICEO) Head John Dozier

wrote in an email to *The Tech* that he expects the policy will not be “disruptive” to MIT’s “bias-related training” programs.

The order states that “many people” in prominent institutions propel a narrative in which certain individuals “are oppressors” based solely “on their race and sex.” The order writes that the aim of the policy was to prevent this type of “scapegoating” from being officially endorsed by federally-funded organizations.

The order provides examples for what it deems to be “malign ideology,” including an excerpt from a Department of the Treasury employee seminar. The seminar stated that “virtually all White people, regard-

less of how ‘woke’ they are, contribute to racism.”

The executive order also writes that according to research, “blame-focused diversity training reinforces biases and decreases opportunities for minorities.”

LEAD’s webpage states that the workshop, designed for staff members, would have included an “implicit bias test” for participants and techniques for “disrupting microaggressions.” The goal was to arm staff members with “theory” they could apply to “student interactions.”

Associate Dean for Intercultural Engagement La-Tarri Canty wrote in an email to *The Tech* that “an abundance of caution” preceded the de-

cision to not hold the workshop on the original date. MIT will review the contents of the workshop so it can “be confident that the workshop meets the executive order’s requirements.” For now, the program is “still unpacking” the implications of the executive order.

Canty also wrote that SPXCE’s “programming focuses on learning and building” and does not “assert that anyone is an oppressor based on their race or sex.”

Dozier wrote that he believes that “using stereotypes to teach or discuss the danger in stereotyping is ineffective and even counterproductive.”

Dozier added that “offering historical and cultural context when

discussing bias is not stereotyping” and that, from the perspective of the ICEO, consideration of such “cognitive bias research” is in fact necessary to addressing “the biases we all harbor regarding the people we live, learn and work with.”

In addition, Dozier wrote that for contractors of the federal government, the executive order takes effect “60 days after the date of its issue,” which would fall after Election Day. Dozier wrote that “the outcome of the general election will almost certainly affect the execution of this order,” making it difficult to decisively anticipate the impact of the order until the results of the election are known.

Ghez: ‘MIT was my first choice, clearly above’ all other undergrad institutions

Nobel Prize, from Page 1

gravity starts to mix space and time. You get into these conundrums that are very fascinating — just by how we experience gravity in our everyday life.

I was fortunate enough to do an REU [MIT’s Research Experience for Undergraduates Program], an undergraduate research project, so I participated in research effectively every year I was at MIT. I have to say I was just hooked. Once you get involved in this world of research, it’s compelling. I love using telescopes, I love programming, I love thinking about future satellites. And I’m so grateful to [physics professor emeritus] Hale Bradt [PhD ’61], who supported my education, really, because when you work with undergrads — and I appreciate this also from a faculty perspective — there’s so much teaching that goes into it. He was really generous with his time and provided me with opportunities that were rather amazing, in terms of both working on future x-ray satellites and getting to go to the telescopes.

MIT is so good at high-energy astrophysics, and black holes — smaller kinds of black holes, in particular — is what we were interested in. The ordinary-mass black holes, looking at the high energy properties with X-ray satellites and then finding optical counterparts to these things at MIT telescopes. And I think that’s when I discovered the wonderment of these objects.

TT: What led you to choose to attend MIT of all places for your undergraduate degree, and what work did you initially envision yourself doing as an undergraduate student?

Ghez: I applied early action. I really wanted to go to MIT; MIT was my first choice, clearly above everything else. In fact, when I was admitted, I threw out all my other applications, to a little bit of my father’s disappointment. To me, MIT was just the perfect school. I really fell in love with it well before I attended. I really wanted to go into math and science. There was no debate about the general direction.

To me, MIT offered everything — it just seemed like the perfect university. It catered to those who were interested in math and sci-

ence, and when I got there, I was like “Oh, I’m with my people.” It was a fun university.

I have to say, MIT is such an interesting place — even the idea that it has a strong Greek system. I actually lived in a co-ed frat when I was there, so it was this combination of a place that people who loved math and science could go to and still have fun. [Ghez was a member of the Number Six Club.] It had a great art museum and had these living groups. It just was like nirvana to me.

I met some of the most interesting people there, and [the community] resonated with me. People were really interested in math and science, yet had a lot of other things going on like sports. It was a place you could nurture those other aspects. At the time, there was the requirement that you had to take basically on average one humanities class every quarter, and I loved the idea that there was sort of this expectation that you maintain this other aspect of yourself, that even though you’re going to a school that’s fully committed to math and science, it was a school that was interested in helping you develop fully as an intellectual individual.

TT: What are some of your most memorable moments at MIT?

Ghez: Oh gosh, I had so many of them. Going to Chile to use the telescopes — just being up in the middle of the night and learning to use the telescope — was an amazing opportunity.

It’s so funny because you know being in college comes with so many different aspects of life. I loved having dinner at Number Six, making the nightly trek, finding an empty classroom to study in with friends. There’s something about the shared comradery of studying hard but not forgetting to have fun. Every weekend we would go out dancing, and I had so much fun as an undergrad, but I worked really hard.

That’s what really stuck with me at MIT — this group of people that was really committed to science and engineering and all these very curious pursuits, but on the weekend were very committed to going out and having some fun. They’re not specific memories, but just living life fully.

TT: What were some of your favorite classes or activities as a MIT student?

Ghez: Logic, Language, and Values was one of the humanities classes I had to take, and it just happens to have stuck with me. I think it was philosophy. Another was an intro to astrophysics and astronomy class [8.282]. During 8.02 (Physics II: Electricity and Magnetism) in 26-100, I can remember the lecture that stuck with me the most, which is when we were doing Maxwell’s Equations in Walter Lewin’s class. He had 400 daffodils for us to celebrate that we had learned these equations, and we could each take a daffodil home. What he did was so clever, like this beautiful celebration of something that was so significant for the class, so that was hard to forget.

TT: Do you have any professors that really impacted you and your work?

Ghez: Hale Bradt, for sure. I think he was one of my discussion leaders in 8.01, and then he taught that introductory class. But 8.01, that’s how I ended up working with him. I worked with him all four years through REU, and it was just a wonderful opportunity. I have to say we had a nice interchange because in addition to doing the REU program, I also had a job working in the MIT List gallery, and he ended up participating in a show there. I still stay in touch with him to this day and I’m so grateful for the opportunity he gave me as an undergrad. I mean MIT is amazing in the way they treat their undergrads and give them these amazing research opportunities. An important part of the MIT experience [is how] it really emphasizes the word “go.” And [Bradt] was so generous in terms of introducing me to a lot of different aspects of astrophysical research. Professor Claude Canizares, who was my academic advisor, was also very encouraging. I think Hale was the primary person, when I think back, just proportionately above everyone else.

TT: As a role model for many, do you have any advice for current MIT students?

Ghez: Pursue things you really enjoy, and keep trying new things, because we don’t know what we enjoy until we try them. I think those are the most important things. If you enjoy what you do, it doesn’t feel like work. I’d also say that anything that’s interesting also comes with a certain number of challenges, and

if you’re passionate about what you do, I think you’ll have the fortitude to overcome any obstacles.

TT: What inspires you in your work?

Ghez: I think when I’m most inspired is when things don’t make sense. I do a lot of work on developing new technologies and methodologies. And the wonderful thing is when these technologies give you a really different view on the universe, you can find things that are inconsistent with our current understanding. That’s what’s most interesting to me — when things have been turned upside down by a new piece of evidence, you have to think about, well, how do you sort out those problems that our current models don’t explain? That’s when I think research gets the most interesting.

TT: Do you have any future plans for your research?

Ghez: I’m going to keep going. There’s just so much more to do. We’re really in the midst of not only having answered the questions that we set out to answer, but also [having] revealed more questions than answers. And there are so many new directions to pursue about understanding supermassive black holes: how does gravity work near super massive black holes? What astrophysical role do these black holes play in the formation and evolution of galaxies? In that arena, so much of the observations have been inconsistent with the data that we have. That tells you there’s a lot more to be done to further our understanding. It’s exciting, I’m thrilled to see this, but in no way do I feel done with the research. It’s become more and more interesting over time.

TT: What are some applications of your research that you look forward to?

Ghez: It’s definitely basic research, it’s not the realm of applied research, where you know that there’s some invention where you’re going to apply it to a different arena. Where it does lead you is to the next step, the next question to ask about understanding how our universe works, understanding the physics, the astrophysics of it. For me, the next steps are all about furthering our fundamental understanding of the universe and training the next generation of students.

TT: What are some of your experiences as a woman in science, and what motivated you to advocate for them?

Ghez: It’s always interesting when you’re a minority in any field. I feel very fortunate to have been at MIT, because MIT is a place that has always been very forward-looking in the sense that for all of its history, there’s always been women there. They may have been in very very small numbers, but they were never excluded, and I think that fundamentally changes the institutional relationship to women. I always felt very welcome at MIT, and I met some of the most amazing women there.

I think one of the things I understood when I was a student there was that when you’re a minority, it’s very hard to be mediocre. They’re all pretty amazing. I think the doubt that people have or any questions that people have really discourages women if they’re not at the very top of their game. I think that being a minority drives you to work harder because you really have to prove that you belong there.

I like to say that you’re guilty before you’re assumed innocent, or accused stupid until you prove you’re smart, so it really pushes you to prove that you belong there.

One of the things I remember at some point [is that] as a student, you start to wonder because the numbers get low, especially in physics, whether or not you belong. The thing I used to think about is “Am I in the wrong playground?” because there are so few people who look like you. And so I started to understand when I was at MIT the importance of visible role models.

That’s why I do my teaching today at the introductory undergraduate level, because I think that’s how you can demonstrate to young women and young men that women are part of this field. It’s not that you have to preach about it, you just have to be visible.

Similarly, I’ve been very fortunate to work at a program that is of interest to the public, so I guess this is what led me to be willing to spend some time working with people doing documentaries. I think that’s the most effective way you can change things: to talk about science, from the public engagement of science, which is now more important than ever, and just to be visible.

Grading and other regulations to be announced later in the fall semester

Spring Semester, from Page 1

likely resemble those of Fall 2020, including quarantine week and regular testing. The presentation writes that during Fall 2020, there have been “very few examples of possible

transmission on campus among positive cases.”

MIT expects to hold about 160 classes with in-person components in the spring, compared to 120 classes with in-person components this fall, according to the presentation.

Independent Activities Period (IAP) will be held remotely Jan. 4–29.

Final exams will take place May 24–27, following a three-day “reading period.” Commencement will be June 4. The calendar also includes Campus Preview Weekend, set to take place from April 15–18.

Compared to the “normal” spring calendar of 65 teaching days, Spring 2021 will have 62 teaching days and end on May 20, Danheiser and Canavan wrote.

MIT declared a “significant disruption” of academic activities for the 2020–2021 school year in June,

and Emergency Academic Regulations for the Fall 2020 were announced Aug. 10. Danheiser and Canavan wrote that further Emergency Academic Regulations, including the IAP and spring grading policies, will be announced “later this fall.”

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Scary

Solution, page 12

| | | | | | |
|------|----|-----|-----|----|-----|
| 20x | | 10+ | | 5+ | |
| | 5- | | 30x | 9+ | 30x |
| 2 | | 4 | | | |
| 120x | | 6 | | 2x | |
| 3 | | 20x | | 5- | |
| 6 | | 24x | | | |

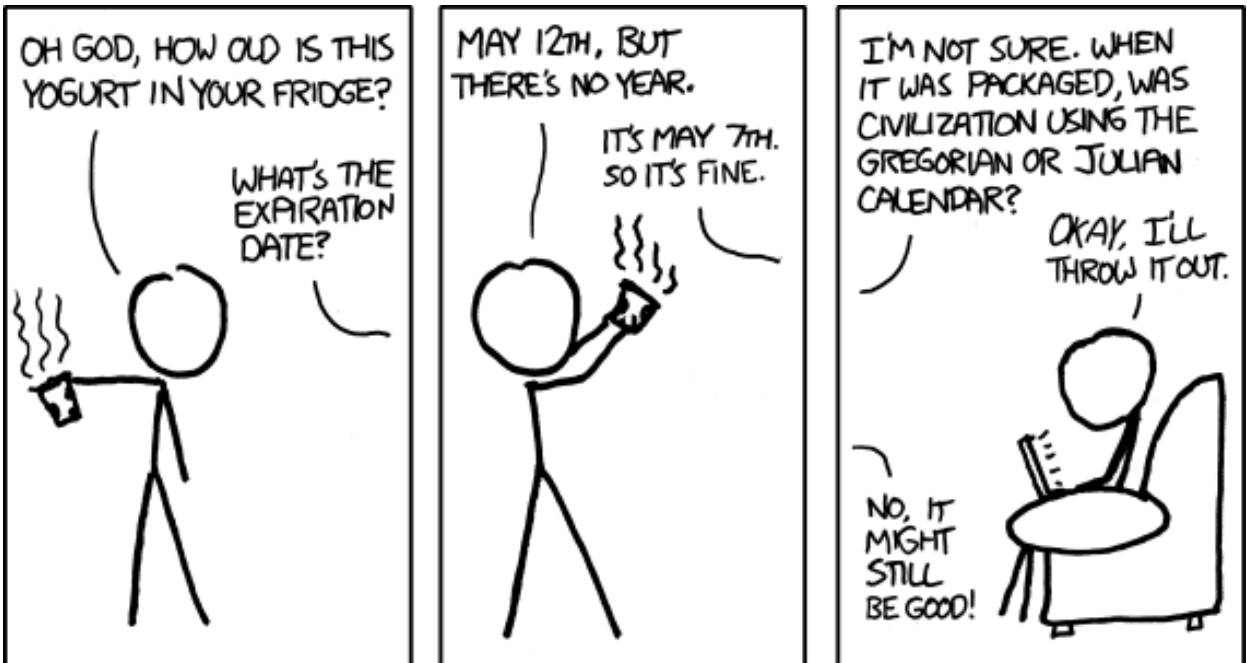
Instructions: Fill in the grid so that each column and row contains exactly one of each of the numbers 1–6. Follow the mathematical operations for each box.

Solution, page 12

8 Reduces one's speed

- 9 Small boat that's paddled
10 Avoid, as a crisis
11 Air Force locations
13 Delay until a later time
14 Installs, as a carpet
20 Hawaiian porch
24 Blog entry
25 Dishonest imitation
26 "See ya later!"
27 Carve a design into glass
28 Wall Street market: Abbr.
29 One more than one
31 Female hoopsters' org.
32 Improve with time, as
wine
34 Cooled with cubes
35 Tattered and __ (raggedy)
36 Give off, as light
37 NNW opposite
39 Possess
40 Taj Mahal's country
45 Refuse to compromise
47 Emcee's opening speech
48 Story from Aesop
49 Give permission for

| | |
|-------------------------------------|----------------------------|
| 50 Cooking appliance | 56 Puts into service |
| 51 Carryall bags | 57 Optimistic feeling |
| 52 Sweater style with an angled cut | 58 Line on a list |
| 53 Aid and ___ (assist in crime) | 59 Typical result |
| | 60 Color of overcast skies |



I am firmly of the opinion that if something doesn't have a year on it, every time the expiration date rolls around it is good again for the two weeks preceding that date.

Solution, page 12

| | | | | | | | | |
|---|---|---|---|--|---|---|---|---|
| 1 | | | | | | 4 | 9 | |
| | | 7 | 9 | | 4 | | 8 | |
| 4 | 9 | | 5 | | | 2 | | |
| | | 2 | 1 | | | | 5 | |
| 3 | | | | | | | | 4 |
| | 5 | | | | 7 | 9 | | |
| | | 5 | | | 3 | | 4 | 9 |
| | 1 | | 7 | | 5 | 3 | | |
| | 3 | 6 | | | | | | 2 |

Instructions: Fill in the grid so that each column, row, and 3 by 3 grid contains exactly one of each of the digits 1 through 9.

HEY, WHAT'S THE TEMPERATURE OUTSIDE?

SHOULD I GIVE IT IN °F OR °C?

DEGREES CELSIUS

- INTERNATIONAL STANDARD
- HELPS REDUCE AMERICA'S WEIRD ISOLATIONISM
- NICE HOW "NEGATIVE" MEANS BELOW FREEZING
- PHYSICS MAJOR LOYALTY
- EASIER TO SPELL
- WE LOST A MARS PROBE OVER THIS CRAP

DEGREES FAHRENHEIT

- 0°F TO 100°F GOOD MATCH FOR TEMPERATURE RANGE IN WHICH MOST HUMANS LIVE
- ROUNDS MORE USEFULLY (70's, 90's)
- UNIT-AWARE COMPUTING MAKES IMPERIAL LESS ANNOYING
- SI PREFIXES LESS RELEVANT FOR TEMPERATURES
- FAHRENHEIT LIKELY MORE CLEAR IN THIS CONTEXT
- VALUING UNIT STANDARDIZATION OVER BEING HELPFUL POSSIBLY MAKES ME A BAD FRIEND

CRAP, GOTTA PICK SOMETHING. UHH... 0.173 RADIANS.

I'LL JUST GO CHECK MYSELF

"Radians Fahrenheit or radians Celsius?" "Uh, sorry, gotta go!"

SportsSports

[illegible][illegible][illegible][illegible][illegible][illegible][illegible][illegible][illegible][illegible][illegible][illegible][illegible][illegible][illegible][illegible][illegible][illegible][illegible]

Sports

[illegible]

Sports

Sports

Sports

Sports

Sports

Sports

[illegible]

Sports

Sports

[illegible]

Sports