



McGill

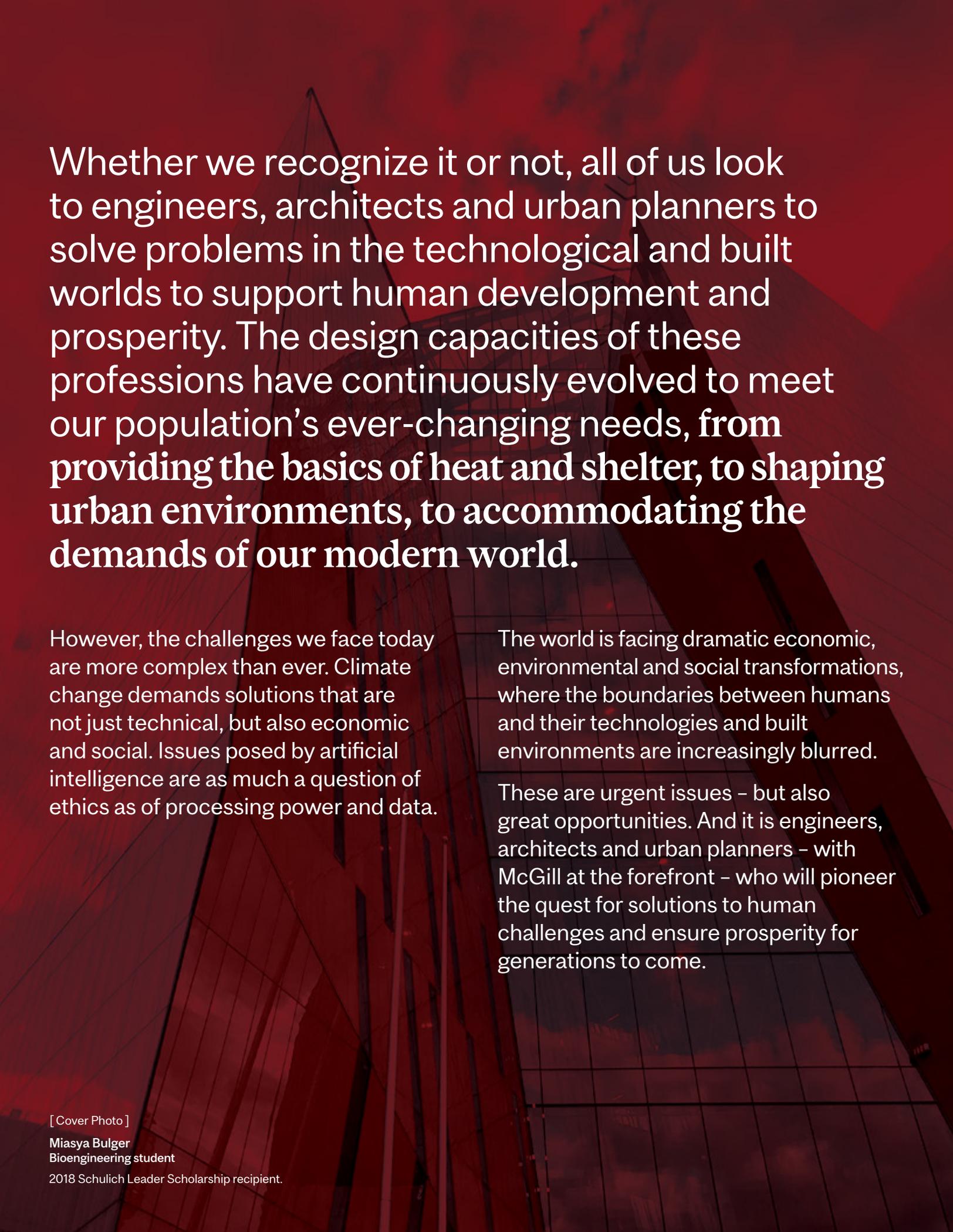
Faculty of
Engineering

Prosperity by design

MADE

by McGill

Miasya Bulger
Bioengineering



Whether we recognize it or not, all of us look to engineers, architects and urban planners to solve problems in the technological and built worlds to support human development and prosperity. The design capacities of these professions have continuously evolved to meet our population's ever-changing needs, **from providing the basics of heat and shelter, to shaping urban environments, to accommodating the demands of our modern world.**

However, the challenges we face today are more complex than ever. Climate change demands solutions that are not just technical, but also economic and social. Issues posed by artificial intelligence are as much a question of ethics as of processing power and data.

The world is facing dramatic economic, environmental and social transformations, where the boundaries between humans and their technologies and built environments are increasingly blurred.

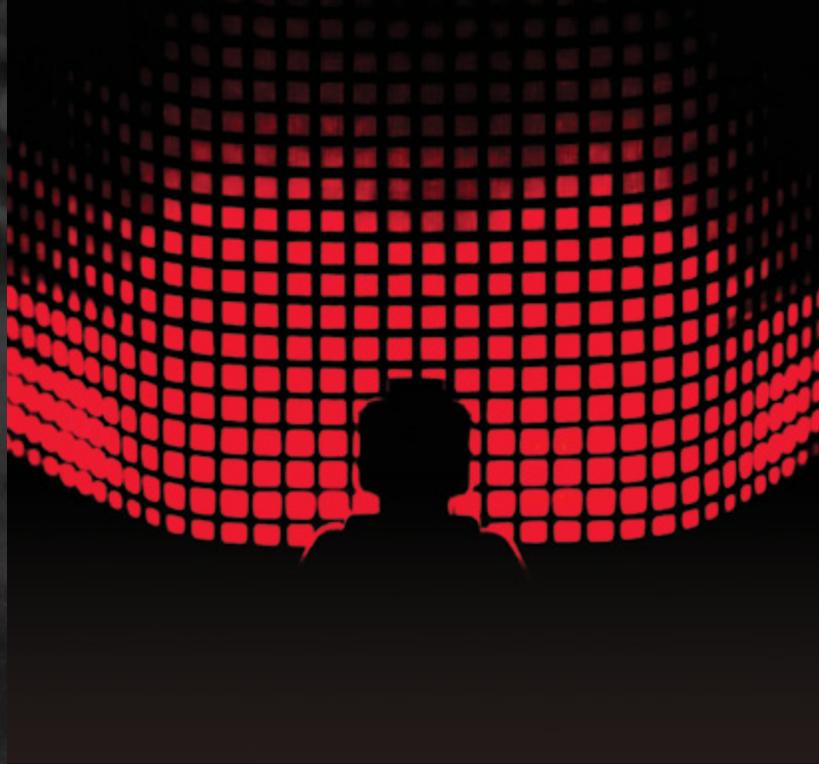
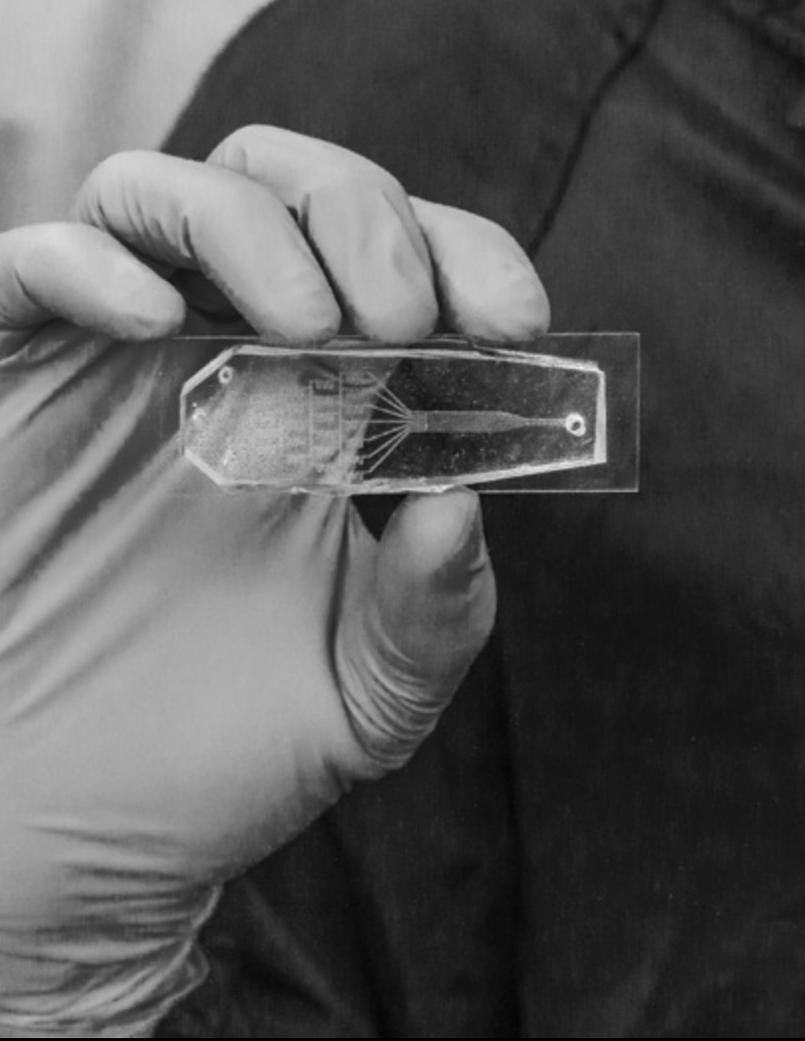
These are urgent issues – but also great opportunities. And it is engineers, architects and urban planners – with McGill at the forefront – who will pioneer the quest for solutions to human challenges and ensure prosperity for generations to come.

[Cover Photo]

Miasya Bulger
Bioengineering student

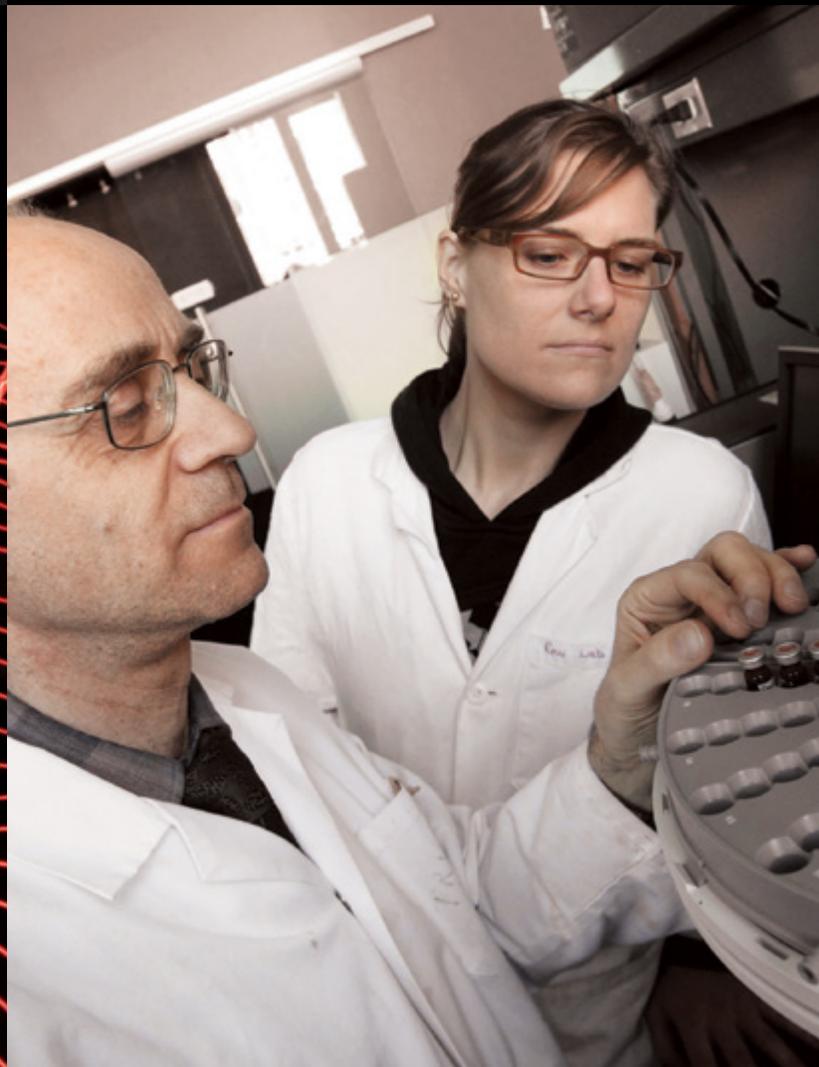
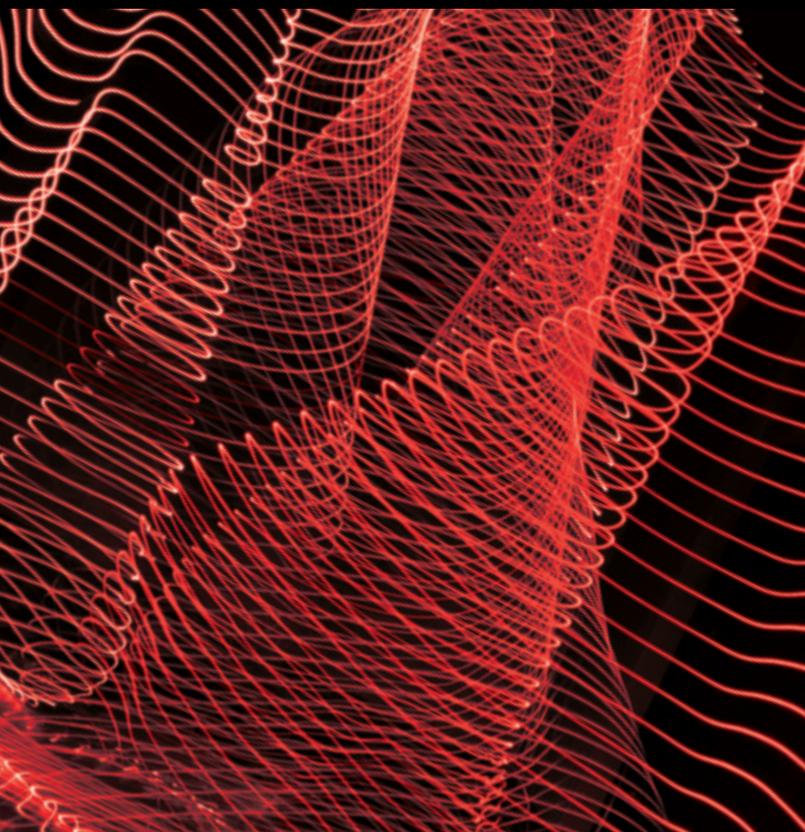
2018 Schulich Leader Scholarship recipient.

**What will it take to find
solutions to the world's
problems?**



We must reshape **how we**
train tomorrow's engineers,
architects and urban planners.

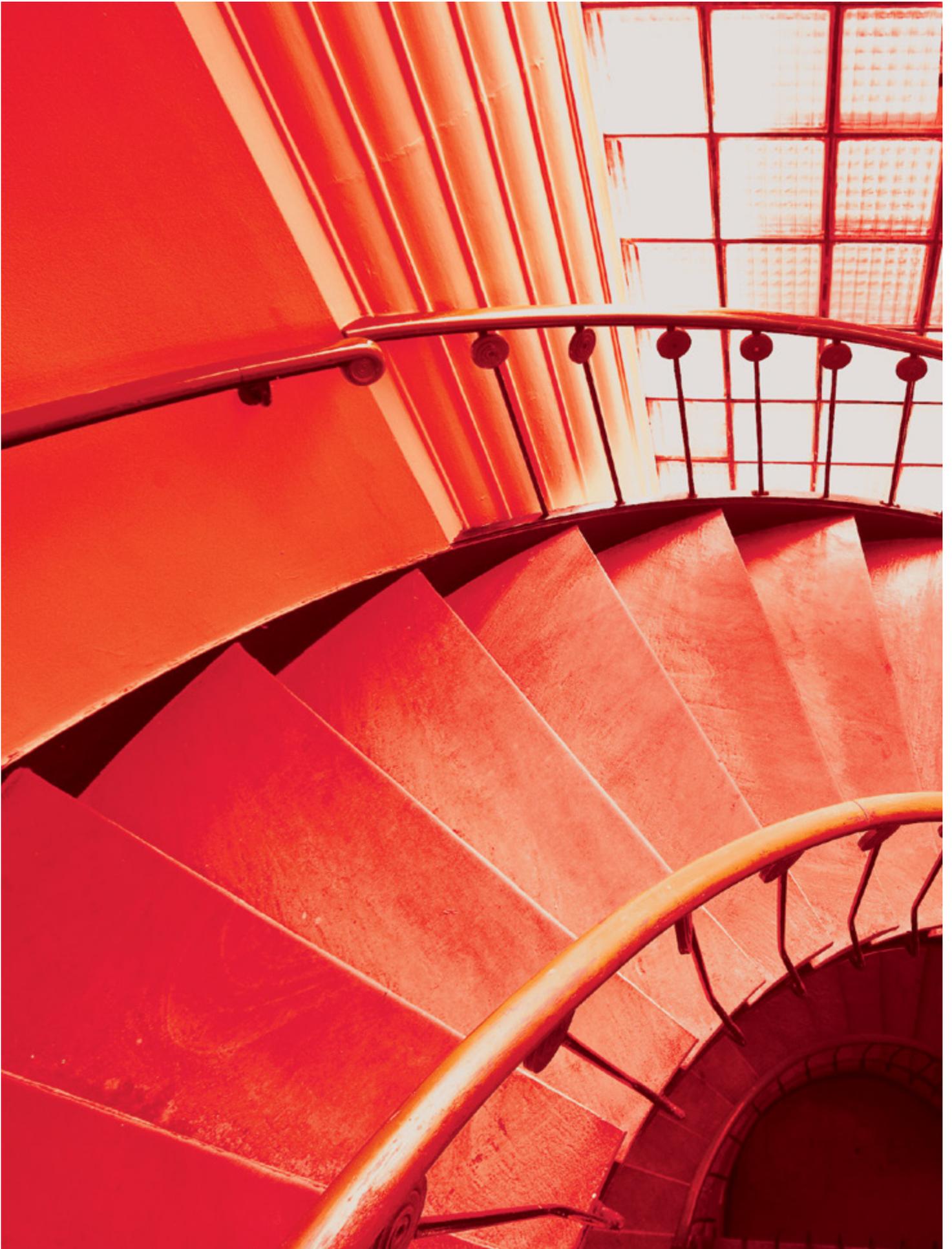
New kinds of challenges **require**
new kinds of professionals.





These professionals need deep technical knowledge but must also be imbued with **creativity, agility and the ability to collaborate across disciplines.**





These are our strengths

Why is McGill's Faculty of Engineering uniquely positioned to train future-ready design professionals?

A vibrant intellectual community

The Faculty is an inspiring assembly of the best and brightest professors and students, who contribute collectively to a learning community that constantly pushes the boundaries of what our professions can achieve.

Access to top-tier knowledge and experience from across disciplines

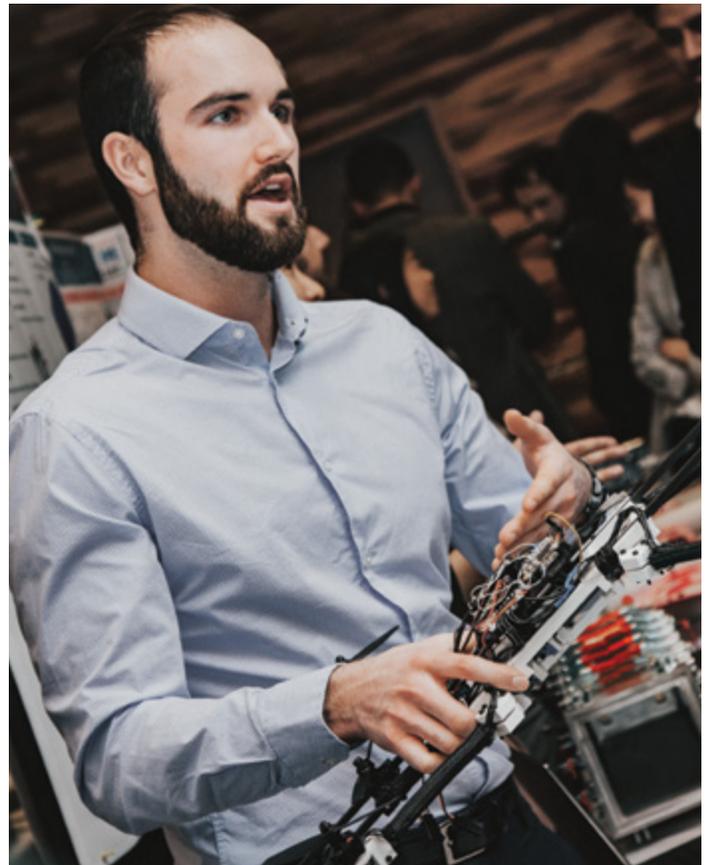
We are an academic unit that is deeply embedded within McGill University, itself a globally renowned institution for education and research in a diverse range of fields. This places us at the heart of a hugely talented and knowledgeable community that is driven to make a positive difference through its work.

Solid connections to industry

McGill's location in Montreal, a vibrant global centre for both emerging and established industries, allows our students and professors to interact directly with practitioners. Access to industries like aerospace, artificial intelligence, health care, biotechnology, and video games helps researchers enhance the application of their work while improving its societal value.

A stellar global reputation

Thanks to the outstanding reputation of both McGill and Montreal, the Faculty of Engineering attracts world-class talent, from across Canada and the world. This creates a diversity of cultures and experiences that enhance education and help our students adapt, wherever they go after graduation.



An extraordinary opportunity to foster interdisciplinary collaboration

The Faculty has a once-in-a-lifetime opportunity to work with others to create a new kind of interdisciplinary facility at the Royal Victoria Hospital site. Professors from fields as diverse as materials, earth systems, the urban environment and public policy will have a space to collaborate on research and education for sustainability, unhindered by traditional departmental and faculty barriers. By uniting a diverse mix of academics and students, and providing them with state-of-the-art facilities and equipment, McGill has the potential to yield the knowledge and the people required to design solutions to complex problems and to redefine the boundaries of what is possible.

This is our vision



Our vision is to prepare globally-minded professionals equipped to solve problems that matter.

Our graduates play a vital role in civil society. They are engaged citizens who create new opportunities to ensure the prosperity of future generations.

But what does it take to continue to shape future-ready design professionals? What must our education provide? Our aspiration is for our students to:

- › Acquire an unparalleled foundation of disciplinary knowledge in their respective fields, complemented by perspectives and knowledge from other disciplines.
- › Foster collaboration on local and global scales by engaging the diversity of people, cultures and disciplines essential to developing meaningful solutions to complex problems.
- › Benefit from applying their knowledge in a real-world environment, and taking ownership of their ideas by bringing them to fruition.
- › Be equipped to adapt to a changing world where the required skills and technical knowledge will change at an ever-increasing rate.
- › Focus on solving problems for the broad benefit of others when creating technologies and built environments

In parallel to undertaking this fundamental shift in the educational environment, the Faculty is dedicated to conducting research that broadens the knowledge base and tools available to our professions.

From pursuing developments in life sciences to creating technologies at the molecular scale, from developing sustainable buildings to investigating applications of machine learning and AI, the Faculty of Engineering is working to find answers to the complex and intertwined problems humanity faces.

To tackle global challenges and train future-ready design professionals we need support in four priority areas:

- **Improving the day-to-day lives of human beings**
- **Creating a more sustainable and prosperous world**
- **Expanding the boundaries of what design professionals can do**
- **Preparing students to be future-ready**

A professional headshot of Tal Arbel, a woman with long, wavy brown hair, wearing a magenta turtleneck and a black blazer. The background is a light gray gradient. The image is framed by a red border on the left and bottom, with a white diagonal shape in the top-left corner.

Innovation in health care.
Driven by new insights from AI.

Made by McGill.

Tal Arbel
BEng'92, MEng'95, PhD'00

Professor of Electrical and Computer Engineering,
Research Director of the Probabilistic Vision Group and
Electrical and Computer Engineering Medical Imaging Lab.

Improving the day-to-day lives of human beings

Engineers, architects and urban planners unite around a common focus: solving problems. This singular focus has yielded a staggering array of innovations that have become so fully integrated into our daily lives that the underlying technological innovations are often imperceptible.



From our cars and the roads we drive on, to the way we navigate and communicate on the go, there is no shortage of indispensable tools for modern life which work intuitively but have taken thousands of hours of creativity to develop. The list is endless and increasingly interconnected: the invention of one technology often results in another.

This interconnectedness - as reflected by the Internet of Things (IoT) - is adding a new dimension to the way we interact with everyday technology. Semi-autonomous machines are being deployed worldwide. These devices, ranging from simple appliances to complex vehicles, are driven by artificial intelligence (AI) and rely on connections with each other and their environments. Other technologies that monitor our health or serve to prevent disease are becoming commonplace. More and more, devices like these are making their way into our homes and lives. While their potential benefits are enormous, these disruptive technologies can come with unforeseen and sometimes regrettable impacts.

How will these devices interact, and what information will they share? Who will ensure public safety and welfare?

These are the pressing issues we must resolve as the wave of IoT and AI sweeps through economies around the world. These are the questions the Faculty is exploring as it works to exploit the full potential of these and other disruptive technologies. Our goal is to ensure that the ideas we advance through our research and the



training we provide our students is not only focused on getting the most out of our technologies, but also to confirm that they truly contribute to advancing the well-being of our communities. This can take many forms and you can help.

For instance, your support can:

- › Enable a better understanding of – and ability to contend with – the role and implementation of AI by establishing a **Chair in Applied AI** who would leverage the strength of our world-leading Centre for Intelligent Machines
- › Create a **Chair in Technology & Humanity** who will strengthen our links to the arts and humanities to ensure that the human condition is enhanced, rather than diminished, through the use of modern technologies
- › Establish **Professorships** in our departments and schools to meet the growing demand for the integration of AI and IoT in sectors that will inevitably rely on these technologies to ensure their global competitiveness
- › Enrich the student experience and leverage McGill research expertise by bringing world-class experts to McGill through an expanded **Visiting Professors** program

- › Provide students with **internships** to give them outside-the-classroom experiences that complement their education and build social awareness that will ultimately inform their work and careers





**A commitment to life-long learning.
Led by professors with a passion for teaching.**

Made by McGill.

Lawrence Chen
BEng'95

Professor in the Department of Electrical
and Computer Engineering. Academic
lead of the ELATE program.

Creating a more sustainable and prosperous world



Sustainability cannot be an afterthought for our graduates; it must be their primary mission. Students want and demand an education that integrates the environmental, social and economic dimensions of sustainable development.

Sustainability must be built into our programs from the ground up to both meet student educational needs and to establish a healthy, prosperous world for future generations.

At McGill, the Trottier Institute for Sustainability in Engineering and Design (TISED) is reshaping how we build and design solutions to interact with our world. The next generation of engineers, architects and urban planners is trained to practice their professions and perform high quality research that strives to create a sustainable planet. TISED connects students, researchers and innovators from all fields to foster the interdisciplinary skills essential to building a better world.

We lead discussions today to create the solutions for tomorrow – we address challenges like increasing efficiency in energy and manufacturing, developing sustainable transit and aviation, and accelerating radical sustainable design in buildings and communities.

With your help, the Faculty of Engineering can become a beacon of excellence for sustainable innovation, benefitting all society with clean air, water and food to not just survive but also thrive on our shared planet.

Your support can help us:

- › Build an interdisciplinary **Climate Change Initiative** focused not only on reducing greenhouse gas emissions but also on preparing communities – urban, rural and remote – to adapt to the reality of changes that are already upon us and ensure their resilience for decades to come
- › Establish a **Chair in Water Security** to help us explore effective and economical solutions for providing clean water and sanitation to people worldwide and, indeed, in our own backyard by addressing critical challenges associated with sustainable water supply and pollution control
- › Create a **Chair in Responsible Design** to put sustainability considerations front and centre in the design process as we develop new technologies and build our communities with the long-term in mind
- › Boost TISED's international impact and profile by bringing world-class thought leaders to McGill through a **Visiting Scholars in Sustainability** program
- › Provide **Sustainability Seed Grants** to enable researchers from multiple disciplines and sectors to explore their ideas and build lasting collaborative relationships that are essential to grapple with the complexities of sustainability challenges

Expanding the boundaries of what design professionals can do



Design and technology permeate all aspects of contemporary life. They are everywhere, from the chairs we sit on to the buildings and spaces we live and work within. At the Faculty of Engineering, our students and professors constantly face exciting new challenges and endless potential applications of their invaluable skills.



As design professionals, we are frequently called upon to propose solutions to societal problems. But, with exponentially complex systems becoming the norm, the focus needs to shift from simply solving short-term problems to asking the right questions so that we can provide the desired outcomes over the long term. But the true potential of our work can only be realized if we take advantage of the developments of complementary fields and apply them to our own.

With your help, we can better face complexity head-on, working across disciplines to broaden research and education in existing domains, while expanding into areas such as bioengineering, advanced materials, additive manufacturing, and nanotechnology.

Broadening research and teaching in existing domains:

As humanity continues to move toward increased connectedness and urbanization, intersectional studies become increasingly urgent. In design, which is involved in all aspects of the built and technological environment, moving beyond traditional boundaries has become a priority.

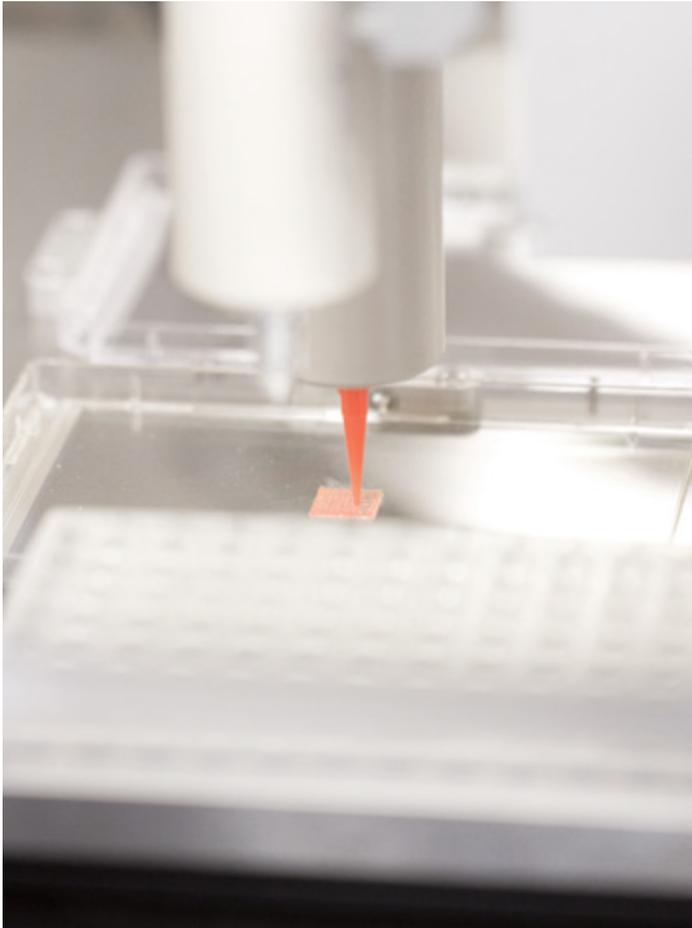
For instance, your support can help us:

- › **Create a Chair in Architectural Design** to explore how we interact with the buildings we live and work in; how these structures interact with their cultural, material and natural surroundings and enable human interaction; and to then use these insights to better inform our designs

- › **Establish a Chair in Urban Innovation** to look beyond the built environment to how urban structures – both physical and social – can lead some cities to become more innovative and adaptive than others and to explore how we can improve the design of our communities at scales ranging from the local to the cityscape
- › Host **Design Workshops and Symposia** that bring recent developments arising from other fields – social, scientific, and technological – into our classrooms and into our research initiatives

Expanding into nascent areas:

The Faculty of Engineering is uniquely positioned to drive the development of new approaches that have the potential to transform professional practice by expanding the tool sets at our disposal and amplifying our positive impact on society. At McGill, we are fortunate to find ourselves next to leading researchers from fields such as science, humanities, management and medicine, among others. By capitalizing on new insights from these domains, we can drive the development of technologies and the built world in ever-expanding and exciting new ways.



For example, we seek to enhance our expertise in the following fields:

- › **Advanced Materials and Nanotechnology:** The applied and theoretical aspects of materials, nanoparticles and nanodevices have wide-ranging impacts, extending across disciplines such as medicine, engineering and science.

Your support can help us:

- Boost nanoscale research through the establishment of a **Chair in Nanotechnology** by recruiting a visionary researcher for the McGill Institute for Advanced Materials (MIAM), which supports nanoscale research across the University
- Establish **leading edge facilities** to equip MIAM researchers to create the next generation of materials to support a sustainable world
- Develop **additive manufacturing technologies** that make it possible to design and build never-before-possible devices in support of aerospace, communications, health care, aerospace, robotics, and countless other fields

- › **Bioengineering:** This burgeoning domain allows engineers to capitalize on the explosion in knowledge in the life sciences to solve diverse problems, ranging from health, to the environment, to computing. The demand for this program is growing, with the Department of Bioengineering having received 20 times more applications for undergraduate admissions since 2016 than places available.

Your support can help us:

- Create a **permanent home for the Department of Bioengineering** with dedicated research space, teaching labs and other facilities
- Bolster the Faculty with new **Bioengineering Professorships** that would expand the range of areas into which life-sciences knowledge can be applied
- Provide undergraduate **scholarships and fellowships** to ensure that our competitive programs are accessible to a diverse range of highly qualified students
- Offer experiential learning opportunities for students through **internships** with biotechnology companies, health care institutions, and other sectors that are positioned to capitalize on the unique insights of bioengineers

A portrait of Stéphanie Breton, a woman with long, straight brown hair and light-colored eyes, wearing a light blue lace top. The background is a plain, light grey color. The top-left corner of the image is cut off by a diagonal line.

Sustainable energy
for the future.

Made by trailblazers
working together.

Made by McGill.

Stéphanie Breton
BEng'15

Energy Research Engineer at CanmetENERGY-
Natural Resources Canada. President of POWE
(Promoting Opportunities for Women in Engineering)
in 2014-15.

Preparing students to be future-ready

Today's students need an education that goes beyond developing traditional technical skills. They need training outside of the classroom environment that equips them to adapt to a changing world and prepares them for real-world tasks.



This is complicated by the technology development cycle, which has shortened dramatically: new technologies are now introduced almost daily. As a result, the half-life of engineering knowledge is becoming increasingly short, and in some fields lasts only a few years. In order to stay relevant, students must adapt to an ever-changing slate of techniques, and they will need to continually upgrade their skills after graduation.

Providing such an education means investing in experiential learning opportunities, which push students outside of their comfort zones, and teach them to accept risk, uncertainty and failure as parts of their learning journey. It means giving students the chance to apply their skills in unfamiliar settings, and to take initiative to address problems in a complex and messy world.

Moreover, our students must not only be able to work seamlessly in collaboration with individuals from diverse backgrounds; students themselves must also be representative of these backgrounds. To truly achieve the potential of our professions, we must enhance the diversity of our graduates and prepare them to not only draw from their own experiences, but to draw from the thoughts and practices of others and ensure that their work responds in a positive, constructive and lasting way to local needs.

In short, the Faculty must not only continually strive to educate students in their core disciplines to the best of our ability but must constantly work to transform our community and the educational process itself to better prepare our graduates to meet the diverse needs of society.

Faculty of Engineering programs can prepare future-ready professionals by providing experiential learning opportunities and continuously innovating in engineering and design education, while maintaining a commitment to accessibility, diversity and inclusion.



Providing experiential learning, entrepreneurship, leadership and inclusivity to enhance the student experience:

Your support can boost the Faculty's established initiatives that are designed to enhance the educational experience of our students and to help them realize their full potential:

Empower is a self-directed, experiential learning framework that develops leadership skills through co-curricular and extra-curricular programs. To successfully expand this program, we seek support for:

- › A **Director of Empower** to oversee the implementation of what promises to be a groundbreaking way forward in the education of future-ready professionals
- › A **Global Challenges Initiative** to provide paid summer internships designed to build leadership skills, drive positive social impact, and provide international exposure
- › Our **Student Initiative Fund** to reduce the financial barriers that prevent students from pursuing activities that contribute to their personal and professional development
- › **Design Teams** to offer our students hands-on learning opportunities in competitive settings, where they can put their classroom learning into practice
- › **Guest Speakers** to inform, inspire and exchange ideas with students

Engine, the Faculty of Engineering Innovation and Entrepreneurship Centre, is dedicated to stimulating technological innovation and entrepreneurship across the University. To help more students benefit from what entrepreneurial experience offers, the Faculty seeks support for:

- › The Faculty's **Innovation Fund** to provide vital financial support for students and professors to explore early-stage business ideas
- › **Social Impact Seed Grants** to allow students to pursue ideas through social innovation and transfer them to the community
- › The **Entrepreneurship-in-Residence** program, which offers students and professors critical advice from practitioners with real-world startup experience
- › **Innovation Fellowships** to help entrepreneurial graduate students take their concepts to market by funding the prototype process and supporting the transfer of technology from lab to industry
- › The outfitting of our **Engine Centre** with personnel and equipment to serve the technological innovation needs of the entire McGill community

ELATE (Enhancing Learning and Teaching in Engineering)

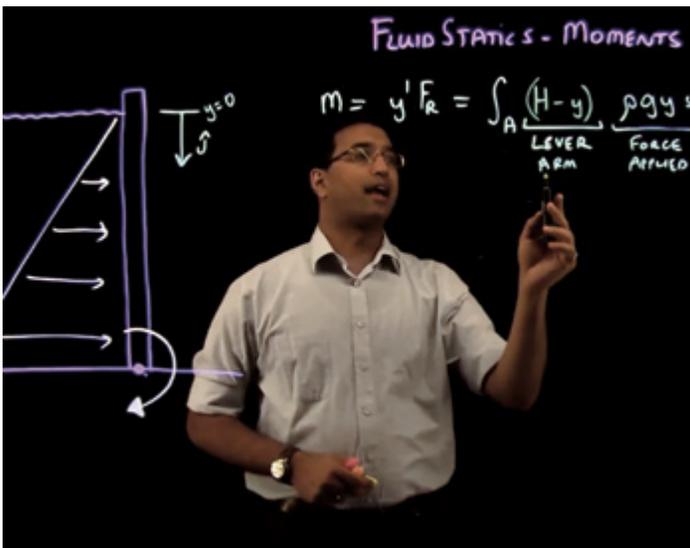
combines active learning techniques to better engage students in their own learning processes with evidence-based research that informs new pedagogical practices. This initiative requires support for the following areas:

- › A **Chair in Teaching & Learning Innovations** who will drive innovative approaches to undergraduate and graduate education
- › **Teaching Initiative Funds** to support professors' work to revamp their approaches to teaching and improve students' learning experiences
- › **Education Research Funding** to help professors conduct studies that lead to evidence-based pedagogical practices in engineering and design education
- › **Training and workshops** to expose professors and teaching assistants to evolving best practices in pedagogy and curriculum design

E-IDEA (Engineering Inclusivity, Diversity and Equity

Advancement) promotes the inclusion of underrepresented groups, including women and Indigenous peoples, who all have a critical role to play in the design professions. This initiative requires support for the following areas:

- › To meaningfully address and eventually achieve gender equality in the design professions, E-IDEA needs funding for:
 - **Youth outreach and engagement** to encourage involvement of young people in the design professions
 - A **Chair for Women in Engineering & Design** to drive initiatives that engage more women and their perspectives in education and research
 - **Scholarships** to support promising female undergraduate and graduate students
 - Inspirational **guest speakers** who can share their life experiences
- › To increase access to engineering education for **Indigenous peoples**, the initiative is seeking:
 - **Scholarships** for undergraduate and graduate students to ensure accessibility to McGill's programs
 - **Academic success programs** to establish a supportive community that meets the unique needs of Indigenous students
 - **Internships** to provide experiential learning opportunities
 - Recruitment of **Professors-of-practice** to bring Indigenous knowledge and experience into the classroom
 - The development of **specialized programs** that are tuned to the needs of Indigenous communities
- › To help student organizations in their efforts to foster a culture of inclusion, empathy, trust and collaboration, E-IDEA is seeking funding for groups such as:
 - Promoting Opportunities for Women in Engineering (POWE)
 - Queer Engineer
 - National Society for Black Engineers





A portrait of Lorne Trottier, a middle-aged man with grey hair, wearing a dark suit jacket, a white shirt, and a patterned tie. He is looking slightly to the right of the camera with a neutral expression. The background is a plain, light color.

A Faculty of Engineering
for McGill's third century.

Made by donors
like Lorne Trottier.

Made by McGill.

Lorne Trottier
BEng'70, MEng'73, DSc'06

Co-founder of Matrox, engineer,
entrepreneur and philanthropist.

The Faculty of Engineering:
Designing solutions to global challenges.

Made by McGill: THE CAMPAIGN FOR OUR THIRD CENTURY.



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