

# IMPACT REPORT 2020



UNIVERSITY OF  
TORONTO

Engineering

## WHAT'S INSIDE



**Engineering  
for the World**



**Educating Tomorrow's  
Engineering Leaders**



**Advancing  
Engineering Research**



**Celebrating  
Our Inclusive Community**



**Strengthening  
Our Faculty**

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### TRADITIONAL LAND ACKNOWLEDGEMENT

We wish to acknowledge this land on which the University of Toronto operates. For thousands of years it has been the traditional land of the Huron-Wendat, the Seneca, and most recently, the Mississaugas of the Credit River. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.

However, gratitude and humility are not enough. The U of T Engineering community lives on, works on and impacts Indigenous lands across Canada and the world. With ongoing self-reflection, we are identifying our responsibilities towards truth and reconciliation with Indigenous people. Through the commitments in our *Blueprint for Action*, we are starting to remove systemic inequity and create a more welcoming and supportive environment for Indigenous learners, faculty and staff. These actions will lay the foundation for improved nation-to-nation relationships between our Faculty and Indigenous communities.



Dean Yip with four of this year's five Pearson Scholars. (Photo: Roberta Baker)

## DEAN'S MESSAGE

I could never have predicted the way my first year as Dean has unfolded.

The unprecedented disruptions brought about by the worldwide COVID-19 pandemic presented challenges for every facet of our Faculty's activities, from education to research and innovation.

**I have been inspired by the way our community — faculty members, staff, students, alumni, industry partners and supporters — has risen to the challenge.**

Drawing on our leadership in technology-enabled teaching, we quickly transitioned our courses, final assessments and even thesis defenses online. We provided our expertise to help the public and government officials understand the direct and indirect impacts of the pandemic. We sewed masks, built apps and developed new techniques for rapid testing. Above all, we kept going, demonstrating the resilience for which our Faculty is known.

In this report, you'll read about our many achievements from the past year, from setting yet another world record for human-powered vehicle speed, to earning some of Canada's most prestigious honours for science and engineering research. You'll see how we continue to

grow and diversify our vibrant community — 38% of our undergraduates are now women, and one in four students come from outside of Canada. Our partnerships, collaborations and opportunities for cultural exchange extend across the globe, demonstrating the philosophy of "Engineering for the World."

There is much more to be done. Though we remain Canada's top-ranked engineering school, we do not yet reflect the full diversity of the communities we serve. We continue to work toward better representation and to build a more equitable and inclusive Faculty. I hope that as you read about our progress, you are as inspired as I am about the future.

The hurdles we face are daunting, but they underscore the critical role that engineering plays in addressing global challenges and building a better world. I am proud of how our community shines under adversity, and I am optimistic about all that is to come.

A handwritten signature in black ink that reads "Chris Yip". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

**CHRIS YIP**

Dean, Faculty of Applied Science & Engineering

# ENGINEERING FOR THE WORLD (E4TW)

We are nurturing global perspectives among engineering leaders.

For generations, U of T Engineering students have sewn the letters E4TW onto their iconic leather jackets as a reminder of the role they will play in serving humanity.

Below are a selection of members of the U of T Engineering community who embodied the spirit of E4TW in 2019–2020 through a range of initiatives — from research collaborations to capstone projects, exchanges, competitions and internships abroad.

## 1. THUNDER BAY, CANADA



Professors Tracey Galloway (Anthropology, at left) and **Chris Beck** (Industrial Engineering) are part of a team of U of T researchers exploring challenges related to the reliability of air service in several remote Indigenous communities in Northern Ontario.





## 2. LAS ARRUGAS, GUATEMALA



In February 2020, fourth-year chemical engineering students **Kejdi Kola** (back left), **Calvin Rieder** (back middle) and **Anton Meier** (back right) met with community members in Las Arrugas, Guatemala to design a water purification system for the community school.

## 5. ZAGREB, CROATIA



Civil engineering MSc student **Olesya Zhychkovska** spent four months at the University of Zagreb studying corrosion in reinforced concrete with Professor Marija Kuster Marić, supported by a scholarship from the Dr. Sc. Jasna Simunic Hrvoic Foundation.

## 8. MOGADISHU, SOMALIA



Engineering Science student **Shrey Jain** led a team from U of T Engineering and beyond to build flatten.ca, an online platform that provides a real-time heatmap of potential and confirmed COVID-19 cases. The tool has been adopted by public health authorities in both Montreal, Canada and Mogadishu, Somalia.

## 3. LIPEZ VILLAGE, BOLIVIA



In July 2019, the U of T chapter of Engineers In Action teamed up with their counterparts at Western University to construct a pedestrian footbridge for this rural Bolivian community, the fourth bridge the team has built since 2016.

## 6. KIGALI, RWANDA



Aerlift, a Hatchery-supported startup created by recent Engineering Science graduates **Ryan Tam** and **Nathaniel Andrego**, creates drones to transport medical equipment. Last February, the team met with Rwandan health officials about a potential pilot project.

## 9. YANGON, MYANMAR



In March 2019, aerospace engineering professor **Jonathan Kelly**, who holds the Canada Research Chair in Collaborative Robotics, visited Yangon to teach a week-long course on robotics to 25 university students in engineering, computer science and physics.

## 4. IBADAN, NIGERIA



Recent civil engineering MSc graduate **Olugbenga Olubanjo** is the founder and CEO of Reeddi, Inc. Created with help from The Entrepreneurship Hatchery, the startup provides affordable electricity to communities in Nigeria and beyond.

## 7. THUWAL, SAUDI ARABIA



A collaboration between King Abdullah University of Science and Technology (KAUST) and U of T Engineering produced a new type of highly efficient tandem solar cell. Left to right: postdoctoral fellows Erkan Aydin (KAUST), **Yi Hou** (U of T Engineering) and Michele De Bastiani (KAUST).

## 10. DARWIN, AUSTRALIA



In October 2019, the **Blue Sky Solar Racing Team** traversed the Australian continent from north to south as part of the Bridgestone World Solar Challenge. Their vehicle, Viridian, placed 11th overall in the international race.



*Third-year mechanical engineering student Mahedah Amjad uses a robotic arm as part of an undergraduate class held in the Energy Lab within the Department of Mechanical & Industrial Engineering. (Photo: Daria Perevezentsev)*

## FACTS & FIGURES

**21**

Multidisciplinary engineering minors and certificates for undergraduate students.

**\$95 M+**

Approximate value of seed funding raised by 95+ Entrepreneurship Hatchery startups since 2012.


**245**

Undergraduate students who traveled abroad in 2019–2020 through PEY Co-op placements, exchanges, capstone projects and more.

**#1**

We are Canada's top-ranked engineering school. U of T Engineering placed 10 spots higher than the next Canadian school in the 2020 QS World University Rankings for Engineering and Technology.



A student wearing a pink sweater is working in a laboratory. They are holding a small, square, white object with a yellow circular feature. In the foreground, a yellow 3D printer is visible. The background shows a blurred lab environment with various equipment and a person in a blue shirt.

# EDUCATING TOMORROW'S ENGINEERING LEADERS

**A rigorous technical education is only the beginning of an engineer's journey.**

UofT Engineering graduates are in demand not only for their problem-solving skills, but for their wide-ranging abilities in communication, leadership and business.

Our programs go well beyond the fundamentals to provide boundless opportunities for our students to apply their knowledge in context, gain practical experience with multidisciplinary design and entrepreneurship, and develop global perspectives.


## FOSTERING ENGINEERING LEADERSHIP

“Expectations of our engineers are greater than ever before,” says Professor **Greg Evans**, director of the Institute for Studies in Transdisciplinary Engineering Education & Practice (ISTEP). “We are drawing on innovative scholarship to prepare the next generation of leaders.”

Created in 2018, ISTEP is the first institute of its kind in Canada. It combines and enhances our existing strengths and thought leadership in pedagogical innovation and transdisciplinary engineering education.

ISTEP encompasses the following areas:

- The Engineering Communication Program (ECP), a hub for teaching and scholarship in professional communication;
- The Troost Institute for Leadership Education (Troost ILead) in Engineering, which prepares students to maximize their impact and leadership potential;
- The undergraduate-level Engineering Business Minor, the most in-demand of the Faculty’s 10 multidisciplinary engineering minors;
- The undergraduate-level Certificate in Entrepreneurship Innovation and Small Business; and
- The graduate-level Collaborative Specialization in Engineering Education (EngEd) program.



*Students prepare for final presentations in The Power of Story: Discovering Your Leadership Narrative, a course from Troost ILead. (Photo: Daria Perevezentsev)*





*The International Virtual Engineering Student Teams (InVEST) team includes: (from top left to bottom right) Oluwatobi Edun, Dr. Debbie Mohammed, Patrick Ishimwe, Dr. Rahim Rezaie, Anuli Ndubuisi, Prof. Elham Marzi (Photo courtesy Elham Marzi)*

## Gaining global perspectives through virtual collaboration

The International Virtual Engineering Student Teams (InVEST) initiative connects UofT Engineering students with their peers at partner universities such as the University of Johannesburg in South Africa, and the University of the West Indies in Trinidad. Teams collaborate via video link on fourth-year capstone courses, MEng research or MAsC theses.

“This is a great opportunity to find out first-hand what intercultural collaboration really looks like,” says Dean’s Emerging Innovation in Teaching Professor **Elham Marzi** (ISTEP). She and the InVEST team plan to expand their partnerships with at least four new institutions, including: the National University of Singapore, Federal University of São João del-Rei in Brazil, University of Technology Sydney in Australia, and Covenant University in Nigeria.



## OPTIONS for PhDs

All professors have a PhD, but in engineering only one in four PhDs become professors. The Opportunities for PhDs: Transitions, Industry Options, Networking and Skills (OPTIONS) program equips PhD students and postdoctoral fellows to explore careers outside academia.

“PhD students in particular are hungry for career advice,” says Professor **Julie Audet**, vice-dean, graduate studies, who launched OPTIONS in the fall of 2017 in collaboration with Troost ILead.

OPTIONS includes resume workshops, career coaching sessions, panel discussions with recent PhD graduates and alumni mentorship. In the fall of 2019, 30 students completed all requirements of the OPTIONS program, with more than 200 others participating in at least one of its complementary events. A version of the program for MEng students launched in January 2020.

## CATALYZING PROFESSIONAL DEVELOPMENT

U of T Engineering undergraduates can choose to graduate with up to 20 months of meaningful work experience, a competitive salary, an extensive network and professional skills they'll leverage for years to come.

That's what we deliver through the Professional Experience Year Co-op Program (PEY Co-op), our flagship work-experience program with a proven track record going back more than 40 years. Created in collaboration with industry partners and engineering leadership experts, this program is designed to help students build their professional profiles and prepare them for long-term career success.



*Materials engineering student Yilin Huang spent a year working at Flyability, a Swiss drone company, through the PEY Co-op Program. (Photos courtesy Flyability)*

### A high-flying experience

Third-year materials engineering student **Yilin Huang** has two big passions: robotics and world travel. She combined them both when she landed a PEY Co-op position at Flyability, a drone company based in Lausanne, Switzerland.

"I am so amazed at how much I learned from this experience," says Huang. "Aerodynamic theory, the chemical basis of energy storage in batteries, and which cheeses you should use in a fondue — this is Switzerland after all!"

Huang led a project to test the robustness of propellers for the company's drones, which are used to do indoor inspections of large or complicated structures in industries from oil and gas to power generation. She also got to spend weekends improving her skills in French and skiing.

Huang was one of more than 700 students employed with leading companies through PEY Co-op in 2019–2020. Dozens of them worked outside of Canada, and many returned to complete their final year with a job offer already in hand.

Her PEY Co-op experience convinced Huang that robotics is the right fit for her, and she plans to pursue graduate studies in the field. But it also taught her something else.

"I learned that it's not just the experience and knowledge I bring, it's the attitude," she says. "Moving forward, I will bring a determined willingness to learn, and I won't forget to bring my happiness too."

## A new home for the Engineering Career Centre

As PEY Co-op celebrated its 40th anniversary in 2019 and the Engineering Career Centre developed new programming to expand its model, the office was also preparing to move into a new, modern space.

Located on the lower floors of the newly completed Theory Condominiums building on the southeast corner of College and St. George Streets, the Experiential Learning Hub will be equipped and staffed to support more than 5,000 students across U of T at different stages of their career development and 500 employers across a broad range of sectors. It will include professional spaces to facilitate interactions between students, employers and staff, such as interviews, workshops and events.

“This new facility has everything we need to expand our flagship program and enhance our offerings,” says **Roger Francis**, executive director of the Engineering Career Centre. “It offers a home base on campus for our partner companies, and a one-stop-shop for everything students need to launch their careers, from professional skills development to building their network.”

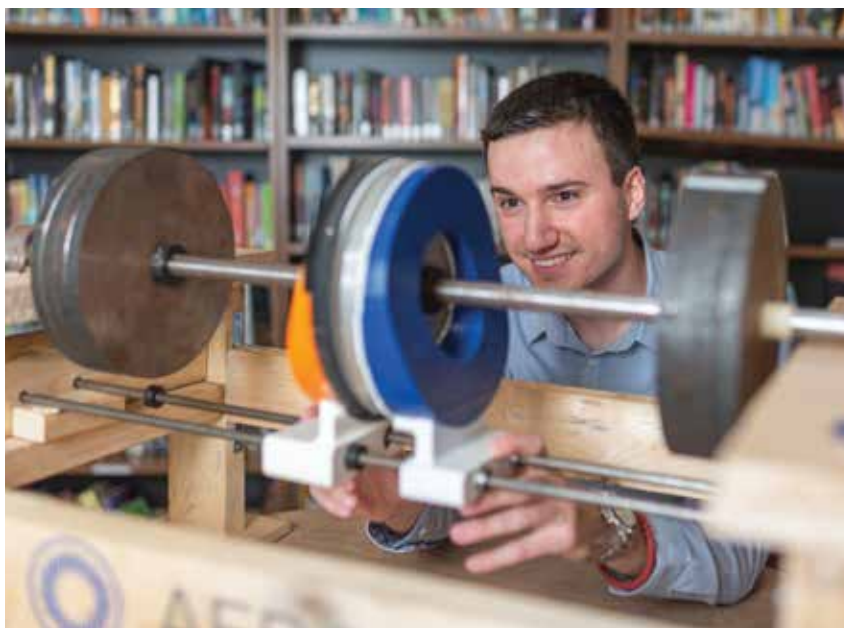
*The PEY Co-op Program will operate out of the lower levels of this new building. (Rendering courtesy Parallax and Westdale)*





## LAUNCHING ENGINEERING STARTUPS

The passion for turning good ideas into viable businesses runs deep in the U of T Engineering community. Whether they are looking to commercialize a research discovery or simply address an unmet market need, we provide our students with the resources, tools and support they need to launch and sustain vibrant companies.



Recent mechanical engineering graduate Nikola Kostic is the co-founder of Aeroflux, which aims to commercialize a new magnetic braking system. (Photo courtesy Aeroflux)

### Magnetic brakes could save airlines millions

Every time a commercial airliner lands, more than 50 tonnes of steel, fuel, cargo and passengers come screeching to a halt. The friction takes a toll on the brakes, which must be replaced dozens of times over the course of a typical airplane's lifetime — but a team from U of T Engineering may have solved that problem.

“We've created a special type of magnetic field generator that allows for a major improvement to existing non-contact braking technology,” says mechanical engineering alumnus **Nikola Kostic**, co-founder of Aeroflux. “Our system eliminates the wear and maintenance of aircraft braking systems, and could help airlines save millions of dollars per plane.”

At The Entrepreneurship Hatchery, a startup incubator at U of T Engineering, the Aeroflux team gained access to mentors who helped them hone their business plans and pitch presentation.

In September 2019, Aeroflux placed first at the annual Hatchery Demo Day live pitch competition. The team also received the Clarke Prize from the Troost Institute for Leadership Education in Engineering, ranked in the global Top 20 for the 2019 James Dyson Award international design competition, and took first place in the Late Stage Competition of the 2020 RBC Prize for Innovation and Entrepreneurship at U of T.

“Our team is so grateful for the support we've had from the Hatchery and the entire U of T entrepreneurship ecosystem,” says Kostic. “It's a big part of the success we've had so far.”

## DEVELOPING GLOBAL PERSPECTIVES

We enable our students to see first-hand how engineering can impact communities around the world. Last year, we facilitated 245 international experiences among undergraduate students, from study-abroad programs to international capstone projects.



*The community school in Cerro Azul, Costa Rica has plenty of donated electronic equipment that could support learning, but currently relies on a gasoline-fuelled generator to run it. A solar array could provide a better solution. (Photo: John Shoust)*

### Power for the people

In Cerro Azul — an isolated mountain community in Costa Rica — the local school has plenty of donated computers, printers and projectors, but the electricity to power this equipment is supplied by a gasoline-fuelled generator which only runs for a few hours each day.

Fourth-year electrical and computer engineering student **Diego Amores** and his mechanical engineering team members **Shafiul Ferdous** and **Zarak Khan** designed a solar panel installation which they hope will provide more consistent and reliable power. The project was part of a fourth-year capstone course at U of T Engineering, and also counted toward the certificate in Global Engineering that Amores is pursuing.

“I am from Ecuador, and I have witnessed first-hand the challenges people face in developing countries,” says Amores. “I decided that I would love to work on a project that could generate a positive impact for somebody who lacks fundamental services.”

The project’s various partners include U of T Engineering’s Centre for Global Engineering, the Canadian non-profit organization Students Offering Support and the development charity Reto Juvenil Internacional, which has many strong connections in Latin America. Throughout the project, the team was advised by engineer and entrepreneur John Shoust, a co-founder of Winds of Change, which has been involved in several previous projects in places such as Pedro Arauz, Nicaragua.

“I am always impressed by the student teams,” says Shoust. “They all seem to share the common goal of helping in any way they can. I think this is critical in the development of the future workforce, in that they gain a global perspective and understand the impact they can have on the lives of others.”

“I feel really grateful for this opportunity and I would like to encourage more engineering students to create a positive impact through these kinds of projects,” says Amores.



*MaRS West Tower is home to the Translational Biology and Engineering Program (TBEP), including team members (left to right) PhD candidate Gordana Scepanovic, Professor Rodrigo Fernandez-Gonzalez and postdoctoral fellow Katy Rothenberg. By studying how cells within fruit fly embryos coordinate their behaviours to generate tissues and heal wounds, this team is gaining insights that could inform new strategies for repairing human hearts or other organs. (Photo: Neil Ta)*



# ADVANCING ENGINEERING RESEARCH

**We bring together the best minds,  
wherever they are found.**

UofT Engineering attracts some of the world's most talented and highly cited researchers. Their work is both accelerated and amplified by our Faculty's ability to build vibrant research networks that transcend both disciplinary and geographic boundaries.

Our projects seamlessly integrate fundamental research with industrial application, and our teams include collaborators from outside of engineering and beyond Canada — connections that deepen and enrich the creative process.

Our six strategic research clusters focus our strengths in areas that are critical to addressing the most pressing challenges of our time: Robotics, Sustainability, Data Analytics & Artificial Intelligence, Advanced Manufacturing, Water and Human Health.

Whether we are developing new ways to capture solar energy, enhancing diagnostics for tracking disease therapies or inventing entirely new businesses and industries, UofT Engineering researchers are at the forefront of global innovation.

## FACTS & FIGURES

**120+**

Research chairs and professorships. These include 34 Canada Research Chairs, of whom more than a third are women.

**100+**

Spinoff companies founded in the past two decades.

**117%**

Increase in industry-sponsored research funding between 2015 and 2019 (7.7M to 16.7M).

**25+**

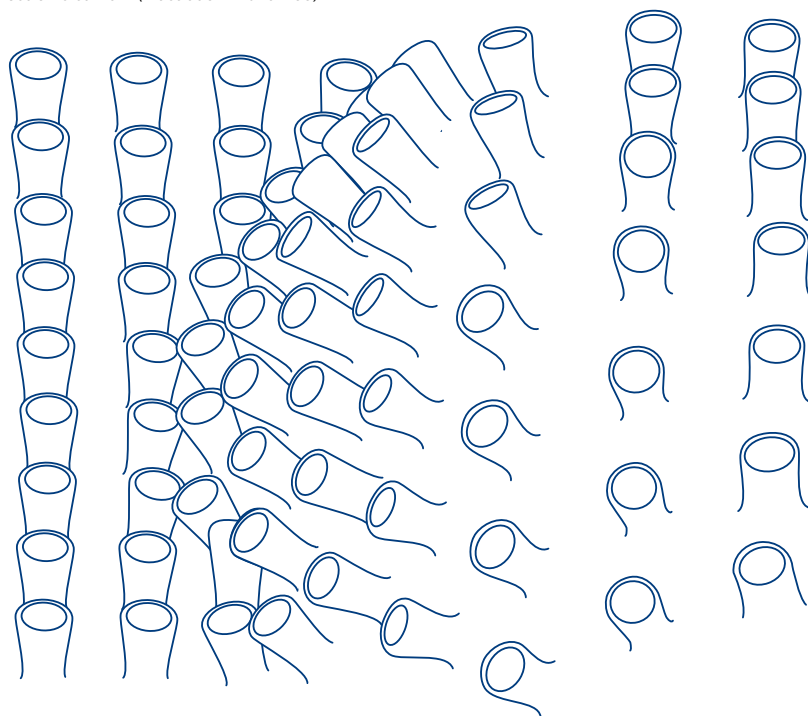
Multidisciplinary research centres and institutes, including the Robotics Institute, the Institute for Sustainable Energy, the Centre for Analytics and Artificial Intelligence Engineering and the Institute for Water Innovation.

## ROBOTICS

Robots go where people can't — under water, in the air, even into outer space. They already work alongside humans in factories, and in the future, they may do the same in new settings, such as hospitals and long-term care homes.

U of T Engineering researchers are leading efforts to make robots more resilient, adaptable and responsive to human needs. Their work enables us to use these amazing tools to enhance the quality of life for people everywhere.

*New materials designed by Professor Benjamin Hatton and his team can alter their adhesive properties in response to electronic stimuli. (Illustration: Adrian So)*



### Octopus-inspired grippers for prosthetics and more

The latest innovation from the lab of materials engineering professor **Benjamin Hatton** was inspired by an unusual source: an octopus.

Hatton and his team are interested in developing new materials with unique surfaces that can actively change their properties in response to stimuli. One model is the ability of an octopus to modify the grip of its tentacles. The team is designing smart pads that can be digitally controlled for dynamic adhesion. By moving microscale surface features on the small pad, they hope to mimic the on-off adhesion of individual octopus suckers.

“We are hoping the smart ‘finger pads’ can help robotic grippers grasp more efficiently,” says Hatton. “Current gripper designs, such as prosthetic hands, have limited control at the material surface, which generally leads to objects slipping or being crushed.”

Hatton and his team plan to use these smart pads to increase sensitivity and dynamic control of robotic grippers. They recently received a Connaught Innovation Award, which will help integrate their work into technological applications within industry, and on a larger scale.

“We appreciate the amazing ability of the human hand to maintain an optimized grip on objects, and constantly change that grip dynamically — all without consciously thinking about it,” says Hatton. “We anticipate this work could improve the designs of prosthetic hands, assistive robotic arms and surgical robotics.”

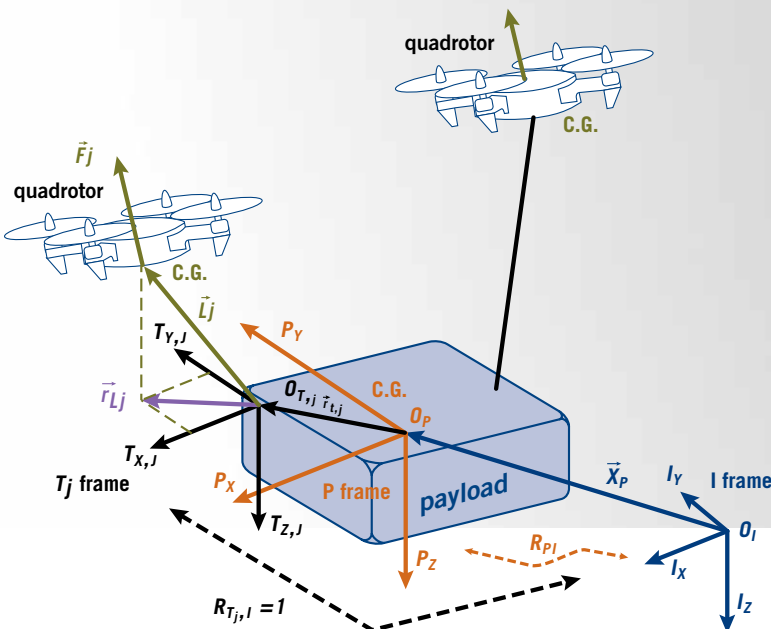


## Drone delivery for remote communities

Canada is home to hundreds of remote communities that lack roads — which makes delivering basic consumer goods very costly. Unmanned aerial vehicles (UAVs), also known as drones, could offer a way forward, and Drone Delivery Canada (DDC) has partnered with U of T Engineering to make it happen.

“Our partnership with DDC is now in its third year, and the benefits have been enormous,” says aerospace engineering professor **Hugh Liu**. Liu and his team are working alongside DDC on coordinated drone delivery, in which groups of small, modular drones would carry and deliver larger packages than any of them could individually. He recently filed a joint patent with DDC related to the technology, and several graduates of his lab group now work for the company.

In addition to Liu’s work on the hardware side, DDC is also collaborating with two professors from the U of T Institute of Aerospace Studies: **Tim Barfoot** and **Angela Schoellig**, who holds the Canada Research Chair in Machine Learning for Robotics and Control. Together, they are working on algorithms that would enable a drone to fly back safely to its launch site even if its satellite connections are not functioning.



Teams of drones working in concert could help overcome the high cost of delivering materials to remote communities. (Image: Hugh Liu/Adrian So)



# SUSTAINABILITY

There is no planet B. Climate change, pollution and environmental degradation are among the most complex global challenges of our time.

U of T Engineering researchers are world leaders in developing new ways of generating and storing energy — techniques that lower or even eliminate emissions. They are also pursuing efforts to design smarter cities by more accurately accounting for the environmental impacts of large infrastructure, and by quantifying the effects of behavioural changes around cycling, public transit, and freight transportation. Together with our industry partners, we are building a cleaner, greener world.

## Out of thin air

Rising global CO<sub>2</sub> emissions have produced a climate crisis. But what if there was a way to capture emissions before they reach the atmosphere — or better yet, extract the carbon that is already there — and turn it into commercially valuable products?

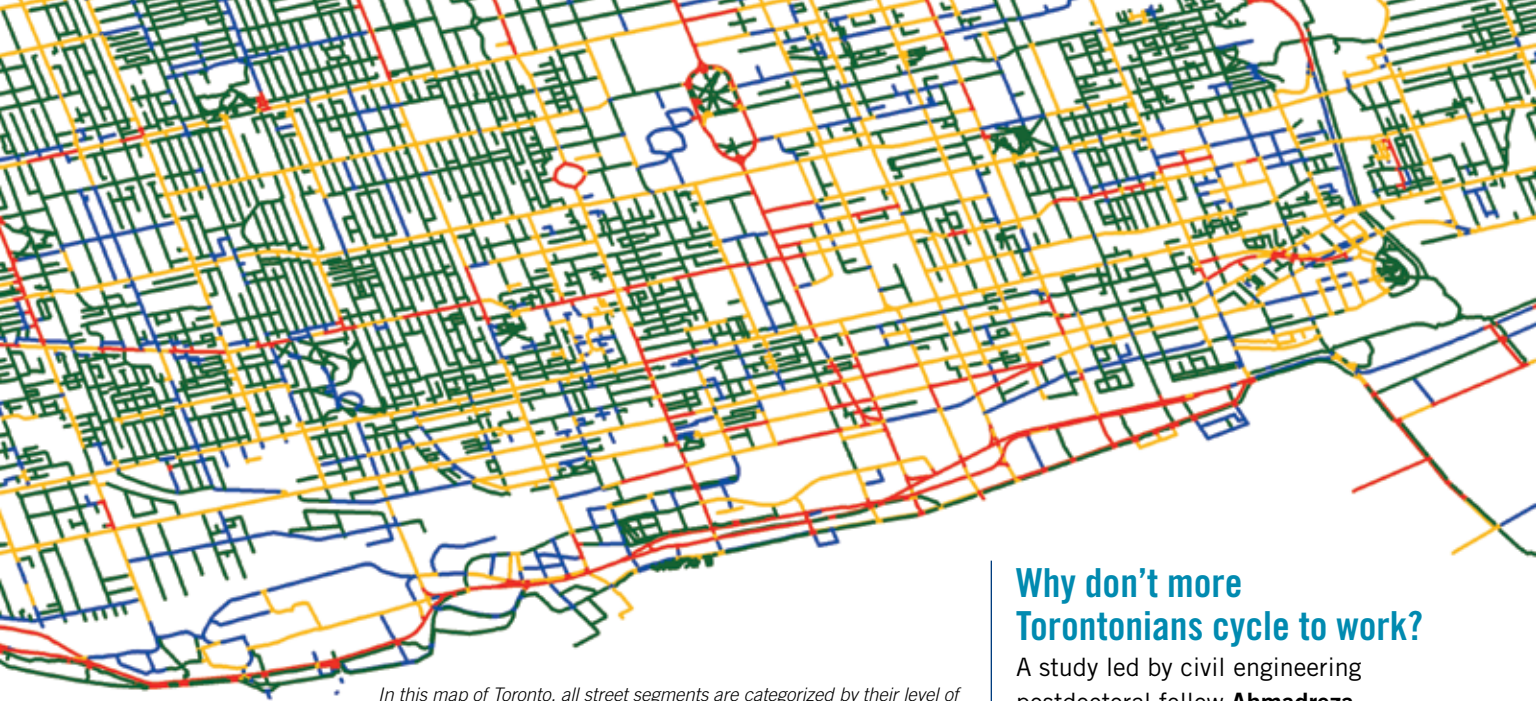
“There are several established chemical pathways for capturing carbon and converting it into fuels or plastic precursors,” says electrical and computer engineering professor **Ted Sargent**, who holds the Canada Research Chair in Nanotechnology and serves as U of T’s vice-president, research and innovation and strategic initiatives. “The challenge is that they are energy-intensive. Our work focuses on ways to lower this energy cost.”

In the past year, Sargent and his team have published several major papers on the use of electrolyzers — devices that use electricity to drive a chemical reaction — to recover value from waste carbon.

With international collaborators, the team has developed highly efficient electrochemical processes for converting CO<sub>2</sub> into ethylene, one of the world’s most widely produced chemicals. They have also used electrolyzers to upgrade ethylene to ethylene oxide, the next step in several complex chemical value chains that eventually end with products such as polyester fabrics and plastic drink bottles.



*Left to right: PhD candidates Adnan Ozden, Joshua Wicks and postdoctoral fellow F. Pelayo García de Arquer operate an electrolyzer that converts CO<sub>2</sub> to valuable products 10 times faster than previous versions. (Photo: Daria Perevezentsev)*



*In this map of Toronto, all street segments are categorized by their level of traffic stress, from one (green) to four (red). (Reprinted from the Journal of Transport Geography, Cycle accessibility and level of traffic stress: A case study of Toronto, Copyright 2019, with permission from Elsevier)*

## Why don't more Torontonians cycle to work?

A study led by civil engineering postdoctoral fellow **Ahmadreza Imani** and professors **Shoshanna Saxe** and **Eric Miller** classified nearly every section of road and intersection in Toronto on a scale of one to four by its level of traffic stress, or LTS.

The team found that across most of the city, cyclists cannot travel for more than about eight minutes before hitting a section with an LTS of more than two. If the disjointed nature of Toronto's cycling infrastructure could be improved, the researchers estimate that the number of citizens cycling to work would rise significantly. The results: improved sustainability and public health.

## Shifting delivery times for faster, cleaner transportation



*(Photo: Nigel Tadyanehondo via Unsplash)*

Delivering goods in a busy city has always been a challenge, but today the pressure is higher than ever before.

"It's the Amazon effect," says civil engineering professor **Matt Roorda**, who holds the Canada Research Chair in Freight Transportation and Logistics. "People are buying things online and expect them delivered within a day or even within a few hours."

Roorda is the lead U of T Engineering researcher on the Smart Freight Centre (SFC), a collaborative network whose partners include McMaster University, York University and the Region of Peel.

Last summer, SFC conducted a pilot study in which industry partners Walmart, Loblaws and LCBO stores shifted key deliveries from daytime hours to the early morning (before 7 a.m.) and late evening (between 7 and 11 p.m.). Roorda and his team found that the shift increased the average speed of trucks by 18%, with associated reductions in key air pollutants of between 10% and 15%.

"There definitely seems to be a lot of spare capacity on our roadways at certain times of day," says Roorda. "Our pilot study suggests that taking advantage of this could have tangible benefits, both economically and for the environment."



## DATA ANALYTICS & ARTIFICIAL INTELLIGENCE

The rise of deep learning and machine intelligence are driving us to re-imagine almost every sector of our society, from finance to human health to transportation. Big data helps us see patterns, identify bottlenecks and design more efficient systems.

Through hubs such as our Centre for Analytics and Artificial Intelligence Engineering (CARTE), U of T Engineering researchers are working with a range of partners to design new algorithms that can enable autonomous vehicles to navigate safely, improve the delivery of health care and much more.

### Can self-driving cars handle a Canadian winter?

A new dataset created by U of T Engineering, the University of Waterloo and Scale AI will help train future self-driving cars to handle the challenges of winter driving.

“Existing datasets were collected on sunny, summer days,” says aerospace engineering professor **Steven Waslander**. “If you take algorithms trained on those datasets and try to use them in adverse conditions, they tend to get confused.”

In collaboration with Professor Krzysztof Czarnecki (University of Waterloo), Waslander and his team used the Autonomoose — a Lincoln MKZ vehicle equipped with sensors — to record data from more than 1,000 kilometres of driving around southeastern Ontario. Of this, approximately 33 kilometres in harsh, snowy conditions were selected to form the basis of the dataset.

The team partnered with Scale AI, a San Francisco-based AI infrastructure company, to label the data and have made the results available for free to researchers. Waslander and his team also plan to use the dataset in their own work.

“We hope that the techniques we develop to locate and track objects in adverse weather will eventually be incorporated into future autonomous vehicle software packages around the world, making them safer for everyone,” he says.



*The Autonomoose is a self-driving car that was used to create the world's first dataset of driving under harsh winter conditions. (Photo courtesy University of Waterloo)*





*(Photo: Mwangi Gatheca via Unsplash)*

## An artificial intelligence innovation HQ in Toronto

For artificial intelligence researchers at U of T, starting a new industry collaboration is as simple as crossing the street.

The LG Toronto AI Lab was created in the summer of 2018. Since then, it has catalyzed more than a dozen collaborations between employees of the company and U of T researchers in both engineering and computer science. Applications include the use of visual cameras for object detection and 3D perception, as well as data-driven protection.

Through 'reverse internships,' LG staff scientists spend up to four months working in academic research labs, returning to the company better equipped to tackle challenging problems. Researchers from LG's labs in Korea also have the option to complete a 'mini master's degree' by working alongside U of T Engineering professors to refine their skills and completing a capstone project.

## ADVANCED MANUFACTURING

Ontario is one of North America's manufacturing hubs, and Toronto lies at the heart of this critical network. New materials and manufacturing methods are key to ensuring that the manufacturing sector remains competitive for decades to come.

U of T Engineering innovation can enhance logistics, improve quality and accelerate development of the next generation of products, businesses and industries.

### Graphene doesn't crack under pressure

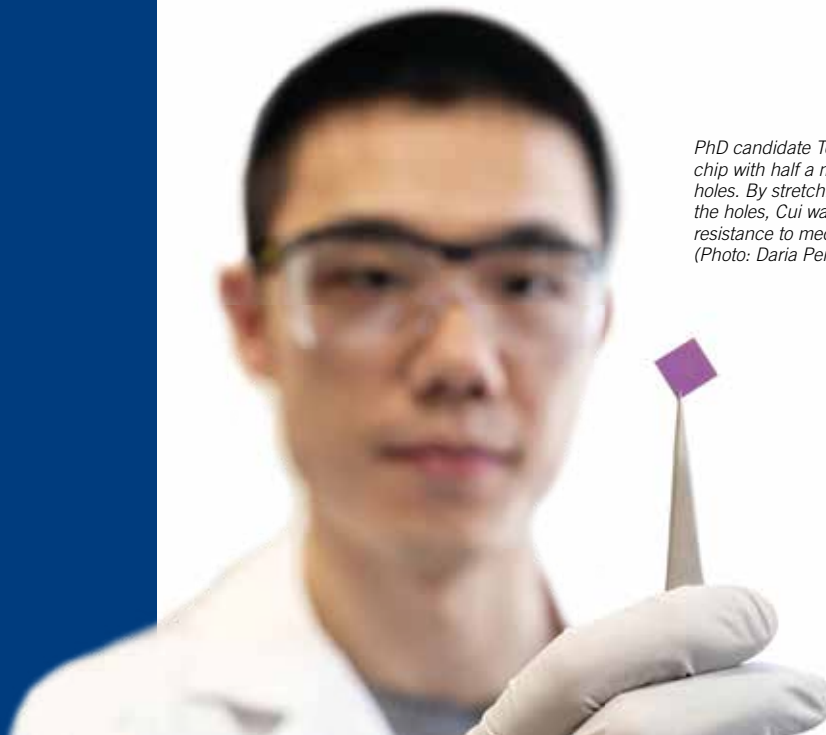
Graphene is a paradox: it is the thinnest material known to science, yet also one of the strongest. Now, research from U of T Engineering shows that graphene is also highly resistant to mechanical fatigue.

The team — including mechanical engineering PhD candidate **Teng Cui**, mechanical engineering professors **Tobin Filleter** and **Yu Sun** (Canada Research Chair in Micro and Nano Engineering Systems), materials engineering professor **Chandra Veer Singh** and collaborators at Rice University — combined computer simulations with physical experiments. In the lab, they stretched a sheet of graphene over holes only a few micrometres in diameter, like the head of a tiny drum.

Using an atomic force microscope, they applied anywhere from 20 to 85% of the force that would break the material. “Even at 70% of the maximum stress, the graphene didn't break for over a billion cycles,” says Cui.

Graphene-containing composites are already finding their way into sports equipment such as tennis rackets and skis, and in the future may be used in cars or in aircraft.

“Until now, nobody had measured the fatigue behaviour of the underlying material,” says Filleter. “Now that we have that, we should be able to design composites that work even better.”



*PhD candidate Teng Cui holds up a silicon chip with half a million embedded tiny holes. By stretching graphene across the holes, Cui was able to measure its resistance to mechanical fatigue. (Photo: Daria Perevezentsev)*

## Tiny features, big challenges

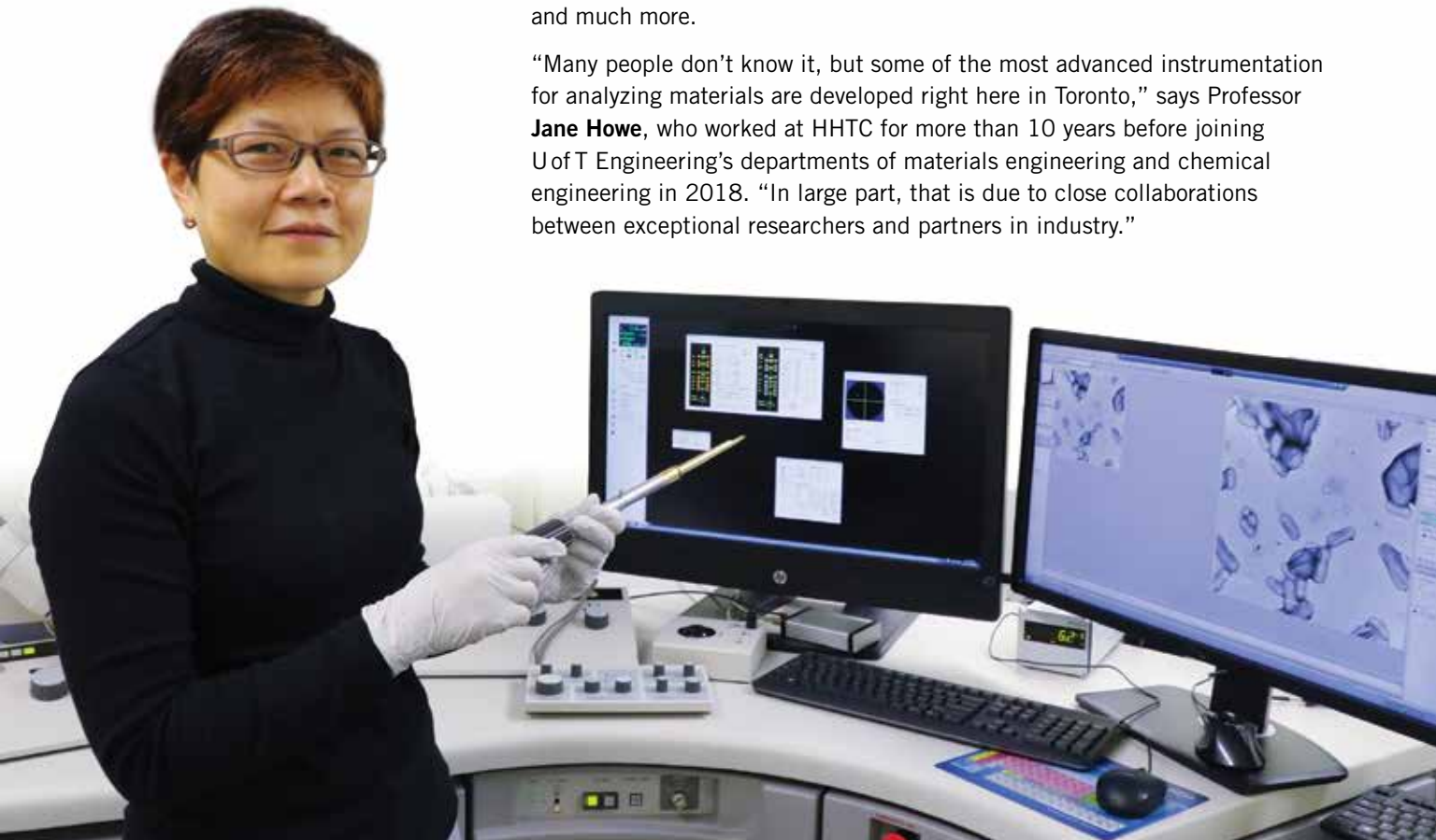
For nearly 30 years, a partnership between Hitachi High-Technologies Canada (HHTC) and U of T Engineering has enabled advanced analysis of a wide range of samples — everything from volcanic glass from the bottom of the ocean to rocks that the Apollo astronauts brought back from the moon.

HHTC designs and deploys electron microscopes, and some of their most advanced equipment is at the Ontario Centre for the Characterisation of Advanced Materials (OCCAM). This interdisciplinary research centre, co-located in the Departments of Material Science & Engineering and Chemical Engineering & Applied Chemistry, is built around state-of-the-art electron microscopy and surface characterization tools.

Involving both equipment and personnel, the partnership enables HHTC to draw on the practical challenges that users are trying to address to catalyze the development of new microscopy technologies. OCCAM is the first place that these technologies are deployed, and the two-way partnership continuously yields new protocols and procedures. By remaining at the forefront of electron microscopy, OCCAM enables its users — from across U of T Engineering and beyond — to gain insight into the natural world and design better devices, from dental implants to microchips, solar cells, aircraft and much more.

“Many people don’t know it, but some of the most advanced instrumentation for analyzing materials are developed right here in Toronto,” says Professor **Jane Howe**, who worked at HHTC for more than 10 years before joining U of T Engineering’s departments of materials engineering and chemical engineering in 2018. “In large part, that is due to close collaborations between exceptional researchers and partners in industry.”

*Professor Jane Howe next to some of the advanced electron microscopy equipment made available by a partnership between Hitachi High-Technologies Canada and U of T Engineering. (Photo: Tyler Irving)*





## WATER

All water on Earth is part of the same cycle — and every drop matters. Yet around the world, water supply and quality are under increasing pressure from growing populations, industrial development and climate change.

U of T Engineering researchers are working together to break down chemical contaminants, develop low-cost solutions for sanitation and design more natural water management structures for cities. Together with our partners, we are ensuring a safe, accessible water supply for generations to come.



*Professor David Taylor checks on his pressure, flow, and turbidity sensors in a valve chamber in Delhi, India. (Photo courtesy David Taylor)*

### Why some cities turn off the taps at night

For more than a billion people around the world, running water is supplied by intermittent systems that turn on and off at various times of the week. Civil engineering professor **David Taylor** studies the design and function of intermittent systems — and how they fit into the global challenge of meeting international targets for human development and safe drinking water.

“These systems are chaotic,” says Taylor. “There are often pipes or valves that are missing from the official charts. We usually don’t know as much as we think we do.”

Rather than use complex hydraulic models typical of the industry, Taylor has developed a single equation that describes how a system behaves when consumers are satisfied versus when they are not.

In the unsatisfied case, turning off the pipes may save water, but it does so by leaving customers thirsty. In the satisfied case, demand tapers off and other effects, such as leakage, come to dominate the system, so turning off the pipes may cause more trouble than it’s worth.

“Without a way to decide which intermittent systems count as ‘safe,’ we don’t stand a chance of hitting our 2030 global goals for access to clean and affordable water,” he adds. “The model can help guide us as we start to make the major infrastructure investments needed.”



## Pollution-eating microbes are ready for action

Chemical engineering professor **Elizabeth Edwards**, who holds the Canada Research Chair in Anaerobic Biotechnology, has spent years developing a potent mix of microbes that can break down toxic chemicals. Now, through spinoff company SiREM, she and her team are preparing to put them to work for the first time.

The bacterial cultures are designed to treat a set of contaminants known as BTEX — benzene, toluene, ethylbenzene and xylene — found in soil and groundwater where crude oil and its products have been used. Selected from natural organisms found at contaminated sites, the cultures are able to survive without oxygen, enabling them to be injected into deep aquifers.

The collaboration has a track record of success. Edwards and SiREM previously commercialized a culture known as KB-1, which was designed to break down chlorinated solvents widely used in dry cleaning and degreasing. If the new cultures are as successful, SiREM plans to add them to their arsenal to increase their share of the multi-billion-dollar global market for biological treatment of contaminants.

*In the lab of Professor Elizabeth Edwards, vessels contain anaerobic bacterial cultures fed with BTEX, a mixture of contaminants from crude oil. The most active cultures are being commercialized for industrial cleanup by spinoff company SiREM. (Photo: Sean Caffrey)*

## HUMAN HEALTH

Doctors and medical researchers work closely with engineers to design better ways of diagnosing and treating disease. These partnerships enable us to cure what was previously incurable, extending and enhancing human lives around the world.

U of T Engineering innovations range from algorithms that point toward promising drug candidates to lab-grown tissues and organs that could one day be re-implanted back into humans to repair damage. They also include simple, low-cost diagnostic tools that reduce the need for complex lab equipment, especially in remote locations.



*Professor Hai-Ling Margaret Cheng, at left, and her team design improved MRI techniques to detect disease and monitor the progress of implanted tissues and scaffolds. (Photo: Neil Ta)*

### Smarter MRI scans for diagnosis and treatment

As stem-cell technology improves, researchers hope to one day repair damaged tissues and organs by implanting lab-grown replacements. Today, however, most implanted cells die, and a great deal of research focuses on what can be done to successfully integrate them into the body.

Biomedical engineering professor **Hai-Ling Margaret Cheng** and her team can help. They are developing substances that could enable the progress of implants to be tracked by non-invasive methods, such as magnetic resonance imaging (MRI).

“Prior to an MRI session, patients may need to intake a contrast agent, a substance that makes certain tissues or organs easier to see in the scan,” says Cheng. “If we could incorporate contrast agents directly into implanted tissues and scaffolds, we could non-invasively track their progress over time.”

Traditional contrast agents are designed to last only a few hours, and many of them cause side effects. Cheng’s approach of leaving them in the body for months on end would require re-designing these substances from the ground up, but the team is up to the challenge.

“As a patient, the last thing you want is to have an implant, and then have a highly invasive surgery a couple of months down the line to check whether the cells are still there,” she says. “If we can provide an alternative, it could be a game-changer for everyone who’s involved in regenerative medicine.”





*Brendan Frey is the founder and CEO of Deep Genomics. (Photo: Johnny Guatto)*

## Using genome-aware AI to discover new drugs

Most new drugs fail. U of T Engineering spinoff company Deep Genomics aims to change that.

Deep Genomics was created in 2015 and based on the work of electrical and computer engineering professor **Brendan Frey**, who holds The Edward S. Rogers Sr. Chair in Engineering and the Canada Research Chair in Information Processing and Machine Learning. It is the only company to combine more than a decade of world-leading expertise in both deep learning and genome biology.

The company's proprietary algorithms crawl through reams of data on the many genetic mutations that can cause disease, and make predictions about the properties of potential therapeutic molecules. Their AI is then used to design new compounds that are therapeutic candidates.

In the fall of 2019, Deep Genomics announced the first-ever therapeutic candidate discovered using artificial intelligence. The candidate has the potential to treat Wilson disease, a rare genetic disorder that causes an accumulation of copper in vital organs, and can be fatal if left untreated.

“Our vision is to develop genetic medicines more rapidly and more accurately than was previously possible,” says Frey.

# CELEBRATING OUR INCLUSIVE COMMUNITY

**U of T Engineering is about people: students, staff, faculty, alumni, supporters and partners.**

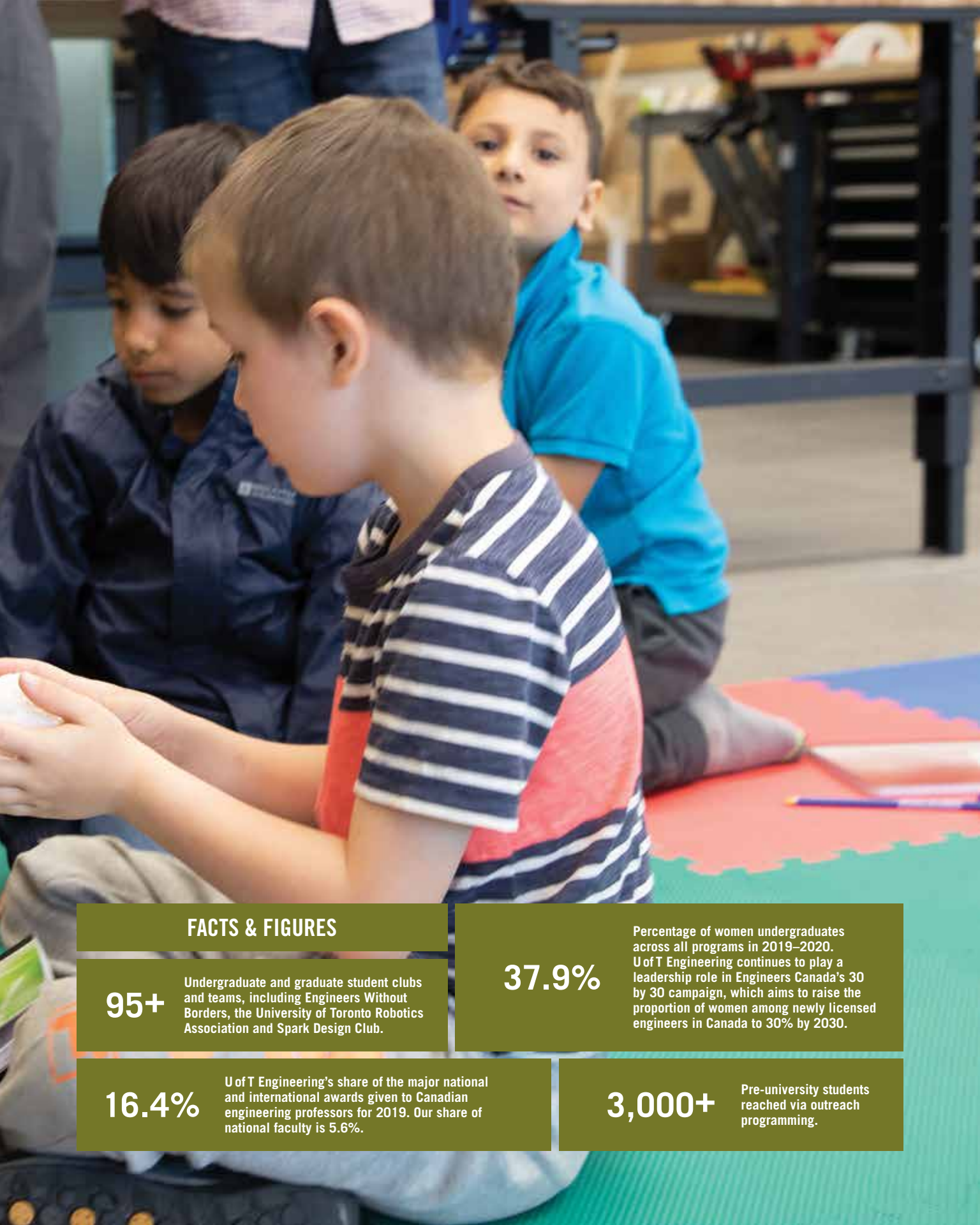
Our vibrant community is truly international, with members from more than 130 countries and strong alumni groups in areas such as Hong Kong, Singapore and California's Silicon Valley. It includes engineers, but also doctors, businesspeople, artists and musicians.

Whether we are using our abilities to respond to the global pandemic or developing technologies that will power the future economy, we are making a tremendous positive impact around the world.

*Senior Kindergarten students from Lord Lansdowne Public School in Toronto visited the fabrication facilities in the Myhal Centre for Engineering Innovation & Entrepreneurship in June 2019. (Photo: Roberta Baker)*







## FACTS & FIGURES

**95+**

Undergraduate and graduate student clubs and teams, including Engineers Without Borders, the University of Toronto Robotics Association and Spark Design Club.

**37.9%**

Percentage of women undergraduates across all programs in 2019–2020. UofT Engineering continues to play a leadership role in Engineers Canada's 30 by 30 campaign, which aims to raise the proportion of women among newly licensed engineers in Canada to 30% by 2030.

**16.4%**

UofT Engineering's share of the major national and international awards given to Canadian engineering professors for 2019. Our share of national faculty is 5.6%.

**3,000+**

Pre-university students reached via outreach programming.





*In February 2020, the UofT chapter of the National Society of Black Engineers hosted NSBEHacks 2020, the only student-run Black hackathon in the GTA. (Photo courtesy Mohamed Hirole)*

## STUDENT GROUPS

Skule™ is just as much about what happens outside of class as what happens within it.

Student clubs, teams and affinity groups offer rich opportunities for students to apply their technical expertise to design challenges, gain global experience, develop their creativity and find a sense of belonging. From the National Society of Black Engineers (NSBE) to the Skule™ Orchestra, there is truly something for everyone.



*Kramay Patel (pictured) is one of the co-founders of Stitch4Corona. (Photo courtesy Kramay Patel)*

### Stitch4Corona

Biomedical engineering PhD candidates **Kramay Patel** and **Chaim Katz** temporarily traded in their electrodes and amplifiers for sewing machines and cotton threads.

In March 2020, they launched Stitch4Corona, a volunteer-driven initiative to sew fabric face masks to help protect Toronto's most vulnerable during the COVID-19 pandemic. Volunteers are provided a kit with enough pre-cut cotton sheets, metal wires and elastic loops to sew 11 masks — with the eleventh mask meant for the volunteer to keep.

Once the masks are finished, the Stitch4Corona team either picks up the masks or makes arrangements for delivery to a nearby drop-off location. In just one month, more than 200 volunteers stitched 2,000 masks for Toronto's Michael Garron Hospital, several local walk-in clinics, as well as respite centres in the city.

## 2019–2020 HIGHLIGHTS

**SKULE™ NITE ONLINE** — This musical and sketch comedy revue has been a U of T Engineering institution for decades, and the show must go on, even during the COVID-19 pandemic.

While two performances went off without a hitch, subsequent live shows had to be cancelled due to physical distancing guidelines. Fortunately, the team was able to capture footage of their performance to create an online version of the show. The video was available from April 10 to 30 on a pay-what-you-can basis and attracted nearly 3,700 online viewers.



**HUMAN POWERED VEHICLE DESIGN TEAM** — In September 2019, U of T Engineering's Human Powered Vehicle Design Team broke the world speed record for a tandem bike. Their speed bike, dubbed Titan, achieved a blistering top speed of 120.2 kilometres per hour, shattering the previous record of 117.61 kilometers per hour set in 2012.

The World Human Powered Speed Challenge is a global competition that takes place annually in Battle Mountain, Nevada, USA. U of T Engineering teams and alumni have historically dominated at the WHPSC, setting records in 2015, 2016 and 2017.



**GRADSWE** — This year, U of T graduate students launched GradSWE, the first official graduate student community of Society of Women Engineers (SWE) in Canada.

SWE is one of the biggest professional organizations in the world for self-identifying women engineers. Led by a team of volunteers, including civil and mineral engineering PhD candidates **Sylvie Spraakman** and **Georgina Kalogerakis**, and chemical engineering PhD candidate **Anupama Sharan**, the group aims to build a sense of community among women pursuing graduate studies in engineering and cultivate professional development opportunities.



**CONCRETE TOBOGGAN** — In January 2020, U of T Engineering hosted the annual Great Northern Concrete Toboggan Race for the first time since the competition was founded in 1974. Held at Snow Valley Ski Resort, near Barrie, Ont., the competition featured 21 teams, with the U of T team taking first place.



## EQUITY, DIVERSITY AND INCLUSION

Equity, diversity and inclusion (EDI) strengthen the engineering creative process. Our Faculty is committed to fostering an environment in which each member of our community can excel, contribute and benefit from different perspectives.

In May 2019, UofT Engineering created the Office of Diversity, Inclusion and Professionalism. Led by Assistant Dean and Director **Marisa Sterling**, P.Eng., who is also president of Professional Engineers Ontario, this office joins several other bodies and positions within the Faculty that are dedicated to aspects of EDI.

Examples include the Dean's Advisor on Black Inclusivity Initiatives and Student Inclusion & Transition Advisor (**Mikhail Burke**), Dean's Advisor on Indigenous



On September 30, 2019, our community came together for Orange Shirt Day, an event to honour survivors and recognize the trauma caused by the residential school system. (Photo: Roberta Baker)

Initiatives (**Jason Bazylak**), the Engineering Equity, Diversity and Inclusion Action Group, and the UofT Engineering Positive Space Committee.

While there is much more to be done, UofT Engineering remains committed

to enhancing equity, diversity and inclusion within the Faculty and the engineering profession.



## Black inclusion at U of T Engineering

In February 2020, our Black Inclusivity Steering Committee (BISC) delivered its final report, *Striving Toward Black Inclusivity*. Its recommendations highlight a number of areas in which UofT Engineering could grow, improve or take a leadership role, such as the collection and sharing of data disaggregated by racial identity, and leveraging frameworks to facilitate diverse candidate pool formulation and consideration for prospective faculty and staff hiring.

Efforts are underway to take concrete action on these recommendations. For example, following the committee's interim recommendations (delivered October 2018) UofT Engineering created a robust campaign for Black History Month in February 2020 featuring the



One of 15 posters created for Black History Month 2020. Visit [www.uoft.me/BHM20](http://www.uoft.me/BHM20) to read more community reflections. (Photo: Daria Perevezentsev)

voices of our students, staff and alumni through posters, our website and social media channels. We received more than 1,500 pageviews and 8,000 engagements on social media throughout the campaign.



## 2019–2020 HIGHLIGHTS

**OPEN DISCUSSIONS** — These monthly events invite students, staff and faculty to discuss issues challenging equity, diversity and inclusion such as imposter phenomena or fostering inclusive spaces. In 2019–2020, four two-hour sessions were held, with a total attendance of approximately 240.



### EQUITY & INCLUSIVITY DIRECTOR

— Second-year Engineering Science student **Savanna Blade** served as Equity & Inclusivity Director of the Engineering Society in 2019–2020. She worked with 15 student groups and external organizations to make equity topics more visible and accessible to students, including facilitating student-run sessions on unconscious bias and consent, and providing equity training for other student leaders.

### TOWARDS INCLUSIVE PRACTICES (TIPs)

— These sessions provide staff and faculty with training to enhance equity, diversity and inclusion in their work. Examples include Identify, Assist, Refer training to recognize students in distress, and making teamwork more accessible. In 2019–2020, two sessions were held with a total attendance of approximately 80.



**#WEREMEMBER** — U of T Engineering hosted an event on December 6, 2019 to remember the 14 women whose lives were taken 30 years ago at École Polytechnique. As part of a national initiative, U of T Engineering was one of 14 engineering schools to shine a beam of light into the sky in a stand against gender-based violence and discrimination. More than 200 community members attended with another 300+ watching on livestream.



### QUEERSPHERE BRIDGE BUILDING COMPETITION

— As a part of Godiva Week in January 2020, Queersphere hosted a gingerbread cookie bridge-building competition, which brought together faculty members, staff and students from across the Faculty.

### MENTAL HEALTH PROGRAMS OFFICER

— **Melissa Fernandes** was recently appointed as U of T Engineering's inaugural Mental Health Programs Officer. The newly created role will develop programs and resources to support student mental wellness and increase awareness of mental health challenges for students, staff and faculty.





Civil engineering undergraduate Keziah Nongo was one of several instructors in the Faculty's new Makerspace program. Launched in July 2019, the program inspires students in Grades 5 and 6 to tackle design challenges in the Myhal Centre's fabrication facilities. (Photo: Julia Fracassi)

## PRE-UNIVERSITY OUTREACH

U of T Engineering's pre-university outreach activities inspire the next generation of global engineering leaders by enabling students in Grades 3 to 12 to experience science, technology, engineering and mathematics (STEM) in a way that is tactile and fun.

These in-school workshops, after-school programs and summer camps engage our partner communities across the Greater Toronto Area, and provide valuable opportunities for the undergraduate and graduate students who design and deliver them to develop their skills in leadership, communication, project management and team building.

Several of our programs focus on groups that have traditionally been under-represented in STEM, including Black students, Indigenous students and women.



Grade 9 student Matthew Robinson was one of 54 Blueprint participants this past summer. Each student received a box of supplies to complete a range of science and engineering activities throughout the program. (Photos courtesy Cassandra Abraham)

## Blueprint

Launched in the spring of 2020, Blueprint is an academic enrichment program designed for highly motivated Black students currently in Grades 9, 10 and 11 who are interested in careers in STEM with a strong interest in engineering.

Due to the COVID-19 pandemic, this program began with three virtual courses, online meet-ups and mentorship activities, offering participants exposure to research experts and current students at Canada's top engineering school. The program had more than 50 participants from across Canada, and will transition to in-person meetings when circumstances allow.



## STEM Day

The innovative approaches to STEM instruction developed by U of T Engineering's outreach team are valuable resources for classroom teachers.

Throughout 2019–2020, Michael Waldman, a STEM teacher with the Toronto District School Board, was seconded to U of T Engineering as the STEM Educator in Residence. Through this new position, the Faculty hosted several events to further enhance collaborations between U of T and elementary school educators.

One of these events was STEM Day, which challenged graduate students in U of T Engineering's Prospective Professors in Training program to design activities that communicated curriculum-relevant science and engineering concepts. Participants had the opportunity to learn about projects in fields from facial recognition technology to environmental remediation to advanced manufacturing.

"Those types of experiences can get students thinking about engineering in a different way," says Waldman. "That's especially valuable for the type of kids who might not traditionally have considered an engineering education. It's a really exciting partnership."

*Mechanical engineering PhD students Yasamin Kazemi (third from left) and Peter Serles (far right) found a creative way to teach students advanced manufacturing by using Play-Doh at STEM Day. (Photo: Liz Do)*



## AWARDS & HONOURS

Between April 2019 and March 2020, our faculty received more than 30 awards and honours at the regional, national and international levels. In the 2019 calendar year, we received 16.4% of all awards presented to Canadian engineering professors, despite making up less than 6% of the nation's faculty. Below is a selection of awards received by our faculty members.

### International

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#### **American Institute of Medical and Biomedical Engineering: Fellow**

Yu Sun (MIE)

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#### **American Society of Mechanical Engineers: Fellow**

Nasser Ashgriz (MIE)

Aimy Bazylak (MIE)

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#### **Google: Faculty Research Award**

Scott Sanner (MIE)

Vaughan Betz (ECE)

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#### **Institute of Electrical and Electronics Engineers: Fellow**

Vaughn Betz (ECE)

Shahrokh Valaee (ECE)

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#### **Institute of Electrical and Electronics Engineers Antennas and Propagation Society: Distinguished Achievement Award**

George Eleftheriades (ECE)

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#### **Institute of Electrical and Electronics Engineers Professional Communications Society: Ronald S. Blicq Award for Distinction in Technical Communication Education**

Robert Irish (ISTEP)

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#### **Institute of Electrical and Electronics Engineers Robotics and Automation Society: Early Academic Career Award in Robotics and Automation**

Eric Diller (MIE)

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#### **International Federation of Automatic Control: Giorgio Quazza Medal**

Murray Wonham (ECE)

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#### **National Academy of Engineering: International Member**

Michael Sefton (ChemE, BME)

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### National

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#### **Canadian Academy of Engineering: Fellow**

Milos Popovic (BME)

David Sinton (MIE)

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#### **Canada Council for the Arts: Killam Prize in Engineering**

Ted Sargent (ECE)

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#### **Canada Council for the Arts: Killam Research Fellowship**

Milica Radisic (BME, ChemE)

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#### **Canadian Society for Chemical Engineering: R.S. Jane Memorial Award**

Levente Diosady (ChemE)

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#### **Canadian Society for Civil Engineering: A.B. Sanderson Award**

Jeffrey Packer (CivMin)

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#### **Canadian Society for Civil Engineering: Fellow**

Paul Gauvreau (CivMin)

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**Canadian Society for  
Civil Engineering:  
Sandford Fleming Award**  
Amer Shalaby (CivMin)

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**Canadian Society for Mechanical  
Engineering: Fellow**  
Xinyu Liu (MIE)

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**Engineers Canada: Gold Medal Award**  
Cristina Amon (MIE)

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**Engineering Institute of Canada:  
Fellow**  
Michael Carter (MIE)  
Nazir Kherani (ECE, MSE)  
Douglas Reeve (ChemE)  
Craig Simmons (MIE, BME)

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**Royal Society of Canada: Fellow**  
Zheng-Hong Lu (MSE)  
Yu Sun (MIE)

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**Women's Executive Network:  
Canada's Most Powerful Women:  
Top 100**  
Cristina Amon (MIE)

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## Provincial / Municipal

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**Ontario Professional Engineers Awards:  
Engineering Excellence Medal**  
Goldie Nejat (MIE)

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### LEGEND:

**BME** Institute of Biomedical Engineering  
**ChemE** Department of Chemical Engineering & Applied Chemistry  
**CivMin** Department of Civil & Mineral Engineering  
**ECE** The Edward S. Rogers Sr. Department of Electrical & Computer Engineering  
**ISTEP** Institute for Studies in Transdisciplinary Engineering Education & Practice  
**MIE** Department of Mechanical & Industrial Engineering  
**MSE** Department of Materials Science & Engineering

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## University of Toronto

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**Joan E. Foley Quality of  
Student Experience Award**  
Jason Bazylak (MIE)

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**McLean Award**  
Natalie Enright Jerger (ECE)

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**President's Impact Award**  
Tom Chau (BME)

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**President's Teaching Award**  
Micah Stickel (ECE)

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**Vivek Goel Faculty Citizenship Award**  
Cristina Amon (MIE)

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*The Stewart Blusson Visualization Laboratory is a leading-edge facility within the Myhal Centre for Engineering Innovation & Entrepreneurship, opened in the spring of 2020. Featuring an 11 metre-wide immersive video wall with ultra-high-resolution technology, it enables students to experience larger-than-life images, videos, models and simulations. The facility was made possible by a gift from Stewart Blusson, president of Archon Minerals Ltd. (Photo: Daria Perevezentsev)*

# STRENGTHENING OUR FACULTY

Support from our community  
keeps us at the leading edge.

Whether through scholarships, research chairs or physical infrastructure, the contributions of our supporters enhance our global impact and student experience.

## FACTS & FIGURES

**130+**

Number of countries where  
U of T Engineering alumni  
live and work.

**\$17.6 M**

Philanthropic support  
in 2019–2020.

**10,000+**

Membership within U of T  
Engineering CONNECT, an  
online social network of  
alumni and supporters.

**50,000+**

U of T Engineering  
alumni worldwide.



# SELECTED HIGHLIGHTS

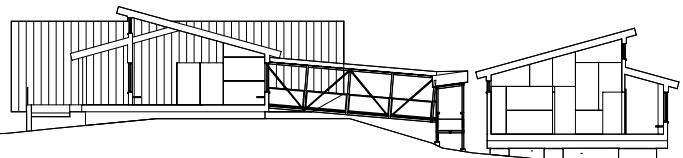
## CAMP 100

One of UofT Engineering's most beloved buildings isn't on campus — it is located more than 100 kilometres north of Toronto, on the shore of Gull Lake, near Minden, Ont., and it's about to get a major upgrade.

Since 1920, the two-week Civil and Mineral Practicals (CAMP) course has provided students with the opportunity to further their understanding of the vital interactions between the natural and built environments. On September 7, 2019, more than 100 attendees celebrated a century of Survey Camp. With a fantastic turnout of alumni, students, faculty and friends, the event showcased existing facilities at Gull Lake and marked a ceremonial groundbreaking for a planned Heavy Construction Association of Toronto (HCAT) bunkhouse and MacGillivray Common Room.



Top: Alumni break ground during the CAMP 100 celebration, held September 7, 2019 at Gull Lake near Minden, Ont. (Photo: Phill Snel) Bottom: Architectural drawing of the west face of the proposed bunkhouse. (Image courtesy V + A Architects)



Left to right: Dean Emeritus Michael Charles, U of T Chancellor Rose Patten, Dean Emerita Cristina Amon and Professor Emeritus Ron Venter unveil a portrait of Amon that now hangs in the lobby of the Myhal Centre for Engineering Innovation & Entrepreneurship. (Photo: Lisa Sakulensky)

## Decanal Chair in Innovation

On June 26, 2019, more than 400 members of the UofT Engineering community came together to celebrate the transformative leadership of **Cristina Amon**, who served as Dean from 2007 to 2019. Under her visionary leadership, the Faculty has become a global leader in multidisciplinary research, education and innovation.

In recognition of Amon's enormous impact and lasting legacy, alumnus Paul Cadario announced the creation of the Decanal Chair in Innovation, an endowed chair to be held by all future U of T Engineering deans that will seed innovative projects in perpetuity. A testament to her unwavering dedication to fostering innovation and collaboration, the Decanal Chair will be renamed in honour of Amon upon her retirement in accordance with University policy.

## Entrepreneurial partnership with Bereskin & Parr

A gift from boutique intellectual property law firm Bereskin & Parr LLP is further enhancing programs at UofT Engineering's Entrepreneurship Hatchery.

"Year after year, the creativity and drive of the students I see in the Hatchery's programs amazes me," said **Isi Caulder**, a Bereskin & Parr partner and co-leader of the firm's AI patent practice group. A triple UofT alumna with degrees in engineering science, electrical and computer engineering, and law, Caulder has served as a dedicated mentor and advisor to teams for more than five years.

"In fields from AI to medicine to entertainment, I truly believe that the businesses and products they are inventing and refining today will become some of the technologies that will define our future, and I am thrilled to be a part of their process as they make that happen."

The \$50,000 donation is doubled via a match by the University of Toronto's True Blue Fund. These funds enable the creation of flexible grants that will be awarded to teams in the Hatchery's programs and support their development.



*UofT Engineering alumna Isi Caulder addresses the crowd at Hatchery Demo Day 2019. Caulder is a partner at Bereskin & Parr, LLP which this year donated \$50,000 to support the Hatchery. (Photo: Tyler Irving)*



## A living laboratory for sustainability research

A new, purpose-built facility for sustainability research is taking shape on the rooftop of the Wallberg Building.

Designed to foster bold experimentation and act as a catalyst for accelerating our research and training activities, the Sustainability Lab (S-Lab) is not only a space in which to do research, but part of the research itself.

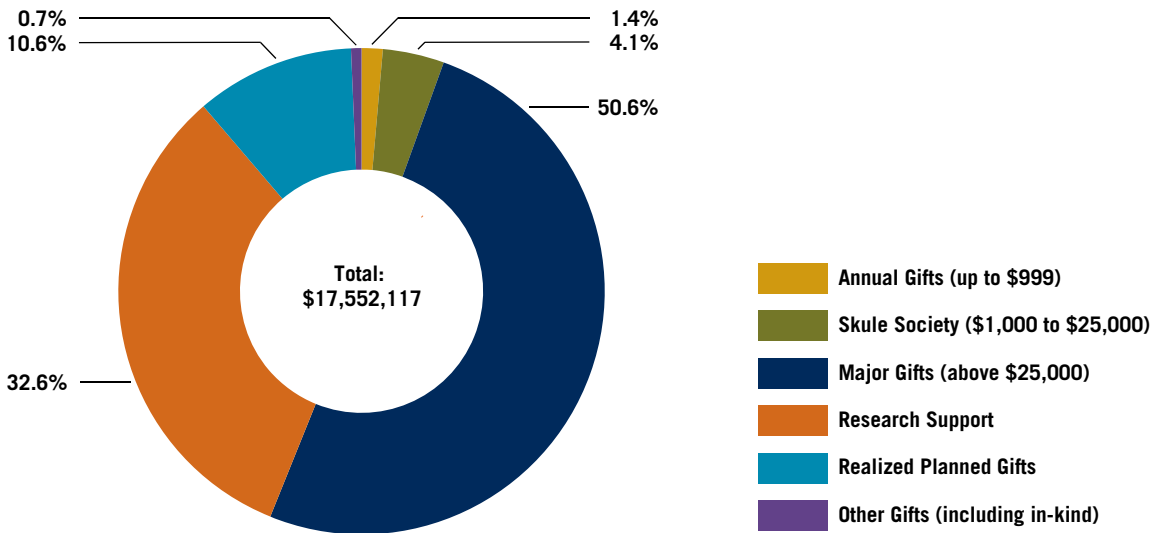
S-Lab will feature a 550 square metre rooftop solar array and advanced environmental sensors that can inform innovations to the built environment. Features such as smart lighting with daylight dimming and advanced low-velocity fumehoods will reduce the facility's carbon footprint, with a goal of net zero carbon.

At the core of S-Lab is an open concept space that encourages both structured and informal interaction. Students and researchers from more than a dozen lab groups will share tools, equipment and resources, catalyzing new ideas and new ways of thinking.

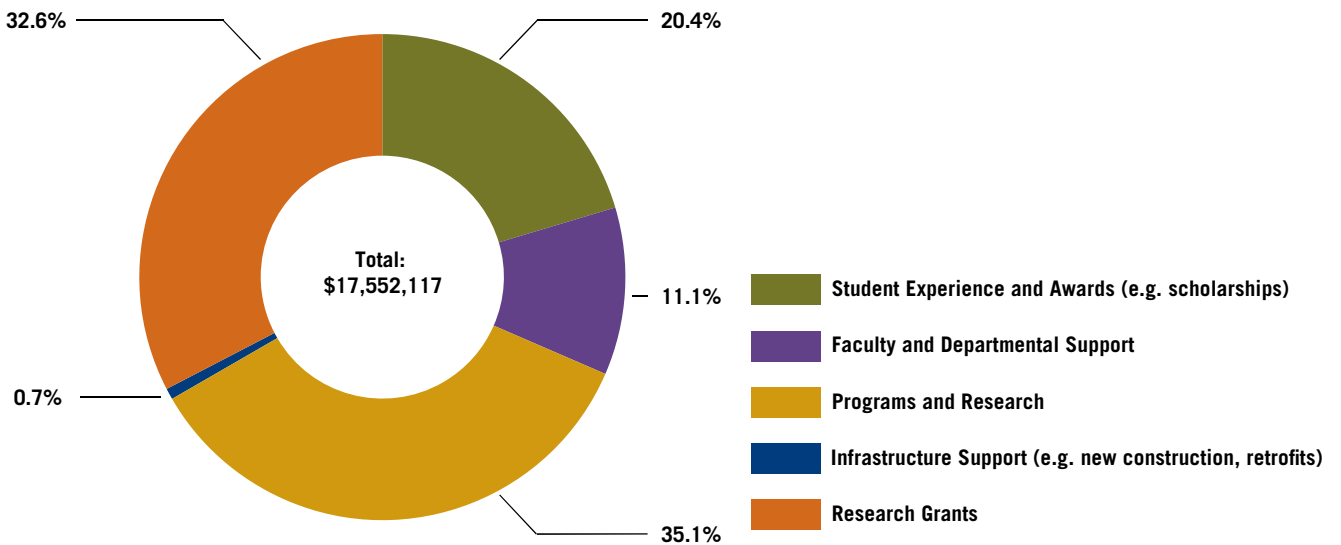
*This rendering shows the vision for the Sustainability Lab, a new facility to be constructed on the roof of the Wallberg Building. (Image courtesy Baird Sampson Neuert Architects)*

# PHILANTHROPIC SUPPORT

Advancement results, May 1, 2019 to April 30, 2020



## Gift designations, May 1, 2019 to April 30, 2020





# FINANCIAL HIGHLIGHTS



**\$101.5 M**

Total research infrastructure funding and research operating funding, 2018–2019, an increase of \$22.3M over the past five years.

**\$45 M+**

Approximate value of infrastructure projects currently underway, either in design or construction phases.

**\$52.3 M**

Total graduate student funding, 2018–2019, an increase of \$7.6M over the past five years.

**\$375.4 K**

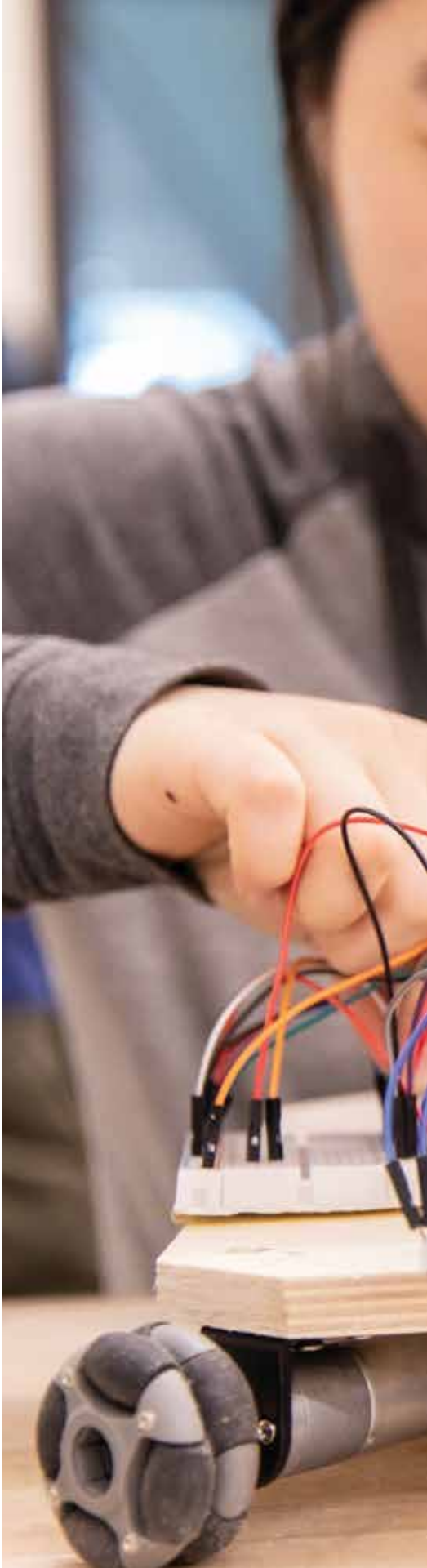
Support distributed to student clubs and teams, 2019–2020.

**\$12.0 M**

Undergraduate financial assistance distributed in 2019–2020, supporting 1,641 students.

**\$16.7 M**

Industry research funding for 2018–2019, an increase of \$9.0M over the past five years.



## STAY CONNECTED

Our campus is in Toronto, but our community spans the globe. Each year, our students, faculty and staff work with hundreds of external partners, from local startups to large international corporations, as well as hospitals, government agencies, academic institutions and NGOs.

It is easier than ever before to access all U of T Engineering has to offer, whether your goal is to leverage our research expertise through a new partnership, inquire about our innovative educational programs or simply learn about our latest developments.

Visit our home page:

[uofteng.ca/faculty](https://uofteng.ca/faculty)

Read the latest news:

[uofteng.ca/news](https://uofteng.ca/news)

Learn more about industry partnerships:

[uofteng.ca/partnerships](https://uofteng.ca/partnerships)

Learn more about our commitment to equity, diversity and inclusion:

[uofteng.ca/edi](https://uofteng.ca/edi)

Discover our undergraduate educational offerings:

[uofteng.ca/discover](https://uofteng.ca/discover)

Explore our graduate-level programs:

[uofteng.ca/gradstudies](https://uofteng.ca/gradstudies)

Hire our students for co-op positions:

[uofteng.ca/hire](https://uofteng.ca/hire)

Join our global online community of alumni and supporters:

[uofteng.ca/connect](https://uofteng.ca/connect)

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To review supporting data, read our

**By The Numbers 2020** report:

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