



Infinite Perspectives

The leaders of tomorrow's world are not those who have the answers today. That's why for every big question we have infinite perspectives.

Faculty of Engineering & Architectural Science

At FEAS, we immerse ourselves in the economic, social and technological communities we serve. As they evolve, we shift to meet their needs, leveraging our strengths and generating novel solutions. More and more, inventing with meaning requires the capacity to solve for exponential complexity and understand systems. That's why our research and education programs emphasize the value of inherent difference and multiple perspectives. These priorities are also the foundation of our network of interdisciplinary clusters, our student development framework, and our unique approach to experiential learning.

Faculty Highlights

During a ten year period of exponential growth, FEAS external research revenue increased 329% (2001–2014). From 2010–2016, research revenue increased 72% from the same pool of approximately 150 faculty members. In the next several years, FEAS is hiring over 12 new faculty members to bolster our research enterprise.

Since 2013, our innovation and entrepreneurship ecosystem has helped advance over 200 entrepreneurial ideas through \$2 million in funding from the Norman Esch Engineering and Entrepreneurship Awards. FEAS student entrepreneurs have leveraged that seed funding to secure an additional \$4 million in capital from other sources and created 100 new jobs.

The citation impact of our engineering research is ranked 4th in all of Canada and 115th internationally (US News).

FEAS Architectural Science faculty and students are regularly successful in international architectural competitions as well as art and design fairs including Art Basel and the Venice Biennial. They also excel in Toronto-based events such as Nuit Blanche and Luminato.

Research Infosource named Ryerson as the top undergraduate university in Canada for research income and producing peer-reviewed academic publications over the last 15 years.

Table of Contents

5

The Future of Professions

Can the End of Professions Teach Us the Future of Leadership?

- 6 The Whole Student is a Balanced Student
- 12 Millennials and the Workplace Culture Shift
- 18 Designing for Number Two by Putting People First

20

Changing Economies

Are there Practical Tools that Can Help Organizations Realize their Innovation Potential?

- 21 Getting Real About Augmented Reality
- 23 Cutting Through the Hype Cycle for a More Sustainable Future
- 27 The Entrepreneur's Journey to Business Success

30

Artificial Intelligence

Artificial Intelligence is Already Here. And it's Here to Help. (Maybe?)

- 31 Training Watson and Hiring for Big Data
- 32 Rather than Replace Us, AI May Be the Best Job Creator Ever

37

Healthcare and Technology

Is Technology Adoption the Biggest Threat to Healthcare?

- 38 iHealth and the Quantified Self
- 39 Medical Ideation to Commercialization
- 41 The Next Generation of Healthcare in Real Time

46

Smart Energy Storage

How Will Green Energy Scale?

- 47 Power in the Age of Renewables
- 48 Saving and Storing Energy
- 49 Flywheels, Battery Boxes and Compressed Air Balloons

51

Cities as Systems

How can Architecture Measurably Improve the Lives of the People Who Use It?

- 52 Race to Net Zero Homes
- 55 Making Aging Cities Smarter
- 57 The Healthy Community of the Future is Happening Today

Can the End of Professions Teach Us the Future of Leadership?

Solving for exponential complexity through new models of collaboration.

- 6 The Whole Student is a Balanced Student
- 12 Millennials and the Workforce Culture Shift
- 18 Designing for Number Two by Putting People First

Ray Kurzweil's Law of Accelerating Returns dictates that the rapid development of technology will soon result in exponentially more powerful computer processing capabilities. Using a measure of calculations per second per \$1,000, he predicts that, by 2023, we will achieve the computing power of a human brain.

This ever-shifting landscape requires a thoughtful and varied approach. The result will be a more intrinsically interconnected world requiring more imaginative problem-solving focused on creating better human experiences that derive insight from vast amounts of available data. The new exponential world will mean the end of traditional categories and professions.

How will we navigate the new emerging reality?

The Whole Student is a Balanced Student



The job market for architects and engineers is ever more competitive and changing quickly. Not only do employers want one to three years of work experience, even at entry-level positions, they also want to know that graduates are ready to lead and think laterally within and outside the field they are graduating from. What do these graduates look like?

At Ryerson, we believe every student should strive for all six elements of a successful post-secondary experience:

- ♦ **Wellness** Championing mental, social, emotional, spiritual, occupational, intellectual and physical health
- ♦ **Identity Fluency & Competency** Actively re-imagining positive shifts in culture, gender, and class-related power dynamics
- ♦ **Experiential Learning** Participating in co-operative internships, student design teams, student government and societies, student groups and clubs, research assistantships, clusters and zones, and community volunteerism
- ♦ **Academic & Career Preparation** Striving for academic integrity and seeking career advice and support from the Career Centre
- ♦ **Scholarships & Awards** Pursuing scholarships, bursaries, and academic, entrepreneurial and leadership awards
- ♦ **Personal Profile** Sharing one's story and cultivating an engaged personal and professional network

Four students share how the experiences that shaped their time at Ryerson helped to differentiate them in an increasingly competitive world.

Henry Mai

Undergraduate Architectural
Science Student
Graduating April 2018

“The time I dedicate to student groups, design projects and travel influences who I am as a person and who I want to be as a designer.”



Henry Mai is the current president of Ryerson’s Architecture Course Union (ACU), where he has coordinated various events, including industry panels and studio tours of local architectural firms. Travel has played an important role in his academics, including trips to Bergen, Norway, in 2015 for a design and build project exploring wood as a sustainable resource. He also participated in the 2017 Kakehashi Project exchange program focused on urban infrastructure sponsored by the Government of Japan. Henry is passionate about capturing his travels through photography.



Wintta Ghebreiyesus

Aerospace Engineering PhD Candidate
Graduating January 2021

“The outstanding learning opportunities at Ryerson have allowed me to earn my undergraduate and masters degrees in engineering — both of which have been challenging milestones in my life. As I continue to pursue my PhD in Aerospace Engineering, I will promote the field through my strong involvement in design teams, speaking at women in STEM panels and working closely with industry.”

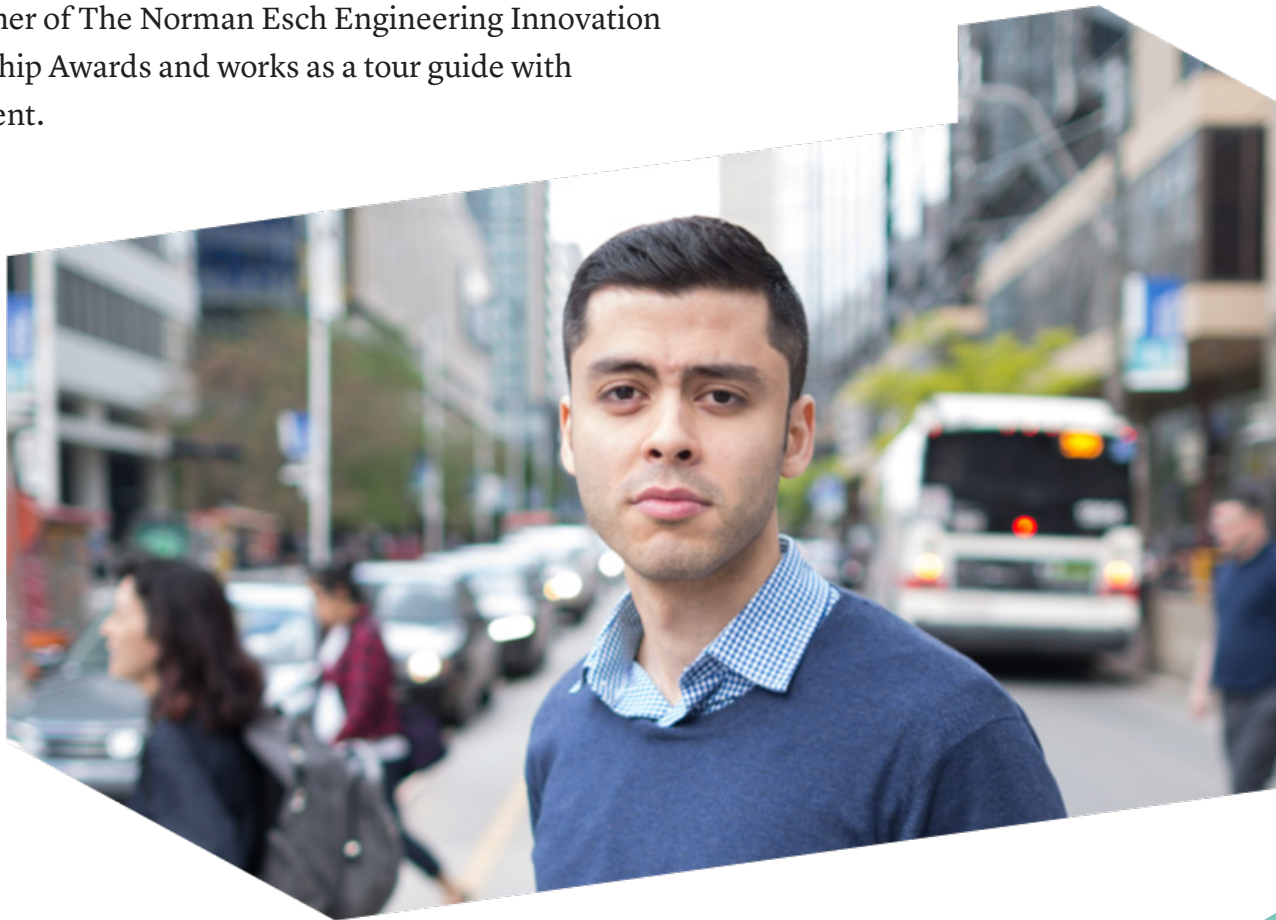
Wintta Ghebreiyesus was a member of Ryerson’s International Hyperloop team that was invited by SpaceX to demonstrate the fully-functioning deployable wheel system at the 2017 pod competition. She’s received the Women in Aerospace Canada Scholarship for a female student making significant contributions to the aerospace community and was sponsored by WestJet to attend the Biennial Canadian Women in Aviation Conference in 2017. During her studies she was vice-president of the Ryerson Rocketry Club and a member of Ryerson’s Power Cheerleading Team.

Farbod Mansorian

Mechanical Engineering Class of 2017
Co-Founder, PawCharge

“I have received an enormous amount of support and mentorship as a Ryerson student, and I take it upon myself to give back to our vibrant, energetic and entrepreneurial community.”

Farbod is the co-founder of PawCharge, a startup that's developed a battery sharing program and prototype that allows smartphone users to charge their devices on the go. He is also the co-founder of EtotheX, a Ryerson-based program aimed at guiding engineers through the learning curve of entrepreneurship. Farbod has been a multi-award winner of The Norman Esch Engineering Innovation and Entrepreneurship Awards and works as a tour guide with Campus Recruitment.






Taspia Wahid is currently working as a research assistant at the Signals Analysis Research Group with Sri Krishnan, a professor in Electrical and Computer Engineering, and is set to be listed as an author in an upcoming academic publication. In addition to working as UI/UX developer for a startup with the DMZ, she has contributed to the Ryerson Rams Robotics Team on upgrading the RamsBot, a robot designed to play basketball and shoot three-pointers. Taspia is set to attend a series of upcoming regional and national engineering competitions.

Taspia Wahid

Undergraduate Biomedical Engineering Student
Graduating April 2018

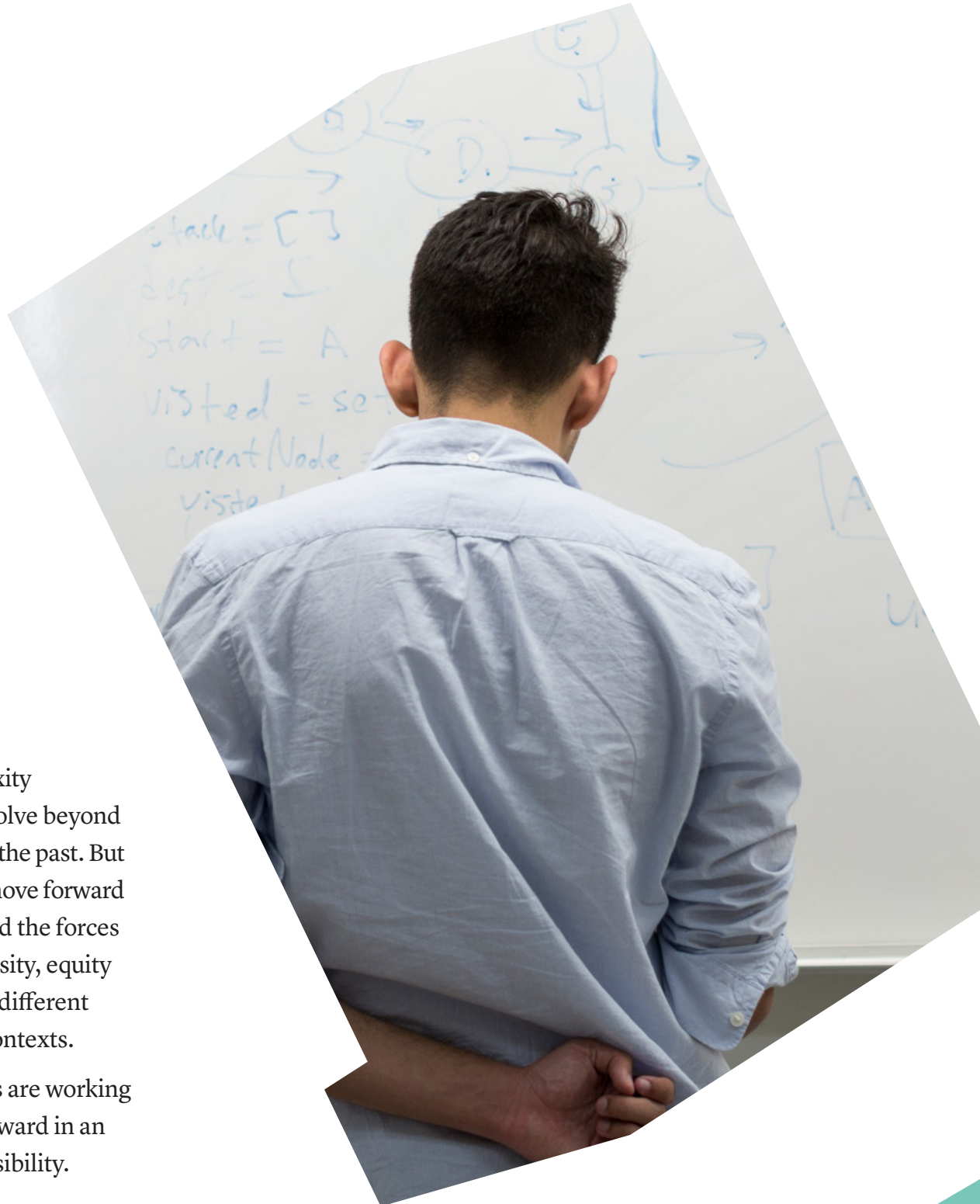
“Since first year I have been heavily involved with Ryerson’s Engineering Student Society, volunteering for events and holding positions on the board. I have also been a part of two startups working out of the Design Fabrication Zone (DFZ) and Digital Media Zone (DMZ). Ryerson’s zone learning environment is helping to grow our ideas into a business with tangible mentorship.”

A large teal geometric shape, resembling a stylized mountain or a large 'V' rotated 45 degrees, is positioned at the top left of the page.

“We are always looking for creative and collaborative team members who demonstrate leadership and ownership behaviour, and share our values and passion for being responsible, excellent and innovative.”

*Dr. Tom Murad, Head of Siemens Canada Engineering
& Technology Academy, Siemens Canada Limited*

Millennials and the Workplace Culture Shift



Exponential complexity demands that we evolve beyond the old structures of the past. But the world does not move forward in a uniform way, and the forces of digitization, diversity, equity and inclusion mean different things in different contexts.

Millennial engineers are working to find new ways forward in an era of untapped possibility.

Urooj Siddiqui

Industrial Engineering Class of 2016

Industrial Engineer, MHI Canada Aerospace, Inc

“In my lifetime, at least, we as a society will continue to face challenges presented by gender, sexual orientation and race-based stereotypes. Most companies recognize the role workplaces can play in addressing some of these challenges, but more needs to be done. In order to overcome deeply ingrained power dynamics, everyone needs to strive for greater understanding and respect.”





Aidan Messom

Undergraduate Industrial Engineering Student
Graduating April 2019

“In my various summer jobs, I’ve always valued being trusted with responsibility. The organizations that will most benefit from engaged and eager problem solvers are those that celebrate employee diversity and support people to freely express themselves.”

Sabrina Gomez Vila

Aerospace Engineering Class of 2016
Aircraft Economics Analyst, Bombardier

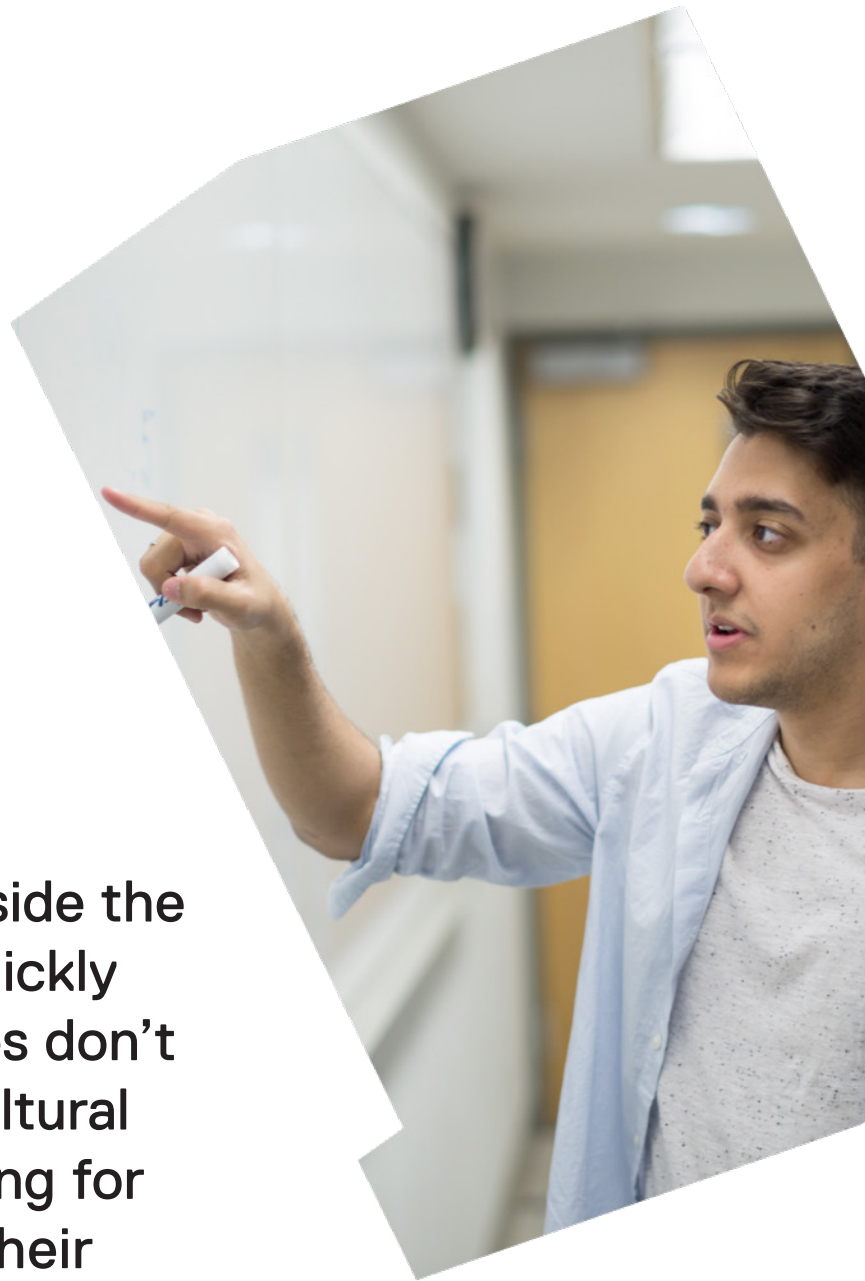
“I have met many successful and diverse women within the aerospace industry, but I believe we need more role models with diverse identities to champion equity, diversity and inclusion at all levels of the organization, not only to mentor new graduates in the workforce, but also to inspire them to stay.”




Anthony Sistilli

Computer Engineering Class of 2017
Software Engineer, Intuit

“Working at Intuit, right inside the heart of Silicon Valley, I quickly learned that top companies don’t just hire for skill but for cultural fit. I pride myself on working for a company that looks at their employees as an asset to invest in and chooses candidates based on cultural longevity as well as growth potential. Being able to market and represent yourself properly is just as important as having the technical skills to be a rockstar at your job.”

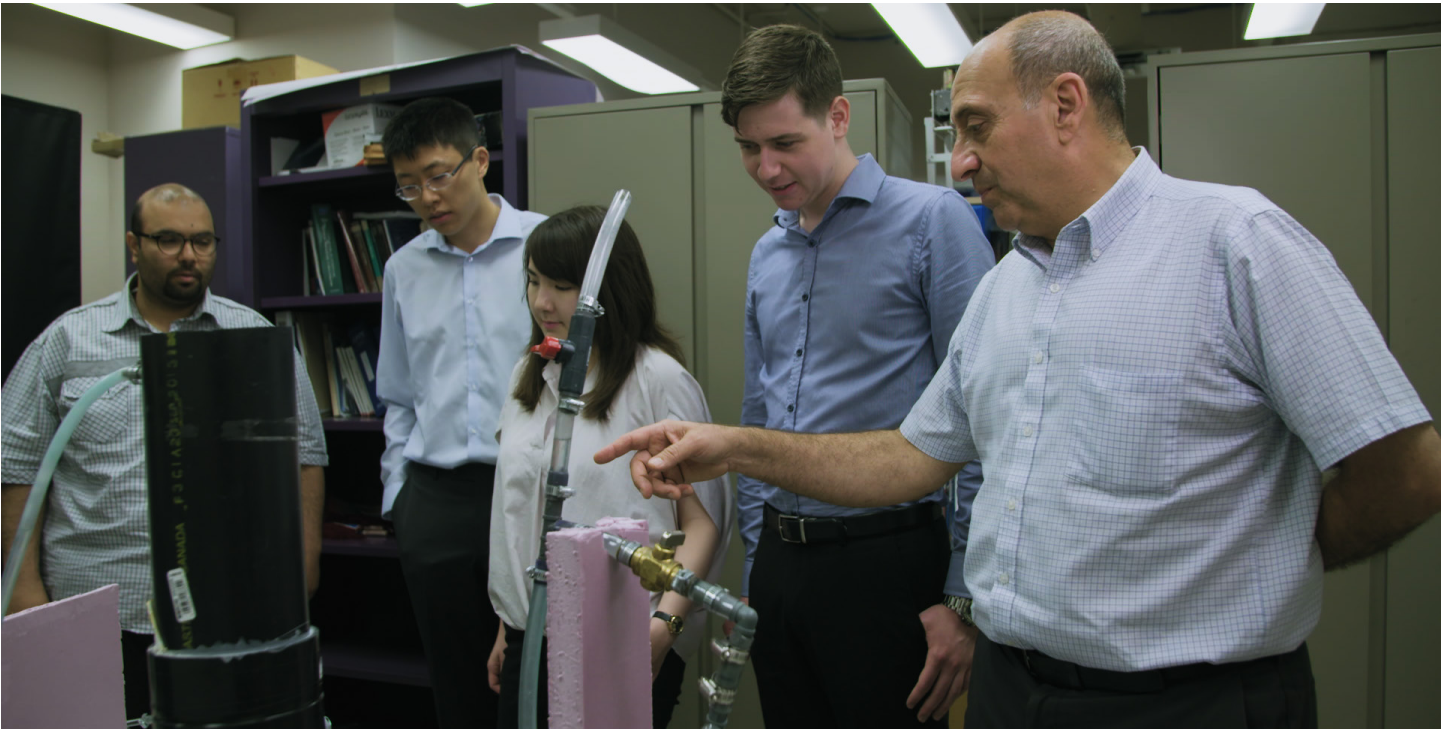




“One attribute that sets people apart is emotional intelligence. Learning how best to engage with, and to effectively collaborate with colleagues, customers and management (from all generations) will really determine success in the workplace.”

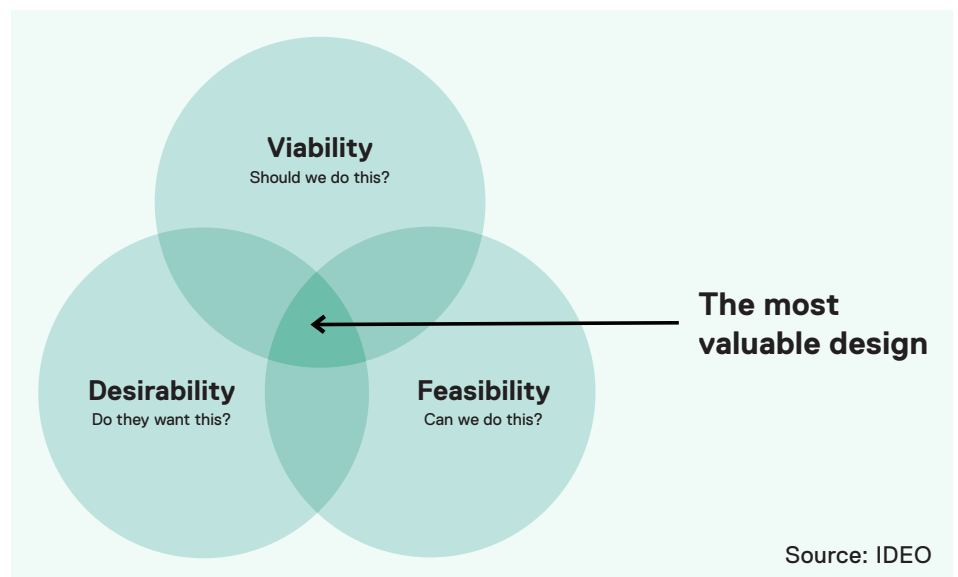
*Irene Yang, Head of Business Development,
BASF Canadian Leadership Team*

Designing for Number Two by Putting People First



In his book, *Change by Design*, Tim Brown, CEO of IDEO, describes design thinking as a method for putting the needs of people at the heart of human progress by focusing on the desirability of a solution as the key driver rather than simply feasibility and viability.

This approach was central to one student team's response to an open call from NASA for solutions for better managing astronauts' bodily fluids in



space. The goal was to design a collector to be located inside a spacesuit that hampered the astronauts as little as possible. NASA recognized the interdisciplinary team of Ryerson engineering students for their innovative and human-centric design solution.

The team included biomedical, industrial and mechanical undergraduate engineering students Cayley Delisle, Jennifer Eshoua, Caleb McNevin, Noor Shehata, Arianna Soave and Christopher Welsford. They placed in the top tier of 10,000 international teams.



Watch the full video online at the Ryerson FEAS YouTube channel.



“The team’s winning engineering solution beat out other international teams with a human-centred design optimized for a harsh zero-gravity environment.”

*Ziad Saghir, Professor,
Mechanical and Industrial Engineering*

Are there Practical Tools that Can Help Organizations Realize their Innovation Potential?

There are entrepreneurs who respond to market demands and then there are those who create new markets from uncharted territory.

- 21 Getting Real About Augmented Reality
- 23 Cutting Through the Hype Cycle for a More Sustainable Future
- 27 The Entrepreneur's Journey to Business Success

The Gartner Hype Cycle illustrates a familiar experience for many of us. Our social feeds are full of new world-changing technology promising a seemingly impossible future. Then, sure enough, we learn the technology that seemed like it was just around the corner is often much further off than we first thought.

What the Gartner Hype Cycle diagram lays out is the actual trajectory of many emerging technologies and where they fall on the is-this-real-or-is-it-too-good-to-be-true spectrum. It communicates a concern that many organizations have: How can we innovate in a genuinely meaningful and sustainable way?

While there is no one answer to this question, there are many perspectives on how it can be done.

Getting Real About Augmented Reality



Augmented Reality is still hype for most of us. Wide adoption always seems to be one or two breakthroughs away from delivering on its promises. But progress is never linear. Dr. Naimul Khan and Dr. Ling Guan are exploring ways that AR can solve challenges on highways and in surgical rooms of the near future by understanding how to connect real and augmented worlds in practical ways.

Dr. Naimul Khan and Dr. Ling Guan work in the Centre

for Interactive Multimedia Mining. Their research has used a technology called cave automatic virtual environment, or CAVE as it's commonly known. CAVE is an immersive virtual reality environment where projectors are directed to between three and six of the walls of a room-sized cube. This tech is used for:

- ♦ **Architectural Modelling** Providing virtual walkthroughs of future buildings
- ♦ **City Planning** Enabling virtual flight around cities, following

traffic routes and altering building scales

♦ **Medical Visualization**

Allowing doctors to project MRI data and walk inside a body part to plan a surgery

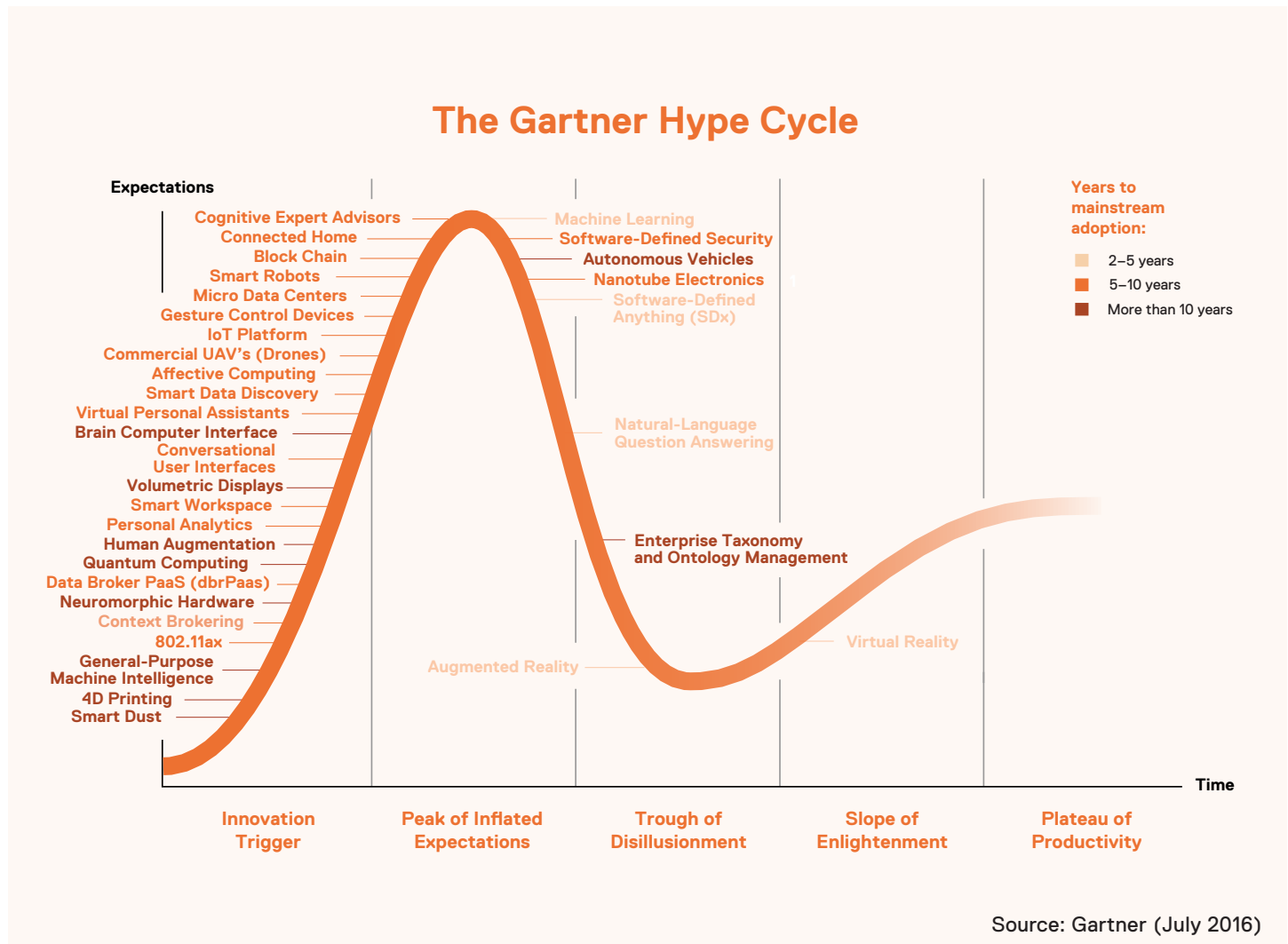


Watch the full video online at the Ryerson FEAS YouTube channel.

“Virtual reality is the convergence of artificial intelligence, image analysis, computer graphics and immersive communication.”

Dr. Ling Guan, Professor, Electrical and Computer Engineering

Cutting Through the Hype Cycle for a More Sustainable Future



Issues of sustainability within the Gartner Hype Cycle are complex. Citizens and shareholders have better access to information than ever before and are becoming active advocates with a new power to force corporate interests

to shift direction. In this new world, there is no top-down and bottom-up solution. An intersecting mesh of systems, products and policy is working to push us towards a more sustainable future.



Babak Khodaparast

Mechanical and Industrial Engineering,
Undergraduate Student

Founded by Babak Khodaparast, Clean Oil International is a company whose intelligent system eliminates the environmental damage and financial cost associated with collecting and separating oil on the surface of water following a spill.



Corey Searcy

Professor, Mechanical and
Industrial Engineering

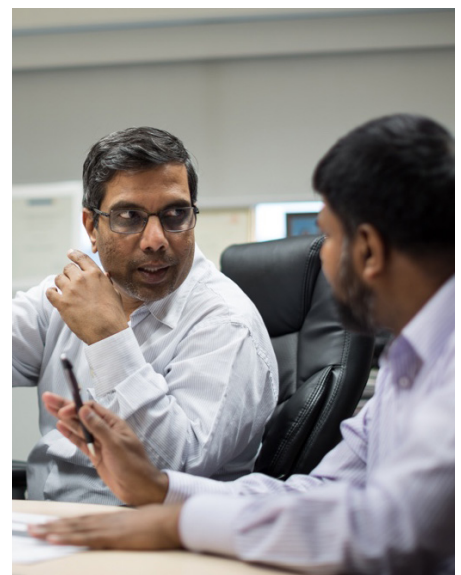
Dr. Searcy is focused on helping organizations understand data derived from supply chain management so that they can set corporate sustainability priorities based on real insight.



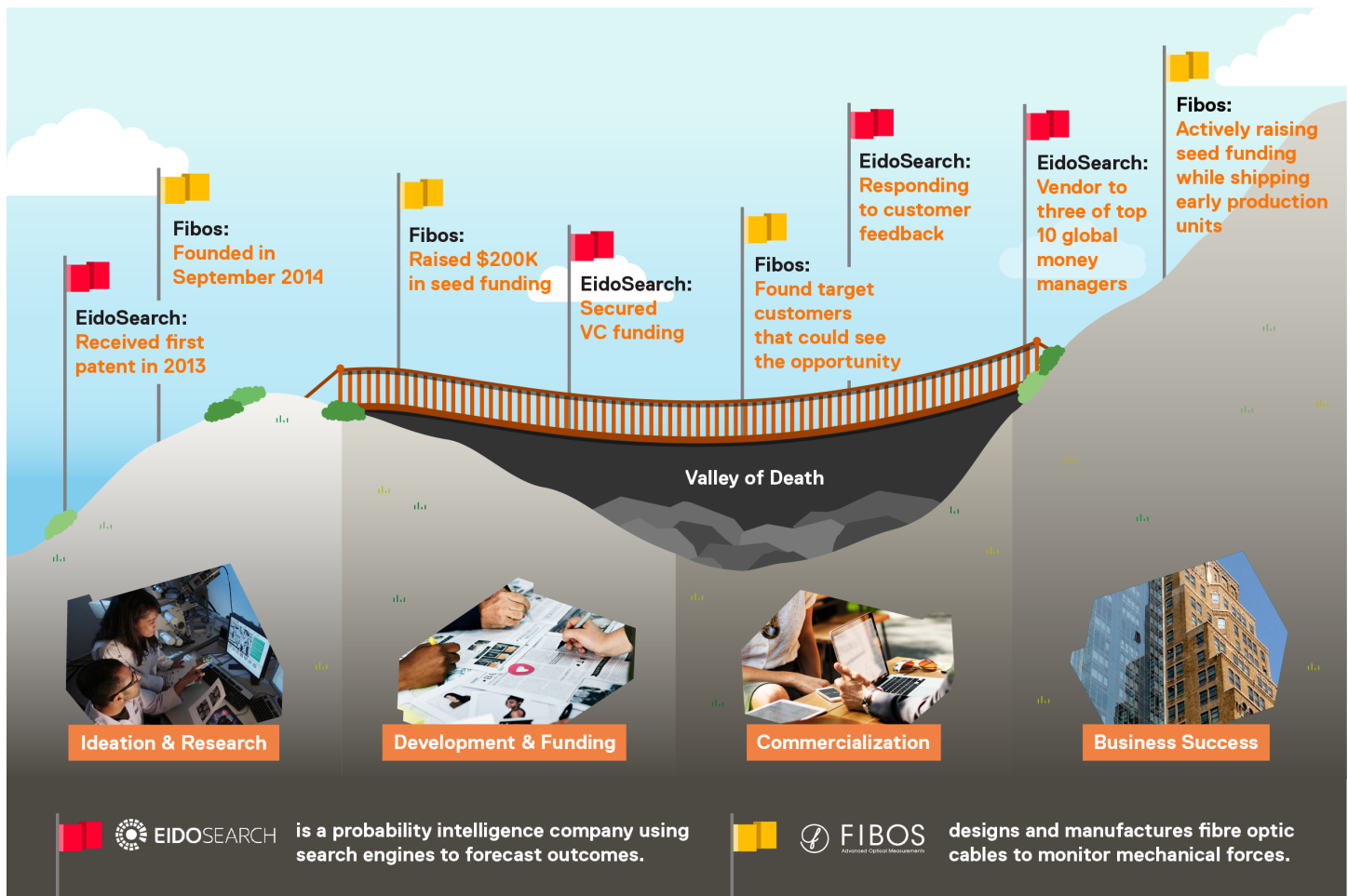
Xavier Fernando

Professor, Electrical and
Computer Engineering

Dr. Fernando's efforts with the IEEE International Humanitarian Technology Conference in Toronto showcased how technology can improve humanity in accordance with the United Nations Sustainable Development Goals.



The Entrepreneur's Journey to Business Success



The combination of engineering and entrepreneurship is defining the first quarter century of this millennium. From fintech to fibre optics, we're seeing that the revolution isn't so straightforward. Meaningful innovation tends to move incrementally and steady rather than big and fast.

The story of two startups, EidoSearch and Fibos, illustrates the journey from ideation and research to business success. Dr. Xiao-Ping Zhang's EidoSearch is a probability intelligence company. Nicholas Burgwin's Fibos enables high-speed, high-

resolution measurements to be performed with unprecedented precision.



Nicholas Burgwin

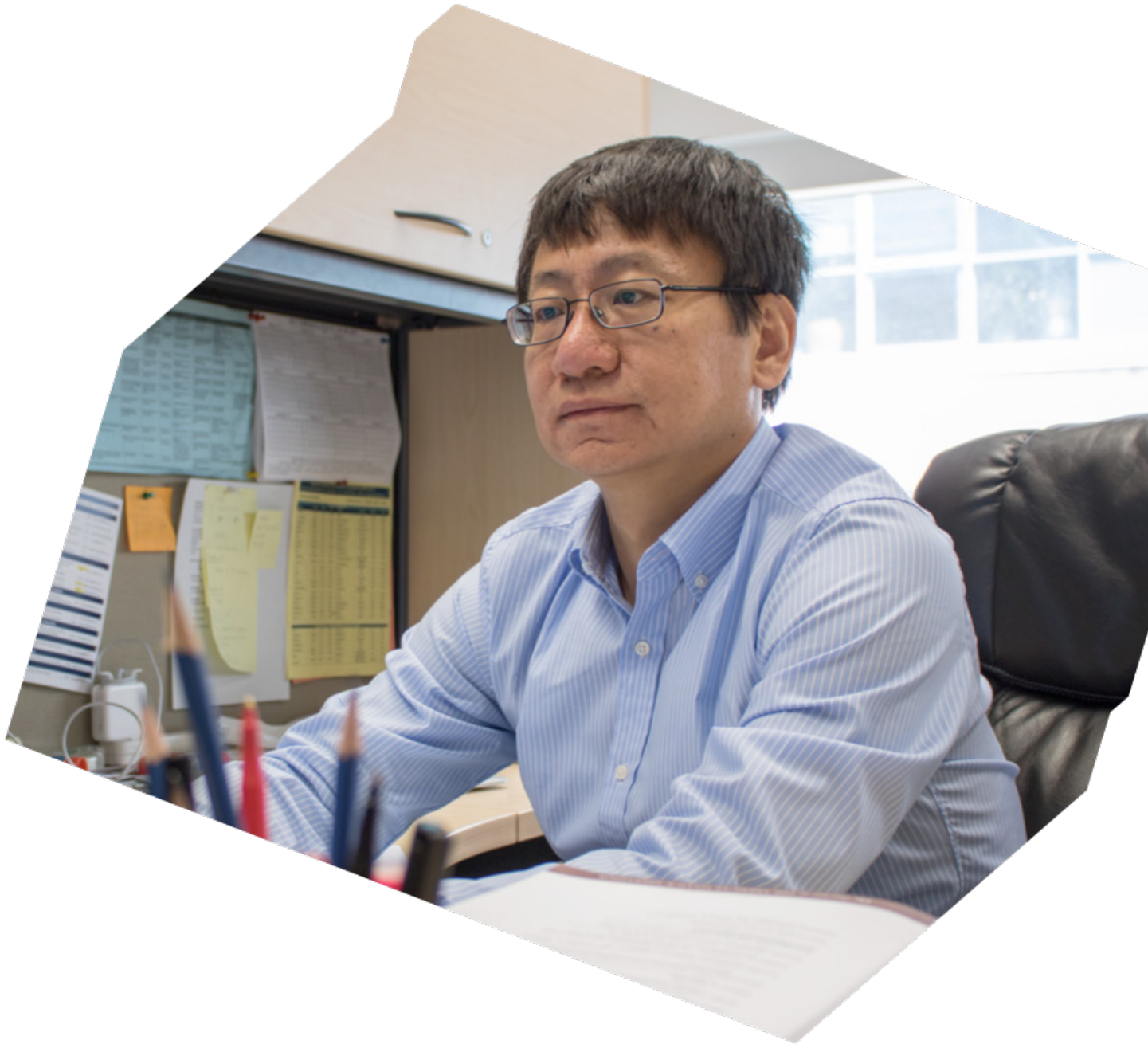
Masters Electrical Engineering Class of 2016
Fibos Co-Founder & CEO

“The Norman Esch Engineering and Entrepreneurship Award at Ryerson was incredibly instrumental in developing Fibos, as it provided \$38,000 to establish the company and build prototypes to validate both the technology and solution. Not only was this seed funding essential, but the award application process encouraged and challenged me to perform market research and apply critical thinking towards the product and its market fit.”

Dr. Xiao-Ping Zhang

Professor, Electrical and Computer Engineering
EidoSearch Co-Founder & CEO

“We found greater acceptance among hedge funds that use a purely systematic investment approach. We shifted our focus and now concentrate on selling data signals generated by our proprietary forecasting methodology to systematic funds.”



Artificial Intelligence is Already Here. And it's Here to Help. (Maybe?)

Understanding how robotics, automation
and AI will augment technological progress.

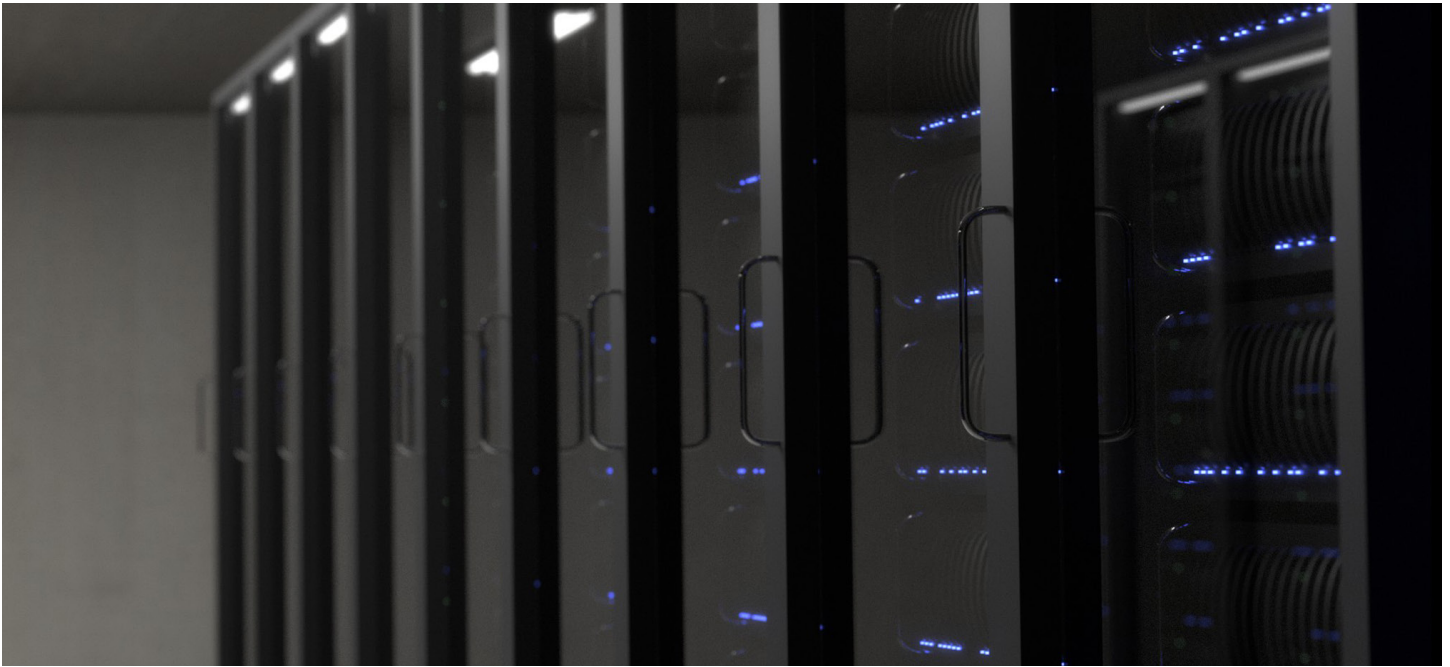
31 Training Watson and
Hiring for Big Data

The field of artificial intelligence is growing exponentially and has already integrated into our daily lives, from targeted advertising, photo tagging and curated newsfeeds to personal assistants like Siri.

32 Rather than Replace Us,
AI May Be the Best Job
Creator Ever

But what's the next wave? What is AI doing today to help shape our future? How is it combining with robotics to create opportunities that could not exist without it? And how much longer until the apocalypse?

Training Watson and Hiring for Big Data



If you can't beat 'em, join 'em — or at least sit down with them and work things out. Such may be the perspective of students at Ryerson, one of only a few select institutions to be granted access to IBM's AI computer system, Watson. By integrating Watson with the curriculum, these students are helping the world understand how AI may help organizations to quickly analyze, understand and respond to Big Data.

But what kind of person does it take to train Watson? Someone who can master data? Someone who understands the nuances of code? Or maybe it's not a single person at all. We asked Dr. Ayse Bener for her insight.



Watch the full video online at the Ryerson FEAS YouTube channel.

“Companies and senior executives need to think strategically about how soon disruptive technologies are going to impact them and how they can transform their organizations in terms of people skills, infrastructure and new markets.”

Ayse Bener
Professor, Mechanical and Industrial Engineering
Director, Big Data

Rather than Replace Us, AI May Be the Best Job Creator Ever

There are legitimate concerns about the role AI will play in replacing human workers. AI will also likely free us to focus on higher-level tasks and partner with us to solve more complex challenges. Both inevitabilities require thoughtful and ethical advancements toward an uncertain future.





Parisa Lak

PhD Candidate, Mechanical and Industrial Engineering

“I believe the ultimate goal of AI is to help human beings have a better and easier life. This is possible by outsourcing some quantifiable decisions to AI, while maintaining that humans are actually the final decision makers. We are working on machine-learning projects that are the backbone and the brain of AI systems.”

The application of AI can be as simple as providing us with online news curated for our specific, individual preferences. But the technology is far from optimized. Parisa is working on the techniques to enhance and personalize the AI engines generating recommendations. For her, a key concern for AI developers is user privacy and how to design AI systems accordingly.

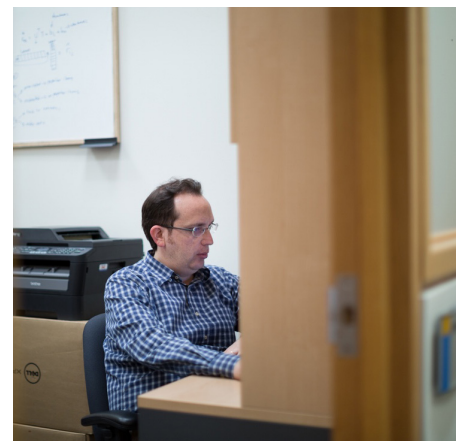
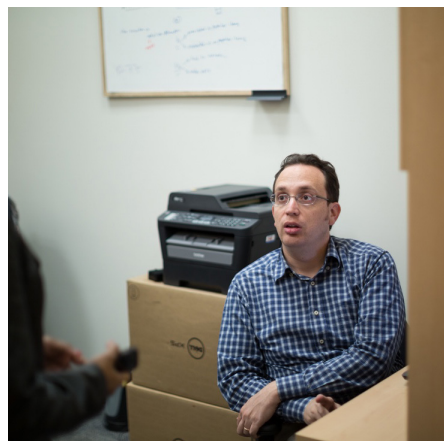


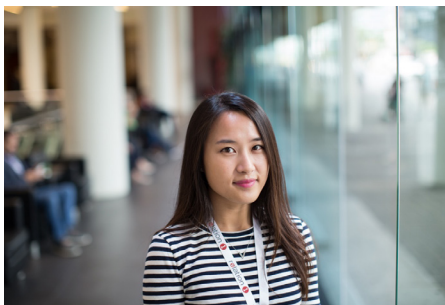
Can Kavaklioglu

PhD Candidate, Mechanical
and Industrial Engineering

“Regardless of how you define AI, everybody will see more of it in their lives. As digital technologies become more integrated into everyday life, so will the demand for devices and systems to be more capable of understanding human lives. This improved understanding leads to more interesting and useful applications and increases the speed of digitization.”

Before we can even have a discussion about AI, we have to understand its parts, namely the integral concept of machine learning. When machines are fed enough data, they can find patterns. PhD candidate Can Kavaklioglu’s research is helping to create the pattern-recognizing agents that we commonly call AI.





Luna (Yue) Feng

Masters Electrical and Computer Engineering,
Class of 2016 and Data Scientist, Thomson Reuters

“One thing to remember is that even though we are trying to put the human brain into an algorithm which a machine can recognize, human wisdom cannot be replaced. Those of us in the AI community need to prove to people how AI can help instead of replace us.”

As a data scientist at Thomson Reuters, Feng sees practical applications across many industries. In fact, there may be AI in your home already in the form of your Roomba vacuum. Rather than see it as a threat, Feng sees many potential uses for AI in various industries. In the financial industry, prediction models can be built to forecast bond issuances or stock prices to help investment bankers make decisions. Graph analysis can be applied to find relationships between people and corporations to detect potential business risk. In the legal industry, natural language processing is broadly used to help lawyers conduct precedent research by extracting facts from legal documents. For Feng, this is only the beginning. AI can do more to help make our lives more efficient and intelligent.



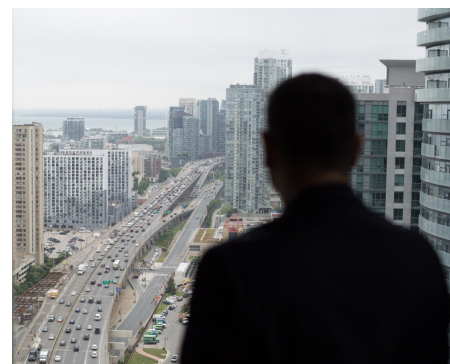


Alireza Vazifedoost

Ryerson Data Science Post Doctoral Fellow
Assistant Vice-President, Data Scientist, Sun Life Financial

“We have read many stories and watched many movies about how AI can destroy humanity. However, I believe that AI is a tool for us to make sense of and make better decisions about data. Similar to any other tool, there are right or wrong ways of using it. It is up to us to make sure we use it toward enhancing human lives, rather than destroying them.”

As a data scientist at Sun Life, Alireza Vazifedoost sees a natural fit for the power of AI. In recent years, competition from new AI-driven finance and insurance companies has pushed larger companies to face their conservatism and disrupt traditional service chains. AI enables intelligent risk-taking that promises better services and reduced costs. In a world where consumers choose more personalized and affordable finance and insurance products, the ethical standards of data scientists like Alireza become increasingly essential.



Is Technology Adoption the Biggest Threat to Healthcare?

Exploring the connection between technological benefit and practical application.

38 iHealth and the Quantifiable Self

We take for granted that our healthcare system focuses on patients. But that hasn't always been the case.

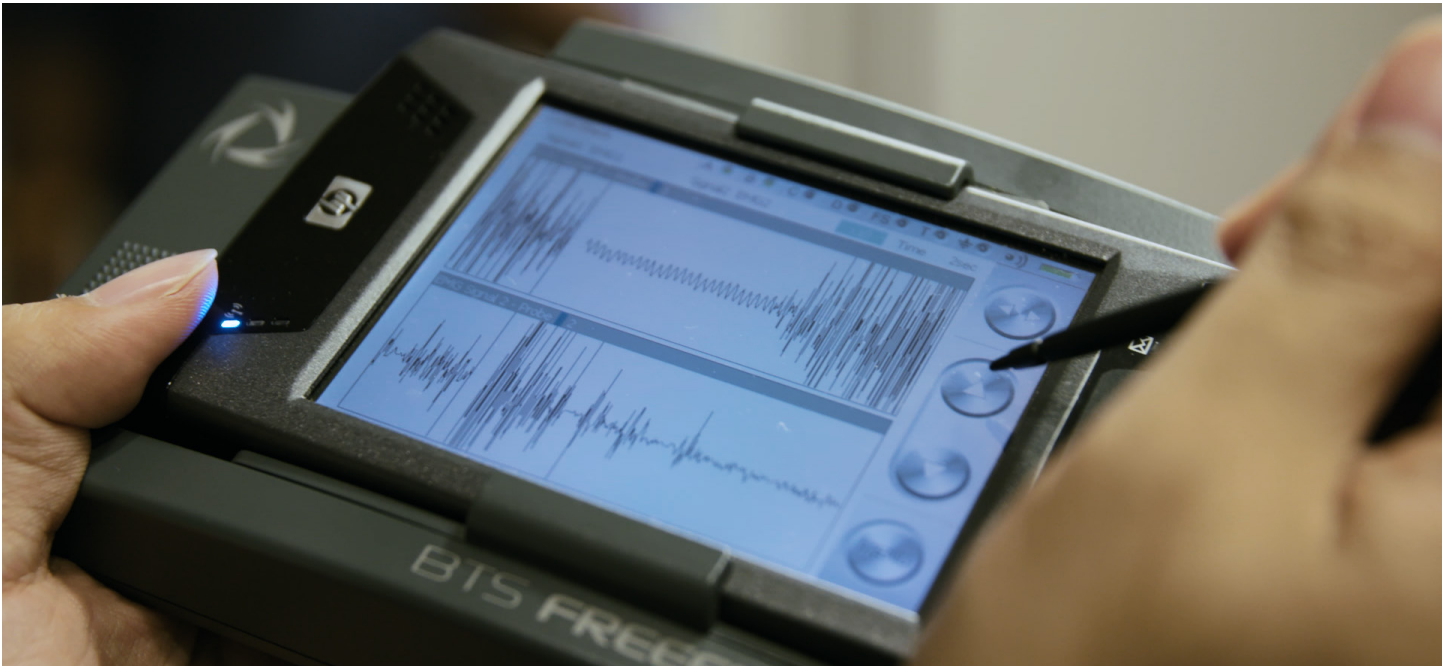
39 Medical Ideation to Commercialization

One hundred years ago, the concept of patient-focused care started in Ontario with William Osler, who is considered by many to be the father of modern medicine. One hundred years later, Ontario may be on the cusp of the next revolution in medicine as technology and innovation in the healthcare sector experience massive growth.

41 The Next Generation of Healthcare in Real Time

But a challenge remains: how can we ensure that these technologies are adopted in a field so traditionally bound by professional best practises that tend to prevent rapid evolution? What perspectives are Ontario's new biotech pioneers offering to advance the field?

iHealth and the Quantified Self



The premise of the “Quantified Self” phenomenon is that people make better decisions about their own health when they have data that helps them understand it. And while momentum around the concept seems recent, there are technologies that have been under development for more than 10 years. iHealth is one example of the future of patient-driven preventative healthcare.

Dr. Sridhar Krishnan’s work focuses on how we can learn from data. One of his many projects identifies cancer through vocal detection and machine learning. He has worked in the field of biomedical signal analysis for the last 20 years.

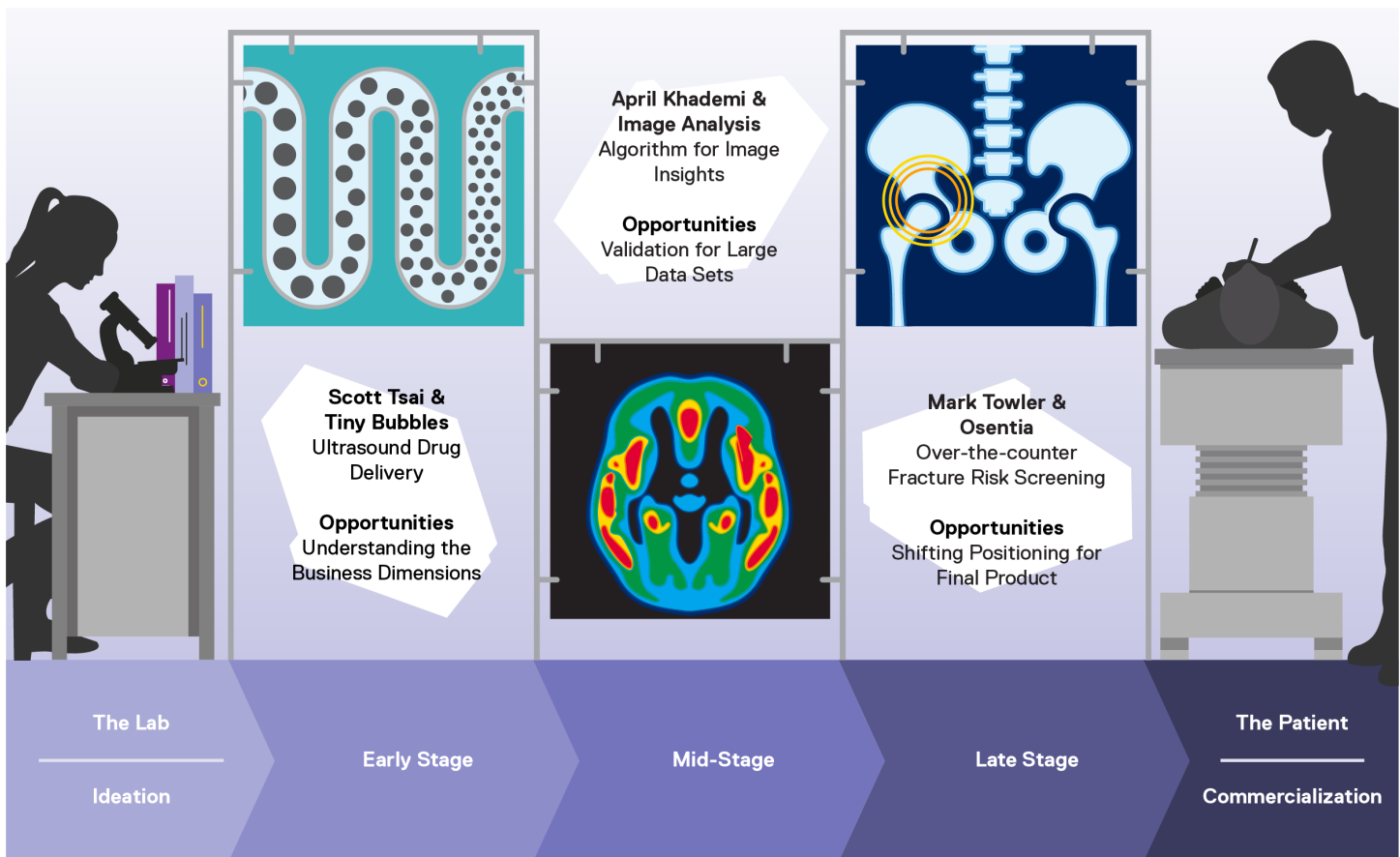
“Wherever there is an electrical signal in the body, we are there. That’s the whole job of this research group — we work on non-invasively detecting signals in the human body.”

*Sridhar Krishnan
Professor and Canada Research Chair, Biomedical Engineering*



Watch the full video online at the Ryerson FEAS YouTube channel.

Medical Ideation to Commercialization



While healthcare innovation can often be stifled by regulatory restrictions and slow adoption, there are ever-expanding emerging technologies that are changing the face of healthcare from the lab to the operating room. And while they may seem like subtle improvements when viewed individually, they add up to radically improved modern healthcare practises.

Scott Tsai

Professor, Mechanical and Industrial Engineering

“I don’t have any formal training in business or commercialization. As a result, sometimes when I am meeting with patent lawyers and other commercialization specialists to discuss, for example, filing intellectual property, I have to think very hard to understand the business aspects of decision-making.”



April Khademi

Professor, Electrical and Computer Engineering

“As with any clinical technology, one of the main challenges is validation. This phase entails proving that the technology is operating as desired with acceptable performance. Validation studies are required for clinical trials or any type of regulatory clearance. For large datasets, validation can be especially cumbersome. To combat this, I am currently investigating new methods to perform validation on medical Big Data.”

Mark Towler

Professor, Mechanical and Industrial Engineering

“The tool was originally designed as a clinical diagnostic but was repositioned for launch as an over-the-counter (OTC) screening tool. As the data builds and as we complete a prospective study, the company intends to expand the tool into the diagnostic field. This will be achieved, in part, using the monies resulting from OTC sales.”



The Next Generation of Healthcare in Real Time

Demand to expedite the rate of health tech adoption is creating opportunities for clinicians to provide better care for their patients.





Jennifer Eshoua

Undergraduate Biomedical Engineering Student
Student Intern, Ontario Medical Association

“As an intern, I used my systems design knowledge to align strategic plans of the Ontario Medical Association and Physician Health Program. My work is helping create paperless health environments where doctors’ notes, patient records, and lab test results are automated. It’s another way engineering is playing a role in achieving the efficiency, privacy and accuracy required of a modern healthcare system.”



Joseph Makanjuloa

Biomedical Engineering, Class of 2016
Research Technician, Toronto Rehab Institute

“As an engineer in research, I’m constantly reminded that whatever stage of problem solving I’m involved in, from research to prototyping, patient care should always be the priority. The study protocol, design idea, technology or treatment may be great — but equally, if not more important, is the patient experience. My engineering designs are constantly influenced by this thought.”



Nabil Uddin

Biomedical Engineering
Class of 2017
Clinical Engagement
Liaison, Biomedical Zone

“How healthcare is delivered in Canada is on the verge of much-needed change. Often, innovations that achieve greater efficiency between quality and quantity of care are coming from outside the medical field. The Biomedical Zone is helping to cultivate this approach to innovation by uniting students, entrepreneurs and doctors to make real differences in all fields of healthcare.”



“Healthcare is ready for a technological revolution, but technologies that have a better chance of success are those that enhance and improve service providers’ current workflow. Entrepreneurs and developers must study this workflow.”

*Suresh Madan, President & CEO, MyHealth Centre and Award Selection Committee
Member, Norman Esch Engineering Innovation and Entrepreneurship Awards*

How Will Green Energy Scale?

Understanding the infrastructure required to build the foundation for the green energy revolution.

47 Power in the Age of Renewables

48 Saving and Storing Energy

49 Flywheels, Battery Boxes and Compressed Air Balloons

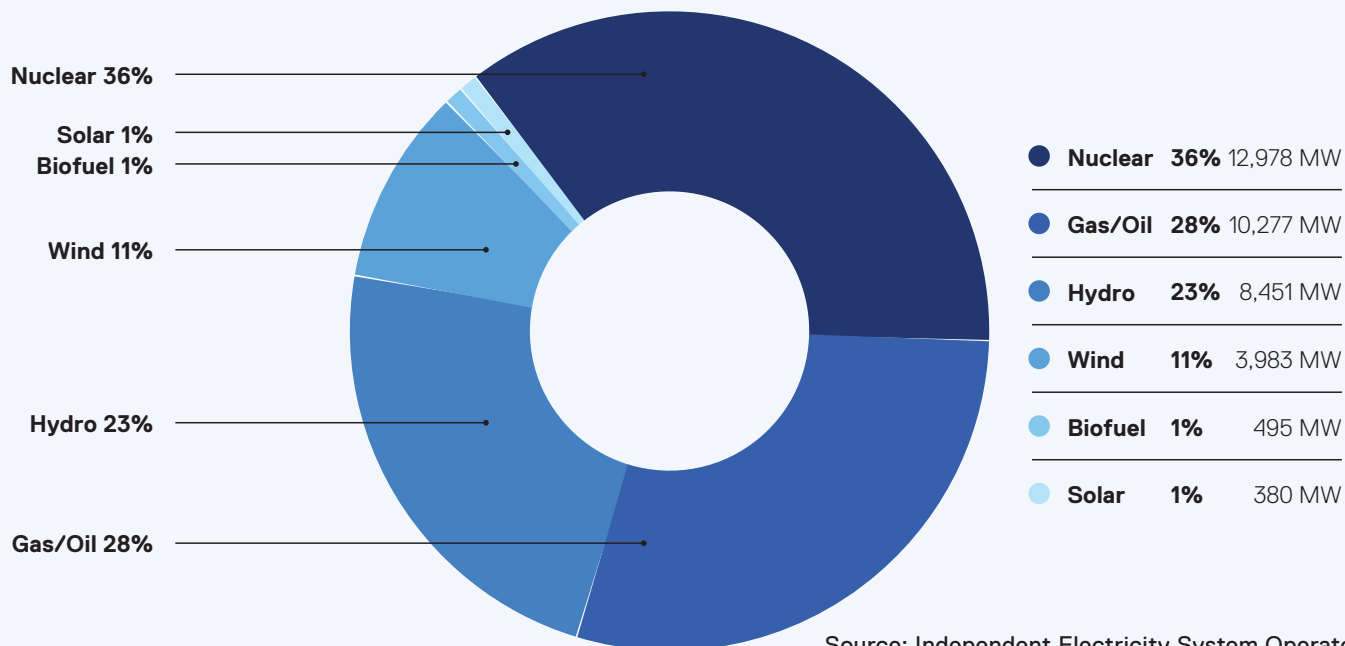
Tesla's announcement that it will double the number of supercharger stations in North America in 2017 hints at an underlying tension with the sustainable mobility and energy revolution. While Tesla is working on its vision of the energy infrastructure required to make the transition to a green mobility future, it is only one part of the puzzle.

Cities around the world are making a move to 100% renewable energy. But how will they do it? And what are the considerations when it comes to energy distribution and storage?

The reality is that a green energy future will require more than one perspective.

Power in the Age of Renewables

Ontario's Installed Electricity Capacity



Source: Independent Electricity System Operator

IESO Distinguished Research Fellow Jessie Ma is focused on energy conservation and the integrated delivery of electricity, gas and water conservation programs. Her research at the Centre for Urban Energy (CUE) demonstrates how, in the next 10-15 years, provinces like Ontario will be able to save consumers money through more efficient use of existing infrastructure.







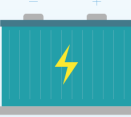


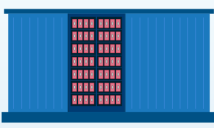


“The electricity sector is on the cusp of transformational change driven by new technologies, environmental imperatives, and the need for electricity to be accessible to and affordable for all. I am proud to contribute to this important endeavour through Ryerson’s collaborative research in urban energy.”

Jessie Ma



Watch the full video online at the Ryerson FEAS YouTube channel.

Saving and Storing Energy

Type	Scale	Output	Capacity
 AA Battery		0.004 kWh	 Yearlong operation of a TV remote control
 Mobile Phone Battery		0.011 kWh	 One day of phone use
 Electric Vehicle Battery		59 kWh	 A drive of 386 kilometres
 Lithium Polymer Battery		625 kWh	 Supplies electricity to 600 homes for 1 hour

Wind power is great as long as the wind is blowing. Once the wind stops, the power stops. Even more challenging

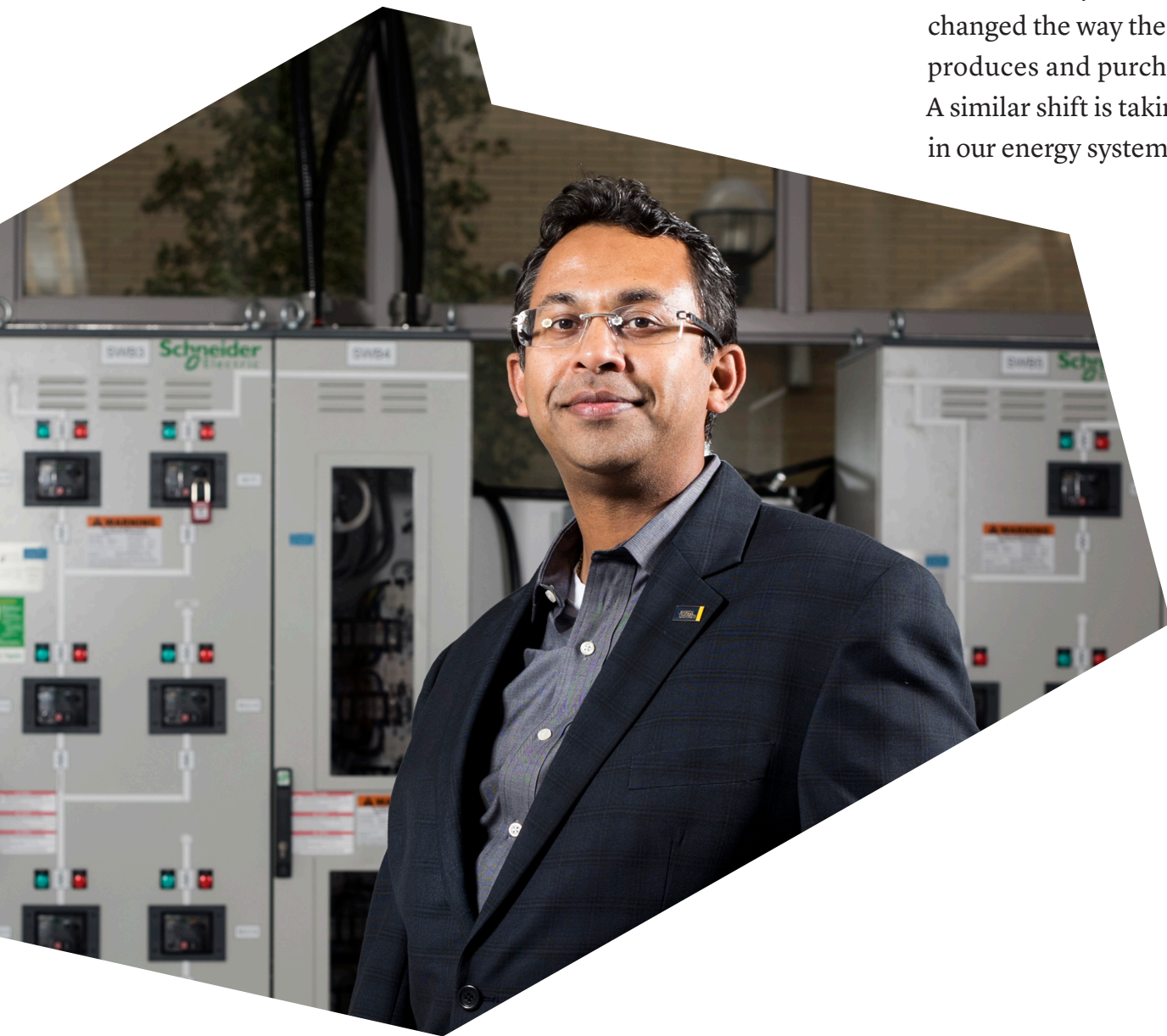
is that we produce more power than we can store from the wind. Dr. Bala Venkatesh is working on storing this excess

power in a way that ensures no interruption in service as we attempt to fully transition to clean energy.

Flywheels, Battery Boxes and Compressed Air Balloons

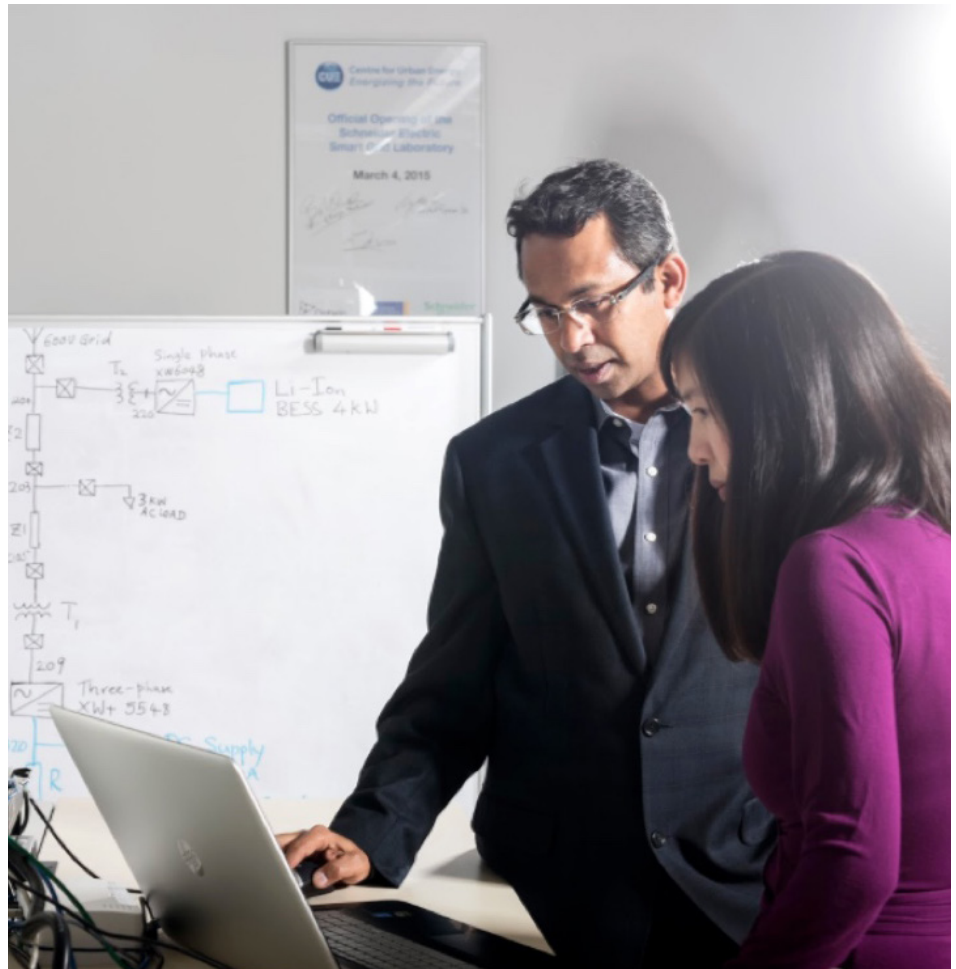
It's useful to think about the impact of storage within an energy system the same way you might think about the role that refrigeration plays in the food system.

As sophisticated refrigeration technologies became ubiquitous, produce no longer had to be bought fresh daily from a market and could be transported across vast distances and stored safely for several days or weeks. This changed the way the world produces and purchases food. A similar shift is taking place in our energy system.



“Being able to store large amounts of electricity for consumption at a later date is seen as the holy grail for engineers, and there are a variety of technologies — like flywheels, battery boxes and compressed air balloons — that are being designed and commercialized.”

Bala Venkatesh, Professor and Academic Director, Centre for Urban Energy



Once these technologies become commonplace, their impact will be felt on both a societal level — allowing us to utilize wind and solar energy around the clock and transition away from fossil fuels — and personal level — helping us power our homes off-grid and use electricity to charge our cars.

Just like refrigeration in the 20th century, grid-scale energy storage has the potential to be one of the game-changing innovations of the 21st century.

How Can Architecture Measurably Improve the Lives of the People Who Use It?

Moving beyond architecture as simply form-making to empowering systems, people and communities.

52 Race to Net Zero Homes

55 Making Aging Cities Smarter

57 The Healthy Community of the Future is Happening Today

Twenty years ago, Frank Gehry's Guggenheim Museum in Bilbao, Spain, opened to immense praise from the global architectural community. It then quickly transcended the profession and became a global phenomenon for its sweeping curves and iconic form.

In 2017, one of the most notable architecture projects may be Bjarke Ingels's Waste-to-Energy Power Plant in Copenhagen. The project is notable for its synthetic ski slope, as well as the rings of steam that will blow from its stacks and serve as a reminder of how much carbon is created from a traditional power plant.

This move from a museum to a power station as potentially the world's most iconic building reflects a global shift in the understanding of the potential of architecture to actively contribute to the cities and systems that support us. A steam-blowing power station is only the beginning.

Race to Net Zero Homes



“Toronto has more than 2,400 publicly owned laneways, covering more than 250 linear kilometres of public space, but lacks policy dictating their use.”

Source: The Laneway Project

Since 2014, the U.S. Department of Energy has held an annual ‘Race to Zero’ competition where 30 teams from four countries compete to design a home so energy efficient that it uses renewable sources to offset all or most of its annual energy consumption. A Ryerson team has won the competition every year.



Watch the full video online at the Ryerson FEAS YouTube channel.



“As our generation gets older and car ownership drops, garages are going to be used less. Our proposal is to use these spaces as opportunities for laneway housing, places for people to live downtown that meet the demands of a growing urban centre as well as creating better neighbourhoods where people want to live.”

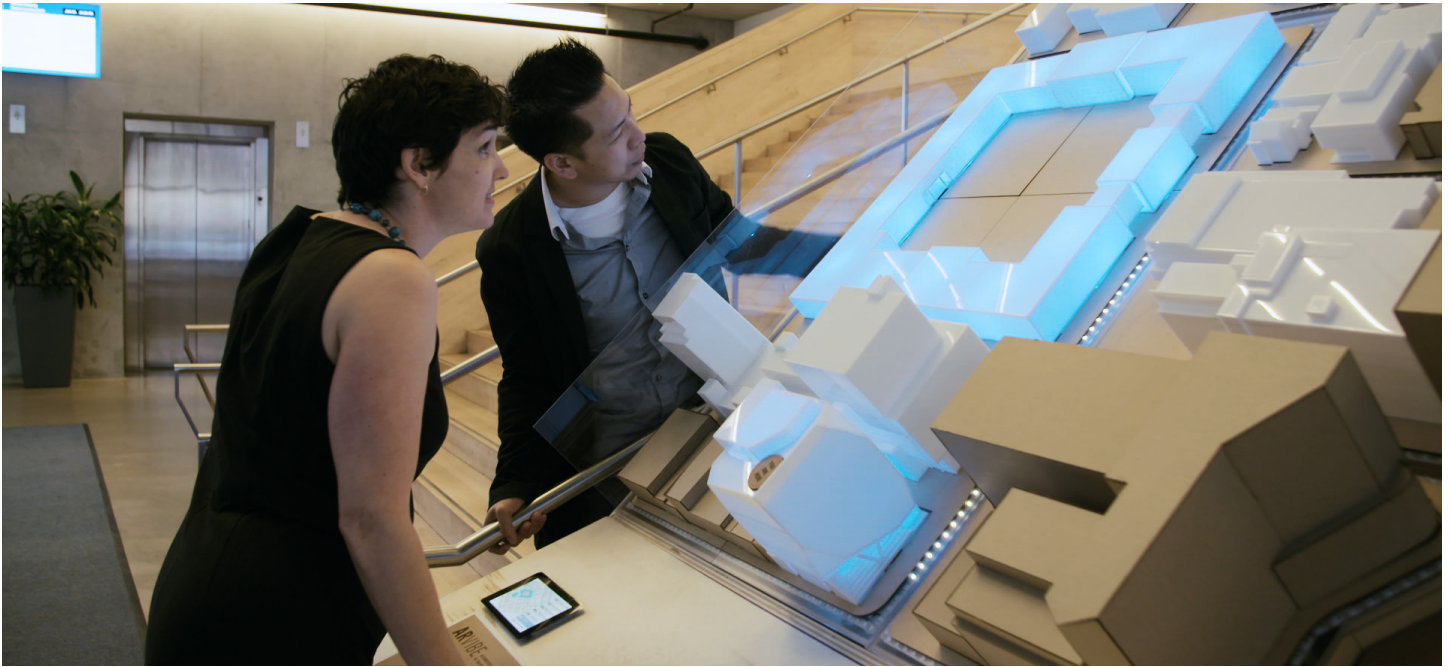
*Matthew Ferguson,
Master of Architecture Candidate*

“I enjoyed branching architecture with building science and creating a beautiful and functional design. The biggest challenge was creating an economic case for the building. It was about optimizing the costs to ensure maximum performance per dollar.”

*Christopher Raghubar, Master of Applied
Science in Building Science Candidate*



Making Aging Cities Smarter



While computer engineers and scientists have expertise in cloud computing and can manage large data sets, not all understand the broader context of building performance. On the other

hand, building management companies and utilities collect enormous data about their assets but lack the expertise to develop analytics to inform operational decision making. The natural


evolution is to combine the best of both through predictive analytics that utilize the data and insights to improve building energy use, and setting us on the path towards smarter cities.

“If you can measure something, you can use it to make more intelligent decisions about the future and predict future use patterns. In my research, I look at how energy is being used and for opportunities to conserve. Given the Paris Agreement and Canada’s efficiency targets to reduce emissions by 30% by 2030, we really need to be making the right decisions about energy.”

*Jennifer McArthur
Professor, Architectural Science*



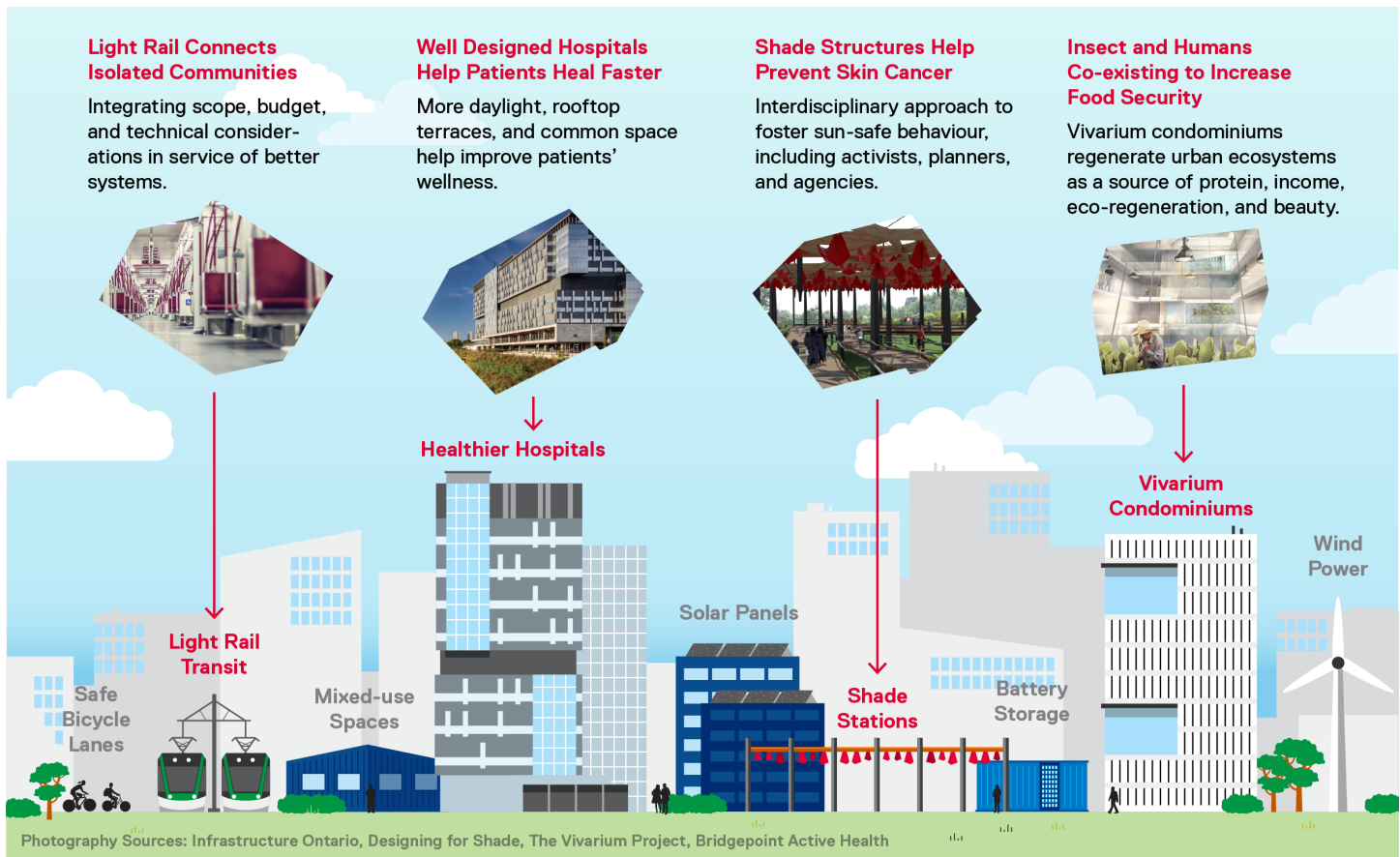
Watch the full video online at the Ryerson FEAS YouTube channel.



“We can now take data about building use — circulation patterns, opening and closing of windows, or the amount of water used — and, instead of it appearing only as a cost on your water or energy bill, we can highlight places in a physical building that consume the most energy and make improvements.”

Vincent Hui, Professor, Architectural Science

The Healthy Community of the Future is Happening Today



Mealworms, skin cancer, high-speed commuting and chronic disease are not typically associated with architecture. Yet each is an example of how the field is evolving to address some of the big challenges of our time.



Light rail connects isolated communities

“On the Finch West LRT, I am working to deliver the best possible value for public transportation.”

*Iqbal Temor, Civil Engineering Class of 2016
Project Coordinator, Infrastructure Ontario*

At Infrastructure Ontario, Ryerson alumnus Iqbal Temor collaborates with Metrolinx on the Finch West Light Rail Transit (LRT) and the Hamilton LRT to deliver the best possible value for public transit. He works with stakeholders on scope, schedule, budget and technical issues to find a common resolution to benefit all.

Well-designed hospitals help patients heal faster

“Patients are healing significantly more quickly — patient stays are 25% shorter.”

Cheryl Atkinson, Professor, Architectural Science

Cheryl Atkinson studied the effects of design on the well-being of hospital patients. She found that a building with a high-level of daylight, a rooftop terrace, and common spaces led to patients moving around the building more, enjoying a greater sense of connectedness to the outside world, reporting improvements in mental health and healing significantly faster.





Shade structures help prevent skin cancer

“The studio underscores the environmental designer’s importance in promoting social change.”

George Kapelos, Professor, Architectural Science

George Kapelos oversaw 12 architecture students as they considered how architecture could foster sun-safe behaviour. The students researched interactive design, proposed park plans and designed structures to protect users from ultraviolet radiation. The studio built on Kapelos’s interdisciplinary research with health promotion and cancer prevention agencies, activities and planners.

Insects and humans co-exist to increase food security

“Vivarium aimed to be a contemplation space, punctuated by the annual release of butterflies.”

Leila Farah, Professor, Architectural Science

Leila Farah’s Vivarium project explored how humans and bugs can co-exist. Insects can be a source of protein, income, ecological regeneration and beauty for food-insecure cities. By cultivating and consuming insects and selling their by-products, Vivarium aimed to act as a regenerator of urban ecosystems (through composting and pollination) and an education provider to its residents.



Share your perspective
with us or learn more about how
you can get involved.

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