

WINTER 2022

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HARVARD UNIVERSITY | THE GRADUATE SCHOOL OF ARTS & SCIENCES



The Art of Science

In the lab and the studio, Ellie Beaudry explores connections between humans and nature

to note

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TWO YEARS AGO, I launched The Advising Project with the aim of improving the advising experience of GSAS students. Over the course of two years, the Project has evaluated what constitutes effective advising, developed best practices, and disseminated information about how

students, faculty, and other partners can work together to enhance the advising experience. We've launched Advice on TAP, an e-newsletter for students, and audited faculty handbooks to determine where guidance on graduate student advising should be added. And we've developed and carried out workshops designed to help faculty with their advising skills and to guide students in "mentoring up" as they learn how to advocate for themselves with advisors and others.

Looking ahead, while continuing to offer workshops for faculty and for students and building on the other efforts described above, the Project will also turn to what we are calling "embedded advising," developing ways for effective advising to become a part of all aspects of the graduate student experience. This approach will highlight the work of offices in GSAS and from across the Faculty of Arts and Sciences and in our interfaculty programs, contributing to the message that advising occurs at many stages and in many parts of the graduate student experience.

These offices form part of the Advising Village—multiple mentors who can support students as they work toward their academic and professional goals. As alumni, you, too, can participate in the Advising Village. You can serve as an alumni ambassador, engage in flash mentoring activities through the Firsthand Advisers platform, or share your advice with current GSAS students through the GSAS Virtual Coffee program. These and other opportunities can be found at gsas.harvard.edu/volunteer.

—EMMA DENCH
DEAN

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LETTERS TO THE EDITOR

We welcome your feedback and ideas. Write to: *Colloquy*, Harvard University Graduate School of Arts and Sciences, 1350 Massachusetts Avenue, Suite 350, Cambridge, MA 02138-3846; or email gsaa@fas.harvard.edu.

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Broaden Your Horizons

JOIN US THIS SPRING FOR PRESENTATIONS AND TALKS BY GSAS STUDENT SCHOLARS.

SAVE THE DATES

Harvard Horizons: April 12, 2022

Hear eight of GSAS's brightest scholars present their research live at Sanders Theatre on the Harvard campus.

Expanded Horizons: May 17, 2022

Join a global audience of alumni and friends for an interactive virtual conversation with Harvard Horizons scholars.

●●● For more information on these events, visit gsas.harvard.edu/alumni



FAS Dean Claudine Gay

An Imperative for Change

Edgerley Family Dean of the Faculty of Arts and Sciences (FAS) **Claudine Gay, PhD '98**, government, last November announced the launch of a three-year strategic planning process for the FAS. The process, which follows the report of the FAS Study Group formed by Dean Gay in 2020, seeks to define the structures and resources needed to support long-term excellence in teaching and research, with special emphasis on graduate education, faculty support and development, and organization of academic communities. As part of the effort, GSAS Dean Emma Dench plans to engage faculty and staff communities to develop a concomitant approach to admissions and to articulate core principles on how GSAS trains its students. "We need intentionality when it comes to the recruitment and training of graduate students and greater focus on their well-being," Dench said. "This is an exciting opportunity to effect change for our current and future students."

STUDENT WELLNESS TEAM FORMED

Co-chaired by GSAS **Dean Emma Dench** and FAS professors **Mario Small, PhD '01**, sociology, and **Matt Nock**, the University's Task Force on Managing Student Mental Health recommended in 2020 that a small team within the Office of the Provost work on student affairs University-wide. In response, the University's newly appointed associate provost for student affairs, **Robin Glover**, last fall formed the Implementation Committee for Student Mental Health and Wellness. Charged with implementing the Task Force's recom-

mendations, the committee will bring together working groups to collect data, develop plans for implementing recommendations, and monitor progress on student wellness across campus. Its goal is to create an environment that supports the flourishing of students by encouraging self-care and ensuring the availability of the necessary resources. "We want to destigmatize mental healthcare and to provide best practices for mental health and wellness at Harvard," Glover says. The committee convened for the first time in January 2022 and

is co-chaired by Glover and **Giang T. Nguyen**, executive director of Harvard University Health Services.



“Ten years or more from now, by being the delegates inside the [2021 United Nations Conference of the Parties on climate change], today’s youth will have a marvelous opportunity to change the world. Let’s hope they do so.” —HARVARD KENNEDY SCHOOL PROFESSOR ROBERT N. STAVINS, PHD '88, ON TWITTER



COVID NEWS

Last August, GSAS fully reopened campus for in-person learning for the first time since the initial wave of the coronavirus pandemic in the winter of 2020. The successful return of students was made possible by thoughtful and extensive preparation for safe in-person instruction, including widespread vaccination, regular testing, and masking requirements. At the time of publication, 97 percent of all active GSAS students and staff were fully vaccinated. Vaccinated students and staff who had a regular campus presence were also required to test once per week. Finally, students and staff were required to wear approved facial masks whenever indoors. As a result, GSAS was able to greatly mitigate the spread of the coronavirus among its student population during the fall term. The pandemic continues to affect campus life at GSAS. The School is committed to the health of all members of its community and will continue to take every precaution to ensure that students and staff can teach, learn, and work in safety.



CORRECTION: The summer 2021 issue of *Colloquy* listed Professor Sheila Sen Jasanoff as PhD '73, mathematics. Professor Jasanoff's PhD is in linguistics. We regret the error.

Potential for Peace

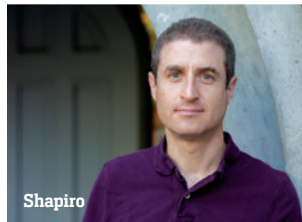
GSAS student **Olivia Woldemikael** was one of 18 Peace Scholar Dissertation Fellows selected by the United States Institute of Peace last September. The fellowships, which are awarded in collaboration with the Minerva Research Initiative of the US Department of Defense, recognize doctoral candidates who demonstrate “the greatest potential to advance the peacebuilding field and the strongest likelihood to inform policy and practice.” Woldemikael, a PhD candidate in the Department of Government, was cited for her work on her dissertation, “South-South Migrants, Refugees, and Hosts: Lessons of Tolerance from Uganda and Colombia.” The award provides a stipend of up to \$20,000 for the academic year in support of “research that deepens our understanding of conflict management, peacebuilding, and relevant security studies.”



Alsan



Bedford



Shapiro

REAL GENIUS

Alumni **Marcella Alsan, PhD '12**, economics, **Trevor Bedford, PhD '08**, organismic & evolutionary biology, and **Jesse Shapiro, PhD '05**, economics, were among 25 scholars and innovators who formed the 2021 cohort of MacArthur Fellows. Awarded by the John D. and Katherine T. MacArthur Foundation of Chicago, this year's fellowships recognized those who “demonstrate that creativity has no boundaries” as they “create objects of beauty and awe, advance our understanding of society, and foment change to improve the human condition.” Alsan, who sits on the faculty of Harvard Kennedy School, is a medical doctor and an applied microeconomist who studies inequity and health. Bedford, an associate professor at the University of Washington, studies the evolution of viruses to help forecast their growth and spread. Shapiro, like Alsan a microeconomist and a professor at Harvard Business School, develops “new frameworks of analysis to advance understanding of media bias, ideological polarization, and the efficacy of public policy interventions.”



CHARTING THE ECONOMICS OF LIFE

HERMAN PONTZER, PHD '06, ASSOCIATE PROFESSOR OF EVOLUTIONARY ANTHROPOLOGY AND GLOBAL HEALTH AT DUKE UNIVERSITY, IS ONE OF THE WORLD'S FOREMOST AUTHORITIES ON METABOLISM AND ITS DEVELOPMENT THROUGHOUT HUMAN HISTORY. THE AUTHOR OF THE BESTSELLING 2021 BOOK, *BURN*, PONTZER PROMISES TO "BLOW THE LID OFF HOW WE REALLY BURN CALORIES, LOSE WEIGHT, AND STAY HEALTHY."

In a March 2021 post on the Duke Research Blog, you referred to metabolism as "the economics of life." What did you mean by that?

Most people who lose weight—even if they have a surgical intervention like gastric bypass surgery—end up putting it back on. You've referred to metabolism as "the economics of life." How are they at work here?

It's as much evolution as economics. For half a billion years, losing weight has been a really bad sign for any animal. If you're losing weight, your economics are not sustainable. You're not bringing in enough to cover your expenses. This

is true not just of humans, but of other species too. That pathway leads to death, so your body is built to defend its body weight. It doesn't want to change weight very easily and if it's going to make a mistake in one direction or the other, it surely doesn't want to lose weight. If you do lose weight, it wants to get back to where you were before.

A common belief is that we can speed up our metabolisms through exercise. What's the truth and how did you find it in northern Tanzania?

Northern Tanzania is where the Hadza live.

“[Exercise] is not a great tool for weight loss—but it’s great for just about every other aspect of human health, including mental health.”

—HERMAN PONTZER

They are a traditional hunter-gatherer community. They don’t have any machines or vehicles or electricity or anything like that. They hunt and gather wild foods each day to live. As you can imagine that’s really physically demanding work. In fact, they get about five to ten times more physical activity every day than the typical American. So, we wanted to understand how metabolism works with the Hadza. And we felt sure going into it that they would have these really elevated metabolic rates—they would burn lots of calories every day, compared to the typical American, because they’re so active.

We spent a summer collecting data through the doubly labeled water technique [which measures energy consumption through the estimation of carbon dioxide elimination in the body]. That allowed us to precisely measure the calories burned by the Hadza. We got back to the US and had the data analyzed by one of the leading doubly labeled water labs in the country. And we were totally shocked. Because even though the Hadza are much more physically active than us, they don’t burn any more calories than we do. In fact, when you account for things like body size, fat percentage, age—no matter how you want to slice it—there’s actually no difference at all in daily energy expenditure between Hadza men and women and adults in the US and Europe and other industrialized population.

But the Hadza are expending so much energy hunting and gathering. Don’t they need to consume an equivalent amount of calories to keep themselves fueled?

Let’s get back to that economics analogy with energy. We tend to focus a lot on the energy that we spend on physical activity because we’re aware that our heart rate

goes up, and the calories we’re burning per minute or per hour are much higher when we’re exercising. But even for someone in the Hadza community, most of the calories every day are burned on other stuff like the immune system and just the basic processes of homeostasis—you know, keeping yourself alive, the reproductive system, the nervous system, all of these processes we aren’t even really aware of. So, what we think is happening is that the Hadza are spending a bit less on those other processes to make room for the physical activity. There’s no magic here. The laws of physics remain undefeated. Their energy is just spent on different tasks.

Is that good news or bad news for long-term health?

I think it’s good news. Here in the US, we see the same kind of compensation happening when people are more physically active. We see people start a new exercise routine and they’re not burning as many calories as you’d expect based on what was assigned to them by their program.

What we know is that exercise is really good for us. And one of the reasons it’s so good for us is that it lowers our inflammation levels, it lowers our stress reactivity, it gets reproductive hormones in a more healthy range. And so, we think those compensations that we see here in the US and in other communities are part of the health benefits of all that activity. I mean, when we look at the Hadza, they don’t get heart disease, they don’t get type two diabetes, they have lower incidence of reproductive cancers than we see here in the US. They’re really healthy, and I think that energy compensation—rejuggling the energy budget—is one of the big reasons that they are so healthy compared to us.

CURRICULUM VITAE

Duke University
Associate Professor of
Evolutionary Anthropology
and Global Health
2018–Present

Hunter College
Associate Professor
of Anthropology, 2013–18
Assistant Professor
of Anthropology, 2011–13

Washington University
Assistant Professor of
Anthropology, 2006–10

Harvard University
PhD in Biological
Anthropology, 2006

Pennsylvania State University
BA in Anthropology, 1999

What’s the message here? Is it that it doesn’t really matter how much activity you engage in?

If we’re strictly looking at weight loss, then the Hadza study is just more evidence that exercise alone is a pretty poor tool for weight loss. If you absolutely push it as hard as you can for as long as you can, you might see some weight loss until your body rights the ship. But even then, the expected weight loss from exercise alone is something less than five pounds per year. It’s not a great tool for weight loss—but it’s great for just about every other aspect of human health, including mental health.

●●● **To hear more** from Herman Pontzer, check out the March episode of the Colloquy podcast: gsas.harvard.edu/colloquy-podcast.

The

「preciousness」

of

Air

THROUGH SCIENCE AND ART, ELLIE BEAUDRY FORGES NEW CONNECTIONS BETWEEN HUMANS AND THE ENVIRONMENT

BY ELIZABETH GEHRMAN | PHOTOGRAPHS BY JOHN SOARES





air should be something everybody has.”

THAT SIMPLE REVELATION CAME TO ELLIE BEAUDRY when she was in high school in Shanghai. China ranks 137th out of 180 countries on Yale University’s Environmental Performance Index, and according to the Swiss company IQAir, it is the 14th most polluted nation in the world. Beaudry, a US citizen whose American father and Chinese mother have lived with her and her younger brother in both countries, says that the international school she went to could afford expensive air purifiers that created “a bubble of clean air around it.” When she got outside, though, she didn’t need a degree in environmental science to know the air was unhealthy.

“I’d go to school on the bus and feel like I was choking on cigarette smoke and ash, and then be in a safe place,” Beaudry recalls. “Local students and even hospitals didn’t have the resources we rich American kids had. I grew up in New Jersey, where no one thinks of air, so it was a mental switch for me. It was something that wasn’t right in the world, and I wanted to help in some way.”

Today, Beaudry, a second-year PhD student, is actually helping in two ways: through her research on ozone pollution in the Atmospheric Chemistry and Modeling Group at the John A. Paulson School of Engineering and Applied Sciences, and through her professional-level multimedia artwork, which highlights environmental themes. And though at Harvard

her attention has necessarily centered on atmospheric chemistry, her art, which has been exhibited internationally, remains a big part of her life—a way to release the “pent-up energy” and creativity that enliven all she does.

“Good Detective Work”

Particulates such as nitrogen oxide and sulfur dioxide, which are emitted by industry, power plants, and vehicles, have dropped by 40 percent since Beijing declared its “war on pollution” in 2014. But ozone pollution, caused at ground level when volatile organic compounds react with one another and with heat and sunlight, has increased significantly in most large Chinese cities, according to Beaudry’s advisor, Daniel Jacob, Vasco McCoy Family Professor of Atmospheric Chemistry and Environmental Engineering. No one is quite sure it has gotten worse, but Beaudry’s research may offer some clues.

“Ozone pollution is what will make your eyes burn and your throat hurt,” Jacobs says. “In looking for some of the sources of that pollution, Ellie found a lobbying-group report that showed the gasoline produced in China contains methanol, which the air-pollution community didn’t know about. It was pretty creative of her to unearth it. Good detective work.”

“Sometimes you get a lucky break,” she shrugs. Methanol additives are promoted for gas in the United States because they make fuel burn cleaner, she explains, but “East Asia has a very different emission profile.” Here, most methanol—an oxygenated volatile organic compound, or OVOC—comes from biomass, while in China OVOCs are more likely anthropogenic, or human-made. “There’s a much higher concentration of them there,” Beaudry says. “We’re underestimating them by an order of magnitude, particularly in urban areas.” OVOCs are a precursor to ozone pollution, and because they can have both pollution-forming and pollution-degrading effects, “having a better understanding of them is really important for us to be able to model pollution processes around them and perhaps begin to regulate them.”

Another largely overlooked source of ozone pollution Beaudry has been studying is VCPs, or volatile chemical products—“the things that smell nice” in household cleaners, beauty products, and perfumes. In cities, she says, more ethanol—an anti-knock gasoline additive and another source of ozone—comes from VCPs than from cars. But “they’re not included in the emissions inventories scientists use to create models,” she says. “Just because a particular compound may have an environmental benefit doesn’t mean we shouldn’t consider the negative effects that might come with using it on a wide scale. It’s always a chain reaction.”

Scientists are researching VCPs in Europe and the US, but Beaudry hasn’t seen any evidence that they’re being studied in Asia, and there seem to be no regulations regarding their use. Laws reducing nitrogen oxide and sulfur dioxide—the chemicals released by the burning of fossil fuels—have been helpful worldwide, she says, “but we’re hitting a wall by only targeting those, and we can’t fix something if we don’t understand it.”

New Pathways

Helping people understand the natural world and the effects humans have on it is one of Beaudry’s goals outside the lab, too. The impulse motivates much of her art, including her most recent installation, the Air Series, a pop-up exhibit Beaudry mounted this summer in the Middlesex Fells. The nine oil paintings on paper danced in the breeze, hung by string and clothespins in a copse of trees so that passersby could interact with them. “By hanging the paintings and letting them move with the wind I was trying to get at qualities of air and visualizing the preciousness of it,” she says. “Art in a museum is stagnant and sits there for an eternity, but this could move and change and be inviting.”

The paintings depict clouds in various moods and configurations—including in a yin-yang-shaped sunset and as cottony puffs against a springtime-blue sky—overlaid with line art adapted from Buddhist cave paintings in Dunhuang, China, which for Beaudry resonate with cultural significance. “The East versus West aspect is part of my identity. It’s a way of saying, ‘This is who I am and I belong here and my views should be considered.’”

Beaudry would like to run her own lab some day,

“Having a better understanding of OVOCs is really important for us to be able to model pollution processes around them and perhaps begin to regulate them.”

— ELLIE BEAUDRY, PHD STUDENT, ENGINEERING SCIENCES

“A lot of young artists repeat what’s been done or what they’ve seen, but she has big, bright, open eyes. She knows she’s a global citizen and uses that to make comments about the world.”

—RENATE FERRO, VISITING ASSOCIATE PROFESSOR AND DIRECTOR OF UNDERGRADUATE STUDIES, CORNELL UNIVERSITY

but even if she doesn’t go into academia, she says becoming an expert in atmospheric chemistry is important to enabling her to communicate science through her art. “People are primed to reject research or just ignore it at a time when air pollution and other issues are coming to a head,” she says. “Being able to share this message in a different way is critical to making people aware and maybe being able to bridge the gap.”

It’s one reason she does installations like the Air Series. “You can touch more people than you can in a gallery,” she says. “The most important thing is that someone feel something when they see the work, and if they feel enough to inquire about it and learn more—if I can spark that curiosity in them—that would be a success. My hope is to encourage engagement and then care.”

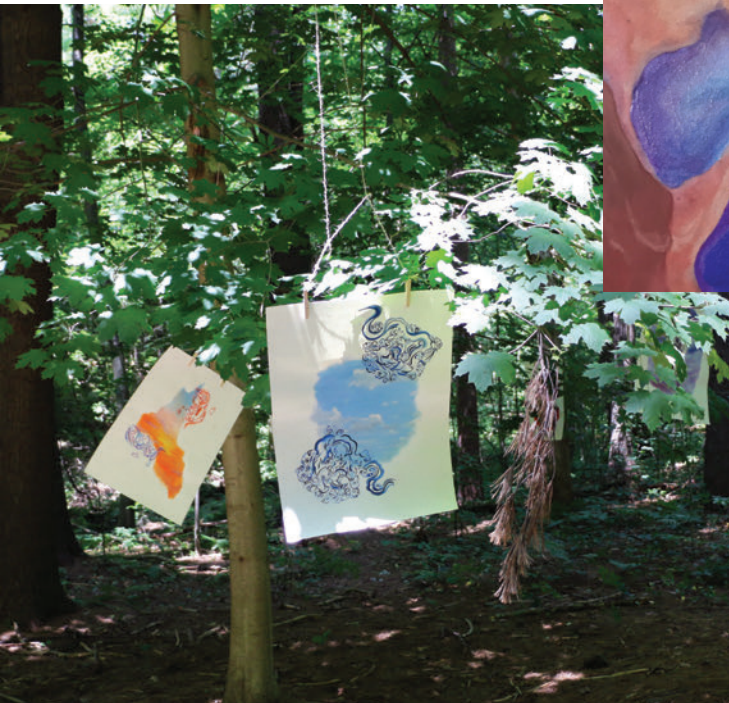
Both Dan Jacobs and Peter Hess, a professor in Cornell’s Department of Biological and Environmental Engineering and the director of graduate studies, say they never had another student like Beaudry, who had enough commitment to visual art and chemistry to pursue both with intensity. “It’s really quite unusual,” says Hess. “Environmental engineering is very quantitative, and art has a completely different way of seeing the world. But Ellie seems to bring her science mind to her art and vice versa.”

Renate Ferro, Beaudry’s art professor at Cornell and the director of undergraduate studies there, says bringing artistic creativity to science, business, and other fields may seem unconventional today, but it’s the wave of the future. Ferro says Beaudry was one of the students she and her colleagues had in mind when they revamped their department to return to being more cross-disciplinary. “In order to envision a

more dynamic future, we need to start thinking out of the box,” Ferro says. “Things are moving quickly and students have changed radically in the past few years because of the pandemic and rampant technology. To meet those new demands we need to collaborate and come up with new paradigms.”

Having more than one focus is nothing new to Beaudry, whose art encompasses painting, drawing, writing, sculpture, stop-motion animation, installations, and digital media. While some of her figurative works draw on the elements of the fantasy and science fiction she grew up reading, many of her videos spotlight a single moving image—water bubbling in a creek, for example, or a small fire amid fallen leaves—superimposed with thought-provoking audio that may recount a day in her life in Shanghai or contemplate the questions of human existence and quantum physics or tell a poetic tale of the earth’s taste for human sacrifice: Rushing waters are a siren song, the roar of crashing force on jagged rocks a lullaby. They call out to the lost, the lonely, the brash, the overconfident, the ones that are just trying to escape. Have you ever stopped and listened to the falls? Have the whispers followed you home at night? “Come closer, for I am not so cold. Don’t be afraid.”

“She has amazing ideas,” says Ferro, who taught Beaudry when she was a freshman at Cornell and recalls asking her at the time why she wasn’t an art major. By sophomore year Beaudry was working toward her dual degree and, Ferro says, “blowing everybody out of the water. A lot of young artists repeat what’s been done or what they’ve seen, but she has big, bright, open eyes. She knows she’s a global citizen and uses that to make comments about the world.”



Beaudry hopes being bilingual and cross-cultural can ease her way toward working jointly with scientists in Asia to do work that “engages with people’s lives rather than just as an intellectual pursuit,” she says. She sees both art and engineering as ways of telling stories—in science, that the choices we make every day “are linked to the air people are breathing at this moment,” and in art, that communication can “transcend borders and generations.”

“Going from something that’s in your head to reality is never a straight line,” she says. “There are always unforeseen bumps in the road that require creative problem-solving.” And that, according to her father, is Beaudry’s true gift.

“It’s not her individual work so much as the questions she raises and the dots she connects,” says Scott Beaudry, who has a BS in chemical engineering but works in private-sector wellness research and development. “As engineers we’re trying to solve problems that haven’t been solved before. Some of us really have to ‘skill up’ to make those connections, but Ellie’s willingness to go from here to there in a nonlinear way can only open new pathways for her.”

And, perhaps, for the field. ♡

PORTFOLIO (clockwise from left)
The Air Series installation at Middlesex Fells, Stoneham, MA;
Skim; *The Yuling Grottoes Cave 3*,
Puxian Buddha; *Drifting Up and Down on the Lakes and Streams and Clouds*; Beaudry and her 2018 video piece, *Flashbacks*.





As Below, So Above

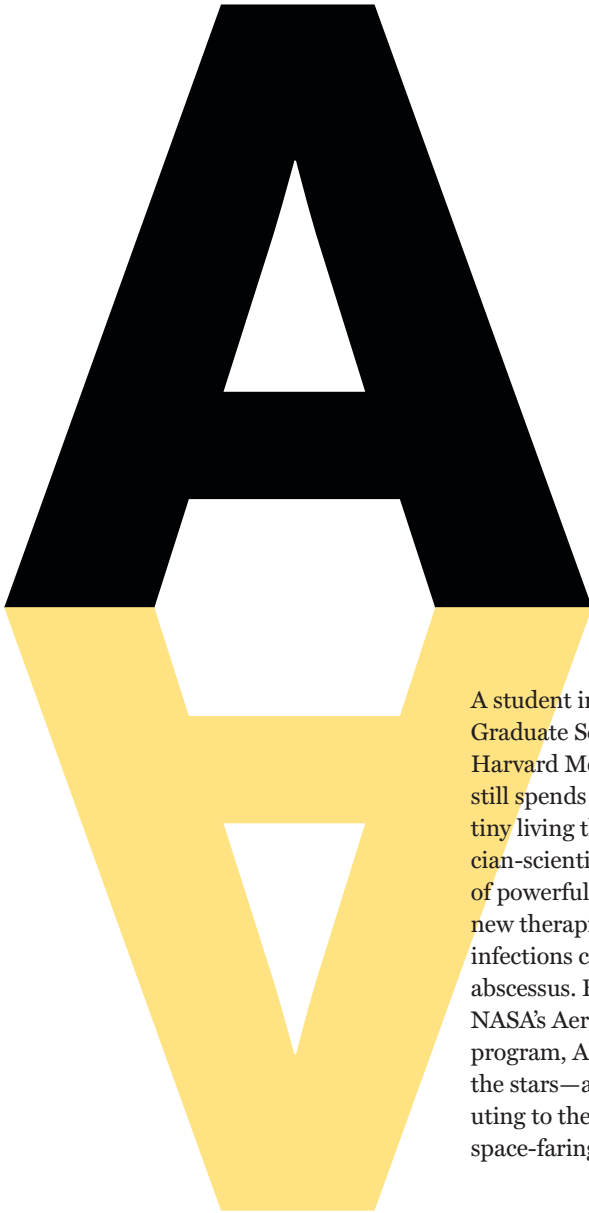
AKUSOBI CASTS HIS GAZE AT MICROBES AND THE STARS IN THE SERVICE OF HUMAN FLOURISHING

BY PAUL MASSARI | PHOTOGRAPHS BY DAVID LEIFER

» CHIDI AKUSOBI wrapped his fingers around the edge of the rock and lifted. Underneath, worms, pillbugs, and many other insects darted and wriggled. The young man was enthralled. He had discovered an entire community of life in his family's Bronx, New York, garden. He wanted to study it, to observe, to discover its secrets of life. So, much to the chagrin of his mother, a nurse, he did what any budding young scientist would do. He tried to recreate the subterranean colony under controlled conditions at home.

"I got some Tupperware and filled it with dirt," the microbiologist remembers. "I put some of the insects in there with leaves and some water, thinking that's what they would eat. I checked every day to see if they were still alive. That was me at 10 years old."

If, in the daytime, Akusobi looked down at the life on the ground, at night he looked up at the stars. "I was a curious child," he says. "And one of the biggest things that inspired my curiosity was looking up in the night sky and asking, 'What else is out there?'"



A student in the MD/PhD program of the Graduate School of Arts and Sciences and Harvard Medical School, Chidi Akusobi still spends a lot of time looking down at tiny living things. As a soon-to-be physician-scientist, he gazes through the lenses of powerful microscopes on the trail of new therapies for the treatment-resistant infections caused by the *Mycobacterium abscessus*. But as a recent participant in NASA's Aerospace Medicine Clerkship program, Akusobi still keeps one eye on the stars—and on the future—contributing to the effort to make humankind a space-faring species.

OBSESSED WITH ABSCESSUS

If you're not familiar with *Mycobacterium abscessus*, chances are you've heard of its close relative *Mycobacterium tuberculosis* (TB), the cause of one of the most deadly infectious diseases in human history. Like TB, abscessus infects the lungs but also other parts of the body, including skin, soft tissue, and blood. Moreover, while abscessus is less deadly than its bacterial cousin, it grows much

faster and can live in a multitude of environments—water and soil—while TB requires a human host to survive. Finally, infections caused by abscessus are far harder to treat than tuberculosis. “You have to be on antibiotics every day for a year to two years, and even then, you still may not be cured,” Akusobi notes.

People who are immunocompromised or who have an underlying lung condition like cystic fibrosis are particularly vulnerable to abscessus infection. For that reason, Akusobi's PhD advisor, Eric Rubin, director of the Rubin Lab at the Harvard T.H. Chan School of Public Health and editor-in-chief of *The New England Journal of Medicine*, says that abscessus is one of the rare infectious diseases that is more prevalent in wealthy countries than in the developing world.

“Because we've done a very good job of controlling TB in the US, infections caused by abscessus and its relatives are actually more common than TB here,” Rubin says. “Infections caused by ‘non-tuberculous mycobacteria’ appear to be on the rise. And, for most, our therapies are very poor. Patients require years of therapy and most still are not cured.”

While abscessus is not as lethal as TB, the fact that it is so difficult to treat makes it a significant cause of morbidity, particularly among those with underlying conditions. Even when patients are otherwise healthy, abscessus infections can be debilitating.

“If patients have a soft tissue infection, then they may experience redness, swelling, and pain at the site,” Akusobi says. “If it gets worse, patients might start seeing pus and drainage from that site, characteristic of abscess formation. For lung infections, patients may experience increased mucous production, shortness of breath, and, over time, may even start

coughing up blood. Patients can also feel the effects of systemic infection like fever, night sweats, and weight loss.”

Abscessus is so difficult to treat because of the thick, waxy cell wall that makes it hard for antibiotic drugs to penetrate and kill the bacterium. Even when medicine does get through, however, the bug has other lines of defense.

“The bacterium encodes many, many genes that allow it to counteract the effects of drugs,” Akusobi says. “So, for instance, they have efflux pumps that push the drugs out as soon as they get in. They have enzymes that can deactivate drugs so that they are rendered useless. They can also evolve resistance to antibiotics by mutating antibiotic targets”

Akusobi’s work on abscessus enabled him to fulfill his ambition for his PhD: to ask a clinically relevant question and conduct research that advances understanding of the fundamental biology of a pathogen. For Akusobi, that question was, “What genes are responsible for conferring abscessus’s increased resistance to antibiotics?”

To answer that question, Akusobi screened around 5,000 genes and identified nearly 400 that were essential for the bacterium’s growth and survival. One gene in particular—penicillin-binding

lipoprotein or PBP lipo—was critical for the proper growth and division of abscessus cells. Furthermore, Akusobi found that when the levels of PBP-lipo were reduced, abscessus became vulnerable to a range of common, cheap, and easily tolerated antibiotics, including ampicillin and amoxicillin.

“All of a sudden abscessus is now sensitized to drugs it was previously resistant to,” he says. “By reducing PBP-lipo’s levels, we ushered in a whole new class of antibiotics to treat abscessus. Moving forward, if we can find a way to target this gene, we could potentially make treatment cheap, well-tolerated, and more effective.”

Rubin says that it’s always hard to assess the ultimate impact of basic science. It takes many steps and many years to develop a new drug. At the same time, he’s optimistic that Akusobi’s research could be a step on the path to new, more effective therapeutics for the treatment of abscessus infections.

“We hope that some of the older drugs might affect the function of the protein that Chidi has identified,” he says. “We are currently trying to see if this is true with Chidi’s protein and a variety of other similar potential antibiotic targets.”

THE FAMILY BUSINESS

Just as Akusobi’s forays into the subterranean world of the family garden was only half of the story of his passion for science, so too his work as a microbiologist is only part of his education and career path. As soon as he received his PhD from GSAS in 2020, Akusobi returned to Harvard Medical School for the last two years of his MD degree, which he expects to complete in May 2022. He says that, in some ways, serving others through medicine is the family business.

“I come from a medical family,” Akusobi says. “Both my parents are nurses. My sister’s a nurse. I understand the joy that being of service to your fellow humans can bring. I also understand the limitations of medicine, and part of why I so enjoy research is I get to work on problems that address those limitations and push treatments forward for those who need them most.”

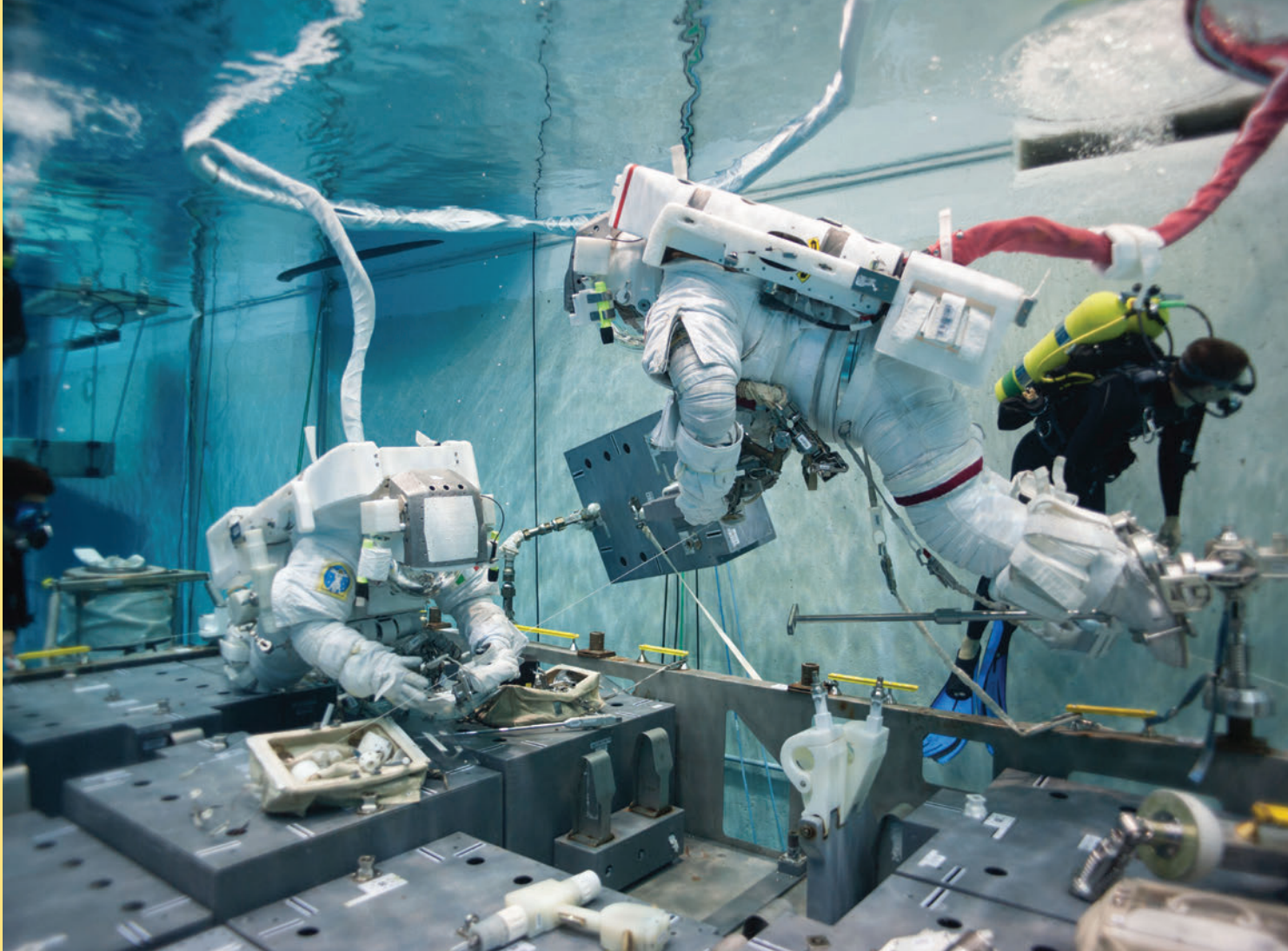
Akusobi also wants to be a doctor for the “one-on-one” connection with patients and the ability to have a direct impact on their lives—to see them get better through the application of science.

“I chose to get an MD and a PhD because I wanted to use and generate scientific knowledge to help people,” he

“For most, our therapies are very poor. Patients require years of therapy and most still are not cured.”

—ERIC RUBIN DIRECTOR OF THE RUBIN LAB AT THE HARVARD T.H. CHAN SCHOOL OF PUBLIC HEALTH AND EDITOR-IN-CHIEF OF *THE NEW ENGLAND JOURNAL OF MEDICINE*





Akusobi helped evaluate the usefulness of tests on astronauts who trained for extravehicular activity at NASA's neutral buoyancy lab.

says. “I think being a physician-scientist and having a real sense of what medicine can do for patients is important.”

Although abscessus infections are more prominent in the developing world, Akusobi says that his choice to focus on the treatment of infectious disease stems from growing up in a West African family.

“My family comes from Nigeria, where I was born,” he says. “In West Africa, infectious diseases like malaria, TB, and HIV are some of the leading causes of death. Being a doctor who specializes in

that area is a way to use my passion for science to give back to my community.”

SPACE DOC

Given Akusobi’s research focus on the molecular level and his practical desire to work with underserved communities, his choice to take part in NASA’s Aerospace Medicine Clerkship program may seem unexpected. But it’s actually in line with a mind that is constantly questioning and filled with wonder for how the universe—whether inside the human body or beyond the limits of the Earth’s atmosphere—functions and evolves.

“I was always curious about space,” he says. “As time went on and I learned more about the planets, our solar system, and the galaxy, it only became more intriguing. I realized there are so many

questions waiting to be answered.”

To help answer the questions that have to do with human biology, medicine, and space exploration, Akusobi joined the Space Medicine Operations team for a four-week program that included “formal lectures on space medicine topics and issues, familiarization with the medical aspects of International Space Station operations, design, and function as well as Exploration Medical Capability for deep space exploration.” (Sadly, his cohort had to work remotely rather than at the program’s headquarters at the Johnson Space Center (JSC) in Houston, Texas, due to the ongoing pandemic.) He and his colleagues were also required to complete a research project. Akusobi chose to study the way that NASA tests astronauts’ lung function during training.

At the JSC, NASA trains astronauts in

“As time went on and I learned more about the planets, our solar system, and the galaxy, it only became more intriguing. I realized there are so many questions waiting to be answered.”

— MD/PHD STUDENT CHIDI AKUSOBI

their neutral buoyancy lab (NBL)—essentially a large pool that simulates a weightless environment. Katherine McMann of the Aerospace Medicine program says that this preparation is critical for participation in the extravehicular activity (EVA) that is the cornerstone of space missions. That’s why the agency subjects trainees to a battery of tests to determine whether or not the trainees hearts and lungs can withstand the extended dives necessary for the simulation.

“While training at NBL, astronauts simulate EVAs in underwater dives that last multiple hours at a time,” McMann explains. “Diving is not without its risks. The change in pressure during ascent and descent increases the risk for pulmonary over-inflation, alveolar rupture, and cerebral air embolization. Thus, before diving, the health of potential divers is assessed to ensure they are physically capable to handle the stresses of diving.”

Akusobi’s job was to assess which tests yielded useful data and which did not.

“There are so many different parameters used in these tests,” he explains. “We found that one of them was not very effective or clinically useful. So, the recommendation that I made from my project was to drop a specific metric because it was not adding valid clinical information. That will help NASA to focus on the data that’s truly useful in assessing someone’s ability to engage in the training.”

The big takeaway for Akusobi was not

the results of his research, but the people he met through the clerkship—new colleagues with whom he may reunite for future projects on space exploration.

“I met a lot of people who shared my interest in space and medicine,” he says. “I’ll continue to stay engaged and go to conferences. I hope at some point to collaborate with NASA on a project or even work for the agency. I would be excited to lend my expertise. This field is only getting bigger.”

McMann says Akusobi was “always engaged,” “extremely proactive,” and “an absolute pleasure to have as one of our top selected candidates” in the Aerospace Medicine Clerkship. “Chidi was truly an asset to the clerkship and I wouldn’t be surprised to see him in the aerospace



medicine community in the future, should it be a part of his pursuits.”

As long as he can return safely to his family, Akusobi would like to experience space travel for himself some day. In the near future, though, his plans are more terrestrial: a residency in internal medicine and then a fellowship in a medicine subspecialty. His goal is to be a “committed physician-scientist” who connects clinical work with basic science, and vice versa. “I want to see patients in the hospital and also have a research program where I work on hard problems that will push medicine forward,” he says.

Consistent with the service ethic with which he grew up, Akusobi wants to reach beyond the hospital and laboratory. He says that, going forward, he hopes to make science communication a part of his career. In light of the recent pandemic, the need has never been greater for those who can help people understand science and medicine—and also inspire others like him to enter those fields.

“I want to talk to the public, especially when it comes to infectious diseases and vaccines,” he says. “I think there’s a lot of education that’s needed to get people on board with public health interventions and I want to be part of that conversation. I also want to inspire more Black and brown students to enter science and medicine. As I finish at Harvard and move onto the next phase of my career, I’m committed to being a mentor and role model in whatever way I can.” 🍷



DEPROGRAMMING

THROUGH ECONOMICS AND POETRY, ZOË HITZIG
TAKES AIM AT THE ALGORITHMS THAT SHAPE OUR LIVES

BY PAUL MASSARI | PHOTOGRAPHS BY MARK OSTOW

THE

Then everyone was plural: data. Everything served and being served on metal servers. It was never our intent to punctuate the sentences of others. But now it's late. Too late to unstate our importance. And besides the crickets died for this.

—ZOË HITZIG, "HOW WE PROGRAMMED THE APOCALYPSE"

IN THE EARLY 2000S, BOSTON PUBLIC SCHOOLS HAD A PROBLEM.

Economists in the fields of game theory and mechanism design pointed out that the algorithm the city used to assign students to its public schools allowed families to game the system and improve their chances of getting into one of their top-choice schools. Moreover, contrary to the city's goal of promoting equity, the families who were most likely to employ these strategies—and get assigned to their preferred schools—tended to be more affluent.

The economists proposed a fix to the algorithm that would make it—and the process of school assignment—"strategy-proof." In 2005 the Boston Public Schools (BPS) implemented the algorithm. It worked. Families were no longer able to improve their chances of getting into a top-choice school. The new algorithm was praised as an example of the way that economic models and mechanisms could solve real-world problems.

The economic theorist and poet Zoë Hitzig sees the BPS story differently. A PhD student in economics whose work incorporates moral philosophy and theories of justice, Hitzig says that when institutions like the BPS choose one algorithm over another, they aren't merely making a technical fix like a civil engineer improving a bridge; they're making a normative judgment, choosing one set of values over another. The tradeoffs involved in that choice are rarely articulated or submitted to a public process. The designers and implementers are usually not accountable to the citizens impacted by their decisions. Hitzig sees this situation as an example of "algorithmic life." In her academic work and her poetry, she lays bare its costs and offers new ways of making decisions and distributing resources in a democratic society.

BRINGING DEMOCRACY TO ALGORITHMIC LIFE

Hitzig studied the case of student assignment in the Boston Public School system to grapple with the gap between ideals of equality and the mechanisms designed to achieve that end. The result was "The Normative Gap: Mechanism Design and Ideal Theories of

Justice," a 2020 paper published in the journal *Economics & Philosophy*. She explains that parents circumvented the intent of the BPS assignment system in the early 2000s by misrepresenting their top-choice school.

"Let's say I had a kid and our top choice school was highly sought," Hitzig says. "Lots of students want to go there. But I also like another less popular school. So, I list that school as my first choice even though it's not because it increases the chance that my child will get in. The cost is that they don't have a shot at getting into our true top choice school but that was already unlikely."

The strategizing conflicted with the BPS's goals of equitable assignment. At the time, researchers found that families in wealthy neighborhoods were more likely to connect and strategize about school choice than were less-affluent families. The economists Atila Abdulkadiroglu, Tayfun Sönmez, Al Roth, and Parag Pathak proposed making the algorithm strategy-proof through "deferred acceptance."

"With deferred acceptance, schools still fill their seats with those who list them as their top choice," Hitzig says. "But the assignment system doesn't end immediately: A student who lists a school as their second choice, for instance, but has higher priority at that school, perhaps because they live within walking distance, could bump another who'd been tentatively accepted after listing that school as their top choice. The bottom line is that you don't improve your chances of getting assigned to your second-choice school by misrepresenting your top choice."

The modified algorithm was hailed as a success when the BPS implemented

APOCALYPSE

it in 2005, but Hitzig says that the new system had its own flaws. Deferral was a less efficient way to assign students than immediate acceptance. Having made the system strategy-proof, there was evidence that not all families understood the change or that it was in their best interests to write down their true preferences, even after they were instructed to. Finally, given that top schools often sat in wealthy neighborhoods, the system might still perpetuate other forms of inequality by giving priority to students who lived within a school's walk zone. Indeed, citing equity and transparency concerns, BPS eliminated walk zones entirely in a later reform of the assignment mechanism.

Hitzig says her intent in pointing out these flaws is not to condemn the BPS;

“
Her work dovetails completely with current trends in economic theory and she is perfectly positioned to push these developments to the next level.”



JERRY R. GREEN, DAVID A. WELLS
PROFESSOR OF POLITICAL
ECONOMY AND JOHN LEVERETT
PROFESSOR IN THE UNIVERSITY

it's to demonstrate that its decision to implement the new algorithm was a normative choice—one with trade-offs—as much as a technical one. “Economics can come up with a formal language that becomes a technical property of the algorithm that leaders and policymakers choose,” she says. “You can say, ‘Look, this algorithm has this particular property. If you think that it represents the kind of equity that you’re after, then you should use this algorithm instead of another.’”

Moreover, Hitzig argues that the values embedded in an algorithm reflect those of the people who design and implement it. More often than not, she says, those people are neither elected nor directly accountable to the citizens their decisions affect.

“School assignment in Boston in 2005 is a stark example of how our lives are shaped by algorithms,” she says. “The people who create and execute them have low visibility and transparency. Their interests are not necessarily aligned with those of the people in the community. Their notions of equity are often limited. It’s a step away from the kind of decentralized process that gives citizens a voice in the way decisions are made.”

A BETTER WAY TO FINANCE PUBLIC GOODS

Giving people more of a voice in the way funding decisions are made is the focus of Hitzig’s recent work. With E. Glen Weyl, an economist at Microsoft, and Vitalik Buterin, co-founder of the cryptocurrency/blockchain ecosystem Ethereum, Hitzig created the “quadratic finance” (QF) mechanism for funding public goods, defined by the team as “any activity with increasing returns in the sense that the socially efficient price to charge for the activity is significantly below the average cost of creating the good.” Think of your local public broadcaster. The cost of producing accurate news and information is significant,

but the “socially efficient price” for that good in a democracy is “free.” Hence the fundraising drives where contributions are frequently matched dollar-for-dollar by funds raised from a small number of large donors.

The problem with this model, Hitzig, Weyl, and Buterin argue in a paper for the journal *Management Science*, is that the public broadcaster has to compete with a thousand other causes—from the local homeless shelter to the ballet. The ones that raise the most money—and attract the greatest matching funds—are not necessarily the ones with the greatest popular support or alignment with the common good. Often, as the authors write, the causes represent “status motivations and parochial, even exclusionary interests.”

With QF, though, projects with the greatest popular support would also get proportionally greater financial support. In this system, philanthropists might raise a large fund and invite the public to contribute to any one of several causes. A project that attracts many small donations—your local homeless shelter, for instance—might receive in matching funds multiples of each dollar raised. A project that attracts a few large donations, on the other hand, would still get matching funds, but perhaps less than a dollar-for-dollar match.

“QF speaks to the democratization of governance systems,” Hitzig says. “And these ideas have been influential already even though they are young. The system we proposed has been used to democratically allocate millions of dollars to open-source software projects in the blockchain space and was also used to allocate emergency stimulus funds during the pandemic in the city of Boulder, Colorado. It’s a concrete example of a new way of organizing ourselves.”

One of Hitzig’s advisors, Jerry R. Green, David A. Wells Professor of Political Economy and John Leverett Professor in



**“WE CAN’T CONTINUE CONSUMING AND
SPENDING ON THINGS THAT JUST END UP
IN LANDFILLS AND BURN FOSSIL FUELS.”**

the University, says that by integrating ethical and moral concerns with classical economic models, Hitzig is “expanding the scope of economics.”

“Zoë and her co-authors explore the extension of market design to include concerns such as the fairness of outcomes, the preservation of privacy, and the potential for collusion,” he says. “They explore motivations and constraints that should be avoided by design mechanisms, some between sets of winning bidders and some between the seller of the goods and losing bidders. Her work dovetails completely with current trends in economic theory and she is perfectly positioned to push these developments to the next level.”

A SHARED PREDICAMENT

As her academic career has developed, so has Hitzig’s poetry, which has appeared in *The New Yorker*, *London Review of Books*, *Paris Review*, *Lana Turner*, and *Harper’s*, among other publications. In 2020, she released her first book of poetry, *Mezzanine*, to critical acclaim. She says that her creative writing and her work in economics “share a predicament”: how to capture and value the aspects of life that cannot be quantified.

Hitzig is drawn to the beautiful, the terrifying, and the mysterious—as well as to the costs of imposing a narrowly defined type of rationality on all aspects of human existence. That fascination is what led her to include in poetic form an epigraph in her book, an excerpt from the UC Berkeley Professor Emerita Caro-

lyn Merchant’s seminal 1980 work, *The Death of Nature* which speaks of “autonomous” and “non-autonomous” (human) machines fundamental to a “new value system” based on power and order. “I’m very glad we have calculus,” Hitzig says. “I’m very glad we have understandings of the human body that allow us to live long healthy lives. But Merchant’s book reminds me that the Enlightenment came at a cost. I made that excerpt the epigraph of *Mezzanine* because I try to capture similar ideas in my poems.”

Poetry is also another way that Hitzig interrogates the influence of economic and technical systems on our lives. Although she did not write it with economic concepts in mind, “How We Programmed the Apocalypse” echoes the “performativity thesis” that Hitzig invoked in her work on school choice algorithms: the notion that economic narratives, when adopted and repeated by society, become self-fulfilling prophecies, engendering the types of behavior that they claim to describe.

“You can hear in the title of that poem the idea of performance,” she says. “If you’re in a system that tells you long enough that this is how you’re supposed to be, at some point that narrative becomes performed. Even if people weren’t acting like ‘rational economic agents’ to begin with, if that’s how to get ahead, people will start behaving that way.”

For Hitzig, the results of this transformation into homo economicus are consumer capitalism, indifference to human suffering, and climatological catastrophe, themes she explores in the poem “The War Gone Wrong Room”

More for your dollar? More for the Dollar. More exotic juice in the juiceboxes to trade with the bullies. More juice to burn into smoke to soot up the ceiling fan. More keypads to catch our twiddling thumbs. More tangling bodies in nets. More nets filling with corpses. More decals for ships and chests. More juice to bargain for, then burn. More fire blankets on our lungs.

“We can’t continue consuming and spending on things that just end up in landfills and burn fossil fuels,” she says. “I can’t rewrite the narrative about what’s happening in the atmosphere, but I can play a small part in rewriting the narrative of how we can relate to each other and the planet.”

As she nears graduation, Hitzig hopes to find a teaching or postdoctoral position that will enable her to continue her theoretical work in economics. Meanwhile, her second book of poems is nearly complete. “In the long run, she hopes to help leaders envision new models, values, philosophies, and narratives and integrate them into a new social system that works for more people.

“We’ve lived for many years under the narrative of neoliberalism,” she says. “Anything’s possible if you work hard. Individuals who are free to act in their own self-interest will always produce the best outcomes for society. Social insurance can fill in the gaps. But so many of those pieces are crumbling. Until we have a new way of thinking about how we live together, it will be very difficult to enact real change. I hope that the work I do can contribute to that new way of thinking.”

RISING STAR AT THE FED

Lael Brainard, PhD '89, economics, was nominated by President Biden to be vice chairwoman of the Board of Governors of the Federal Reserve System. Brainard, a sitting member of the Board of Governors since June 2014, is a world expert in international trade who has worked at the highest levels of the federal government, holding senior leadership positions at the White House, the Treasury, and the Federal Reserve. A 2019 GSAS Centennial Medalist known for recognizing and responding to changes in financial markets, Brainard pledged that as vice chairwoman she would use monetary policy to fight inflation.

ALUMNI UPDATES



Harold J. "Hal" Burstein, PhD '94, medical sciences, last fall was named one of six recipients of the 2021 Harvard Alumni Association (HAA) Awards for his service both at the HAA and at Harvard Medical School (HMS). Dr. Burstein is a professor of medicine at HMS, where he has chaired the admissions subcommittee, and a medical oncologist in Boston.



Mahmood Mamdani, PhD '75, government, was shortlisted for the 2021 British Academy Book Prize for Global Cultural Understanding for *Neither Settler nor Native: The Making and Unmaking of Permanent Minorities*. Mamdani is the Herbert Lehman Professor of Government at Columbia University and specializes in the study of African history and politics.



Christalyn Rhodes, PhD '18, biological sciences in public health, was named one of 1,000 Inspiring Black Scientists by Cell Mentor, a division of Cell Press, publishers of over 50 scientific journals across the life, physical, earth, and health sciences. Rhodes, who was a 2017 Harvard Horizons Scholar, is currently a clinical trial project manager at the pharmaceutical company Eli Lilly.



Louise Richardson, PhD '89, government, was named president of the Carnegie Corporation of New York, one of the leading philanthropic foundations in the United States. Richardson, a 2013 GSAS Centennial Medalist, joined Carnegie after serving as vice-chancellor of the University of Oxford and as principal and vice-chancellor of the University of St Andrews.



Eric Sirota's, PhD '86, physics, musical theatre work was performed last July in a free concert at the historic Park Theatre in Union City, New Jersey. A 2019 recipient of France's Denis Diderot Artists-in-Residence Grant, Sirota's off-Broadway shows include *A Good Day: Music, Memory, an Old Flame, and Alzheimer's; Frankenstein; Your Name on My Lips; and Go, My Child*.



His Eminence Archbishop Demetrios Trakatellis, PhD '72, sociology & the study of religion, was recently honored with the publication of the Festschrift *Evangelist, Shepherd, and Teacher: Studies in Honor of Archbishop Demetrios of America* (Holy Cross Orthodox Press). A prolific author and internationally known scholar of the New Testament, His Eminence is the former archbishop of the Greek Orthodox Church of America.



Harris Wang, PhD '10, biophysics, was awarded a 2022 Vilcek Prize for Creative Promise in Biomedical Science. Given to emerging to mid-career immigrant professionals who have demonstrated exceptional achievements early in their careers, the Vilcek Foundation Prizes include a \$50,000 cash award. Wang is an assistant professor of systems biology at Columbia University.



Michael Whelan, PhD '91, English and American literature and language, was named the ninth president of Wheaton College in Norton, Massachusetts. A scholar of modern and postmodern American literature with a focus on gendered narratology, Whelan previously served as provost and vice president for academic affairs at Emerson College in Boston.

AUTHOR PROFILE

AT THE NEXUS OF SCIENCE, SOCIETY, AND SURVIVAL

Innovations in science and technology promise breathtaking improvements to health, productivity, sustainability, and many other aspects of human life. At the same time, those advances are deeply intertwined with politics, economics, culture, psychology, and a raft of other forces that shape our society—and determine whether new technologies are used to address global crises.

*In his new book, **The Survival Nexus**, Charles Weiss, PhD '65, says that the fate of humanity may well depend on its ability to understand and manage the intersection of science, technology, and world affairs. A distinguished professor emeritus at Georgetown University and the first science and technology advisor to the World Bank, Weiss says that to respond effectively to species-level threats like climate change and nuclear proliferation, an informed public and responsible leaders must collaborate across national boundaries to encourage, guide, and govern certain key innovations.*

How do science and technology interweave with politics, economics, law, business, finance, psychology, culture, and ethics at a nexus that is crucial to human survival?

Many of the most important global issues of the 21st century turn on the political, economic, cultural, and other contexts in which science and technology evolve. Climate change is the ultimate example. Technologies exist that can reduce emissions of greenhouse gases, but it will take worldwide changes in politics, economics, and popular psychology—along with huge public and private investments—if they are to be developed and scaled up in time to prevent catastrophic damage to the earth.

Even more serious is the fact that the world is in increasing danger of accidental nuclear or cyber war. The nuclear arms control and non-proliferation regime, painfully built up after World War II, is being allowed to deteriorate, and no such regime exists to control new technologies like hypersonic missiles, cyberweapons, and autonomous weapons. Fortunately, the taboo against using nuclear weapons still holds.

You write that the global pandemic put humanity face-to-face with the survival nexus?

How did we do?

The record is mixed. Millions have died of COVID-19, although scientists all over the world responded to the challenge and pharmaceutical companies developed multiple vaccines in record time using cutting-edge mRNA technology. Government incentives speeded research and manufacturing scale-up. However, political leaders in many countries ignored and even squelched the warnings of scientific experts. They downplayed the



Charles Weiss, PhD '65,
Chemical Physics

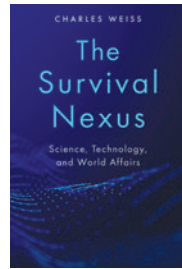
seriousness of the virus, covered up the spread of infection, and hawked ineffective remedies. This squandered critical time that could have been used to save millions of lives, not to mention trillions of dollars in economic losses. The World Health Organization was caught up in the US presidential election campaign and the geopolitical crossfire between the US and China. Billions of people are still unvaccinated. In low-income countries, it's because no vaccines are available. In rich countries, it's because of vaccine hesitancy fueled by misinformation, much of it from political leaders. This has helped the virus to mutate into variants of increasing contagiousness and virulence.

What would an approach to technological innovation look like if it accounted for the political, cultural, and other factors you mention?

Americans tend to think that innovation happens on its own as a result of government support for scientific research and private investment in the commercialization of invention. We tend to forget the enormous government support for applied research, development, demonstration, and commercialization in many of our strongest industries, including aerospace, military, energy, and health. Public support for research and collaboration with industry in advanced manufacturing—which has just begun in parallel, if not in size and scope, with long-standing support for research and extension in agriculture—is one aspect of a different approach.

Another aspect is that special efforts should be undertaken to encourage the development of technologies that address environmental and social problems. This may require not only support to applied research but also removal of obstacles to commercialization. Widespread application of decentralized wind, solar, and other renewable technologies, for example, face a variety of technical, regu-

latory, and institutional obstacles—many backed by strong vested interests. Some requirements of low-income or otherwise disadvantaged people—a malaria vaccine, a low-cost fly-proof latrine, or an emergency ration for starving refugees,



to cite three examples—may require specific technological innovations. Developing them is an ethical imperative but is not usually a profitable undertaking. Public-spirited intervention by a government or a private organization is typically necessary if such products are ever to come into widespread use.

Finally, a different approach to technological innovation would see government and businesses doing their best to predict issues that will foreseeably arise from advances in technology. The pioneers of the internet, for example, deliberately avoided dealing with disinformation, privacy, and security, issues that are difficult to go back and fix. Today's cutting-edge technology for gene drivers and geoengineering present important ethical issues that require broad-gauge discussion before they are put into practice.

Why do we need a global response to the problems that flow from the survival nexus?

Why are market forces and local/national action not enough?

Global problems require global responses. Greenhouse gases, ozone destroyers, and epidemic diseases flow freely around the world. A global internet demands global governance. Global supply chains spread technological unemployment. Geoengineering and gene driver technology can be developed and put into practice anywhere but can have worldwide effects and need globally accepted standards.

RECENTLY PUBLISHED

Joelle M. Abi-Rached, PhD '17, History of Science, *Aşfariyyeh A History of Madness, Modernity, and War in the Middle East*, MIT Press, 2020

Pamela Barmash, PhD '99, Near Eastern Languages and Civilizations, *The Laws of Hammurabi: At the Confluence of Royal and Scribal Traditions*, Oxford University Press, 2020

Fiona Hill, AM '91, Regional Studies—USSR, PhD '98, History, *There Is Nothing For You Here: Finding Opportunity in the 21st Century*, Mariner Books, 2021

Robert P. Inman, PhD '72, Economics, and Daniel L. Rubinfeld, *Democratic Federalism: The Economics, Politics, and Law of Federal Governance*, Princeton University Press, 2020

Andrew Leigh, PhD '04, Public Policy, *What's the Worst That Could Happen? Existential Risk and Extreme Politics*, MIT Press, 2021

Lloyd Schwartz, PhD '76, English and American Literature and Language, *Who's on First? New and Selected Poems*, University of Chicago Press, 2021

Nick R. Smith, PhD '15, Urban Planning, *The End of the Village: Planning the Urbanization of Rural China*, University of Minnesota Press, June 2021

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Coffee Connection

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The GSAS Virtual Coffee program is an informal opportunity for students to “ask alumni anything”—and for alumni to engage and share their wisdom and experience. Help students navigate Harvard and life in graduate school. Impart strategies for getting the most from the advising relationship. Provide insight into different career paths, discuss an aspect of their scholarship and research, or share your journey at and after Harvard. Whether you’re in Cambridge or half a world away, sign up today and leverage digital technology to make a difference in the life of a GSAS student!

Register at
[gsas.harvard.edu/
virtualcoffee](https://gsas.harvard.edu/virtualcoffee)

Questions? Email the
Graduate School
Alumni Association at
gsaa@fas.harvard.edu.

SAVE THE DATES!

Alumni Day: April 9, 2022

Join your fellow GSAS graduates for a day of engagement and learning. This year’s event will feature remarks from Dean Emma Dench and bring together Harvard faculty from across the disciplines.

[gsas.harvard.edu/events/
alumni-day-2022](https://gsas.harvard.edu/events/alumni-day-2022)

Commencement 2020/2021: May 29, 2022

Celebrate the achievements of alumni in the Classes of 2020 and 2021 in a University-wide Commencement ceremony on Sunday, May 29, 2022, at 8 a.m. (ET).

••• Please visit [gsas.harvard.edu/
honoring-classes-2020-and-2021](https://gsas.harvard.edu/honoring-classes-2020-and-2021)
in the coming months for details on
the event and to register for email
updates.



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"I give (___ dollars) or (___ percent of my estate) to Harvard University, a Massachusetts educational, charitable corporation, for the benefit of the Graduate School of Arts and Sciences for its general purposes."

For more information, contact Anna Chiumenti in the Office of Gift Planning at anna_chiumenti@harvard.edu or 617-495-0914.



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