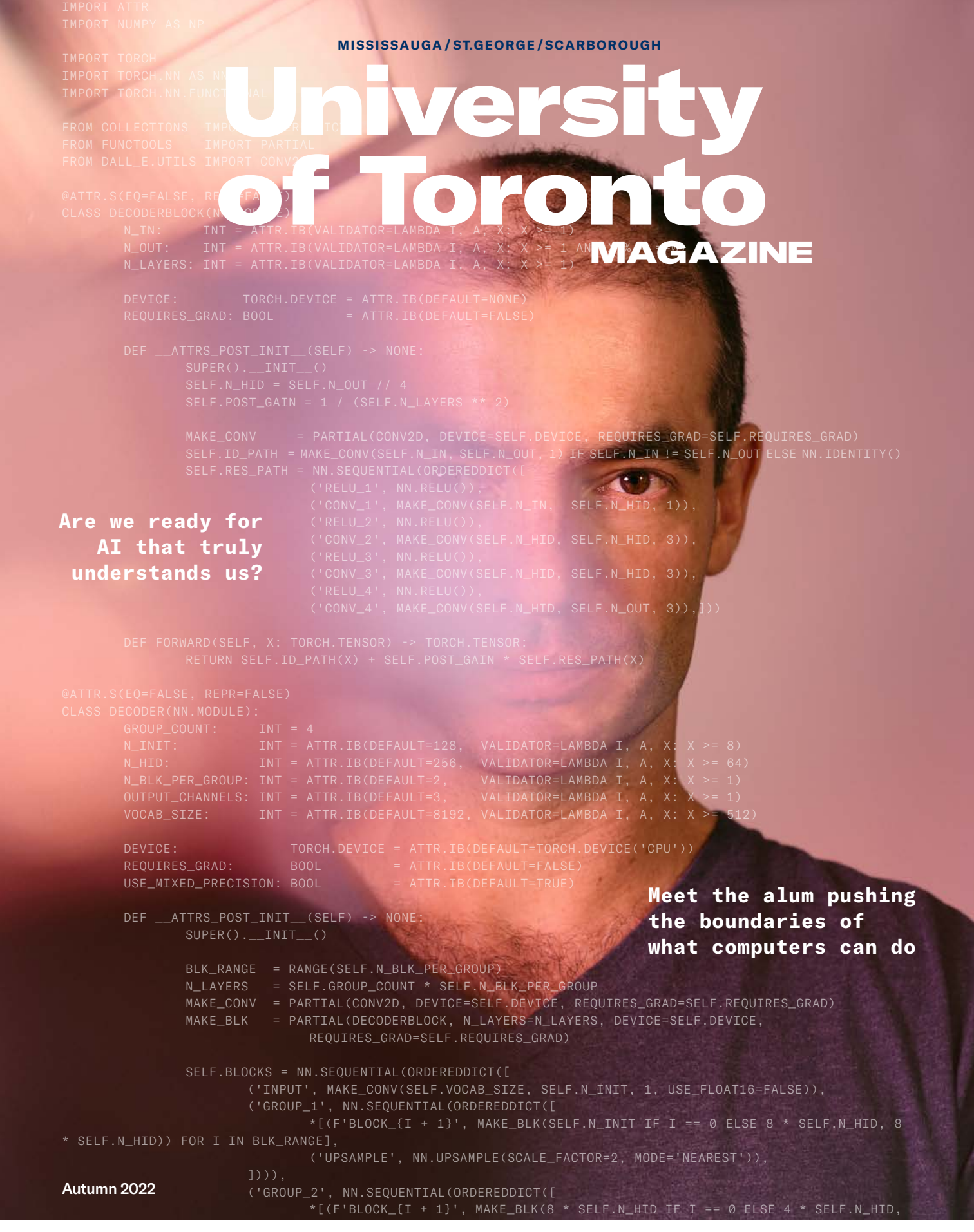
MISSISSAUGA / ST.GEORGE / SCARBOROUGH

University of Toronto MAGAZINE



Are we ready for AI that truly understands us?

Meet the alum pushing the boundaries of what computers can do

Autumn 2022

PHOTOGRAPH BY JOHNNY GUATTO

GOOD NEWS

DATE: JUNE 21
TIME: 10:28 A.M.
CAMPUS: ST. GEORGE

Graduating students made a much-anticipated return to Convocation Hall as in-person graduation ceremonies resumed for the first time in two years. With friends and family looking on, more than 11,000 students took part in 32 different convocations in June.

During the ceremony pictured here, honorary graduate Jim Cuddy, a member of the band Blue Rodeo and an acclaimed solo artist, played "Good News," a song he wrote about getting through the pandemic that was inspired by the Black Lives Matter protests. He says the song is about human resilience in the face of adversity.

Before picking up his guitar, Cuddy told his fellow graduates that he twice deferred going to the University of Windsor so he could pursue his musical ambitions. "Find something you're passionate about," he urged them, "even if it's not how you make your living."

Convocation's cherished traditions were on full display this year, with a few altered elements. In keeping with public health guidelines, everyone wore masks. And instead of shaking hands with a member of the platform party as they crossed the stage, new graduates waved to the audience when their name was called – or, in a few cases, bowed, curtsied or even twirled. At least one took a selfie. **—Staff**

FOOD FOR THOUGHT

DATE: JULY 27
TIME: 3:48 P.M.
CAMPUS: SCARBOROUGH

As part of a course about the history of food in the Americas, students at U of T Scarborough pound corn dough into tortillas, wrap and steam tamales, and make salsa and guacamole from scratch. Afterward, they will feast on their creations. But the point is not about picking up tips in the kitchen.

In the tutorial at right, the students are learning about nixtamalization, a traditional process used by Indigenous peoples in Latin America for preparing maize. The technique involves cooking dried corn kernels steeped in an alkaline solution, usually water and lime, that improves nutritional value, aroma and flavour.

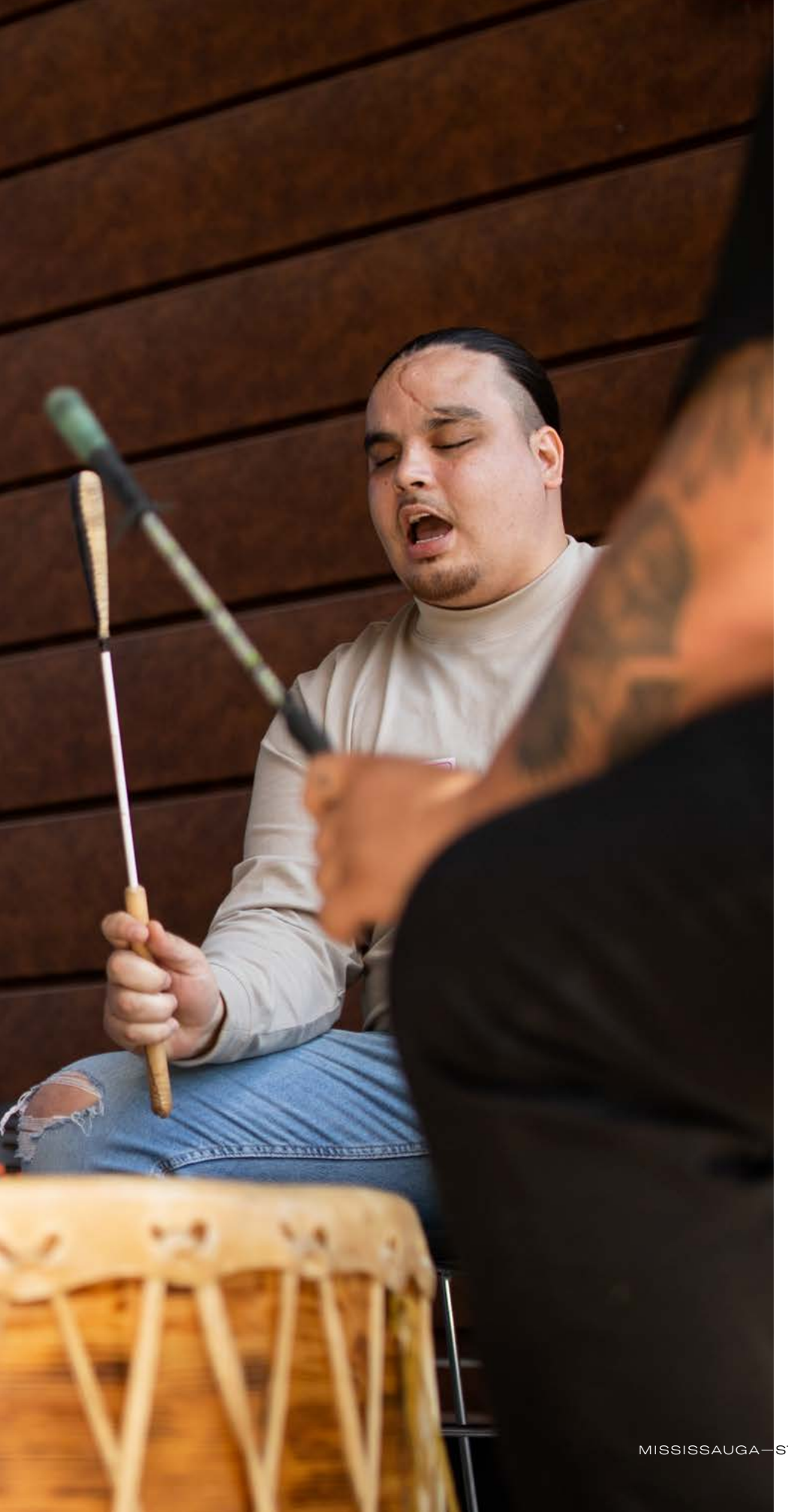
The hands-on instruction takes place in U of T Scarborough's kitchen lab. Opened in 2016, the facility has everything one would find in a standard industrial kitchen but is also equipped with the ability to livestream and record cooking demonstrations.

In the classroom, students learn about the nutrition, culture and history of different foods. Then, in the kitchen, they get to prepare these foods – often with ingredients they have planted and harvested at the campus farm.

"When you grow food, prepare a dish and then taste it, you get a better sense of food production," says Jeffrey Pilcher, a professor in the department of historical and cultural studies. "It's an engaging educational experience." **—Don Campbell**

PHOTOGRAPH BY DON CAMPBELL

PHOTOGRAPH BY NICK IWANYSHYN



RHYTHM NATIONS

DATE: JUNE 3
TIME: 4:03 P.M.
CAMPUS: MISSISSAUGA

Members of the campus community gather for a Drum Social at the Maanjiwe nendamowinan building to kick off National Indigenous History Month, which honours the diverse culture, heritage and achievements of First Nations, Inuit and Metis peoples.

In her message recognizing the special heritage month, Alexandra Gillespie, U of T Mississauga's vice-president and principal, said it was vital to remember the trauma created by Canadian settler colonialism, including residential schools: "The effects of this system persist today in pervasive structures of inequality and in the inter-generational trauma that many Indigenous families continue to experience."

Hosted by the U of T Mississauga Indigenous Centre, the cultural event featured Tsaunka Sugar Drum Group performing a style of drumming and singing that is inclusive of all Indigenous communities. "It's important to acknowledge that Indigenous Peoples in this country have gone through challenges that we are still navigating," says Tee Duke, an Anishinaabekwe and the assistant director of Indigenous Initiatives at UTM. "But I think it's just as important to acknowledge our resiliency and strength, as well as the richness of our culture, knowledge and languages." **—Sharon Aschaiek**

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VOLUME 50, NO. 1

Collecting race-based health data is crucial, says Prof. Notisha Massaquoi. "It's the only way we'll know what the unique issues are for different populations."

COVER PHOTOGRAPHY BY MICHELLE YEE; CODE OVERLAY PROVIDED BY ADITYA RAMESH, OPENAI; (RIGHT) BRENT GOODEN

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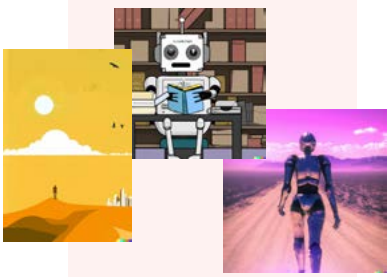
Crops on top: researchers test which foods grow best on green roofs, p. 42

"I didn't grow up in my culture. I don't think it's a coincidence that I have always been interested in origins."
– Prof. Kristen Bos, p. 38

ON THE COVER

Can AI create an original image for a magazine cover? We tested the idea on DALL-E 2, an AI developed by alum Ilya Sutskever and his team at OpenAI (see p. 24). In the end, we went with a photo by Michelle Yee instead. Below are three DALL-E creations:



PHOTOGRAPHS BY (FAR LEFT) DON CAMPBELL; (TOP) VANESSA HILL

Her first act of defiance? Going to school.

Basnama Ayaz still feels lucky. Though her first nursing school was 2,000 kilometres from her home in remote northern Pakistan, she still managed to go despite all obstacles. Today, Basnama has set her sights on becoming "the first woman in my region to earn a PhD in nursing." She'll get there with the help of a scholarship—created by a generous bequest to the Lawrence S. Bloomberg Faculty of Nursing. At U of T, she's researching ways to empower women health workers in conflict-affected countries. And back home, she hopes to build a school for nurses.

Make a gift to U of T in your will today. Find out more by contacting michelle.osborne@utoronto.ca, 416-978-3811 or uoft.me/giftplanning

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DEFY GRAVITY

U of T students get everyone talking.

You help them bring TEDx events to campus.

The students behind TEDx UofT spark debate and open minds with every talk they produce. Their grassroots series exposes U of T to bold thinkers like comedian Salma Hindy (MHSc 2018), inspiring the community to engage with ideas and each other. Our young producers, meanwhile, are building skills and networks for whatever comes next. When you purchase U of T affinity products from our insurance partners, a portion of the proceeds goes to TEDx UofT and other initiatives for students and alumni.

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Salma Hindy
Comedian, Engineer, Alumna

DEFY GRAVITY

Prof. Rawle's approach to teaching is innovative and truly compassionate

SUJATA THAPA, PhD CANDIDATE, UNIVERSITY OF TORONTO

The Importance of Being Kind

The Spring 2022 issue featured a profile of U of T Mississauga biology professor Fiona Rawle, whose teaching philosophy is based on compassion.

I am a retired teacher and I agree that compassionate teaching leads to success. For students to come out of middle school or junior high confident in themselves and knowing that a teacher sincerely cared about them and their success is truly important. Elementary and secondary teachers should all read this article.
HAROLYN PANETTA, MEd 1974 OISE, DON MILLS, ONTARIO

This is such a wonderful approach to teaching. Students are learning not just the subject matter, but also how to grow after struggling. For this to work, a teacher with Prof. Rawle's attitude and compassion is key.
DR. GINO SOMERS, PROFESSOR, TEMERTY FACULTY OF MEDICINE, TORONTO

Needed a pick-me-up this morning and came across the @FiRawle feature in @uoftmagazine. It resonated quite deeply. I love, love your application of the pedagogy of kindness.
@MERYEMASLAM

Prof. Rawle's approach to teaching is innovative and truly compassionate – especially for students of colour who are the first in their family to attend a post-secondary institution. For students to know that their professor values their well-being above all makes a huge difference in their motivation to learn.
SUJATA THAPA, TORONTO

What do you like most about being back on campus?

40%
Seeing friends

36%
In-person learning

11%
Using libraries and other facilities

9%
Participating in campus activities

4%
I prefer online learning

Last year, U of T welcomed students back on campus after an extended period of virtual learning. The vast majority told us they were happy to be back, noting that they find classroom learning more engaging than online instruction. "I feel like I come away with more from in-person lectures," says Faye Shawera, a second-year student in English and art history. Not surprisingly, the resumption of a more active social life was also a bonus – many reported missing their friends during the pandemic and the opportunity to meet new people. Some said they missed specific places on campus, such as the university's many libraries and fitness facilities. And two specifically mentioned the nature trails at UTSC and UTM – and the furry creatures sometimes seen along them.

This highly unscientific poll of 100 U of T students was conducted across the three campuses in July 2022.

ILLUSTRATION BY DAVID SPARSHOTT

The truck convoy and anti-vaxxers have demonstrated that there is less respect for authority, education and science than previously. Fiona Rawle talks about how compassionate teaching can be the bedrock for student success. I would suggest that it can also be the bedrock for responsible citizenship. When people have good experiences with authority, education and science in their youth, they are more likely to respect these things for the rest of their lives.

SHARLEEN TRELEAVEN, BScPhm 1989, STONEY CREEK, ONTARIO

Healthier Minds

In the spring issue, "From Anxiety to Action" examined a U of T research project that has enlisted students as partners to help improve mental health among youth.

As an educator who has provided leadership coaching and mentorship support to schools, system leaders, students and families over the years, I understand the increased anxiety, frustration and even trauma noted at all levels of the educational sector today. I congratulate you for tabling this critical issue.

DR. DENESE BELCHETZ, MEd 1986, EdD 2004, TORONTO

First-rate stuff. As a long-time mental health worker with a master's degree in social work, I think it is great to see the student co-leadership.

GLENN THOMPSON, BA 1958 VICTORIA, BSc 1959, MSW 1963, MISSISSAUGA, ONTARIO

Can We Talk?

In his Spring 2022 column, President Meric Gertler outlined the goals of U of T's new fundraising campaign and why the university's mission remains especially relevant today.

President Gertler points out the troubling truth of today's increasingly polarized culture, writing that "we are retreating into insular silos with seemingly irreconcilable worldviews." Have Canadian universities contributed to this polarization? Prof. Gertler believes we can "bring people together to learn from each other through dialogue."

Could *University of Toronto Magazine* model this kind of dialogue? On matters of potential difference, could informed commentary include alternative viewpoints – even respectful dialogue or debate between those who embrace very different worldviews and "facts"? Demonstrating leadership in this area would benefit us all.

JOHN DUYCK, BEd 1972, TORONTO

Corrections

On p. 4 of the Spring 2022 issue, Kamola Khaitova, a work-study student at the U of T Mississauga greenhouse, was misidentified as Joan Lee, the greenhouse co-ordinator. Apologies to Kamola and Joan.

On p. 44 of the same issue, the ancient book in the top left image is from Ethiopia, not Egypt.

Write to us

University of Toronto Magazine welcomes comments at uoft.magazine@utoronto.ca. All comments may be edited for clarity, civility and length.

@uoftmagazine

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It was a day of immense sacrifice.

On August 19, 1942, 6,100 troops descended on the port of Dieppe in northern France. Nearly 5,000 of them were Canadian.

They were met with fierce resistance. When the Dieppe Raid was over, thousands were captured or wounded. 910 men had lost their lives—including 10 from the University of Toronto. But their sacrifices were not in vain: the lessons learned contributed to the success of D-Day two years later.

We will never forget.

Join us in remembering the many who served by donating to the Soldiers' Tower and attending our Service of Remembrance on Friday, November 11, 2022. Details will be provided closer to the date.

Image of survivors of the Canadian assault at Dieppe
(September 1974 The Varsity Archive pg. 420)

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ILLUSTRATION BY STUDIO WYSE

U OF T MISSISSAUGA

ON THE ROAD TO RECONCILIATION

U of T Mississauga opened an office this past summer for the Mississaugas of the Credit First Nation, representing an important step on the path toward reconciliation.

The office is located in the campus building Maanjiwe nendamowinan – which means "gathering minds" in Anishinaabemowin.

The office gives the First Nation's members a place to conduct their business, including research and teaching collaborations at UTM.

It also features a window mural called Kiinwin Dabaadjmowin, or "Our Story" (created by Indigenous artists Philip Cote and Tracey Anthony), which depicts the origin tale of the Anishinaabe people.

UTM sits on land that falls under the provisions expressed in Treaty 13-A and is the traditional land of the Mississaugas of the Credit, the Huron-Wendat and the Seneca. The office is the latest in a series of steps taken by UTM in recent years to strengthen its relationship with the Indigenous community.

ST. GEORGE

TELLING THE U OF T STORY

If you live in the Toronto area, you may have already seen the colourful new banners flying on U of T's three campuses, boldly asserting that the university can accomplish the seemingly impossible.

Defy Gravity, U of T's new brand, celebrates the many ways that students, faculty, staff and alumni are stepping up to solve global problems, create new knowledge and bring about meaningful change – all while overcoming obstacles and exceeding expectations.

Created by the university's in-house marketing team, with McCann Global, the Defy Gravity brand informs storytelling that showcases how U of T brings together top minds from every discipline, background and perspective in one of the world's most diverse urban regions – and gives them a platform to achieve incredible things. Its defining feature: inclusive excellence with global impact.

The brand underpins the university's new fundraising and alumni engagement campaign, which was launched last December.

U OF T SCARBOROUGH

TOWARD MORE INCLUSIVE LEARNING

U of T Scarborough is one step closer to achieving an inclusive curriculum that includes the knowledge and perspectives of its Indigenous, Black and racialized communities.

A campus-wide review launched in 2020 proposes 56 changes, including to how courses are designed and taught and to hiring priorities, and advocates for the creation of academic programs and spaces that support equity-based, accessible, anti-racist and anti-colonial practices.

Among the recommended actions: creating courses and programs and supporting teaching methods inspired by Indigenous knowledge and Black, racialized and international perspectives; building spaces on campus to support Indigenous and Black excellence; and hiring more Indigenous and Black faculty, librarians and staff.

The ongoing review has been led collectively by a large working circle of students, faculty, staff and community members. The campus aims to achieve most of the initial recommendations by 2025.

UNIVERSITIES CAN BOLSTER DEMOCRACY

Reflecting on the increasing turmoil and polarization around the world in recent years, we would do well to ask: what is the role of universities in helping to secure peaceful and sustainable democracies?

First, we must ensure that our campuses remain places that accommodate, foster and enable important discussions about difficult and contentious issues. Dialogue and debate across difference are the lifeblood of the academy – and indeed, the lifeblood of democracy.

University communities must engage challenging topics both to advance social progress and to teach the fundamentals of citizenship. If we succeed, we will enhance our ability to educate democratic citizens who are prepared to engage fully in civic life.

The second responsibility for universities flows directly from the first. We must foster excellence in all its forms. A broad and diverse range of people, experiences and perspectives must thrive on our campuses. Wrestling with new or uncomfortable ideas in the shared pursuit of knowledge sparks understanding and innovation. Healthy debate and purposeful pluralism require a varied intellectual environment. Echo-chamber dialogue, as we so often see online, is not dialogue at all, but empty monologue.

This points to the third key responsibility for universities: ensuring equality of access to education for students, and equality of opportunity for diverse faculty and staff. Universities have a special role to play in creating opportunity for those who come from disadvantaged and underrepresented backgrounds, providing a springboard to upward social mobility and seeding our campuses with a wider variety of perspectives.

To do this, universities must remain accessible to the broadest range of prospective students, faculty and staff, and we must seek them out rather than waiting for them to come to us. This means recruiting purposefully, as well as committing to student aid.

Canada's university system is relatively successful in welcoming students from diverse backgrounds and offering an exceptional education. For example, the University of Toronto hosts upwards of 95,000 students, more than two-thirds of whom come from racialized communities, and one-half of our domestic undergraduate students come from households of modest means. At the same time, U of T is consistently ranked among the world's top universities. So it is possible to do "excellence at scale," and to achieve what we call "inclusive excellence."

The COVID-19 pandemic and other major developments have exposed new challenges for pluralism, diversity and opportunity – and they have exacerbated traditional ones. Universities must acknowledge these challenges and tackle them head-on. After all, the support we enjoy from the public may well depend on our success in ensuring access for academically deserving students, regardless of their means or socio-cultural background, as well as our ability to model meaningful debate among people of diverse views.

MERIC GERTLER

PHOTOGRAPH BY LISA SAKULENSKY

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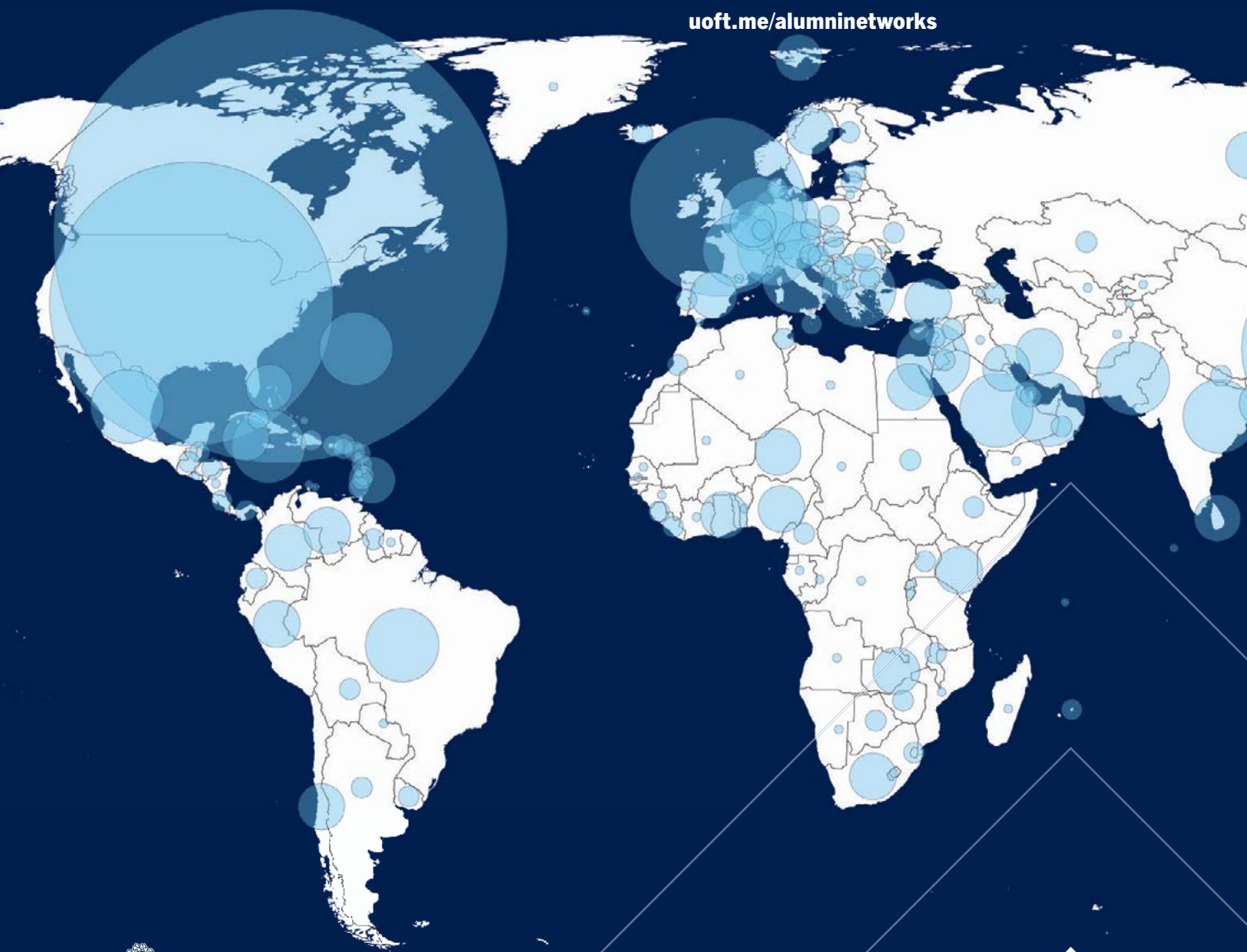


UNIVERSITY OF TORONTO

DEFY GRAVITY

A PRESCRIPTION FOR EQUALITY

A NEW MEDICAL ACADEMY AT U OF T SCARBOROUGH WILL TRY TO CLOSE CANADA'S RACIAL HEALTH GAP

BY ALISON MOTLUK

ILLUSTRATIONS BY ALEXIS EKE

ROGER ANTABE WANTED TO UNDERSTAND WHAT WAS MAKING STRAIGHT BLACK MEN IN CANADA VULNERABLE TO HIV.

He knew from previous research that they were not using the drop-in centres that provided services such as testing, counselling and information about preventative medicines like PReP. But he wasn't entirely sure why.

The question was an important one. Overall, Canada was doing well at keeping HIV at bay. The rate of new infection was quite low compared to the 1980s peak and declining in historically at-risk groups, such as men who have sex with men.

But among some populations, including straight Black men, the number of new cases was trending higher. Statistics showed that a small but significant portion of the transmission in the Black community was occurring through heterosexual contact. Despite making up less than five per cent of the Canadian population, Black people accounted for 25 per cent of the country's new HIV cases. (Indigenous people, who likewise represent only a fraction of Canada's population, also account for 25 per cent of new HIV infections.)

How could such small populations account for such a high proportion of infections, wondered Antabe, an assistant professor in the department of health and society at U of T Scarborough. "Fundamentally, there must be something wrong with the way we have looked at HIV, or with Canada's approach to addressing the issues of HIV," he says.

From a series of surveys, small focus groups and individual in-depth interviews, Antabe and his colleagues learned that many members of the Black community were unaware that HIV was even a problem in Canada, let alone that their group might be at heightened risk. Many didn't know there were services available to help. But more worrisome, even those who did know often chose not to use these services. The number one reason? They felt they would be treated as people who *make* others ill rather than as patients.

Dr. Roger Antabe's research revealed pervasive racial stereotypes held by health-care workers

Antabe's research revealed pervasive racial stereotypes held by health-care workers, lack of representation from the Black community both in clinics and in leadership, and inequitable funding models. Public health, he says, was letting this population down.

How HIV has been treated in the Black and Indigenous communities is a useful illustration of problems seen across the board in health care for racialized people. It becomes a vicious cycle. People are stigmatized for their poor health, so they do not trust the medical establishment. (There are also historical reasons for this lack of trust.) They are reluctant to seek treatment, so their health problems get worse. The underlying issues that predisposed them to worse health in the first place – problems such as poverty, poor housing, food insecurity and racism – get worse still as their health declines.

This year, U of T Scarborough and the Temerty Faculty of Medicine, in partnership with the Lawrence S. Bloomberg Faculty of Nursing and local hospitals, announced they will launch a community-focused expansion of the university's medical and health-care education programs that aims to break this cycle. The Scarborough Academy of Medicine and Integrated Health, scheduled to open as early as 2024, will focus on improving health care for marginalized populations.

It will put a greater emphasis on recognizing how social factors such as poverty, housing, food insecurity and systemic racism affect health, says Notisha Massaquoi, an assistant professor in the department of health and society at U of T Scarborough. It won't see health as strictly a biomedical matter. "It's ushering in a new way of educating health-care professionals," she says.

EXPERIENCING DISCRIMINATION ON A REGULAR BASIS IS ASSOCIATED WITH NEARLY TWICE THE ODDS OF HAVING A CHRONIC MEDICAL CONDITION,

according to research led by Arjumand Siddiqi at the Dalla Lana School of Public Health. The researchers found that "in Canada, experience of discrimination is a determinant of chronic disease and chronic disease risk factors, and Blacks and Aboriginals are far more exposed to experiences of discrimination."

And if the HIV pandemic did not already make it abundantly clear, the COVID

PHOTOGRAPHS BY BRENT GOODEN

pandemic hammered it home: there are health inequities in Canada. In COVID's first summer, even though Black and racialized people constituted only half of Toronto's population, they accounted for 83 per cent of the city's reported COVID cases. Racialized people were disproportionately represented in hospitalizations and deaths as well, says Massaquoi. "The thing is, we predicted it," she says. "We already had so much evidence on the HIV pandemic. But our system didn't respond. It wasn't prepared – and it never has been."

The vaccination strategy, she says, is a case in point. "They started rolling out the vaccination in corporate pharmacies, like Shoppers Drug Mart and Pharma Plus," says Massaquoi. "But if you go into the neighbourhoods that had the highest percentage of Black people, they didn't have corporate pharmacies."

And they rolled out vaccines based primarily on age. They started with people over age 80, but that ignored the fact that more than half of Ontario's Black population is under the age of 30, she says. "So even though they knew Black people had among the highest rates of COVID, they didn't design rollout strategies that would accommodate that particular population," she says. "Then you saw those rates escalate."

Rosemarie Lall, a family doctor in Scarborough and assistant professor in U of T's department of family and community medicine, felt frustrated by the simplistic calls to "isolate" and "stay home." Policymakers were not considering the living situation of her patients, she says. "I had a family of six, two bedrooms, one bathroom, and the grandmother got COVID." How were they supposed to isolate, she wondered.

A new study co-led by Tracey Galloway, an associate professor in the department of anthropology at U of T Mississauga, aims to learn more about the lived experience of racialized people during the pandemic. "We wanted to really understand the experience of the pandemic through people's voices and stories," she says. There was ample data from the province and the modelling table, she says. "But what we really lacked was access to people on the ground, living."

The researchers recruited and trained eight students with diverse backgrounds and language skills to do the interviewing. Some 80 residents of Peel Region participated. The transcripts are still being analyzed, but what stood out for Galloway was how much more complex the pandemic has been for many racialized people.

Among the challenges: multigenerational homes, overcrowding, living pay cheque to pay cheque, no access to a car, no money for good masks, poor quality internet, doing everything over the phone in a second language. Even critical tasks such as managing an immigration application or navigating chemo for a family member were unfathomably difficult. "The layers of complexity in people's lives are a story that we didn't see," says Galloway.

Prof. Notisha Massaquoi: Scarborough Academy will usher in "a new way of educating health-care professionals"

ONE OF THE THINGS THAT MIGHT HELP IS GREATER REPRESENTATION OF BLACK, INDIGENOUS AND OTHER MARGINALIZED PEOPLES IN HEALTH CARE, ESPECIALLY IN POSITIONS OF POWER.

"Representation is important," says Onyenyechukwu Nnorom, a family doctor, public health specialist and

Black Health Theme Lead for the Temerty Faculty of Medicine. "Increasing the number of Black physicians is part of what's required. It's not enough, but it is part of what you need to see change."

Though Black people make up about nine per cent of the Toronto population, that level of representation is absent among doctors and hospital administrators. There are few Black people in health-care leadership roles in the city, and there are no Black hospital CEOs.

Medical schools have been part of the problem. In 2016, only one medical student self-identified as Black in U of T's class of 259 students. At the time, faculty and staff had been working on changes to the application process that were similar to ones the faculty had made in 2012 for Indigenous students. The new process requires students to do a bit of extra work – write an essay, for instance – but applications are reviewed by a committee that includes members of the Black community. In 2024, the Temerty Faculty of Medicine is expected to graduate more than 20 Black doctors – the largest such cohort from one university in Canada's history.

But simply minting more Black and Indigenous health-care professionals is not enough. Racism needs to be addressed. If a university is going to recruit Black students, for instance, it has to provide a safe space for them, says Nnorom. Initiatives such as "Black at Temerty," which encourages feedback from the community, aim to recognize and combat the biases and prejudices Black students, staff and faculty face at medical school.

Health-care workplaces need to do better as well, says Nnorom. In a survey of Black physicians and postgraduate medical trainees conducted through the Black Physicians' Association of Ontario, more than 70 per cent of respondents reported negative experiences. According to the survey, these included being mistaken for housekeeping staff, getting unwanted comments about their hair, being asked where they come from (when they were Canadian-born), and having patients refuse treatment because "I don't want that [N-word] taking care of my kid." Nnorom says a few hospitals in Toronto have started to collect information from their staff on the Black experience, but more is needed.

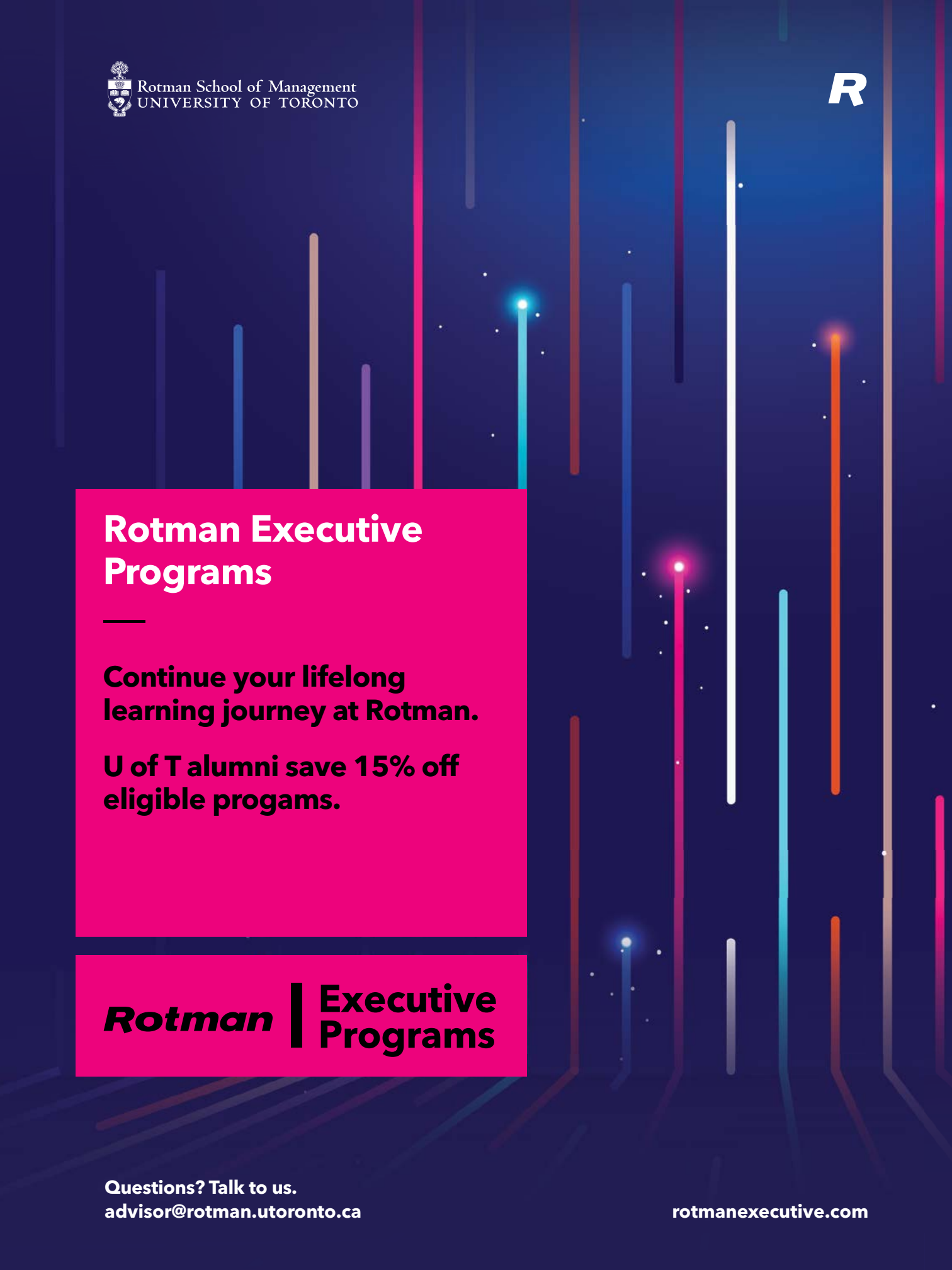
Massaquoi is advocating for more race-based data collection regarding patients. "It's the only way we'll know what the unique issues are for different populations," she says. "It's the only way we'll know if they're even accessing our services. And it's the only way we'll know what kind of experience they have when they do access our services."

She wants this data collected as part of a patient's intake into any health-care service. Researchers can trace a patient's movement through the health-care system by OHIP number – they can see who did cancer screening, who visited the emergency room and how often, who got vaccinated. A patient's age, sex and address are all collected. "Data scientists can tell you just about everything you need to know about who's using the health-care system, but they can't tell what's happening based on race," says Massaquoi. "Now imagine if race was attached to that number."

If you look at the Public Health Agency of Canada's data on chronic disease, for instance, it delivers data by disease, by year, by province or territory, and by sex – but not by race. Massaquoi is a former executive director of the Women's Health in Women's Hands Community Health Centre. The facility, for Black and racialized women in downtown Toronto, has been collecting race-based health data for more than 25 years. It is carefully attuned to a person's health requirements in relationship to their race, she says. "It becomes a very effective health organization, because I know exactly who is coming and what their needs are."

Nnorom says it's also time to contemplate a different, more inclusive approach to medicine. For one thing, doctors need to listen better, she says, and then modify their response to meet a patient's stated need. They also need to understand cultural difference and cultural barriers – and to accept that some patients are going to need to come back a few times because there is a lot of chaos in their lives. "Poverty is racialized. People are being evicted from their houses. People are losing their jobs," she says. "And so sometimes taking their medications, or showing up on time for an appointment, or listening to a doctor's advice might not happen right away."

First and foremost, health care needs to respect our shared humanity, says Nnorom. "When people get dignified care, culturally safe care and holistic care, we see that there are improvements in health outcomes. Whether that happens to be blood pressure, or diabetes, or increased cancer screening, or better COVID vaccine uptake, it takes time, and it takes deep listening, and it takes the respect of community to be able to do that. But we've seen time and time again that it works." ■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HEARD IT THROUGH THE AI*

ILYA SUTSKEVER IS BUILDING ARTIFICIAL INTELLIGENCE THAT'S MASTERING A NEW SKILL – LANGUAGE

BY ALEC SCOTT

PHOTOGRAPHS BY MICHELLE YEE

The dawn of smart, self-aware machines is a popular sci-fi storyline that, for many years, seemed destined to remain in the realm of make-believe, or at least in the distant future. Recently, though, many problems that long bedevilled computer scientists have fallen one by one – so much so that insiders are calling the last 10 years a golden decade in artificial intelligence. Computers can now outshine humans in recognizing images, can understand what we're saying and often respond sensibly to questions, can translate competently from one language to another and can defeat us in even the most complicated strategy games.

Recent advances in AI have largely built on work by Geoffrey Hinton, a U of T professor emeritus of computer science and chief scientific advisor at the Vector Institute. For years, he worked in relative obscurity, his main idea on this burgeoning field's fringes. He was one of a few scientists to back the idea that a machine mimicking the neural networks we have in our brains could, if given masses of data, find patterns there, make its own version of sense out of it all and propose solutions.

***AN AI WROTE THIS HEADLINE**

His approach to building artificial intelligence gained sudden credibility when, in 2012, a neural net that he and two of his graduate students created won a major international competition to identify the content of images.

One of those graduate students was Ilya Sutskever (BSc 2005, MSc 2007, PhD 2012), whose career since finishing his doctorate at U of T has touched on many of AI's big wins in the last decade. Currently the chief scientist at OpenAI, a San Francisco-based enterprise he co-founded in 2015, Sutskever has expressed the hope of growing an artificial intelligence there that "loves humanity." (The company's mission statement characterizes this, in a more pedestrian way, as ensuring that artificial intelligence "benefits all of humanity.")

OpenAI has the backing of two of the world's leading tech entrepreneurs – Tesla's Elon Musk and Peter Thiel, the co-founder of PayPal – who together, with others, invested $1 billion in the company. Sam Altman, the longtime head of the tech accelerator Y Combinator is the company's CEO, and Greg Brockman, who helped turn the payment-processing company Stripe from a start-up to a global player, is president and chairman.

I spoke recently with Sutskever at OpenAI's headquarters, located in a mid-rise building in San Francisco's Mission District. Walking through the office, with its blonde wood, lush plants and sleek futurist furniture, I half-expected to be greeted at reception by one of the robot "hosts" from *Westworld*. Instead, a very friendly (and very human) staff member led me to a conference room named for the star Betelgeuse – a red supergiant that shines brightly in the night sky. There, Sutskever and I talked about some of the advanced computer tools he and his team are creating.

OpenAI's flagship product is DALL-E 2, a system released earlier this year that can create original images and edit existing ones based on text commands. (Its name is a play on Pixar's animated robot WALL-E and the artist Salvador Dali.) Although there is currently a waitlist to try the system, some of the early adopters have shared their creations on social media: a raccoon playing tennis at Wimbledon; an Italian town made out of pasta, tomatoes, basil and parmesan. Users can also specify the *style* of the image they want. In a demo, I watched it conjure up an illustration of a comic-book rabbit working as a tattoo artist. What's intriguing about the program is how it can combine completely unrelated concepts in imaginative and seamless ways.

OpenAI's DALL-E 2 creates art from a text description: "An astronaut plays basketball with cats in space, as a children's book illustration"

Or "Teddy bears shop for groceries in the style of ukiyo-e"

Sutskever is clearly proud of what DALL-E 2 can achieve, though he acknowledges a limitation when compared with humans: "It's creative but it can't come up with a whole new aesthetic in the way that a genius like Picasso did."

OpenAI is also well known for GPT-3 (or Generative Pre-Trained Transformer), an AI that produces human-like text. Using a supercomputer based in Iowa, the system – soon to be released in its fourth iteration – has consumed all the digitized books in the world and much of the internet's text. Having learned from this vast corpus, it can now write short, original essays, using a specific prompt. Ask it about the moon, for example, or author Italo Calvino and it can generally supply something informative and well-written in reply. It can write original poetry and even headlines. It can also give short summaries of a much longer text. And, when given a few sentences, it can go on to write several sentences more in the same vein. Though its programmers worked on its competence in English, the program basically taught itself other languages, including Vietnamese and French.

The human seeking to create a human-friendly artificial intelligence is a fairly private, work-oriented man. When this former mathematics student speaks of the theory behind the technology's development, his eyes go over your head, as he moves into a private space where the ideas are real to him – even more real, perhaps, than you are. He has a monk's close-shaven head, but sports, on the day of our interview, a T-shirt with penguins – a playful choice that belies the serious way he responds to questions.

Born in Nizhny Novgorod, Russia, but raised mostly in Jerusalem, Sutskever remembers the first time, at about age five, that he saw a computer – at an expo he went to with his father, an engineer: "I was utterly enchanted." By the time his family emigrated to Canada when he was 16, he had developed solid programming skills. Soon, he began to imagine building computers to do things that until then only humans could.

IMAGES COURTESY OF OPEN AI

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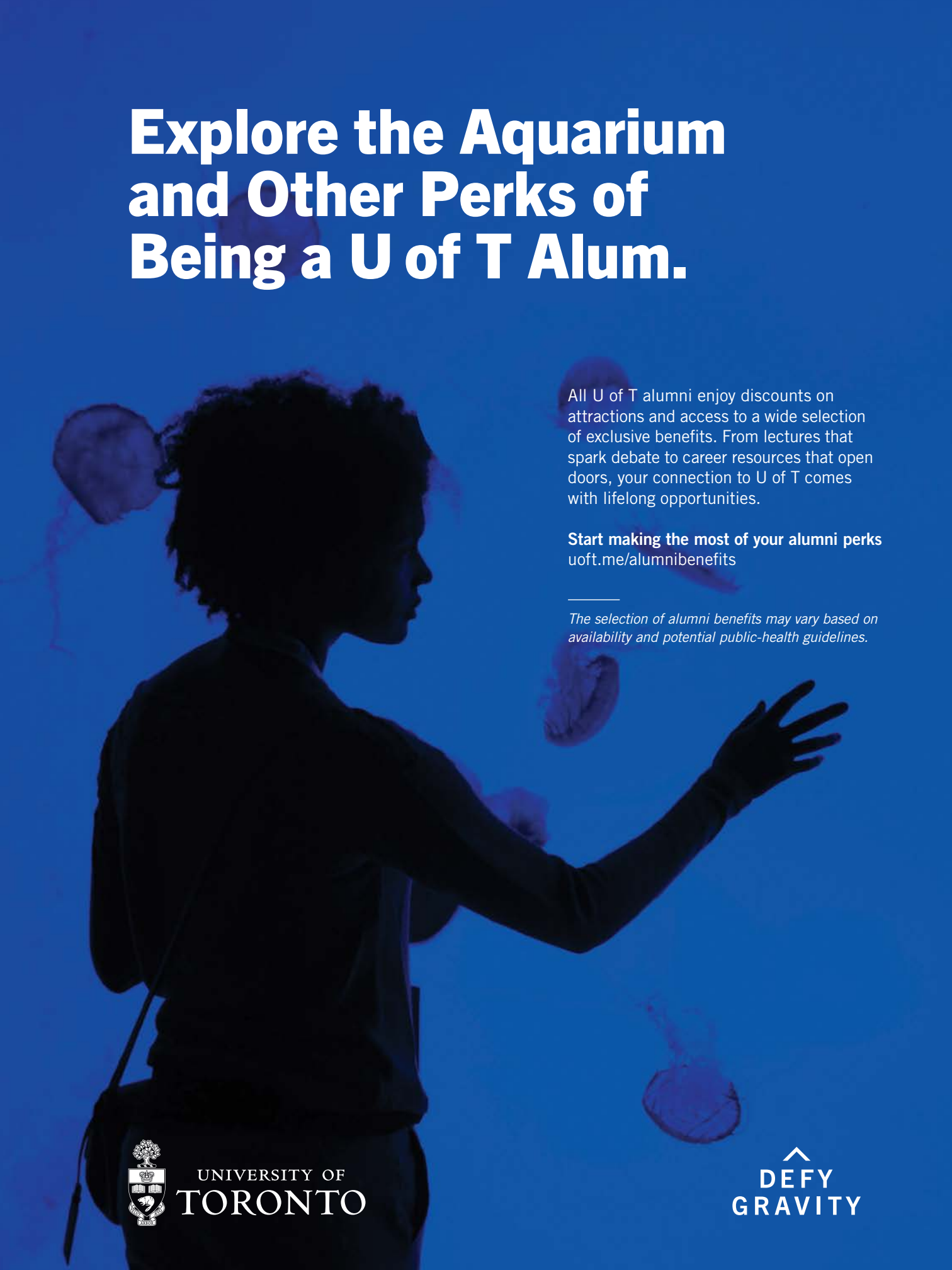

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UNIVERSITY OF TORONTO

DEFY GRAVITY

"I remember thinking a lot about the nature of existence and consciousness, as teenagers do, about souls and intelligence. I felt very strongly that learning was this mysterious thing: humans clearly learn, computers clearly don't."

U of T admitted Sutskever from Grade 11 into a math program on the basis of his studies at the Open University of Israel. He leapt directly into second- and third-year courses, and stayed for three degrees. "I was really focused on my studies," he says. (Now, in his spare time, he likes to play the piano and keep in shape, but he remains singularly devoted to his work.) He sought out Hinton early on, working with him closely for more than a decade. For his part, Hinton remembers Sutskever, a student member of his research team, completing a coding task in an afternoon that might have taken someone else weeks. He quickly developed confidence in Sutskever because, Hinton says, "he asked the right questions."

Could artificial intelligence one day develop self-awareness? It's unlikely, says OpenAI's chief scientist Ilya Sutskever

Based in part on his work with Hinton, Sutskever was hired by Google. There, he implemented a neural-network-driven approach to language translation that produced fewer errors than competing efforts. His work provided the basis for a major upgrade to Google Translate. "Researchers didn't believe that neural networks could do translation, so it was a big surprise when they could," he says.

A couple of years into his time at Google, in 2015, Sutskever was invited for dinner at a swanky hotel in Palo Alto by Sam Altman; Musk and Brockman were among the other guests. The talk proposed the sort of initiative that Sutskever had been daydreaming of, "a large-scale project where many researchers and engineers come together" – a kind of moonshot for AI. "We just spoke and we vibed and we continued the conversation. Two days after the dinner I emailed Sam to say, I'd like to be involved if you're interested."

Given its up-with-humanity aims, OpenAI was set up, initially, as a non-profit corporation that would use technology to solve big problems (and, with care, avoid creating new ones). But the model didn't provide the infusions of cash needed to implement the group's ambitions – the hiring of top minds, the building of the supercomputer in Iowa. So, a different sort of legal entity was created – one that would cap the upside for investors, at 100 times outlay (a good return in Silicon Valley can be much higher) and pump any gains above that back into the company's mission to create beneficial AI.

About a third of the staff is involved in making sure the company's AI actually works as intended – that it does "what it's asked to do," Sutskever says, and is not used in harmful or offensive ways. For Sutskever and the team who built DALL-E 2, this meant removing a wide range of content from the program's training data in order to limit the creation of violent, sexual or hateful images, and developing techniques to prevent the program from using faces of real people, such as politicians and other public figures.

Gillian Hadfield, the director of U of T's Schwartz Reisman Institute for Technology and Society, consults with Sutskever and other members of OpenAI's leadership on its efforts to ensure the technology heads in a socially beneficial direction. "We could see how it might assist in the management of a future pandemic or in the creation of safer cities," says Hadfield. "Imagine," Sutskever says, "having a doctor who refers to every single study in medicine."

Of course, both Hadfield and Sutskever recognize that AI will likely displace people from certain jobs. Telephone customer service reps seem especially vulnerable, as do bookkeepers and receptionists. On the positive side, Sutskever notes that AI will also create skilled jobs, in fields such as data and computer science, and replace certain *parts* of jobs, leaving more time for people to focus on the most creative aspects of their work. Lawyers, for example, might employ AI to do legal research, allowing them more time to focus on strategy, arguments and business development. Of the advances in AI that most assuredly are coming, Sutskever says, "there is no area of human life that will be left untouched."

Hadfield's research proposes ways to manage the disruption – and the other downside risks that AI poses. "Fear is the human condition," she wrote in a *Toronto Star* op-ed. "But so too is designing rules and systems to manage what frightens us." Her work, accordingly, focuses on what kind of regulation, private and government, would minimize the most harmful aspects of AI.

Looking much further into the future, could those sci-fi storylines about artificial intelligence developing consciousness – becoming self-aware – come true? To Sutskever, the very idea of sentient AI is less a possibility than it is a provocation – often hyped by the media – that distracts us from how the technology is actually advancing. As he notes, in his typically understated way, "It's an unlikely scenario." ■

Needed: Three Alumni

UNIVERSITY OF TORONTO

The College of Electors is seeking candidates who reflect the diversity of the University's alumni, will enrich the U of T community with their perspectives, experiences and connections, and actively participate in the governance of the University.

The *Call for Applications* for one of three alumni governor seats on the Governing Council—the senior body that oversees the University's academic, business and student affairs—will open at noon on Thursday, November 17, 2022.

Each seat is for a three-year term beginning July 1, 2023 (two incumbents are eligible to stand for re-election, and one incumbent has reached the maximum service and is not eligible to stand for re-election).

The deadline is December 15, 2022. Additional information is available at: https://governingcouncil.utoronto.ca/needed-three-alumni

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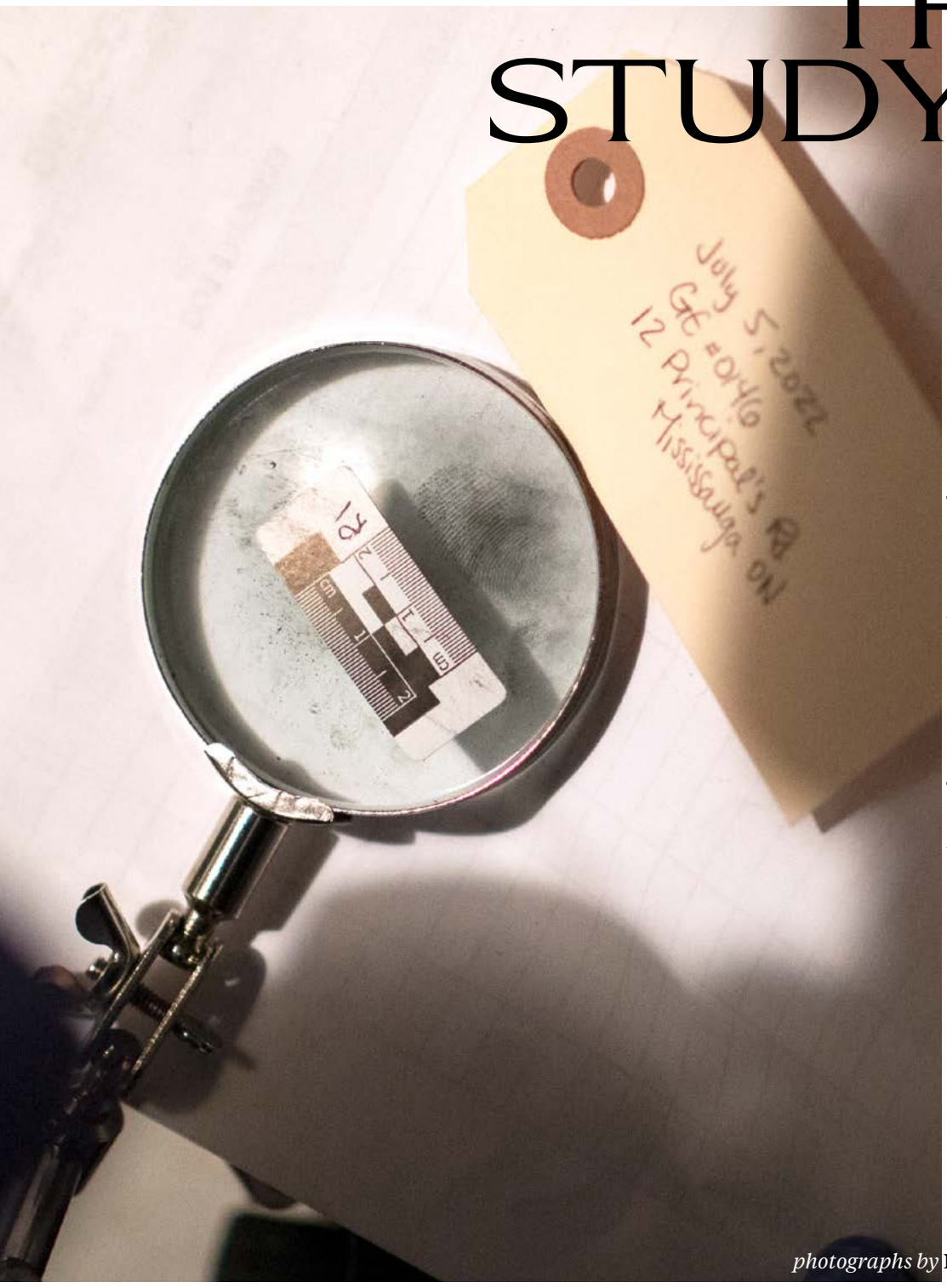
MURDER, THEY STUDY



Students dust for fingerprints, study blood spatter, and even analyze handwriting at a mock crime scene as part of UTM's forensic science program

photographs by Nick Iwanyshyn

The staged crime scenes that students investigate vary from year to year, but each comes with a detailed back story. This year's was based loosely on the Boston Marathon bombing.

An emergency responder briefs the investigators who have gathered at U of T Mississauga: a body, along with shrapnel and pages from *The Anarchist Cookbook*, has been found outside a house adjacent to a shipping container. Another body lies near a car. On the vehicle's roof appears to be the remnants of an explosion. If not for the mannequins, the area might be mistaken for a real crime scene. That is the point.

The staged setting is part of the degree program in forensic science at U of T Mississauga, and is designed to give upper-year students "on-the-job" experience as a crime scene investigator before they graduate. The work involves everything from securing the location and collecting evidence such as fingerprints and DNA, collaborating with forensic chemistry students to analyze what they've found, and later testifying in a mock courtroom.

Sahana Pirapakaran, a fourth-year student specializing in forensic anthropology, worked on the simulated crime scene earlier this year and found the set-up highly realistic. "I felt like I really was a crime scene officer," she says.

Graduates of U of T Mississauga's forensic science program have gone on to work at Toronto Police Services and other law enforcement agencies, the RCMP and the Centre for Forensic Sciences.

The detailed scenes, which are prepared by the program's staff, are also used to give high school students, rotary clubs and other community groups a firsthand introduction to crime scene investigations. Murray Clayton, the program officer and outreach co-ordinator, likens these one-day events to an "educational escape room" in which participants get a chance to solve the "crime."

Although students in recent years have been drawn to forensics through the television show *CSI*, it doesn't take long for them to realize that what they see on TV is far from reality. On screen, one forensic investigator typically collects the evidence, analyzes it in the lab and solves the case. In real life, each task goes to a uniquely trained forensic specialist, such as an anthropologist, biologist, chemist or psychologist.

Pirapakaran says her experience with the mock investigation hammered home how little room for error there is. "In a real-life situation, you don't get a redo," she says. "You're dealing with someone's life."

At U of T Mississauga, forensics students wear jackets with patches on the sleeve (like Scout badges) representing their area of focus – a skull, for instance, represents forensic anthropology. Only a few people can claim a patch for each specialty offered at the campus; one is Prof. Tracy Rogers, the program's director since 2001.

For Rogers, who has worked on some of the highest-profile cases in Canada, the work of forensic investigators helps society answer questions about criminal activity and puts to rest questions that family members have about their loved ones. "In a sense it helps the victim," she says. "At least having their story told and getting some kind of justice for them is a valuable service." **—Geoffrey Vendeville and Scott Anderson**

← Each mock crime scene is designed to contain many different kinds of evidence, and to test the range of skills students have learned in the program. This year, students retrieved a handwritten note with an anti-government message, which they could send for handwriting or pen analysis.

←
Fourth-year student Sahana Pirapakaran says until working the mock crime scene she hadn't fully considered how the weather can impede an investigator's work. "Our area was outdoors, and it started to rain. So, you have to think critically about which evidence to collect first."

←
The students work in small groups, and each group is assigned to investigate a specific area of the crime scene. Agata Gapinska-Serwin, the program's laboratory co-ordinator who helped prepare the scene, says one of her trickier tasks is making sure that there are enough pieces of evidence, and that they are spread approximately equally across the different areas.

↑
In the basement of a house, students found a table with long plastic tubes, a battery, cables and gun powder. Droplets of blood marked the floor and a Band-Aid wrapper bore a bloody fingerprint. One of the challenges as an investigator is deciding what to collect as evidence. "A drinking straw could contain the DNA of the perpetrator," says Pirapakaran. "The smallest thing could be the key to the scene – and the case."

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Displaced by War

U of T has a history of helping scholars fleeing violence in their home countries. This year, many Ukrainians have found a haven here

Shortly after Russia invaded Ukraine last February, Olha Maliienko and her husband drove west to stay with his grandparents. The couple, married only six months earlier, lived near the eastern Donbas region and knew it would quickly become a Russian target. When Maliienko's husband left to enlist in the army, she returned home, spent several nights in a bomb shelter and then decided she needed to leave the country.

Maliienko, 27, who had worked as a marketing manager before she left Donbas, reckoned she could find a university abroad where she could complete her doctoral work in applied mathematics. She packed a bag, got in her car and spent 40 hours in a massive traffic jam on the way to the Polish border, where she waited another 16 hours to get through.

Eventually arriving in Warsaw, she set to work searching for universities and found programs in Taiwan and Israel. Ultimately, she opted for a U of T summer program for Ukrainian students being offered by the department of computer science and the Vector

ILLUSTRATION BY KLAWE RZECZY

"EVEN SIX MONTHS AGO I WAS THINKING OF BUILDING A FAMILY. BUT NOW I'M NOT SURE"

Institute. "Canada," she says, "was the safest place for me." She bought a $200 one-way ticket and arrived in Toronto in May.

Last March, after the war began, U of T put out a call for donors to help Ukrainian students continue their education here. The request brought in more than $4 million, including a $3.2 million gift from the Temerty Foundation. The Temerty gift has so far supported 20 Ukrainian students through an exchange between U of T's Faculty of Arts and Science and the National University of Kyiv-Mohyla Academy, according to Gwen Burrows, assistant vice-president for international engagement and impact; up to 200 more students are expected by early 2023.

The remaining funds raised will support the university's Scholars-at-Risk program, which since 2016 has admitted both undergraduate and graduate students fleeing turmoil and violence in their home countries, offering up to $10,000 toward tuition and other costs, as well as other services. (An earlier version of the program, only for graduate students, was launched by Massey College and the School of Graduate Studies in 1999. Over the years, it has supported dozens of students from countries such as Azerbaijan, Iran, Syria, Venezuela and Zimbabwe.)

Because the university welcomes students and faculty from around the world, assisting those who have had their academic careers and freedom interrupted by war is an extension of U of T's broader outlook, explains Burrows. "It's an important part of our international engagement."

Roman (who asked that his real name not be used), 21, first heard about the opportunity to attend U of T on a group chat in March. He had been living in Kyiv early in the war, then moved to western Ukraine with his family as the fighting intensified, eventually returning to Kyiv. He swiftly completed U of T's requirements online and secured an acceptance before the Ukrainian government moved to prevent fit adult males from leaving. But the lengthy wait at the border was excruciating because there was no guarantee that the guards would allow him to depart. "I don't know why, but I got lucky," he says.

To flee war is to be caught in a kind of geopolitical limbo, physically in one place and emotionally in another. With the Ukrainian students who have come to U of T, the transition, in some ways, has been relatively straightforward. Many are fully conversant in English. As well, members of the local Ukrainian community (and other volunteers) have mobilized to provide everything from apartments to household utensils. "They tried to make our life as easy as they can," says Maliienko.

Still, the sense of separation is intense, and the students' smartphones provide a steady diet of news from home and other reminders, including air raid alerts they never deleted. "Being not home is hard," Roman says. "You feel homesick really quick."

Maliienko, who spent the summer living on the St. George campus in residence, says her own sense of dislocation is compounded by the fact that her husband, who is now fighting the war, can only contact her once a week, via Elon Musk's satellite internet service Starlink.

Through the Summer Program for Students from Ukraine, however, she and other Ukrainian students have received a steady diet of practical information about jobs, accommodations and the city's social offerings, among other topics. There have been meetings with potential employers and even a camping trip. "This schedule helped me not to think all the time about Ukraine and missing my husband," she says.

ABOUT SCHOLARS AT RISK...

The initiative is modelled after the Writers-in-Exile program, created by Massey College and PEN Canada in 1995

Ballet star Mikhail Baryshnikov was an early donor to the program

The first participants were a writer from Ethiopia and a professor from Iran

The program expanded in 2016 during the Syrian refugee crisis

SPOT ILLUSTRATION BY DAVID SPARSHOTT

At U of T Mississauga, Khrystyna Radchenko, 20, has been working through a summer program in computer science, and is considering extending her time here by a year. "My mom is asking me to stay longer just to be safe," she says, noting that, beginning in October, the Ukrainian government will restrict women with certain specialties or professions from leaving the country.

Roman, who had considered studying abroad before the war began, was aware of U of T's strength in research. After he arrived, he sought out computer science professors with the goal of pursuing research in coding, including machine learning.

Dariia Kucheruk, who hopes to finish her computer science degree at U of T, is also focused on machine learning, and its application in fields such as health care. A resident of Odesa, she had been travelling with her parents in Africa when the war began, and ended up in Istanbul for two months after all flights into Odesa were cancelled.

Like Roman, she had thought about studying abroad before the war and wanted to end up in a university with faculty who were the best in their field. But, she notes, she never expected this to happen because of a war, adding that she didn't think she had the strength to leave her homeland: "I didn't ever imagine I could do this."

Maliienko wanted to go home this fall and return to U of T later to finish her PhD, but these decisions, like so much else for millions of Ukrainians, are on hold as the war grinds on. "Even six months ago, I was thinking about building a family," she says, "but now I'm not sure." For the moment, she's focused on her studies and adjusting to life in Toronto bit by bit. Reflecting on her current situation, she muses: "People are stronger than they think." **—John Lorinc**

A RECOMMENDATION

How to Eat Sustainably on a Budget

Amid record high food prices, finding healthy and sustainable food can be a major challenge. But there are ways to save money while making eco-friendly choices at the grocery store, says Claire Marshall, an ambassador in U of T Scarborough's sustainability office. Marshall, who has worked as an environmental technician protecting honeybees and once advised customers on produce as a Whole Foods employee, offers four savvy eco-shopping tips. **—Alexa Battler**

Show lumpy food some love
Shoppers tend to assume produce that looks perfect will taste perfect. That's not true, Marshall says, and picking a slightly lumpy or wrinkled fruit or vegetable reduces what the grocery store ends up tossing. These can also be the foods that end up on sale. "It's a whole different way of looking at food," says Marshall.

Shop savvy
According to Statistics Canada's monthly list of average food prices, the price of some fruits and vegetables remained relatively unchanged since last year. The cost of bananas, broccoli, cucumbers and potatoes has risen, but not by nearly as much as most cuts of beef and pork. You'll also cut your carbon footprint by reducing meat consumption.

Do the math
Marshall advises to check whether options that cost a bit more actually contain more food. Check by dividing the price by the number of grams or millilitres in a package. Figure out the shelf life for your foods to pick ones that will last longer. Always check best-before dates and place newer items further back in your fridge.

Avoid food waste
If your fridge's vegetable drawer leads you to forget your produce is there, try storing it in obvious places to avoid letting it rot. Give your fridge an audit before hitting the store to make sure you buy only what you will eat — and don't go grocery shopping while hungry.

The Costs of Extraction

Prof. Kristen Bos investigates how pollution has affected — and continues to affect — Indigenous communities

Like many people who grew up in Canada, Kristen Bos remembers flipping through *National Geographic* magazines as a kid. She loved writing and science, and read a lot about history. These interests outlasted childhood, and she decided to do an archeology degree at U of T. "I was very into the idea that you could get closer to the past," she says.

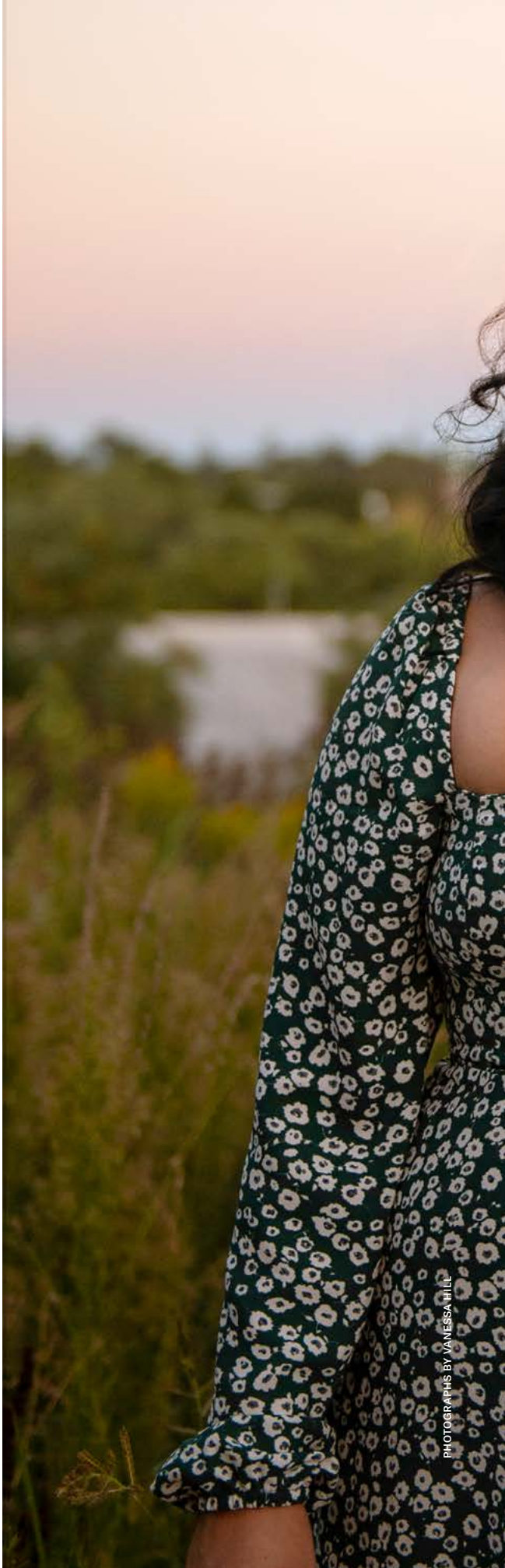
The reality of being an Indigenous woman in archeology, however, proved to be much more problematic than any romantic notion presented in a magazine. (Bos is Métis, with homelands in northern Alberta in Treaty 8 Territory.) "The vast majority of archeologists are white, including the ones studying Indigenous things. And conventional research involves collecting and studying these things without Indigenous Peoples' input," she says.

As an archeologist, Bos saw how the stories that archeologists tell get turned into facts and history, which then become ingrained in society. "Archeology is part of colonization," she says.

Today, Bos is finding new ways to tell the stories of the past as an assistant professor in the department of historical studies at U of T Mississauga. "Colonialism is so big when you think about its structures and technologies, so I'm trying to make its effects more comprehensible through projects that have a visual component," she says. Most recently, her research has painted a picture of how historic and ongoing pollution have affected – and continue to affect – Indigenous land, people and culture.

Bos is co-director of the Indigenous-led Technoscience Research Unit, where researchers from several U of T faculties take a social justice approach to technoscience – a field that examines the social, political and historical results of science and technology. Her path to reach this position wasn't direct, but she says the twists and turns make sense given her own history: her mother is a Sixties Scoop survivor and Bos was adopted by a white family in Toronto. "I didn't grow up in my culture. I don't think it is a coincidence that I have always been interested in origins."

Her early education at Catholic and predominantly white public schools was difficult. "I liked



PHOTOGRAPHS BY VANESSA HILL

U of T Mississauga professor Kristen Bos ←

learning, but as I got older what we were being taught didn't feel accurate," she says, referring to the way the curriculum tended to erase Indigenous Peoples' history. "Also, I was reading about colonialism and Indigenous issues on the internet, so I knew there were other things going on that nobody wanted to talk about. It just wasn't working for me, so I stopped attending school at 15." She didn't give up on her long-time plan to go to university, though, gaining entry to U of T a few years later by completing the Transitional Year Programme. Once in, she thrived, receiving the President's Award for the Outstanding Indigenous Student of the Year for academic achievement and contributions to the Indigenous community.

By the time she had completed a master's degree at Oxford University, where she became the first Indigenous graduate in archeology, Bos was determined to find a new way to pursue her academic interests. She found a place to do that when she met M. Murphy, who is Métis from Winnipeg and co-director of U of T's Technoscience Research Unit. Bos, Murphy and their colleagues flipped the script on conventional research practices. Instead of going into Indigenous communities, finding the data they need and leaving, they enlist Indigenous community members to lead the research project with them. Together, they make decisions about how data is gathered and shared.

You can see this method in action in a project Bos and Murphy are leading with Vanessa and Beze Gray of the Aamjiwnaang First Nation in southwestern Ontario's Chemical Valley – where 40 per

cent of Canada's petrochemical processing takes place. The team is investigating polluters in the area, and their first task was delving into the history and operations of Imperial Oil, North America's oldest operating – and highest-emitting – refinery. "Colonial processes made Chemical Valley possible, removing land from Indigenous governance, turning the oil springs into property owned by settlers, and inhibiting Indigenous Peoples' ability to care for the land, air and water," says Bos, who teaches a course called Histories of Extraction.

In studying Imperial Oil, she says the inadequacy of pollution data in Canada was strikingly evident to the research team. "There's little direct measurement of pollution, no quality assurance in industry self-reports and no context. The data is completely disconnected from the lived experience of communities like Aamjiwnaang, which has been coping with pollution for 150 years."

When spills, leaks or other problems happen, the relevant companies sometimes send alerts to people in the surrounding region. "These alerts tend to be vague and technical. They bet on people not understanding technical information," says Bos. "We wanted to reimagine the collection and reporting of pollution data for the people on the ground, so that they can hold companies responsible for the pollution they produce." The project team

"[POLLUTERS'] ALERTS TEND TO BE VAGUE AND TECHNICAL. THEY BET ON PEOPLE NOT UNDERSTANDING"

created the Pollution Reporter mobile app, which allows users to quickly get information on pollution in Chemical Valley – including specific chemicals' known health harms – and easily report adverse events to the Ontario Ministry of the Environment's Spills Action Centre.

If someone smells or sees or hears something in the middle of the night, or gets an alert, they can pull up the app to get crucial information and create a record of the event. "They can then take that knowledge to environmental meetings or to the refineries' leadership if they choose to," says Bos. "It makes it harder for industry not to answer questions." While the initial app, released in 2019, focused on Imperial Oil, the latest version includes data on all the area's refineries back to 1994, including ones that have closed. "So often in environmental and health studies, people have to speak of and account for their suffering to be heard," says Bos. "We didn't want that." Users can opt to keep a record of their reports, but the app collects no user data and is open source, meaning other communities on the front-

lines of pollution can use it too.

Bos says users have expressed an appreciation for the app's ease of reporting, and she cites feedback from Aamjiwnaang Elder Mike Plain who noted an effect beyond his immediate community. "We as human beings have to make reports for those who can't," he said. "We have to be their voice. We're speaking for the fish, birds and butterflies too."

Bos's other central research interest – beads – is also looking at the long-term impact of toxic chemicals connected to colonialism. Indigenous people have been using beads made of natural materials such as shells and meteoric iron for thousands of years. Later, under settler colonialism, they also began using tiny, colourful glass seed beads from Europe obtained through trade. Collectors and museums started keeping examples of Indigenous beadwork in the 1700s, and applied harsh chemicals and preservatives to make them last.

Those dangerous chemicals have persisted, says Bos, and researchers and curators have to don protective gear around them. "There is no way to remove these chemicals," she says. Perhaps partly due to that avoidance, beads and beaded items often lack historical information. "When I went into a collection at a museum in Germany there were beautiful beaded bags and objects in drawers in a basement with no context or provenance attached to them," she says.

She adds that her research into beads and pollution shows how the harm colonialism caused Indigenous communities endures today. Thinking back on her early drive to connect with undiscovered pieces of the past, Bos says her perspective has shifted. "Why do we separate the past from the present so profoundly? Maybe it's not that separate at all. Maybe it's still very much here." —**Megan Easton**

ILLUSTRATION BY DAVID SPARSHOTT

AN ORIGIN

Of Pies, Nuclear Plants and the Early Days of Co-op Education at U of T

Glenn De Baeremaeker remembers feeling like a fish out of water when he walked into the Ontario premier's office for the first time in 1981. He was there to start what was then a relatively new addition to a U of T Scarborough degree: a co-op work term. "I was just a kid from a working-class family in Scarborough, so never in a million years would I have gotten a job in the premier's office without a co-op placement."

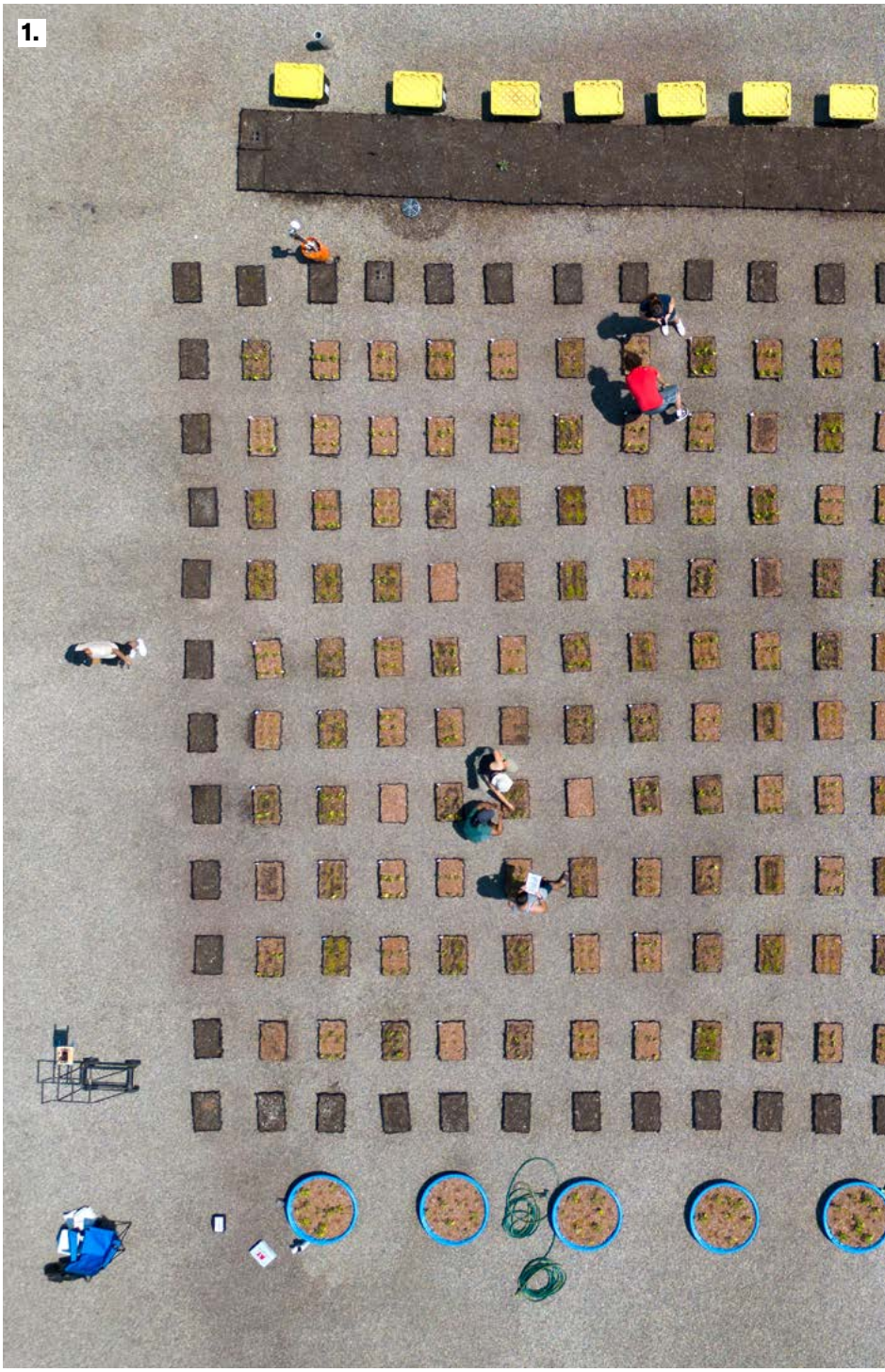
His role in the communications department included responding to letters from the public on everything from Ontario's nuclear plants to then-Premier Bill Davis's favourite pie. "That experience had a huge impact on my life and really started my journey into politics," says De Baeremaeker, who worked for years as an environmental activist before being elected to Toronto's city council in 2010.

It was the possibility of encouraging more university-educated young people to work in government that prompted Professor Ralph Campbell to start a co-op program in public administration at U of T Scarborough in 1975. Campbell, an economist and the principal of Scarborough College (as the campus was known), had observed a need for renewal in Canada's public sector and felt this would benefit the country.

The task of finding placements for students fell to Jon Dellandrea, who was Campbell's executive assistant and de facto co-ordinator of the new program. Dellandrea, who would later become U of T's vice-president and chief advancement officer, travelled across Ontario to meet with government employees to find jobs for co-op students. In the first year, 25 students enrolled, each paying an extra $20 for tuition.

Nearly 50 years later, U of T Scarborough is recognized as a leader in co-operative education in Canada, boasting programs in about 50 different subject areas and an annual enrollment of almost 4,000 students, divided broadly between management and arts and science. **—Don Campbell**

What is the future of urban farming? UTSC researchers test which crops fare best on city roofs



Toronto has one of the most progressive green roof policies in North America – and was the first city on the continent to make them mandatory for new construction. Green roofs help cool buildings, leading to lower energy costs.

There are currently more than 700 dotting the city but most use shallow substrates (a mix of organic material, crushed bricks and some minerals such as sand and shale) instead of soil – and little to no irrigation. They require minimal maintenance and have not been designed with farming in mind.

"Growing food in these conditions is not easy," says Marney Isaac, a professor in the department of physical and environmental sciences at U of T Scarborough who is co-leading a project with Scott MacIvor, an assistant professor in UTSC's department of biological sciences, to test whether these roofs can become food-growing gardens.

Isaac, who is an expert on plant-soil interactions and sustainable agriculture, says a major challenge is making sure the crops get enough nutrients. Since the typical green-roof substrate is not as nutrient-rich as soil – and dumping loads of fertilizer on the tops of buildings isn't possible – the team is testing a type of organic fertilizer.

Heat (too much) and moisture (not enough) are also concerns. Most Toronto green roofs are planted with sedum, a durable and drought-tolerant type of succulent that is efficient at storing water and cooling the soil. The researchers are looking at how different species of sedum might help more sensitive plants, such as crops, grow in harsh conditions.

The researchers are currently growing a variety of crops in 400 individual modules

1. Researchers planted dozens of boxes atop UTSC's Highland Hall with a mix of crops and sedum. The team provides varying levels of water and nutrients to simulate stress on the plants

PHOTOGRAPHS BY DON CAMPBELL

2. The research team measures leaves and vegetables to track plant growth. Here, a researcher cuts a vine with scissors to harvest a bean

3. This machine detects how well the plant is breathing

4. Another device helps determine how well the plants perform photosynthesis. When taking measurements, the researchers use remote sensing to avoid harming the plants

5. At the end of the season, crops are picked, dried and weighed

– boxes measuring 60 centimetres by 40 centimetres – on the roof of Highland Hall at U of T Scarborough. The goal is to see how certain plants interact with each other – a tried-and-true farming process known as intercropping. For example, planting legumes contributes nitrogen to the soil, which supports the growth of other crops.

It's possible that one day your local grocery store will be able to grow food on its roof. Or people living in condos and apartments will be able to ascend a few floors to harvest their own fruits, vegetables and herbs, including ones not commonly stocked in stores. "It could give people living in cities an opportunity to grow the types of culturally important foods they can't easily get," says Isaac. **—Don Campbell**

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PHOTOGRAPH BY IRA JACOBS

From Strength to Strength

U of T's new Tanenbaum Institute for Science in Sport will help athletes at all levels perform better

Most sports have rules that protect the safety of athletes. But how do we come up with these rules? And which rules work best to keep athletes healthy and able to play?

Several years ago, Michael Hutchison, an associate professor in the Faculty of Kinesiology and Physical Education, conducted research into concussions among National Hockey League players. Through a video analysis, Hutchison and his research team found that almost two-thirds of concussions were caused by direct hits to the head. The team's finding led to a new NHL rule prohibiting this kind of player-to-player contact.

Hutchison's research demonstrates how science, when applied to sport, can help reduce the frequency of a serious but common injury among high-performance athletes. It's the kind of valuable knowledge that could be generated by U of T's new Tanenbaum Institute for Science in Sport, established earlier this year with a $20-million gift from the Larry and Judy Tanenbaum Family Foundation.

"A dream come true"

The Tanenbaum Institute will be one of the largest centres for sport science and sport medicine in North America, bringing together sport and exercise researchers at the Faculty of Kinesiology and Physical Education, clinician scientists in sport medicine at the Temerty Faculty of Medicine, and clinicians and researchers at Toronto's Sinai Health.

The Tanenbaum Institute for Science in Sport:

- Will offer eight scholarships in sport science for graduate students and postdocs
- Is partnering with high-performance sports groups to provide students with work and research opportunities
- Will share its research findings for free around the world

Ira Jacobs, the institute's interim director, says the new centre will fund research to support high-performance athletes across a spectrum of abilities, from world-class professional athletes to para-athletes to recreational and amateur players who want to optimize their performance and training. "It's a dream come true for the study of our physical and mental capabilities in sport," Jacobs says.

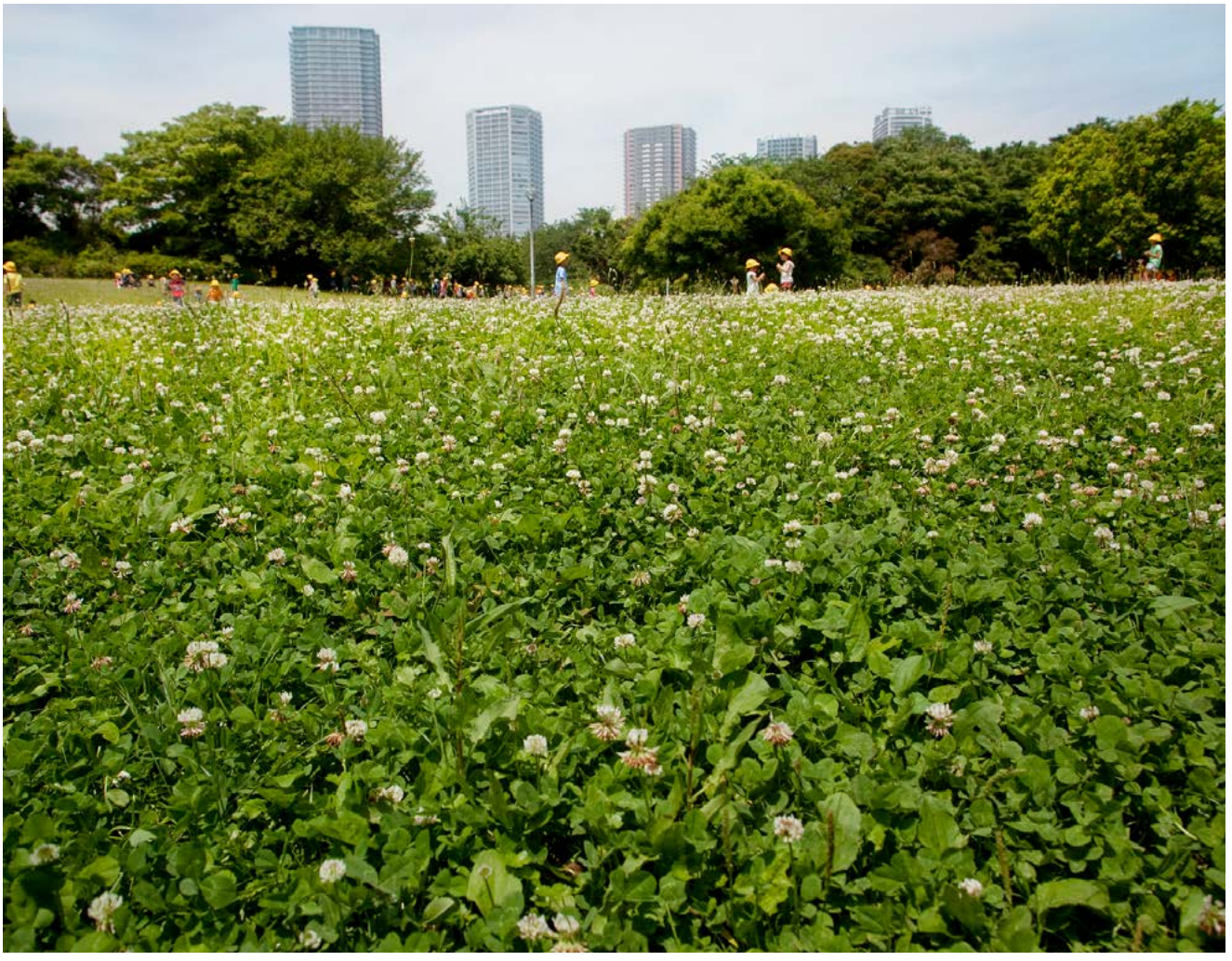
Research topics will range from athletes' nutritional needs to team psychology to rehabilitation of athletic injuries. Other important topics include how biomechanics – the study of the physics of movement – and wearable technologies can improve training and performance, and how to determine when an athlete who has suffered a concussion can safely return to play (still not clear after decades of research, notes Jacobs).

Sharing knowledge widely

A chair in sport science and data modelling, funded by the gift, will help gather data about athletes across the Toronto region – including from underrepresented communities and the thousands of U of T students who play varsity and intramural sports – to generate new knowledge that both high-performance and everyday athletes can use. A database of sports injuries, for example, could track which treatments are most effective for different demographics. To share its findings, the institute will host regular conferences and public lectures.

"I truly believe that sport unites us, inspires us and offers all people a path toward becoming their best selves," says Larry Tanenbaum, chairman of the Tanenbaum Family Foundation and Maple Leaf Sports and Entertainment. "I'm proud to join with U of T and Sinai Health in transforming athlete health and well-being."

—Scott Anderson



Cities Are Driving Evolution

Globally crowdsourced study shows that white clovers are biologically adapting to city life, demonstrating the profound impact of urbanization

The common white clover is both everywhere and nowhere: it grows widely in the grassy areas of cities worldwide but barely takes root in our imagination. Yet this inconspicuous little plant holds a giant clue about how species adapt to urbanization.

Like many organisms, the white clover defends itself against potential predators. Snails, slugs and voles that graze on this herbaceous perennial encounter an unpleasant bitter taste caused by hydrogen cyanide, which can kill them. But new U of T–led research shows that in the world's concrete jungles, which host fewer foraging herbivores, white clovers have naturally evolved to be less guarded: they are 44 per cent less likely to emit this toxic chemical than their siblings in rural areas.

"This is the first time we've documented this kind of pattern happening across the whole world. I think it's pretty strong evidence that humans are influencing the evolution of the life that surrounds us," says James Santangelo, who recently earned a PhD in biology at U of T Mississauga. Santangelo helped unearth this new phenomenon in natural selection as a researcher on the Global Urban Evolution Project.

In this first-of-its-kind study, Santangelo and two UTM professors were able to enlist 287 scientists in 26 countries on every continent except Antarctica to study the urban adaptation of white

PHOTOGRAPH BY (TOP LEFT) HIROSHI WATANABE/GETTY IMAGES

clovers. Fanning out across lawns and parks in Tampa, Helsinki, Cape Town, Tehran and dozens of other cities, they collected some 110,000 samples and sequenced the genomes of more than 2,000 individual plants. Their findings, which were published in *Science,* clearly show how the plant is undergoing "parallel evolution" – meaning it is biologically changing to adapt to the circumstances of urban life.

"Humans have become the major driver of evolutionary change on Earth," says Marc Johnson, one of the study's principal investigators and a U of T Mississauga biology professor. "If we want to keep living here in a sustainable way, we need to better understand this trend."

Johnson, who leads the EvoEco Lab at UTM and is the Canada Research Chair in Urban Environmental Science, first explored this trend in white clover populations in Toronto. In an earlier study, he found that the frequency of plants producing hydrogen cyanide (a process known as cyanogenesis) increased with greater distance from downtown. A new idea germinated one day while he was in the shower, and as he wrote in a project blog post: "Holy cow, we could use white clover to understand whether organisms are adapting to cities in similar ways throughout the entire world."

The seed was planted, and Johnson attracted interest from Rob Ness, an assistant biology professor at U of T Mississauga, and Santangelo, who was already doing similar research. They initially aimed to include scientists from 50 cities, but after Johnson posted an open invitation on Twitter and circulated the proposal among colleagues, more than triple that number signed up.

The project's goal was to document the genetic diversity of white clover over a wide geographic range. So, starting on foot at their city's centre, the participating scientists travelled outwards on linear paths like bicycle spokes, stopping at least every 200 metres to collect 20 plants at up to 50 sites.

The sampling effort turned into a family affair during Johnson's sabbatical as his two children, then ages 12 and 9, helped pick clovers during travels to Argentina, Chile and Japan. Santangelo himself collected 12,000 clovers on a 16-city road trip in eastern North America, where a stop in some neighbourhoods attracted the wrong kind of attention from residents: "People assume you're up to no good and want you out of there," he says.

The global scientists were supported in their work by an equipment kit assembled and delivered to them by the project team – and an emailed link to videos outlining detailed protocols for testing samples and recording results.

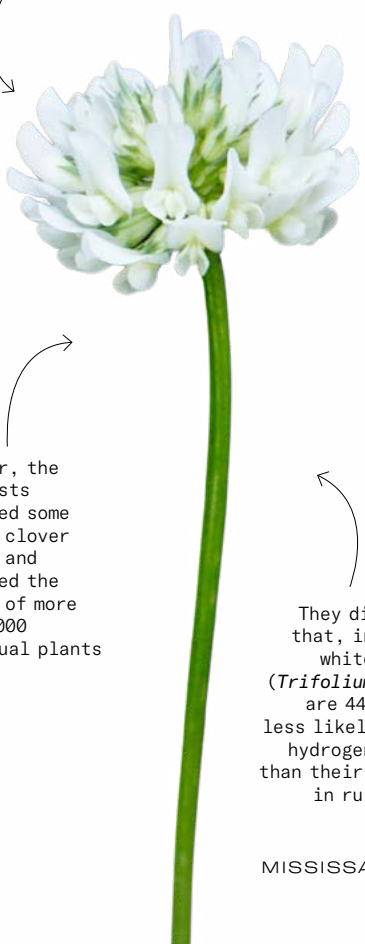
Johnson co-ordinated the researchers, and says engaging so many far-flung participants posed some unique challenges. For example, while most collaboration took place via Google Docs and Sheets, a different approach was needed for participants in China, where the government mostly denies access to Google products. He also spent ample time clarifying how to record data. "With so many different people, regions and cultures involved, there were tons of these hiccups," says Johnson.

Rob Ness, another of the study's principal investigators, conducted genomic analysis of the plants, which required some creative problem-solving. "The plants without hydrogen cyanide are missing one or two genes, and detecting the absence of something is tricky," says Ness. So, he helped design a new analysis to detect missing sections in the clover genomes.

The findings that emerged from the project are still being parsed. Some urban clovers actually showed a higher presence of hydrogen cyanide than their rural counterparts, which the researchers speculate is caused by dryer city conditions. They believe this triggers cyanogenesis as a way for the plant to store nitrogen, which has drought-protective functions. Multiple spinoff projects with project partners are now focusing on further understanding the clover's genetics and adaptations.

In the meantime, Santangelo says, this study provides fertile soil for reimagining how we approach city building and conservation in the future. "I think clover is going to be just fine, but we may need to be concerned about other species, such as birds that rely on song for mating and whose songs are now disrupted by noise pollution," he says. "Our best shot at conserving most biodiversity is to build more connected green spaces that are uniformly distributed across the city. That's how we maintain large populations that are at less risk of going extinct." **—Sharon Aschaiek**

To launch their study, U of T researchers took to Twitter to enlist the help of 287 scientists in 26 countries on every continent except Antarctica



Together, the scientists collected some 110,000 clover samples and sequenced the genomes of more than 2,000 individual plants

They discovered that, in cities, white clovers (*Trifolium repens*) are 44 per cent less likely to emit hydrogen cyanide than their siblings in rural areas

Spreading the Gospel

A Juno Award-winning teacher wants all his students to feel there is a place for them in music

Darren Hamilton (BEd 2008 OISE) grew up in Toronto listening to gospel music at home and in church. Today, he teaches music to high school students in the Peel District School Board, sharing with them his love for an artform which, he says, brings him joy every day. In May, in recognition of his commitment to music education, Hamilton won the MusiCounts Teacher of the Year Juno Award, becoming the first Black person ever to receive the honour.

What did winning the Juno Award mean to you?

I can't tell you how many of my students – Black, white, East Asian and South Asian, and even students I never taught – congratulated me and told me how inspired they are that I won. This kind of recognition is so important because it helps racialized students see that they can pursue a career in music, that there is a place for them in music.

When did you begin learning how to play music?

My parents started me and my brother in classical piano training when I was about eight or nine.

In middle school, you tried saxophone and bass but didn't take music at all in high school. What happened?

The genres I loved – R&B and gospel music – weren't available to study. So I focused on business courses and played music outside of class. In undergrad, my musical journey was … not smooth. My passion was gospel music and again there was no opportunity to pursue it. I struggled to see where I fit in. I started a double major in music and computer science, but ended up moving to Edmonton for a music program that offered R & B, blues and funk. I returned to Toronto later to do a teaching degree.

Has your journey influenced how you teach?

I want to ensure my students can explore the music they're actually interested in, no matter the genre. I don't set the agenda. It's more, "Let's listen to some pieces together and decide as a class which ones to play."

What do you think should change about how music is taught?

If you listen to popular music such as Beyoncé and sing along with the melody, you don't look at sheet music. But you're still learning. A lot of African music and gospel music is call and response. It's important for music educators to value these aural skills just as much as they value notation skills.

—Raquel A. Russell

←

Where do you keep your Juno?
It's on display in our living room

What are your favourite instruments?
I enjoy singing and playing piano

It's been a rough three years. What music brings you joy?
American gospel singer CeCe Winans' "Never Lost"

PHOTOGRAPH BY SABRINA SISCO

Is it time to reset the way you protect your loved ones?

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