POLYTECHNIQUE MONTRÉAL

Celebrating 150 years of impact

Friday, March 24, 2023

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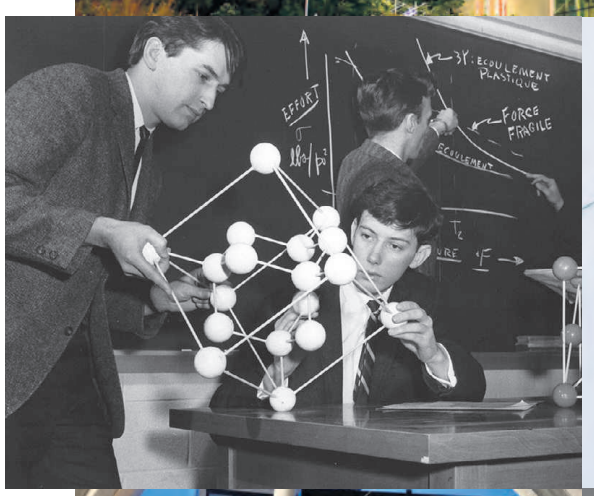

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ALL THE MORE REASON TO LEARN

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POLYTECHNIQUE MONTRÉAL

150 YEARS

JUSTIN TRUDEAU
PRIME MINISTER OF CANADA

It is with great honour that I extend my heartiest congratulations to Polytechnique Montréal as it marks its 150th anniversary this year. For a century and a half, this institution has been at the forefront of cutting-edge research while providing some of the best education in the world.

I would know. The years I spent there were some of the most informative and inspirational ones of my life.

Even in the most difficult, unimaginable of times, Polytechnique Montréal has stood strong. The face of resilience; an inspiration for us all.

Today, as immense global challenges spread far and wide, education is the key to us successfully tackling and overcoming them.

To the entire team behind this wonderful institution, I wish you continued success and continued impact. We need it and we will all be better off for it.

With my warmest regards and very best wishes for the next 150 years!

ALL THE MORE REASON TO DREAM
ALL THE MORE REASON TO CELEBRATE
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ALL THE MORE REASON TO EVOLVE
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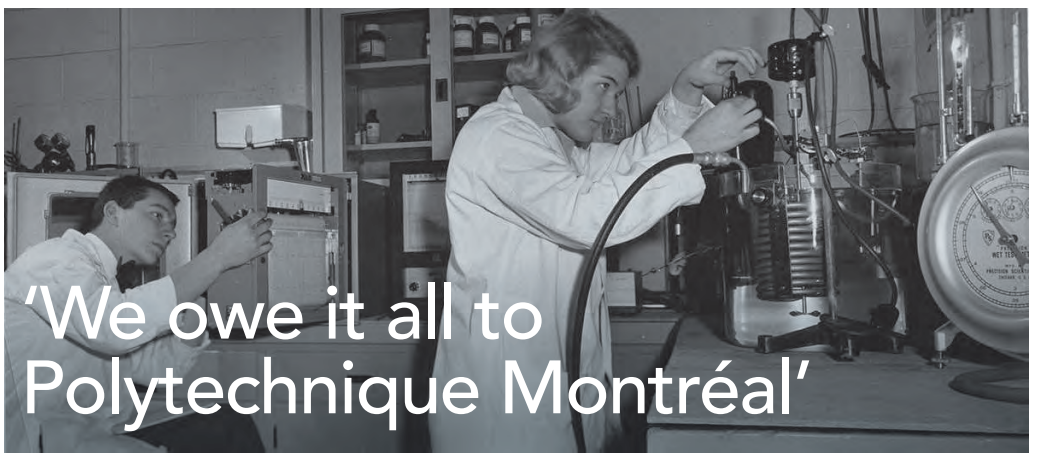

'We owe it all to Polytechnique Montréal'

Polytechnique Montréal has a long history of providing solutions for industry, such as work on advancing mining engineering in 1965. SUPPLIED

What major accomplishments can be attributed to Polytechnique Montréal since it was founded in 1873? "Where to begin," says historian Robert Gagnon, laughing. "We could talk about it all day."

The Université du Québec à Montréal (UQAM) professor should know. He wrote a hefty 528-page volume on the topic: *Histoire de l'École Polytechnique de Montréal*.

The university was founded by Urgel-Eugène Archambault to train the engineers needed during Canada's rapid industrialization. The early years of the first francophone engineering university in North America were difficult. Five students graduated in 1877, only one the following year. The first three decades saw no more than an average of four graduates a year.

The tide began to turn around 1905. "Polytechnique graduates started playing an increasingly important role in the public sphere. They held major positions in municipal, provincial and federal governments," says Dr. Gagnon. This trend accelerated though the 1910s, the 1920s and the 1930s.

Historian Robert Gagnon. SUPPLIED

Although they were widely perceived as community leaders, Polytechnique Montréal alumni were still under-represented in the business world until the 1950s, when that, too, began to shift, says Dr. Gagnon. "Polytechnique Montréal engineers developed strong ties with the private sector, which was vital to the development of the province. Suddenly, a host of emerging companies were being created by former students."

Henri Audet, who founded telecommunication behemoth COGECO in 1957, was a Polytechnique engineer. So was Robert Boyd, one of the first francophones hired by Hydro-Québec, and Paul-Aimé Sauriol, founder of Dessau, one of Canada's largest engineering-construction firms. The list goes on.

CHANGING THE FACE OF QUEBEC – AND THE COUNTRY

Alumni also played a vital role in driving Quebec's urbanization. Émile Vanier, who earned a diploma from Polytechnique Montréal in 1877, helped to develop Montreal's sewer system. Marius Dufresne, who graduated in 1905, founded the Dufresne Construction Company and the Dufresne Engineering Company with his brother Oscar. They went on to build tunnels, dams, power plants and bridges across Quebec, including the Sainte-Anne and Pie-IX bridges, the Ontario Street tunnel and parts of the Jacques-Cartier Bridge.

"Most of the sewer systems built in Quebec were designed by Polytechnique Montréal engineers, as were most bridges built in the 1960s," says Dr. Gagnon. Alumni also helped build a series of hydroelectric power stations, like the dam on the Manicouagan River and the James Bay Project, one of the world's largest energy producers that generates electricity not just in Quebec but for much of the northeastern United States.

Augustin Frigon, a former student who became a professor, then the director and later the president of the university, was the first French Canadian to get a doctorate from the renowned Paris-Sorbonne University. In 1943, Dr. Frigon became general manager of CBC/Radio-Canada and was instrumental in making the public broadcaster what is today.

"It's obvious that Quebec, and the country as a whole, would not be the same without Polytechnique Montréal's alumni. The electrification of rural areas, the highway system, aqueducts and streets, Polytechnique people built all that," says Dr. Gagnon.

"We owe it all to them."

SOCIETAL IMPACT: THE MEASURE OF A GREAT UNIVERSITY

From urban centres to remote corners on Earth and into space, the ingenuity of engineers has been central to humanity's quest to overcome barriers, solve challenges and create opportunities.

"If you want to change the world, there is no better way to achieve this than through engineering," says Pierre Lassonde, chair of the board of directors at Polytechnique Montréal, an engineering university with an impressive track record of impact spanning 150 years.

At the heart of this impact are deep connections to industry, communities and society, he explains. "Partnerships are very important to Polytechnique Montréal; they give us a front-row seat to current needs."

Although conditions have changed over the past century and a half, the institution continues to tackle current and emerging challenges. At the time of its inception, there was a strong drive to develop Quebec's abundant natural resources, including hydropower.

As a result, Quebec is now a leader in hydropower, which provides 90 per cent of the province's electricity, and Hydro-Québec, the main utility, is recognized for its foresight in delivering clean energy solutions.

Pierre Lassonde, chair of the board of directors, Polytechnique Montréal. CAROLINE PERRON

"Quebec has one of the greenest energy grids in the world," says Mr. Lassonde. "We are also looking at other renewable power sources."

Among the province's natural resources are rich mineral deposits, including copper, nickel and gold. The government's recent critical minerals strategy creates a supportive environment for resource development, and engineering expertise at Polytechnique Montréal will help to facilitate turning these assets into societal benefits.

"We want to create a greener, more sustainable future. We are working on new forms of energy, on new technologies that depend on critical metals, and on new materials," he says. "We are also leaders in fields like artificial intelligence and cybersecurity, which are absolutely vital."

At the foundation of Polytechnique Montréal's success are efforts to "create a virtuous cycle," Mr. Lassonde explains. "It starts with students who are keen and interested. They will one day be our ambassadors. Then we have our university, comprising of world-renowned experts who are dedicated to teaching the next generation as well as conducting research and development."

Since 1873, the institution has produced more than 57,000 graduates who have had major positive impacts in Quebec, Canada and around the world. "The Polytechnique community is united and strongly mobilized, thanks in particular to the work of our foundation and alumni," he says. "Thanks to them, we can achieve major breakthroughs in the development of new projects and university spaces and support our teaching and research activities."

While the calibre of graduates and professors helps to elevate a university's reputation, Mr. Lassonde considers "impact the final connector of the virtuous cycle.

"Too many research efforts at universities don't get applied in the real world. That's where an entrepreneurial mindset can make a difference, as well as dedicated centres and divisions for translating research findings into tangible benefits."

For example, Polytechnique Montréal's entrepreneurship office, Propolys, has already supported more than 150 projects since its creation in 2019. Two programs for entrepreneurs, in cybersecurity and clean technologies, are offered to support key sectors of the economy and society.

Concrete outcomes matter, says Mr. Lassonde, and Polytechnique Montréal's portfolio includes 105 improvements to existing technologies, 56 patents held and 27 active spinoff companies.

Achieving real-world impact is a priority at Polytechnique Montréal, and this is something that draws partners, students and professors to the university, he adds.

The engineer of the future

BY MAUD COHEN,
PRESIDENT, POLYTECHNIQUE MONTRÉAL

Polytechnique Montréal was created 150 years ago in answer to pressing societal needs. Over time, the organization has evolved along with changing conditions – to continually provide the solutions that allow communities and industry to thrive.

While the many success stories speak for the impressive impact of Polytechnique Montréal and the professionals trained here, more work is required to tackle the complex challenges we face today – and equip coming generations of engineers with the skills and knowledge that can help to shape a better world.

LEARNING FROM THE PAST INSPIRES BIG-PICTURE THINKING

Engineering has always been a profession focused on problem-solving. In an increasingly connected world, with many challenges and issues intricately linked, engineers are now called upon to create solutions with the big picture in mind. This means that an innovation designed to address a particular challenge cannot cause problems in other areas. It means every solution has to be carefully scrutinized to ensure it contributes to the greater good.

We know from history, and especially from climate change, that it is important to consider both intended and unintended consequences. Yet how can we ensure engineers approach their work with this wider perspective? By educating them to be global citizens, by instilling openness and respect for other voices, by fostering competencies like critical thinking, civic engagement, innovation and collaboration. By empowering conscious and engaged professionals with the tools that enable them to bring change.

Polytechnique's Lassonde buildings have become a benchmark in sustainable construction. D. FARLEY

The idea that engineering has to be in sync with the needs of society has always been integral to our approach. At the time Polytechnique Montréal was founded, Quebec was developing rapidly. With industries and infrastructure being built, there was a strong demand for francophone engineers. From answering this call in 1873, our graduates have continued to play an instrumental role in enabling the success of industries and communities in Quebec and beyond.

They have helped to make names like Hydro-Québec and Bombardier synonymous with leadership as well as added discovery upon discovery to the list of accomplishments for Polytechnique Montréal.

Yet while our path has been considered "tried and true," I believe we have come to a fork in the road. To go forward with confidence requires us to not only celebrate past successes but learn from failures. Only by openly acknowledging and addressing challenges and issues can we build resilience in our organization and in society.

In my view, to stay relevant – and continue to deliver positive impact – in the coming years, we have to break down barriers to participation, both for entering the profession and for collaborating with people from industry and communities.

PROMOTING DIVERSITY AND INCLUSION

A core focus for Polytechnique Montréal is to increase diversity and inclusion in the engineering profession, with a special dedication to encouraging the participation of women in honour of the students and staff who lost their lives in the December 6, 1989, shooting.

Progress has been made over the years, but more must to be done. According to Engineers Canada, the percentage of newly licensed female engineers is currently 18.1 per cent – while women make up more than half of the Canadian population.

At Polytechnique Montréal, women enrolled in the first year of bachelor degree programs make up 33 per cent (up from 17 per cent in 1996, when I was a student). About 20 per cent of our professors are women, and we also aim to increase the percentage of women in leadership positions.

We take these efforts very seriously and have thought deeply about how to ensure our institution is a place where women feel welcome, where they can flourish and achieve a high level of success in a profession that is still dominated by men.

There are two main requirements for moving forward. One, we need an action plan and a strong commitment to delivering tangible result. Two, we need to understand the barriers in order to overcome them.

Response to efforts to increase diversity among the student body – and include people from different backgrounds and with different challenges, such as students with autism and ADHD – has been very positive. What often comes up in my conversations with professors are experiences related to helping students overcome obstacles, and the resulting success is always a source of deep fulfilment.

This feedback reinforces our commitment to making the engineering profession accessible to diverse learners, to be more intentional about removing barriers, and to ensuring those who struggle receive support.

THE NEXT GENERATION

When I look at the students who arrive at Polytechnique Montréal, I am very hopeful. I see a generation with a passion for addressing the major challenges we currently face. I see a generation that forces us to become more creative and look at how we deliver training and conduct research with fresh eyes.

For cohorts of future engineers, I envision more opportunities to engage with multidisciplinary teams as well as with community members. I imagine a collaborative environment where we bring together diverse voices to ensure the positive impact of solutions we design for some don't bring negative consequences for others.

Only by working together can we create a brighter future for all.

POLYTECHNIQUE AT A GLANCE

Founded in 1873 as a university entirely dedicated to engineering, Polytechnique Montréal is among the three largest engineering universities in Canada – and the largest in Quebec.

With nearly 57,000 graduates, Polytechnique currently has more than 10,000 students, with nearly one-third of the student body made up of international students from 128 different countries.

In 2020, for the first time in its history, 30.2 per cent of Polytechnique's engineering bachelor's degree recipients were women, making it the first French-language university in North America to achieve that objective – a decade ahead of the "30 by 30" goal set by Engineers Canada to raise the percentage of newly licensed female engineers to 30 per cent by 2030.

Offering 120 programs in numerous engineering specialties, Polytechnique is responsible for nearly one-quarter of the total university research in those fields in Quebec and ranks first in the province in terms of the scope of its research. The university also conducts some of Canada's most intensive research activities through its approximately 60 research units, 32 Industrial Research Chairs, 24 Canada Research Chairs, and a faculty comprising more than 300 world-renowned experts. Polytechnique's overall annual budget is $300-million, including a $100-million annual research budget.

As a world-class science and technology hub, Polytechnique has more than 300 agreements with institutions around the globe.

THE CAMPUS

Polytechnique Montréal is located on the campus of Université de Montréal, the largest French-language university campus in North America.

By volume and quality of research, expertise and knowledge, Université de Montréal, with its affiliated schools – HEC Montréal and Polytechnique Montréal – is the leading hub of higher education in Quebec and ranks fourth in Canada. Close collaborations among the three institutions strengthen their capacity for innovation and accelerate discoveries.

A true city within a city, the Université de Montréal campus extends over 65 hectares of greenery, roads and paths. This provides an exceptional backdrop to student life, part of the reason why Montreal, for the sixth year in a row, was named Canada's top university city and number two in North America, according to the QS Best Student Cities index.

FOLIE TECHNIQUE: OVER 32 YEARS OF FUN FOR BUDDING SCIENTISTS

The summer camp has been helping young minds explore science since 1991

In pictures, the kids are wearing colourful camp t-shirts and huge smiles, but also lab coats and safety goggles. They're holding smoking beakers and rockets. It's clear the 2,000 or so young people aged seven to 17 who attend each year Folie Technique – one of Canada's oldest science camps – are there to have fun, but also to learn.

Folie Technique organizes summer camps around several themes – such as biochemistry, mechanics, physics and aerospace – supervised by a team of around 30 Polytechnique Montréal students eager to share their passion. They also provide free workshops to thousands of pupils around the province of Quebec. Between May and June of last year, they visited 111 classrooms.

"Our goal is to make science and engineering accessible to all young people, regardless of where they live, their socioeconomic situation, or their gender," says Folie Technique executive director Julie Doucet Lamoureux.

Folie Technique offers grants and organizes special activities to help narrow the gender gap by stimulating girls' interest in the world of science (top), and Folie Technique executive director Julie Doucet Lamoureux (left) believes this engagement can spark an interest in STEM-related careers. CAROLINE PERRON

GIRLS AND SCIENCE: A WINNING FORMULA

Women are still under-represented in science, although that's beginning to change: in 2020, 30.2 per cent of Polytechnique's undergraduate engineering students were women. Overall though, Quebec and Canadian averages for female engineering graduates hover just over 23 per cent.

Folie Technique offers scholarships and organizes special activities to help narrow that gap by stimulating girls' interest in the world of science.

"We want to break down stereotypes and give them the chance to conduct experiments," says Ms. Doucet Lamoureux. "We also want them to meet women who work or study in engineering and science. That's so important. Being able to interact with female role models is key to the success of our programs."

An annual fundraiser is held every December to help underwrite those activities while honouring the tragic events of December 6, 1989. Since its inception in 2014, The Week of the White Rose has amassed over $225,000, including a record-breaking $54,448 last year. Anyone can contribute by purchasing virtual white roses on the organization's website.

A CAMP FOR ALL

Folie Technique offers financial assistance and workshops to young people from underprivileged backgrounds.

"School children don't always know who we are. They might even be a little wary at first. But once they realize that they are able to solve scientific challenges, they are amazed," says Ms. Doucet Lamoureux. "They get so into it. When the bell rings, they don't want to leave."

The non-profit organization doesn't just criss-cross the province to fulfill its mission. In northern Quebec, in the Inuit community of Kangiqsujuaq, in Nunavik, its involvement runs deep. After providing science workshops to school children last year, Folie Technique prepares to launch a one-week summer camp in 2023.

"When kids discover science, they see what they are capable of, and then they feel proud of what they accomplish," says Ms. Doucet Lamoureux. "Every fun learning experience creates a spark. Once that spark is lit, who knows where it will take them?"

150 YEARS

MONA NEMER
CHIEF SCIENCE ADVISOR OF CANADA

Montreal is known worldwide for its style, its flair and its passion for living. That passion extends not only to literature, music and the performing arts, but to science and technology as well. The city is a centre of scientific learning and research, and for 150 years, Polytechnique Montréal, the oldest francophone engineering university in North America, has been a foundation of the city's global reputation in the applied sciences. It has long been a magnet for talent, bringing to Montreal, Quebec and Canada top students, engineers and researchers from around the world.

For 150 years, Polytechnique Montréal has made major contributions to Canada's strength in science and technology and helped to keep French voices at the forefront of scientific discovery, innovation and application. English may have become the predominant language of international scientific exchange and publication, but people of all languages need to be able to communicate about science and use it in their vernacular. This is especially true of engineering and the applied disciplines, which use science to bend and shape the neighbourhoods and communities we live in, from infrastructure, buildings and machines to manufacturing and communication systems, not to mention every electronic device used in our homes and workplaces.

Polytechnique Montréal's leadership in diversifying the science and engineering workforce is exemplary. In a field dominated by men, the university has made unparalleled efforts to recruit women to its programs. By 2020, Polytechnique had already met the Engineers Canada goal of increasing female engineering graduation to 30 per cent, 10 years ahead of schedule.

The university's motto, taken from Hooke's law of physics, is *Ut tensio sic vis* – a phrase whose symbolic meaning is that results are proportional to effort. Throughout its history, Polytechnique has lived up to this maxim. No wonder it's the pride of its city, its province and the entire country. I applaud Polytechnique Montréal's 150 years of achievement and look forward to many successful decades ahead.

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ALL THE MORE REASON TO CONTRIBUTE

Engineering space exploration tools

From the James Webb Space Telescope discovering thousands of new galaxies more distant and ancient than previously documented to Mars rovers tracing evidence of ancient lakes on the red planet, humanity's understanding of space is expanding at a rapid pace.

Beyond sparking the imagination of where space exploration may take us in the future – such as human habitation on the Moon and Mars or accelerating the energy transition with critical minerals mined in space – this knowledge is inspiring engineers to design the tools that will enable us to take next steps.

At Polytechnique Montréal, research teams have turned their attention to enlisting space-worthy robotic systems in the quest to go further and deeper: into the ground and into caves.

INTO THE GROUND

As the closest cosmic body to Earth, the Moon has long been investigated for its potential for human habitation and resource development, with most insights coming from exploration tools that focus on surface scanning.

A desire to "dig deeper" led Pooneh Maghoul, associate professor, Department of Civil, Geological and Mining Engineering, to design and test tools for exploring beneath the surface.

"What we know about the geology of the Moon is all about the surface. Going deeper represents an important step for getting an idea about the composition of the ground," explains Dr. Maghoul. Beyond learning whether the Moon's soil is porous or hard, and whether the ground is stable enough to support structures, below-surface investigations can also yield insights on valuable resources: ice and minerals.

"We need more and more resources to tackle climate change, including critical minerals and rare earth metals, and extracting them from the Earth brings its own challenges," she says. "Why not look for sources in space, for example, asteroids or the Moon?"

The aim of Dr. Maghoul's research is *in situ* resource utilization in space, yet the ideas for designing tools came from closer to home. "We can find lots of inspiration in nature," she notes. "For our work on energy-efficient robotic systems able to penetrate the ground, we were inspired by the movement of snakes when they burrow into sand."

In desert habitats, some snakes employ rapid cycles of contraction and stretching that achieve a displacement of soil as well as break down larger particles into smaller pieces. Dr. Maghoul and her team set out to create devices that mimic this locomotion.

The result is a robotic system with components that, through an electric current, vibrate at high frequencies, close to ultrasound-wave territory. What's more, the system can adapt its frequencies to the type of soil it encounters to enhance functionality even in very dense soil.

The head of the device is equipped with a set of sensors for geophysical and geometallurgical analysis to provide two important insights. One, to get an idea of where the ground is suitable for building lunar infrastructure, such as a lunar base, roads, launching and landing pads, or a solar power generation plant, she explains. "We need to investigate what type of foundation would be suitable, and where the ground is good enough to support this infrastructure."

The second purpose is to locate resources, says Dr. Maghoul. "Looking at the chemical and metallurgical composition of the ground can tell us whether there are critical minerals or rare earth metals present."

What makes the team's invention different from similar tools – used, for example, in mineral exploration on Earth – is its size. With a length of 30 to 50 centimetres and weight of less than five kilograms (including the batteries located at the "tail"), it addresses one of the biggest challenges in space exploration: mass and volume restriction.

"Bringing one kilogram of materials to the Moon's surface would cost roughly $1-million," she says. "So we had to design compact, light-weight and energy-efficient systems."

While these attributes are prerequisite for deploying the devices in space, they also make them useful for projects on Earth, and the innovation is well on its way to commercialization, with a patent in place and a proof-of-concept study completed, reports Dr. Maghoul. "We are now at the stage of starting marketing."

INTO CAVES

Beyond developing capabilities for below-ground exploration, researchers at Polytechnique Montréal are working on systems that enable forays into caves, which is seen as priority for space organizations keen on establishing bases on the Moon and on Mars.

"Our main objective is to explore caves on the Moon and Mars," says Giovanni Beltrame, full professor in the Department of Computer and Software Engineering, whose team is carrying out a series of experiments with exploration-focused robots. "Why are we interested in caves? Fundamentally, caves are the best places to establish a base, since they provide radiation shielding – and an environment that can easily be reinforced and made safe for astronauts."

In addition, caves attract scientific interest because they can provide insights about geology. Long considered essential for extraterrestrial exploration, robots deployed in space are fairly advanced yet face a number of limitations that Dr. Beltrame and his team are seeking to address.

"In addition to being very expensive, these robots are limited in their movements and typically rely on being connected to orbiting satellites," he says. "That's why you wouldn't want to send them into a cave, where transmission signals may be blocked and uneven surfaces present a challenge. You could lose connection and, if the robot doesn't come back out, you wouldn't know why."

Deploying a fleet of robots would address these concerns and essentially "multiply exploration capabilities," suggests Dr. Beltrame, who is a former microelectronics engineer at the European Space Agency and the current director at Polytechnique Montréal's Making Innovative Space Technology (MIST) laboratory, where multi-robot systems are under investigation.

"Multiple robots can relay information from one to another – and then to a rover or a base station outside, from where it can be transmitted to satellites and to Earth," he says, adding that having smaller robots working together can help to cover larger areas in shorter periods of time and better manage risks.

However, getting robots to communicate and collaborate is no easy task, with research teams focusing their attention on aspects like perception and navigation, co-ordination, decision-making and energy maintenance, says Dr. Beltrame. "We've recently done a lot of work on perception, allowing the robot to know where it is, where it's going and what is around it. This information is key to functioning in difficult environments like caves, where it's dark and you have varied terrain."

Enhancing the robots' navigation capabilities are LiDAR (Light Detection and Ranging) systems, which use light in the form of a pulsed laser to measure ranges. Through combining data from different sources, the quality of the information – and a resulting three-dimensional map – can be enhanced.

Robots can also warn one another away from risky areas, and Dr. Beltrame mentions a paper about these efforts titled DORA (Distributed Online Risk Aware) explorer. "We developed a system that allows robots to talk to each other. They exchange information, which is then relayed to an operator."

Another challenge is to allow the operator to not just receive information but to act on it, and Dr. Beltrame's team is testing several types of interfaces that could potentially enable such interactions "without exceeding the cognitive capacity of the operator."

From calibrating operators to enhancing sensing capabilities and looking how "swarm intelligence" can enable robots to collectively solve problems by forming advantageous structures and behaviours similar to the ones observed in natural systems, the research at MIST has already attracted the attention of a range of stakeholders, space agencies among them.

TESTING AND APPLICATIONS ON EARTH

From devices capable of burrowing into the ground to multiple robots exploring caves as a team, the technology advances realized at Polytechnique Montréal hold answers to a range of challenges, both in space and on Earth.

Dr. Beltrame and his team, for example, are planning to test their multi-robot system in an upcoming cave exploration expedition. "We're going to Mexico to map an unexplored cave system with a depth of at least 500 metres," he says, adding that in this particular case, human speleologists will collect information alongside their robotic counterparts.

While such missions allow the testing of various components of robotic systems, including operator interface, co-ordination and communication, "the upcoming demonstration will be focused on mapping aspects," says Dr. Beltrame.

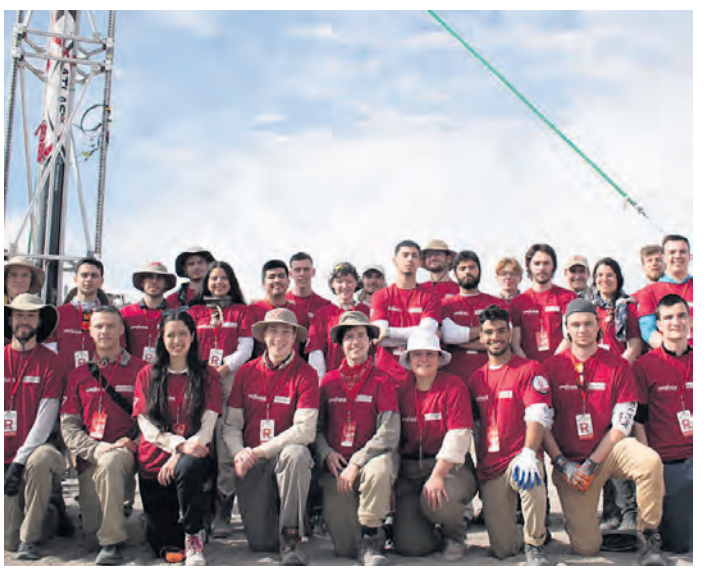
Beyond cave exploration, multi-robot systems could also be helpful in search and rescue operations. Disaster response is also an area where Dr. Maghoul's work can make a difference.

"Ground assessments can be helpful for gauging the damage from an earthquake, for example. Our robotic system can also be useful for infrastructure asset management, such as monitoring pipelines and dams. We have lots of potential applications in many areas of civil engineering, especially for work in areas that are remote," says Dr. Maghoul.

"But our dream is to use our systems for space exploration."

Polytechnique Montreal's aspirations for realizing humanity's dream of exploring space include producing robots that can help to probe caves on Mars and the Moon (top: Dr. Giovanni Beltrame and his team). Astronaut David Saint-Jacques, a Polytechnique graduate, took a Polytechnique lapel pin into space (centre). Gabriel Dubé, a Polytechnique student, during the NASA Haughton Mars Project 2022 mission in Nunavut (bottom). CAROLINE PERRON, CANADIAN SPACE AGENCY, ROD PYLE

> We need more and more resources to tackle climate change, including critical minerals and rare earth metals, and extracting them from the Earth brings its own challenges. Why not look for sources in space, for example, asteroids or the Moon?
>
> **Dr. Pooneh Maghoul**
> Associate Professor, Department of Civil, Geological and Mining Engineering



With its Atlas MK II rocket, Polytechnique's technical society won first place at the Spaceport America Cup 2022 – the world's largest rocket competition. SUPPLIED

From discovery to impact

Michel Gareau, founder, president and CEO of Starpax (left), works with technology that integrates the proofs-of-concepts of two exclusive patents in electromagnetism resulting from the work of Dr. Sylain Martel at Polytechnique Montréal (right). DAVID HIMBERT, STARPAX BIOPHARMA

Pioneering research by a professor of computer engineering at Polytechnique Montréal has produced a promising treatment for cancer that uses bacteria and magnetic fields to spread chemotherapy drugs throughout the volume of tumours.

Stemming from more than 20 years of study by Dr. Sylvain Martel and his team at the university's nanorobotics laboratory, the work has been further developed by a Montreal company, Starpax Biopharma Inc., into a technology to treat cancer, with plans to start clinical human trials of the therapy this autumn.

"This will have a huge impact," says Dr. Martel, whose first breakthrough came in 2001, shortly after arriving at Polytechnique Montréal from the Massachusetts Institute of Technology. He initially focused on using microscopic robots and then on special "magnetotactic" bacteria to transport cancer drugs to tumours, avoiding the exposure of healthy organs and the side-effects of standard chemotherapy. He says the research has benefited from his position at Polytechnique Montréal, from the financial resources of Quebec and Canadian granting agencies to the laboratory space and sophisticated equipment he uses and collaborations with university hospitals in Montreal.

> "Research is not a straight line. You start with a fundamental idea, but it's a blank page. Then you learn, and you go deeper. Polytechnique Montréal made that possible."
>
> **Dr. Sylvain Martel**
> Professor of computer engineering at Polytechnique Montréal

"Research is not a straight line," explains Dr. Martel. "You start with a fundamental idea, but it's a blank page. Then you learn, and you go deeper. Polytechnique Montréal made that possible."

Today, Starpax has developed a technology that integrates the proofs-of-concepts of two exclusive patents in electromagnetism resulting from the work of Dr. Martel, acquired in 2018 from Polytechnique Montréal. The company's cancer-treatment technology brings together 31 patented or patent-pending inventions in all, says Michel Gareau, the founder, president and CEO of Starpax.

He says chemotherapy drugs for more than a century have been injected in the bloodstream, so less than 1 per cent of the dose reaches the tumour while the rest of the toxic molecules spread throughout the body. "A meta-analysis of 117 studies around the world concluded that 90 per cent of the volume of a tumour receives little or no drug at all with systemic chemotherapy," Mr. Gareau notes. It's especially difficult to penetrate "hypoxic" zones in tumours that are low in oxygen and are not vascularized, which can cause cancer recurrence and metastasis.

The Starpax technology injects the medication directly into the tumour in a high concentration, transported by a patented non-pathogenic bacterium that is sensitive to magnetic fields so it can be precisely controlled. A Starpax "PolarTrak" creates a magnetic sphere around the tumour to contain and distribute these "Magnetodrones" throughout the tumour, targeting cancer cells and penetrating hypoxic zones.

Starpax expects the technology to work for 90 per cent of cancers, says Mr. Gareau, pointing out that the technology uses available, approved drugs. "We just get more of them to the right place, limiting toxicity because they only affect the tumour." The company is also developing applications for non-cancer conditions such as heart, lung, brain and eye diseases.

Starpax today has 45 staff, and it's supported by more than 350 experts helping to research, develop and produce the technology in clinical settings with humans.

Mr. Gareau, an engineer who worked in high-tech private equity for more than 40 years, says academic researchers such as Dr. Martel are critical in inventing concepts "because they have no limits," although they depend on companies like Starpax to take their discoveries beyond the laboratory. "It's a team effort."

Dr. Martel and others at Polytechnique Montréal continue to actively collaborate with Starpax, which plans to have its product in commercial use within two years.

"It's very exciting," says Dr. Martel, who's convinced this will change the face of cancer treatment. "Every day, I do calculations, and the more I look at it, the more I believe in the technology."

COLLABORATING FOR BETTER HEALTH OUTCOMES

Developing new health technologies, bringing them to market and integrating them into the health-care system is a complex undertaking. From concept to commercialization, it takes time, money and the involvement of players including biomedical researchers, health-care institutions, investors, patients and caregivers.

MEDTEQ+ has a long history of supporting health-care innovators at every step of this journey. The consortium for industrial research, of which Polytechnique Montréal is a founding member, has brought important expertise to advancing the development of solutions in Canada and around the world.

"Polytechnique is a mainstay of MEDTEQ+," says Diane Côté, president and CEO of the not-for-profit organization, which was established in 2012 and today includes more than 200 members and 27 partners focused on collaborative, industry-led projects that accelerate innovation. With a dual provincial and federal mandate, MEDTEQ+ positions Canadian products and services on a global scale, generating economic impacts while benefiting patients.

Diane Côté is the president and CEO of MEDTEQ+, a not-for-profit organization focused on collaborative, industry-led projects that accelerate innovation. SUPPLIED

Ms. Côté says Polytechnique Montréal was critical in the development of MEDTEQ+, with a forward-looking approach and an understanding of the importance of medical technologies for health care.

The MEDTEQ+ ecosystem has contributed to the development of more than 200 innovation projects in Canada. Polytechnique Montréal plays an important role in the consortium, Ms. Côté says, participating in its steering and project-evaluation committees as well as co-financing projects, collaborating on mobilization and networking events and knowledge transfer.

Several projects under MEDTEQ+ have come out of Polytechnique Montréal, she notes, leading to promising health-care solutions. These include AlayaCare, which uses artificial intelligence to help medical staff, patients and families better plan and manage home and community care via mobile apps and portals. And Reveal Surgical has developed a special probe that helps surgeons detect cancerous tissue around the margins of tumours.

The consortium is a partner of the Polytechnique's TransMedTech Institute, which includes a living laboratory that supports innovation "at each stage of development," Ms. Côté says.

The Government of Canada recently announced it would invest $47-million in the envisAGE Network that MEDTEQ+ has established with AGE-WELL, a national organization focused on technology for healthy aging. The funds will support up to 100 projects to scale up and commercialize technologies that improve the quality of life of older adults, which Ms. Côté says will "move the needle" in the field and have international significance.

"It is an economic development play, a technological play, a care and social-economy play, and a demographic play," she adds. "The objective here is to be transformative."

150 YEARS

ROSEANN O'REILLY RUNTE
PRESIDENT AND CEO, CANADA FOUNDATION FOR INNOVATION

As the first French-language engineering university in North America, Polytechnique Montréal is an essential hub for training top engineers, and a leading-edge research destination that has earned an international reputation for excellence. With 150 years of research and service to the community, this is a milestone worth celebrating.

The university has contributed to numerous technological and scientific innovations in Canada, notably in the fields of biomedical engineering, water treatment, innovative materials, and safe and green transportation. These accomplishments, among others, also make its researchers highly sought-after partners by scientific teams from around the world.

Canada Foundation for Innovation, an organization that invests in the research infrastructure needs of researchers at post-secondary research institutions across Canada, is proud to support Polytechnique Montréal by investing in equipment and facilities that are not only essential for cutting-edge research but are also instrumental in training the next generation of talented and ambitious researchers who will be key contributors to a bright future for Quebec and Canada.

150 YEARS

ALL THE MORE REASON TO DREAM
ALL THE MORE REASON TO CELEBRATE
ALL THE MORE REASON TO SUPPORT
ALL THE MORE REASON TO POWER SUSTAINABILITY
ALL THE MORE REASON TO EVOLVE
ALL THE MORE REASON TO CONTRIBUTE
ALL THE MORE REASON TO LEARN

KATHY BAIG
PRESIDENT, ENGINEERS CANADA
VICE-PRESIDENT, BUSINESS DEVELOPMENT, STANTEC

On behalf of Canada's 12 provincial and territorial engineering regulators and the more than 300,000 members of the engineering profession in Canada, it is my great pleasure to extend my warmest congratulations to Polytechnique Montréal on its 150th anniversary.

Since its founding in 1873, Polytechnique Montréal has left an indelible mark on the engineering profession in Quebec and throughout Canada. It has provided thousands of engineers with the educational foundation upon which they have built successful careers. Their graduates have gone on to make significant engineering contributions in a wide range of industries not only in Quebec but also across Canada and around the world.

As the only national voice of the engineering profession, Engineers Canada is proud to have a long-standing relationship with Polytechnique Montréal. For example, we have teamed up to offer a free virtual course on applying sustainability guidelines in engineering practice that has attracted more than 10,000 participants in Canada and globally. Polytechnique Montréal's professors and alumni have been volunteers on our committees and champions of our work. And Polytechnique Montréal has made a sustained effort to attract more women to engineering – achieving a milestone in 2021 with 30 per cent of graduates being women – and is an important partner in our national effort to make the engineering profession more equitable, diverse and inclusive.

As a graduate of Polytechnique Montréal myself, I witnessed first-hand its commitment to training future engineers. The education and experiences I gained there have been invaluable to me in my professional journey and have helped shape me into the engineer and leader I am today. I am honoured to have been even just a small part of the university's history and to be part of such a vibrant and innovative community.

This anniversary is not just a celebration of Polytechnique Montreal's rich history and its commitment to excellence in engineering education and research, but also an opportunity to recognize the achievements of its students, faculty, staff and alumni. Polytechnique Montréal's first 150 years have built a legacy of innovation and progress that I am confident will continue for the next 150 years.

Changing attitudes, providing accessibility

Improving sustainability is a key priority for engineering students and professors at Polytechnique Montréal. SUPPLIED

In a culture where the automobile is king, where splashy ads promise that dreams come true merely by making the right car purchase, moving towards a built environment that promotes healthier and environmentally friendly infrastructure has its challenges.

"We need to find ways to change attitudes and sell a new narrative and a lifestyle that relies less on the car for daily travel," says Jérôme Laviolette.

Mr. Laviolette, a PhD candidate in transport and mobility planning at Polytechnique Montréal, recently completed a doctoral thesis on the structural and psychosocial factors of Canadians' attachment to cars – and was one of the first three scholarship recipients of the David Suzuki Foundation.

As a transportation and climate change guest researcher, he focused on finding alternatives and changing minds around car dependency. He explored the questions: How do we bring sustainable change in people's mobility behaviour? How do we change our behaviours so that we can meet our climate goals?

> "It means making changes to the built environment, public policies to develop public transit services, promote carsharing services, implementing high-quality cycling infrastructures, making it more compelling for people to use active and public transit systems.
>
> **Jérôme Laviolette**
> PhD candidate in transport and mobility planning at Polytechnique Montréal.
> Photo: Daniel Francis Haber

"I wanted to understand the factors that are influencing people's car travel behaviour decisions, including car ownership, so we can design transportation and urban planning policies to support changes towards active travel and public transportation," explains Mr. Laviolette. He points out that in Canada, as around the world, transportation systems and cities have been designed to facilitate driving, making car ownership attractive and in many cases necessary.

Mr. Laviolette's thesis focuses on the influence of new mobility offerings, such as carsharing services that help "households rethink their need for car ownership." In Canada's major urban areas, people are embracing this alternative mode of transportation, he says. "It's not just trendy, it's transforming the mobility in our cities because it's giving people access to a car without owning one."

Furthermore, "if people can access a car without having to own one, studies have demonstrated, car ownership will drop," says Mr. Laviolette. That's important because research shows that car ownership increases car travel, which has negative impacts on the environment and on public health. Beyond creating air and noise pollution and exacerbating climate change, this leads to sedentary lifestyles as well as private and public economic consequences.

People's attachment to the automobile makes it hard for municipalities to introduce more inclusive urban planning in cities, such as adding cycling infrastructure or removing street parking to create more pedestrian-friendly areas, says Mr. Laviolette. "When you do things that are perceived as taking away the freedom of people to drive and park anywhere they want, there's going to be a backlash. That means all those people who do not own cars, who do not drive, cannot benefit from the curb space that is being used by cars. So it's really also an equity issue in our cities."

The solution to shifting lifestyle habits, to convincing people to embrace more sustainable modes of transportation includes increasing accessibility to alternatives such as public transit, carsharing and bike-sharing, options that still guarantee freedom of movement, says Mr. Laviolette. "It has to be seamless, efficient, on time, comfortable and pleasurable and, in the case of active travel such as cycling, it has to be safe.

"It means making changes to the built environment, public policies to develop public transit services, promote carsharing services, implementing high-quality cycling infrastructures, making it more compelling for people to use active and public transit systems."

To achieve this, Mr. Laviolette says, there's one other important piece. "We need transportation engineers to work with urban planners, social psychologists, sociologists and economists.

"We need to break the silos of disciplines," he concludes.

MEASURING A MEAL'S CARBON FOOTPRINT

Imagine it's lunchtime and choices on the menu include a lentil-based vegetarian shepherd's pie and a locally farmed beef dip sandwich. Diners deciding which savoury meal they choose may be influenced by their cuisine preference. Price might be a factor. But what about the carbon footprint of the dish to be consumed? Would that make a difference?

A Canadian first-ever project underway at Polytechnique Montréal is measuring the greenhouse gas (GHG) emissions of cafeteria meals to help create awareness around the "environmental impact of the food we eat," says Patrick Cigana, senior advisor, Office of Sustainability. "Food is a non-negligible part of our carbon footprint."

Launched this past fall, the project is a collaboration of the International Reference Center for Life Cycle Assessment and Sustainable Transition (CIRAIG) and the Association des Services Alimentaires de Polytechnique (ASaP), the non-profit food services organization on campus. A number of hot meals were selected to undergo a life-cycle assessment, which examined production, processing, packaging, transportation, preparation, cooking and waste.

Each meal's ecological footprint was determined by measuring the CO_2-equivalent kilograms that were emitted in preparation, explains Mr. Cigana. Students of the Association étudiante de Polytechnique (AEP) suggested adopting a grading scale, rather than relying on numbers to reflect the scores of the meals.

Predictably, "the meals that scored the worst are those that contain red meat, essentially beef, veal and lamb," he says, but there were some surprising results as well.

A meat-based shepherd's pie earned a B while a vegetarian-based focaccia dish was graded a D+. The explanation lies in the cheese, says Mr. Cigana, a dairy product that requires cattle, who emit methane, a very powerful greenhouse gas.

Next steps will be to expand the project from one to five days a week and review whether awareness of the grades of meals impact students' choices. "Did it really change behaviours in a measurable way? If it did, success! If it didn't, we may have to rethink the messaging," he says. "But let's get some data and let the science talk first."

The cafeteria project is part of a broader objective to ensure that "sustainability is integrated in as many aspects as possible at Polytechnique Montréal," which has signed a commitment towards carbon neutrality by 2050, says Mr. Cigana.

It's part of the institution's outreach mission "to influence not only what happens on campus but beyond our walls."

A Canadian first-ever project underway at Polytechnique Montréal is measuring the greenhouse gas emissions of cafeteria meals. CAROLINE PERRON

ADVANCING THE FUTURE OF SUSTAINABLE ENERGY

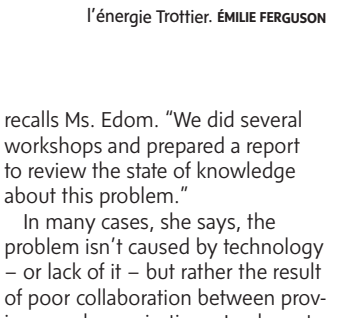
Canada's energy systems are critical, highly complex and overdue for changes that will advance the country towards a zero-carbon economy. Éloïse Edom, an associate researcher at Polytechnique Montréal's Institut de l'énergie Trottier – whose mission is to support the search for sustainable solutions towards a clean energy transition as well as to disseminate knowledge and contribute to the conversation on energy issues – has made it her life's work to figure out how to make electricity grids cleaner, more resilient and sustainable.

"My work in the energy sector has always been from the perspective of decarbonizing our society by 2050," says Ms. Edom, who graduated from Polytechnique Montréal with a bachelor's degree in mechanical engineering, a professional master's degree in energy engineering and a research master's degree in applied mathematics. "I focus mainly on the subject of electrification: How do we electrify heating in buildings? How can we improve the electricity grid so we can rely more on it in the future?"

To advance these goals, Ms. Edom leads studies and analyses that are shared with governments, utilities and other decision-makers. A recent project, for example, looked at the pros and cons of developing hydrogen power in Quebec. Ms. Edom's research underlined the high costs of such an undertaking but also concluded that it may still be a viable choice for certain remote locations where the current power source is gasoline.

Another project examined the obstacles to improving the power gid in Eastern Canada, from Ontario to the Atlantic provinces.

"We talked to people working in the field to try and find out what's making it so difficult to produce and distribute more electricity," recalls Ms. Edom. "We did several workshops and prepared a report to review the state of knowledge about this problem."



Éloise Edom is a Polytechnique graduate and research associate at the Institut de l'énergie Trottier. ÉMILIE FERGUSON

In many cases, she says, the problem isn't caused by technology – or lack of it – but rather the result of poor collaboration between provinces and organizations. Inadequate funding to put towards the grid is also a common issue.

Politics can sometimes play a role. In particular, a change in government has from time to time upended public policy on electricity systems and energy, says Ms. Edom.

"It's a very long-term and complex challenge, and I'm like a grain of rice – but each grain can make a difference," she says. "For me, it's really important for society to have a long-term vision."

Talking to media about the science and rationale behind decarbonization has been an important way to help shape this societal vision, adds Ms. Edom. She's learned to explain complex concepts in a way that people can understand easily and relate to.

"But there's still much work to be done – there's a lot of awareness but not a lot of impactful actions," she says. "There's a lot of opportunity for organizations like ours to help Canada reach a net-zero target for 2050."

Improving water security

Optimism can become scarce when your work gives you a front-row seat to the deterioration of one of life's most vital elements. But Michèle Prévost, professor and Industrial Chair on Drinking Water at Polytechnique Montréal, considers finding solutions to the problem of water quality and quantity a hopeful and collaborative undertaking.

While many Canadians take it for granted that clean, abundant water will always flow from their faucets, the reality is a growing number of areas are running out of this precious resource, says Dr. Prévost, who has more than three decades of research and technology experience in drinking water treatment and distribution.

Some parts of Quebec, for example, can no longer develop because of lack of water. On the Great Lakes, blue green algae blooms now occur and persist for much longer periods.

The problem can be attributed to two key factors: climate change and human activity. The latter, says Dr. Prévost, has pushed the planet outside of the safe limits of its capacity for chemicals such as fertilizers, plastics and persistent contaminants.

Dr. Michèle Prévost, Industrial Chair on Drinking Water (one of Canada's oldest research chairs), and her team work to ensure access to quality drinking water. TOM MORIN

Many of these trace contaminants end up in our sources of drinking water and in the tap water of Canadians. Finding ways to remove them is a big focus for Dr. Prévost and her collaborators at Polytechnique Montréal and at the Centre de recherche, développement et validation des technologies et procédés de traitement des eaux, a research consortium of five academic institutions that includes Polytechnique Montréal.

"We work in close collaboration with homeowners, schools, municipal, provincial and federal governments to establish the scope of the problem and to find solutions to fix it," explains Dr. Prévost, whose applied research covers the entire water cycle to include water sources, drinking water, waste- and rainwater, industrial effluents, sludge treatment, air quality and odours.

Her co-operative approach to research has given her extensive access to information and resources, and delivered outstanding results. One major project – which looked at the presence of lead in the blood of 305 Canadian children – resulted in the push to remove lead service pipes and a significant reduction of acceptable lead standards across Canada.

As she continues to research solutions to Canada's water problems, Dr. Prévost sees the need for systems and societies to adapt to a changing future. Instead of the large water systems that have been in place for decades, communities need smaller systems that are more agile. Water could be segmented based on varying uses: for drinking, bathing or flushing the toilet.

"I'm optimistic that, even though we're facing such a serious problem, we will find innovative solutions," says Dr. Prévost. "Canadians are very good at innovating, and nowhere is that more evident than here at Polytechnique Montréal."

PARTNERSHIPS GENERATING VALUE FOR SOCIETY

The complexity of today's most pressing issues – including health, sustainability and digital transformation – calls for an approach informed by different perspectives. That's why Polytechnique Montréal makes collaboration a priority – and has built partnerships across disciplines and with government, academia, industry and the non-profit sector.

Among the many examples of impact-generating collaborations are the TransMedTech Institute and IVADO, two major projects in which the university is involved and that are funded, in part, by the Canada First Research Excellence Fund.

Two examples of successful collaborations at Polytechnique Montréal are the TransMedTech Institute (left) and IVADO (right). CAROLINE PERRON, CHRISTIAN BRAULT

TRANSMEDTECH INSTITUTE

Led by Polytechnique Montréal, TransMedTech is an institute that brings together a number of partners and associates and that was developed in 2016 "to catalyze the development of medical technologies in areas that are important for Canadians," says Carl-Éric Aubin, CEO and scientific officer at TransMedTech, and full professor at the Department of Mechanical Engineering at Polytechnique Montréal. "The idea was to provide researchers and clinicians with services that are normally not found in any university." This complex journey involves engineering, medicine, funding and a ton of regulatory work, says Dr. Aubin. Often, commercializing the product, getting it into the market and implementing it into the health-care system, is where Canadian innovation fails, so this collaboration – which includes three Montreal teaching hospitals – is designed to improve the chances of success.

"We have a long-term established partnership on the campus with engineering and medicine, but other faculties as well," says Dr. Aubin, whose own current research is in finding engineering solutions to spinal deformities in children. "Over time, we found that it was more valuable to work together on solutions, and by doing this, we were able to build a community that is working together."

TransMedTech also brings together medical technology companies, patients and health-care stakeholders. The goal of such collaborations, for which Montreal and the province of Quebec are recognized, is to "make a difference" and come up with innovations that will improve society, notes Dr. Aubin.

"Health is an important issue for our country and for every other nation," he says, naming such ideas as connected health, remote care, precision health and minimally invasive interventions. "There's an important need for innovation in terms of technology that could facilitate prevention, diagnosis and treatment."

Dr. Aubin, who is an engineer in the world of medical doctors, also works with colleagues who are kinesiologists and molecular biologists.

Such partnerships are essential "because it's impossible to find solutions if there's no interdisciplinarity," he says. "It's timely to work collaboratively and develop innovations that transcend disciplines."

IVADO (THE INSTITUTE FOR DATA VALORIZATION)

IVADO is a collaboration of Université de Montréal, HEC Montréal and Polytechnique Montréal with a mission to generate, encourage and support artificial intelligence initiatives. IVADO brings together researchers, business, government and institutions.

The institute, which is now led by Luc Vinet, a physicist and mathematician at the Université de Montréal, was launched in 2016 with a $95-million grant from the Canada First Research Excellence Fund and with Professor Gilles Savard from Polytechnique Montréal as its founding CEO.

"This is how IVADO was created, and through this collaboration with universities and also with many industrial partners, government and NGOs and so on, it did extremely well," says Dr. Vinet. "There was a mid-term review that was glowing with all but only a few of its key performance indicators already attained. This has been a tremendous success, and we're building on it now.

"IVADO has been the catalyst of the booming development of AI across Canada, but in particular, the Montreal area," he adds. "We're now proposing a truly new paradigm shift in the way AI is developed and adopted."

Dr. Vinet, whose own research is in mathematical quantum physics, notes that Facebook founder Mark Zuckerberg has given $500-million to Harvard to create an institute with the same goal as IVADO: to bring artificial intelligence closer to human intelligence. Already, IVADO has made it possible to hire 36 new faculty members, and the plan is to hire 48 more over the next six to seven years.

Part of the goal is to "speed up scientific discoveries and generate more value for society," Dr. Vinet says. "[IVADO] brings together 14 institutes that study everything from cancer research and AI to ethics – this is a broad and multisectoral collaborative effort, and it's a privilege to be asked to orchestrate it."

150 YEARS

ALEJANDRO ADEM
PRESIDENT, NATURAL SCIENCES AND ENGINEERING RESEARCH COUNCIL OF CANADA (NSERC)

As the first French-speaking engineering university in North America, Polytechnique Montréal has a long history of educating professionals who are attuned to the needs of our society. These professionals – along with research efforts at the institution – have been instrumental in moving Quebec, Canada and the world forward through the advancement and application of science and technology.

Continuing this trajectory of societal impact are the far-reaching and ambitious projects currently underway at Polytechnique Montréal. They will help to create a more sustainable future, for example, through the investigation and application of clean energy sources, green materials and technologies that promise better outcomes in many fields, including health care, manufacturing, transportation, mining, cybersecurity and more.

Due to close collaborations with academic, industry and community partners, the solutions under investigation for today's most pressing challenges at Polytechnique Montréal promise to advance the UN Sustainable Development Goals. Furthermore, the institution's long-standing commitment to equity, diversity and inclusion is reflected in efforts to reduce barriers to participation and increase diversity in the engineering profession.

On the occasion of the 150th anniversary, we congratulate Polytechnique Montréal on the many achievements that have helped to create a brighter and more sustainable future in Canada and beyond.

POLY MTL

150 YEARS

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ALL THE MORE REASON TO INNOVATE

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