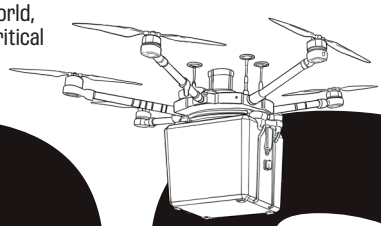
MOTOR SKILLS Robots are changing everything / **GOING VIRAL** How a virus can become a cure / **RISK AVERSION** In a warming world, adaptation is critical



MaRS

25 YEARS OF CANADIAN INNOVATION

NOVEMBER 2026

Scan to explore what's next at MaRS

Cracking the code

Canadian visionaries are advancing cutting-edge solutions in climate, healthcare, housing and space


MaRS
Network
Connect with advisory, capital and customers to develop unique IP into leading companies
A universe of possibility
Capital
MaRS IAF has invested more than $90 million in early-stage startups, sparking $2 billion+ in follow-on funding
Space
More than 1.5 million square feet of lab and office space
Analysis
Capital insights, user surveys and research projects to give startups a competitive edge
MaRS helps the next wave of innovators transform promising research into real-world impact
marsdd.com

MaRS

NOVEMBER 2026

We would like to give a special thank you to the Government of Canada and the Ontario Ministry of Economic Development, Job Creation and Trade for their ongoing support of MaRS programming.

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Clearing the path

At MaRS, we help innovators scale their solutions and compete on the global stage.

Grace Lee Reynolds is the CEO of MaRS, North America's largest innovation hub.

A FACILITY THAT EXTRACTS CRITICAL MINERAL RESOURCES from mine tailings. A self-driving lab that expedites the discovery of life-saving medications. A platform that halves the energy consumed by large language models. These are the kinds of groundbreaking solutions in our orbit at MaRS.

We work with founders who are extraordinary problem-solvers. But it's one thing to engineer a device or pinpoint a novel therapeutic; it's a different battle to bring it to market. MaRS was founded to make that easier: Twenty-five years ago, physician and civic leader Dr. John Evans recognized Canada needed a place to incubate the best ideas in science and technology more than it needed another condo. Then, as now, the country's innovators struggled to commercialize their innovations. He established MaRS to help clear obstacles so that we can all see the impact of their solutions faster.

I've been a MaRSian for the better part of the past decade and a half, and I still find myself marvelling at what a privilege it is to have a hand in shaping a better future. In 2011, I was flipping through *The Globe and Mail* and spotted a "finance director wanted" ad. (An ironically analog origin story for the CEO of a tech hub.) It was a very different time, for MaRS and for the world.

But in any ecosystem, the species that flourish are the ones that evolve and adapt to their surroundings. MaRS is no exception. The past quarter century has required constant iteration and recalibration of where our resources are most needed. Although MaRS remains committed to inclusive innovation with the twin goals of social impact and economic prosperity, it's our agility and eagerness to meet the moment that have allowed us to thrive. The mercurial geopolitical landscape informs our sense of the role Canada plays within a broader system; the global market is integral to our pursuit of digital sovereignty and domestic growth. In turn, our understanding of the importance of place has expanded – catalytic connections can happen in the atrium of the MaRS Centre, online during a livestreamed panel or abroad during a market visit for one of our mission-based cohorts. We're the spark that transfers that energy from node to node to node.

When I responded to that ad, I had only a vague notion of what MaRS was. But as I connected with MaRSians, it became apparent they shared a distinctive quality – a get-it-done pragmatism paired with a drive to pursue the loftiest dreams. That's when I thought: *Oh, my gosh, I really want to be part of this.* That essence is still at the heart of the organization. We are resolute in our mission to help Canadian entrepreneurs make global impact while strengthening the foundations of our country. With the world in flux, when accelerating change seems like the only constant, domestic innovation is a powerful driver of progress. ●

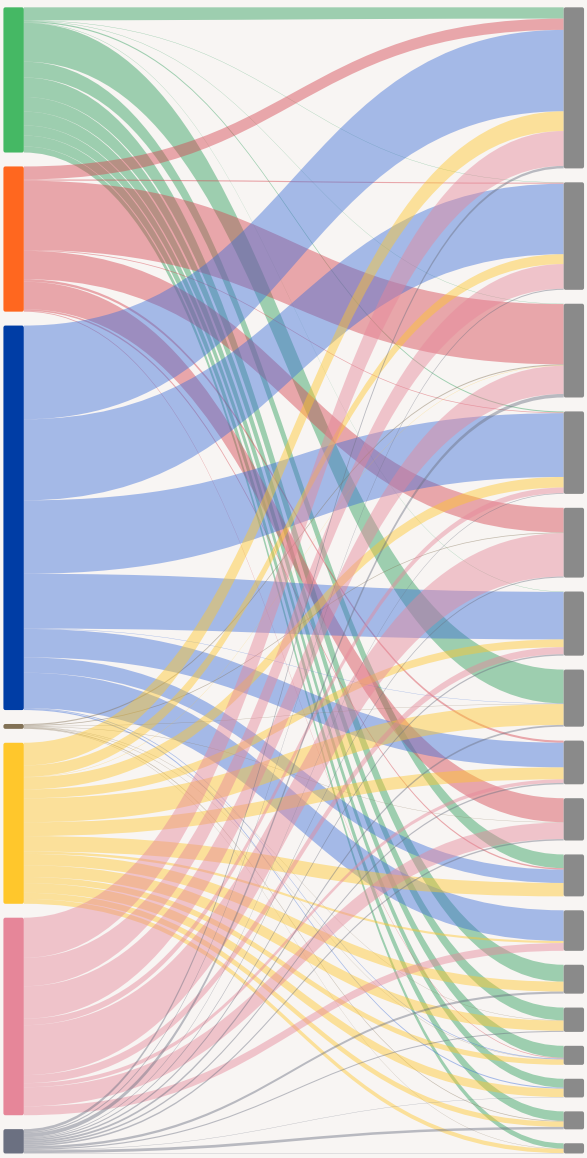


GRACE LEE REYNOLDS, CEO
MARS DISCOVERY DISTRICT

PHOTOGRAPHY: COLIN SNEYD **RESEARCH:** SANA MAQBOOL AND POUYA DANESHPAJOOH

Life on MaRS

New startups are constantly entering the MaRS orbit: More than 1,200 ventures across Canada can access our services at any time. Here's a snapshot of what they're working on.



Supporting tech (13.2%)

Blue J, an AI company that streamlines tax research processes for the legal sector, raised U.S.$122 million last year.

Business services & productivity (22.4%)

Basetwo's AI platform helps manufacturers optimize operations in real time.

Biotech (19.6%)

Ripple Therapeutics, a biotech firm that develops advanced ophthalmic drug delivery systems, was founded by leaders of Interface Biologics, which was the first-ever tenant in the MaRS Centre.

Finance & fintech (17.2%)

Calgary-based **ZayZoon's** platform allows workers to access a portion of their wages ahead of their regular pay period, providing an alternative to payday loans.

Digital health (14.6%)

Commerce & marketplace (13.4%)

Close to 50 companies are developing batteries and long-duration power storage, including **eZinc**, which is currently working on a backup energy project in California.

Energy & grid (19.6%)

Logistics & mobility (9.1%)

Qidni Care has developed a portable and nearly waterless dialysis system that can run on batteries. Its compact system is designed to treat kidney failure in remote, disaster or military contexts.

Medical devices (8.8%)

Built environment (8.8%)

Education & workforce (8.5%)

FireSwarm Solutions is developing specialized drones to fight wildfires. Its autonomous devices can deliver large water or retardant payloads in remote areas, during times of low visibility or under other conditions that make it too dangerous for human crews.

Waste & circularity (6.0%)

Climate & carbon (5.1%)

Food & agtech (4.0%)

Transportation & mobility (3.9%)

Sustainable materials (3.8%)

Water & resource systems (2.1%)

Montreal firm **Opalia** is developing a way to produce animal-free milk by growing bovine mammary cells in bioreactors.

Cleantech (13.2%) Health (17.3%) Enterprise (44.7%) Cleantech + health (0.4%)

Cleantech + Enterprise (9.8%) Health + enterprise (13.5%) Cleantech + health + enterprise (1.2%)

The MaRS difference

CATALYZING CHANGE

As North America's largest innovation hub, MaRS helps Canada's most innovative leaders commercialize technologies that can help tackle the world's toughest challenges.

79%
of MaRS ventures use AI in their internal operations.

31,000+
Number of people employed by MaRS ventures.

$14.7B+
Amount raised by MaRS-supported startups since 2020.

Head trip

Can ultra-low doses of psychedelics abolish anxiety?

BY KATRINA ONSTAD



Judy Blumstock
CEO, Diamond Therapeutics

JUDY BLUMSTOCK HAS A FAVOURITE psychedelic song: the polyphonic 1977 folk-rock hymn "Cathedral," by Crosby, Stills & Nash. In it, Graham Nash sings of dropping acid in a Rolls-Royce bound for Stonehenge, and stopping by Winchester Cathedral en route. There, he has a few cosmic revelations "high upon the altar."

Blumstock is a sucker for harmonies, and she visited the cathedral recently, blasting the song in her headphones. "It's a source of inspiration," she says.

But Blumstock is at the forefront of a very different drug revolution than the one espoused by Nash and his generation. Rather than seeking out the mind-altering effects of psychedelics, she and her Toronto-based pharmaceutical company, Diamond Therapeutics, are exploring how extremely low doses of psilocybin, the psychoactive compound found in "magic mushrooms," can actually calm – not blow – one's mind. Diamond recently commenced a Phase 2 clinical trial to see how subjects with generalized anxiety disorder (GAD) respond to this treatment.

One of the early taglines Blumstock considered for Diamond Therapeutics was "things can get better," and there's urgency behind that sentiment: More than 5 million Canadians experience significant symptoms of mood, anxiety or substance use disorder. The number of Canadians suffering specifically from GAD doubled between 2012 and 2022 – it's now 5.2 percent of the population – and research shows that up to 40 percent of patients with anxiety may not respond to first-line treatments. "My team and I share that drive to improve the human condition," says Blumstock.

As a kid growing up in the late '60s, the message inside and outside her Hamilton, Ontario home was that drugs were bad. It wasn't always thus. The medical applications of LSD and other psychedelics had been studied extensively in the preceding decade, but recreational use of the Stonehenge-road-trip variety helped trigger a Nixon-era moral panic.

PHOTOGRAPHY: COLIN SNEYD

Psychedelics, including psilocybin, were placed under DEA Schedule 1 status in 1970, the most restrictive category of controlled substances, and research cratered. Canada imposed similar restrictions.

Blumstock herself was fairly psychedelics-agnostic until an encounter with a 2006 article in *The Economist* called "The God Pill." The piece reported that a small group of researchers were resuscitating long-dormant investigations into the mood-lifting powers of hallucinogens. Blumstock became captivated by the question of how to separate the medicine in psychedelics from the trip: At low doses, could the compounds' therapeutic effects survive without the hallucinations that made them so controversial?

Blumstock had studied biology at the University of Toronto but ended up on the investment side of the life sciences sector. When she tested the waters with potential investors, she discovered that the God Pill–inspired company she envisioned wasn't an easy sell. "It felt like the world's worst idea for a long time. Nobody thought that the low doses would work," she says.

But if they do work, it would represent a fundamental shift from today's psychedelic treatments, which typically rely on high doses administered over multiple sessions in tightly controlled clinical settings, with extensive supervision before, during and after the experience. A low-dose treatment that works without inducing hallucinations could dramatically simplify that model, according to Ishrat Husain, a senior scientist at the Centre for Addiction and Mental Health and University Health Network. "It could potentially be taken outside that supervised setting, which would move it from a boutique intervention into something resembling conventional psychiatric prescribing," he says.

The implications are profound: Treatment could become accessible to far more patients, expanding access while reducing the time, cost and specialized resources required for current options.



Chill Pills

A brief, recent history of psychedelics in medicine.

1954

Saskatchewan psychiatrist Humphry Osmond uses LSD to treat alcoholism.

1958

Albert Hoffman, discoverer of LSD, isolates psilocybin in mushrooms for use in psychotherapy.

1990

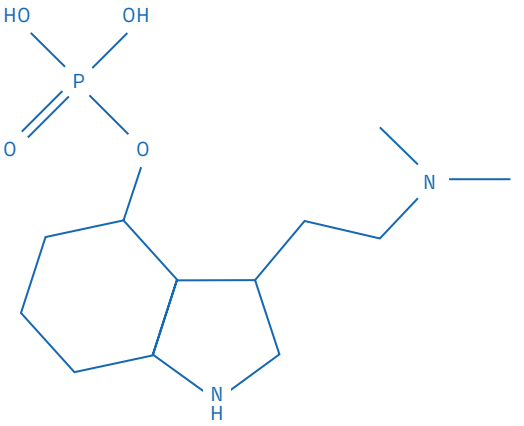
A second wave of research begins with Rick Strassman's DMT experiments at the University of New Mexico.

2023

Australia becomes first country to approve use of MDMA for PTSD treatment.

2026

An international consortium led by a McGill researcher demonstrates, for the first time, that different psychedelics produce common brain activity.



Psilocybin molecule

Almost a decade ago, the legalization of medical and recreational cannabis loosened the stigma and primed the culture for a conversation about a therapeutic paradigm for once-illicit drugs. Diamond Therapeutics launched in 2018, its name a nod to another psychedelic anthem, "Lucy in the Sky With Diamonds."

Backed by private investors and support from the Ontario Brain Institute, Diamond Therapeutics' first research study found that low-dose, sub-perceptual psilocybin improved motivation and attention in rats. A Phase 1 human trial was promising enough that Health Canada approved a much bigger Phase 2, now underway at Kingston General Hospital, to evaluate the world's first at-home, non-hallucinogenic psilocybin treatment. Diamond will be assessing the drug's safety and also how it affects the participant's quality of life, testing the hypothesis that psilocybin can increase neuroplasticity – the brain's ability to reconfigure itself. If the brain is a network of well-worn paths, psilocybin appears to rough some of them up, dislodging those entrenched habits of thought that can trigger anxiety and leaving space to learn new, more positive emotional habits.

The trial is a major development in psychopharmacology, but there are many more clinical studies and regulatory hurdles before a doctor will be able to write a prescription for psilocybin. "We're still seven to eight years from a drug being on the market," says Blumstock.

This past spring, however, Blumstock's sector suddenly got a green light to accelerate. In April, Donald Trump signed an executive order directing the FDA to fast-track research into psychedelic therapies. Drugs and culture collided once again at the White House signing ceremony, where Trump was accompanied by the world's biggest podcaster, Joe Rogan. Rogan, an advocate for the plant-based psychoactive compound ibogaine, had messaged Trump with a plea to hurry the research, and it was quickly a done deal.

Diamond is a beneficiary of this moment: The executive order should make it easier to get agency approvals for new research that's tied to a multi-million dollar funding award from the U.S. Advanced Research Projects Agency for Health (ARPA-H). That award builds on the Phase 2 trial, adding another 50 subjects to the 60 that are part of the Kingston program, and launching a clinical site in Tampa, Florida to focus on the veteran population. With this expansion, Diamond hopes to gather enough biological data to identify biomarkers – objective signs in the brain or body that could reveal who responds best to the treatment and why. If successful, the research will make psilocybin treatment targeted and precise, bringing relief to many.

"Things have changed," says Blumstock. "These drugs had such a perceived bad legacy but it's not 1971 anymore. We have a seal of approval. I think 15 years from now, we're going to have a pharmacopeia of options." ●



PLACE

Cold effect

Relocalize's robot-operated ice factories help food companies reduce waste and costs.

Here's a hot idea: Instead of trucking cold packs and ice cubes to food-processing plants to preserve the temperature of shrimp rings, Greek yogurt and other victuals as they travel to distribution centres and then on to your local grocer, a Quebec startup has developed a way to cool things off in situ.

Relocalize's fully autonomous micro-factories make cold-chain products on demand, sidestepping both middle-mile headaches and ozone-depleting refrigerants. The company's first commercial deployment is at a grocery warehouse in Florida, where seven robots crank out, package and palletize 20 tonnes of ice per day, reducing water waste, plastic pollution and more than 90 percent of the site's transportation-related emissions.

"We hear a lot about autonomy — cars, taxis, drones — but this is the world's first end-to-end autonomous factory for the food industry," says co-founder and CEO Wayne McIntyre. Relocalize plans to deploy hundreds of these decentralized production facilities in the coming years, all overseen remotely from the company's Montreal headquarters. The value proposition, says McIntyre, is simple: "It's better, greener and cheaper." – KATHRYN HAYWARD





Arca's project in Western Australia was the first time a mineralization project was deployed at an active mine site.

Rock and roll

Arca's autonomous rover churns mine tailings to clear the air.

BY KATHRYN HAYWARD

With its corkscrew wheels and tiller blades, the main objective of Arca's self-driving device is, quite literally, to stir things up. The rover roams the barren plains of waste material at mining sites, sparking a natural chemical reaction that removes carbon dioxide from the atmosphere and permanently stores it in rock. While it sounds like alchemy, enhanced rock weathering is a highly scalable climate solution that cleans up two messes – mine tailings and legacy emissions – at once.

TURNING AIR INTO STONE

Canada generates around 650 million tonnes of geological waste from mining each year. That rubble, however, is often full of magnesium and calcium, elements that bond with carbon dioxide to form mineral salts when exposed to air. "Carbon dioxide is acidic, and magnesium and calcium are alkaline," explains Sean Lowrie, head of external affairs at the Vancouver startup. As he puts it, this "powerful combination produces new baby rocks," an order of magnitude faster than natural geological formations.

KICK-STARTING A REACTION

Not all rocks respond that quickly, however. Arca shuttles the unreactive material through a massive microwave on a conveyor belt, which "blows apart the crystal structure, liberating more magnesium so it will react with the carbon dioxide," Lowrie says.

CREATING A CARBON SINK

Arca's smart monitoring system continuously analyzes the site, identifying the spots where rovers should churn to bring new tailings to the surface or highlighting which areas might need an extra zap. It also tracks exactly how much carbon is being mineralized to deliver high-quality carbon removal credits.

BUILDING A NEW GROWTH INDUSTRY

Canada's many decades of mineral extraction mean there are mountains of tailings that could be processed, creating new revenue streams for mining companies while cleaning up the atmosphere. "This is an emerging industry," says Lowrie. "One that will be needed for centuries." ●

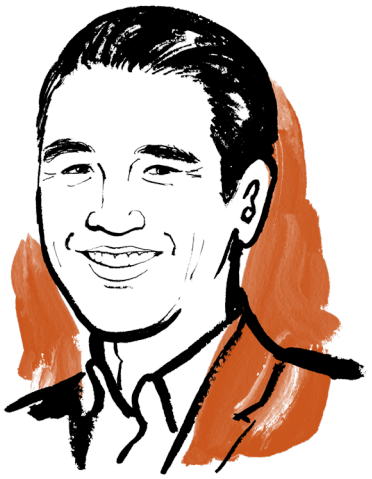
The next big bets in Canadian technology

These are head-spinning times for Canada's entrepreneurs. After decades of taking free trade and globalization as standard, geopolitics has barged back into the boardroom. Trade barriers are replacing trade deals and economic priorities are shifting toward sovereignty and resilience.

But the long-term question facing Canada is how we can compete, particularly in the key technology sectors that will shape the future.

As Ottawa spends billions to reorient the economy, it has become a national imperative to identify the green shoots that need the most careful tending.

Three MaRS experts share their thoughts on where they're looking for the next wave of Canadian innovations — and what's needed to ensure those solutions make the leap from genius idea to market-leading product.



Backing intelligent machines is the smart move

William Ma is the managing director of the MaRS Investment Accelerator Fund, which invests in early-stage ventures that have the potential to disrupt entire sectors.

WHAT I'M MOST EXCITED ABOUT: Robotics. We're not talking about humanoids like Rosey from *The Jetsons*, yet. Rather, it's industrial automation using intelligent machines capable of perception, reasoning and action, known as physical AI. As AI migrates from chatbot to robot, it can take a much greater range of actions and has the potential to make almost every industry more productive.

There are some exciting Canadian startups in this field, including Toronto-based startup ForceN, which makes sensors for surgical and logistics robots (see page 35). For physical AI companies, early deployments can create competitive advantages that are difficult for others to replicate. That's because solving complex challenges in the real world involves integrating into customers' workflows, building trust, gathering data and handling the strange edge cases that only emerge in a live environment. Each deployment makes the product better, creating advantages that compound over time.

CANADA'S ADVANTAGE: China has an enormous lead in robotics manufacturing and deployment, so Canada shouldn't try to compete everywhere. We can specialize in sectors in which we have the talent, expertise and customers to solve hard problems. Agriculture is an obvious example, where we already have companies like Haven Greens operating a fully automated greenhouse and Vivid Machines (see page 16), which uses computer vision to monitor crop health. The auto sector is another.

But there are also areas where our geography could compel us to excel. With our vast expanses and industries like mining and fossil fuel extraction, there's huge potential to use autonomous drones for maintenance of pipelines and remote facilities. Skygauge, which is based in Hamilton, is already using manually controlled drones to perform ultrasonic inspections of ships and industrial exhaust stacks and even conduct some rust repairs and painting. It's easy to imagine that more of these tasks could be automated.

THE CHALLENGE: Canada's larger constraint may be adoption, not invention. Industrial infrastructure is expensive and companies may have sunk millions of dollars into their existing ways of working, which creates a reluctance to change. Developing physical AI is also more capital intensive than building software. But this isn't an all-or-nothing situation. There may be instances where existing industrial robots can be made intelligent through software upgrades and enhancements like adding computer vision. You don't always need a fully self-driving car; sometimes adding cruise control and parking assist will do the job.

MOONSHOT IDEA: Make Canada the world's first autonomous industrial economy. Our mines, farms and remote infrastructure could become proving grounds for intelligent machines doing increasingly complex physical work. If we can make those systems work in some of the world's toughest environments, we can export them anywhere. ●

↑ Physical AI is where that artificial intelligence starts to move beyond the screen and into the machines and infrastructure around us.



Canada must go heavy on metals

Tyler Hamilton is senior director of climate at MaRS, where he builds coalitions between ventures, corporate partners and investors to create a more sustainable economy.

WHAT I'M MOST EXCITED ABOUT: Canada is getting serious about critical minerals. China dominates the global supply of these vital elements and components derived from them, including providing 90 percent of rare earth magnets that are used in electric cars, wind turbines and other electronics. That has been a concern for years, but after Beijing briefly imposed export controls last year, Canada and other G7 countries have pledged to build more of our critical mineral supply chains at home.

The federal government is now investing $2 billion to make it happen. That doesn't just mean developing environmentally responsible ways to mine. It means creating the entire value chain here, including the infrastructure to refine the ore more efficiently and developing better systems for recycling the supplies that are trapped in old consumer electronics, industrial equipment and batteries.

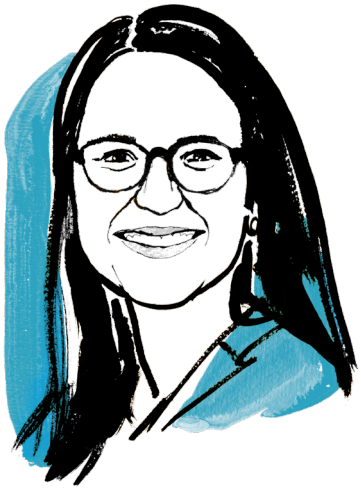
CANADA'S ADVANTAGE: This country sits on a (metaphorical) gold mine with proven reserves of 34 critical minerals, including uranium, tin, magnesium and tungsten. We are also a significant producer of copper, which is the main component in wires. Scarcity of copper is expected to be a significant bottleneck as electricity grids expand to support the shift away from fossil fuels.

But the knowledge in Canadians' heads is just as important as the minerals under our feet. We have one of the world's strongest climate technology ecosystems, and our companies usually account for 10 percent of the entries on the global Cleantech 100 list. We also have deep pools of mining expertise, with people who have 20 or 30 years in the industry. That combination is creating some truly extraordinary technologies. Companies like Exterra Technologies, which is extracting critical minerals from asbestos mining waste. Or Cyclic Materials, which is pioneering the concept of "urban mining" and can recover 90 percent of the rare earth elements in everything from car components to hard disk drives.

THE CHALLENGE: When it comes to trade, Canada tends to sell low and buy high. While our mineral sector exports grew 6 percent in 2025 to reach $162 billion, we are a net importer of the high-value goods that those raw materials are eventually used in.

Reversing this pattern and building a full mineral supply chain at home will be a national project spanning decades. Ironically, Canada has a solid playbook to follow: the oil sands. They came into existence thanks to huge public funding in the '70s and '80s to build the infrastructure that eventually made them profitable. We need to repeat that approach, with federal and provincial governments working together with innovators and industry to build a sustainable critical minerals ecosystem for the clean economy.

MOONSHOT IDEA: Putting the frost back in permafrost. A staggering amount of carbon is locked up in the world's permafrost as methane and carbon dioxide, likely twice as much as is in the atmosphere. But it's starting to melt, setting us on a path toward catastrophic releases of greenhouse gases. Some promising technologies are emerging in Canada that may at least slow the thawing. These include reverse heat pumps that can refreeze the ground. As a bonus, they also generate heat that can warm greenhouses for remote communities to grow vegetables. ●



Urban mining – recovering critical minerals from e-waste – can help shore up our supply chains. Currently, just 1 percent of rare earth elements are recycled globally.

Clinicians can see more clearly

Louise Pichette is director of health at MaRS. She helps accelerate the growth of high-potential startups in biotech, medical devices and digital health.

WHAT I'M MOST EXCITED ABOUT: Image-guided therapeutics (IGT), which use techniques like ultrasound, MRI and CT scans to give surgeons a real-time view of what's happening inside the body as they are treating the patient. This is a rapidly advancing area where Canada has established an early lead, partly through pioneering work at Sunnybrook Hospital. Doctors there were the first in the world to use ultrasound to create tiny openings in the brain's protective barrier to precisely deliver a therapeutic enzyme for Parkinson's disease. IGT is now being used for a growing range of procedures, including treatment for breast and lung cancers, and it can be paired with AI technology and robotics to enable surgeons to make incredibly precise incisions and minimize damage to healthy tissues.

CANADA'S ADVANTAGE: The work at Sunnybrook has created a deep talent pool with expertise in IGT, and several startups have spun out of it already. A notable one is MOLLI Surgical, which developed a system to mark soft tissue tumours in breast cancer and was eventually acquired by Stryker. Canada is also building the infrastructure for an IGT ecosystem across the country. For instance, INOVAIT, a nationwide network of institutions and companies working in IGT and AI, has funded 86 projects to the tune of $128 million, with backing from the federal government. And we've seen some significant funding rounds, including Sound Blade Medical raising more than U.S.$16 million and Profound Medical raising $40 million.

THE CHALLENGE: The U.S.$5-trillion American healthcare market exerts a gravitational pull that's difficult for Canadian ventures to resist. Securing FDA approvals and entering the American market is the top priority for most health ventures. Geography is destiny, so we must accept this reality and work to ensure that companies founded in Canada stay headquartered here rather than relocating to the U.S. That means we need to make Canada the best place to grow a sustainable business. Increasing the supply of capital is vital, but there are other factors that could help. Tackling barriers to interprovincial trade is an obvious one, but we could also be more ambitious in seeking to harmonize some processes with the FDA and EU regulators to smooth the path to market for our ventures. If we are nimble and willing to adopt innovative approaches, then we can grow globally leading companies here in Canada.

MOONSHOT IDEA: Use AI to make healthcare more equitable. AI can bring capabilities to places where clinical expertise is in short supply. Corvita Biomedical, for instance, is developing an automated incubator for premature infants in remote communities, with an embedded AI that can screen for conditions like neonatal jaundice across all skin tones (see page 18). According to the Canadian Institute for Health Information, little progress has been made in closing the gap in health outcomes between rich and poor Canadians over the past decade. My hope is that AI could finally change that. ●



Image-guided medicine holds promise for diagnosis, too. Retinal scans, for example, can help physicians detect disease before any symptoms emerge.

ILLUSTRATION: LAUREN TAMAKI



Going viral

Viruses have shaped life for billions of years. Now scientists are learning to turn their most ingenious tricks into treatments for cancer, genetic diseases and other disorders.

BY CAITLIN WALSH MILLER

IT STARTED with an eye exam. In 2013, when Adam Sorenson, a 13-year-old from Calgary, visited the optometrist before the start of eighth grade, a routine scan revealed swelling in his optic nerve. A follow-up MRI revealed he had glioblastoma multiforme, or GBM, the most aggressive form of brain cancer, with a typical life expectancy of just 12 to 18 months after diagnosis.

Surgeons removed all but 2 percent of the baseball-sized tumour, and Adam went through radiation. For nearly a decade, there was no sign of disease. Then, in 2023, something in his eye felt off. His cancer was back, this time in his brainstem and spinal fluid. He was offered palliative care.

But Adam's father had something else in the works. At the time of the initial diagnosis – by some extraordinary coincidence – Brad Sorenson was working for a biotech company, developing therapies for the very cancer that had taken root in his son's brain. The startup was testing whether lipid nanoparticles, which resemble a kind of microscopic padded envelope, could deliver genetic instructions into a patient's cells, teaching the immune system to recognize and attack the tumour.

In 2015, he founded Providence Therapeutics to further pursue the idea. For eons, viruses have been slipping genetic instructions into cells, which dutifully build the proteins that then flag those cells for destruction. What if that process could be hijacked to heal instead of infect?

The concept of mimicking viral mechanisms is at the centre of some of the most promising therapeutic science being developed today. From cancer vaccines to gene therapies to viral-vector manufacturing, researchers are learning to borrow one of biology's oldest tricks and turn it against diseases that resist almost everything else.

This is how a virus becomes a cure.

SCIENTISTS ESTIMATE there are 10 nonillion – that's 10 followed by 30 zeros – viruses on our planet. According to recent research, only a few hundred of those are able to infect humans. Most viruses, really, have nothing to do with us at all.

Where Providence's tumour-specific mRNA vaccines emulate viruses to trigger a targeted immune response, oncolytic virotherapy mobilizes the

viruses themselves to kill cancer. Ottawa researcher John Bell has been a leader in the field of oncolytic (a.k.a. cancer-killing) viruses since the 1990s. As he explains, our bodies have developed mechanisms that allow us to coexist alongside most viruses, and protect us from ones we're susceptible to. "Our cells are altruistic," he says. "If one gets infected by a virus, it'll kill itself to stop the spread." That self-sacrifice is part of the antiviral machinery.

Cancer cells are the opposite of altruistic. They want to live forever. And in that quest for immortality, they have disabled the pathways that would normally trigger cell death. On the flip side, that suppression also leaves cancer cells unusually vulnerable to viral infections. (Immortality always comes at a cost.) Bell and colleagues at the Ottawa Regional Cancer Centre Research Laboratories reported the finding in a foundational *Nature Medicine* paper in 2000.

In principle, a virus-susceptible cancer cell should be easy prey. That vulnerability, however, normally lies dormant and unexploited, because most cancers never meet a virus in the first place – the body filters them out long before they'd make it to a tumour. But what if doctors could flood the body with a virus and force that chance encounter? The healthy cells, with their intact antiviral machinery, would shut down the infection. In a tumour, the virus could take hold and spread, ripping apart the cancer cells from the inside. "That was the original dream, anyway," says Bell.

Turns out, that's only part of the story. The viral infection acts more like a flare. As an oncolytic virus invades the tumour, it attracts the attention of an immune system that had largely ignored it. The immune response is the real weapon.

In 2006, Bell helped found the Ottawa Hospital's non-profit Biotherapeutics Manufacturing Centre to develop clinical-grade versions of those viruses. Since then, it's produced more than 300 clinical batches and supported more than 20 trials worldwide. This past summer, bolstered by millions in federal funding, the centre rebranded as Boreal Biomanufacturing and expanded its capacity. Boreal engineers viruses to play a variety of roles. In addition to tumour-invading oncolytic viruses, it also makes viral vaccines that train the immune system to recognize a future threat. Once stripped of their ability to replicate, viruses can be repurposed as couriers that ferry healthy genes into a patient's cells. Those delivery viruses have become essential tools in modern medicine, powering gene therapies and advanced treatments such as CAR-T, which genetically reprograms a patient's own immune cells to attack cancer.

This is no longer niche science. Early viral-vector therapies were built for rare diseases, sometimes needing only 1,000 doses across an entire development and commercialization run. In 2022, there were 24 gene therapies approved for global clinical use. Today, there are 40, many of which rely on viral vectors, as well as 37 RNA therapies. They're also expanding to treat more common diseases, including cardiovascular and neurological conditions. Success in the lab has created a new bottleneck: manufacturing at scale. Researchers estimate the industry will need to increase viral-vector production capacity at least 10-fold to meet demand.

10,000,000,000,000,000,000,0

Estimated number of viruses on this planet.

TO MAKE A therapeutic virus or viral vector, you first have to grow it inside living cells. It's the central irony of viral medicine: The same cellular defences that keep us alive during a real infection are, in a manufacturing lab, the enemy.

Biotech companies are attacking the issue from every angle. Some are engineering cell lines that are better at producing viruses from the outset. Others work on raw inputs: Toronto's Novel Bio makes plasmid DNA, the genetic template cells used to build many viral vectors, while Edmonton's Future Fields uses genetically engineered fruit flies to grow specialized proteins involved in therapeutic R&D. Still others are redesigning bioreactors or trying to eliminate living cells from the process altogether.

Jean-Simon Diallo has a different approach. As a postdoctoral fellow in Bell's lab, he helped identify a set of small molecules that enhance viral infection, quieting the cell's alarm system just long enough to promote the growth of a virus instead of fighting it off. In 2018, he founded Virica Biotech based on that research. The Ottawa company now has a library of more than a hundred of these molecules, which it refers to as viral sensitizers, or VSEs.

According to Diallo, Virica's VSEs can boost yields two to six times. A single batch of manufactured virus can cost millions to produce, and a clinical trial might require the equivalent of 10 batches to hit its target supply, so the economics are not trivial. Virica works with biotech and pharma firms, contract manufacturers and academic labs that can now buy cheaper pre-formulated VSEs off the shelf. One of the company's current projects, backed by federal innovation funding, pairs its enhancers with Fujifilm Biosciences' cell culture media to boost yields specifically for a vector called adeno-associated virus, or AAV – an incredibly prolific platform in gene therapy and one of the hardest to manufacture at scale.

Over the years, Virica has screened tens of thousands of molecules against different viruses, building a massive dataset of what works and what doesn't. As manual screening grew more expensive, first during COVID-era supply shortages and later amid rising material costs, the company began asking whether those lessons could be used to predict promising candidates. This spring, Virica launched Viric.AI, a machine-learning platform that mines that data to guide experimental design, identify high-value conditions earlier, reduce development timelines and improve viral yields.

One of the first tests of that theory is happening through Canada's Pandemic Preparedness Hub, known as CP2H, which is using Viric.AI to find molecules that can boost production of adenovirus. The virus, which typically causes a sore throat and a cough, has a fraught history in medicine. In 1999, 18-year-old Jesse Gelsinger died after

a severe immune reaction to an adenovirus used in experimental gene therapy, and the field largely shifted to milder vectors. But the same reaction that makes adenovirus risky for gene therapy makes it useful in a vaccine, where provoking the immune system is the goal. It was the backbone of the Oxford-AstraZeneca and Johnson & Johnson COVID vaccines. Swap out the genetic payload and the same shell carries a new vaccine. The challenge is making enough of it. If Viric.AI can help optimize production, it

100,000,000,000

could become a tool to rapidly scale domestic vaccine manufacturing when the next pandemic hits. "Imagine you're trying to make a billion doses of a vaccine in a year. We can double the yield," says Diallo. "It would make a massive difference."

PREPARING FOR the next pandemic is one kind of race against time. Treating a patient who has glioblastoma – and who happens to be your son – is another.

In 2024, Providence Therapeutics was working on a vaccine for glioblastoma multiforme. The therapy took its cue from the viral strategy: An mRNA strand, delivered inside a protective lipid nanoparticle, instructs cells to produce neoantigens – proteins unique to a patient's tumour. The immune system then learns to recognize those markers and specialized cells attack the cancer cells carrying them.

When Adam Sorenson's cancer came back, the vaccine was enmeshed in Health Canada's complex approval process. The Sorensons planned to travel to Mexico, where the drug could be approved for use faster, but a bureaucratic error scuttled the vaccine's import permit. Fixing it would take months; Adam had been given weeks to live.

The next day, Sorenson retrieved the vaccine from the freezer at Providence's offices. He remembers staring at the vial. "Ten years of high and lows," he said later, "and it comes down to something the size of a teardrop." After a long conversation, father and son recorded a video documenting Adam's informed consent. Sorenson injected the vaccine himself. Neither expected it to work.

That treatment was followed by a period of remission. When Adam had another recurrence in 2025, Sorensen amended the vaccine based on the updated genetic profile of the tumour. In September 2026, Adam celebrated his 26th birthday and hit a significant milestone: he's lived more years with GBM than before his diagnosis.

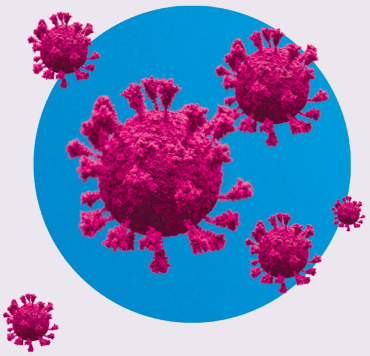
A single case, especially one outside a clinical trial, cannot prove the vaccine worked. But Providence has administered the treatment twice through Health Canada's OLIP program in partnership with Alberta Children's Hospital, and the subjects' immunological and clinical responses, Sorenson says, "have given us early indications that we're on the right track."

Now the company is trying to answer a critical question: Is this a breakthrough, or a miraculous outlier?

Last February, Providence launched a clinical trial testing individualized mRNA vaccines medulloblastoma, diffuse midline glioma and ependymoma – three rare, terminal pediatric brain cancers. Run across eight pediatric hospitals in Australia, the trial uses genome sequencing to identify each child's specific tumour markers, then manufactures a custom vaccine.

Over the past few decades, Bell has seen investment interest in virology oscillate. Now, he believes it's climbing again. Several oncolytic viruses are nearing regulatory decisions – dozens more are in development – and one approval could reshape how investors see the field. Emerging technologies, like self-amplifying RNA – mRNA engineered to copy itself inside a cell so a smaller dose goes further – are opening another frontier. The common thread is the virus's playbook, adapted for medicine.

It's tempting to think of viruses as outsiders, as invaders. "They're brilliant – and they're diabolical," says Bell, "but they're not to be feared." Our genomes carry the fingerprints of ancient viral encounters, and much of what scientists know about how cells read genes, build proteins and communicate with one another came from studying the ingenious ways viruses manipulate those same processes. The better we understand viruses, says Bell, the better we understand ourselves. ●



The first viral hack

In 1904, a 42-year-old woman with myelogenous leukemia came down with the flu, and then something unexpected happened. Her enlarged liver and spleen shrank down to nearly normal size, and her elevated white blood cell count plummeted. The remission was brief — she died 18 months later — but similar anecdotes piled up over the next few decades, hinting at the ability of a virus to trigger anti-tumour immunity.

The first intentional attempts to turn viruses into cancer treatments were as audacious as they were dangerous. In the 1950s, doctors infected patients with live viruses, including hepatitis B, West Nile and adenovirus, hoping the pathogens would destroy tumours. There were flashes of promise but there were also fatal infections.

One of the issues — besides the questionable medical ethics — was that, for decades, scientists had little choice but to work with the viruses nature had given them. Recombinant DNA technology, which came of age in the 1990s, changed that. Researchers could now edit viral genomes, retaining the features that made viruses effective invaders while stripping away those that caused disease. The age of viral medicine had begun — not by defeating viruses, but by learning to repurpose their power.
– CAITLIN WALSH MILLER



Portraits of innovation

The challenges facing the planet are many, from climate change to food security to our evolving medical needs. Here are the visionaries confronting them head-on with cutting-edge solutions.

BY DYLAN ADAMSON, FLANNERY DEAN, SARAH HAMPSON, JASON MCBRIDE AND STÉPHANIE VERGE
PHOTOGRAPHY BY CARMEN CHEUNG AND DARREN CALABRESE



Clearing the air by fixing our rivers

EDMUND HALFYARD
CO-FOUNDER AND CTO, CARBONRUN
JOINED MaRS IN 2023

Research scientist Eddie Halfyard is on a mission to save the planet river by river. CarbonRun, the Nova Scotia–based company he co-founded in 2022 with Dalhousie professor Shannon Sterling, adds powdered limestone to waterways, which effectively neutralizes over-acidified rivers while also restoring biodiversity. The number of young salmon has tripled in the rivers that CarbonRun has treated, and the company is also the first in the world to verifiably sequester carbon dioxide in rivers. “We want to put a dent in this climate challenge,” Halfyard says.

Shot at CarbonRun’s dosing site on the Moser River in Nova Scotia.

Increasing yields

JENNY LEMIEUX
CO-FOUNDER AND CEO, VIVID MACHINES
JOINED MaRS IN 2024

Jenny Lemieux spent 20 years developing artificial intelligence tools to help a variety of companies, including Ford, GM and Scotiabank, better understand their customers' needs. In 2020, she turned her eye to agriculture, a world in which she had grown up. She soon discovered that growing fruit, in particular, was ripe for transformation. With her company Vivid Machines, she developed a computer vision platform that captures real-time data about trees and vines. The tool can be mounted on existing farm equipment and helps growers optimize crop production and maximize cost efficiencies. "Think of it like precision medicine for trees," says Lemieux. "We give each tree exactly what it needs."

Shot at Cave Spring Vineyard in Beamsville, Ontario.







Making it easier to build

AZAM KHAN
CO-FOUNDER AND CEO, TRAX
JOINED MaRS IN 2023

There are many reasons Canada remains mired in a housing crisis – lack of government investment, skyrocketing labour and material costs – but something that often gets overlooked are the bewilderingly byzantine building codes and standards that govern planning and construction. Since 2019, however, Toronto startup Trax has been bringing the industry into the 21st century. Its cloud-based regulatory intelligence platform houses the 60,000-odd pages of codes, guides and statutes for Canada, Ontario, B.C. and Alberta, helping architects, engineers and builders navigate these compliance requirements. “It doesn’t just help resolve an argument,” says CEO Azam Khan. “It helps avoid one in the first place.”

Photographed in Toronto’s quickly growing East Bayfront neighbourhood.



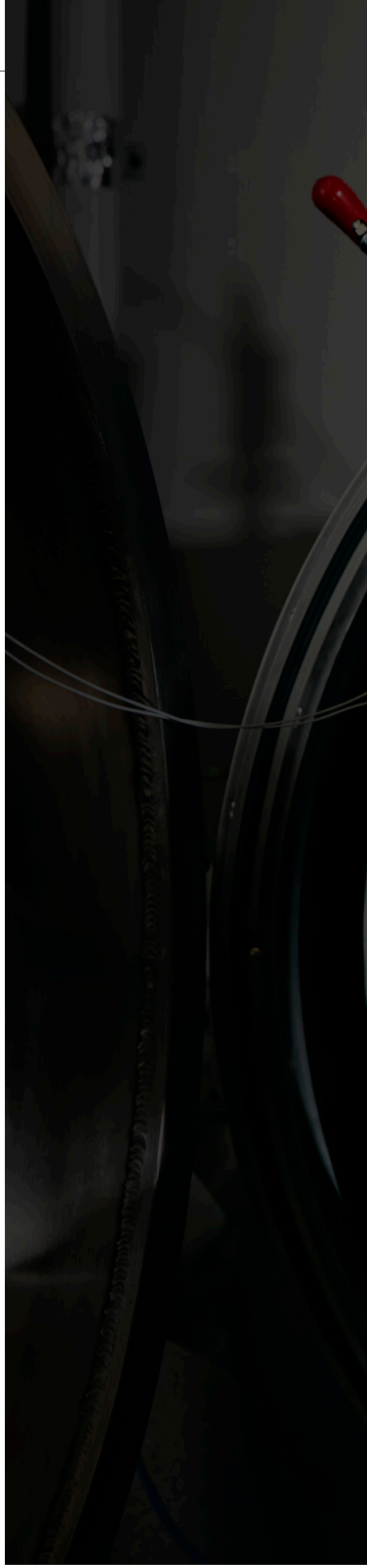
Improving care for our most vulnerable

SALIM KANDEDI
CO- FOUNDER AND CEO, CORVITA
JOINED MaRS IN 2023

Salim Kandedi wants the 30,000 premature babies born in Canada each year to get the same standard of neonatal care whether they're born in a fully staffed Toronto hospital or a resource-strapped NGO in a remote northern community. To achieve that goal, he's spent the last two years developing the ARK incubator, a portable neonatal intensive care unit, which consolidates many of the monitors, machines and sensors that keep infants alive. It also integrates machine learning to provide insights on the best care.

The ARK is Kandedi's contribution to neonatal care, but its very existence reflects the inherent value of expanding access. Back in 2002, Kandedi was himself a micro-preemie born at 23 weeks gestational age. He survived because he had access to thorough neonatal intensive care, a stroke of luck his mother couldn't help but remind him of when he started researching the ARK. "She told me, 'If someone has to do something about those babies, it's you, because you've been there, and without those machines, you wouldn't have survived.'"

↑ Photographed at the MaRS Centre.



Keeping us connected

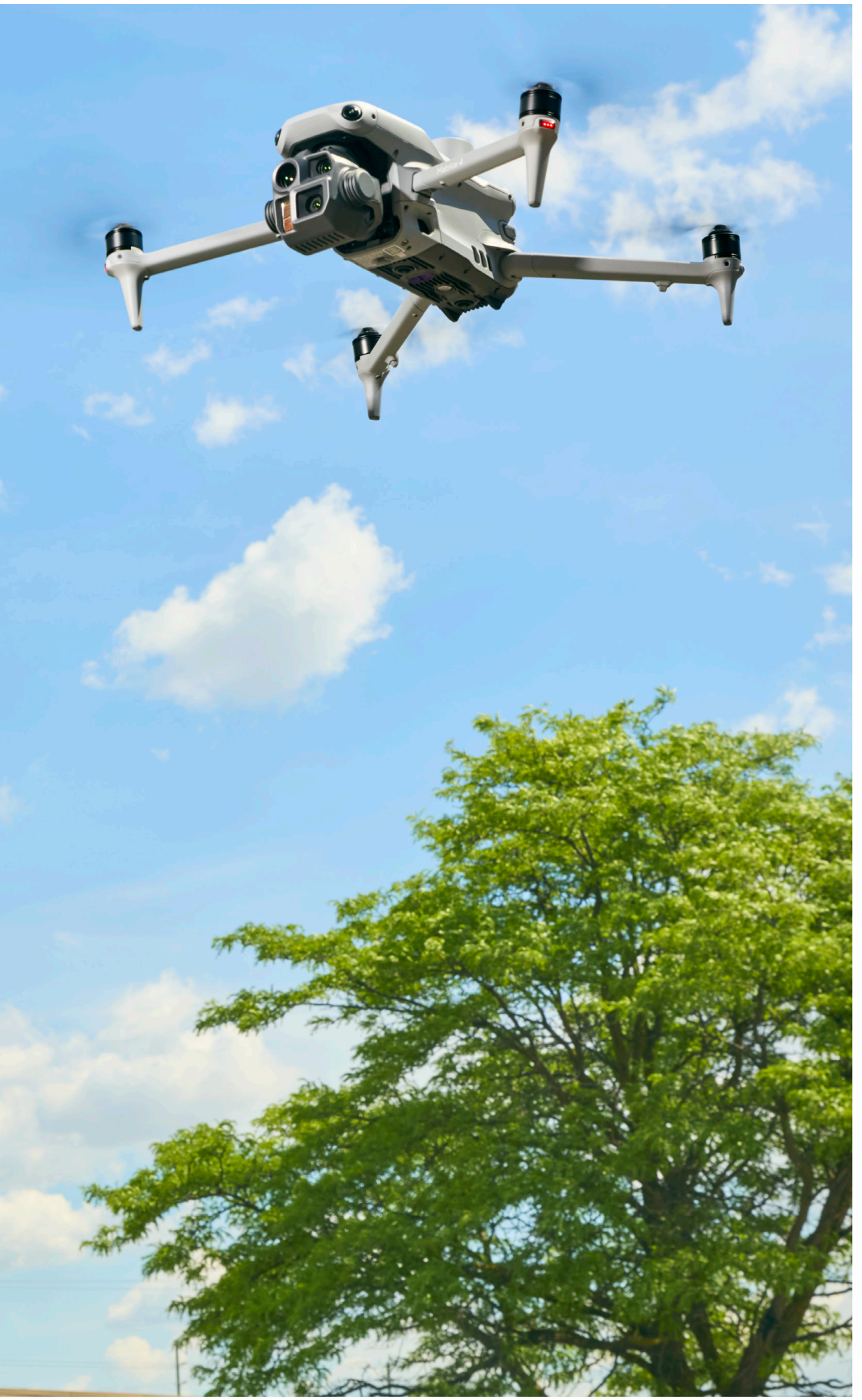
MINA MITRY
CEO, KEPLER COMMUNICATIONS
JOINED MARS 2023

It's one thing to shoot a rocket into space, it's another to build the communications network a starship needs once it's there. Since 2015, Toronto startup Kepler has been doing just that, developing what co-founder Mina Mitry calls the "telephone poles" of space. Kepler's infrastructure, which enables the transmission of real-time data, is critical for many things: wildfire monitoring, Arctic surveillance, military intelligence. It recently launched an orbital data centre – a collection of 300-kg satellites that communicate via lasers. As our daily lives and national security become increasingly dependent on data gathered from space, reliable access to it becomes more crucial. "The idea has always been that we would enable space to become more accessible and more useful to life on Earth," says Mitry.

Shot at Kepler's headquarters in Toronto.







Scanning for improvements

PEYVAND MELATI
CO-FOUNDER AND CEO, QEA TECH
JOINED MaRS IN 2022

Canada's buildings are leaking energy – out of their walls, their snow-damaged roofs and their ancient single-pane windows – which causes operating costs and greenhouse gas emissions to snowball. Building inspections are an essential way to identify areas in need of repair, but they can be expensive, time-consuming and intrusive for occupants. In 2019, Peyvand Melati and his co-founder, Mansour Asrani, lit upon a high-level way to revolutionize this process. By deploying drones equipped with infrared sensors, they could conduct non-invasive inspections within hours, then analyze that data to suggest retrofit options tailored to clients' budgets, priorities and timelines. Overseeing a fleet of heat-sensing unmanned aerial vehicles wasn't what Melati envisioned when he left Iran in 2002 with an electrical engineering degree and plans to pursue a PhD. But as he explains, QEA Tech was aligned with his entrepreneurial values: "Build something technologically difficult, make sure there is a real business behind it, and use that to make a meaningful difference."

Shot at the QEA Tech offices in Markham.

Using quantum chemistry to quash water pollution

DIANA VIRGOVICOVA
CO-FOUNDER AND CEO, XATOMS
JOINED MaRS in 2024

The remarkable life of Diana Virgovicova, founder and CEO of Xatoms, reads like a novel. Born in a small village in Slovakia in 2002 to a single mother, she began teaching herself quantum chemistry as a teenager to help solve water pollution. By 17, she had modelled a sunlight-activated photocatalyst that makes contaminated water drinkable. That earned her the Stockholm Junior Water Prize and a full scholarship to the University of Toronto. She co-founded Xatoms while still an undergraduate. “With quantum chemistry, we can design perfect materials,” Virgovicova says. “And these perfect materials, in our case, are used for purifying water with sunlight.”

Photographed at the MaRS Waterfront.







Engineering a new way of healing

MILICA RADISIC
FOUNDER AND CEO, QUTHERO
JOINED MaRS IN 2018

For more than 25 years, Milica Radisic has been compelled by matters of the heart. As an undergraduate, she learned that scientists were growing human tissue from isolated cells and promptly devoted herself to unlocking the life-saving potential of tissue engineering. Her lab at the University of Toronto transforms human stem cells into "organs on a chip" – tiny bits of engineered tissue that mimic our hearts, kidneys and lungs, and can be used to test new drugs. The lab's overarching goal – to repair, and ultimately avoid, damage to organs – is shared by her biotechnology company, Quthero, which has developed a proprietary peptide drug to reduce inflammation and promote regeneration, especially after a cardiac event. "Heart disease kills more people than all cancers combined," says Radisic. "We're told all the time that it's such a hard problem to work on, that so many people have tried and failed, that we should focus on easier things." But, she adds, "if everybody goes for the low-hanging fruit, these really big impediments will never be solved."

↑ Shot at Quthero's lab at the MaRS Centre.

Site of impact

Toronto's Discovery District has long been a place where breakthroughs happen. Here are 12 of the most surprising and significant innovations since MaRS opened 25 years ago.

BY KATHRYN HAYWARD



IT ALL STARTED HERE
One of the desks Sir Frederick Banting used at his eponymous medical institute established at U of T in 1930 sits in the MaRS Collaboration Centre. Slightly scuffed from decades of work, the modest desk is a salient reminder of where innovation begins.

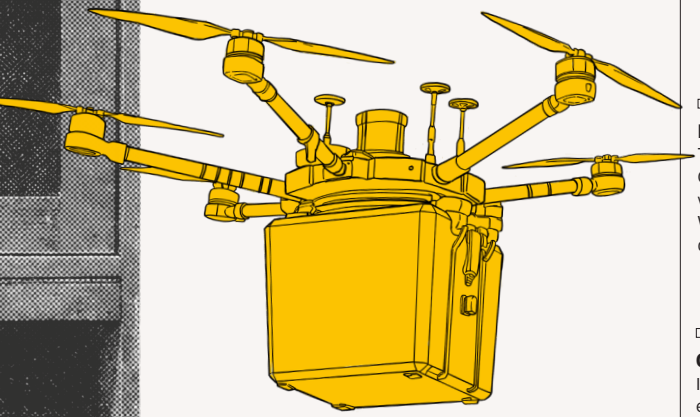
IN MAY 1921, SIR FREDERICK BANTING secured an unused room at the University of Toronto to conduct experiments that would test his theory about the treatment of diabetes. Less than eight months later, the first dose of insulin serum was administered across the street at what was then Toronto General Hospital to Leonard Thompson, a 14-year-old whose health was rapidly declining. It's difficult to overstate the impact the discovery of insulin has had on modern medicine. Back then, the average patient might live three or four years after a diabetes diagnosis. Today, insulin helps more than 150 million people around the world go about their daily lives.

MaRS was founded in 2001 on the site of the old hospital wing where Banting and his research assistant Charles Best first treated Thompson. The organization's goal? To catalyze meaningful change. MaRS brings together the major players – researchers, founders, investors, corporate leaders and policy-makers – to ensure that great ideas have extraordinary impact. ●



HOME STRETCH
In 2015, MaRS convened major players to tackle the thorny problem of housing affordability. Coming out of those discussions, Toronto amended its bylaws to allow for laneway housing in 2018.

INTELLIGENT MACHINES
Vector Institute co-founder Geoffrey Hinton, Alex Krizhevsky and Ilya Sutskever jump-started the modern artificial intelligence age in 2012 with their landmark paper, which introduced their work with a deep convolutional neural network.

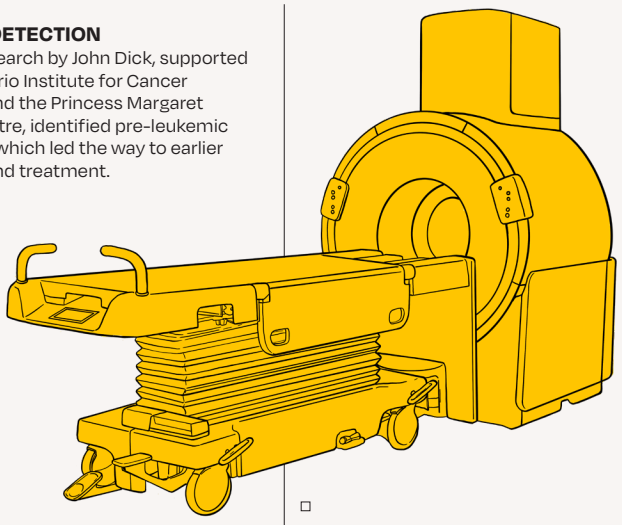


NEXT-GEN COURIER SERVICE
In September 2021, University Health Network and Unither Bioelectronics transported donor lungs for organ transplant from Toronto Western Hospital to Toronto General Hospital using an unmanned drone — a global first.

BRAIN-COMPUTER INTERFACES
In 2010, InteraXon demonstrated the power of its EEG technology at the Vancouver Winter Olympics, enabling visitors to control the lights at the CN Tower, Niagara Falls and other tourist attractions using their minds.

AI DRUG DISCOVERY
In September 2019, Deep Genomics identified a therapeutic candidate for Wilson disease, a rare genetic disorder. In a world first, it used a deep-learning platform, speeding up drug discovery from three years to 18 months.

CANCER DETECTION
In 2014, research by John Dick, supported by the Ontario Institute for Cancer Research and the Princess Margaret Cancer Centre, identified pre-leukemic stem cells, which led the way to earlier diagnosis and treatment.

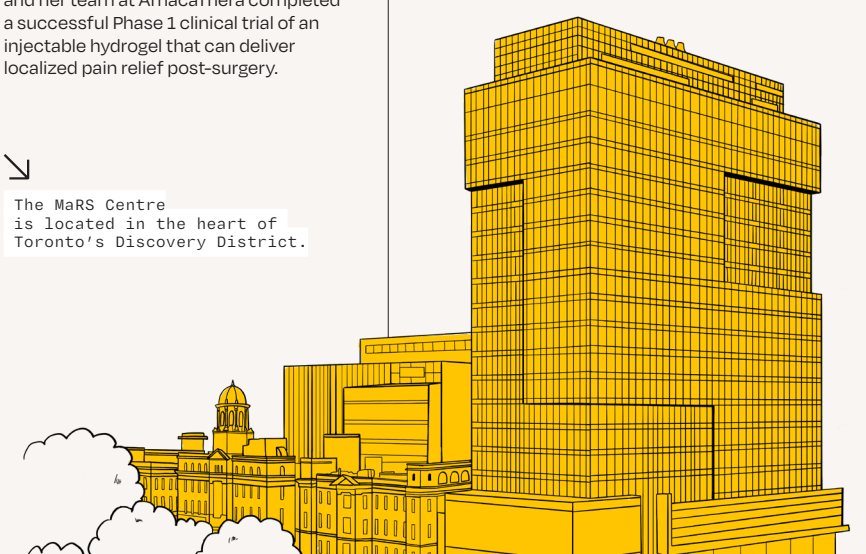


BACKUP POWER
The Oneida Energy Storage Project became Canada's largest battery storage facility when it began operations in May 2025. With 278 lithium-ion units, it effectively doubled Ontario's energy storage capacity.

GUT CHECK
In 2005, the FDA greenlit the use of exenatide, a glucagon-like peptide-1 receptor agonist (GLP-1) that helps control blood sugar, building off of foundational research by U of T endocrinologist Daniel Drucker. The approval paved the way for blockbuster drugs Ozempic and Wegovy.



AN ALTERNATIVE TO OPIOIDS
In 2024, U of T professor Molly Shoichet and her team at AmacaThera completed a successful Phase 1 clinical trial of an injectable hydrogel that can deliver localized pain relief post-surgery.



The MaRS Centre is located in the heart of Toronto's Discovery District.

SMART SURGERY
In 2015, Synaptive Medical launched the first generation of robotic devices to help neurosurgeons perform less invasive procedures. That year, the FDA cleared the system for use in U.S. operating rooms.

SOCIAL STORYTELLING
In 2006, Wattpad launched its e-reading app, giving easy access to a trove of books. This library evolved into a robust social platform that allowed nascent writers to share stories directly with readers, igniting a data-driven publishing revolution.

HEAT-SEEKING MISSION
Returning to a freezing house after a vacation in 2007 provided serial entrepreneur Stuart Lombard with the spark for his next company. Within 24 months, his cleantech startup ecobee had released the world's first smart thermostat.

Model behaviour

Climate forecasting tools are getting better every day. But what happens after we have that data?

BY JASON MCBRIDE



XANDER WANG USED TO BE A KIND OF ORACLE of the ocean. For years, the University of Prince Edward Island professor got emails and calls from wealthy people in Ontario and Quebec, looking to acquire coastal property on the island. What they all wanted to know was how safe a prospective vacation home would be from rising sea levels. "They'd say, 'Hey, Xander, I want to buy this property at this address. Can you tell me how many years I have?'"

In 2024, however, those emails and calls stopped coming. That year, Wang and the P.E.I. government released a free, interactive flood risk map known as the Climate Hazard and Risk Information System (CHRIS). Wang runs the Climate Smart Lab, which is part of the Canadian Centre for Climate Change and Adaptation at UPEI. CHRIS made it possible for anyone to see, in comprehensive detail, exactly how vulnerable every property was to coastal or inland flooding. The tool captures everything from water depth predictions to rates of erosion and, with the click of a mouse, how those numbers will change 50 or 100 years from now. (Spoiler alert: In a business-as-usual emissions scenario, they get much, much worse.)

As Wang points out, however, gathering good data is just the beginning. "When it comes to climate adaptation, you need action," he says. To that end, his lab has also installed, in various provincial parks, 10-metre-tall monitoring towers that, through video and other sensors, collect data on erosion, ice coverage and storm patterns to help shape decisions about protection measures. Scale-model replicas of these measures – vegetation plantings, rock barriers, sea walls – are being simultaneously tested in the lab's flood



simulator. One of the only such devices in the country, this is essentially a Plexiglas water tank, five metres long and two metres wide, within which Wang has built a miniature east coast village and shoreline. Sprinklers and a wave machine simulate rainfall and tides respectively, with Wang's team able to "plug in" the replica protection measures to see exactly how they fare against large waves.

The brutal impacts of a rapidly warming world have been on full, terrifying display this year – catastrophic heatwaves and wildfire across Europe and North America, deadly floods in Nepal and Tibet. With the world blowing past the temperature targets outlined in the Paris Agreement, it's clear that mitigation is no longer a sufficient strategy. Adaptation, as Wang's lab demonstrates, is only going to grow more urgent, with communities requiring short-term, immediate protections. While adaptation can be a hard sell – loss avoidance doesn't generate cash flow – an economic case can be made. This year, the federal government released a report claiming that every dollar invested in adaptation generates $13 to $15 in economic benefits. The Canadian Climate Institute similarly argues that investing $4 billion a year in proactive adaptation would prevent most of the infrastructure damage caused by growing heat and heavier rainfall.

Like Wang's lab, a number of Canadian companies are developing forecasting tools that can give us a much better understanding of flooding, wildfire and extreme heat, anticipating where and when new resilience measures will be most needed. That data is imperative, improving its quality necessary. But we can no longer build, work and live as if we still enjoy the relatively stable climate of the 20th century. We need to prepare for and adapt to a harsher, more chaotic world, and translating that data into meaningful, life-saving action is the only option we have.

BEFORE THE FLOOD

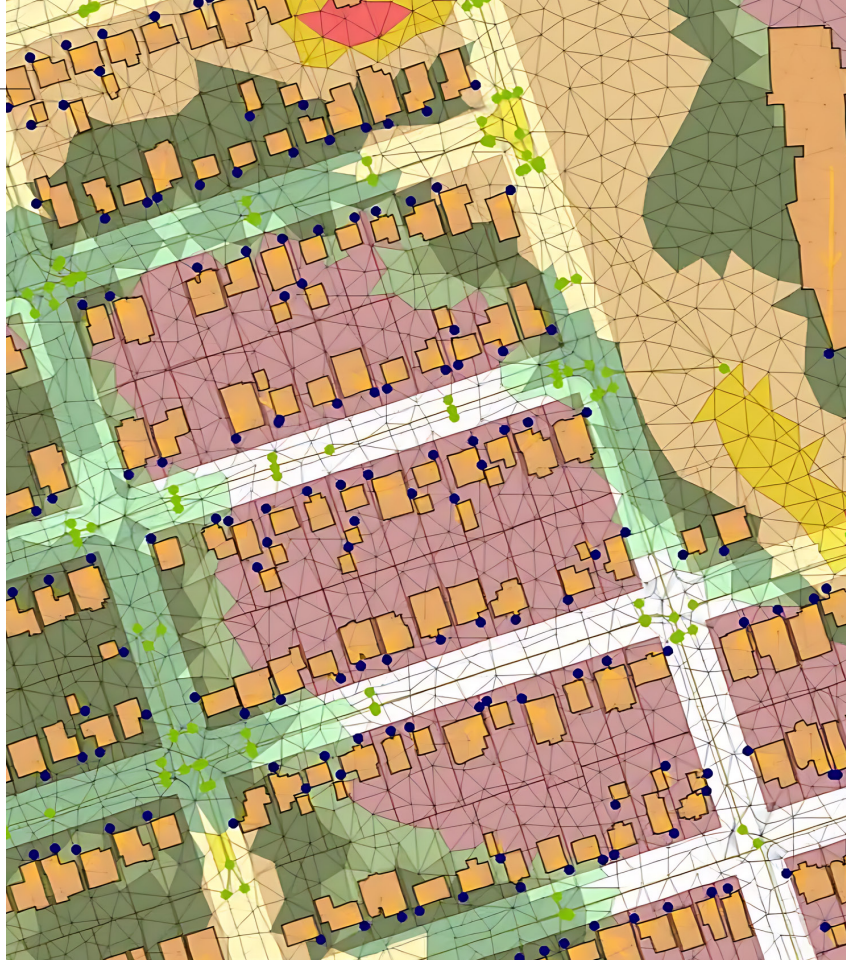
The CHRIS flood risk map, as detailled as it is, comes with a disclaimer: "These results are approximate and not suitable for site-specific property or infrastructure assessments." Property and infrastructure assessments, however, are exactly what Toronto startup NOAH Intelligence does. Founded in 2024, NOAH is a flood risk modelling company that, using a physics-based model, has mapped the entire city of Toronto

– 472,000 properties in total – to determine the vulnerability of each structure to rainfall. NOAH is currently in the process of applying the same approach to the entire country.

Like most North American cities, Toronto wasn't built for the supercharged storm systems that now routinely drench the city. But adapting to this new meteorological reality is extremely costly and time-consuming. The city's Basement Flooding Prevention Plan, which Toronto established in 2006, has ballooned to $18.6 billion and counting. Other interventions, such as new bypass tunnels to contain excess rainwater, are decades away from completion. "The city doesn't have $18 billion dollars to fix the problem," says NOAH's co-founder and CEO, Chris Godsall. "And even if it did, it would take 30 years to fix it."

What NOAH offers, then, is a way to better triage and direct that investment. More than 2,500 American municipalities and dozens of Canadian ones charge residents stormwater utility fees (aka "rain taxes") to offset the cost of infrastructure upgrades. The City of Toronto, however, voted down such a fee in favour of doubling the support available to homeowners, subsidizing the cost of sump pumps and backwater valves. But according to Godsall, only 15 percent of property owners have taken advantage of those subsidies so far. With NOAH's technology, however, more property owners can gain a keener understanding of their flood risk and, theoretically, act on it – the system also recommends concrete resilience measures that can reduce your specific risk. Municipalities, in turn, can then prioritize limited infrastructure budgets for areas at greater risk. Effectively, this buys municipalities time and more evenly distributes the adaptation load.

"It becomes a partnership between the citizen and the city in terms of resilience," Godsall says. "There's an enlightened self-interest."



NOAH's simulation of the flood risk in Harrow, Ontario after a historic storm in 1989, colour-coded to indicate severity.

18.5 B

The number of hectares in Canada burned by wildfires in 2023, the worst year on record.

LINE OF FIRE

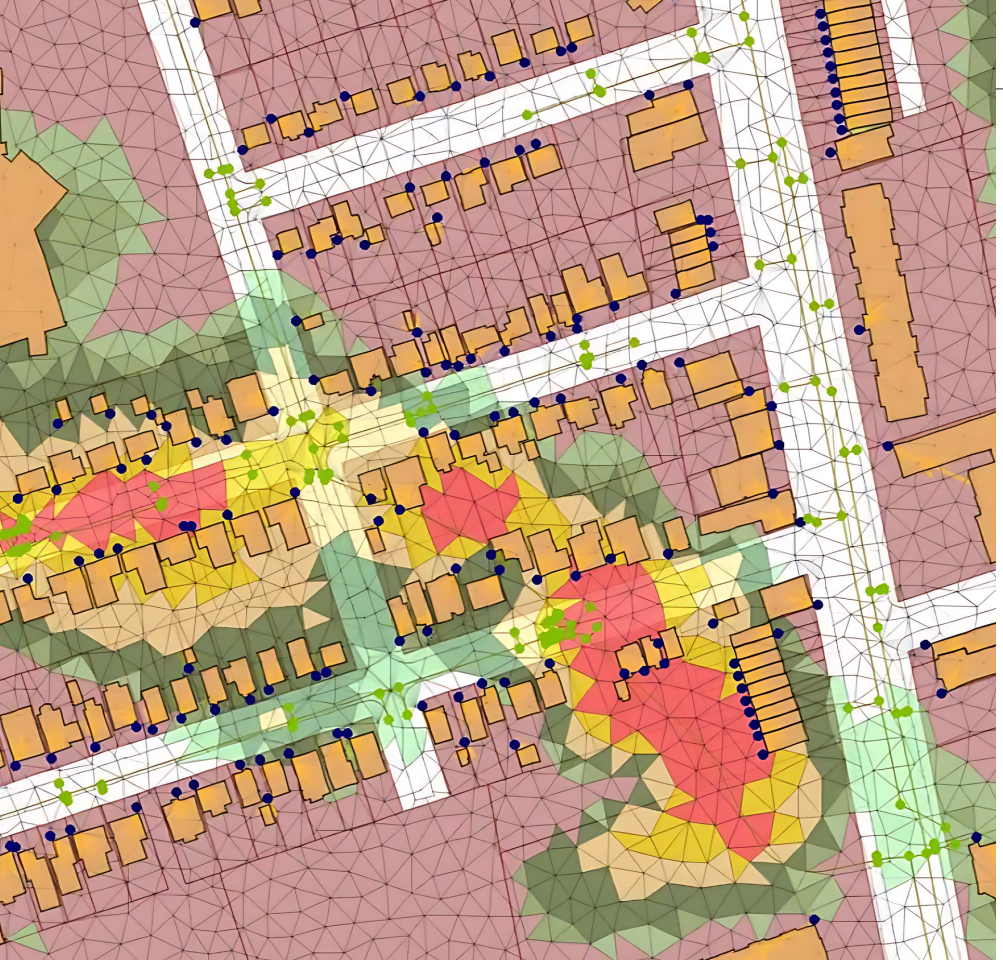
The circle of enlightened self-interest includes, critically, the insurance industry. Insurers are on the front lines of the climate crisis, grappling with the fiendish problem of having to underwrite properties increasingly under threat without putting themselves at financial risk. In 2024, for the first time, the insured damage caused by severe weather events in Canada exceeded $9.2 billion; between 2016 and 2025, there was $37 billion in insured losses from catastrophic weather and wildfires, nearly three times the amount recorded from 2006 to 2015. It's nothing less than an existential threat to the industry.

With so much at stake, insurance companies have a clear incentive to invest in, and push for, better, faster adaptation technologies. Following 2024's so-called "Summer of Catastrophe," the Insurance Board of Canada released a resilience plan calling for changes to how and where we build, new regulatory frameworks that encourage risk-based pricing and the development of more accurate, sophisticated hazard maps.

Mapping floods is challenging enough, but wildfire – the other main climate peril Canada now routinely experiences – is even more difficult. Until recently, most decision-makers have relied on static, coarse maps that haven't kept pace with the increasing speed and spread of wildfire. In 2025, however, Property Guardian, a U.S. company that provides wildfire intelligence to the American insurance industry, approached Apex Resource Management Solutions about developing similar solutions for Canadian customers. The Ottawa-based startup has spent decades perfecting its ecological modelling platform, which is used by dozens of government agencies and NGOs to track everything from wildlife populations to carbon dynamics. Adding wildfire modelling to the platform was achievable, and, according to ApexRMS president Colin Daniel, made possible because of the recent availability of affordable, high-performance computing. "Only in the last two years has it been practical to generate a hazard map of the entire country," he says.

Feeding data from the Canadian Forest Service and other government agencies into its platform, ApexRMS is able to create annually updated wildfire hazard maps at fine, 30-metre resolution, which can simulate tens of millions of fires. Just like NOAH and flooding, ApexRMS's software can also run "what if" scenarios to determine how adaptation strategies – removing vegetation from outside a home, say, or adding a golf course as a firebreak to a housing development – will reduce risk.

Over the last few months, since releasing the product, ApexRMS has been on a listening tour, meeting with insurance companies, utilities and, most recently, municipalities. The demand for better wildfire data, Daniel says, is there. But the data still needs to be leveraged for actual, ground-level protection. "It's billions of dollars to do fuel



treatments on any kind of scale to protect a town or city of any size," Daniel says. "Where's that funding going to come from?"

What could significantly change things, as everyone from insurers to the Canadian Climate Institute have argued, is an overhaul of how we bankroll climate adaptation infrastructure. "We need to find ways to get additional sources of capital flow and investment into these things," says Brendan Seale, assistant vice president and head of sustainability at Definity. (Full disclosure: Definity is a sponsor of MaRS's Adaptech Accelerator.) Currently, Canadian municipalities maintain 60 percent of roads, bridges and waste systems but receive only 8 percent of tax revenue. Seale would like to see this imbalance addressed through more strategic, innovative use of private capital: "We have to figure out a way to get the pension funds, the insurance companies and the banks bringing money to the table where they can get some return back for investments in infrastructure that make us more resilient."

LINE OF DEFENSE

At the moment, P.E.I. is the only province or territory that has free, public access to comprehensive flood risk data. And it was possible to do, Wang acknowledges, because the province is small and relatively tight-knit, with a government that has invested significantly in resilience. (The Government of Canada has developed an open-source flood data map for the whole country, but other provinces have been slow to adopt it out of concerns such information will negatively impact housing markets.) Wang is trying to go even further, however, and is working on a real-time flood risk tool, which would give users up-to-the-minute data about localized flooding; he hopes to have that available in two or three years.

There isn't a national standard for protection measures, however. Those are far more costly and complex, with different provinces and municipalities facing unique challenges – preventing overland flooding in Toronto or Winnipeg is different than it is in Charlottetown. But without them, the data that we so carefully collect, the maps we so carefully construct, are meaningless.

"With the emissions that we've pumped into the atmosphere worldwide over the last 40 years, there's a certain amount of climate destabilization that's just baked into the system," says Definity's Seale. "We have to respond to that. And it's going to be economically damaging to delay and defer those kinds of investments." ●



Be prepared

MaRS's Adaptech Accelerator, designed to scale technologies that help Canadians predict, withstand, respond to and recover from the impacts of climate change, features several startups developing new climate modelling and forecasting tools.

APEXRMS (Ottawa) uses two products, its SyncroSim modelling platform and its Fire Hazard Canada subscription service, to help property owners, insurers, utility companies and municipalities better plan for wildfire risk.

CLIMATE RISK (Guelph) provides the commercial real estate sector with rapid climate-risk screenings and assessments, as well as custom adaptation recommendations.

GEOSAPIENS (Quebec City) combines advanced geospatial data, AI, hydrology and climate science to improve the understanding and mitigation of all kinds of extreme climate hazards.

NOAH INTELLIGENCE (Toronto) uses physics-based models to provide flood risk insights and adaptation recommendations to property owners and municipalities.

RUNWITHIT SYNTHETICS (Edmonton) creates multidimensional digital twins of cities and their populations, allowing clients to simulate, among other things, various climate scenarios and their outcomes.

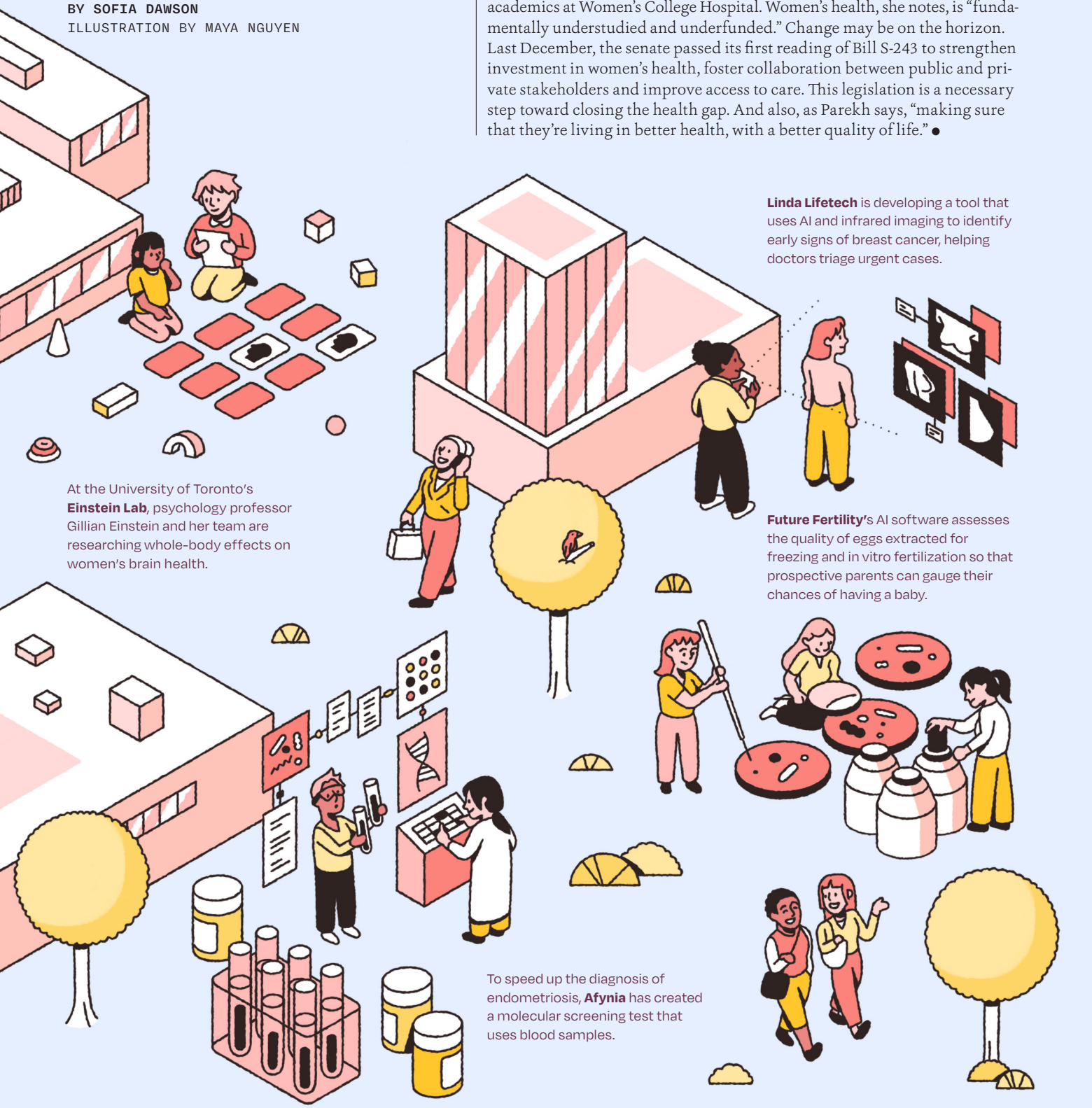
– JASON McBRIDE

X factor

Nine promising developments in women's health.

BY SOFIA DAWSON
ILLUSTRATION BY MAYA NGUYEN

THE ECONOMIC ARGUMENT FOR INVESTING IN WOMEN'S HEALTH couldn't be clearer. For every $1 invested, the return is $3 – in the form of reduced healthcare costs, workforce participation and economic growth. Statistically, women live longer than men, but because diagnostics and protocols aren't tailored to their needs, they end up spending more of that time in poor health. "We need to understand the gap better," says Dr. Rulan Parekh, a professor of pediatrics and medicine at the University of Toronto and vice president of academics at Women's College Hospital. Women's health, she notes, is "fundamentally understudied and underfunded." Change may be on the horizon. Last December, the senate passed its first reading of Bill S-243 to strengthen investment in women's health, foster collaboration between public and private stakeholders and improve access to care. This legislation is a necessary step toward closing the health gap. And also, as Parekh says, "making sure that they're living in better health, with a better quality of life." ●



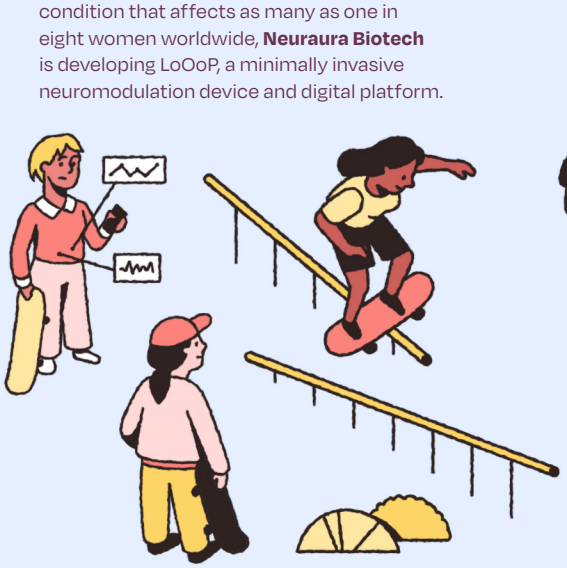
Linda Lifetech is developing a tool that uses AI and infrared imaging to identify early signs of breast cancer, helping doctors triage urgent cases.

At the University of Toronto's **Einstein Lab**, psychology professor Gillian Einstein and her team are researching whole-body effects on women's brain health.

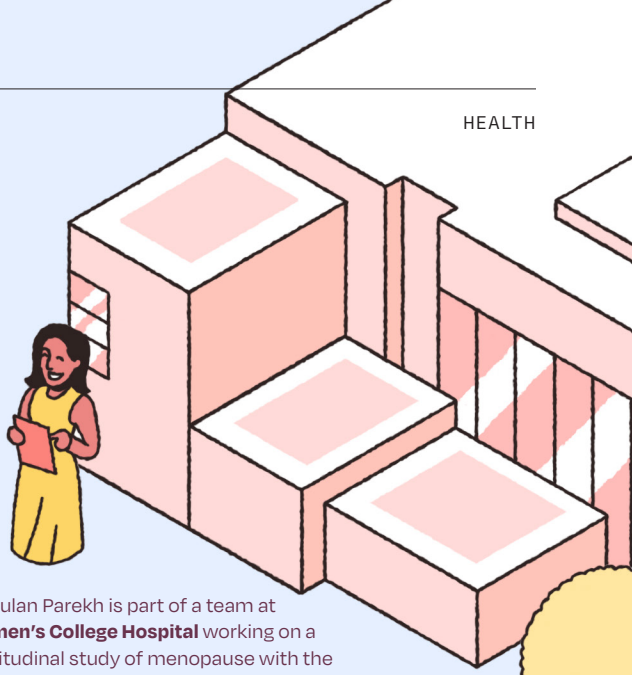
Future Fertility's AI software assesses the quality of eggs extracted for freezing and in vitro fertilization so that prospective parents can gauge their chances of having a baby.

To speed up the diagnosis of endometriosis, **Afynia** has created a molecular screening test that uses blood samples.

To help manage symptoms of polyendocrine metabolic ovarian syndrome, a chronic condition that affects as many as one in eight women worldwide, **Neuraura Biotech** is developing LoOoP, a minimally invasive neuromodulation device and digital platform.







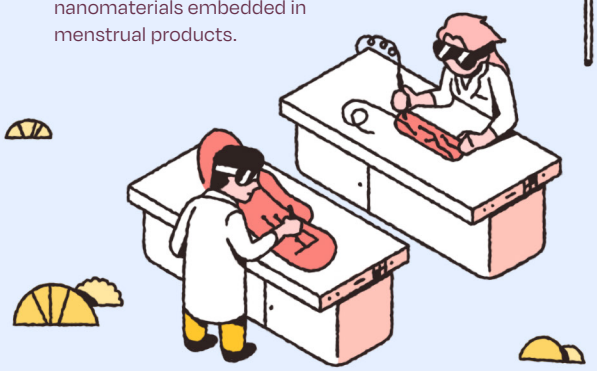
Dr. Rulan Parekh is part of a team at **Women's College Hospital** working on a longitudinal study of menopause with the goal of recruiting 30,000 mid-life women and gender-diverse individuals. The researchers are looking to uncover insights on how menopause affects women's health, including inflammation, frailty, cardiometabolic disease and brain health.



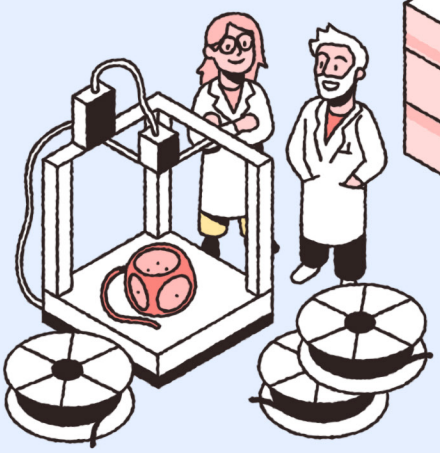


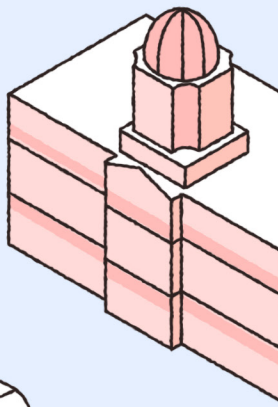


Cellect Laboratories is working on a less invasive alternative to Pap smears using specialized nanomaterials embedded in menstrual products.

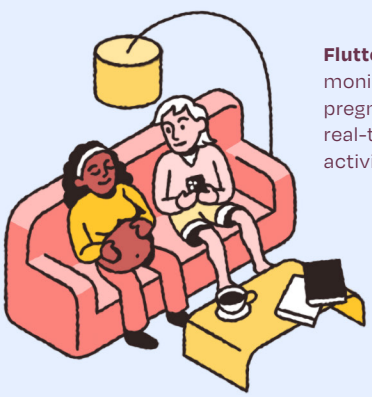


Cosm Medical uses ultrasound, AI and 3D printing to create personalized gynecological pessaries to treat pelvic floor disorders.





Flutter Care is working on a monitoring device that allows pregnant people to access real-time insights about fetal activity and health.





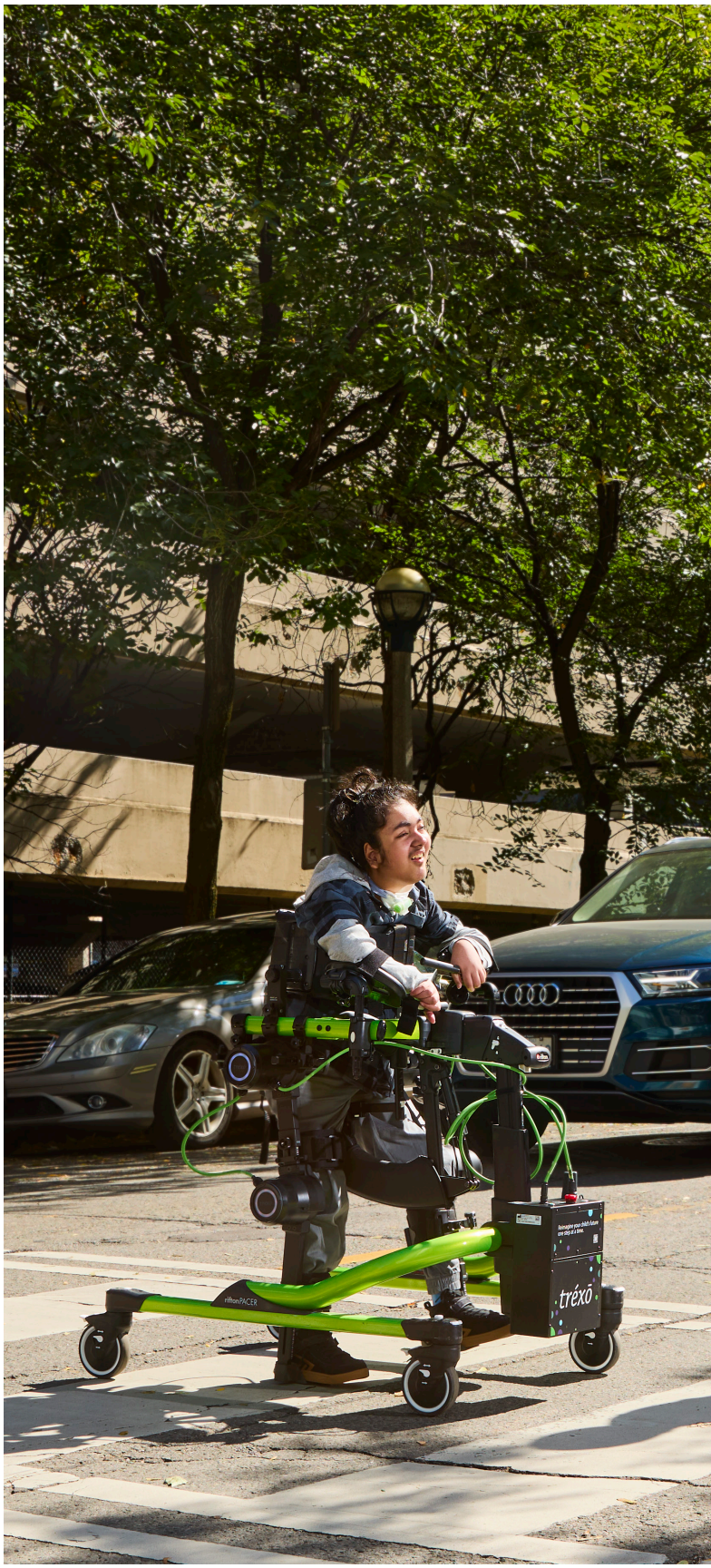
Gap analysis

~7%
Percentage of Canadian Institutes of Health Research grants between 2009 and 2023 that focused specifically on women's health.

78%
Percentage of cases of heart attacks experienced by women where early signs were missed.

$37B
Potential annual economic benefits that could be accessed if Canada closes the women's health gap by 2040.

2/3
Proportion of clinical heart disease research that focuses on men.



Mighty machines

Advances in robotics are transforming how we live, work and get around.

BY JASON MCBRIDE
PHOTOGRAPHY BY CARMEN CHEUNG



Manmeet Maggu devised an exoskeleton to help his nephew walk independently.

Walk tall

Trexo Robotics is giving children with disabilities a new kind of freedom.

MANMEET MAGGU STARTED HIS COMPANY, Trexo Robotics, with one big goal: to give every kid who wants to walk the ability to do so. He started out, however, by helping just one boy: his 10-year-old nephew, Praneit, who was born with cerebral palsy. Doctors had said he'd never be able to walk, but Maggu, then a third-year mechatronics student at the University of Waterloo and self-described "robotics nerd," had other ideas. He took Praneit's ordinary walker and turbocharged it, transforming it into a robotic exoskeleton. To Maggu's great pride, Praneit took his first steps with that device.

A decade later, Trexo has refined its original design – the robotic legs now help initiate walking movements while also correcting the user's gait and building strength and agility. And the device's updated control board allows users to change the speed of the device themselves, simply by pushing harder on the steering mechanism or exoskeleton itself. Today, more than 400 clients in Canada and abroad use Trexo, including children living with cerebral palsy, spinal cord injuries and other neuromuscular conditions.

Maggu always wanted the device to be as accessible as possible, and he's now focused on scaling it and getting it out to as many kids as he can. That means convincing insurers and payers that, as he puts it, "walking is a human right." In Canada, he's pushing provincial governments to include Trexo under their assisted devices programs, allowing the exoskeleton to get the same coverage as a wheelchair. In the U.S., Maggu's efforts have already paid off – there's now a reimbursement code and payment schedule for personal exoskeletons. "This technology is not just for people who can afford to buy it," he says, "but for any child who wishes to walk." ●

Built to scale

Robot-built homes are faster, cheaper and gentler on the planet.

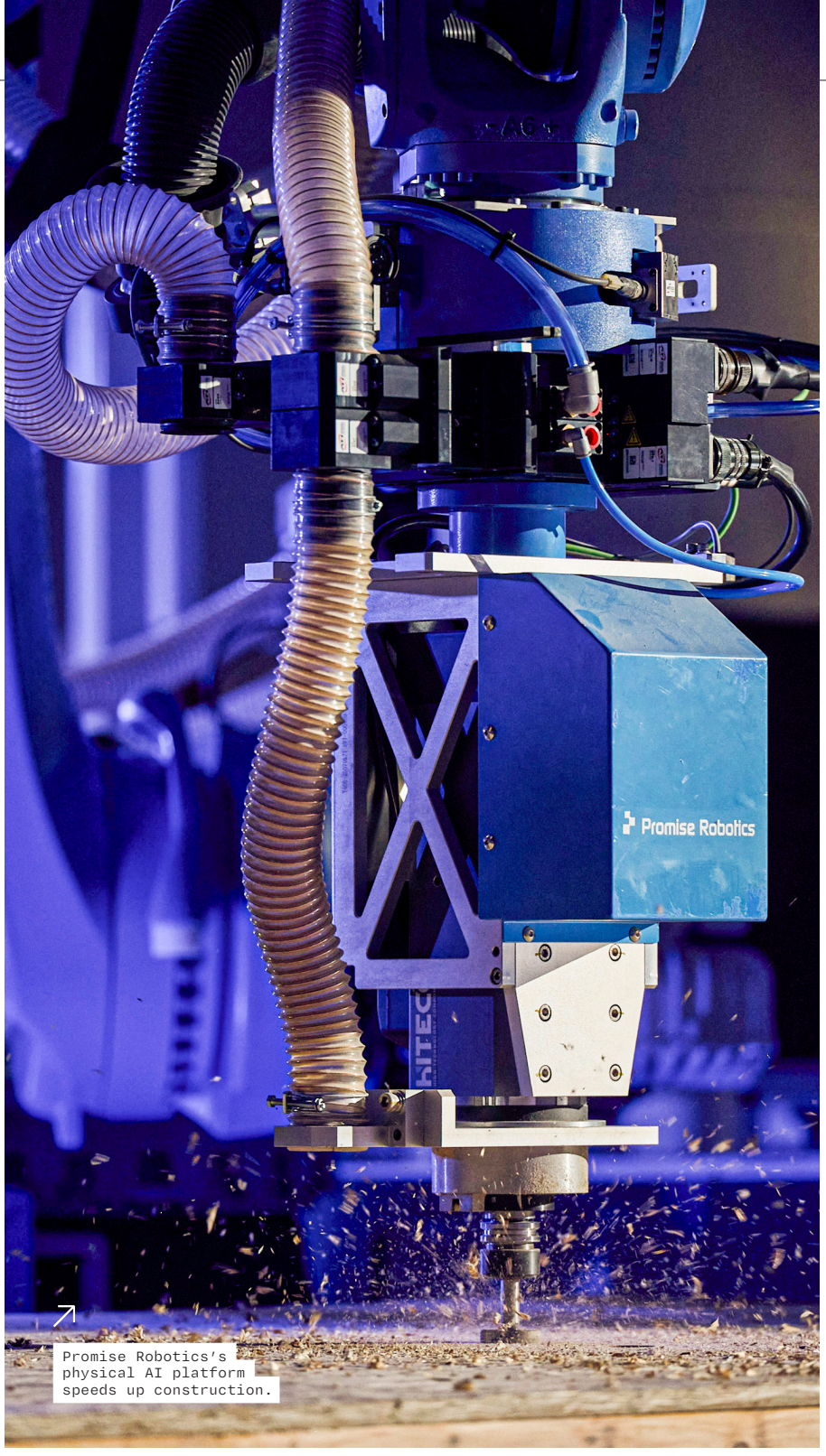
You wouldn't build a car or a toothbrush one by one, but that's typically how we build houses in Canada – bespoke, stick-frame structures constructed on site. It's slow, expensive and, in our current housing crisis, unsustainable.

But a new generation of innovators are developing cutting-edge technologies, materials and methods that could revolutionize the construction industry. Chief among these is Toronto's Promise Robotics. Founded in 2020 by Ramtin Attar, former head of R&D at Autodesk, and Alberta-based homebuilder Reza Nasseri, Promise has built an integrated production platform that combines off-the-shelf robots and physical AI to give homebuilders the ability to create housing with the speed and scale of modern manufacturing. The intelligent and adaptive platform does everything short of making the lunchtime sammies: it interprets blueprints, generates production plans and robotic instructions, coordinates the manufacturing and connects production with site installation.

Harnessing automation can radically speed up construction – with Promise's platform, a single-family home can be assembled in as little as four hours. It also makes the process cheaper and more sustainable: For every million new homes, the tech can save $130 billion in costs and cut GHG emissions by 560 megatonnes. It began operations in a micro-factory in Edmonton, and opened a second facility in Calgary in 2025 – so far, the company has helped build 200 homes.

What enables companies with new tech to scale is predictable, consistent demand. That appears to be on the horizon for Promise. After opening its Calgary factory, Promise announced a partnership with the Alberta division of Mattamy Homes. And next March, it will open yet another factory, this time in Phoenix, Arizona, where it's joining forces with D.R. Horton, the largest homebuilder by volume in the U.S., to help construct more than 1,250 homes in the area. The company has its eye on other potential American markets as well, including Florida and Colorado.

With labour shortages expected to worsen – job vacancies among skilled trades in residential construction are growing at an average rate of 11 percent per year – and interest rates again on the rise, embracing such technology is arguably the industry's best way forward. "We're just at the beginning," Attar says. ●



Promise Robotics's physical AI platform speeds up construction.

For more machinic magic, listen to the "Degrees of Freedom" episode of the MaRS podcast *Solve for X*. marsdd.com/solveforx

PHOTOGRAPHY (LEFT): PROMISE ROBOTICS (RIGHT): CARMEN CHEUNG



SmartARM's prosthetic is able to adjust its grip in real time.

Show of hands

Robots are getting a better grip on the world.

How do you replicate the dexterity of the human hand? It's a problem that's vexed roboticists for decades. Our mitts are miracles of evolution, capable of a vast range of sophisticated movements: wielding scalpels, catching baseballs, peeling fruit. They can, in fact, move 25 different ways – "degrees of freedom," to use the engineering term – whereas even the most cutting-edge robots can only move 10. But advances in AI are making it much easier to train machines, and a number of Canadian companies are now developing robot appendages that can give us a helping hand.

CAP IN HAND

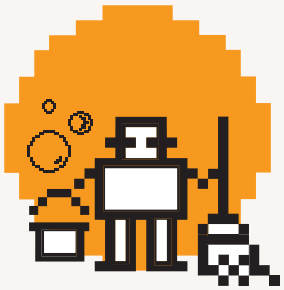
To build the perfect robot mushroom picker, Kitchener-based **Mycionics** looked to emulate both the cushion of a finger pad and the firmness of bone. Its two-digit pincer is sensitive, soft and swift enough to harvest easily bruised, fast-growing mushrooms. AI-powered computer vision allows the gripper to instantly scan the growing bed and assess mass and growth, picking mushrooms, 80 per minute, at peak quality and size.

WITHIN REACH

SmartARM has been billed as the world's first AI-powered prosthetic arm that's able to "see" and "think" for itself. Its hand has five articulated fingers, guided by a camera embedded in the palm. When a user reaches for an object, the camera streams the visual data to the Toronto company's AI platform, which identifies it and instructs the hand on the optimal grip. At the moment, smartARM can recognize more than 365 items, with the device learning as it goes and becoming more personalized with use.

PERFECT SENSE

Toronto's **ForceN** makes products that help robots better sense and manipulate the world around them. Among these are sensors that gauge the amount of force and torque necessary to perform certain tasks, as well as robotic joints and wrists. ForceN got its start in surgical robots, moved into logistics robots during the pandemic and is now also working with humanoids, including Agility's Digit robot. Toyota has ordered seven of Agility's machines for its plant in Woodstock, Ontario. ●



Botz n' the hood

Meet the robots coming soon to a hospital, farmer's field and parking lot near you.

THEY CHARGE YOUR CAR!

No driveway? No problem. **Kiwi Charge**'s self-driving mobile chargers will travel to condo garages, car dealerships and other key locations where energy-sapped EVs need a battery boost.

THEY HARVEST BROCCOLI!

Founded in the suburbs of Montreal, **Sami Robotics** offers harvesting as a service by way of its adaptable 31,000-kilogram robot, which uses AI analytics, veggie-specific settings, a suite of potential applications and a soupçon of human oversight to optimize crop yields.

THEY COOK DINNER!

The pizza-slinging automatons developed by London, Ontario–based **Appetronix** use an array of specialized robo-appendages to stretch dough, slather sauce, distribute toppings and bake pies that can be snatched from vending machine–style windows by hungry customers. Its next offering — located in downtown Toronto — leverages similar technology to assemble Chipotle-inspired Tex-Mex bowls.

THEY CLEAN!

It's a sickening truth: Patients in Canadian hospitals contract around 220,000 healthcare-acquired infections each year. **HygenX** is on a mission to zap those bugs. The Ottawa startup is developing a fleet of AI-calibrated autonomous bots that use UV-C light to disinfect hospital rooms and other clinical settings.

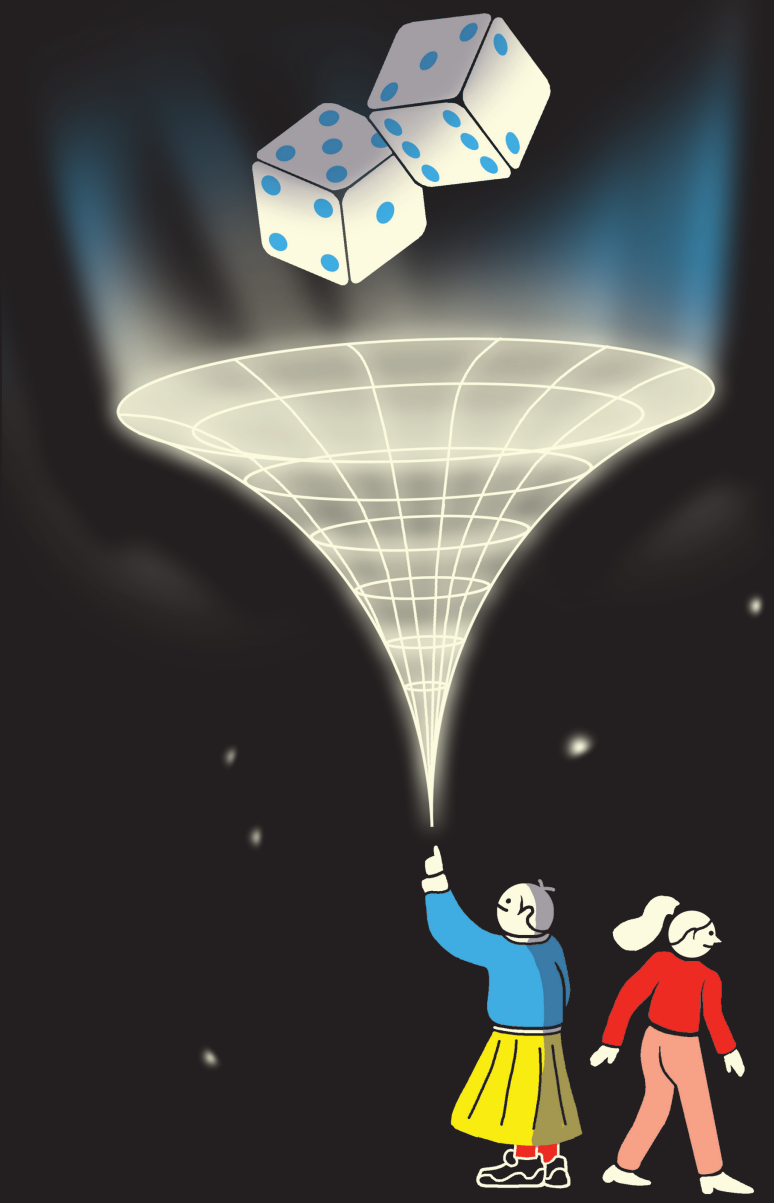
– SARAH LISS

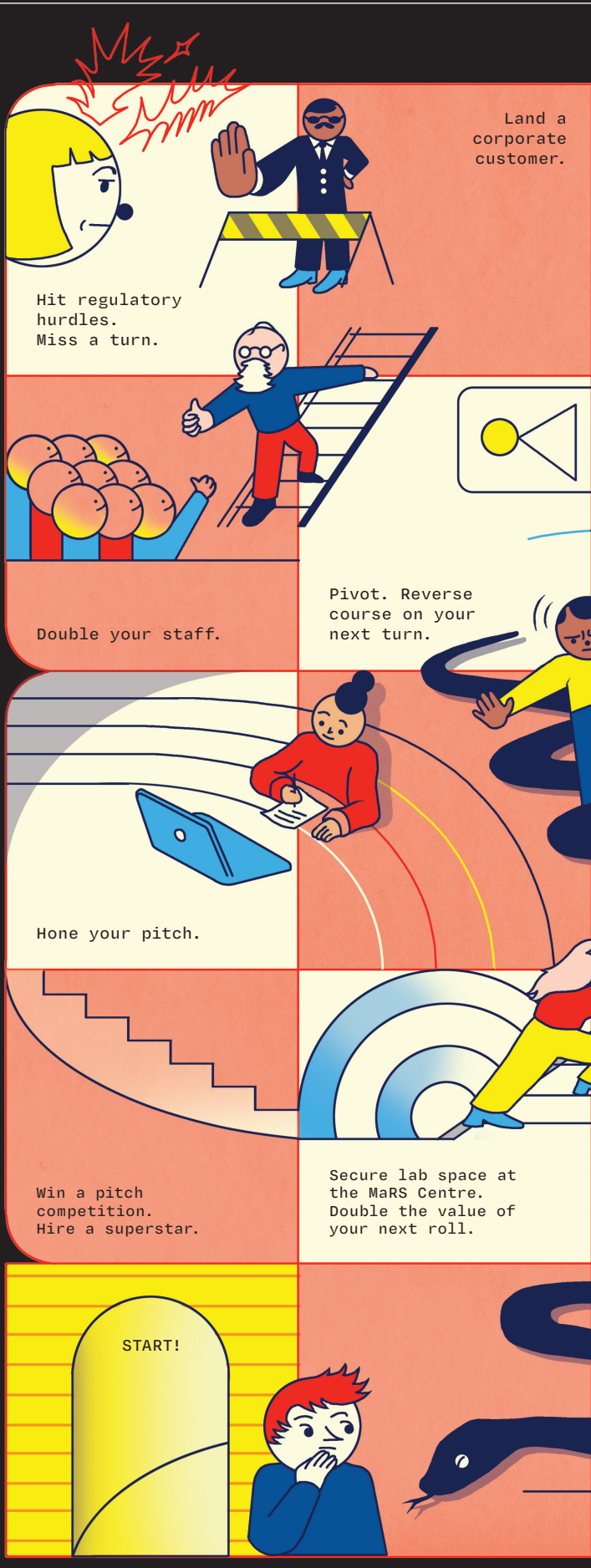
DE-RISK!

How MaRS helps bring the best tech solutions to life.

ILLUSTRATION BY DALBERT VILARINO

Transforming unique intellectual property into a sector-disrupting company is a perilous journey. MaRS makes that path smoother and shorter by providing the resources entrepreneurs need, bringing Canada's most innovative leaders together to remove systemic barriers and supporting startups every step of the way.







MaRS as a support system

LANDING A GOVERNMENT CONTRACT

Flash Forest's drone reforestation tech was so new, federal procurement rules had no box for it. MaRS worked with policy-makers to create a pilot. It became a $1.3-million contract.

NAVIGATING REGULATIONS

Peer-to-peer sessions with founders in the MaRS Mobility Unlimited Hub helped **Axtion Independence Mobility** speed up product development by a year, saving the startup millions.

FINDING A HELPING HAND

Materia Bioworks developed a R&D platform, but wasn't sure how much it was worth. After working with a MaRS advisor, the company formulated a winning pricing strategy.

BUILDING A PROFILE

RetiSpec needed to raise awareness about its non-invasive eye scan. Through the MaRS PR Accelerator, it landed stories in major news outlets at strategic moments.

PAYING IT FORWARD

When **Flexiti**'s biggest lender pulled its funding, it launched an emergency raise and rebuilt the business. The team shared its hard-won playbook with the MaRS network to give others a leg up.

Gateway to the world

With strong connections to capital, mentorship and corporate leaders, MaRS is a portal for international startups looking to enter the North American market as well as for Canadian companies expanding beyond our borders.

BY MARS STAFF

Global exchange

We've partnered with organizations around the world to help founders take their businesses to the next level. By equipping them with strategic market intelligence, access to networks and programming tailored to their individual needs, MaRS makes it easier for startups to bridge the divide between innovation and real-world impact.

INVEST NORTHERN IRELAND

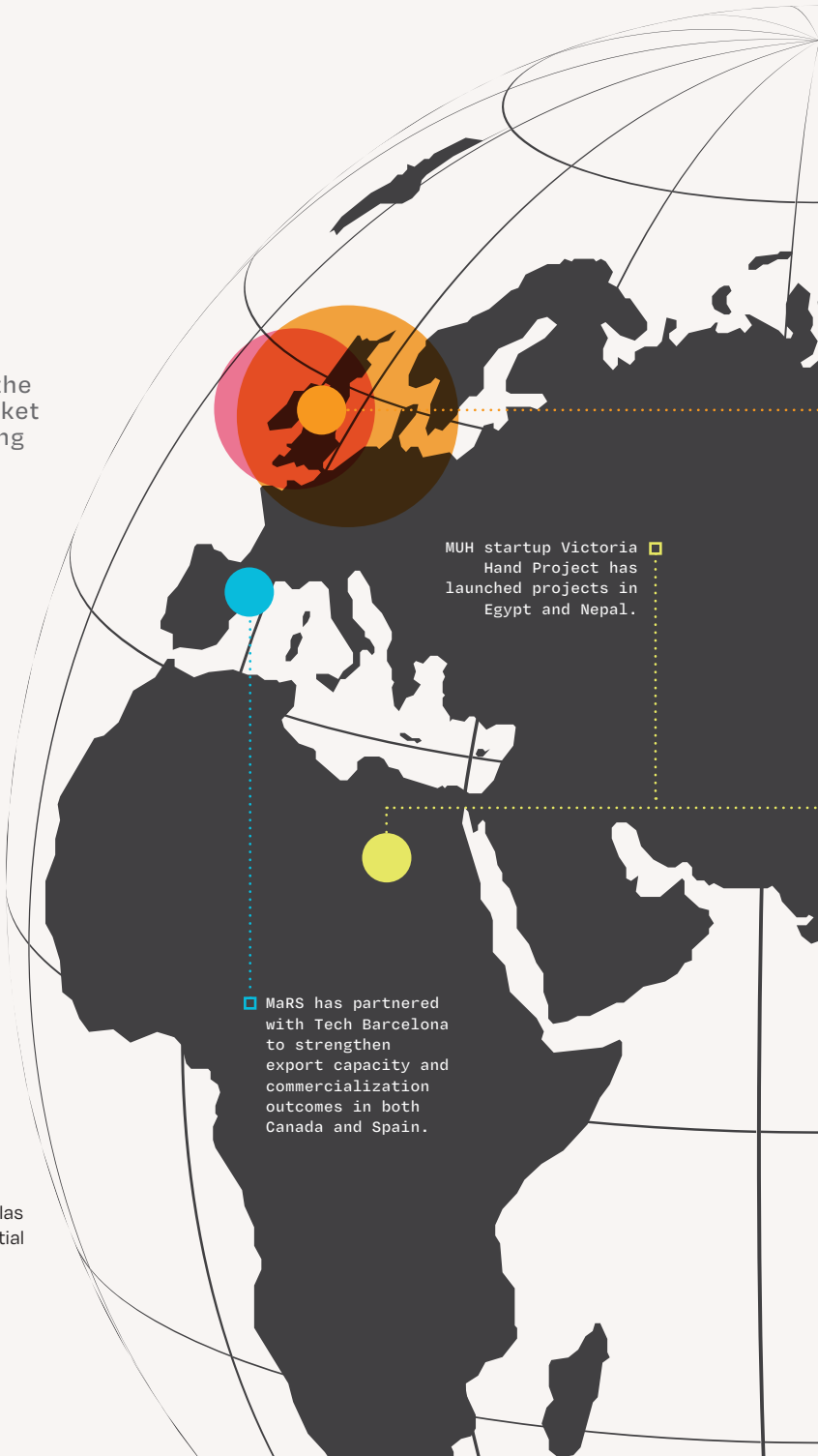
This initiative, which comprises a virtual incubator and an intensive market visit, has helped nine founders from Northern Ireland as they build momentum to expand into North America. "This was an incredible opportunity," says Christine Boyle, CEO of Senergy Innovations. "MaRS was the perfect partner, a true juggernaut, connecting companies with the people who can help them scale."

INNOVATE UK

Since 2020, more than 60 startups across eight cohorts have participated in the Global Incubator Programme, which provides tactical support to early-stage ventures from the United Kingdom working in health tech, AI and advanced manufacturing. For Therion, an advanced digital tool company, the program sped up its entry to market. "The opportunities you get while you're here: to meet people you've never met, to engage with organizations you wouldn't see, to get market research — without this program, we wouldn't have had that," says co-founder James Hall.

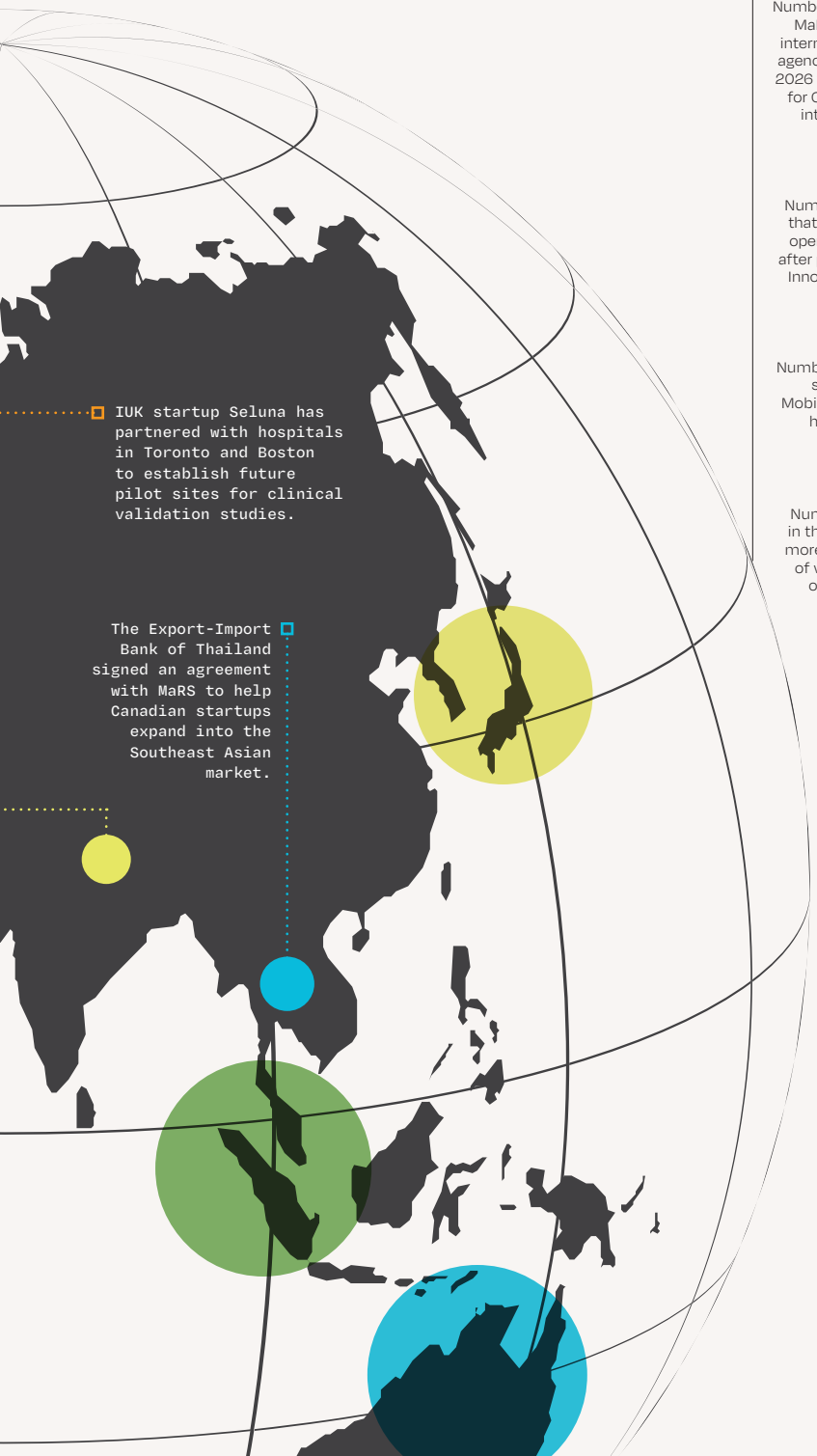
MOBILITY UNLIMITED HUB

With catalytic support from the Toyota Mobility Foundation (TMF), MaRS launched this program in 2024 to accelerate the development of assistive technologies. In the first two cohorts, we supported startups that are helping kids with disabilities take their first steps, restoring independence to amputees in underserved communities and reimagining what rehabilitation can look like. As Kinesix XR's Nicolas Jimenez says, MUH has "opened the door to resources that are essential to development, including support for business growth, patents and regulatory strategy." This summer, TMF opened a second hub in São Carlos, Brazil; MaRS will play a key role in leading global coordination.



“It’s incredible how MaRS is able to take a spark of an idea and nurture it and grow it into something as big and as substantial as what we have today. What I love about MaRS is that it focuses on a real outcome – building successful companies.”

SHIRLEY SPEAKMAN
Managing Partner, Climate Tech Fund and Sustainability Venture Funds, BDC



By the numbers

47%
Proportion of Canadian scale-up founders who report they’ve shifted focus to markets beyond the U.S. in the past 18 months.

20+
Number of commitments MaRS secured from international innovation agencies and partners in 2026 to create pathways for Canadian startups into new markets.

8
Number of companies that have established operations in Canada after participating in the Innovate UK program.

23
Number of new markets startups in the Mobility Unlimited Hub have accessed.

600+
Number of investors in the MaRS network; more than 60 percent of whom are based outside Canada.

Northern exposure

MaRS provides the platform — both digital and IRL — to connect founders with what they need to make the leap onto the global stage.

FUNDING

MaRS’s multi-pronged approach helps startups fuel their growth. Our Capital Program provides 1:1 support for entrepreneurs raising seed and Series A funding, and the digital marketplace MaRS Connect uses data-driven tools and AI-powered matching to pair ventures with accredited investors suited to their sector and growth stage. We also shine a spotlight on high-potential solutions at our curated events. This network approach works: A few days after seeing the pitch for Aslan Renewables’s modular hydropower system at the MaRS Climate Impact conference last year, Singapore-based Antares Ventures announced it would lead the startup’s $1.25-million financing round.

CLIENTS

All the capital in the world won’t take you far if you don’t have customers. That’s where the MaRS Corporate Innovation team comes in. The group works with corporate partners interested in collaborating with startups or purchasing new technology and connects them to vetted companies in our portfolio. For instance, Skygauge, which has developed drones that can inspect infrastructure and perform manual jobs, was introduced to key contacts at a corporate event. That meeting led to Mitsubishi requesting an in-person visit to the startup’s facilities as well as a project with steel and mining giant ArcelorMittal Dofasco. “By being introduced to the right people, we were able to land pilot projects, deployments and demonstrations, and have had continued deployment success in different industrial settings and environments,” says co-founder and chief commercial officer Nikita Iliushkin.

ON-THE-GROUND SUPPORT

By exploring new markets with a delegation, startup leaders are presented with more expansive networking opportunities, dedicated resources and targeted market intelligence than they would be able to access on their own. During a market visit to Australia last May, founders in the Mobility Unlimited Hub were introduced to more than 120 industry experts; several are now in active discussions with potential customers. Entrepreneurs in the RBC Women in Cleantech Accelerator recently travelled to Singapore, where they met with government agencies and local investors, attended industry events and forged new relationships. Since returning home, the founders are exploring pilot opportunities and startup competitions. ●



Wards at the new Toronto General Hospital were designed so that patients – newborns included – could be rolled out onto verandas for fresh air and sunshine.

PHOTOGRAPHY: JAMES SALMON COLLECTION, CITY OF TORONTO ARCHIVES

Legacy in the making

The MaRS Centre is built on the foundations of revolutionary research.

WHEN TORONTO GENERAL HOSPITAL opened its new location at 101 College Street in 1913, the first clue that this was a space designed for innovation was immediately underfoot. To minimize noise on the wards, the cement floors of the 670-bed facility had been overlaid with red Scotch battleship linoleum, which, as Construction magazine noted that year, was "an ineffable boon to the nurses, who will have to traverse it almost unceasingly for hours both day and night." It was an era of rapid medical advances in the city, as low-cost diphtheria treatments, a vaccine for rabies, the first pediatric blood transfusions and radical public health initiatives transformed care.

Over the years, that rate of discovery has only accelerated. Today, researchers and entrepreneurs at what is now the MaRS Centre are building high-resolution vector maps, unlocking precision medicine for pancreatic cancer, developing better semiconductor chips and deploying robots in self-driving labs. It remains a place where you can glimpse the future. ●



Build the future

In this moment of uncertainty, we see an opportunity to spark change and transform things for the better. MaRS connects the country's most innovative leaders so that together we can tackle the world's toughest problems. Through bold partnerships and strategic vision, we'll catalyze what's next.

marsdd.com


UNIVERSITY OF
TORONTO
Big ideas
start here.
#1 in Canada for
research-based startups.
By connecting researchers and entrepreneurs with industry, expertise and capital, we're accelerating the path from discovery to commercialization. In the last decade alone, U of T's startup community has launched more than **1,800 venture-backed companies** that have raised over **$27 billion in funding**. These companies, including Xatoms, Cohere, Xanadu, Waabi, Kepler, Ada and erthos, are building transformative technologies in Canada with global impact.
Explore U of T's innovation in action at uoft.me/innovators
XATOMS
CLEAN WATER FOR ALL
Diana Virgovicova,
founder and CEO of Xatoms
DEFY
GRAVITY